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Security management system for oilfield based on embedded wireless communications: A design approach

SYED MINHAJ ALI[1], SATISH V REVE[1], ROOHI ALI[2]* and SANA IQBAL[3]

[1]Department of Computer Science & Engg., RGPV University, Bhopal (India).
[2]Department of MCA, GGGC, RGPV University, Bhopal (India).
[3]Department of Computers, Saifia Science College, Bhopal (India).

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ABSTRACT

This paper is concerned with the security management system for oilfield based on Embedded wireless communication. The site of oil-well is distributed dispersedly, but distribution area is wide. Oil exhauster continuous working for 24 hours. Regional of Perambulation for the site of oil-well is very vast, meanwhile, as for the problem of petroleum being stolen, transmission line being stolen, transformer being stolen, which has been one of the important objective condition restriction of geographical environment, the implementation of safe management for oilfield is very difficult. We overcome these difficulties, which management works. With Consideration of the comes from geographical environment. The cost is not only high if the fiber cable would be lay between working station in the several tens of square kilometers, but also need to put into a lot of human and material resources with line maintenance and guard against theft. It is a perfect scheme that remote wireless monitoring and control system is established.

Key words: Security Management System, Wireless, communication, Embedded construction.

INTRODUCTION

A security system is necessary for a building to guarantee the safety of the residents. The security system has gone through single-route monitor system, control loop monitor system, and processor plus multimedia monitor system eras in the past twenty years. With rapid development of national economic construction, there is a great demand and dependent on patriotic in various industries. The international price of petroleum has been kept at a high level in recent years, so production efficiency on domestic oilfield is urgently needed to be improved, new requirements for oilfield information construction is raised, construction of information and digitalization become development direction for oilfield The Distribution State of working environment in oilfield is very special, the site of oil-well is distributed dispersedly, but distribution area is widely, oil exhauster continuous working for 24h, regional of Perambulation for the site of oil-well is very vast, meanwhile, as for the problem of petroleum' being stolen, transmission line being stolen, transformer' being stolen, which has been one of the important management works. With Consideration of the objective condition restriction of geographical environment, The implementation of safe management for oilfield is very difficult. We overcome these difficulties, which comes from geographical environment. the cost is not only high if the fiber cable would be lay between working station in the several tens of square kilometers, but also need to put into a lot of human and material resources with line maintenance and guard against theft. This system can improve the level of oilfield 'security, enhance the security checking, strengthen the management of digitalization and informatization, The method could solve problems with highly efficient and rapid, also could reduce the loss of country with effective, So It has the

important significance and social and economic benefits for the dependability and the controllability of remote communication.

System structure

The wireless security system adopts distributed structure, which is showed as fig.1. The system consists of detect sensors, intelligent terminal, alarm devices and wireless communication network. The detect sensors installed in residence are used to acquire the information and transmit them to the intelligent terminal. The intelligent terminal which designed based on embedded system is used to realize acquisition information submitted from detect sensors, control the alarm devices and report the information to the host or police. The alarm information and control signals transmitted between the detect sensors and intelligent terminal by dint of wireless communication network.

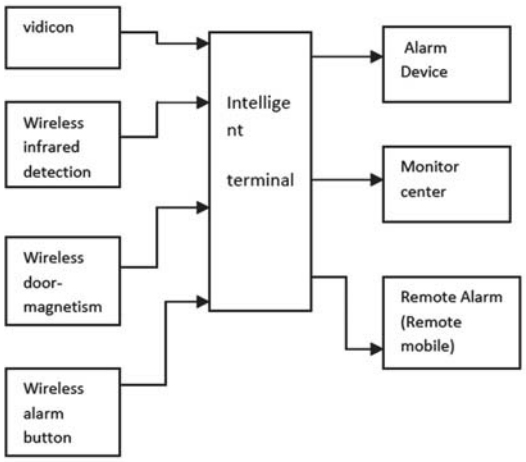

Fig. 1: Structure digagram of wireless security system

Using wireless and computer technologies, a security managing system is designed,which can be used for both areas of guard against theft and night patrol. It's structure adopts tow-level scheme, which is shown in Figure 1. The first level is consist of a launcher and some remote controllers ,which include wireless burglar alarm, fault alarm, power-off alarm, self-checking alarm and some wireless night patrol point. The launcher, which is more than 1W, is a wireless receiver, another is a wireless transmitter, it receives the information of the front-end alarm equipments and can send message by the wireless transmitter. The second level is consist of a wireless receiver and a wireless alarm controller in the system. The function of a wireless receiver can receive the information of some frontend launchers and send it to PC through RS232 communication.

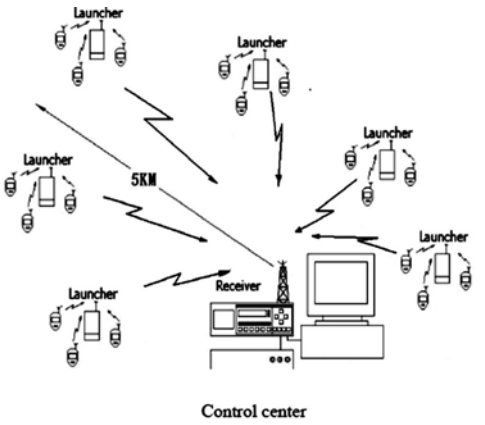

Fig. 2: System structure of wireless security management

This system is of much benefit to night patrol and alarm of diversification manager and adds the safety of oilfield. The problem of the oil well's equipment unattended can is solved.

Wireless data transmission

The system designed in this article employ wireless system in the front-end of data acquisition, which consists of oil well shutdown alarm, oil well running alarm, power failure alarm, oil stealing alarm, night patrol alarm.

Wireless acquisition function

According to actual situation of oilfield, the security management should be complete a lot of wireless acquisition function in this system.

Function of oil well shutdown alarm

Wireless transmitter is installed on starter of the power distribution box. when the oil well is shutdown and the belt of pumping is fracture, It send a wireless information. And then passing through wireless receiver, the information is sent to duty room and is received and is taken by the operator

on duty in real-time, so as to reduce the time of oil well shutdown.

Function of oil well running alarm

After solve problems of fault, we need to make oil well running. So, transmitter will send a message when the oil well is restarted. The green lamp will be lighted, the buzzer will send out monotone alarm sound when the receiver receive a message with running alarm, which suggested that the oil well could go normal.

Function of power failure alarm

Wireless transmitter is installed on the power. The wireless transmitter is automatically converted into working state of DC battery of the internal when the power stops, meanwhile, the wireless transmitter send a message with power failure alarm , which is received by the receiver and the operator on duty is suggested that a warning signal. Because the first step of criminals will stop the power when the electrical circuitry equipment is destroyed. So, this function can widely used in many situations, such as prevent the transmission line from being stolen, prevent the transformer from being stolen and so on.

Function of guard against theft oil alarm

The criminals must rotate the handle on the well location when they steal oil. Because the remote control as protection is installed on the handle, it will sent a wireless signal to the launcher when the emergency of theft is happened, then through secondary emission of the launcher, the message will be received by the receiver in the control center of several kilometers away, the message to sound and to light will notice the duty human. This will lead to the failure of criminals' attaining their purpose.

Function of the night patrol alarm

In order to ensure safe operation of the oil production, the oil workers must be go everywhere and check the equipment on time every day, it is because the well location is not only widely distributed in oil, but also the oil production adopt working state without watch. After the oil production workers arrive at the oil well around several meters of the distribution box, to click the button on the remote controller, and the remote controller sent a message to the launcher, and then send it to the host receiver in the control center to record the number of the well location, the number of workers and the time immediately.

Hardware Structure

The first launcher and the second receiver are the intelligent wireless equipment based on embedded. It is consisted of data acquisition and storage module, wireless communication module, device controlling module, user setting module, display module and power supply module. The block diagram of main circuit is showed as figure3. The control platform of the security management uses the Samsung's S3C44B0 32-bit RISC microprocessor as its kernel processor, it also have many serial port and parallel port to collect and send out information. In the launcher, we uses D ports as wireless data receiver port through PT2272, Tout port as the end of wireless emission with binary frequency shift keying(2FSK) in software radio using arithmetic method. Meanwhile, Receiver, which is located in the control center with several kilometers away, receive the signal and then uses Frequency-shift Signal Demodulation.

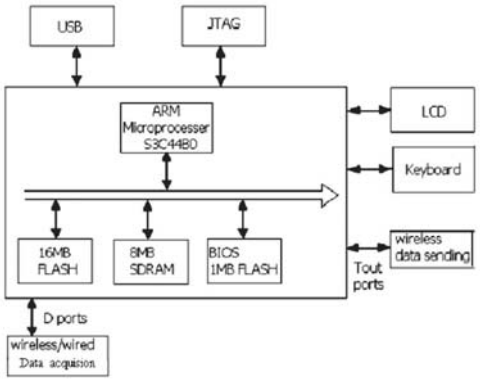

Fig. 3: Hardware Structure of system

Data acquisition and Data emission

PT2262 is remote control encoder paired with PT2272 utilizing CMOS technology.It encodes data and address pins into a serial coded waveform suitable for RF or IR modulation. PT2262 has a maximum of 12 bits of tri-state address pins providing up to 531,441(or 312) address codes; thereby, drastically reducing any code collision and unauthorized code scanning possibilities. it's main

circuit is showed as fig.4. In this Fig.4, There are 4 switches which can obtained oil well shutdown alarm, oil well running alarm, power failure alarm, guard against theft oil alarm. This information is send out by Pin 17 after PT2262 encode. PT2272 is remote control decoder paired with PT2262 utilizing CMOS technology. It has a maximum of 12 bits of tri-state address pins providing up to 531,441(or 312) address codes

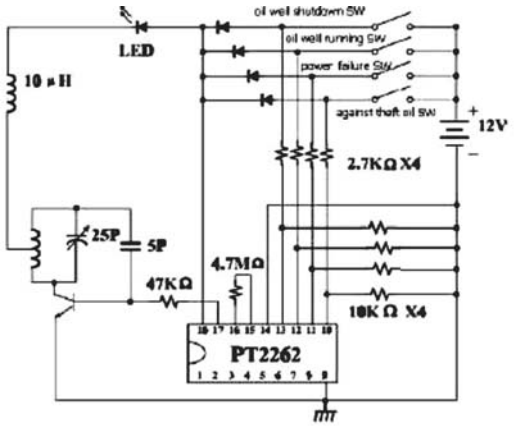

Fig. 4: The circuit diagram of remote controller

Main features of PT2272 include CMOS technology, low power consumption, very high noise immunity, up to 12 tri-state code address pins, up to 6 data pins, wide range of operating, voltage (Vcc=4 >‘ 15(V)), single resistor oscillator, latch or momentary output type, available in DIP(Dual In-line) and SO(Small-Outline) package. It’s pin configuration showed as fig.5. It is available in several options to suit every application need: variable number of data output pins, latch or momentary output type. It’s main circuit is showed as fig.5. Special attention should be set PT2262 and PT2272 with the same address in order to recognize each other when the massage is received and is sent out

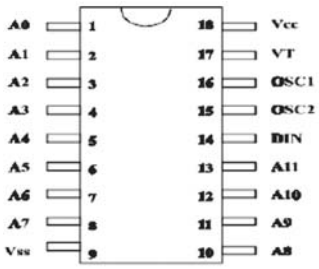

Fig. 5: The diagram of PT2272 pin configuration

Data receiver

There are two type receivers in the system. The first one use PT2272, which is receiver, paired with PT2262. It is mainly applied to data acquisition of the front-end. Another one is to use S3C44B0’Tout pin to send the message with binary frequency shift keying (2FSK), and then through the link of Low pass filter, frequency selection, 3 times frequency multiplication, shaping, driving in a certain order. Through the information treatments, to make Emission frequency reached 36, 37MHz. This process showed in Fig6. The effect of receiver is just opposite.

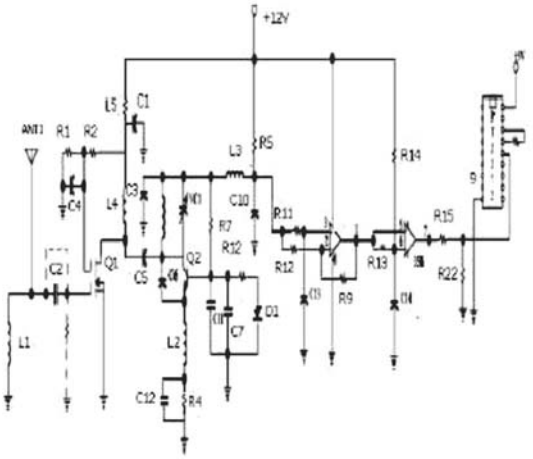

Fig. 6: The circuit diagram of PT2272

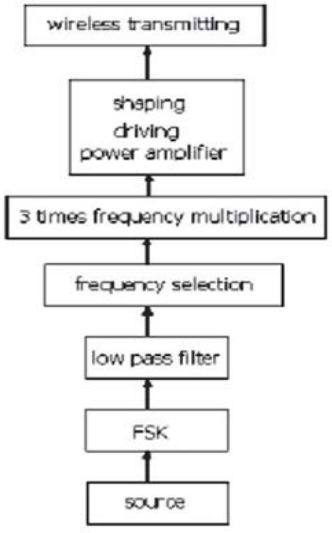

Fig. 6: The process of wireless transmitting

CONCLUSION

The security management system for oilfield in this paper adopted wireless communication technology and embedded system. This paper discusses the hardware of wireless communication in the system mainly. There are two ways of wireless communication in the system. Through the theory analysis, this method has feasibility.

For future work, we can implement more parameters for the oilfield area. We can provide sudden power failure presentation technique. In further development, the theft recognition can also be done automatically or using Neural Network.

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