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Solar Based Safety Stick for Farmers and Scarecrow for Agriculture Purpose

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Abstract - The undertaking consists of two sections. In farming, two implements are utilized: the automated scarecrow and the farmer's safety stick. The avoidable causes of death for many farmers include electric shocks, thunder strikes, snake bites, and other similar incidents. For those without cellphones who must yet traverse potentially hazardous areas like forests, farms, and other rural areas, the plan is to develop a portable "smart stick" that makes use of the internet of things (IoT). The project describes the "smart stick" in depth, including its functions, benefits, block diagram, and design. The fundamental objective of this proposal is to alleviate human suffering by guaranteeing the safety of farmers and the elderly who toil in remote areas or who are otherwise unable to use conventional emergency notification systems.

Automatic scarecrow technology has been around for a while and is effective at keeping animals and birds away from crops. Scarecrows are a great way to keep birds away from crops in a safe and humane way. The main goal of this project was to build a functional scarecrow model that can dynamically disperse birds in reaction to adjacent sound effects. A built-in microphone allows the scarecrow to relay any ambient noise to an Arduino controller. Next, the controller instructs the scarecrow's two servo motors to wave its hands, frightening away any birds or animals in the vicinity. Finally, the technology behind this cutting-edge scarecrow has several applications, including reducing agricultural losses due to birds, distributing birds in a safe, reliable, and compassionate way, and becoming the favored technique of bird control in the business. The scarecrow is powered by a rechargeable battery that delivers 12V. Rechargeable +12V batteries used by the two modules we just discussed are powered by sunlight collected by solar panels placed on the field.

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Introduction

Food and other commercially feasible survival aids are produced by agriculture, one of numerous auxiliary industries. It would indicate that the agricultural area is home to a wide variety of tiny animals. All of these animals are going to be a major pain for farmers who depend on their fields for farming. This is in addition to the other issues that already present there. The many sensors shown below are attached to a battery and the suggested model. These include a light sensor, an emergency switch, a shock pulse generator, a vibrator to scare away animals, a GPS, a GSM, and a plethora of others. It primarily consists of a farmer's safety stick and an automated scarecrow designed to keep birds off of the field.

Wild animal encroachment, nighttime field monitoring, inadvertent contacts with snakes, insects, and electric dangers, and a lack of dependable power supply in rural regions are just a few of the many issues that farmers in developing nations like India confront. Agriculture is still the backbone of many countries. Manual field guarding techniques and traditional scarecrows are time-consuming and ineffective.

Smart scarecrow systems that include sensors, sound generators, illumination, and wireless connectivity have been the subject of research to address these challenges. One autonomous, eco-friendly, and cost-effective option for farmer safety and crop security is a solar-powered safety stick paired with an intelligent scarecrow.

The problem of ravenous birds has long plagued farmers. If birds ate all the grain and maize, a farmer and his family may be hungry during winter. Almost three thousand years ago, scarecrows were an essential part of agricultural. Birds that prey on rice are physically harming paddy fields, which in turn reduces yield, quality, and quantity—costing farmers a ton of money. This is due to the fact that static scarecrows and other antiquated methods can only cover a limited region for farmers. The high cost and potential scarcity of workers to frighten away birds were further obstacles for large-scale commercial rice producers. Using chemical pesticides like Avicides 3, which kill just certain kinds of birds, is one hazardous way to manage birds. For example, this is common practice in rice fields. The activity in question endangers not just humans but also the ecosystem.

A computer-hardware system's included software is a crucial component. This specialized computer network controls one or more products or programs. This could be a standalone object or a component of something bigger. With software already included in ROM, there's no need for secondary storage media like CD-ROM optical memory or diskettes, cartridge tapes, or hard disks with magnetic memory.

Literature Review

Several studies have focused on solar energy because of its extensive availability in rural areas, low maintenance cost, and potential for significant cost savings. Kumar et al. (2018) found that solar-powered farming implements significantly reduced grid power use. In their 2019 publication, Patel and Shah highlighted solar energy as a sustainable and ecologically conscious choice for field security systems, especially in off-grid locations. Solar panels with rechargeable batteries are essential to the operation of many everyday electronic gadgets. This includes microcontrollers, LED lights, buzzers, sensors, and GSM modules.
Research on farmer safety sticks primarily focuses on personal protection and alert measures.

For the purpose of detecting obstacles and animals, Ramesh et al. (2020) developed a smart stick with ultrasonic sensors. Researchers Singh et al. (2021) suggested that farmers may be better protected on nighttime field visits if they used a combination of shock prevention, torchlight, and sound alarms. Some models include sensors that can detect snakes using vibration or infrared light, giving you prior warning of any danger. Such technology considerably improves farmers' security by alerting them to potentially dangerous animals, pits, or invaders.
Recent publications have detailed the following uses of automation and electronics: According to Lee et al. (2017), there should be an electronic scarecrow that can make noises and track motion. Using ultrasonic sound generators and flashing light-emitting diodes, Ahmad et al. (2019) were able to deter birds and animals.
Internet of Things (IoT) scarecrows equipped with PIR sensors and GSM alerts were proposed by Verma et al. (2020) to enable farmers to get invasion warnings on their phones. Results demonstrated that these technologies outperformed more traditional methods of crop protection.

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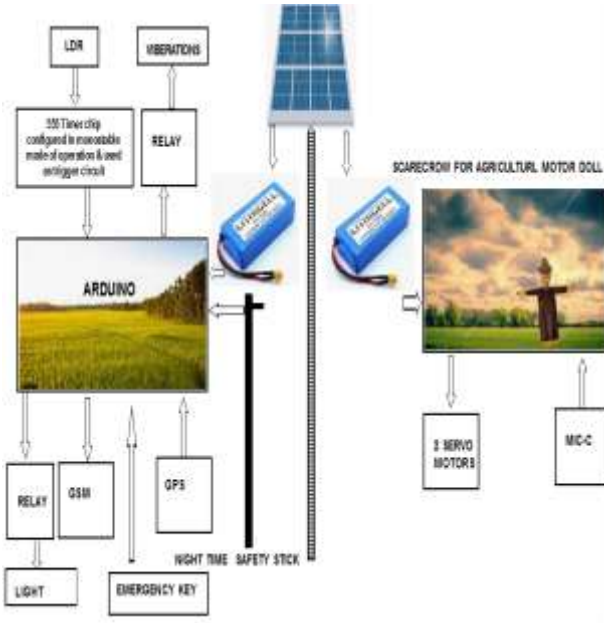
Methodology



Block diagram

Technology has advanced at a dizzying rate recently, and everything has been pushed to new heights. Additionally, there is a huge improvement to daily living in every sector. By working on this artificial vision system, we were able to make a difference in the lives of the visually impaired. You may find the schematics for the blocks and circuits in the chapter that follows. Here we break down the whole project into its component parts and explain what they are for your convenience.

For this project to work, the microcontroller is essential. Here, we choose the ATMEL group microcontroller chip. An automatic light, a vibrator for frightening animals, an emergency switch, GSM, GPS, an alarm, and more are all covered in detail in the following chapters. Pressing the emergency button triggers the use of both GSM for the transfer of information to the appropriate cellphone and GPS for the person's precise position. The central processing unit is connected to all of these peripherals.

The proposal includes a multitude of sensors, as mentioned in the abstract, in addition to GPS and GSM. The vibrator successfully disperses the creatures. Additionally, the authorized mobile will immediately get the location data upon pressing the emergency button.

A simple and effective way to decrease crop damage caused by animals and birds is to employ autonomous scarecrow technology. An effective and humane method of protecting crops from birds is to use scarecrows. Protecting rural and agricultural regions, the nature-inspired device uses bio-acoustics. Among the many advantages of scarecrow technology are the following: decreased expenses associated with crop damage; safer and more compassionate distribution of agricultural birds; and the approach most preferred by the business for managing birds.

A light sensor, a shock pulse generator, and a vibrator are just a few of the sensors included in the sample module. The former allows for automatic lighting management, while the latter is useful for controlling animals. In addition, the stick has an emergency button that, when pushed, summons immediate medical help. When the user presses a key or an emergency button, the controller uses the GPS module to determine the user's present location. Subsequently, the GSM module notifies the authorized mobile phone via SMS. The system's brain is an arduino microcontroller that has non-volatile memory. In a similar vein, the light-dependent resistor (LDR) on the stick can sense when the light outside is dim and activate the built-in light. The whole module is powered by a +12V rechargeable battery that is attached to the stick. A long-distance transmission is now possible with the help of GSM.

ARDUINO UNO controller

The Arduino Uno is a microcontroller board that is based on the ATmega328 (datasheet). A 16 MHz ceramic resonator, a USB port, a power connection, an ICSP header, six analogue inputs, fourteen digital inputs and outputs (six of which are PWM outputs), and a reset button round out the inputs and outputs. Everything you need to support the microcontroller is already there; to start, all you need is a battery, an AC-to-DC converter, or a USB cable.

LIGHT SENSING CIRCUIT

An LDR is used for light detection, as stated in the abstract. Due to their considerable range in resistance, LDRs are often selected for monitoring light intensity. An key management function for many applications is the measurement of light intensity. A light meter may be termed a "lux meter" since the most common unit of measurement for light intensity is the lumen, but foot candles are also used.

The primary purpose of a light sensor is to detect the brightness of light, although there are other methods for measuring light intensity that vary according to the availability of light sensors. The aim of using a hear LDR as a light sensor is to regulate street lights, not to measure light levels. In this project, we're using a light-dependent resistor (LDR), a very

sensitive device that changes its resistance value in response to changes in light intensity. Light has an inverse proportional effect on resistance, meaning that it drops as light intensity rises. The objective of the light sensor device is to transform the quantity of light hitting its surface into a corresponding DC level. To create a potential splitting network, a 10k resistor is linked in series with the LDR. The output voltage changes in relation to the light intensity and is measured from the center, also known as the reference voltage. The reference voltage is acquired from the resistor, which is linked to the LDR on one end and to the continuous +5V DC supply on the other. The ground terminal is attached to the other end of the LDR. The 555 timer IC, set to "MONOSTABLE" mode of operation, receives the output of the potential division network.

GSM MODEM

When it comes to mobile phone standards, the most widely used one is the Global System for Mobile Communications. It may be found in almost every nation in the globe and on every continent. Since GSM is a cellular network, a mobile phone may join it by actively seeking out nearby cells. It is usable in four distinct frequency bands, the most popular of which is 900 MHz/1800 MHz, with 850 MHz/1900 MHz being the most prevalent in the Americas. A GSM modem is a versatile, pre-configured, and durable device that may be integrated or connected to a wide variety of applications. The basic AT commands allow for extensive control and customization of the modem. This type-approved modem can expedite data transfers on the fly while supporting a wide variety of voice, data, fax, and short message formats (including Point-to-Point and Cell Broadcast). In this project, the GSM MODEM plays a crucial role in transmitting and receiving messages.

GPS RECEIVER

Due to its extensive availability, the ProGin SR-87 series of GPS modules has gained considerable notoriety. This gadget is perfect for the job, but if you can't find it, any branded GPS receiver will work. The aforementioned GPS module has all three of these attributes: high sensitivity, high performance, and cheap cost. Because of these factors, designers of vehicle-tracking systems greatly like this technology. This module can keep tabs on twenty satellites at once thanks to its quick time-to-first-fix and one-hertz navigation update. The many general-purpose applications of this gadget are numerous, and handheld tracking devices are only one of them.

A GPS receiver, the ProGin SR-91, which runs at a 9600 baud rate, receives the data from the space section. The data received from the GPS satellites is processed by the microcontroller before being sent to GSM. The data produced by the GPS module is sent in this project using the RF network. Longitude, latitude, and altitude are the only three bits of data that the GPS module receives. The microcontroller only reads the coordinates (longitude and latitude) and disregards all other data (time, altitude, authentication, satellite name, etc.). Take LAT: 1728:2470 LOG: 7843.3089 as an example.

SERVO MOTOR

Precision control of angular or linear position, velocity, and acceleration may be achieved in mechanical systems with the help of servomotors, which are rotary actuators or linear actuators. It is made up of a position-feedback sensor connected to an appropriate motor. Additionally, a very complex controller is needed, often a servomotor-specific module.

Although servomotor is often used to describe a kind of motor that works well in a closed-loop control system, it does not really describe a particular class of motors. Robots, computer numerical control (CNC) equipment, and automated manufacturing are just a few of the many uses for servomotors. In order to regulate its movement and ultimate location, servomotors employ position feedback, making them closed-loop servomechanisms. An analog or digital signal indicating the desired position of the output shaft is sent into its control.

Conclusion

The project work has been designed and developed efficiently, as shown by the excellent outcomes of the prototype module that was made for demonstration purposes. The first and foremost task is to configure the software so that it can process the inputs and perform the actions. Only the code we provide in the controller will have an impact on the module's performance. Further advancements in the technologies used to construct the prototype module are necessary to transform this into a fully operational system.

FUTURE SCOPE

A wireless video camera attached to the stick may further improve this by transmitting video signals to a central station where the operator can keep an eye on things. In order to facilitate real-time operations, it is possible to augment the same module with more modules that ward off wild animals.

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Catalogs:

(1) TEXAS - LINEAR IC's manual

(2) SIGNETICS - DIGITAL IC's manual

RESEARCH HIGHLIGHTS

- Solar-powered smart stick with GPS–GSM emergency alert system
- Arduino-based automatic scarecrow with servo motor movement
- Renewable 12V solar battery for off-grid operation
- Multi-sensor integration for farmer safety and crop protection