Vehicle Tracking and Monitoring By ARM7

Gangadhar M[1], Madhu M S[2]
(M Tech) Dept. of Computer Network Engineering
VTU PG Studies, Visvesvaraya Technological University
Belgaum, India

Prof. Pushpalatha S[3]
Dept. of Computer Network Engineering
VTU PG Studies, Visvesvaraya Technological University
Belgaum, India

***Abstract*— This paper mainly deals with concept of Vehicle tracking, Monitoring and providing security by theft. This system is based on ARM7, GSM and GPS is proposed. GSM technology is used to send information about the vehicle by using GPS receiver, information contains location, speed, temperature of vehicle and control message to stop the vehicle in case of theft. ARM7 TDMI-S core processor with LPC 2148 microcontroller collects the information and sends to the Monitoring system using GSM modem. The Monitoring system uses GUI to display the received information. GUI is developed by using Visual Studio 2010. The Monitoring system can turn OFF the vehicle engine by using relays in case of theft.**

Keywords- ARM7 TDMI-S, LPC2148, GPS MT 3318, LM-35, GSM, Accelerometer.

I. INTRODUCTION

In present day's as population increases the number of vehicles also increases. This results in more accidents and deaths and also theft [1]. The result of this system saves death or reduces the death rates, by providing information about the accident to the Monitoring system immediately.

It improves the level of management in buses of travel agencies and cargo transportation vehicles, such as trucks [2].

It also provides security to personal vehicles like car by locking the vehicle engine from remote location using GSM in case of theft [3]. A Monitoring system continuously waits for information sent from vehicle system. The information sent by the vehicle system includes position of a vehicle (Longitude and Latitude), speed and temperature. The information provided to the Monitoring system when accident happens or when user accesses the system to get the information about the vehicle.

Key feature of this design include:

a) User can access the system to get the information about vehicle at any time whenever needed.

b) Vehicle system will send the information about vehicle automatically to Monitoring system . This results in medical help in case of accident and in case of theft.

c) User can stop the vehicle engine, whenever theft of vehicle by using Relays.

d) It includes a temperature sensor that gives temperature in degree Celsius for monitoring the environmental conditions around the goods or other stuff in the transport vehicle.

II. HARDWARE COMPONENTS OF VEHICLE SYSTEM

1. ARM7 TDMI-S LPC2148 controller
2. Dc Power supply unit
3. 16×2 LCD
4. Temperature sensor LM 35
5. Accelerometer
6. Pressure sensor
7. GSM modem
8. GPS Receiver MT 3318
9. MAX 232 line driver
10. Relays

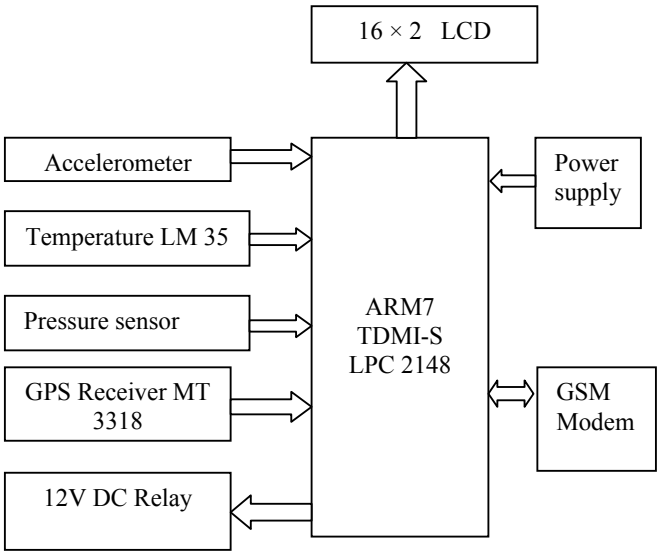

Figure 1:Block Diagram

1. *Microcontroller Unit*

The complete block diagram is as shown in figure1 explains the complete operation of vehicle system. The vehicle system contains hardware peripherals like, ARM7 TDMI-S Core processor, pressure sensor, temperature sensor,

accelerometer, GPS MT 3318 receiver, DC Relay, 16×2 LCD, SD memory card, GSM modem and power supply.

The temperature sensor provides temperature per degree Celsius to an ARM7 processor. The temperature sensor is interfaced to an ADC1 of ARM7 processor. Vehicle speed, position and temperature are stored in a SD card. The SD card is interfaced to an ARM processor by using SPI (Serial Peripheral Interface). This information is shown on LCD that is interfaced to a GPIO0 and send it to a Monitoring system (receiver side) by GSM module wirelessly that is interfaced to a UART0 of ARM processor.

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Features of ARM7 TDMI-S LPC2148:

- ARM7 TDMI –S LPC2148 microcontroller with 512 Kbyte program Flash and 32+8 Kbyte SRAM.
- 16/32-bit ARM7TDMI-S microcontroller in a 64 or 144 pin package.
- 32.768 kHz RTC crystal.
- Onboard Peripherals
  - 2x16 character LCD with background light
  - Joystick switch
  - UART-to-USB bridge interface on UART #0
  - USB 2.0 device interface
  - RGB-LED, each color can be controlled via PWM Signal.
  - 8 LEDs
  - Temperature sensor (LM75) on I2C bus
  - Pushbutton on P0.14 (interrupt input)
  - 8x8 LED matrix, controlled via shift registers in the SPI bus
  - MMC/SD memory card interface
  - Step motor (bipolar driving)
- 60 MHz maximum CPU clock available from programmable on-chip Phase-Locked Loop.
- Dual power supply
  - CPU operating voltage range of 1.65V to 1.95V (1.8V +/- 8.3%).
  - I/O power supply range of 3.0V to 3.6V (3.3V +/- 10%).
- In-System Programming (ISP) and In-Application Programming (IAP) via on-chip boot-loader software. Flash programming takes 1 ms per 512 byte line. Single sector or full chip erase takes 400 ms.

2. *GPS Receiver*

Global Positioning System. A possible to precisely identify locations on earth by measuring distance from the satellites. This system uses MT 3318 GPS Receiver which contains high gain active patch antenna by cirocomm. The GPS receiver interfaced with microcontroller through the UART1 serial communication. The GPS receiver may track upto 51 satellites simultaneously. The GPS receiver is mounted on PCB along with the 3.3V voltage regulator, transmit, receive and power indication LED's. The GPS receiver output data is in the form of NMEA (National Marine Electronics Association) standard format. network of satellites that continuously transmit coded information, which makes it.

The details of NMEA format:

a) GPGGA – Global Positioning System Fix Data
b) GPGSA –GPS DOP and active satellites
c) GPGSV –GPS satellites in view
d) GPVTG –Track Made Good and Ground

Example of GPGGA format:

Sentence Identifier	$GPGGA	Global Positioning System Fix Data
Time	170834	17:08:34 Z
Latitude	4124.8963, N	41d 24.8963' N or 41d 24' 54" N
Longitude	08151.6838, W	81d 51.6838' W or 81d 51' 41" W
Fix Quality: - 0 = Invalid - 1 = GPS fix - 2 = DGPS fix	1	Data is from a GPS fix
Number of Satellites	05	5 Satellites are in view
Altitude	280.2, M	280.2 meters above mean sea level
Checksum	*75	Used by program to check for transmission errors

Table 1: GPGGA Format

Figure 2: GPS Receiver MT 3318 Cirocom

3. *GSM Modem*

Global System for Mobile communication. This GSM Modem can accept any GSM network operator SIM card and act just like a mobile phone with its own unique phone

number. Advantage of using this modem will be that you can use its RS232 port to communicate and develop embedded applications. Applications like SMS Control, data transfer, remote control and logging can be developed easily.
This GSM modem is a highly flexible plug and play quad band GSM modem for direct and easy integration to RS232 applications. Supports features like Voice, SMS, Data/Fax, GPRS and integrated TCP/IP stack.

This system uses SIM 300 GSM module in text mode. This system uses SIM300 GSM module that provide 900/1800/1900MHz Tri-band for VOICE, SMS, DATA, and FAX. This module is operates on AT command. AT command is an abbreviation for Attention command that is recognized by GSM Module. "AT command set for GSM Mobile Equipment" describes the Main AT commands to Communicate via a serial interface with the GSM subsystem of the phone. The GSM modem is interfaced to microcontroller through UART0 serial communication.

Examples of AT commands:

Command	Description
AT	Check if serial interface and GSM modem is working
ATA	Answer an incoming call
ATD><MEM><N>	Originate call to phone number in memory
ATDL	Redial last telephone number used

Table 2: AT Commands

Figure 3:GSM Modem SIM 300

4. *Relay*

The relay is an electromagnetic switch. When relay is activated, then it closes the loop of ignition, hence start the Engine. When relay is de-activated, it opens the loop of ignition, hence stop the ignition of the automobile.

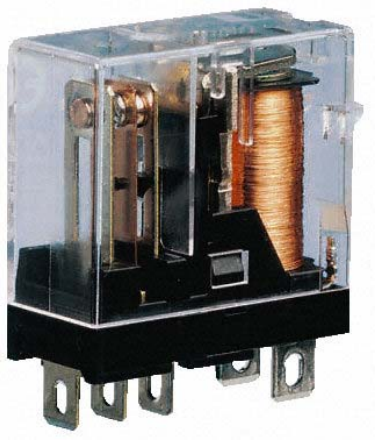

Figure 4: Electromechanical Relay

5. *Accelerometer*

Accelerometer measures acceleration. Acceleration is the time rate of change of velocity. This means how quickly changes speed. The measurement of acceleration is used as an input into some types of control systems. Accelerometer sensor is used to measure static (earth Gravity) or dynamic acceleration in all three axes, forward/backward, left/right and up/down. The output of accelerometer provides 1.65V to 3.3V in positive direction and in negative direction the voltage drop from 1.65V to 0V. The output of accelerometer is in analogue form with three different output voltages each representing X, Y and Z direction of motion. These three voltage signal are processed through ADC0 on three different Channels available on ARM.

III. MONITORING SYSTEM

GSM Modem SIM 300

MAX 232

Figure 5: Interfacing GSM Modem with PC

The information provided by the GSM modem is in the form of text. The text mode information is send to the PC by interfacing GSM Modem to the PC using MAX 232 which is USB to Serial converter. The information received by the GSM modem at Monitoring system is sent by the vehicle system. The information contains Location, Speed, and Identity of a vehicle and Temperature. This information is displayed on GUI and stored into the database. By using this information can also send to the nearest hospital or police system to help the victims. Here GUI is developed by the visual Studio 2010.

IV. WORKING OF SYSTEM

Figure 4: Complete model of system

The entire vehicle system is installed in the vehicle as shown in above figure and Monitoring system at remote location. The entire system works in the following cases.

First case is, when vehicle get accident the pressure sensor and accelerometer senses and sends sensed values to the microcontroller. The microcontroller then collects the information like position, speed from the GPS receiver and also collects the values from the temperature sensor. Then the microcontroller sends complete information to the GSM modem, this information is in the form of text mode. The GSM modem sends received information by microcontroller to the Monitoring system. The Monitoring system receives message and verifies the identification, if in-valid then the message will be discarded; otherwise the information is displayed on the GUI. Then we can get exact location of a vehicle by plotting the longitude and latitude values on Google maps. Then we forward the message to the nearest hospital or Police system to help the victims.

Second case is, when user wants to access the system to know the vehicle information, the user will send request message to the Vehicle system from Monitoring system through GSM modem. The GSM modem at Vehicle system receives user request and verifies, if in-valid discards the message, otherwise forwards message to the microcontroller. The microcontroller collects the necessary information from different peripherals and sends back to the GSM modem. The GSM modem will forward information to the Monitoring system, and then the information is displayed on the GUI.

Third case is, when the user comes to know that, the Vehicle is theft, and then the user will send the stop message to the vehicle system. The microcontroller receives the STOP message and turn OFF the relay which is connected to the vehicle engine. By this case we can provide the security to the Vehicle.

V. SOFTWARE USED

a) Kiel µvision4 IDE:

KeilµVision4 IDE (Integrated Development Environment) is based on windows front end for the C Compiler and assembler. KeilµVision4 is used to write embedded C programs. Embedded C is a high level language, which includes many aspects of the ANSI (American National Standard Institute) C programming language.

b) GUI:

The GUI for the proposed system is designed on Visual Studio 2010. C # is a simple, modern, object-oriented, and type-safe programming language. Microsoft's C# compiler for the .NET Framework is a conforming implementation of both of these standards. ***Exception handling*** provides a structured and extensible approach to error detection and recovery. Also this language is compatible with all Microsoft applications.

c) OS II:

Hardware RTOS Application program

User

Figure 5: Real Time embedded system with RTOS

An Operating system (OS) is nothing but a collection of system calls or functions which provides an interface between hardware and application programs. Real-time systems are those systems in which the correctness of the system depends not only on the logical result of computation, but also on the time at which the results are produced. Basic Structure is similar to regular OS

RTOS is key to many embedded systems and provides a platform to build applications. All embedded systems are not designed with RTOS. Embedded systems with relatively simple/small hardware/code might not require an RTOS. Embedded systems with moderate-to-large software

applications require some form of scheduling, and hence RTOS.

VI. CONCLUSION

Finally concluded that the vehicle system provides information of a vehicle like, position, speed, through a GPS receiver, and temperature to a Monitoring system. Using Accelerometer and Pressure sensor accident can be identified and information is send to a Monitoring system. That information is send to the nearest hospital / police system. The information at Monitoring system is displayed on GUI. A user can access the system whenever at any time. This system provides security in case of theft. The vehicle can be identified and stopped at anywhere. This system can be installed in cargo trucks, buses, cars and boats.

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