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A SMART HELMET FOR MINING WORKERS USING BLUETOOTH TECHNOLOGY

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Abstract – *A Smart helmet can be detecting the hazardous events in the mines industry. In the development of helmet, we have considered the three main hazards such as air quality, helmet removal and temperature. The first is the concentration level of the hazardous gas like CO_2. The first is the The second hazardous event is when a miner removing the Helmet off his head. The third hazardous event is the rise of temperature. Presently, mining safety helmets only have the purpose of protecting the miner's head against potential hazardous bumps. The safety helmets do not have any technology added to it to let miners know when a fellow miner has encountered a hazardous event. The literature on mines technology is available but very limited. For this helmet Co2, IR and temperature sensors are used. The micro controller which acts as a data processing unit used for getting all the data from the above sensors and concludes whether need any intimation to wireless unit or the user wearing it. Wireless transmission and alerting unit are used to transfer the data obtained from the processing unit. It is achieved through Bluetooth and an android app.*

1. INTRODUCTION

This process of removing rich minerals from the earth is known as mining. It is crucial in today's world because of the increased demand for metals and other commodities as a result of rising urbanization and industrialization. India is a country having numerous mineral and valuable rock reserves. Some of the mining techniques employed in the country include underground mining, surface mining, high wall mining, and quarrying. In India, there are approximately 11 coal mines, 13 iron ore mines, 9 bauxite (aluminum ore) mines, 5 manganese mines, 5 copper mines, 3 diamond mines, and 2 gold mines. Due to issues such as mine ventilation, danger from hazardous gases, and occurrences such as rockfalls and head injuries, the mining business poses a high safety risk. These are direct threats to the environment.

2. LITERATURE SURVEY

The mining industry mostly uses cables and wired network to communicate with the ground center. In mines, if an accident happens, these sensors and cables were usually damaged fatally by the explosion, and so we couldn't provide information for rescue search and detection events. We used wireless sensor network to communicate at times of such accidents and to detect a number of activities like helmet removal, collision detection and air quality measurement by using PIC microcontroller. For our paper, we observed from different reference papers developed by researches. Michael Zuba, Carlos Villa, Alexandria Byrd proposed about an Autonomous Coalmine System (AUV) networks are becoming increasingly popular in scientific, commercial, and military applications. In undersea exploration and environmental monitoring AUVs are used for tasks such as detection of oil fields and marine life, distributed tactical surveillance for off shore and seaport defense and my reconnaissance. AUV networks are also becoming an important interest in an effort to enhance the capabilities of coal mine sensor networks (UWSNs). In this paper we propose a control system for networked autonomous coal mine systems that includes both hardware and software modules. Burke, S.E. and Rosenstrach proposed an overall sonar sensor is described which utilizes two coincident, distributed, shaded methane sensor and co2 sensors to provide high resolution target bearing estimates. Sensor shading is accomplished by suitably shaping the charge collection electrodes deposited on the sensing layer. When these two sensor shadings are matched via a derivative in space, the ratio of their signal outputs is linearly proportional to the direction cosine of an incident acoustic field; it is an extension of the well-known mono pulse concept. C. J. Behr, A. Kumar and G.P. Hancke proposed "A Smart Helmet for Air Quality and Hazardous Event Detection for Mining Industry "has been developed that is able to detect of hazardous events in the mines industry. In this paper, no collision detection and helmet removal scheme

3. METHODOLOGY

3.1 CO2 Sensors

Sensorium's next-generation small CO2 sensor is the SCD4x. This sensor uses the photo acoustic sensing concept, as well as Sensorium's patented PA sensor and CMO Sensor technology, to provide great accuracy at an unbeatable price and in the smallest form factor possible. The sensor can be integrated in a cost- and space-effective manner with maximum design freedom using SMD assembly. The built-in SHT4x humidity and temperature sensor allow for on-chip signal correction. CO2 is an important indicator of indoor air quality since high amounts endanger people's cognitive abilities and well-being. Smart ventilation systems can use the SCD4x to regulate ventilation in the most energy-efficient and human-friendly way possible. Indoor air quality monitors and other connected devices based on the SCD4x can also assist in maintaining low CO2 concentrations for long periods of time.

Table -1: Co2 Sensor

3.2 IR SENSOR

The emitter and receiver (transmitter and receiver) of an infrared sensor are referred to collectively as an optocoupler or a photo-coupler. The emitter is an infrared LED, while the receiver is an infrared photodiode. The infrared light created by an infrared LED is particularly sensitive to the photodiode utilized in this. The photodiode's resistance and output voltage can be adjusted in response to the amount of infrared light collected. This is the basic functioning concept of an infrared sensor. The sort of incident that occurred was either direct or indirect, and in the case of the latter, the placement of infrared LED ahead of a photodiode can be done without difficulty. Both diodes are positioned side by side in the indirect kind.

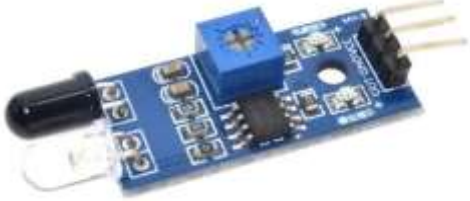

Table -2: IR Sensors

3.3 Buzzer

A buzzer is an a little yet effective component that may be used to bring sound to our project or system. Its small and compact 2-pin shape allows it to be utilized on a breadboard, a Perf Board, or even a PCB, making it a common component in most electrical applications. There are two sorts of buzzers on the market now. The one pictured here is a simple buzzer that, when powered, produces a Continuous Beeeeeepp Beep. Beep. It produces sound owing to an inbuilt oscillating circuit. However, the one illustrated here is the most popular because it can be altered with the help of other circuits to meet specific needs.

Table -3: Buzzer

3.4 LCD 16*2 DISPLAY

In LCD 16×2, the term LCD stands for Liquid Crystal Display that uses a plane panel display technology, used in screens of computer monitors & TVs, smartphones, tablets, mobile devices, etc. Both the displays like LCD & CRTs look the same but their operation is different. Instead of electrons diffraction at a glass display, a liquid crystal display has a backlight that provides light to each pixel that is arranged in a rectangular network. Every pixel includes a blue, red, green sub-pixel that can be switched ON/OFF. Once all these pixels are deactivated, then it will appear black and when all the sub-pixels are activated then it will appear white. By changing the levels of each light, different color combinations are achievable. This article discusses an overview of LCD 16X2 & it's working with applications.

Table -4: 16*2 DISPLAYS

3.5 ARDUNIO UNO

Arduino is a free and open-source electronics prototyping platform with adaptable hardware and software. It's for artists, designers, amateurs, and anyone else who wants to make interactive things or surroundings. It's a microcontroller-based physical computing platform with an open-source development environment for building applications for the board. Arduino is a compact microcontroller board with a USB connector for connecting to your computer and a number of connection connectors for connecting to other devices like motors, relays, light sensors, laser diodes, loudspeakers, microphones, and so on. They can be powered either by a 9V battery or by a USB connection from a computer. They can be controlled by a computer or programmed by a computer before being disconnected and reconnected.

Table -5: ARDUINO UNO BOARD

4. WORKING MODEL

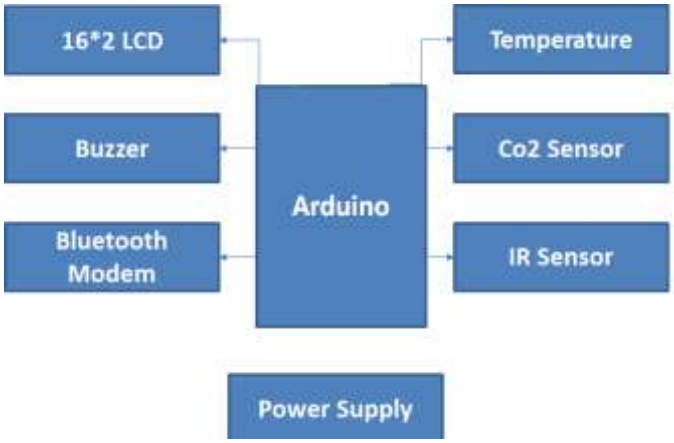

Fig 1: Block Diagram

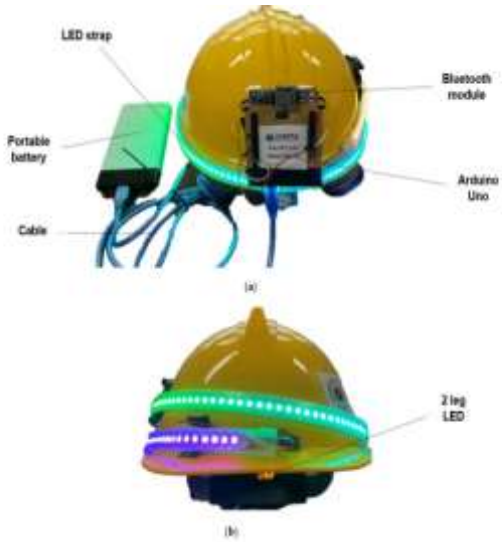

Fig 2: The component of the smart helmet. The rear part (a) and the front part (b) of the helmet.

All the sensors that are used to avoid the hazardous events are assembled with the micro controller. All the necessary software program coding is done to know the hazardous events by analyzing the values recorded. Data processing unit of the micro controller which is used to get all the data from the above all sensor and concludes whether need any intimation to wireless unit or the user wearing it. Wireless transmission and alerting unit is used to transfer the data obtained from the processing unit. It is achieved through Bluetooth modem and an android app.

5. RESULTS

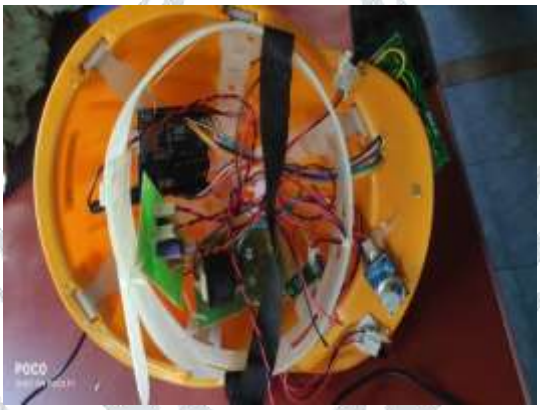

Fig 3: Inner view of the helmet

Fig -4: Results of fire sensor on LCD display

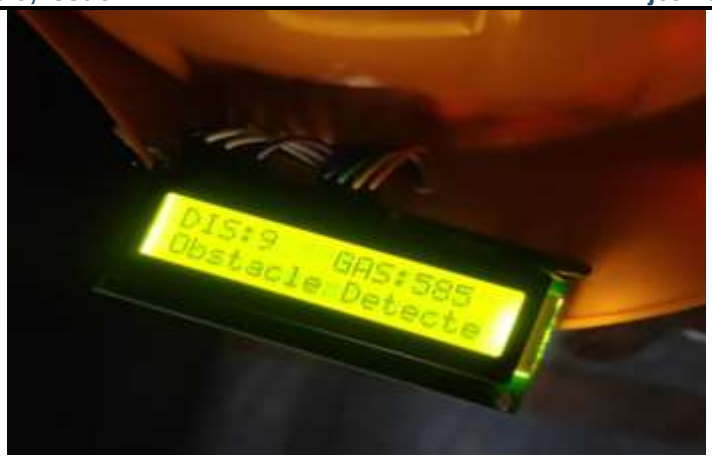

Fig-5: Results of ultrasonic sensor on LCD display

Fig-6: Results of Co2 sensor on LCD display

6. CONCLUSIONS

With the hazardous events in mining industry, with the help of current technology such as Arduino and sensors we are able to solve the issues. Bringing the smart helmet into the use we can measurably reduce the damage to the workers in case of hazardous events. We can also develop this smart helmet by introducing various sensors to find out and minimize the damage from other such dangerous events. Here we find values digital or analog and connecting the sensors which read the values and given to Arduino, so that the main station can detect the problems faced by workers in mining industry. Over the years, Arduino has gone out to become a huge success and a common name among students. With Google deploying it, people's imagination has gone out too much higher level than before. A developer in the annual GOOGLE IO conference said "when Arduino and Android coming together, this really proves "INFINITY EXISTS" in the future". I think a study on Arduino and practical experiments on Arduino must be added for UG courses of engineering, to help students to leverage their talents, and imagination.

7. FUTURE SCOPE

1. We Instead of using android app or pc for receiving the information we can use smart watches then it is easy to alert them from hazards
2. We can add more sensors like heart rate, collision, gas, flame, blood oxygen, etc. to prevent some more hazards faced by the mining workers
3. In future work, smart helmet based personal PWS can be expanded by adding sensors to the Arduino board
4. The environment at the mine site can be monitored, and when a high concentration of harmful gases is detected, the pedestrian worker can be warned of danger
5. We can add another application like GPS tracking

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