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DESIGN OF UNDERGROUND MINING VEHICLE FOR PROPAGATION MODELING

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Abstract - In mining operations, communication systems play vital roles in ensuring personnel safety, enhancing operational efficiency and process optimization. Identifying and solving a rescue problem in underground mines is a big task for the monitoring team. The need for wireless communication in underground mining process has evolved from basic emergency signal and using voice communication with high speed data transmission by collecting the data and signals from the number of vehicles in mining process. In this work, by using wireless communication and propagation modeling between monitoring system and underground vehicles which helps in reducing the drawbacks of manual risk and easy monitoring of vehicles. The applications are the progress in understanding and modeling the underground wireless propagation modeling system.

Key Words: Controller, Label, Crystal display, Temperature sensor, Stepper motor

1. INTRODUCTION

The mining industry plays a vital role in the global economy. The communication system play an increasingly important role in ensuring personnel safety and optimizing the mining process. The modern era of underground communications design is based on ultra-high-frequency technology and it increases the attention in safety operation and safety communication. Recent interest in deploying next generation wireless communications technology in underground mines which has stemmed from recent advances in short-range wireless communications technology and commercial-off-the shelf, wireless-personal-area-network, radar devices, and the potential to increase mine efficiency and productivity through more effective voice communications, better access to management information systems and automated dispatch. The need for wireless communication in the underground mining industry has evolved from basic emergency signals to person-to-person voice communication and with high speed real-time data transmission. Accordingly, the supporting technologies have emerged through-the-earth transmission, radiating cables are also point-to-point and multi-point radios. Applications utilizing these technologies include voice communication, video surveillance, tele-operation of mining equipment tele-mining, wireless sensors networks, geo-location and tracking of personnel assets. To develop and evaluate these technologies appropriately, wireless propagation and channel models are essential. The measurement and theoretical approach to channel modeling are increasingly seen as complementary. The analytical and numerical models based on waveguide theory, geometrical optical ray-tracing and other methods have been developed by many researchers. While the single-mode waveguide model is simpler and requires fewer inputs about the physical environment, it is not effective on predicting propagation for near-field and it is too short tunnels with complex geometries at higher frequencies. Ray-optical models on the other hand, provide more detailed prediction for higher frequencies and complex geometries and computational burden which increases significantly prolonged fields. The multi-mode waveguide model offers more accurate and realistic model with reasonable runtime, which can also characterize small-scale fading statistics. The main advantage of this model is the ability to accurately characterize both the near-zone and far zone of the tunnel.

2. ELEMENTAL COMPONENTS OF UNDERGROUND MINING VEHICLE

The Microcontroller is the control unit and it controls the devices being interfaced and communicates with the devices according to their propagation. The liquid crystal display is a seven segment display which uses the light modulation properties of liquid crystals because liquid crystals do not emit light directly and the images are made up of a large

number of small pixels. The underground mining vehicle having different information of different route members by using the radio frequency identification readers and tags. In that one different route is having vehicle which has temperature and pressure sensor and by using these sensors the information about the persons in different route area in underground mines and vice-versa in other routes are obtained. The active tags require a power source i.e., they are either connected to a powered infrastructure or use energy stored in an integrated battery. A passive tag consists of three parts: an antenna, a semiconductor chip attached to the antenna and some form of encapsulation. The tag reader is responsible for powering and communicating with a tag. The thermistor is a type of resistor whose resistance varies significantly with temperature. The thermister is a temperature sensor and is able to reset over current protector and also self regulate heat elements. The speed of dc motor will be varied according to the speed set by the switches. A step down transformer is an electrical device which is used to convert electrical power from one electrical circuit to another without change in frequency and the circuit is subjected to rectifier.

3. DESIGN PROCEDURE OF UNDERGROUND MINING VEHICLE

The components of underground mining vehicle are modules used to transmit the signals, radio frequency identification labels, temperature sensors, stepper motor, liquid crystal display, switches are mounted over a wooden plank are connected to a microcontroller and the power supply obtained from high voltage ac mains electricity to a suitable low voltage supply for electronic circuits and other devices to allows the movement of vehicles. The front and rear views of underground mining vehicle is shown in fig 1 and fig 2. When the driver drives the vehicle into underground mines by using the radio frequency identification labels the location of the vehicle can be easily located.

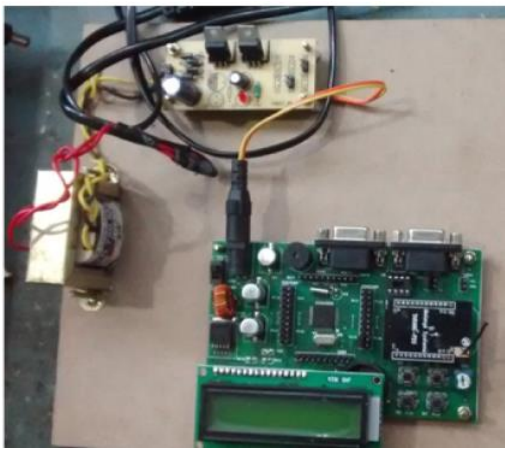

Fig - 1: Front view of underground mining vehicle

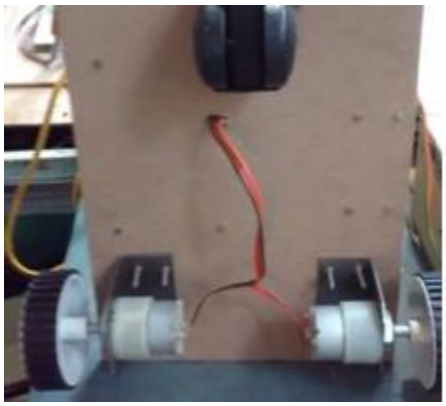

Fig - 2: Rear view of underground mining vehicle

The temperature sensors connected to the stepper motors and will sense the temperature of surroundings of underground mining vehicles. The switches are used to transmit immediate signals and to minimize the accidents. The signals from the underground vehicles are connected through modules and the data is displayed on liquid crystal display. The advantage of underground mining vehicles are to save human effort, power, life, action time, safety, easily detect the problem, flexible process, easy monitoring of vehicles and minimizing the accidents.

4. CONCLUSIONS

The wireless communication and propagation modeling with vehicles, in underground mines helps in decreasing the manual risks. The design of underground mining vehicle for propagation modeling which shows as an effective underground mining with highly detective sensors and wireless communication and is operated neither on power nor on primary battery supplies. Suppose if it is powered from the ac main nor has a battery that is float-charged so

that in the event of power failure the systems will remain functional. The basic level of underground mining can overcome with this updated mining process. The system is extensible and can add many other sensors like detecting gas levels in underground for a driver safety, pressure bared by manuals, temperature levels in the tunnels. This work is designed in such a way that, if the explosion or some other gases are released out, the sensor can sense those and the buzzer indication is given to alert the driver and the workers in underground mines. In Future these systems can be made more useful integrating many sensors enabling monitoring of the safety issues communication issues.

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