Air Pollution Monitoring System using Node Mcu and Air Quality Sensors

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Abstract: In today's world, due to the fast growth in number of motor vehicles and industrial evolution, the environment around us is more polluted. The pollution majorly affects the quality of air and causes the major health issues to living beings. The major reason for atmosphere contamination is due to releasing of harmful gases like carbon di-oxide, carbon monoxide etc. from factories, vehicles and from combustion of fossil fuels. It is necessary to monitor the percentage of pollutant present in the air which will leads to environmental issues. To overcome this, we have designed a tool using IoT technology. The air pollution monitoring tool includes Microcontroller and Sensors that provides the provision to monitor the quality of air by detecting the harmful gases present in the atmosphere. The pollution level can be monitored remotely using PC or smart phones. The data is store in cloud and can be accessed remotely.

Index Terms: Internet of Things, Microcontroller, Sensors, Air Quality, Monitor.

I. INTRODUCTION

Air pollution occurs when the toxic or harmful substances including gases, dust particles and biological molecules are introduced into Earth's atmosphere. It is caused by the rapid increasing and development in industrial evolution and transportation, air contamination has recently become serious problem for developing countries. It is one of the major issues in the atmosphere. Air contamination should be controlled in order to overcome life threatening diseases like cancer, respiratory diseases and much more which are faced by the human beings.

Air pollution Monitoring System is designed using Node MCU and air quality sensors. The automation is done using these hardware components, which enables wireless communication and can control the behavior of sensors. Node Microcontroller Unit is responsible for controlling sensors such as Temperature and Humidity sensor, Air quality Sensors and Gas Sensors. Node MCU sends signals to each sensors to perform specific action or retrieve data from a specific sensor. The data sent from the microcontroller is sent to the ThingSpeak cloud.

Wireless communication between each device had been a difficult task which was achieved using ESP8266. ESP8266 assisted in wireless communication between microcontroller and cloud. The integration of cloud networking and storing the data in the cloud is more efficient and safer. In this system, real-time monitoring is done with the help of Thing Speak, which can monitor the parameters like Temperature, Humidity, Resistance, Air Quality of LPG, PPM of Air Quality and LPG, Alcohol of the remote location. The system is able to represent the data in a presentable format. A secure communication is required between IoT devices is provided by thing speak cloud and According to climatic conditions air quality readings are varied based on which location the system is being situated, we can view the data on cloud and the same information is integrated on mobile app so that the variations in the readings can be viewed remotely.

II. LITERATURE SURVEY

In traditional approach, readings of air pollution are checked using different digital air quality detector and moisture meters which has to be taken to different location every time to check the values, it is of time consuming and risk of travelling from one location to another is high. Collection of data has to be done manually. At times the appliances are kept on unknowingly which directly affects the energy consumption, Storage of data are not safe in existing system and data cannot be fetched on time when ever required.

There are different air quality identifiable meters available in retail shops such as Am probe meter and Liquid petroleum gas leakage sensor alarm etc. also we have Bluetooth oriented transmitting devices which has a very limited user to find the contamination level in atmosphere. [1] Monitors the pollution level in terms of parts per million and also adapted general packet radio service using Arduino Uno board. And Low power wide area technology is implemented to find out to machine to machine communications and air quality index is computed by using the concentration of gases. [2]. To monitor the air pollution buzzer is implemented, buzzer intimates when air impurity goes beyond the certain level and it will be displayed on liquid crystal display. [3] The REST protocol is adapted to find out air conditioning control as well as AC split device through the network using Wi-Fi connection, Infra-red LED to transmit Infrared commands. [4] Author discussed and represented A novel IoT access architecture for vehicle monitoring system [7].

III. PROPOSED SYSTEM

In this project we are monitoring the quality of air based on the amount of polluted air in our atmosphere by using air quality sensors.

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The temperature and humidity sensors will monitor temperature as well as humidity based on climatic conditions. Whenever the pollution rate extends beyond the moderate level the sensors will record the values will record the values and update in cloud database. This project is mainly designed and developed with concerned of untidy places where all the waste substances are dumped at a place so that when all the waste substances are decayed and many air polluting gases like carbon monoxide, carbon dioxide, are released to atmosphere due to which air is polluted. Integrating a wired network or devices in an existing infrastructure may be difficult and will increase cost. This system can be integrated with ease and installation cost will be reduced.

The parameters that are observed by sensors in this framework are: Carbon di-oxide (CO_2), Smoke, LPG, Temp & humidity, Sulphur di-oxide (SO_2), Nitrogen di-oxide (NO_2), Alcohol (C2H5OH).

IV. PROPOSED MODEL

Air Pollution Monitoring System is integrated with Node MCU, Air Quality Sensors and Gas Sensors. Node Microcontroller Unit is a main unit and It has ESP8266 inbuilt Wi-Fi module with a minimum of 512kb Flash memory. The Sensors like Air quality Sensor, Gas Sensors, Temperature and Humidity Sensors and Batteries are linked to the Node MCU so that required output is achieved when the system is subjected to surrounding atmosphere. MQ135 sensor used in our project which detects major gases in our surroundings and the delicate material used is SnO2 also the conductivity of this material is low in clear atmosphere. If the polluting gases are high then this sensor will detects those gases also. MQ3 is the Alcohol gas sensor as ethanol gas detecting component. It does not require any segments to plug in voltage common collector and ground pins. It also detects minute components of Benzene. DHT11 detects Temperature and Humidity in our atmosphere and it has excellent quality, fast response and it has high performance. It also gives the accurate readings when it is subjected to surroundings. The integration of this sensor is quick and easy due to the pins established in this device. Bread board is used to connect all the equipment's, it is more likely called as circuit board the digital pins are directly joined based on the circuit diagram so that required output is achieved. Li- ion battery can be recharged when it is connected to charging circuit. These batteries have a high energy intensity. Once the battery is completely charged it can be used for longer time duration. Relay Module is used to connect different sensors like MQ3, DHT11 and MQ135. The microcontroller contains only one analog pin whereas all the other sensors uses analog pins so that the relay switches are being established for interconnection of sensors to the Node MCU board. It has a definitive interface that can be controlled directly by microcontroller. Mobile phone -Android enabled is used in our project to install the application which monitors the air quality readings as well as presence of temp and moisture level of air, it is connected to cloud database so that variations in the graph can be viewed based on pollution levels. Resistors, Capacitors and Wires are used in our device to get resistance values, capacitors are used in circuit to store

charge. Wires are used to interconnect controllers as well as sensors to find out the expected results.
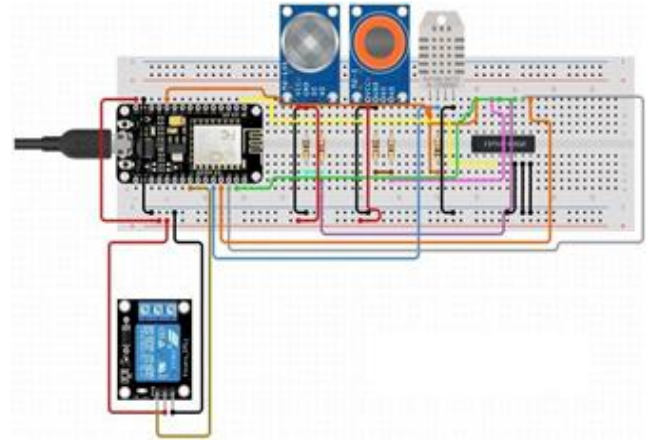

Figure 1: Circuit Diagram

Block diagram of Circuit contains the following components used in Air Pollution Monitoring System.

1. ELECTRICAL COMPONENTS

1. Node Microcontroller Unit
2. Air quality Sensor
3. Gas Sensor
4. Temperature and Humidity Sensor
5. Bread board
6. Li-ion Batteries
7. Relay Module
8. Smart Phone (Android Enabled)
9. Resistors, Capacitors and Wires

V. IMPLEMENTATION

ARDUINO IDE

Arduino IDE is an open-source programming which makes it simple to compose code utilizing Embedded C and transfer into a few sheets. As it is an open source programming a few libraries can be incorporated to work and test code and the working of the board. It can keep running on a few working framework stages, for example, Windows, Mac OS X and Linux. This condition is manufactured utilizing Java. Arduino IDE can be utilized to transfer code to Node MCU and a few different sheets. In Arduino IDE, sketch implies code precedents or code pieces. It gives a few representations identified with numerous sensors. These portrayals help in testing a gadget and comprehend the working with associations. It is one of the simple to utilize IDEs for working with Arduino gadgets. Serial monitor displays the recorded readings on the Arduino IDE screen. Readings of different parameters like resistance, raw value of air quality and LPG are viewed.
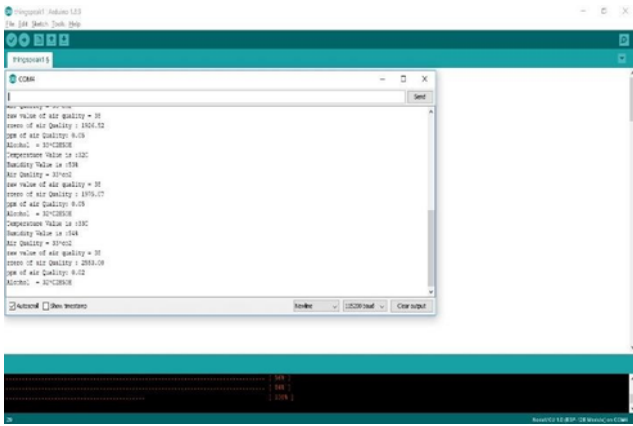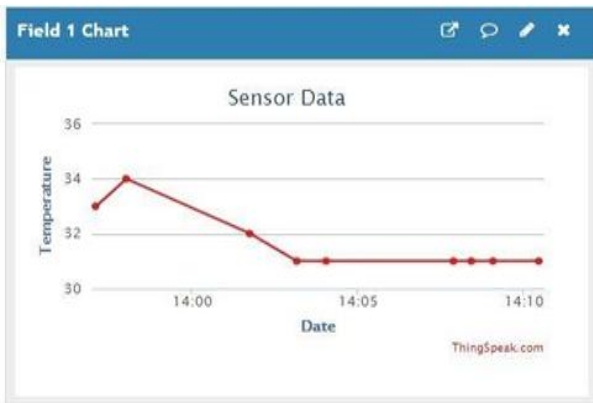
Figure 2: Arduino IDE Terminal THINGSPEAK CLOUD

Figure 3: Temperature Variation on ThingSpeak

ThingSpeak is an open-source IoT application and Application Program Interface is provided to store and retrieve information over the cloud. ThingSpeak provides different API keys for different channels created so that the information exchanged through internet is safe and secure. The data can be extracted whenever required based on the user requirements. With the help of visual data provided by the cloud it is very easy to find out the variations in the readings depending upon the ambient gases present in the surrounding regions.
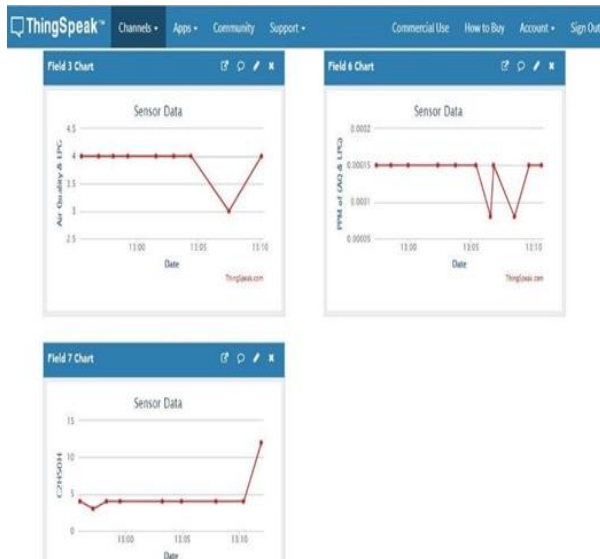

Figure 4: Graphical Representation of Sensor Readings

on ThingSpeak

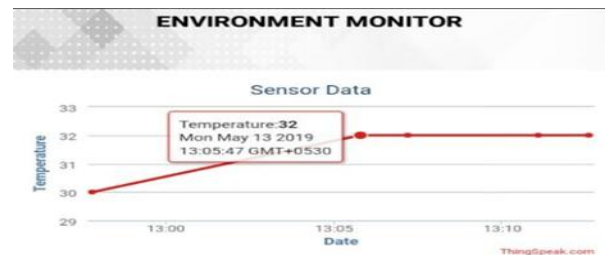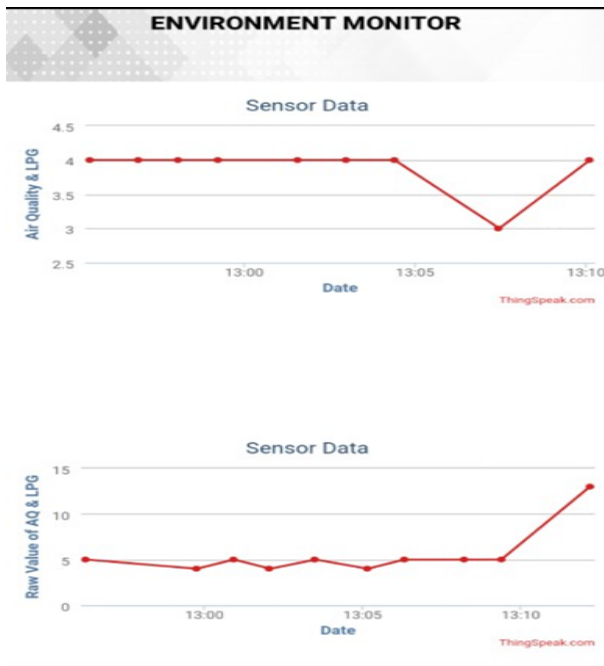**Figure 5: Sensor data of Resistance Zero, AQ and LPG**
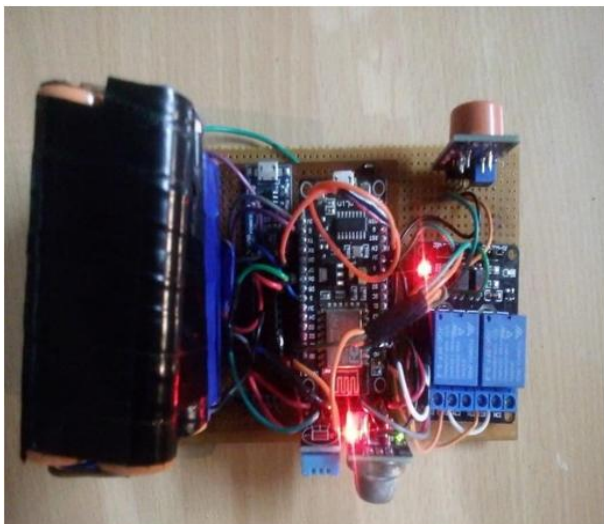

Figure 6: Temperature Readings on Mobile App

Figure 7: Sensor Data of C2H5OH on Mobile App

Figure 8: Raw value of Air Quality and LPG

Figure 9: Device Setup of Proposed System

VI. CONCLUSION

The System is integrated with other modern tools such as Air Quality Sensors, Gas Sensors, Node microcontroller unit Boards for making the process of automation more interactive. By placing our equipment in different locations we can collect the readings of different gases present in the air and updated on cloud. This tool displays the details of polluted air in the developed mobile app and the same information is updated to the cloud. The data stored in the cloud can be further analyzed to know the air quality according to the recorded region. This helps in knowing the major cause and pollutants contributing to the polluted air and suitable precautionary measures can be taken to overcome and minimize the air pollution.

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