

GPS Based Monitoring and Tracking of Vehicles Using ARM7 LPC2148

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Abstract – The paper presents an efficient system for monitoring and tracking of vehicle. It provides proper solution against accidents of vehicles, theft of vehicle etc. It includes ARM7 LPC2148 processor, MEMS, temperature sensor, GSM/GPRS, GPS etc. The whole system is controlled by the ARM7 LPC2148 processor to provide exact location of the vehicle. The designed system monitors the vehicle parameters e.g. temperature, humidity, speed etc. To carry the desirable operation, without any error, a proper program is installed into the LPC2148 processor.

Key Words: LPC2148, GSM, GPRS, GPS, tracking system, monitoring system, accelerometer

1. INTRODUCTION

The transportation is one of the important ways of communication. As the growth rate of population is increasing day by day, the need of transportation is also increasing. This leads to increase in number of vehicles. As a result of traffic jams, theft of vehicles, accidents of vehicles, and similar problems related to the rush of vehicles are increasing day by day.

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 behind increasing road accidents. According to a survey the India has got 64th rank in road accidents occurred per year.

To avoid the problems, related to rush of vehicles mentioned above, we have designed a system which can reduce the problems to greater extend. The system consists of two parts. One of those is monitoring system and another one is tracking system. The monitoring system consists of a computer and a GSM/GPRS module. The tracking system consists of GSM module, GPS module, accelerometer, temperature sensor, liquid crystal display, power supply and most importantly LPC2148 processor.

The brief information of the system is mentioned in this paper. It describes the system components and their function. It also describes the applications of the same.

2. SYSTEM OPERATION DESCRIPTION

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 modem is used to send the SMS to the registered numbers like family, police, hospital etc.

The MEMS sensor is used to detect the vibration caused due to accidents. The thermistor is used as temperature sensor used for monitoring the temperature continuously. The system is used to detect the accidents. It is also used to monitor and tracking of vehicles. System block diagram is shown in figure given below.

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

Basically system monitors following parameters related to the vehicles:

1) Location of vehicle

- 2) Temperature monitoring
- 3) Vehicle identity
- 4) Humidity

The system components are shown in block diagram of the system. The block diagram is given below. It consists of processors along with other components. The overview of hardware of system and block diagram is shown in figure 1.

customer specific integrated circuits. It is particularly suitable for cost and power-sensitive applications.

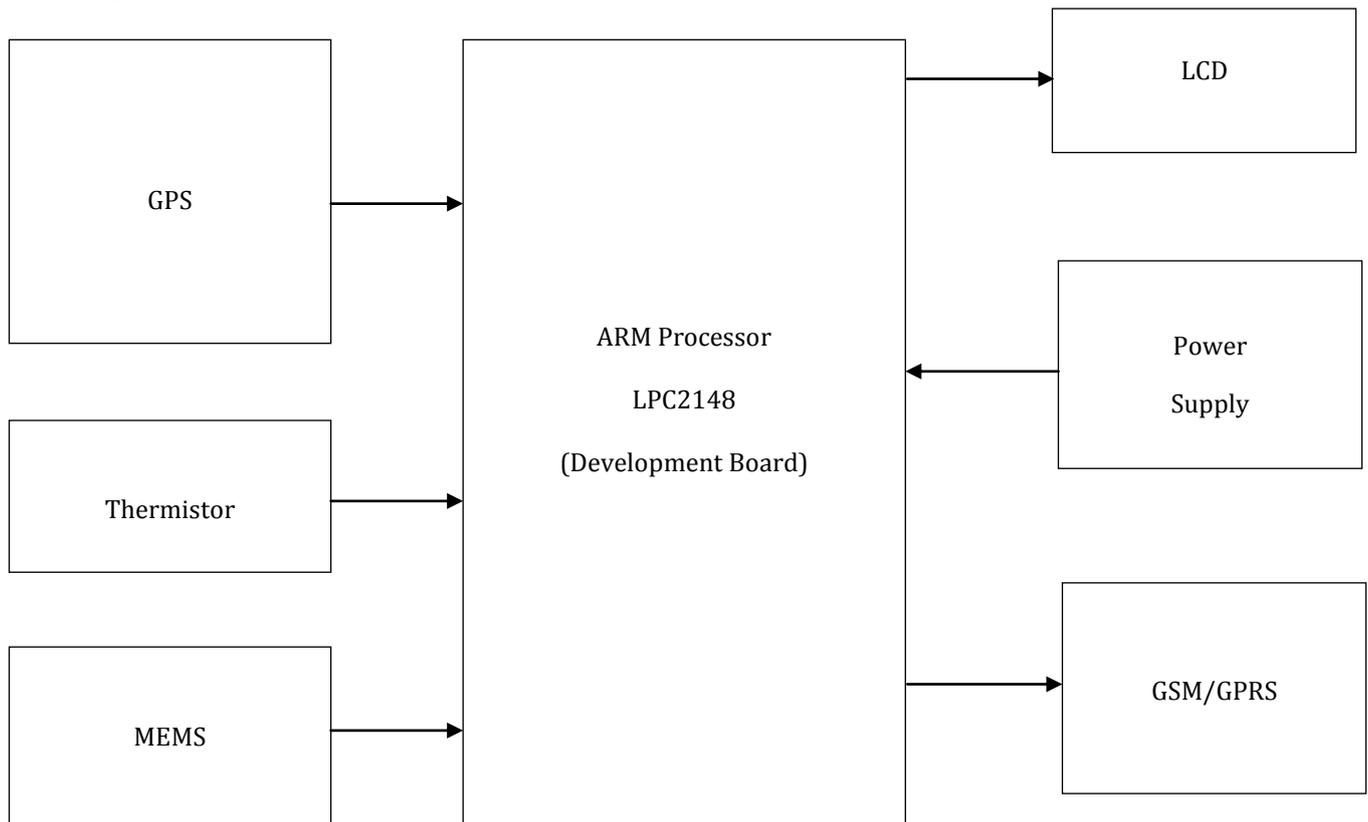


Fig -1: System Block Diagram

3. SYSTEM COMPONENTS

This section gives knowledge about various components related to the system. Some of the important components are given below.

- ARM7 (Advanced RISC Machine) based LPC2148
- Global Positioning System
- GSM/GPRS
- Accelerometer

3.1 ARM7

The ARM7 is part of family of the ARM (Advanced RISC Machines). It is a low power, 32-bit RISC (Reduced Instruction Set Computer) microprocessor. The original ARM7 was based on ARM6 design. It has very simple, fine and fully static design. It can be used in applications or

LPC2148 is the widely used integrated chip from ARM-7 family. It is manufactured by Philips and pre-loaded with many inbuilt peripherals. It is more reliable as well as efficient option for the beginners. It is also beneficial for high end application developer. LPC2148 has huge number of features. Some features are listed 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 does single flash sector or full chip erase in 400 ms and programming of 256 bytes in 1ms.
- 6) It has Single 10-bit D/A converter provides variable analog output.
- 7) Two 32-bit timers/external counters, PWM and watchdog.

8) It has Multiple serial interfaces including two UARTs, two fast I2C-bus (400 kbit/s), SPI and SSP with buffering and variable data length capabilities.

9) It has Vectored interrupt controller with configurable priorities and vector addresses.

10) It has up to 45 of 5 V tolerant fast general purpose I/O pins in a tiny LQFP64 package.

11) It has On-chip integrated oscillator operates with an external crystal in range from 1 MHz to 30 MHz and with an external oscillator up to 50 MHz.

12) It includes Idle and Power-down power saving modes. Following figure shows lpc2148 pin configuration.

The following figure shows the LPC2148 pin diagram.

13) It has low power real-time clock with independent power and dedicated 32 kHz clock input.

Wireless MODEMs are used to generate, transmit or decode data. These are nothing but modem devices. These are used for establishing communication link between the cellular network and the user's computer. These are manufactured for a particular cellular network. These are also manufactured for particular cellular data standard or technology (GPS/SIM). Wireless MODEMs use serial communication to interface with and need Hayes AT commands for communication with the computer or any microprocessor or microcontroller system.

3.4 GPS

GPS is one of the popular systems in communication. Global positioning system technology became a reality through the efforts of military of the American. It established a satellite-based navigation system consisting of a network of group of satellites orbiting the earth. There are 24 satellites in a system. GPS is also known as the NAVSTAR.

It operates all across the world. It works in all weather conditions. It helps users to track locations as well as objects. By using GPS technology we can track each individual having GPS receiver. Thus we can say that the GPS technology can be used by any person having GPS on the earth.

3.5 Accelerometer

Acceleration and vibration is sensed by accelerometer. It defines a measure of how quickly speed changes. Accelerometer sensor is used to measure dynamic acceleration or static (earth Gravity). It measures acceleration in all 3 axes. Those three axes are forward/backward, left/right and up/down. The output of accelerometer provides 1.65V to 3.3V in positive direction. The output can also be measured in negative direction in terms of the voltage drop from 1.65V to 0V.

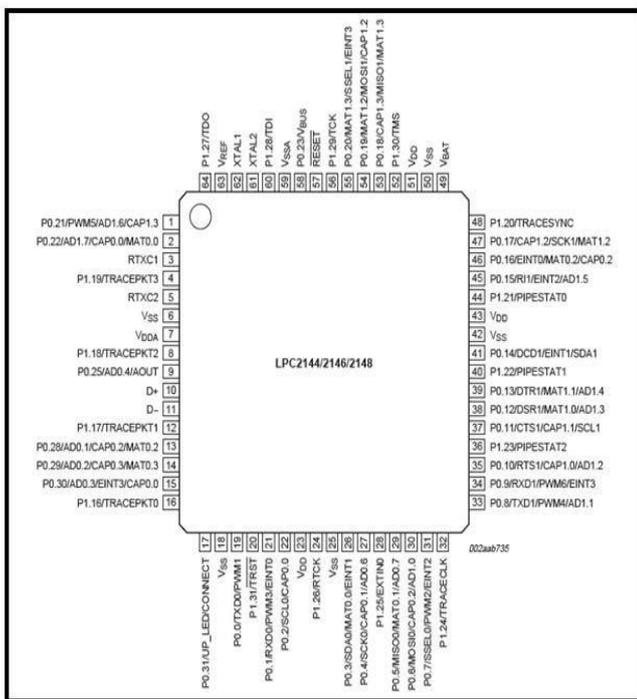


Fig -2: Pin Configuration of LPC2148

3.3 GSM/GPRS

Global System for Mobile communication is a standard accepted worldwide for mobile communication. GSM/GPRS module is used for establishing communication link between a computer and a GSM-GPRS system. GSM is an architecture used for mobile communication in number of countries in the world. GPRS (Global Packet Radio Service) is an extension of GSM. It allows higher data transmission rate for the efficient communication purpose. GSM/GPRS module consists of a GSM/GPRS modem assembled together. It is assembled with power supply circuit and communication interfaces like RS-232, USB, etc for users' computer. We are using Sim300 in our system.

4 SOFTWARE REQUIREMENTS

We are using Kiel Software for writing program of the desired system. It includes C/C++ compilers, debuggers. The Keil includes integrated development and simulation environments. It consists of RTOS and middleware libraries, and evaluation boards. These stuffs are used for ARM, Cortex-M, Cortex-R4, 8051, C166, and 251 processor families.

Standard libraries are altered or enhanced to address the peculiarities of an embedded target processor. The signal from accelerometer module is processed by the ARM7 based

processor. The analog signal from accelerometer is applied to the on-chip peripheral 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.

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