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A PROTOTYPE OF SMART HELMET FOR WORKERS SAFETY IN HAZARDOUS ENVIRONMENT

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ABSTRACT—*Safety is the most vital part of any type of industry. Negligence in the safety may cause damage of high quality equipment or may cause loss of human life also in extreme cases. To avoid any kind of unwanted phenomena all mining industries follow some basic precautions. Communication is the most vital key factor today, to monitor different parameters continuously and to take necessary actions accordingly to avoid any types of hazards related to production, managing of human resources.*

To improve safety in underground mines, a reliable and range efficient communication system must be established between workers moving in the mine and control room. Inside underground mines, the wired communication network system is not that effective.

The demo module is constructed with four gas sensors for four directions that are connected to the controller 89C2051 through trigger circuit designed using comparator. When harmful gas is detected in any of the direction that appropriate gas sensor will provide a logic signal to the controller by which the voice channel in the voice chip will be activated by the controller to announce the information. The same way temperature sensor is interfaced to the controller 89C51 through ADC. All these parameter values are read and displayed in the LCD interfaced to the controller 89C51 and when any of the parameter goes abnormal, automatically the information will be transmitted to the monitoring station through zigbee technology.

Keywords—*Liquid Crystal Diode(LCD), Light Emitting Diode(LED), Microcontroller (89C52), LM 35, ZigBee.*

I. INTRODUCTION

Underground safety has a higher priority in both mining and tunneling industries. Due to high number of potential hazards that can occur in such arduous workplaces, a comprehensive monitoring system containing independently certified equipment compatible with the challenging environment is required. In underground mines, it is important that you are immediately alerted to any potential hazards due to the remote and isolated nature of the environment. The underground safety system provides live data feedback both below and above ground, while each sensing element comes with its own processor for data storage.

This project is designed to present a cost-effective, and ZigBee protocol based wireless sensor network that provides an intelligent surveillance and safety system for underground mine applications. The sensor node consists of a ZigBee protocol based low power transceiver integrated with a high performance, low power microcontroller on single chip. For demo purpose single point is demonstrated. Wireless sensor nodes join to other sensor node in specific multi-hop mesh network topology, that creates a ZigBee based wireless sensor network. It provides us with a real-time data communication between miners and surface base station through highly reliable wireless sensor nodes. The proposed system improves the existing miner's safety and early warning surveillance in underground mining operations.

The mining safety systems can include:

- **Fixed gas detection systems** - a gas detector can monitor flammable and toxic gases, including methane, carbon monoxide and CO2. We can monitor a full range of different gases at different sensitivity levels.
- **Environmental monitoring** - air and gas flow, temperature and humidity sensors measuring changes to your mining operations make sure that conditions remain safe.

A hazardous area is a location or confined space where there is likely to be clouds of dust, humidity, flammable gases or vapors, temperatures, etc. This could cover many industries, from underground mines and tunnels to oil rigs. Many of these workplaces also carry a risk of gases; so for the safety of your workers and valuable machinery, there is need for the environmental monitoring and gas detection systems.

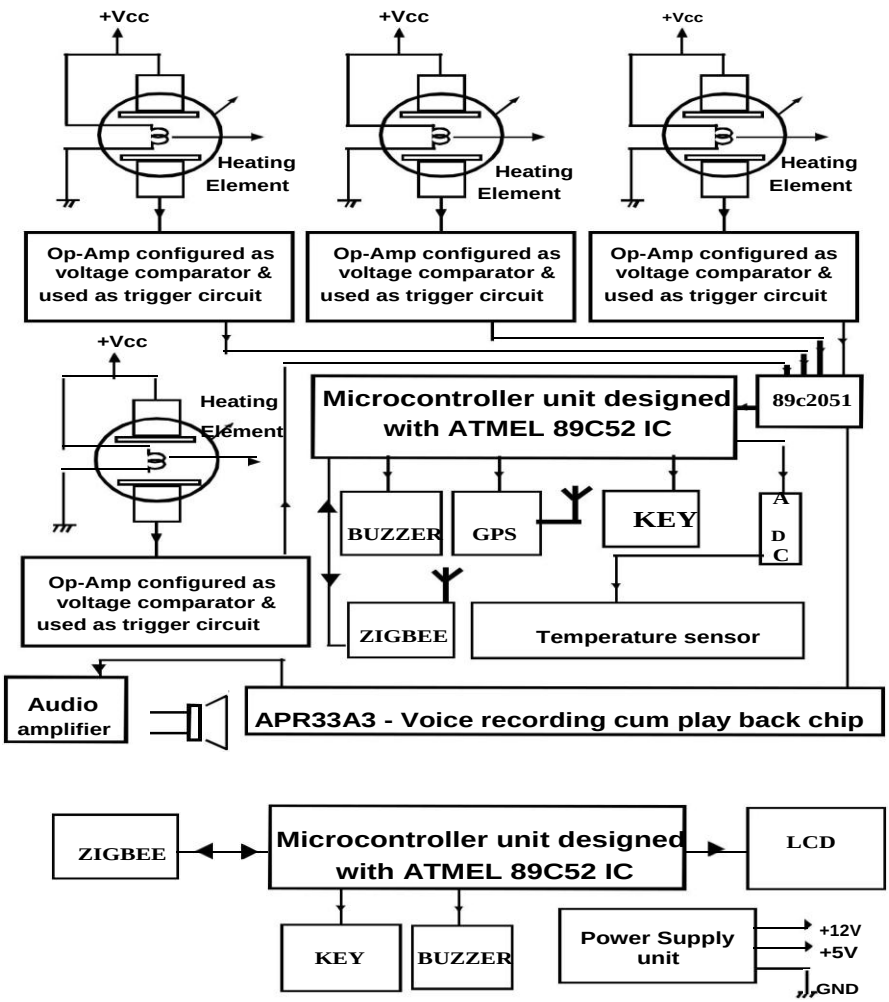
However, not every product is suitable for use in a hazardous area. Electrical equipment used in a hazardous area, whether it's lighting, an environmental monitoring system or a telephone, needs to be specially designed so that it will not cause an explosion. This is known as intrinsic safety or IS, a standard requirement for any electronic device in mines and tunnels. Features of an intrinsically safe device include:

- Low voltage and current controlled with resistors
- Minimum surface temperature
- Robust heat and spark proof casings
- Isolating relays within circuits

II. LITERATURE SURVEY

In this system, the basic parameters like temperature, direction of hazardous gases and location of the worker are going to be monitored and if there are any kind of abnormalities observed then it will be intimated in the form of voice i.e. in which direction the gas is being released. So that the worker could help himself by not going in that direction and at the same time the location of the worker is being seen by the base station. The mode of transmission is done via ZigBee communication module. For the required operation to be performed we have attached the system with a microcontroller, in which the sensors are interfaced. Here we are using a Voice IC(APR9600) for recording the messages which are required. The output this IC is connected to a speaker to intimate the worker about the abnormality.
The LED miner's helmets are being deployed extensively in recent years. They are for large and medium sized coal mines. Due to the flexible(Light in weight and low power consumption) use they are being prominently used in mines. Due to remote environment monitoring capabilities, the zigbee based wireless communication is used in this project. The zigbee network can easily collect the sensors data and transmit to the receiver. By combining zigbee and the flexible helmets we design a smart helmet, which enables us to access the location of the miner who is injured and from where the hazardous gases are being leaked for taking the necessary precautions to avoid further damage. By providing a early warning to the workers by building a real time surveillance in the parameters of the environment, potential safety measures can be taken care of.

III. PROPOSED ALGORITHM



The main aim of this project is to provide security to the workers who are working in the mining industry and in tunnels. This system provides live data feedback to both below and above ground, while each sensing element comes with its own processor for data accumulation. This project addresses a cost effective, flexible solution of underground mine worker's safety. A module of MEMS based sensors are being used for monitoring the underground environment and automating progression of measurements data through digital wireless communication technique is proposed with high accuracy, smooth control and reliability.

V. CONCLUSION AND FUTURE SCOPE

The project work is designed and developed successfully. For the demonstration purpose, a prototype module is constructed and the results are found to be satisfactory. Since it is a prototype module, a simple module is constructed, which can be used for many applications. While designing and developing this proto type module, we have consulted few experts those who are having knowledge in embedded systems and these professionals working at different organizations belongs to Hyderabad helped us while fabricating this project work. Since it is a prototype module, much amount is not invested. The whole machine is constructed with locally available components. Some of the modifications must be carried out in design to make it as real working system.

VI. REFERENCES

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