A Smart Helmet for Improving Safety in Mining Industry

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Abstract: *A smart helmet has been developed which includes various features such as the two-way communication, detection of the hazardous gases, providing notification in the case of helmet removal, collision (miners are struck by an object), panic switch for emergency situations, continuous monitoring of the environmental conditions such as temperature and pressure in the mining industry and GPS is provided to track the location of the miner. Once the poisonous gas is detected the helmet opening gets closed and the oxygen supply is provided within the helmet for the miners by the opening of solenoid valve of the oxygen cylinder. Panic switch is provided for the safety of the miners and it is used to provide alert signal to the control room during any emergency situations. Temperature and Pressure sensors are used for the continuous monitoring of environmental conditions. The information is sent to the control room through wireless network. The layout of the visualization was completed and displayed in the control room with the help of a Lab VIEW software. This paper presents the undertaken design detailing solutions to issues raised in previous research.*

Keywords: Mining, Environmental Condition, Collision, Hazardous Gases

I. INTRODUCTION

Mining is a multifaceted industry which includes complicated operations carried within the tunnels, underground etc. This involves various risk factors which affects the health of miners. The Chasnala mining disaster that took place near Dhanbad in the Indian state of Jharkhand almost killed 372 miners. This was considered as one of the worst disasters in the mining industry. Miners may not be aware of the external conditions such as rise or fall of temperature, pressure etc. Sometimes Miners collide with the heavy objects like mining objects, hard rock which risks their life. Another factor that affects the miners is the inhalation of hazardous gases that provokes them in danger. In this situation miners are not able to communicate with the outside world. In this case, the smart helmet system becomes an essential and helpful measure to protect the miners from various accidents. This project aims at designing a smart helmet for hazardous event detection, monitoring the surrounding environmental conditions and updating information like GPS location and sensor data to the central console for easy tracking and providing oxygen supplements to avoid the inhalation of poisonous gases. This secures the life of miners in mining industries.

From the Survey, various information is gathered One death every third day in India's most dangerous job is Mining. According to the International Labour Organization (ILO), while mining employs around 1% of the global labour force, it generates 8% of the fatal accidents China has the largest mining industry producing up to three billion tons of coal each year. Though China accounts for 40% global coal output, it is responsible for 80% of mining deaths around the world each year. This survey clearly shows that the requirement for safety measure must be extended to save the life of miners. This survey motivated us for initializing this project.

II. BLOCK DIAGRAM
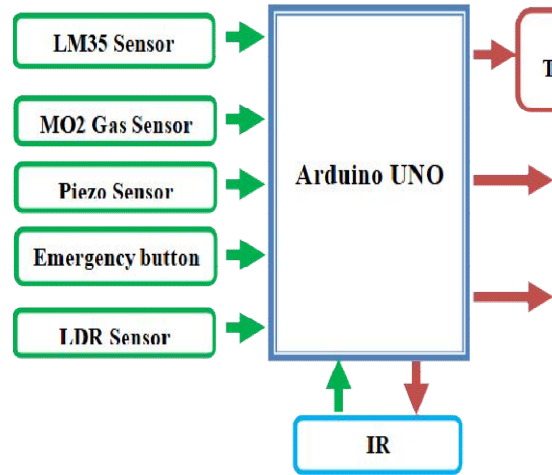
Fig 1: Transmitter Block Diagram
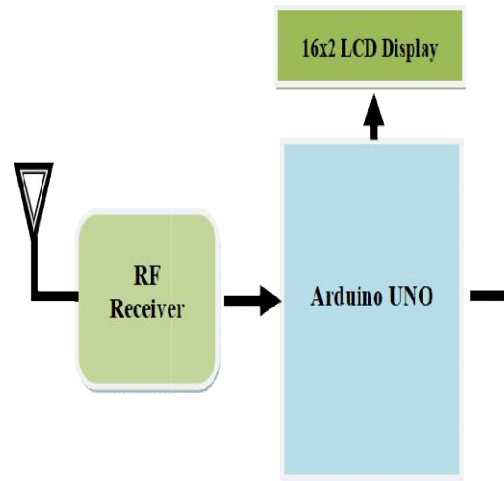
Fig 2: Receiver Block Diagram

III. METHODOLOGY

This project has two sections. They are transmitter section and receiver section. The transmitter section consists of ATmega328 microcontroller, collision sensor, MQ2 gas sensor, temperature sensor, emergency button, LDR sensor, emergency light, IR Sensor module, Buzzer and RF transmitter. In receiver section, ATmega328 is interfaced with buzzer, LCD Display and RF receiver.

The transmitter section is placed on the person's helmet in the underground mining areas. In transmitter section collision sensor, MQ2 gas sensor, temperature sensor, emergency button, LDR sensor, emergency light, IR Sensor module, Buzzer are interfaced with ATmega328 microcontroller and then ATmega328 microcontroller connected with RF transmitter. The temperature sensor, gas sensor, emergency button and collision sensor collect information and send it to receiver section through RF transmitter.

The receiver section is placed in the control room. In receiver section, buzzer and LCD display is interfaced with ATmega328 microcontroller and RF receiver also connected with ATmega328 microcontroller. The transmitted information from RF transmitter is received by using RF receiver. If the detected values are higher than pre-defined limit, then buzzer gives warning signal and LCD display shows status. The advantage of placing transmitter section on

the underground mining areas, we can know gases level, collision, any emergencies and temperature level of that transmitter section placed on the helmet.
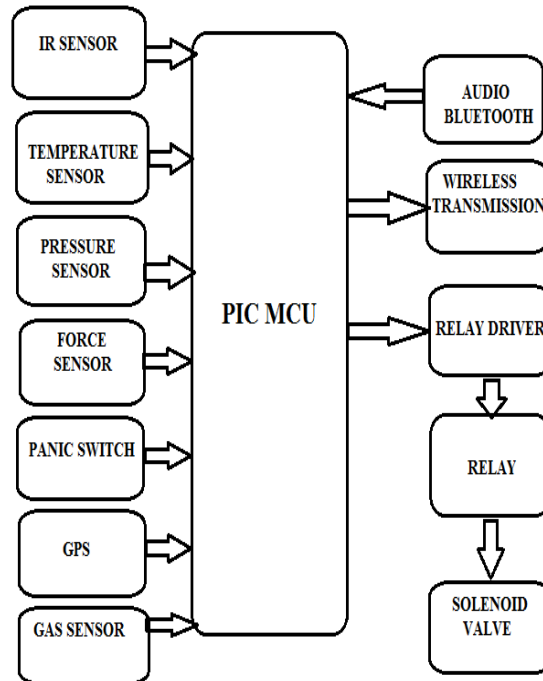

Fig 3: Block Diagram

IV. ADVANTAGES

- The testing of the person for the presence of low and high temperature is easy using this model
- There will be no contact between the person and the temperature measuring sensor
- The person need not open the door by being in contact with the door
- The test being done is fast there would be no manual errors due to the automatic checking of the temperature.

V. DISADVANTAGES

- It requires power supply to be connected to make it perform the task which is desired by the user.
- The failure of single component affects functionality of the overall system being designed.
- It is somewhat costlier than the normal thermal scanner which is being used now-a-days.

VI. CONCLUSION

A system is developed and collected the dangerous gases, pressure and temperature information and transferred to the control room. With the help of the collected information available on the person helmet they will take precautions or rescue the mine workers. The safety is the top priority of all in mining industry by using our system we can achieve the safety of the mine workers. This project covered the first aspect of safety of the workers in the underground coal mining. This project is not only for coal miners, but also wherever the underground works are done by the workers. In the project Module NRF24L01 is used due to simple and cost effective. In future this project is to be sent to the control room or manager office using IOT and we are also going to add some new sensor to this system.

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