

Design and Research of Anti-Theft Alarm

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Abstract: The automobile intelligent anti-theft system is an important part of the development of modern automobile industry. In view of the problems existing in the traditional automobile anti-theft system, this paper further adopts the combination of GSM network and GPS positioning system to design a new type of multi-sensor electronic intelligent automobile anti-theft alarm system. The STM32 microcontroller is used to try to construct the GSM module to realize the wireless interaction between the owner and the anti-theft system, and the GPS anti-theft module is constructed to enable the owner to locate the car location information in real time. It is expected that the research of this paper will be helpful to the research and development of anti-theft alarm in automobile industry.

Keywords: *GSM communication system, GPS positioning system*

I. INTRODUCTION

The number of private cars in China is increasing, and the problem of car theft is becoming more and more serious. For these theft cases, anti-theft alarm is a good way to avoid the risk of theft. With the continuous development of GPS and GSM technology, automotive anti-theft products are also gradually technical iteration, sensor technology also plays a key role in the development of automotive anti-theft products. Therefore, in today's highly developed electronic information technology today, it is necessary for the car anti-theft system of electronic sensor and communication network, GPS positioning and other leading high-tech integrated electronic network model technology innovation. This paper is based on STM32 microcontroller as the main control core of automobile anti-theft system, trying to design the technical application theory of GSM module, GPS module and sensor module for traditional automobile anti-theft system.

II. THE KEY TECHNOLOGY OF AUTOMOBILE ELECTRONIC ANTI-THEFT ALARM DESIGN AND DEVELOPMENT

The key electronic technologies used in the design and research of this paper include the following three types :

First, GSM communication technology. GSM technology refers to the digital cellular communication system, which consists of three parts, including network, base station and mobile station. Most of the network is authorized according to the GSM protocol, and the right to use the GSM network digital communication is standardized. In addition, it provides register function for access location, in-situ location and device logo, and is also responsible for the maintenance of the operating system. The function of GSM system includes the transmission of control information and business information, which can support the communication between digital network users such as local telephone network, domestic long telephone and international long telephone. This paper mainly applies the short message receiving and sending service in GSM communication technology, and completes the automatic control of GSM module through AT command. In addition, with the help of PDU coding mode, the short message information is encoded by UTF-16 character set and sent to the mobile communication system, and then decoded by mobile phone to generate short message

text. The SMS alarm function in the automobile electronic anti-theft alarm designed in this paper and the SMS remote control automobile fuel supply self-locking function all need to use GSM communication technology.

Second, GPS positioning technology. This technology refers to the global positioning system, which consists of positioning satellite, ground monitoring system and user positioning module. The positioning satellite calculates the three-dimensional coordinates of time and space on the ground to determine the detailed coordinates of the target position. Ground monitoring receives satellite signals and encodes and stores these signals to facilitate subsequent calls. The user positioning module collects the signals sent by the satellite, and has the function of amplifying, compiling and converting the satellite signals, and can directly calculate the spatial three-dimensional coordinates of the satellite signals. At present, GPS has the advantages of wide application range, high positioning accuracy and simple operation. It is the most widely used positioning system. In this paper, most of the author can obtain the information in the actual position of the car in real time through this technology, which is used to judge whether the car is stolen or the trajectory after the theft.

III. HARDWARE CIRCUIT DESIGN OF AUTOMOBILE ELECTRONIC ANTI-THEFT ALARM

A. MCU controller module

The controller of automobile electronic alarm is a control system based on single chip microcomputer technology. It is mainly responsible for the intelligent control of GSM module, GPS module, sensor and other data collection modules and alarm operation modules, and connects the whole electronic anti-theft alarm system through I/O communication channel. In this paper, ARM's STM32F103C8 series single-chip microcomputer is selected. The series of single-chip microcomputers are integrated with 512K Flash memory, so that the data collected by nodes and programs in the working process can be saved. 72MHZ is its working frequency ; it contains three universal 16-bit timers, a PWM timer, a USB interface, a CAN, two SPI, three USART and two I2C ; using five universal serial interfaces, it can communicate with PC host computer on instructions and data. Using two 12-bit ADCs, the signal collected by the acoustic sensor can be converted from analog to digital, and then transmitted to the single chip microcomputer 10 for operation and processing. Single chip microcomputer can realize the operation of the whole system and the core control of the system. It is GPS module information transmission and reception and GSM module SMS transceiver. GSM module and GPS module communicate with STM32F103C8 by serial port. There are two clock signals, 32.768KHZ is one of them, 32MHZ is another. The capacitor C3 and C4 are used to filter the input harmonics of the power supply, which further stabilizes the power supply.

B. Power module

In order to ensure the stability of the anti-theft alarm system, the sensor module needs to be in operation at all times, so a stable power supply is needed. The power supply of the

automobile battery is usually 12V. In order to ensure the stability of the alarm system, it is necessary to design a backup power supply in addition to the main power supply of the automobile power supply. The relay operating voltage of the standby power supply should be consistent with the battery voltage. The working state of the GSM module requires a large instantaneous current supply. Therefore, in order to ensure the stability of the power supply of each module of the anti-theft alarm system, it is necessary to design an adjustable power supply circuit for the other power supply. This paper proposes to use the step-down integrated voltage regulator circuit of LM2576 chip. The circuit integrates the functions of circuit amplifier, comparator, current limiter, voltage regulator circuit, etc., and there are few heat sink devices, so there is no problem that the heating performance of continuous working components decreases.

C. Sensor module

The sensor module of this system is composed of acceleration sensor and vibration sensor. The acceleration sensor is used to check the instantaneous acceleration of the car. Regardless of the direction of the car's movement, when the instantaneous acceleration of the car body occurs, the collected acceleration data will be transmitted to the MCU main control system through the I2C channel. In this paper, the acceleration sensor of MMA7660FC series is recommended. The sensor has three-axis acceleration sensitive detection function, and can be compatible with the I2C communication mode of single-chip microcomputer. The volume is relatively small, and it has standby, active and closed states. When the car is in the normal driving state, it enters the closed state to save module energy consumption.

The vibration sensor is mainly to monitor the vibration frequency of the car. When the car is shaken, the system will automatically send text messages to the target mobile phone. This paper proposes to use a normally closed vibration sensor. The working voltage of the sensor is between 3.3V and 5V, which is compatible with the power module. In addition, the detection signal output by the sensor is binary, which is more convenient to access the I2C channel of the single chip microcomputer.

D. GPS module

The GPS module mainly collects the location information of the car. When the alarm system is in operation, the GPS positioning module needs to detect and output the location information of the car in real time. Therefore, this paper proposes to choose a high-performance GPS module. The ATK-NEO-6M module comes with four pins, which correspond to the TXD, RXD, GND ground and power line of the single-chip microcomputer, respectively. At the same time, it can output position information in real time. In addition, the GPS module of this model is also consistent with the working voltage of the single chip microcomputer, and the operation of the access system is relatively simple.

E. Anti-theft alarm module

The GSM module used in the anti-theft alarm circuit is shown. The mobile phone card slot and the chip are all behind, and the DC voltage of 5-26V needs to be connected. However, it cannot be lower than 2A, so as to ensure smooth operation. At the same time, the baud rate has adaptive function, which usually does not need to be set. It will adjust its internal frequency according to the frequency. Once the module is charged, the reset button is first pressed for 3s until the blue light is released, and this time can work normally.

In addition to the GSM SMS alarm device, the alarm also has a whistle alarm device. This system is connected to the module in the global positioning system through a single chip microcomputer. Once an abnormal situation occurs in the vehicle, the system will immediately send the real-time status of the vehicle in the form of text messages, and the user will view the vehicle at the first time. When the car is unfortunately lost, the owner can locate the car through GPS, and the stolen car can also be found. Installing this alarm in the vehicle can have a deterrent effect on the thieves. Once the vehicle has no abnormal situation, the optocoupler will not output the signal, and the horn will not pass through any current, so it cannot alarm. Once the vehicle has an abnormal situation, it will output the signal immediately, and there will be an alarm. After being stolen, it will continue to transmit the signal for 10 s. At this time, TC35 will be controlled by the single-chip STM32F103C8, which will send messages to the user in time, so that the user can decide whether to lock the vehicle.

F. Anti-theft execution module

The main function of this module is that once the vehicle is abnormal, the user can control the vehicle through the mobile phone, so that it has no way to drive, and then will not be stolen. At the same time, combined with the global positioning system and other related equipment, the anti-theft performance of the whole vehicle is obviously enhanced. At the same time, for the structure of the whole power supply system, most of its power supply is carried out through the automobile battery, whether it is lighting or other electrical equipment, the power supply in this anti-theft alarm system is also taken from it. If you want to effectively control the engine, you must be able to achieve effective control through the power supply in the electronic injection system. At the same time, adding a normally closed controller to this power supply can effectively control this power supply. However, the driving ability is relatively weak. Therefore, it is impossible to effectively drive this relay. Therefore, it must be effectively excessive through another.

In addition, the PA14 of the single chip microcomputer can be used to control the opening and closing state of the common relay to realize the self-locking control of the remote fuel supply system of the automobile. When the pin of the 'INI' of ULN2003A is input at a high level, the output pin 'OUT1' will output a low voltage, and the voltages applied to both ends of the relay coil are +12V and 0, respectively. At this time, the relay output will be turned on, making the ignition circuit work. When the pin of the 'INI' of ULN2003A is input at a low level, the voltage of the output pin 'OUT1' is 12V, and there is no pressure difference at both ends of the relay coil, that is, the coil has no current to pass through, and the power relay coil can be turned off.

IV. SOFTWARE DESIGN OF AUTOMOBILE ELECTRONIC ANTI-THEFT ALARM

A. Software system structure design

In the whole system design, the main control module is the core part, and each module is initialized and controlled. First of all, it is necessary to initialize each module device. First of all, it is necessary to carry out defense. Once there is no effect, it will not alarm. Once it is successful, the alarm will work normally, the sensor will be detected, and sampling will be carried out at the same time. If it is found to be abnormal in this process, it will continue. Once there is no abnormality, it is necessary to call the GSM module. All modules must be effectively controlled by user instructions.

B. Sensor module software design

In the design of the whole system, the sensor module is the most important part. If the initialization is set, when the anti-theft system is started, the processor will effectively query the whole state. The system is connected with the vibration sensor. Once the vibration occurs, it will automatically output a high level. At the same time, after receiving this signal, it will take corresponding action.

C. GSM module software design

During the whole software design period, it is mainly considered to be a processing setting for GSM, which is effectively scheduled through the main program. The single-chip microcomputer needs to be connected with the serial port in GSM, and the work is controlled by hardware. First, it is necessary to effectively judge the initialization of this module. Once it is found that there is no initialization, the hardware can not receive the mobile network. Once the initialization occurs, it can receive and process the relevant short message, and then close the work. At the end of the whole task, once there is no initialization, it is necessary to turn on the system to receive short messages. This system can use hardware to work, and can also use software to initialize.

D. Module software design

In the whole system, the global positioning system processing task is one of the task links. Its purpose is to read the signal information of the global positioning system from the serial port, and to determine whether the signal in the global positioning system can be effectively measured. Once it exists, it can obtain a series of information in the global positioning system. Once it does not, it needs to be continuously detected.

CONCLUSION

Aiming at the problems of easy interference and poor anti-theft effect of automobile anti-theft alarm signal, this paper designs a vehicle state information collection and monitoring system integrating GPS module, acceleration sensor and vibration sensor by using single chip microcomputer technology, GSM technology and GPS technology. The GSM module realizes the remote SMS alarm and SMS control of the car, and further improves the anti-theft effect of the whole anti-theft alarm system. In this paper, the author gives a comprehensive discussion on the relevant design of the automobile anti-theft alarm system, and also designs the specific software program flow for the main functional modules. It is hoped that the research in this paper will be helpful to the development and design of new multi-sensor automotive anti-theft alarm electronic products.

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