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IoT Based Air QualityMonitoring System

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***Abstract*: The level of pollution has increased with times by lot of factors like the increased vehicle use, industrialization and urbanization which results in harmful effects on human wellbeing by directly affecting health of population exposed to it. In order to monitor this an IoT Based Air Pollution Monitoring System is developed in which the air quality will be monitored over a web server using internet and will trigger alert message when the air quality goes down beyond a certain level. It will show the air quality in PPM on the LCD and as well as on webpage. In this IoT project, the air pollution will be monitored from anywhere using your computer or mobile. This system will be developed by using gas sensor, temperature and humidity sensor, sound sensor, Arduino, GSM and a Wi-Fi module. This system can be physically placed in various cities to monitoring air quality. The sensors gather data from surroundings and forward the data to the Arduino. The Arduino transmits the data to the cloud through the Wi-Fi module. The proposed system predicts quality of air using different sensors and stored data in database and cloud so any one can retrieve data from anywhere anytime.**

***Keywords*:** Arduino, IoT, GSM, sound sensor, Alcohol Sensor, Wi-Fi module etc.

1.INTRODUCTION

The Air Excellence Guide (AEG) may be a common indicator of air quality. The Air Quality Indicator (AQI) is calculated and supported on air pollutants like CO and NO2 compounds that consume opposing possessions happening the atmosphere and human health. The Air Quality Indicator may be a range that represents the very finest meditation of a specific air unused matter at a particular time. I propose an air quality as well as air pollution monitoring system that allows us to monitor and check live air quality as well as air pollution in an area through Internet of Things (IOT). It uses air sensors (Gas Sensor MQ135) to sense presence of harmful gases/compounds in the air and constantly transmit this data. In addition, system keeps measuring air level and reports it. The sensors interact with Arduino Uno (Microcontroller) which processes this data and transmits it over the application. This allows authorities to monitor air pollution in different areas and act against it [1].

In addition, authorities can keep a watch on the air pollution near schools, and hospitals areas. Normally, little concentrations area unit measured exploitation ppb (parts per billion), that represents units of mass of a material per one billion units of total mass. Parts per million (PPM) may be similar and unremarkable used unit to measure concentrations of pollutants. It determines the requirements of a new system and analyze on product and resource requirement, which is required for the successful system. The product requirement contains input and output requirements it gives the wants in term of input to produce the required productivity. The resource requirements define in brief about the hardware that are needed to achieve the required functionality. In this project I am going to make an IoT based Air Pollution Detection Monitoring System in which I monitor the Air Quality over a web server using ESP8266 Wi-Fi device and a trigger alarm when the air quality goes down a certain level means when there is amount of harmful gases is present in the air like CO2. It shows the air quality in PPM

(Parts Per Million) on LCD and webpage so that I monitor it very easily

2. LITARATURE SURVEY

IoT based Air Pollution Monitoring System screens the Air Quality over a web server using web and will trigger an alert when the air quality goes down past a particular measurement, suggests when there are total of dangerous gases present recognizable all around like CO2, smoke, alcohol, benzene, NH3, NOx and LPG. The system will show the air quality in PPM on the LCD and similarly as on site page with the objective that it might be checked in all respects successfully. Temperature and Humidity is perceived and saw in the system. [3] The authors Ray and ParthaPratim proposed a technique which can measure 2.5µm particulate matter in a smarter way. Internet of Things (IoT) based cloud services has been incorporated to analyze the measured data in cloud servers. An optical

sensor is coordinated with the framework which empowers the client to imagine the thickness dimension of particulate issues progressively. Sequential yield enables the client to screen the procedure of catch the information, arrange availability and information transmission towards the cloud.[4] A surrounding of a constant real time air quality monitoring system is presented by Kadri Abdullah. The system comprises of a few dispersed monitoring stations that discuss remotely with a backend server utilizing machine-to-machine correspondence. Each station is equipped with humidity and temperature sensor just as information logging and remote correspondence capacities. The backend server gathers continuous information from the system and changes over it into data conveyed to clients through online interfaces and portable devices.[5]

The authors Khodve, Shilpa R. and A. N. Kulkarni has given an insight of a system which will have ARM7 LPC2138 which is the heart of the system. Sensors like gas sensors, temperature, humidity etc. are interfaced with the microcontroller for the air pollution monitoring system. The obtained values are given to smart phone using Bluetooth.[6]

The portable framework for air quality also, contamination estimation appropriate for the urban condition has been explained in a paper by Tudose. Continuous assembled information can be openly gotten to by general society through an internet web interface. Applicants can select and see diverse gases and fixations covered on a guide of the place.[7]

3. PROPOSED METHOD

The main aim behind this idea is to monitor temperature, humidity, sound and gases in air over a web server using internet and to trigger alert message when the air quality goes down a certain level. The level of pollution has increased with times by lot of factors like the increased vehicle use, industrialization and urbanization which results in harmful effects on human wellbeing by directly affecting health of population exposed to it. In order to monitor this an IOT Based Air Pollution Monitoring System is developed in which the air quality will be monitored over a web server using internet and will trigger alert message when the air quality goes down beyond a certain level. It will show the air quality in PPM on the LCD and as well as on webpage. In this IOT project, the air pollution will be monitored from anywhere using your computer or mobile.

This system will be developed by using gas sensor, temperature and humidity sensor, sound sensor, Arduino, GSM and a Wi-Fi module. This system can be physically placed in various cities to monitoring air quality. The sensors gather data from surroundings and forward the data to the Arduino. The Arduino transmits the data to the cloud through the Wi-Fi module. The proposed system predicts quality of air using different sensors and stored data in database and cloud so any one can retrieve data from anywhere anytime.

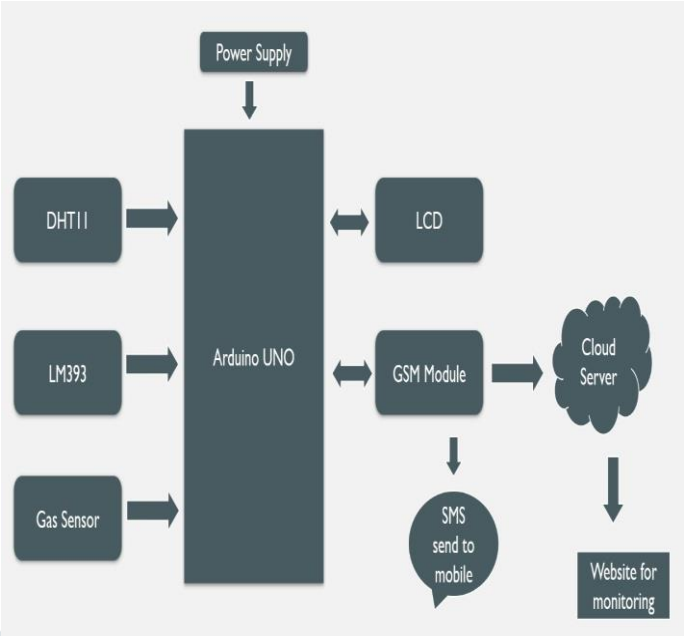

Fig 1: Block diagram IoT Based Air Quality Monitoring System

A.HARDWARE DESCRIPTION

Arduino Uno

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter. "Uno" means "One" in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions, see the index of Arduino boards.

The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (nonUSB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the GND and Vin pin headers of the POWER connector. The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5Vpin may supply less than five volts and the board may be unstable.

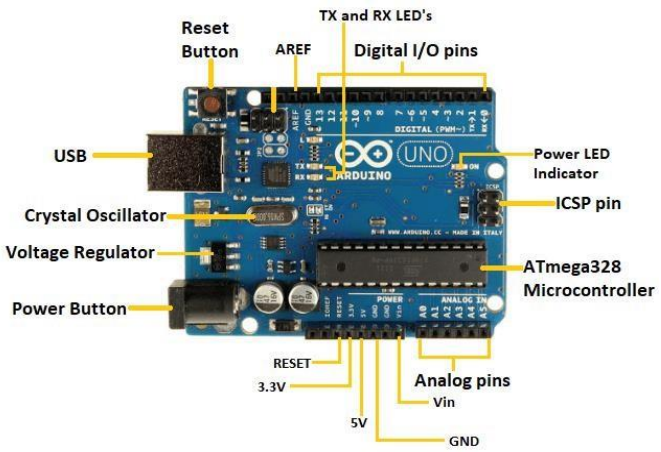

Fig. 2: Arduino Uno

Temperature and Humidity Sensor

An Temperature and humidity sensor is basically an electronic device which is used to detect the temperature and humidity level present in air. It senses, measures and reports the relative humidity in the air. It therefore measures both moisture and air temperature. It use capacitive measurement, which relies on electrical capacitance. Electrical capacity is the ability of two nearby electrical conductors to create an electrical field between them. The sensor is composed of two metal plates and contains a nonconductive polymer film between them. This film collects moisture from the air, which causes the voltage between the two plates to change. These voltage changes are converted into digital readings showing the level of moisture in the air.

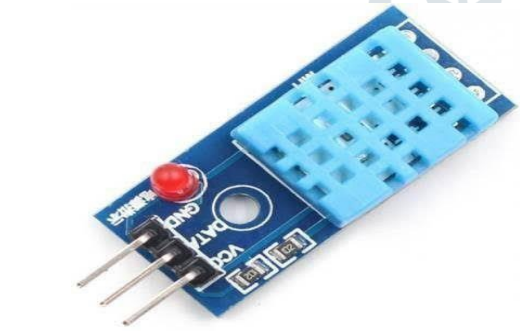

Fig.3: Temperature and Humidity Sensor

Sound Sensor

The sound sensor is one type of module used to notice the sound. Generally, this module is used to detect the intensity of sound. The applications of this module mainly include switch, security, as well as monitoring. The accuracy of this sensor can be changed for the ease of usage.

This sensor employs a microphone to provide input to buffer, peak detector and an amplifier. This sensor notices a sound, & processes an o/p voltage signal to a microcontroller. After that, it executes required processing.This sensor is capable to determine noise levels within DB's or decibels at 3 kHz 6 kHz frequencies approximately wherever the human ear is sensitive. In smartphones, there is an android application namely decibel meter used to measure the sound level.

Fig.4: Sound Sensor

Gas Sensor

Gas sensors main aim is to sense hazardous gases that evolve its surroundings.Gas sensor detects the concentrations of combustible gas in the air and outputs its reading as an analog voltage. The sensor can measure concentrations of flammable gas of 300 to 10,000 ppm. The sensor can operate at temperatures from -20 to 50°C and consumes less than 150 mA at 5 V. High sensitivity to LPG, Propane and Hydrogen. Gas Sensor (MQ9) module is useful for gas leakage detection (in home and industry). It is suitable for detecting LPG, CO, and CH4. Due to its high sensitivity and fast response time, measurements can be taken as soon as possible. The sensitivity of the sensor can be adjusted by using the potentiometer.

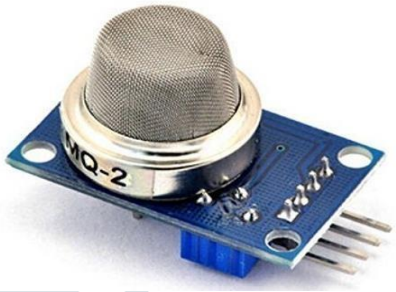

Fig.5: Gas Sensor

LCD MODULE

It includes alphabets and numerics which is used to display atmost 32 characters. An LCD is an electronic display module that uses liquid crystal to produce a visible image. The 16×2 LCD display is a very basic module commonly used in DIYs and circuits. The 16×2 translates 0 a display 16 characters per line in 2 such lines.

An LCD (Liquid Crystal Display) screen is an electronic display module and has a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. The 16 x 2 intelligent alphanumeric dot matrix display is capable of displaying 224 different characters and symbols. This LCD has two registers, namely, Command and Data.

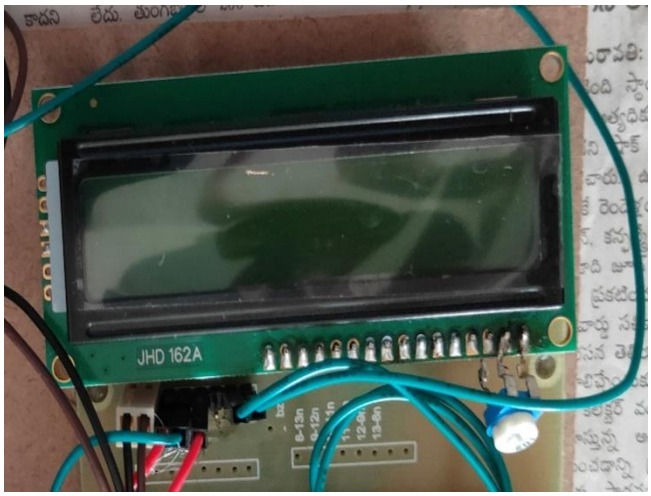

Fig.6: LCD Display

Wi-Fi Module

An ESP8266 Wi-Fi module is a SOC microchip mainly used for the development of end-point IoT (Internet of things) applications. It is referred to as a standalone wireless transceiver, available at a very low price. It is used to enable the internet connection to various applications of embedded systems. Especially systems designed the ESP8266 Wi-Fi module to support both the TCP/IP capability and the microcontroller access to any Wi-Fi network. It provides the solutions to meet the requirements of industries of IoT such as cost, power, performance, and design. It can work as either a slave or a standalone application. If the ESP8266 Wi-Fi runs as a slave to a microcontroller host, then it can be used as a Wi-Fi adaptor to any type of microcontroller using UART or SPI. If the module is used as a standalone application, then it provides the functions of the microcontroller and Wi-Fi network.

Fig.7: Wi-Fi module

B.WORKING

The main aim behind this idea is to monitor temperature, humidity, sound and gases in air over a web server using internet and to trigger alert message when the air quality goes down a certain level. The level of pollution has increased with times by lot of factors like the increased vehicle use, industrialization and urbanization which results in harmful effects on human wellbeing by directly affecting health of population exposed to it. In order to monitor this an IOT Based Air Pollution Monitoring System is developed in which the air quality will be monitored over a web server using internet and will trigger alert message when the air quality goes down beyond a certain level. It will show the air quality in PPM on the LCD and as well as on webpage. In this IOT project, the air pollution will be monitored from anywhere using your computer or mobile.

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4. EXPERIMENTAL RESULTS

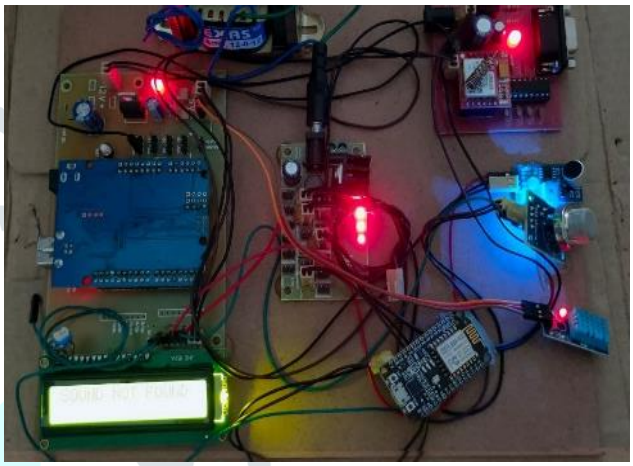

Fig.8: IoT Based Air Quality Monitoring System

Fig.9: Sound Detected

Fig.10: Monitoring Temperature and Humidity

Fig.11: Gas Detected

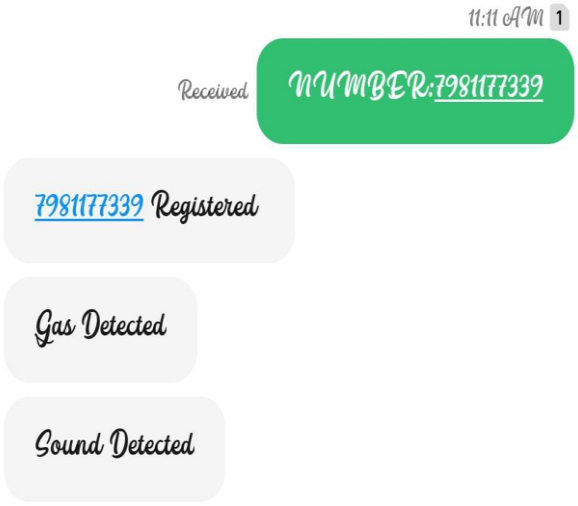

Fig.12: Alert Message Through Mobile

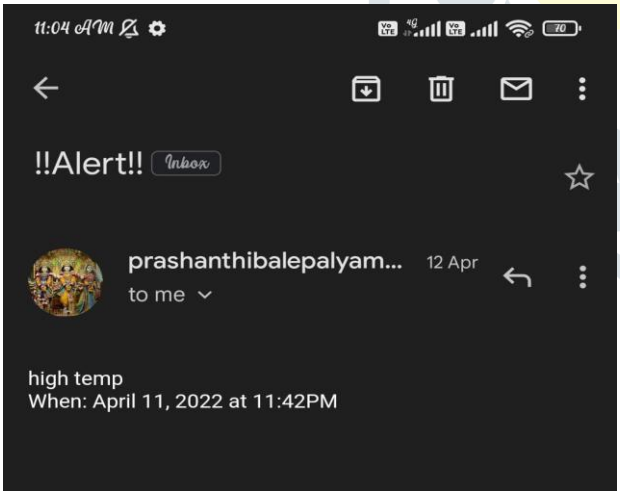

Fig.13: Alert Message Through mail

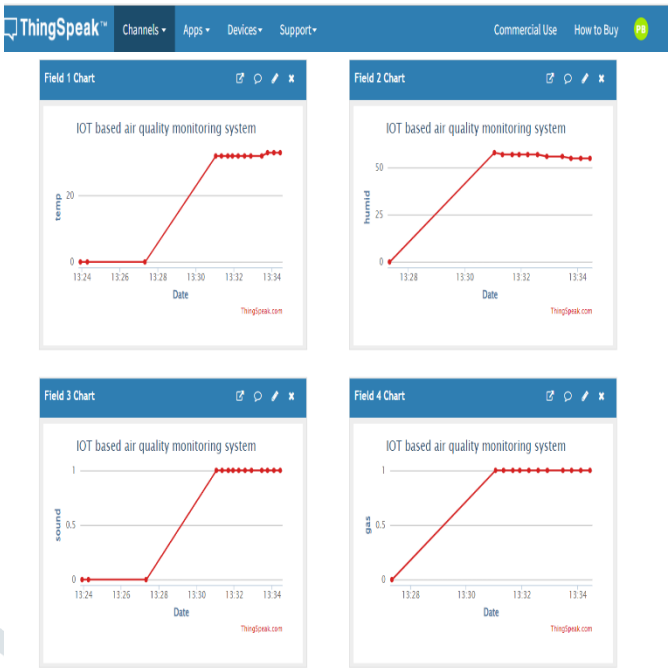

Fig.14: Graphs Through ThingSpeak

5. ADVANTAGES

1. Simple, compact and easy to handle.
2. Sensors have long life, less cost and easily available.
3. Updates on phone directly.
4. Easy to install.
5. Continuous update of change in percentage of air quality.
6. Simple drive circuit.

6. CONCLUSION

It is concluded that, the system to monitor the air of environment using Arduino microcontroller, IoT Technology is proposed to improve quality of air. With the use of IoT technology enhances the process of monitoring various aspects of environment such as air quality monitoring issue proposed in this paper. Here, using the MQ135 gives the sense of different type of dangerous gas and Arduino is the heart of this project. Which control the entire process, Arduino module connects the whole process to LCD and serial monitor is used for the visual Output.

The proposed IoT based air pollution system is a good device to measure the air quality in outdoors and indoors. This device can be useful to measure the level of gases in a highly dense area like markets hospitals, railway station, bus stand etc. from the remote-control room. If data is stored, we can use the data for further experiments which can conclude a significant result. This system is IoT based so it can be used in the smart home for the purpose of cooling, ventilation and other purposes. IoT will enhance the artificial intelligence in the world, so the system can be used in automated systems in factories and industries.

Future Scope

The future scope is that device which we are having can be done in a compact way by reducing the size of the device for further implementation or the modifications which can be is that detecting the vehicles amount of pollution which can be determined. In future the range can be made increased according to the bandwidth for the high range frequencies. Further research can be made by making the people in the right direction for their welfare. Therefore, there is another beneficiary by using this device in an app so the all can be used in an GSM mobile phone for their daily updates by increasing their range.

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