MINERPAD: A Safety Gadget for Miners Using Visible Light

Hariharan Ashok, Vishal.M , and Parthiban.R

***Abstract*---** This paper proposes a system that would help miners to stay away from effects of harmful gases and other chemical, toxic substances and harmful gases using visible light communication. We have developed a simple and easy to use safety gadgets that alerts the miner and also his adjacent or immediate employee in case of an abnormality of the employee or presence of toxic chemicals and gases using lights source available in mining area itself using visible light communication technology and Light emitting diodes.

***Keywords*----** Light emitting diodes, lights source, safety gadgets, Visible light communication.

I. Introduction

MINING in general is a multidimensional industry with complex chains of operations, processes in many areas. These challenges are added with some of other problems like geological conditions, human capital, and energy management. Though all these factors are the major challenges that are to be addressed, the human capital is to be addressed immediately.

Human capitals are influenced by many factors like no of graduates opting for mining industry, the ratio of retirements of mining engineers to their replacements. To make it more complicated the developments in economy, the expansions of the mining projects are also increased in rapid rate. These cumulatively effects to bring immediate and more reliable solutions to these problems.

One of the major hurdles that affects the people to take up is mining is the safety provided in this field. Since in mining the exposure to toxic and harmful gases, chemicals and substances are more compared to any other field of work. It may by mining or oring processes the risk involved is more.

In order to address this solution we had come up with this minierpad which helps in protecting mining workers from harmful gases and substances using visible light communications and LED's. Minierpad is simple and easy to use safety gadgets that alert the miner and also his adjacent or immediate employee in case of an abnormality of the employee or presence of toxic chemicals and gases using lights source available in mining area itself using visible light communication technology and Light emitting diodes.

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II. Visible Light Communication (VLC)

VLC is most reliable and fastest communications technique for data transmissions. VISIBLE LIGHT COMMUNICATION (VLC) is a promising solution for high speed data transmission indoor applications. VLC was first proposed in Japan [1] and has since aroused significant interest around the world .VLC possesses many advantages over its RF counterpart. As the light cannot pass through opaque obstacles, the visible light band can be reused without any interference indifferent (even neighboring) rooms. Additionally, as long as the eye-and-skin safety regulations are satisfied, there are no health concerns. Many VLC systems use white LEDs as transmitters. Even though designed primarily for lighting, unlike conventional light sources, these white LEDs can be modulated at frequencies up to 20 MHz, and as a result, can form the basis of arrange of novel data communication systems.

The advantages of VLC can be listed out as

1. No licensing requirements.
2. Low-cost frontends.
3. Simultaneous illumination and communication, and high received signal-to-noise ratio (SNR).

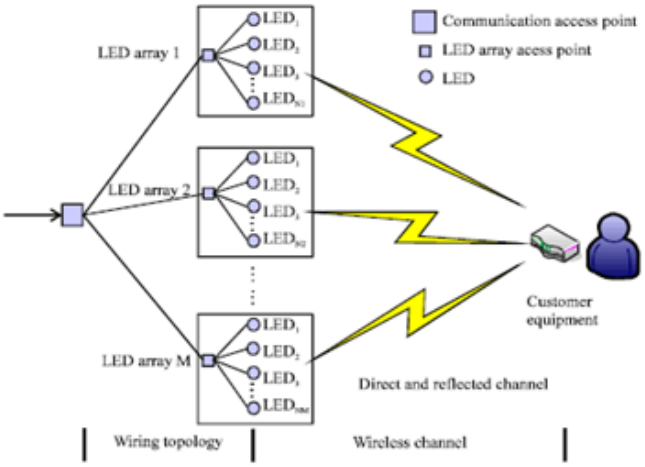


Fig. 1 An overview of VLC'S communication

Light propagating from each LED to the photo detector is generally made up of two components, the LOS component which transmits from the LED to the receiver directly and the diffuse component which propagates via reflections. Previous studies have shown that the LOS component is usually much stronger than the diffuse component. In this paper, we consider only the LOS component and leave the analysis of multi-path transmission for a future study.

The use of LEDS and VLC in this work enables us to design a system that would be simple to use and with less cost spent for the productions as the entire work needs the visible light as the raw material. The visible light would be present at mining hole itself for working and hence this lights acts and light source to communicates the raw data inside the mining holes effectively.

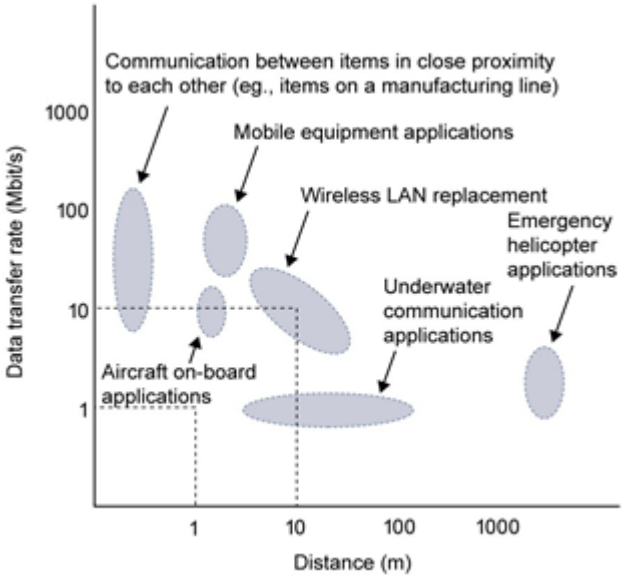


Fig. 2 comparison between Data rate and Distance

Methodology and Execution:

The minierpad is safety gadget that's designed to provide for the safety of the workers who are involved in the mining and oring process. It thus use the concepts VLC'S and LEDS to achieve our objective. The following diagram would illustrate the working of minierpad.

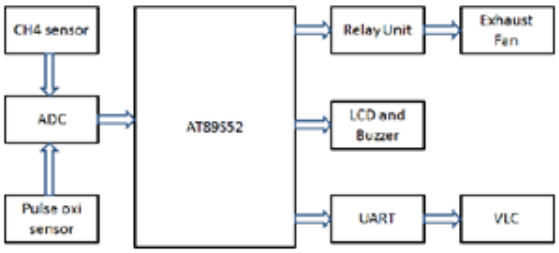


Fig. 3 Block diagram of Mining process

The following are procedure for the mining processes:

1. The minierpad is attached in helmet of the layman, with appropriate gas sensors and pulse oxi sensors.
2. The raw data is processed by the ADC'S which coverts them to digital signals. These signals are processed by the microcontroller.
3. The microcontroller would process the digital signals and when it encounters the presences of any gases or abnormalities of employee and would indicate it to nearby employee using the VLC which emits a signals that alerts the next worker to look into the situation.
4. A similar method is used for oring process, it uses a toxic sensor to achieve the objective. The following block diagram would illustrate it.

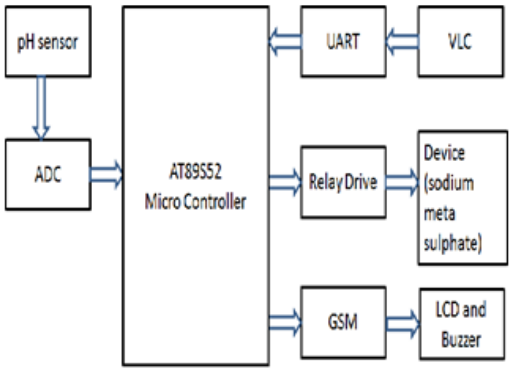
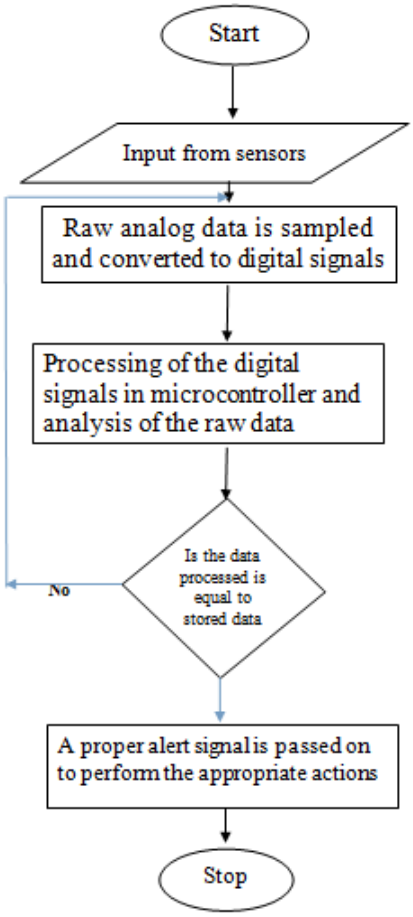


Fig. 3 Block diagram of Oring process

Software Implementation:

The microcontroller is coded with Embedded C and it uses Keil compliers. The flow chart below explains about the overall mechanism of minierpad.



The pipeline structure of the two modes are given below:

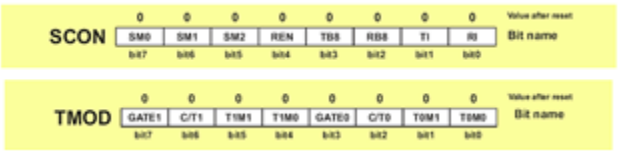


Fig. 4 Pipeline structure of AT59S52

III. CONCLUSION

Thus we attempted to propose a system that would allow secure working environment for the miner who works deep inside earth surface. On successful completion of this project we have inferred the following advantages:

1. Minerpad could be developed in low price that is affordable by a layman.
2. Employee secure system could be improved and by which the challenge of human capital in mining industry could be addressed
3. Measurements are made easier and accurate i.e. alerts with less false positives and with no false negatives for dangerous activities that are detected.
4. Faster data rate transmission is achieved

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