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IOT based Noise and Air Pollution Monitoring in Industrial Sector

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Abstract: ***In the present era, air and noise pollution is the growing hazardous issue. It is necessary to monitor air quality and keep it under control #or a better #uture and healthy living #or all. This project is an air and noise pollution monitoring system that can monitor air pollution and sound pollution in particular areas through IoT which would be a way to make our place a smart city. This system uses air sensors to sense presence o# harm#ul gases/compounds in the air and constantly transmits this data to microcontroller. Also system keeps measuring sound level and reports it to the online server over IOT. The sensors interact with microcontroller which processes this data and transmits it over internet. This allows authorities to monitor air pollution in di#ferent areas and take action against it. Authorities can keep a watch on the noise pollution near industries, schools, hospitals and no honking areas. I# system detects air quality and noise issues, it alerts authorities so that they can take necessary measures to control the issue.***

Keywords: Air and noise polution,MQ sensors,Ethernet shield,IoT,ATmega 328,Ethernet shield.

I. INTRODUCTION

Humans and eco system are a#fected by the pollutants present in air. Some o# the substances present in air include solid particles, liquid droplets and gases. A pollutant can be o# natural origin or man-made. Pollutants are classi#ied as primary or secondary. Primary pollutants are usually produced #rom a volcanic eruption. Carbon monoxidegas emitted #rom vehicles and sulphur dioxide released #rom #actories also cause pollution. Secondary pollutants are not emitted directly. Rather, they are #ormed in the air when primary pollutants react or interact. Ground level ozone is a prominent example o secondary pollutants. Noise pollutants are sounds with high intensity which can a#fect both human and animal health. Such pollutions are caused by industries, #actories, mills, vehicles, etc. Prolonged exposure to noise o# certain #requency pattern leads to severe health problems. In order to mitigate the impacts o# air and noise pollution on human health, global environment and worldwide economy, governments have put tremendous e#forts in monitoring air and noise pollution. Sensors are used in gathering data to monitor air and noise pollution. Initially the sensor devices are deployed in environment to detect the parameters noise and air pollutants. The sensor devices are placed at di#ferent locations to collect the data to predict the behavior o# particular area. The main aim o# this project is to design and implement e#ficient monitoring system using IoT. Embedded computing is a solution #or monitoring noise and air quality levels.

II.EXISTING METHODOLOGY

Previously computerized tomography technique was used to monitor air pollution which generates a two dimensional map of pollutant concentration. It provides many advantages over the differential absorption method. In this system at the centre of the area there is a single laser source located. This laser beam rotates and is directed towards the circumference of the circle. There is a cylindrical mirror on which the incident laser beam is reflected in a fan beam over angle across the circle. The beam from the mirrors strikes a set of detectors that lie in same plane parallel to the ground. This technique focuses on transmitted laser energy increasing the range and ability to monitor the area that contains several pollutant. Another way of monitoring air pollution is through the online GPRS sensor array which has been designed, implemented and tested. This system consists of microcontroller and a pollution server with a internet connection where the mobile data acquisition unit collects the pollution level and pack it into a frame with GPS location, date and time. This is uploaded to the GPRS modem and transmitted to the pollution server through the public mobile network. A data base server which is attached to the pollution level which is used by the various client. Clients can use the pollution server in which the pollution level is stored. To provide a real time pollutants level as well as the location in large metropolitan area pollution server have been interfaced with the google map.

III. PROPOSED METHODOLOGY

The proposed block diagram consists of Atmega328 arduino, gas sensor, sound sensor and wifi module. System consists of the sensors used for acquiring required data from the atmosphere. Sensor used for measuring air pollutants is MQ135. For the

measurement of sound levels a sound sensor module microphone is used. Air pollution sensors measure the quality of air while sound pollution sensors measure the sound levels. Data from these sensors are basically analog signals. These analog signals are converted to its equivalent digital form. The data can be displayed on the 16x2 LCD connected to the microcontroller. To send data to a remote location the data from system is sent to the Ethernet shield. Wi-Fi module is connected to the microcontroller.

The Wi-Fi module interacts with microcontroller using two ports i.e. transmitter and receiver provided on it. The measured data is sent from the module to any location within its range from which the data can be fetched using a laptop / mobile. To give the module the Wi-Fi details, connect the internet and then provide the IP address of the website.

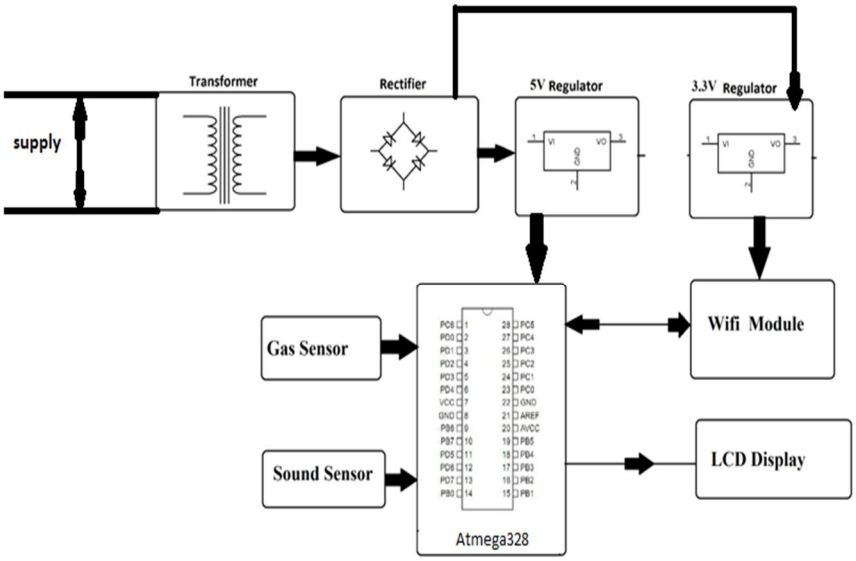

Fig 1: Block Diagram

IV. SYSTEM ARCHITECTURE

A. Gas Sensor

MQ 2, MQ 3 AND MQ 7 sensors are used. Module sensor has lower conductivity in clean air. When the target combustible gas exist, the sensors conductivity is higher along with the gas concentration rising. MQ gas sensors have high sensitivity to Ammonia, Sulphide and Benzene steam and also sensitive to smoke and other harmful gases. It is a low cost sensor suitable for different applications like harmful gases/smoke detection.

Output voltage of the sensor boosts as the concentration of the measured gases increases. It gives fast response and recovery. This sensor offers adjustable sensitivity.

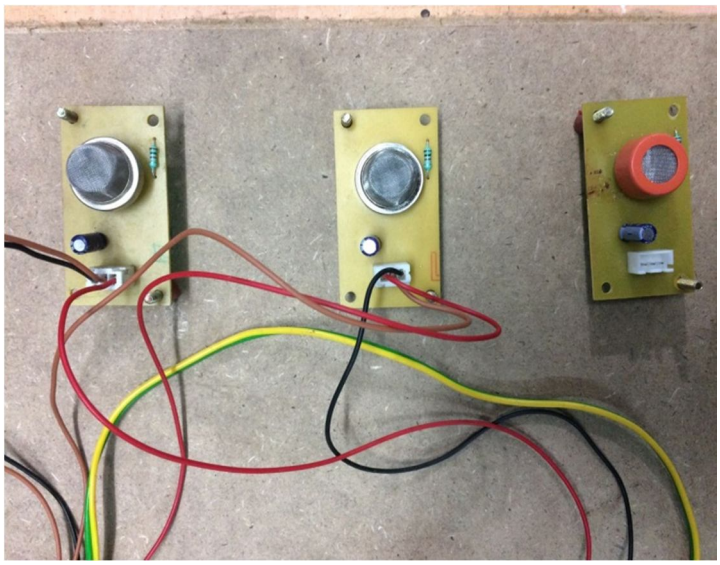

Fig.2: MQ series Gas Sensors

B. Noise Sensor

Condenser microphones are operated based on the electrostatic field. They require power from a battery or an external source. The resulting audio signal is stronger than that of dynamic microphone. These microphones are sensitive and responsive than the dynamic microscope, which makes them more suitable for capturing subtle nuances in a sound.

A typical condenser microphone will include a capacitor having two plates with a voltage applied between them. One of these plates tends to be very light and acts as the diaphragm. The diaphragm starts to vibrate when it is struck by sound waves. As a result, the distance between the two plates changes thereby changing the capacitance. When the plates are close together when the capacitance increases, a electrical current is generated. When the plates are further apart, capacitance decreases and a discharge current is formed. A capacitor supplies the necessary voltage for the microphone.

C. Ethernet shield

The Arduino Ethernet Shield V1 allows an Arduino board to connect to the internet. It is based on the Wiznet W5100ethernet chip (datasheet). The Wiznet W5100 provides a network (IP) stack capable of both TCP and UDP. It supports up to four simultaneous socket connections. Use the Ethernet library to write sketches which connect to the internet using the shield. The ethernet shield connects to an Arduino board using long wire-wrap headers which extend through the shield. This keeps the pin layout intact and allows another shield to be stacked on top. There is an onboard micro-SD card slot, which can be used to store files for serving over the network. It is compatible with all the Arduino/Genuino boards. The on-board micro SD card reader is accessible through the SD Library. When working with this library, SS is on Pin 4. The original revision of the shield contained a full-size SD card slot; this is not supported.The shield also includes a reset controller, to ensure that the W5100 Ethernet module is properly reset on power-up.

D. 16mhz Crystall Oscillator

Crystal oscillator circuit usually works on the principle of the inverse piezoelectric effect. The applied electric field will produce a mechanical deformation across some materials. Thus, it utilizes the vibrating crystal's mechanical resonance, that is made with a piezoelectric material for generating an electrical signal of a particular frequency

E. Atmega328

The microcontroller that has been used for this project is from ATmega series in arduino UNO. ATmega is the RISC based microcontroller fabricated in CMOS (complementary metal oxide semiconductor) that uses separate bus for instruction and data allowing simultaneous access of program and data memory. The main advantage of CMOS and RISC combination is low power consumption resulting in a very small chip size with a small pin count. The main advantage of CMOS is that it has immunity to noise than other fabrication techniques.

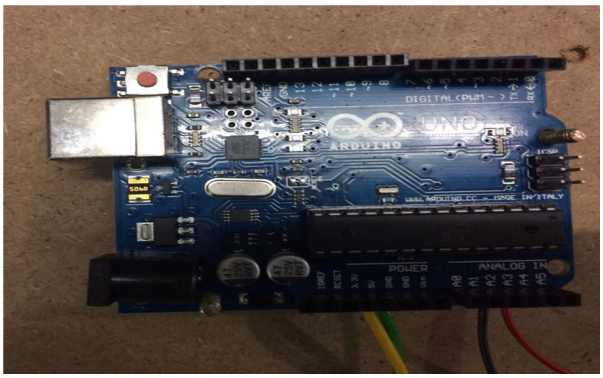

Fig 3: ATmega328

Arduino boards consist of an Atmel 8-bit AVR microcontroller (ATmega8, ATmega168, ATmega328, ATmega1280, ATmega2560) with varying amounts of flash memory, pins, and features. The 32-bit Arduino Due, based on the Atmel SAM3X8E was introduced in 2012.The boards use single or double-row pins or female headers that facilitate connections for programming and incorporation into other circuits. These may connect with add-on modules termed shields. Multiple, and possibly stacked shields may be individually addressable via an I²C serial bus. Most boards include a 5 V linear regulator and a 16 MHz crystal oscillator or ceramic resonator. Some designs, such as the LilyPad, run at 8 MHz and dispense with the onboard voltage regulator due to specific form-factor restrictions.

V. RESULTS AND ANALYSIS

This system includes the sensors that detect the parameters causing pollution. Whenever there is an increase in the level of these parameters the sensors sense the situation and gives information to the microcontroller. An Ethernet shield is connected to the microcontroller Using Ethernet shield, this information is transferred over the internet and can be assessed from anywhere using the IP address of the Ethernet shield.

his system can be used to monitor air and noise pollution using IoT industrial sector. This system provides information when pollution levels exceed the predefined value. The implementation of this project will help to monitor the pollution in industries and also in other places. By monitoring the pollution, our project helps in assisting the respective authorities to take action to control pollution and provide a healthy environment for the workers to work in. The system is cost effective and easy to operate.

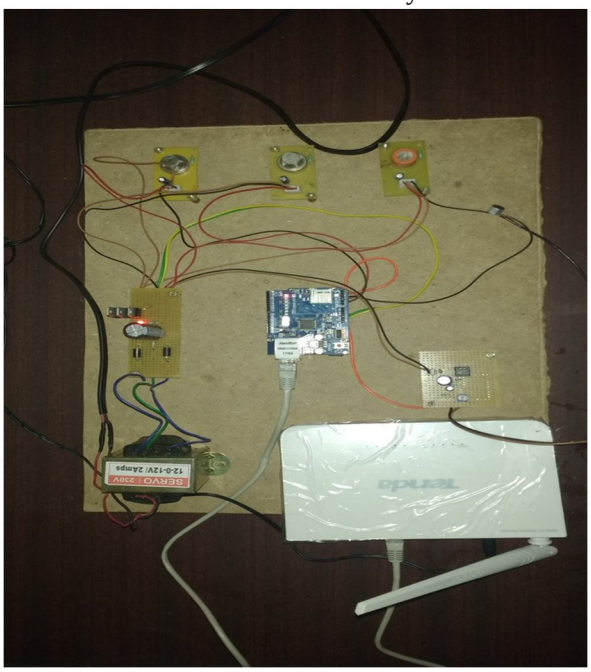

Fig 4: Proposed System

VI. VISUAL BASIC OUTPUT

Figure 5 and figure 6 shows the output of the proposed system.

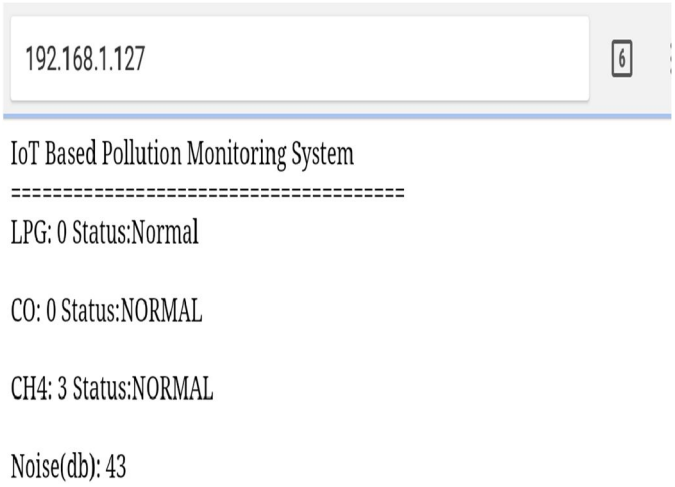

Fig 5: Result of the project under normal conditions

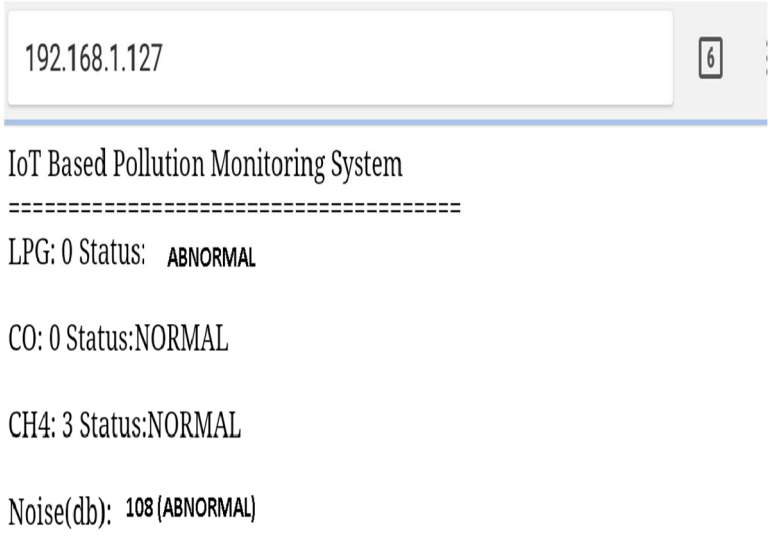

Fig 6: Result of the project under abnormal conditions

VII. SUMMARY AND CONCLUSION

An efficient, low cost embedded system and smart way to monitor environment is presented with different models in this paper. In the proposed architecture functions of different modules were discussed. The noise and air pollution monitoring system with Internet of Things (IoT) concept experimentally tested for monitoring two parameters. It also sent the sensor parameters to the cloud. This data will be helpful for future analysis and it can be easily shared to other end users. This model can be further expanded to monitor the developing cities and industrial zones for pollution monitoring. This project is an efficient and low cost solution for continuous monitoring of environment which can protect the public health from pollution.

VIII. FUTURE SCOPE

This project can be expanded in future in many ways to serve many purpose.

A web can be created where data from cities and various countries are available. Thus, providing a single platform to monitor and analyze air pollution at various locations. This web platform can act as a beneficial resource for making people aware of their environments.

Along with air and noise pollution monitoring, this project can be extended to monitor water pollution also.

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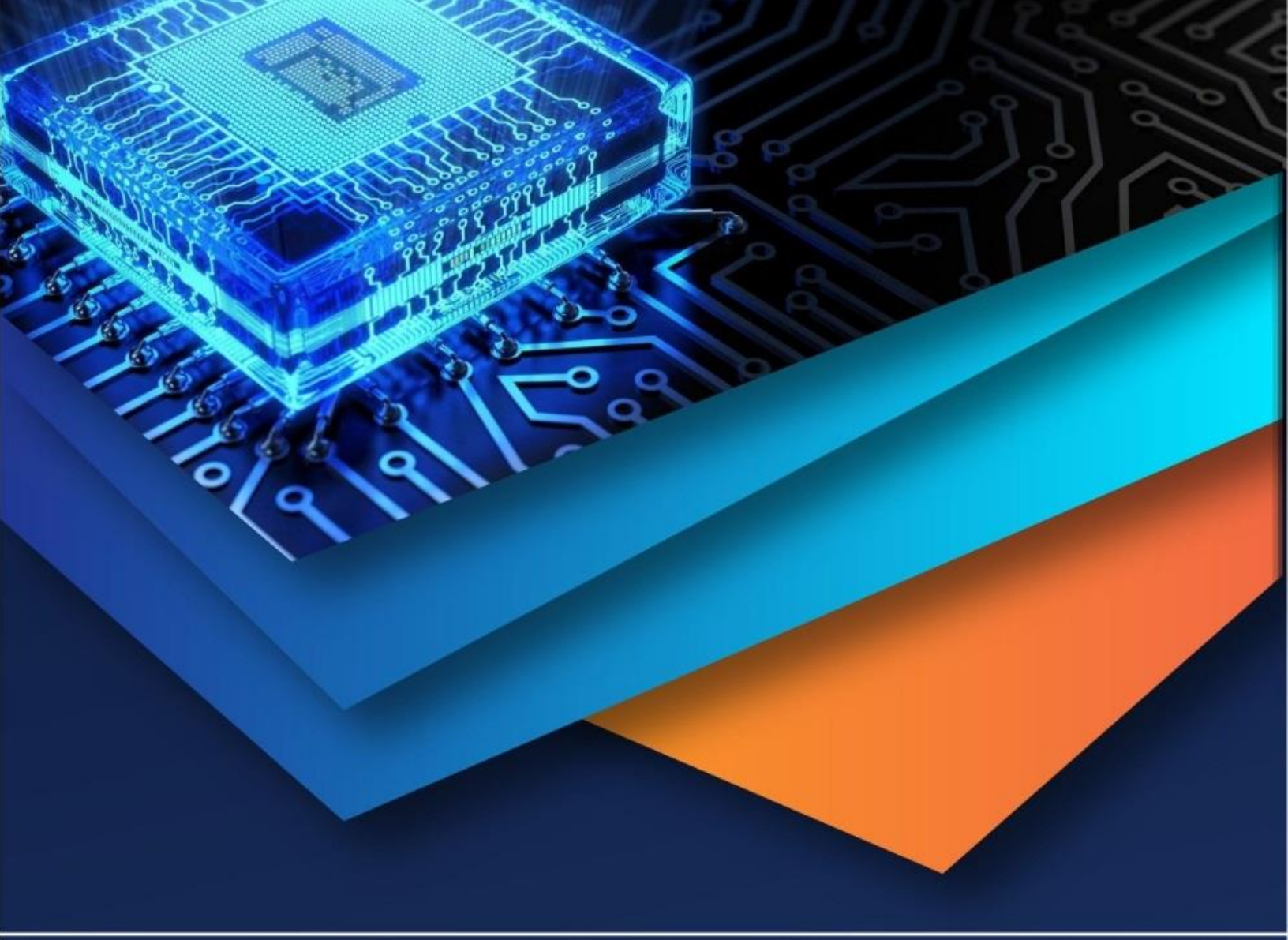

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