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Coal Mine Safety Alerting and Health Monitoring System

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ABSTRACT: Mining is the first step in the dirty life cycle of coal. When coal mines move in, whole communities are forced off their land by expanding mines, coal fires, subsidence, and overused and contaminated water supplies. Mines are quick to dig up and destroy forests and soils. But once the coal is gone, the problems they leave behind, like acid mine drainage, can persist for decades. Around the world, Greenpeace campaigns to help communities stop coal mines, and speed up the shift to 100 percent clean, safe renewable energy. In this we are going to use Arduino, temperature sensor, humidity sensor, and heartbeat sensor and smoke sensor. The sensor information are collected by the Arduino and they are stored in cloud. And the alert message is passed to the Gmail and mobile phone using IOT. With continuous enlarging of exploiting areas and extension of depth during a coal pit, several laneways become blind areas, whereby there are unit uncountable hidden dangers. Moreover, it's inconvenient to put cables that area unit costly and consume time. so as to resolve the issues, we'll style a coal pit safety watching system supported wireless detector network, which may improve the extent of watching production safety and scale back accident within the coal mines Wireless detector networks area unit composed of an oversized variety of micro-sensor nodes that have tiny volume and low price.

I. INTRODUCTION

Underground mining operations proves to be a risky venture as far as the safety and health of workers are concerned. These risks are due to different techniques used for extracting different minerals. The deeper the mine, the greater is the risk. These safety issues are of grave concern especially in case of coal industries. Thus, safety of workers should always be of major consideration in any form of mining, whether it is coal or any other minerals. Underground coal mining involves a higher risk than open pit mining due to the problems of ventilation and potential for collapse. However, the utilization of heavy machinery and the methods performed during excavations result into safety risks in all types of mining. Modern mines often implement several safety procedures, education and training for workers, health and safety standards, which lead to substantial changes and improvements and safety level both in opencast and underground mining. Coal has always been the primary resource of energy in India, which has significantly contributed to the rapid industrial development of the country. About 70% of the power generation is dependent on it thus, the importance of coal in energy sector is indispensable. But the production brings with it the other byproducts, which proves to be a potential threat to the environment and the people associated with it. In lieu of that the present work is a sincere attempt in analyzing the graveness and designing a real time monitoring system of detection by using the ZigBee technology.



II. LITERATURE SURVEY

1. Yu et al. (2005) proposed a real-time forest fire detection system based on wireless sensor network. The system collects the data and processes it in the WSN for detecting the forest fire. They designed the monitoring and detecting sensor networks using neural network.
2. Joseph et al. (2007) focused on the problems and hazards of fire in libraries or archives and described the necessary preventive steps to be adopted. They identified the diverse parts which are applied for fire detection and alert system and also provided necessary strategies for the selection and installation of an ideal fire alarm system.
3. Fischer (2007) considered the simulation technique and applied this technique to design a fire detection system. This system detects the fire as well as differentiates fire and non-fire spot to decrease the false alarm rate in the non-fire event.
4. Tan et al. (2007) designed a system, which is applied for mine safety monitoring. They called the system WSN based Mine Safety System. This system is capable of real time monitoring of the mine environment and provide the pre-warning for the fire or explosion.
5. Niu Xiaoguang et al. (2007) presented a distributed heterogeneous hierarchal mine safety monitoring prototype system (HHMSM) which is based on features of the underground mine gallery and necessities of mine safety. This system monitors the methane concentration and the location of miner. They proposed an overhearing-based adaptive data collecting system, which makes use of the redundancy and the correlation of the sampling reading in both time and space to ease the traffic and control.

III. PROPOSED SYSTEM

The progression of technology has allowed mine monitoring techniques to become more sophisticated, yet explosions in underground coal mines still occur. The safety issues of coal mines have gradually turned into a major concern for the society and nation. The occurrence of disasters in coal mines is mainly due to the harsh environment and variability of working conditions. So, it makes the implementation of mine monitoring systems essential for the safety purpose. Wired network systems used to be a trend for traditional coal mines, which have really played a significant role in safely production in coal mines. With the continuous enlargement of enlargement exploiting areas and depth expansion, laneways have become blind zones, where numerous unseen dangers are hidden out. Moreover, it is not possible there to lay expensive cables, which is also time consuming. So, it is essential to have a wireless sensor network mine monitoring system, which can be disposed in such mines in order to have a safe production within.

IV. BLOCK DIAGRAM

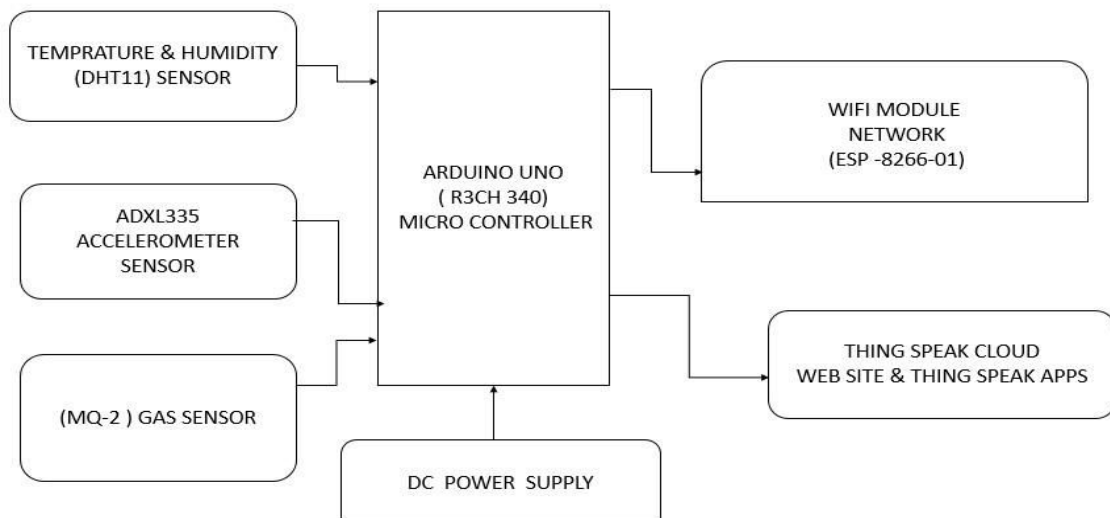


Fig 1. Block diagram



COMPONENTS

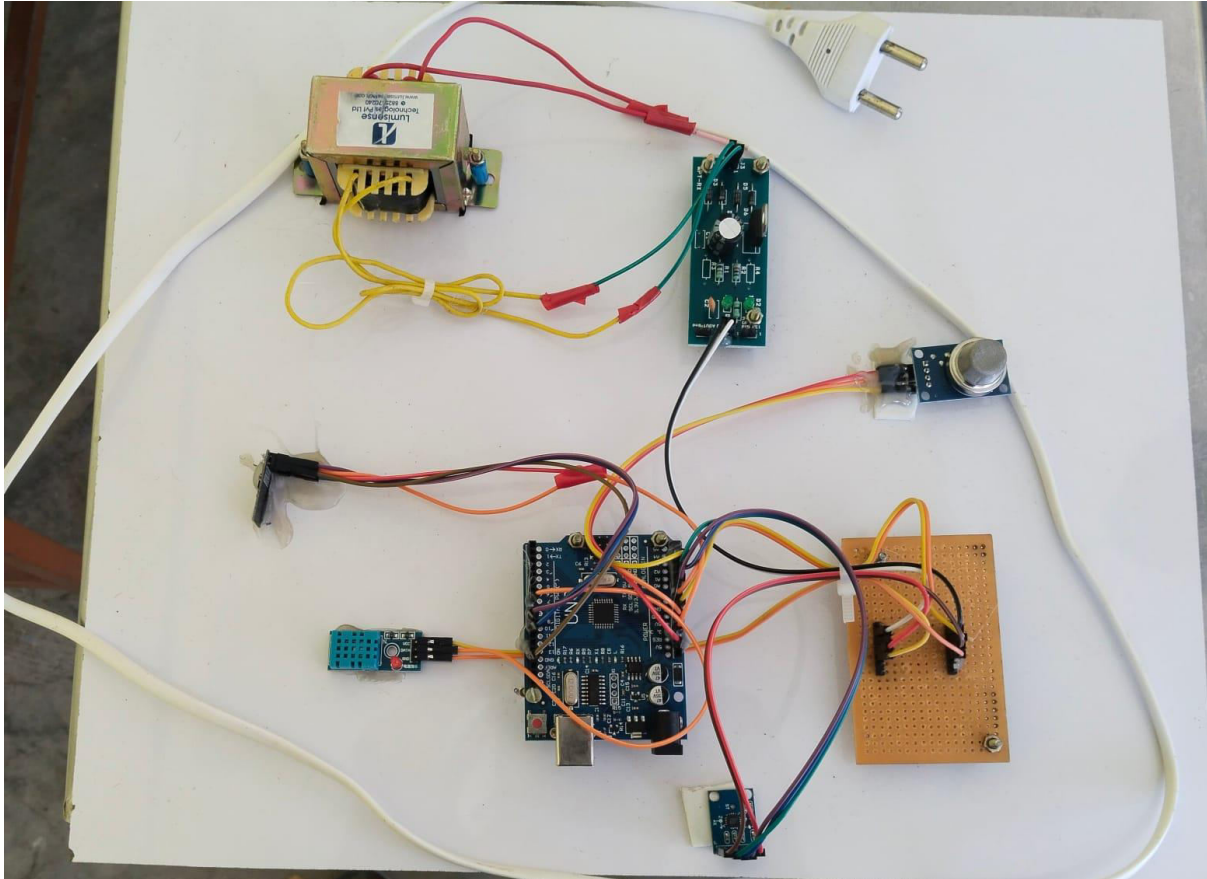
ARDUINO UNO BOARD: The Arduino Uno is a microcontroller board. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. "Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the 7 reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform.

NODE MCU: The ESP8266 is the name of a micro controller designed by Espressif Systems. The ESP8266 itself is a self-contained WiFi networking solution offering as a bridge from existing micro controller to WiFi and is also capable of running self-contained applications. This module comes with a built in USB connector and a rich assortment of pin-outs. With a micro USB cable, you can connect Node MCU devkit to your laptop and flash it without any trouble, just like Arduino. It is also immediately breadboard friendly.

TEMPERATURE SENSOR: The measurement of temperature is one of the fundamental requirements for environmental control, as well as certain chemical, electrical and mechanical controls. Many different types of temperature sensors are commercially available, and the type of temperature sensor that will be used in any particular application will depend on several factors. For example, cost, space constraints, durability, and accuracy of the temperature sensor are all considerations that typically need to be taken into account. Various types of temperature sensors are known including liquid-in-glass (LIG) thermometers, bimetallic thermometers, resistance thermometers, thermocouples, and radiometers. Depending upon the temperature to be measured, the required accuracy of the measurement, and other factors such as durability or cost, one type of temperature sensor may be preferable over another.

GAS SENSOR: In current technology scenario, monitoring of gases produced is very important. From home appliances such as air conditioners to electric chimneys and safety systems at industries monitoring of gases is very crucial. Gas sensors are a very important part of such systems. Small like a nose, gas sensors spontaneously react to the gas present, thus keeping the system updated about any alterations that occur in the concentration of molecules at gaseous state. Sensors are available in wide specifications depending on the sensitivity levels, type of gas to be sensed, physical dimensions and numerous other factors. The insight covers a methane gas sensor that can sense gases such as ammonia which might get produced from methane.

MICRO-ELECTROMECHANICAL SYSTEM: Micro-electromechanical systems (MEMS) is a technology that combines computers with tiny mechanical devices such as sensors, valves, gears, mirrors, and actuators embedded in semiconductor chips. MEMS or what he calls analog computing will be the foundational technology of the next decade." MEMS is also sometimes called smart matter. MEMS are already used as accelerometers in automobile air-bags. They've replaced a less reliable device at lower cost and show promise of being able to inflate a bag not only on the basis of sensed deceleration but also on the basis of the size of the person they are protecting. Basically a MEMS device contains micro circuitry on a tiny silicon chip into which some mechanical device such as a mirror or a sensor has been manufactured. Potentially, such chips can be built in large quantities at low cost, making them cost-effective for many uses.

PHOTOGRAPH OF MACHINE**Fig 2.** Photograph of Machine**V. CONCLUSION AND FUTURE SCOPE**

The study on real-time monitoring of toxic gases and other parameters present in underground mine has analyzed using wireless sensor networks. A real-time monitoring system is developed to provide clearer and more point to point perspective of the underground mine. This system is displaying the parameters on the serial monitor at the underground section where sensor unit is installed as well as on the monitoring unit; it will be helpful to all miners present inside the mine to save their life before any casualty occurs. Alarm triggers when sensor values cross the threshold level. This system also stores all the data in the IOT cloud. safety is paramount in coal mining operations, and implementing robust safety measures is essential to protect the well-being of miners and ensure the efficient operation of the mine. By utilizing advanced technologies such as gas sensors, temperature sensors, humidity sensors, and data logging systems, along with communication systems powered by DC power supplies, coal mines can continuously monitor environmental conditions and respond quickly to any potential hazards. Real-time monitoring, safety alert systems, and remote control capabilities provided by platforms like Thing Speak, along with the versatility and cost-effectiveness of devices like the Arduino Uno microcontroller, contribute significantly to improving safety standards in coal mines. With these technologies in place, mine operators can ensure the safety of their workforce while optimizing mining operations for maximum efficiency and productivity.

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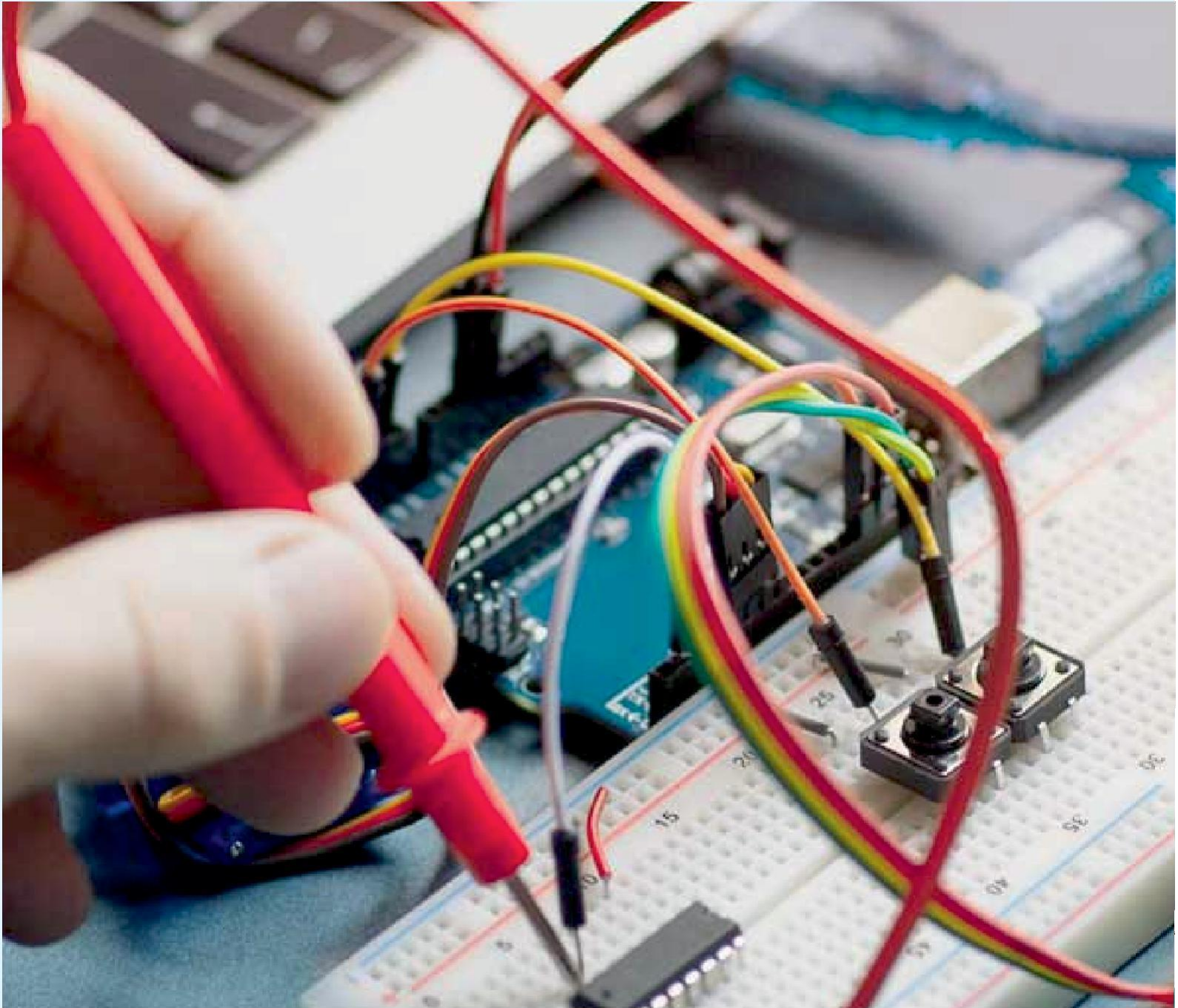
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