Intelligent Helmet for Coal Mine Workers

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Abstract - *Laborers in mining territory hazards their lives on the normal premise. Mining is significant need to the making of products, foundation and administrations. Mining is hazardous movement since Laborers are persistently in contact with perilous gases. In the case of something turns out badly, if the specialist becomes unconcious because of hazardous gases, the signal for an emergency response which is mounted on the protective cap will help them in such circumstances. The specialist needs to press the catch thrice so as to illuminate the control room through ringer's sound, with the goal that the control room gives the necessary assistance to laborers. Examination of gases turns into a significant viewpoint here. For this reason AI Calculation named Bolster Vector Machines (SVM) is utilized to investigate the degree of gases.*

***Key Words*: Gas sensor(MQ-5), NodeMCU, Panic button.**

1. INTRODUCTION

In coal mining areas, worker safety is an important issue. Every year thousands of miners die in accidents and many gets injured especially in the processes of coal and hard rock mining. Considering all these problems, a classic model of smart helmet is to be developed to detect all hazardous events in the mining environment. The main reason for miners death is explosion of harmful gases. In coal mining areas carbon monoxide, methane, LPG gases are existing and they are very detrimental for human body. The purpose of mining safety helmet is to protect minors head against heavy object fall. The proper supervision and proper communication is an important requirement of mine industry. The smart helmet provides a real time monitoring of harmful gases like carbon monoxide, LPG, methane and also temperature is monitored using this system. The wired communication network is not so effective because when a natural calamity or a roof fall occurs wired network gets damaged so it is very difficult and also costly to reinstall the entire system. In wired network technology installation and maintenance cost is very high. The hardware component include air quality sensor, data processing unit, wireless transmission and alternating unit. The system use WIFI for transmission of wireless data from underground mines to the base station. Bluetooth is also wireless system but the range of both the system is limited to few distances [2].

2. OBJECTIVES

This project focuses on a mine supervising system which is based on the cost effective IOT system. Our project aims at developing a sensor networks, realized real-time surveillance with early-warning intelligence on harmful gases and be easily available for the help of miner in panic situation. parameters are detected continuously gas sensor and if they cross the pre-defined limit, then the user gets information about all three sensors and it displays in control room and it will automatically updates the values.

3. HARDWARE UNIT IMPLEMENTATION

3.1 Sensor Network :

3.1.1 Air Quality Sensor: In this project we used MQ5 gas sensor to identify the level of dangerous gases in air. The MQ5 gas sensor device is used to detect various types of gases such as hydrogen, carbon monoxide and methane. MQ5 gas sensor is a device which is highly sensitivity to detect LPG. The cast of MQ5 is low and it is suitable for different application [5].

Figure 1: Gas Sensor (MQ5)

3.2 Buzzer :

Buzzer for generating alert for the miner, if Hazardous gas is detected while mining [3].

Figure 2: Buzzer

3.3 Panic Switch :

Panic switch is used for the miner if he required any emergency help. The Switch will give alert to control room.

Figure 3: Panic Switch

3.4 NodeMCU :

ESP8266EX has 17 GPIO pins which can be assigned to various functions by programming the appropriate registers. Each GPIO can be configured with internal pull-up or pull-down, or set to high impedance, and when configured as an input, the data are stored in software registers; the input can also be set to edge-trigger or level trigger CPU interrupts [6].

In short, the IO pads are bidirectional, non-inverting and tristate, which includes input and output buffer with tristate control inputs. These pins can be multiplexed with other functions such as I2C, I2S, UART, PWM, IR Remote Control, etc. As it has on board Wi-fi connectivity, It can communicate with control room through internet.
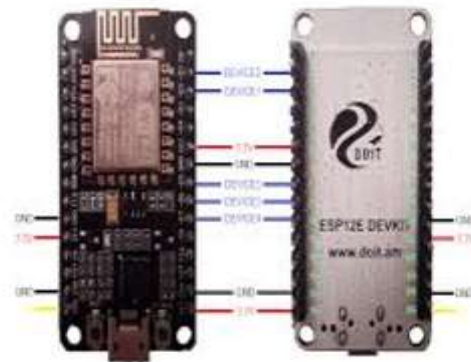

Figure 4: Micro-controller(NodeMCU)

4. ALGORITHM USED:

4.1 SVM algorithm:

"Support Vector Machine" (SVM) is a supervised machine learning algorithm which can be used for both classification or regression challenges. However, it is mostly used in classification problems.

In the SVM algorithm, we plot each data item as a point in n-dimensional space (where n is number of features you have) with the value of each feature being the value of a particular coordinate. Then, we perform classification by finding the hyper-plane that differentiates the two classes very well.
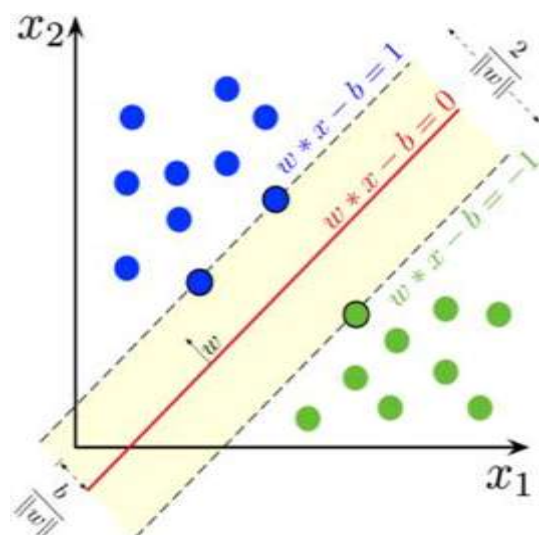

Figure 5: Support Vector Machine

Support Vectors are simply the co-ordinates of individual observation. The SVM classifier is a frontier which best segregates the two classes (hyper-plane/line).

5. WORKING

The intelligent security system consists of a helmet, which is mounted with the sensor circuits. The transmitter section has a microcontroller which receives input from section like gas sensor in certain case when dangerous event occurred then helmet transfer alert towards control room. These signals are received by the control room.
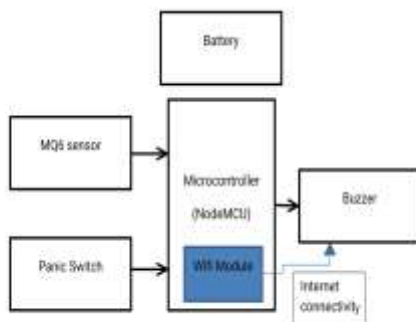
5.1 Helmet System block diagram:

Figure 6: Block Diagram of intelligent helmet for workers.
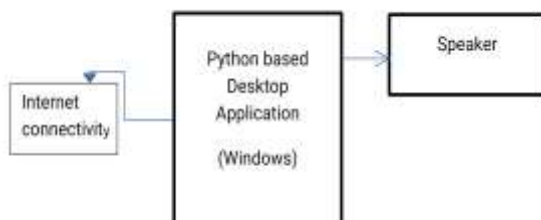
5.2 Control Room block diagram:

Figure 7: Block diagram of control room

6. ADVANTAGES

• System is very easy and simple to handle.
• No complicated connections on the helmet.
• Helmet is light weight and comfortable to workers.
• Sensors do not affect on the worker's health.

7. DISADVANTAGES

• If power supply is lost then the connection between workers and control room will break.

8. APPLICATIONS

This helmet helps the workers in any critical situation. If some problem occurs in the mine, then the sensors

will work actively and give the alert message to the control room by using NodeMCU. The Panic button which is mounted on the helmet helps the worker in case of any accident. When the Worker presses the panic button three times, the control room will provide the help to the worker.

9. RESULT

In result we have taken some tests practically to know the exact value of gases by that we can track the status of the person working in the mining field.

9.1 Control room for coal mining workers :
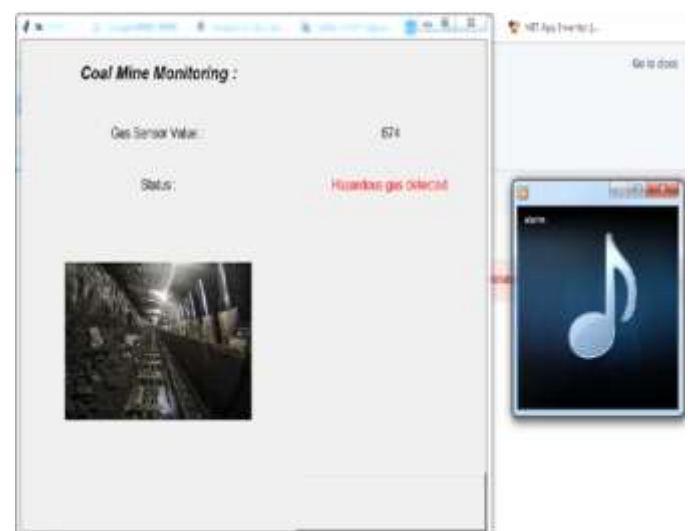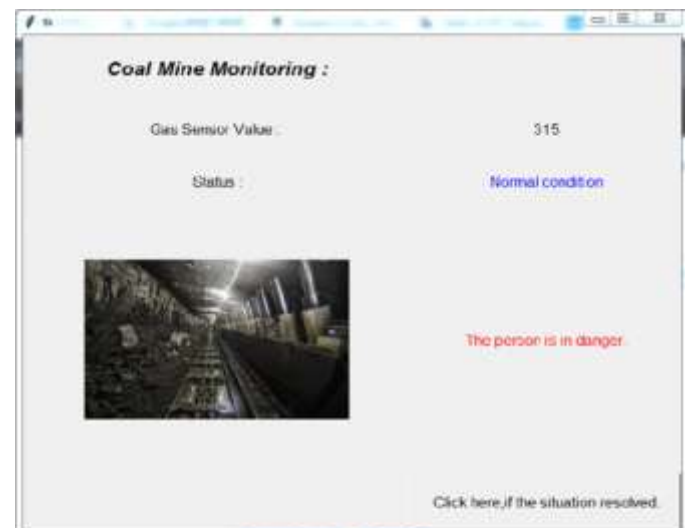

Figure 8: Hazardous Gas detected

10. CONCLUSION

A model is created which helps in distinguishing different kinds of perilous occasion, for example, air quality digger evacuating the security protective cap and impact on excavator head and send this hazardous occasion data towards the checking segment which gives salvage activity to the excavator. the current mine security framework can be viably supplanted by utilizing this salvage wellbeing framework. this framework secured the most significant and essential need part of any diggers wellbeing. the observing of profundity and hazardous mines is made simple with this paper. right now utilized low force rf transmission and collector. all the sensors can be effectively place on head protector that helps in constant checking.

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