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"IOT based system for coal miners safety and health Monitoring"

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Abstract: A smart helmet has been developed that is able to detect of hazardous events in the mines industry. In the development of helmet, we have considered the three main types of hazards such as air quality, helmet removal, and collision. The first is the concentration level of the hazardous gases such as CO, SO2, NO2, and particulate matter. The second hazardous event was classified as a miner removing the mining helmet off their head. IR sensor was then used to successfully determine when the helmet is on the miner's head. The third hazardous event is defined as an event where miners are struck by an object against the head with a force. An accelerometer was used to measure the acceleration of the head and the HIC was calculated in software. Tests were successfully done to calibrate the accelerometer. The experimental prototype consists of three sensors namely gas, infra-red and proximity sensor for their usage and the sensor data are monitored in pc via Node MCU transceiver unit.

Keywords: Arduino Uno, DTH Sensor, Gas Sensor etc.

I. INTRODUCTION

Accidents can happen in any line of work for various reasons, including carelessness or unfortunate circumstances. In the mining industry, the consequences of accidents can be extremely high, leading to loss of life, property damage, and disruption. Alerting miners in underground mines is challenging due to the dark and noisy working conditions. Traditional warning systems such as alarms, speakers, vibrations, or LED devices may not be effective as miners might not be able to hear or notice them.

Human error is a significant factor in mining incidents, and preventing such errors can greatly improve workplace safety. Miners face numerous hazards, including inadequate ventilation, flooding, explosions, collapses, haulage accidents, inrushes, inundations, spontaneous combustion, and insufficient evacuation routes. Unfortunately, there is no foolproof solution to predict and prevent these hazards before they occur.

To address these challenges, a wearable device with integrated sensors can be developed. This device would monitor a worker's physical health and the surrounding conditions, providing real-time data to managers for continuous monitoring and supervision. Additionally, an internet-based application can be created to allow administrators to access and analyze the collected data for better decision-making and proactive safety measures.

II. METHDOLOGY

I. *Block diagram*:

The Arduino Integrated Development atmosphere - or Arduino computer code (IDE) - contains a text editor for writing code, a message space, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to transfer programs and communicate with them. Programs written victimization Arduino computer code (IDE) area unit area unit. These sketches area unit written within the text editor and area unit saved with the file extension .ino.

The editor has options for cutting/pasting and for searching/replacing text. The message space provides feedback whereas saving and commerce and conjointly displays errors. The console displays text output by the Arduino computer code (IDE), including complete error messages and other information. The bottom righthand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

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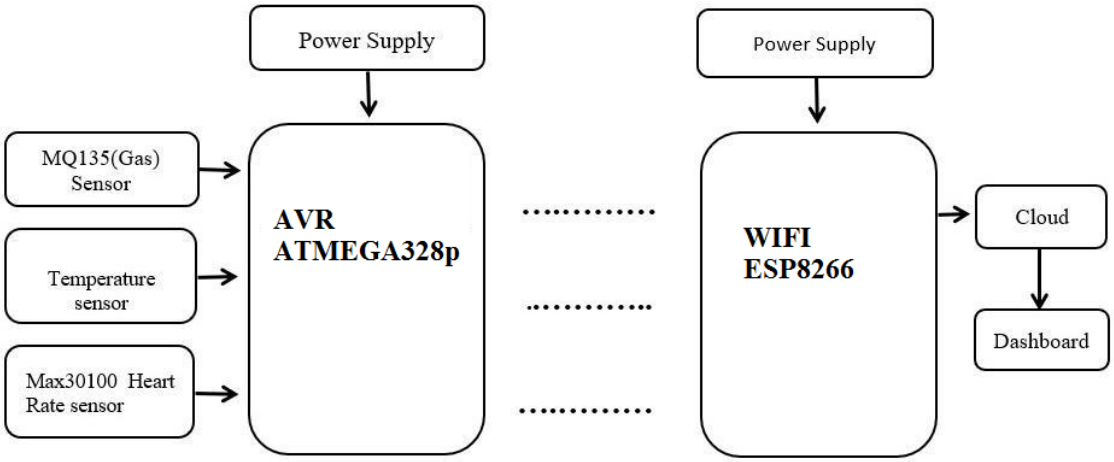

Fig. I. System Block diagram

The process begins with the collection of data by sensors, which captures information about the environment and worker conditions. This data is then transmitted to a development kit comprising an ESP8266 microcontroller, a IOT module for long-range wireless communication, and an LCD display. Utilizing the ESP8266 and AVR module, the development kit sends the collected data to a distant receiver node. The receiver kit, consisting of an ESP8266, AVR module, and lcd display, receives the transmitted data and forwards it to the cloud for further processing and analysis.Incorporating an alert system, the cloud integrates the received data and presents it on a dashboard for visualization. If any sensor value surpasses a predetermined threshold, the alert system generates an alert message on the dashboard, serving as an indication of potential issues or hazards. Additionally, to ensure timely notifications, the alert system sends messages and emails to relevant stakeholders such as supervisors or safety personnel. This feature enables swift communication, allowing prompt actions to be taken in response to critical sensor readings. Overall, the methodology combines data collection, wireless transmission, cloud integration, dashboard visualization, and alert notifications to enhance safety and facilitate efficient monitoring in the coal mine environment.

III. CONCLUSION

The implementation of a mine safety system is a complex process that requires the utilization of various sensors. The primary objective of the system is to improve the protection of workers in coal mines by preventing potential hazards and ensuring their safety. To accomplish this objective, the system employs IoT technology to constantly monitor the mine. The sensors installed in the system transmit crucial information about the mine's environmental conditions to a centralized monitoring system that deploys advanced algorithms and analytics to analyze the data in real-time. This sophisticated system ensures that any anomalies or irregularities in the mine's environment are detected immediately, and workers are alerted instantly to take appropriate measures. The system also provides valuable insights into the conditions of the mine, enabling mine operators to take proactive measures to eliminate potential hazards and improve worker safety. With this system in place, the risk of accidents and injuries in the mine can be greatly minimized, and workers can work in a secure and safe environment.

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