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Drone Based Weather Monitoring System

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Abstract: Over the past few years, the manner of life has undergone a significant evolution. The development of robotics and the Internet of Things (IoT) through technology has not only enhanced our way of life but has also grown to be an indispensable aspect of it. A world without vehicles, phones, computers, etc. seems unimaginable in the modern era. Since there is still much to be done, new, creative ideas continue to be generated. The similar thought process guided the beginning of this research. The need to monitor our environment has arisen because of the ongoing improvements in technology. In this research, we attempt to offer a method for drone-based continuous environmental monitoring.

Keywords: Drone, Environment Monitoring, Unmanned Aerial Vehicle (UAV)

1. INTRODUCTION

The wonders of science are endless. The way we live has been fundamentally transformed by technology. No area of our lives is exempt from their involvement. Time and space have been mastered by science and technology. For instance, the geographical and natural boundaries separating one country from another have been completely eliminated by modern transportation methods. It has forged ties among all nations in the world. People work hard to create new items and devices that could improve our lives as technology advances and living standards rise. Quadcopters, UAVs, and general robotics are two examples of such fields.

But not all wonders are advantageous to the cosmos. These inventions have the potential to result in devastating global accidents.

With 5 million deaths brought on annually by air pollution, it is one of the top causes of death worldwide. Additionally, it is rising to the top of the list of:

- a variety of illnesses. pollution of the air
- contributes approximately 9% of all fatalities worldwide. Massive costs to human, animal, and forest life are incurred each year as the number of wildfires rises.
- At least 80% of all fire deaths take place in houses, making fire the third most common unintentional fatality in a house.

When we consider the points, we must manage environmental pollution, which is growing at an alarming rate, and monitor the neighborhood where we reside. Therefore, a combined drone unit mounted with a smart environment monitoring system appears to be quite effective for achieving our goals of reducing environmental pollution and lowering the risk to life through observation of our immediate surroundings. We can assess the situation at that specific place and take the necessary actions with the assistance of the surveillance data given.

Due to their numerous applications in resolving issues in daily life, quadcopters are becoming more and more popular. Additionally, it has numerous industrial uses and facilitates physical labor.

This paper describes the functions, modelling, and features of an Arduino Nano-based quadcopter-based environment monitoring and surveillance system. Every component has been thoroughly analysed and constructively described. The key goal is to make it versatile and cost-effective, with an emphasis on the environment. The technology is highly effective and flexible because the drone itself may be utilised in rescue operations, environmental monitoring, firefighting operations, surveillance, payload delivery, and more.

2. LITERATURE REVIEW

The use of drones for environment monitoring has gained a lot of attention in recent years due to their ability to collect data from remote or hart-to-reach areas that are less affected by the same people. Arduino is an open-source microcontroller platform that has become a popular choice or powering drones for environmental monitoring. This review paper provides an overview of the research and implementation of environmental monitoring drones using Arduino.

“unmanned aerial vehicles (UAVs) have great potential to aid new applications in many fields, including Military, Défense, Medical, Surveillance applications, and Vehicle tracking.” Developing unmanned drones and multiple drone systems, coordinate and complete missions more efficiently and cost-effectively. However, for drones to be used effectively, many issues need to be resolved, including protection, privacy, and control. Therefore, in this post, we examine new areas for IoT-enabled drones, and 5G technology, identifying sensor needs and analysing flight control systems for designed air traffic, privacy and security issues.
Finally, we propose to promote and facilitate UVA technology. The content of the framework demonstrates the overall architecture that protects drones as “flying” objects in a collaborative environment.

"The main problem of Flight Weather Network (FWN) is subsystem travel. Using Unmanned Aerial Vehicle (UAV) subsystems or modified UAV quadcopters, using a similar operation specific path. The system has many subsystems. E.g. drones, many sensors nodes (IoT devices), weather monitoring, collaboration in FWN system.
When the drone starts flying, it uses the wireless network environment and is in connection with the FWN. Some sensor nodes collect the weather monitoring centre and then send the weather data to the weather monitoring centre. In order to ensure consistency and accuracy in data recording, the subsystem using drone as a telemetry environment should be investigated. The questions were studied and analysed on several fronts, including flight mode tests, quadcopter stretch break stability checks, autonomous mode investigations, and velocity point surveys of drones in autonomous state mode or in real coordinates, and a break-down of the observed failure state. Voltage drop and RC transmitters."

"Integrated electronics and electronic devices play an important role in connecting the scientific and virtual worlds. Millions of devices such as Smartphones, Smartwatches, Wearables, Medical implants, and wireless sensor nodes have been found to make up these devices. It carries sensitive or proprietary information and is used in critical applications, including the use of wireless sensor nodes to remotely capture atmospheric emission data. However, some systems are used to collect data in remote areas because there is no local connection anywhere and is inaccessible to work. The use of wireless sensor nodes has proven to be faster, less energy intensive and more cost effective. The aim of this project is to monitor mountains from afar.
The systems uses drones to collect data from remote streaming sites. The technology used has been proven by environmental research showing the benefits of introducing wireless sensor nodes, including access to remote locations continuous data collection, and the labour and expense associated with data collection in the field."

"Unmanned Aerial Vehicles are frequently used in situations such as weather monitoring, pest control, infrastructure inspection, monitoring of communities where people and vehicles do not enter. Yes, there have been 418 accidents in which drones have been used in the US Situations. The purpose of this article is to create a protection system for the use of the engine and to prevent whether the Raspberry Pi is normal, it is connected to the drone and the temperature is connected to the engine.
The DS-18-820 thermometer is used to measure the temperature. For testing, we created an OS that will open the Raspberry Pi screen on the PC, in the background. If the difference reaches the maximum temperature of the engine, the drone will stop working. The findings show that the new system can make the drone safer by connecting sensors to data from the drone's engine to control the drone."

"Unmanned Aerial Vehicle (UAVs) have gained popularity in two military areas in the past. Also, disasters, terrorism, and based use have grown rapidly when comparing security concerns and capabilities, aka drone network (LAV Nets) – Hoc is one of the communications. Also, these issues need to be addressed to ensure that drones behave properly when controlled with respect to them. Adequate protection and attachment must be considered in many ways, including a good understanding of the vehicle's operating procedures. 'Terrain < Weather < Contact UAV Net'. This can be done by creating a simulator that includes certain factors. With a suitable UAV simulator, performance evaluation becomes an important method, configuration and design, to show results and be used for comparative situations.

Therefore, it is important to maintain the reliability of the simulation results by analysing the advantages and disadvantages of each simulator until the collection becomes significant. Based on this inspiration, we made a comprehensive evaluation of current drone simulators. However, it addressed and clarifies open data problems and research questions. ”

3. PROPOSED METHODOLOGY

The research methodology shall analyze methods and approaches for the handling and evaluation of test data.

For this paper the most important thing is deciding the temperature. This means that a person can't go where he can. We'll defect it with a drone weather monitor which we'll test with a DHT sensor. Additionally, this drone can assess the air pressure and air humidity.

3.1 Specification

3.1.1 Hardware Requirement:

3.1.1.1 UAV Quadrotor: Building a quad-rotor UAV capable of transporting a load of battery packs, sensors, microcontrollers are the first step. You can buy and assemble a quad-rotor UAV, commonly known as a drone, to cut down on the time needed to programme its control and flight capabilities.
A drone's four evenly spaced propeller-equipped rotors are kept together by a lightweight frame in the shape of a 'X'. To achieve balanced flying and help the drone stay upright and not readily slanted by wind or other object during flight, the rotor is situated at the end of the X-shaped chassis. One example of a quad-rotor UAV is shown in Fig. 1.

Fig. 1 Example of Quadrotor UAV Drone

3.1.1.2 DHT11 Sensor: The humidity and temperature sensors utilised in this project are DHT 11 Sensors. The DHT11 is a hybrid sensor that outputs temperature and humidity as calibrated digital signals. It is an extremely stable and dependable component. The parts of the DHT11 humidity and temperature sensor are shown in Fig. 2.

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Fig.2 DTH11 Temperature and Humidity Sensor

3.1.1.3 MQ2 Sensor: The MQ2 sensor is a gas sensor module that can be used to find gas leaks. It reacts almost instantly and is very sensitive. Potentiometers can be used to modify its sensitivity. Liquefied petroleum gas (LPG), methane, and carbon monoxide are all highly sensitive to the MQ2 Gas Sensor. The MQ2 Gas sensor is shown in Fig. 3.

Fig. 3 MQ9 Gas Sensor

3.1.1.4 Arduino Nano: The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328 (Arduino Nano 3.x). It has more or less the same functionality of the Arduino Demilune, but in a different package. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one. Arduino Nano is shown in Fig.4.

Fig. 4 Arduino Nano Microcontroller

3.1.1.5 SD Card Module: A breakout board called an SD Card Module is used for microcontroller-based SD card operations including reading and writing. In this project we use SD Card module to store our data. SD Card Module is shown in Fig.5.

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Fig. 5 SD Card Module

3.1.2 Software Requirement:

DHT11 temperature and humidity sensors can be used with the Arduino microcontroller board thanks to their own library. As a result, the Arduino Uno needs the DHT11 library to identify the component and read data from the DHT11 sensor. The MQ2 gas sensor can be detected by the microcontroller UNO without the need for any library or interface coding. Each sensor's sensitivity can be adjusted using both hardware and software based on the environment.

3.2 Circuit Diagram

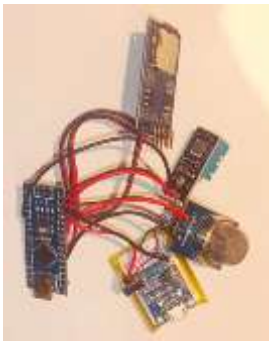

Fig 6. Experimental Setup

3.3 Working

1. Calibrated sensors are used for this monitoring system (sensors used are temperature and humidity sensor, and Gas sensor). SD card module used for storing the data retrieved.
2. After calibration of various sensors and the supply of power through the battery. We start our working module.
3. All the data is collected from the sensors and via calibrated sensors it is sent to Arduino Nano.
4. From Arduino Nano the data gets translated to the digital format and stored in the SD card.

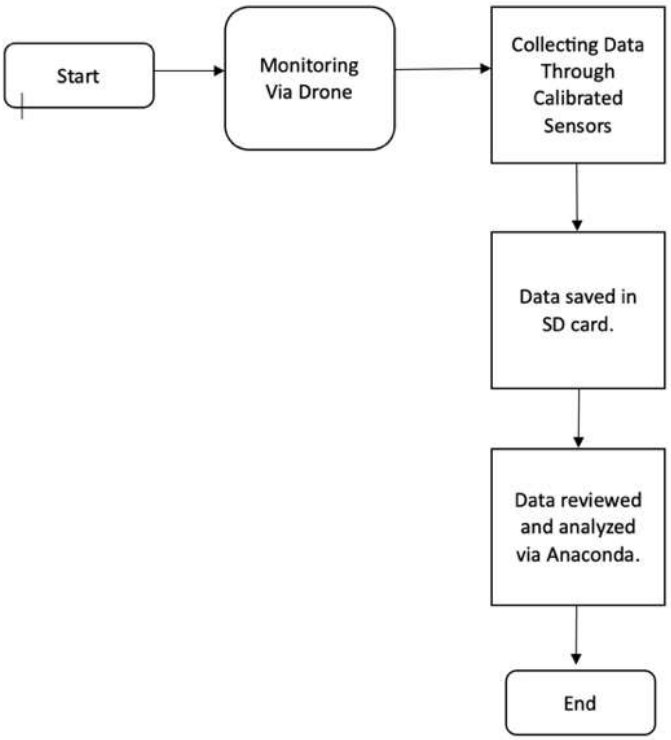

Fig. 7 Flowchart of working

4 RESULT

After analyzing the data gathered from the calibrated sensors and stored with the use of SD card, we collected data at three different timelines, i.e., Morning, Afternoon, and Night. Fig. 8,9, and 10 are the following graphical representation of data collected.

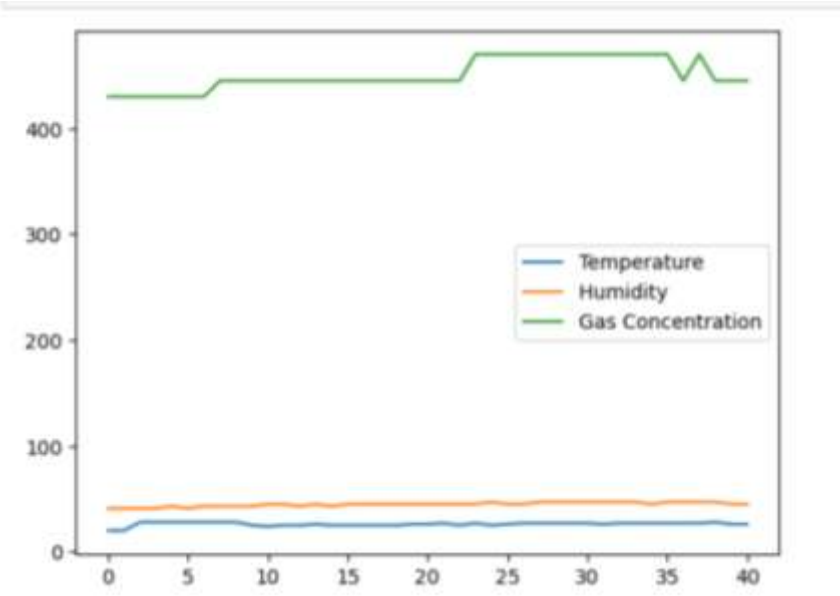

Fig. 8 Graphical representation of data retrieved at Morning.

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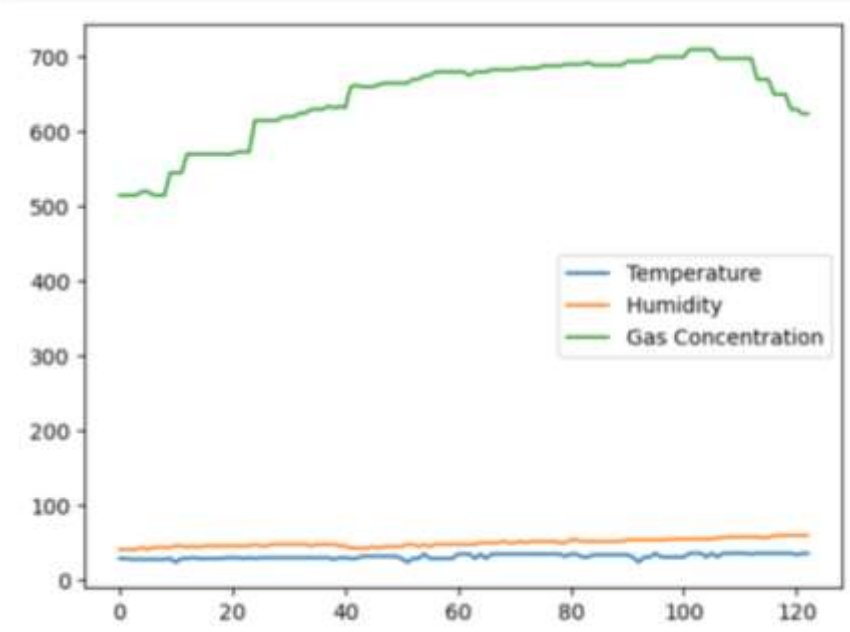

Fig. 9 Graphical Representation of data retrieved at Afternoon.

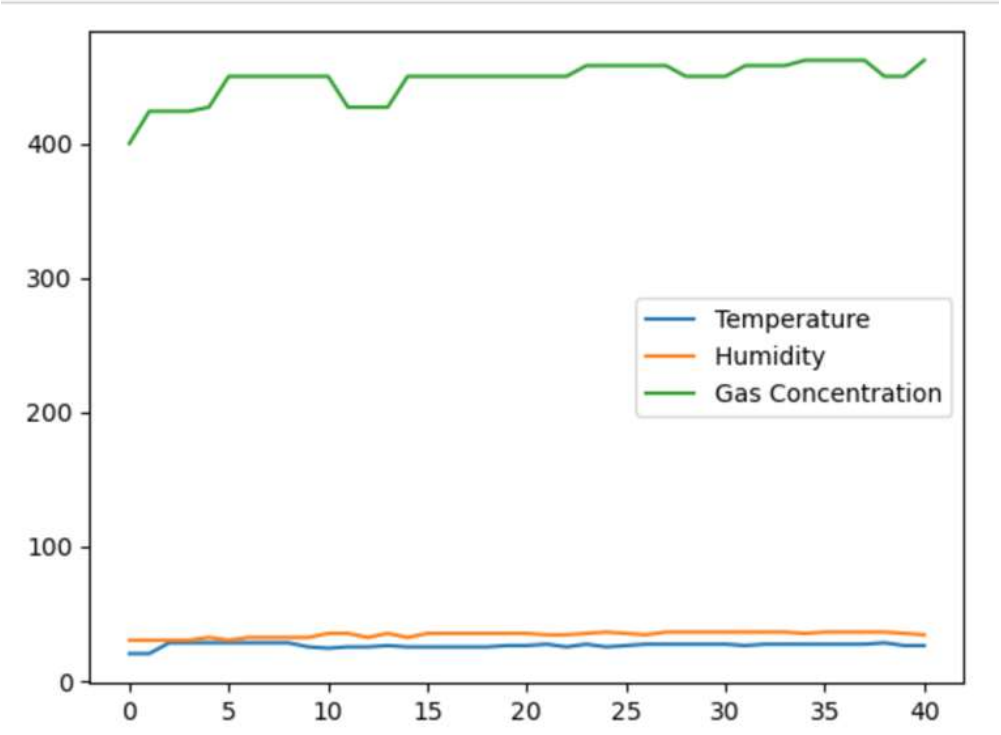

Fig. 10 Graphical Representation of data retrieved at Night.

By correlating the data calibrated at different timelines, we concluded that whenever the suns solar power is more, the temperature and gas concentration increases in the environment. That means, the increase in gas concentration is directly proportional to the temperature of the environment.

5 CONCLUSION

As we already know, increasing air pollution and fire-related fatalities are two serious problems that require quick attention. The model put out in this work attempts to address these issues by swiftly and effectively monitoring the environment. This will allow us to keep an eye on the environment, which is crucial right now, especially in locations like marketplaces, shopping malls, schools, colleges, train stations, and metro stations. By doing this, we are safeguarding lives in addition to preventing potential harm.

6 FUTURE WORK

Since technology is constantly developing, there is a lot of room for advancement. By providing our drone autonomy and the ability to study its environment on its own, we intend to make it "intelligent" and only alert us to potentially dangerous situations.
Other similar drones that support firefighting efforts over a greater affected region may accompany these autonomous UAVs.
Arduino can be used to facilitate communication between these drones, and sensor data is gathered from them using SD Card module.
This model will utilize neural networks that have been trained using environmental data. A swarm of drones would also be useful for future surveillance tasks.

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