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Household IOT Based Air Pollution Controlling and Monitoring System using Arduino

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Abstract **– Promotion and propagation of a healthy environment has been our aim as we foresee its shortcomings. We propose a Smart Air Pollution Controller which not only monitors the air pollutants present but also harness and oxidise them .The system comprises of the sensors which identifies the greenhouse gases (CO, NH3, SO3, No2, Benzene and other alcohols)-tgs2600, tgs2602, tgs8100.It also contains an IR sensor which computes the amount of radiation emitted from the pollutants. Realization of data gathered by sensors is displayed on Arduino based web server. The data gathered is then sent and developed through GSM by MEAN stack.**

The system includes a MQ Series sensor interfaced to a NodeMCU equipped with a SIM800L GPRS GSM MODULE WLAN adaptor to send the sensor reading to the server. The recorded data is then checked for the gases detected if any of the gases go beyond the suffocation level it sends a signal to the relay. The relay is then connected to the oxidising agent which is triggered in order to reduce the gases which are abundant in polluting the environment. This continues until the atmospheric conditions are balanced. The data is recorded and monitored for every 5 minutes.

The above is the outcome of the **Combination of a Timed Series Analysis and IOT (Internet of Things).**

Keywords: Internet of Things, Greenhouse gases, tgs2600, tgs2602, tgs8100, Arduino, MQ Sensor, SIM800L GPRS GSM MODULE WLAN adaptor

I INTODUCTION

The main objective of IOT Air & Sound Monitoring System is that the Air and sound pollution is a growing issue these days. It is necessary to monitor air quality and keep it under control for a better future and healthy living for all. Due to flexibility and low cost Internet of things (IOT) is getting popular day by day. With the urbanization and with the increase in vehicles on road the atmospheric conditions have been worsened. IOT Based Air Pollution Monitoring System monitors the Air quality over a web server using Internet and will trigger an alarm when the air quality goes down beyond a certain threshold level, means when there are sufficient amount of harmful gases present in the air like CO2, smoke, alcohol, benzene, NH3, LPG and NOx. It will show the air quality in PPM on the LCD and as well as on webpage so that it can monitor it very easily. LPG sensor is added in this system which is used mostly in houses. The system will show temperature and humidity. The system can be installed anywhere but mostly in industries and houses where the gases are found triggering the oxidizing agent to balance the atmospheric conditions. Monitoring the pollutions based on the recent advancements does not bring back any revolutions but a change in a way. The proposed work aims at the development of a healthy society by the combination of IOT and the environmental studies. The researchers in this field have proposed various air quality monitoring systems based on WSN, GSM and GIS. The recorded data is periodically transferred to a computer through a General Packet Radio Service (GPRS) connection and then the data will be displayed on the dedicated website with user acceptance. As a result large number of people can be benefited with the large.

The proposed work aims to present a time series analysis for analyzing air pollutants with the help of gas sensors and the comparison with that of the suffocating level.

It is done before it causes any suffocation or it leading cause diseases like asthma, bronchitis. The remainder of the paper is sectioned as follows: Section 2 enlightens the basic concept of IOT and Requirements, Section 3 discusses about the proposed methodology, Section 4 details about the working methodology and Section 5 concludes this paper.

II OVERVIEW
This consists of three sections

IOT
Gas Sensors
Arduino Uno R3 microcontroller

2.1 IOT

The Internet of Things (IOT) is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human- to-computer interaction. IOT has evolved from the convergence of wireless technologies, micro-electro mechanical systems (MEMS), micro services and the internet. The convergence has helped tear down the silo walls between operational technology (OT) and information technology (IT), allowing unstructured machine - generated data to be analyzed for insights that will drive improvements.

2.2 Arduino Uno R3 Microcontrollers

It is the most flexible hardware platform used based on ATmega328P which can be programmed according to the function where it is to be used. It has 6 analog inputs, 14 digital input/output pins (6 pins of these can be used as PWM outputs), a USB Connection, a 16 MHz quartz crystal, SPI, serial interface, a reset button, a power jack and an ICSP header .The Arduino microcontroller is not only for technical audience but is intended for designers and artists as well because of its focus to usability based on its primary component of the framework. In addition, it is an open source microcontroller device with easily accessible software/hardware Platform and is compatible with many sensors available. Everything needed for its working is present on the board; we only require a USB cable to directly connect it to the computer or give power using battery source or AC to DC adapter to get started

2.2 Gas Sensors

The Sensitive material used in MQ135 gas sensor is SnO2. The conductivity of this material is lower in clean air. The sensor conductivity increases with the increasing concentration of target pollution gas. MQ135 can monitor different kinds of toxic gases such as sulphide, ammonia gas, benzene series steam and CO2. The detection range is 10-10,000 ppm (parts per million) with the voltage rate of about 5.0V±0.1V AC or DC.

III LITERATURE SURVEY

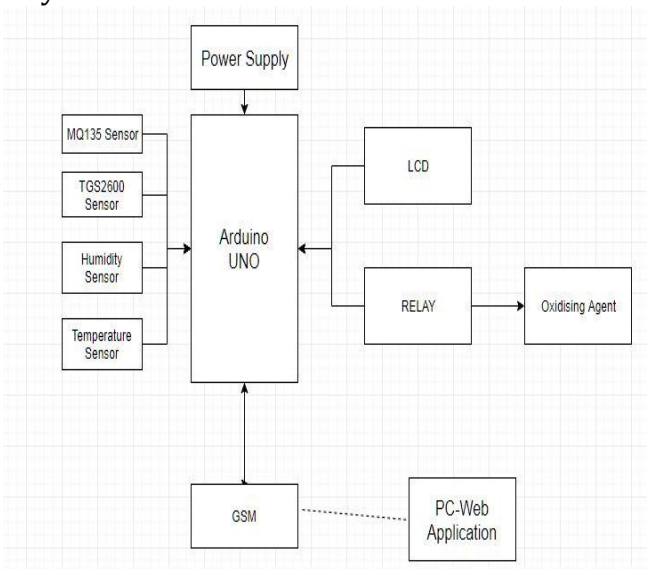
- Monitoring environmental conditions in homes have been inspected in WHO, "Global Environmental Change". A framework is proposed by author to monitor temperature, humidity and light intensity, which is based on a combination of pervasive distributed sensing units, information system for data aggregation, and reasoning and context awareness.
- In "Online Monitoring of Geological CO2 Storage and Leakage Based on Wireless Sensor Networks" a monitoring system is developed which gives the concentration of Carbon-di-oxide of remote area.
- An urban CO2 monitoring system presented by author in "CitySee: Urban CO2 monitoring with sensors". The system operates outdoor at an urban area around 100 square kilometers.

IV OBJECTIVE

The main objective is to establish the familiarization with the state of the art in Human Computer Interface
(HCI
a) To overcome the difficulties of air pollution

b) To eliminate the human error.
c) To analyse the data for future comparisons and analogies.
d) To make the diagnosis result in an easier, faster and accurate way.
e) To provide a device with accurate prediction.

V System Architecture



V WORKING

The working methodology is explained in two different categories

I. One involving the Overall Circuit
II. Other involving the concept of processing and displaying the results in the Web Application.

Circuit-Phase I

We start with connecting the SIM800L GPRS GSM MODULE with the Arduino. SIM800L GPRS GSM MODULE runs on 3.3V and if you will give it 5V from the Arduino then it won't work properly and it may get damage. Connect the VCC and the CH_PD to the 3.3V pin of Arduino. The RX pin of SIM800L GPRS GSM MODULE works on 3.3V and it will not communicate with the Arduino when we will connect it directly to the Arduino. So, we will have to make a voltage divider for it which will convert the 5V into 3.3V. This can be done by connecting three resistors in series like we did in the circuit. Connect the TX pin of the SIM800L GPRS GSM MODULE to the pin 10 of the Arduino and the RX pin of the Sim800L GPRS GSM Module to the pin 9 of Arduino through the resistors. SIM800L GPRS GSM module gives your projects access to SMS or internet (GPRS). It is a very cheap device and makes your projects very powerful. It can communicate with any microcontroller and it is the most leading devices in the IOT platform. Learn more about here. Then we will connect the MQ135 sensor with the Arduino. Connect the VCC and the ground pin of the sensor to the 5V and ground of the Arduino and the Analog pin of sensor to the A0 of the Arduino. Connect a buzzer to the pin 8 of the Arduino which will start to beep when the condition becomes true. The MQ135 sensor can sense NH3, NOx, alcohol, Benzene, smoke, CO2 and some other gases, so it is perfect gas sensor for our Air Quality Monitoring Project. When we will connect it to Arduino then it will sense the gases, and we will get the Pollution level in PPM (parts per million). MQ135 gas sensor gives the output in form of voltage levels and we need to convert it into PPM.

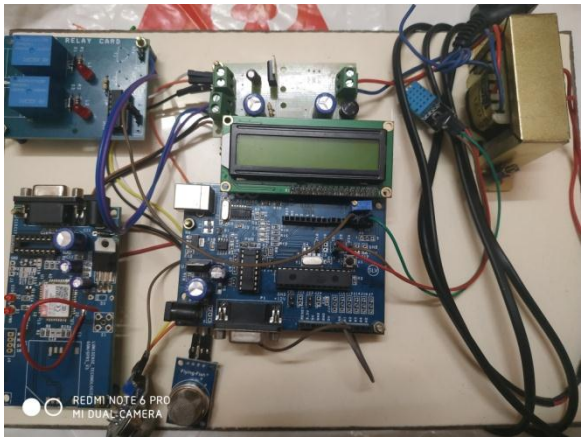


Figure3. Overall Circuit using Arduino and Transformer.

Processing the data-Phase II

a. The data is acquired from the gas sensors, temperature sensor and humidity sensor
b. The acquired data is converted to Voltage.
c. Transmit the data, eliminate noise

Processing

- The transmitted data is displayed in the LED display.
- Using MatLab a python code is written

- **If any of the gas sensor records the voltage level beyond the suffocation level it sends a signal to the relay.**
- It also simultaneously check if the temperature goes high or if the humidity goes high
- The relay is then connected to the Cylinder to which the battery is connected to the positive terminal of the negative terminal of the relay
- If any of the gases' level exceeds beyond a particular level the oxidizing agents sprays to the area until it reduces the pollutant
- It also simultaneously sends an alert message to the particular individual who owns the house "GAS LEVEL HIGH!!"
- The time at which the signals are recorded is also noted
- This is done and checked for every 5 minutes.

IOT Based Air Pollution Monitoring system

S.No	Date	Gas 1	Gas 2
1	2019-03-09 07:45:35	1:g2=2	
2	2019-03-09 07:49:46	1:	2
3	2019-03-09 07:50:12	1	2
4	2019-03-09 09:01:14		
5	2019-03-09 09:52:12	130	0
6	2019-03-09 09:52:48	109	0
7	2019-03-09 09:53:24	95	0
8	2019-03-09 09:54:00	87	0
9	2019-03-09 09:54:36	78	0
10	2019-03-09 10:16:25	90	208
11	2019-03-09 10:17:13	70	0
12	2019-03-09 10:18:01	59	344
13	2019-03-09 10:18:49	54	198
14	2019-03-10 06:29:10	1:g2=2	

Figure4.1 Results displayed based on two gas sensors over a particular time period

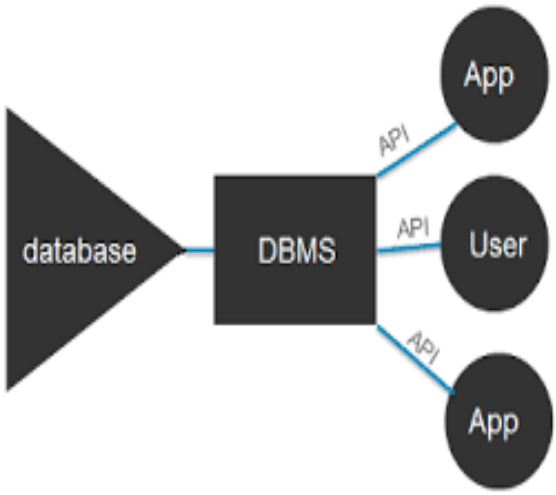
- The above said thing is said to be one of the main motive of this application.

Figure4.2 Message being displayed to the mobile by the means of GSM.

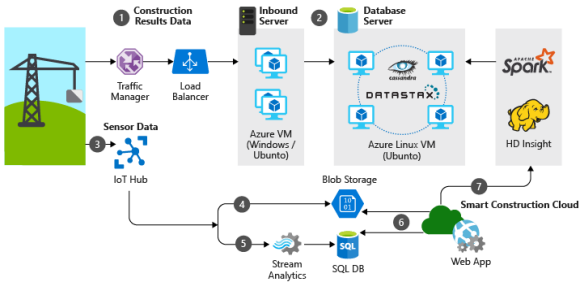
VI CONCEPTS

For this the concepts used in the application development depends on the task we implement:

- EMBEDDED SYSTEMS
- MOBILE COMPUTING
- MATLAB
- ANALOG AND DIGITAL CONCEPTS
- COMPUTER NETWORKING
- MICRCONTROLLERS
- MICROPROCESSORS AND DIGITIZERS



- The concept of advanced Mobile Computing is used in order to process the data over a large quantity
- The compiler and the source code (Lines of code) depends on the type of programming language being used



For making the prediction
Data Acquisition
Classifying parameters
Relating signals obtained with the defined suffocating signals.

For this the following block diagram is used

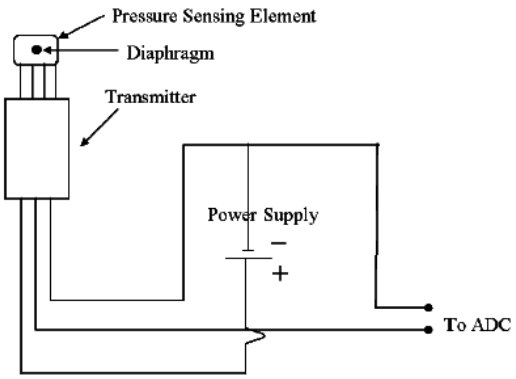


Figure 5. The Electrical line diagram of the sensors used

VII CONCLUSION

The art of science along with the recent advancement in software and communications resulted in developing this DEVICE along with the Mobile Application. It helps us to do this task in a cost efficient manner in order to meet needs of the people. It also produces an accurate prediction, along with it gives out related information. The future direction of this paper is to give out the above details of each and every location using GPS within a particular community.

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