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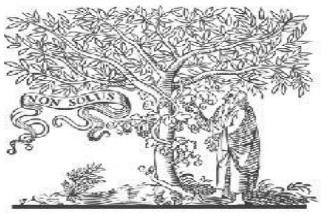

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DESIGN AND DEVELOPMENT OF SMART HELMET FOR MONITORING AND CONTROLLING OF HEALTH PARAMETERS

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ABSTARCT: In construction sites, many laborers will be working for the completion of the construction project. Since labors are scattered in the field, it will be difficult to monitor them by the supervisors as well as round the clock, they will not be able to monitor whether the labors were wearing safety helmets or not. In this project design and development of smart helmet for monitoring and controlling of health parameters is presented. The present invention is a low cost integrated system that alerts the supervisor with the smart helmet using ARM processor. The temperature and oxygen level sensors are used to monitor the health parameters of workers and the respective controlling actions can be taken by using various technologies. IR sensor is also used to detect the objects that are being attacked to the workers. The GSM technology is used in this system to send an SMS notification about health condition of work to the respective health authority based on sensor information.

KEY WORDS: Smart helmet, ARM, Temperature sensor, oxygen level sensors, IR sensor, GSM module.

I. INTRODUCTION

The monitoring of physiological signals using wearable devices is increasingly becoming a prerequisite for the assessment of the state of body and mind in natural environments. This has been facilitated by small-scale analogue and digital integrated circuit technology, together with on-chip processing power for dealing with movement induced artifacts in bio potentials, which are present when performing daily activities. Physiological signals recorded in real life tend to be notoriously weak and with a low signal to-noise ratio (SNR). To this end, an amplifier with a high common mode rejection ratio is required; such high quality bio-appliers are typically integrated into the analogue front end of large stationary devices. Because of the many leads and electrodes required, such devices are well suited for clinical environments, where patients are normally stationary (except e.g. for cardiac stress tests), so that the noise level is relatively low [1].

The nature of Mining Industries are more dynamic, which loses thousands of human lives and wealth. Frequent coal mine accidents are a big problem in underground mine and the environment conditions are worse and complex. The critical parameters are dust density, temperature, harmful gas density. It is significant to monitor the miner's health, activities, physical condition and the environment. The IoT can provide support for real-time decision making for managerial activities and improve the

productivity of the construction industry [2]. As wearable IoT sensors can be carried by humans (and animals), they or their behavior will also become a part of the information flow. Improving safety with IoT technologies will benefit from using sensors with workers at the construction site and there are some prototypes and many future visions about how IoT sensors could be integrated with protective clothing or helmets [3-5]. Although such sensor-integrated safety equipment and clothing could be provided by the employer, continuous monitoring of employee's activities raises many questions and trust between different stakeholders is needed. Resistance to change in the construction industry highlights the need to investigate the underlying factors behind technology adoption also from the perspective of construction site workers. Although studies investigating human aspects as part of technology acceptance in the construction industry are rare. Although there are many technology adoption and user acceptance related studies, research on employees' perceptions of emerging IoT technologies in the construction industry has remained limited. Particularly, studies focusing on construction workers' perceptions concerning the use of measured personal data for promoting safety and wellbeing in the construction site environment are lacking. In this paper, we discuss about our system design which monitors the miner's health and environment of the mining areas using smart helmet design and development.

I. LITERATURE SURVEY

With a rise in the human population and becoming ageing day by day, people suffering from chronic diseases are growing at a worried rate. In the previous years, the data pertaining to various physiological parameters of the critically ill infected workers were collected using both invasive and non-invasive sensors. According to World Health organization people spend one third of their time at the workplace. Naturally working conditions have a huge impact on human health. Good working conditions provide protection from hazards and provide opportunity for personal development. A good work environment reflects a good physiological well-being of employees. Health of an employee is an essential factor that must be taken into consideration if industries want to boost productivity and efficiency.

Despite a degree of resistance to adopting new IoT technologies at construction sites due to perceived uselessness and privacy risks among workers [6], the development is strong with many solutions and pilots focusing on monitoring fatigue, monitoring work ergonomics and postures [7], tracking workers' physical demands, implementing activity recognition [8], and monitoring workers' heart rate and temperature. Numerous types of sensors have been used for detecting various construction site hazards from workers, the main types being accelerometer, gyroscope, ECG/EKG, infrared and RFID sensors. In addition to measuring hazards based on the qualities of the individual worker, also the surrounding conditions are being tracked by, for example, collision detection with proximity sensors, detecting unsafe construction site locations with GPS, and collision prevention with RF transceivers and ultrasounds sensors. Taken together, recent advances in the IoT and data analysis are enabling the procurement and integration of various personal and workplace data not previously available, and the provision of (personalized) services to improve the work

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productivity, safety and wellbeing of construction site workers.

In another work [9], telephone network assisted by Global System for Mobile/General Packet Radio Service (GSM/GPRS) modem was used to send blood pressure and body temperature readings. All the ideas and the implemented systems discussed above are either costly or have a short range. In the proposed idea, measured readings of blood pressure, heart rate, and body temperature are sent using LoRa and Bluetooth using a gateway (Raspberry pi). Global System for Mobile/Global Positioning System (GSM/GPS) modules have a high-power consumption except GSM/GPRS all other modules provide a short range which is not suitable for practical requirements. A wireless blood pressure monitoring system that measures blood pressure and heart rate was proposed by Wun-Jin Li, Yuan-Long Luo, Yao-Shun Chang, and YuanHsiang Lin [10]. It forwarded the measured blood pressure and heart rate to a management unit with the help of ZigBee. The management unit was pc based that consisted of a graphical user interface and database.

III. PROPOSED SYSTEM

The proposed system consists of ARM microcontroller along with Temperature sensor, oxygen level sensor, IR sensor, LCD and GSM modem. The ARM microcontroller used control all the signals and activities in the soldier unit. The overview of the system is shown below figure (1) and explained briefly.

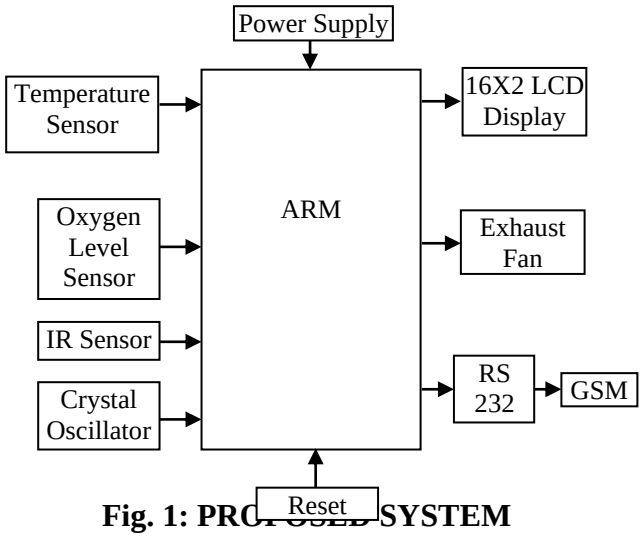

Fig. 1: PROPOSED SYSTEM

This proposed system is placed on the helmet to monitor and control the health parameters of worker in industrial environments. Here, health parameters such as temperature and oxygen level are monitored continuously by using temperature and oxygen level monitoring sensors respectively. IR sensor is also used to detect the objects behind the worker. If the high temperature is observed by temperature sensor then it is activated and automatically turns ON the exhaust fan to provide cooling to the worker. Similarly oxygen level around the worker is monitored continuously and low oxygen level is detected then sensor will be activated and sends an SMS to the respective health authority of industry using GSM technology then the workers can be moved to another safe location. If any object is present behind the worker hen IR sensor is activated and sends an SMS to the respective health authority of industry using GSM technology.

3.1 ARM

The LPC2148 microcontrollers are focused around a 16- bit or 32-bit ARM7TDMI-S CPU with constant imitating and implanted follow help, which consolidate microcontroller with inserted high velocity

streak memory extending from 32 kb to 512 kb. A 128-bit wide memory interface and one of a kind quickening agent building design empower 32-bit code execution at the most extreme clock rate. For discriminating code size applications, the option 16-bit Thumb mode decreases code by more than 30 percent with negligible execution punishment.

Because of their little size and low power utilization, LPC2148 are perfect for applications where scaling down is a key prerequisite, for example, access control and purpose of offer. Serial interchanges interfaces running from an USB 2.0 Full-speed gadget, various UARTS, SPI, SSP to I2c-transport and on chip SRAM of 8 kilo Bytes up to 40 Kilo Bytes, make these gadgets extremely appropriate for correspondence entryways and convention converters, delicate modems, voice distinguishment and low end imaging, giving both extensive cradle size and high transforming force. Different 32-bit clocks, single or double 10-bit ADC(s), 10-bit DAC, PWM channels and 45 quick GPIO lines with up to nine edge or level touchy outside intrude on pins make these microcontrollers suitable for mechanical control and restorative frameworks.

3.2 Crystal Oscillator

An oscillator gives a wellspring of tedious A.C. motion over its yield terminals without requiring any contribution (aside from a D.C. supply). The flag produced by the oscillator is more often than not of steady sufficiency. The wave shape and sufficiency are controlled by the plan of the oscillator circuit and decision of segment esteems. The recurrence of the yield wave might be fixed or variable, contingent upon the oscillator structure.

3.3 Power Supply

Power supplies in recent times have greatly improved in reliability but, because they have to handle considerably higher voltages and currents than any or most of the circuitry they supply, they are often the most susceptible to failure of any part of an electronic system. Modern power supplies have also increased greatly in their complexity, and can supply very stable output voltages controlled by feedback systems. Many power supply circuits also contain automatic safety circuits to prevent dangerous over voltage or over current situations.

3.4 LCD Display

LCD is used to display the data. 16x2 is the LCD that has been used i.e. 16 characters in 1 line, total 2 lines are there. It requires +5V to operate. It is connected to port 2 of microcontroller. It acts as an output to microcontroller. It uses ASCII values to display the character.

3.5 Temperature Sensor

LM35 is an analog, linear temperature sensor whose output voltage varies linearly with change in temperature. LM35 is three terminal linear temperature sensor from National semiconductors. It can measure temperature from-55 degree Celsius to +150 degree Celsius. The voltage output of the LM35 increases 10mV per degree Celsius rise in temperature. LM35 can be operated from a 5V supply and the stand by current is less than 60uA

3.6 Oxygen Level Monitoring Sensors

The Oxygen Level monitoring sensor is related to chemical, however these are especially used for observing the alternates in the quality of air and also detecting the appearance of different gases. For example

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in chemical sensors, these are utilized in several industries like agriculture, manufacturing, air quality monitoring, health industry, detecting the combustible gas or toxic, and in coal mines used as hazardous gas monitoring, gas and oil industries, research of chemical laboratory, as well as it can be manufacturing the plastic, rubber, paint, petrochemical, pharmaceutical etc.

3.7 I.R Sensor

An infrared sensor is an electronic device that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measure only infrared radiation, rather than emitting it that is called as a passive IR sensor.

3.8 GSM

Global System for Mobile Communications (GSM) modems are specialized types of modems that operate over subscription based wireless networks, similar to a mobile phone. A GSM modem accepts a Subscriber Identity Module (SIM) card, and basically acts like a mobile phone for a computer. Such a modem can even be a dedicated mobile phone that the computer uses for GSM network capabilities.

IV. RESULTS

The following figure (2) shows the complete circuit diagram of proposed system.

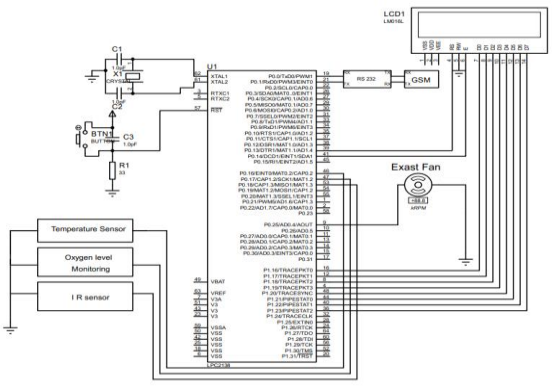

Fig. 2: CIRCUIT DIAGRAM OF PROPOSED SYSTEM

The following figure (3) shows the circuit diagram when the temperature sensor is activated. When the temperature sensor activated the exhaust fan will be activated. GSM will also be activated and the SMS can be sending to the respective authority along with the location using GPS.

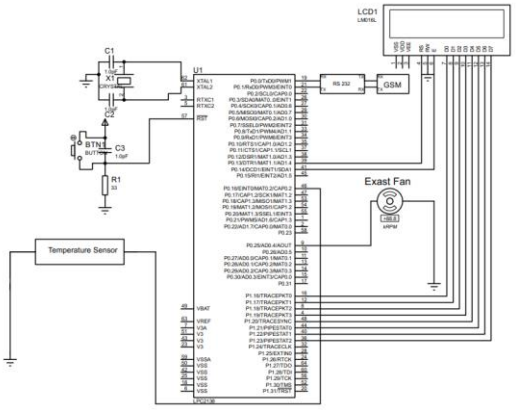

Fig. 3: WHEN TEMPRATURE SENSOR IS ACTIVATED

The following figure (4) shows the circuit diagram when the Oxygen level monitoring and IR sensors are activated. When the Oxygen level monitoring sensor is activated the GSM will be activated and the SMS can be sending to the respective person. Similarly SMS is also send by activating GSM when IR sensor is activated.

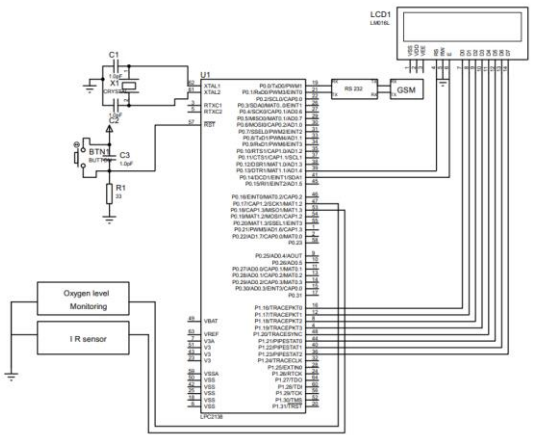

Fig. 4: WHEN TEMPRATURE SENSOR IS ACTIVATED

V. CONCLUSION

The design and development of smart helmet for monitoring and controlling of health parameters was presented in this document. In this system health and security of industrial worker is continuously monitored and by using the temperature, oxygen level monitoring sensor and IR sensors. The ARM processor is used in this system to transfer the control signals between various devices of the system. In this system, the GSM module is used to track the sensors is in order to track the health condition of the soldier and provide an essential aid during emergency. The temperature sensor activates the exhaust fan when the temperature level is high and sends a SMS to the authority. The oxygen level sensor and IR sensors also send a SMS notification about sensor information to the authority when they are activated.

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