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# Toxic Gas Detection and Monitoring Using IOT

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**ABSTRACT:** A Today safety of toxic gas is a major challenge. toxic gases health and life is vulnerable to several critical issues, which includes not only the working environment, but also the after effect of it. Mining activities release harmful and toxic gas in turn exposing the associated workers into the danger of survival. This puts a lot of pressure on the mining industry. To increase productivity and reduce the cost of mining along with consideration of the safety of workers, an innovative approach is required. toxic gas's health is in danger mainly because of the toxic gas which are very often released in underground toxic gas. These gas cannot be detected easily by human senses. This thesis investigates the presence of toxic gas in critical regions and their effects on toxic gas. A real time monitoring system using wireless sensor networks, which includes multiple sensors, is developed. This system monitors surrounding environmental parameters such as temperature, humidity and multiple toxic gas. This system also provides an early warning, which will be helpful to all toxic gas present inside the toxic gas to save their life before any casualty occurs. The system uses Wi-Fi technology to establish a wireless sensor network.

## I. INTRODUCTION

Underground mining operations proves to be a risky venture as far as the safety and health of workers are concerned. These risks are due to different techniques used for extracting different toxic gas. The deeper the toxic gas, the greater is the risk. These safety issues are of grave concern especially in case of coal industries. Thus, safety of workers should always be of major consideration in any form of mining, whether it is coal or any other toxic gas. Underground coal mining involves a higher risk than open pit mining due to the problems of ventilation and potential for collapse. However, the utilization of heavy machinery and the methods performed during excavations result into safety risks in all types of mining. Modern toxic gas often implement several safety procedures, education and training for workers, health and safety standards, which lead to substantial changes and improvements and safety level both in opencast and underground mining. Coal has always been the primary resource of energy in India, which has significantly contributed to the rapid industrial development of the country. About 70% of the power generation is dependent on it thus, the importance of coal in energy sector is indispensable. But the production brings with it the other by products, which proves to be a potential threat to the environment and the people associated with it. In lieu of that the present work is a sincere attempt in analyzing the graveness and designing a real time monitoring system of detection by using the Wi-Fi technology.

## II. LITERATURE REVIEW

Yu et al. (2005) proposed a real-time forest fire detection system based on wireless sensor network. The system collects the data and processes it in the WSN for detecting the forest fire. They designed the monitoring and detecting sensor networks using neural network.

Joseph et al. (2007) focused on the problems and hazards of fire in libraries or archives and described the necessary preventive steps to be adopted. They identified the diverse parts which are applied for fire detection and alert system and also provided necessary strategies for the selection and installation of an ideal fire alarm system.

Fischer (2007) considered the simulation technique and applied this technique to design a fire detection system. This system detects the fire as well as differentiates fire and non-fire spot to decrease the false alarm rate in the non-fire event.

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Tan et al. (2007) designed a system, which is applied for toxic gas safety monitoring. They called the system WSN based toxic gas Safety System. This system is capable of real time monitoring of the toxic gas environment and provide the pre-warning for the fire or explosion.

NiuXiaoguang et al. (2007) presented a distributed heterogeneous hierarchal toxic gas safety monitoring prototype system (HHMSM) which is based on features of the underground toxic gas gallery and necessities of toxic gas safety. This system monitors the methane concentration and the location of toxic gas. They proposed an overhearing-based adaptive data collecting system, which makes use of the redundancy and the correlation of the sampling readings in both time and space to ease the traffic and control.

He Hong Jiang et al. (2008) designed a system using low power ARM (Advanced RISC Machines) processor chip S3C2410 as the control of core and Wi-Fi as a communication platform of WSN. This system composed of network mode, communication network of CAN BUS as well as monitoring sensors.

Zheng Sun et al. (2008) analyzed the problems of toxic gas safety monitoring and an improved Tiny OS Beaconing-based WSN. This protocol can not only aware Energy and repair route automatically, but also can prevent the number of child nodes and that of system levels. The features are small routing Table, high stabilization, high self-repairing and long lifetime. It may be suitable for coal toxic gas data acquisition and applied to toxic gas safety monitoring.

## III. EXISTING SYSTEM

- IOT- based system for toxic gas detection use sensors to detect harmful gases like carbon monoxide or methane.
- These system send real time data wirelessly to the central hub or the cloud for monitoring and analysis. If the gas levels are to high, alerts are triggered, usually via SMS, email, or app notification.
- The benefits include remote monitoring, instant alerts, and easy scalability, while challengers involve ensuring sensor accuracy, maintaining security, and managing battery life for wireless sensors.

## IV.DISADVANTAGES

- Security Vulnerabilities : IOT-based toxic gas detection system can be susceptible to cyber attack or unauthorized access. Hackers can potentially manipulate sensors reading, disable devices, or gain unauthorized access to sensitive information.
- Reliability and connectivity issues : IOT device rely heavily on stable network connections in a environments where connectivity these weak or intermittent, such as remote or industrial areas, sensor data may not be transferred in real time, reading to delays in detection and response.

## V. PROPOSED SYSTEM

The system will consist of various gas sensors capable of detecting harmful gases such as carbon monoxide (CO), methane (CH4), hydrogen sulfide (H2S), etc. These sensors will be strategically deployed in the target area for comprehensive coverage. The sensors will be interfaced with a microcontroller or a single-board computer equipped with IoT capabilities, such as a Raspberry Pi or an Arduino with a Wi-Fi or GSM module. This setup will enable real-time data collection from the sensors. Additionally, the system will be designed to trigger alerts or alarms in the event of gas detection beyond safe levels. Furthermore, the collected data will be transmitted to a centralized server or cloud platform using wireless communication protocols such as Wi-Fi, Bluetooth, or LoRaWAN. This will allow remote monitoring of gas levels from anywhere with internet connectivity.

To enhance user accessibility and visualization of the data, a web-based or mobile application interface will be developed. This interface will provide users with real-time updates on gas levels, historical data analysis, and customizable alert settings.Overall, the proposed system will provide an effective and efficient solution for toxic gas detection and monitoring, enabling timely responses to mitigate potential risks and ensure safety in various environments.

## VI. ADVANTAGES OF PROPOSED SYSTEM

- Enhanced Safety: Proactively detects potential explosion risks, reducing the likelihood of injuries or fatalities.

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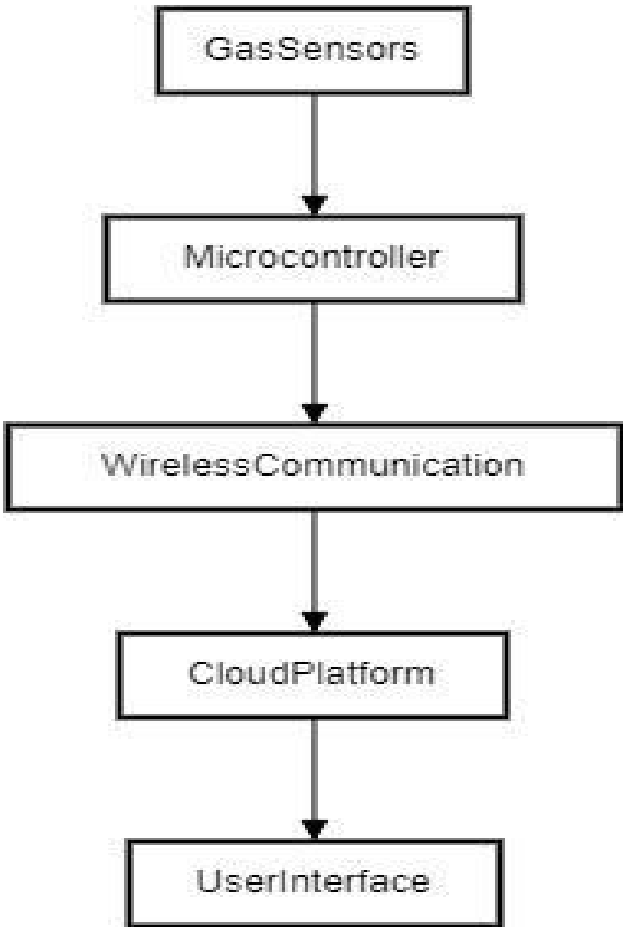
- Real-time Monitoring: Provides up-to-date information on potential hazards, enabling timely responses to changing conditions.
- Automation and Efficiency: Reduces reliance on manual inspection, increasing operational efficiency through sensor technology and machine learning algorithms.
- Predictive Capabilities: Learns from historical data to identify patterns and trends associated with explosion risks, allowing for early identification of potential hazards.
- Customizable Alerts: Tailored warning system with various delivery channels (visual, auditory, electronic) to suit specific facility needs.

**BLOCK DIAGRAM:**




## VII. COMPONENTS

ARDUINO UNO: The Arduino Uno is a small computer that you can program to control electronic circuits. It's popular because it's easy to use and versatile, making it great for hobbyists and professionals to build all sorts of projects.

WIFI INTERFACING BOARD: Wi-Fi (Xbee) USB Interfacing Board is used to interface Xbee wireless module with computer systems. This Board is used to connect Wi-Fi modules to make communication between PC to PC or laptop, PC to Mechanical Assembly or robot, PC to embedded and microcontroller based Circuits.

GAS SENSOR: MQ series sensors(MQ-2,MQ-3,MQ-8) for detecting specific toxic gases such as CO,CO2,H2, Methane and alcohol.

TRANSFORMER: Transformer is a passive component that transfers electrical energy from one electrical circuit to another circuit, or multiple circuits.

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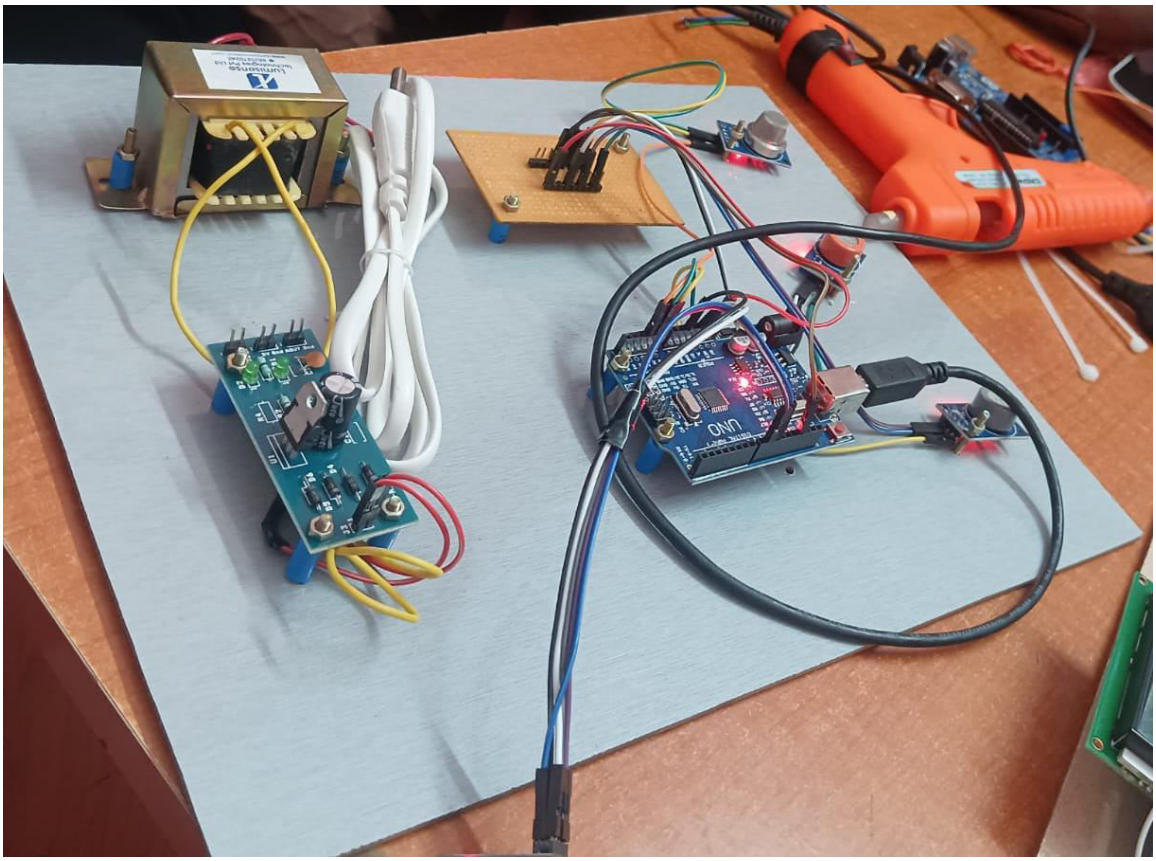

**PHOTOGRAPH OF MACHINE:**

## VIII. CONCLUSION

The study on real time monitoring of toxic gas and other parameters present in underground toxic gas has analyzed using wireless sensor network. A real time monitoring system is developed to provide clearer and more point to point perspective of the underground toxic gas. This system is displaying the parameters on the LCD at the underground section where sensor unit is installed as well as on the monitoring unit; it will be helpful to all toxic gases present inside the toxic gas to save their life before any casualty occurs. Alarm triggers when sensor values crosses the threshold level. This system also stores all the data in the computer for future inspection. From the experiments and observations, the following conclusion can be drawn:

- Each node in a particular framework functions as the pioneer robot when all its parameters are configured properly.
- Sensor nodes can reconfigure remotely over a wireless network and most of the processing done in software on computer side.
- The calibration equations of gas sensors may have affected the accuracy of the ppm results.
- This is a low cost and lifelong system. The overall cost of this system is around 320-380 $ when using 2 sensor nodes and 250$ extra for each additional sensor node.

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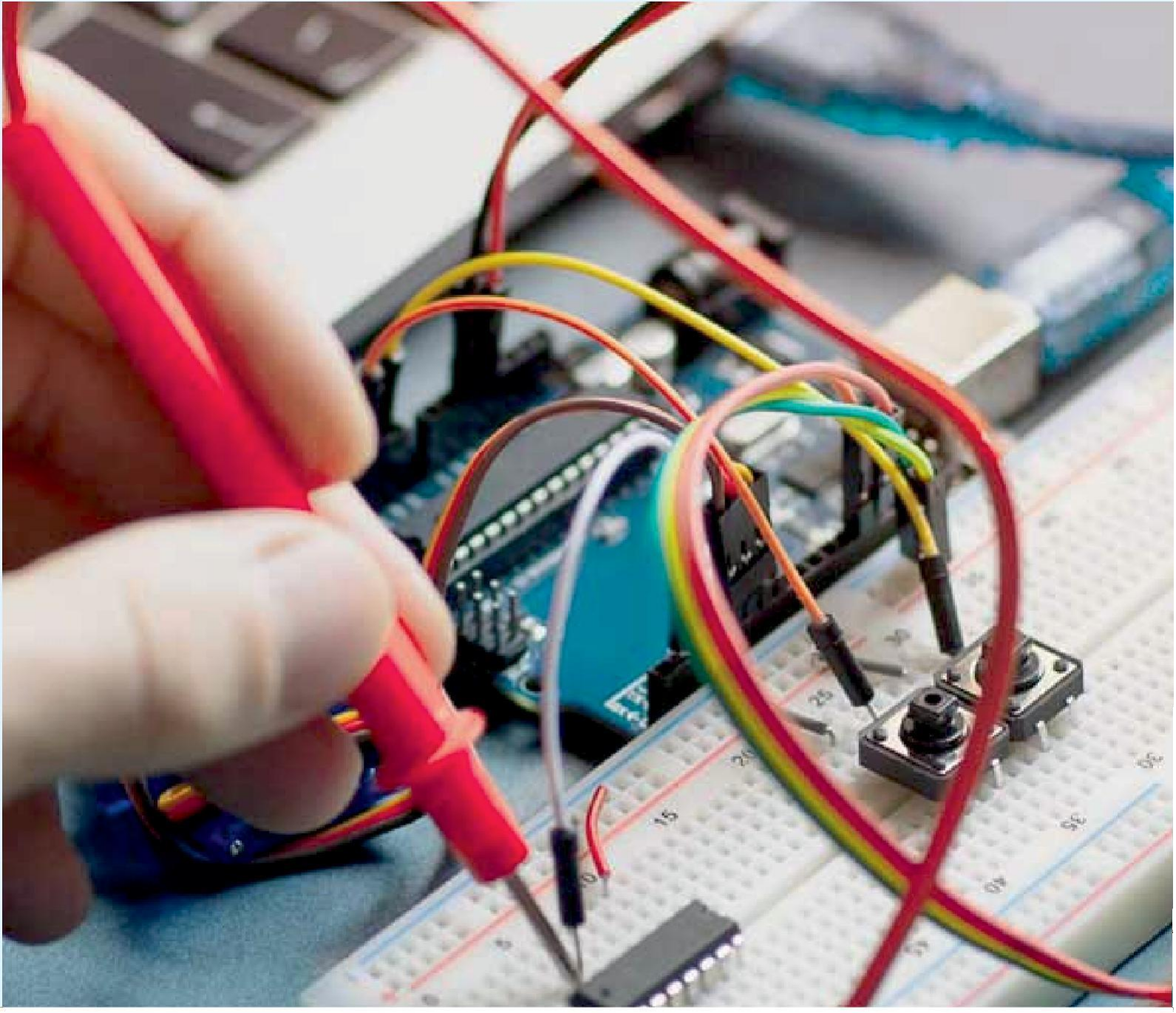

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