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Real Time Implementation of Air Quality Monitoring System using IoT and Ubidots

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Abstract: ***Nowadays air pollution is main distress for the human being, as it is demeaning the green health and inhale the pollutant air is hazardous for the health of the human being. Because of bad things of the air pollution on the human being, the demand for the improvement of enormous quality air monitoring systems has been in superior demand. The air pollution monitoring system detect the concentration levels of air pollutants and the analysis of the collected information is required for the policymakers to take necessary and proper steps to decrease the level of air pollution for the wellbeing of their citizens. The air pollution monitoring mechanism implemented in this paper is based on Arduino UNO board and IoT platform. The Arduino UNO board interface with Ubidots platform using ESP8266 Wi-Fi Module. Generally in cities Wi-Fi hotspots are available at many locations, so the air pollution monitoring mechanism can be easily set up at any hotspot. Ubidots is one of the smart IoT platforms. Sensor data is displayed in terms of ppm with different levels and different events in IoT device. The detecting of information and deliver it to the Ubidots server through Wi-Fi module is guided by the Arduino Sketch. The Arduino sketch is composed, compiled and supplied to the Arduino board using Arduino IDE.***

Keywords: Arduino IDE, Ubidots, Internet of Things

I. INTRODUCTION

Indoor air quality monitoring system monitors the levels of various harmful gases and pollutants and alerts the user through their smart phones giving notifications and respective preventive measures. This system is based on Arduino board is an open source which sense and control physical devices. The various sensors are attached to board to sense temperature, humidity, dust particles, and many harmful gases including CO2, SO2, NO2, CO, etc. There are so many variety of interior contaminant, the design of an air monitor must be multi-sensory, portable, and within adequate sensitivity. In addition, users must be able to access the server through wireless connection to attain the real time data graphically, and the data can be stored in cloud, the data stored in the cloud can be communicated with several users at any time. The communication between the sensors and the user is in wired mode and LCD display is used to display all the data. By comparing the wired network, with wireless network, wireless connections don't require wiring, and it is not constrained by the limitation of wiring. Generally there are three 2.4GHz short-distance (limited) communication, namely Bluetooth, Zig Bee and Wi-Fi.

The main objective of the proposed work is to design real time indoor air quality mechanism using Ubidots and IoT with less-cost and multiple-sensor. The real time sensor data can be obtained by the users, through Wi-Fi using Laptops, smart phones, and the cloud is used to store all data.

Now in this project named "Real Time Indoor Air Quality Monitoring System Using Arduino Uno" we are going to measure the quality of air using sensors. It consists of three sensors namely gas sensor, VOC (Volatile Organic compound) sensor and dust sensor connected to analog pins of Arduino Uno. The gas and voc sensors measure the air quality in ppm where the air quality in percentage measured by dust sensor. If the air is polluted, alert messages are sent by the GSM module. When the air quality exceeds 2500 ppm and 10% alert messages are send to phone to alert the people saying that air level exceeds. Then people will take certain precautions to be away from air pollution.

The code is written in Arduino Uno IDE software and it is displayed using LCD display. Due to interfacing between Uno and IDE software, when the power supply is switched ON, the Arduino Uno read the code. Then the sensors connected to the Uno will display the result. The air quality levels of the sensors are displayed in 16*2 LCD display.

II. AIR QUALITY MONITORING SYSTEM USING IoT

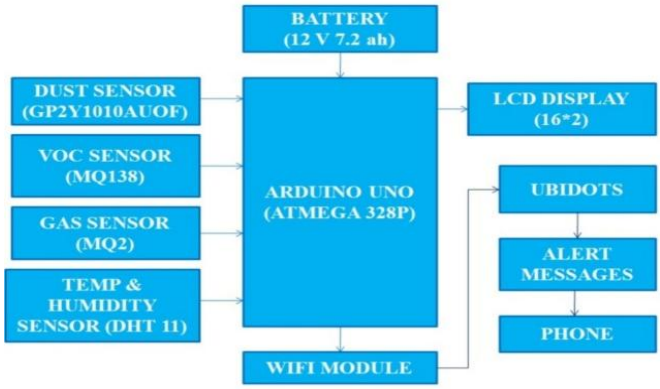

Fig 2.1 Block Diagram of Air Quality Monitoring System Using IoT

REQUIREMENTS:

a) Temperature and Humidity Sensor.
b) Gas and Dust sensor

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c) Wi-fi Module.
d) Ubidots website.
e) Arduio Uno
f) Buzzer

III. RESULTS

Implementation of Air Quality Monitoring System using IoT:

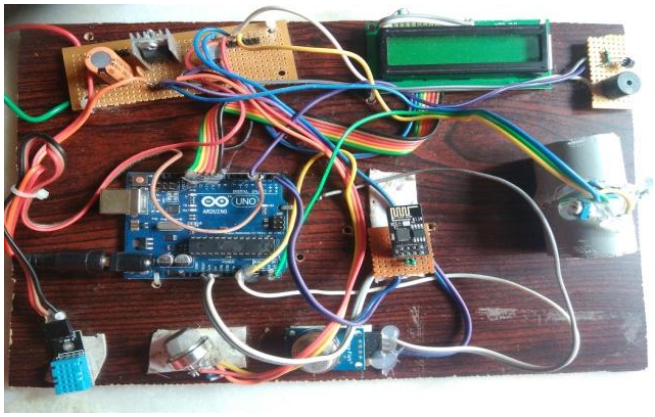

Fig 3.1 Interfacing of Hardware modules using IoT

The above fig 3.1 shows the schematic view of "Real Time Indoor Air Quality Monitoring System Using Arduino Uno" which measures the quality of air using sensors connected to Arduino Uno. This system is implemented using IoT. Temperature and humidity sensor, Wi-Fi module (ESP8266) and buzzer are added to the previous system. GSM module is replaced by Wi-Fi module.

3.1 Outputs of various Sensors using IoT: The standard value of VOC sensor is 150 ppm. Since the value obtained is 58 ppm hence VOC value is normal. If the temperature is less than 35℃, the temperature at that place is normal. If the dust value is greater than 50 the buzzer rings. But the dust value is 20 and hence the surrounding is clear without dust particles.

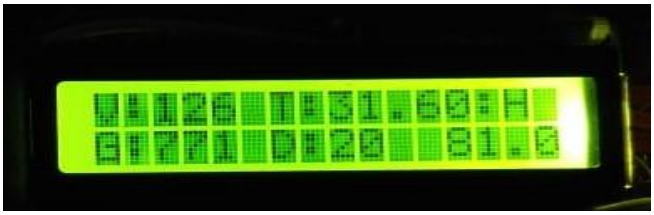

Fig 3.2 Standard values of Gas and Humidity sensors before Lab session

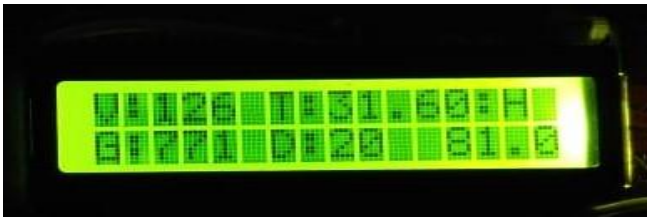

Fig 3.3 Standard values of Gas and Humidity sensors before Lab session

The standard value of gases in air is about 500 ppm. Since the project is going to be implemented in chemistry lab the gases conceding in that lab are more. Hence the value of gases present in air is about 771 ppm. The humidity value ranges from 50 to 90. Hence the value obtained is normal i.e 81 RH.

Fig 3.4 Standard values of sensors during Lab

The value of all sensors has been increased during lab. It is important to note that gas sensor value has been increased highly due to more release of gases that are obtained when the experiments are going in the lab. So the proposed model is helpful to implement in real time applications and take certain precautions to increase the quality of air.

The standard level of Temp and Humidity sensor is 30℃. The value of sensor in the LCD Display is 40.60℃. Since the temperature in the air exceeds the standards it sends an alert message to phone through Wi-Fi module. So we should take certain precautions to keep the room cool.

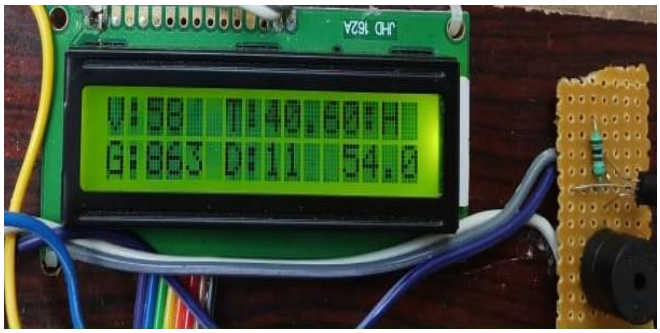

Fig 3.5 Exceeded level of Temp & Humidity sensor in air

Table -I: Comparison of Theoretical and Practical values using IoT

Air Quality Monitoring System Using IoT		
Sensor	**Theoretical Value**	**Practical Value**
VOC	1024 PPM	68 PPM
GAS	1024 PPM	824 PPM
DUST	100%	19%
Temperature	0-50℃	32.5℃
Humidity	20-90 RH	88

IV. IMPLEMENTATION OF AIR QUALITY MONITORING SYSTEM USING UBIDOTS

The Ubidots is most trendy IoT platform, and it is easy to program and easy to use. To display the sensor data in terms of meters with different levels, Monitoring IoT device creates different events.
The Wi-Fi module is used for data sensing and transfer it to the Ubidots server and this is monitored by the Arduino Sketch.

4.1 Simulation results for VOC Sensor using Ubidot:

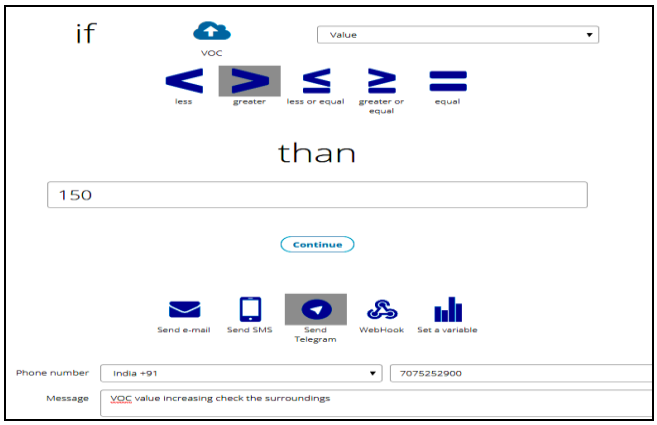

Fig 4.1.1 Simulation result, if VOC value is >150

The Simulation result shown in fig 4.1.1, represents that if VOC value is greater than 150 then alert message send is "VOC value increasing check the surroundings".

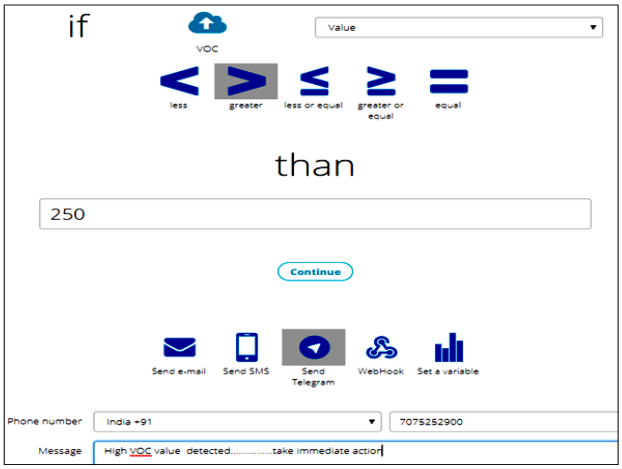

Fig 4.1.2 Simulation result if VOC value is >250

The Simulation result shown in fig 4.1.2, represents that if VOC value is greater than 250 then alert message send is "High VOC value detected .....take immediate action".

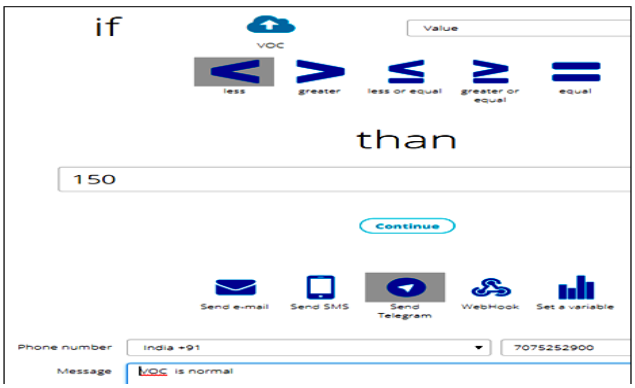

Fig 4.1.3 Simulation result if VOC value is <150

The Simulation result shown in fig 4.1.3, represents that if VOC value is less than 150 then alert message send is "VOC is normal".

4.2 Simulation results for Gas Sensor using Ubidot:

The Simulation result shown in fig 4.2.1, represents that if Gas value is less than 500 then alert message send is "Gas sensor value is normal".

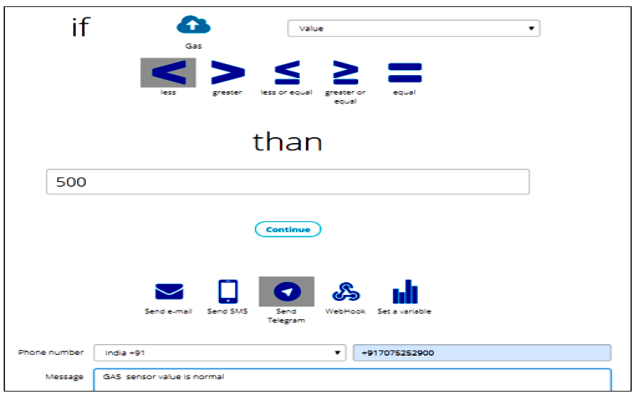

Fig 4.2.1 Simulation result if Gas value is <500

The Simulation result shown in fig 4.2.2, represents that if Gas value is greater than 700 then alert message send is "Gas sensor value is increasing.....check the surroundings".

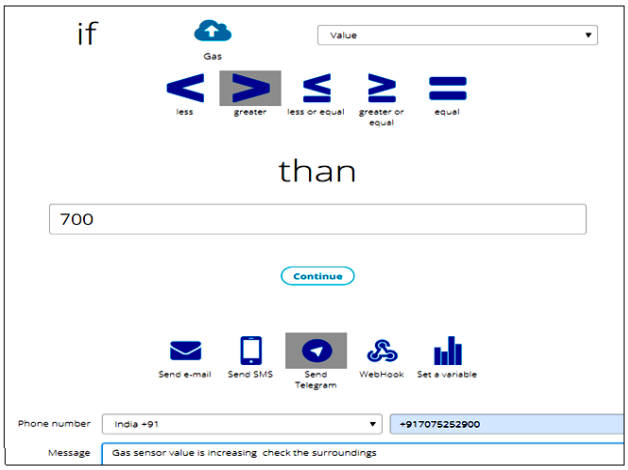

Fig 4.2.2 Simulation result if Gas value is >700

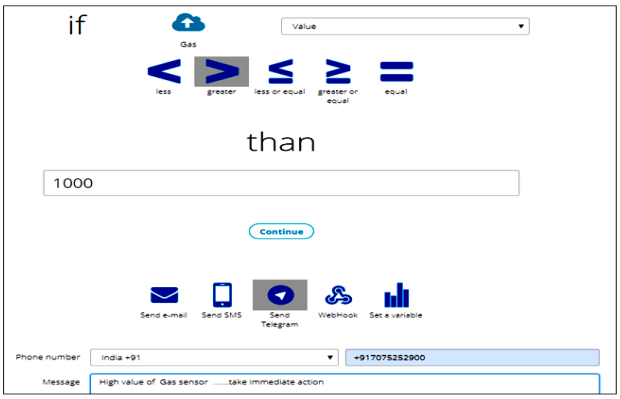

Fig 4.2.3 Simulation result if Gas value is > 1000

The Simulation result shown in fig 4.2.3, represents that if Gas value is greater than 1000 then alert message send is "High value of Gas sensor.....take immediate action".

4.3 Simulation results for Dust Sensor using Ubidot:

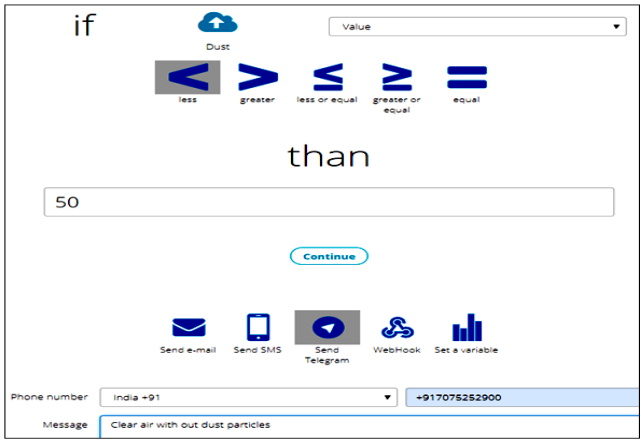

Fig 4.3.1 Simulation result if dust value is < 50

The Simulation result shown in fig 4.3.1, represents that if dust value is less than 50 then alert message send is "Clear air without dust particles".

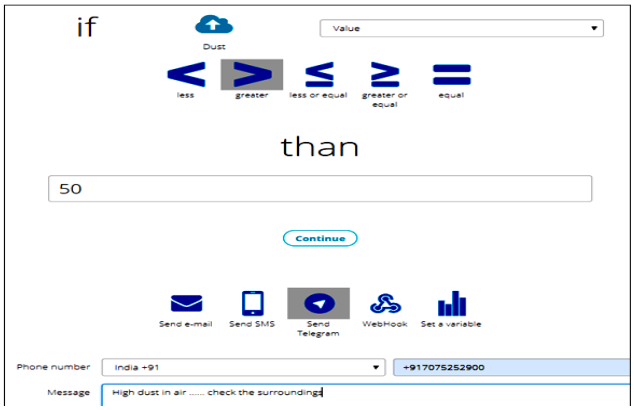

Fig 4.3.2 Simulation result if dust value is >50

The Simulation result shown in fig 4.3.2, represents that if Gas value is greater than 50 then alert message send is "High dust in air.....check the surroundings".

4.4 Simulation results for Temperature Sensor:

The Simulation result shown in fig 4.4.1, represents that if temperature value is less than 20 then alert message send is "Temperature is decreasing!!!!!!".

The Simulation result shown in fig 4.4.2, represents that if temperature value is less than or equal to 30 then alert message send is "Room temperature is normal".

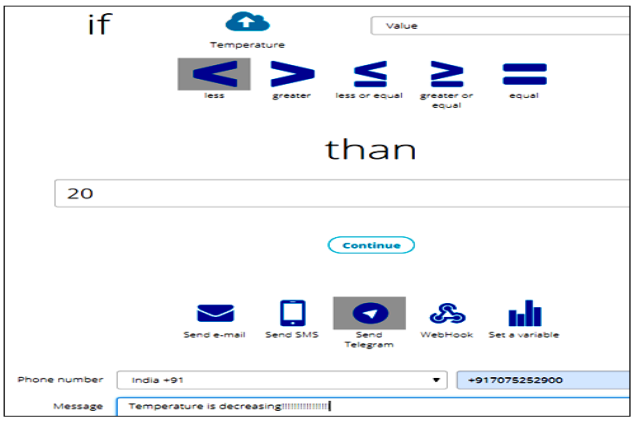

Fig 4.4.1 Simulation result if temperature value is <20

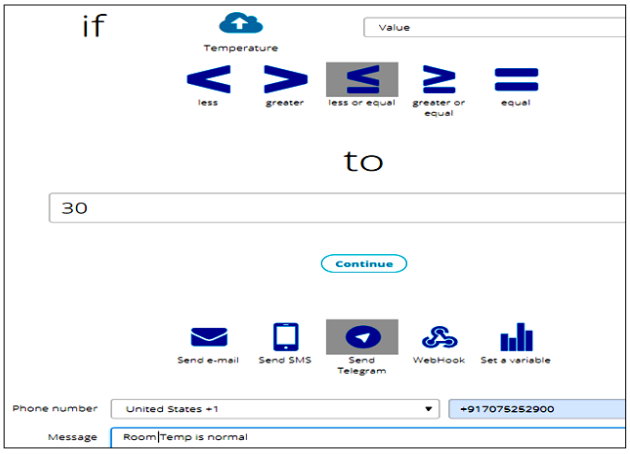

Fig 4.4.2 Simulation result if temp value is ≤30

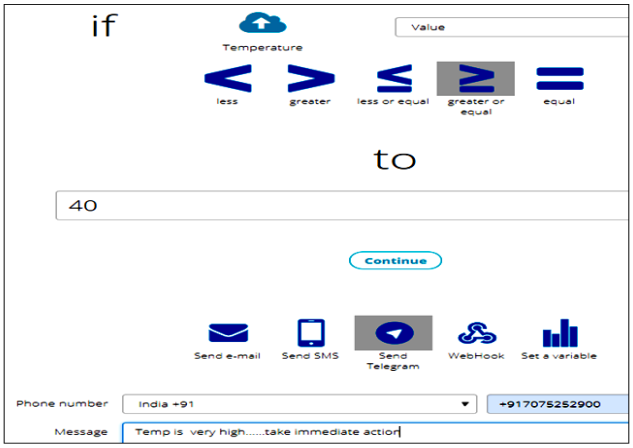

Fig 4.4.3 Simulation result if temp value is ≥40

The Simulation result shown in fig 4.4.3, represents that if temperature value is greater than or equal to 40 then alert message send is "Temp is very high.....take immediate action".

4.5 Simulation results for Humidity Sensor:

The Simulation result shown in fig 4.5.1, if humidity value is less than 50 then alert message send is "Humidity is low".

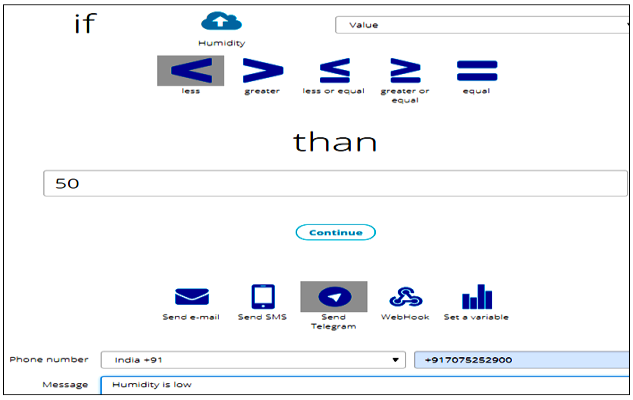

Fig 4.5.1 Simulation result if humidity value is <50

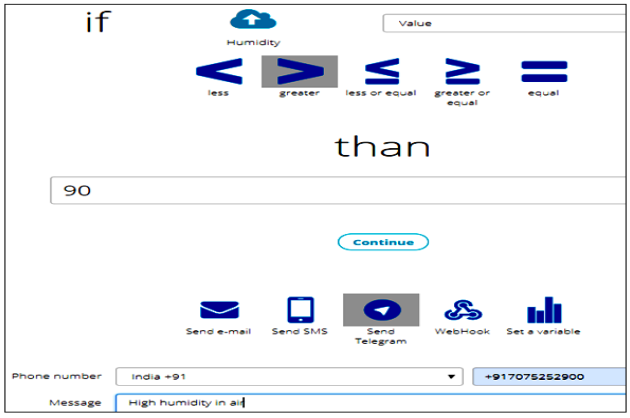

Fig 4.5.2 Simulation result if humidity value is >90

The Simulation result shown in fig 4.5.2, if humidity value is greater than 90 then alert message send is "High humidity in air".

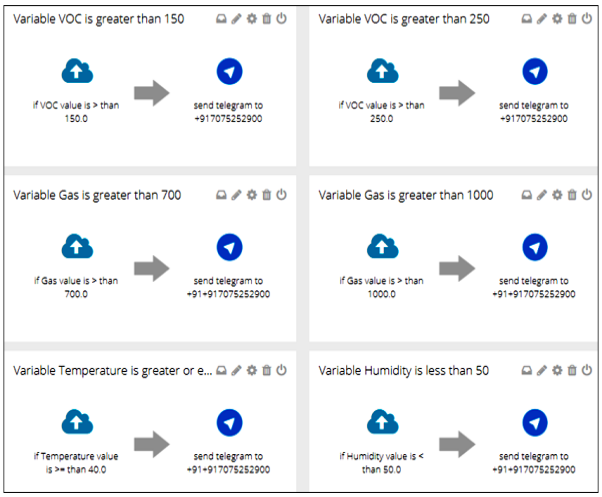

Fig 4.5.3 over view of simulation result

The alert messages are sent to the mobile based on the outputs obtained in ubidots. If the practical values obtained in chemistry lab are greater than predefined values, then the alert messages are sent to the mobile. The fig 4.5.6 shown below represents the alert messages.

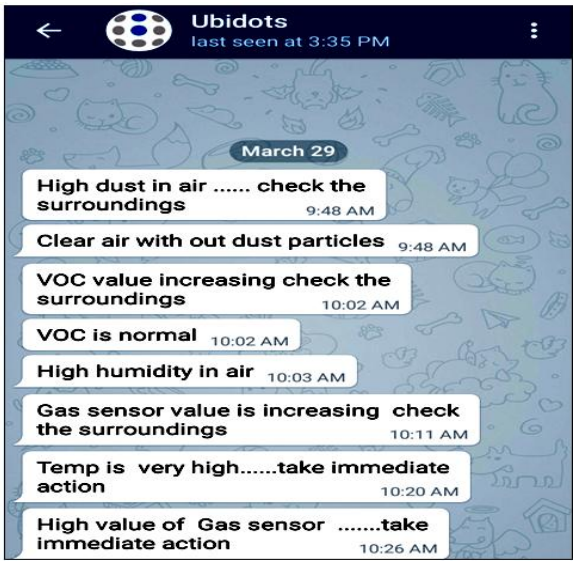

Fig 4.5.6 Alert messages sent to phone

V. CONCLUSION

Since the paper is implemented using IoT the alert messages are sent to phone using Wi-Fi module. One of the easy to program and easy to use software is Ubidots, it is the best smart IoT platform. GSM module is used to send the notifications and alert messages to user mobile phone, when the typical levels are over reach. When the typical values are over reached, necessary action to be taken against real time indoor air conditions. To increase the lifetime of human and live a better life, new system was implemented that is "Real Time Indoor Air Quality Monitoring System Using IoT and Ubidots". In the proposed method several sensors (Temperature, VOC, Humidity, Gas) are used to detect harmful gases available in air. Experimental results shown that, the proposed system can measure the presence of various pollutants and gases available in the air with acceptable sensitivity.

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