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An Extensive Review of Methods of Identification of Bat Species through Acoustics.

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Abstract: Bat is an important keystone member in the ecosystem, which is the only flying mammal. It plays a vital role in maintaining eco-balance through propagation of vital flora. Bat has a major role in pest management in the forest. Bats give major indication for biodiversity conservation through propagation and pest management. Bats are also the key informers of climate change and its impact on their habitat. Bat species and their activity are useful to assess habitat quality and they serve as biological indicators of the ecosystem conditions and degradation. Diversity of bat species is studied using various techniques including speech recognition, voice recognition, artificial neural networks etc. and to detect the presence of bats acoustically. In this paper, the various computer techniques used to study bats are surveyed.

Keywords: bats, echolocation call, acoustic survey, artificial neural networks, support vector machine.

1. INTRODUCTION

India holds a wide diversity of bat species. In the tropical region, fruit and nectar feeding bats play a vital role in the survival and re-growth of the rainforests. Fruit-bats spread seeds as they fly and digest their food. Nectar feeding bats pollinate many valuable plants such as banana, avocado, date, fig, mango etc. Insect-eating bats do pest management. Bats are not blind, but in addition to sight, many species have highly developed ultrasonic bio-sonar capabilities, referred to as "echolocation", which they use to navigate and catch insects in total darkness. India holds one hundred and twenty bat species representations. Among them forty three are represented from Kalakad Mundanthurai Tiger Reserve[KMTR] of which six species are frugivores and the rest are insectivores. The fourteen types of forests of KMTR serve as the abode for the diversified species.

Kalakad Mundanthurai Tiger Reserve[KMTR], is located in the Western Ghats which is one of the biodiversity hotspots and also declared as "world heritage centre" by the UNESCO. KMTR has a coverage of 895 Sq.kms (Coordinates : latitude 8° 25' and 8° 53' N and longitude 77° 10' and 77° 35' E.). KMTR comprises of twelve major forest types to sustain biodiversity including bat species. The annual precipitation in this area is 3,500 mm.

Bats emit calls from about 12 kHz to 160 kHz, but the upper frequencies in this range are rapidly absorbed in air. Many bat detectors are limited to around 15 kHz to 125 kHz at best. Bat detectors are available commercially and also can be self-built. Some early bat detectors used ex-Navy, low frequency radio sets, simply replacing the aerial with a microphone and pre-amplifier. A bat detector is a device used to detect the presence of bats by converting their echolocation ultrasound signals, as they are emitted by the bats, to audible frequencies, usually about 300 Hz to 5 kHz.

Audio signals are generally referred to as signals that are audible to humans. Audio signals usually come from a sound source which vibrates in the audible frequency range. There are many ways to classify audio signals. An audio stream can be segmented into many categories such as silence, environmental sound, music and speech. Audio data is an integral part of many computer and multimedia applications. Audio recordings are dealt with in audio and multimedia applications. The effectiveness of their deployment is dependent on the ability to classify and retrieve the audio files in terms of their sound properties. Rapid increase in the amount of audio data demands for a computerized method for automated content-based classification.

A systematic computerized method of classification is necessary to classify the bats' audio signals as converted by the bat detectors. Bat detectors are used to detect the presence of bats and they are helpful to form conclusions about the different species of bats. Some bat calls are distinct and easy to recognize. But certain other bats emit social calls and thus vary their calls as they fly and hunt.

Acoustics is the interdisciplinary science that deals with the study of all mechanical waves including vibration, sound, ultrasound and infrasound. Acoustic surveys are very useful in assessing the activity pattern of bats. Such surveys are widely used for describing the prevalence of bats and are very important for habitat management and to assess the quality of a habitat[1].

A bat call library is a database in which there are acoustic details of all species of bats in a region, specifying the frequency range of the calls, shape of the calls etc. There are call libraries for European bats[2] and in other continents too.

The Megabats or the fruit-eating bats find food by sight and smell and do not echolocate. But micro bats or the insect-eating bats locate their prey, using sound waves by a process known as 'Echolocation'.

2. BAT SPECIES IDENTIFICATION SYSTEMS

The term 'Echolocation' was first coined by Donald Redfield Griffin to describe how bats use echoes of sounds they produce to locate objects in their path [3]. Echolocation[4], also called bio sonar, is the biological sonar used by several kinds of animals including bats. By producing short ultrasonic calls through their mouth or nose, bats trigger echoes from reflective surfaces for both orientation and object analysis[5]. Echolocating animals emit calls out to the environment and

listen to the echoes of those calls that return from various objects near them. They use these echoes to locate and identify the objects. Echolocation is used for navigation and for foraging [6,7] (hunting, resting, feeding etc.) in various environments. Only insectivorous [8, 9] bats use echolocation. Bats produce ultrasonic sounds for the purpose of moving about in the darkness. They send the ultrasonic sound as an echo which may hit any obstruction and return back to the bat, implying that there is an obstruction ahead. This is called echolocation call.

Walters et.al.[2] have said that a call library contains recordings from a variety of methods and surroundings providing confidence to classify the variations represented in the calls. To ensure correct classification, the best quality calls within a recorded sequence can be taken into account. They have proposed a continental-scale tool for acoustic identification of European bats. They found that the use of acoustic methods at continental scales can be hampered by the lack of standardized and objective methods to identify all species recorded. They developed a continental-scale classifier for acoustic identification of bats, which can be used throughout Europe to ensure objective, consistent and comparable species identifications. They selected one-thousand-three-hundred-and-fifty full-spectrum reference calls from a set of fifteen-thousand-eight-hundred-and-fifty-eight calls of thirty four European species, from EchoBank, a global echolocation call library. They assessed twenty-four call parameters to evaluate how well they distinguish between species and used the twelve most useful, to train a hierarchy of ensembles of artificial neural networks to distinguish the echolocation calls of these bat species. Calls are first classified to one of five call-type groups, with a median accuracy of 97 6%. The median species-level classification accuracy is 83 7%, providing robust classification for most European species, and an estimate of classification error for each species.

Identification of bats from their calls can be split broadly into two paradigms: Qualitative and Quantitative. Qualitative methods involve researchers listening to calls [13], taking account of the echolocation call structure [10]. These methods require that the researcher has to get a good site(a suitable habitat) in which they can see the bats and record the echolocation calls. Hence the observer must wait for the opportunity to identify a bat and identify its staying place which is called the roost[13]. The researcher must follow the bats along flight paths to roosts where bats can be captured. These methods require several field visits and a lot of time; multiple observers may need to survey multiple sites simultaneously. Qualitative methods rely heavily on observer experience.

Vaughan et.al.[10] have done multivariate analysis of echolocation call parameters for the identification of British bat species. They presented a method for the identification of bat species from time-expanded broad-band recordings of their echolocation calls and suggested that the method may be used for the assessment of habitat use by bats. They placed British bats in three groups according to the structure of their calls: high duty cycle FM/CF/FM bats (Rhinolophus spp.), low duty cycle FM bats (Myotis spp. and Plecotus spp.) and intermediate duty cycle FM/CF bats (Pipistrellus and Nyctalus spp. and Eptesicus serotinus).

Wickramasinghe et.al.[11] have found that Bat activity was quantified using acoustic surveys within specific habitats on farms in southern England and Wales. Eighty-nine per cent of bat passes were identified to species level using artificial neural networks (ANN). A further nine percent were identified to genus. The dominant species on both farm types were Pipistrellus pipistrellus and Pipistrellus pygmaeus. Significantly more passes of Myotis species were recorded on organic farms than on conventional farms. This difference was also significant when water habitats were considered alone.

The echolocation calls of bats (call structure and shape of calls)[10] differ from species to species, that is, species-specific[11]. This facilitates acoustic identification of bat species. However, call structures within species can be extremely flexible and depend on factors including habitat, age, sex and the presence of conspecifics.[10,2]

Murray et.al.[12] have studied the variation in search phase calls of bats. Although echolocation calls of most bats exhibit species-specific characteristics, intraspecific variation can obscure differences among species and make reliable acoustic identification difficult. Levels of intraspecific variation in search-phase calls of 7species of vespertilionid bats from several locations in the eastern and central United States were examined. Echolocation calls were recorded from light-tagged bats using the Anabat II detector and associated software. Analook software was used to calculate values for 5 parameters of calls: duration, maximum frequency, minimum frequency, frequency of the body, and slope of the body. Analysis of our results indicates that most intraspecific variability in calls was attributable to differences among individuals and within individual call sequences. Observed levels of geographic variation, although significant in all species examined, were comparatively small and showed no trends among areas. They also included a preliminary description of variability in echolocation calls of Nyticeius humeralis and Myotis leibii.

Russo and Jones [13] have proposed identification of twenty-two bat species(Mammalia: Chiroptera) from Italy by analysis of time-expanded recordings of echolocation calls. They described the spectral and temporal features of echolocation calls emitted by twenty two bat species from Italy (three rhinolophids, eighteen vespertilionids and the molossid Tadarida teniotis). They examined time-expanded recordings of calls from nine hundred and fifty bats of known identity. Rhinolophus ferrumequinum, R. hipposideros, R. euryale and T. teniotis could be identified by measuring the call frequency of highest energy (FMAXE). They applied quadratic discriminant function analysis with cross-validation to calls from the remaining eighteen species. A function based on start frequency (SF), end frequency (EF), FMAXE and duration (D) provided a correct overall classification of approximately eighty two percent. They put forth a classification model at genus level that also comprised middle frequency (MF) and inter-pulse interval (IPI) that reached ninety four percent correct classification. They also devised two separate discriminant functions for species emitting FM (frequency modulated) and FM/QCF calls (i.e. calls consisting of a frequency-modulated component followed by a terminal part whose frequency is almost constant) respectively. The former function included SF, EF, FMAXE and D and provided an overall classification rate of 71%; the latter comprised EF, MF, D and IPI, and reached 96%. The functions can be applied to bat habitat surveys in southern Italy since they cover most of the species occurring in the area

A decision tree was used to classify zero-crossed echolocation call recordings from eight Australian species [14]. Machine learning techniques which are used in automated(human) speech recognition[15,16] have been used to detect and

classify calls from five North American bat species. These methods allow satisfactory identification of several species.

Sound event classification is attracting a growing attention recently in the field of acoustic signal analysis[17]. An acoustic survey is one of the research methods of gathering information on the abundance of a species and detecting their presence using acoustic detectors. Acoustic surveys are carried out in a wide range of habitats to detect large number of species.

Support Vector Machines(SVM) [18-20], Artificial Neural Networks(ANN) [21] and Synergetic Pattern Recognition [22] are the frequently used to classify bats. Redgwell et.al.[18] have classified the echolocation calls of fourteen species of bats by support vector machines and ensembles of neural networks. Calls from fourteen species of bat were classified to genus and species using discriminant function analysis (DFA), support vector machines (SVM) and ensembles of neural networks (ENN). They found that both SVMs and ENNs outperformed DFA for every species while ENNs (mean identification rate–97%) consistently outperformed SVMs (mean identification rate – 87%). Correct classification rates produced by the ENNs varied from 91% to 100%; calls from six species were correctly identified with 100% accuracy. Calls from the five species of Myotis, a genus whose species are considered difficult to distinguish acoustically, had correct identification rates that varied from 91 – 100%. Five parameters were most important for classifying calls correctly while seven others contributed little to classification performance.

Neural networks have also been used to identify species of British bats flying over organic and conventional farms. Although these previous studies accurately classify many of the species on which they are trained and prove the concept and value of quantitative call identification, they have not been made publicly accessible and are restricted to a regional(often national) level (eg. Venezuela[8]; Greece; Italy [13]; Meditteranean area[23]; UK [24]; Switzerland [22];). Therefore, they cannot be used to generate comparable classifications at a continental scale[2]. For continent-wide survey and monitoring programmes that aim to assess changes in activity over time or between sites, a quantitative method of identification that is objective, standardized and repeatable is essential.

Orbist M K et.al. [22] have found a variability in echolocation call design of twenty six Swiss bat species and have put forth the consequences, limits and options for automated field identification with a synergetic pattern recognition approach. They used pattern recognition algorithms for recognizing bat species by their echolocation calls. Automated systems like synergetic classifiers may contribute significantly to operator-independent species identification in the field. It necessitates the assembling of an appropriate database of reference calls. They presented data on species-specific flexibility in call parameters of all Swiss bat species (except Nyctalus lasiopterus and Plecotus alpinus). They found that the selection of "training-calls" for the classifier is crucial for species identification success, in the context of echolocation call variability differing between species and its consequences for the implementation of an automated, species specific bat activity monitoring system.

Jennings et.al. [25] have put forth their findings of human vs machine, in the identification of bat species from their echolocation calls by humans and by artificial neural network. Automated remote ultrasound detectors allow data on bat presence and activity to be collected. Processing of data involves identifying bat species from their echolocation calls. Automated species identification has the potential to provide consistent and potentially higher levels of accuracy than identification done by humans. Identification done by humans permits flexibility and intelligence in identification. The authors compared humans with artificial neural networks in their ability to classify recordings of bat echolocation calls of variable signal-to-noise ratios. These sequences are typical of those obtained from remote automated recording systems that are used in large-scale ecological studies. In this work, they presented forty five recordings produced by known species of bats to artificial neural networks and to twenty six human participants with one month to twenty three years of experience in acoustic identification of bats. Humans classified eighty six percent of recordings to genus and fifty six percent to species. Artificial neural networks correctly identified ninety two percent and sixty two percent respectively. There was no significant difference between the performance of artificial neural networks and that of humans. But artificial neural networks performed better than about seventy five percent of humans. There was little relationship between the experience of human participants and their classification rate. However, humans with less than one year of experience performed worse than others. Currently, identification of bat-echolocation calls by humans is suitable for ecological research. However, improvements to artificial neural networks and the data that they are trained on may increase their performance to those demonstrated by humans in future.

Bohn et.al.[26] have studied syllable acoustics, temporal pattern and have found that call composition vary with behavioural context. They have put forth a vocal repertoire of Mexican free-tailed bats, *T.brasiliensis.* They found that some syllables are unique to specific calls while others are shared among different calls.

Ahlen and Baggoe[27] have examined the use of ultrasound detectors for bat studies in Europe with their experiences from field identification, surveys and monitoring. No single variable of bat sound can be used to separate all species. Identification of bat species is based on a number of characters in combination. They used ultrasound detectors equipped with heterodyne and time expansion systems in combination. This combination has many advantages for instant identification as well as subsequent analysis.

Arnett et.al.[28] have evaluated the effectiveness of an ultrasonic acoustic deterrent for reducing bat fatalities at wind turbines. They suggest that broadband ultrasound broadcasts may reduce bat fatalities by discouraging bats from approaching sound sources. But the effectiveness of ultrasonic deterrents is limited by distance and area. Ultrasound can be broadcast in part due to rapid attenuation in humid conditions.

Sun et.al.[29] have studied the geographic variation in the acoustic traits of greater horseshoe bats, testing the importance of drift and ecological selection in evolutionary processes. Intraspecific geographic variation of signaling systems provide insight into the microevolutionary processes driving phenotypic divergence. The acoustic calls of bats are sensitive to diverse evolutionary forces. They found that in China, *Rhinolophus ferrumequinum* displays a diverse call frequency and inhabits a heterogeneous landscape. They quantified geographic variation in resting frequency (RF) of echolocation calls, estimated genetic structure and phylogeny of *R. ferrumequinum* populations, and combined this with

climatic factors to explain acoustic variation in genetic drift, cultural drift, and local adaptation.

Miller et.al.[30] studied the acoustic behavior of four species of vespertilionid bats in the field using high speed tape recorders and ultrasonic detectors. The bats can be identified solely on the basis of their cries when using a 'divide-by-ten' detector. Several aspects of the cry repertoire can be correlated with the bats' activities and acoustic environment. During aerial chases and when circling the roost, *Eptesicus serotinus*, *Nyctalus noctula*, *andPipistrellus pipistrellus* emit ultrasound that is distinctly different from their orientational cries. They found that such ultrasound may have a social function.

Airas M [31] has put forth his findings regarding acoustical properties such as the temporal and frequency domain qualities of echolocation signals. He studied the echolocation voice production and perception capabilities of Chiroptera including the vocal organs and ear anatomy, voice control capabilities and neurological aspects.

Ghose and Moss [32] have done research on the direction of the ultrasonic beam produced by the bat and the direction in which it moves in flight. Bat is an acoustically guided animal and not a visually guided animal. There is an anticipatory relationship between the direction of the sonar beam and the locomotory flight plan as the bat searches for and intercepts insect prey. Echolocating bats emit brief, intermittent ultrasonic pulses. Each pulse forms a beam of sound that echoes off objects in its path. Bats compute the direction and distance to obstacles and prey, from a spectrotemporal analysis of the returning echoes. Auditory directional information, however, requires a complex mapping of binaural spectrotemporal information into spatial location. The ability to localize objects and navigate via echolocation is very well developed in bats, and the distinctive aspects of echolocation as a sensory system suggest that the study of auditory guided locomotion in bats offers a valuable complement to similar studies in visually guided animals.

Jakobsen et.al. [33] have studied the convergent acoustic field of view in echolocating bats. Most echolocating bats exhibit a strong correlation between body size and the frequency of maximum energy in their echolocation calls that is, the peak frequency. The smaller species use signals of higher frequency and the larger species use signals of lower frequency. They found that smaller bats emit higher frequencies to achieve directional sonar beams and that variable beam width is critical for bats. Bats that emit their calls through their mouths show a relationship between mouth size and wavelength, driving smaller bats to signals of higher frequency.

Yovel et.al. [34] have taken up a study of active control of acoustic field-of-view in a biosonar system. Echolocation system in bats or the biosonar is an active sensing system. Echolocating bats actively emit the energy with which they probe their surroundings, and they can control many aspects of sensory acquisition, such as the temporal or spectral resolution of their signals. The importance of "active sensing," by which an animal actively interacts with the environment to adaptively control the acquisition of sensory information, is fundamental to perception across sensory modalities. Bat echolocation, an active sensory system, enables an acoustic representation of the environment through precise control of outgoing sonar signals.

Tressler et.al. [35] have studied the regulation of bat echolocation pulse acoustics by striatal dopamine. The ability to control the bandwidth, amplitude and duration of echolocation pulses is a crucial aspect of echolocation performance. Echolocating bats precisely regulate the acoustic properties of their echolocating pulses to maximize the efficiency of their sonar behavior. The vocal plasticity displayed by echolocating bats is uncommon among mammals because it represents a cognitive rather than limbic control of the vocal motor circuitry.

Adams A M [36] analysed the bat activity with acoustic monitoring. There was difference in the results by comparing the detection of bats by using various commonly available bat detectors. The variation resulting from the differences between bat detectors used was put forth by analyzing the variation in the detection of echolocation pulses and found significant differences in distance and angle of detection.

TABLE I
Summary of Strong Points and Limitations of Proposed Techniques and Frameworks

Effort	Techniques Proposed	Strong Point
1	A practical sampling design for acoustic surveys of bats.	Acoustic surveys are very important for habitat management and to assess the quality of a habitat

2	A continental-scale tool for acoustic identification of European bats.	A bat call libraries are defined
3	Bat Echolocation Research: tools, techniques and analysis	Describes how bats use echoes of sounds they produce to locate objects in their path
4	Echolocation-producing short ultrasonic calls	The communicative potential of bat echolocation pulses.
5	Coordination of bat sonar activity and flight for the exploration of three-dimensional objects.	Bats trigger echoes from reflective surfaces for both orientation and object analysis
6	Foraging activity of bats in historic landscape parks in relation to habitat composition	Echolocation is used for navigation and for foraging
7	Spatial orientation and food acquisition of echolocating bats	Bats use echoes to locate and identify the objects and for foraging (hunting, resting, feeding etc.) in various environments
8	Recognition of species of insectivorous bats by their echolocation calls.	Only insectivorous bats use echolocation.
9	Contribution of acoustic methods to the study of insectivorous bat diversity in protected areas	Insectivorous bats produce ultrasonic sounds which may hit any obstruction and return back to the bat
10	Identification of British bat species by multivariate analysis of echolocation calls.	Multivariate analysis of echolocation call parameters- from time-expanded broad-band recordings of their echolocation calls-using call structure and shape of calls
11	Bat activity and species richness on organic and conventional farms: impact of agricultural intensification	Echolocation calls of bats differ from species to species, that is, species-specific
12	Variation in Search Phase Calls of Bats.	Intraspecific variation can obscure differences among species and make reliable acoustic identification difficult
13	Identification of bat species by analysis of time-expanded recordings of echolocation calls	Spectral and temporal features of echolocation calls emitted by bat species
14	Identification of bat echolocation calls using a decision tree classification system	Classify zero-crossed echolocation call recordings
15	Acoustic detection and classification of microchiroptera using machine learning: lessons learned from automatic speech recognition.	Machine learning techniques which are used in automated(human) speech recognition
16	Efficient Discrete Tchebichef on Spectrum Analysis of Speech Recognition.	Discrete Tchebichef Transform outperforms Fourier Transform and Fast Fourier Transform
17	Semi-supervised learning helps in sound event classification.	Sound event classification in acoustic signal analysis. Acoustic survey by detecting the presence of bats using acoustic detectors.
18	Classification of echolocation calls by support vector machines and ensembles of neural networks.	Support vector machines for the acoustic identification
19	Content-based audio classification and retrieval by support vector machines	Classification of sounds acoustically using support vector machines
20	Mixed type audio classification with support vector machine	SVM-based audio classification for music, speech, environment sound, speech mixed with music and music mixed with environment sound
21	Acoustic identification of echolocating bats by discriminant function analysis and artificial neural networks.	Echolocation calls were 190igitized- one temporal and four spectral features were measured from each call
22	Variability in echolocation call design of bat species	Consequences, limits and options for automated field identification with a synergetic pattern recognition.

23	Use of foraging habits by bats (Mammalia: Chiroptera)	Type of foraging habits determined by acoustic surveys: conservation implications.
24	Acoustic Bat Monitoring Programme	Quantitative bat call identification
25	Human vs machine: identification of bat species from their echolocation calls by humans and by artificial neural network.	Machines with artificial neural networks' advantages and disadvantages on comparison with human beings
26	Syllable acoustics, temporal pattern	Some syllables are unique to specific calls while others are shared among different calls
27	Ultrasound detectors for bat studies	Ultrasound detectors equipped with heterodyne and time expansion systems in combination
28	Ultrasonic acoustic deterrent	Effectiveness of ultrasonic deterrents is limited by distance and area
29	Geographic variation in the acoustic traits	Intraspecific geographic variation of signaling systems influence the microevolutionary processes driving phenotypic divergence
30	Acoustic behaviour	Cry repertoire can be correlated with the bats' activities and acoustic environment.
31	Echolocation in bats	Acoustical properties such as the temporal and frequency domain qualities of echolocation signals
32	Acoustic gaze linked to flight plan	Direction of sonar beam is related to the locomotory flight direction
33	Convergent acoustics in echolocating bats	Smaller bats emit higher frequency and larger bats emit lower frequency ultrasonic beams
34	Active control of acoustics in a biosonar system	Bat echolocation, an active sensory system, enables an acoustic representation of the environment through precise control of outgoing sonar signals.
35	The regulation of bat echolocation pulse acoustics	Echolocating bats precisely regulate the acoustic properties of their echolocating pulses to maximize the efficiency of their sonar behavior
36	Bat activity with acoustic monitoring	Variation with different bat detectors

3. CONCLUSION

Acoustic monitoring is one of the powerful techniques for learning the ecology of bats. Acoustic surveys are used for identifying the occurrence of bats, their habitat management and activity patterns. Several researchers have carried out studies on bats in various parts of the world using several techniques such as artificial neural networks, speech recognition, voice recognition, pattern recognition algorithms, support vector machines, artificial intelligence etc. In this paper, we have carried out an extensive review on the various techniques used to identify and classify bats using their species-specific echolocation calls, which will be useful for the on-going and future researchers for their study in this area.

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Order Size Dependent Trade Credit Study in a Three Echelon Supply Chain Model

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Abstract: In present study, we generalize order linked trade credit policy in three echelon supply chain system where manufacturer, distributor and retailer are involved and manufacturer provide a delay period to distributor and distributor also provide a order linked trade credit policy to his retailers. Whole study is discussed in time dependent production and demand rate. We model a three echelon supply chain system as cost minimization to determine the system's optimal cycle time. In this paper, we determine the optimal cycle time, optimal order quantity and optimal payment time. Finally numerical examples are given to illustrate the result and the managerial insights are also obtained.

Keywords: Time dependent demand, variable production rate, three echelon supply chain, order linked trade credit.

1. INTRODUCTION

Over the last few decades, the supply chain design and management issues have been widely studied. Still, these are attractive research topics, partly because of the relentless drive to lower cost and partly because of improving service quality through efficient information sharing/exchange among different parties involved in the entire supply chain.

Traditionally, inventory models considered the different subsystem in the supply chain independently. With the recent advances in communication and information technologies, the integration of these function are a common phenomena. Moreover due to limited resources, increasing competition and market globalization, enterprises are force to develop supply chain that can respond quickly to customer need with minimum stock and minimum service level. The cooperation between manufacturers and retailers, Ishii et al (1988) considered a three echelon system with one manufacturer, one wholesaler and one retailer respectively. Haq et al (1991) considered a three echelon system with one production facility, several warehouses and several retailers. Woo et al (2001) considered an integrated inventory system where a vendor purchases and process raw materials and delivered the finished items to multiple buyers. Rau et al (2003) developed a multi-echelon inventory model for a deteriorating item and derived an optimal joint total cost from an integrated perspective among the suppliers, the producer and the buyers. We address in this paper a three echelon supply chain with linearly increasing time dependent demand rate, production rate and permissible delay in payments. Under most market behavior, permissible delay in payment can provide economic sense for vendor because of the vendor provides a credit period to the buyer can stimulate demand so as minimize the vendor's own benefits and advantage or minimize total cost. Therefore, the extensive use of trade credit as an alternative has been addressed by Goyal (1985) who stabilized a single item inventory model under permissible delay in payment. Chang (1998) developed an alternative approach to determine the EOQ under the condition of permissible delay in payments. Abad and Jaggi (2003) developed a seller-buyer model with a permissible delay in payments by game theory to determine the optimal unit price and the credit period, considering that the demand rate is a function of retail price. Ouyang et al. (2006) discussed a study on an inventory model for non instantaneous deteriorating items with permissible delay in payments. Goyal et al. (2007) established optimal ordering policies when the supplier provides a progressive interest-payable scheme. Singh et al. (2007) presented an inventory model for perishable with quadratic demand, partial backlogging and permissible delay in payments. Liao (2008) studied deteriorating items under two-level trade credit. Jaber and Goyal (2008) considered channel coordination in a three-level supply chain. They assumed that both demand and supply are certain. Thangam and Uthaykumar (2009) developed two echelon trade credits financing for perishable items in a supply chain when demands on both selling price and credit period. Singh et al (2010) developed an EOQ model with Pareto distribution for deterioration, Trapezoidal type demand and backlogging under trade credit policy. Chen and Bell (2011) investigated a channel that consists of a manufacturer and a retailer where the retailer simultaneously determines the retail price and order quantity while experiencing customer returns and price dependent stochastic demand. They proposed an agreement that includes two buyback prices, one for unsold inventory and one for customer returns and show that this revised returns policy can achieve perfect supply-chain coordination and lead to a win–win situation. Singh et al (2011) developed two warehouse fuzzy inventory models under the condition of permissible delay in payments. Su (2012) presented an optimal replenishment policy for an integrated inventory system with defective items and allowable shortage under trade credit. Singh and Singh (2012) discussed an integrated supply chain model for perishable items with trade credit policy under imprecise environment. Soni (2013) discussed optimal replenishment policies for deteriorating items with stock sensitive demand under two-level trade credit and limited capacity. Yadav et al (2013) analyzed the retailer's optimal policy under inflation in fuzzy environment with trade credit. Omar et al (2013) discussed a just-in-time three-level integrated manufacturing system for linearly time-varying demand process and has taken decreasing time varying demand rate for customer. Chung and Barron (2013) simplified solution procedure for deteriorating items under stock dependent demand and two level trade credits in the supply chain management.

Supplier credit policy offered to the retailer where credit terms are independent of the order quantity. That is, whatever the order quantity is small or large the retailer can take the benefits of payment delay. Under this condition, the effect of stimulating the retailer's demand may reduce. So, the present study will adopt the following assumption to modify the Goyal (1985) model. To encourage to retailer to order a large quantity the supplier may give the trade credit period only for a large order quantity. In other word the retailer requires payment for a small order quantity. For this point Khouja and Mehrez (1996) investigated the effect of supplier credit policies where credit terms are linked to the order quantity. There are so many researchers that have done work in this direction as Jaggi et al. (2008) developed an optimal replenishment decisions policy with credit-linked demand under permissible delay in payments for retailer. Chang et al. (2009) analyzed the optimal pricing and ordering policy for an integrated inventory model when trade credit linked to order quantity. Chang et al. (2010) derived the optimal ordering policies for deteriorating items when a trade credit is linked to order quantity.

In this study we have considered the order linked trade credit concept in three echelon supply chain inventory model where manufacturer also provides a delay period to his distributor and distributor offer order linked delay period to his retailers to promote his sell. The main purpose of this study to discuss this order linked trade credit policy with time dependent demand rate and production rate in three echelon supply chain inventory model.

2. ASSUMPTIONS AND NOTATIONS

The following assumptions and notations are used to the single channel multi-echelon supply chain system with trade credit consideration.

2.1 Assumptions

1. The retailer's ordering quantity from distributor has to be on JIT basis that may require small and frequent replenishment basis and all shipments are of equal basis.
2. Demand rate is variable and time dependent, D = a+bt and Production rate is demand dependent, i.e. P=k D, where a, b ≥0, a > b and k>1
3. Manufacturer offers a certain permissible delay period to his distributor and the distributer offers a conditional trade credit to the retailers such as if Q_r < w, the trade credit is not permitted. Otherwise, fixed trade credit period *M* is permitted. Hence, if Q_r < w, pay S_dQ_r when order is received. If $Q_r \geq$ w, pay S_dQ_r *M* time periods after the order is received.
4. During the time the account is not settled, generated sales revenue is deposited in an interest bearing account. When T ≥ M, the account is settled at T=M, the retailer starts paying for the higher interest charges on the items in stock. When T ≤ M, the account is settled at T=M and the retailer does not need to pay any interest charges.
5. The ordering cycle times (the time interval in successive orders) are equal for both distribution canters and retailers, that is same as the production cycle time of the manufacturer.
6. There is no repair and replenishment of deteriorated items.
7. Time horizon is infinite. $S_d \geq S_m$, $S_r \geq S_d$, $I_s \geq I_c$, $N \geq M$

2.2 Notations

Manufacturer's parameters

D	annual demand rate such as $D = a + bt$ where a, b≥0 and a>b
P	annual production rate of manufacturer as $P = kD$ where k>1
A_m	fixed production setup cost per lot size
h_m	stock holding cost per unit per year ($ / unit/ year)
τ_m	the transportation cost of a shipment from manufacturer to supplier
$I_{m_1}(t)$	the inventory level that changes with time t during production period
$I_{m_2}(t)$	the inventory level that changes with time t during non-production period
T	common cycle time of production/ordering cycle
S_m	unit selling price per item of good quality
I_m	annual interest rate for calculating the manufacturer's opportunity interest loss due to the delay payment
TAC_m	the annual total relevant cost of the manufacturer

Distributor's parameters

A_d	the distributor ordering cost per shipment
h_d	stock holding cost per unit per year (dollar/unit/year)
τ_{d1}	the transportation cost of receiving a shipment from manufacturer
τ_{d2}	the transportation cost of the distributor of delivering a shipment to retailer
N	distributor's permissible delay period offered by manufacturer to distributor
n	number of shipment per order from manufacturer to distributor, $n \geq 1$
$I_d(t)$	the inventory level that changes with time t during the period T_3
T_3	the replenishment time interval and $T_3 = T/n$
I_0	annual interest rate for calculating the distributor
S_d	unit selling price per item of good quality
Q_d	shipment quantity from manufacturer to distributor in each shipment (unit)
TAC_d	the annual total relevant cost of the distributor

Retailer's parameters

A_r	the retailer ordering cost per contract
h_r	stock holding cost per unit per year ($/unit/year)
τ_r	the fixed transportation cost of receiving a shipment from distributor ($/shipment)
Q_r	shipment size from distributor to retailer in each shipment (unit)
S_r	unit selling price per item of good quality
m	number of shipment per order from distributor to retailer $m \geq 1$
w	minimum order quantity at which the trade credit is permitted
M	retailer's trade credit period offered by distributor linked to order quantity w
I_e	interest earned per dollar per year
I_p	interest payable per dollar per year

$I_r(t)$ the inventory level that changes with time t during the period T_4

T_4 the replenishment time interval and $T_4 = T_3 / \mathrm{m} = \mathrm{T}/\mathrm{mn}$

TAC_r the annual total relevant cost of the retailer

3. MODEL FORMULATION

In order not to allow any shortage, the production rate P is assumed to be higher than the time dependent demand rate of the product through the parameter k (k>1, P=kD). Given that in each ordering cycle, the manufacturer delivers n shipments to the distributor and each shipment having Q_d units of products; the manufacturer uses a policy of producing nQ_d units with time dependent production rate in time T_1 shown in Fig. 1(a) and 1(b).

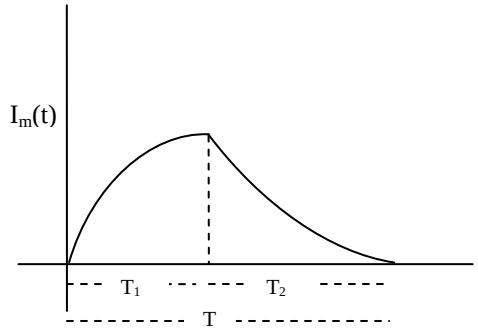

Fig. 1 (a) Manufacturer inventory level with respect to time

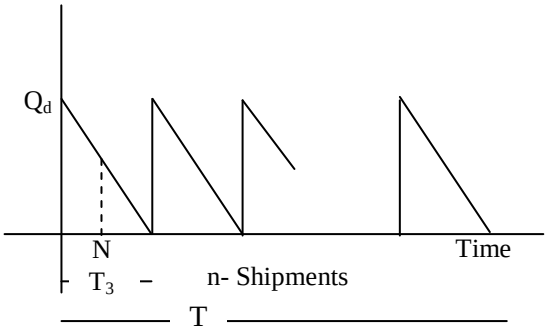

Fig. 1(b), for Distributor

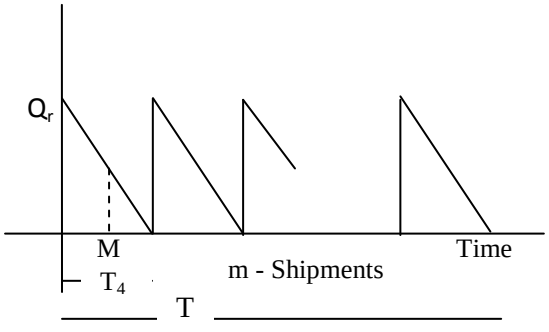

Fig. 1(c), for Retailers

Distributor again splits the quantity Q_d into m shipments and delivers Q_r units of the products to the m retailers in each shipment. So the inventory of the distribution centre resembles a step function, each step having the height of quantity Q_r (Q_d /m) shown in Fig. 1(c).

3.1 Manufacturer's model

A variable production rate starts at t=0 and continuous up to t= T_1 where inventory level reaches the maximum level. Production then stops at t= T_1 and the inventory gradually depletes to zero at the end of cycle time t=T due to consumption as shown in Fig. 1(a). Therefore, during the time interval (0 T_1), the system is subject to the effect of production and demand and the time interval (0 T_2), the system is subject to the effect of demand only. Then the change in inventory level can be described by the following differential equation

$$\frac{dI_{m1}(t)}{dt} = (k-1)(a+bt) \qquad \text{where} \quad 0 \le t \le T_1$$

And $$\frac{dI_{m2}(t)}{dt} = -(a+bt) \qquad \text{where} \quad 0 \le t \le T_2$$

with conditions $I_{m1}(0) = 0$ and $I_{m2}(T_2) = 0$ Solutions of above eq. are

$$I_{m1}(t) = (k-1)\left(at + \frac{1}{2}bt^2\right) \qquad \text{where} \quad 0 \le t \le T_1$$

and $I_{m2}(t) = a(T_2 - t) + \frac{1}{2}b\left(T_2^2 - t^2\right)$ where $0 \le t \le T_2$

In addition, from the boundary condition $I_{m1}(T_1) = I_{m2}(0)$, we can derive the following equation;

$$(k-1)\left(aT_1 + \frac{1}{2}bT_1^2\right) = aT_2 + \frac{1}{2}bT_2^2 \qquad \text{..... (1)}$$

The individual costs are now evaluated before they are grouped together

1. Annual set-up cost (SC_m) = A_m/T
2. Annual transportation cost (TC_m) = $\tau_m.n/T$
3. Annual stockholding cost (HC_m)

$$= \frac{h_m}{T}\left[\int_0^{T_1} I_{m1}(t)\,dt + \int_0^{T2} I_{m2}(t)\,dt\right]$$

$$= \frac{h_m}{T}\left[(k-1)\left(\frac{1}{2}aT_1^2 + \frac{1}{6}bT_1^3\right) + \left(\frac{1}{2}aT_2^2 + \frac{1}{6}bT_2^3\right)\right]$$

4. Opportunity interest loss per unit time in n shipments

$$\mathrm{IL_m} = \frac{I_m.S_m.n}{T}\int_0^N D(t)\,dt = \frac{I_m.S_m.n}{T}\left(aN + \frac{1}{2}bN^2\right)$$

The annual total relevant cost of the manufacturer

$TAC_m = SC_m + TC_m + HC_m + IL_m$ ……. (2)

Determination of the values of T_1 and T_2

In this section, we shall determine the values of T_1 and T_2

Solving eq. (1) and $T_1 + T_2 = T$, we find

$$T_1 = \frac{-(bT + ka) + \sqrt{(k-1)b^2T^2 + 4(k-1)abT + k^2a^2}}{(k-2)b}$$

……. (3)

$$T_2 = \frac{\left[(k-1)bT + ka\right] + \sqrt{(k-1)b^2T^2 + 4(k-1)abT + k^2a^2}}{(k-2)b}$$

Where k >2 …… (4)

Because if k=1 that is, production and demand rate are same, there is no accumulation and stock will finish at the end of T_1. It means T_2 = 0. If k=2, the values of T_1 and T_2 are undetermined (0/0 form), that is two time production rate of the demand rate is not possible in this situation with this rate

(a+bt). Therefore all discussion will be done for the value of k>2.

Lemma 1. For positive value of T_1 and T_2

Let us suppose that $T_1 > 0$ then

$$\frac{-(bT+ka)+\sqrt{(k-1)b^2T^2+4(k-1)abT+k^2a^2}}{(k-2)b}>0$$

$$\sqrt{(k-1)b^2T^2+4(k-1)abT+k^2a^2}>(bT+ka)$$

$$(k-1)b^2T^2+4(k-1)abT+k^2a^2>b^2T^2+k^2a^2+2kabT$$

$$(k-2)b^2T^2+2(k-2)abT>0$$ [k > 2, so (k-2) is a positive number]

$bT(bT+2a)>0$ [If l.m > 0, then either both positive or both negative]

Here according to the assumptions a, b, k and T all are positive, then

$(bT+2a)>0$ is true. Therefore T_1 is a positive number.

And same way we can show that T_2 is also a positive number.

3.2 Distributor's model

The level of inventory $I_d(t)$ gradually decreases to meet demands to retailers. It is shown in Fig.1(b). Hence the variation of inventory with respect to time t can be described by the following differential equations;

$$\frac{dI_d(t)}{dt}=-(a+bt) \quad \text{where} \quad 0\le t\le T_3 \quad \text{and} \quad I_d(T_3)=0,$$

consequently solution is given by

$$I_d(t)=a(T_3-t)+\frac{1}{2}b(T_3^2-t^2) \quad \text{where} \quad 0\le t\le T_3 \quad \text{and}$$

$T_3=T/n$ and the order quantity is

$$Q_d=I_d(0)=aT_3+\frac{1}{2}bT_3^2 \qquad \ldots\ldots (5)$$

The individual costs are now evaluated before they are grouped together

1. Annual ordering cost (OC_d) = nA_d/T
2. Annual stockholding cost (excluding interest charges)

$$HC_d = \frac{n.h_d}{T}\int_0^{T_3} I_d(t)\,dt = \frac{n.h_d}{T}\left(\frac{1}{2}aT_3^2+\frac{1}{6}bT_3^3\right)$$

3. The distributor incurs two annual shipment cost element, one for receiving shipments from manufacturer and the other for delivering shipments to the retailers

   The shipment cost for receiving (TC_{d1}) = $\tau_{d1}.n/T$
   The shipment cost for delivering (TC_{d2}) = $\tau_{d2}.mn/T$

4. Opportunity interest loss per unit time in mn shipments

$$IL_d=\frac{I_o.S_d.\mathrm{mn}}{T}\int_0^{M} D(t)\,dt=\frac{I_o.S_d.\mathrm{mn}}{T}\left(aM+\frac{1}{2}bM^2\right)$$

5. Regarding interest earned and payable, we have following two possible cases based on the value of T_3 and N

Case-I when $N \le T_3$

i. Interest earned per year in n shipments

$$IE_{d1}=\frac{n.I_e.S_d}{T}\int_0^{T_3}(T_3-t)D(t)\,dt=\frac{n.I_e.S_d}{T}\left(\frac{1}{2}aT_3^2+\frac{1}{6}bT_3^3\right)$$

ii. Interest payable per year in n shipments

$$IP_{d1}=\frac{n.I_p.S_m}{T}\int_N^{T_3} I_d(t)\,dt$$

$$=\frac{n.I_p.S_m}{T}\left[\frac{1}{2}a(T_3-N)^2+\frac{1}{6}b(2T_3^3-3T_3^2N+N^3)\right]$$

Case-II when $N \ge T_3$

i. Interest earned per year in n shipments

$$IE_{d2}=\frac{n.I_e.S_d}{T}\left[\int_0^{T_3}(T_3-t)D(t)\,dt+(N-T_3)\int_0^{T_3}D(t)\,dt\right]$$

$$=\frac{n.I_e.S_d}{T}\left[N\left(aT_3+\frac{1}{2}bT_3^2\right)-\left(\frac{1}{2}aT_3^2+\frac{1}{3}bT_3^3\right)\right]$$

In this case, no interest charges are paid for the items kept in stock, i.e. $IP_{d2}=0$

Therefore, the annual total relevant cost of the distributor is

$$TAC_d=\begin{cases}TAC_{d1} & if \quad N\le T_3\\ TAC_{d2} & if \quad N\ge T_3\end{cases} \quad \text{where} \qquad \ldots\ldots\ldots (6)$$

$TAC_{d1} = OC_d + HC_d + TC_{d1} + TC_{d2} + IL_d + IP_{d1} - IE_{d1}$ … (7)

$TAC_{d2} = OC_d + HC_d + TC_{d1} + TC_{d2} + IL_d + IP_{d2} - IE_{d2}$ … (8)

3.3 Retailer's model

The level of inventory $I_r(t)$ gradually decreases to meet demands to customers. It is shown in Fig.1(c). Hence the variation of inventory with respect to time t can be described by the following differential equations

$$\frac{dI_r(t)}{dt}=-(a+bt) \quad \text{where} \quad 0\le t\le T_4 \quad \text{and} \quad I_r(T_4)=0,$$

consequently solution is given by

$$I_r(t)=a(T_4-t)+\frac{1}{2}b(T_4^2-t^2) \quad \text{where} \quad 0\le t\le T_4 \quad ,$$

$T_4=T_3/\mathrm{m}$ and $T_4=T/\mathrm{m}n$ and the order quantity is

$$Q_r=I_r(0)=aT_4+\frac{1}{2}bT_4^2 \qquad \ldots\ldots\ldots (9)$$

The individual costs are now evaluated before they are grouped together

1. Annual ordering cost (OC_r) = mnA_r/T
2. Annual stockholding cost (excluding interest charges)

$$HC_r=\frac{mn.h_r}{T}\int_0^{T_4} I_r(t)\,dt=\frac{mn.h_r}{T}\left(\frac{1}{2}aT_4^2+\frac{1}{6}bT_4^3\right)$$

3. The transportation cost for receiving shipments from distributor $TC_r = \tau_r\, mn/T$
4. Regarding interest earned and payable, we have following three cases based on the values of Q_r, w, M and T_4.

Case-1 when $Q_r < w$

According to assumption, the trade credit is not permitted. The retailer must pay $S_d.Q_r$ when the order is received. Therefore,

(i) In this case, no earned interest, i. e., $IE_{r1}=0$

(ii) Interest payable for the items kept in stock per year in mn shipments

$$IP_{r1} = \frac{mn.I_p.S_d}{T}\int_0^{T_4} t.\mathrm{D}(t)\,dt = \frac{mn.I_p.S_d}{T}\left(\frac{1}{2}aT_4^2 + \frac{1}{3}bT_4^3\right)$$

Case-2 when $Q_r > w$, the fixed credit period M is permitted. Therefore two cases arise

Case-2.1 when $M < T_4$

(i) Interest earned per year in mn shipments

$$IE_{r2} = \frac{mn.I_e.S_r}{T}\int_0^{T_4} t.\mathrm{D}(t)\,dt = \frac{mn.I_p.S_r}{T}\left(\frac{1}{2}aT_4^2 + \frac{1}{3}bT_4^3\right)$$

(ii) Interest payable per year in mn shipments

$$IP_{r2} = \frac{mn.I_p.S_d}{T}\int_M^{T_4} t.\mathrm{D}(t)\,dt$$
$$= \frac{mn.I_p.S_d}{T}\left(\frac{1}{2}a\left(T_4^2 - M^2\right) + \frac{1}{3}b\left(T_4^3 - M^3\right)\right)$$

Case-2.2 when $M \geq T_4$

(i) Interest earned per year in mn shipments

$$IE_{r3} = \frac{mn.I_e.S_r}{T}\left[\int_0^{T_4}(T_4 - t).D(t)\,dt + (M - T_4)\int_0^{T_4} D(t)\,dt\right]$$
$$= \frac{mn.I_e.S_r}{T}\left[M\left(aT_4 + \frac{1}{2}bT_4^2\right) - \left(\frac{1}{2}aT_4^2 + \frac{1}{3}bT_4^3\right)\right]$$

(ii) In this case, no interest charges are paid for the items kept in stock. i. e. $IP_{r3} = 0$

Therefore, the annual total relevant cost of the retailers is

$$TAC_r = \begin{cases} TAC_{r1} & if \quad Q_r < w \\ & when Q_r > w \\ TAC_{r2} & if \quad M < T_4 \\ TAC_{r3} & if \quad M \geq T_4 \end{cases}$$ Where ……. (10)

$TAC_{r1} = OC_r + HC_r + TC_r + IP_{r1} - IE_{r1}$ ……. (11)

$TAC_{r2} = OC_r + HC_r + TC_r + IP_{r2} - IE_{r2}$ ……. (12)

And

$TAC_{r3} = OC_r + HC_r + TC_r + IP_{r3} - IE_{r3}$ ……. (13)

Finally, the annual total cost of the entire supply chain *TCS* is composed of the manufacturer's annual cost TAC_m, the distributor's annual cost TAC_d and retailer's annual cost TAC_r. It is important to note that having cycle time T and permissible delay periods N and M incur different annual cost to the distributor and retailer. Hence, the annual total relevant cost of the entire system will also be different for different cases

Case-I when $N \leq T_3$

The annual total cost of the system can be written as

$$TCS^{\alpha} = \begin{cases} TCS_1 & if \quad Q_r < w \quad (a) \\ & when Q_r > w \\ TCS_2 & if \quad M < T_4 \quad (b) \\ TCS_3 & if \quad M \geq T_4 \quad (c) \end{cases}$$ …… (14)

Where

$TCS_1 = TAC_m + TAC_{d1} + TAC_{r1}$

$TCS_2 = TAC_m + TAC_{d1} + TAC_{r2}$ and

$TCS_3 = TAC_m + TAC_{d1} + TAC_{r3}$

Case-II when $N \geq T_3$

$$TCS^{\beta} = \begin{cases} TCS_4 & if \quad Q_r < w \quad (a) \\ & when Q_r > w \\ TCS_5 & if \quad M < T_4 \quad (b) \\ TCS_6 & if \quad M \geq T_4 \quad (c) \end{cases}$$ …… (15)

Where

$TCS_4 = TAC_m + TAC_{d2} + TAC_{r1}$,

$TCS_5 = TAC_m + TAC_{d2} + TAC_{r2}$ and

$TCS_6 = TAC_m + TAC_{d2} + TAC_{r3}$

This study develops an integrated production-inventory model with a certain permissible delay in payment for distributor and retailers. An approximate models with a single manufacturer a single distributor and a single retailer is developed to derive the optimal production policy and lot size. Since T_4=T/mn, T_3=T/n and the values of T_1 and T_2 are from eq. (3) and (4), the problem can stated as an optimization problem and it can be formulated as

Minimize: TCS (m, n, T) = $TAC_m + TAC_d + TAC_r$ ..... (16)

Subject: $0 \leq T, 0 \leq m, 0 \leq n$ ..... (17)

4. SOLUTION PROCEDURE

The optimization technique is used to minimize (16) to derive T as follow;

Step1. Since the number of delivery per order m and n are an integer value, start by choosing an integer value of m, $n \geq 1$

Step2. Take the derivative of TCS (m, n, T) with respect to T and equate the result to zero.

$TCS^{I}(\mathrm{m,n},T) = 0$ and solving for T

Step3. Find those values of T from step 2 for that $TCS^{II}(\mathrm{m,n},T) > 0$

Step4. Using these values of T in eq. (16) and find the minimum value of TCS

Step5. Repeat steps 2 and 3 for all possible values of m, n until the minimum TCS (m^*, n^*, T^*) is found. The TCS (m^*, n^*, T^*) values constitute the optimal solution that satisfy the condition mentioned in step 3.

Step6. Derive the T_1^*, T_2^*, T_3^*, T_4^*, Q_m^*, Q_d^*, Q_r^*, TAC_m^*, TAC_d^*, TAC_r^* .

5. NUMERICAL EXAMPLES

Optimal production and replenishment policy to minimize the total system cost may be obtained by using the methodology proposed in the proceeding section. The following numerical examples are illustrated the model. The values of parameters adopted in this study are $A_m = 500,\ A_d = 300,\ A_r = 100,\ \tau_m = 300,\ \tau_{d1} = 70,\ \tau_{d2} = 150,\ \tau_r = 50,\ I_e = 0.2,\ I_p = 0.3,\ I_m = 0.1,\ I_o = 0.15, s_m = 8, s_d = 10, s_r = 12, h_m = 2,\ h_d = 3, h_r = 5, a = 10, b = 5,\ k = 3, M = 2,\ N = 3$. The computational results are shown below as

For $n = 2,\ m = 3\ and\ w = 25$

Using eq. 14 (a) we found the value of $T = 9.02$ then $T_1 = 3.6,\quad T_2 = 5.4,\quad T_3 = 4.5\quad T_4 = 1.5,$ $Q_r = 20$ and the optimal value of the total system cost $TCS = \$659$. We can see that the results we have found from this analysis satisfied conditions $N \leq T_3\ and\ Q_r < w$, i. e. There is no permissible delay to the retailer.

For $n = 1,\ m = 2\ and\ w = 25$

Using eq. 14 (b) we found the value of $T = 4.70$ then $T_1 = 1.88,\quad T_2 = 2.82,\ T_3 = 4.70\ T_4 = 2.35,$ $Q_r = 37$ and the optimal value of the total system cost $TCS = \$565$. We can see that the results we have found from this analysis satisfied conditions $Q_r > w,\ N \leq T_3\ and\ M \leq T_4$

For $n = 1,\ m = 3\ and\ w = 25$

Using eq. 14 (c) we found the value of $T = 5.40$ then $T_1 = 2.16,\quad T_2 = 3.24,\ T_3 = 5.40\ T_4 = 1.8,$ $Q_r = 28$ and the optimal value of the total system cost $TCS = \$586$. We can see that the results we have found from this analysis satisfied conditions $Q_r > w,\ N \leq T_3\ and\ M \geq T_4$

For $n = 3,\ m = 1\ and\ w = 30$

Using eq. 15 (a) we found the value of $T = 7.7$ then $T_1 = 3.08,\quad T_2 = 4.62,\ T_3 = 2.8\ T_4 = 2.8,$ $Q_r = 25$ and the optimal value of the total system cost $TCS = \$712$. We can see that the results we have found from this analysis satisfied conditions $N \geq T_3\ and\ Q_r < w$, i. e. There is no permissible delay to the retailer.

For $n = 4,\ m = 2\ and\ w = 30$

Using eq. 15 (b) we found the value of $T = 11.6$ then $T_1 = 4.64,\quad T_2 = 6.96,\ T_3 = 2.9\ T_4 = 1.45,$ $Q_r = 40$ and the optimal value of the total system cost $TCS = \$682$. We can see that the results we have found from this analysis satisfied conditions $Q_r > w,\ N \leq T_3\ and\ M \leq T_4$

For $n = 4,\ m = 1\ and\ w = 30$

Using eq. 15 (c) we found the value of $T = 10.22$ then $T_1 = 4.08,\quad T_2 = 6.13,\ T_3 = 2.5\ T_4 = 2.5,$ $Q_r = 42$ and the optimal value of the total system cost $TCS = \$664$. We can see that the results we have found from this analysis satisfied conditions $Q_r > w,\ N \leq T_3\ and\ M \geq T_4$

6. CONCLUSION

Using various methods to reduce costs has become the major focus for supply chain management. In order to decrease the joint total cost, the manufacturer, distributor and retailer are willing to invest in reducing the different costs. This paper develops the integrated manufacturer-distributor-retailer models with different type of permissible delays in payments (manufacturer offers distributor and distributor provides order linked trade credit to the retailer) to determine the optimal replenishment time interval and replenishment frequency to reduce the total system costs to the all. We have provided an example, discussed all the cases and found the results that satisfied all the required conditions. We have used some realistic costs like transportation cost and cost for opportunity interest loss due to permissible delay. The proposed model can be extended in several ways. For example, we may generalize the model to allow for imperfect production process and deteriorating items.

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AUTHENTICATE SYSTEM OBJECTS USING ACCESS CONTROL POLICY BASED MANAGEMENT

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Abstract: The network level access control policy is based on policy rule. The policy rule is a basic building of a policy based system. Each policy contains set of conditions and actions. Here conditions are evaluated to determine whether the actions are performed. The existing work is based on packet filtering scenario. Here every policy can be translated into canonical form. That uses the "First Matching Rule" resolution strategy. The access control matrix is proposed to translate the policy. The Generalized Aryabhata Reminder Theorem (GART) is used for to construct the access control matrix. In this access control matrix rows represent users and columns represent files. In which each user is associated with key and each digital file is associated with lock.

Keywords: Policy Algebra Framework; Ubiquitous Enforcement Mechanism; Policy Administration; Policy Matching; Algebraic Framework; Policy Composition and Delegation.

1. INTRODUCTION

The term 'network' is frequently used to describe clusters of different kinds of actor who are linked together in political, social or economic life. Networks may be loosely structured but still capable of spreading information or engaging in collective action. Security in computer systems is based on protecting resources from unauthorized access before that we have to ensure that whether all given requests can be satisfied all the time. The growth of computer systems, both in scale and complexity, so management of the system is very difficult. These systems are often interconnected and form a distributed environment with a large number of devices and users, vast amounts of data and resources, and a variety of applications, protocols, and mechanisms. Policy-based systems management is a very useful for this scenario.

Access Control is any mechanism by which a system grants or revokes the right to access some data, or perform some action. Normally, a user must first login to a system, using some authentication system. Next, the Access Control mechanism controls what operations the user may or may not make by comparing the User ID to an Access Control database. Access Control systems include:

- File permissions, such as create, read, edit or delete on a file server.
- Program permissions, such as the right to execute a program on an application server.
- Data rights, such as the right to retrieve or update information in a database.

A General policy definition adopted in [1] considers policies as rules governing the behavior choices of a system. The policy-driven approach facilitates the dynamic change of behavior of the distributed management system, while avoiding the burden of recoding system functionality upon changes.

1.1 Problem Description

A very important aspect for any policy-based systems management is to protect managed data and resources against unauthorized access, while ensuring their availability to legitimate users. This process is called access control [2]. Access control is a crucial aspect of a system's security, and provides the basis for all the other mechanisms and procedures the system may utilize.

The development of any access control system requires the following two concepts: an access control policy that defines high-level rules according to which access control must be regulated, and an enforcement mechanism that implements the controls imposed by the policy using software and/or hardware solutions.

Given the large number of system elements managed in a distributed environment, the access control mechanism employed must be scalable. The traditional way of dealing with scalability at the human level has been decentralization of management and delegation of authority. Thus it is impossible to maintain a central policy agent for managing all the system devices, which implies the need for integrating and analyzing policies issued by multiple policy authors to ensure that they are always consistent and compliant with the global security requirements.

The goal of policy refinement is to generate low-level rules such that their syntax and semantics can be interpreted by the chosen enforcement mechanism. Given a large number of system elements managed in a distributed scenario, it is efficient and scalable to issue global service and security requirements in terms of high-level policies rather than mechanism rules. On the other hand, these high-level requirements are mostly specified by policy makers without an intimate knowledge of the underlying system.

1.2 Network Access Control

Network access control is concerned with regulating access to protected resource in a communications network that complies with defined security policies. Generally network access control deals with two levels of protection [3]:

- *Host-based security* protects the safety of a single host that is connected to a network. Where hosts within the same administrative zone tend to trust each other such that one weak link can compromise the whole cluster of systems.
- *Perimeter security* protects a cluster of hosts using two components: a layer of defense built up around the

cluster, called the wall, and the gate that allows legitimate traffic to pass through while blocking malicious one. This approach often assumes every host behind the wall is trusted.

Generally a network access control solution unifies a number of mechanisms [4] including, but not limited to, the following techniques

- Endpoint security techniques such as antivirus software to prevent, detect and remove malware such as computer virus, worms, Torjan horses, etc.; host-based intrusion detection and prevention systems that monitor system activities to report malicious behavior and policy violation.
- User or system authentication methods such as passwords (something you know), secure devices (something you own), and biometric (something you have)
- Network security enforcement such as firewalls to protect local system from network-based threat through traffic filtering, IPsec protocols to provide end-to-end or end-to gateway encryption and authentication, etc.

Moreover, there is a growing trend of enforcing access control based on the end-to-end design principle in distributed systems, similar to the IP structure in the communications network. This approach implements access control in a distributed manner by removing potential performance bottleneck to corporate rapidly growing networks, and hence yields better scalability.

1.3 Hypothesis

A policy mechanism containing the following essential elements will provide a more flexible, more efficient, and more secure access control solution [5] for distributed systems,

1. A *distributed policy refinement scheme* automating the translation from high-level security and service requirements into low-level implementable rules as inputs to the enforcement mechanism;

2. A *policy algebra framework* providing a formalism for policy delegation, composition, and analysis in distributed networks, and defining mechanisms to reason about policy languages;

3. A *ubiquitous enforcement mechanism* implementing policy delegation, whose correctness and consistency can be verified using the policy algebra.

The process of authorization is guided by access control policies, and these two terms are often used interchangeably in the context of security policy management. While authorization is concerned with specifying permissions and prohibitions, obligations (or refrain policies) specify management actions that must or must not be performed.

2 POLICY BASED MANAGEMENT

Figure 1.1 depicts the logic flow of policies in the policy based management system. A policy is the combination of rules and services where rules define the criteria for resource access and usage.

Block Diagram:

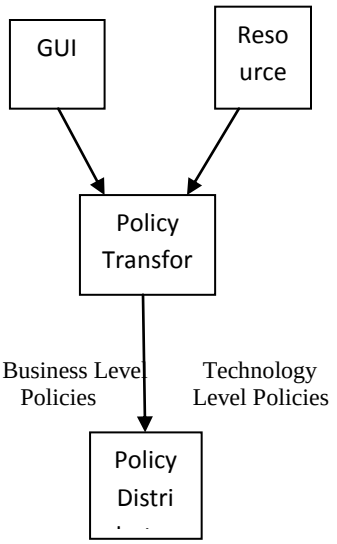

Figure 1.1 A generic policy management tool

A policy is formally defined as an aggregation of policy rules. Each policy rule is composed of a set of conditions and a corresponding set of actions. The condition defines when the policy rule is applicable. Once a policy rule is activated, one or more actions contained by that policy rule may be executed. These actions are associated with either meeting or not meeting the set of conditions specified in the policy rule.

Policy-based systems have become a promising solution for implementing many forms of large-scale, adaptive systems that dynamically change their behavior in response to changes in the environment or to changing application requirements. This can be achieved by modifying the policy rules interpreted by distributed entities, without recoding or stopping the system. Such dynamic adaptability is fundamentally important in the management of increasingly complex computing systems.

Policy-based management (PBM) is a management paradigm that separates the rules governing the behavior of a system from its functionality. It promises to reduce maintenance costs of information and communication systems while improving flexibility and runtime adaptability.

The policy-based technology could relieve the suffering of managing the large computer systems and free the manager from monitoring the equipments and systems directly and supply a systematic method for establishing, revising, and distributing policies. Policy is a kind of criterion that aims at determining the choice of the actions in an individual system. The criterion is long-lasting, illustrative, and originated from the target of the management.

2.1 Policy Specification

To configure access control mechanisms, a number of specification languages have been defined that assist users to specify policies. The Chinese wall policy combines commercial discretion with legally enforceable mandatory controls. Unlike Bell-La Padula like policies, a user's permitted accesses are constrained by the history of his previous accesses. Several attempts have been made towards a single policy framework, which is able to investigate and enforce multiple security policies. Use logic-languages for the specification of authorizations for distributed systems [6]. Their proposal abstracts from low level

authorization triples and adopts a high level specification language to achieve the need of expressiveness and flexibility.

2.2 Policy Composition and Analysis

Policy composition facilitates the sharing of protected data and resources among multiple parties in a controlled way [7]. It allows policies specified by more than one policy authors to be integrated to verify their compliance with the global requirements.

The algebra provided various type of operators for composing and restricting enterprise privacy policies like conjunction, disjunction and scoping together with its formal semantics. Security policies as access right matrices in terms of principals, typed objects and rights [8]. They define operations like Add, Or and Minus for combining and changing security policies.

- *Dominance check*: The effect of adding one policy to a group of existing ones. Policy A is dominated by policy group G if the adding of A does not affect the behavior of the system governed by G. Thus it helps to detect redundancy at the semantic level.
- *Coverage check*: Whether the specified policies have covered a certain range of input parameters.
- *Conflict check:* Detects conflict between two policies when they cannot be satisfied simultaneously.
- *Consistent priority assignment:* prioritizes policies by assigning an integer value to each policy. It is considered the primary method of resolving conflicts.

Among these tasks for policy analysis, lots of effort has been devoted to studying conflict detection and resolution techniques [9]. Proposed a logical language for the specification of authorizations. This language allows users to specify different kinds of security requirements, according to which access control decisions are to be made [10].

The logic representation also helps to perform conflict resolution and constraint checking. [11] reviews conflicts that may arise in a large-scale distributed system with role based management. Since management policies are specified in terms of domains, conflicts arise when there are overlapping between domains. Application specific conflicts can be resolved using meta-policies. [12] proposed a set of techniques to automatically discover policy anomalies and conflicts in centralized and distributed firewalls. Policy tree and state diagrams can be constructed to discover intra-firewall/inter-firewall anomalies and to determine the proper rule placement and ordering.

2.3 Policy Refinement

In policy-based security management, high-level security requirements need to be translated to low level rules, for which the syntax and semantics can be interpreted and implemented by individual enforcement points in order to make an appropriate and consistent decision upon receiving an access request. This process is often referred to policy refinement that remains one of the most ambitious goals in policy-based system management [13]. It fills the gap between policy specification and enforcement.

{Subject} can (or cannot) perform {Action} on {Target} if {Condition}.

It states that the subject is allowed or prohibited to perform an action on the target if certain condition is satisfied. Depending on the specific enforcement mechanism, subject (target) can be a simple identifier, a domain scope expression, a public key, etc [14]. The specified action field can be a high-level goal or a low-level operation, which emphasizes the needs for translating high-level policies into low-level mechanism rules for enforcement.

Existing work on policy composition focuses on the integration of policies using algebraic operations to produce compound rules. However, policy algebra goes beyond the semantic level when tied with policy distribution and enforcement. It allows policies to be rearranged in the network [15] and studies the enforcement effect of compound policies using algebraic operations.

Sometimes, policy analysis tasks cannot be applied directly to high-level policies as they carry less-detailed domain knowledge of the managed system. Therefore policy analysis must be interwoven with policy refinement to achieve desired results.

3 AN ALGEBRAIC FRAMEWORK FOR POLICY COMPOSITION AND DELEGATION

Security policy research largely focuses on the specification and management of access control requirements. The questions of how to understand the interactions between access control policies and how to enforce consistency in a policy-based system have not yet been adequately investigated. Moreover, existing policy composition and analysis solutions are mostly concerned with merging individual policy authors' security requirements in a controlled way. However, policy integration has another important but often neglected implication - that is to enable enforcement delegation in heterogeneous environments, where each device may incur different expense in terms of cost and risk for enforcing the same security policy.

Therefore, proposed an algebraic framework for policy composition, analysis and delegation, the first step towards a distributed policy management solution. Algebra defines mechanisms to reason about policy languages. It takes sets of policy rules as input and output, manipulates them, move them around, and combine them to understand the semantics of the policy language.

4 . SYSTEM OVERVIEW

A security policy consists of a set of information classes and constraints on flow of information. The constraints are specified by a specific type of logic called branching time temporal logic. A security policy is specified as a specific case of a regulation. The system to be regulated consists of agents which can execute actions on some objects. Each role is associated with a set of norms (permissions, obligations and prohibitions). An agent can play one or more roles. In this approach, regulation is specified using a logic based on SDL (Standard Deontic Logic). LaSCO (the Language for Security Constraints on Objects) is a language for specifying policy as a directed graph. The semantics of the language was represented by a first ordered logic.

A.ON{Event}IF{Condition}THEN {Action}

As it is well known, its semantics is as follows: if the event arises and the condition evaluates to true, the specified action is executed. In context, an event is the detection of an anomaly by the detection engine. A condition is specified on the attributes of the detected anomaly.

B. Anomaly Attributes

The anomaly detection mechanism provides its assessment of the anomaly using the anomaly attributes. Here identified two main categories for such attributes. The first category, referred to as contextual category, includes all attributes describing the context of the anomalous request such as user, role, source, and time. The second category, referred to as structural category, includes all attributes conveying information about the structure of the anomalous request.

C. Response Actions

Once a database request has been flagged off as anomalous, an action is executed by the response system to address the anomaly. A tainted request is simply marked as a potential suspicious request resulting in further monitoring of the user and possibly in the suspension or dropping of subsequent requests by the same user.

D. Policy Administration

The main issue in the administration of response policies is how to protect a policy from malicious modifications made by a DBA that has legitimate access rights to the policy object.

E. Policy Matching

Algorithms for finding the set of policies matching an anomaly. Such search is executed by matching the attributes of the anomaly assessment with the conditions in the policies. Base Policy Matching, Ordered Policy Matching and Response Action Selection.

A rule is defined as a set of criteria and an action to perform when a packet matches the criteria. The criteria of a rule consist of the elements direction, protocol, source IP, source port, destination IP and destination port. Therefore a complete rule may be defined by the ordered tuple direction, protocol, source IP, source port, destination IP, destination port, action. Each attribute can be defined as a range of values, which can be represented and analyzed as sets.

5. CONCLUSION

The management of network infrastructure in an enterprise is a complex and daunting affair. The concept of policy based management has help the administrator to manage the user actions, with proven validity as an intuitive and scalable way for administrators to keep large information systems under control, ensuring the continuous enforcement of domain directives. Here check how building a dependability management framework on a policy based core has indeed achieved to leverage the potential of this paradigm, applying it to a novel field. The proposed framework allows using the same abstract approach inherent to policy based solutions for managing also use Encrypt List is used for to translate the policies.

As future work, some extensions remain to be taken into account which would improve this framework considerably. The current configuration policies that govern the system should be extended to include also setting up in a similar manner the modules belonging to the framework; for example, the collection of sensors needed for a concrete operational plan, indicating the configuration for each of them. The history based approach is also use for to identify the anomalies in the given rule set.

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An Adaptive Energy Aware Clustering Based Reliable Routing for in-Network Aggregation in Wireless Sensor Network

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Abstract: Wireless Sensor Network (WSN) consists of spatially distributed autonomous devices that cooperatively sense physical or environmental conditions. Due to the non-uniform node deployment, the energy consumption among nodes are more imbalanced in cluster-based wireless sensor networks this factor will affect the network life time. Cluster-based routing and EADC algorithm through an efficient energy aware clustering algorithm is employed to avoid imbalance network distribution. Our proposed protocol EADC aims at minimizing the overall network overhead and energy expenditure associated with the multi hop data retrieval process while also ensuring balanced energy consumption among SNs and prolonged network life time .A optimal one-hop based selective node in building cluster structures consisted of member nodes that route their measured data to their assigned cluster head is identified to ensure efficient communication. The proposed routing algorithm increases forwarding tasks of the nodes in scarcely covered areas by forcing cluster heads to choose nodes with higher energy and fewer member nodes and finally, achieves imbalanced among cluster head and improve the network life time.

Keywords: Cluster Head(CH),Sink,EADC

1. INTRODUCTION

Sensor nodes measure various parameters of the environment and transmit data collected to one or more sinks using hop-by-hop communication. The main goal of WSN is to collect useful information as much as possible in the monitoring area, which implies that energy efficiency and lifetime of networks are very important. In wireless sensor networks, sensor nodes are usually powered by batteries that cannot be replaced in most cases. As a result, the energy constraint has significant effect on the network design and makes energy efficiency a major design challenge. In order to achieve high energy efficiency and increase network lifetime, sensors are often hierarchically organized into clusters.

Typically, a clustering algorithm divides the network into subsets of nodes, called clusters, each with one serving as the as the cluster head. Within a cluster, each node has its own cluster head (CH) and transmits data to its CH over relatively short distance, which in turn forwards the data to the sink.

Cluster heads aggregate the data from their cluster members, and send the aggregated data to the sink. Communications between cluster heads and the BS is single-hop communication and multi-hop communication. In single-hop communication the data packets are directly send to the CH or BS without any relay node. So If any CH node will be die due to some power failure and data will be lost. To overcome this using multi-hop communication clustering algorithms, the energy consumption of cluster heads consists of the energy for receiving, aggregating and sending the data from their cluster members (intra-cluster energy consumption) and the energy for forwarding data for their neighbor cluster heads (inter-cluster energy consumption).

In previous method DRINA paper is used on the routing techniques in uniform node distribution in clustering based techniques. But this approach is not suitable in the non uniform node distribution and load balancing in sensor network. Imbalance in network traffic load has a negative effect on network lifetime since transmit and receive operations are not evenly spread among network nodes.

In this paper, we propose a cluster-based routing protocol for wireless sensor networks with non uniform node distribution whose cores are an energy-aware clustering algorithm EADC and a cluster-based routing algorithm. EADC constructs clusters of even sizes using competition range in order to balance the energy consumption among cluster members. To solve the imbalanced energy consumption among cluster heads caused by the non uniform node distribution, a cluster-based routing algorithm is used for balance the energy consumption among cluster heads by adjusting the intra-cluster and inter-cluster energy consumption of cluster heads. Therefore, it can achieve the balance of energy consumption among nodes and prolong the network lifetime.

2. RELATED WORK

Cluster routing is an energy efficient routing model as compared with direct routing and Multihop routing A new adaptive cluster routing algorithm CIDRSN (Cluster ID based Routing in Sensor Networks) Cluster routing is adopted in this research work. In this research work Cluster ID based routing is adopted and adaptive cluster size is proposed.

In this algorithm Cluster ID is used as next hop rather than CH-ID in routing table. In this way cluster formation process is eliminated for each round. Cluster formation is only carried out in start thus reduces the energy consumption and increases

the network lifetime to about 16% A maximum-Votes and Load-balance Clustering Algorithm (VLCA) was presented by (Zhang et al., 2008) to reduce the number of clusters and prolong network lifetime. To balance the workload among cluster-heads, this algorithm selects the cluster-head by considering the number of member nodes and the residual battery level. (Murthy et al., 2008) proposed a level controlled clustering to reduce the number of messages toward the base station and increase the network lifetime of WSN. This method assumes that the base station is able to transmit at various power levels. The cluster head selection method is also based on the maximum residual battery level.

PEACH (Power Efficient And Adaptive Clustering Hierarchy) is a cluster formation technique based on overheard information from the sensor nodes. According to this approach, if a cluster head node becomes an intermediate node of a transmission, it first sets the sink node as its next hop. Then it sets a timer to receive and aggregate multiple packets from the nodes in the cluster set for a pre-specified time. It checks whether the distance between this node and the original destination node is shorter than that between this node and the already selected next hop node. If the distance is shorter, this node joins to the cluster of the original destination node and the next hop of this node is changed to the original destination node. PEACH is an adaptive clustering approach for multi-hop inter-cluster communication. How-ever, it suffers from almost the same limitations of PEGASIS due to the choice of physical propinquity.

Clustering Network Topology Control the CNTCABRT algorithm follows the same clustering principle as the LEACH algorithm. Studies on the mechanism of wireless sensor network data transmission have revealed that sensor network data transmission improves with responsibility transmission. Thus, we pro- posed an algorithm that selects the cluster head through the strategy of accumulating evidence with responsibility. Briefly, the algorithm periodically divides the whole sensor network into several clusters, with each cycle referred to as a round. Each round involves cluster formation and data transmission. The algorithm exhibited good performance in controlling cluster head selection, cluster deployment, and cluster size.

All the algorithms mentioned above are all based on the assumption that all the nodes are uniformly distributed in the networks. In networks with non uniform node distribution, considering the network coverage problem, proposed some good cluster head election techniques. However, this paper focused on coverage preservation, while the energy consumption balance and network lifetime on the back burner. Considering the node distribution, the authors in proposed a hierarchical architecture of sensor network with cluster formation and cluster head selection algorithm. The authors used various parameter metrics related to node density and indicate the deployment density variation of nodes by the edge of link lengths standard deviations. In proposed an energy-aware distributed unequal clustering protocol (EADUC) in multi-hop heterogeneous wireless sensor networks to “energy hole” problem

3. NETWORK MODEL

A network system consists of static and battery-powered sensor nodes as well as one sink node. Sensor nodes are distributed randomly in a reliable environment and have the same physical capabilities. . The sink node is responsible for receiving the user query, propagating it through a like tree structure, and then collecting the results from the sensors. All the nodes and the BS are stationary after deployment. All the sensor nodes can be heterogeneous, but whose energy cannot be recharged. All the sensor nodes are location-unaware. All the nodes can use power control to vary the amount of transmit power. The BS is out of the sensor field. It has a sufficient energy resource and the location of the BS is known by each node. cluster heads to choose nodes with higher energy and fewer member nodes as their next hops, and finally, achieves load balance among cluster heads.

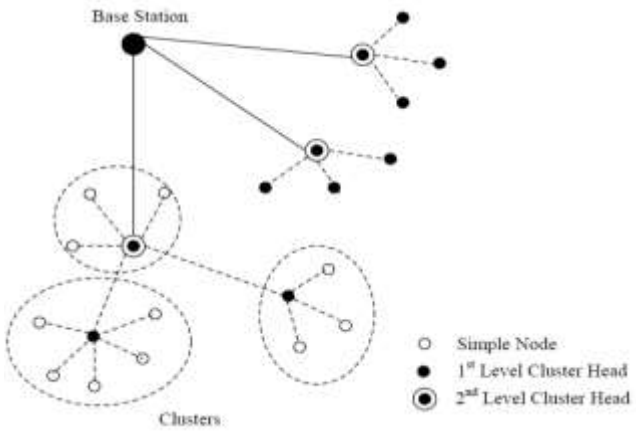

Fig 1:Network Model

3.1 Cluster based Routing Algorithm

This protocol contains an energy-aware clustering algorithm EADC and a cluster-based routing algorithm. In order to elect cluster heads with higher energy, the parameter of cluster head competition in EADC is based on the ratio between the average residual energy of neighbor nodes and the residual energy of the node itself. Moreover, cluster heads broadcast head messages using the same competition range to construct clusters of even sizes. Thus, the energy consumption among cluster members can be balanced well. However, the even cluster size also makes the energy consumption among cluster heads imbalanced, due to non uniform distribution of nodes. Cluster heads in dense areas have more members nodes, so they have high intra-cluster energy consumption. For this, we propose an inter-cluster energy-efficient multi-hop routing protocol, in which cluster heads select the neighbor cluster head with higher residual energy and a smaller number of cluster members as the next hop to balance the energy consumption among cluster heads.

4. EADC DETAILS

This process is similar to the cluster set-up phase in EADC proposed previously by us. The whole process is divided into three phases: information collection phase, whose duration is T1; cluster head competition phase, whose duration is T2; cluster formation phase, whose duration is T3.

4.1 Information collection phase

The duration of the phase is defined as T1, during which each node broadcasts a Node Msg with the following two values: one is the node id, and the other is the residual energy of this node within radio range r. At the same time, it receives the Node messages from its neighbor nodes, according to which, e each node si calculates the average residual energy.

4.2 Cluster Head Selection Phase

When T1 has expired, EADC begins the cluster head competition phase whose duration is T2. In this phase, if node si receives no Head Msg when timer ti expires, it broadcasts the Head Msg within radio range Rc to advertise that it will be a cluster head. Otherwise, it gives up the competition. The following pseudo-code gives the details of this phase.

```
Begin (cluster head competition algorithm)
   While (T2 has not expired) do
       If Current Time <  ti  do
          If receive Head Msg from a neighbor NT[ j] do
              Sate <- plain
              NT[ j ].state <- Head
     Else
         Continue
     End
     Else if state = Candidate do
             State <- Head
             Broadcast Head_Msg
     End
   End
End
```

4.3 Cluster Formation Phase

After T2 expires, the last phase of EADC is the cluster formation phase, we define the duration as T3. In this phase, each non-cluster head node chooses the nearest cluster head and sends the Join Message which contains the id and residual energy of this node. According to the received Join Messages, each cluster head creates a node schedule list including the Schedule Message for its cluster members, the Schedule Message is used for telling the cluster members when they can transmit their data to the cluster head and in other time interval they can alter their state to asleep to reduce the energy consumption. At this point, the entire process of EADC is completed. Each cluster is composed of the nodes in the Voronoi cell around the cluster head.

4.4 Routing Formation

The elected group leader, starts establishing the new route for the event dissemination. For that, the cluster head sends a route establishment message to its NextHop node. When the NextHop node receives a route establishment message, it retransmits the message to its NextHop and starts the hop tree updating process. These steps are repeated until either the sink is reached or a node that is part of an already established route is found. The routes are created by choosing the best neighbor at each hop. The choices for the best neighbor are twofold:

1) When the first event occurs, the node that leads to the shortest path to the sink is chosen and

2) After the occurrence of subsequent events, the best neighbor is the one that leads to the closest node that is already part of an established route .This process tends to increase the aggregation points, ensuring that they occur as close as possible to the events. The resulting route is a tree that connects the Coordinator nodes to the sink. When the route is established, the hop tree updating phase is started. The main goal of this phase is to update the HopToTree value of all nodes so they can take into consideration the newly established route. This is done by the new relay nodes that are part of an established route. These nodes send an HCM message (by means of a controlled flooding) for the hop updating. The whole cost of this process is the same of a flooding, i.e., each node will send only one packet.

4.5 Performance Analysis

The lifetime of a WSN can be quantified using the following three kinds of metrics: (1) the time from the deployment of the network to the death of the first node.

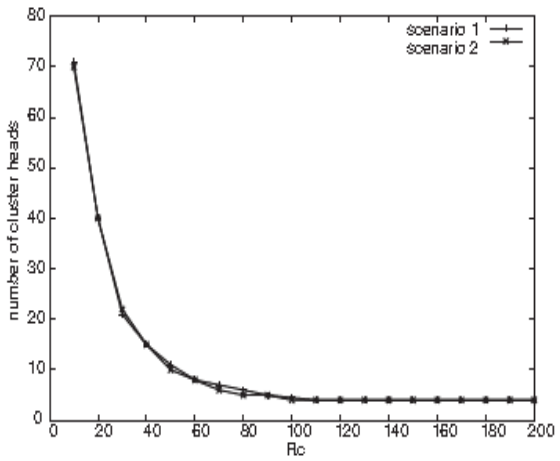

Fig.2 Number of cluster heads generated in each scenario.

(2) the time when a certain percent of nodes alive (3) the time when all the nodes are dead in the network. The network lifetime is defined as the time when 90 percent of nodes alive.

In Fig.2 it exhibits the number of cluster heads generated in each scenario. As shown in the figure, the two curves coincide roughly which means that the number of cluster generated in the two scenarios are approximately equal. The reason for this phenomenon is that Rc controls the coverage of cluster head, so that clusters have uniform cluster sizes. Therefore, the number of cluster heads is unaffected by the node distribution. In addition, the uniform cluster size ensures the balance energy consumption among cluster members.

In wireless sensor network, too many or too few of the cluster heads will cause energy waste, affecting the network lifetime fig.3 the number of cluster heads decreases when Rc increases.

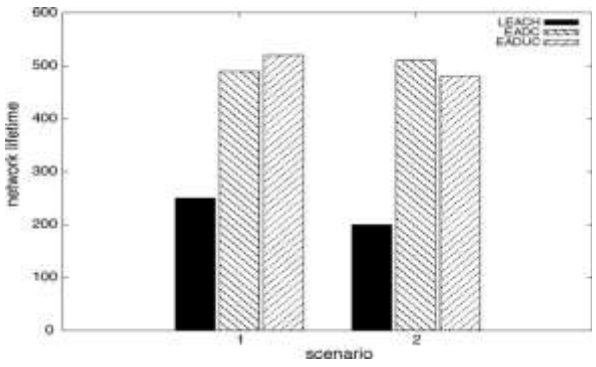

Fig.3 the number of cluster heads decreases when Rc increases.

Furthermore, the rates of decrease gradually slow down. Therefore, the network lifetime should increase gradually with the increase of Rc. In EADC performance is better than LEACH in prolonging network lifetime. The reason is that LEACH does not take into account the energy of nodes while choosing cluster heads.fig 4 increase the throughput of the system and EADC overcomes the imbalance energy consumption problem by introducing a cluster based intercluster routing protocol. EDAC can solve the non uniform distribution and heterogeneity of nodes well, and prolong the network lifetime significantly.

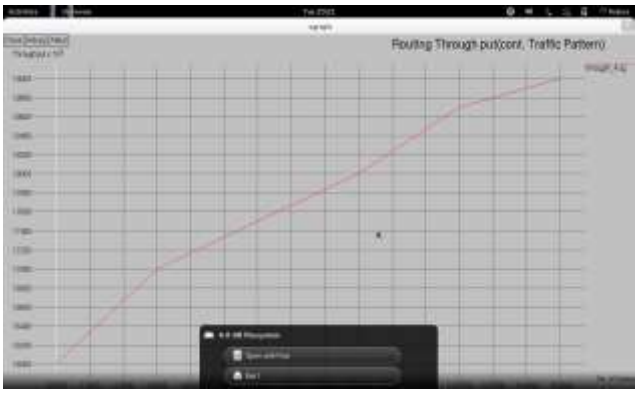

Fig. 4 Throughput Performance

From fig. 4 we can see that EADUC and EADC perform far between than LEACH in prolonging network lifetime. The reason is that LEACH does not take into account the energy of nodes while choosing cluster heads. In our system, the low energy nodes restrict the network lifetime, and the energy of high-energy nodes is wasted.

5. CONCLUSION

In this paper, we propose a cluster-based routing protocol for wireless sensor networks with non uniform node distribution which contains an energy-aware clustering algorithm and a cluster based routing algorithm. The clustering algorithm balances the energy consumption among cluster members by constructing equal clusters. Inevitably, the energy consumption among cluster heads is imbalance due to the non uniform node distribution. Therefore, we propose a cluster-based inter-cluster routing algorithm to balance the energy consumption among cluster heads by adjusting intra-cluster energy consumption and inter-cluster energy consumption. Each cluster head chooses a cluster head with higher residual energy and fewer cluster members as its next hop. The imbalanced energy consumption caused by non uniform node distribution is solved by increasing forwarding task of the cluster heads in sparse areas. By using the above mechanisms, our protocol can take advantage of the non uniform distribution and heterogeneity of nodes well, and prolong the network lifetime significantly.

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Survey on Efficient and Secure Anonymous Communication in Manets

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Abstract: Mobile ad-hoc networks require anonymous communications in order to thwart new wireless passive attacks; and to protect new assets of information such as nodes locations, motion patterns, network topology and traffic patterns in addition to conventional identity and message privacy. The transmitted routing messages and cached active routing entries leave plenty of opportunities for eavesdroppers. Anonymity and location privacy guarantees for the deployed ad hoc networks are critical in military and real time communication systems, otherwise the entire mission may be compromised. This poses challenging constraints on MANET routing and data forwarding. To address the new challenges, several anonymous routing schemes have been proposed recently.

Keywords: Mobile ad-hoc networks, Anonymity, Routing protocol, Geographic routing, Military communication Network Security.

1. INTRODUCTION

High Security and privacy in ad-hoc networks has been a major issue, while it comes in the field of defense and other such sensitive communications. Most of the communication system provides security in routing and data content. But a secure anonymous communication is not possible just by securing the routing map or data contents. Anonymous communications should focus on anonymity in identity, location and route of the participating nodes. The paper performs an extensive literature survey of various existing anonymous protocols in Manets

Anonymous communication between the Manet nodes are challenging as the nodes are free to move anywhere. No centralized node is there to monitor or to control the other nodes. Here the chance of attack from foreign/malicious nodes is high. Anonymous communication guarantees that no malicious nodes should identify (1) from where the communication starts (2) where it terminates (3) path of communication. Since mobile ad-hoc networks change their topology frequently and without prior notice, routing is a challenging task. Two approaches are used: Topology based and Position based routing. Topology based routing protocols use the information about the links that exist in the network to perform packet forwarding, while in Position based routing algorithms eliminate some of the limitations of topology based approach by using information about the physical position of the participating nodes. This approach doesn't require the establishment or maintenance of routes and nodes have neither to store routing tables nor to transmit messages to keep routing tables up-to-date.

2. LITERATURE SURVEY

Researchers are always being conducted to improve the security and efficiency of the anonymous routing algorithms. Focussing on the basic conditions for the anonymity, an extensive literature survey was made to analyse whether they are providing the anonymity in-

communication. Some of the innovative approaches to anonymity are described.

2.1 ANODR (Anonymous On demand Routing)

ANODR, one of the first anonymous routing schemes for mobile ad-hoc networks [1]. ANODR is a unicast anonymous MANET routing protocol. ANODR is identity i.e. it does not use the nodes' identities but it exploits a route pseudonymity approach to address the route untraceability problem. It uses a trapdoor boomerang onion encryption while forwarding route requests.

2.2 ASR (Anonymous Secure Routing)

The functionality of the ASR[2] protocol proposed by Zhu et al is essentially the same as that of ANODR. ASR makes no use of onion encryption as in ANODR that are built up as the Route request progresses through the network, but instead relies on state information that is kept at the forwarding nodes.

2.3 AO2P(Ad-hoc On demand position based routing protocol)

A02P [10] works in the network with relatively high node densities, where the positions of destinations are the only position information disclosed in the network for routing. In A02P, route is discovered by delivering a routing request message from the source to the position of the destination. However it does not rely on the local position information exchange. In A02P, once a previous hop sends out a routing request, its neighboring nodes who receive the request will contend to access the channel to be the next hop. In the receiver contention mechanism, receiving nodes are divided into different classes according to how close they can bring the routing request towards the destination. A receiver geographically closer to the destination is assigned to a class with a higher priority, and it generally can win the contention. This results in the routes with a lower number of hops. Fewer forwarders are needed and, hence, the ad hoc channel is shared by fewer nodes. In a network with a fixed data rate, these routes generally have a better routing performance. Once a route is built, pseudo IDS and temporary MAC addresses are used for the nodes in the routes, such as sources, destinations, and intermediate forwarders. Since the node identities are not disclosed, communication anonymity can be

achieved. For a destination whose position is revealed, its privacy is preserved by hiding the match between a position and its ID through the secure position management scheme. Eavesdroppers or attackers only know that a node at a certain position will receive data, but they do not know which node it is.

2.4 SDAR (Secure Distributed Anonymous Routing)

In contrast to the previously presented protocols, Boukerche et al proposed SDAR[3] which doesn't use temporary or continuously changing identities. Instead SDAR uses a single fixed identity for every node. Every intermediate node inserts its identity as the source address of every message it broadcast. It requires every forwarding node to perform a public key decryption, a public key encryption and a signature generation for every Route request message. It forwards protocol does not require the source node to gather and store information about the network topology.

2.5 ALARM (Anonymous Location Aided Routing)

ALARM [6] uses nodes current locations to securely disseminate and construct topology snapshots and forward data. With the aid of advanced cryptographic techniques (e.g., group signatures), ALARM provides both security and privacy features, including node authentication, data integrity, anonymity, and untraceability (tracking-resistance).Although it doesn't provide full security on the location anonymity of source and destination.

2.6 ALERT(Anonymous Location Based Efficient Routing)

Anonymous Location based efficient Routing Protocol in MANETs-ALERT [7] proposed by Haiying Shen and Lianyu Zhao dynamically partitions the network field into zones and randomly chooses nodes in zones as intermediate relay nodes, which form a nontraceable anonymous route. In addition, it hides the data initiator/receiver among many initiators/receivers to strengthen source and destination anonymity protection. ALERT offers anonymity protection to sources, destinations, and routes. In each routing step, a data sender or forwarder partitions the network field in order to separate itself and the destination into two zones. It then randomly chooses a node in the other zone as the next relay node and uses the GPSR[5]algorithm to send the data to the relay node. In the last step, the data is broadcasted to k nodes in the destination zone, providing k-anonymity to the destination. A notify and go mechanism is incorporated in order to have the source anonymity

3. PERFORMANCE ANALYSIS

A detailed analysis of the techniques seen in section II are done and based on it we have some results which can be used to determine which protocol is better suite for different Manet communication environment.
Computation costs of various existing protocols are found out. Computation costs determine the complexity of encryption/decryption computations by the nodes in each protocol. ANODR, ASR, SDAR and ALARM are analyzed for their computation cost. Results are summarized in the table 1 below.

Table 1:Computation cost of various anonymous routing protocols

Methods	Source	Destination	Intermediate
ANODR	KG+1PK(1PK)	1PK	KG+2PK(2PK)
ASR	KG+1PK(1PK)	1PK	KG+2PK(2PK)
SDAR	KG+2PK(2PK)	(L+1)*PK	KG+1PK(1PK)
ALARM	KG+2PK(2PK)	2PK	0

Numbers in brackets are computation complexity with pre-computation. L is the hops from the source to destination, KG denotes public key generation, PK denotes public key operations

Performance of some geographic routing protocols like ALERT, AO2P, ALARM are compared with GPSR [5], which is a baseline routing protocol of ALERT. In GPSR a packet is always forwarded to the node nearest to the destination. When such a node doesn't exist, GPSR uses perimeter forwarding to find the hop that is closest to destination. Here we evaluate the routing performance in terms of latency, number of hops/packets and delivery rate.

The tests were carried out on NS-2.33 simulator using standard wireless transmission range of 250 m and UDP/CBR traffic with a packet size of 512 bytes. The test field was set to a 1000 m × 1000 m area with 200 nodes moving at a speed of 2 m/s.

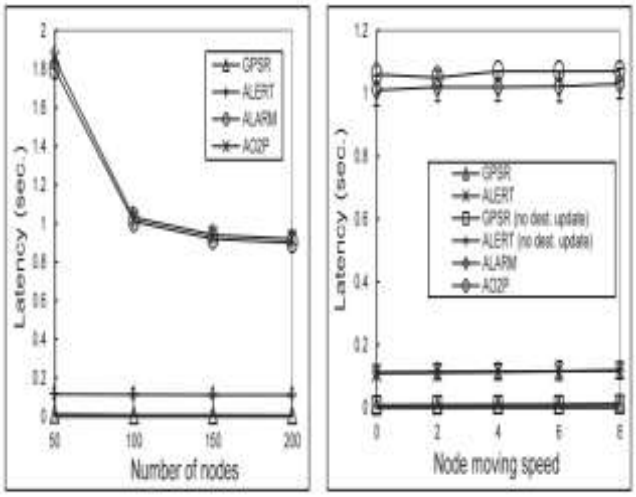

Fig 1(a): Node density Fig 1(b): Node moving speed

Figure 1(a) shows latency per packet versus total number of nodes. ALERT doesn't take shortest path in routing, while ALARM and AO2P takes shortest path in routing. Latency of ALERT is much lower than ALARM and AO2P. Figure 1(b) shows latency versus node moving speed varies from 2 m/s to 8 m/s. ALERT produce slightly higher latency than GPSR.

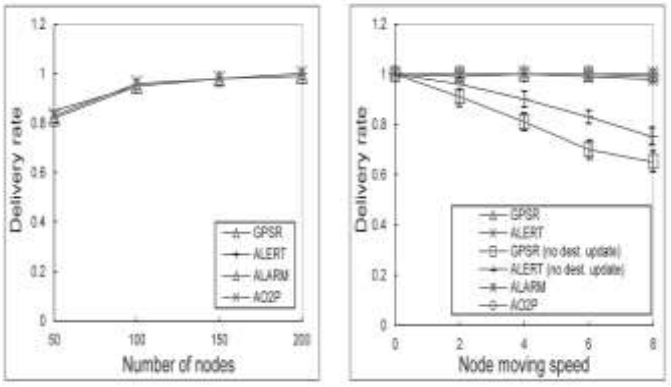

Fig 2(a): Node density Fig 2(b): Node moving speed

Figure 2(b) presents the delivery rate versus number of nodes with destination update. We see that delivery rate of all techniques that have taken are close to 1. But in figure 2(b), there is a destination update. ALERT produces higher delivery rate than GPSR.
Comparisons are also made with the protocols to check whether they are providing the basic conditions of anonymity in communication. Analysis is summarized as the table below.

Table 2: Summary of existing Anonymous routing protocols

PROTOCOL	IDENTITY	LOCATION	ROUTE
ANODR (TOPOLOGY)	SOURCE DESTINATION	N/A	YES
AO2P (GEOGRAPHIC)	SOURCE DESTINATION	SOURCE DESTINATION	NO
ASR (GEOGRAPHIC)	SOURCE DESTINATION	SOURCE DESTINATION	NO
SDAR (TOPOLOGY)	SOURCE DESTINATION	N/A	YES
ALARM (GEOGRAPHIC)	SOURCE DESTINATION	SOURCE	NO
ALERT (GEOGRAPHIC)	SOURCE DESTINATION	SOURCE DESTINATION	YES

4. CONCLUSION

Anonymous routing protocols, relying on either hop by-hop encryption or redundant traffic, generate high cost. Also, some protocols are unable to provide complete source, destination, and route anonymity protection. Though many researches are going on in this field a widely accepted version of Anonymous routing protocol has yet to come. All the problems have to be solved such that a secure communication with authentic source and destination to be made in MANET environment with security considerations.

5. ACKNOWLEDGEMENTS

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Implementation of FSM-MBIST and Design of Hybrid MBIST for Memory cluster in Asynchronous SoC

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Abstract: In current scenario, power efficient MPSoC's are of great demand. The power efficient asynchronous MPSoC's with multiple memories are thought-off to replace clocked synchronous SoC, in which clock consumes more than 40% of the total power. It is right time to develop the test compliant asynchronous MpSoC. In this paper, Traditional MBIST and FSM based MBIST schemes are designed and applied to single port RAM. The results are discussed based on the synthesis reports obtained from *RTL Complier from Cadence*. FSM based MBIST is power and area efficient method for single memory testing. It consumes 40% less power when compared with traditional MBIST. But, in case of multiple memory scenarios, separate MBIST controllers are required to test each individual memories. Thus this scheme consumes huge area and becomes inefficient. A novel technique for testing different memories which are working at different frequencies is in need. Therefore, an area efficient Hybrid MBIST is proposed with single MBIST controller to test multiple memories in an Asynchronous SoC. It also includes multiple test algorithms to detect various faults. An Asynchronous SoC with DWT processor and multiple memories is discussed in this paper, which will used as Design under Test [DUT] and Hybrid MBIST is built around it to test the heterogeneous memories. The design is coded in Verilog and Validated in Spartan-3e FPGA kit.

Keywords: FSM MBIST, Hybrid MBIST, Asynchronous SoC, low area, flexible, MARCH Algorithms

1. INTRODUCTION

Today's SoC's are memory dominant. More than 90% of physical area is dominated by memory according to the ITRS [International Technology Roadmap for Semiconductors] [3]. As memories become denser, they are more prone to defects and faults are more complex. Using external Automatic Test Equipment (ATE) will become expensive for dense memories due to pin inductance and tester pins cost [12]. Also, at-speed testing is not possible. Test time increases as the number of memories increase in a chip. An on-chip at-speed testing technique is the call of the hour. BIST is a Design for Test (DFT) technique [2] in which part of the circuit is used to test the circuit itself. MBIST is the most widely used technique for testing memories. MBIST technique integrates the functionality of automatic test equipment on the same die as embedded memories. It provides high speed testing and also testing can be done during operation and maintenance stage even outside the electrical testing environment.

There are two widely used techniques for MBIST. FSM based MBIST and microcode based MBIST. In FSM based MBIST, control signals for BIST controller operations are defined as state machines [8]. It is hardwired. Microcode based MBIST has a Programmable Memory BIST (P-MBIST) controller. It has flexibility of programming new test algorithms into the controller as and when needed, but suffers from area overhead [8].

The paper is organised as follows. Section 2 describes FSM based MBIST and introduces a hybrid MBIST scheme called *FSM-based Programmable MBIST*. Section 3 describes various MBIST algorithms. Section 4 describes Design Under Test (DUT) for hybrid MBIST and the proposed MBIST Controller.

2. FSM BASED BIST

FSM based BIST has a number of states. This technique uses 1 test algorithm for test operation. In the proposed paper, MARCH C- algorithm is used. This algorithm is chosen because it is simple and yet can detect many faults like ***stuck-at faults, address decoder faults, transition faults and some coupling faults*** [9].

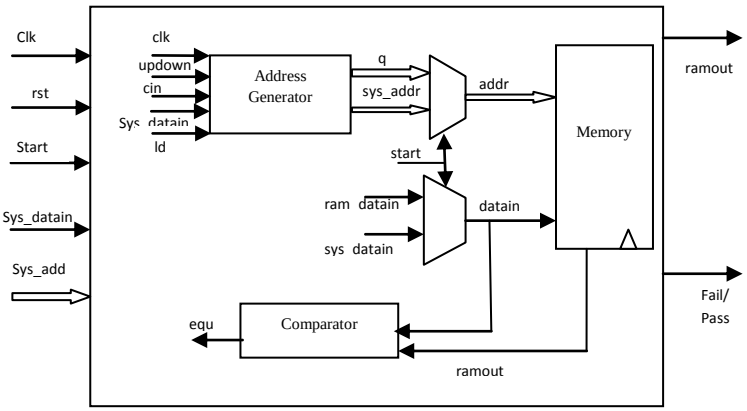

Figure. 1 Block Diagram for FSM MBIST

Figure 1 Shows block diagram for FSM based MBIST Architecture. In the block diagram ***Start, rst, Clk, Sys_datain, Sys_addr*** are input signals, ***ramout and Fail/Pass*** are the output signals. The blocks in Figure 1 are ***Address generator, Single -port Memory, Comparator and Multiplexers***. The Address generator is a counter which generates address for the memory to be tested. It can count up or down to provide address in ascending or descending order. Comparator compares the datain and ramout, if they are not equal ***Fail*** signal is raised, else, ***Pass*** signal is raised. The multiplexer

chooses between ***normal mode*** and ***test mode***. When start=1, test mode is selected.

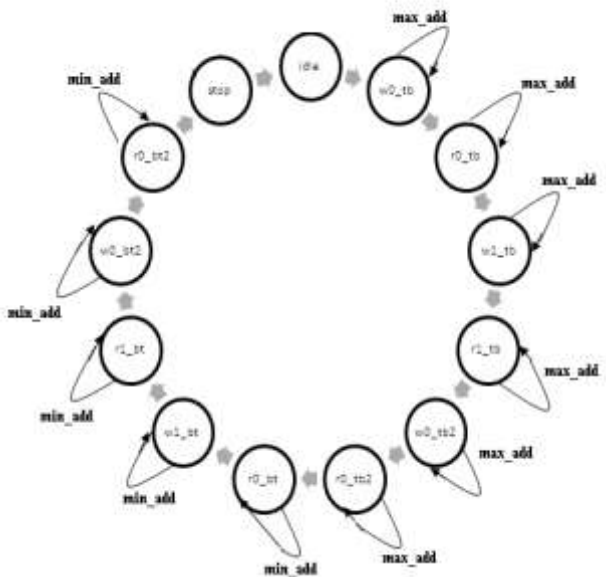

Figure. 2 State Diagram of FSM MBIST

Figure 2 shows the State Diagram for implemented FSM MBIST. The faults covered by this architecture are Address Decoder Faults, Transition Faults and Stuck-at Faults [2] The FSM MBIST has low area and good fault coverage. The percentage of fault coverage depends on the MARCH algorithm used. But since FSM MBIST is hard-wired, it is not flexible.

Presently, due to the need for low power and low area, asynchronous System on Chip (SoC)s are evolving. An asynchronous SoC contains memories of different types and different sizes operating at different frequencies. Hence a MBIST controller should be capable of testing heterogeneous memories at their respective frequency of operation. A single algorithm is not sufficient to test all the memories. Hence FSM MBIST will not be efficient in case of multiple memories. A microcode MBIST scheme can be used, but it results in larger area. To compensate for lack of flexibility in FSM MBIST and area overhead in microcode MBIST, a hybrid scheme is proposed- ***FSM based programmable MBIST***. The test algorithms and the MARCH elements are represented by codes and clusters of micro codes. Read/write operations, the applied test data and the addressing orders in an element are still controlled by the FSM.

3. MARCH ALGORITHMS

Patterns are the key elements in memory testing. These patterns look for weakness in the analog circuitry and for interaction between two or more neighboring structures [2]. A test algorithm is a finite sequence of test elements. A test element contains memory operations, data for write and read operations and address specified for the read and write operations to the memory [4].

A march based test algorithm is a finite sequence of March elements. A March element is specified by an address order and a number of reads and writes. March based tests are simple and they bear good fault coverage. Hence they are widely accepted and implemented in most modern memory BIST schemes [5].

The manner in which an operation of March algorithm progresses from cell- to-cell is determined by the addressing order, which can be an ascending order (addresses moving up from cell 0 to cell n- 1), denoted by the '↑' symbol, or a descending order, denoted by the '↓' symbol (addresses moving down from cell n-1 to cell 0). For some March elements the address order can be chosen arbitrarily, ie either ascending or descending. This will be indicated by the '↕' symbol. operations applicable to cells can be a 'w0', a 'wl', an 'r0' or an 'rl' operation. A complete march test is contained within the '{...}' bracket pair; while a March element is contained within the '(...)' bracket pair [13]. The codes of all test algorithms used in the proposed work are listed in the Table I. 8 MARCH algorithms are used.

Table 1. Test Algorithms with March Element Codes

Sl No.	Code	Algorithm	March Element Code
1	000	Mats Plus	{↕(w0); ↑(r0,w1); ↓(r1,w0)}
2	001	March X	{↕(w0); ↑(r0,w1); ↓(r1,w0);↕(r0)}
3	010	March C Minus	{↕(w0); ↑(r0,w1); ↑(r1,w0); ↓(r0,w1); ↓(r1,w0); ↕(r0)}
4	011	March LR	{↕(w0);↓(r0,w1);↑(r1,w0,r0,w1); ↑(r1,w0); ↑(r0,w1,r1,w0); ↑(r0)}
5	100	March A	{↕(w0);↑(r0,w1,w0,w1) ;↑(r1,w0,w1); ↓(r1,w0,w1,w0); ↓(r0,w1,w0);}
6	101	March U	{↕(w0);↑(r0,w1,r1,w0); ↑(r0,w1); ↓(r1,w0,r0,w1); ↓(r1,w0)}
7	110	March B	{↕(w0);↑(r0,w1,r1,w0,r0,w1); ↑(r1,w0,w1);↓(r1,w0,w1,w0); ↓(r0,w1,w0)}
8	111	March SS	{↕(w0);↑(r0,r0,w0,r0,w1); ↑(r1,r1,w1,r1,w0); ↓(r0,r0,w0,r0,w1); ↓(r1,r1,w1,r1,w0); ↕(r0)}

4. DUT AND HYBRID MBIST TOP MODULE

Due to the recent trend in the use of asynchronous SoC's, a prototype has been designed to replicate the scenario. The asynchronous SoC in the proposed paper has a Discrete Wavelet Transform (DWT) processor, a Dual port RAM (Memory-1) and two Single port RAMs (Memory-2, Memory-3). All the blocks interact via asynchronous handshaking signals.

An input image is stored in Memory-1. The DWT processor requests the image and converts it to ***high frequency and low frequency components***. On request by Memory-2 and Memory-3 the high and low frequency components are stored in these two memories respectively. All the 3 memories are operating at different frequencies. The proposed BIST controller tests these heterogeneous memories at their respective frequency of operation. The design operates in two modes **– *normal mode*** and ***test mode.***

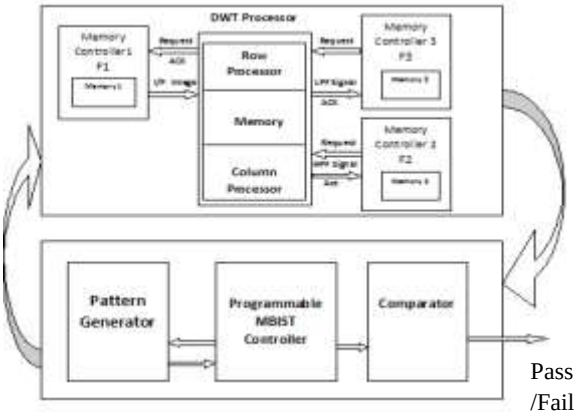

Figure. 3 DUT and Top Level of Hybrid MBIST

The top level of MBIST consists of a pattern generator, PMBIST controller and a comparator. The pattern generator generates the necessary MARCH patterns which are written to and read from the memory under test (MUT). The PMBIST controller controls the read and write operations. The comparator compares the pattern read from the memory with the pattern given by pattern generator and issues Pass/Fail signal.

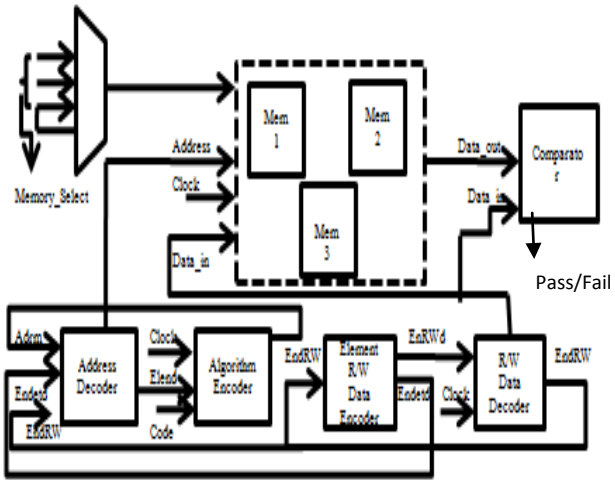

Figure. 4 Hybrid MBIST Controller

Figure 4 shows the block diagram for implementation of the proposed MBIST scheme. The MBIST controller shown if Figure 4 comprises of 4 blocks; ***Address Decoder***, ***Algorithm Encoder***, ***Element R/W Data Encoder*** and ***Data Decoder***. The Algorithm Encoder sends the MARCH elements' code and the address microcode to the Element R/W Data Encoder and the Address Decoder. The Element R/W Data Encoder receives the MARCH element's code and encodes the R/W operation as 0 for Read and 1 for Write. For example, element 2, r1w0 is encoded as 0110. It produces the ***Endetd*** signal to indicate the end of the encoding for the element under test. The address decoder is controlled by ***Endetd*** and ***Adrm*** (which represents address sequence microcode). It generates the ***Elend*** signal which triggers the Algorithm Encoder. The active ***Elend*** signal means the MARCH element under test has reached the last address and is ready for the next MARCH element. Finally the R/W-Data Decoder receives the encoded test data in form of microcode instructions, decodes it and writes to the memory. It also creates the ***EndRW*** signal to signify the end of RW operation for that cluster. The comparator compares the data read from memory, Data_out and data written to memory, Data_in. if both data are same, Pass signal is asserted, else Fail signal is asserted. This block shares the same clock as the memory under test. In this paper a multiplexer is used to select one of the three memories, for test.

Table 2. March Element Clusters

4 bits MARCH Element Code	R/W Operation in the Element
0000	w0
0001	r0
0010	w1
0011	r1
0100	r1,w0
0101	r0,w1
0110	r1,w0,w1
0111	r0,w1,wo
1000	r0,w0
1001	r1,w1
1010	r0,w1,r1,w0

Table 1 shows the 8 MARCH algorithms used in the proposed hybrid MBIST scheme. Based on the code, Algorithm Encoder selects one of the 8 algorithms and encodes it in form of clusters of microcode. Clusters are shown in Table 2. As the algorithms use common clusters, area is reduced. The first algorithm is selected and if no faults are detected next algorithm is selected and so on. If no faults are detected in all 8 algorithms, the memory is defect free.

5. RESULTS AND DISCUSSIONS

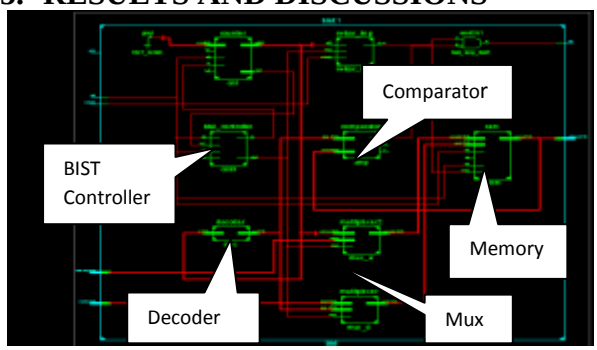

Figure. 5 RTL Schematic of Traditional MBIST

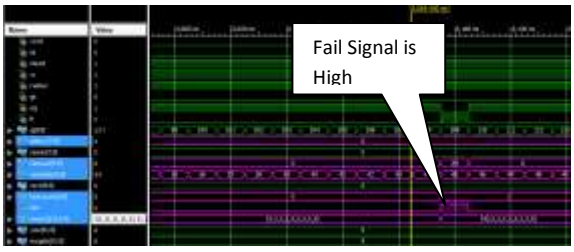

Figure. 6 Simulation result of Traditional MBIST with fault at address 45

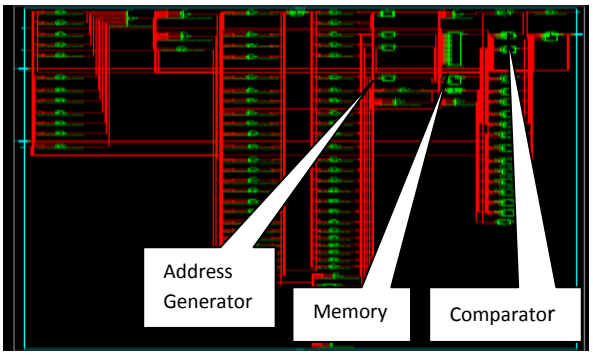

Figure. 7 RTL Schematic of FSM MBIST

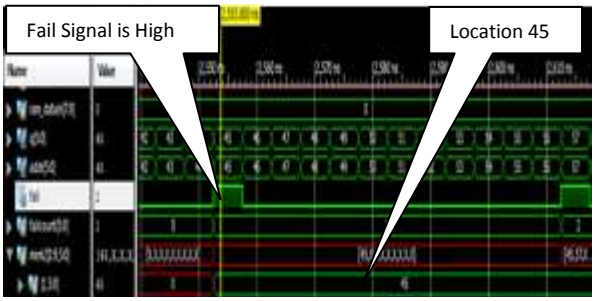

Figure. 8 Simulation result of FSM MBIST with fault at address 45

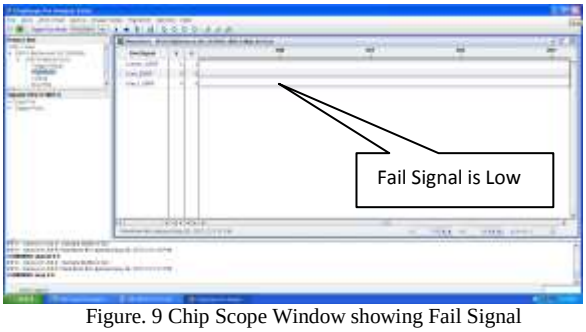

Figure. 9 Chip Scope Window showing Fail Signal

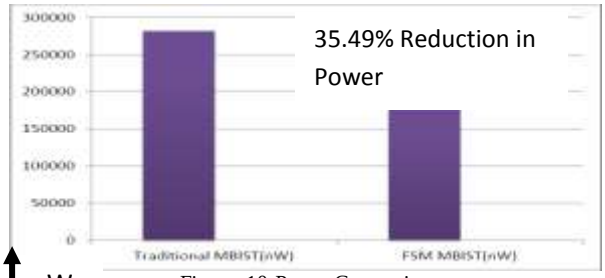

Figure. 10 Power Comparison

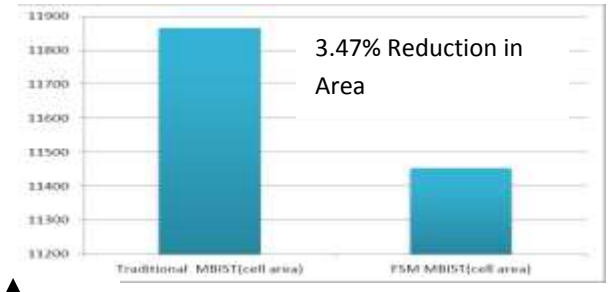

Figure. 11 Area Comparison

The Traditional MBIST was developed and the results obtained has been compared with FSM based MBIST. Figure 5 shows the RTL schematic for traditional MBIST. Figure 6 shows the simulation where Fail signal is asserted at location 45. Similarly Figure 7 shows the RTL schematic for FSM MBIST. Figure 8 shows the Fail signal being asserted in FSM MBIST. The fault is at address location 45 and it is stored in a register. FSM MBIST was successfully downloaded on the Spartan 3e kit and results were verified on chip scope as shown in Figure 9, where a fail signal is shown low for faultless architecture. The synthesis reports obtained from RTL Compiler from Cadence are used for comparison. The power taken by FSM MBIST is about 36% less when compared with the traditional one. The area remains almost same as that of traditional. The comparison graphs for power and area are shown in Figure 10. The fault coverage of the proposed hybrid MBIST is expected to be higher than that for FSM MBIST.

6. CONCLUSION

MBIST is the most widely used technique for testing memories. Traditional MBIST and FSM based MBIST can be applied to single memory at any given instant of time. Both these techniques are coded in Verilog and validated in Spartan-3e FPGA kit. The synthesis reports obtained from *RTL Complier from Cadence* are used to arrive at conclusion. FSM based MBIST is power and area efficient method for memory testing. It consumes nearly 40% less power when compared with traditional MBIST. But, in case of multiple memory scenarios, separate MBIST controllers are required to test individual memory. This method of testing memories consumes huge area and becomes inefficient. Therefore, an area efficient Hybrid MBIST is proposed with single MBIST controller to test multiple memories in an Asynchronous SoC. It also includes multiple test algorithms to detect various faults.

7. ACKNOWLEDGEMENTS

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Algorithmic Analysis to Video Object Tracking and Background Segmentation and Wavelet Transform as New Approach to Video Object Tracking

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Abstract: Video object tracking and segmentation are the fundamental building blocks for smart surveillance system. Various algorithms like partial least square analysis, Markov model, Temporal differencing, background subtraction algorithm, adaptive background updating have been proposed but each were having drawbacks like object tracking problem, multibackground congestion, illumination changes, occlusion etc. The background segmentation worked on to principled object tracking by using two models Gaussian mixture model and level centre model. Wavelet transforms have been one of the important signal processing developments, especially for the applications such as time-frequency analysis, data compression, segmentation and vision. The key idea of the wavelet transform approach is to represents any arbitrary function f (t) as a superposition of a set of such wavelets or basis functions. Results show that algorithm performs well to remove occlusion and multibackground congestion as well as algorithm worked with removal of noise in the signals.

Keywords: Temporal differencing, occlusion, gaussian mixture, level set, wavelets transform

1. INTRODUCTION

Video object tracking and segmentation had the roots in solving problem like traffic surveillance system, suspicious person monitoring. Several algorithms have been proposed for video object tracking and segmentation. Partial least square analysis worked on principle of object tracking posed as a binary classification problem in which the correlation of object appearance and class labels from foreground and background is modeled by partial least squares (PLS) analysis, for generating a low-dimensional discriminative feature subspace. The algorithm had high performance rate and lower tracking algorithm. Markov random field model worked only on background subtraction having drawback like occlusion. Temporal differencing [1] is very adaptive to dynamic environments, as only the current frames are used for analysis, but generally does a poor job of extracting all the relevant object pixels corresponding to object motion. Back-ground subtraction [2][3], provides the most complete object data but is extremely sensitive to dynamic scene changes due to lighting and extraneous events [4]. More recent adaptive back grounding methods can cope much better with environment dynamism. However, they cannot handle multi-modal backgrounds and have problems in scenes with many moving objects.

Background Segmentation is a more advanced adaptive background modeling method. Here, each pixel is modeled using a mixture of Gaussians and is updated by an on-line

approximation. The adaptive background model based segmentation method would alone suffice for applications where a rough estimate of the moving foreground, is in the form of irregular space blobs, is sufficient. Here the exact shape of the moving object need not be determined and only some post processing of the segmentation output using appropriate filters would give the desired blobs of interest. Recently, the level set method has become popular for object shape extraction and tracking purposes. The central idea is to evolve a higher dimensional function whose zero-level set always corresponds to the position of the propagating contour. There are several advantages of this level set formulation. Topological changes such as splitting and merging of contours are naturally handled. The final extracted contour is independent of the curve initialization, unlike other active contour models like the snakes, where the final object contour is very much determined by the contour initialization.

Wavelet transform is theory of wavelets having roots in quantum mechanics and the theory of functions though a unifying framework is a recent occurrence. Wavelet analysis is performed using a prototype function called a wavelet. Wavelets are functions defined over a finite interval and having an average value of zero. The basic idea of the wavelet transform is to represent any arbitrary function f (t) as a superposition of a set of such wavelets or basis functions. These basis functions or baby wavelets are obtained from a single prototype wavelet called the mother wavelet, by dilations or contractions (scaling) and translations (shifts). Efficient implementation of the wavelet transforms has been derived based on the Fast Fourier transform and short-length fast-running FIR algorithms in order to reduce the computational complexity per computed coefficient. All wavelet packet transforms are calculated in a similar way. Therefore we shall concentrate initially on the Haar wavelet packet transform, which is the easiest to describe and implement. The Haar wavelet packet transform is usually referred to as the Walsh transform.

2. LITERATURE SURVEY

This topic of paper shows the analysis and from analysis guides about the drawback of various algorithms that have been proposed for video object tracking and segmentation for smart surveillance system and the advantage of background segmentation and wavelet transform on it. In this topic each algorithm is studied in finer detail.

2.1 Analysis Of Partial Least Square Algorithm

Partial least squares analysis (PLS) [5], is a statistical method for modeling relations between sets of variables via some latent quantities.PLS starts at the point where maximum likelihood covariance-based system reach their limit. PLS works well with object tracking by using methods that find new spaces where most variations of the samples can be preserved, and the learned latent variables from two blocks are more correlated than those in the original spaces PLS therefore combines information about the variances of both the predictors and the responses, while also considering the correlations among them [10].

The major limitations of PLS algorithm are high risk of overlooking real correlations and sensitivity to relative scaling of descriptor variables [22].

2.2 Hidden Markov Model Explanation

The hidden markov model is stochastic model based on markov property which studies the detail of each hidden states. The video object tracking process can be modeled with the hidden Markov model (HMM) shown in Fig. 1. In this model, system state, *Xt*, is the object state to be estimated at time *t*

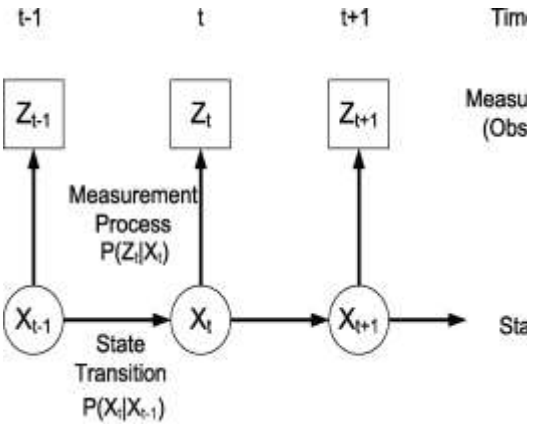

Figure 1: Illustration of system model. The video object tracking problem can be modeled with a hidden Markov model (HMM).

(e.g., object position, object velocity, objects size, etc). Measurement, *Zt*, is the observation from the current frame. Video object tracking is an inverse problem; that is, object states are inferred from the measurements (features extracted from video sequences) such as color, texture, and gradient [8]. The model in Fig. 1 can be specified further using the following equations:

$Xt = f(Xt-1) + nx$, ---------- (1)

$Zt = g(Xt) + nz$, ---------- (2)

Where $f(\cdot)$ is the state transition function, $g(\cdot)$ is the Measurement function, and *nx* and *nz* are noise. HMM requires the prior knowledge for building the architecture. The major disadvantage of the model is speed Almost everything one does in an HMM involves: "enumerating all possible paths through the model". This model is still slow in comparison to other methods.

2.3 Analysis Of CAMSHIFT

Continuously Adaptive Mean Shift algorithm (CAMSHIFT) is a popular algorithm for visual tracking [7], providing speed and robustness with minimal training and computational cost. CamShift is an adaptation of the Mean Shift algorithm for object tracking that is intended as a step towards head and face tracking for a perceptual user interface using minimum CPU cycles and thereby a single color hue. The CamShift algorithm can be summarized in the following steps:

1. Set the region of interest (ROI) of the probability distribution image to the entire image.

2. Select an initial location of the Mean Shift search window. The selected location is the target distribution to be tracked.

3. Calculate a color probability distribution of the region centered at the Mean Shift search window.

4. Iterate Mean Shift algorithm to find the centroid of the probability image. Store the zeroth moment (distribution area) and centroid location.

5. For the following frame, center the search window at the mean location found in Step 4 and set the window size to a function of the zeroth moment. Go to Step 3.

The algorithm may fail to track multi-hued objects or objects where hue alone cannot allow the object to be distinguished from the background and other objects. It can fail rapidly when the camera moves since it relies on static models of both background and the tracked object [09]. Furthermore, it is unable to track objects passing in front of backgrounds with which it shares significant colors [10].

3. PROPOSED ALGORITHM

The above topic depicts the various problems faced by the algorithm that are used for video object tracking and segmentation. More advanced adaptive background modeling methods have been proposed for video object tracking and segmentation. Here, each pixel is modeled using a mixture of Gaussians and is updated by an on-line approximation. Filters would give the desired blobs of interest. Recently, the level set method has become popular for object shape extraction and tracking purposes. Both the algorithm explained deals with background segmentation and is explained in minute detail below:

3.1 Background Segmentation

3.1.1 Gaussian mixture model

Background subtraction involves calculating a reference background image, subtracting each new frame from this image and thresholding the result that results in a binary segmentation image that highlights the regions of non-stationary objects. Non-adaptive background models, computed over a training sequence of sufficient length involving only the background, could only be used in case of short-time surveillance applications, where we assume that the background model, both in terms of pixel intensity distribution and background composition, have not changed significantly to undo the background subtraction philosophy. But the above assumptions cannot be guaranteed to hold good for long-time surveillance applications, where not only scene composition but also the intensity distributions of the background can change over time. When the background scene involves large or sudden changes, a single Gaussian model is not adequate, and a multi-model distribution is needed to fully describe the scene dynamics. GMM allows the representation of a background scene with multi-modal distributions [11]. Here, multi-model distribution means multiple- Gaussian distribution, which essentially means a "multiple-surface" background representation of a pixel. In GMM, each pixel is modeled parametrically by a mixture of K Gaussians as the intensity of each pixel evolves over time (temporally). The model is parameterized by a mean, a covariance matrix, a priori probability for each of the K components. Similar to the single Gaussian method, they can be implemented using a running average method. The parameters are updated for each frame and hence the method does not require a large buffer of video frames with high memory requirement. GMM is a more general approach when compared to the single Gaussian model. For every pixel, each of the K Gaussian distributions corresponds to the probability of observing a particular intensity. The probabilities are then evaluated to determine which are most likely to be resulted from the background scene, and which are most likely to be resulted from the foreground objects. The probability of observing the pixel intensity in the current frame is:

$$P(I_t) = \sum_{i=1}^{K} \omega_{i,t}\eta(I_t, \mu_{i,t}, \Sigma_{i,t})$$

…… (3)

where K is number of distributions, it is chosen to be usually 3 . . . 5, ωi,t is an estimate a priori probability (what portion of the data is accounted for by this Gaussian) of the ith Gaussian at time t, η(It, μi,t,_i,t) is the ith Gaussian model, with mean μ and covariance matrix of the pixel intensities. For computational simplicity, the covariance matrix is assumed to be diagonal so that the inverse can be determined easily. The distribution of recently observed values of each pixel in the scene is characterized by a mixture of Gaussians. A new pixel in the current frame is representing by one of the K components of the mixture model. To update the background model, each new pixel in the current frame, is checked against the existing K Gaussian distributions, until a "match" is found. A match is defined as a pixel value within 2.5 standard deviations of a distribution (out of the K components), and this matched component can be a background component or a foreground component which will be verified later.

3.1.2 Foreground Segmentation

As the background model has a stochastic nature, we expect the entire segmentation problem to be cast in a similar stochastic framework. Following steps are required to deal with random variables which follow some particular distribution.

1. To calculate incoming pixel intensity using Gaussian random variable, whose mean is the observed intensity and variance is some small prefixed value, i.e. if I(x) denotes the incoming pixel intensity is at location x, then the observed intensity is modeled as random variable X, such that X N (I(x)). This random model is in fact intuitive considering random factors such as camera feed perturbations and source intensity fluctuations.

2. To solve the above problem the observed pixel intensity as a Gaussian signal is modeled, highly spiked about its mean, rather than treating it as a deterministic signal.
3. Then usual background subtraction procedures need to be recast into this stochastic framework. This leads to the deployment of divergence measures between the two probability distributions: the background distribution and the incoming pixel distribution. The Jeffrey's divergence measure is used which is similar to the KL measure but having the additional property of symmetry about its arguments.
4. Jeffrey's information measure between two distributions having density functions f and g is defined as:

$$J(f,g)=\int [f(x)-g(x)]log(\frac{f(x)}{g(x)})dx$$

---------- **(4)**

As obvious from the above definition, J(f,g) satisfies the following desirable properties:

1. J(f,g)≥0
2. J(f,g)==0 if and only if f and g are identical functions
3. J(f,g)==J(g,f)

3.1.3 Background Model Initialization

In order to avoid the assumption of a sequence starting in the absence of foreground objects, simple temporal frame differencing is used for the initial phase of background model initialization until the background pixels are "stable" [12] The temporal frame difference FDt(x, y) at time t is defined as:

$$FD_t(x,y) = |I_t(x,y) - I_{t-1}(x,y)|$$

…….(5)

where It(x, y) is the intensity of pixel (x, y) in the frame at time t. The foreground binary mask FGt(x, y) is determined by comparing FDt(x, y) to a threshold T1 which is empirically determined and set to be 20, a pixel is considered as having significant motion, and labeled as a foreground pixel, if the difference is greater than a threshold,

$$FG_t(x,y) = \begin{cases} 1 & \text{if } FD_t(x,y) \geq T1 \\ 0 & \text{otherwise.} \end{cases}$$

…--**……(6)**

A pixel is considered as a "stable" background pixel if there is no significant motion detected (i.e. FDt(x, y) < T1) for a certain number of frames (denoted by Tfr). Consider a frame count Cfr that is incremented by 1 each time FDt(x, y) < T1, when this frame counts Cfr > Tfr (the consecutive background frame count Tfr is empirically determined and set to be 100), we can use this pixel in the current frame to construct the background model:

$$BM_t(x,y) = \begin{cases} I_t(x,y) & \text{if } C_{fr} > T_{fr}, \\ 0 & \text{otherwise.} \end{cases}$$

…**……(7)**

This background model initialization method assumes every pixel of the background will be uncovered at some time.

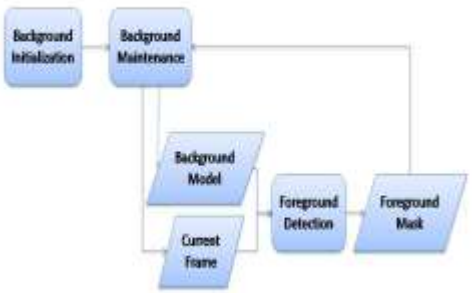

Figure 2: Background Subtraction

4. Wavelet Transform Method

A wavelet series is a representation of a square-integral (real- or complex-valued) function by orthonormal series generated by a wavelet[13]. Nowadays, wavelet transformation is one of the most popular candidates of the time-frequency-transformation.The Haar wavelet packet transform is usually referred to as the Walsh transform. Figure 3 represents the wavelet transform processes in terms of time and frequency.

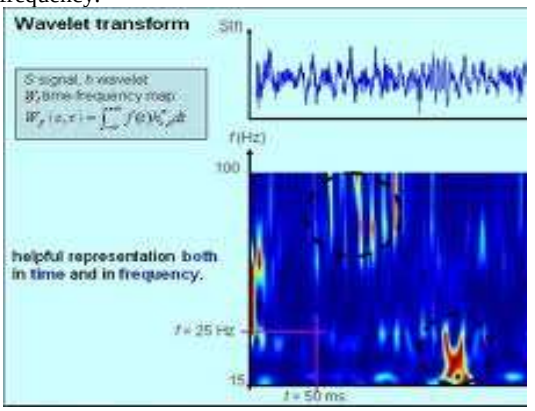

Figure: 3 Wavelet Transform Processes in terms of time and frequency

4.1 Haar Transform Method

The Haar transform is the simplest of the wavelet transforms. This transform cross-multiplies a function against the Haar wavelet with various shifts and stretches, like the Fourier transform cross-multiplies a function against a sine wave with two phases and many stretches.[1]

The attracting features of the Haar transform, includes fast for implementation and able to analyze the local feature, make it a potential candidate in modern electrical and computer engineering applications, such as signal and image compression

The Haar transform is found effective as it provides a simple approach for analyzing the local aspects of a signal. The Haar transform is derived from the Haar matrix which can be used for removing occlusion. An example of a 4x4 Haar transformation matrix is shown below.

$$H_4 = \frac{1}{\sqrt{4}} \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & -1 & -1 \\ \sqrt{2} & -\sqrt{2} & 0 & 0 \\ 0 & 0 & \sqrt{2} & -\sqrt{2} \end{bmatrix}$$

The Haar transform can be thought of as a sampling processes in which rows of the transformation matrix act as samples of finer and finer resolution [14].

Property of haar transform

1. No need for multiplications. It requires only additions and there are many elements with zero value in the Haar matrix, so the computation time is short. It is faster than Walsh transform, whose matrix is composed of +1 and -1.
2. Input and output length are the same. However, the length should be a power of 2, i.e. $N = 2^k$.
3. It can be used to analyse the localized feature of signals. Due to the orthogonal property of Haar function, the frequency components of input signal can be analyzed.

Working of Haar transform

1. Form the orthogonal series of the periodic mean-square spectrum estimate.
2. Construct the ECG waveform. The objective of ECG signal processing is manifold and comprises the improvement of measurement accuracy and reproducibility (when compared with manual measurements) and the extraction of information not readily available from the signal through visual assessment. The ECG waveform will help in removing the noise in signals.
3. Then the Gaussian filter analysis is performed (explained in section 3.1.1)
4. The magnitude response is calculated giving the desired output. (Error free video).
5. Near-optimal performance is obtained at substantially reduced complexity, due to

the availability of fast computational schemes.

The figure represents the result for the images considering the time, frequency and amplitude.

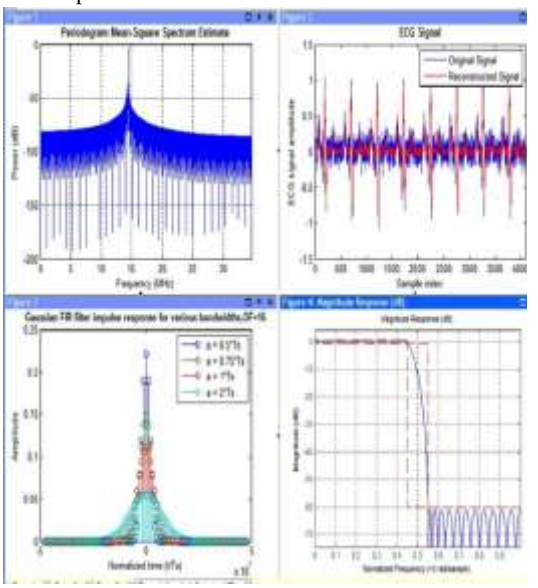

Figure 4: Haar Wavelet Transform Processes

5. CONCLUSION:

The paper proposed guides about the previous algorithm that were proposed for video object tracking and segmentation for smart surveillance system. Paper also explains the drawback that each algorithm were having (occlusion, illumination changes, least accurate results etc.).

In the next section of paper background segmentation and wavelet transform a more advanced algorithm are discussed The background segmentation algorithm extracts the background and foreground data using Gaussian mixture and level-set algorithm.

The wavelet transform helps in compressing the data collected for segmentation and vision analysis

Both the algorithm work well in solving the problems like occlusion, sudden background change, detecting stationary background, solving illumination change problem.

6. ACKNOWLEDGEMENT

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Analysis of Various Periodicity Detection Algorithms in Time Series Data with Design of New Algorithm

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Abstract:Time series datasets consist of sequence of numeric values obtained over repeated measurements of time. They are Popular in many applications such as stock market analysis, power consumption, economic and sells forecasting, temperature etc. Periodic pattern mining or periodicity detection is process of finding periodic patterns in time series database. It has a number of applications, such as prediction, forecasting, detection of unusual activities, etc. Periodicity mining needs to give more attention as its increased need in real life applications. The types of periodicities are symbol periodicity, sequence periodicity and segment periodicity and they should be identified even in the presence of noise in the time series database. There are number of algorithms exists for periodic pattern mining. Those algorithms have some advantages and disadvantages. In this paper, we have compared different periodicity mining algorithms and given plan for developing efficient periodicity mining algorithm which detect symbol periodicity, sequence periodicity and segment periodicity and noise-resilient .

Keywords: periodic pattern mining, periodicity detection, time series data, symbol periodicity, sequence periodicity, segment periodicity.

1. INTRODUCTION

Time series data captures the evolution of a data value over time. Life includes several examples of time series data. Examples are meteorological data containing several measurements,e.g., temperature and humidity, stock prices depicted in financial market, power consumption data reported in energy companies, and event logs monitored in computer networks A time series data is a collection of values represented at uniform intervals of time.A pattern is said to be periodic if, it appears again and again in time series at uniform intervals of time. The length of interval defines period of the frequent pattern. Periodicity mining deals with the methods for analyzing time series data in order to extract meaningful statistics and other characteristics of data. Periodicity mining is a tool that helps in predicting the behavior of time series data. For example, periodicity mining allows an energy company to analyze power consumption patterns and predict periods of high and low usage so that proper planning may take place. Data mining, which is also called Knowledge-Discovery from data. It is the process of searching enormous volumes of data for patterns using association rules with the help of computer programs. It is one of the most important area of research. A time series is mostly characterized by being composed of repeating cycles. For instance, there is a traffic jam twice a day when the schools are open; number of transactions in a superstore is high at certain periods during the

day, certain days during the week, and so on. Identifying repeating (periodic) patterns could reveal important observations about the behavior and future trends of the case represented by the time series and hence would lead to more effective decision making. In other words, periodicity detection is a process for finding temporal regularities within the time series, and the goal of analyzing a time series is to find whether and how frequent a periodic pattern (full or partial) is repeated within the series. In this paper our focus is on analysing various periodicity detection algorithms in time series data.

1.1 Types Of Periodic Patterns

In general, three types of periodic patterns can be detected in a time series:

1.1.1 Symbol Periodicity

A time series is said to have symbol periodicity if at least one symbol is repeated periodically For example, in time series T =abd acb aba abc, symbol a is periodic with periodicity p = 3, starting at position zero (stPos= 0).

1.1.2 Sequence Periodicity

A pattern consisting of more than one symbol may be periodic in a time series; and this leads to partial periodic patterns. For instance, in time series T = bbaa abbd abca abbc abcd, the sequence ab is periodic with periodicity p= 4, starting at position 4 (stPos= 4);and the partial periodic pattern ab _ _ exists in T, where _denotes any symbol or don't care mark.

1.1.3 Segment Periodicity.

If the whole time series can be mostly represented as a repetition of a pattern or segment, then this type of periodicity is called segment or full-cycle periodicity.For instance, the time series T = abcab abcab abcab has segment periodicity of 5 (p = 5) starting at the first position (stPos 0), i.e., T consists of only three occurrences of the segment abcab. It is not necessary to always have perfect periodicity in a time series as in the above three examples.Usually the degree of perfection is represented by confidence, which is 100 percent in the above three examples. On the other hand, real-life examples are mostly characterized by the presence of noise in the data and this negatively affects the confidence level.

1.2Periodicity Detection In Time Series Data In Presence Of Noise

Three types of noise usually measured in time series data are substitution, addition, and deletion noise. In substitution noise, various symbols in the dishonored time series are restored at arbitrary with further symbols. In case of addition and deletion noise, several symbols are interleaved or deleted, correspondingly arbitrarily at diverse locations (or time values). Noise is also a combination of these three kinds, for example, substitution type noise resources the consistent combination of replacement (R) and addition (I) noise. When the time series is moreover completely cyclic or includes only substitution noise and achieves inadequately in the occurrence of addition or deletion noise. This is since insertion and deletion noise develops or deals the time axis important to move of the imaginative time series values.This paper provides some discussion about some of the available algorithms for periodicity detection. It also includes design of efficient technique that has optimum performance parameter.

2. LITERATURE SURVEY

B.Sujatha and Dr.S.Chenthur Pandian have Presented a survey on periodicity detection in time series database[1]. Their paper presents a survey on some of the existing periodic pattern mining techniques.There are many emerging applications in periodic pattern mining, including weather predictions, computer networks and biological data. The discovery of patterns with periodicity is of great importance and has been rapidly developed in recent years. The problem of discovering periods for time series databases,

referred as periodicity detection. These types of periodicities are available such as symbol periodicity, sequence periodicity and segment periodicity and they are identified even in the presence of noise in the time series database. Using pruning strategy some of these patterns are identified and extracted from the given time series database. There are different techniques already exists for periodic pattern mining. Those existing techniques have their own merits and demerits.

Jisha Krishnan and Chitharanjan K have studied different periodicity algorithm and done comparison among four algorithms[2]. They state that Periodicity mining is used for predicting different applications such as prediction, forecasting etc. It has several application in Time series databases. Several algorithms are present for detecting the periodicity. But most of the algorithm do not take into account the presence of noise or partial periodicity. Based on time wrapping, the first algorithm wraps the time axis to optimally remove the noise at various locations. The Partial Periodic Detection Algorithm algorithm can be viewed as a variation of the approximate string matching algorithm. Periodic Detection using convolution method algorithm is used for partial periodicity detection and in the Periodic Detection using SuffixTree the periodic detection is done using suffix tree.This algorithms detects periodicity in noise and also detects partial periodicity.

Christos Berberidis, Walid G. Aref, Mikhail Atallah, Ioannis Vlahavas, Ahmed K. Elmagarmid[3] have put limelight on Multiple and Partial Periodicity Mining in Time Series Databases. Periodicity search in time series is a problem that has been investigated by mathematicians in various areas, such as statistics, economics, and digital signal processing. For large databases of time series data, scalability becomes an issue that traditional techniques fail to address. In existing time series mining algorithms for detecting periodic patterns, the period length is user specified. This is a drawback especially for datasets where no period length is known in advance. They propose an algorithm that extracts a set of candidate periods featured in a time series that satisfy a minimum confidence threshold, by utilizing the autocorrelation function and FFT as a filter.

G.N.V.G. Sirisha , M. Shashi & G.V. Padma Raju have studied the periodic pattern mining[4]. The merits and demerits of different algorithms was given in their paper. Owing to a large number of applications periodic pattern mining has been extensively studied for over a decade. Periodic pattern is a pattern that repeats itself with a specific period in a given sequence. Periodic patterns can be mined from datasets like biological sequences, continuous and discrete time series data, spatiotemporal data and social networks. Periodic patterns are classified based on different criteria. Periodic patterns are categorized as frequent periodic patterns and statistically significant patterns based on the frequency of occurrence. Frequent periodic patterns are classified as perfect and imperfect periodic patterns, full and partial periodic patterns, synchronous and asynchronous periodic patterns, dense periodic patterns, approximate periodic patterns. Their paper presents a survey of research on periodic pattern mining algorithms and their application areas. They also presents a brief overview of algorithms that can be applied for specific types of datasets like spatiotemporal data and social networks.

M.G. Elfeky, W.G. Aref, and A.K. Elmagarmid have developed an efficient algorithm for detecting each type of periodicity in O(nlogn)[5]. In their paper, they defined two types of periodicities for time series databases. Whereas symbol periodicity addresses the periodicity of the symbols in the time series, segment periodicity addresses the periodicity of the entire time series regarding its segments. They have proposed a scalable, computationally efficient algorithm for detecting each type of periodicity in O(nlogn) time, for a time series of length n. An empirical study of the algorithms using real- world and synthetic

data sets proves the practicality of the problem, validates the accuracy of the algorithms, and validates the usefulness of their outputs. Moreover, segment periodicity detection takes less execution time whereas symbol periodicity detects more periods. They conclude that in practice, segment periodicity detection could be applied first and if the results are not sufficient, or not appealing, symbol periodicity detection can be applied. They also have studied the integration of their proposed periodicity detection algorithms in the entire process of time series mining, and have proved its effectiveness in the case of partial periodic patterns mining.

M.G. Elfeky, W.G. Aref, and A.K. Elmagarmid, mentioned the concept of time warping for periodicity algorithm[6]. In that paper, they have proposed a time warping algorithm, named WARP, for periodicity detection in the presence of noise. To handle efficiently all types of noise, WARP extends or shrinks the time axis at various locations to optimally remove the noise. Furthermore, he have proposed an online version of WARP that fits the data stream model. An empirical study using synthetic data shows that there is a tradeoff between noise resiliency and time performance. WARP is more noise resilient, yet requires more processing time, than the previous periodicity detection algorithms. Moreover, Online WARP is shown empirically to be reasonably accurate, even under low memory resources.

David Lo et al has put forth a novel method, frame work, and tool for mining inter-object scenario-based specifications in the form of a UML2-compliant variant of Damm and Harel's live sequence charts (LSC)[7]. LSC as a specification language extends the partial order semantics of sequence diagram with temporal liveness and symbolic class level lifeliness to generate compact specifications. The output of this algorithm is satisfying the given thresholds of support and confidence, mined from an input program execution race. The author uses search pruning strategy, specifically adapted to LSCs, which provides efficient mining of scenarios of arbitrary size.Live sequence charts (LSC), a visual model, scenario-based, inter-object language is proposed by David Lo et al., to investigate the problem of mining scenario-based triggers and effects from program execution tracers. The author uses data mining methods to provide significant and complete results of modulo user-defined thresholds. The input trigger and effect scenarios and the resulting candidate modal scenarios are represented and visualized using a UML2- complaint variant of LSC.

Jinlin Chen has presented an updown directed acyclic graph approach for sequential pattern mining[8]. Sequential pattern mining is an important data mining problem that detects frequent subsequences in a sequence database. The author proposed an UDDAG for fast pattern growth. It is a new novel data structure, which supports bidirectional pattern growth from both ends of detected patterns. With UDDAG, at level i recursion, we may grow the length of patterns by 2i-1 at most. Thus, a length-k pattern can be detected in [log2 k+1] levels of recursion at best and that will give result in fewer levels of recursion and faster pattern growth.

A suffix tree based noise resilent algorithm for periodicity detection in time series database is proposed by Faraz Rasheed et al [9]. They present a noise resilent algorithm using suffix tree as an underlying data structure. This algorithm not only calculates symbol and segment periodicity, but also detects the partial periodicity in time series. It also efficiently detects periodicity in the presence of noise compared with existing algorithm. It detects periodicity in the presence of replacement, insertion, deletion or a mixture of any of this type of noise. The authors improve their previous algorithm by incorporating the time tolerance window so as to make it more silent to insertion and deletion noise.

Dr.Ramachandra, V.Pujeri, G.M.Karthik[10] have proposed a novel algorithm that uses FP tree as underlying structure. The algorithm can detect symbol, sequence and segment

periodicity as well as present the patterns that are periodic.The search for the periodicity in time-series database has a number of application, is an interesting data mining problem. In real world dataset are mostly noisy and rarely a perfect periodicity, this problem is not trivial. Periodicity is very common practice in time series mining algorithms, since it is more likely trying to discover periodicity signal with no time limit. They propose an algorithm uses FP-tree for finding symbol, partial and full periodicity in time series. They designed the algorithm complexity as *O (kN)*, where *N* is the length of input sequence and *k* is length of periodic pattern. They have shown their algorithm is fixed parameter tractable with respect to fixed symbol set size and fixed length of input sequences. Experiment results on both synthetic and real data from different domains have shown their algorithms has time efficient and noise-resilient feature. A comparison with some current algorithms demonstrates the applicability and effectiveness of the proposed algorithm.

Efficient periodicity mining in time series databases using suffix tree is proposed by Faraz Rasheed et al.[11] Time series database is a collection of data values stored at uniform interval of time to show the behavior of an entity. Periodicity detection is a method for detecting temporal regularities within the time series and the goal of analyzing this database is to find whether and how frequent a periodic pattern is repeated within the series. Here, the data to be analyzed are mostly noisy and there of different periodicity types. The author used STNR as a suffix-tree based algorithm for periodicity detection in time series data. This algorithm is noise-resilient and run in O (kn2) in the worst case. This method also found symbol, sequence and segment periodicity in the time series.

David Lo et al [12] provides mining iterative generators and representative rules for the specification of software. It is best if the software is developed with clear, precise and documented specifications. But the software products are often come with poor, incomplete and even without any documented specifications. These factors are contributed to high software maintenance cost. This is mainly due to the effort put in comprehending or understanding the software code base. So, to improve program understanding, author introduces iterative pattern mining that outputs pattern that are occurred frequently within a program trace. Frequent program behaviors that in turn represents software specifications. So, author introduces mining closed iterative patterns (i.e) maximal patterns without any superpattern having the same support. These generators can be joined with the closed patterns to produce a set of rules called representative rules for forward, backward in-between temporal conditions among events in one general representation.

Avrilia Floratou et al [13] give a technique for efficient and accurate discovery of patterns in sequence datasets. The main aim of sequential data mining applications is to discover frequently occurring patterns. The challenge behind this frequent pattern is allowing some noise in the matching process. The main thing is the definition of a pattern and the definition of similarity between two patterns. This definition of similarity can vary from one application to another. The Author presents a new algorithm called FLAME (Flexible and Accurate Motif Detector) is a flexible suffix tree based algorithm that can be used to find frequent patterns with a variety of definition of motif (pattern) models. FLAME is accurate, fast and scalable one.

Obules u et al., suggests a pruning strategy to remove redundant data in spatiotemporal database[14]. The spatiotemporal data movements obey periodic patterns. (ie) the objects follow the same route over regular time intervals. Author presented the pattern matching technique to find the patterns that were repeated in the time-series database. Three kinds of patterns such as symbols, sequence and segment periodicity are also discovered. Using pruning strategy redundant data are deduced in order to reduce the memory usage and complexities.

S. Drishya, and I. Nancy Jeba Jingle have implemented the concept of periodicity mining from the generated time series database[15]. This will make the prediction process in the time series database to be more efficient. This database contains information about the data which can be duplicated for a particular time period. Periodicity detection is a process for finding temporal regularities within the time series, and the goal of analyzing a time series is to find whether and how frequent a periodic pattern (full or partial) is repeated within the series. Suffix tree formation is useful to find the repeated patterns. Existing work mainly focused on predicting future data based pattern only which is not adopted in all types of data. They have implemented the concept of periodicity mining from the generated time series database. This will make the prediction process in the time series database to be more efficient. This database contains information about the data which can be duplicated for a particular time period. Periodicity detection is a process for finding temporal regularities within the time series, and the goal of analyzing a time series is to find whether and how frequent a periodic pattern (full or partial) is repeated within the series. Suffix tree formation is useful to find the repeated patterns. Existing work mainly focused on predicting future data based pattern only which is not adopted in all types of data. To avoid it they have implemented Suffix tree formation for predicting future data in Time Series Databases.

Eammon Keogh, Jessica Lin and Ada fu have put watch on Finding the Most Unusual Time Series Subsequence[16].In their work, they introduce the new problem of finding time series discords. Time series discords are subsequences of a longer time series that are maximally different to all the rest of the time series subsequences. They thus capture the sense of the most unusual subsequence within a time series. Time series discords have many uses for data mining, including improving the quality of clustering, data cleaning, summarization, and anomaly detection. As they have shown, discords are particularly attractive as anomaly detectors because they only require one intuitive parameter (the length of the subsequence) unlike most anomaly detection algorithms that typically require many parameters. They evaluate their work with a comprehensive set of experiments. In particular, they demonstrate the utility of discords with objective experiments on domains as diverse as Space Shuttle telemetry monitoring, medicine, surveillance, and industry, and demonstrate the effectiveness of our discord discovery algorithm with more than one million experiments, on 82 different datasets from diverse domains.

3. COMPARISON BETWEEN VARIOUS ALGORITHMS

Features	STNR	CONV	WARP	PARPER
Periodicity detection	All type	Segment periodicity	Segment periodicity	Partial periodicity
Complexity	$O(n^2)$	O(nlog n)	$O(n^2)$	O(n)
Time Performance	Average	Best	Worst	Best
Noise resilience	Good	Worst	Good	Worst
Time performance in various noise ratio	Take more time	Does not effect	Does not effect	Does not effect

For comparing different types of algorithms such as WRAP,CONV, Parper, STNR etc different features are considered. The type of periodicity detected, noise ratio, time performance and algorithmic complexies are take into account. By using STNR all type of periodicity such as symbol ,segment and partial periodicity can be detected .By using CONV only symbol and segment periodicity is detected. By using WRAP only segment

periodicity is detected and Parper detects only partial periodicity Next feature considered is the time performance. By comparing STNR against Parper, Parper performs well since it specify only partial periodicity. while STNR is general and finds the periodicity for all patterns which are periodic for any periodic value starting and ending anywhere in the time series.So time performance of Parper is better than Stnr but it only detects partial periodicity. By comparing CONV with STNR the time performance of CONV is better than STNR. By comparing the complexity of the four algorithm CONV perform best running time complexity of O(nlogn).The time complexity of STNR is O(n2) but it perform better because Stnr applies various optimization strategies like redundant period pruning technique.The complexity of WRAP is worse than remaining algorithm since its running time is O(n2). Parper has best running algorithm of O(n) but it is not best because it only detect partial periodicity When the noise ratio increases the efficiency of STNR increases. WRAP and STNR have good effect on noise resilience.

3.1Disadvantages Of Existing Algorithms

Algorithms based on convolution Technique has complexity of O(nlogn) and it fails to perform well when the time series contain insertion and deletion noise. CONV and Parper does not have any effect on noise ratio .When the noise increases then the efficiency of WRAP decreases. Algorithm based on time warping technique reporting $O(n^2)$ WRAP has the worse time performance among the four type of algorithms WRAP detect only segment periodicity. The efficiency of WRAP in various noise ratio is worst. When comparing the time performance of algorithms in different noise ratio, the STNR takes more time if the noise ratio is small. PARPER needs the user to provide the expected period values and runs in linear O(n) time. It detect only partial periodic pattern. The existing algorithm has some advantages and disadvantages so we have decided to develop new algorithm.

4.PROPOSED PLAN FOR WORK

In our paper, we will study different periodicity mining algorithm and compare those algorithm and find out solution to design an efficient periodicity mining algorithm to overcome the potential demerits. For this purpose we are going to use temperature, weather and power consumption data as a input and results will be represented.

4.1Basic Plan To Design New Algorithm

It consist of some phases. In the first phase, we will study and analyse the existing algorithm so that we should aware of their merits , dmerits and complexities. In the second phase, we will present the design of the proposed algorithm. The basic structure of algorithm will be given in this phase. In next phase, we will give implementation details of proposed algorithm. In this phase the input dataset,output dataset ,flowchart, hardware and software requirements will be discussed. In the last phase, testing will be done on designed algorithm with temperature, weather and power consumption databases which are examples of time series databases.

4.2 Methodology

we will use MATLAB 7.10 to implement and evaluate the performance of the algorithm. Datasets can be used for evaluation are temperature and weather data The parameters required for evaluation are

4.2.1 Accuracy

The accuracy measure is the ability of the algorithm to detect the different periodicities that are embedded in the time series. The parameters that determine accuracy are data distribution, alphabet size (number of unique symbols in the data), size of the data (number of symbols in the data), period size, and the type and amount of noise in the data.

4.2.2 Time Complexity

The algorithm is examined to be efficient as it has the capability to detect all different kinds of periodicities (Symbol, Sequence & Segment) at their different occurrences (perfect & imperfect) within this time complexity. The time complexity is approximately the same for all different kinds of data namely the text, images and audio. The time complexity of an algorithm quantifies the amount of time taken by an algorithm to run as a function of the length of the string representing the input.

In our work, the following input parameters along with time series data will be Considered. They are Input Pattern (String), Confidence Measure , Minimum Support and Period Of Interest. The result of experiment on time series data set will be presented and evaluated on the basis of key factors accuracy and time performance and the input data will be processed using proposed algorithm in order to mine periodicity efficiently. Results will be displayed in tabular and graphical form.

5.IMPLEMENTATION PLAN

5.1 Input Dataset

Input dataset is time series databases that can be weather,temperature or power consumption data.The time series data can be represented in different forms

5.1.1 Data Adaptive

It includes Sorted Coefficients ,Piecewise Polynomial, Singular value Decomposition ,symbolic ,Trees.The Piecewise Polynomial can be subdivided in to piecewise Linear Approximation and Adaptive piecewise constant Approximation. Symbolic can be classified as Natural Language and Strings.

5.1.2 Non Data Adaptive

It is subdivided as Wavelets, Random mappings, Spectral and Piecewise Aggregate approximation. Wavelets can be represented in Orthonormal and Biorthonormal. Spectral has subtypes as discrete fourier transform and discrete cosine transform.

5.2 Pre-Processing

In this, the system is concerned with proper categorization of data stream provided as input. In addition to that the data will be normalized in proper range of values.

5.3 Symbolization

The time series database is a large volume of data, non-finite, noise interference forms. It is infeasible to analyze large data manually. So automatic or semi automatic tools are used for data analysis. Symbolization technique can be used to reduce the number of values for a given continuous attribute, by dividing the range of attribute into interval. The interval labels (input symbols) can then be used to replace actual data values. The time series database should be symbolized in order to improve analysis that is complex.The symbolization methods are evaluate in terms of information loss and compression factor.

5.4 Binarization

Binarizes a set of real-valued time series using k-means clustering edge detection, or scan statistics.

5.4.1 K-Means Clustering

For each gene, k-means clusterings are performed to determine a good separation of groups. The values belonging to the cluster with the smaller centroid are set to 0, and the values belonging to the greater centroid are set to 1.

5.4.2 Edge Detector

This approach first sorts the measurements for each gene.In the sorted measurements, the algorithm searches for differences of two successive values that satisfy a predefined condition:If the "firstEdge" method was chosen, the pair of values whose difference exceeds the scaled average gradient of all values is chosen and used as maximum and minimum value of the two groups.If the "maxEdge" method was chosen,the largest difference between two successive values is taken.

5.4.3 Scan Statistic

The scan statistic assumes that the measurements for each gene are uniformly and independently distributed independently over a certain range. The scan statistic shifts a scanning window across the data and decides for each window position whether there is an unusual accumulation of data points based on an approximated test statistic. The window with the smallest p-value is remembered. The boundaries of this window form two thresholds, from which the value that results in more balanced groups is taken for binarization.Depending on the supplied significance level, gene binarizations are rated according to the p-value of the chosen window.

5.5 Fast Fourier Transform

FFT=Fast Fourier Transform. The FFT is a faster Version of the Discrete Fourier Transform. The FFT utilizes some clever algorithms to do the same thing as the DTF, but in much less Time. FFT represent periodic time series data as a sum of sinusoidal components(sine and cosine).It also represent time series in the frequency domain We can Filter data/Extract pattern with Fourier Transform as it is one of the application of FFT. If we want to extract a pattern from time series data it is better to see it in the graph.so for that reason we are using a tool like Matlab.

5.6 Autocorrelation

We can look directly at yhe time series and ask how much information there is in the previous value that help to predict the current value acf function looks at the correlation between now and various points in the past. Autocorrelation refers to the correlation of a time series with its own past and future values. Autocorrelation is also sometimes called “lagged correlation” or “serial correlation”, which refers to the correlation between members of a series of numbers arranged in time. Positive autocorrelation might be considered a specific form of “persistence”, a tendency for a system to remain in the same state from one observation to the next. For example, the likelihood of tomorrow being rainy is greater if today is rainy than if today is dry. Geophysical time series are frequently autocorrelated because of inertia or carry over processes in the physical system. For example, the slowly evolving and moving low pressure systems in the atmosphere might impart persistence to daily rainfall. Or the slow drainage of groundwater reserves might impart correlation to successive annual flows of a river. Or stored photosynthates might impart correlation to successive annual values of tree-ring indices.Autocorrelation complicates the application of statistical tests by reducing the number of independent observations .Autocorrelation can also complicate the identification of significant covariance or correlation between time series. Autocorrelation can be exploited for predictions. An autocorrelated time series is predictable because future values depend on current and past values.Three tools for assessing the autocorrelation of a time series are the time series plot, the lagged scatterplot, and the autocorrelation function.

5.7 Output

Results will be displayed in tabular and graphical form. In output we have to consider Periodic Patterns, Period and Confidence Measure.

5.8 Platform Required

5.8.1 Software Specification

Operating System: Windows XP/7/8
Technology: MATLAB 7.10
Database : MySQL

5.8.2 Hardware Specification

Processor: Pentium Processor
Ram: 64 MB
Hard Disk: 2 GB

6. CONCLUSION

In this paper we have discussed various periodicity detection algorithms and done comparision among those algorithms. After understanding the drawbacks of existing algorithm we proposed the design of efficient algorithm. For testing the efficiency of our

algorithm we have selected input as weather, temperature and power consumption data.

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Optical Character Recognition from Text Image

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Abstract: Optical Character Recognition (OCR) is a system that provides a full alphanumeric recognition of printed or handwritten characters by simply scanning the text image. OCR system interprets the printed or handwritten characters image and converts it into corresponding editable text document. The text image is divided into regions by isolating each line, then individual characters with spaces. After character extraction, the texture and topological features like corner points, features of different regions, ratio of character area and convex area of all characters of text image are calculated. Previously features of each uppercase and lowercase letter, digit, and symbols are stored as a template. Based on the texture and topological features, the system recognizes the exact character using feature matching between the extracted character and the template of all characters as a measure of similarity.

Keywords: character recognition; feature extraction; feature matching; text extraction; character extraction

1. INTRODUCTION

Optical character recognition (OCR) is the conversion of scanned images of printed, handwritten or typewritten text into machine-encoded text. This technology allows to automatically recognizing characters through an optical mechanism. In case of human beings, our eyes are optical mechanism. The image seen by eyes is input for brain. OCR is a technology that functions like human ability of reading. OCR is not able to compete with human reading capabilities. OCR is a technology that enables you to convert different types of documents such as scanned paper documents, PDF files or images captured by a digital camera into editable and searchable data.

One widely known application is in banking, where OCR is used to process demand draft or cheque without human involvement. An image of demand draft or cheque can be captured by mobile camera, the writing on it is scanned instantly, and the correct amount of money is transferred. This technology has nearly been perfected for printed demand draft or cheque, and is fairly accurate for handwritten demand draft or cheque as well, though it requires signature verification. In the legal industry, there has also been a significant movement to digitize paper documents. In order to save space and eliminate the need to sift through boxes of paper files, documents are being scanned. OCR further simplifies the process by making documents text-searchable, so that they are easier to locate and work with once in the database. Legal professionals now have fast, easy access to a huge library of documents in electronic format, which they can find simply by typing in a few keywords. OCR is widely used in many other fields, including education, finance, and government agencies.

In this paper, one effective optical character recognition from text image using texture and topological features is proposed. For better performance, the texture and topological features of all characters of text image like corner points, features of different regions, and ratio of character area and convex area are calculated. Based on the texture and topological information, character verification is done using feature matching between the extracted character and the template of all character serves as a measure of similarity between the two. This paper is organized into the following sections. Section II describes an overview of previous work. Implementation details for optical character recognition are mentioned in section III. Experimented results are shown in section IV. Finally, the conclusions are in section V.

2. PREVIOUS WORK

Several approaches for text detection in images and videos have been proposed in the past. Based on the methods being used to localize text regions, these approaches can be categorized into two main classes: connected component based methods and texture based methods. The first class of approaches employs connected component analysis, which consists of analyzing the geometrical arrangement of edges or homogeneous color and grayscale components that belong to characters. The second class of approaches regards texts as regions with distinct textural properties, such as character components that contrast with the background and at the same time exhibit a periodic horizontal intensity variation, due to the horizontal alignment of characters.

An automatic text extraction system is proposed in [1], where second order derivatives of Gaussian filters followed by several non-linear transformations are used for a texture segmentation process. Then, features are computed to form a feature vector for each pixel from the filtered images in order to classify them into text or non-text pixels. Methods of texture analysis like Gabor filtering and spatial variance are used to automatically locate text regions in [2]. A new approach is proposed in [3] to perform a color reduction by bit dropping and color clustering quantization, and afterwards, a multi-value image decomposition algorithm is applied to decompose the input image into multiple foreground and background images. An approach in which LCQ (Local Color Quantization) is performed for each color separately is proposed in [4]. Each color is assumed as a text color without knowing whether it is real text color or not. [5] has presented an algorithm which uses only the red part of the RGB color space to obtain high contrast edges for the frequent text colors. By means of a convolution process with specific masks it first enhances the image and then detects edges. [6] has presented a technique that performs an eight-connected component analysis on a binary image, which is obtained as the union of local edged maps that are produced by applying the band Deriche filter on each color. A work on chinese

script recognition for business card images is reported in [7]. A new approach for video text detection is reported in [8].

A number of research works on mobile OCR systems have been found. Motorola China Research Center have presented camera based mobile OCR systems for camera phones in [9]. A business card image is first down sampled to estimate the skew angle. Then the text regions are skew corrected by that angle and binarized thereafter. Such text regions are segmented into lines and characters, and subsequently passed to an OCR engine for recognition. The OCR engine is designed as a two layer template based classifier. A similar system is presented for Chinese-English mixed script business card images in [10]. An outline of a prototype Kanji OCR for recognizing machine printed Japanese texts and translating them into English is proposed in [11]. An approach of character recognition system for Chinese scripts has been presented in [12]. A system is developed for only English capital letters in [13]. At first, the captured image is skew corrected by looking for a line having the highest number of consecutive white pixels and by maximizing the given alignment criterion. Then, the image is segmented based on X-Y Tree decomposition and recognized by measuring Manhattan distance based similarity for a set of centroid to boundary features. However, this work addresses only the English capital letters and the accuracy obtained is not satisfactory for real life applications. Moreover, research in developing OCR systems for mobile devices is not limited to document images only. [14] worked on reading LCD/LED displays with a camera phone. Text/Graphics Separation for Business Card Images for Mobile Devices is proposed in [15]. A Fast Skew Correction Technique for Camera Captured Business Card Images is proposed in [16]. Segmentation of Camera Captured Business Card Images for Mobile Devices is proposed in [17]. Optical character recognition still remains an open challenge for many languages.

3. IMPLEMENTATION

Optical character recognition (OCR) takes a text image as input and gives editable text document as output. The OCR system primarily involves four steps: Pre-processing, Features extraction, Features training, and Feature matching. Flow chart of the OCR is shown in Figure 1. Here, two data sets are considered, one for training dataset and another for test dataset. Preprocessing and feature extraction is done in both cases. Features extracted from test data is compared with features extracted from training data to get the desired output.

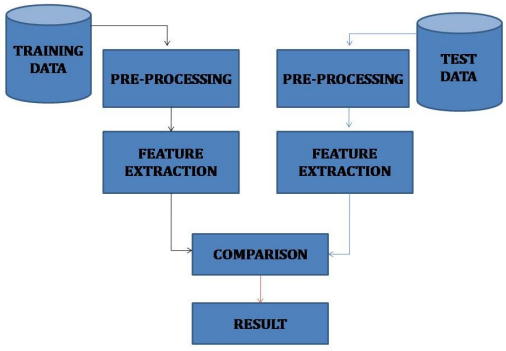

Figure 1: Flowchart of OCR system

3.1 Pre-processing

The text image is converted into binary image for further working as shown in Figure 2 and Figure 3. When any image is converted to binary, it is easy to work with pixel values 0 and 1. The binary image is complimented so that the letters constitute by binary 1 (one) and background constitute by binary 0 (zero) as shown in Figure 4.

Figure 2: Text Image

Figure 3: Binary Image

Now, individual text lines are separated from the binary image. This is done by calculating the sum of all values in a row. When the sum is 0, a new line is identified and separation is done. The sum of all rows in between two lines should be zero. The image is divided into several lines and each line is extracted one by one as shown in Figure 5. This procedure is repeated until all lines are extracted.

Figure 4: Complimented Binary Image

Figure 5: Extracted lines

Single lines are extracted due to the fact that, dealing with one line is easier than dealing with the whole image. Again, for each line, the letters are to be extracted as shown in Figure 6 and Figure 7. This is done by calculating the sum of all values in a column. When sum is zero, a character is identified and separation is done. In this way, all individual characters (alphabets, digits, punctuations) are separated.

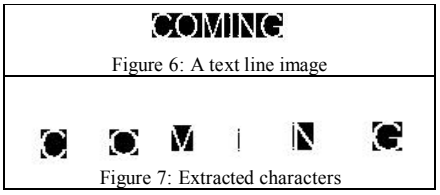

Figure 6: A text line image

Figure 7: Extracted characters

3.2 Features Extraction

Feature extraction technique is applied for all individual extracted characters. The character image is divided into four regions as shown in Figure 8.

Figure 8: Extracted character

Sum of the pixels value of the whole image and sum of pixels value in each of the sub-regions are calculated. Then their ratios are calculated as the features value of f1, f2, f3, f4 respectively.

f1= Sum of the pixels value of 1st quadrant /
Sum of the pixels value of the whole image

f2= Sum of the pixels value of 2nd quadrant /
Sum of the pixels value of the whole image

f3= Sum of the pixels value of 3rd quadrant /
Sum of the pixels value of the whole image

f4= Sum of the pixels value of 4th quadrant /
Sum of the pixels value of the whole image

To get better accuracy, features f5, f6, f7, f8, f9, and f10 are calculated using f1, f2, f3, and f4.

f5=f1+f2

f6=f2+f3

f7=f3+f4

f8=f1+f4

f9=f2+f4

f10=f1+f3

Using Harris corner method, numbers of corner points are calculated from character image. Feature f11 is considered as the number of corner points of a character. Total area of extracted character image is calculated using the actual number of pixels in the character image. Convex area of the character is calculated using the number of pixels in convex hull that can contain the character region. Feature f12 is ratio of convex area to total area.

f12= Convex Area / Total Area

Total twelve features f1 to f12 are extracted for all individual extracted characters.

3.3 Features Training

Here, three fonts, namely 'Lucida Fax', 'Berlin Sans' and 'Arial' have been considered as training data set. Three images Figure 9, Figure 10, and Figure 11 is used to extract the character features for training the system. The trained features value will be used for recognizing the extracted character.

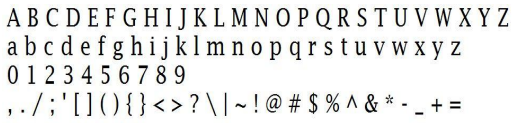

Figure 9: Text Image of Lucida Fax

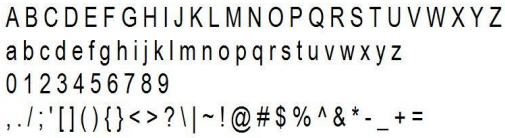

Figure 10: Text Image of Arial

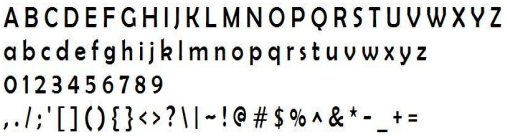

Figure 11: Text Image of Berlin Sans

3.4 Feature Matching

The features value is matched with the trained features set to recognize the exact character. Different matching algorithm can be used for feature matching. The minimum distance value with respect to all the features (f1 to f12) is selected as required character.

ALGORITHM FOR OCR

STEP 1: The input text image is converted into binary image.

STEP 2: The binary image is complimented so that the letters constitute by binary 1 (one) and background constitute by binary 0 (zero).

STEP 3: All text lines are separated from the binary image. This is done by finding the sum of all values in a row. When the sum is 0, a new line is identified and separation is done. The sum of all rows in between two lines should be zero.

STEP 4: For each line, the characters are to be extracted. This is done by finding the sum of all pixels value in a column. When sum is zero, a new character is identified and separation is done.

STEP 5: Total 12 features value f1 to f12 are extracted for each character.

STEP 6: The features value are matched with the trained features set to recognize the exact character.

4. EXPERIMENTAL RESULTS

This section introduces the experimental results. Only three fonts, namely 'Arial', 'Berlin Sans' and 'Lucida Fax' have been considered as training data set. Based on training data set, five cases each comprising of different text images (different number of characters) with five different fonts is tested for optical character recognition. The letters which are correctly and incorrectly interpreted are counted and the accuracy is calculated as shown in Table 1.

Table 1: Result of OCR

Test Image	Font Name	Correct Recognition	Incorrect Recognition	Accuracy
Case 1 (consist of 10 characters)	Arial	6	4	60%
	Berlin Sans	10	0	100%
	Cambria	5	5	50%
	Lucida Fax	6	4	60%
	Times New Roman	6	4	60%
Case 2 (consist of 20 characters)	Arial	19	1	95%
	Berlin Sans	19	1	95%
	Cambria	6	14	30%
	Lucida Fax	16	4	80%
	Times New Roman	7	13	35%
Case 3 (consist of 25 characters)	Arial	24	1	96%
	Berlin Sans	25	0	100%
	Cambria	1	24	4%
	Lucida Fax	14	11	56%
	Times New Roman	7	18	28%
Case 4 (consist of 30 characters)	Arial	28	2	93.33%
	Berlin Sans	30	0	100%
	Cambria	5	25	16.66%
	Lucida Fax	20	10	66.66%
	Times New Roman	9	21	30%
Case 5 (consist of 70 characters)	Arial	61	7	87.14%
	Berlin Sans	66	4	94.28%
	Cambria	10	60	14.28%
	Lucida Fax	45	25	64.28%
	Times New Roman	15	55	21.42%

The text image of Arial font is used as input of the OCR as shown in Figure 12. The output of OCR is the editable text document as shown in Figure13. Out of 70 characters, 61 characters are correctly interpreted.

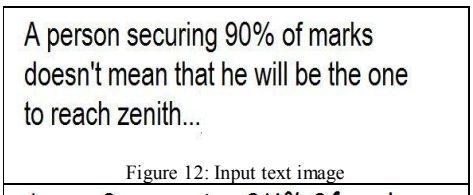

Figure 12: Input text image

A pers8n securing 9M% 8fmarks
d8esn"t mean that hewill bethe 8ne
t8 reach zenith...

Figure 13: Output of OCR

5. CONCLUSIONS

A number of methods have been proposed by several authors for optical character recognition. A new method to extract features from text images and recognition of exact character to produce text document is presented here. The proposed method promises a very simple but reliable solution to the problem of optical character recognition. The technique that is used based on calculating the number of corner points and utilizing the various properties like object area and convex areas of the image. Only three fonts, namely 'Arial', 'Berlin Sans' and 'Lucida Fax' have been considered as training data set. Experimental results on a set of images show accuracy up to 100% for 'Berlin Sans', 96% for 'Arial' and 80% for 'Lucida Fax'. Achieved results are encouraging and suggest the adequacy of the selected features. Accuracy for 'Cambria' and 'Times New Roman' font is very poor. Accuracy for these fonts can be achieved by training the system with 'Cambria'

and 'Times New Roman' characters set. The proposed algorithm will help the community in the field of handwritten character recognition. By introducing more features, the accuracy can be enhanced.

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A Novel DBSCAN Approach to Identify Microcalcifications in Cancer Images with Noise

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Abstract: Cancer is the most deadly disease among the human life. Breast Cancer is one of the most common cancers in this industrialized world and it is the most common cause of cancer related death among worldwide. Many segmentation technologies and clustering technologies like K-Means, K-Mediod, CLARANS etc have been proposed to identify the microcalcifications but this paper presents our new approach of identification of cancer cells in the images containing with noise and the performance analysis.

Key Words: Cancer, Breast Cancer, Segmentation, Clustering, K-Means, K-Medoid, CLARANS.

1. INTRODUCTION:

The most frequently diagnosed cancer in females is breast cancer, the variation may be due to the racial and genetic differences, cultural differences and the environmental factors that are varied throughout the world. There are two main types of breast cancer non-invasive (in situ) and invasive breast cancer. In non-invasive breast cancer the cancer cells remains within their place of origin and they have not spread to the breast tissue around the duct or lobule. In this we have two subtypes Ductal Carcinoma InSitu (DCIS) which is precancerous lesion and Lobular Carcinoma In Situ (LCIS) which is not precancerous and may increase the risk of cancer in both breasts. In invasive breast cancer it spreads outside the membrane that lines a duct or lobule, invading the surrounding tissues. Cancer stages with I, II, III, IV (will be discussed later) are invasive breast cancer.

1.1 Parts of Breast cancer:

- Milk Ducts: DCIS is the most common type of breast cancer which forms in the lining of a milk duct within the breast.
- Milk producing lobules: LCIS starts in the lobules of the breast, where breast milk is produced. The lobules are connected to the ducts, which carry breast milk to nipple.
- Connective tissues: the connective tissue made up of muscles, fat and blood vessels will be rarely affected by the cancer cells.

1.2 Symptoms of breast cancer:

For women:

- Breast lump in the armpit which will be hard and having uneven edges which usually doesn't hurt.
- Change in the size, shape or feel of the breast or nipple.
- Fluid coming from nipple may be bloody, clear to yellow, green and look like pus.

For men:

- Breast lump and breast pain and tenderness, advanced stage may include bone pain, skin ulcers, swelling of arms, weight loss.

1.3 Issues in breast cancer:

- Mammography is one of the tool which is used to identify the breast lump screening with mammography is suggested by many doctors for the detection of breast cancer but the mammography is done once the age of women reaches 40 which fails for the early detection of breast cancer. Mammograms [12-13]are most often used in women over 40, unless they are at high risk, like carrying a mutation of the BRCA1 or BRCA2 gene. Having such a

mutation increases the risk of developing cancer five-fold. Even though many methods[1] are involved for the detection the radiation and the mammography techniques may increase the risk of breast cancer for younger age women

- Which types of tumors benefit most from early detection? The major problem is breast cancer at the early stages is not seen any case in the sense the symptoms will not give a clear picture of presence of the cancer cells.
- Monitoring and evaluation of individualized screening has to be taken care which means not only a single screening technique and different therapy can be suggested based on the risk of breast cancer[7-9].
- Many modern techniques have to be found for the faster evaluation of the results of the screening technologies [4]so that the accuracy of the results can be upgraded.
- Some studies have suggested women with the genetic mutations could be more sensitive to radiation because the genes are involved in fixing DNA problems. If those genes are damaged by radiation, they may not be able to repair DNA properly, raising the cancer risk. Researchers found women with a history of chest radiation in their 20s had a 43 per cent increased relative risk of breast cancer compared to women who had no chest radiation at that age. Any exposure before age 20 seemed to raise the risk by 62 per cent. Radiation after age 30 did not seem to affect breast cancer risk.
- Psychological issues also should be taken care in the sense proper knowledge about the disease, role and care of the family, sexual functioning, type and degree of disruption in life cycle tasks such as proper menstrual cycle, child bearing etc., personality and ability to cope up with stress, anxiety, prior psychiatric history, availability of psychological and social support and other factors.

2. METHODOLOGIES USED:

2.1 Improved k-Means clustering.

In the proposed methodology[5-6] there are mainly three important steps the first is the image which will be input to the machine which will be provided by the image database and filtering of the image and next important step is the implementation of k-means algorithm and lastly the classification of the image and producing the output image. The block diagram below shows the steps

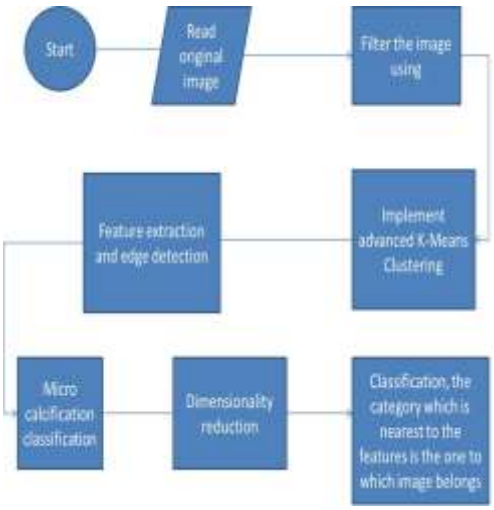

Figure 1: block diagram of the prosed adaptive k-means algorithm.

Clustering algorithms[10-12] can be applied to solve the segmentation problem. They consist in choosing an initial pixel or region that belongs to one object of interest, followed by an interactive process of neighborhoods analysis, deciding if whether each neighboring pixel belongs or not to the same object. In this work we use the K-Means[2-3] to resolve the mass detection task on mammograms using texture information obtained from Haralick's descriptors. The K-means algorithm is one of the simplest non-supervised learning algorithms class that solves the clustering segmentation problem . The method follows the usual steps to satisfy the primary objective: clustering all the image objects into K distinct groups. First, K centroids are defined, one for each group, being their initial position very important to the result. After that, it is determined a property region for each centroid, which groups a set of similar objects. The interactive stage of the algorithm is started, in which the centroid of each

group is recalculated in order to minimize the objective function. This function, for K-means, is the minimum square method, calculated by

$$J = \sum_{j=1}^{k} \sum_{i=1}^{n} ||x_i^{(j)} - c_j||^2$$

$||x_i^{(j)} - c_j||^2$ ⟶ Distance metric from any point from any point $x_i^{(j)}$ to the group c_j

Thus, the J (objective function) represents the similarity measure of the n objects contained in their respective groups.

The proposed idea comes from the fact that the k-means algorithm discovers spherical shaped cluster, whose center is the gravity center of points in that cluster, this center moves as new points are added to or removed from it. This motion makes the center closer to some points and far apart from the other points, the points that become closer to the center will stay in that cluster, so there is no need to find its distances to other cluster centers. The points far apart from the center may change the cluster, so only for these points their distances to other cluster centers will be calculated, and assigned to the nearest center. In the proposed method, we write two functions. The first function is the basic function of the k-means algorithm, that finds the nearest center for each data point, by computing the distances to the k centers, and for each data point keeps its distance to the nearest center.

2.2 Improved K-Medoid

Input: K: The number of segments D: An images

Output: A segmented image that minimizes the sum of the dissimilarities of all the pixels to their nearest medoid. Method: Convert image into gray scale; Equalize histogram; Store the equalized intensities into an array; Select randomly K medoids from array; Remove the selected medoids from array; Segment image using this medoids; Calculate the total cost T and store medoids and cost;

Repeat: Randomly select a non medoid Orandom from array and remove it from array ; Assign each remaining pixel to the segment with the nearest medoid; Compute the new total cost Tnew of swap point Oj with Orandom if Tnew < T then swap Oj with Orandom to form the new set of k medoid Until array is not empty;

In the place of advanced K-Means we implement Improved K-Medoid along with the two phase approach to increase the performance and to obtain accurate results.

Phase 1

Step 1: Threshold the image using Otsu's method.

Step2: Label the connected components of the binary image as L1, L2..., Ln where n is the number of connected areas.

Step3: Find the reference area A=(L1.area+ L2.area+…+Ln.area)/n*10.

Step 4 : Copy all connected regions having area less than A into the output image.

Phase 2

Step 1: The process begins in the region of interest.

Step 2: a) For each pixel in the identified region calculate the intensity difference between that pixel and eight neighboring pixels

b) If there is any pixel having intensity difference greater than a predefined value, put it into the new image of the same size as the input image.

c) Repeat the above two steps for two times(Done in order to create ample gap between the cancer nodules and noncancerous tissues).

Step 3: Erode each of the resulting images with their

Step 4: Combine all the resulting images to form the final output image

2.3 CLARANS:

CLARANS (A Clustering Algorithm based on Randomized Search) . CLARANS draws sample of neighbors dynamically. The clustering process can be presented as searching a graph where every node is a potential solution, that is, a set of k medoids. If the local optimum is found, CLARANS starts with new randomly selected node in search for a new local optimum. It is more efficient and scalable than both PAM and CLARA . A node is represented by the set of k objects {Om1, …, Omk}. Two nodes are neighbors if their sets differ by

only one object S1 = {Om1, …, Omk}, S2 = {Ow1, …, Owk}

$$|S1 \cap S2| = k - 1$$

each node has k(n-k) neighbors. each node represent a collection of k medoids, each node corresponds to a clustering (dynamic). draws a sample of neighbors in each step of a search. if a better neighbor is found, moves to the neighbor's node

3 DBSCAN:

Relies on a density-based notion of cluster: A cluster is defined as a maximal set of density-connected points. Discovers clusters of arbitrary shape in spatial databases [9]with noise. Arbitrary select a point p . Retrieve all points density-reachable from p with respect to Eps and MinPts. If p is a core point, a cluster is formed. If p is a border point, no points are density-reachable from p and DBSCAN visits the next point of the database. Continue the process until all of the points have been processed.

4 PERFORMANCE EVALUATION:

We have implemented the same methodology for identifying the masses which is specified in the figure above. Compared to other technologies DBSCAN can give a better performance even when noise is included oin the image. Based on our study conducted we have the possible performance evaluated based on various parameters.

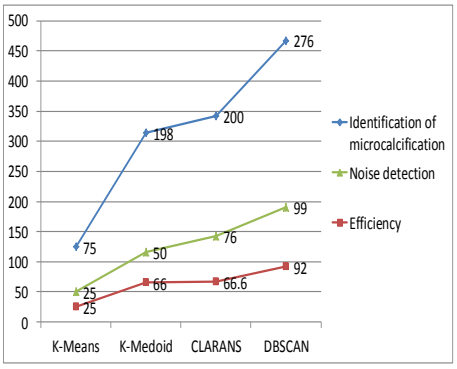

Figure.2: Graph representing the results

The above graph specifies the performance evaluation considering the parameters like identification of microcalcification, noise detection and effeciency for the methodologies discussed.

5. CONCLUSION:

Developing countries need a concentration on the diseases like cancer especially the cervical cancer and breast cancer which accounts for major death in women. This method provides an efficient way to identify the tumor and treatment can be taken. And awareness program has to be conducted in the country. This method provides an accurate result and which says that DBSCAN provides efficient way t identify noise in cancer cells and increase the performance.

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Parameterized Image Filtering Using fuzzy Logic

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Abstract: The principal source of blur in digital images arise during image acquisition (digitization) or transmission. The performance of imaging sensors is affected by a variety of factors, such as the environmental conditions during image acquisition. Blurry images are the result of movement of the camera during shooting (not holding it still) or the camera not being capable of choosing a fast enough shutter speed to freeze the action under the light conditions. For instance, in acquiring images with a camera, light levels and sensor temperature are major factors affecting the amount of blur in the resulting image.

Blur was implemented by first creating a PSF filter in MatLab that would approximate linear motion blur. This PSF was then convolved with the original image to produce the blurred image. Convolution is a mathematical process by which a signal, in this case the image, is acted on by a system, the filter, in order to find the resulting signal. The amount of blur added to the original image depended on two parameters of the PSF: length of blur (in pixels), and the angle of the blur. This thesis work is going to provide a new, faster, and more efficient noise reduction method for images corrupted with motion blur. This new filter has two separated steps or phases: the detection phase and the filtering phase. The detection phase uses fuzzy rules to determine whether a image is blurred or not. When blurry image is detected, Then we use fuzzy filtering technique focuses only on the on the real blurred pixels.

Keywords: Impulse noise, iterative filtering algorithm, Gaussian noise, edge based comparison

1. INTRODUCTION

The process of receiving and analyzing visual information by the human species is referred to as sight, perception or understanding. Similarly, the process of receiving and analyzing visual information by digital computer is called *digital image processing* [5].One of the first applications of digital images was in the newspaper industry, when pictures were first sent by submarine cable between London and New York. The term digital image processing refers to processing of a two dimensional picture by a digital computer. In other words, it implies digital processing of any two dimensional data. A digital image is an array of real or complex numbers represented by a finite number of bits. An image given in the form of a transparency, slide, photograph, and chart is first digitized and stored as a matrix of binary digits in computer memory. The digitized image can then be processed on a high resolution television monitor. For display, the image is stored in a rapid access buffer memory which refreshes the monitor at 30 frames per second to produce a visibly continuous display.

The principal source of noise in digital images arise during image acquisition (digitization) or transmission. The performance of imaging sensors is affected by a variety of factors, such as the environmental conditions during image acquisition, and by the quality of the sensing elements themselves. For instance, in acquiring images with a camera, light levels and sensor temperature are major factors affecting the amount of noise in the resulting image. Images are also corrupted during transmission principally due to interference in the channel used for transmission. For example, an image transmitted using a wireless network might be corrupted as a result of lighting or other atmospheric disturbance. There are various types of noise can be added in image.

2. DETECTION AND FILTERING ANALYSIS

Noise is usually quantified by the percentage of pixels which are corrupted. Corrupted pixels are either set to the maximum value or have single bits flipped over. In some cases, single pixels are set alternatively to zero or to the maximum value. This is the most common form of impulse noise and is called salt and pepper noise.

This new filter has two separated steps or phases: the detection phase and the filtering phase. The detection phase uses fuzzy rules to determine whether a pixel is corrupted with impulse noise or not. When impulse noise is detected, some parameters will be determined which will be passed to the filtering phase. After this detection, the fuzzy filtering technique focuses only on the on the real noisy pixels A digital image $a[m, n]$ described in a 2D discrete space is derived from an analog image $a(x, y)$ in a 2D continuous space through a sampling process that is frequently referred to as digitization. The 2D continuous image $a(x, y)$ is divided into *N rows* and *M columns*. The intersection of a row and a column is termed a *pixel*. The value assigned to the integer coordinates $[m, n]$ with {m=0,1,2,...,M-1} and {n=0,1,2,...,N-1} is $a[m, n]$. In fact, in most cases $a(x, y)$ which we might consider to be the physical signal that impinges on the face of a 2D sensor is actually a function of many variables including depth (z),

color (λ), and time (t). Unless otherwise stated, we will consider the case of 2D, monochromatic, static images.

Local operations produce an output pixel value b[m=mo, n=no] based upon the pixel values in the neighborhood of a[m=mo, n=no]. Some of the most common neighborhoods are the 4-connected neighborhood and the 8-connected neighborhood in the case of rectangular sampling and the 6-connected neighborhood in the case of hexagonal sampling illustrated in figure.

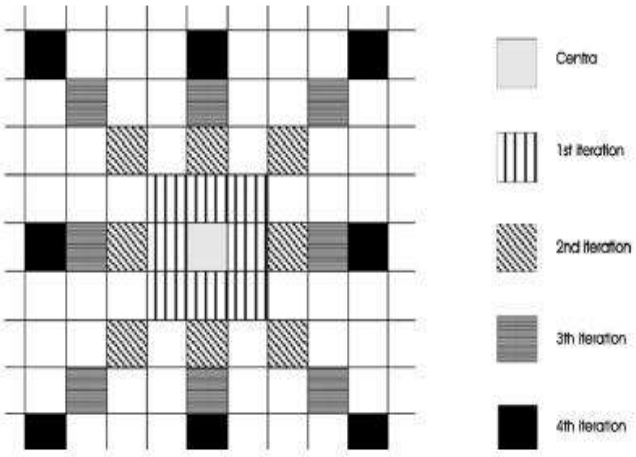

Fig. 1. Hexagonal sampling in 6-connected neighborhood

In Image representation one is concerned with the characterization of the quantity that each picture element represents [3]. An image could represent luminance of objects in a scene, the absorption characteristics of the body tissue, the radar cross section of the target, the temperature profile of the region or the gravitational field in an area. In general, any two dimensional function that bears information can be considered an image.

3. TRADITIONAL TACTICS

An adaptive approach to solve the restoration problem in which filtering is conditioned on the current state of the algorithm. The state variable is defined as the output of a classifier that acts on the differences between the current pixel value and the remaining ordered pixel values inside a window centered around the pixel of interest. This scheme is undoubtedly one of the robust and simple scheme but it fails in preserving the finer details of the image.

Z. Wang and D. Zhang. proposed Progressive-Switching Median filter. It is a median based filter, which works in two stages. In the first stage an impulse detection algorithm is used to generate a sequence of binary flag images [1].. This binary flag image predicts the location of noise in the observed image. In the second stage noise filtering is applied progressively through several iterations. This filter is a very good filter for fixed valued impulsive noise but for random values the performance is abysmal.

T. Chen and H. R. Wu. proposed Adaptive Centre Weighted Median Filter [10]. This work is an improvement of previously described Centre Weighted Median (CWM) filter. It works on the estimates based on the differences between the current pixel and the outputs of the CWM filters with varied center weights. These estimates decide the switching between the current pixel and median of the window. This is a good filter and is robust for a wide variety of images. But it is inefficient in recovering the exact values of the corrupted pixels.

X. Xu and E. L. Miller. proposed Adaptive Two-Pass Median filter. As the name suggests it employs median filter on the noisy image twice. This adaptive system tries to correct for false replacements generated by the first round of median filtering operation. Based on the estimated distribution of the noise, some pixels changed by first median filter are replaced by their original values and kept unchanged in the second median filtering. And in the second round it filters out the remaining impulses. Even though the filter gives some good results in terms of noise suppression but spoiling of good pixels is more and it results in overall poor performance.

4. ENHANCEMENT WITH FUZZY STRATEGY

Fuzzy logic was first introduced in the 1965 as a new way to represent vagueness in everyday life. The definition of fuzzy logic as a superset of conventional(Boolean) logic that has been extended to handle the concept of partial truth values between "completely true" and "completely false". By this definition, fuzzy logic departs from classical two-valued set logic. It uses soft linguistic system variables and a continuous range of true values in the interval [0, 1], rather than strict binary values. It is basically a multi valued logic that allows intermediate values to be defined between conventional evaluations like yes/no or true/false**,** etc. Notions like rather warm or pretty cold can be formulated mathematically and processed by computers."

Fuzzy logic is also a structured, model-free estimator that approximates a function through linguistic input/output associations. Fuzzy logic is a powerful, yet straight forward, problem solving technique with wide spread applicability, especially in the areas of control and decision making [6]. Fuzzy Logic was first invented as a

representation scheme and calculus for uncertain or vague notions. It allows more human-like interpretation and reasoning in machines by resolving intermediate categories between notations such as true/false, hot/cold etc used in Boolean logic In this context, Fuzzy Logic is a problem-solving control system methodology that lends itself to implementation in systems ranging from simple, small, embedded micro-controllers to large, networked, multi-channel PC or workstation-based data acquisition and

control systems. It can be implemented in hardware, software, or a combination of both. FL provides a simple way to arrive at a definite conclusion based upon vague, ambiguous, imprecise, noisy, or missing input information. FL's approach to control problems mimics how a person would make decisions, only much faster

5. FUZZY FILTERING OF BLURRED IMAGES

After the detection of blurred images from above traditional tactics the filtering is done. For this there is need to calculate some parameters which are used to construct the fuzzy set more or less impulse noise [6]. Afterward the iteration process is done for the filtering phase based on the membership functions that represents the fuzzy set. The obtained membership functions is a simplification of the obtained noise histogram.

In this if the membership function value greater then threshold value. If the membership value greater than threshold value then image is blurred. The extreme large value cause wide membership function that results some kind of blurring of the image.

The filtering step of first iteration is given in the algorithm .

This method is based on the membership function. The

pixels which are the part of the support of the fuzzy set are blurred have to be filtered, otherwise leave pixels unchanged. A 3x3 window around the filtered pixel is used. If the output image is the same as the input image(A) then the filter method is called recursive; otherwise non-recursive.

A. Algorithm for the first iteration
input : A : The noisy image with impulse noise.

□(*A*(*i*, *j*)): the membership degree for the fuzzy set more or less impulse noise.

F: the output image.

Steps:

(1) FOR each border pixel (*i,j*)□*A*
(2) Perform comparison with neighbor pixel in window of 3x3
(3) if the blur detected in image, perform the fuzzy filtration
(4) Replace the pixel in window by the fuzzy derived pixels
(5) If there is no blur detected by neighbor comparison

i. Perform the edge based comparison within window
ii. If it satisfy then perform fuzzy filtration
iii. Replace the pixel by new fuzzy derived pixels

(6) END FOR

After the first iteration, it is possible as a side effect (especially with high initial blurred pixel) that the there is a number of moving pixel. To reduce these noisy pixels, some more (recursive) iterations are provided that are quite similar to the first one. In each iteration, we use the modified image of the previous performed iteration and a different window as shown in Fig. 5.6 around a given pixel. Fig.5.6 shows the neighborhood windows used in the first, second, third, and fourth iteration. The changing window is used to avoid future clustering and also speeds up the execution time. In addition to the different window the modification of the membership function “more or less impulse noise” (for the mth iteration) is also done by changing the parameters. This change is going to reduce the slope of the membership functions, and therefore the amount of investigated pixels for an image A, It will speed up the execution time cause the amount of noisy pixels was already reduced in the previous iteration.

B. Algorithms for the next filtering iterations(m □2)

Input : F : The output image of the previous iteration

Steps:

(1) FOR each border pixel (*i,j*)□*A*

(2) Perform comparison with neighbour pixel in window of 3x3

(3) If the blur detected in image, perform the fuzzy filtration

(4) Replace the pixel in window by the fuzzy derived pixels

(5) If there is no blur detected by neighbour comparison

i. Perform the edge based comparison within window
ii. If it satisfy then perform fuzzy filtration
iii. Replace the pixel by new fuzzy derived pixels

(6) END FOR

To stop the iteration procedure there should be some criteria. During the first iteration every pixel is checked one by one. If the pixel value does not depend belong to the support of the fuzzy set more or less impulse noise then this pixel value is not going to changed, not only in this iteration neither in other ones. By remembering only the positions of pixels, whose pixel value is an element of the support of the fuzzy set *more or less noise*, one can drastically reduce the scanning amount in the next iterations. By applying these rules the iteration may stop and the filtered result can be obtained.

6. CONCLUSION AND FUTURE WORK

It primarily focuses on impulsive & Gaussian noise suppression from images. A new two step filter (FIDRM), which uses a fuzzy detection and an iterative filtering algorithm, has been presented. This filter is especially developed for reducing all kinds of impulse noise (not only salt and pepper noise). Its main feature is that it leaves the pixels which are noise-free unchanged. Experimental results show the feasibility of the new filter. A numerical measure, such as the PSNR, and visual observations show convincing results for grayscale images. But the filter does not gives good result for the Gaussian noise. Finally, this new method is easy to implement and has a very low execution time.

As it has been stated that the proposed technique is not good for Gaussian noise removal , investigation may be carried out in this direction. Development of parallel algorithms can also be done to counter attack the computational overhead.

In this method we have used fuzzy logic for noise detection. Investigation may be carried out to use neural network for detection of noisy pixels in the image and fuzzy logic to remove the detected noise from the image .

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A Web Page Change Detection System For Selected Zone Using Tree Comparison Technique

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Abstract: This paper describes Web Page Change Detection System for Selected Zone based on tree comparison mechanism corresponding to HTML pages. Two sub trees for the selected zone will be generated one for initial and another for changed version of Web Document. The Generalized Tree Comparison Algorithm is developed to compare these sub trees for selected zone. This algorithm uses the properties of HTML page and heuristics as a node of the trees. This proposed system will include functionalities and interfaces for processing user request, fetching web pages from the internet allowing users to select zone in web pages to monitor. This method performs well and is able to detect the structural as well as content level changes even at the minute level and helps to locate minor or major changes within the selected zone of document.

Keywords: Change Monitoring, Generalized Tree Comparison, Zone Selection of Web Page, Web Page Change Detection, Web Page Monitoring, Web Mining, Node Comparison, HTML, XML.

1. INTRODUCTION

Internet forms the important form of Information and Communication exchange. Everyone using internet is interested in a very specific type of data and it can be said that user visits some of these website regularly so as to track if some information has change overnight. If the web page changes too often, then it is cumbersome for the user to visit these sites frequently. For example, a user want to know about the latest recruitment in particular field related to particular location in the recent time. In this case, the user wants to be notified of the changes related to various recruitment details present on different web pages. In general, the ability to specify changes to this particular location in the document called here as zone of the document and notify it to user in different ways which will be useful for reducing the inefficient navigation. Due to rapid changes in the content of the web pages it has become very necessary to develop a Web Page Detection System which can detect these changes in the selected zone of the Web page in minimum browsing time.

There are basically four types of changes.

i. ***Structural Changes:*** It occurs when some HTML tags have been added or deleted in the web pages. Structural Elements like   <header> <meta> <article> and their attributes are used.
ii. ***Content Changes:*** It occurs when the content or information of the web page has been added, deleted or updated. Content Categories like Metadata, Flow, Sectioning, Heading, Phrasing etc. are used.
iii. ***Presentation Changes****:* It occurs when the design or appearances of the web page have been changed but the content or the information have not been changed. The tags of <b>,<i>,<p>,<h1>,<u>,<font>,<strike> etc are used.
iv. ***Behavioral Changes:*** Behavioral changes have been occurred when the active components such as applets, scripts, etc. have been changed [2].

A web page change detection system helps to reduce the browsing time of the user and allows the user to find the items in web page which change frequently. Change detection systems should provide the possibility of specifying the changes the user is interested in, to select the region of the document of interest, the items inside the region whose changes have to be monitored, and conditions on the type of changes which must be detected. Systems detecting changes on HTML pages with fixed structure are not able to satisfy these kinds of user needs since the page regions considered depend on the user's request. Current techniques for detecting document differences are computationally expensive and unable to focus on the portion of the page that is considered interesting for the user. Our technique represents the document as a tree and permits the user to focus on specific portions of it e.g. sub-trees. In particular the aim of our technique is that of efficiently monitor changes on small portion of a web page for instance of a job in recruitment process.

The main objective is to find the zone in the downloaded entire modified web page most similar to that selected by the user. This comparison process will be performed by generating the trees for selected zone of old web page and newly downloaded web page [4].

There are various types of properties which should be considered for detecting the changes in different versions of the web page like speed, accuracy, complexity, storage space, effective version management etc. [3]

2. Literature Survey

Number of research papers was found that handled the design of efficient algorithms for detecting changes in Web pages.

1) ***Document Tree based Approach*** [1] detects the structural and content changes. This Tree based approach is good for comparing the nodes of both the tree as old web page tree and modified web page tree. It gives the relevancy to the web pages and notifies the user about detecting the changes. For detecting structural change document tree is constructed and then signature values assigned to the root nodes and child nodes of the old and new web pages are compared. And for detecting content change first calculates the ASCII value of each character and then it is divided by those particular characters which are occurred in web page only once. Then it determines the text code for the different versions of the page and compares them. This algorithm defines the good comparison study for the different algorithms and provides simple method for detecting changes. Limitation of this paper is that comparison becomes longer if numbers of nodes are increased. So it's difficult to compare signature for each and every child node.
2) ***Optimized Hungarian algorithm*** [4] introduced three running time optimizations that control the operations of the Hungarian by considering time and accuracy analysis. This algorithm focuses on finding the most similar subtree, finding out of order tags or unclosed tags, edit scripting to find minimum edge weight monitoring for bipartite graph. Three measures for detecting changes are also considered which are *intersect*(percentage of similar words) ,*typedist* (position of elements),*attdist*(relative weight of similar attributes). This algorithm also defines that performance is inversely proportional to the depth of tree. Limitation of this algorithm is that running time may be large.
3) ***BIODIFF*** [8] algorithm covers some limitation of X-Diff algorithm. Unlike X-DIFF algorithm, BIODIFF designed for genomic and proteomic data. It outperforms app. 1.5 – 6 times faster than X-DIFF for different datasets. But one limitation of this algorithm is that If a database has more nodes that require min-cost max-flow matching, the improvement of Bio Diff is less as compared to X DiFF. Another limitation is that it takes more time to assign different matching types to the nodes in XML tree.
4) ***XML TREE DIFF*** [9] algorithm presents support for change control in the context of the Xyleme project that is investigating dynamic warehouses capable of storing massive volume of XML data. This algorithm is efficient in speed and memory space. It uses operations such as change node, delete node and insert node. Delta is constructed to find the matching of nodes between two trees. The use of XML specificities in algorithm leads to significant improvements. Drawback of this algorithm is that there is some loss of quality. Another drawback is that there is need of gathering more statistics about the size of deltas and in particular for real web data.
5) ***CH-DIFF*** **and** ***CX-DIFF*** [10] are developed by the Webvigil, a system that automates the change detection and timely notification of HTML/XML pages based on user specified changes of interest. *CH-DIFF* detects changes to various components such as links, images, keywords, phrases and any change using Longest Common Subsequence (LCS). But using LCS will be computationally expensive. *CX-DIFF* algorithm consists of steps like object extraction and signature computation, filtering of unique inserts/deletes and finding the common order subsequence between the leaf nodes of the given trees. Assorted and Linked Monitoring is also introduced in the paper. Immediate, Best-effort, Interval based, Interactive notifications are provided to the user. Drawback of this paper is that expensive computation and sentinels or user requests can be overloaded on the single server.
6) ***Level Order Traversal*** [11] is another form of the breadth first traversal. It includes document tree construction, document tree encoding and tree matching (based upon the concept of R.M.S. value of the content), for the detection of structural changes and content changes. Parameters used in this algorithm are node id, child node, parent node, level, tag name, content value or RMS value (sum of multiply the position of the character with its ASCII value). It has linear time complexity because it traverses only the changed portion of the tree rather than the whole tree and hence saves the time. It also extracts effectively the changed content from different versions of a web page. It is simple, less cost, and understandable and can reduce the network traffic by using HTTP metadata. It can successfully retrieve the summary but not the complete content of the newly created page which is insufficient information for the user.
7) ***Hashing*** **based** [12] saves computation time by limiting the similarity computations between two versions of a web page to nodes having the same HTML tag type, and by hashing the web page in order to provide direct access to node information. To speed up the process of web change detection system a hashing based technique is used for direct lookup of subtree node information during comparisons, and eliminated irrelevant node comparisons by limiting them to nodes of the same type. This algorithm is also applied to RSS (really simple syndication) feeds change detection for delivering regularly changing web content, such as news. Original and enhanced approaches are introduced to improve the comparisons. This algorithm suffers from one limitation that inability to detect changes when root tag is changed. Multithreading is used for improving the performance. This algorithm can be further implemented on dynamic web pages and can also be defined in XML file as future work.
8) ***Tree traversing*** [13] is developed for detecting the structural as well as content change. This algorithm is divided into two parts tree development and change detection. The proposed algorithm used bottom up approach for assigning hash value to each leaf node and tag value to the non-leaf nodes. This algorithm include extracting the tags from html code of the page, assigning node number to each node, finding multiple child of node, calculating the hash value and tag value by assigning hash function, comparing tags. This algorithm is based on depth first search. This algorithm is simple to understand and it saves the browsing time. But the drawback of this algorithm is that performance is not defined when depth or levels of the tree is increased.
9) An existing product is ***Copernic Tracker*** [5] that seems to be the most mature software aimed at monitoring Web

sites. The software can track changes in the text and images and monitors for the presence of specific text. The system however does not allow for specifying how much emphasis to place on monitoring different aspects of the Web page and does not provide a utility for monitoring a specific region of the web page. This product does not reveal performance data that discusses speed or accuracy.

10) A ***Website-Watcher*** [6] which includes the ability to monitor password protected web pages. The system offers limited freedom for selecting a zone to monitor and lacks a proper user interface to show the changes. This system also does not provide objective performance data other than subjective user reviews.
11) ***WYSIGOT*** [7] which is a commercial application that detects changes between HTML pages. This system has to be installed on the local machine and the granularity of change detection is at page level.

3. General Design

3.1 Overview

Web page change detection system for selected zone based on tree comparison mechanism corresponding to HTML pages. It uses generalized tree Comparison Algorithm to compare the trees. Algorithm uses the properties of HTML page and heuristics as a node of the trees. This proposed system includes functionalities and interfaces for processing user request, fetching web page from the internet and allowing users to select zone in a web page to monitor. In addition to above this proposal highlights changes on the web page of selected zone being monitored.

3.2 General Architecture

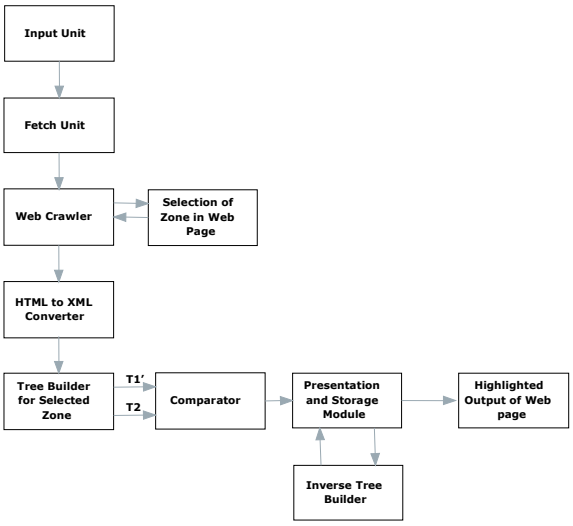


Figure 1. Architecture of Web page Change Detection System for selected Zone.

The figure 1 depicts Architecture of the working model of Web Page Change Detection System.

The step by step working model of architecture is represented as follows:

Step 1. Fetching of old Web Page and Generation of Tree
The web crawler will fetch the old HTML web page which user wants to monitor and the tree will be generated for complete web page.

Step 2. Selection of Zone of old Web Page [14][15].
The system provides the zone selector tool to allow user to select zone to monitor. For the selected zone the user will specify which portion of web page to monitor and the period of time between two successive monitoring tasks.

Step 3. Generation of Tree for the selected zone of Webpage
We have develop tree builder which will be responsible for converting of web page to tree data structure in which node contain tag and their attribute, while leaves contain their text content. The process of building the tree is described in section 3.3.1. The data will be generated from the tree generated for old HTML web page. The tree for the selected zone of the Web Page is also stored.

Step 4. Fetching of Modified web page.
After completion of time slot which is set by user, the browser will download the web page which is to be monitored.

Step 5. Generation of modified tree for fetched web page.
The system will generate the tree for complete modified web page using Tree Builder.

Step 6. Checking the sub tree for change in content attribute & layout.
Let T1' be a abstract general tree generated by user corresponding to the zone selected by user and T2 tree will be for the modified web page. In the comparator module, comparator will find the most similar zone in the new web page. In this comparison T1' the subtree of selected zone of Old Web page is searched in T2 Tree of Modified Web Page and it outputs corresponding changes in subtree of T2.
In Comparator module we are using the following modules
i) **Text Compare Module** for comparing content i.e. HTML text.
ii) **Attribute Compare Module** that will compare HTML attributes.

Step 7. Change detection and report generation:-
Presentation and Storage module stores the result & reports after every monitoring period using the Inverse Tree Builder. Output Center will notify user about the detected changes.

3.3 Modules

3.3.1 Tree Builder

We have developed tree builder which will be responsible for converting of web page to tree data structure in which node contain tag and their attribute, while leaves contain their text content. The process of building the tree is as shown in figure 2.

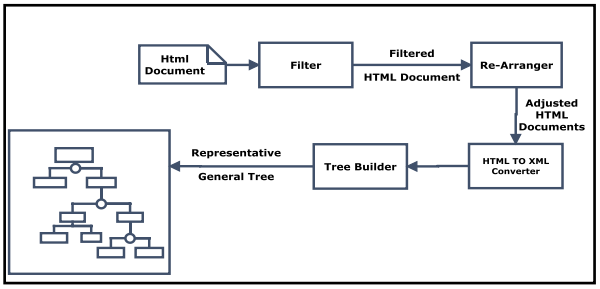


Figure 2. The Tree Builder Sub-Module

This will consist of four modules:-

i) Filter
ii) Re-Arranger
iii) HTML to XML Converter
iv) Tree Builder

i) Filter:-It filters the HTML document from all irrelevant content like comments and non HTML content e.g. Script, applet etc.

ii) Re-Arranger:-It will re-arrange HTML document to fix out of order tags e.g. <a>text1text2text3text4 .The tags <a> and are terminated out of order which results in an improper tree representation of this code.

iii) HTML to XML converter: It will convert the html webpage to XML webpage.

iv) Tree Builder:-This step will generate trees from the processed HTML pages.

The example of the Tree builder can be explained as follows

```
<html>
<head>
<title>Dept. of Tech</title>
</head>
<! This is comment>
<body bgcolor=skyblue>
<h1> Dept. of Tech </h1>
<h2>Shivaji  University </h2>
</body>
</html>
```

Original HTML Page

```
- <html>
- <head>
  <title>Dept. of Tech</title>
    </head>
- <body bgcolor="skyblue">
  <h1>Dept. of Tech</h1>
  <h2>Shivaji University</h2>
    </body>
    </html>
```

Converted XML Page

The Figure 3 represents the structure of the document we just created. This document is based on document object model which is describes in 3.3.2. An XML document has a single root element which contains the document's entire element.

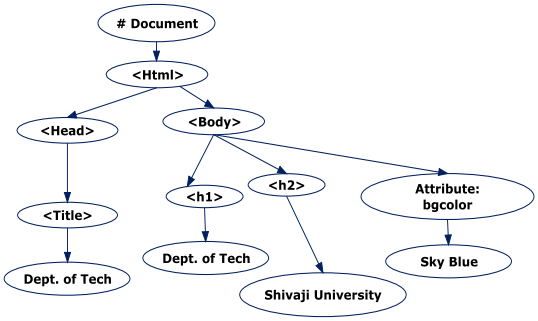


Figure 3. Tree structure of an XML document

In Figure 3 three kinds of nodes are observed in the DOM tree. They are element, text, and attribute nodes. Text nodes are leaf nodes with one value. Attribute nodes are non-leaf nodes, but they have two labels name and value. According to the DOM specification, element nodes and text nodes are ordered while attribute nodes are unordered.

3.3.3.2 Pseudo code of Tree generation

The Tree Generation Pseudo code is as follows

Tree generation Pseudo code

1. Read Xml document into XmlNode

2. Generate the modifiedTreeNode

3. Add XmlNode to the collection of tree Nodes

4. Check the type of XmlNode

4.1. Processing instruction or Xml declaration Set modifiedTreeNode Text="<?" +

XmlNode Name and XmlNode Text

4.2. IF element set modifiedTreeNode Text = "<" + xmlNode Name +">"

4.3. Attribute Set modifiedTreeNode Text = "ATTRIBUTE: " + xmlNode Name

4.4. Text and CDATA Set modifiedTreeN ode Text = xmlNode Value

4.5. Comment Set modifiedTreeNode Text ="<!-"+xmlNode Value+"— >"

5. Read attribute collection

6. For each attribute Go to step 1

7. Read ChildNodes Collection

8. For each ChildNodes Go to step 1

3.3.2 Document Object Model

Definition 1 (Document tree): A document tree is a tuple T=<N, p, r, l, t, a> where

(1) N is the set of nodes of the tree,
(2) p is the parent function associating each node (except the root r) of the tree with its parent,
(3) r is the distinguished root of T ,
(4) l is a labeling function from leaf (T) to $\sum^{+}$
(5) t is a typing function from N to τ and
(6) a is an attribute function from N to A* $\sum^{*}$

Thus, a document tree is an unordered tree whose nodes (elements) are characterized by their markup type and the

associated set of attribute-value pairs. Leaf nodes have associated the actual textual content of the document. Given a document tree T , whose root is r, and a node en of T, we denote with T(en) the sub-tree of T rooted at e_n. However, to be suitable for a change detection tools, this model should be extended by associating more information to internal nodes of the tree. We define two functions characterizing an element w.r.t. the whole document tree, type (e_n) and w(e_n). If r, e_2, . . . , e_n is the path from the root r to the element e_n, type (e_n) =t(r) t(e_2) …. t(e_n) whereas w(e_n)={s|s is a word(substring separated by blank to the other substring) contained in l(e) ∧e ϵ leaf (T (e_n))}. We also define a (e_n) as the set of attributes associated to en. Essentially w (e_n) is a set of words contained in the various text strings associated to the leaves of the sub-tree rooted at en, and type(n) is the concatenation of type label in the path starting from the root of the tree and ending in en, i.e. the complete type of the element [14].

3.3.3 Zone Selection Tool

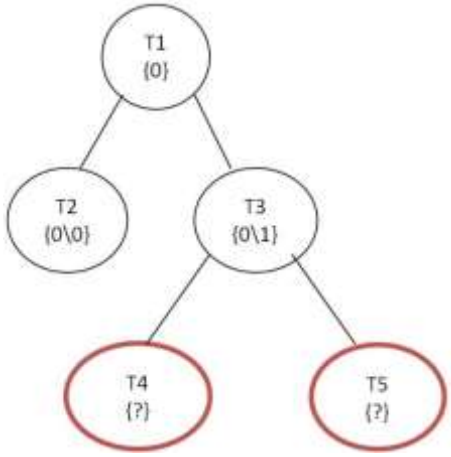
User first input the Web Page and then selects the zone of his interest. After selection of zone, the Tree is generated for Web Page and positions are assigned to all the nodes of entire tree starting from root node of tree. Positions are nothing but it is relationship between parent and child element of tree. The positions are assigned using AssignPosition algorithm. In addition to that, tree for selected zone i.e. Tz is prepared. Now text of Root of Tz is compared in the tree of Old Web Page. When search is found the position of that node i.e. selected zone's node in the Old Tree T1, it's position is recorded in the position variable Pos.

3.3.3.1 Pseudo code of Zone Selection

Positioning (AssignPosition)

1. If tree node T is root node, then assign index number to tag of T
2. Else, concatenate tag of parent node P and the index number of T
3. Assign the concatenation to the tag of T
4. Recursively call AssignPosition on every child node

The steps of execution of assign position is described using Figure 4



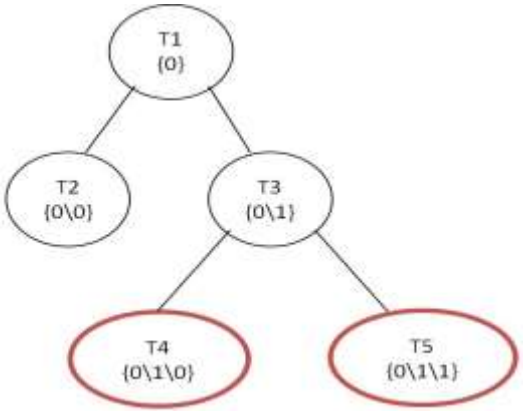


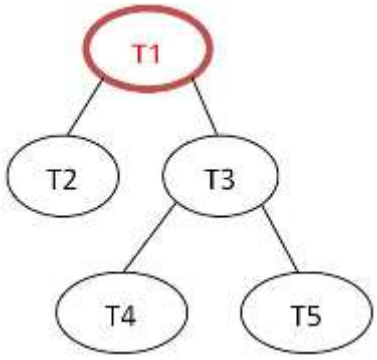
Figure 4. Typical Tree for Assigning Position.

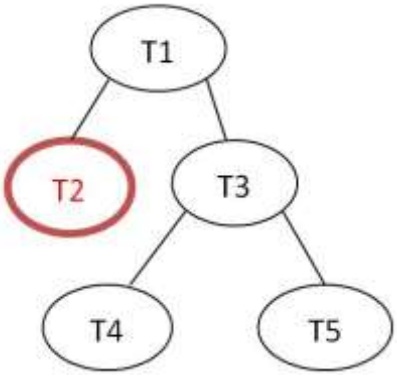
In Step1, first node traversed is the node T1. It has no parent node. Hence, the root node T1 is assigned position **{0}**. In Step2, the next node traversed is the node T2. It has parent T1. Hence it is assigned the position **{0\0}**, which indicates, the 1st child node under the parent node. In Step3,the node T3 is similarly assigned the value **{0\1} .** In Step4, the node T4 is assigned the position **{0\1\0}** and T5 is assigned **{0\1\1}.**

3.3.3.2 Pseudo code of retrieving the position from text (GetPosByText)

Retrieving the position from text (GetPosByText)

1. Compare given text with text of treenode T1
2. If text matches, then return the position from tag property
3. Else, recursively call GetPosByText on each child node





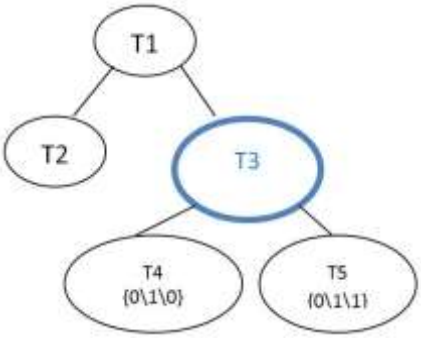


Figure 5. Typical tree for GetPosByText

Steps of execution of GetPosByText are described using Figure 5.

The node with text "T3" is to be searched. In Step1, the root node T1 is compared with "T3". It does not match the given text. Hence it is skipped.

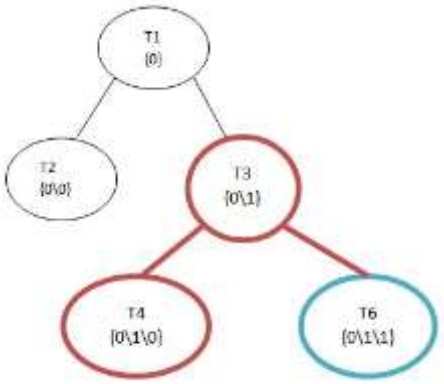
In Step2, the next node T2 is then compared with the same procedure. It also does not match the given text "T3". Hence this node is also bypassed.

In Step3, the next node T3 is then compared. This node matches the given text "T3". This ends the search and node T3 is returned.

3.3.3.3 Pseudo code for Zone selection

1. Prepare a sub tree for selected zone from the root node T of selected zone T1(Tz)
2. Retrieve the position of the selected zone's root node i.e T1(Tz) in the tree of Old Web Page
3. Save the position in a temporary variable Pos
4. Assign positions to the tree of Modified Web Page using AssignPosition algorithm.
5. Traverse T1 from root and find T1(Tz) using position "pos" from the tree of Old Web Page
6. Traverse T2 from root and find T2(Tz) using position "pos" from the tree of Modified Web Page
7. Compare the tree nodes T1(Tz) and T2(Tz) using Generalize tree comparison.

Here T1(Tz) and T2(Tz) are treated as root nodes and generalized comparison starts comparison and find the changes in Modified Web Page for selected zone i.e. T1(Tz). The steps of execution of zone selection are described using Figure 6.



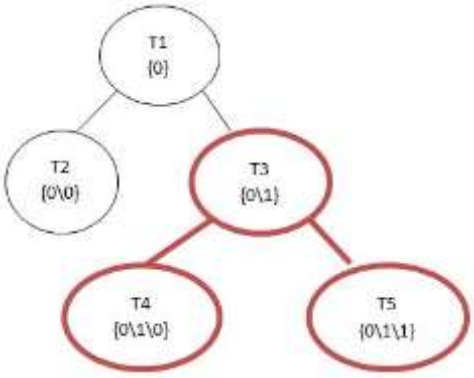


Figure 6. Tree For Zone Selection.

In Step1, the user selects the zone. Then the main tree (with the positioning) is selected and the position of the root node of selected zone is recorded. The figure 6 shows the selected zone containing the nodes T3, T4, T5. Here the root node of selected zone is node T3. Hence the position **{0\1}** is recorded.

In Step2, the Next, the node at the recorded position i.e. at the position {0\1} is searched in the tree of Modified web page.

In Step3, using the tree comparison both the sub trees are compared. T3 matches with node T3, T4 matches with node T4.

In Step4 whenever a mismatch is found, the change is recorded. The node **T5** does not match with the node at same position i.e. the node **T6**. This change is then recorded.

The stepwise execution of change detection of selected zone is described using typical trees of Old Web page and Modified Web page as shown in figure 7, 8,9,10.

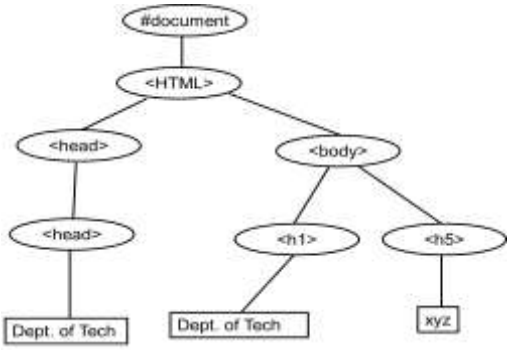


Figure 7. Typical tree of Old Web Page.

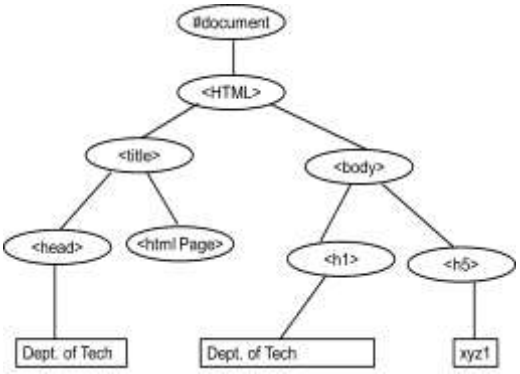


Figure 8. Typical tree of Modified Web page

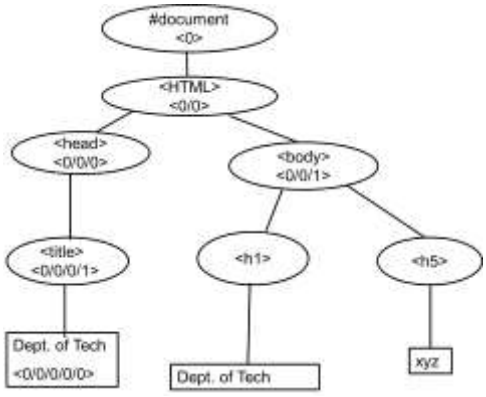


Figure 9. Assigned positions to the tree

For inputted Old Web page, users selects zone and its Sub tree is shown in Figure 10

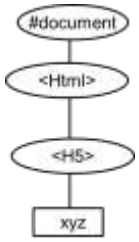


Figure 10. Tree for Selected Zone

Now T1(Tz) is find i.e (h5) in T1 using GetPostBy(Text). It selects text "<h5>" and searches this text in tree of Old Web Page. Searching starts from the root node i.e. "#document" then "#<html>." …….so on the from left to right. It locate the position of text "<h5>" in T1 tree i.e. position of <h5> i.e. {0/0/1/2} . Now it Save the position of <h5>i.e. {<0\0\1\2>} in variable Pos. Now Modified Page is inputted and it's tree is given in Figure 8 Positions are assigned to tree T1 are shown in Figure 9. Using variable Pos, search selected zone's node in T2 tree i.e. T2(Tz)=Pos. Now, applying Generalized tree comparison algorithm By using T1(Tz)-- <h5>----<xyz> and T2(Tz)----- <h5> ----- <xyz1>, Change detected in xyz and xyz1.

3.3.4 Comparator

The Comparator has the task of performing the bulk of the change detection process. To perform this, an algorithm is developed for generalized tree comparison algorithm. This algorithm uses trees generated from Tree Builder of HTML pages and detects the changes automatically.

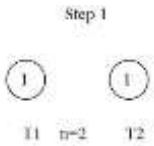
For the generalized tree comparison algorithm, the inputs are T1' and T2 two abstract general trees generated by the Tree Builder module discussed earlier. They correspond to the selected zone of Old Web Page and to the Modified Web Page. Now the Comparator finds the most similar sub tree as that of selected zone in the modified web page .Then these two trees are compared. When comparison is finished, it outputs changes in T2 tree as content change, attribute change.

Our Comparator matches each node of selected zone in the Old version i.e. T1' with its corresponding MSST node in the Modified version i.e.T2. Then the entire search space will be explored to detect changes incurring high execution time. This is a tree to tree correction algorithm by defining the ordered mapping between trees. This algorithm gives the best possible matching between two trees but with a run time of $O(n^2 h^4)$ where n= $max(n_1,n_2)$ h= max (h_1,h_2) , h_1=height of T1 and h_2= height of T2 [20].

3.3.4.1 Pseudo code of Tree Comparison

1. Load T1' and T2
2. Count the nodes of selected zone of T1' and MSST of T2
3. Assign lowest value to n
4. Traverse T1 and T2 up to n
5. Read the text for current node of T1 and T2
6. Compare both text
7. If text are note equal than current node has difference
8. And if text are equal call same algorithm recursively for child

The steps of execution of Pseudo code of Tree Comparison is given in Figure 11.



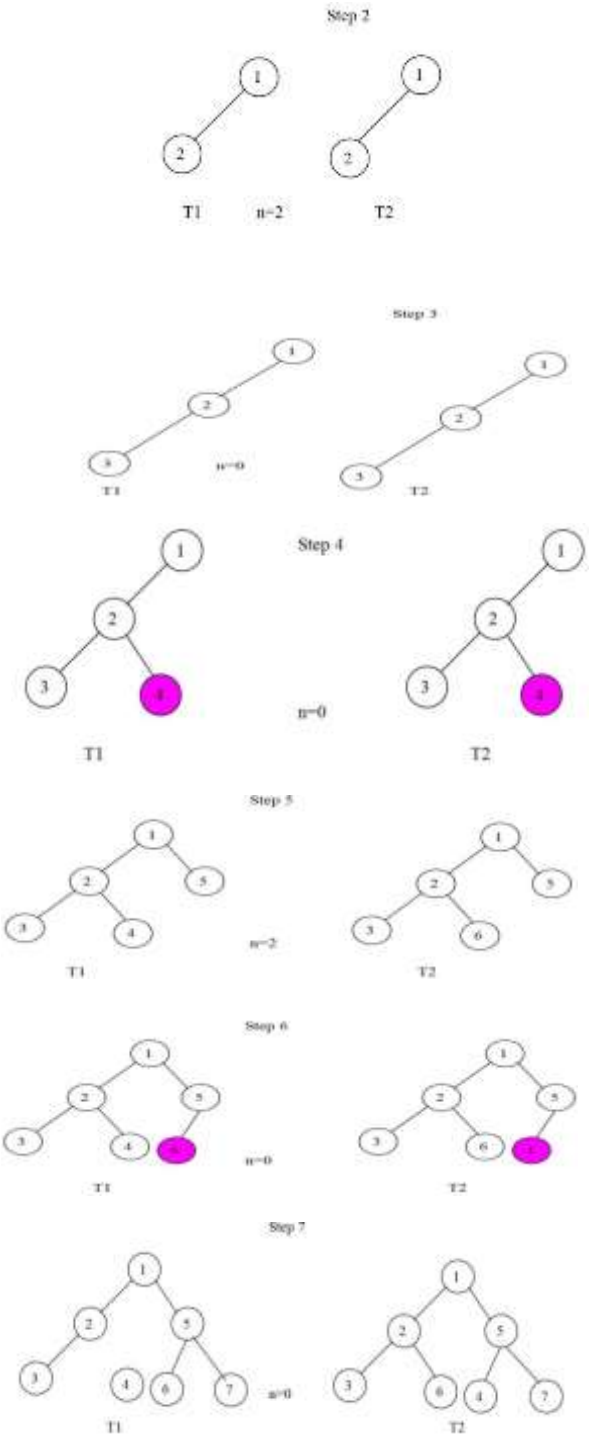


Figure 11. Steps of Execution of Pseudo of Tree comparison execution.

4. Implementation

The Application which is discussed in this paper is developed using the C# language and .NET platform. The Typical web Page considered for an experiment is as shown in figure 12. The old Web page and the modified Webpage is given as input to the system.

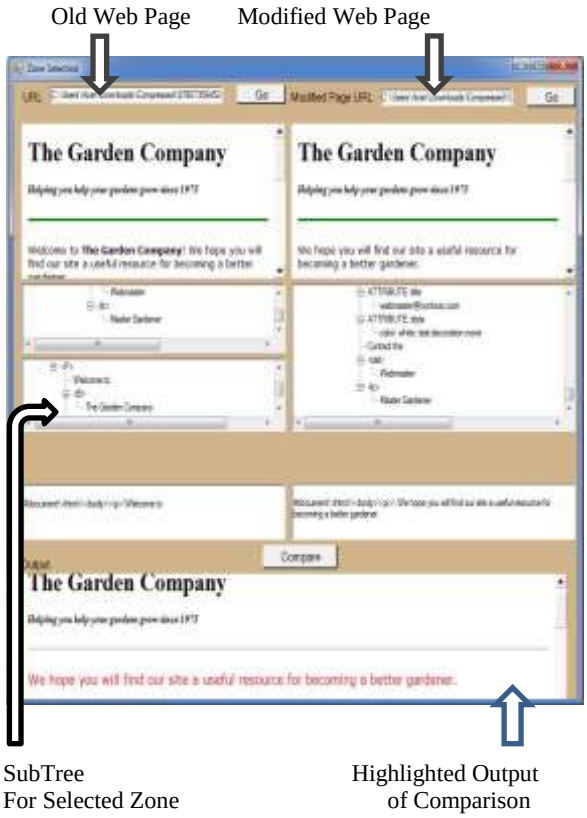


Figure 12. Web page Change detection for Selected Zone

5. Conclusion

The Web Page Detection system is for selection zone using generalized Technique detects changes for selected zone. It detects changes for text and attributes at minute level. We have developed generalized tree comparison Algorithm for selected zone. It helps us to reduce browsing time. It shows the output of change text in red color. This saves the time of detecting the changes in the entire Web page. Such system is useful as described above for stock broker, job seekers who are continuously monitoring the changes in the web pages.

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Design of Serial-Serial Multiplier based on the Asynchronous Counter Accumulation

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Abstract: A system's performance is generally determined by the performance of the multiplier because the multiplier is generally the slowest clement in the system. Furthermore, it is generally the most area consuming. Hence, optimizing the speed and area of the multiplier is a major design issue. However, area and speed are usually conflicting constraints so that improving speed results mostly in larger areas. In this project we design a serial –serial multiplier based on the asynchronous counter accumulation. In this serial – serial multiplier the number of sampling cycles is reduced to n from 2n by the reduction of partial products which is based on the asynchronous counters. It achieves high bit sampling rate by replacing conventional fulladder and highest 5:3 counters by simple asynchronous 1's counters so that the critical path is limited to only AND gate and D Flip-flops.

Keywords: Partial Products (PPs), Serial-Serial Multiplier, Ripple carry adder (RCA), CSA, Accumulation.

1. INTRODUCTION

Multipliers are the basic and essential building blocks of VLSI systems. The basic factors which are taken into consideration for a design of a multiplier are speed, area and power consumption. In general a low power and a high speed multiplier circuits are preferred which are not possible to achieve to achieve both the criteria simultaneously. So a good multiplier design requires some tradeoff between speed and power consumption. Hardware implementation of multipliers consists of three stages they are the generation of partial products (PPs), the reduction of partial products (PPs), and the final carry propagation addition. Based on the input data the partial products (PPs) are being generated either serially or parallel.

2. REVIEW OF SERIAL MULTIPLIERS

In a serial-serial multiplier both the operands are loaded in a bit-serial fashion, reducing the data input pads to two whereas a serial-parallel multiplier loads one operand in a bit-serial fashion and the other is always available for parallel operation.

Lyon [1] proposed a bit-serial input output multiplier in 1976 which features high throughput at the expense of truncated output. A full precision bit-serial multiplier was introduced by Strader *et al.* for unsigned numbers [2]. The rudimentary cell consists of a 5:3 counter and some DFFs. Later, Gnanasekaran [5] extended the work in [2] and developed the first bit-serial multiplier that directly handles the negative weight of the most significant bit (MSB) in 2's complement representation. This method needs only cells for an n-bit multiplication but it introduces an XOR gate in the critical path, which ends up with a more complicated overall design. Lenne *et al.* [3] designed a bit-serial-serial multiplier that is modular in structure and can operate on both signed and unsigned numbers.

The 1-bit slice of a typical serial-serial multiplier, called a bit-cell (BC), is excerpted from is shown. Such cells are interconnected to produce the output in a bit-serial manner for an serial-serial multiplier. The operands bits and are loaded serially in each cycle and added with the far carry, local carry, and the partial sum in the5:3 counter. To reduce the number of computational cycles from 2n to n in an nxn serial multiplier, several serial-parallel multipliers have been developed over the years. Most of them are based on a carry save add shift (CSAS) structure. It shows the unsigned and 2's complement serial-parallel multiplier based on the CSAS structure. It can be observed that the critical path consists of an FA, a DFF, and an AND gate for the unsigned multiplier

3. PROPOSED SERIAL-SERIAL MULTIPLIER

This section proposes a new technique of generating the individual row of partial products by considering two serial inputs, one starting from the LSB and the other from MSB. Using this feeding sequence and the proposed counter-based accumulation technique is presented in the following section; it takes only n cycles to complete the entire partial product generation and accumulation process for an nxn multiplication. The Partial products generation of the Conventional Serial –Serial multiplier is shown in the Fig 1.
The theoretical explanation of the proposed serial-serial multiplier which is based on the asynchronous counters accumulation explained as follows.

The product P of two -bit unsigned binary numbers X and Y can be expressed as

$$P = \sum_{i=0}^{n-1} \sum_{j=0}^{n-1} x_i y_j 2^{i+j}$$

Where, x_i and y_j are the ith and jth bits of X and Y respectively, with bit 0 being the LSB. By reversing the sequence of index i and rearranging the above equation can be written as

$$P = \sum_{i=n-1}^{0} \sum_{j=0}^{n-1} x_i y_j 2^{i+j}$$

On rearranging the above equation,

$$P = \sum_{}^{n-1} PPr$$

r=0 $PPr=PPr^{L}+PPr^{C}+PPr^{R}$

Where,

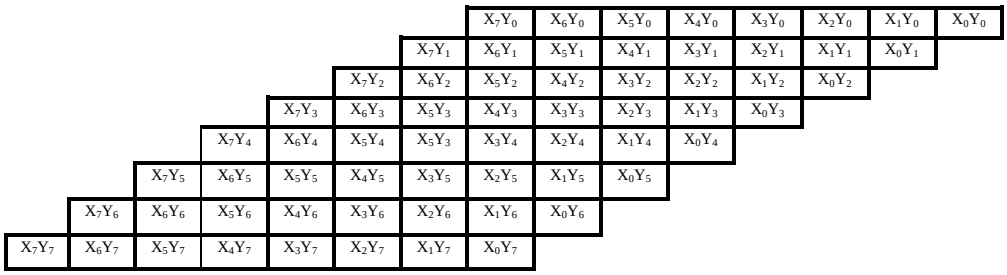

Fig 1 Partial Product generation scheme for an 8x8 Conventional serial-serial multiplier

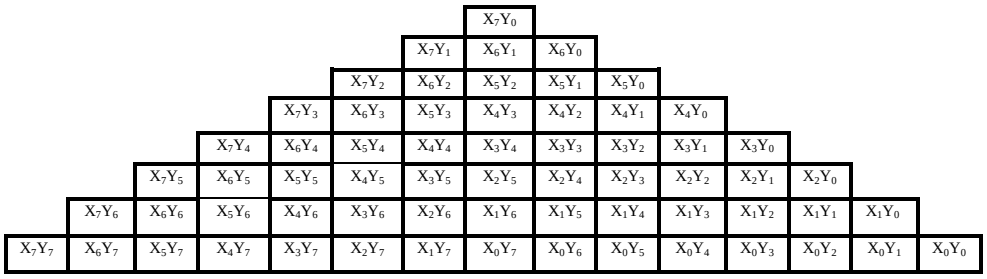

Fig 2 Partial Product generation scheme for an 8x8 Proposed serial-serial multiplier

The partial product row PPr can be generated in r cycles if X is fed from MSB (bit n-1) first and Y is fed from LSB first (bit 0), then in the r^{th} cycle ,PPr^{C} is a partial product bit generated by the current input bits x_{n-r-1} and y_r, PPr^{L} are partial product bits of the current input bit, y_r and each of the preceding input bits of X, i.e x_{n-k-1},for k=0,1,….r-1.and PPr^{R} are the partial product bits of the input bit x_{n-r-1},and each of the preceding input bits of Y, i.e Yr-k-1 for k=0,1,2,….r-1.By appropriately sequencing the input bits of X and Y into a shift register, one PP(PPr)in each cycle can be generated. As a result P can be obtained in n cycles

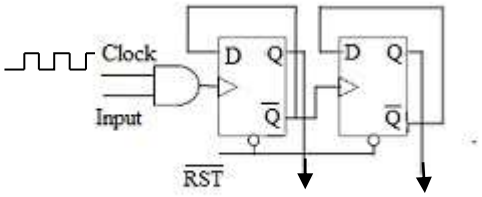

Fig 3.Hardware Architecture of 2bit 1's counter

3.1 Counter -based Accumulation Technique

Accumulation of the partial products is done by using the asynchronous 1's counters. A typical Accumulator is an adder which successively adds the current input with the value stored in its internal register. Generally, the adder can be a simple RCA but the speed of accumulation is limited by the carry propagation chain. The accumulation can be speed up by using a CSA with two registers to store the intermediate sum and carry vectors, but a more complex fast vector merged adder is needed to add the final outputs of these registers. In either case, the basic functional unit is an FA cell. A new approach to serial accumulation of data by using asynchronous counters is suggested here which essentially count the number of 1's in respective input sequences (columns).

These counters execute independently and concurrently. In each cycle of accumulation, a new operand is loaded and the counters corresponding to the columns that have a 1 input are incremented. The counters can be clocked at high frequency and all the operands will be accumulated at the end of the 'n'th clock. The final outputs of the counters need to be further reduced to only two rows of partial products by a CSA tree, such as a Wallace's or Dadda's tree . A carry propagate adder is then used to obtain the final sum.

3.2 Proposed Architecture

The complete architecture for the proposed serial - serial multiplier (8x8) which is based on the asynchronous counter accumulation is shown in the figure 1.3. A PP bit corresponding to the middle column of the PP is produced by the center AND gate when a new pair of input bits (x_{n-i-1} and y_i) is latched by the two DFFs (top-middle) in each clock cycle. In the next cycle, x_{n-i-1} and y_i are shifted to the left and right, respectively, to produce the partial product bits with another pair of input bits and by the array of AND gates. The outputs of the AND gates are given as the inputs to the respective asynchronous counters .To ensure that the outputs of the AND gates which are used to drive the counters are being gated by a Clock 1(Clk1).If the output of the driving AND gate is '1'then the state of the counter takes place at the rising edge of the clock. After the completion of 'n' cycles for an nxn serial –serial multiplier, all the counters hold the sums

of all the 1's in the respective columns and their outputs are latched to the second stage for summation. The latching register which is present in between the counter stage and the adder stage not only makes it possible to pipeline the serial

data accumulation and the CSA tree reduction, but also it avoids the unnecessary transitions from propagating into the adder tree. To synchronize the data flow between the counter and adder stages two clocks namely Clock1 (Clk1) and Clock 2(Clk2) are employed.Clock2 is derived from Clock1 in order to drive the latching register.

According to the Positional weights of the output bits produced by the counters, the latched outputs are being wired to the correct Fulladders (FAs) and Halfadders (HAs) so that the column height has been reduced from 8 to 4 and the final product P is obtained with in two stages of CSA tree and final RCA as shown in the Fig 4.

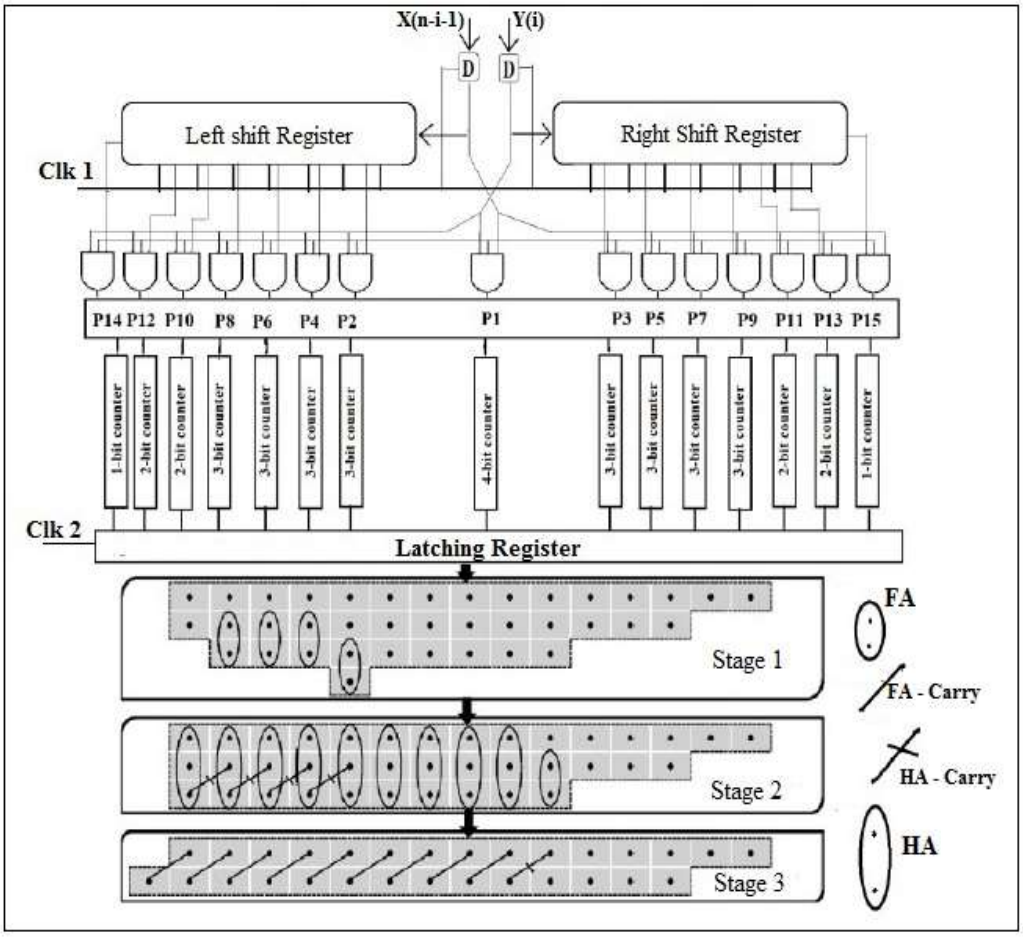

Fig 4 Proposed Architecture for 8x8 serial – serial multiplier

4. RESULTS OBTAINED

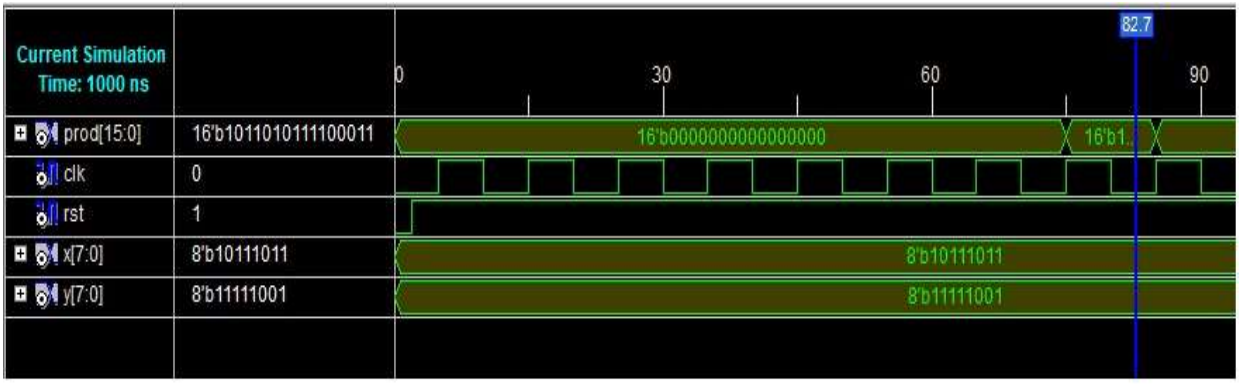

Fig 6 Proposed Unsigned Serial-Serial Multiplier output in Decimal format

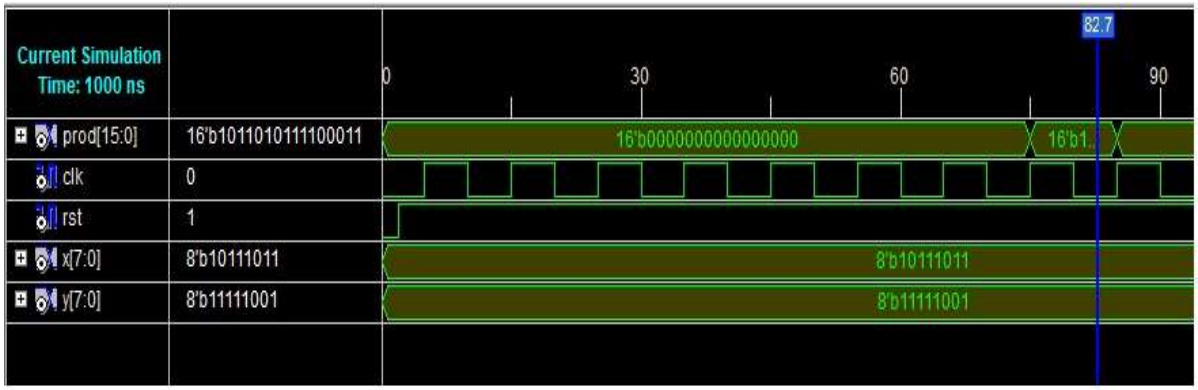

Fig 6 Proposed Unsigned Serial-Serial Multiplier output in Binary format

5. CONCLUSION

In this paper a new method of computing serial-serial multiplication is introduced by using low complexity asynchronous counters. By exploiting the relationship among the bits of a partial product matrix it is possible to generate all the rows serially in just n cycles for an n x n multiplication. Employing counters to count no of ones in each column allows the partial products bits to be generated on-the-fly and partially accumulated in place with a critical path delay of only an AND gate and a DFF . The counter-based accumulation reduces the partial product height logarithmically and makes it possible to achieve an effective reduction rate. The proposed method outperforms many serial-serial and serial-parallel multipliers in speed. This approach has clear advantage of low I/O requirement and hence is most suitable for complex SOCs, advanced FPGAs and high speed bit serial application

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A Review on Parameter Estimation Techniques of Software Reliability Growth Models

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Abstract: Software reliability is considered as a quantifiable metric, which is defined as the probability of a software to operate without failure for a specified period of time in a specific environment. Various software reliability growth models have been proposed to predict the reliability of a software. These models help vendors to predict the behaviour of the software before shipment. The reliability is predicted by estimating the parameters of the software reliability growth models. But the model parameters are generally in nonlinear relationships which creates many problems in finding the optimal parameters using traditional techniques like Maximum Likelihood and least Square Estimation. Various stochastic search algorithms have been introduced which have made the task of parameter estimation, more reliable and computationally easier. Parameter estimation of NHPP based reliability models, using MLE and using an evolutionary search algorithm called Particle Swarm Optimization, has been explored in the paper.

Keywords: Software Reliability, Software Reliability Growth Models, Parameter Estimation, Maximum Likelihood Estimation, Partical Swarm Optimization

1. INTRODUCTION

Software can be defined as an instrument comprising a set of coded statements which takes a discrete set of inputs and transform them into a discrete set of outputs. Software may contain discrepancies or faults which may result into software failures. Any kind of deviation from the desired behaviour of the software is apparently unwanted for the user and to check the correctness of the program two approaches were used which can be named as : program proving and program testing. Program proving is a formal and mathematical approach in which a finite sequence of logical statements ending in the statement, usually the output specification statement, to be proved is constructed. Each of the logical statements is either an axiom or is a statement derived from earlier statements by the application of an inference rule. However Gerhart and Yelowitz [1] presented various programs which were proved to be correct by this approach but in actually, were containing faults. On the other hand program testing is more practical approach and is heuristic in nature. Program testing basically involves symbolic or physical execution of a set of test cases with the objective of exposing embedded faults in the program. Program testing, like that of program proving is an imperfect tool for ensuring program correctness. As these approaches cannot completely assure about the correctness of the program, a metric is required which can help in assessing the degree of program correctness and software reliability fulfils this requirement. Reliability of a software can be defined as: "*The probability of failure-free software operation for a specific period of time in a specified environment*" [2]. Reliability of a software needs to be assessed before it is delivered to the customer. Various software reliability growth models (SRGM) has been introduced for predicting the reliability of a software. Although according to an observation made by M. R. Lyu in [3], "There is no universally acceptable model that can be trusted to give accurate results in all circumstances; users should not trust claims to the contrary." Every model has some advantages and some disadvantages. The choice regarding which model to follow for the prediction depends upon the requirements of the software.

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2. SOFTWARE RELIABILITY GROWTH MODELS

A Software Reliability Growth Model can be considered as one of the fundamental techniques to assess the reliability of a software quantitatively. Any software reliability model presents a mathematical function which illustrates defect detection rates. These models are classified in two categories: Concave and S-shaped models , which can be illustrated with the help of fig-1[4].

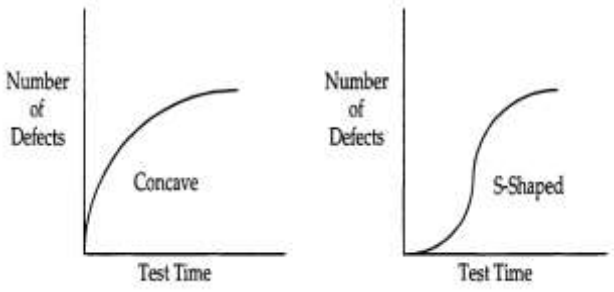

Figure-1: Concave and S-Shaped Models

Concave rnodels are so-called because they bend downward. S-shaped models, on the other hand, are first convex and then concave. This reflects their underlying assumption that early testing is not as efficient as later testing, so there is a "ramp-up" period during which the defect-detection rate increases. This period terminates at the inflection point in the S-shaped curve. The most important thing about both models is that they have the same asymptotic behavior: The defect-detection rate decreases as the number of defects detected increases, and

the total number of defects detected asymptotically approaches a finite value. Several models had been proposed for assessing the reliability of the softwares, basic assumptions of some of the models are discussed below :

Goel-Okumoto Model :

This model was first introduced by Goel and Okumoto [5] and is based on the following

assumptions:

- All faults in the software are mutually independent from the failure detection point of

  view.
- The number of failures detected at any time is proportional to the current number of faults in the software. This means that the probability of the failures or faults actually occurring, i.e., being detected, is constant.
- The isolated faults are removed prior to future test occasions.
- Each time a software failure occurs, the software error which caused it is immediately removed and no new errors are introduced.

These assumptions lead to the following differential equations:

$$\frac{\partial}{\partial t}\ \mu(t)|\text{=b(a- }\mu(t)) \qquad (1)$$

In this equation, a represents the expected total number of faults in the software before testing. Parameter b stands for the failure detection rate or the failure intensity of a fault and μ (t) for the expected number of failures detected at time t. Solving above equation for μ (t), we obtain the following mean value function

$$\mu(t) = a(1 - e^{-bt}) \qquad (2)$$

Yamada S-Shaped Model :

The Yamada S-Shaped model was first introduced in Yamada et al. [6]. The model is based on the following assumptions:

- All faults in the software are mutually independent from the failure detection point of view.
- The probability of failure detection at any time is proportional to the current number of faults in the software.
- The proportionality of failure detection is constant.
- The initial error content of the software is a random variable.
- A software system is subject to failures at random times caused by errors present in the system.
- The time between the (i-1)th and the ith failure, depends on the time of the (i-1)th failure.

Musa's basic execution time model [7]

It assumes that there are N software faults at the start of testing, each is independent of others and is equally likely to cause a failure during testing. A detected fault is removed with certainty in a negligible time and no new faults are introduced during the debugging process. The hazard function for this model is given by

$$z(\tau) = \phi f(N - n_c) \qquad (3)$$

where τ is the execution time utilized in executing the program up to the present, f is the linear execution frequency (average instruction execution rate divided by the number of instructions in the program), ϕ is a proportionality constant, which is a fault exposure ratio that relates fault exposure frequency to the linear execution frequency, and n, is the number of faults corrected during (0,τ). One of the main features of this model is that it explicitly emphasizes the dependence of the hazard function on execution time. Musa also provides a systematic approach for converting the model so that it can be applicable for calendar time as well.

3. PARAMETER ESTIMATION TECHNIQUES

A software reliability model is simply a function and fitting this function to the data means estimating its parameters from the data. One approach to estimating parameters is to input the data directly into equations for the parameters. The most common method for this direct parameter estimation is the maximum likelihood technique. Maximum Likelihood Estimation is a method which is used for the estimation of the parameters of a statistical models. If maximum likelihood estimation is applied to a data set for a given statistical model then it provides the estimates of that model's parameters. A second approach is fitting the curve described by the function to the data and estimating the parameters from the best fit to the curve. The most common method for this indirect parameter estimation is the least squares technique. Although methods like MLE and LSE provide a way to estimate the parameters of reliability models, but the model parameters are normally in nonlinear relationships and this makes traditional parameter estimation techniques suffer many problems in finding the optimal parameters to tune the model for a better prediction. Parameter estimation problem for nonlinear systems can be stated and formulated as a function optimization problem in which the objective is to obtain a set of parameters that provide the best fit to a measured data based on a specific type of function to be optimized. Such parameters are obtained using a search technique in the space of values specified in advance. Searching techniques are bound to the complexity of the search space, and the use of Gradient search might find local minimum solution but not optimal ones. Stochastic search algorithms, on the other hand, such as Evolutionary Algorithms e.g Genetic Algorithm (GA) and Particle Swarm Optimization (PSO) present a more reliable functionality in estimating models' parameters.

4. LITERATURE REVIEW

4.1 Parameter Estimation Using Maximum Likelihood Estimation

Barnard and Bayes [8] depicted that for most mathematical models, if the number of parameters is large and the observed data is erroneous, calibration can be performed in maximum likelihood (ML) framework, where the state estimate is the parameter which maximizes the likelihood function.

Knafl [9] proposed existence conditions for maximum likelihood parameter estimates for several commonly

employed two-parameter software reliability models. For these models, the maximum likelihood equations were expressed in terms of a single equation in one unknown. Bounds were given on solutions to these single equations problems to serve as initial intervals for search algorithms like bisection. Uniqueness of the solutions is established in some cases. Results were given for the case of grouped failure data.

Okumoto [10] reviewed four analytical software reliability models which are used for estimating and monitoring software reliability. These models include Times Between failure Models, Failure Count Models, Fault Studying models and Input Domain Models. Goel and Okumoto proposed Non homogeneous Poisson Process model which lie in the category of Failure Count models of software reliability estimation. In this model it is assumed that failures occur during execution of the software, at random times because of faults present in the software. If we represent cumulative number of failures occurred in system till time t by N(t) then the non homogeneous poisson model can be represented as follows:

$$(P\{N(t=y)\}) = \frac{(m(t))^y}{y!} e^{-m(t)} \quad (4)$$

Where $m(t) = a(1-e^{-bt})$ (5)

$\lambda(t) = m'(t) = abe^{-bt}$ (6)

m(t) in above equations is the expected no. of failures observed by time t and λ(t) is the failure intensity function. Here 'a' is the expected number of failures to be observed eventually and 'b' is the fault detection rate per fault.

Knafl and Morgan [11] proposed that the reliability of the software can be estimated using software reliability growth models, or a non-homogeneous poisson process model with mean value function μ(t). As in Goel-Gkumoto model μ(t) consists of two parameters a and b and in order to predict the reliability of any software the values of these parameters need to be estimated. These parameters can be estimated by using the Maximum Likelihood Estimation method. An observation interval of $(0,t_k]$ was considered and divided into various subintervals given by $(0, t_1]$, $(t_1, t_2]$……, $(t_{k-1}, t_k]$,the number of failures per subinterval is denoted by n_i where (i=1,2,3….k) with respect to the number of failures in $(t_{i-1}, t_i]$. Thus the likelihood function for mean value function μ(t) of G-D model can be given by—

$$L(n_1, \dots\dots, n_k) = \prod_{i=1}^{k} \frac{\{\mu(t_i)-\mu t_{i-1}\}^{n_i}}{n_i!} \exp\{-\mu(t_i) - \mu t_{i-1}\} \quad (7)$$

By taking natural logarithm on both sides of equation (7)-

$$\ln L(n_1, \dots\dots, n_k) = \ln \prod_{i=1}^{k} \frac{\{\mu(t_i)-\mu t_{i-1}\}^{n_i}}{n_i!} \exp\{-\mu(t_i) - \mu t_{i-1}\} \quad (8)$$

$$= ln \sum_{i=1}^{k} \frac{\{\mu(t_i)-\mu t_{i-1}\}^{n_i}}{n_i!} \exp\{-\mu(t_i) - \mu t_{i-1}\} \quad (9)$$

$$= \sum_{i1}^{k}\{ n_i \ln[\mu(t_i) - \mu(t_{i-1})] - [\mu(t_i) - \mu(t_{i-1})] - \ln n_i! \quad (10)$$

Maximum likelihood estimates of the parameters a and b can be computed by taking the partial derivative of equation (8) with respect to each model parameter and then equating the derivatives to zero one by one. Thus the estimates of the model parameters will be computed as follows:

$$= \sum_{i=1}^{k}\{\frac{n_i}{a} + e^{-bt_i} - e^{-bt_{i-1}}\} = 0 \quad (11)$$

$$\frac{\partial ln\, L}{\partial b} = \sum_{i=1}^{k}\left(\frac{n_i}{e^{-bt_i}-e^{-bt_{i-1}}} - a\right)(t_i e^{-bt_i} - t_{i-1}e^{-bt_{i-1}}) = 0 \quad (12)$$

Expression for a and b can be obtained by solving the following equations:

$$a = \frac{\sum_{i=1}^{k} n_i}{1-e^{-bt_k}} \quad (13)$$

$$\sum_{i=1}^{k}\left(\frac{n_i}{e^{-bt_i}-e^{-bt_{i-1}}} - \frac{\sum_{i=1}^{k} n_i}{1-e^{-bt_k}}\right)(t_i e^{-bt_i} - t_{i-1}e^{-bt_{i-1}}) = 0 \quad (14)$$

Equation (12) is a nonlinear equation and its not possible to solve it analytically hence it must be solved numerically. It can be solved using newton's method. A modification of G-O model was presented by Hossain and Dahiya [12] in which Maximum likelihood (ML) equations were investigated and a sufficient condition for the ML estimators to be finite was given. In the G-O model the probability distribution function (p.d.f) of the time to first failure is given by:

$$g(t) = \frac{a\, b\, e^{-bt} e^{ae^{-bt}}}{e^a} \quad (15)$$

this is an improper p.d.f which is a big drawback of this model. The modified model uses the proper p.d.f which is given as:

$$f(t) = \frac{a\, b\, e^{-bt} e^{ae^{-bt}}}{e^a - 1} \quad (16)$$

using this equation the modified model was given by:

$$f(t) = \frac{a\, b\, e^{-bt} e^{ae^{-bt}}}{e^a - c} \quad (16)$$

with the hope that it will do better than the G-O model.The model (5), when c=0, is G-O model and when c= 1, the corresponding pdf{time to failure} is proper. In this kind of model we might anticipate that m(∞) is finite. But when **c** = 1, then m(∞) = ∞ , giving rise to a new problem in determining the mean total number of failures in the system. So to avoid this situation the modified model needs to choose a {c: $0 \leq c < 1$ } that gives a better (in some sense) estimated mean number of failures in the system than the G-O estimate. H-D model is superior to the G-O model because: **1)** it is more flexible; 2) it assigns less weight at infinity in the pdf of the time to failure; and 3) the sufficient condition for the existence of finite solution of ML equations is the same as the necessary & sufficient condition for the GO model.

4.2 Parameter Estimation Using particle Swarm Optimization

Kennedy and Eberhart [13] depicted that PSO is a simple model of social learning whose emergent behaviour has found popularity in solving difficult optimization problems. The initial metaphor had two cognitive aspects, individual learning and learning from a social group. Where an individual finds itself in a problem space by using its own experience and that of its peers to move itself toward the solution

$$v_{t+1} = v_i + \varphi_1\beta_1(p_i - x_i) + \varphi_2\beta_2(p_g - x_i) \quad (18)$$

$$x_{t+1} = x_t + v_{t+1} \quad (19)$$

where constants φ_1 and φ_2 determine the balance between the influence of the individual's knowledge (φ_1) and that of the group (φ_2) (both set initially to 2), β_1 and β_2 are uniformly distributed random numbers defined by some upper limit, β_{max}, that is a parameter of the algorithm, p_i and p_g are the individual's previous best position and the group's previous best position, and x_i is the current position in the dimension considered.

This was found to suffer from instability caused by particles accelerating out of the solution space. Eberhart et al [14] proposed clamping scheme that limited the speed of each particle to a range [-v_{max}, v_{max}] with v_{max} usually being somewhere between 0.1 and 1.0 times the maximum position of the particle. This reduced the possibility of particles flying out of the problem space.

The most problematic characteristic of PSO is its propensity to converge, prematurely, on early best solutions. Many strategies have been developed in attempts to overcome this but by far the most popular are inertia and constriction. Therefore Shi and Eberhart [15] introduced the term inertia, w, as follows:

$$v_{t+1} = \omega\, v_i + \varphi_1\beta_1(p_i - x_i) + \varphi_2\beta_2(p_g - x_i) \qquad (20)$$

Eberhart and Shi [16] introduced an optimal strategy of initially setting ω to 0.9 and reducing it linearly to 0.4, allowing initial exploration followed by acceleration toward an improved global optimum. They also showed that combining them by setting the inertia weight, ω, to the constriction factor, χ , improved performance across a wide range of problems.

Clerc and Kennedy [17] proposed an idea of introducing constriction, χ , which alleviated the requirement to clamp the velocity and is applied as follows:

$$\chi = \frac{2}{2-\varphi-\sqrt{\varphi^2-4\varphi}} \qquad (21)$$

Where $\varphi = \varphi_1 + \varphi_2$, $\varphi > 4$

Kennedy [18] revisited the constricted PSO and examined whether the added components were necessary, and whether any further components could be removed. Various experiments were performed with a view to paring the process for further efficiency gains. To achieve this, a Gaussian PSO was developed. In this implementation the entire velocity vector is replaced by a random number generated around the mean $(p_{id} + p_{gd})/2$ with a Gaussian distribution of $|p_{id} - p_{gd}|$ in each dimension (d). This effectively means that the particles no longer 'fly' but are 'teleported'. Kennedy justified this departure on the grounds that it is the social aspect of the swarm that is more important to its effectiveness. This was empirically backed up with the Gaussian influenced swarms performing competitively.

Merwe et al [19] investigated the application of the PSO to cluster data vectors. Two algorithms were tested, namely a standard gbest PSO and a Hybrid approach where the individuals of the swarm were seeded by the result of the K-means algorithm. The two PSO approaches were compared against K-means clustering, which showed that the PSO approaches have better convergence to lower quantization errors, and in general, larger inter-cluster distances and smaller intracluster distances. It was shown that how PSO should be used to find the centroids of a user specified number of clusters. The algorithm was then extended to use K-means clustering to seed the initial swarm. The second algorithm basically used PSO to refine the clusters formed by K-means. The new PSO algorithms was evaluated on six data sets, and compared to the performance of K-means clustering. Results showed that both PSO clustering techniques have much potential.

Monson and Seppi [20], showed that particle motion could be further improved through changing the mechanism to a system influenced by Kalman filtering in which the motion was entirely described by predictions produced by the filter. Once again, the justification for such a radical change to particle movement was the maintenance of the social aspect of PSO, which was achieved through the Kalman filter's sensor model. The approach, whilst providing very accurate optimization, was found to be computationally expensive compared with the canonical PSO.

Parsopoulos and Vrahatis [21] modified the constricted algorithm to harness the explorative behaviour of global search and exploitative nature of a local neighbourhood scheme. To combine the two, two velocity updates were initially calculated:

$$G_{t+1} = \chi\{v_i + \varphi_1\beta_1(p_i - x_i) + \varphi_2\beta_2(p_g - x_i)\} \qquad (22)$$

$$L_{t+1} = \chi\{v_i + \varphi_1\beta_1'(p_i - x_i) + \varphi_2\beta_2'(p_{gl} - x_i)\} \qquad (23)$$

where G and L are the global and local velocity updates respectively, p_g is the global best particle position and p_{gl} is the particle's local neighborhood best particle position. These two updates were then combined to form a unified velocity update (U), which is then applied to the current position:

$$U_{t+1} = (1-u)L_{t+1} + uG_{t+1} \quad u \in [0,1] \qquad (24)$$

$$x_{t+1} = x_t + U_{t+1} \qquad (25)$$

where u is a unification factor that balances the global and local aspects of the search and suggestions were given to add mutation style influences to each in turn.

Kaewkamnerdpong and Bentley [22] introduced more realistic model of particle perception to PSO, with the aim of making it a viable option for applications that might otherwise suffer from imperfect communication, such as robotics. In the natural world, a social animal would often suffer imperfect perception of the other animals in its sociometric neighbourhood and must rely on information it receives via limited perceptive acuity. To model this, the particles were not allowed to communicate directly but only to observe particles within their pre-set perceptive range (replicating the stigmergic behaviour of some species, such as dancing honeybees); this was also realistic in that the information was regarded as more reliable where its source was closer. Each particle was also allowed to observe the local area (i.e. sample the local solution space). If there was a better solution nearby it used that as its individual best position. The position update algorithm for this method is dependent on the current state of the particle and can be summarised as follows:

• If there is an observed position $p_{observed} > p_i$ then set p_i to $p_{observed}$.

• If no neighbouring particles are perceived then do not use a social component.

• If multiple particles are perceived use their average current position as the group best(p_g).

• If a single particle is perceived then use its position as the group best (p_g).

Habibi et al. [23] developed a hybrid PSO, with Ant Colony (AC) and Simulated Annealing (SA). The AC algorithm replaced the individual best element of PSO, whilst the cooling process of SA was used to control the exploration of the group best element, both of which were then applied within the PSO framework (all random numbers being generated using a Gaussian distribution function). Experimentation with known TSP instances indicated that the hybrid approach was capable of finding good approximations efficiently.

Sheta [24] In this paper proposed the preliminary idea of using particle swarm optimization (PSO) technique to help in solving the reliability growth modeling problem had been explored. The proposed approach was used to estimate the parameters of the well known reliability growth models such as the exponential model, power model and S-shaped models. The results were promising.

According to Zhu [25] *et.al* Particle swarm optimization (PSO), a swarm intelligence algorithm, had been successfully applied to many engineering optimization problems and shown its high search speed in these applications. However, as the dimension and the number of local optima of optimization problems increase, PSO and most existing improved PSO algorithms such as, the standard particle swarm optimization (SPSO) and the Gaussian particle swarm optimization (GPSO), were easily trapped in local optima. In this paper a novel algorithm was proposed which was based on SPSO called Euclidean particle swarm optimization (EPSO) which had greatly improved the ability of escaping from local optima. To confirm the effectiveness of EPSO, five benchmark functions had been employed to examine it, and compared it with SPSO and GPSO. The experiments results showed that EPSO is significantly better than SPSO and GPSO, especially obvious in higher-dimension problems.

Engelbrecht [26] proposed a heterogeneous PSO (HPSO) in this paper, where particles were allowed to follow different search behaviors selected from a behaviour pool, thereby efficiently addressing the exploration–exploitation trade-off problem. A preliminary empirical analysis showed that using heterogeneous swarms would give better results.

According to Quin [27] software reliability prediction classifies software modules as fault-prone modules and less fault-prone modules at the early age of software development. As to a difficult problem of choosing parameters for Support Vector Machine (SVM), this paper introduced Particle Swarm Optimization (PSO) to automatically optimize the parameters of SVM, and constructed a software reliability prediction

model based on PSO and SVM. Finally, the paper introduced Principal Component Analysis (PCA) method to reduce the dimension of experimental data, and inputs these reduced data into software reliability prediction model to implement a simulation. The results showed that the proposed prediction model surpassed the traditional SVM in prediction performance.

According to Malhotra *et.al* [28] software quality includes many attributes including reliability of a software. Prediction of reliability of a software in early phases of software development would enable software practitioners in developing robust and fault tolerant systems. The purpose of the paper was to predict software reliability, by estimating the parameters of Software Reliability Growth Models (SRGMs). SRGMs are the mathematical models which generally reflect the properties of the process of fault detection during testing. Particle Swarm Optimization (PSO) has been applied to several optimization problems and has showed good performance. PSO is a popular machine learning algorithm under the category of Swarm Intelligence. PSO is an evolutionary algorithm like Genetic Algorithm (GA). In this paper the use of PSO algorithm was proposed to estimate parameters of delayed S-shaped model using machine learning method PSO and then compare the results with those of GA. The results are validated using data obtained from 16 projects. The results obtained from PSO had high predictive ability which was reflected by low error predictions. The results obtained using PSO are better than those obtained from GA.

Jadon et.al [29] proposed improved version of PSO called Self Adaptive Acceleration Factors in PSO (SAAFPSO) to balance between exploration and exploitation. The constant acceleration factors used in standard PSO had been converted into function of particle's fitness. If a particle was more fit then it gave more importance to global best particle and less to itself to avoid local convergence. In later stages, particles would be more fitter so all would move towards global best particle, thus achieved the convergence speed. Experiment was performed and compared with standard PSO and Artificial bee colony (ABC) on 14 unbiased benchmark optimization functions and one real world engineering optimization problem (known as pressure vessel design) and results showed that proposed algorithm SAAFPSO dominated others.

According to Al gargoor et al [30], due to the growth in demand for software with high reliability and safety, software reliability prediction becomes more and more essential. Software reliability is a key part of software quality. However so many models had been proposed for the software reliability prediction but none of them can give accurate prediction for all cases. So in order to improve the accuracy of software reliability prediction the proposed model combine the software reliability models with the neural networks (NN). Particle swarm optimization (PSO) algorithm had been chosen and applied for learning process to select the best architecture of the neural network. The applicability of the proposed model was demonstrated through three software failure data sets. The results showed that the proposed model has good prediction capability and more applicable for software reliability prediction.

5. CONCLUSION

It has been explored that solving optimization problems using evolutionary algorithms like particle swarm optimization is found to be more reliable and computationally easier as compared to traditional techniques. Parameter estimation of the software reliability models is also an optimization problem. Traditionally MlE and LSE were used for the parameter estimation but evolutionary techniques like that of Genetic Algorithms, Swarm Intelligence etc have shown better results than that of the traditional methods. The model parameters usually follow nonlinear relationships which makes traditional parameter estimation techniques suffer many problems in finding the optimal parameters to tune the model for a better prediction these problems can be overcome by stochastic search methods.

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Improvising Network life time of Wireless sensor networks using mobile data aggregator

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Abstract: Energy consumption becomes a primary concern in a Wireless Sensor Network. To pursue high energy saving at sensor nodes, a mobile collector should traverse the transmission range of each sensor in the field such that each data packet can be directly transmitted to the mobile collector without any relay.

Keywords: Wireless sensor networks (WSN); sensor; data sink; handover; polling point.

1. INTRODUCTION

In wireless sensor networks (WSNs) a large number of sensors scatter over a surveillance field and extract data of interests by reading real-world phenomena from the physical environment. Since sensors are typically battery-powered and left unattended after the initial deployment, it is generally infeasible to replenish the power supplies once they deplete the energy. Thus, energy consumption becomes a primary concern in a WSN, as it is crucial for the network to functionally operate for an expected period of time.

2. RELATED WORK

[1] In this paper, author proposed a new energy-efficient approach for clustering nodes in ad hoc sensor networks. Based on Hybrid Energy-Efficient Distributed clustering, which periodically selects cluster heads according to a hybrid of their residual energy and secondary parameter, such as nude proximity to its neighbors or node degree
Pros and Cons:
This method can be applied to the design of several types of sensor network protocols that require energy efficiency, scalability, prolonged network lifetime, and load balancing. Only provided a protocol for building a single cluster layer.

[2] In this paper, author first present how to place SNs by use of a minimal number to maximize the coverage area when the communication radius of the SN is not less than the sensing radius, which results in the application of regular topology to WSNs deployment.
Pros and cons:
WSN topology lifetime can extend by more than eight times on average by the mobile node rotation which is significantly better than existing alternatives.
It considers WSNs that are mostly static with a small number of mobile relays not practically declared for Dynamic WSNs.

[3] This paper deals with mobile data gathering in the sensor network which employs one or more mobile collectors that are robots or vehicles equipped with powerful transceivers and batteries.
Pros and cons:
The performance metrics observed are the data success rate (the fraction of generated data that matches the access points) and the required buffer capacities of the sensors and the MULEs.
An important issue that is not addressed in this paper i.e. latency.

[4] In this paper author presented the design and analysis of novel protocols that can dynamically configure a network to achieve guaranteed degrees of coverage and connectivity. Proposed work differs from existing connectivity or coverage maintenance protocols in several key ways.
Pros and cons:
Guaranteed connectivity and coverage configurations through both geometric analysis and extensive simulations can be provided which is the capability of our protocols.
It is not extending solution to handle more sophisticated coverage models and connectivity configuration and develop adaptive coverage reconfiguration for energy-efficient distributed detection and tracking techniques.

[5] In this paper author have developed an embedded networked sensor architecture that merges sensing and articulation with adaptive algorithms that are responsive to both variability in environmental phenomena discovered by the mobile sensors and to discrete events discovered by static sensors.
Pros and cons:
They also showed relationship among sampling methods, event arrival rate, and sampling performance are presented.
Sensing diversity does not introduced which is used to enhance Fidelity Driven Sampling

3. ALGORITHM

Step 1: Initial setup is to design the network as less hop count transmission.

Step 2: Design a pp from the sensor devices (here we are setting PP which can receive the data from number of nodes).

Step3: if sensor having the data, then sensor finding the PP, which is near to that sensor.

Step 4: if sensor found any PP point node is available then transfers data to PP

Step 5: if PP has more data then it informs to control station.

Step 6: control station receives the number of control information from different PP's.

Step 7: after collecting the control message, CS makes the shortest route to collect the data from PP's.

Step 8: MC moves towards each PP's and collects the info and returns back to CS.

4. MODULES

There are five modules in this section. Those are

I. Analyzing the data sink details

II. Setting less hop count transmission
- Problem in static forward node
- Dynamic forward node

III. Select sensor as pp
- Static P
- Dynamic PP

IV. Find and collect data from pp's

V. Handover the data o BS.

4.1 Analyzing the data sink details

Handover the data to data sink when data sink within the transmission coverage area of sensors. The sensors which are located in the range of data sink it transforms all the information to the data sink with minimum hops.

4.2 Setting Less Hop Count Transmission

Multi-hop routing, packets have to experience multiple relays before reaching the data sink. Minimizing energy consumption on the forwarding path does not necessarily prolong network lifetime as some popular sensors on the path. So to avoid the problem in multi-hop routing we are setting the less hop count transmission.

4.2.1 Static forward node:

When the node forwarding the data continuously, then that node will loss more energy. It may causes node failure.

4.2.2 Dynamic forward node:

If the forward node is dynamically changed with less hop count node then energy loss of node should be very less.
So, In the first path the hop count is 3 where as the hop couny for the second path is 2, Therefore for data transmission the preferable path is second path.

4.3 Select Sensor as PP

The selected polling points are the subset of sensors, each aggregating the local data from its affiliated sensors within a certain number of relay hops.
These PPs will temporarily store the data and upload them to the mobile collector when it arrives.

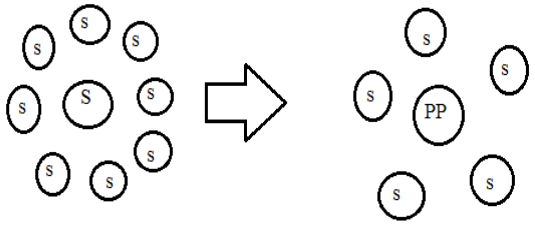

Figure 1: a) Group of sensors b) Group of sensors with polling point.

The PPs which are selected can simply be a subset of sensors in the network or some other special devices, such as storage nodes with larger memory and more battery power.

From a group of sensors one sensor will be elected as a polling point, which receives and send the information to the sensors.

4.4 Find and Collect Data from Pp's

Because of the freedom of mobile collector to move to any location in the sensing field, it provides an opportunity to plan an optimal tour for it.

Our main idea is first to find a set of special nodes referred to as PPs in the network and then determine the tour of the mobile collector by visiting each PP in a specific sequence.
When the mobile collector arrives it polls each PP to request data uploading and then it upload the data to MC.
The Polling points collect the information from all the sensors and that aggregated information is collected by the Mobile collector.

4.5 Handover the Data to BS

A Polling Point uploads the data packets to the mobile collector in a single hop.

Mobile collector begins its tour from the static data sink, which is located either inside or outside the sensing field, and collects data packets at the PPs and then returns the data to the data sink.

Finally MC Handover the data to data sink, such as BS.

The Mobile collectors move through all the polling points and collect the information and send it to Base Station

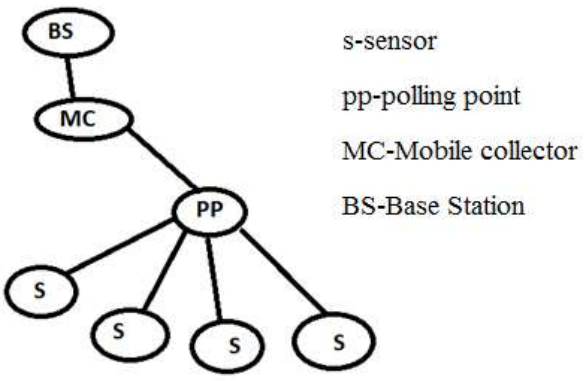

Figure 2: Mobile hierarchy

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5. RESULTS

We did our research analysis in WSN by using NS2. In Ns2 we can show two type of output, one is Nam window and another one is x graph.

In this paper, we showed our model testing output. From this model result, we can conclude our proposed method is better than previous one.

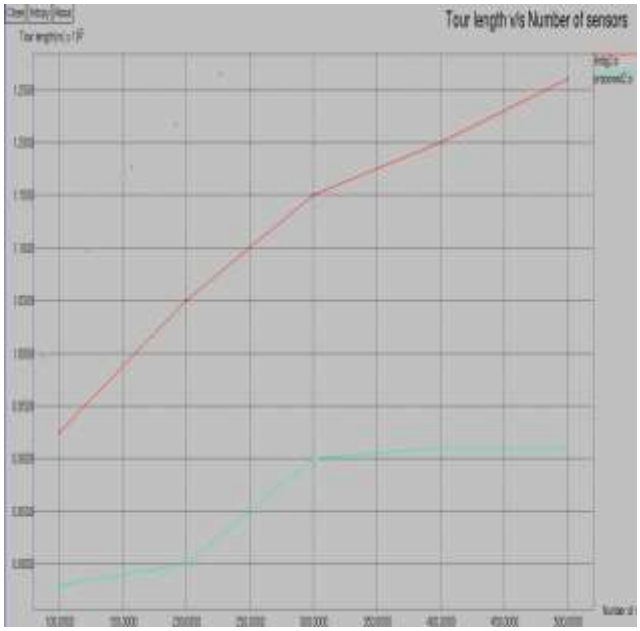

Figure 3: Tour length of proposed system and existing

From above graph, we got the result as we can avoid unnessary travalling time.

Figure 4: Energy comparison b/w proposed and existing

From this model result, we improved energy level and we reduced the energy consumption

From Nam window result we can see the process of our proposed model (data transmission, mobile collector movement)

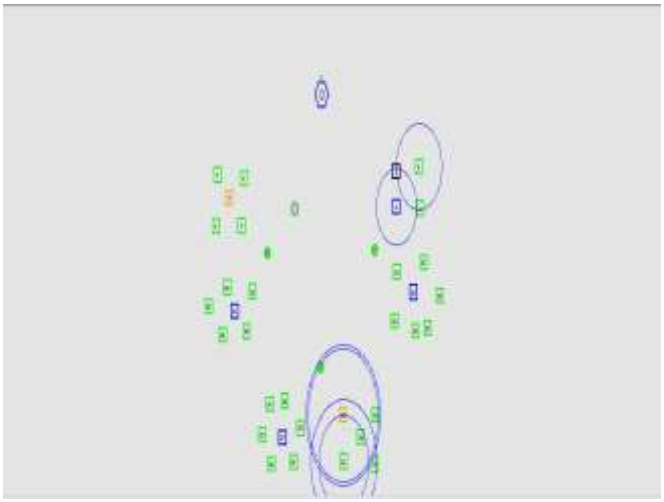

Figure 5: Nam window result mobile collector travelling

6. CONCLUSION

In this paper, we studied mobile data collection in wireless sensor networks by researching the tradeoff between the relay hop count of sensors for local data aggregation and the travel length of the mobile data aggregator. We proposed a polling-based scheme and formulated it into the problem, then presented two efficient algorithms to give practically good results. Extensive simulations have been carried out to validate the efficiency of the system.

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