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COAL MINE ROBOT

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Abstract: *Coal mine workers are working in unhealthy environment. Increased level of CO and methane gas, Temperature, Coal dust etc. affects the health of coal mine workers. Hence there is need of effective solution for the same.*
In our system we use Robot for capturing the data:

- *CO level*
- *Temperature level*
- *Gas leakage*

The Robot will carry camera, the output of camera is send to central location or server room where the operator will operate the robot. The path of robot is guided by the commands send by robot operator. Based on the information send by robot, operators get the idea of environment of mine. If any of the value like temperature or the CO level exceeds the threshold value the buzzer will be ring and all the workers in the mine get alerted. Or if sometimes any accident occurs due to gas leakage or roof collapse or any other reason. Rescue operation has to be done. Rescue operation in coal mine is extremely dangerous due to several factors. It is particularly very harmful for the rescuers to get into the coal mine tunnel in disaster without the prior knowledge of environment because the subsequent explosions may likely to occur at any time visual inspection of miners, trapped in collapsed tunnel through a wireless camera. This paper designs an advanced rescue robot for coal mines. It is composed of a mechanism to bear the rest of the subsystems and also to assist the locomotion, a control system to control and a communication system to transfer the environment data acquired through the camera and other sensors. Also it can carry some food and medicine to the miners trapped in the disaster. With the help of this mobile robot, we reduce the loss due to coal mine disaster and efficient rescue operation can be carried out.

Keywords- *Mobile Robot, Coal mine, Rescue, Sensors.*

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1. INTRODUCTION

Safety is a prime intension of a coal industry for proper functioning. It's not only for employees and workers but also for the environment and nation. Coal mines are the most critical challenge for safety, health and environment compared to other industry due to the complication in its operation and maintenance with wide range of hazardous. Due to huge technological progress, the safety culture and safety at work still serious issues. That's why maintaining of high standards of health, safety and environment in coal mines is of immense significance.

To save the fatalities life of coal mines workers, due to unfortunate natural accident or unknowingly human made disaster, demands sophisticated and organized rescue planning from a government or rescue team [7]. The intension is to get out to the accident areas, find the affected workers and help them as fast as possible. Accident comes with many obstacles for the rescue team that makes it hard for them to reach the victims, for example rainstorms, collapsed roof or side walls, obstructions, explosion and dangerous gases and different substances. The rescue team must rapidly and securely collect information of the accident areas, a task that is both difficult and dangerous [6]. Rescue robots, that are a type of field robots, can serve as appreciated tools for human teams under disasters [5]. They can reach places between rubble and hazardous places that humans cannot, and effectively gather crucial information. The robots can also reach victims through narrow spaces and apply them with fluids and medication. To be useful tools the rescue robots must be smart and dynamic so they do not become obstacles for the rescue team. Because of the unstructured and dynamic environment that occurs during disasters, the robots are nowadays in a degree teleported [1], which demands that the robots have a good communication with the rescue team.

There are several rescue robots still under progress and some of them have even been used in some emergence situations. The challenge facing to get perfect rescue robots working on the different field is to make them advanced or intelligent in software and reliable hardware to work in critical zone in the way that it can handle all possible obstacles [4]. The significance of this paper is to get a valuable introduction of rescue robotics or unmanned machines, their challenges, how they are used today and what improvements could be in future of rescue robots for coal mine

2. LITERATURE REVIEW

The collecting data from [1] reveals that large number of accidents occur in a coal mine during and after a disaster. The main reasons being, gas accidents, explosives, flood, caving, etc. It requires the development of a system that can help minimize the human and material loss that happens during rescue operations in coal mines. [2] Thus sensors for detect the gas are mandatory in the robot to be deployed.

The idea of a Mobile Robot is able to aid the rescue team entering into a coal mine [3] got picked up with the tremendous uplift in the technology. The Robot is used to get in to the

disaster zone and rescue research operations. The robot can go in to mine and detect CO levels, temperature, gas contents, etc. The data can be sent to controller in safe field.

The mobile robots designed for that it can run in explosion environment, climbs over uneven surface areas, check gas, and provided where in it can carry food and first aid kit to the workers trapped inside. A biped robot was initially tipped to be used in the coal mines [4] which can move inside the tunnel interfacing with RS 232 cable. The robot couldn't travel a long distance it tripped on moving across the path and also the cable RS 232 couldn't be used for a long distance. Thus different types of legged robot had to be used and after research, a belt type robot was developed. The conveyor belt as seen on the military tanks would move over debris and rough terrains. For communication Blue Tooth would work only to a specified area and the robot couldn't be controlled beyond the signal region. This lead to the usage of wide wireless communication technologies like RF transceiver and Zigbee[6]. The Zigbee had much better range when compared with Blue Tooth and it could transmit the data or commands and receive data from long distance from the mine. Once the communication and sensing of robot was finalized the focus is shifted on how to make it more reliable. The idea of camera on the robot helps in getting live feed of what is happening inside the tunnel and it will help the rescue team to follow the less dangerous path and the way for rescuers get in to the mine. Robot wireless sensor networks are an highly capable platform and show great potential in environments to disaster discovery. Mobile robot wireless sensor networks had multimedia surveillance and provide the great strategies based on multi sensor integration [7]. The IEEE paper of Zhao-long, Xu Jie, Yang Xiao-zhi Liu et al [8] robot system is fit for detecting mine disaster information. It introduces in details the structure of the robot system, the technology of obstacle avoidance by using various sensors, and collection of information, wired, wireless transmission modules, local area network , wireless cameras, including gas sensors and temperature sensors.

3. PROPOSED SYSTEM

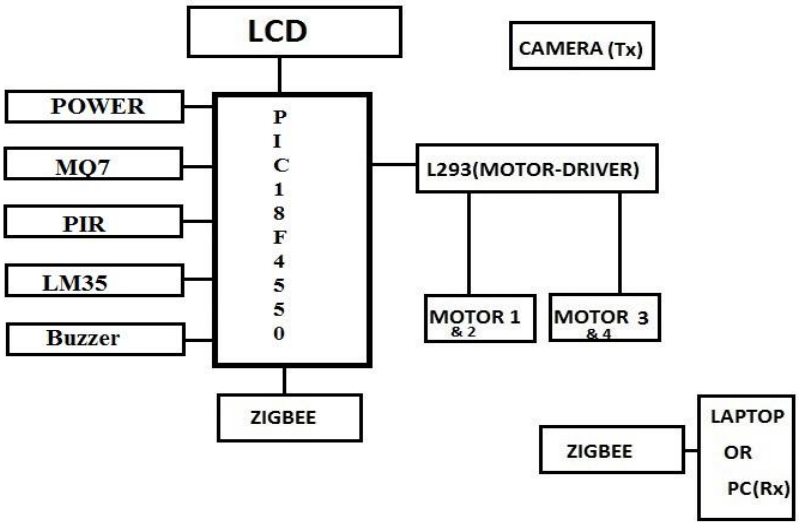

Figure 1: Proposed system

4. WORKING PROCEDURE

The block diagram of proposed system is depicted in fig.1; it consists of LCD, Microcontroller, MQ7, PIR, LM35 and Zigbee, Buzzer.

Power supply - In this system we are using 5V power supply for microcontroller of Transmitter section as well as receiver section. We use rectifiers for converting the A.C. into D.C and a step down transformer to step down the voltage.

Microcontroller - In this work the micro-controller is playing a major role. Micro-controllers were originally used as components in complicated process-control systems. However, because of their small size and low price, Micro-controllers are now also being used in regulators for individual control loops. The purpose of this work is to present control theory that is relevant to the analysis and design of Micro-controller system with an emphasis on basic concept and ideas. It is assumed that a Microcontroller with reasonable software is available for computations and simulations [3] so that many tedious details can be left to the Microcontroller. The control system design is also carried out up to the stage of implementation in the form of controller programs in assembly language OR in C-Language.

Zigbee Module - Zigbee is an established set of specifications for wireless personal area networking (WPAN), i.e. digital radio connections between computers and related devices. WPAN Low Rate or Zigbee provides specifications for devices that have low data rates, consume very low power and are thus characterized by long battery life. Zigbee makes possible completely networked homes where all devices are able to communicate and be controlled by a single unit.

MQ7 Sensor - Carbon monoxide detectors trigger an alarm based on an accumulation of carbon monoxide over time. Detectors may be based on a chemical reaction causing a color change, an electrochemical reaction that produces current to trigger an alarm, or a semiconductor sensor that changes its electrical resistance in the presence of CO. Most carbon monoxide detectors require a continuous power supply, so if the power cuts off then the alarm becomes ineffective.

LCD - LCD is used to display the data. LCD we have used is 16x2 i.e. 16 characters in 1 line, total 2 lines are there. We could have used a better resolution LCD but due to limitation of money and for project requirement 16x2 LCD is sufficient.

LM35 - The LM35 is an integrated circuit sensor that can be used to measure temperature with an electrical output proportional to the temperature.

5. CONCLUSION

The project is aimed to provide human safety for coal mine workers. It can be implemented in real time by using with better range and efficiency. This robot enters into every situation in the mine and provides data like various gas leakage that has been occurred also gives the

temperature details in mine in order to make sure that workers or employers does not come across any harm.

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