

NAVIGATION IN MINES USING RFID TECHNOLOGY

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Abstract - The mineral extraction is growing consistently from past few years and is projected to grow more in coming years. Miners work in mines which are located away from human habitat, like in forests or mountains with limited resources. Mines generally expand horizontally and vertically depending upon mineral procurement. In mines, miners should be aware of their location. For that purpose we have proposed this project in which we equip every worker with a system which shows them their current location on an offline map. This is achieved using RFID technology by placing RFID tags at certain distances, on particular locations in mines. Major components of our proposed system are microcontroller Atmega328p, EM-18 transponder, GLCD display, power supply and RFID tags.

Key Words: Mines, miner's location, RFID technology, Atmega328p.

1. INTRODUCTION

Mining is responsible for our well being and better lifestyle. Aside from supporting thousands of jobs, the mining industry provides raw materials, minerals and metals critical to our economy. Extracted minerals are used to make medicines, roads, automobiles, electronics, construct infrastructures and generate energy. Now because of the acceleration in development of countries, demand for minerals are increasing. Like lithium and cobalt which are required for batteries in electric vehicles, smartphones etc, copper, gold, silver for electronics and requirement of other rare minerals. This will lead to an increase in mining activities and hence the size of mines will also increase.

1.1 Aim of our project

The motive of our project is to provide additional security to mine workers by keeping them informed about their current location in the mines by detecting RFID card nearest to them installed on mine walls.

1.2 Existing Technologies.

Existing technology helps miners by informing them of temperature, humidity, condition of air in the working area. Two main features are tracking and communication, but these features are not network independent. They require the network to be wired or wireless like wifi, wibree or

zigbee which connects them to the base station. But one of the main objective of tracking and communication is to guide miners by providing them their real time location. But if network fails because of any mishap like fall of ground from the mine roof miners may be misguided which may prove harmful for their life.

2. METHODOLOGY

2.1 Working Principle

The proposed system in our project uses RFID technology. This technology works on one of the two principles depending upon operating frequency. First is Inductive coupling, in case of less distance (around 1 metre) and frequency 125–135 kHz and 13.56 MHz for passive tags. Second is Backscatter coupling in case of high distance 12 metre for passive tag and above 100 metre for UHF active tag, its operating frequency is beyond 100 MHz, such as 860–960 MHz and 2400 and 5800 MHz, 3GHz.

2.2 System Model

In the prototype of our proposed system we are installing passive RFID tags at the actual location for our offline map. The system, supposed to be carried by workers, consists of circuit having an Atmega328p microcontroller that stores the map and codes of RFID tags corresponding to locations on the map and GLCD for display and EM-18 transponder to detect the tag, buzzer, power supply and other components.

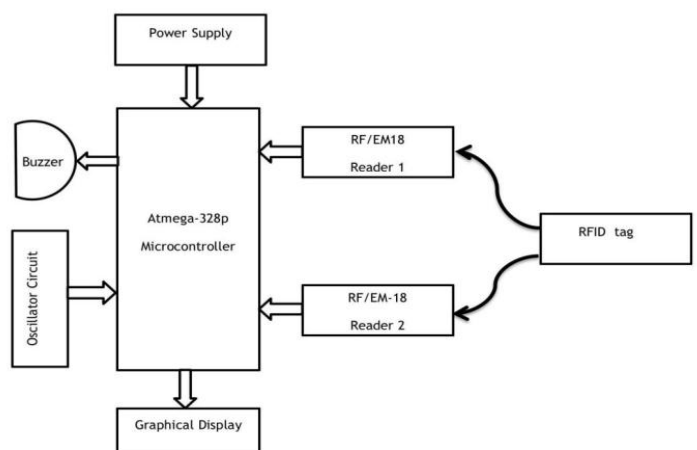


Fig-1: Block Diagram

An RFID tag corresponding to each location on the map to be placed into the mines at a certain distance from each other so that two locations won't be displayed simultaneously and confusing workers. Here whenever the GLCD integrated transponder circuit gets in the range of the RFID tag then location associated with that tag is highlighted on the GLCD map. Then the worker gets the idea of his location to decide the future course of his action.

3. MODELING AND ANALYSIS

Main components of our project are graphical lcd, EM-18 reader, RFID tags, Atmega328p.

3.1 GLCD module JHD12864E

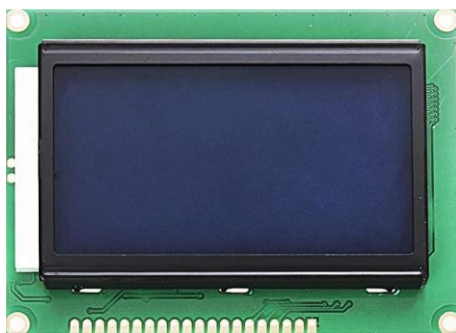


Fig-2: GLCD Display

Graphical LCD has 128x64 pixels. It has 128 columns and 64 row segments. It has 20 pins, and is powered by 12V DC supply. It has 2 segment drivers for columns and one for row, as each driver has 64 channels.

3.2 EM-18 Reader



Fig-3: EM-18 reader module

This board is based on the EM-18 RFID Module. It serially connects with microcontroller, powered by 12V DC supply. It has power indication LED (Labeled red in color) and to indicate the detection of Card/Tag, it has a LED (Labeled green in color) and Buzzer.

3.3 Passive RFID tag



Fig-4: Passive RFID cards

Passive RFID tag are powered solely by the reader's magnetic field emissions, which induce a current in a passive tag's antenna. It has the shortest read distance, about 10 centimeters between the reader and the tag. It's operating frequency is 13.56MHz.

3.4 Atmega328p



Fig-5: Atmega328p microcontroller

Atmega328p is 8-bit RISC-based microcontroller combines 32 KB ISP Flash memory with read-while-write capabilities, 1024B EEPROM, 2 KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented Two-Wire serial interface, SPI serial port, a 6-channel 10-bit A/D converter, programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts.

4. PROTOTYPE MODEL

When GLCD integrated, an Atmega328p powered system equipped with an EM-18 reader comes in the range of RFID tags. Then the reader reads the code by receiving the modulated wave sent by the reader itself by noticing the variations between sent and received wave. The code is then received by the microcontroller by serial communication. Then if code matches with existing code which belongs to some location on map, then that location is highlighted, indicating the user's presence at that place.

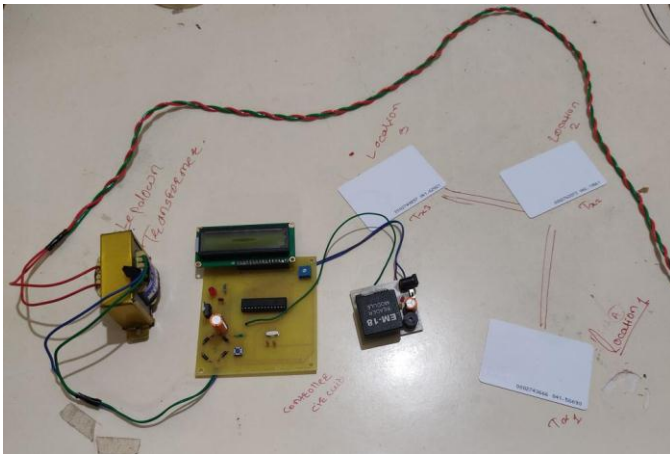


Fig -6: Result

5. CONCLUSION

Hence we have developed a prototype of a system which will provide location to miners based on RFID tag. This system is independent of connection to larger networks so it won't face problems due to network failure. But for this system to be implemented in mines, we will have to use active RFID tags.

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