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SMART SENSOR SUITE FOR COAL MINE SAFETY WORKERS

A.Chaitanya
Department of Electronics and Communication
Sathyabama Institute of Science and Technology, Chennai, India.

B.SumanthKalyan
Department of Electronics and Communication
Sathyabama Institute of Science and Technology, Chennai, India.

Dr.M.R.Ebenezar Jebarani
Department of Electronics and Communication
Sathyabama Institute of Science and Technology, Chennai, India.

Abstract -Today, it is extremely difficult to keep mine workers safe. When compared to other nations in the globe, the working environment in the country has the greatest impact on the health and quality of life of miners. People in India work in different sectors for daily wages, and one such sector is coal mining. India is also known as the largest coal supplier in the world. A new and inventive approach is needed to increase mining profitability, reduce costs, and keep miners' safety in mind. The suggested system has two sections: one to track the status of the mineworkers and the other to track everything. The discharges are mostly responsible for the air pollution in the mine worker region.

***Key Words*:** Fire sensor, Gas sensor, Coal mine safety, temperature sensor, ZigBee wireless sensor network**.**

INTRODUCTION

Mining is the process of removing valuable materials from the ground, including solids, liquids, and gases. All the essential resources, such as oil and gas, utilized by contemporary civilization are supplied by the minerals collected during mining. Gold, silver, diamonds, copper, lead, zinc, aluminum, copper, and coal are among the materials that may be recovered by mining. Electricity generation requires a significant amount of coal. Over 861 billion tonnes of coal have been projected to be available worldwide. At the same time, India's coal reserves total 286 billion tonnes (as on 31 March 2011).The United States, China, Australia, Indonesia, South Africa, and Mozambique are further nations having significant amounts of natural resources [1]. About 30.3 percent of the world's basic energy demands are met by coal, which also produces 42 percent of the world's electricity [1]. After China and the United States, India is the leading producer of ethical goods. India's main energy source is coal. The primary source of energy in India is coal. Coal now supplies 51% of all commercial energy requirements. Surface mining and underground mining are the two major ways to get coal from the soil. Open pit or open cast mines make up the majority of surface mines.The surface mine is completely in the open and is run from the ground. High production, low operating costs, and adequate safety conditions are benefits of surface mining. The surface approach is used to remove the majority of the coal. When coal is located extremely far below the surface, an underground method is utilized. There are supported as well as unsupported subterranean mines. Artificial pillars were utilized in the supported method to support the opening. In mines with fragile rock formations, supported mining techniques are frequently used. For mining techniques that are not supported, there are no artificial supports available. In places where there is a strong rock structure, unsupported methods are used. Because of ventilation problems and the possibility of collapse, underground coal mining contains a greater risk as compared to surface mining. Most accidents take place in underground mines. In the mining business, worker safety is a major concern. Each year, hundreds of miners are killed in calamities, and a lot of suffer injuries, particularly during hard rock and coal mining procedures. Gas explosions, dust explosions, and gas intoxications are the primary causes of mishaps. Erroneous explosive usage, Electrical burns, fires, the collapse of mine buildings, rock falls from roofs as well as from side walls, worker tripping, flooding, falling, or mistakes from broken or incorrectly utilized mining equipment. The usage of personal protection equipment in coal mines, such as helmets, shoes, etc., is improper, and there are no adequate preparations to determine if an individual is wearing personal protective tool or not [2]. The right monitoring of workers who are wearing protective gear is a crucial issue to take into account. Because of how dark underground mines are, if a miner becomes unconscious due to asphyxia or a building collapsing on them, the supervisor is not aware of her medical state and cannot promptly provide the necessary care. Explosions of hazardous gases are the leading cause of miner fatalities. Gases, including carbon monoxide, methane, and LPG, are found in coal mines and are particularly dangerous to human health. In the mining sector, appropriate management and communication are essential prerequisites. The smart helmet offers real-time gas monitoring and fall detection for people. And whether or not miners wear helmets. This system is used to monitor dangerous gases, including carbon monoxide, LPG, and methane, as well as temperature. Because the wired network is broken when a natural disaster or a roof collapses, it is exceedingly difficult and expensive to completely rebuild the system. Installation and maintenance costs for wired network technologies are quite expensive. A Wi-Fi wireless network is the most practical method of communication between the base stations and the underground mine. Mesh topology in Wi-Fi technology offers a long-distance wireless communication network.

EXISTING SYSTEM

One of the key elements of the industry is industrial safety, especially in the coal mining sector. Suffocation, gas poisoning, the item falls, ceiling collapses, and gas explosions are among the risks of underground mining. As a result, detecting hazardous events and air quality are crucial elements in the mining industry. This system offers a WSN (“Wireless Sensor Network”)so that the base station

can keep track of the state of underground mines in real-time. It offers real-time supervising of harmful gases, including location

And heart and respiratory sensors. The primary cause of mining deaths is that when they fall and lose consciousness for whatever reason, medical attention is not given to them in a timely manner. In order to solve this issue, the system sends a supervisor an emergency alert if a person falls down for whatever reason. Some employees don't wear helmets because they are unaware of safety precautions. Then, it was successfully determined using a Limit switch if a miner had taken off his helmet or not. The system transmits data from the underground mine to the base station using Wi-Fi technology. At mines and base stations, an alert switch is available for emergencies.

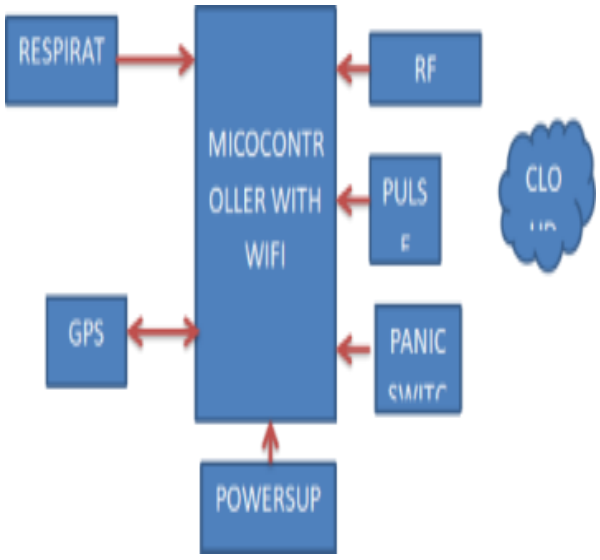

Fig 1: BLOCK DIAGRAM EXISTING SYSTEM

PROPOSED SYSTEM

The safety of mining employees is a major problem nowadays. The working environment and a few other fundamental problems, including their delayed effects, are powerless to affect a miner's health or way of life. A new and inventive approach is needed to increase mining profitability, reduce costs, and keep miners' safety in mind. The suggested system is divided into two sections: one is for tracking the status of the mineworkers, and the other is for overall monitoring discharges are the main cause of air pollution in the mine worker area.

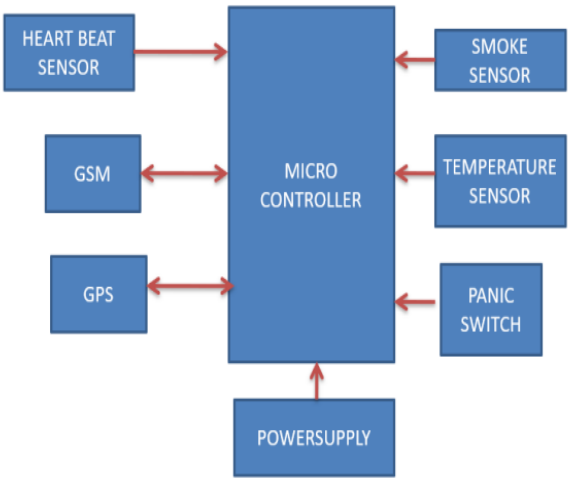

Fig 2: BLOCK DIAGRAM PROPOSED SYSTEM

PULSE WIDTH MODULATION

PWM is a useful technique for modifying the power provided to the load. The PWM approach has the advantage of being extremely dependable and smooth. The motor terminal voltage can fluctuate with the duty cycle, and the speed will also vary at the same time as the microcontroller generates a PWM signal to modify the duty cycle of the pulse. The duty cycle is the ratio of on-time to off-time. By adjusting the duty cycle, the required speed may be achieved. The microcontroller's PWM ("Pulse-Width Modulation") is utilized to regulate the duty cycle of the DC motor drive. A completely different method of managing a DC motor's speed is PWM. The motor is powered by a square wave with a fixed voltage and variable pulse width or duty cycle. The duty cycle is the fraction of a cycle during which a continuous train of pulses operates. Since the frequency of PWM is fixed, the duty cycle is also fixed, but the on-off time is flexible. The duty cycle change of the PWM microcontroller is seen in the figure. When a microcontroller has a duty cycle of 25%, it powers the motor with 1/4 of its power. When it has a duty cycle of 50%, it powers the motor with an eighth of its power, and when it has a duty cycle of 75%, it powers the motor with a third of its power.

RESULT

The suggested system has two portions, one to track the state of the mineworkers, and the other is the overall monitoring section, as we have already described. The outflows are the main cause of air pollution in the mine worker region. Additionally, it warns the miner when dangerous gases, including CO, LPG, and CH4, exceed their safety limits, personal fall detection, and removes helmets. All of the miners within the mine will benefit from this before anybody gets injured.

CONCLUSION AND FUTURE SCOPE:

For the purpose of offering an exact and detailed vision of the underground mine, a real-time monitoring system is formed. This system informs the miner when dangerous gases, including CH4, LPG, and CO, surpass their limit, a person falls, or the helmet is removed. It also displays the information on the base station PC. To save their lives before there are any casualties would be beneficial to all miners present within the mining area. All potential safety hazards, like water leakage, vibration, dust, etc., might be tracked in the future utilizing more sensors. Additionally, we mayincrease the data transmission distance by using the number of salves.

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