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IOT Based Atmosphere Monitoring of Confined Space

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Abstract: ***Infrastructural Development and urbanization has led to high living standards and luxurious lifestyles. Smart homes and workspaces with automated technologies are found in all urban areas. The key aspect with all the above noted points have also led to increase in population in urban areas as well as the dynamic degradation in air quality due to increased air pollution. There are many aspects that contribute to air pollution such as increased vehicular traffic density, excessive burning of garbage, industrial air pollution etc. This paper presents a novel approach to monitor air quality in confined spaces which can help to monitor the air quality as well as alert the users in case of LPG gas leakages. Another important parameter that affects the human health is the presence of dust which if exceeds above a certain level can cause repeated allergies and flu to people. The main aim of this proposed model is to monitor the air quality of any confined space from any part of the world with authentic access mechanism. It can be used in homes, offices, small scale industries to keep the health and safety of workers in mind. As this system is IOT enabled it helps to monitor the data and also analyze it graphically on Thingspeak platform***
Keywords: Air quality monitoring, CO, LPG.

I. INTRODUCTION

Over the years world has seen a striking level of increased air pollution and it has also led to severe health impacts on humans. There have been many innovations to overcome this problem like development of air purifiers etc. There are two ways to monitor the air quality, it can be outdoor air quality monitoring or monitoring of air quality of confined spaces. Depending upon the type of monitoring needed, the system design shall change due to change in parameters, as outdoor air is more polluted than the air in confined spaces.

The proposed work is a novel approach to monitor the air quality in confined spaces where mainly overall air quality has to be monitored as well as levels of carbon monoxide is monitored. Generally confined spaces can be homes, schools, colleges, workplaces or small scale industries hence there might be a chance of leakage of LPG gas through kitchens which can be a cause of major accidents, to avoid this an LPG gas sensor is also used in this model.

Particulate dust matter is an important growing concern for humans as these are very small particles but long term exposure to these dust particles can cause severe allergic problems or respiratory diseases to humans hence a dust sensor is also used to detect the dust particles above a threshold. Generally the available data can be displayed using LCD display but to access this data remotely, some communication technology shall be needed.

There are many technologies such as use of Bluetooth, GSM, IOT but amongst them best suited for use is IOT as it helps to display data over any mobile or computer device through internet with authentic user access. Bluetooth based air quality monitoring systems face a major drawback in terms of range over which they can transmit data. Arduino based air quality monitoring system requires an additional Bluetooth module for system communication [3].

GSM based air quality system monitoring system requires a GSM modem at transmitter side and the readings can be received at timely basis or whenever readings are requested using keywords from user. This faces a drawback that all the information is sent and received in SMS which is text format and hence it is difficult for overall air quality analysis [4]. Air quality or any other quality parameter is best perceived and understood through graphical formats.

Internet of things has seen a widespread among users due to the availability of internet even at remote areas. IOT has given rise to a lot of third party applications and websites which provides a platform for displaying data on a personalized access dashboards or domains as well as channels o display data that can be shared for monitoring purposes. In this novel approach we have used IOT's third party platform Thingspeak as a display section in which the data is presented in graphical forma. This data can be accessed wither from mobiles or PC's. This system will prove very useful to remotely monitor the homes and offices even for gas leakage detection or alert systems.

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II. METHODOLOGY

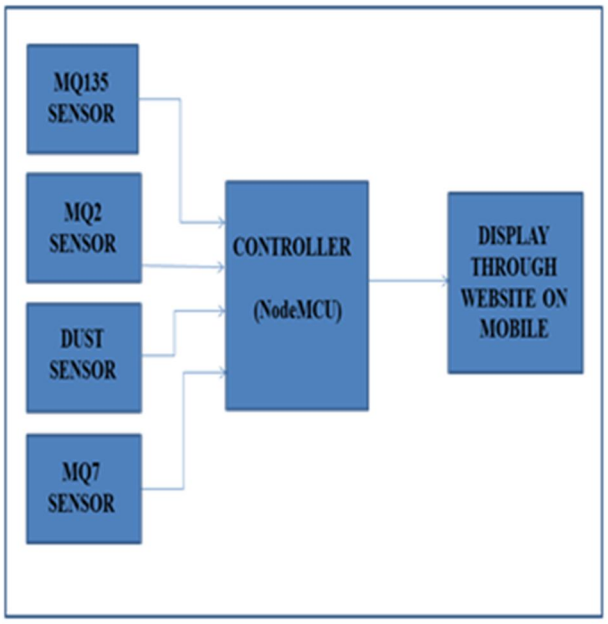


Fig i. block diagram of Air quality monitoring system

The above figure shows the basic block diagram of the proposed system. It has a controller which has builtin wifi module called the NodeMCU (Node microcontroller). It has one analog pin but as there is a requirement of three analog inputs, a multiplexer is used to take the three inputs. Dust sensor provides digital output that is in terms of presence or absence of dust. Carbon monoxide sensor (MQ7 sensor) detects the presence of CO gas in atmosphere and displays the data over the website. Presence of CO gas in exceeding levels can be harmful for human health hence if high levels are detected then corrective actions can be taken accordingly. Air quality in different areas varies to a great extent like pollution levels in Delhi, India has already crossed high level air quality danger marks many a times hence a particular set value over which a user should be alerted is of no use rather a continuous display can help to check for increase or decrease in air quality over a period of time. The NodeMCU is programmed using Arduino IDE and to protect the system from illegal access, an SSID and password is set in programming, only with that the device shall be able to connect with Internet.

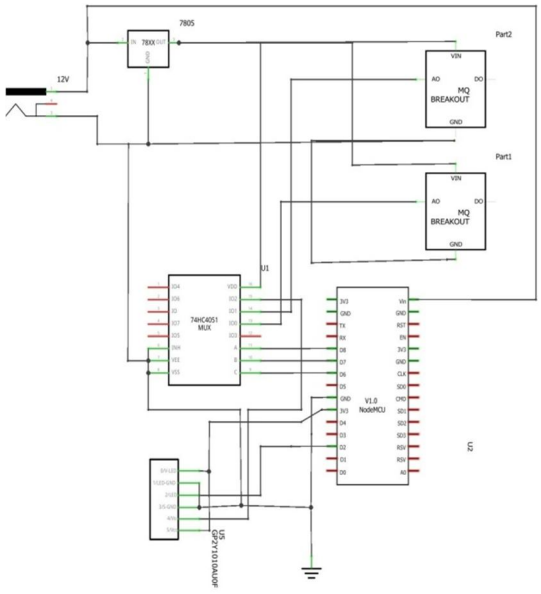


Fig ii Schematic diagram of proposed system

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A. Components Used in Implemented Design

1) NodeMCU (Node Microcontroller): It is a controller with high functioning capacity and specifically used for input output and control applications which deal with internet connectivity for displaying data. It supports different styles of programming. In this project we have preferred Arduino IDE to program it. Thingspeak is used for displaying data and GUI design which will help to monitor the air quality.



Fig iii: NodeMCU

2) MQ7 sensor

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Fig iv: MQ7 sensor

MQ7 sensor is used to detect the carbon monoxide levels in air. It provides the data output in analog form. This data is then read by the controller and scaled to provide relevant output which can be plotted graphically through Thingspeak tool.

3) MQ135 Sensor: It is used to monitor overall air quality of the confined space. The MQ135 sensor helps to monitor the air quality as a whole because air is a mixture of gases, all gases should be present in some amount hence overall air quality plays a vital role in analyzing air quality of the confined space in an efficient way.

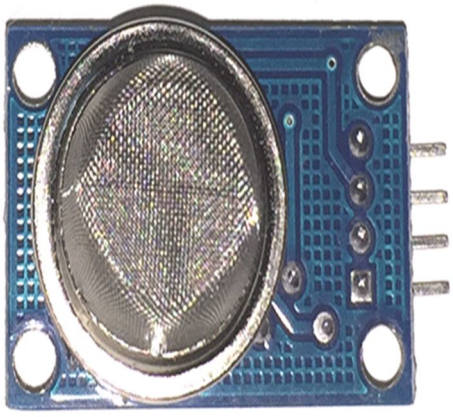


Fig v. *MQ135 sensor*

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4) *MQ2 Sensor:* There are many common cases of major fire outbreaks due to LPG gas leakages either when office pantries are closed or during night hours at home when people are asleep. To avoid these major losses there is a provision of gas leakage detection and alert mechanism using MQ2 sensor. It provides data output in analog form. This data is fed to the controller and through it is sent to the Thingspeak platform for display.



Fig v: MQ2 sensor

5) *Dust Sensor:* GP2Y1010AU0F is an optical air quality sensor it is designed to sense dust particles. It is especially effective in detecting very fine particles like cigarette smoke, and is commonly used in air purifier systems. It provides output in digital format.



Fig vi: Dust sensor

6) *Thingspeak Platform:* It is a third party service provider for communicating with devices through IOT. It requires a user to create a login id and password which will help to authenticate the users and also avoid illegal access to the monitoring data.

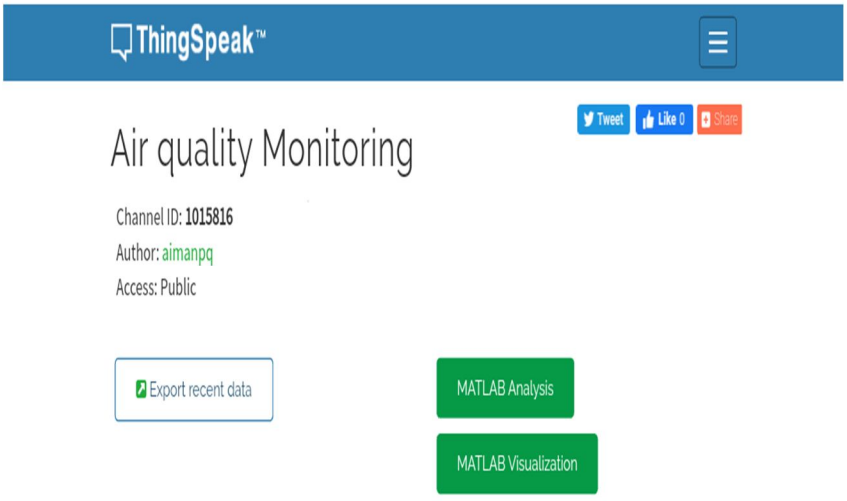


Fig vii: Thingspeak system dashboard

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7) Flowchart

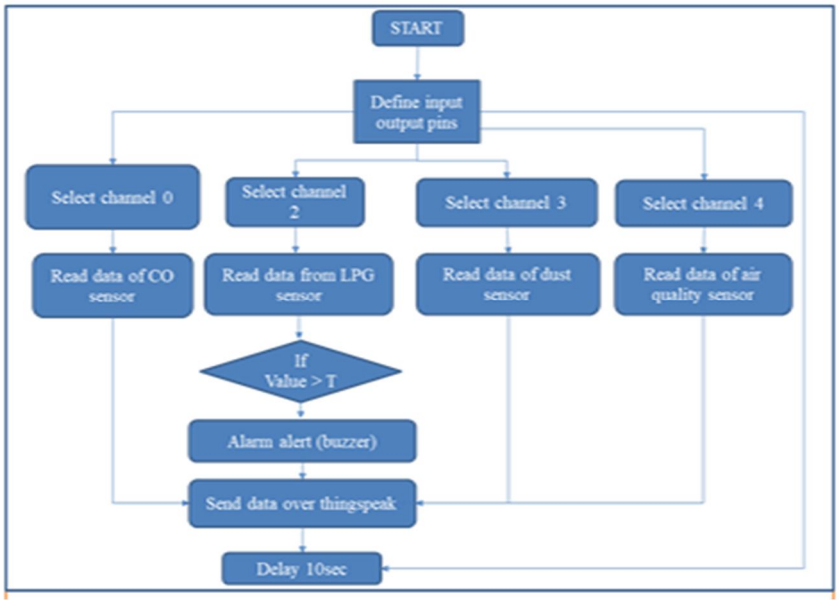


Fig viii: flowchart

8) Working: Initially system is turned on and all the sensors provide data to the controller, specific channels are allotted for displaying data of different sensors. If LPG gas is detected, then the users is alerted else continuous monitoring of data is done and till the system is kept switched on all the data is displayed over the website and display is graphical in format hence easy to analyze and understand as well.



Fig ix: Output display

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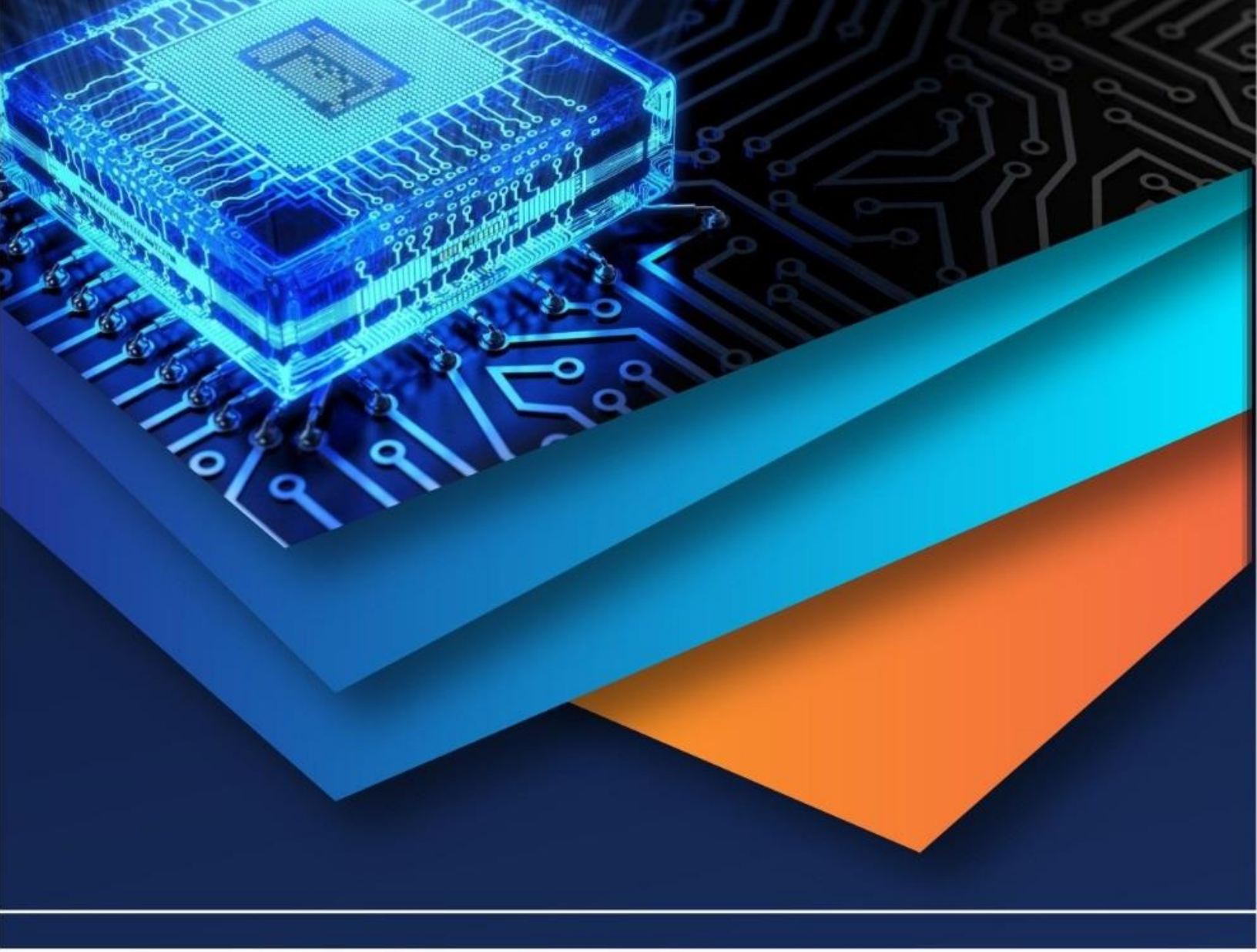
III. RESULTS AND CONCLUSION

An efficient air quality monitoring system has been proposed which can be used to monitor the overall air quality of a confined space over IOT. We would like to express our heartfelt gratitude to our guide for helping us time to time with the new technological skills needed in designing this system.

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