Policing of the Environment by using an Integrated system

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ABSTRACT: -

Noticing the current state of the environment is one of the most difficult tasks in today's world since there is a heap of challenges that arise when the current state of the environment is measured. The system suggested in this study is an advanced approach for tracking atmospheric conditions in a specific location and making the data available to everyone, anywhere on the planet. The Internet of Things (IoT) is the technology underlying this, which is a cultured and efficient method for connecting things to the internet and linking the entire universe of things in a network. The data from the installed system may be accessed over the internet from any location on the planet. During specific weather hazards, checking and monitoring weather parameters through cables and analog instruments will be extremely difficult in the agricultural zone. However, we came up with the best system which could collect all relevant data on the weather through a wireless connection. Using the data from the system we can provide a valid recommendation for the place. This system monitors environmental factors like Temperature, Humidity, Atmospheric Pressure, Light Intensity, and Noise. Exercising multiple nature of data of a place and collective data in a region. The system uses data and recommends measures to be taken to keep the environment safe. The main objective is to make a small and easy-to-use mechanism to examine the weather conditions. The key idea is to have more devices developed over the area to address environmental data to the AWS IoT platform for computing and analysis... Based on this real-time data, new public facilities could be offered. This embedded system is integrated with sensors for close monitoring of the parameters in the Environment. In this system, there is the involvement of sensors like the DHT11 sensor, BMP180 sensor, LM393 Comparator, LDR Photo Resistor, ESP8266(ESP01 Serial Wi-Fi Module) and Arduino ATMEGA328P used to monitor the environmental conditions.

Keywords: - Environment, ESP8266 (ESP01 Serial Wi-Fi Module), LDR Photo Resistor, Temperature and Humidity sensor, Atmospheric pressure sensor, Noise sensor.

1. INTRODUCTION: -

The importance of weather monitoring in everyone's life cannot be overstated. The impact of the environment's state creates significant issues in a variety of industries, including agriculture, industry, construction, and a variety of others. People who need to travel from one location to another occasionally want weather information for their destination. They must take a sweater and necessary precautions if the weather at their destination is cold. The occurrence of major global warming is the primary cause of climate and temperature variations. The weather and temperature will readily change as a result of this. Climate change, according to the Intergovernmental Panel on Climate Change (IPCC), will have an impact on natural cycle changes produced by global warming, particularly in terms of temperatures, sea levels, precipitation, and extreme occurrences. Earth's temperature has risen by 0.08°C per decade since 1880, and the rate of warming over the past 40 years is more than twice that: 0.18° C per decade since 1981. Temperature rises, changes in weather patterns, changes in air humidity, and changes in air pressure are all possible consequences of rising temperature values. Climate change, which results in increased temperatures in an area, is another issue that can cause temperature variations. Existing technology is primarily focused on the control and monitoring of various operations. And this system also focuses on sound pollution by sensing noise value through a noise sensor. These are becoming more prevalent to meet human requirements. If the prescribed levels of parameters are exceeded, an effective environmental monitoring system is needed to monitor and assess the situation. Sensors are installed in various locations to collect data to forecast the behavior of a certain region of interest. The major goal of this work is to design and build an effective monitoring system in which the required parameters are monitored remotely over the internet, the data collected from the sensors is stored in the cloud, and the estimated trend is projected on a web browser. Every moment, the cloud values are updated. This study also intends to assist consumers who require weather information for a specific location or area in real-time and with pinpoint accuracy.

2. Literature Review: -

Human living styles will be changed as a result of weather disasters and uneven environmental changes. During particular hazardous circumstances and crucial situations, monitoring multiple weather parameters using wired system design and

analog devices in a farm zone is quite challenging. To solve the challenge of monitoring weather parameters with wired devices, wireless sensors network devices may take specific measures and issues for monitoring weather parameters, even in the worst-case scenario. In [1,] the author proposed a reliable and cost-effective automatic weather station. The author proposed a wireless sensor network-based automatic weather monitoring station. The author intends to create three generations of Automated Weather Stations (AWS) prototypes. The author of this study reviews the first-generation AWS prototype in order to improve the second generation based on the requirement and generation. In order to have an Automatic Weather Station, the author suggests improving non-functional requirements such as power consumption, data accuracy, availability, and data transfer. The non-functional requirement was eliminated by cost reduction in order to manufacture a reliable and economical Automatic Weather Station (AWS). As a result, developing countries like Uganda would be able to obtain the AWS in sufficient quantities under the proposed work. So that the weather forecasting might be improved. In [2,] the author describes an IoT-based weather monitoring system. The environmental parameter can be acquired using sensors in this study. The author scales several parameters such as humidity, temperature, pressure, rain value, and the LDR sensor using a separate sensor. The system also uses the temperature prototype to determine the dew point value. The temperature sensor can be used to determine the temperature of a certain region, room, or location. The light intensity can be employed as described by the author with the help of the LDR sensor. The author employed an additional functionality of weather monitoring in this as an SMS alert system depending on the value of sensing parameters such as temperature, humidity, pressure, light intensity, and rain value exceeding the value of the sensing parameters. The author depicts a low-cost live weather monitoring system utilising an OLED display in this work [3], in which the author demonstrates the numerous domains in which the Internet of Things has developed creative things in the system. A new innovative system was described by the author. Which assesses the current state of the weather. Weather monitoring is extremely beneficial to everyone, whether it is a farmer, an industry, a regular worker, or a student. As a result, the author decreased the difficulty level for farmers and business by designing a live weather monitoring system. The data is shown on an OLED screen and in the cloud by the system. The author's goal is to obtain real-time weather information on an OLED display. In [4], the author described a system that monitors and predicts weather conditions so that people may plan for their daily lives. This exercise proved to be beneficial in a variety of fields, including agriculture and industry. The author employs two steps of the weather management system to monitor and predict weather data. In this project, they combined data from sensors, bus mobility, and deep learning technology to create a real-time weather reporting system for stations and buses. Finally, the author shows how this system uses bus information management to present a real-time weather monitoring and prediction system. The author represents four fundamental elements. 1- Information management. 2- Bus stop that is interactive 3- Predictive machine learning model 4- A platform for weather data. Information is displayed using a dynamic chart in this case. The "Embedded weather station with Remote wireless control" is defined in this effort [10]. The author of this paper discusses the importance of a weather monitoring system. The author explains how the current weather monitoring system works. Before heading outside for any type of task, it is critical to be aware of the current weather conditions. This study explains the importance of weather monitoring in the field. The author describes a weather station with temperature, luminosity, pressure, and humidity sensors implanted with a microcontroller based on the board in this research study. The weather station is restricted by a mobile phone SMS service.

3. Development of Environment Policing System Using Multi Sensors

The goal of this study is to create an Environment Policing system that will continuously monitor live environmental parameters while watching the weather through LCD screen and Wi-Fi. To measure the parameters, the weather monitoring system employs a variety of sensors.

Table 1. Multiple modes in Environment Policing System

Mode 1	In this mode, DHT11 sensors i.e., Temperature and Humidity can be captured and displays on Lcd screen and through Wi-Fi
Mode 2	In this mode, BMP180 sensor i.e., Atmospheric Pressure can be captured and gives output
Mode 3	In this mode, Photoresistor LDR captures the Luminosity
Mode 4	In this mode, LM393 sound Sensor detects the noise value in the surroundings

Table 2. Sensors under various modes.

Sensor 1	Sensor 2	Sensor 3	Sensor 4
DHT11 (Temperature & Humidity) sensor	BMP180 (Pressure sensor)	LDR (Light Intensity Sensor)	LM393 (Sound Sensor)

This System describes how the sensors are connected to the Arduino UNO micro controller. Sensors were connected to the Arduino UNO in the block diagram. The system is set up in such a way that data is automatically received from sensors, displayed on a 16*2 LCD screen simultaneously with help of ESP8266 Wi-Fi module the data is uploaded when connected to Wi-Fi, and displayed on webpages. The proposed model uses four sensors to measure temperature, humidity, pressure, light intensity, and sound, as mentioned in table 1 with mode 1, mode 2, mode 3, and mode 4. Temperature and humidity (MODE-1), barometric pressure (MODE2), light intensity sensor (MODE-3), and sound sensor (MODE-4) are all represented in table 2. By combining table 1 and table 2, mode 1 is identified as Sensor 1, which has one DHT11sensor for detecting the environment's temperature and humidity. Sensor 2 features a BMP 180 sensor for sensing atmospheric pressure from the surroundings in mode 2. Mode 3 denotes sensor 3, which contains an LDR sensor for detecting light intensity, and Mode 4 denotes sensor 4, which contains an LM393 Comparator sensor for measuring the environment's noise value. With few sensors, the proposed system provides an effective environment policing system. It is dependable, as well as free and open to the public. Rain computation, wind speed, wind direction, PIR sensor, and other sensors can all be used to monitor the weather. However, in our proposed model, four sensors are used to test the system's functionality and reliability. The proposed model accurately evaluates the state of the environment.

4. The Suggested system's hardware is illustrated in this diagram.

The given Figure 1 shows a block diagram... Here every sensor is connected to the Arduino Uno using this block diagram. The ESP8266 module receives values from the Arduino Uno, while the LCD screen receives values from the I2C module. The Arduino Uno receives electricity via USB, which is connected to a computer.

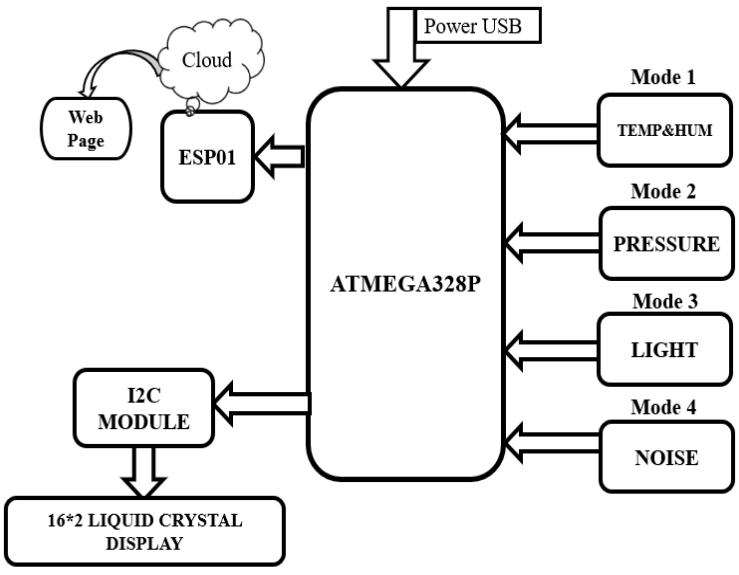

Fig 1.: Block diagram of Environment Policing system.

4.1 Data Collector, Gateways and Sensors.

4.1.1 Data collector: The Arduino ATMega328P acts as the model's Micro Controller in our proposed system. And its job is to collect data from sensors and send it to the LCD and the ESP01 module.

4.1.2 Gateways

4.1.2.1 I2C Module For 16*2 LCD: The I2C module acts as the gateway to display the data in the LCD screen coming from Arduino microcontroller.

4.1.2.2 ESP8266(ESP01): The module ESP01 acts as a gateway to give the data to the cloud from Microcontroller and the data is uploaded to the webpage through cloud.

4.1.3 Sensors

Mode 1 Sensor (Temp & Hum): The DHT11 sensor allows us to monitor our system's temperature and humidity. This sensor uses a current of 2.5 mA and runs at 5V. The sensor can detect temperatures ranging from 0 to 50 degrees. The relative humidity ranges from 20% to 90% With a + 1 degree accuracy and a +-1 percent accuracy. It runs on 3 to 5 volts and has a 3-to-5-volt input/output.

- During conversion, it uses a maximum current of 2.5 mA.
- It has a humidity range of 20 to 90 percent and a 5 percent accuracy.
- It is only suitable for temperatures of 0-50 degrees Celsius.
- It consists of four pins separated by 0.1 mm.

Mode 2 Sensor (Atmospheric Pressure): The BMP 180 is a digital barometric pressure sensor that measures ambient pressure. It is a follow-up to BMP085 which has numerous improvements.

- It has a very low power usage of only 3 micro amperes.
- It runs on a dc voltage of 3 to 5 volts.
- The pressure detection rate of the BMP 180 is 3001100 Hpa (9000500m above sea level) and the operating temperature range is 40 to +85 degrees Celsius.

Mode 3 Sensor (Light Sensor): The Photoresistor sensor is another name for this sensor. An inbuilt LDR (Light Dependent Resistor) helps in the detection of light in this sensor. The light-dependent resistance is controlled by the principle of "photoconductivity" (LDR). The resistance of the LDR changes as the intensity of light falls on it. As the light intensity on the LDR surface increases, the LDR resistance decreases and the conductivity of the element increases. As the intensity of light on the LDR surface decreases, the LDR resistance increases and the conductivity of the element decreases.

Mode 4 Sensor (Sound Sensor): The sound sensor receives the sound waves and displays the sound vibration image. It has a sound-sensitive capacitively electret microphone built-in. The electrical mini microphone vibrates in response to the sound wave, causing a change in capacitance and a micro voltage. The micro voltage is then passed to the module's LM393 comparator, where it is compared to the threshold specified by the blue potentiometer. When the sound intensity in the environment does not exceed the threshold, Otherwise, the OUT-interface outputs low-level signals.

- Adjustable sensitivity (the blue potentiometer in the illustration can be used).
- Voltage range: 3.3V to 5V.
- Mounting Hole, Frequency Range 50Hz ~ 20KHz.
- PCB Dimensions: 3.2cm x 1.7cm

5. Circuit diagram

Policing of the environment using the circuit diagram of an integrated system is shown below. The diagrams show how the sensor will be connected and how it will be done.

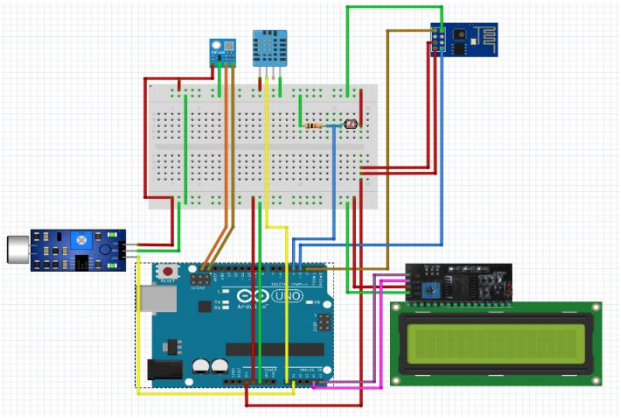

Fig 2: Circuit diagram of the environmental police system

The Dht11 sensor, BMP 180 sensor, LDR sensor, and Noise Sensors are all linked to the Arduino Uno pins, and the hardware is powered by a USB wire. The data from the sensors is sent to the ESP01 Wi-Fi module and shown on the LCD screen. The prototype model can be seen in the above image. All connections must be made in the same way in order to obtain an adequate result.

6. The flowchart of the proposed model

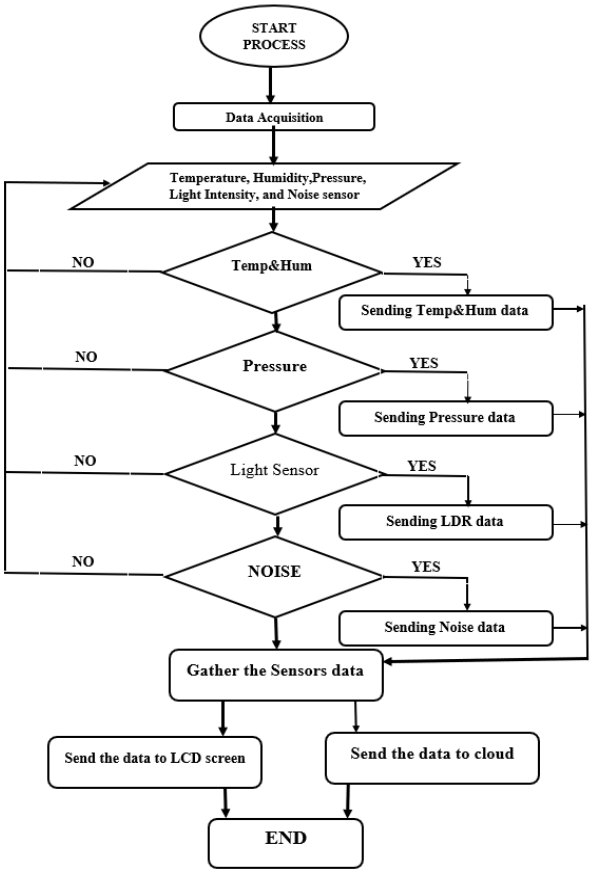

Fig.3. Flow chart of the projected model

The flowchart explains how our suggested system operates. This proposed system is being created as an environmental policing mechanism for our immediate area. This system uses only four sensors and uses the Wife module to display the results on an LCD screen as well as on a webpage.

7. ThingSpeak

ThingSpeak is an IoT platform that allows you to collect and store sensor data in the cloud while also developing IoT applications. The ThingSpeak IoT platform offers programs that allow you to study and display data in MATLAB before taking action on it. Sensor data from Arduino, Raspberry Pi, Beagle Bone Black, and other hardware platforms can be communicated to ThingSpeak. ThingSpeak is a data analysis tool that is mostly used for Internet of Things (IoT) devices. Users can create whatever form of project they want to modify data from IoT devices. ThingSpeak offers a number of useful features, including real-time data handling, static and dynamic data processing, MATLAB visualizations, and, finally, applications and plugins. ThingSpeak's Communicating the ThingSpeak channel is its most important feature. Users can transmit and receive data from the saved location. Each channel can have up to 8 fields of various data types, three location fields, and one channel field for the status value. After you've created your own channel in the tool, you can send data into it, let ThingSpeak assess and analyse it, and then examine the results in a way that suits you.

8. Implemented Hardware

After you've made all of the connections as indicated in fig.2, you're ready to move on to the next step. A USB cable is used to supply power to the Arduino uno. That is, it is connected to our computer. Two code modules have been written. The first is to use Arduino code to link to various sensors. And the second module is to display the result on LCD screen. After that, you'll need to connect to the hardware. Then, after that, upload the code that we've written. However, it is necessary to test the code before uploading it. So, open Arduino IDE, write code there, click verify, wait for approximately 1-2 minutes for verification to complete, then choose an option to upload the code, and it compiles and uploads successfully.

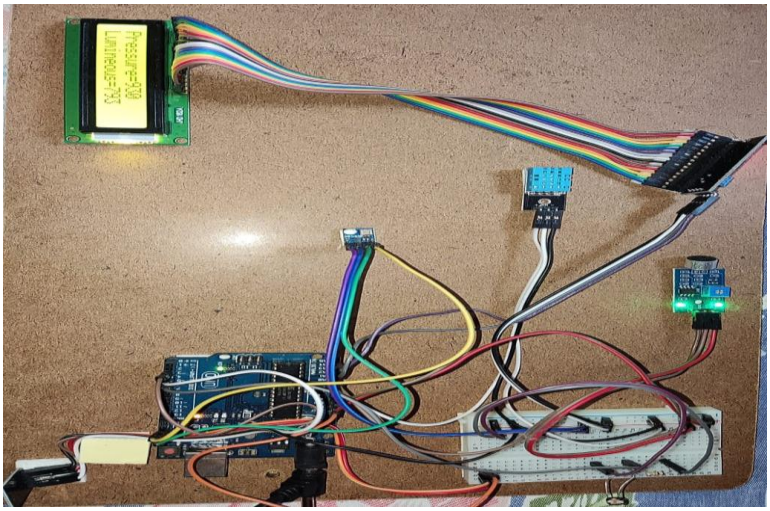

Fig 4. Implemented Hardware Picture

8.Experimental Results and Analysis

In this set of results, we have shown the results on hardware and Simultaneously on ThingSpeak website. The goal of this system's "Policing of Environment Using an Integrated Circuit" is to design a system that keeps track of weather conditions while also measuring environmental variables via the internet of things. It measures the temperature, Humidity, Pressure, Light intensity, and Sound value of present area so that we can aware of that specific area weather conditions.

Table 1: Measures taken on 20th March 2022, Sunday

Date	Policing Of Environment				
Mar 20th (2022) Sunday	Temperature Values (Celsius)	Humidity (RH)	Pressure (hPa)	Light Intensity (Lux)	Sound Value (db)
10:02 PM	31.2	72	790	782	15
10:12 PM	32.1	87	800	779	21

Table 2: Measures taken on 21st March 2022, Monday

Date	Policing Of Environment				
Mar 21st (2022) Monday	Temperature Values (Celsius)	Humidity (RH)	Pressure (hPa)	Light Intensity (Lux)	Sound Value (db)
09:51 AM	30.6	68	840	771	26
09:57 AM	30.9	68	840	779	19

Table 3: Measures taken on 16th April 2022, Saturday

Date	Policing Of Environment				
Apr 16th (2022) Saturday	Temperature Values (Celsius)	Humidity (RH)	Pressure (hPa)	Light Intensity (Lux)	Sound Value (db)
11:43 PM	32.7	71	920	788	28
11:57 PM	33.3	69	930	785	71

Table 4: Measures taken on 25th April 2022, Monday

Date	Policing Of Environment				
Apr 25th (2022) Monday	Temperature Values (Celsius)	Humidity (RH)	Pressure (hPa)	Light Intensity (Lux)	Sound Value (db)
11:37 AM	32.7	63	860	791	22
11:38 AM	32.8	63	790	792	23

Results on ThingSpeak

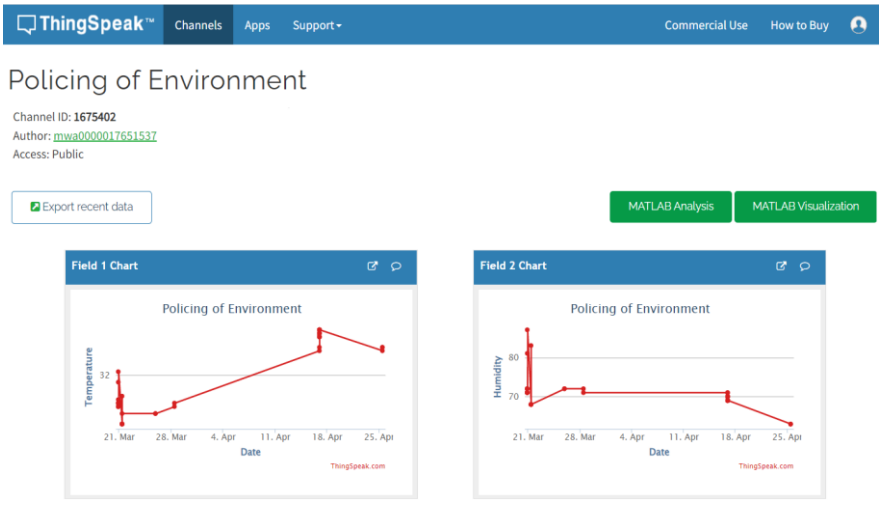

Fig 5: Measures of Temperature and Humidity

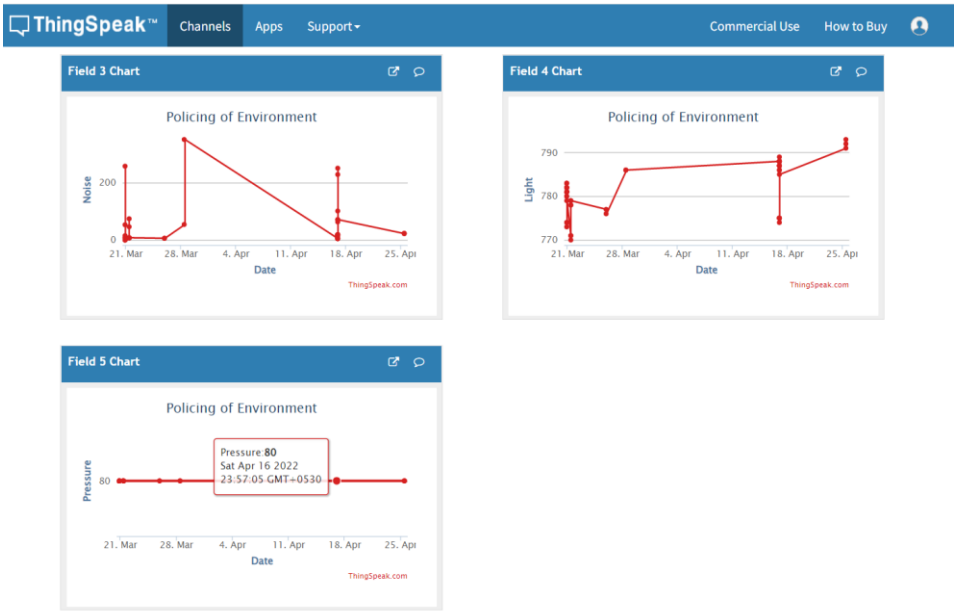

Fig 6: Measures of Pressure, Light, and Noise

Figures 5 and 6 display the results of humidity, temperature, pressure, light intensity, and noise in a graphical style that allows the user to easily understand the environmental conditions in the area. The results for specific intervals are displayed in the graph.

9. Advantages of Proposed system

1. When compared to normal weather monitoring systems, the Smart Weather Monitoring System is quite small and simple to install.

2. Smart Weather Monitoring Systems have Low Power Requirements.

3. The Policing of Environment by using an integrated System uses far less expensive sensors, making this project very cost effective.

4. Sensor data can also be sent to a web page that can be accessed from anywhere in the world.

5. Because there are fewer parts, the proposed System has a low maintenance cost.

6. The data collected and analysed by the System's sensors accurately predicts the weather's outcome.

7. Because of their high speed, these sensors can also detect any sudden changes in the forecast.

8. In the case of a smart weather monitoring system, a prior warning of weather conditions is also possible.

10. Future scope

More sensors can be added to monitor various environmental parameters such as soil PH, CO2, and oxygen, while present sensors can be replaced if a larger range of readings is desired. Additionally, other monitoring equipment, such as a Wi-Fi camera, can be integrated to track the Environment. Also, the data can be continuously uploaded to the web server. This project can be expanded to include web interfaces and mobile applications.

11. Conclusion

Our suggested system consists of devices that monitor environmental parameters at a low cost. The suggested solution uses a client-side architecture. Using many sensors, the proposed method observed diverse environmental data. The designed system uses fewer sensors than the existing model. Our proposed model's key goal is to make the system cost-

effective and cheap. So that anyone can utilize it without limitation. In our suggested system, we collect data from many sensors and deliver it all to a webpage using the HTTP request protocol on the webserver. With real data, the proposed model's accuracy is nearly perfect. The results of the experiments using ThingSpeak MATLAB show that weather data analysis is easier and clearer. Using IoT sensors and data analysis tools like ThingSpeak, we can easily handle and analyse streaming data. When compared to existing systems, this project's performance for weather analysis is faster, more efficient, and more effective. We can gather, track, and analyse any sort of streaming data in this way for improved performance, speed, and efficiency.

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