

GPS Based Tracking and Monitoring of Vehicle Using ARM

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Abstract: Nowadays, increased population leads to rush of vehicles. As a result, people are facing the problems like accidents, heavy traffic, theft of vehicles etc. This paper presents a system which is not only smarter but economical. It provides proper solution against the problems like accidents of vehicles etc. It consists of ARM7 LPC2148 processor, MEMS, GSM/GPRS, GPS, a thermistor as temperature sensor etc. The whole system is controlled by the ARM7 based LPC2148 processor to provide accurate location of the vehicle. It also monitors the vehicle parameters like temperature. To carry the proper operation, without any error, a program is stored into the ARM7 LPC2148 processor. The system described in this paper is able to reduce the problems mentioned above to the greater extend.

Keywords: ARM7 LPC2148, GPS, GSM/GPRS, Thermistor, Accelerometer

1. Introduction

According to Road Transport Yearbook of 2011 published by Ministry of Road Transport and Highways, Government of India, the registration of vehicle per thousand paper people is reached up to seven hundred. This is the huge reason of increasing road accidents. According to a survey the India has got 64th rank in road accidents occurred per year.

We all know, the transportation is one of the important ways of communication. With increasing growth rate of population, the need of transportation is also increasing. This leads to increase in rush of vehicles. As a result, traffic jam, theft of vehicles, accidents of vehicles, and similar problems related to the rush of vehicles are increasing.

To avoid the problems mentioned above, it is very important to design a system which can reduce the problems to greater extend. Such system, which can help human beings to reduce the problems mentioned above, is designed by us and also we are trying to develop it in our own way.

The system consists of 2 parts. One of those is tracking system and another one is monitoring system. The monitoring system consists of a GSM/GPRS module and a computer. The tracking system consists of LPC2148 processor, GSM module, GPS module, accelerometer, temperature sensor, liquid crystal display and power supply.

The designed system is very reliable and cost effective. All the electronic components and devices are available in local market. Therefore for buying or designing such system is not a big deal. So I would suggest everyone that you can design such system for your vehicle So that you will protect yourself and your family from accidental disasters. This paper gives the basic idea about the system and its design.

2. System Components

The following figure shows the components used in the system.

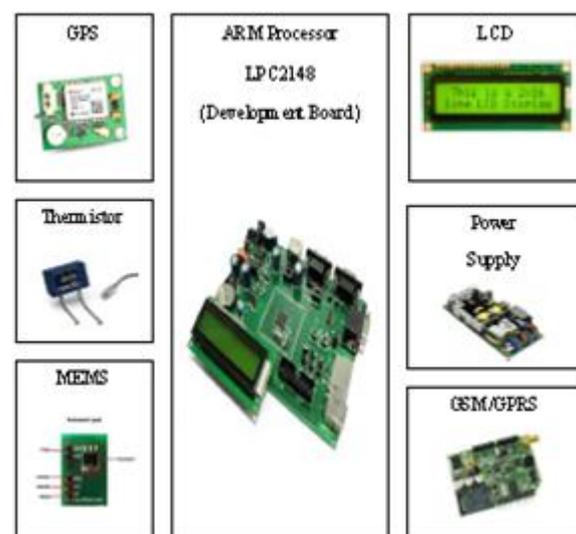


Figure 1: Components of the system

The aim of project is to track and monitor the vehicles. For this purpose we have to use:

- 1) The device which can help us to track the vehicle
- 2) The device which can help us to monitor the parameters of vehicles
- 3) Sensors
- 4) Accident or collision detector
- 5) Processor to process whole information
- 6) Power supply to supply the power to the whole electronic circuit
- 7) Display device to display temperature and locations of vehicles

The device which can be used to track the vehicles is GPS tracker. The GSM module can be used to inform the

locations of the vehicle. The power supply unit gives three types of output voltages 3v, 5v and 12v. For the collision detection we have to use MEMS sensor. The processor used in the project is from the ARM family. 16x2 LCD display is used to display location and temperature. The main components used in project are given below:

- 1) Processor: ARM7 LPC2148
- 2) GPS receiver SIM39EA
- 3) GSM module: SIM900A
- 4) MEMS: MMA7660
- 5) Thermistor: TMP103

3. Processor

The ARM7 based LPC2148 is used to control and manage the operation of the system. The brief description is given below.

3.1 ARM7 Basic Architecture

The ARM7 is a part of family of Advanced RISC Machines (ARM). It is a low power 32-bit Reduced Instruction Set Computer (RISC) microprocessor. It can be used in application or customer specific ICs. The original ARM7 was based on ARM6 design. It has very simple and fully static design. It is particularly suitable for cost and power-sensitive applications. The figure is given below & it shows basic architecture of ARM7.

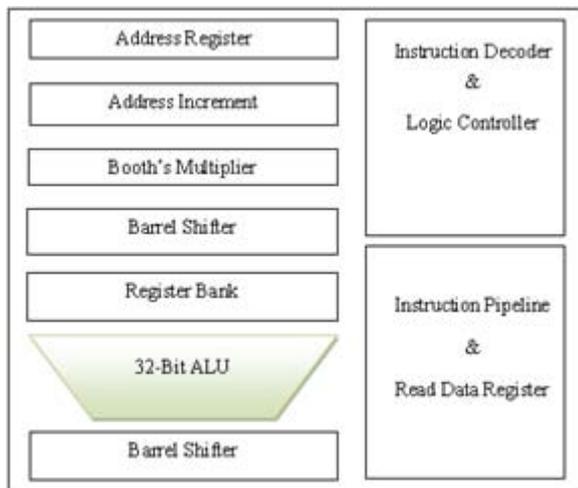


Figure 2: Basic architecture of ARM7

3.2 LPC2148

LPC2148 is the widely used integrated chip (IC) from ARM7 family. It is manufactured by Philips. It is pre-loaded with many inbuilt peripherals. It is more reliable and efficient option for the beginners. It can also be used by high end application developer.

LPC2148 has number of features. Some features are mentioned below.

- 1) It has 8 to 40 kB of on-chip static RAM.
- 2) It has 32 to 512 kB of on-chip flash program memory.
- 3) It has 128 bit wide interface enables high speed 60 MHz operation.

- 4) It does In-System/In-Application Programming (ISP/IAP) via on-chip boot-loader software.
- 5) It erases full chip in 400 ms and programming of 256 bytes in 1ms.
- 6) It has Single 10-bit D/A converter provides variable analog output.
- 7) It has Multiple serial interfaces including two UARTs, two fast I2C-bus (400 kbit/s), SPI & SSP with buffering capabilities.
- 8) It has Vectored interrupt controller with configurable priorities and vector addresses.
- 9) It has a tiny LQFP64 package. It has up to 45 of 5 V tolerant fast general purpose I/O pins.
- 10) It has On-chip integrated oscillator. It operates with an external crystal in range from 1 MHz to 30 MHz and with an external oscillator up to 50 MHz.
- 11) It includes Idle and Power-down power saving modes.
- 12) It has low power real-time clock. It has independent power and dedicated 32 kHz clock input.

The following figure shows pin configuration of LPC2148

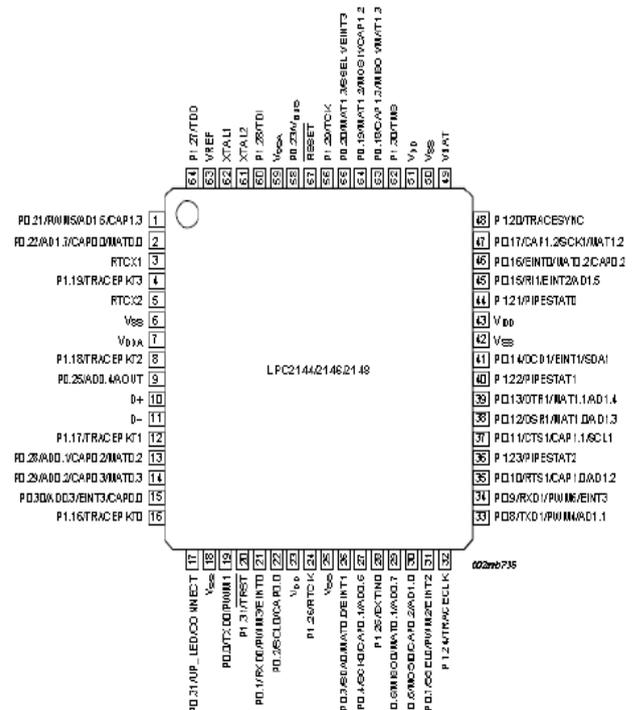


Figure 3: Pin configuration of LPC2148

4. Block Diagram

The following figure shows block diagram of the system.

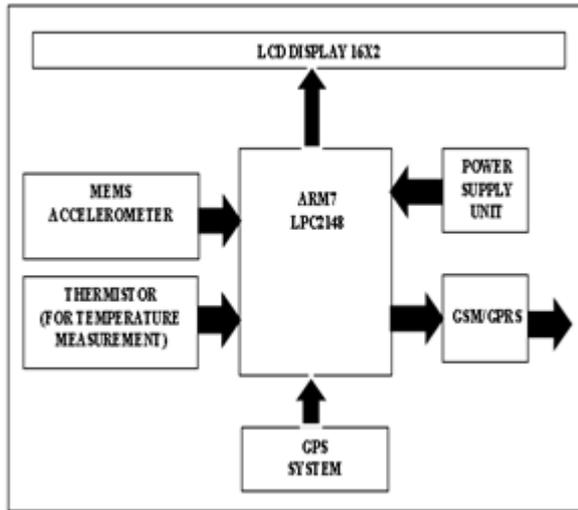


Figure 4: System block diagram

The system block diagram consists of ARM7 based LPC2148 processor, GPS module, GSM module, thermistor as temperature Sensor, MEMS accelerometer, GPRS module for monitoring system.

The whole operation is controlled by the ARM7 LPC2148 processor. ARM7 is one of the popular microcontrollers' families in embedded system application. GPS module is used to track the vehicle continuously. GSM is used to send the SMS to the registered numbers e.g. family, police, hospital etc.

The MEMS sensor is used to detect the vibration or collision caused due to accidents. The thermistor is used as temperature sensor used for measuring temperature continuously. In this way we can say it monitors the temperature continuously. The system is used for detecting the accidents of vehicles. It is also used to monitor and track the vehicles.

Main purpose of the system is to detect the accident and provide emergency services to the accident victims to avoid accidental fatalities. MEMS sensor is used for detecting accidents.

First of all one should have to wait for signal from MEMS accelerometer or vibration sensor. As mentioned above it will sense the collisions. Once collisions detected the signal from MEMS sensor will be sent to the microcontroller unit. ARM will process those signals and send to GSM. At the same time the processor will make GPS module will track the location of the vehicle. Now GSM will collect all the information which is needed and it will be sent to the registered numbers as soon as possible. In this way the emergency service will be called and we can save the lives of accident victims and avoid the accidental deaths. The system can also be used for checking the vehicle identity.

5. Circuit Diagram

Circuit diagram of system is shown in figure given below.

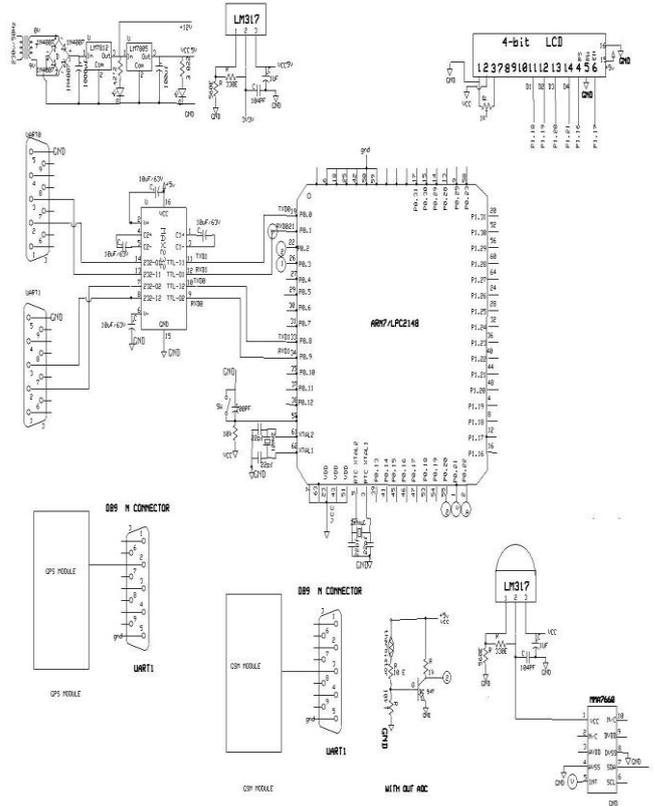


Figure 5: Circuit diagram of system

ExpressPCB is a simple electronics circuit board design tool. Drawing a schematic with the ExpressSCH program is as easy as placing the components on the page and wiring the pins together. The schematic can then be linked to your PCB file, so that the PCB knows what needs to be connected together. The circuit diagram of the system is drawn by using this software. Circuit diagram of system is shown in figure.

6. Flowchart for Accident Detection

The flowchart for accident detection is given below. It describes the operation conducted by the system when the accident will occur. The following components of system play the important role in detecting the accidents:

- 1) LPC2148
- 2) Accelerometer
- 3) GPS
- 4) GSM/GPRS

The flowchart for accident detection is shown in figure 6.

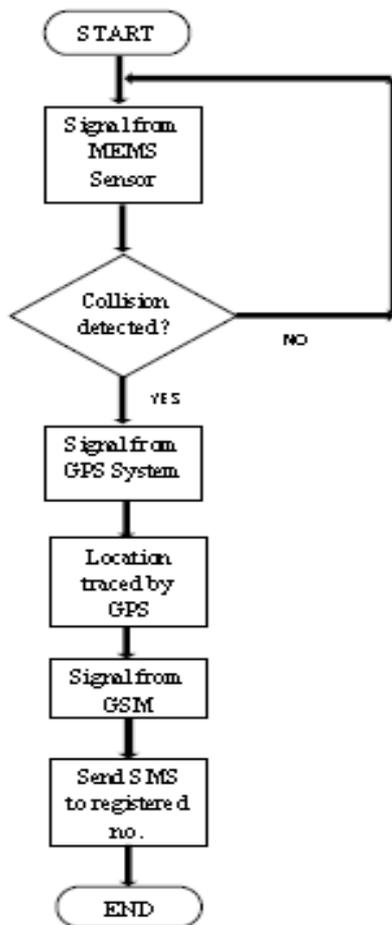


Figure 6: Flowchart for accident detection

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- [4] "Vehicle Accident Automatic Detection and Remote Alarm Device" by Varsha Goud; V. Padmaja.

7. Software Requirements

The Kiel Software is used for writing program, which is used for the system. It includes C/C++ compilers, debuggers. The Keil software includes integrated development and simulation environments. It consists of middleware libraries & RTOS, and evaluation boards. These stuffs are used for ARM, Cortex-M, Cortex-R4, 8051, C166, and 251 processor families. Standard libraries are enhanced or altered to address the peculiarities of an embedded target processor. The signal from accelerometer module is processed by the ARM7 based LPC2148 processor. The analog signal, which is obtained from accelerometer, is applied to the on-chip ADC0. This ADC0 is configured as a 10-bit output data which gives high precision compared to the 8-bit microprocessors. Here the UART1 is used for transmitting the digital data. The 8-bit data is transmitted at a time by the UART1. These digital values (or digital) data are transmitted to GSM module through UART1.

References

- [1] "Automatic Vehicle Accident Detection and Messaging System Using GSM and GPS Modem" by C. Prabha ; R. Sunitha; R. Anitha.
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