ARM based Smart Coal mine Monitoring System by using WSN

M. Sirisha

Department of ECE GVR&S College of Engineering & Technology

Asst prof.B. Chinna Kotaiah

Department of ECE
GVR&S College of Engineering & Technology

Prof.Y. Sreenivasulu

Department of ECE, HOD GVR&S College of Engineering & Technology

yerraboina@yahoo.com

mobile no:8978389238

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 aim of this project is to design an investigative study on underground Mine workers safety & security measures. 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.

INTRODUCTION

Along with the application of information technology in coal mine production, the future developing direction of coal mining system is systematic, automation and diversity. Coal system is a huge and complicated system, whose components are mutual influence and mutual restriction. In face of such a large complicated system, it requires us to have a rapid and accurate understanding of the operation condition of coal mine system and the characteristics of each part and make accurate decisions to give full play to the system ability and efficiency, complete and unify system, and coal mine automation system is thus generated.

Real-time mine surveying, GPS real-time navigation and remote control, GIS management and aid decision making and 3DGM application have appeared internationally.

Some large opencast mines have realized generating deposit models and making mine

mining plans in the office, with mining equipments connected, a complete dynamic management and remote control command system has been formed. In addition, artificial intelligence technology such as neural network, fuzzy logic, adaptive pattern recognition and genetic algorithm, GPS technology, radio frequency identification technology, global optimization method and remote sensing technology have been applied in many research areas such as intelligent geological exploration survey, intelligent mining, intelligent mine design, planning and control and mine disasters remote sensing prediction, etc. Coal mine information system is a combination of comprehensive technologies such as computer technology, automatic control, communications, information technology and modern management technology and so on.

It controls and manages the enterprise production process control, operation and management as a whole, and provides the overall solution, in order to realize the optimization of enterprise operation and control, and improve the status of production, safety level, and the accident hazard prediction and production business management level, so as to improve the core competitiveness of the enterprise.

In recent years, with more attentions and implementation to the coal mine safety production

measures from country, many coal mines installed underground personnel positioning system, equipment check point system and wireless communication system, etc.. But some universal problems exist: one is simple system function. Systems isolate from one another in production and safety management, which makes efficiency maximization can't be achieved, the cooperative function between the systems is hard to play, and the systems can't harmonize well with the actual production and safety management of the enterprise, as a result, system became "isolated island" and even became a decoration or "visited project"; The second problem is system is still not perfect or has blank, such as locomotive positioning system, equipment positioning system, the powder transportation and management system in the mine, etc.; The third problem is the present system still does not have the function of disaster recovery and emergency communication.

COAL PRODUCTION SITUATION

Most are still underground mined, key coal mines are basically gas, coal and gas outburst mine, and mostly low permeability coal seam. Coal occurrence condition is poor and mining depth is deep, the coal dust, flood, fire, and other serious problems trouble the development of the mining industry. Coal industry is not only an important pillar of the national energy, but a high-risk industry in China. In recent years, In recent years, with more attentions and implementation to the coal mine safety production measures from country, many coal mines installed underground personnel positioning system, equipment check point system and wireless communication system, etc..

PROBLEM IDENTIFICATION

Coal mining deep underground involves a higher safety risk than coal mined in open cast pits, due primarily to problems associated with mine ventilation and the potential for mining collapse.

However, there are safety risks associated with all forms of coal mining in order to make cash. Methane released from the coal seam and surrounding rock strata during the process of mining can present a high risk of explosion. Methane is one of the most problematic gases experienced in underground coal, trona, potash, limestone, oil shale, and salt mines. Small amounts of methane have also been detected in copper, tungsten, iron, gypsum, marble, gold, and silver mines. Methane can be contained within the coal seam or inside of fissures in the coal and surrounding strata. The amount of methane in a seam depends on temperature, pressure, degree of fracturing, and permeability of the coal and surrounding strata. Methane tends to accumulate along the roof and in high areas of the mine because it is less dense than air.

PROPOSED SOLUTION

The designed system comprises of electronic gadget consisting of sensors to measure surrounding environment parameters within the Mine area & also modules to know the health condition of the Mine worker. The Microcontroller chip is used as the core of these systems which is associated with sensors & RF communication device to transmit the information to server present at ground.

The proposed system collects the environment parameters using temperature, light & gas sensors respectively & if the value goes beyond critical conditions necessary measures will be taken.

Here we are using Heart beat module to measure the heart beat of the miner & if the heart beat is unstable then information will be transmitted to the server. So that immediate action can be taken and also we are using MEMS sensor to detect fall, in case any worker fall due to unconsciousness.

The sampled data at Cumberland Mine were recorded every minute on the surface mine-site monitoring system PC and the fire probability was

calculated with the NN software in real time using the algorithm derived from data collected from previous experiments in the SRCM. After initial mine-site installation, site-specific modifications were required to the algorithm related to the calculation of the daily averages of the sensor ambient values and the criterion for an alarm

The alert messages are passed to mine workers in terms of voice. A record & playback chip is used which plays prestored messages in it. Communication is achieved between mine & ground server using Zigbee, built from small, low-power digital radios. ZigBee is based on an IEEE 802.15.4 standards. Its low power consumption limits transmission distances to 10–100 meters line-of-sight, depending on power output and environmental characteristics
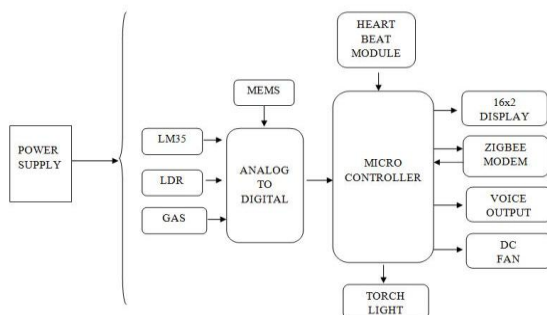

Fig: 1 Block Diagram

ARM7 microprocessor and peripheral equipment includes a ARM7 chip, a clock circuit, a reset circuit, a 32MB flash memory, . All of these make up the control and process core of the system. The on chip features can significantly reduce the total system cost to design network devices. It has 8 kB to 40 kB of on-chip static RAM and 32 kB to 512 kB of on-chip flash memory, so it can execute longer programming code and has larger RAM to store more data.

An ADC may also provide an isolated measurement such an electronic an log voltage or current to a digital number proportional to the magnitude of the voltage or current. However, some non-electronic or only partially electronic devices, such as rotary encoders, can also be considered ADCs. The digital output may use different coding schemes. Typically the digital output will be a two's complement binary number that is proportional to the input, but there are other possibilities. An encoder, for example, might output a Gray code.

MEMS are a process technology used to create tiny integrated devices or systems that combine mechanical and electrical components. They are fabricated using integrated circuit (IC) batch processing techniques and can range in size from a few micrometers to millimetres. These devices (or systems) have the ability to sense, control and actuate on the micro scale, and generate effects on the macro scale.
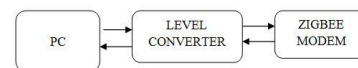

Fig: 2 Server Section

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.

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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