

Application of RFID Monitoring System for Identification of Mine Workers

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ABSTRACT

In the mining industry safety is a very important factor because there are lot of accidents that occur during mining operations. Nowadays accident rate is increasing day by day. The mining accidents like roof fall, side fall, sudden unconscious of a person, inundation, air blast, emission of gases, and loss of a person during and after working hours. In that case identification of the person's location is very difficult. For the solution of identification of the untraceable location of the person we are using an RFID system for the tracking and monitoring of the workers location. In the mines, manually recorded attendance of all the employees has produced some problems such as, data inaccuracy and counterfeit attendance so, RFID is very helpful to identify and eliminate these kinds of actions and the discipline attitude of the employee, which also improves the performance of the staff gradually. In this work we are implementing this RFID monitoring system to locate the zone of workplace of workers. The RFID tags are provided for each worker and the RFID readers are placed in various zones of work in underground. The worker needs to mark his presence for every RFID reader the worker passes through. From this the present zone of workers location is identified. The modelling and working of this monitoring system is developed.

KEYWORDS: Mining, RFID, Monitoring, Node-MCU, Rescue

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I. INTRODUCTION

In mining the extraction of mineral reserves there are two types of methods. Opencast and underground. In opencast mining less accidents occur throughout mining operations compared to underground because of loss of mild and various underground environmental situations. In opencast mining the workers seen in each point in mine due to daylight. Break out of people is easy and brief, coming to underground mining there's no right lighting fixtures association in underground and identification of hazard is tough in underground and escaping from threat is likewise tough and

identification of trapped workers in underground is difficult because of extra wide variety of seams and panels and growing intensive in conjunction with the extraction. Rescuing of character is hard because of inadequate records approximately the region and quantity of individuals trapped in the mine. To conquer those conditions, RFID system is very helpful in mines.

"Radio Frequency identification" (RFID) refers to a wireless device made out of two additives: tags and readers. The reader is a device that has one or greater antennas that emit radio waves and receive indicators again from the RFID tag. Tags, which use radio waves to communicate their identification and different

information to nearby readers, can be passive or active[11].

Radio-frequency identity (RFID) has been around for over 80 years and has advanced into one of the maximum powerful technologies available for pattern monitoring and asset management. Along with an RFID reader and transponder, RFID systems can consist of more than one tags (antenna paired with a microchip) which could ship out longwave alerts, either actively or in reaction to a signal emitted by means of a scanning transmitter. These tags have revolutionized the industrial area and biomedical labs and allowed whole pattern inventories to be tracked in real-time, without ever casting off them from garage [12].

A) Sorts of RFID Tags:

1) *Passive RFID tags*

- They are powered with the help of the reader and do no longer have a battery.
- Smaller size tags, must be with in close range of reader.

2) *Active RFID tags*

- They're powered with the help of batteries.
- larger, extra pricey, shorter existence.
- Longer studying stages, more memory.

RFID tags can store a range of information from one serial number to numerous pages of data. Tags are like read only or read/write. Contact-less non-line sight. Readers can be mobile in order that they may be carried via hand, or they can be installed overhead [11]. We are using active RFID tags for this project.

C) Antenna

An antenna is an electrical device which converts electrical power into radio wave, and vice versa. It is used for verbal exchange among reader and tags.

D) RFID Reader

- Retrieves statistics from the RFID tag.
- Detects/activates tag, reads and writes data to tag.
- It can also include a signal processor, running system, antenna, digital memory, and transmitter/receiver unit.

II. COMPONENTS

A) ESP8266 Node-MCU

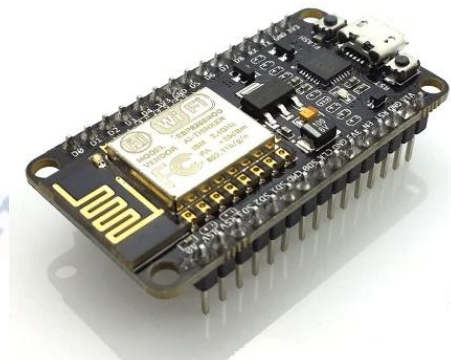


Fig1:ESP8266 Node-MCU

Lolin Node MCU ESP8266 CP2102 Node MCU it is a Wi-Fi serial wi-fi module. It is the primary element of this project. Which offers the power to the project. It is able to additionally join the complete gadgets to it and transmits the information through Wi-Fi. The Lolin Node-MCU ESP8266 CP2102 is a development board that is based on the ESP8266 Wi-Fi module. It features an on-board USB-to-serial converter (CP2102) that allows it to be easily programmed and debugged using a computer. The ESP8266 module is a low-cost Wi-Fi chip that can be programmed using the Arduino IDE or other programming languages. The Node-MCU board includes a microcontroller that provides GPIO, I2C, SPI, and UART interfaces, making it easy to connect to other devices and sensors.

B) RFID Reader Module



Fig2:RFID Reader Module

The MFRC522 is a highly integrated RFID reader IC (Integrated Circuit) that is commonly used for contactless communication using radio frequency (RF) waves. The MFRC522 reader module includes an on-board antenna, which allows it to communicate with RFID tags and cards over a short distance. It also includes an SPI interface, which allows it to be easily integrated with microcontrollers such as Arduino,

Raspberry Pi, and other embedded systems. The MFRC522 reader module can be powered using a 3.3V or 5V power supply, making it easy to integrate into a wide range of projects. It also includes several built-in security features, such as data encryption and authentication, which can help to protect sensitive information.

C) Jumper Wires



Fig3: Jumper wires

In this project jumper wires are used for the connection of Node MCU to the RFID Reader module and to the buzzer. An electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them - simply "tinned") is known as a jump wire (also known as a jumper, jumper wire, or DuPont wire), and it is typically used to connect the parts of a breadboard or other prototype or test circuit, internally or with other machinery or components, without soldering. Male-to-male, male-to-female, and female-to-female jumper cables are the most common types. The wire's terminal tip distinguishes each one from the other. While female ends do not have a protruding pin and are used to connect into objects, male ends do. The most typical and frequently utilized adapter cables are male to male. A male-to-male wire is required to link two terminals on a breadboard.

D) Tags



Fig4:Tags

An RFID (Radio Frequency Identification) card is a small plastic card that contains a tiny integrated circuit and an antenna, which allows it to communicate with an RFID reader wirelessly. The card's information is stored in the integrated circuit and can be accessed by the reader without any physical contact. RFID cards can be classified based on the frequency they operate on. The most commonly used frequencies for RFID cards are 125 kHz and 13.56 (MHz). Each frequency has its advantages and disadvantages, and the choice of frequency depends on the specific application.

E) Buzzer



Fig5:Buzzer

This buzzer also has an important position on this module. On every occasion the user will test his/her card then this buzzer. Beeps for some seconds in order that the one who scanned the Card will recognize that his card is scanned nicely. Without a Buzzer, you could best expect the cardboard has been detected but, He/she will be able to no longer be sure so the buzzer is important right here.

III. METHODOLOGY

In this project which specifically includes Node-MCU (ESP-8266), RFID cards RFID readers. Right here Node-MCU acts as a vital processing unit (CPU) for controlling all the enter/output additives. For this undertaking, we have used a 5v energy deliver to power up the node MCU and different components. RFID reader module is interfaced with Node-MCU to study the statistics from RFID cards/tags. The real- time place of the employees is stored. On a google sheet the usage of IoT. On this device, a worker has to place positioned his card on an RFID reader. While the RFID reader reads the data it directly transfers the data to Node-MCU and the actual-time location can be Stored on a google sheet.

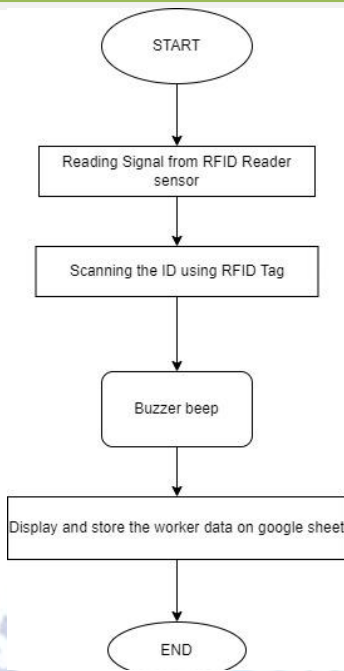


Fig6:Process Flow sheet of RFID system

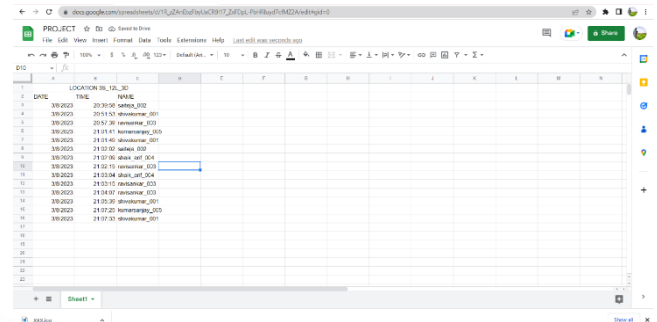


Fig9:Recorded Data Displayed on Google Sheet

IV. RESULTS

A) Block Diagram

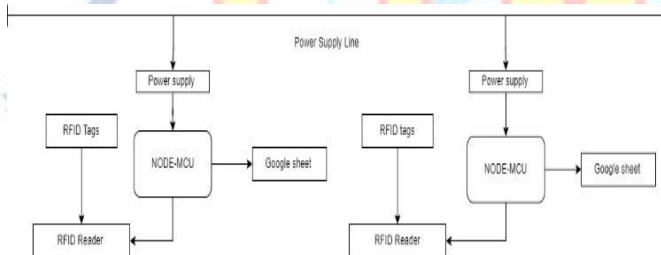


Fig7:Block Diagram of the proposed monitoring system

B) Hardware Implementation

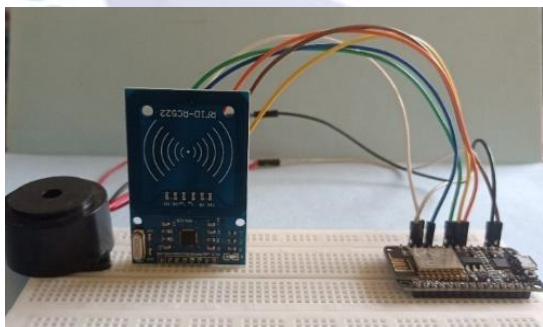


Fig8:Hardware Implementation

The RFID readers are installed at various locations throughout the underground. As workers enter the underground, they must scan their tags to the RFID reader module so that the location of the worker may be transmitted to the surface by the data displayed in the Google sheet shown in figure 9.

C) Google sheet data

V. CONCLUSION

The proposed RFID system improves the safety conditions of workers and increase the working efficiency for mineworkers. In this system the working location of worker is monitored by the RFID tag provided to the every worker by marking his present location on the reader which are located at various working zones. The data received from the reader is sent to node-MCU. This data is transmitted by the node-MCU and interpreted in the google sheets. From this data the location of worker is identified. If any unattended incidents or accidents happen to any mine worker, based on his previous location the mine worker can be rescued. Such RFID monitoring system is suggested to be implemented in underground mines where the identification of the location of workers is difficult to monitor.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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LINK FOR GOOGLE SHEET

https://docs.google.com/spreadsheets/d/1R_zZAnEbzfbyUaCR9I17_ZxFdPL-PbHRLuyd7cfMZ2A/edit?usp=sharing

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