Lora Network for Data Transmit in Coal Mine Industry

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***Abstract*—** *The Long Range (Lora) Network is a wireless technology in which a low power transmitter sends small packet data to a receiver, usually over long distances. The limit for rural environments is about 20 km. However in the urban environment, it is 5 km. An example of a low power wide area network is Lorawan technology, private cellular (single-hop) communications in the industrial sector. In particular, they were useful in regular IoT applications such as environmental monitoring.The system has several lora nodes with sensors to measure industry temperature and gas volume. In this paper, proposed the design of a wireless sensor network (WSN) with the help of the Arduino controller, which can monitor and control the industrial climate.*

Keywords*—long range; sensor; industry; temperature; private cellular network.*


I. INTRODUCTION

A mining accident is an accident that occurs while mining minerals or metals. Every year thousands of miners die in mining accidents, especially in underground coal mining, and accidents in hard rock mines. Coal mining is considered more dangerous than hard rock mining due to the flat lying layer, generally inefficient rock, methane gas and coal dust. Most of the deaths these days occur in developing countries and in rural areas of developed countries where safety measures are not fully implemented. Mining accidents can be caused by a variety of factors, including hydrogen sulfide or explosive natural gases, especially firetamp or methane, dust explosions, mine stops collapsing, mine-triggered earthquakes, floods, or the leakage of toxic gases from a public machine. Errors from improperly used or inactive mining equipment (such as safety lights or electrical equipment). Methane and coal dust explosions can be caused by improper use of underground explosives. This coal mining is causing insecurity and bigotry material size and, in some cases, even personal damage. Today most deaths occur in developing countries, especially China. China's coal mines are the worst in the world, killing an average of 13 miners a day. China accounts for only 80% of the world's total coal mining deaths, although it produces only 35% of the world's coal. In a comparison, the U.S. In the early 20th century, coal mining deaths were more than 1,000 per year, down from an average of 450 annual deaths in the 1950s and 141 in the 1970s. The most common accidents that occur in the mining industry are accidents involving the use of poison or explosive gases or explosives for explosive activities.
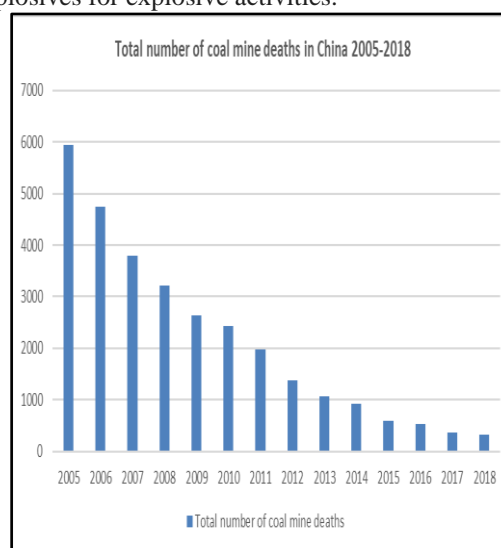
Total number of coal mine deaths in China 2005-2018
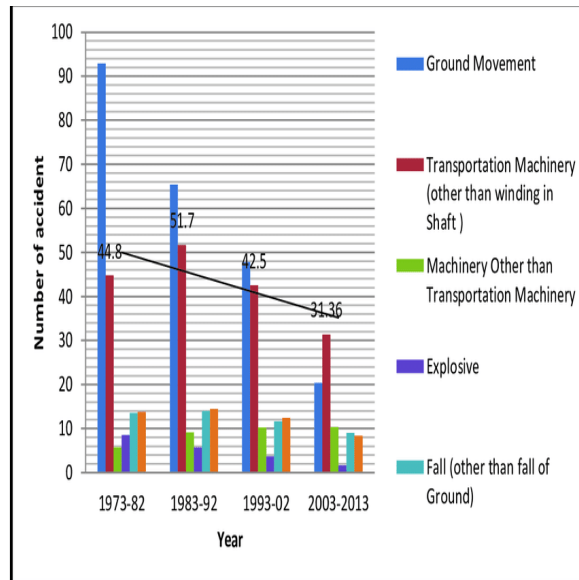
Methane may be a extremely explosive gas treed within coal layers. Mechanical errors will trigger gas and initiate continuous coal dirt eruptions by improperly used or malfunctioning mining instrumentality (such as safety lights or electrical equipment) or the utilization of improper explosives ensuing section describes lora technology In Section III describes the operating principle. In Section IV describes concerning the hardware description and section V concludes.

LORA TECHNOLOGY OVERVIEW

Lora is a lengthy-distance protocol. This Capable of sending records over lengthy distances. A unmarried front covers a place of 100 rectangular kilometers. Long Lora generation variety it makes use of because of its connectivity price range and the laughter diffusion spectrum modulation it causes. Lora makes use of the chirp unfold Spectrum modulation approach. This approach is utilized in navy and aerospace communications for many years its robustness and lengthy variety capability. It is used now Commercial Lora Communication. It affords Immunity to multipath and fading. The Chirp spectrum calls for low transmission power. Chirp is a sign whose frequency will increase or decreases over time. Thus, a chirp sign may be up-chirp and down-chirp.

The desired ones in the chirpp spread spectrum modulation are amplified with the data signal chirp signal. It transmits bandwidth signal beyond the bandwidth of the original data. The signal received at the receiver end is amplified again with a locally generated copy of the chirp signal. It compresses the modified signal back to the original bandwidth. This reduces noise and interference. The increase in signal frequency provides error free data sent over long distances. It may be visualized by comparing the Lora modulated sensitivity to the frequency change key to the modulated signal. The chirp diffusion spectrum is the sensitivity of the modulated signal. The frequency change force is much higher than the modulation.

Lora Technology has a connection budget that is higher than any other technology currently available. Connection budget accounts for its long distance. The connection budget is the accounting of all gains and losses in a transfer system. Link budget is the power derived receiver side. Lora's merger budget is high Its high sensitivity accounts. Most of the technologies used. Uses Frequency Shift Key (FSK) to connect to IoT Modulation

Battery Lifetime.

The most important criteria of embedded device is its battery lifetime. Most of the embedded devices required communicate with other devices near or far away. It consumes more power. All embedded devices are mostly battery driven. So, this embedded essential needs the devices are its battery lifetime. Most algorithms or the techniques used to create an embedded device are now in a day using the highest power, the battery lifespan decreases. Lora has improves battery consumption on a device and battery operated is very suitable for embedded device. Lora uses the lowest power compared to the existing everything technologies.

Lora networks are low battery consumption accounts for Asynchronous Communications of the Nodes Network. Only the nodes in a Lora network are involved. When they have any data to send whether energy is operated or not planned. They follow Aloha's method. Aloha frame will be sent only when there is any data to send otherwise any transaction will not be held. If the frame is received successfully sent another frame or the same frame sent back. Aloha mode saves battery life network transmission makes when there is any

information. This does not make any other transaction. And, for most other technologies are mesh network or accepted coherent correlation to get rid of the edges synchronize occasionally. It uses more power. Lora technology is revealed in the latest study of 4-5 times better than any other technology.

Star network is used in Lora network. The LoRa network gateway receives data from large number of nodes. For this the gateway must have high capacity. This is achieved by adaptive data rate and multichannel multi-modem transceiver at the gateway.

II. WORKING PRINCIPLE

In this document, the main topic is industrial surveillance. Monitor the gas level and temperature, and then transmit it to the data controller. Then, the LORA technology used transmits the data to the master node. Receive data from the Lora transmitter and then send it to the receiver. Praise the teacher. Regulator. The slave never sends data and never receives a request from the master. The slave stations will never influence each other. Master/Slave is an asymmetric communication or control model in which one device or process ("Master") controls one or more other devices or processes. The master node is a complete node that enables node operators to perform basic agreed functions to start the blockchain. In the node temperature device, the slave LM35 continuously monitors the industry temperature. The gas temperature sensor can monitor wax in the industry. The vibration sensor detects vibration. What is happening in the industry?The Lora transmitter sends the sensor value to the Lora receiver. any vibration is detected by vibration sensor, then the alarm will ON.

SLVE NODE

MASTER NODE
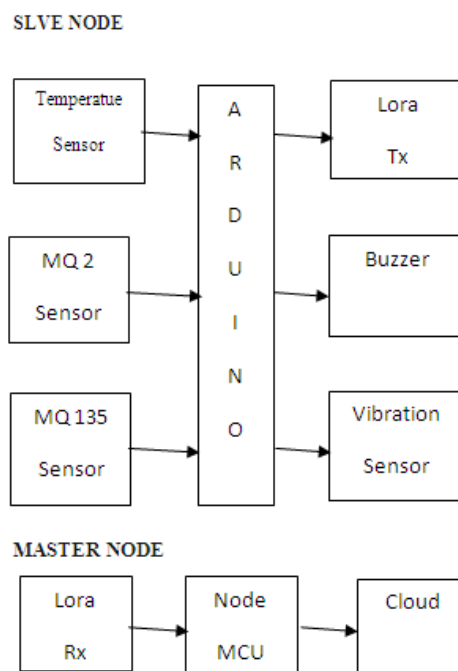
The Lora receiver receives the sensor value from the lora transmitter. It sends the data to the cloud using Node MCU. Using web page, the sensor values were continuosly monitored by the user in the range of 4-5km.

HARDWARE DESCRIPTION
Arduino

"Uno" is the "one" in Italian and was chosen to commemorate the release of Arduino Software (IDE) 1. Arduino is an open source platform for creating electronic projects. Arduino can interact with buttons, LEDs, motors, speakers, GPS devices, cameras, the Internet and even your smartphone or TV! There are many types of Arduino boards that can be used for different purposes.
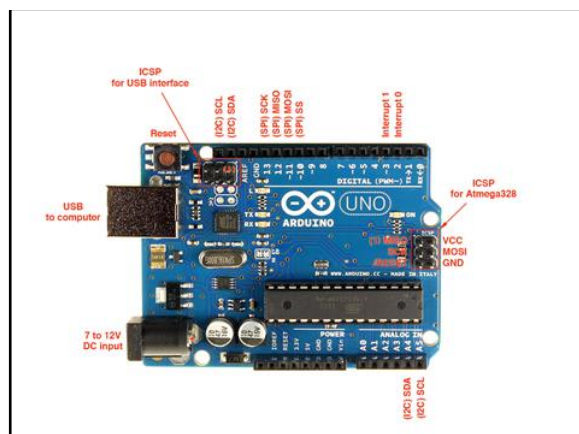
Programming

Uno can be programmed using Arduino software (IDE). Select Arduino / Genuino Uno under "Other"> "Card" (depending on the microcontroller on the card). For more information, see References and Instructions. It comes with a pre-programmed boot loader, so you can load new codes without using an external hardware programmer. Communicate through the original STK500 protocol (link, C header file). You can also bypass the bootloader and use the Arduino ISP or similar to program the microcontroller via ICSP header (In-Circuit Serial Programming). See these instructions for details. The source code for ATmega16U2 (or 8U2 on Rev1 and Rev2 cards) can be found in the Arduino repository. ATmega16U2/8U2 is equipped with DFU bootloader, which can be activated by the following methods:

● On Rev1 boards: connecting the solder jumper at the returned of the board (close to the map of Italy) after which rese ing the 8U2.

● On Rev2 or later boards: there may be a resistor that pulling the 8U2/16U2 HWB line to ground, making it simpler to position into DFU mode.

You can then use Atmel's FLIP software (Windows) or the DFU programmer (Mac OS X and Linux) to load a new firmware. Or you can use the ISP header with an external programmer (overwriting the DFU bootloader). See this user-contributed tutorial for more information.
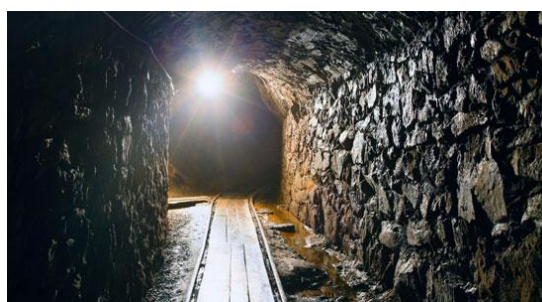

INPUT AND OUTPUT

See Mapping Arduino pins to ATmega328P ports. The display of Atmega8, 168 and 328 is the same. Each of Uno's 14 digital pins can be used as input or output via pinMode(), digitalWrite() and digitalRead(). They operate at 5 volts. Each pin can provide or receive 20 mA as the recommended operating state, and has an internal pull-up resistor of 20-50kΩ (disabled by default). The maximum value of 40 mA must not be exceeded on any I/O pin to avoid irreversible damage to the microcontroller. Some pins also have special functions:

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The Uno has 6 analog inputs, labeled A0 through A5, each of which provide 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the analogReference() function.

Status	Arduino uno	Sensors	Lora Tx
Phases of MQ135	46 mA	150mA	0.2 mA
Measurement	46 mA	152.5 mA	0.2 mA
Lora Tx	46 mA	0.15 mA	10.3 mA
Sleep mode	0.058 mA	0.15 mA	0.2 mA

Figure consumption of each device
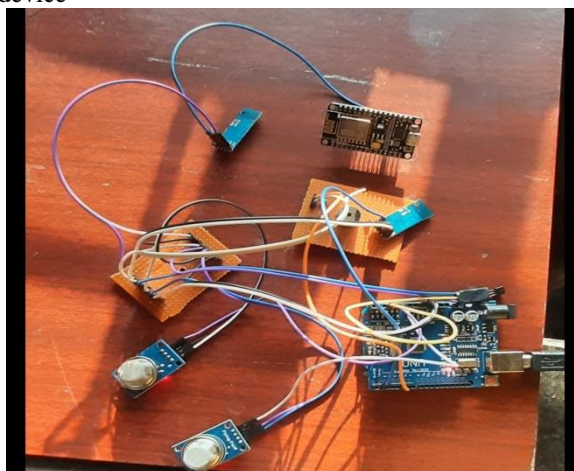
III.   CONCLUSION

The developed robot is reliable and can be used in any working environment. The sensor used is very sensitive. The gas sensor can also detect other leaks, such as hydrogen, smoke, etc. The model can also be used for other purposes. Seen from the control room. Because Wi-Fi is used, data can be transferred from anywhere. Avoid the danger of suffocation when working in the mine. This application can be used in all industrial fields where human intervention can be avoided for safety reasons. This application can also be used in hospitals and shopping malls.This design can be enhanced by spraying water on the robot. In case of fire, spray water in the right place. In addition, there are some other sensors, such as B. Dust sensor and humidity sensor can be connected to each other to improve the convenience of the staff.

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