DESIGNING OF A SMART CAR USING ARM7

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ABSTRACT

Security system nowadays become a need for vehicles and available with many modern features. This car security system comes with extra secure access and message on GSM net. The system only can be accessed and configured by owner using GSM module communication via mobile phone. In this project, when the car is theft, an intruder alert message will be sent to the user's phone through GSM communication and GPS positioning. After the certain time, by using the GSM net and the GPS positioning techniques the probability of finding car where accident occurs or the car parked location will done easily . And in this project the wireless camera is used to capture the video in digital form. The digital video can be transferred into an image by using dot net and image processing technologies. With ARM7 as the core, the new intelligent mobile vehicle checking system integrated a lot of hardware modules such as video capture, GPS positioning and wireless transmission, the design of the system software used the embedded software developing platform based on ADS integrated development environment. By the hardware/software co-design, the new intelligent mobile vehicle checking system implemented the functions of video capturing, intelligent plate distinguishing, GPS positioning and wireless transmission, met the traffic auditing department's needs about Mobile Vehicle Checking.

KEYWORDS: *Mobile Vehicle checking, video capture, GPS, GPRS, embedded system*

I. INTRODUCTION

In the past decades, the issue of security has become more significant and the need for effective security systems has intensified [1]. Many areas were marked as restricted, since illegal access can have serious consequences for homeland security and can even result in the loss of lives in the case of an explosive armed vehicle. To increase security in access control applications for a vehicle that enters a restricted area, this work proposes the architecture and installation of a vehicle inspection system. Three different computer vision applications are integrated in the system, namely license plate recognition, vehicle manufacturer/model detection and under-vehicle inspection. The systems use several vehicle features to identify the vehicle from different aspects and their combination could improve the overall system effectiveness and identify attempts of fraudulence, such as the use of stolen plates. Typical applications would include high-security areas such as airports, embassies, power plants and military camps. In these areas, registered vehicles are allowed to enter, where other vehicles are prohibited. In the literature, License Plate Recognition (LPR) remains the principal vehicle identifier. Systems of this type, detect the vehicle license plate, segment its characters and proceed to character recognition. Such systems are still widely researched and used, despite the fact that license plates can be easily altered in case of fraud. Fitting a piece of glass in front of the plate to cause light deflection and replacing the plates with stolen or counterfeit ones, are just a few examples. System effectiveness can be drastically improved if license plate recognition is combined with simultaneous vehicle manufacturer and model recognition. In the latter, recognition is conducted through the vehicle mask and the manufacturer logo and is based on machine learning techniques and artificial intelligence. These features can help to identify a vehicle with a tampered or stolen plate. With the development of technology, people have higher expectation of living, country has invested a huge amount of money to the capital construction, especially to roads infrastructure. In this situation, the roads infrastructure is developing fast, the highway mileage has enormous increase and

there is an increasing number of vehicles on the roads. However, the huge number of cars raises problems of its own; there are more and more car thefts, lost and violations of rules which are given serious attentions. The time which is spent on checking on the roads by the department of traffic charge, check and police has been taken too much. Meanwhile, vehicles overload problem is getting worse around the country. Because of the merits of high capacity, large services and economy, public buses have become the main means of urban traffic. If the bus which took lots of people had a traffic accident, the result would be serious. The main cause of those serious accidents is overload; therefore, it is time to find some way to resolve this problem. However, most departments take care of this problem in traditional way, such as manual judgment and road checking. This traditional vehicle checking way has some faults such as leak checking, false checking, and is a heavy work for vehicle checking people, so it needs to find a intelligent mobile vehicle checking system to replace the traditional one. The new intelligent mobile vehicle checking system is designed to meet this need. This paper is giving the main idea of designing of an intelligent mobile vehicle checking system using ARM 7 and the GSM and GPS positioning techniques .In this paper the section 1describes the introduction ,section 2 describes the system design and composition techniques and the processes of video capture, vehicle licence recognition system and ARM7 peripheral interface. Section 3 describes hardware design and section 4 describes the software design

1.1. RELATED WORK

In this paper we are using the ARM7 as the core and the GPS and GSM techniques for the position and for sending the msg to mobile. We will also use the Bluetooth and 8051 controller in the place of ARM 7 in order to perform the controlling of the system. The following section represents the system function and composition of the system by using the ARM7.

II. SYSTEM FUNCTION AND COMPOSITION

As shown in the figure 1, this system builds a new intelligent vehicle checking system based on ARM7, embedded processing technology, processing technology of digital videos, vehicle identification technology, GSM wireless mobile telecommunication technology, GPS positioning technique, implements the checking to vehicles which break the rules or owe the charge. This system has the following features.

2.1. Video Capture

When the system works, the camera in the front of the car collects the data automatically and saves it in the video buffer,

2.2. Vehicle Recognition

The system recognizes the vehicle license by digital video data. The digital video is captured by the digital camera. The dot net and image processing technologies are used to convert the digital data into the image which contains the information of licence of the car. By collecting the data it will store the licence number and information of the car.

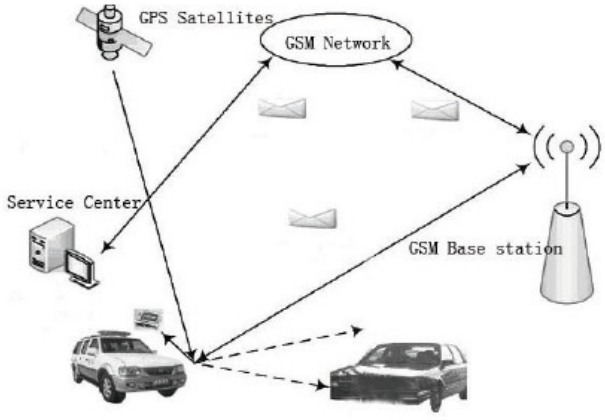

Figure 1. System Composition

2.3. Communication Function

The vehicle checking terminal communicates with the server center by the SMS message on the GSM net;

2.4. Gps Positioning

The system can correctly send the position and time of the checking vehicle to the server center by GPS positioning, therefore, the terminals can be coordinated properly.

III. HARDWARE DESIGN

Intelligent mobile vehicle checking system is composed of ARM7 microprocessor, peripheral equipment, and video capture, GPS positioning module GS-216 m, wireless telecommunication module Q24PL002 and remote control receiver. The detailed hardware composition is shown in figure 2.

3.1. ARM7 microprocessor and peripheral equipment

The circuit of ARM7 microprocessor and peripheral equipment includes a ARM7 chip, a clock circuit, a reset 115 circuit, a 32MB flash memory, a LCD. All of these make up the control and process core of the system.

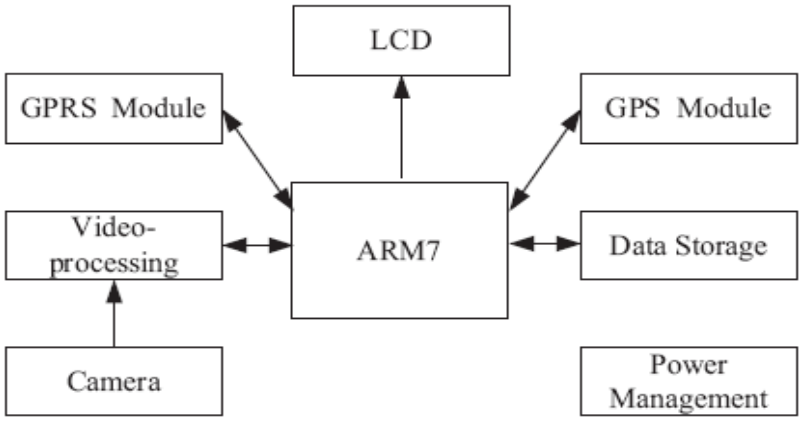

Figure 2. Hardware Composition

3.2. Video capture

The video capture module includes: video decoder and output, data buffering and data transmission. The implementation-principle of video capture is shown in figure 3. The analog video signal captured from the camera is changed to digital signal by SAAA7111A signal-chip video decoder. The SAAA7111A signal-chip is initialized and controlled by ARM7. The SAAA7111A output data is written into FIFO buffer. The ARM7 generates interrupt when the data reaches a certain amount. The DMA is started after ARM7 interrupt and sends the video data into buffer.

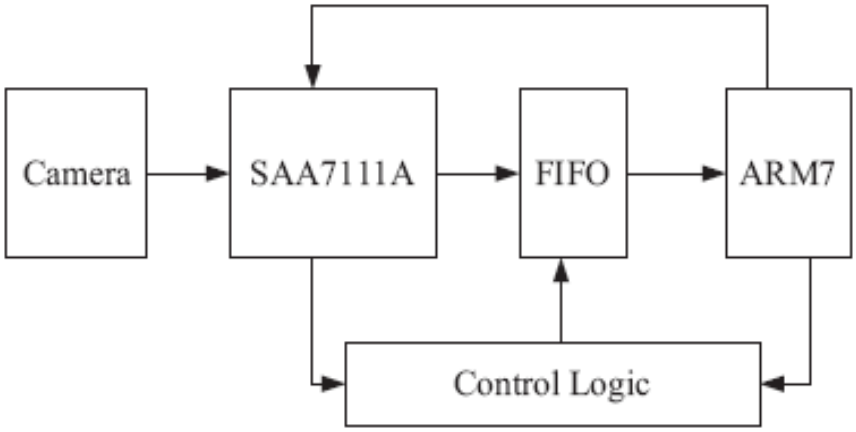

Figure 3. Principles of video Capture

3.3. ARM7 architecture

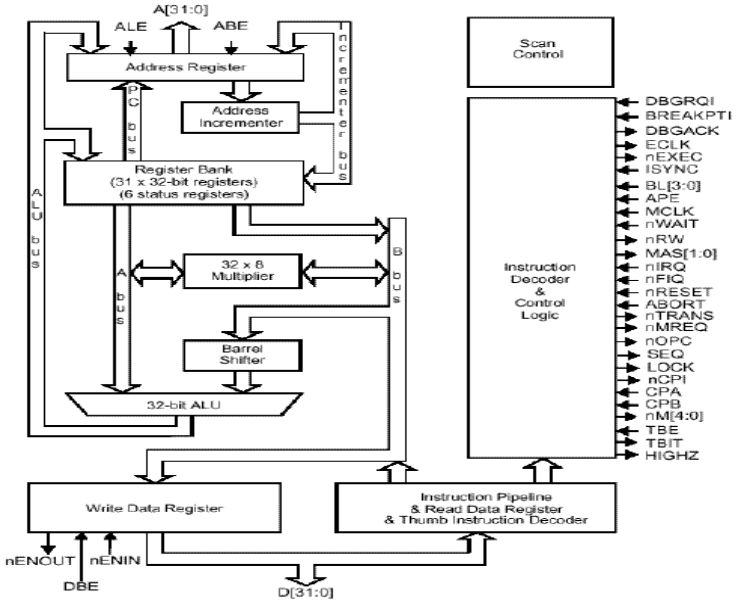

Figure 4. ARM7 architecture

3.4. Equation output and input of GPS data

The GPS module in this system is GS-216m made by Gstar, Korea. The GPS module can receive the data by connected to ARM7 development-board URAT0 through RS232 port. When the ARM7 chip sends the instruction AT to GPS module, the GPS module starts receiving the data and saves it into memory. This instruction sends the region information with the vehicle license information to the support-server center through GSM net. Because the system is based on GPS data which is sent through GPRS net, it must be initialed at first. The initial instructions are following:

Reset

User settings initialized

Press□++++++□to enter the setup mode…Done

Init command List:

AT+ID=X CR

AT+IP=X CR

AT+PORT=X CR

AT+HTH=X CR

AT+BAUD=X CR

AT+APN=X CR

AT+AGREE=X CR

AT+REST=X CR

AT+ID=X: this instruction is used to set the terminal address. Each device must be set the address which indicates its ID, the default ID is 139XXXXXXXX. The default address is the SIM card mobile phone number which contains 11 numbers, the address can be changed as required.

AT+ID=? : This instruction is used to inquire the ID of the terminal. The instruction can be used to check whether the set of the device is correct.

AT+IP=X□ this instruction is used to set the IP address of the server in surveillance centre. The format of IP is X.X.X.X. AT+IP=? □this instruction is used to inquire the IP address.

AT+PORT=X□this instruction is used to set the port number of the application software in surveillance center server. AT+PORT=? □this instruction is used to inquire the port number.

AT+HTH=X□AT+HTH=? this instruction is used to set and inquire the time intervals of the GPS positioning information which the terminals send automatically. The unit of the time interval is second.
AT+BAUD=X□AT+BAUD=? □this instruction is used to set and inquire the initial baud rate. The default is 4800 and does not need changing usually.
AT+APN=X□AT+APN=? □this instruction is used to set and inquire the connect port of GPRS telecommunication. The default value is CMNET.
AT+AGREE=X□AT+AGREE=? □this instruction is used to set and inquire the net communication protocol. The default value is TCP protocol. The terminal on car supports the UDP and the TCP protocol. Users can change the protocol as needs.

3.5. GPRS Wireless Communication

The GPRS communication device used in this system consists of Q24PL002 GPRS module made by Wave COM and the development-board. The GPRS module is installed on the development-board, the RS232 port on the development-board is connected to URAT1 on the ARM7 experiment & development board in order to implement that the ARM7 chip has control over the GPRS communication device. The GPRS device is controlled by the ARM7 through AT instructions. The GPRS device includes 24 operation instructions in common use, 10 talking operation instructions, 9 message operation instructions, 7 TCP/IP operation instructions. Some simple operations, such as signal strength checking, module vision checking, serial port baud rate checking, SIM card state reading, should be done when the GPRS device connects to the support server center. After making sure that the state which the ARM7 experiment-development board connects to the server center by the GPRS device is normal, the ARM7 chip outputs the AT instructions in order to send the vehicle-region information which is acquired by GPS module and vehicle license information which is acquired by vehicle-checking and distinguishing device to the server center through GSM net. After receiving the data, the server center compares the data with the black list in database and sends the result to the ARM7 experiment-development board through GSM net.

IV. SOFTWARE DESIGN

The software of the new intelligent mobile vehicle checking system includes two parts, the remote-server center software and embedded terminal software. The development of the software is based on ADS integrated development environment.

4.1. Introduction of ADS integrated development environment

The ADS integrated development environment is a microcontroller for ARM which is developed by the ARM Company, its full name is ARM Developer Suit and the mature vision is ADS1.2. ADS1.2 supports all the ARM microcontroller before ARM10, supports the software debug and JTAG simulate, supports the assembly language, C and C++ language. It has the merits of high compile efficiency and rich system libraries. The environment can run on Windows98 WindowsXP Windows 2000 and Red Hat Linux.

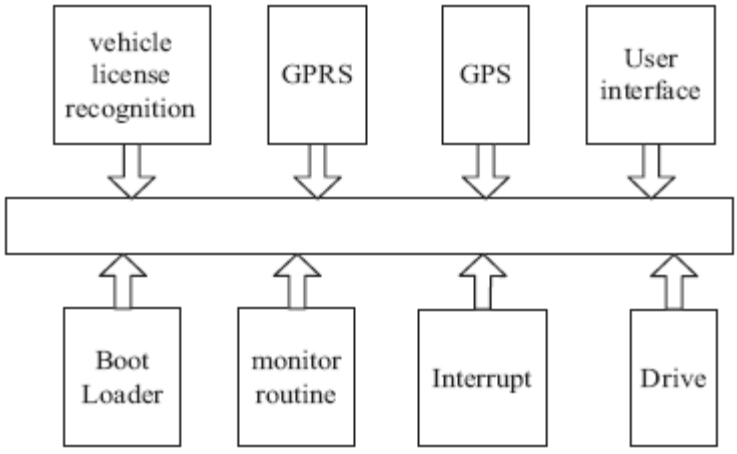

Figure 5. Composition software

4.2. Functions of the system software and implementation

4.2.1. Composition of software

The server center saves the data library which contains the newest vehicles in the 'black list' or the date from Q24PL002 into SD card. The video capture software collects the video data and changes its format, and then the video capture software sends the data to the identification buffer. Date is sampled and sent to the vehicle checking software. The vehicle checking software identifies the vehicle license and compares it with the data in the SD card. If the car is the one which breaks the rules, the software displays the information of the car (include the license of the car, the name of the car and its owner). If the information is not in the SD card, the soft will inquire the server center and send the result to terminal.

4.2.2. Implementation

The design of this system software can be divided into four modules, they are video capture module, vehicle license identification module, the graphical user interface module and communication module. The video capture module is executed in interrupt instruction, the vehicle license identification module and the graphical user interface module are executed in the main programme and the communication module is executed in a programme alone. The communication between each module depends on the message passing.

4.3 Development of interrelated software

4.3.1. Development of Boot Loader

Boot Loader is a boot programme which runs before the operating system nucleus. This programme is on the entrance of reset, and implements the download and load of programme.

4.3.2. Driver

The abstraction level separates the part which depends on the hardware platform and makes the amount of work reach least. The driver just needs to design the codes which are relate to hardware, and provide a unified interface for the operation software. During the development of the embedded software used in the terminal, the driver of SD card, the driver of serial port and the driver of remote control are designed.

4.3.3. Identification software

The vehicle license identification module includes the region location of vehicle license, the pre-processing of the vehicle license image, the cutting up and Identification of the single character on the vehicle license. The software depends on the date to implement real-time Identification of vehicle license.

V. CONCLUSIONS AND FURTHER RECOMMENDATIONS

This paper proposes the integration of a vehicle inspection system, which significantly increases security in vehicle identification by integrating different computer vision modules. Three different subsystem implementations were presented, namely the license plate recognition system, vehicle manufacturer/ model detection and under-vehicle inspection. The three distinct modules were analyzed and discussed. Results show that each method reaches good success rates, which in turn indicate that these modules can be used to boost the overall performance of an integrated platform for security inspection and access control. Finally, issues such as installation and operation principles were briefly discussed. The proposed system could be installed in entrance check points that require high security standards, such as government buildings, army camps or country borders and it can considerably facilitate prompt and effective vehicle inspection. Immediate benefits are the ability to reduce the number of personnel required to operate security gates, as well as to increase their level of awareness, while ensuring their personal safety. The new intelligent mobile vehicle checking system uses the detection technique of video capture, the wireless communication technique, meets the traffic auditing department's needs about Mobile Vehicle Checking. The system has the advantages of small size, low costs, full featured and powerful expansibility.

VI. RESULTS

By using this smart car system we will easily find the location of a car .By using the GPS and GSM technique the longitudinal values will send to the mobile which is connected to the system. By

calculating these values in Google earth we will find out the location. And by using the Wireless camera the thief image is also capture so the thief will easily caught. And by using this system the traffic will be easily controlled. So by using this system the vehicles easily recognised which are not follows the traffic rules.

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Short Biography

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