

Based on STM32 Illegal Vehicle Monitoring System

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Abstract

In recent years, with the rapid development of social economy, the number of cars in the country is growing rapidly, the length of the national road is also growing rapidly, people's appearance has been greatly facilitated, but also caused many traffic problems, many vehicles on the road have the phenomenon of illegal driving, traffic accidents caused by illegal driving increase every year, because of domestic traffic problems day More and more serious, an intelligent traffic supervision system based on STM32 is designed, which uses ultrasonic distance measurement module as sensor to measure the driving speed of the target vehicle, STM32 single-chip microcomputer as control chip to analyze the driving speed of the target vehicle and judge whether there is illegal driving behavior of speeding. When the driving speed of the target vehicle is higher than the set threshold value, it will be judged the vehicle is speeding in violation of regulations. The single chip microcomputer detects the illegal driving behavior of the target vehicle, the control unit outputs a control signal, controls the camera module to capture the target vehicle, and then stores the captured vehicle information. In this design, the sensor technology and the image processing technology of single chip microcomputer control technology are used to realize the intelligent supervision function of the vehicles that violate the speed limit on the road. By using this system, we can monitor whether there is any illegal driving behavior of the vehicle couples on the road, record the information of the illegal vehicles, and cooperate with the vehicle supervision department to enter the illegal vehicles To investigate and deal with illegal vehicles. It not only greatly saves human and material resources, but also realizes the intelligent management of urban traffic.

Keywords

Vehicle; Llegal Driving; Traffic Problem; Intelligent Monitorin.

1. Introduction

With the development and progress of modern scientific information technology and autonomous driving information processing technology, the two concepts of intelligent urban rail transit and autonomous driving intelligent city have been gradually implemented[1]. however, has some of the techniques in the field of smart cities and application system, because of the cost of the current intelligent technology and information processing limits exist or it is to have a lot of road traffic, traffic police on duty or is inefficient to use high technology costs for capturing an illegal driving, human recognition and other human vehicle license plate number and automatic logging identification and processing and the analysis of the vehicle information problems[2]. Most of them still need the intervention of traffic police and law enforcement personnel and the automatic monitoring system to be completed together, with a low degree of intelligence[3]. Therefore, intelligent, high precision violation is the primary target of vehicle detection.

There is a growing demand for automatic monitoring system based on intelligent identification and control to detect illegal vehicle behaviors. Some applications in the field of the existing system, however, because of the cost of the current technology and advantages of limit there have a lot of road traffic cameras on duty means and method, or it is the high cost of low technical efficiency to capture some automatic driving vehicle, the human eye can't identify license plate number and vehicle information problems of illegal human records[4]. The main goal of this design is to successfully design a set of illegal vehicle monitoring system based on STM32. To solve the problem of low level of intelligent technology, most of the violation monitoring systems in use still need to be completed jointly by law enforcement personnel and monitoring system. Because the vehicles on the road condition is relatively complex, and environmental factors is not stable, so the main task of this design for, research data characteristics of vehicles on the road, compared its characteristics with suitable for all kinds of application scenarios, at the same time, the sensor module in this system, camera module and control module involved in technology research, analysis of the principle of complete design, implementation and verification of each module. In order to achieve the high-precision vehicle speed measurement function and illegal vehicles to judge and illegal vehicles information recording function. Finally selected the stm32 low cost high performance chip is used to analyze the sensor acquisition to the movement of the vehicle data, to determine whether a self-driving vehicles on the road right there are irregularities, coupled with the module in the software platform to complete the programming, implementation USES the vehicle's speed and the camera to capture and record illegal driving. Compared with the previous research systems, both in the level of intelligence and accuracy are improved.

2. The design scheme of the illegal vehicle monitoring system based on STM32

Figure 1 is the block diagram of stM32-based illegal vehicle monitoring system. First use of ultrasonic distance measuring vehicle repeatedly measuring vehicle distance detector, respectively, by monitoring displacement of vehicles in a certain period of time to determine the speed of the vehicle, and then through the stm32 MCU of ultrasonic module to process the data upload to judge whether tested vehicles speeding, if the stm32 MCU judgment for speeding the output a control signal to control the digital camera to the target vehicle snapped, and keep records of the captured information.

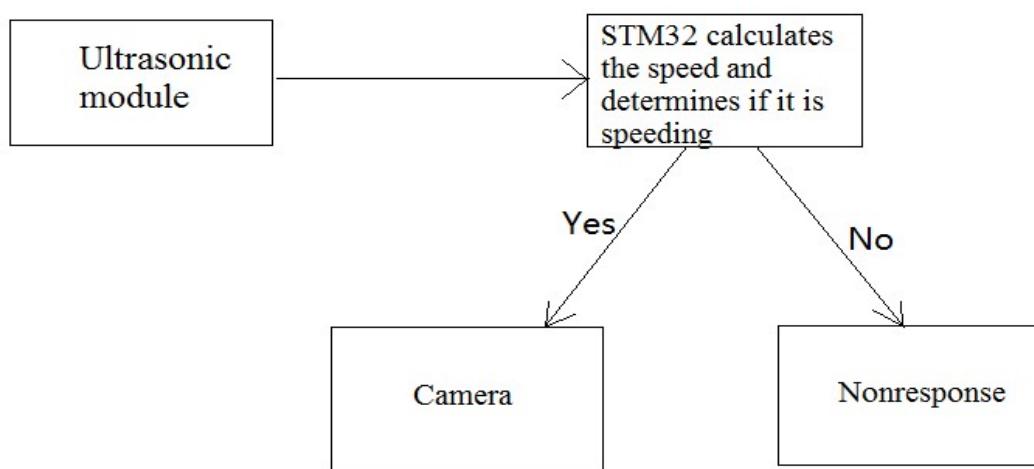


Figure 1. Block diagram of stM32-based illegal vehicle monitoring system

3. Hardware testing

According to the principle flow chart and principle structure diagram of integrated circuit already designed before, the parameters of each integrated circuit component in the integrated circuit system are calculated in detail, and a corresponding component is selected to make the actual circuit board.

Use the 200 ohm test wire of the multimeter to accurately test the corresponding circuit board after welding.

3.1 Test of crystal oscillator circuit

The normal work and operation of the MCU first need to consider how to ensure the reliability of the whole MCU system and the normal stability of the clock[5]. However, in practice, due to various reasons that lead to system reliability and clock abnormal and the system computer can not work normally and run a variety of situations, so how to judge the system reliability and clock normal stability vibration is the single chip electrical equipment check the first consideration of a link[4]. Under the normal condition of the system computer being energized, the two DC voltage ranges (20V) of the universal voltmeter are used to measure the two DC voltages of the pins of voltage XTAL1 and voltage XTAL2 respectively to see if they are normal[6].

3.2 Test of reset circuit

Possible problems with the reset pin circuit will directly cause the system to fail to work under normal conditions. For example, when the reset level of the system is high power, the system may be in a state of unable to reset. Therefore, when the reset level of the system is low power, the pin cannot be reset to generate a high level signal pulse necessary for the SCM reset, and the system may not be able to work under normal state. When the system works in the normal state of the MCU, the reset pin voltage between RST should be 0V. When the reset pin button of the MCU is pressed, the reset pin is about 5V high level. Figure 2 and 3 are the physical picture and camera of ultrasonic ranging module respectively[7].

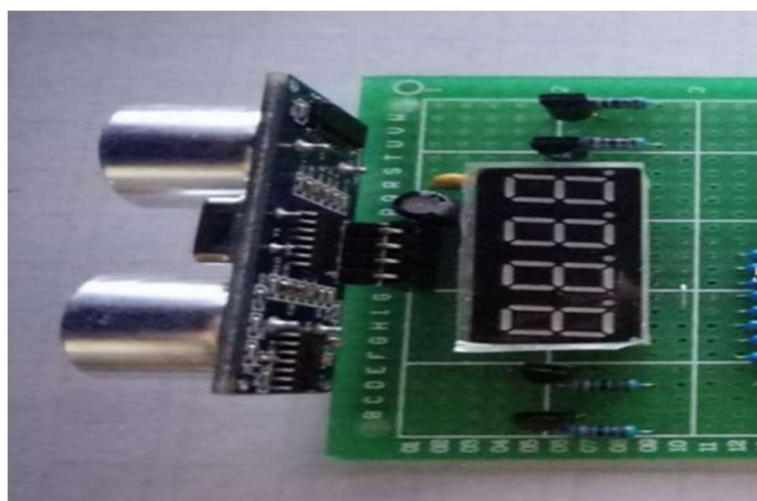


Figure 2. Ultrasonic ranging module



Figure 3. Camera module

4. Software debugging of the system

In the debugging of software, the use of powerful and MDK software debugging system for compilation of software and system debugging, after the successful compilation with micro controller isp software buffer will write good program into the single chip microcomputer. The methods and processes of software compilation and debugging are generally as follows: firstly, the main software debugging functions and program modules are simulated and debugged respectively; Then, the main modules in each debugging program are organized, and finally the corresponding system debugging is carried out [8]. Host installation and startup of the software:

Step 1: Direct click software installation, restart and run Opt micro controller isp software vice host software.

Step 2: Then directly click an op select device vice software option with options bar in the window; Then window will automatically appear a host software selection dialog window, click the window icon right after after select the software, click on the bar under the window a ok option button, if you don't appear as shown in the window, is a good chance that you directly this computer and other MCU software development board has not been good connection or other computer MCU with you didn't even plug, etc., should be carried out in a timely manner after reshipment host software and check your computer and is no connection between the host hardware, if the software does not shown in the window at the same time appear likely directly shows that initial success.

Step 3: Manually click the option "File" in the CD menu to open the file editing option in FiloadBuffer to open the fihex file of the CD that has been re-burned and compiled. Then directly by clicking the right mouse button to load, appeared ofiokferr and other words also means that has been burned successfully.

Many problems in the program were detected by the software. Constantly modify the program to solve existing problems. The problems encountered in the debugging of software are as follows:

(1) In the test, the MCU output camera control signal, the camera did not respond.

Solution: Aiming at the welding stability problem of integrated circuit, the practical tester is used for the integrated circuit. Each welding link has been tested to check whether there is damage, poor welding or welding leakage phenomenon in the welding process of electronic components.

(2) After input program, sometimes the measured object moving speed and the actual object moving speed deviation.

Solution: Improve the code, in the data collection is to take more than a few groups of data to take the average, and then on the average data processing.

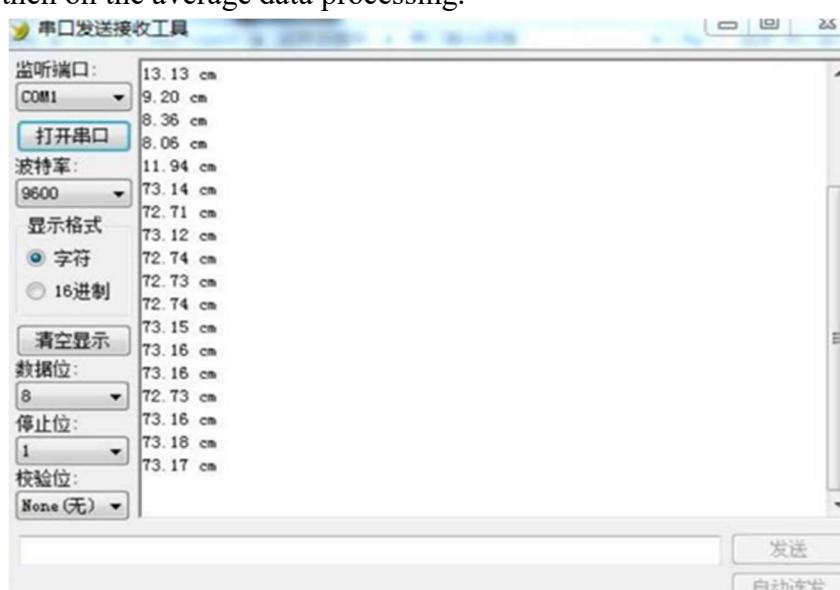


Figure 4. Serial port output of distance data

The ultrasonic module can accurately output the distance between the target vehicle and the monitor after the program is perfected. In the program, the obtained distance parameters are input to the SCM in the form of serial port input. Figure 4 shows the distance data output by the ultrasonic module.

The MCU conducts timing processing on the distance parameters received, gets the speed of the target vehicle, judges whether there is overspeed of the target vehicle, and controls the camera to capture the overspeed when it is found. Figure 5 shows the picture taken by the control camera under the output control signal when the MCU determines the speed limit. Table 1 shows the system test results.



Figure 5. Camera shot

Table 1. System test results table

Target actual speed	Set the speed threshold	The speed measured by MCU	The result that MCU decides	Is the camera working
0.3m/s	0.5m/s	0.3m/s	No speeding	No
0.4m/s	0.5m/s	0.4m/s	No speeding	No
0.5m/s	0.5m/s	0.5m/s	No speeding	No
0.6m/s	0.6m/s	0.6m/s	Speeding	Yes
0.7m/s	0.5m/s	0.7m/s	Speeding	Yes

Through the simulation experiment of the system, the working state of the entire STM32 -based illegal vehicle monitoring system is verified. First of all, it can detect the movement speed of the target object basically and accurately. After obtaining the speed data, it can make the correct system judgment, and control the camera to capture the speed when it is judged as exceeding the speed limit. Its prearranged function realizes basically. The final simulation results of the system show that the environmental monitoring system is stable and reliable, and combined with the current market and people's needs in this respect, the system has a good prospect of promotion.

5. Conclusion

The content of this topic is the monitoring system of illegal speeding vehicles. Based on ultrasonic ranging and speed measurement, the ultrasonic ranging module is used to measure the displacement of the car in unit time and the speed is obtained by single-chip microcomputer. Then the single-chip microcomputer control camera is used to capture and record the vehicle judged by single-chip microcomputer to be overspeed. Achievements achieved in the realization of functions:

- (1) It can accurately detect the moving speed of the car.
- (2) In many experiments, the speeding vehicles can be detected, and can take the initiative to capture.

(3) Vehicle images and data captured by the system can be completely stored in the data storage space, and the storage space can record the information of vehicles violating traffic regulations in a complete and real-time manner.

Stm32 based traffic violation vehicle monitoring and management system belongs to the relevant application technology development project, involving a variety of industries and disciplines, due to the extensive experimental nature and continuous improvement of this research subject [9]. Compared with other developed countries, the degree of perfection of traffic management equipment in China still needs to be improved [10]. The promotion of intelligent traffic management in China is an inevitable trend, and there is still a long way to go for intelligent traffic management in China. According to the data of previous years, the traffic problem is very serious now, and there are more and more traffic accidents every year. It is inevitable to promote more efficient and accurate traffic supervision system in the future.

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