

ARM BASED COAL MINE MONITORING SYSTEM

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Abstract: Coal mine accidents have been freak and steps taken to avoid them by the government is immense, yet cannot be controlled drastically. We have designed a module that can prevent these accidents. The project aims at designing Coal mine detection system using ARM processor which is 32 bit processor. We had made used of two sensors which monitors the environmental conditions in the new carved coal mine spot. They are temperature and gas sensor and this information is updated using wireless medium ZIGBEE. ZIGBEE comes under IEEE 802.15.4 standard and it's a robust transceiver. The application software is well equipped with monitoring and controlling the coal mine region with the relay. Thus the manual intervention is totally avoided in this project.

I. INTRODUCTION

Coal is an essential energy resource in both industrialized countries and emerging economies. Meeting the voracious energy demand, particularly in some rapidly-growing economies, has placed pressure on coal mines to increase their production—sometimes to levels beyond what can be safely sustained, leading to stresses on overall mining operations and compromising safety. The presence of methane in coal mines presents a serious safety concern that needs to be managed professionally and effectively.

Accidents can occur when methane enters the mine space from the coal seam and surrounding strata as a result of the disturbance created by the mining operation. The amount of gas released into the mine is a function of both the rate of coal extraction and the in situ gas content of the coal and surrounding strata.

With the practice of methane drainage for power generation now on the increase, it has become vital to ensure that effective methane recovery monitoring is in place. Accurate continuous monitoring

is crucial as changes in a methane drainage system can lead to possibly even damage, reducing revenue and endangering both plant and personnel. Now many companies have developed advanced equipments to improve monitoring quality, which depends on not only the sensors' reliability, positioning, maintenance and calibration, but also the realtime of parameter collection and processing. Core dataacquisition and analysis is an indispensable step in coal mines in order to broaden the scope of methane.

As coal mine methane drainage systems have been widely used, the equipments become more and more complex with the increasing number of monitoring parameters such that the real-time acquisition systems are necessary. This paper presents a data acquisition system based on ARM technology, which provides a continuous online and high accuracy acquisition for the methane drainage monitoring system with standardization, automation and intelligent features.

II. EXISTING SYSTEM

The maximum rate of coal extraction is determined by the combination of ventilation capacity to dilute pollutants to acceptable concentrations and methane drainage efficiency.

Ventilation is the primary means of diluting and dispersing hazardous gases in underground mineroadways. Mine ventilation systems are critical components of an overall system to effectively remove methane from mine workings. A mine ventilation system is designed to achieve three objectives: 1) deliver breathable fresh air to the workers, 2) control mine air temperature and humidity, 3) effectively dilute or remove hazardous gases and airborne respirable dust.

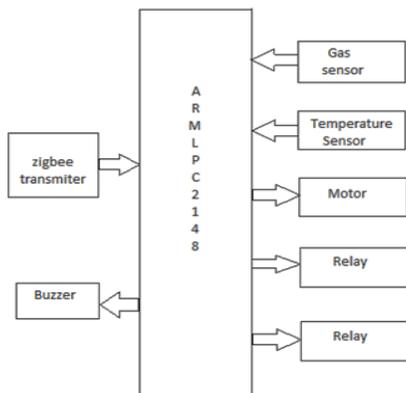
The existing monitoring systems underground of coal mine mostly use cable network and very often of

them use wireless sensor networks. When an accident happened, especially explosion, the sensors and cables usually were damaged fatally, and couldn't provide information for rescue search and detection events. In this application, Wireless sensor network can solve the key issues of communication bandwidth, mobile data transmission, working surface real-time monitoring. Now a day's every system is automated in order to face new challenges. In the present days Automated systems have less manual operations, flexibility, reliability and accurate. Due to this demand every field prefers automated control systems.

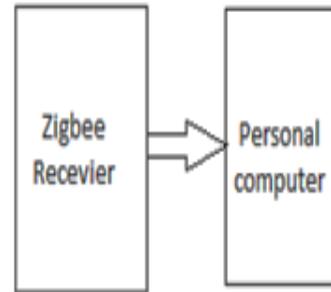
III. PROPOSED SYSTEM

We are proposing a design which is used to monitor and control the process taking place in coal mines. The main aim of our project is to perform the data acquisition process effectively and accurately using ARM. Methane gas sensor is used to detect the toxic methane level in the coal mines and Temperature sensors are used to identify the underground temperature and their values are recorded and further process is carried out. If the methane gas level increase above the threshold value then the controller alarms the survivors through the buzzer, simultaneously motor is switched ON to drain the excess gas. Once coal is recovered from mines it can be used for various applications. In power generation the coal is passed through various units. The automatic control of these units are carried out using relays. Relays are used to control condenser unit, feed pump unit, pulverizer unit and feed conveyor unit. The data acquired is displayed in PC at the receiver side for monitoring purpose. The wireless communication is carried out using Zigbee and it comes under IEEE 802.15.4 standard and it's a robust transceiver.

IV. BLOCK DIAGRAM TRANSMITTER SIDE



V. RECEIVER SIDE



System implementation

The ARM controller perform various integration process. They interpret the data available from various sensors and send necessary control signals. These control signals are used for automation of motor and relays. ARM controller is 64-bit it has several features such as 512 on chip flash memory, power saving modes such as active mode and idle modes are available. The speed of execution is very high, so we are using this controller. The data obtained through ARM is reliable and highly accurate.

Methane Gas sensor sense the methane gas which prevails in the coal mining area and send the level of methane to the ARM controller. This can also be displayed in the personal computer for monitoring purpose and the controller automatically switch on the motor to drain the excess gas level for safety purposes.

The LM35 is precision integrated-circuit temperature sensor whose output is linearly proportional to Celsius (centigrade) temperature. It can be used with single power supply or with plus or minus supply. It operate over -55c to 150c temperature range.

The Relay driver ULN2803 contains eight darlington transistors with common emitters and integral Suppression diodes for inductive loads. Each Darlington features a peak load current rating of 600mA (500mA continuous) and can withstand at least 50V in the off state. Outputs maybe paralleled for higher current capability. ULN2803 has a 2.7kΩ input resistor for 5V TTL and CMOS; All types are supplied in a 18-lead plastic DIP with a copper lead from and feature the convenient input opposite-output pin out to simplify board layout.

System application

The data acquisition system for methane drainage integrates some functions including parameters collection, output control, data processing, parameters display, communication and other functions, such that it can meet the needs of signals collection with various types of sensors. The high-speed grouping parallel mechanism based on ARM increases the acquisition efficiency. The modular design makes the system easier to maintain and upgrade. At present, the data acquisition system, a variety of sensors, the central station and other devices are connected to work in the methane monitoring system.

Advantages

- Monitoring and also draining of gas take place in our project.
- Methane gas have wide range of applications especially used for power generation so the drained gas can be stored and it is used effectively.
- Automatic switching is performed to ON/OFF the various units present in the coal mining fields.
- Data acquisition is very fast because of ARM controller.
- Visual display is used for monitoring purpose in the control room.
- Circuit Design complexity is very low.
- The life of person can be saved from release of toxic gas.

VI. CONCLUSION

The data acquisition system for methane drainage based on ARM can meet the real-time acquisition and real-time processing requirements. In this application, as we are storing the values of the parameters in the PC, the stored values can be used to detect the hazards before they happen. As we are giving the information to the personnel regarding the measures to be taken in case of a hazard, it will be useful for them to save their life before any one comes and help them to come out of the mine.

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