

Design of IoT Based Coal Mine Safety System Using Arduino UNO

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ABSTRACT

For this project, a coal mine safety system is implemented by the use of a webpage as a medium to transmit the data. The device is introduced to monitor various parameters inside the coal mines, such as light detection, gas leakage, temperature and humidity conditions, and fire detection. This system of sensors is known as one large device and is mounted in the coal mines. All the sensor rankings are automatically fed into the thinking processors, which generates a multitude of ideas for them to explore. Here, gas monitoring equipment is still running in order to detect any possible issues, and a buzzer is used to warn the staff. Laser-detection (LDR) sensors are used in this framework to detect the presence of light. Automatically lights illuminate when you have them on, and they can be operated using the LED button. To ensure the proper response to any potential fire hazard, a notice is sent to the mail of the designated individual. A collection of constantly measured and recorded temperature values is available as well, shown on the serial monitor and the website platform. Additionally, a vibration sensor is used to detect any movements in the mine.

Index Terms: LDR, LED, IoT

I 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. 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. Automatic or manual control may be used to regulate how much to use. It is the Arduino microcontroller that we utilized in our project.

II LITERATURESURVEY

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 [2]. Also at the same 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 [5]. 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.

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.

Underground coal miners have an efficiently policed investigation and safety framework due to their having earned a degree. These nodes are used to link the miners on the surface to the room system. These nodes provide real-time electronic contact between miners and the room system. This approach is applied to my equipment and hence the drawback occurs because manual labourers don't seem to be sufficiently proficient with the procedure. Although this device is primarily focused on the underground mine, it does not control the physical health of the miners.

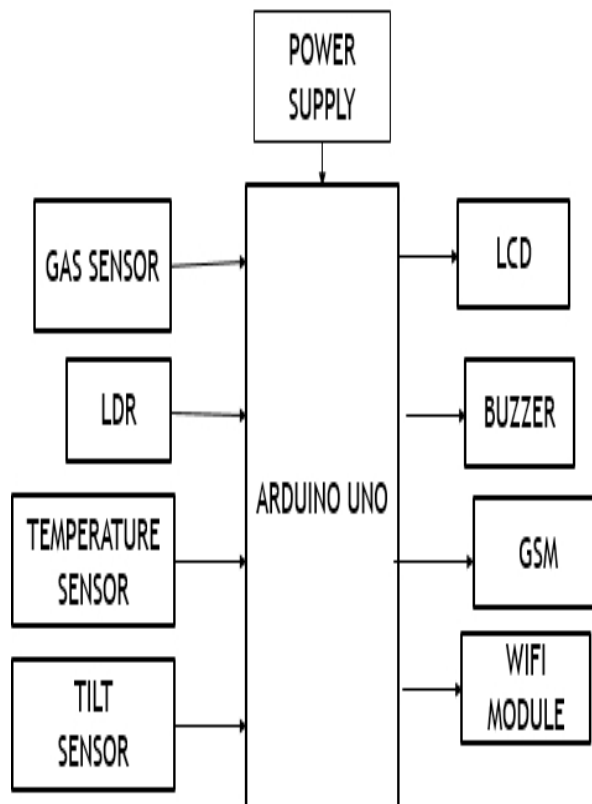
III EXISTINGSYSTEM

It is a widespread technology for underground contact, and it is called Zigbee. While it being an occasional force and being a simple procedure, its importance is greater. because of the broad range of applications, the expense is trying to be reduced these days. The Zigbee module will pass on the information to the microcontroller. The microcontroller will then check to see if any of the values have changed, and if any of the values have increased above the maximum allowed value, it will produce a warning by sounding the buzzer. This information has been transmitted to the bottom station through the ZigBee module. It is therefore important that the base station department takes sensible steps to safeguard all those that help supply coal mining. The maximum distance that the contact between the transmitter and receiver is allowed to go is limited to what is termed as bounded distance.

IV PROPOSEDSYSTEM

It is possible that in the underground world there may be dramatic changes that will have an effect on the miners who are working within the mines. For this purpose, it is impossible to have an absolute measure of protection. a more effective sensing system as well as the capability to pinpoint location to enhance mine worker safety is also developed. To find any gas leakage, mine temperature, or light intensity within the mine, we are using a sensor equipped with a gas sensor, a temperature sensor, an LDR, and a vibration sensor. When some abnormality is detected, the buzzer will warn the team. This circuit has sensors on it, and they're all attached to the Arduino microcontroller, which allows them to be controlled in the web page using the Wi-Fi module. A GSM modem is used to transmit messages to designated persons in the event of an abnormality.

Fig.1 BlockDiagramof Arduino



4.1MODULEDESCRIPTION

4.1.1 ARDUINOUNO

The Arduino Uno is a microcontroller board that incorporates the ATmega328P microcontroller, which is an 8-bit microcontroller. It is attached to the ATmega328P, which often contains various external components such as a crystal oscillator, serial connectivity, voltage regulator, etc., to help with the microcontroller. As seen above, the Arduino Uno has 14 digital input/output pins (of which six can be used as PWM outputs), six analogue input pins, a USB connector, a power barrel jack, an ICSP header, and a reset button. As a result, it is prepared for all the different types of projects that one may like to create. In comparison to the rest of the world, Adafruit appear to be less talkative, choosing to speak to a machine, another Adafruit console, or another microcontroller. The ATmega328P microcontroller features serial connectivity with the normal voltage of 5V via UART TTL (pin RTS is digital pin zero and pin DTR is digital pin one) (Tx). The ATmega16U2 chip on the board tends to be a real COM port to computer programming, although it really

provides serial connectivity over USB and acts as a simulated COM port to programmes on the device. In order to make use of the standard USB COM drivers, and no external driver is needed, the ATmega16U2 code utilises standard USB COM drivers.



Fig.2Arduino UNO

4.1.1 LDR

The **Light Dependent Resistor (LDR)** is a special kind of resistor, not unlike any other kind of resistor, and thus it does not have a polarity. Photoresist, which is given the nickname LDR (Light Dependent Resistor), can be modified by the daylight, with LDRs simply becoming LDRs because of the sunlight's influence. Once the electrical circuit is installed in a dark space, the resistance would be anywhere about a hundred Mega Ohms. as we gradually increase the weight over the unit, the resistance will decrease from Mega Ohms to a few Ohms The property that is employed here is useful for allowing the LDR to be used as a light sensor. By using this technology, it would be able to measure the amount of sunlight that falls on that, which will enable it to forecast days and nights.

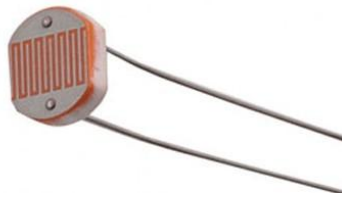


Fig3.LDR

4.1.2 TILTSENSOR

The **tilt detector** module is a handy tool for comprehending the spreadsheet movement. Though these simple tasks are made available in various ways, the end result is still the same. They conducted an operation to find out if the plane change from horizontal to vertical had occurred, and when they found it, they sent a symptom. The module we're planning to speak about in this section are sensors which can recognize even small plane shifts but we intend to be more interested in touch sort tilt detector modules.



Fig4.TiltSensor

4.1.3 MQ2GASSENSOR

MQ-2 gas sensor is effective in detecting or measuring various gases, such as LPG, alcohol, propane, hydrogen, CO, and even methane. In this device's module edition, a Digital Pin is added which makes it possible for this device to work even if there is no microcontroller around.. This feature comes in handy when you are exclusively searching for a specific gas. when in meters the gas ppm is required, then the analogy pin has to be utilised. This analogy pin is powered by TTL and works on 5 volts, as well as with popular microcontrollers.



Fig 5.MQ2Gassensor

4.1.4 LM35TEMPERATURESENSOR

LM35 may be a precession Integrated Circuit Temperature sensor, whose output voltage varies, and may have been used to support the temperature around it. It is a very low cost and low-power IC which is predicted to be used at temperatures ranging from -55 °C to 150 °C. It will only be interfaced with any Microcontroller that has an ADC capable of performing or with any development platform like Arduino.

The circuit has power connected to both the input and ground pins, allowing for regulation by adding +5V (VS) to the input pin and connected to ground through the ground pin of the circuit. If the temperature is zero degrees Celsius, so the output voltage would also be zero volts. Each degree above room temperature can lead to a ten millivolt (0.01 volt) increase in voltage.

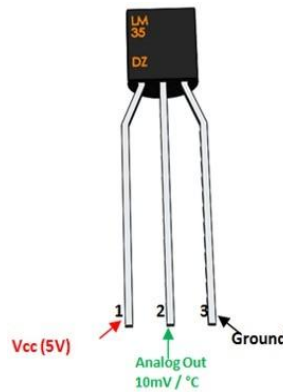


Fig6.Temperature Sensor

4.1.5 ESP8266WIFIMODULE

The ESP8266 is a low-cost and simple to use computer that can allow internet connectivity for your projects. This module will act as both an access point (capable of creating a hotspot) and a station (capable of connecting to Wi-Fi), making it very simple to obtain data and transfer it to the internet, resulting in a broad implementation of the Internet of Things.

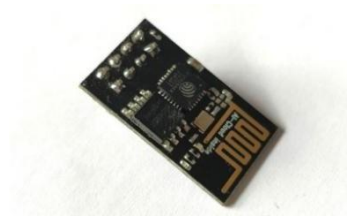
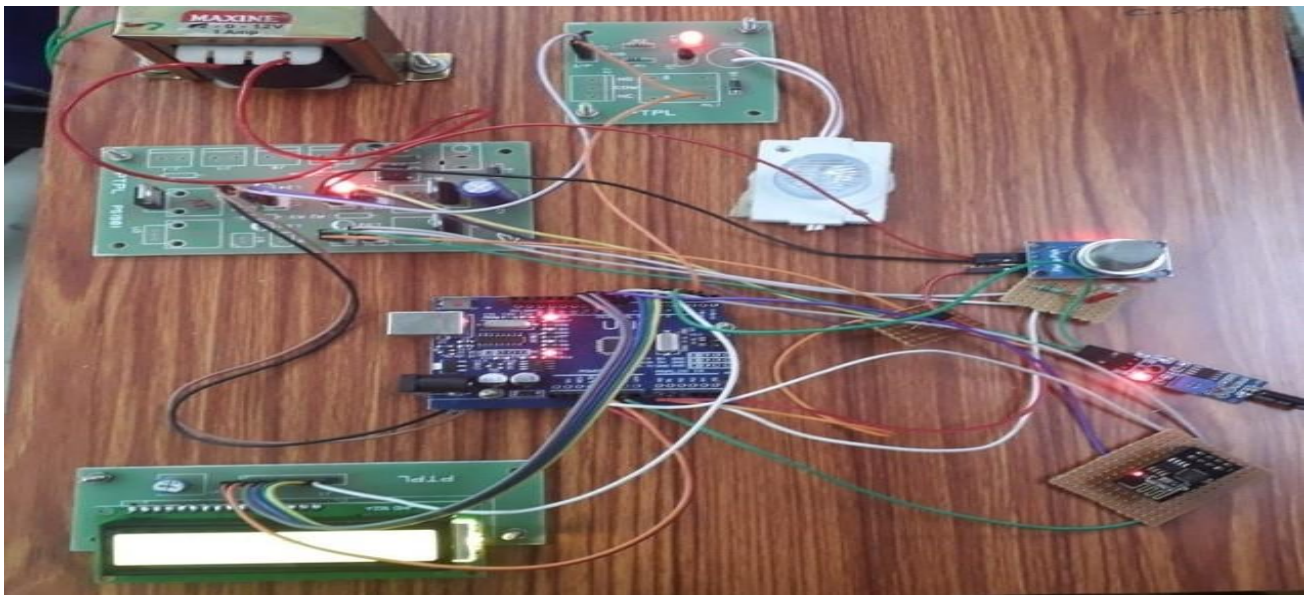


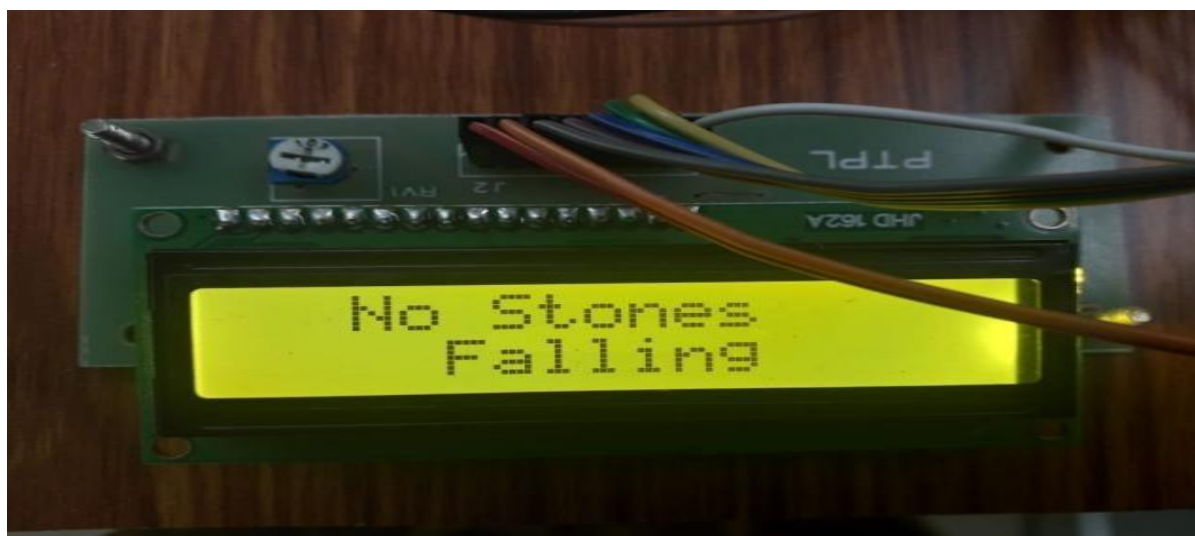
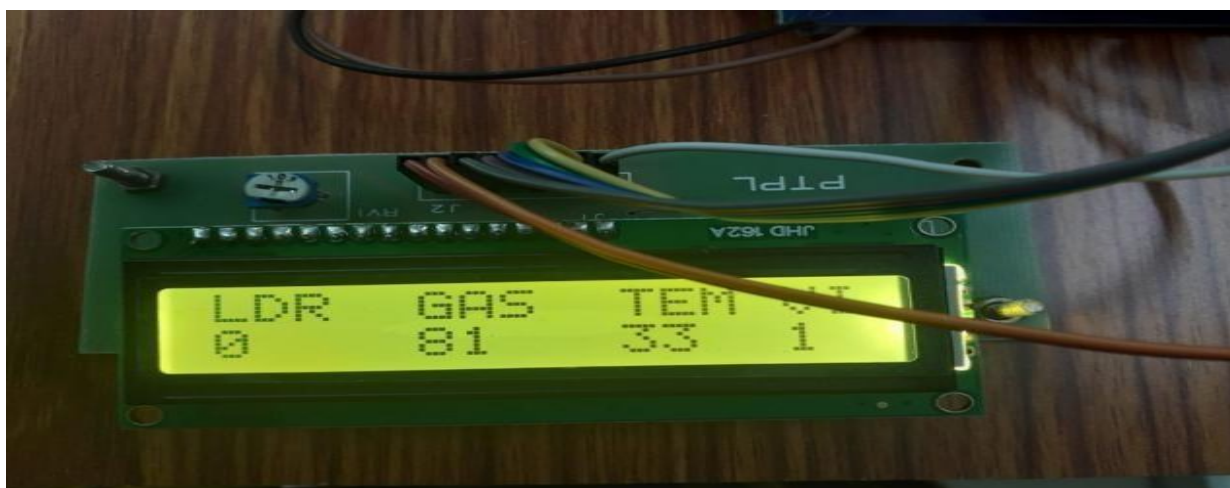
Fig 7.ESP8266WiFi module

RESULTS 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 to detect the leakage of hazardous gas. If any of the sensors is found to be malfunctioning, the page will be modified automatically.

OUTPUTS





CONCLUSION

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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