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KITE SATELLITE

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***Abstract*— These days a lot of modern weather monitoring systems are available for weather monitoring. These systems are executed on a very grand scale for monitoring real-time weather for a full city or nation. Implementing such a system for a small area is not feasible since they are not designed for it and the overhead cost for maintaining such systems for a small area is very high. Our proposed system makes use of multiple sensors to measure the weather or environmental parameters with the help of a Box Kite at a certain height. The values read from the sensors are processed by the Arduino micro-controller and then it sends the parameters to the base station using IoT techniques. The readings uploaded on a web server and are also displayed onboard LCD for quick viewing. All these readings will provide the weather characteristics of a particular area and record the weather pattern.**

***Keywords*— Internet of Things (IoT), Can Sat, real-time weather monitoring system, Thing Speak, RF communication**.

I. INTRODUCTION

Present-day discoveries in technology mainly concentrate on controlling and monitoring of different devices wirelessly over the internet. Such that the internet acts as a means for communication between the devices. Most of this technology is focused on efficient monitoring and controlling. A function of an efficient environment monitoring system is to monitor and assess the weather conditions in case of passing the designated level of parameters (e.g., noise, air quality, and nuclear radiation) and for collecting data for analysis purposes. A smart system is a system that is equipped with sensor nodes, microcontrollers, and different software applications so that it can protect and monitor itself. We have proposed a system that consists of a Kite Satellite that will act as a weather monitoring system when uplifted using a Box Kite, providing us real-time data on a server. A Kite Satellite is a simulation of a true satellite, placed within a soft drink can that is then connected to a BoxKite. Our primary goal is to implement all the major systems found in a satellite, such as power, sensors, and a communication system, into this least volume. Then it is raised to an altitude of some meters using the Box Kite and its purpose to measure multiple parameters from the surroundings. This KiteSat will act as a local geostationary satellite and can collect data for environmental services and natural variation with the help of a Box Kite at a height of few meters. A Box Kite is a specific kite used for developing a relatively higher lift. Most of the altitude records for kite flying are held by box kites. One of the most important parts of this project is that it is based on IoT. Using Internet of Things, we can upload these weather parameters data to the server using internet connectivity over a Wi-Fi module through wireless communication. We have presented the construction of sustainable hardware and an effective ground station in this paper. An ideal KiteSat mostly has the following features; sensing, processing, and storing sensor data, and transmitting it to a ground station. The satellite is tracked using a ground Station on a Personal Computer to display the received information with the help of suitable graphics and tables.

II. PROPOSED ALGORITHM

The system proposed is an advanced solution for weather monitoring that uses IoT to make its real-time data easily accessible over a very wide range. The system deals with monitoring weather and climate changes like

1. Temperature, humidity by using the DHT11 sensor,
2. Air Quality by using MQ135sensor,
3. Pressure and Altitude using BMP280 sensor,
4. Light intensity using an LDR sensor,
5. Water Droplets using Rain sensor.

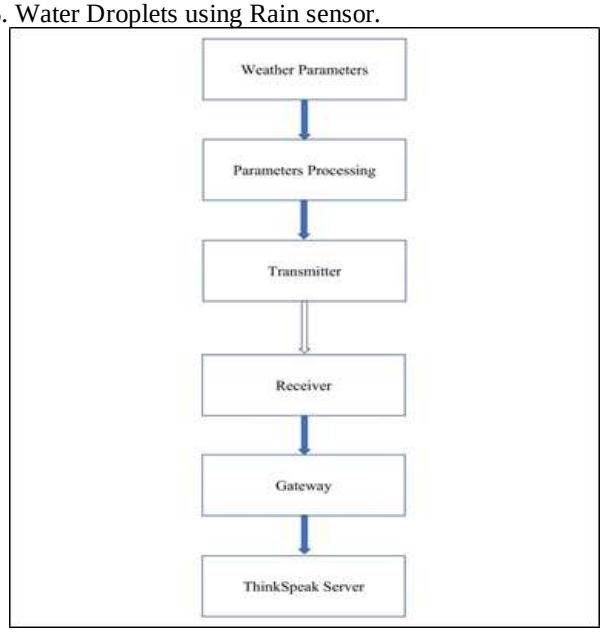

Fig. 1. Flowchart

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A. Flowchart Description –

1. The weather parameters like Temperature, Humidity, Light Intensity, Rainfall, Atmospheric Pressure, Air Quality & Altitude are detected via their respective sensors.
2. Parameter Processing involves collecting the detected parameters and converting them into values that can be used for further analysis.
3. Transmitter & Receiver are the 2 HC-12 trans-receiver modules that perform serial communication between them.
4. The Internet is used as a gateway to connect the ESP8266 module to the server.
5. The ThingSpeak server collects all the data and helps to display it graphically via MATLAB.

B. Feature and advantages of the proposed system –

1. Our proposed 'Smart weather monitoring system' unlike conventional weather monitoring instruments is extremely small and compact so that it can be uplifted anywhere, anytime.
2. It's light and portable; this advantage allows us to easily carry it to a remote location.
3. The sensors utilized in our product are less costly compared to people who are utilized within the prevailing
weather monitoring systems making our design more cost-effective.

4. These sensors send the data to a server (Thing Speak) and thus the sensor data is plotted as graphical statistics. the data uploaded to the server can easily be accessible from anywhere within the planet. the data gathered in these servers can be used for future references. Unlike the prevailing system where data possesses to be physically transferred.

III. EXPERIMENT AND RESULT

The project involved a hardware part with assembly and construction of a satellite with the shape and dimensions of a can (CanSat) which will be connected to a Box Kite. The software part involved programming of several components, an HC12 module for communication, the use of several sensors to measure data, and the employment of transceivers for the transmission and reception of data. Our objective was to make a Box Kite holding dimensions (75x25x25) such that it can uplift a can of a maximum of 300 grams. We fixed the Can by connecting its string to the kite's string which is connected at the cross-segment of dowels i.e., the center of mass of Box kite. Hence as the kite would fly, the can which is connected to it will be suspended in the air.
The Can was fitted with a PCB board having different sensors to collect varying parameters from the surrounding. We selected to install the PCB board within the Can and all the sensors on the exposed coating of the can to avoid any kind of interference and get accurate data. We elevated the kite on multiple altitudes to measure different parameters.

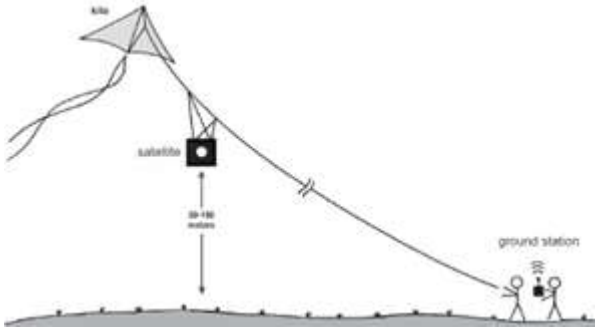

Fig. 2. Prototype

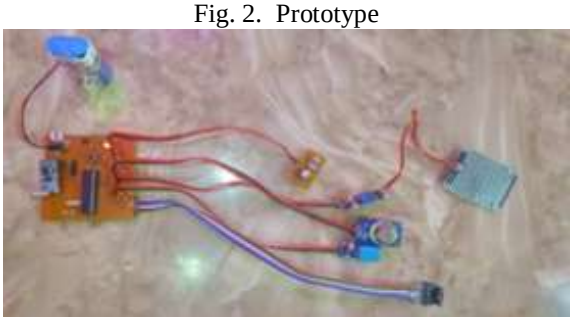
Fig. 3. Transmitter


Fig. 4. Receiver

A. DESIGNING OF BOX KITE

A Box Kite is a high-performance kite, noted for developing relatively high lift; it is a type within the family of cellular kites. The typical design has four parallel struts.

The box is made rigid with diagonal crossed struts. The horizontal cross-pieces are longer than the vertical ones, giving the kite a slightly 'squashed' appearance. This boosts performance, with just a small cost in stability.

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Fig. 5. Box Kite

B. Designing Of Can Satellite

Our Objective is to fit all the components of a transmitter into a can. For this, we are using a can with a minimum of 4cm as a radius and approx. 9 cm in height. We are going to fit the transmitter PCB vertically inside the can along with a 9V battery which will be adjacent to the PCB.

All the sensors will be taken out of the can through a grommet hole. These sensors will be attached to the outer surface of the can. So that we can get accurate and reliable readings. The whole weight of the can will be kept under 350grams.

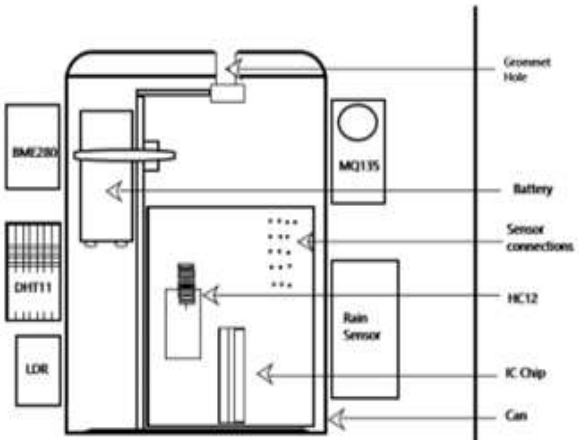

Fig. 6 . Can Satellite

C. Uml Diagram

The working of our system is shown by following UML activity Diagram.

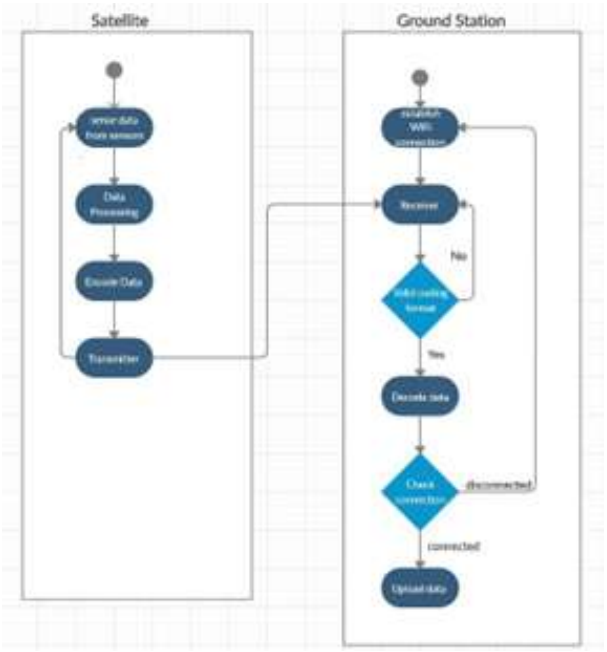

Fig. 7. UML Diagram

D. Result

All the modules were designed and every one the components were assembled. The testing of every module was administered successfully. Graphical charts were then plotted using the information which presented a pleasant analytical view of weather patterns according to the sensor readings. Thus, the testing phase was completed. This study was performed in a very controlled manner. The following table below shows the results obtained from the experiments. This connectivity will allow the user to observe the weather metrics like air quality and temperature humidity etc., over a centralized data analytics server.

Temperature

Humidity

LDR

Rain

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Air Quality

Atmospheric Pressure

Altitude

Fig. 8. Results

E. Accuracy

To check the accuracy of our prototype we took readings from our project on the 16th and 17th of April 2020 and compared it with actual data which was given by a reputed weather forecasting website on those days.

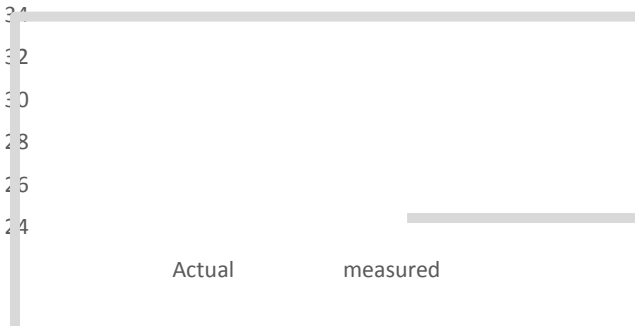

Fig. 9. Comparison graph

This plotted graph shows the similarities between the readings taken from our can satellite and from the official weather forecasting website. We can see that the actual values and our tested values are mostly alike. Hence this proves that our prototype is pretty accurate and reliable.

IV.CONCLUSION

Arduino microcontroller and ATMEGA microchips are cheap, widely available, globally approved, open-source computing platforms for controlling hardware. Many environmental monitoring sensors are easy to interface with Arduino boards.

The proposed system measures environmental parameters and stores data collected with the date and time stamps, for later retrieval. It introduces the use of IoT techniques for sending weather station data from one module to another to another. The modules that make up the Kite satellite and ground station have been well thought of, to make sure that the sensors used are giving the most accurate reading and are compatible with the microchip used.

The main intention of this proposed system is to develop local area weather and environmental parameters monitoring system using the Internet of Things. IoT is the modern trending area technology, used to access the information remotely. All the past developments have encouraged us to go forward and try to make our own Mini Satellite (Kite Satellite). What sets the project apart is that it uses a Box Kite as a medium to take the Mini Satellite in the air.

Kite Sat will provide an affordable way to acquire basic knowledge of space, environmental and electrical engineering and to experience engineering challenges in building a Near-Earth Object Surveillance Satellite.

This is a promising project, with an increase in its technical capability and an increase in resources this project can be used for security, weather monitoring forecasting, and much more. This local satellite with a high-definition camera and proper image processing can be used for security purposes. For example, it will be able to detect people violating a traffic rule like parking in a no-parking area or driving through a no-entry. This project can form as a base for networking of local area satellite. General Weather stations are fine for general info. To see localized weather data and forecasts, only a local or regional weather station fits the bill. A few of these satellites can be arranged to form a cluster to look over a local area. Data acquired from these satellites can be used to obtain quick and accurate weather forecasts for that local area and thus help local people to take necessary actions. Thus, a network of local area satellites can be developed, this network will help us monitor changes or drifts of toxic gases or similar parameters in a more dynamic way.

This data which is concentrated on a particular area will be much more reliable than the generalized data and will give more beneficial and accurate results after data analysis. For example, a proficient weather station can help us decide when can we avoid watering our plants and lawn. The use of daily reports of actual rainfall helps in predicting its future possibility and this helps to decide whether you can skip a day of irrigation.

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