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SMART HELMET

[1]Erigela Theja Sree, [2]N.Vinod Kumar
M. Tech Student, Assistant Professor
DEPT OF ECE
K.V.SUBBA REDDY COLLEGE OF ENGINEERING FOR WOMEN (KVSRCEW)

ABSTRACT:
A smart helmet has been developed that is able to detect of hazardous events in the mines industry. In the development of helmet, we have considered the three main types of hazard such as air quality, helmet removal, and collision (miners are struck by an object). The first is the concentration level of the hazardous gases such as CO, SO2,NO2, and particulate matter. The second hazardous event was classified as a miner removing the mining helmet of the ir head. An Magnetic Read Sensor was then used to successfully determine when the helmet is on the miner's head. The third hazardous event is defined as an event where miners are struck by an object against the head with a force exceeding a value of 1000 on the HIC (Head Injury Criteria).An accelerometer was used to measure the acceleration of the head and the HIC was calculated in software.

I. INTRODUCTION

Industrial saftey is one of the main aspects of industry specially coal mine industry.Coal mines involves various risk factors which effects the health of miners.Miners removes their helmet may cause hazardous.sometimes miners collide with the heavy objects like mining objects,hard rock which risks their life.Another factor that effects the miners is the inhalation of hazardous gases that provokes them in danger .In this situation miners are not able to communicate with the outside world. In this case the smart helmet system bacomes an essential and helpful measure to protect the miners from various accidents.This project aims at designing a smart helmet for hazardous event detection,monitoring the surrounding environmental conditions.

INTERNET OF THINGS

Connecting everyday things embedded with electronics, software, and sensors to internet enabling to collect and exchange data without human interaction called as the Internet of Things (IoT).The term "Things" in the Internet of Things refers to anything and everything in day to day life which is accessed or connected through the internet.

Figure 1.Internet of things

IoT is an advanced automation and analytics system which deals with artificial intelligence, sensor, networking, electronic, cloud messaging etc. to deliver complete systems for the product or services. The system created by IoT has greater transparency, control, and performance. As we have a platform such as a cloud that contains all the data through which we connect all the things around us. For example, a house, where we can connect our home appliances such as air conditioner, light, etc. through each other and all these things are managed at the same platform. Since we have a platform, we can connect our car, track its fuel meter, speed level, and also track the location of the car.

HISTORY

As of 2016, the vision of the Internet of things has evolved due to a convergence of multiple technologies, including ubiquitous wireless communication, real-time analytics, machine learning, commodity sensors, and embedded system.This means that the traditional fields of embedded systems, wireless sensor networks, control systems, automation (including home and building automation), and others all contribute to enabling the Internet of things.

The concept of a network of smart devices was discussed as early as 1982, with a modified Coke machine at Carnegie Mellon University becoming the first Internet-connected appliance, able to report its inventory and whether newly loaded drinks were cold. Mark Weiser's seminal 1991 paper on ubiquitous computing, "The Computer of the 21st Century", as well as academic venues such as Unicom and Per Com produced the contemporary vision of IoT. In 1994 Reza Raji described the concept in IEEE Spectrum as small packets of data to a large set of nodes, so as to

integrate and automate everything from home appliances to entire factories". Between 1993 and 1996 several companies proposed solutions like Microsoft's at Work or Novell's NEST. However, only in 1999 did the field start gathering momentum. Bill Joy envisioned Device to Device (D2D)communication as part of his "Six Webs" framework, presented at the World Economic Forum at Davos in 1999 The concept of the Internet of things became popular in 1999, through the Auto-ID Center at MIT and related market-analysis publications. Radio-frequency identification (RFID) was seen by Kevin Ashton (one of the founders of the original Auto-ID Center) as a prerequisite for the Internet of things at that point.Ashton prefers the phrase "Internet forthings."If all objects and people in daily life were equipped with identifiers, computers could manage and store them. Besides using RFID, the tagging of things may be achieved through such technologies as near field communication, barcodes, QR codes and digital watermarking.

II. LITERATURE SURVEY

Internet of Things (IoT) is a worldwide system of “smart devices” that can sense and connect with their surroundings and interact with users and other systems. Global air pollution is one of the major concerns of our era. Existing monitoring systems have inferior precision, low sensitivity, and require laboratory analysis. Therefore, improved monitoring systems are needed. To overcome the problems of existing systems, we propose a three-phase air pollution monitoring system. An IoT kit was prepared using gas sensors, Arduino IDE (Integrated Development Environment), and a Wi-Fi module. This kit can be physically placed in various cities to monitoring air pollution. The gas sensors gather data from air and forward the data to the Arduino IDE. The Arduino IDE transmits the data to the cloud via the Wi-Fi module. We also developed an Android application termed IoT-Mobair so that users can access relevant air quality data from the cloud. If a user is traveling to a destination, the pollution level of the entire route is predicted, and a warning is displayed if the pollution level is too high. The proposed system is analogous to Google Traffic or the Navigation application of Google Maps. Furthermore, air quality data can be used to predict future air quality index (AQI) level

III. EXISTING METHOD

3.1 EXISTING METHOD:

In mines safety of workers is very crucial. At present the supervising of the safety is done by manually by safety engineers and supervisors. There is no sophisticated way or technical way to supervise the safety of the mine workers

PROPOSED METHOD

In the proposed system there are three types of safety modules

1. Intimation of hazardous gases in short time.
2. Head injury criteria.
3. Making sure worker has put on safety helmet.

IV. BLOCK DIAGRAM:

TRANSMISSION NODE :

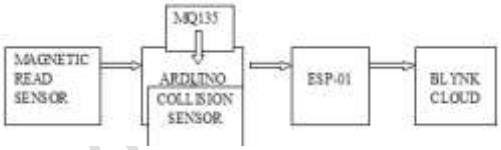

Figure 2. Transmission Node

RECEIVING NODE :

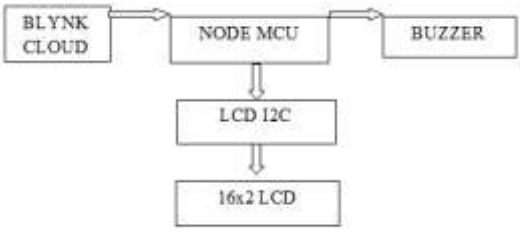

Figure. 3. Receiving Node

FUNCTIONING OF THE SYSTEM

A smart helmet has been developed that is able to detect of hazardous events in the mines industry. In the development of helmet, we have considered the three main

types of hazardous events such as air quality, helmet removal, and collision (miners are struck by an object).The first is the concentration level of the hazardous gases such as CO,SO2, NO2, and particulate matter. The second hazardous event was classified as a miner removing the mining helmet of their head. The third hazardous event was classified as a miners collide with the heavy objects like mining objects, hard rock which risks their life.

An Magnetic Read sensor was then used to successfully determine when the helmet is on the miner’s head or not. If the helmet is not on the miner’s head. The information will send to receiving node via BLNK cloud and Buzzer rings.

At the receiver node, Node MCU receives the data sent by the Transmission Node and it

displays the data on the LCD. LCD is interfaced to Node MCU via LCD I2c adapter. When the data received is above than the threshold value it sends data to the Receiving Node via BLYNK Cloud and Buzzer rings if there is any hazardous gases releases in the coal mines.

V. HARD WARE

ARDUINO UNO

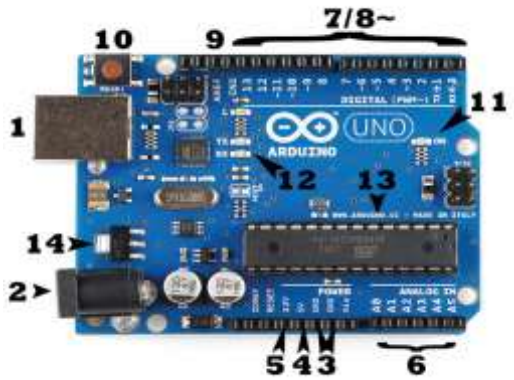

Figure 4.Arduino Uno

PIN CONFIGURATION

Power (USB / Barrel Jack)

Every Arduino board needs a way to be connected to a power source. The Arduino UNO can be powered from a USB cable coming from your computer or a wall power supply (like this) that is terminated in a barrel jack. In the picture above the USB connection is labeled and the barrel jack is labeled .

On how to program with Arduino can be found in our Installing and Programming. The USB connection is also how you will load code onto your Arduino board. More Arduino tutorial.

NOTE:

Do NOT use a power supply greater than 20 Volts as you will overpower (and thereby destroy) your Arduino. The recommended voltage for most Arduino models is between 6 and 12 Volts.

Pins (5V, 3.3V, GND, Analog, Digital, PWM, AREF)

The pins on your Arduino are the places where you connect wires to construct a circuit (probably in conjunction with a breadboard and some wire. They usually have black plastic 'headers' that allow you to just plug a wire right into the board. The Arduino has several different kinds of pins, each of which is labeled on the board and used for different functions.

- **GND (3)**:Short for 'Ground'. There are several GND pins on the Arduino, any of which can be used to ground your circuit.
- **5V (4) & 3.3V (5)**: As you might guess, the 5V pin supplies 5 volts of power, and the 3.3V pin supplies 3.3 volts of power. Most of the simple components used with the Arduino run happily off of 5 or 3.3 volts.
- **Analog (6)**: The areas of pins under the 'Analog In' label (A0 through A5 on the UNO) are Analog In pins. These pins can read the signal from an analog sensor (like a temperature sensor) and convert it into a digital value that we can read.
- **Digital (7)**: Across from the analog pins are the digital pins (0 through 13 on the UNO). These pins can be used for both digital input (like telling if a button is pushed) and digital output (like powering an LED).
- **PWM (8)**: You may have noticed the tilde (~) next to some of the digital pins (3, 5, 6, 9, 10, and 11 on the UNO). These pins act as normal digital pins, but can also be used for something called Pulse-Width Modulation (PWM). We have a tutorial on PWM, but for now, think of these pins as being able to simulate analog output (like fading an LED in and out).
- **AREF (9)**: Stands for Analog Reference. Most of the time you can leave this pin alone. It is sometimes used to set an external reference voltage (between 0 and 5 Volts) as the upper limit for the analog input pins.

RESET BUTTON

Just like the original Nintendo, the Arduino has a reset button **(10)**. Pushing it will temporarily connect the reset pin to ground and restart any code that is loaded on the Arduino. This can be very useful if your code doesn't repeat, but you want to test it multiple times. Unlike the original Nintendo however, blowing on the Arduino doesn't usually fix any problems.

MAGNETIC REED SENSOR:

The reed sensor is an electrical switch operated by an applied magnetic field. It was invented at Bell Telephone Laboratories in 1936 by W. B. Ellwood. It consists of a pair of contacts on ferromagnetic metal reeds in a hermetically sealed glass envelope. The contacts

may be normally open, closing when a magnetic field is present, or normally closed and opening when a magnetic field is applied. The switch may be actuated by a coil, making a reed relay,or by bringing a magnet near to the switch. Once the magnet is pulled away from the switch, the reed switch will go back to its original position.

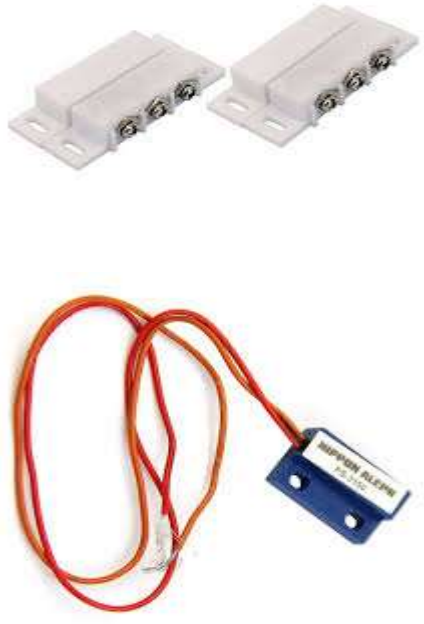

Figure .6.Magnetic reed sensor

MQ 135 GAS DETECTOR:

Figure .7.MQ135

A gas detector is a device that detects the presence of gases in an area, often as part of a safety system. Gas Sensor (MQ2) module is useful for gas leakage detection (in home and industry). It is suitable for detecting H2, LPG, CH4, CO, Alcohol, Smoke or Propane. Due to its high sensitivity and fast response time, measurements can be taken as soon as possible. The sensitivity of the sensor can be adjusted by using the potentiometer.

ESP8266 MODULE

ESP-01 WiFi module is developed by Ai-thinker Team. core processor ESP8266 in smaller sizes of the module encapsulates Tensilica L106 integrates industry-leading ultra low power 32-bit MCU micro, with the 16-bit short mode, Clock speed support 80 MHz, 160 MHz, supports the RTOS, integrated Wi-Fi MAC/BB/RF/PA/LLNA, on-board antenna. The module supports standard IEEE802.11 b/g/n agreement, complete TCP/IP protocol stack. Users can use the add modules to an existing device networking, or building a separate network controller.ESP8266 is high integration wireless SOCs, designed for space and power constrained mobile platform designers. It provides unsurpassed ability to embed Wi-Fi capabilities within other systems, or to function as a standalone application, with the lowest cost, and minimal space requirement.

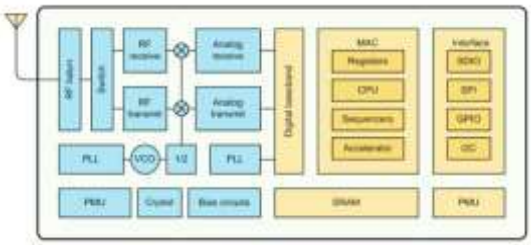

Figure .8. ESP8266EX Block Diagram

5PIN OUT DIAGRAM

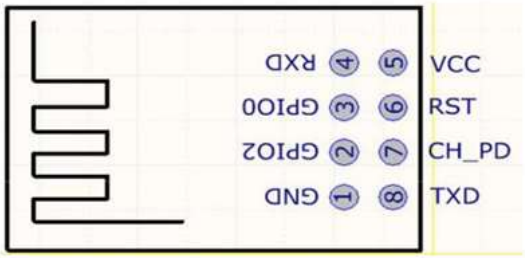

Figure 9.Pin out Diagram for ESP-01

I2C ADAPTER

IIC/I2C Interface Adapter Module is used for 16×2 LCD Display. It uses the PCF8574T IC chip which converts I2C serial data to parallel data for the LCD display. Also this interface module

simplifies connecting an Arduino to a 16×2 Liquid Crystal display using only 4 wires.

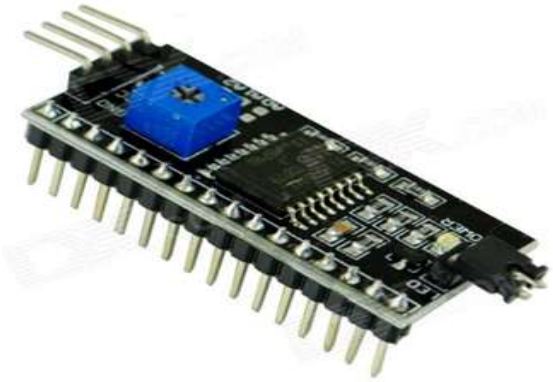

Figure.10. I2C Adapter

LIQUID CRYSTAL DISPLAY

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

Figure .11.Liquid Crystal Display

BUZZER:

A buzzer or beepern is an audio signalling device. When the buzzer gets the required voltage, which actually is monitored and instructed by MCU it begins to buzz and alerts the nearby. Buzzer starts beeping and a message is displayed on LCD to alert the users and nearby people. Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or key stroke.

Figure .12. Buzzer

VIBRATION SENSOR

The vibration sensor is also called as piezoelectric sensor. These sensors are flexible devices which are used for measuring various processes. This sensor uses piezoelectric effects while measuring the changes within acceleration pressure ,temperature, force

Figure .13. Vibration sensor

VI. EXPERIMENTAL RESULTS

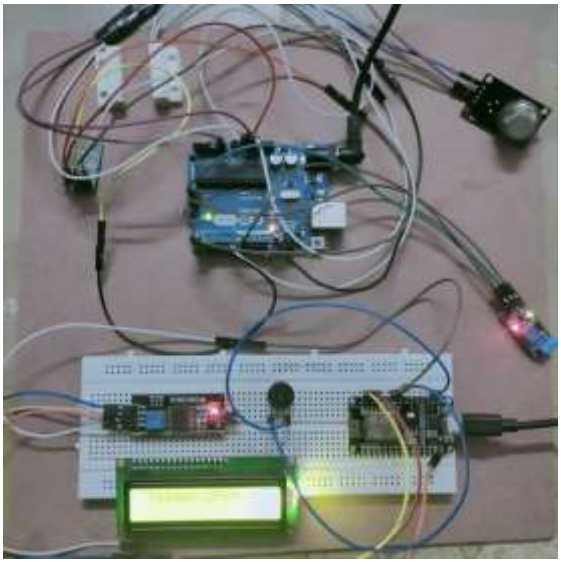

Figure:14. Experimental Setup

AIR QUALITY TEST

Air quality test is done by air quality sensor MQ 135.MQ 135 sensor measures a wide range of gases like LPG,CO and CO_2 .This sensor detect critical levels of dangerous poisonous gases which are hazardous for human health in the mining industry and it has been indicated through alerting unit and the data is displayed in LCD as shown in fig 7.1 The data is transmitted to monitoring section by using IOT technology.

Figure :15. Air Quality Test Result

HELMET REMOVAL TEST

Helmet removal test is done by using magnetic reed sensor. When helmet is removing then helmet helmet removal event is detected and displayed in LCD "HELMET OPENED" as shown in fig 7.2 and it has been indicated through alert unit(buzzer)

Figure :16. Helmet Removal Test Result

COLLISION DETECTION TEST

Collision test is done by using vibration sensor. When collision is done then collision detection event is detected and displayed in LCD as" COLLISION" and it has been indicated through alerting unit.

Figure 17: Collision Detection Test Result

VII. CONCLUSION

The paper builds a middle ware of protection with remote observations and give audio alerts. This system observes the parameters like hazardous gases, humidity, and temperature and fire condition present in underground mining section. This system displays all these parameter in LCD at the underground area where sensor unit introduced. It will be helpful to every one of excavators present inside mine unit spare their life before any loss happens. This framework likewise records every one of the information in hyper terminal in the PC for further review. This is a light weight with low cost smart and lifelong system.

FUTURE SCOPE

The frame work can be enhanced by adding all the more estimating gadgets to check the excavator's circulatory strain and heart rate. In future, it could likewise be utilized for auxiliary administrations.

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