

The design of intelligent seal management system

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Abstract-This paper proposes an intelligent seal integrated management system which consists of three parts: intelligent seal, intelligent seal management platform (B / S) and intelligent seal data server (B / S). The seal management platform is the management station of the intelligent seal management system. It adopts B / S architecture and is mainly used by the group or industry seal management personnel for unified registration management of the seal under their jurisdiction. The data server in the intelligent seal management system adopts B/S architecture, which is mainly used by the system administrator to store and manage all accounts, permissions, other data in the system.

Keywords-intelligent seal; positioning; seal detection; intelligent supervision

I. INTRODUCTION

In the government, banks, enterprises, schools and other institutions, there are a large number file that need to be sealed. Sometimes, due to the problems of seal use and management, the seal may be abused.

Therefore, it is impossible to know the use of seals, causing certain economic and legal risks to relevant institutions. The intelligent seal management system can prevent in advance, control in the process, it can effectively improve the seal use efficiency and provide a seal management scheme.

II. SYSTEM ARCHITECTURE

Intelligent seal management system consists of three parts: intelligent seal, intelligent seal management platform (B / S) and intelligent seal management background (B / S). shown in Figure 1.

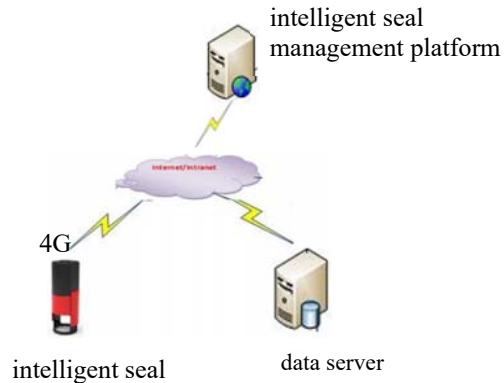


Figure 1 system

A. Intelligent seal

The intelligent seal is the ontology of the entity seal, including the mechanical entity of the seal and the intelligent hardware.

Functions of intelligent seal:

- Vibration wake-up function: vibration sensor to wake up the seal when there is vibration and enter the active state.
- Seal action recognition function: collect the action data of the seal mechanical entity through intelligent hardware, and analyze whether there is a seal operation. If there is a seal operation, record the seal position、state、time、battery level and report to the intelligent seal data server.
- Sleep function: when the seal is in a non-active state for a long time, the seal enters the sleep state.
- Auto wake up function: wake up every 12 hours.
- Status reporting function: when the seal is wake up, the status data is reported according to certain rules.

- f) Server IP address and port configuration: the IP address and reporting port of the server can be modified remotely through the net-work.
- g) Anti disassembly function: The photoelectric sensor detects whether the seal is disassembled. If the seal is disassembled, the disassembly record can be saved and re-reported.

B. Intelligent seal management platform

The intelligent seal management platform is the management end of the intelligent seal management system. The seal administrator register and manage the seals.

Functions of the intelligent seal management platform:

- a) Account management.
- b) Set up the information of the account.
- c) Intelligent seal binding and activation.
- d) Location and query of intelligent seals.
- e) Trace the historical track.
- f) Establishment of electronic fence.
- g) Create, inquire and modify intelligent seal archives.
- h) SMS push.

C. Intelligent seal data server

The intelligent seal data server is the back-ground data management end of the intelligent seal management system, mainly used for communication with the intelligent seal and management of all accounts, authorities, seals and other data in the system.

The functions of data server:

- a) Intelligent seal communication
- b) Intelligent seal data storage
- c) Administrator operation log

III. HARDWARE AND SOFTWARE

A. Hardware

The hardware is composed of microprocessor, anti disassembly photoelectric sensor, vibration sensor, remote communication module and Beidou /GPS positioning module.

Figure 2 show the block diagram

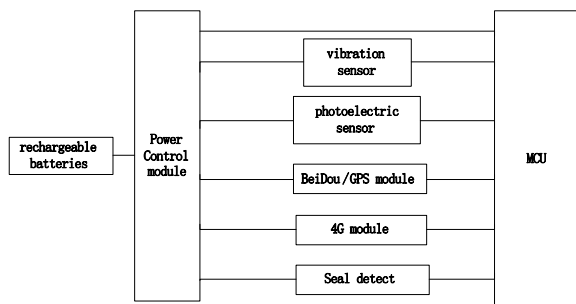


Figure 2 block diagram

The microprocessor use ARM Coretx-M0 architecture chip from Beijing smart chip microelectronics, SCM330 is 32-bit architecture with 3-stage pipeline RISC processor. As a new generation of processors, and ultra-low power with the minimum power 0.8uA. The micro-processor can provide

three power modes, which is RUN, SLEEP, DEEP SLEEP. SCM330 have a lot of peripherals, such as UART, SPI and IIC.

The vibration sensor is used to detect whether the intelligent seal vibrates. Its output pin is connected to GPIO, which can wake up of the microprocessor. When the intelligent seal vibrates, the vibration sensor detects the vibration and outputs a high level to wake up the microprocessor, the intelligent seal start work. The circuit of the vibration sensor is shown in Figure 3.

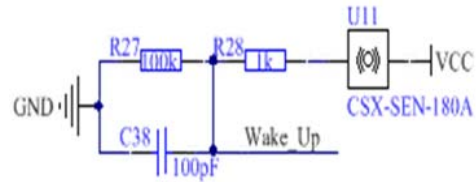


Figure 3 vibration sensor

The Beidou/GPS module is used for global positioning, At the same time, the calibration time to ensure the accurate operation of the real-time clock RTC of the microprocessor.

The seal use the 4G network to communicate with the intelligent seal management platform and report the location information, track information, status information and other data. In this design, 4G and Beidou /GPS integrated in a chip, which is EC20. The circuit is shown in Figure 4.

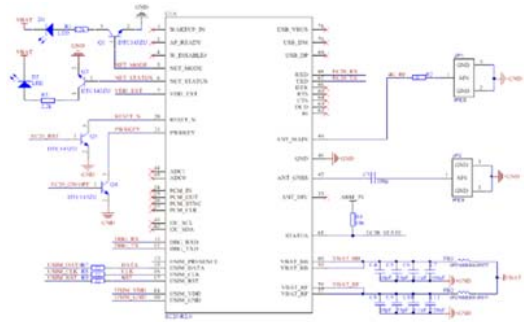


Figure 4 EC20

In active state, the mechanical part of the seal body will have reciprocation movement, the reciprocation movement will trigger a button to press and up. The button is connected to the GPIO of the microcontroller. By triggering the GPIO external interrupt edge, the rising edge and the falling edge will be captured, the interval between the rising edge and the falling edge will be used to determine whether it is an effective seal process.

The anti disassembly photoelectric sensor use apds-9960, when the intelligent seal is opened, the upper and lower parts are separated, the interrupt will be generated. it can read apds-9960 via IIC interface. The circuit of apds-9960 is shown in Figure 5.

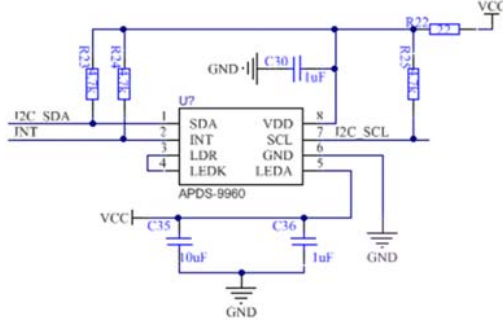


Figure 5 apds-9960

The power supply/charging part is the power supply of the intelligent seal, the battery power and charging are detected at the same time. When the battery power is lower than 20%, shut down EC20, and save all data. After the battery charge reaches 60%, start the EC20 to report the saved data.

B. Software

The software use embedded C language, which needs to drive the vibration sensor, anti- disassembly sensor, Beidou/GPS, 4G module, seal detection module and power/charging detection module, the data collection and analysis of various sensors and modules, and process the business logic part of the intelligent seal.

The whole process includes active state and sleep state. The process of sleep state in Figure 6.

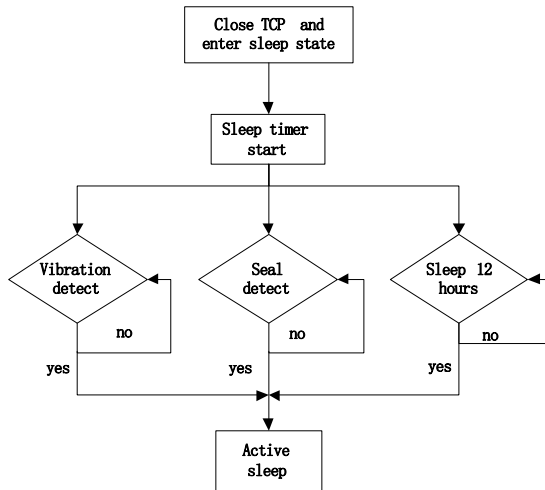


Figure 6 The process of sleep state

After the intelligent seal is wake up by the source (vibration, sleep timer) and enters the active state. In the active state, the intelligent seal will establish TCP connection through the 4G to the intelligent seal data server and open the Beidou/GPS module to obtain the positioning information and report the positioning data and status data. The intelligent seal will automatically disconnect the TCP connection and close the sensor when there is no vibration, after 120 seconds. The vibration sensor will be kept in a resting state and the micr-processing will enter a low-power sleep to save battery energy.

The process of active state in Figure 7.

IV. CONCLUSION

The intelligent seal management system use advanced communication technology and positioning technology to manage and monitor the seal, prevent the occurrence of various risks such as embezzlement and abuse of the seal, and realize the intelligent management of the seal.

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REFERENCES

- [1] Lifeng Mei.. Principle and interface tech-nology of MCU[M]. Beijing: Tsinghua unive-rsity press, 2009.
- [2] Xiaohe Yan, Lingjiao Dong, Shaoxing su. Development and application of photoelectric sensors [J]. Electronic industrial equipment, 2006(1):59-62.
- [3] Haoqiang Tan. C language programming [M]. Beijing: Tsinghua university press, 1991.
- [4] Xiren Xie. Computer network [M]. Beijing: Electronics industry press, 2008.
- [5] Xianfu Zhang, Liqu Su, Mingfu Zhao. Principle and application of intelligent photo-electric sensor [J]. Magnetic materials and devices, 2009 (2) : 54-56.

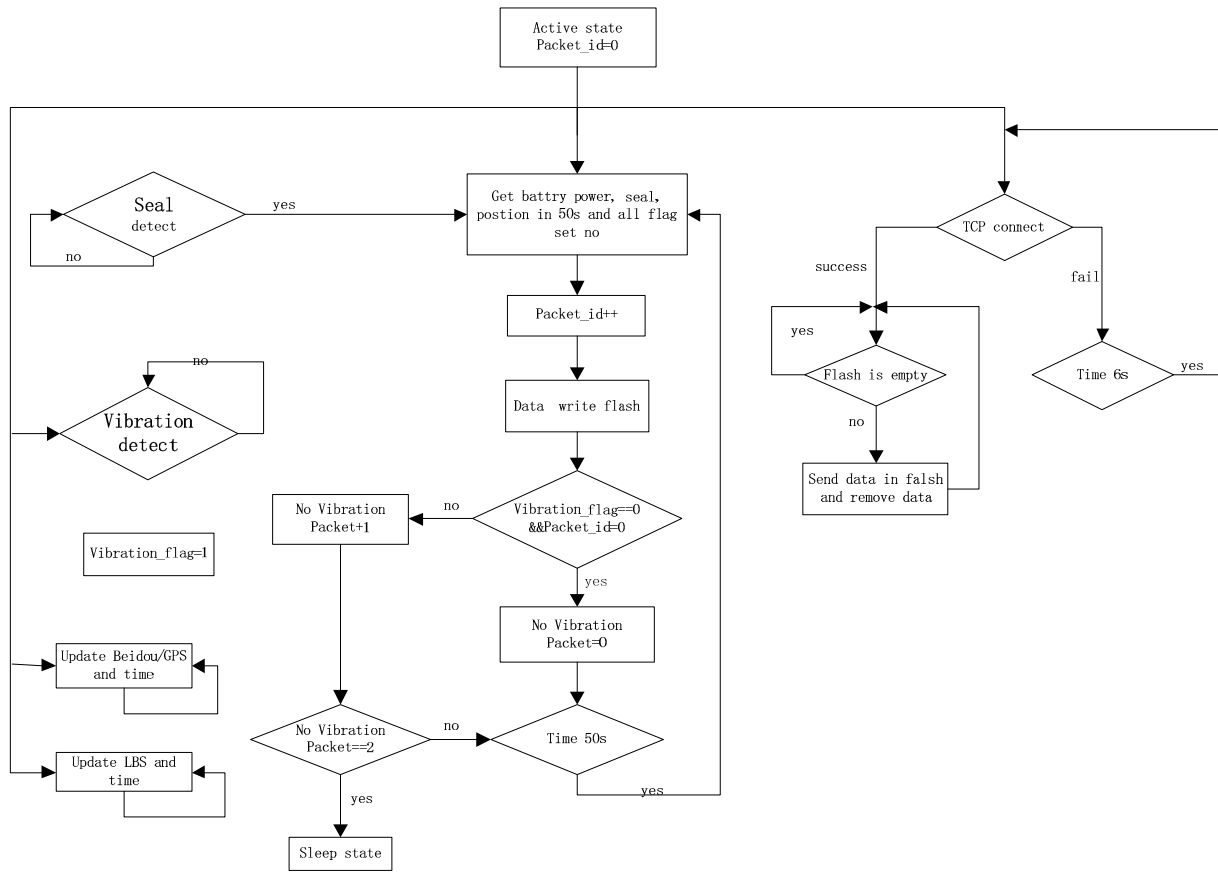


Figure 7 The process of active state