IOT BASED COAL MINING SAFETY FOR WORKERS USING ARDUINO

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ABSTRACT:

A coal mine safety system is implemented for this project by using a webpage as a data transmission medium. The device is used to monitor a variety of parameters inside coal mines, including light detection, gas leakage, temperature and humidity levels, and fire detection. This sensor network is known as one large device and is installed in coal mines. All sensor rankings are automatically fed into the thinking processors, generating a plethora of ideas for them to investigate. Gas monitoring equipment is still running here to detect any potential problems, and a buzzer is used to alert the staff. In this framework, laser-detection (LDR) sensors are used to detect the presence of light. When you turn on the lights, they illuminate automatically, and you can control them with the LED button. A notice is sent to the designated individual's mail to ensure proper response to any potential fire hazard. There is also a collection of constantly measured and recorded temperature values, which are displayed on the serial monitor and the website platform. A vibration sensor is also used to detect any movement in the mine.

Keywords: *LDR, LED, IoT, Arduino, Gas sensor, Internet of Things (IoT)*

INTRODUCTION:

The Internet of Things (IoT) is just another term for devices that connect to the internet and talk to each other. There are several different types of IoT applications on a wide scale. Cluster on the internet of Things classifies IoT technologies as some of the most critical areas for building thoughtful facilities, the advancement of smart transport, the advance of sensible power, smart industry, smart health, and smart environments. The IoT may be a technology that serves as a trendsetter that collects and stores all device information in the cloud wherever it is accessible via the internet. This technology also uses sensors and actuators for gathering information and distributing it across the network. Additionally, we use cloud to store data, but we also use it to conduct data analysis, collect data, and visually present data. So, if increasing technologies such as associate degree in applied science rises is often utilized to expand existing systems and make them more effective in numerous IoT applications, for example, agriculture, health, sensible home, etc., In order to say something positive about coal, you should say that it is a non-renewable energy source, and as a result, it can never be commonly replaced by humans. As a result, incidents of coal mine explosions occur, and miners put their lives at risk every day, since they are often employed in the coal mines. A significant number of mishaps, both small and large, occur due to the recent instrumentation and wired equipment, which then leads to the destruction, mishandling, spillage of the deteriorating gases in the coal mines, thereby resulting in considerable hazards for the excavators. lightweight is a critical consideration in the particular duties of an

underground coal miner, since they are unable to proceed into the mine if there is no legal illumination that is capable of hindering their vision due to the heavy workload underground. Since it was obvious that the coal mine protection system must avoid this issue, a design for the system was developed Automatic or manual control may be used to regulate how much to use. It is the Arduino microcontroller that we utilized in our project. [1]

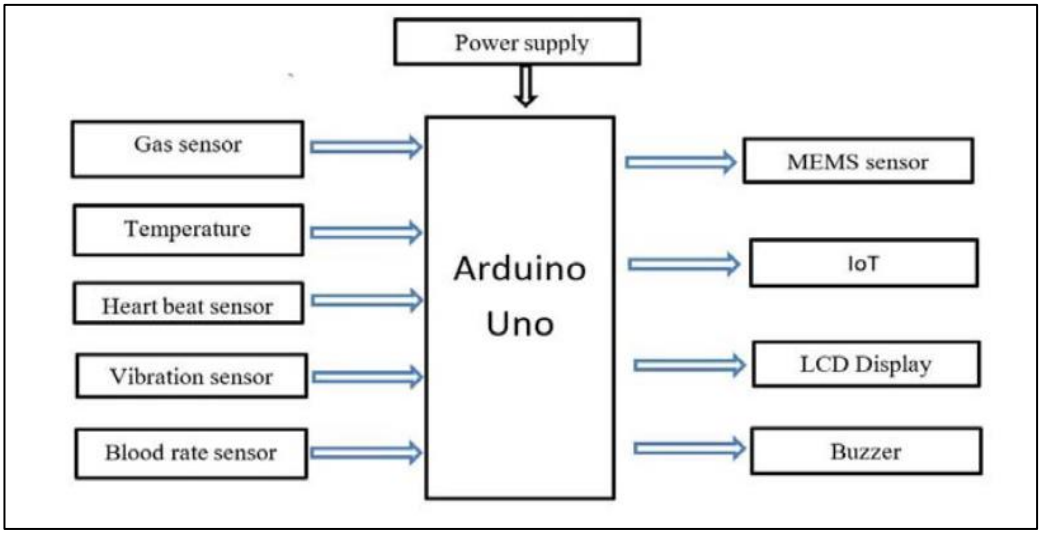


Figure 1: Block diagram of the system

The conventional approach of using wired network networks for coal mine control, i.e. laying underground cables or parallel lines, proved inconvenient for safety reasons. In the underground mining area, the methane gas level present in the mine is detect by Electronic Gas Sensor. The climatic conditions in underground mine including temperature and humidity is measures by the Temperature sensor. The vibrations occurring in the mines while mining is detect using the Vibration sensor. This senses the vibration level and occurrence of earthquake can be known easily. With a power supply given, the data which the various sensors collects are fed to the Arduino UNO, the numbers are displayed in the LCD display module. The numbers also check with the maximum level each parameter like gas, pressure, temperature, vibration etc., using the IoT module. If the number crosses the predefined level, the buffer buffers and gives alert to the miners. The machine collects data in a coal mine using a sensor network based on (MEMS) Micro Electrical Mechanical Systems. The sensor

module is made up of MEMS sensors that range in size from 1 to 100 micrometres. The Arduino receives the sensed data and transmits it. The mining staff are notified when a parameter's extreme condition is detected. This is the rationale for the block diagram shown in Figure 1. [2]

HARDWARE DESCRIPTION:

Arduino UNO:

A microcontroller is a small computer with a processor core, memory, and programmable input/output peripherals on a single integrated circuit. The important part for us is that a microcontroller has a

processor (which all computers have) and memory, as well as some controllable input/output pins. This kit includes a microcontroller as well as all of the required extras to make building and debugging your projects a breeze. The ATmega328P is utilized in the Uno shown in figure 2 which is a microcontroller board. There are 14 advanced information/yield pins (six of which can be utilized as PWM yields), six simple data sources, a 16 MHz quartz precious stone, a USB interface, a force jack, an ICSP header, and a reset button on the board. It incorporates all you'll require to begin with the microcontroller, including a USB link to associate it to a gadget and an AC-to-DC connector or battery to control it.

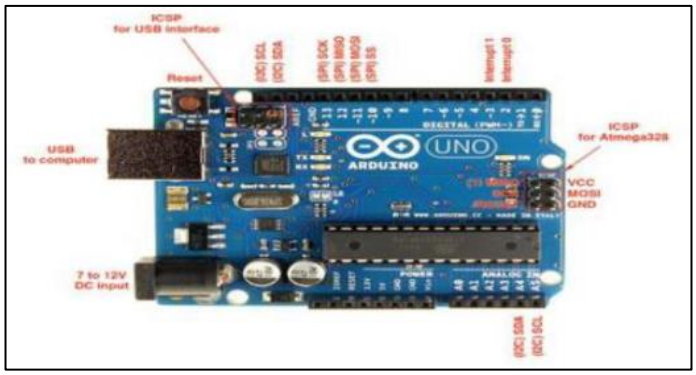


Figure 2: Arduino UNO

Gas Sensor:

The Gas sensor shown in figure 3 has a high sensitivity as well as a quick response time. Iso-butane, propane, and methane can all be detected by the sensor. Biometric sensors, electrochemical sensors, and Metal Oxide Semiconductor sensors are the three types of gas sensors. A sensor is used in gas detectors to determine the concentration of specific gases in the atmosphere. When a chemical reaction triggered by a particular gas occurs, the sensor acts as a reference point and scale, generating a measurable electric current.

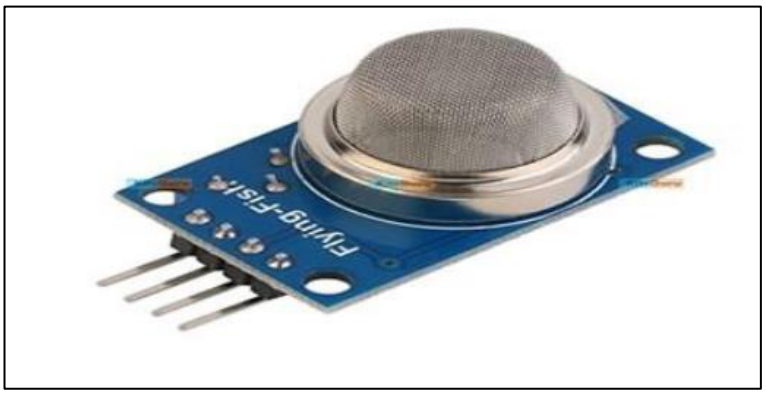


Figure: 3 Gas Sensor

Temperature Sensor:

The LM35 shown in figure 4 has arrangement of exactness coordinated circuit temperature sensors have a yield voltage that is directly relative to the temperature in Celsius (Centigrade). The Sensor is more precise than a thermistor at measuring temperature. The sensor circuitry is sealed and not susceptible to oxidation or other forms of degradation. The LM35 produces a higher output voltage than thermocouples, so it might not be necessary to amplify the output voltage.

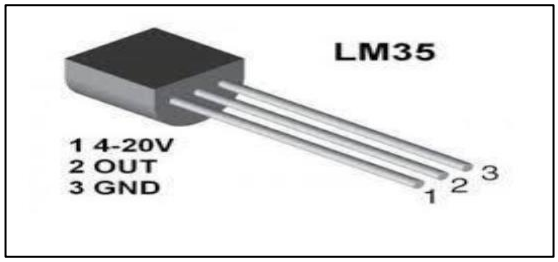


Figure 4: Temperature Sensor

Vibration Sensor:

In the event of a debris flow, vibration sensors shown in figure 5 will sense the vibration of the ground soil. Prior to installing a vibration sensor, it's critical to figure out what amount of vibration can activate the sensor in the event of a debris flow. It's also necessary to consider the possibility of unintended sensor activation triggered by earthquakes, as well as areas where there's construction traffic and other vibration sources. Monitoring vibration levels over time allows for early detection of issues until they become dangerous. Machine-mounted sensors are important for vibration monitoring and analysis.

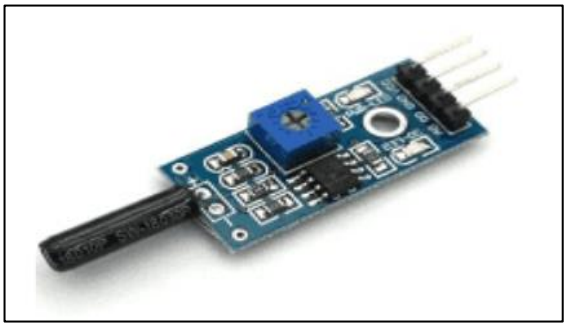


Figure 5: Vibration Sensor

MEMS Sensor:

Micro Electromechanical Systems (MEMS) shown in figure 6 is a shortening for Micro Electro Mechanical Systems. In other words, MEMS are microscopic integrated devices made up of electronics, electrical, and mechanical components that work together to fulfil a single functional requirement, thanks to a technology known as Microsystems Technology (MST). The sensor module is made up of MEMS sensors that range in size from 1 to 100 micrometres.

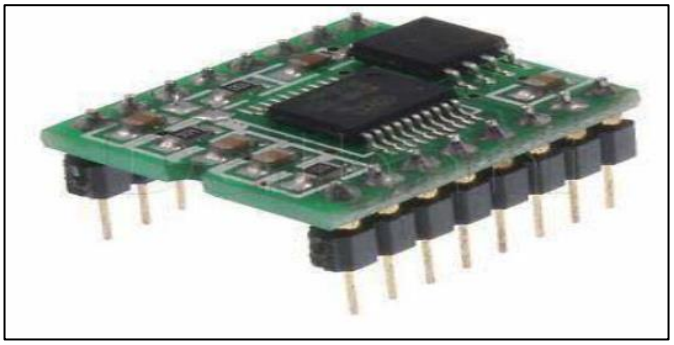


Figure 6: MEMS Sensor

OBJECTIVES:

1. To study of IoT Based Coal Mining.
2. The purpose of implementing security and detection of hazards inside a coal mine.
3. The hardware implementation of the IoT Based Coal Mining safety for Workers

RESEARCH METHODOLOGY:

We tackled the issues in our research by testing each of the information collected by the sensors, we use and finishing the analysis using the Thinger system. Controlling can be done automatically or manually. The microcontroller is Arduino in the work we used. we are predisposed to solving the problems that we identify in our research by testing of the information gathered by the sensors, we are able to make use of and finish the study victimization the Thinker method.

REVIEW OF LITERATURE:

As the administrators of the Coal Mine Monitoring section, Yongping Wu and Guo Feng make use of A Bluetooth wireless transmission device has been implemented in coal mine monitoring to greatly expand the scope of the technology.

Currently, the industry believes that to control costs and provide a standard in the short-range wireless networking market, Bluetooth is supposed to implement a powerful kit gap scheme, and it is also expected to provide a minimum power. demand for low-cost, low-power air interfaces. This paper describes the context of the situation, as well as different technical choices, as well as the architecture of the protocol stack of Bluetooth technology. Also, the paper goes into possible solutions for the Bluetooth HCI wireless networking, which is a necessary component in the development of this technology. Also at the same moment, the system has completed the integration of wired and wireless information transfer. This use of the new technologies, known as the "Wired Bus," is being employed. The problems that come along with this strategy include the main ones. For one, Bluetooth is a short-range wireless system. The implementation of cabling, in this case, can be very complicated. In the case of a natural disaster or roof failure, the cabling is most likely damaged. That the long lifespan and extensive burden of standard communication systems is problematic. Even though it's difficult to work

in the mine due to the abrasive environment, it is even more difficult to install and maintain the wired communication system.

The DCS Coal Mine Monitoring System was developed by Zhenzhen Sun. A computerized bus that runs on the same lines as RS485 uses a bus structure that supports multipoint and two-way communication. So, the design of such a watching device will be done using commonly available 8-bit microcontrollers. With a circuit structure that is both simple and inexpensive, you enjoy the advantages of inexpensive circuit design. Thus, on the contrary, due to the use of a master-slave network arrangement, it is almost impossible to ensure the liability of the network structure. In addition, the amount of information that can be transmitted over a line with a subpar real-time output is also limited [3-4].

The JINGLING SONG and YINGLI ZHU's design of an automated mine safety monitoring device assisted by a wireless sensing element network. MSP430F and nRF2401 have been implemented in the process design to watch for mine protection. Sensor teams in the device intensively track temperature, humidity, and various parameters in the underground mine. Temperature, humidity, and various parameters are monitored by sensors and sent to a wireless communication module by the microcontroller. That information is sent via cable to the far-off location where it is watched by the observers. The problem with this implementation is that hardware is installed in the coal mines when disasters or roof collapses occur, and once the damage has occurred, it's impossible to repair the device. Typical communication systems have a bad track record when it comes to reliability and long life. A great amount of work is needed to keep this mine in operational condition because of the harsh working conditions inside it. The other drawback is that the working state of the coal pit is extremely shaky, and if the gap between the manual labourer and the system is long, the miner will not receive the correct instructions. [5]

In the style of Y. S. Dohare and Tanmoy Maity, the Ogendra S. Dohare and Tanmoy Maity police investigation and protection scheme for underground coal mines used Low Power WSN. while the device is operating, a coffee control, cost-effective, and Zigbee protocol based mostly wireless detector network that delivers an intelligent police investigation associate-trained protection system for underground coal mines. This is an example of a wireless networking scheme, where several nodes are associated with one another through a wireless connection. It is very simple to set up this network within underground mines.

RESULT AND DISCUSSION:

This new system we put in place is built on the internet of things (IOT) for coal mine safety. The here tilt sensor is used to detect whether stones are dropping or not. Surrounding light is sensed by LDR, and if the detected light is dark, the light is turned on automatically. The ambient temperature is detected by a temperature sensor, and if the sensor senses high temperature, the website will be automatically modified, and a buzzer will sound. Additionally, a gas sensor is used ton detect the leakage of hazardous gas. If any of the sensors is found to be malfunctioning, the page will be modified automatically.

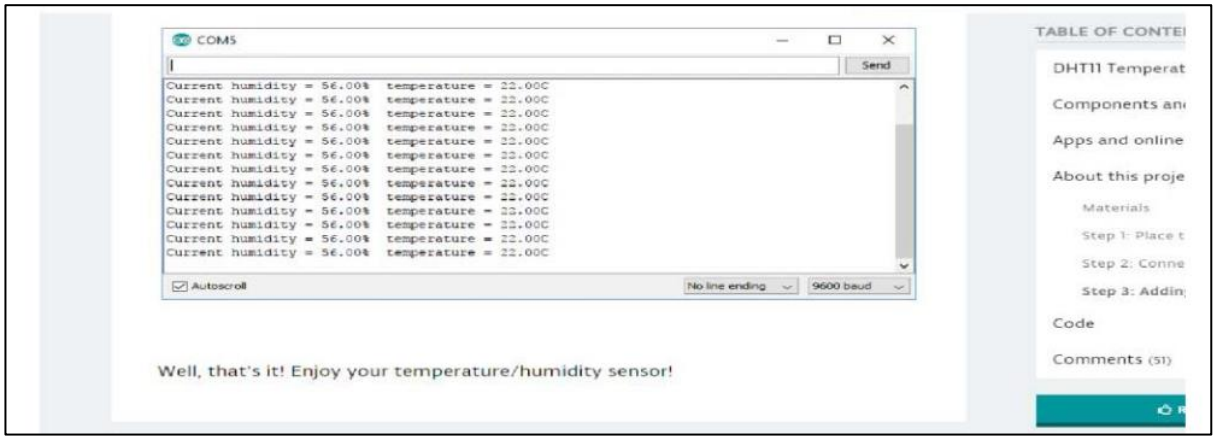
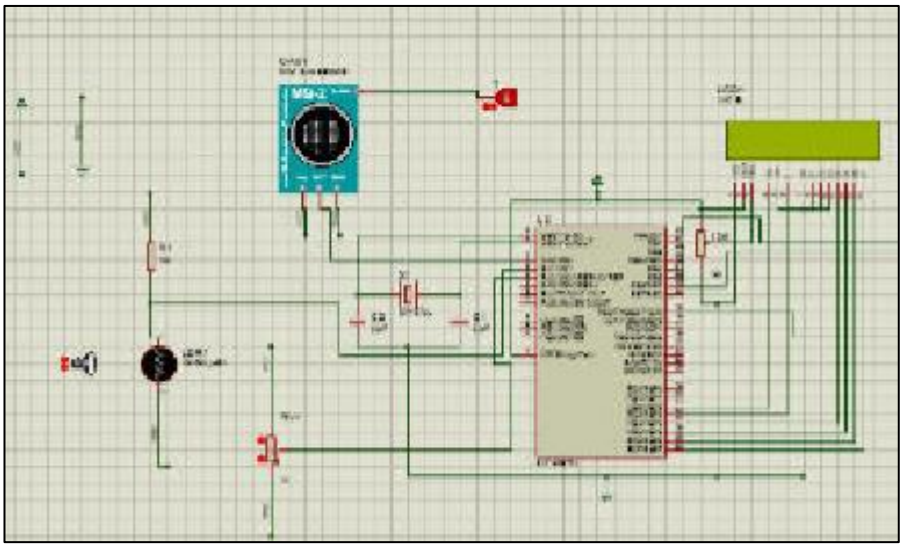


Figure 7: Output Results

The hardware implementation of the IoT Based Coal Mining safety for Workers Using Arduino is shown below.



The development of coal mining protection for employees using Arduino, Gas Sensor, LDR, Temperature and Humidity Sensor continues to track the safety of mining and update information to the IoT site.[6]

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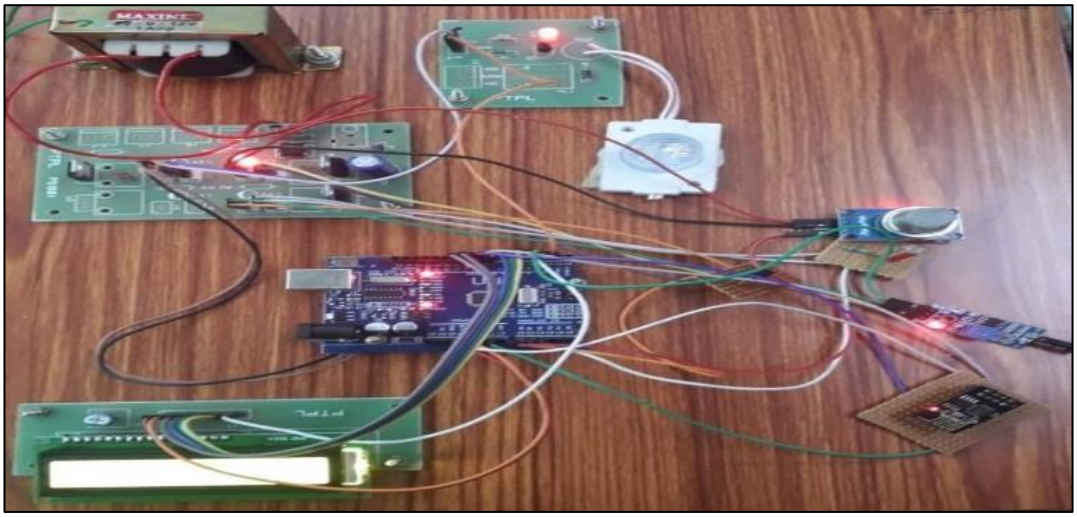

CONCLUSION :

The Arduino microcontroller is used to create a prototype for a mine safety system in this proposed method. This device is made from each hardware and software program factors. The hardware is made

from several sensors, while the software program is made of an Android software that connects to the Arduino board and other hardware additives via the internet of things. The android-based totally programme consists of signals and a database in which readings from sensors are presented and inserted the usage of hardware.

With the installation of a real-time observation device, a clearer and additional objective is given for assessing mine point perspective, which leads to greater accuracy. In this case, this technique will display the parameters on the monitoring screen. Everybody who is currently working in the mine, as well as any worker, will profit from this proposal., who will be able to use it to avoid losing their lives in a work-related accident. When sensing element values have crossed the alarm threshold, the alarm goes off.

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