IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 3, Issue 1, February 2023
Impact Factor: 7.301

Smart Helmet for Coal Mining

Prof. Yogesh Mali[1], Nilay Sawant[2], Suhas Patil[3], Sonali Kumari[4], Maya Anose[5]
Professor, Department of Computer Engineering[1]
Students, Department of Computer Engineering[2,3,4,5]
G H Raisoni Institute of Engineering and Technology, Pune, Maharashtra, India

Abstract: *The Coal Mining Helmet designed on this paper aims to offer protection to miners through alerting them. All the elements may be referred to only if the person is carrying the helmet. The output from the helmet module continues updating every instance i.e., actual time information is been updated to the cloud. These wearable gadgets get to share their information or retrieve the information thru different source through using internet of things (IOT). Alerts are sent to the miner and the supervisor if any hazard is detected. Ubiquitous computing and wearable computer systems have contributed extremely to the evolution of wearable gadgets. Thus, this wearable device consists of the diverse sensors, alerting mechanism and communication system to broaden and enhance protection of the miner. The hardware incorporates of information collection, data processing and data communication sections. Sensors employed a) Temperature and humidity sensor (DHT11): In mines, the extent of temperature and humidity will become excessive at instances and prove to be fatal to the miner. The liberation of those gases should result in respiratory trouble to the person within the mines and could result in choking. If one or extra of these portions exceed the threshold limit, an alert is sent to the miner as well as the base Authorizer. The data collection or measuring of the parameters is achieved using WSN technology. WSN technology is a network of sensors, in which each of the sensors has unique parameters to sense but carry out collectively as part of the system. The level of temperature and humidity is understood to the miner through showing it on an OLED (Organic LED) and for the gas a threshold is set and a buzzer alert is given if it's far past the threshold.*

Keywords: OLED (organic LED), Humidity sensor (DH11), MQ2, Arduino

I. INTRODUCTION

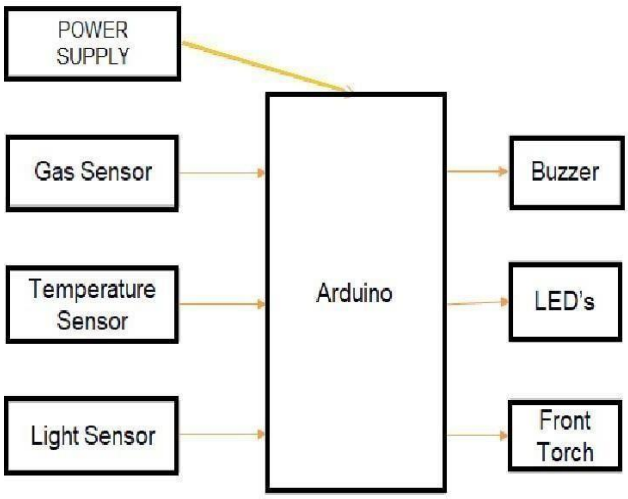
The world has extensive and diverse mineral resources and huge mining industry. Correct oversight and proper communication are extremely vital demand of the mining industry. Supervisors are held responsible for all injuries sustained underneath their supervision, and will thus be aware of probably risky situations. The issue being addressed is that the improvement of a mining helmet to extend miner safety awareness. Once operating with clamorous equipment, being conscious of one's surroundings will generally, be challenging. Miners within the mining business often take away a number of their safety instrumentation as a result of it is too heavy, heated, or uncomfortable to wear Miners, on the opposite hand, seldom take away their helmets. Presently mining safety helmets solely have the aim of protective the miner's head against potential hazardous bumps, no technology has been in place to security helmets to alert miners once a fellow miner has encountered a hazardous incident. As a result, the project' goal is to feature a wireless sensor node network to associate existing mining safety helmet to form it even safer the goal was expanded to include coming up with a system that could fit inside a safety helmet associated last long enough on battery power. Another issue was modifying the helmet' physical style while not compromising its function. The additional weight had to be kept as lightweight as possible. A mining helmet should be modified to boost manual laborer safety by incorporating intelligence. When a miner removes his helmet, A miner must be told before removing his helmet. If an object falls on a miner, even when carrying his helmet, he will become unconscious or immobile. The system must decide whether a manual laborer has suffered a probably fatal injury. These two events are outlined as venturous events. Third, dangerous gases got to be detected and announced.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 3, Issue 1, February 2023
Impact Factor: 7.301

II. ARCHITECTURE

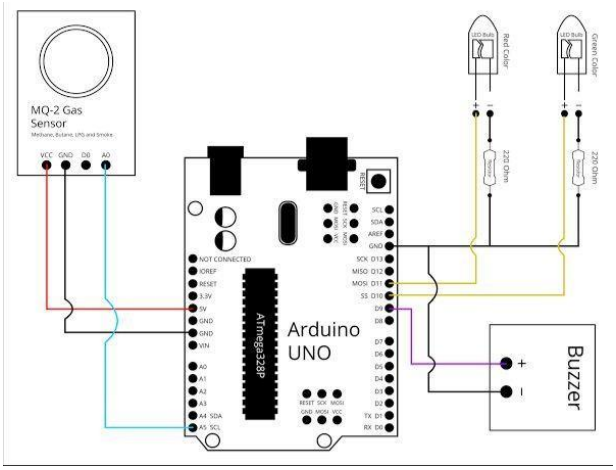
The system design is split into two parts transmitter half and receiver part transmitter part consists - Gas sensor, Temperature and humidity sensor, LDR, and Power supply. Then there's Arduino UNO and within the receiver section there is a buzzer and LED. When the manual laborer enters, he activates the helmet circuitry. The temperature and humidity sensor DHT11 observes the encompassing temperature and humidity continuously and checks if the worker is safe or not and saves the data. Hence when temperature or humidity anyone of the conditions becomes unfavorable for the workers, safety measures might be taken means that the light-emitting diode will blink and indicate that it's not safe for the worker. The gas sensor i.e., MQ2 sensor detects toxic gases like ethane, methane, butane, etc., and if such gas is detected then the buzzer is turned ON, and it'll begin beeping and therefore the system should decide whether a manual laborer has suffered a potentially fatal injury. This helps in avoiding the exposure of workers to the harmful toxic gases.

III. BLOCK DIAGRAM



IV. WORKING OF SENSORS

4.1 MQ2

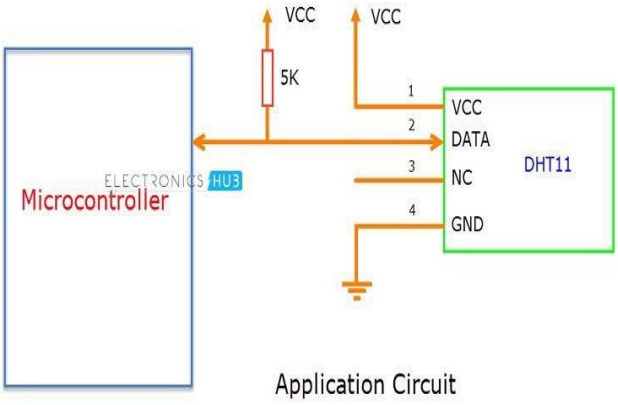


MQ2 may be a metal oxide semiconductor-type gas sensor. A voltage divider network within the sensor is employed to monitor gas concentrations in the gas. A sensing element, largely aluminum-oxide-based ceramic lined with tin dioxide, is contained in a very stainless-steel mesh during this sensor. Six connecting legs are linked to the sensing frame. The heating of the sensing element is handled by two leads, whereas the output signals are handled by the remaining four. Once a sensor material is heated to an extreme temperature in air, oxygen is adsorbed on the surface. The donor electrons in tin oxide are then drawn to this oxygen, interference this from flowing. When reducing gases

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 3, Issue 1, February 2023
Impact Factor: 7.301

are present, these oxygen atoms react with the reducing gases, lowering the adsorbed oxygen' surface density Currently, that current will flow through the sensor, analogue voltage values are created. These voltage values are used to verify the gas concentration. Once the gas concentration is high, the voltage values are higher.

4.2 DHT11

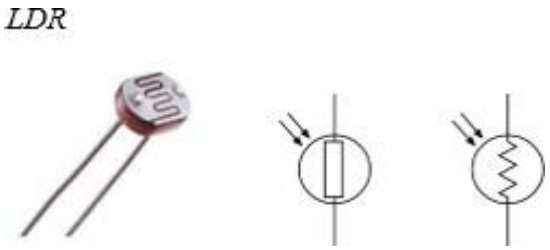


Application Circuit

DHT11 is a low-priced digital sensor for sensing temperature and humidity Any microcontroller, equivalent to Arduino or Raspberry Pi, may pronto communicate with this sensor. To measure humidity & DHT11 sensor temperature instantaneously.

An electrical phenomenon humidity detecting element and a thermistor for temperature detection compose the DHT11 sensor. A moisture-holding substrate acts as a dielectric between the humidity sensor capacitor' two electrodes. With changes in humidity levels, the capacitance worth changes. The IC measure, method these modified resistance values and changes them into digital form. This sensor measures temperature with a Negative Temperature constant Thermistor, that decreases resistance as temperature rises. To induce a bigger resistance worth even for the tiniest modification in temperature, this detector is typically created from semiconductor ceramics or polymers. DHT11 encompasses a temperature vary of zero to 50 degrees Celsius with a 2-degree accuracy. The humidity range of this sensor is from twenty to 80% with 5% accuracy. This sensor' sampling rate is 1Hz, i.e. it provides one reading for each second DHT11 may be a small semiconductor with a three to 5 V operating voltage. During measurement, throughout measurement, the utmost current used is 2.5mA. VCC, GND, information Pin, and a not connected pin are the four pins on the DHT11 sensor for communication between the sensor and also the microcontroller, a pull-up resistor of 5k to 10k ohms is provided.

4.3 LDR



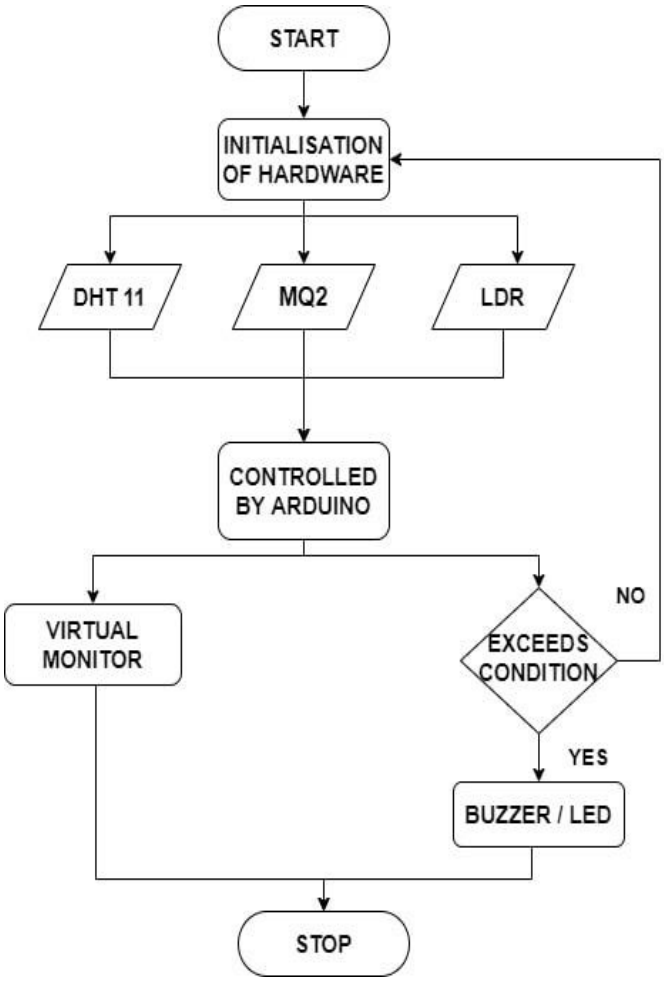
An electronic part like LDR or a light-dependent resistance is tuned in to light. Once light rays drop on it, then the resistance will be suddenly changed. The working principle of an LDR is photo-conductive, that is nothing but an optical phenomenon. The material's physical phenomenon improves once light is absorbed by the substance. When light shines on the LDR, the electrons within the material' valence band rush to the conduction band. However, the photons in the incident light must have an energy greater than the band gap of the incident light as a result, when light contains a lot of energy, additional electrons are excited to the physical phenomenon band, leading to a lot of charge carriers. When the impact of this method and also the flow of this starts flowing more, the resistance of the device decreases.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 3, Issue 1, February 2023
Impact Factor: 7.301

V. ALGORITHM

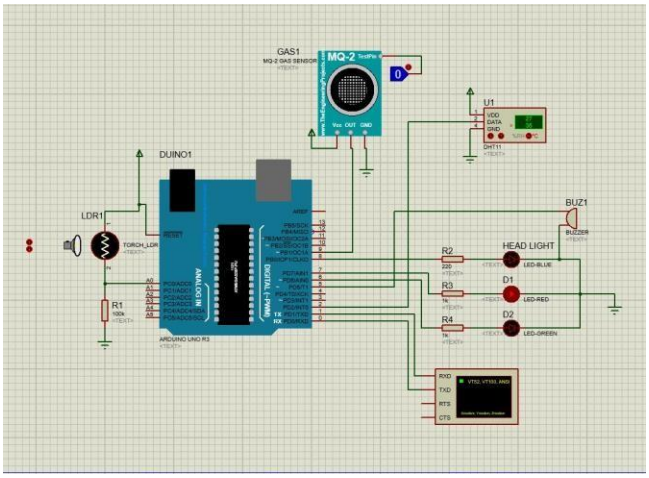
1. Begin
2. Import DHT11 libraries and outline the pins of DHT PIN as and DHTTYPE as DHT11.
3. Set the smokeA0 variable to A0, the buzzer to 11, and also the light and gled to 10.
4. Within the Setup, the function defines the input and output pins using pin Mode and using serial begin to start the Arduino. The input pins are SmokeA0 and DHT PIN and the output pins are green LED and buzzer.
5. In Loop function browse the sensor worth of MQ2 using analog read and if the sensor value is bigger than 300 then print that smoke is detected and conjointly keep a delay of {two} sec between two values.
6. Read the LDR as analog read and store it during a light variable if the worth of light if there are fewer than 500, print Keep the light intensity low if the light value is greater than the print value, keep the light intensity low and switch it on; if the value of light is greater than print, keep the light intensity high and turn it off.
7. In DHT11 use the constitutional function corresponding to read Humidity to get wetness and read Temperature to induce the temperature and store them in humi and tempc variable respectively, if the worth of humi is bigger than 22 or tempc is greater than 33 then flip the gled on.
8. Stop

VI. FLOWCHART



IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 3, Issue 1, February 2023
Impact Factor: 7.301

VII. CIRCUIT DIAGRAM AND WORKING



MQ2 sensor, Dht11 sensor, LDR resistor, and three led. We've a standard VCC for most devices and is connected with pin reset to the left we have LDR the negative pin of LDR is connected to the ground and the Positive end is connected with a resistor of 100K ohm at A0 pin the output of LDR is given with blue light- emitting diode that is connected to the output pin 8. MQ2 sensor consists of three pins the VCC, Ground, and output the output pin is connected to pin 9, and output is given with red light- emitting diode and buzzer. DHT11 sensor consists of three pins VCC, Ground, and information the data pin is connected to the output pin two and the output is given with green LED

VIII. TESTING OUTPUT

The output of MQ2, LDR, DHT11 are shown respectively on the virtual terminal. Apart from this the real time notification or alert for MQ2 will be given by the buzzer, for DHT11 output can be seen in green LED and for LDR output can be seen in red LE

Symbol	MQ-2	MQ-3	MQ-5
Gas Detection	Combustible Gas, Smoke	Alcohol Vapor	LPG, Natural Gas
Detect Concentration	300-10000 Ppm	0.04–4mg/L alcohol	300 –10000 ppm

Parameter	DHT11	DHT22
Temp. Measurement Range	0 to 50 Deg. C	-40 to 80 Deg. C
Temp. Accuracy	+- 1 to 2 Deg. C	+- 0.5 Deg. C
Relative Humidity Range	30% to 90%	0% to 100 %
Relative Humidity Accuracy	+- 4% to 5%	+-2% to 5%
Operating Voltage	3.3 V to 5V	3.3 V to 5 V
Resolution	8 bits	16 bits
Sampling period	>=1 sec	>=2 sec

IX. FUTURE SCOPE

The set-up is to incorporate a WiFi module that may collect all the mandatory info and update it within the database. The data are going to be sent continuously, so the database will contain the period on-site surroundings details. The database will then be made available remotely so the supervisors and higher authorities can watch out of just in case of any venturous condition and also the medical facilitate can be made available sooner. The GPS module will help the emergency department to. Locate the miners in case of dangerous things and to send help sooner.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 3, Issue 1, February 2023
Impact Factor: 7.301

X. CONCLUSION

We have successfully created a wise helmet for laborers which will observe gases, humidity, temperature, and light. The edge values are manually set however can be updated as per the traditional situation of the mining sites. Just in case of any unpredictable situations the modifications will be detected by the sensors and if hazardous the notification can be received within the form of change in light-emitting diode color and alarm from buzzer, so the miner can act accordingly. We have conjointly integrated a GPS module which may provide real time position of miners in case they're unreachable. This system has designed an observation system for underground environmental of mine supported wireless detector network, which may monitor data in real time. It can notice information interaction between mine terminal and mine and alarm abnormal environmental parameters. This system has the benefits of convenient networking, smart flexibility and expansibility, low installation and maintenance cost

XI. ACKNOWLEDGEMENT

We take this opportunity to thank our project guide and Head of Department, Prof. Yogesh Mali, for his valuable guidance and for providing all the necessary facilities that were essential for the completion of this project report. We also thank all the staff at the Department of Computer Engineering of G.H. Raisoni Institute of Engineering and Technology, Pune, for their valuable time, support, comments, suggestions, and persuasion. We would also like to thank the Institute to provide the required facilities, internet access and essential books.

REFERENCES

[1]. Yingli Zhu,Guoping You, “Monitoring system for coal mine safety based on wireless sensor network”,IEEE 2020

[2]. Pranay Mangukar and Urmila Sharawankar, “Monitoring and Safety System for Underground Calamities”, Research Gate April 2019.

[3]. A.J. Pudke And Sanket Banger, “Coal Mine Monitoring And Alert System With Data Acquisition” IEEE September 2019

[4]. Warsha M.Choudhari Professor, Datta Meghe, “Coal Mine Security System ” International Journal of Applied Information Systems (IJAIS) – ISSN : 2249- 0868 Foundation of Computer Science FCS, New York, USA Volume 4– No.10, December 2013.

[5]. Prof. Himanshu K. Patel, Deep H. Desai, Tanvi G. Badheka,“GSM Based Flexible Calling System ”International Journal of Engineering Trends and Technology (IJETT) - Volume4Issue4- April 2013 .

[6]. Vandana,PG Scholar,“Development of Coalmine Safety System Using WirelessSensor Network” Department of Electronics and Communications Engineering Sri Vasavi Engineering College, Tadepalligudem Andhra Pradesh, India ,2012 .

[7]. Huping Xu, Feng Li, Yancheng Ma, A ZigBee-based miner Localization System’, IEEE, 2012.

[8]. Shuo pang, Ricardo Trujillo, Indoor Localization Using Ultrasonic Time Difference of Arrival’, IEEE, 2013.

[9]. Yongping Wu, Guo Feng, Zhang Meng, The Study on Coal Mine Using the Bluetooth Wireless Transmission’, IEEE, 2014.

[10]. Yuping Zhang, Yinghui Zhang, Chen Li2, Research of Short Distance Wireless Communication Technology in the Mine Underground’,IEEE, 2014.

[11]. Andreas fink, Helmut Beikirch, Matthiassvob, Christian Schroder, RSSI Based Indoor positioning using Diversity and Industrial Navigation’, IEEE, 2010

[12]. ShehadiDayekh, Sofi eneAffes, NahiKandil, Chah e Nerguizian, Cooperative Localization in Mines Using Fingerprinting and Neural Networks’, IEEE, 2010

[13]. Angus F.C.Errington, Brian L.F. Daku, Arnfinn F. Prugger, Initial Position Estimation Using RFID Tags: A Least-Squares Approach’, IEEE, 2010

[14]. HyochangAhn, Sang-Burm Rhee, Simulation of a RSSI- Based Indoor Localization System Using Wireless SensorNetwork’, IEEE, 2010

[15]. Johannes Schmid, Tobias G¨adeke, Wilhelm Stork, KlausD. M¨uller-Glaser, On the Fusion of Inertial Data for Signal Strength Localization’, IEEE, 2011.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 3, Issue 1, February 2023
Impact Factor: 7.301

[16]. Huping Xu, Feng Li, Yancheng Ma, A ZigBee-based miner Localization System', IEEE, 2012.
[17]. Shuo pang, Ricardo Trujillo, Indoor Localization Using Ultrasonic Time Difference of Arrival', IEEE, 2013.
[18]. Yongping Wu, Guo Feng, Zhang Meng, The Study on Coal Mine Using the Bluetooth Wireless Transmission',IEEE, 2014.