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VISIBLE LIGHT COMMUNICATION BASED SAFETY SYSTEM FOR SCAVENGING OPERATIONS

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Abstract: *The project gives the solution for the problem in the manual scavenging processes. Manual scavenging refers to the practice of manually cleaning, carrying, disposing or handling in any manner, human excreta from dry latrines and sewers. The manual scavengers are exposed to harmful gases such as methane and hydrogen sulfide, which causes infections like hepatitis, leptospirosis, skin problems and respiratory system problems. The scavengers were affected by acute lung disease while inhaling methane gas in the scavenging environment. The proposed system monitors toxic gas (methane) in the scavenging environment and heart beat pulses of the workers, using multiple sensors. Light fidelity (Li-Fi) technology is introduced to forecast the monitored data. Li-Fi uses LED light source to transmit the data in a wireless manner this method is widely called as VLC (visible light communication). The detected values are sent to the receiver part through VLC transmitter and receiver. These values are displayed in the LCD in the receiver section to ensure the workers conditions. Thus by using this Li-Fi technology data transmission and reception can be done in problem less manner.*

Keywords: manual scavengers, Li-Fi, VLC (visible light communication).

I. INTRODUCTION

The visible light communication (VLC) refers to the communication technology which utilizes the visible light source as a signal transmitter, the air as the transmission medium, and the appropriate photodiode as a signal receiving component. Visible light communications (VLC) can provide cable free communication at very high bit rates as high as 100Mbps. In addition, it has a major advantage that it causes no interference to RF-based devices. This made wireless communication possible in RF hazardous areas such as hospitals and space station. In addition to these two key advantages, safety, simple installation procedures and band licensing-free characteristic also helped to increase VLC's potential to be developed as an alternative, or even a new standard to Light Emitting Diodes (LED), which send data by flashing light at speed. VLC uses white Light Emitting Diodes (LED), which send data by flashing light at speeds undetectable to the human eye. In this case, high speed data can be carried by the modulated light from the LED, which

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makes information transmission possible while lighting our life. When signals reach the receiver, the photodiode will convert the optical signals to electrical ones and the original information will be recovered. The first sophisticated attempt to harness visible light for transmitting data was carried out by the Scottish scientist and inventor Alexander Graham Bell who is credited with inventing among other devices the photo phone. Using visible light for data transmission entails many advantages and eliminates most drawbacks of transmission via electromagnetic waves outside the visible spectrum White HB-LED's present themselves as the future of both indoor and outdoor lighting scenarios. By joining the penetration of HB-LED's in our daily lives, and the knowledge available on IR wireless communications, VLC presents itself as a promising technology for the future of wireless communications. It is a ubiquitous technology, generating no interference to human life or existing electronic devices. Unlike RF systems, VLC can be used in other electromagnetic interference sensible locations. Applications such as visible light communication for audio systems, information broadcasting using LED traffic lights and integration of VLC with power-line communications (PLC), are examples of the capabilities of VLC.

II. DESIGN AND IMPLEMENTATION

A. System architecture

The AT89S52 microcontroller is used in this project. It obtains the value from the gas sensor and heart beat sensor.MQ-2 Sensor is used as CH_4 sensor. MQ-2 gas sensor has high sensitity to LPG, Propane and Hydrogen also could be used to Methane and other combustible steam, it is with low cost and suitable for different application. Pulse oximeter sensor is used as heart beat sensor which gives the digital output of heart beat when finger is placed on it. ADC is used in between the two sensors in order to convert the analog values form. Buzzer is used to generate the loud sound outputs to alert the workers in the scavenging environment.

A Relay is an electronic switch in which it is used to drive the DC motor. VLC transmitter is used to transmit the data by using light for communication. VLC receiver is used for receiving the data by using photo detector which detects light signals from the transmitter. LCD is used to display the values in the receiver part.

B. System Design

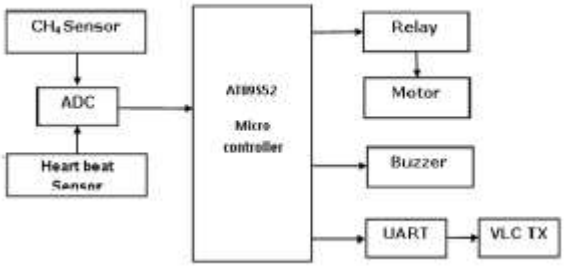

Fig. 1 Block diagram of transmitter part.

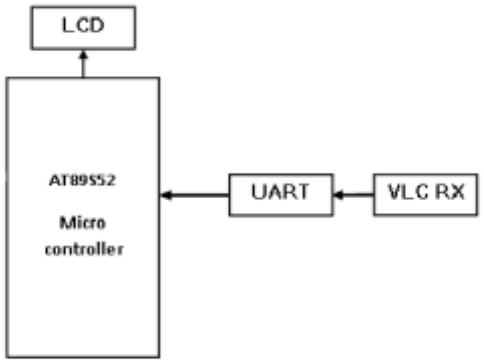

Fig .2 Block diagram of receiver part

Transmitter Part

The CH_4 sensor (MQ-2 sensor) is used to sense the level of methane gas present in the drainage system and it sent the value of gas content to ADC device. The pulse oximeter is used to monitor the heart beat of the worker who is working in the drainage system and this value is also sent to the ADC device. The ADC device which gets the analog value from both the sensor and coverts it into digital value and transmitted to the microcontroller. The microcontroller keeps on getting the value from the sensors but when methane gas level exceeds more than 100 it will intimate the worker about the presence of hazardous gas by producing an alarm sound through Buzzer. When the buzzers starts generating sound the DC Motor is made to switch on using a single pole single throw switch to exhaust the gas into the environment or to spray a reducing agent to diffuse methane gas. This setup is possible only in practical case. Here till a motor setup is developed. Similarly when the process is going on, both the data which is the value obtained from sensors are transmitted to the monitoring section through VLC transmitter. The obtained data is transmitted by the visible light using VLC Transmitter. VLC transmitter uses the white light emitting diodes which send data by flashing light at speed undetectable to the human eye. LED would have been kept on to transmit data. LED will be off and on at a very high rate by switching the currents. Thus the data is transmitted to the receiver part.

Fig.3 Image of transmitter part

Receiver part

The receiver consists of an optical element to collect and concentrate the radiation onto the receiver photo detector; photodiode convert visible light into an electrical signal biased the photodiode operates in the photoconductive mode generating a current proportional to the collected light. The photo detector transmits these values into the microcontroller. From the microcontroller the values are sent to the 16*2 Liquid Crystal Display. In the 16*2 LCD the methane gas and heart beat pulse rate values are shown in the receiver section. This displayed value is used to ensure the safety of the workers.

Fig.4 Image of receiver part

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C .System Implementation

Fig .5 Implementation of the whole project

This Image shows the output of the kit. It displays the value of CH_4 sensor and Heart beat sensor in LCD when the light from the LED reaches the photo detector in the receiver part. Thus the displayed values will helps to ensure the condition of workers in the scavenging environment.

III. CONCLUSION AND FUTURE WORK

In this project visible light communication is used for data transmission. VLC is less dangerous for high power applications because humans can perceive the light and act to protect their eyes for damage. The drainage cleaning is a major problem for scavengers. The workers life is saved by monitoring the heart beat pulse using pulse oximeter sensor and the methane gas is detected using MQ2 sensor. The values are displayed in LCD. Further this project can be enhanced by reducing the installation cost and increasing the reliability. Visible Light Communication (VLC) present fascinating challenges for using appropriate techniques to construct cheap processing units and high brightness LEDs. VLC is still in its beginning stages, but improvements are being made rapidly, and soon this technology will be able to be used in our daily lives. Thus visible light communication is a rapid growing segment of the field of communication.

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