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EFFECTIVE SURVEILLANCE OF AIR QUALITY AND AIR POLLUTANTS USING IOT

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ABSTRACT

The levels of pollution have increased with time by a lot of factors like population, vehicle use, industrialization, volcanoes, wildfires and urbanization. Hence, it has become the need of the hour to monitor the level of air pollution. Our project aims to develop a system that can detect and monitor the presence of various air pollutants in real-time. The developed air pollution monitoring system would constantly keep track of air pollution levels using an IoT network formed by Arduino based system, mobile phone and a computer. Whenever the poisonous gases exceed their limits, an SMS alert and an email will be sent to the user. Also, the availability of a Chabot can be very useful provided the user is believed to be in a potentially hazardous situation. It is believed that technology will play a significant role in attaining the objectives of human beings; this monitoring device can deliver real-time measurements of air quality and hence saving many lives.

Keywords: Arduino, Air Pollution, Chabot, Industrialization, IoT.

I. INTRODUCTION

Whether it is developed or developing, air pollution is the biggest problem of every nation. Health problems have been growing at a faster rate especially in urban areas of developing countries where industrialization and the growing number of vehicles lead to the release of a lot of gaseous pollutants and make the noisy sound. Harmful effects of the pollution include mild allergic reactions such as irritation of the throat, eyes and nose, headache, insomnia as well as some serious problems like bronchitis, heart diseases, pneumonia, lung and aggravated asthma. According to a survey, the combined effects of outdoor and household air pollution cause about 65 lakh premature deaths every year all over the world. About 2.5 million die in India every year from air pollution caused by burning fossil fuels. It implies that about 30.7 percent of deaths in India are from air pollution, a study has said. Various kinds of anthropogenic emissions named as primary pollutants are pumped into the atmosphere that undergoes a chemical reaction and further leads to the formation of new pollutants normally called secondary pollutants.

Air pollutants exert a good range of impacts on biological, physical and economical systems. Their effects on human health are of great concern. Consequently, it'll become an important task to accurately keep track of the variation of ambient pollution levels in urban areas. Elevated ozone levels are linked to increases in hospitalizations, ER visits and premature death. Pollutants cause environmental damage and fine particles may impair visibility. Among the simplest known toxic gases are carbon monoxide gas, Chlorine, dioxide and Phosgene.

It is vital to gather suitable data sets from multiple air quality parameters one containing yearly average pollutant concentrations at a selected location and therefore the other containing daily average pollutant concentrations record for a significantly longer duration. Moreover, the performance of various modules had not been well measured since earlier researchers used different parameters or metrics for performance evaluation.

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II. METHODOLOGY

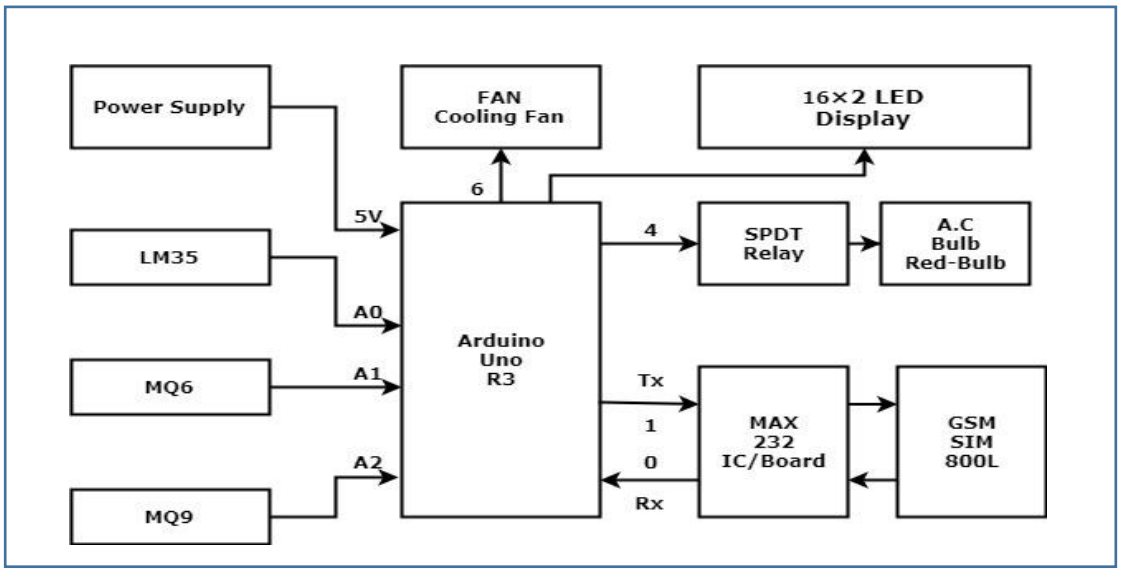

Figure 1: Block Diagram of proposed Systems.

Embedded Systems

The salient objective of this project is to develop a system that would monitor the air in real-time, tell the quality of air and log data to a Web server and an Android App. The air monitor developed during this project is predicated on Arduino Uno. The Arduino board is connected with GSM SIM 800L Module to send SMS alerts and access the data services.

The device uses multiple sensors for monitoring air pollution like MQ-9, MQ-6, LM-35 etc. The Air Pollution levels of poisonous gases are displayed on a 16x2 LCD screen (liquid crystal display) and Barometer Dashboard which can be accessed by an Android App.

The system can be used to detect harmful pollutants in the air and constantly transmit this data to Arduino. It keeps measuring and report real-time data to the Web Server over IoT network. Users would be notified about the abnormal air pollution levels on Desktop, mobile and other devices.

An Android App can be availed to keep the tab on the air quality of a particular demographic region and the same can be viewed in the form of a barometer. Authorities can keep a watch on the air quality so that they can take measures and necessary actions to control the issue. While the embedded system will keep a tab on the air quality, the Chabot would come to their rescue providing all the useful information in case of any emergency or outburst of poisonous gases. The system will reduce a lot of paperwork and the time that is wasted in manual processes. Hence, it would be very efficient.

Hardware Requirements

Arduino Uno, Wires, LED, DC Motor, On/Off Switch, LCD Display, Bulb, Relay, MQ-9 (Carbon Monoxide Sensor), MQ6 (LPG Gas Sensor), LM35 (Temperature Sensor), GPRS Modem/SIM 800L, Battery 9V, a SIM card.

Software Requirements

Operating System: Windows10/Windows 7

Programming Languages: Java, PHP, C++

Platform: Arduino IDE. Android Studio

Mobile Device: Any entry-level Android Phone

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Schematic Diagram

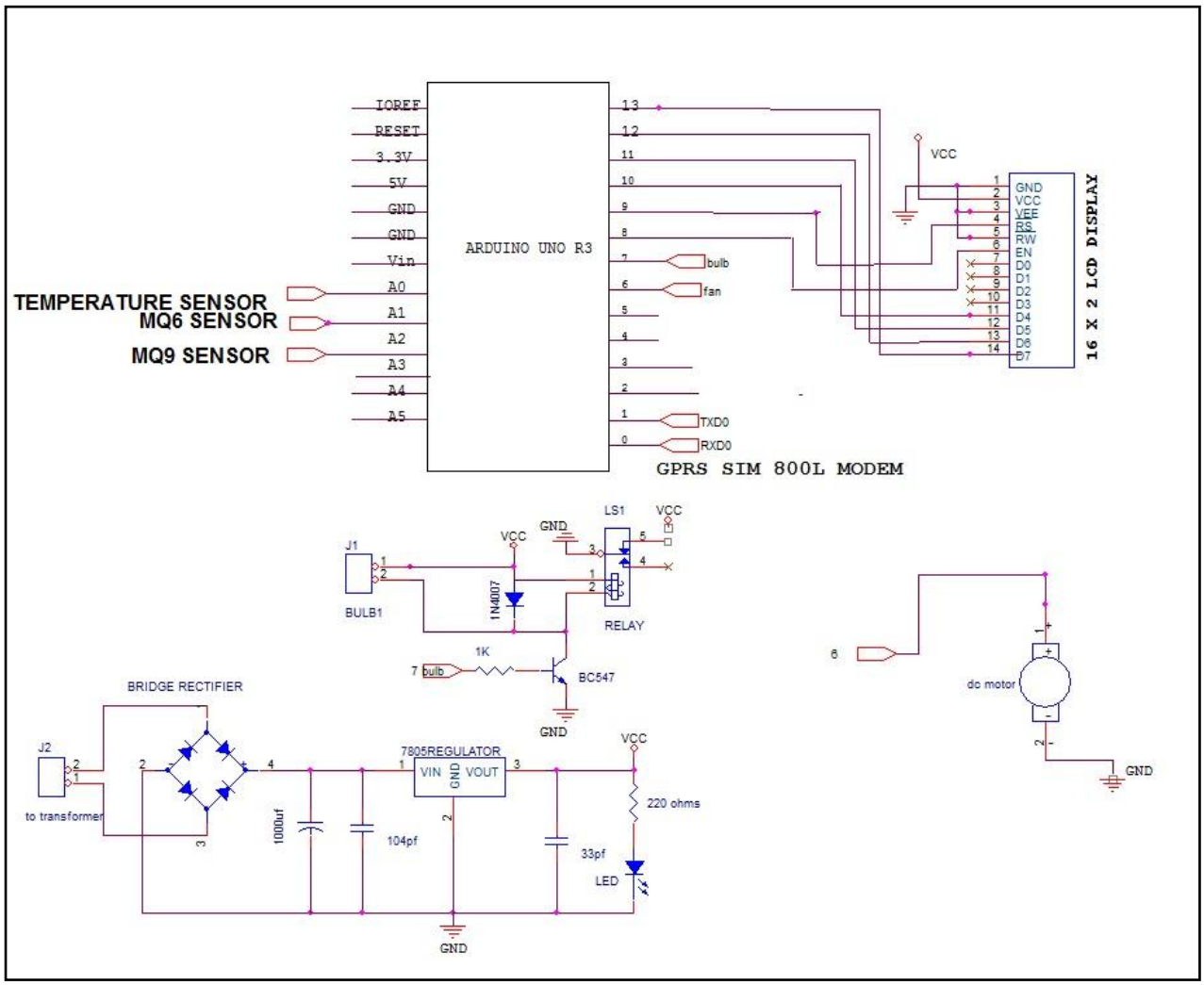

Figure 2: Schematic Diagram of embedded Systems

Pseudo code

The working of the program can be explained by following steps:

Step 1: Start

Step 2: Collect data from sensors

Step 3: Declare variables to store collected values.

Step 4: Sensor values are sent to the Arduino Uno

Step 5:

If (temp <50)

Then

LCD display shows the temperature value.

Else

High temperature message is sent to Mobile Phone, Email and Web Portal

Then go to step 6.

Step 6: If (MQ6 > 200)

Then

Buzzer Starts Buzzing & High MQ6 sensor value is sent to Mobile Phone, Email and Web Portal.

Then go to step 7.

Step 7: If (MQ9 > 200)
Then

The bulb starts glowing & High MQ9 sensor value is sent to Mobile Phone, Email and Web Portal.

Then go to step 8.

Step 8: The air pollution values are displayed on Various Platforms.
Then go to step 2.

Step 9: End

III. RESULT & IMPLEMENTATION

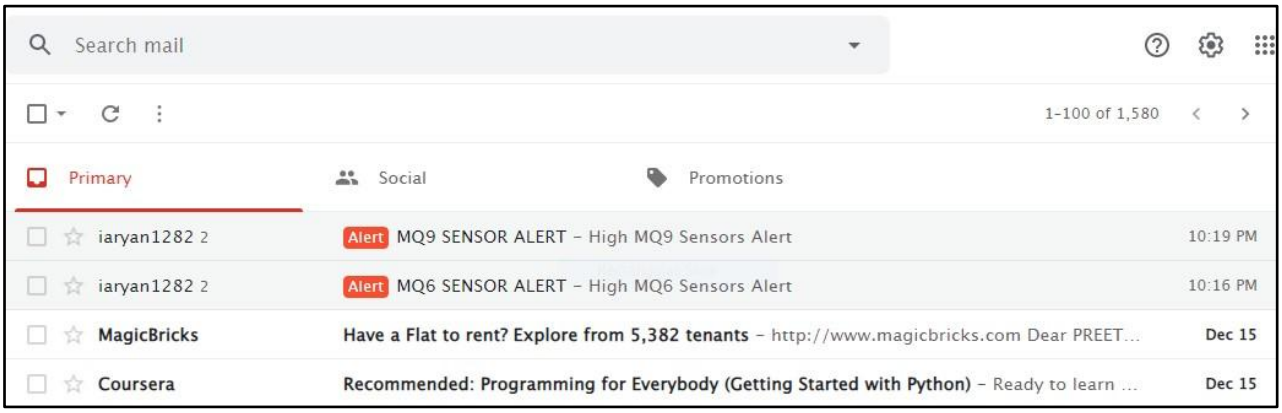

Figure 3: Email alert of sensors sent to the user.

Whenever there's an outburst of Methane or Carbon Monoxide gas, an email alert will be sent to the user so that it can be brought to his notice and any hazardous situation is avoided.

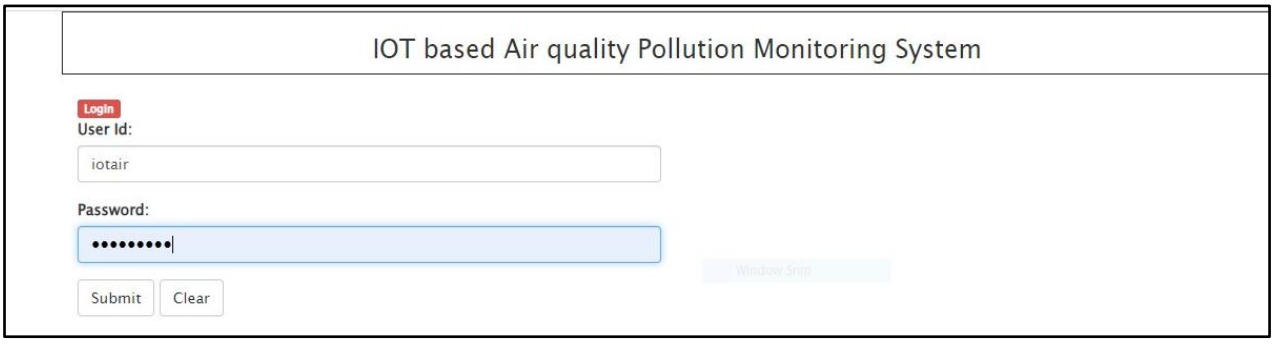

Figure 4:. Login Page

The user will be able to log in to a website where he can observe all the sensors' values and can also view the previous data.

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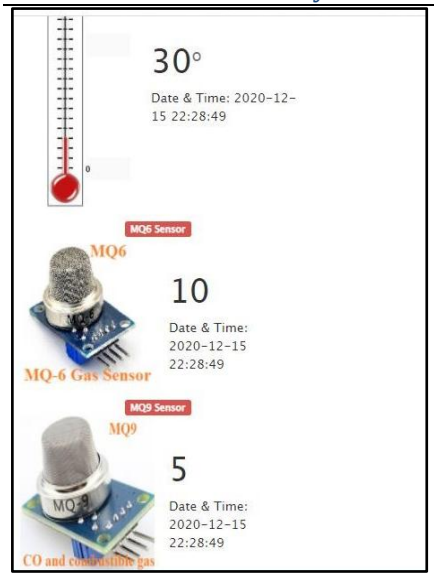

IOT based Air quality Pollution Monitoring System

TEMP	MQ6	MQ9	Date / Time
30	10	5	2020-12-15 22:28:49
31	11	5	2020-12-15 22:27:43
29	11	7	2020-12-15 22:26:35
30	58	6	2020-12-15 22:25:28
33	11	7	2020-12-15 22:24:21
31	55	8	2020-12-15 22:23:14
33	12	8	2020-12-15 22:22:07
31	14	10	2020-12-15 22:21:00
30	16	15	2020-12-15 22:19:52
35	41	246	2020-12-15 22:19:01
33	21	4	2020-12-15 22:18:21
31	22	5	2020-12-15 22:17:15
32	220	11	2020-12-15 22:16:28
32	15	4	2020-12-15 22:15:47
35	16	4	2020-12-15 22:14:41
32	17	4	2020-12-15 22:13:35
32	15	6	2020-12-15 22:12:30
32	22	4	2020-12-15 22:11:24
33	21	4	2020-12-15 22:10:19
39	20	4	2020-12-15 22:09:13
41	22	5	2020-12-15 22:08:07
49	19	5	2020-12-15 22:07:02
42	16	5	2020-12-15 22:05:55
45	34	7	2020-12-15 22:04:49

Figure 5: All Sensor Data on the Website

Figure 6: SMS alert on Mobile Phone

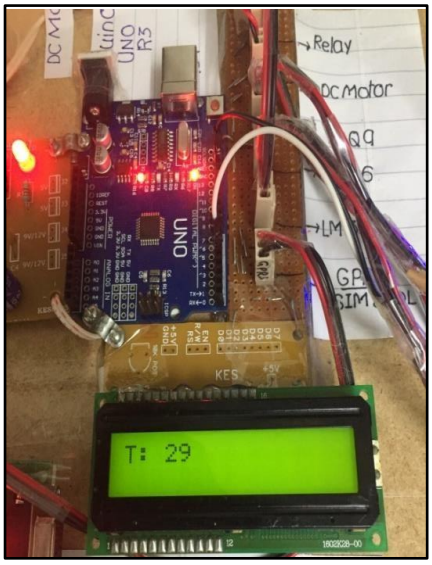

Figure 7: LCD Display shows the temperature

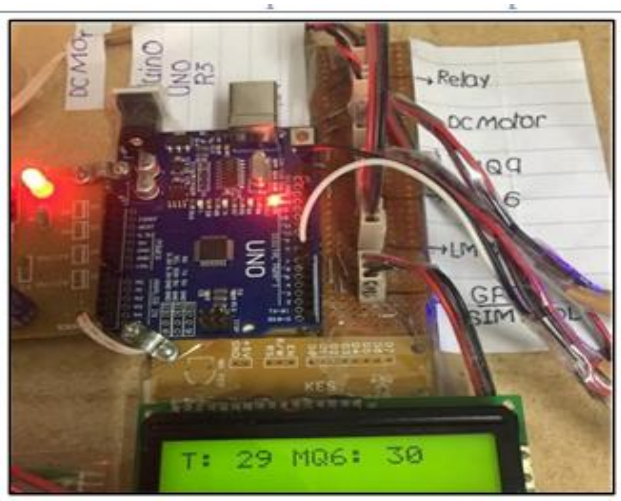

Figure 8: Display showing the value from LM-35 and MQ6 sensors

Figure 9: An interactive Chabot

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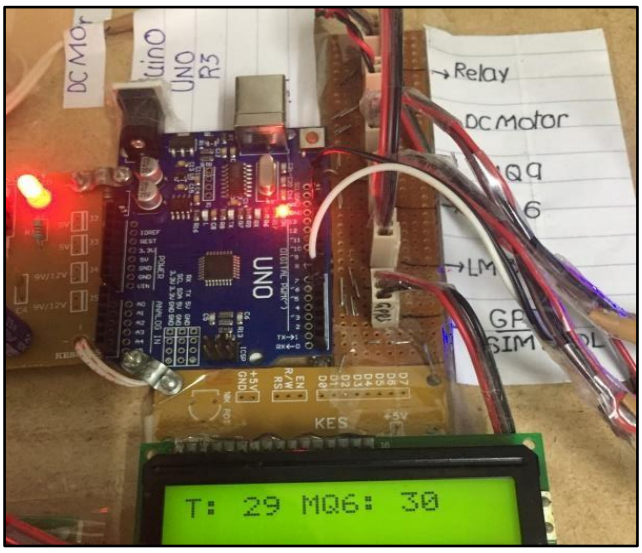

Figure 8: Display showing the value from LM-35 and MQ6 sensors

Figure 9: An interactive Chabot

A handy Chabot can play crucial roles in situations where the user may find himself in a state of trouble and it can guide him to make the rational decision and inform him about all the safety measure he can take to get better of the situation

IV. CONCLUSION

In this paper, we have proposed a system that will help the user to keep a real-time tab on the air pollution and air quality of a particular place and premises. This research proposed an IoT-based air monitoring system that displays the air quality measured on various parameters and platforms. It is cost and energy-efficient request and response protocol is used along with the combination of address and data-centric protocols. The paper presents a summary. The use of IoT technology enhances the tactic of monitoring various aspects of the environment just like the air quality monitoring issue proposed during this paper. Here, using the LM35, MQ9 and MQ6 gas sensor gives the sense of the different types of dangerous gas and Arduino is the heart of this project which controls the entire process. SIM 800L module connects the whole process to the internet and LCD is used for the visual Output.

Future Work:

In the future, the present system will be made more compact to make it handier by the end-user. This system allows us to integrate other hardware components with the Arduino Uno. The system can be upgraded by adding more sensing nodes. The current system is accurate based on giving suggestions. Also, a more informative and interactive Android Application would be a great addition.

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