

Embedded Wireless Based Communications & Security Application for Oilfield for Automatic Controlling

Er. Ganesh V. Padole, Er. Sandip N. Kamble

Embedded System & Computing

G. H. Raisoni College of Engineering, Nagpur, Maharashtra, INDIA

Computer Science and Engineering

Sagar Institute of Research and Technology, Bhopal, Maharashtra, INDIA

Abstract

The site of oil-well is distributed dispersedly, but distribution area is wide. Oil exhauster continuous working for 24 hours. As the problem of petroleum being stolen, transmission line being stolen, and transformer being stolen exists which requires the strong secures management system. 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. It is a perfect scheme that remote wireless monitoring and control system is established. The system is required to manage the data received from the various site and providing the security by managing and providing automatic controlling structure.

Keywords- *LDR, Temperature sensors potentiometer, Java communications, Security Management System, Wireless communication, embedded construction*

1. INTRODUCTION

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 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 management works. 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. 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. By developing the desktop application, it is easier to monitoring all the activities of the oilfield. This includes the accessing the sensed data from the different types of sensors like motion sensors, gas sensor, chemical sensor and managing the databases of the same. Administrator manages all the data, and if any condition occurs, then he can control the entire thing remotely. The communication between the application software and the electronics devices takes place wirelessly.

1.1 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 sends 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.

1.2 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.

1.3 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.

1.4 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.

1.5 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.

2. System Structure

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. This system operates on Linux on the server side which has the java desktop application for managing the whole databases. 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 consisting 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 wireless communication with RF trans receiver

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.

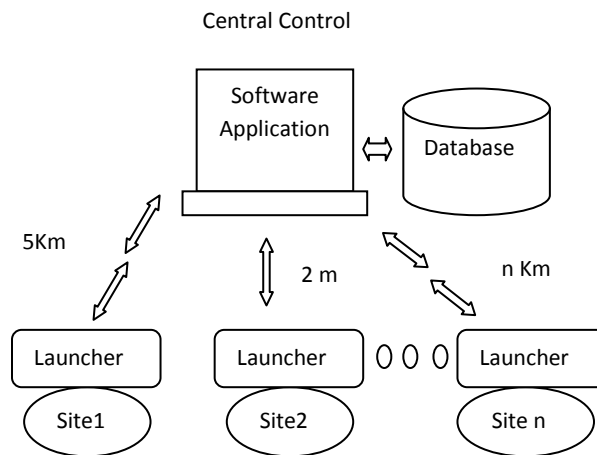


Figure 1. System structure of wireless security management

3. Wireless Data Transmission

The embedded kit has a RF-Tran receiver for both the data sending as well as data receiving purpose. 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.

3.1. Wireless acquisition function

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

3.1.1 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 sends 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.

3.1.2 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.

3.1.3 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.

3.1.4 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.

3.1.5 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.

4. 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 figure2. The control platform of the security management uses the AT Mega 8 microcontroller, 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. Figure 2 showing Hardware Structure of system.

1) Data acquisition and Data emission: TXD Output serial data at 9600 bps of 3V or 5V logic level, usually connected to RXD pin of microcontrollers working at 5V or 3V. or 5V logic level, usually connected to RXD pin level, usually

connected level, usually connected to RXD pin of microcontrollers working at 5V or 3V.

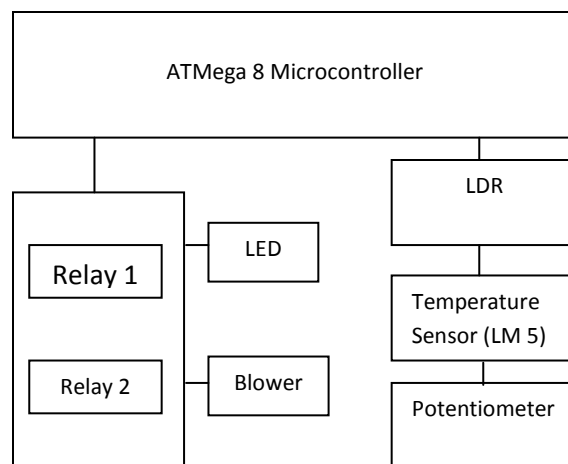


Figure 2. Hardware structure of system

TE(Transmit Enable) This pin goes HIGH during transmit mode. It can be used to enable PA if any on RF module. Pin can be left unconnected if there is no PA pin in RF module

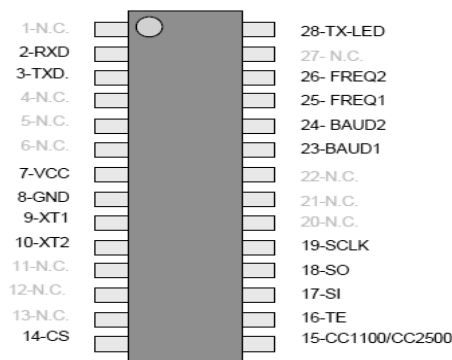


Figure 3. The diagram of RF Transceiver pin configuration

2) Data receiver: RXD Input serial data at 9600 bps of 3 or 5V logic level, usually connected to TXD pin of microcontrollers working at 5V or 3V. If your MCU is working at 5V and ST1197 is working at 3V then insert a 1K resistor in series. X1-X2-Connect a 8 Mhz crystal with 33pF load capacitors

5. Result

Figure 4 shows the various temperature data taken from the oil well and controlling structure of the application. This application is also able to show the graphic representation of the power failure and the different level of oil in the oil well. Figure 5 shows the controlling means when power fails in the oil well. When clicking the On Generator button, it automatically on the generator.

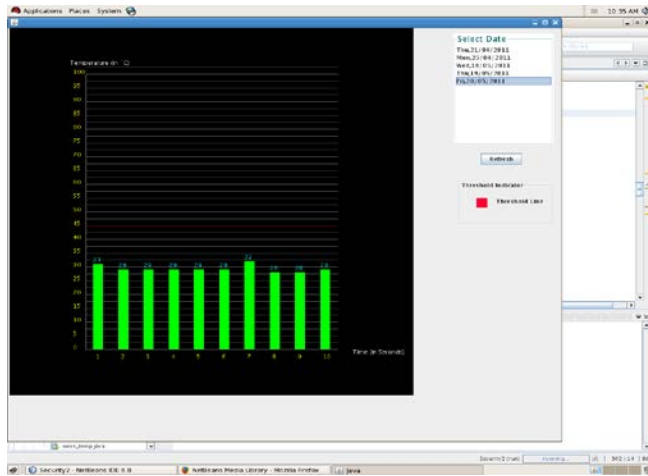


Figure 4. Graph of various temperature values

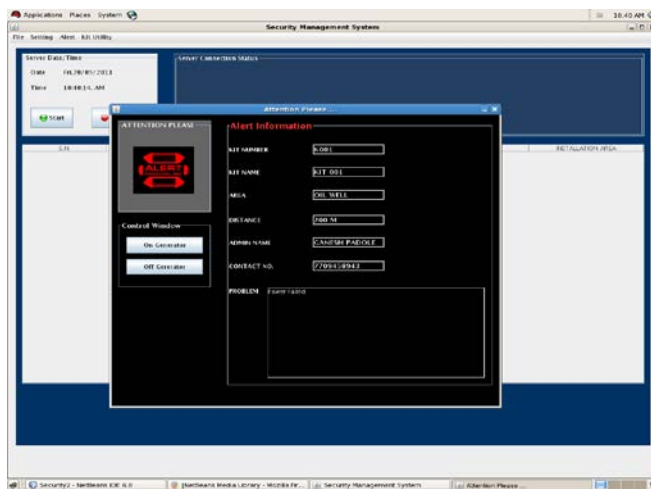


Figure 5. Alert when power fails and controlling

6. Conclusion

The System is able to receive all the oil well parameters like the current oil level, temperature of oil well, power supply status. This system enables central controlling and manages the entire database and hence requires low man power. This system has its wide use in the real life too such as it can be used in military application to recognize the position of the soldiers with the help of motion sensors. This application can further extended to have a neural network technology to recognize the theft.

References

1] Jiang Wei, "Security Management System for Oilfield Based On Embedded Wireless Communication", 2009 International Conference on Network Security Wireless Communications and Trusted Computing. Issue Date: 25-26 April

2009, On page(s): 604 – 606, INSPEC Accession Number: 10627363

2] Sung Park, "Simulating Network of Wireless Sensors", Proceeding of the 2001 Winter Simulation Conference. IEEE Trans. On VLSI System, June 2006.

3] Liting Cao, Jingwen Tian and Wei Jiang, "Distributed Security System for Intelligent Building Based on Wireless Communication Network", Proceedings of the 2006 IEEE International Conference on Information Acquisition August 20-20, 2006, Issue Date: Aug. 2006, On page(s): 177 - 182 Weihai, Shandong, China.

4] Xiao Liang, En Li, Zizi Liang, "Intelligent Monitoring System based on the Embedded Technology", Proceeding of the 2007 IEEE International Conference on Network, Sensing and Control, London, UK, 15-17 April.

5] Srovnal, V. Machacek, Z. "Wireless Communication for Mobile Robotics and Industrial Embedded Devices", Eighth International Conference on Networks, 2009 ICN 09, 1-6 March 2009.

6] Zheng Qiao, Hu Wei-Ding Liu Li, "An Embedded short-range wireless data communication protocol Design", 2001, ICACIA 2009.

7] Liao Wenjiang, Dong Nanping, "Design and Implement of the Embedded Elevator Monitoring System Based on Wireless Communication", ICCCMS 10, Second International Conference Volume 2.

8] Hua-Quen Tserng, "Embedded transmission line, MMIC for low-cost, high-density, wireless communication applications", 1997 IEEE.

9] Shyh Jye Jou, "An Embedded DSP core for wireless communication", Circuits and System, 2002. ISCAS Volume: 4

10] Ajj Mouton, C Smith, "Wireless Control and Communication to Motor Protection Relay by using an Embedded Microprocessor", CCECE '06.

11] Lu, J.W.; Thiel, D.V.; "Multi-beam switched parasitic antenna Embedded in dielectric for wireless communication systems" ICSEC, Volume 37 Issues: 14

12] Bonizzi, F.; D.; "An Embedded system for wireless data communications on train", Consumer Electronics, 2004 IEEE International Conference.

13] Pillin, N.; Joehl, N.; "Wireless Voltage Regulation for Passive Transponders Using an IF to

- Communicate*", Circuits and System 1: Regular Paper IEEE Transaction on Volume:57
- 14] Lu, J.; Ireland, D.; Schlub, R "Dielectric Embedded ESPAR(DE-ESPAR) Antenna Array for Wireless Communications", Antenna and Propagation, IEEE Transactions on Volume: 53, Issue:8, Part: 1
- 15] Demeter, Robert, "Display module for wireless embedded communication system", Roedunet International Conference, 2010 9th Publication Year-2010
- 16] Wu Dajun; Lim Keng Pang; "Wireless video communication on embedded system" , Signal Processing, 2002 6th International Conference Volume:2
- 17] Pinto, A.;D'Angelo,"Synthesis of embedded network for building automation and control", American Control Conference, 2008
- 18] Wang, Yuanlog; Wu,"An Embedded wireless transmission system based on the extended user datagram protocol (EUDP)", Future Computer and Communication (ICIECC) 2010 ,2nd International Conference Volume: 03
- 19] Wei Han, Ying Yi, "Heterogenous multi-core architecture with dynamically reconfigurable processors for wireless communication", Application Specific Processors, 2009, SASP'09, IEEE.