Pollution monitoring and controlling system using Internet of Things (IOT)

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Abstract: The change of ecosystem and the surrounding atmosphere by different forms of pollutants are called environmental pollution.[1]The level of pollution has increased with times by lot of factors like the increase in population, increased vehicle uses, industrialization which result in harmful effect on human well being by directly affecting health of population exposed to it.[2]When the objects like environment equipped with sensor devices, microcontroller and various software applications becomes a self-protecting and self monitoring environment and it is also called as smart environment. The effects due to the environmental changes on animals, plants and human beings can be monitored and controlled by using environmental monitoring and controlling system. By using embedded intelligence into the environment makes the environment interactive with other objectives. In this project we can monitor the pollution level from anywhere using sensor based control system.

Keywords: IOT, Monitoring system, controlling equipment, sensors

I. INTRODUCTION

The main objective of Pollution Monitoring and controlling system using IOT is that the pollution is a growing issue nowadays. It is necessary to monitor the pollution and keep it under control for better future and healthy living for all. Due to flexibility and low cost IOT is getting popular day by day with the urbanization and with the increase in the vehicles on road the atmospheric conditions have considerably affected. Harmful effect of pollution include mild allergic reaction such as irritation of throat, eyes and nose as well as some serious problems like heart diseases, pneumonia, lung and asthma. The main aim of this paper is to design and implement an pollution monitoring and controlling system through which the required parameters are monitored using internet and the data gathered from the sensors are stored in the cloud and to project the estimated trend on the web browser. For controlling purpose we set the reference level for each sensor if pollution level goes above the reference level then controlling equipment gets started.

II. PURPOSE OF THE SYSTEM

We propose an air quality as well as sound pollution and temperature monitoring system that allow us to monitor and check live air quality as well as sound pollution and temperature of an environment through IOT. System uses air quality sensor to sense the presence of harmful gases and constantly transmit this data, also system keep measuring sound level and temperature level and report it. The sensor interact with ATMEGA 16 Which processes this data and transmits it over the application. This allows authorities to monitor pollution in particular area and act again it.

III. IOT

The Internet of Things is an ecosystem of connected physical objects that are accessible through the internet. It is a system of interrelated computing devices, mechanical and digital machines or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human, human-to-computer interaction. Embedded with electronics, Internet connectivity, and other forms of Hardware (such as sensors) these devices can communicate and interact with others over the Internet and they can be monitored and controlled.The embedded technology in the objects helps them to interact with internal states or the external environment,which in turn affects the decisions taken.

IV. SYSTEM COMPOSITION

- **ATMEGA 16 MICROCONTROLLER**

ATMEGA 16 is an 8 bit high performance micro controller of ATMEL Mega AVR family with low power consumption. ATMEGA 16 is based on enhanced RISC architecture with powerful instructions.By executing powerful instructions in a single clock cycle, the ATmega16 achieves. 'AT' refers to ATMEL the manufacturer, 'Mega' means that the microcontroller belong to Mega AVR category, '16' signifies the memory of the controller, which is 16KB. Some of the essential features of ATmega16 are 131 powerful instructions – most single-clock cycle execution, up to 16 MIPS throughput at 16 MHz, 16k bytes of in-system self-programmable flash program memory, 8-channel, 10-bit ADC, Master/Slave Serial Peripheral Interface.Operating voltage is within a range of 2.7 - 5.5V for ATmega16L.

- **ESP 8266 WIFI MODULE**

The ESP8266 Wi-Fi module is a self contained SOC with integrated TCP/IP protocol stack that can give any micro controller access to your Wi-Fi network. Wi-Fi module is a capable of either hosting an application or off loading all Wi-Fi networking function from another application processor.Every ESP8266 module comes pr-programmed with an AT command set firmware, meaning we can simply connect to the micro controller.

- **TEMPERATURE SENSOR**

Some of the research work has been implemented in monitoring green-house environment, home automation, distributed solar panels, high voltage switch gears in substations. Temperature is one of the main parameter which needs to be monitor in various application areas. The main objectives of this research are: Continuous monitoring as well as controlling of temperature, designing of GUI window and to transmit the real time data serially on the PC in the form of graph. Nowadays, the human kind is moving towards the new technologies by replacing the manual operations to automatic controlled devices. One of the basic requirements of the people during hot weather is a cooling fan. But, the speed of the fan can be controlled by manual operation using a manual switch namely fan regulator or dimmer. By turning the dimmer, the fan speed can be altered. It can be watch in some places like where the temperature is high during the morning though the temperature falls down radically at night time. The users do not understand the difference in temperature. Hence to overcome the speed of the fan here is a solution to vary according to temperature. This project will convert the manual fan into automatic fans. If a fan is required that means if the temperature goes beyond the reference temperature, the fan will start and if it does not crosses the value it remains to be turned off. The reference value is set according to the convenience.

- **AIR QUALITY SENSOR**

Due to the increase in vehicles and industries quality of air has become worse and it has affected living beings. Diseases like asthma and other respiratory disorders have increased drastically even with children below the age of ten. Chimney from industries releases lots of harmful gases, though air control monitoring is established in most parts of the world. Still increase in industries has caused a major air pollution problem. This creates a toxic atmosphere around the factories and spoils the well being of a human. With the drastic evolution in the field if the Internet of Things (IOT) it is made possible to monitor the amount of toxic substances in air particles and can even control the quality of air. The objective is to develop a system which can sense the amount of toxic particles in air using the air quality sensor. The quality of air is controlled over the web using a dedicated server. When the toxic particles in the air like CO2 increase, an alarm will be triggered. Air quality in PPM is displayed on the web server when the toxicity in the air crosses the threshold value and automatically air purifier gets switched on, and it detoxifies the air. This device can be installed anywhere and when pollution crosses the safe value some external devices can be triggered, like displaying an alert message on the LCD display or can send a notification to all the people over there through a speaker or via SMS by using a GSM module. The proposed system is linked with a cloud service. The system enables to monitor the exact amount of pollutants at the given time slot. The data will be stored in the database for comparing it with the value obtained in future executions. For each execution, the database will be modified. The final resultant includes a line graph that depicts the amount of pollutants ranging from each time slot. If the amount of pollutants is increasing graph will be growing. If it decreases then the graph will be diminishing.

- **SOUND SENSOR**

The sound sensor is able to record noise levels because of its integrated microphone. It is able to analyze the surrounding ambient sound in the audible frequency spectrum for the human ear, showing collected data in db. This information is essential in places with high levels of noise pollution or with restrictions on noise levels. The sensor registers information of sound level on a specific time (measurements each predetermined interval of time) or continuous (levels reached during a period of time) in the area in which it is located. Further more, it provides an analysis classified in percentile and absolute maximum, allowing the user to control the acoustic levels of a neighborhood , factory, etc. and to proceed with its improvement by taking the necessary actions.

V. IMPLEMENTATION

The generalized block diagram representation show in figure 1.This system monitor the current pollution status .This will update in the web server. So, we can monitor anywhere through the internet. The block diagram consist of three sensor(air quality sensor, temperature sensor, sound sensor) and ATMEGA 16 micro controller. The sensors are connected to the micro controller which receives the value and convert into digital form and those values are updated in the web server.
Temperature sensor and air quality sensor give the output in analog form.ADC are inbuilt in micro controller which covert the analog input from the sensor into digital form and display the value on 16x2 LCD. The Wi-Fi module is a self contained SOC with integrated TCP/IP protocol stack that can give any micro controller access to your Wi-Fi network. Wi-Fi router is used to provide access to the internet. The data gathered from the sensors are stored in the cloud and analysis results will be available to the end

user through the Wi-Fi on web page.

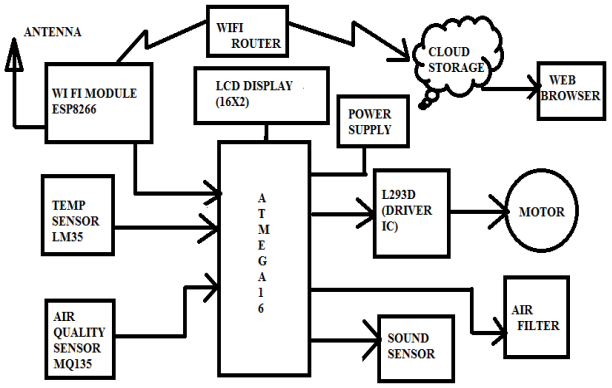

Fig 1: Block Diagram Representation

VI. DESCRIPTION

In the circuit diagram we used the ATMEGA 16 micro controller and three sensor which is air, sound and temperature sensor .This sensor interact with ATMEGA 16 Which processes this data .ESP8266 connecting with ATMEGA 16.ESP 8266 runs on 3.3V and if we give it 5V from the microcontroller then it won't work properly and it may get damage. So we will have to make a voltage divider for it which will convert the 5V into 3.3V.Connect the TX pin of the ESP 8266 to the pin 15 of the micro controller and

then it won't work properly and it may get damage. So we will have to make a voltage divider for it which will convert the 5V into 3.3V.Connect the TX pin of the ESP 8266 to the pin 15 of the micro controller and The RX pin of the ESP 8266 to the pin 14 of the micro controller.ESP 8266 Wi-Fi module gives our project access to Wi-Fi or internet. It is very cheap device and makes our project very powerful. It can communicate with any micro controller and it is the most leading devices in the IOT platform. Then we will connect The MQ135 (Air quality sensor) with the microcontroller. Connect the VCC and GND pin of the sensor to the 5V and ground of the microcontroller and the analog pin of the sensor to the pin number 37 of the microcontroller. The MQ135 sensor can sense CO2, smoke, NH3 and some other gases. In our project air quality sensor can sense the CO2 gas, and give the output in the form of PPM (part per million).The LM35 (temperature sensor) are used to monitor the temperature level of particular areas. The LM 35 sensor are connect with the pin number 38 of the micro controller and connect the VCC and GND pin of the sensor to the 5V and ground of the micro controller. Sound sensor is used to monitor the sound level. The data gathered from the sensors are stored in the cloud and display on web browser in the form of graph. For controlling purpose we set the reference level for each sensor if pollution level goes above the reference level then controlling equipment gets started. For air quality sensor we used air filter as a controlling device and for temperature sensor we used cooling fan as a controlling device.

VII. CONCLUSION

This project deals about the well fare of the society which would be beneficiary for all peoples by avoiding themselves from pollution. The air and sound pollution monitoring system overcomes the problem of the highly-polluted areas which is a major issue and the temperature sensors are used to monitor the temperature level of environment. It supports the new technology and effectively supports the healthy life concept. It can interact with other objects through the network, Then the collected data and analysis results will be available to the end user through the Wi-Fi on web page and also monitor the pollution and keep it under control for better future and healthy living for all.

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