Design of Vehicle Positioning System Based on Arm

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Abstract— This paper is about discussion of design and structure of vehicle positioning system using ARM processor. The architecture and working process of this system is explained in details, and introduces the vehicle positioning system which uses the ARM microprocessor LPC2148 as a controller to combinative with GPS LR9548 and GSMTC35 modules. This gives location solution, matching of maps and data compression that associated with the vehicle positioning system. It shows by a program flowchart and gives new version of the vehicle positioning system in the future.

Key words: ARM (LPC2148) Embedded System, GSM Module TC35i, GPS Module LR9548S

I. INTRODUCTION

Vehicle positioning system means automatically determination and transmission the geographic location of a vehicle. The location is determined by using GPS, and the transmission mechanism is determined by using SMS or by using GPRS or satellite or terrestrial radio from the vehicle (kit) to a radio receiver. Automatic location of vehicle is a essential concept for tracing of vehicles, as service vehicles for transportation, emergency vehicles such as a ambulance, and especially precious construction equipment, also public transport vehicles such as buses. It is also used to track mobile equipments, mobile phones. It uses the most widely used positioning system that is the Global Positioning System (GPS), this system consist of 24 satellites revolving around the globe. In that each 8 satellites are approximately in 3 circular orbits. From given point on earth more than 4 satellites will be observed at one time, thus making sure that they can have information of the longitude and latitude of the view point, and next that understanding the function of navigation, positioning, and time service.

A. Project Description

The design of this vehicle positioning System Based on ARM is a combination of GPS and GSM an upload the data of the vehicle such as the position and speed to make it convenient to control the traffic. Users can use the password/keywords to track vehicles for security also for anti-robbery and call manual and automatic alarm, and check the position of vehicle. Vehicle location system which uses the ARM processor LPC2148 as a controller with GPS and GSM modules that means the vehicle positioning system kit which is kept inside the vehicle. When a missed call given to the mobile number of a system kit which placed inside the vehicle from that it gets the latitude and longitude values from the GPS and sends it as the text message over the GSM network to the authorized person which controls the system. Hence Vehicle Positioning System is reliable, small, stable and faster, which can be overcome the disadvantages of poor real-time and high costs of operation existed in the system.
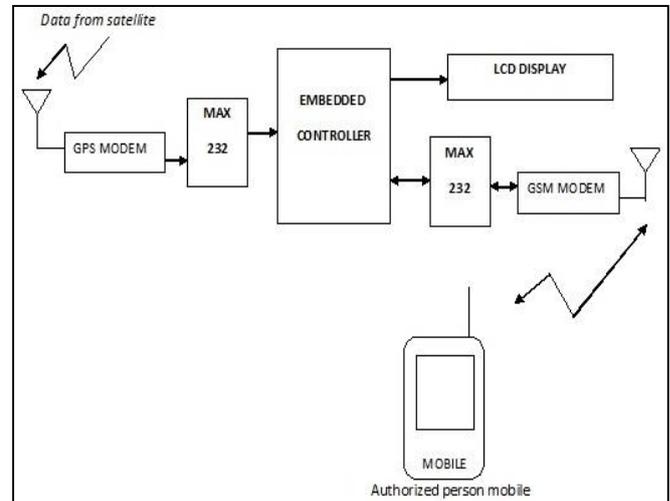
B. Block Diagram

Fig. 1: Block Diagram

II. HARDWARE DESCRIPTION

A. ARM Based LPC2148

LPC2148 is the regularly and most of the time used IC from family of ARM-7. Philips is the manufacturer of this IC and it is loaded at the time of manufacturing with many inbuilt peripherals. It is more efficient and a reliable. It has ISP/IAP through on-chip boot-loader software with Single flash sector or take 400ms to erase full chip and 1 ms for programming of 256 bytes. It has on-chip static RAM of 8 to 40 kB and on-chip flash program memory is about 32 to 512 kB also 128 bit wide interface enables high speed operation at 60 MHz. Embedded ICE RT and Embedded Trace interfaces gives real-time to the on-chip Real Monitor debugger software and instruction execution with high speed tracing. It uses USB 2.0 Full Speed Device Controller having 2 kB of RAM. 8 kB of on-chip RAM of LPC2148 can be access able USB by DMA. LPC2148 ARM 10-bit A/D converters gives a total of 6 to14analog inputs, with conversion time 2.44 us per channel. Single 10-bit D/A converter gives variable analog output. Two timers/external event counters are of 32 bits each, PWM unit (six outputs) and watchdog timer. Real time clock with Low power with independent power and having 32 kHz clock input. Processor wake-up from Power-down mode through external interrupt, USB, Brown-Out Detect (BOD) or Real-Time Clock (RTC). Single power supply chip having Power-On Reset (POR) and CPU with BOD circuits having operating voltage range of 3.0 V to 3.6 V (3.3 V ± 10 %) with 5 V tolerant I/O pins.

B. GSM

The TC35i GSM module is a Dual-Band device which has specially designed for applications transmitting a low size of data. The wireless communications device is protected by

strongly industrial housing that also having advance technology that series of standard connectors and a SIM cardholder. As this is standalone device, it is plug and-play device, connected with standard connectors for power supply, antenna, serial port, and handset. Siemens TC35i wireless communication module having gained the domestic network card of Radio equipment, it operates in dual-band GSM900 and GSM1800, having power consumption of 2W and 1W respectively. The DC power supply having ranges from 3.3v to 4.8V. Combination of RF and baseband signal, this module provides users with a standard AT command interface and transmission of data, voice, SMS and fax is speedy, secure and reliable. The Data input / output interface of TC35 having effect a Serial Asynchronous Receiver Transmitter. It has fixed variables and is in line with RS232 interface standard 8 data bits and 1 stop bit, no parity. It sends standard AT commands to TC35i module serial port using the serial port of a microprocessor LPC2129, to fulfill the Locator's function of sending and receiving text messages, therefore realizing the communication with mobile phone users outside.

C. GPS

The Global Positioning System (GPS) is a navigation system it gives errorless location and time information in all conditions of weather, anywhere on the Earth where there is non-obstructed line of sight to four or more GPS satellites. The system gives critical capabilities to military department as well as civil and commercial users in whole world. The United States government developed the system, maintains it, and it is freely accessible to anyone on earth with a GPS receiver.

The Leadtek LR9548S GPS module having high sensitivity, low power consumption, Surface Mount Device (SMD) module. This global positioning system (GPS) receiver which has 20 channels is designed for a number of applications and is based on the newest chipset technology. The LR9548S is also compatible Pin to pin with the LR9548 and due to this it is easier and faster transition of data. The LR9548S is designed to allow faster and easy integration into GPS-related equipments such as PDA, cellular phones, Pocket PC, and computing devices, Car and Hand-Held Device such as a mobile phones for Personal Positioning and Navigation**.**

D. GPIO

GPIO will able to give direction control registers (either the selected pin can be used as input pin or output pin) of individual bits. It can be obtain by IODIR register. We can fix the values of register by writing one, obtain high at the corresponding port pins, whereas writing zero will haven't any effect. This can be done by using IOSET. When we fix any value we have to clear those bit using IOCLR register. This IOCLR will clear the particular bits we have selected. The LPC2148 processor has mainly four ports

- GPIO Port Pin Value Register (IOPIN)
- GPIO Port Output Set Register (IOSET)
- GPIO Port Direction Register (IODIR)
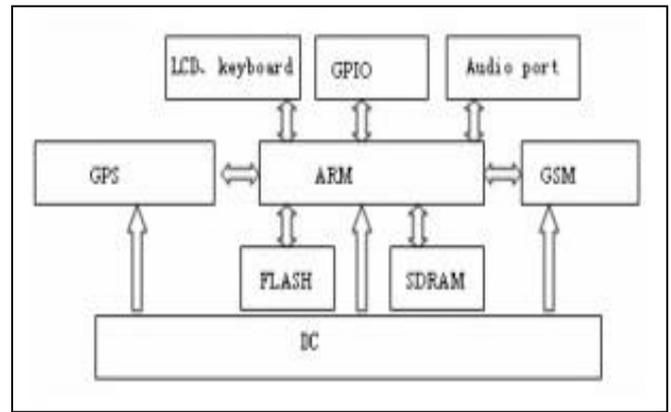- GPIO Port Output Clear Register (IOCLR)

E. System Structure

Fig. 2: System Structure

III. FLOW CHART

When the program begins LPC2148 controller must begin the runtime environment and this is writing start code for ARM chips which includes the exception vector table, stack initialization, the storage system initialization and target board initialization, generally written in assembly language. If you use the GPRS services developed based on GSM while using the SMS service for delivery of positioning Information. The key of software design is to write function. Functions are realized by calling the corresponding function, which includes four parts: GPS data analysis and extraction, encoding and decoding PDU messages, sending and receiving text messages, and parsing and executing the command. After the first boot of the device, the locator is firstly initialized, including selecting pin function of the controller LPC2148, setting the serial port work, initializing interrupt vectors and TC35i, and setting the working mode. Then program will run according to the flow chart.
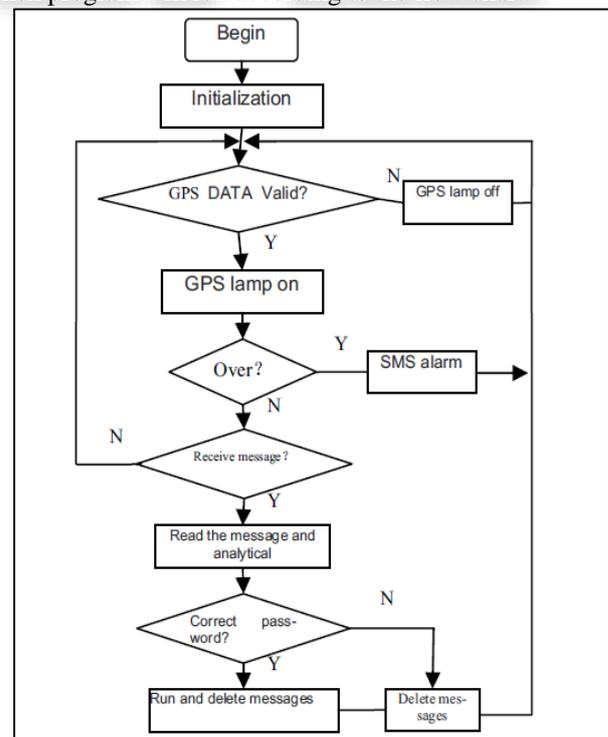

Fig. 3: Flow Chart

IV. SIGNALING SCHEMES AND CIPHERING CODES USED

GSM is digital signal but voice is the analog signal. So the analog signal is to be converted into digital signal and then transmitted over network. The GSM used coding scheme that is RPE-LTP (Rectangular pulse Excitation – Long Term Prediction)
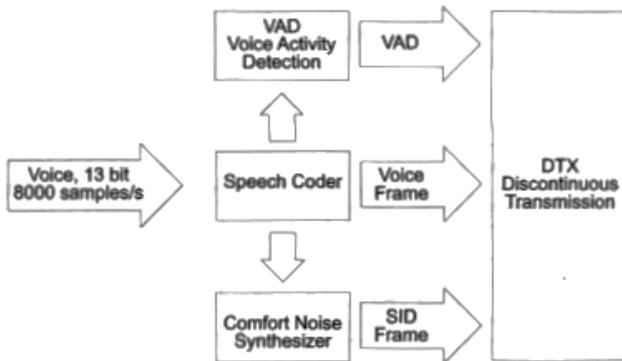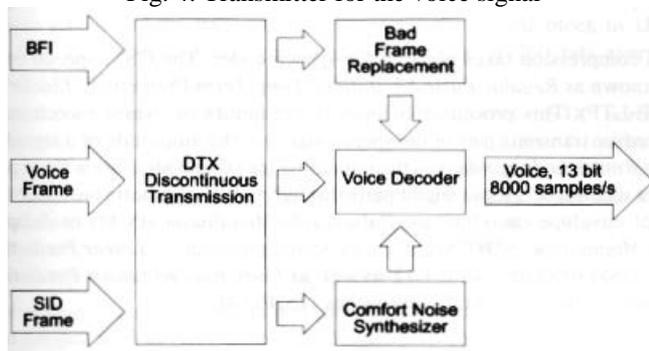

Fig. 4: Transmitter for the voice signal

Fig. 5: Receiver for the Voice signal

1) The voice signal is at receiver sampled at 8000 bits/sec and is quantized to get a 13 bit resolution corresponding to a bit rate of 104 Kbits/sec.
2) This signal is input to a speech coder that compresses this speech into a source-coded speech signal of 260 bit at a bit rate of 13 Kbit/sec.
3) The codec gets 1:8 compression ratio. The coder also has a Voice activity detector (VAD) and noise synthesizer. The VAD decides whether the current speech frame contains speech or pause, then it is used to decide whether to turn on or off the transmitter according to the control of the Discontinuous Transmission (DTX).
4) This transmission takes advantage of that thing during a phone conversation both the users rarely speak at the same time. Thus the DTX helps to reduce the power consumption and increasing the life of battery.
5) The missing speech frames are replaced by synthetic background noise generated by the comfort noise synthesize in a Silence Descriptor (SID) frame.
6) Suppose a loss off speech frame occurs due to bad transmission or any introduction of noise in the signal and if it is not corrected by the channel coding protection mechanism then the decoder flags such frames with a bad frame indicator (BFI) In such a case the speech frame is discarded and technique that uses called error covering which calculates the next frame based on the previous frame.

A. Send Message +CMGS Description

The <address> field is the address of the terminal to which the message is sent. To send the
Message, simply type, <ctrl-Z> character (ASCII 26). The text can contain all existing
Characters except <ctrl-Z> and <ESC> (ASCII 27). This command can be discarded using the
<ESC> character when entering text. In PDU mode, hexadecimal characters are used that is [0 to 9 and A to F]

B. Syntax

Command syntax in text mode*:*
AT+CMGS= <da> [,<toda>] <CR> *text is entered* <ctrl-Z / ESC >

Command	Possible responses
AT+CMGS="+33146290800"<CR>	+CMGS: <mr>
Please call me soon, Fred. <ctrl-Z>	OK
Note: Send a message in text mode	Note: Successful transmission
AT+CMGS=<length><CR><pdu><ctrl-Z>	+CMGS: <mr>
Note: Send a message in PDU mode	OK
	Note: Successful transmission

Table 1: commands to send gsm messages

The message reference, <mr>, which is returned to the application, is assigned by the product.

This number starts with 0 and for each outgoing message it is incremented by one (successful and failure cases); it is cyclic on one byte (0 follows 255).

Note: This number is not a storage number. Outgoing messages are not stored.

C. Delete message +CMGD

1) Description

This command deletes one or several messages from preferred message storage ("BM" SMS CB 'RAM storage', "SM" SMSPP storage 'SIM storage' or "SR" SMS Status-Report storage).

2) Syntax

Command syntax: AT+CMGD=<Index> [,<DelFalg>]

V. CONCLUSION

Taking ARM as platform, and GPS and GSM as wireless data communication platform, Vehicle Positioning System is reliable, small, stable and faster, which can be overcome the disadvantages of poor real-time and high costs of operation existed in the system. Vehicle positioning system is trying to achieve complexion of positioning technology, integration of positioning systems, and network of location-based services in the form of the current Client / Server. It is believed that the system will have broad application prospects

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