*International Journal of Engineering &Technology*, 7 (3.12) (2018) 677-680

International Journal of Engineering & Technology

*Website: www.sciencepubco.com/index.php/IJET*

***Research paper***

# Intelligent Wearable Device for Coal Miners

**[1]P.Prabhu, [2]Umang, [3]Jyothi Jayakumar, [4]ChPhanindra Kumar**

*[1]Assistant Professor, [2,3,4]B Tech Embedded System Technology,*
*[1,2,3,4]Department of electronics and communication, SRM Institute of Science and Technology, Chennai*
**Corresponding Author Emai: l[1]prabhu.p@ktr.srmuniv.ac.in ,[2]umg.0515@gmail.com,[3]jyothi.jayakumar@rediffmail.com, [4]chphani2014@gmail.com*

**Abstract**

In this paper we are designing an intelligent wearable device for coal miners. This proposed system not only helps the workers in telling about the poisonous gases that are present but also tracks them if any mishap occurs. The device is provided with methane and carbon monoxide gas sensor. It ensures the supervision based on IoT (Internet of Things). We make use of mainly NRF module and RFID technology. RFID can easily track a person in case of an accident. Use of IoT helps us to make the database as well as helps us in communication to the nearest hospital if help needed.

***Keywords:*** *wearable device, methane and carbon monoxide gas sensor, IoT, RFID.*

## 1. Introduction

Wellbeing is the interminable topic of the coal business. Because of complex geographical conditions and poor creation conditions in coal mines, a large portion of the past checking frameworks depend on the wired system design. Nonetheless, this sort of design additionally brings a few issues: underground organization of these frameworks is troublesome; and in light of the fact that the hardware in view of wired correspondence is poor in versatility and adaptability, it likewise is hard to completely screen all zones of mines.

The system uses arduino microcontroller. The arduino mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital I/O pins to be used as PWM 16 Analog inputs, 4 UART'S , a USB association, a 16 MHz crystal oscillator ,an ICSP header, a power jack, and a button to reset .It has vital necessities to help the microcontroller. The Arduino mega 2560 board is matchable with several shields designed for Uno also the former boards .To switch on the board it can be connected to a computer using a USB cable or powered with an AC-to-DC adapter.




**Fig. 1 :**Arduino board

## 2. Review of Literature

### Literature Survey:

### 1. Implementation of Smart Safety Helmet forCoal Mine Workers

This paper presents execution of security cap for coal excavators. This protective cap is furnished with methane and carbon monoxide gas sensor. This sensor sense the gas and the information is transmitted to the control room remotely, through a remote module called X-Bee associated with the head protector. At the point when the methane or carbon-monoxide gas focus is past the basic level, controller in the control room triggers a caution and guards the plant and the laborers by keeping an up and coming mishap. The significant issue is the execution, all things considered, as this is fundamentally performed in MATLAB and AUTOCAD.

### 2. ZigBee Based Intelligent Helmet for Coal Miners

In this paper, a fiscally sharp ZigBee-based remote mine supervising structure is displayed. This arrangement used adroit head defenders as voice terminal and ultra-low-control centers of remote sensor sort out. The engineer got ZigBee remote advancement to manufacture remote sensor frameworks, recognized constant perception with early-alerted knowledge on methane, temperature, stickiness in mining zone, and utilized discourse correspondence to decrease potential wellbeing issues in coal generation. The additional items that can be incorporated are the remote situating gadgets that can give the exact position of the diggers.

## 3. Existing System

Most of the previously existing systems use the ARM7 microcontroller and the AVR microcontroller which although are

**Copyright © 2018 Authors. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.**

highly efficient, have been outdated and replaced by more efficient technologies. Although the existing systems are functional, they are incapable in some aspects, such as a tracking device reporting itself inside a coal mine. Moreover, global position system (GPS) system does not work in an underground mine, so there is need for a new technology. The Zigbee protocol has been used. Zigbee is a good wireless solution for arduino long time; however, it is expensive.Robots are used for surveillance of mine that too are expensive.

### Problems in existing system

1. ARM7 and AVR micro-controller are now latent technologies further upped by open source Arduino platform.
2. GSM is a wide communication standard that is used in our mobile phones but inside mine signal availability is none so they are useless.
3. Zigbee protocol while good for wireless communication can be too short ranged and expensive.

## 4. Proposed System

The system we propose makes use of an external intelligent wearable device or coat for the convenience of the miners. Unlike the existing systems that uses a helmet which might put the miner in risk at the time of short circuit and effect the brain, a jacket is more convenient. Arduino mega is used which has good set of pins for sensors. It is also very less power consuming NRF is used for wireless communication of the data. RFID is used for the tracking of the person.

### Advantages of Proposed System

1. RFID can easily track a person in case of mishap.
2. Data security.
3. Efficient power consumption.
4. NRF module range is better than Zigbee modules range.
5. Use of IoT helps us to make the database as well as helps us in communication to the nearest hospital if help needed.

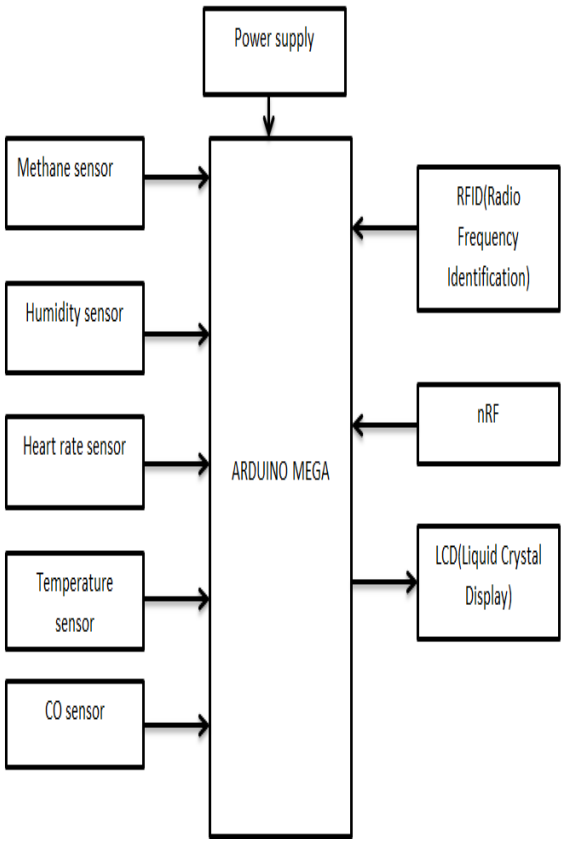
## 5. Working System

The excavator's coat comprises of gas sensors, RFID tag, temperature and humidity sensors, and an LED (gleams on the off chance that they are in the unsafe territory). Gas sensor is utilized to recognize the centralization of various gases like, methane, CO2 inside the coal mine. RFID labels are utilized for the participation purposes and it additionally helps in following the excavators on the off chance that they are lost inside the mine utilizing the idea of "most limited way guideline". Temperature sensor can be LM35 to gain the points of interest of temperature inside the mine.
Humidity sensor is utilized for computing the measure of dampness exhibit noticeable all around at various areas inside the mine and it additionally encourages us to keep up the ventilation inside the mine. The signs which are gained by the sensors are gathered and sent to the PCs exhibit in the control room through the different switches introduce inside the mine. These data are gathered and put away for all the excavators. In the control room the PC thinks about every one of the qualities that are gotten with the qualities show in the database. It is done independently for every one of the people. On the off chance that the qualities are over the suggested esteems then it sends an alarm flag to the safeguard division and furthermore to that specific individual and the LED in their coat gleams. It helps in guaranteeing the wellbeing of the mineworkers.

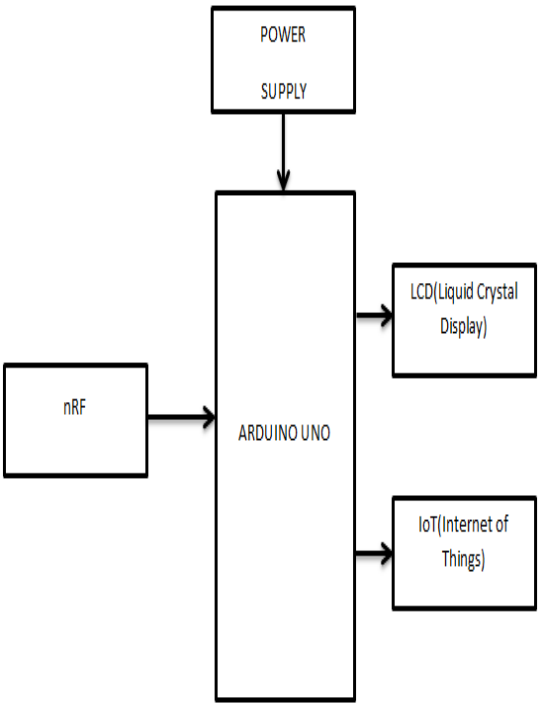
## 6. System Architecture

The system consists of two units, one is the transmitting and the other receiving.

### Transmitter Unit:



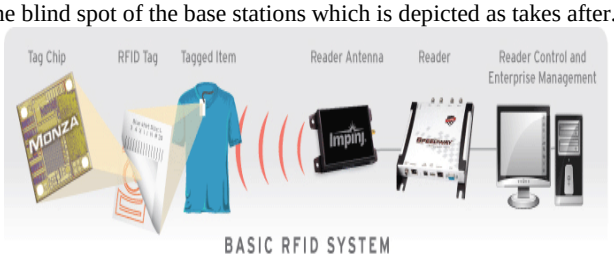

### Receiver Unit:



## 7. Technology Used

### RFID Technology

The figure illustrates the rudimentary RFID development, where it is placed in the coat which is proposed our idea .Marks are associated with everything that are to be taken after in a RFID system. A minor tag-chip is utilized for creating these names, occasionally called a integrated circuit (IC), a wide combination of mechanical asset names and a vast range of names which includes dress hang names, imprints, and security marks, IC that is a radio wire can be fused with the above mentioned items. Electronic product code (EPC) and other shifting information with the goal that it could be scrutinized and taken after by RFID pursuers wherever it stores in the name chip memory. An RFID pursuer is a framework related contraption (settled or compact) with a radio wire that sends data and requests and control to the tags. A persons data can be made available to a foreordained application by the RFID pursuer which acts like a passageway point for RFID marked things .Thus, data of the right position of the tag and besides the time at which the device is last analysed can be secured .Not only it gives the data at any instance inside the base station but also it is used for the desire of the person in the blind spot of the base stations which is depicted as takes after.




### IoT

The Internet of Things (IoT) is a graph of inter connected picking appliances, mechanical and pushed devices, articles or people which are suited with dazzling identifiers and capable of exchanging information over a structure.In IoT things can be seen and controlled remotely. Effectively when sensors and actuators are used in IoT , the propel is converted into a broader class of modernized structures, that in like way joins sorts of progress. Following total is incomprehensibly clear through its displayed administering structure however can interoperate inside the present Internet foundation. Experts' watch that IoT will join romanticize around 70 billion of excitement by 2025. Internet of Things (IoT) is an area in which creatures, articles or individuals are locked in uncommon identifiers and to exchange data over a structure Information might be re-built up to a site or a social relationship through which the user can deal with so as to get to the data

## 8. System Hardwares and Softwares

### Hardwares

**Arduino Mega-** Different microchips and small scale controllers are utilized for Arduino board plans. The sheets have sets of Analog input/output (I/O) pins and advanced I/O sticks that are interfaced to different development sheets and different circuits. The arduino mega 2560 has 54 advanced I/O pins and 16 simple inputs. The board features serial correspondences interfaces like USB on a couple of models, that can be used for stack up programs from PC's. Smaller scale microcontrollers are re-modified using features from programming Languages C and C++.

**Heart Beat Sensor- U**tilizing a high power composed LDR and LED ,heart beat is measured. Between them, the finger is put. As sensors capture diode or a capture transistor can be used.
The skin is lit up red using reflected or transmitted light for acknowledgment. The moving blood substance of human tissue causes little changes in reflectivity or in transmittance that are generally impalpable. The setup depicted uses an LED for transmitting light illumination and an LDR as pointer.Simply light modifications in the pre enhancer unit comparable circuit and programming can be used with other light and acknowledgment thoughts.

**Webserver/Webpage-** A page on the Internet gets the information from the Arduino and presentations the units expended and cost brought about in a straightforward arrangement.

**MQ4 Gas sensor-** MQ arrangement sensors utilize a little radiator inside with an electro-substance sensor to gauge distinctive sort of gases blend. They can be adjusted, in any case, all together to do that a known convergence of the deliberate gas or gases is required for that. For mechanical reason adjustments are done in uncommon metrology research facilities with precise.
**Temperature Sensor-** The LM35 is a consolidated circuit sensor which is used to evaluate temperature with an electrical yield in respect to the temperature (in oC).

**RFID Reader and Tag A** gadget that is utilized to examine a RFID tag is an RFID reader. The per user has a receiving wire that transmits radio waves; the tag responds by sending back its data. A n RFID tag is a microchip joined with a radio wire in a limited package; the packaging is composed to allow the RFID tag to be annexed to a dissent be taken after. "RFID" remains for Radio Frequency Identification. The reception apparatus gets signals from a RFID per user or scanner and afterward restores the flag, ordinarily with some extra information (like a one of a kind serial number or other modified data).

**NRF24L01**-The module using the band of 2.4 GHz and position with modem speed rate of 250 kbps up to 2 Mbps. On the off chance that utilized as a part of broad region and its range can reach up to 100 meters with lesser modem speed rate. It could utilize 125 unique channels that gives an opportunity to have a system of 125 freely functioning device in a single region. Every path could have 6 addresses, each unit can speak with 6 different units in the meanwhile.12mA is the power utilization of this module in between communication, that is lower than an LED. 1.9 to 3.6V is the working voltage of the module , yet the best part is that alternate nodes endure 5V logic, thereby without using any logic level converters we could very easily interface it to an Arduino.
.
**LCD** -A 16*2 display system is placed inside the vehicle for displaying sensor alerts and transaction details.

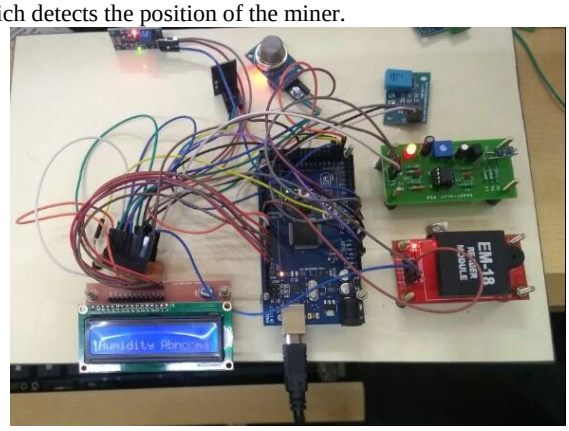
### Softwares

**Arduino:-** The microcontroller on the board is changed using the Arduino programming tongue (in light of Wiring) and the Arduino change condition (in light of Processing). Arduino endeavours can be stay lone or they can talk with programming running on a PC. The codes required for various sensors especially the point of confinement regards set are directed using this item.

## 9. Result and Discussions

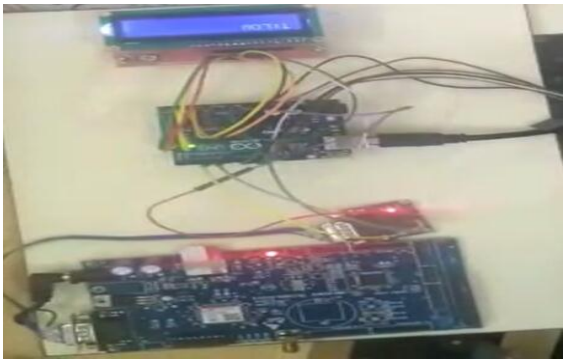
### Transmitter unit:-

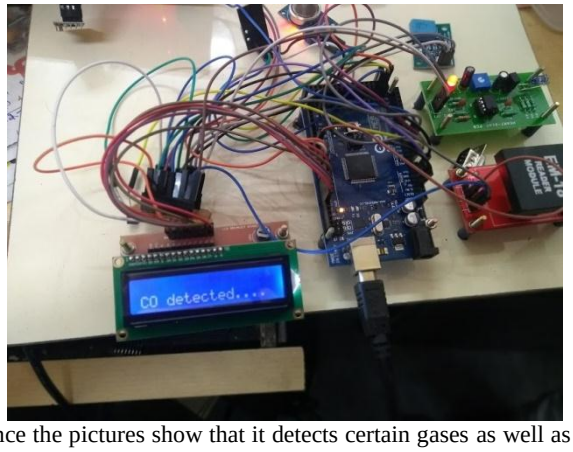
The transmitter unit consists of various sensors like the temperature sensor, humidity sensor, gas sensors and heartbeat sensor. The unit has all the sensors connected to the Arduino mega and an nRF module connected to it. It consists of an RFID reader which detects the position of the miner.



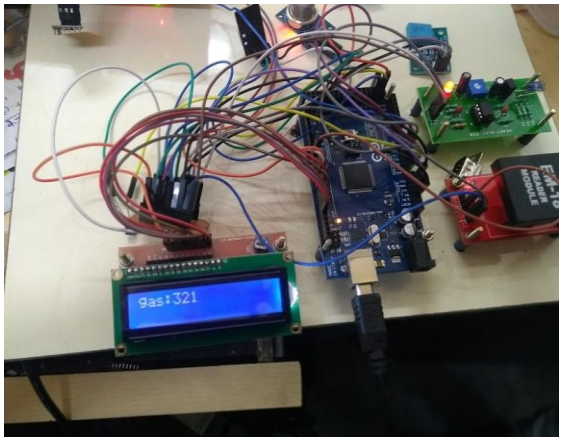

### Receiver unit:-

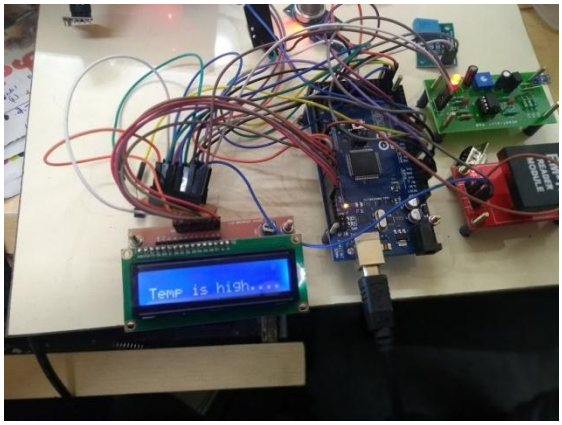
The receiver unit consists of an Arduino UNO to which the receiver nRF module is connected. Here the receiver nRF module receives the various values of the sensors. there is an IoT board which is connected to Arduino UNO. So the received sensor's values get updated in the cloud. By doing so the condition of the person inside the mine can be monitored by the people outside the mine.






Hence the pictures show that it detects certain gases as well as the temperature and humidity of an area which are displayed on the screen.




## 10. Conclusion

A keen coat for the miners in light IoT and NRF technology is the execution of IoT in remote sensor systems which made utilization of correspondence conventions, for example, NRF, RFID innovation measures. As the aftereffect of wearing this coat, more significance is given to the individual observation and also gives security supervision in the coal mining industry. It additionally alarms the individual in the event of basic crises and furthermore the supervision. Along these lines it gives a coordinated general supervision framework in the coal mining industry

## References

[1] "Intelligent coal mine monitoring system based on the Internet of Things",Consumer Electronics, Communications and Networks (CECNet), 2013 3rd International Conference

[2] "SMART JACKET FOR THE COAL MINERS BASED ON WIRELESS SENSOR NETWORKS & WoT" International Journal on Application in Information and Communication Engineering Volume 3:Issue 1: January 2017 .

[3] "Rescue System for Coal Mine Workers using Different Sensors Based on GSM and RF-PRO" International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume 3 Issue 7, July 2014.

[4] "Coal Mining Safety using IoT" Imperial Journal of Interdisciplinary Research IJIR(vol 3)

[5] Intelligent Coal Mine Monitoring System based on the Internet of Things International School of Software, Wuhan University, Wuhan, China 2School of Electronic Engineering, Dublin City University, Dublin, Ireland