

# MONITORING OF MINING WORKERS AT HIGH ALTITUDE

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**Abstract** - The Mine worker faces lots of health problems for the whole of their work, so this system is used to monitoring physiological of mining workers. The proposed system includes physiological variables: electrocardiogram, respiratory activity, and body temperature; and environmental variables: ambient temperature and relative humidity. The non-invasive sensors of the proposed system are embedded all throughout a T-shirt (first layer of protecting clothing) to achieve a functional device and maximum comfort for the users. The device is able to continuously calculate heart and respiration rate, temperature and humidity value in air and also concentrations of chemicals in human bodies. The sensor sensing any irregular activity in human body then LCD shows that problem with buzzer sound. To establish a wireless data transmission to a central monitoring station by using zigbee technology.

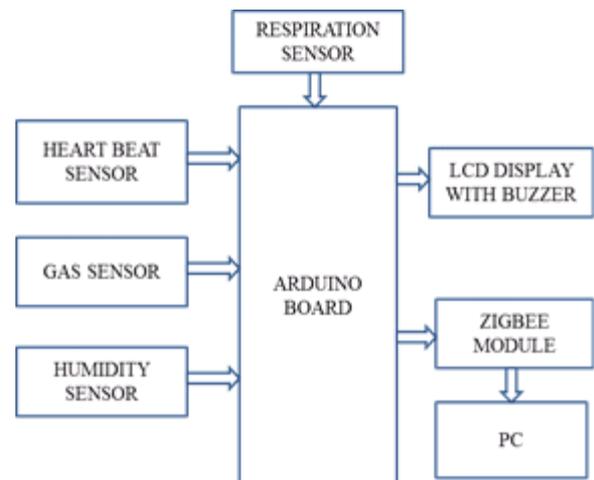


Fig- 1: Proposed diagram

**Key Words:** Mining, Workers health, Monitoring, Multiple Sensors, Data Transmission.

## 1. INTRODUCTION

Workers in hazard areas like mining or gas industry must handle extreme climatic and physiological hazards without specialized medical supervision. For this reason, the industry is constantly looking for improvements to existing occupational safety and health programs in order to enhance working conditions for people and equipment. The proposed system will use to continuous monitor and measure the physiological variables of the Worker's in hazard areas. Therefore a continuous control of the Worker's vital signs is necessary. This paper introduced a new system to monitor the health of mine-worker and also monitor the variations in surroundings. There by improve worker's safety and ensures a comfortable working environment.

### 1.1 Proposed System

The proposed system includes physiological variables: heart beat rate, respiratory activity. We are monitoring additionally respiration rate and concentration of gas. In human body and environmental variables: ambient temperature and relative humidity. The non-invasive sensors of the proposed system are embedded all throughout a T-shirt (first layer of protecting clothing) to achieve a functional device and maximum comfort for the users.

## 1.2 Working Principle

To monitoring the physiological variables and environmental variables by using respiration sensor, heart beat sensor, gas sensor and humidity sensor that are observing value. All sensors are connected through the arduino. If any are identify the problem then LCD display shows that problem and produce the buzzer sound. Display the problem in computer through the zigbee module through this system easily prevents that Worker's.

## 2. MATERIALS AND METHODS

We are using Respiration sensor, Heart beat sensor, Gas sensor and Humidity sensor to get the data from the workers. The LCD and Buzzer are used for indicating the data rate to the worker. If any value will be cross there rate then it automatically make a sound. Zigbee transmitter and receiver are used for data transmission. Each sensor has some saturation rate that rate are consider as a higher rate of the variables. These are monitoring the mining workers.

### 2.1 Arduino

Arduino is an open source hardware and software based on microcontroller which is very easy to use. Arduino is an inexpensive control board that's easy to program and can hook up to a wide variety of hardware. It is intended for anyone making project. Arduino senses the environment by receiving input from many sensors and affects its surroundings. . The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip.

Instead, it features an ATmega16U2 programmed as a USB-to-serial converter.

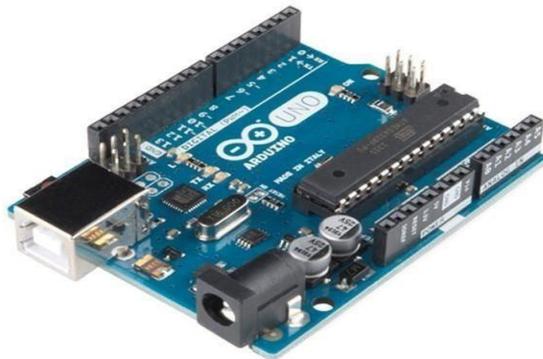


Fig- 2: Arduino Uno board

## 2.2 Heart Beat Sensor

There are three sensors utilized inside the transmitter module. They are the, Heartbeat Sensor, Pressure Sensor and Drug discovery Sensor. This sensor is intended to show advanced yield of coronary heart beat while a finger is situated on it. The beat LED flashes as one with every pulse. This virtual yield might be identified with microcontroller without a moment's delay to degree the Beats in venture with Minute (BPM) charge.



Fig- 3: Heart Beat Sensor

## 2.3 Gas Sensor

A gas sensor is a device that detects the presence of gases in an area, often as part of a safety system. This type of equipment is used to detect a gas leak and interface with a control system. Gas sensor can detect combustible, flammable and toxic gases and oxygen depletion. A gas sensor can sound an alarm to operator sin the area where the leak is occurring, giving them the opportunity to leave. This type of device is important because there are many gases that can be harmful to organic life, such as humans or animals.

**Heater Voltage:** 5.0V ± 0.2V

**Load Resistance:** Adjustable Heater

**Resistance:** 31Ω ± 3Ω

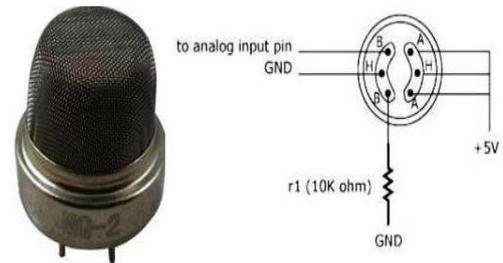


Fig- 4: Gas Sensor

## 2.4 Respiration Sensor

The Respiration Sensor measures breathing rate and relative depth of abdominal or thoracic breathing. It is provided with an easy to apply elastic band and can be worn over clothing. The Respiration Sensor is usually placed over the abdomen. Respiration is often used in combination with the Blood Volume Pulse Sensor for HRV Training.



Fig- 5: Respiration Sensor

Air and gas flows as well as line and therapy pressures have to be monitored and controlled in numerous medical instruments such as respiratory devices, an esthetic devices, sleep diagnosis devices, sleep apnea therapy devices (CPAP), pyrometers and oxygen concentrators. High-quality sensors in respiratory devices measure minute flow rates around the zero point of the respiratory flow and also detect flow rates of several hundred l/min.

## 2.5 Humidity Sensor

A humidity sensor (or hygrometer) senses, measures and reports both moisture and air temperature. The ratio of moisture in the air to the highest amount of moisture at a particular air temperature is called relative humidity. Relative humidity becomes an important factor when looking for comfort. Humidity sensors relying on this principle consists of a hygroscopic dielectric material sandwiched between a pair of electrodes forming a small capacitor. Most capacitive sensors use a plastic or polymer as the dielectric material, with a typical dielectric constant ranging from 2 to 15. In absence of moisture, the dielectric constant of the hygroscopic dielectric material and the sensor geometry determine the value of capacitance.

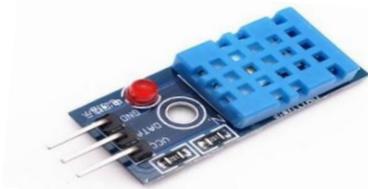


Fig- 6: Humidity Sensor

## 2.6 Zigbee Module

Zigbee standard is an IEEE 802.15.4. Zigbee is used to create PAN and it suite for high level communication protocols. It used for home automation, in medical for data collection; it provides wireless communication for small scale projects. Zigbee requires less power and its data rate is low and it is close to wireless and hoc networks. This device network has the characteristics of electric power-saving, reliability, low cost, large capacity and security, and it can be widely used in various fields of automatic control. These Zigbee WPANs operate at 868 MHz, 902-928MHz and 2.4 GHz frequencies. The date rate of 250 kbps is best suited for periodic as well as intermediate two way transmission of data between sensors and controllers.

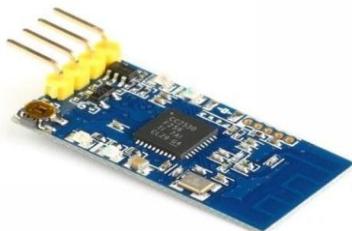


Fig- 7: Zigbee Module

## 2.7 LCD

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals combined with polarizes. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and seven-segment displays, as in a digital clock.



Fig-8: LCD

## 2.8 Buzzer

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke. It generates consistent single tone sound just by applying D.C voltage. Using a suitably designed resonant system, this type can be used where large sound volumes are needed. At Future electronics we stock many of the most common types categorized by Type, Sound Level, Frequency, Rated Voltage, Dimension and Packaging Type.



Fig-9: Buzzer

## 3. SYSTEM IMPLEMENTATION

In below Fig-10 consist of Heart Beat sensor, Humidity sensor and Respiration sensor with Arduino. A humidity sensor measures and reports both moisture and

temperature in air. The ratio of moisture in the air to the highest amount of moisture at a particular air temperature. The heart beat sensor sensing the heart beat. Normal heart rate of a resting person is about 70 bpm for adult males and 75 bpm for adult females and it will show the readings in BPM on the LCD connected to it. In this project we can digitally sensing heart rate, using arduino. Mainly arduino is used because it can sense the environment by receiving input from variety of sensors. Respiration activity and surrounding temperature, water

wafer present in the air and heart rate will be displayed on the LCD. This systems continuously monitor the inside the mining area conditions and update to the control unit wirelessly using zigbee wireless network.

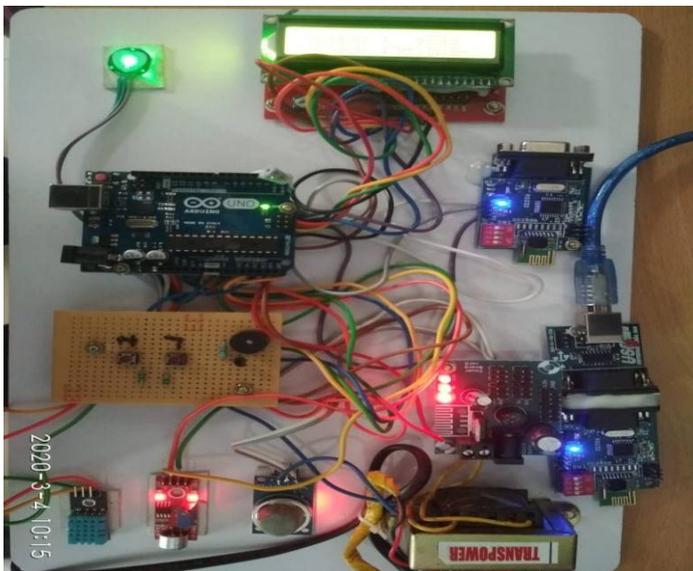


Fig- 10: Mining workers monitoring system

#### 4. CONCLUSIONS

In this system we are using Arduino UNO, DHT11 Humidity, heart beat sensor, respiratory sensor and gas Sensor. The humidity sensor is used for sensing the surrounding temperature and humidity level. Heart beat sensor was used for sensing heart rate, gas sensor used to detect the chemical gases and respiratory sensor used to monitoring the respiration of the person. We use arduino module to connect the overall system. The program will make the Arduino to automatically read the data from the sensors and display in LCD as Humidity, Temperature, heart rate, chemical gas activity and respiratory in display. Then automatically update the date to computer through the zigbee network.

#### REFERENCES

- [1] Jimenez D, (1995), "High altitude intermittent chronic exposure: Andean miners" in Hypoxia and the Brain, Burlington, VT, USA: QueenCity Printers, pp. 284-291.
- [2] Pablo Aqueveque, Christopher Gutierrez, Francisco Saavedra, Esteban J. Pino, Anibal S. Morales, and Eduardo Wiechmann, (2017) "Monitoring Physiological Variables of Mining Workers at High Altitude", IEEE.
- [3] Pino E.J, Dorner De la Paz A, Aqueveque P, (2015), "Noninvasive monitoring device to evaluate sleep quality at mining facilities", IEEE Trans. Ind. Appl., vol. 51, no. 1, pp. 101-108.
- [4] Siliverstovs B, Herzer D, (2007), "Manufacturing exports mining exports and growth: Conintegration and causality analysis for Chile (1960 - 2001)", Appl. Econ., vol. 39, pp. 153-167.
- [5] Valdo Henriques and Reza Malekian, (2016), "Mine safety system using wireless sensor network", IEEE.

#### BIOGRAPHIES



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