A REPORT ON

SMART PHONE BASED VEHICLE TRACKING AND EVIDENCE COLLECTION FROM CAR BLACK BOX

ABSTRACT

An efficient vehicle tracking system is designed and implemented for tracking the movement of any equipped vehicle from any location at any time. The proposed system made good use of a popular technology that combines a Smart phone application with a micro controller. This will be easy to make and inexpensive compared to others. The designed in-vehicle device works using Global Positioning System (GPS) and Global system for mobile communication (GSM) technology that is one of the most common ways for vehicle tracking. The device is embedded inside a vehicle whose position is to be determined and tracked in real-time. A micro controller is used to control the GPS and GSM modules. The vehicle tracking system uses the GPS module to get geographic coordinates at regular time intervals. The GSM module is used to transmit and update the vehicle location to a owner. A Smart phone application is also developed for continuously monitoring the vehicle location. The Google Maps API is used to display the vehicle on the map in the Smart phone application. Thus, users will be able to continuously monitor a moving vehicle on demand using the Smart phone application and determine the estimated distance and time for the vehicle to arrive at a given destination. In order to show the feasibility and effectiveness of the system.Along with tracking system here we can able check if vehicle met with accident or not using accelerometer.

CHAPTER

INTRODUCTION

This project is about a system which is developed to automatically detect an accident and alert the nearest hospitals and medical services about it. This system can also locate the place of the accident so that the medical services can be directed immediately towards it.

A newly developed sensor technology called the MEMS Accelerometer is used in this project to detect an accident. Accelerometer is a device which can detect a tilt or a sudden jerk in any of the 3 axis(x,y,z).

It can be used to detect any unusual acceleration and tilting of vehicles which indicates that the vehicle is out of control and could have suffered an accident. The accelerometers output can be analyzed by the microcontroller to find if it has crossed the threshold.

GPS system is deployed to locate the place of the accident and GSM technology is used to send messages to emergency services and family. If the medical services get an alert through GSM message about an accident and its location through GPS coordinates they can reach there immediately.

If the person who has suffered the accident receive medical help in time he can survive the accident and many important lives can be saved. The system is easy to build and compact in size so that it can be easily installed in any vehicle.

For wireless data transmission, GSM and SMS technology are commonly used. The SMS technology through GSM network and GSM modem provide a user with vehicle location information . Utilization of SMS technology has become popular because it does not require much cost. It is convenient and accessible way of transferring and receiving data with high reliability . Instead of using SMS, the proposed vehicle tracking system uses the Smart phone application to track and monitor a vehicle location obtained from the in-vehicle tracking device controlled by a micro controller. The vehicle location is automatically placed on Google maps, which make it easier for tracking a vehicle and provides users with more accurate vehicle location information.

The basic purpose of a vehicle tracking system is to track a specific target vehicle or other objects. The tracking device is able to relay information concerning the current location of the vehicle . Most of such tracking systems consist of an electronic device as usually installed in-vehicle and can be used for tracking motor cycles, buses, and trains.

Along with this we are including Alcohol Sensor to detect whether driver is alcoholic or not then based on that the vehicle will start.

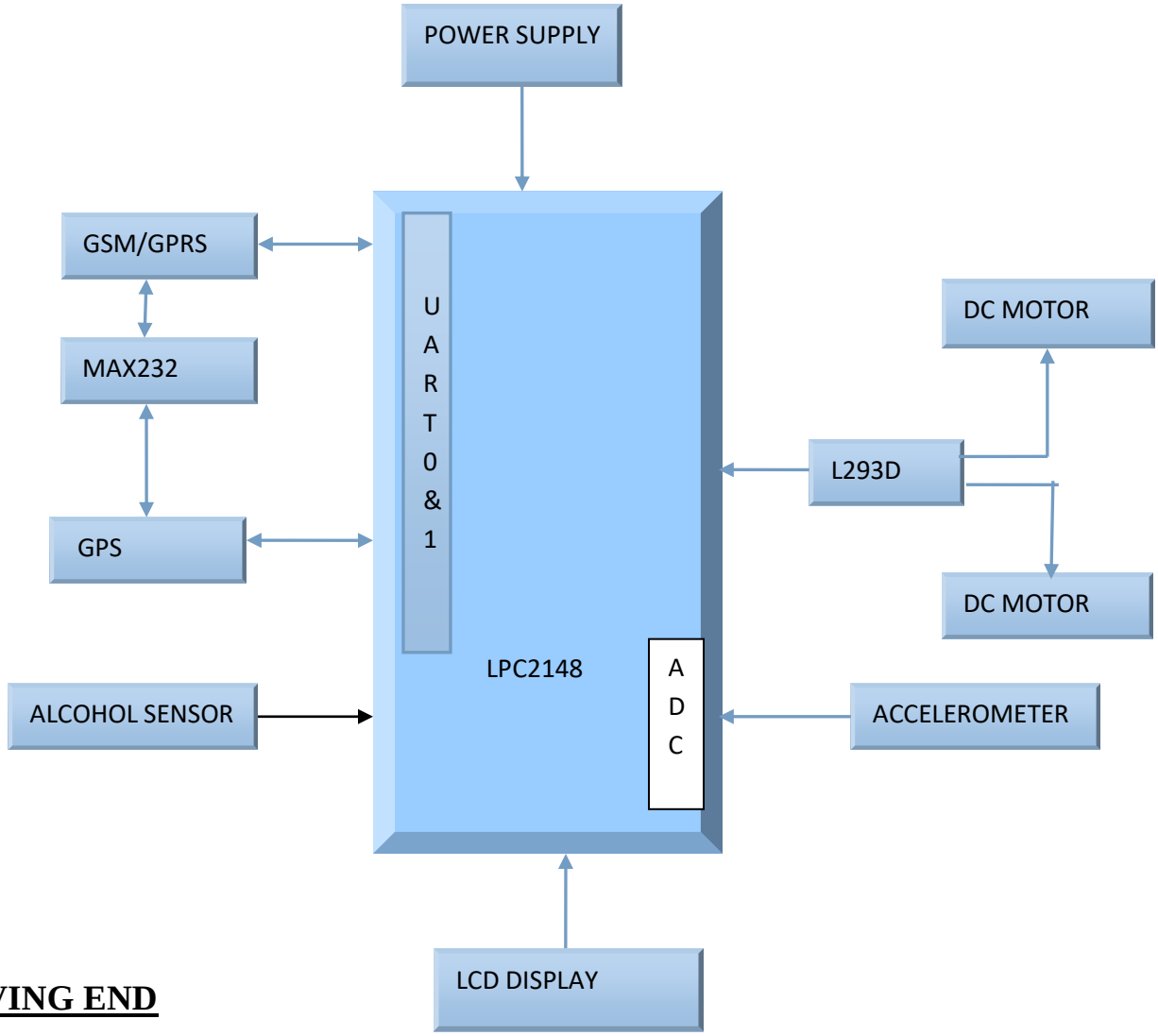
PROPOSED SYSTEM

In the existing system we are using GSM & GPS to track the vehicle

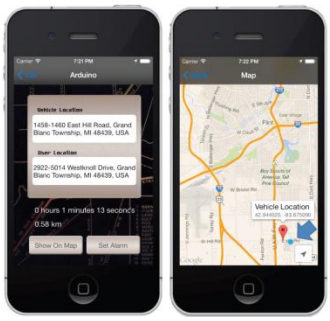
Advantages are owner has complete authentication on vehicle movement,he can control from remote location

BLOCK DIAGRAM

TRANSMITTING END



RECEIVING END



LITERATURE SURVEY

1. On the architecture of vehicle tracking system using wireless sensor devices

Integration of different technologies potentially provides support to wide variety of applications and systems with vastly varying requirements and characteristics. Vehicle tracking system is one of such applications possible by embedding wireless sensor devices on the vehicles. The most of the state-of the-art technology uses GPS (global positioning system) for tracking vehicles which is very expensive. The focus of the proposed vehicle tracking system is to track the desired vehicle with low-cost, effective implementation as in contrast to the existing high-cost tracking systems. In this paper, we present architecture for vehicle tracking system using wireless sensor technology. We have defined the packet structure for communication between the nodes. Certain issues that arise during implementation are discussed. To investigate our proposed design towards implementation, we have performed simulations for different scenarios under certain realistic conditions using Qualnet network simulator. The results from the analysis and evaluation through simulations provide general design guidelines to implement the proposed solution.

2. A real-time computer vision system for vehicle tracking and traffic surveillance

Increasing congestion on freeways and problems associated with existing detectors have spawned an interest in new vehicle detection technologies such as video image processing. Existing commercial image processing systems work well in free-flowing traffic, but the systems have difficulties with congestion, shadows and lighting transitions. These problems stem from vehicles partially occluding one another and the fact that vehicles appear differently under various lighting conditions. We are developing a feature-based tracking system for detecting vehicles under these challenging conditions. Instead of tracking entire vehicles, vehicle features are tracked to make the system robust to partial occlusion. The system is fully functional under changing lighting conditions because the most salient features at the given moment are tracked. After the features exit the tracking region, they are grouped into discrete vehicles using a common motion constraint. The groups represent individual vehicle trajectories which can be

used to measure traditional traffic parameters as well as new metrics suitable for improved automated surveillance. This paper describes the issues associated with feature based tracking, presents the real-time implementation of a prototype system, and the performance of the system on a large data set.

3. Vehicle Tracking and Locking System Based on GSM and GPS

Currently almost of the public having an own vehicle, theft is happening on parking and sometimes driving insecurity places. The safe of vehicles is extremely essential for public vehicles. Vehicle tracking and locking system installed in the vehicle, to track the place and locking engine motor. The place of the vehicle identified using Global Positioning system (GPS) and Global system mobile communication (GSM). These systems constantly watch a moving Vehicle and report the status on demand. When the theft identified, the responsible person send SMS to the microcontroller, then microcontroller issue the control signals to stop the engine motor. Authorized person need to send the password to controller to restart the vehicle and open the door. This is more secured, reliable and low cost.

Hardware Requirements:

- Power Supply - DC Adaptor 9V/1A
- Controller - P89V51RD2
- LCD - Liquid Crystal Display, 16x 2 lines
- GPS
- MAX232 - For serial communication
- GSM SIM 300
- Accelerometer
- Alcohol Sensor

Software Requirements:

- Keil Micro vision.
- Embedded c.
- Willar Programmer(Flash Magic).

Applications:

- Vehicle Tracking
- Horticulture

Outcome:

- Complete knowledge of design and implementation of embedded system based on ARM7 controllers.
- Knowledge and Implementation of GPS,GSM & UART Technologies

CHAPTER II

The block diagram consist of power supply to give power to the entire components, LCD display to display the output, ARM7 as the main component used to interface and control entire component,Accelerometer sensors to detect the accident and ARM7 interfacing with GPS to read the location of the vehicle.GSM to send the location information to the owner.

The system consist of two modules

1. Transmitter section
2. Receiver section

2.1.1 Transmitter Section

The transmitter section does the function of controlling GSM and GPS,reading the location of vehicle,and to get information about the accidentoccured or not about the vehicle and then transmit signal to the microcontroller.

2.1.2 Receiver Section

The receiver section consists of mobile

2.2 System Requirements

The system designed in our project need basically two things:

2.2.1 Software Requirements

2.2.2 Hardware Requirements

2.2.1 Software Requirements

The system designing requires the following software's:

2.2.1.1 Keil Software

2.2.1.2 Flash magic

2.2.1.1 Keil Software

Keil Software development tools for the 8051 microcontroller family support every level of developer from the professional applications engineer to the student just learning about embedded software development. The industry-standard Keil C Compilers, Macro Assemblers, Debuggers, Real-time Kernels, and Single-board Computers support ALL 8051-compatible derivatives and help you get your projects completed on schedule.

Development Tools

The Keil development tools for the 8051 offer numerous features and advantages that help you quickly and successfully develop embedded applications. They are easy to use and are guaranteed to help you achieve your design goals. The µVision4 IDE is a Windows- based software development platform that combines a robust editor, project manager, and make facility. µVision4 supports all of the Keil tools for the 8051 including:

- C51 C Cross Compiler
- A51 Macro Assembler
- BL51 Code Banking Linker/Locator
- LIB51 Library Manager
- OC51 Banked Object File Converter
- OH51 Object Hex Converter

▪

Test Programs with the µVISION4 Debugger

This topic describes the Debug Mode of µVision4 and shows you how to use the user interface to test a sample program. Also discussed are simulation mode and the different options available for program debugging.

You can use µVision4 Debugger to test the applications you develop using the C51 Compiler and A51 macro assembler. The µVision4 Debugger offers two operating modes that are selected in the Options for Target – Debug dialog.

- Use Simulator allows configuring the µVision4 Debugger as software-only product that simulates most features of the 8051 microcontroller without actually having target hardware. You can test and debug your embedded application before the hardware is ready. µVision4 simulates a wide variety of peripherals including the serial port, external I/O, and timers. The peripheral set is selected when you select a CPU from the device database for your target.
- Use Advance GDI drivers, like the Keil ULINK ARM Debugger provide an interface to target hardware. With the Advanced GDI interface you may connect the µVision3 Debugger directly to emulators, Embedded ICE (On-chip Debug System) for example with the Keil ULINK USB-JTAG Adapter.

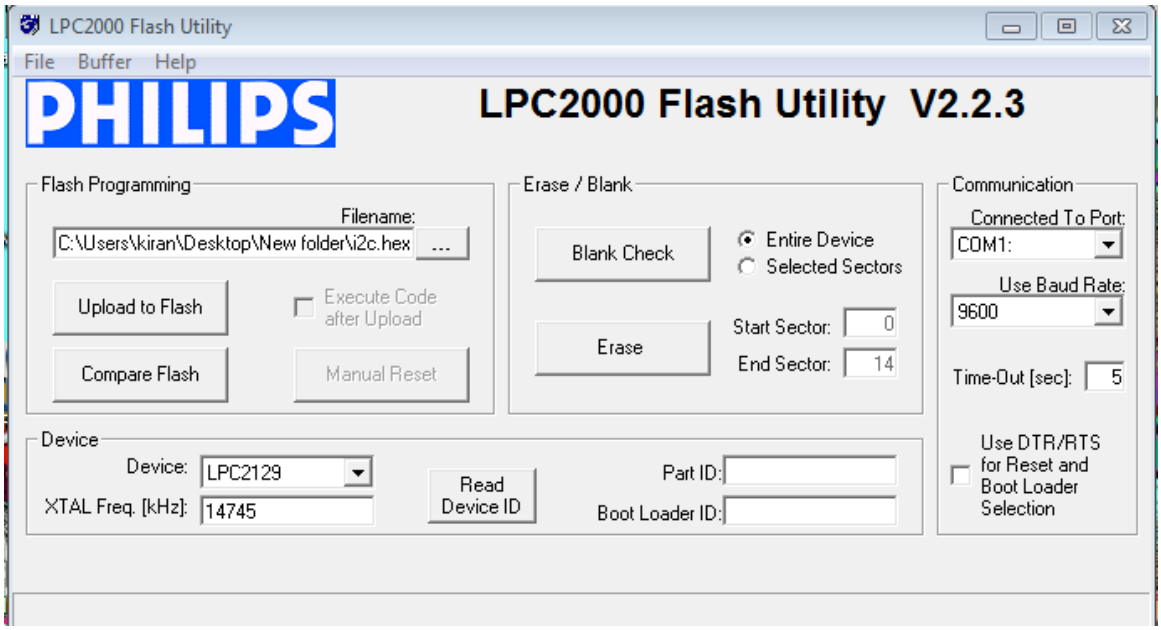
2.2.1.2 Flash utility

Philips Semiconductors produce a range of Microcontrollers that feature both on-chip Flash memory and the ability to be reprogrammed using In-System Programming technology. Flash utility is Windows software from the Embedded Systems Academy that allows easy access to all the ISP features provided by the devices.

These features include:

- Erasing the Flash memory (individual blocks or the whole device)
- Programming the Flash memory
- Modifying the Boot Vector and Status Byte
- Reading Flash memory
- Performing a blank check on a section of Flash memory
- Reading the signature bytes
- Reading and writing the security bits
- Direct load of a new baud rate (high speed communications)
- Sending commands to place device in Boot loader mode

Flash utility provides a clear and simple user interface to these features and more as described in the following sections. Under Windows, only one application may have access the COM Port at any one time, preventing other applications from using the COM Port. Flash utility only obtains access to the selected COM Port when ISP operations are being performed. This means that other applications that need to use the COM Port, such as debugging tools, may be used while Flash utility is loaded. Note that in this manual third party Compilers are listed alphabetically. No preferences are indicated or implied .



EMBEDDED C

Embedded C uses KEIL IDE software. The system program written in embedded C will be stored in Microcontroller. The following are some of the major reasons for writing programs in C instead of assembly. It is easier and less time consuming to write in C then assembly. C is easier to modify and update. You can use code available in function libraries. C code is portable to other microcontrollers with little or no modification. Historically, embedded C programming requires nonstandard extensions to the C language in order to support exotic features such as fixed-point arithmetic, multiple distinct memory banks, and basic I/O operations.

In 2008, the C Standards Committee extended the C language to address these issues by providing a common standard for all implementations to adhere to. It includes a number of features not available in normal C, such as, fixed-point arithmetic, named address spaces, and basic I/O hardware addressing.

Embedded C use most of the syntax and semantics of standard C, e.g., main() function, variable definition, data type declaration, conditional statements (if, switch. case), loops (while, for), functions, arrays and strings, structures and union, bit operations, macros, unions, etc.

Embedded systems programming

Embedded systems programming is different from developing applications on a desktop computers. Key characteristics of an embedded system, when compared to PCs, are as follows:

- Embedded devices have resource constraints (limited ROM, limited RAM, limited stack space, less processing power)
- Components used in embedded system and PCs are different; embedded systems typically uses smaller, less power consuming components. Embedded systems are more tied to the hardware.

Two salient features of Embedded Programming are code speed and code size. Code speed is governed by the processing power, timing constraints, whereas code size is governed by available program memory and use of programming language. Goal of embedded system programming is to get maximum features in minimum space and minimum time.

Embedded systems are programmed using different type of languages:

- Machine Code
- Low level language, i.e., assembly
- High level language like C, C++, Java, Ada, etc.
- Application level language like Visual Basic, scripts, Access, etc.

2.2.2 Hardware Requirements

The system to be designed is an automation system, where we are controlling the status of the devices sitting at remote place. Therefore the system requires the following hardware:

2.2.2.1 Microcontroller ARM7.

2.2.2.2 Power Supply 5V DC.

2.2.2.3 Liquid crystal display (LCD) 16X2

2.2.2.4 GSM 300.

2.2.2.5 GPS

2.2.2.6 ACCELEROMETER

2.2.2.1 Microcontroller ARM7

ARM CONTROLLER

ARM is a family of instruction set architectures for computer processors based on a reduced instruction set computing (RISC) architecture developed by British company ARM Holdings.

A RISC-based computer design approach means ARM processors require significantly fewer transistors than typical CISC x86 processors in most personal computers. This approach reduces costs, heat and power use. These are desirable traits for light, portable, battery-powered devices—including smart phones, laptops, tablet and notepad computers, and other embedded systems. A simpler design facilitates more efficient multi-core CPUs and higher core counts at lower cost, providing improved energy efficiency for servers.

ARM Holdings develops the instruction set and architecture for ARM-based products, but does not manufacture products. The company periodically releases updates to its cores. Current cores from ARM Holdings support a 32-bit address space and 32-bit arithmetic; the ARMv8-A architecture, announced in October 2011,[6] adds support for a 64-bit address space and 64-bit arithmetic. Instructions for ARM Holdings' cores have 32 bits wide fixed-length instructions, but later versions of the architecture also support a variable-length instruction set that provides both 32 and 16 bits wide instructions for improved code density. Some cores can also provide hardware execution ofJava byte codes.

ARM Holdings licenses the chip designs and the ARM instruction set architectures to third-parties, who design their own products that implement one of those architectures—including systems-on-chips (SoC) that incorporate memory, interfaces, radios, etc. Currently, the widely used Cortex cores, older "classic" cores, and specialized Secur Core cores variants are available for each of these to include or exclude optional capabilities. Companies that make chips that implement an ARM architecture include Apple, Nvidia, Qualcomm,Samsung Electronics, and Texas Instruments. Apple first implemented the new (backwards compatible) ARMv8-A architecture in the Apple A7 chip in theiPhone 5S.

Globally ARM is the most widely used 32-bit instruction set architecture in terms of quantity produced.[7][8][9][10] The low power consumption of ARM processors has made them very

popular: over 50 billion ARM processors have been produced as of 2014, thereof 10 billion in 2013[11] and "ARM-based chips are found in nearly 60 percent of the world's mobile devices". In 2008, 10 billion chips had been produced.[12] The ARM architecture (32-bit) is the most widely used architecture in mobile devices, and most popular 32-bit one in embedded systems.[13] In 2005, about 98% of all mobile phones sold used at least one ARM processor.[14] According to ARM Holdings, in 2010 alone, producers of chips based on ARM architectures reported shipments of 6.1 billion ARM-based processors, representing 95% of smartphones, 35% ofdigital televisions and set-top boxes and 10% of mobile computers.

4.2 LPC2148 MICRO-CONTROLLER

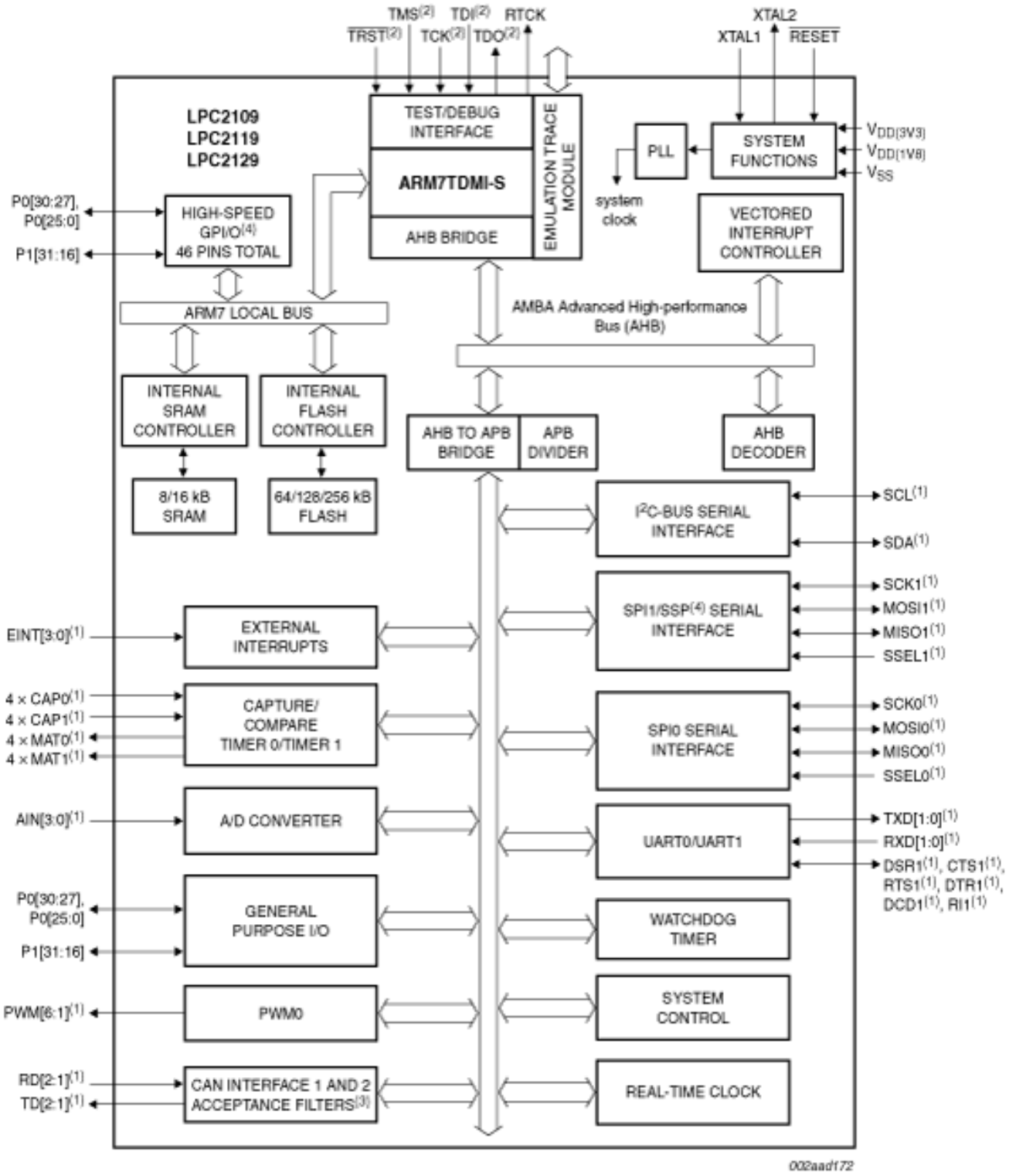


Fig 4.2 Block diagram of LPC2148

4.2.1 GENERAL DESCRIPTION

LPC2148 is the widely used IC from ARM-7 family. It is manufactured by Philips and it is pre-loaded with many inbuilt peripherals making it more efficient and a reliable option for the beginners as well as high end application developer.

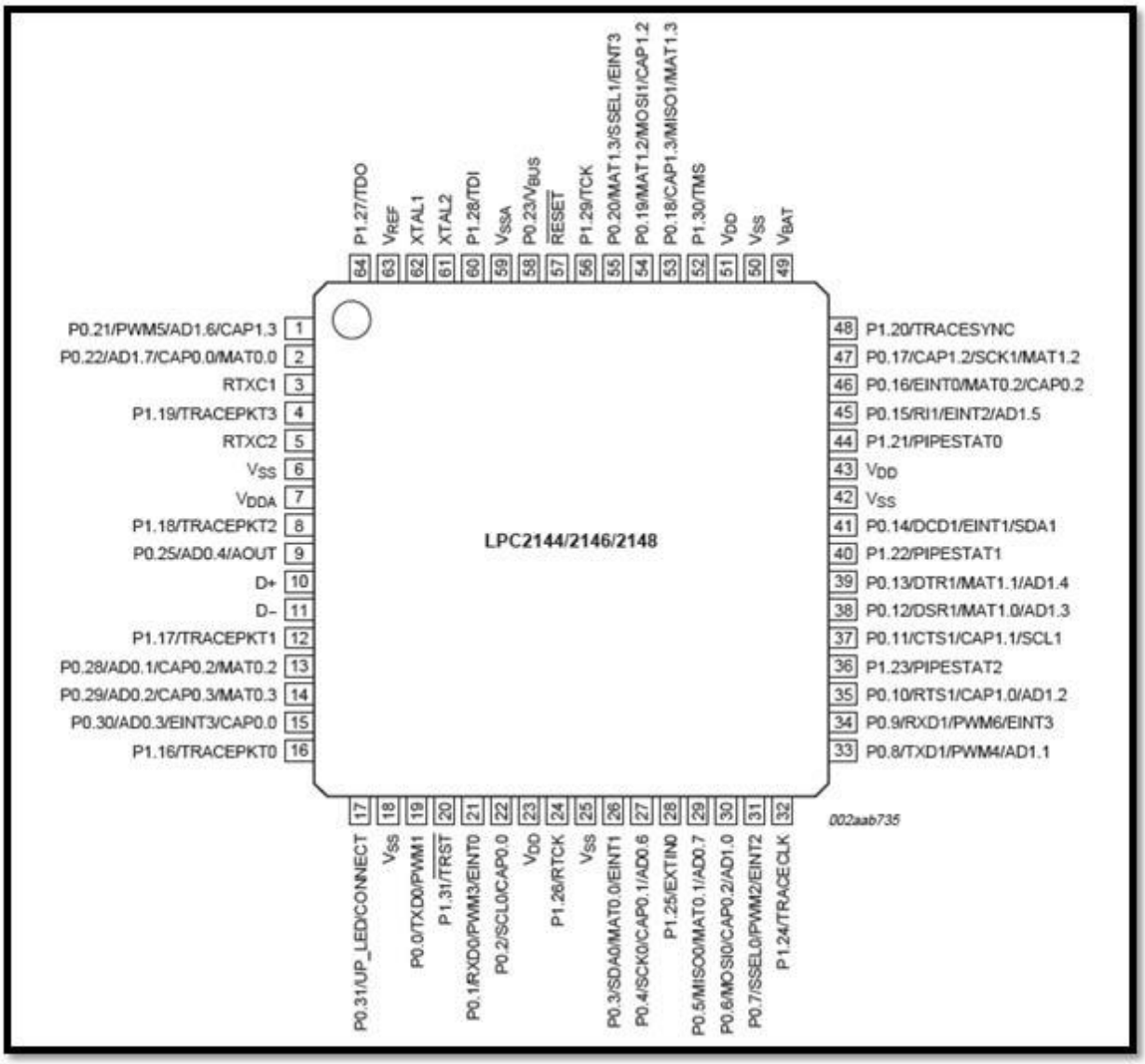
Let us go through the **features of LPC214x series controllers**.

• 8 to 40 kB of on-chip static RAM and 32 to 512 kB of on-chip flash program memory.128 bit wide interface/accelerator enables high speed 60 MHz operation.
• In-System/In-Application Programming (ISP/IAP) via on-chip boot-loader software.Single flash sector or full chip erase in 400 ms and programming of 256 bytes in 1ms.
• EmbeddedICE RT and Embedded Trace interfaces offer real-time debugging with theon-chip RealMonitor software and high speed tracing of instruction execution.
• USB 2.0 Full Speed compliant Device Controller with 2 kB of endpoint RAM.In addition, the LPC2146/8 provides 8 kB of on-chip RAM accessible to USB by DMA.
• One or two (**LPC2141/2 vs. LPC2144/6/8**) 10-bit A/D converters provide a total of 6/14analog inputs, with conversion times as low as 2.44 us per channel.
• Single 10-bit D/A converter provides variable analog output.
• Two 32-bit timers/external event counters (with four capture and four comparechannels each), PWM unit (six outputs) and watchdog.
• Low power real-time clock with independent power and dedicated 32 kHz clock input.
• Multiple serial interfaces including two UARTs (16C550), two Fast I2C-bus(400 kbit/s), SPI and SSP with buffering and variable data length capabilities.
• Vectored interrupt controller with configurable priorities and vector addresses.
• Up to 45 of 5 V tolerant fast general purpose I/O pins in a tiny LQFP64 package.
• Up to nine edge or level sensitive external interrupt pins available.
• On-chip integrated oscillator operates with an external crystal in range from 1 MHz to30 MHz and with an external oscillator up to 50 MHz.
• Power saving modes include Idle and Power-down.
• Individual enable/disable of peripheral functions as well as peripheral clock scaling foradditional power optimization.
• Processor wake-up from Power-down mode via external interrupt, USB, Brown-OutDetect (BOD) or Real-Time Clock (RTC).
• Single power supply chip with Power-On Reset (POR) and BOD circuits:
– CPU operating voltage range of 3.0 V to 3.6 V (3.3 V ± 10 %) with 5 V tolerant I/Opads.

4.2.2 FEATURES:

• 16/32-bit ARM7TDMI-S microcontroller in a 64 or 144 pin package.
• 16 kB on-chip Static RAM
• 128/256 kB on-chip Flash Program Memory. 128-bit wide interface/accelerator enables high speed 60 MHz operation.
• External 8, 16 or 32-bit bus (144 pin package only)
• 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.
• EmbeddedICE-RT interface enables breakpoints and watch points. Interrupt service routines can continue to execute whilst the foreground task is debugged with the on-chip RealMonitor software.
• Embedded Trace Macrocell enables non-intrusive high speed real-time tracing of instruction execution.
• Two/four interconnected CAN interfaces with advanced acceptance filters.
• Four/eight channel (64/144 pin package) 10-bit A/D converter with conversion time as low as 2.44 ms.
• Two 32-bit timers (with 4 capture and 4 compare channels), PWM unit (6 outputs), Real Time Clock and Watchdog.
• Multiple serial interfaces including two UARTs (16C550), Fast I2C (400 kbits/s) and two SPIs™.
• 60 MHz maximum CPU clock available from programmable on-chip Phase-Locked Loop.
• Vectored Interrupt Controller with configurable priorities and vector addresses.
• Up to forty-six (64 pin) and hundred-twelve (144 pin package) 5 V tolerant general purpose I/O pins. Up to 12 independent external interrupt pins available (EIN and CAP functions).
• On-chip crystal oscillator with an operating range of 1 MHz to 30 MHz.
• Two low power modes, Idle and Power-down.
• Processor wake-up from Power-down mode via external interrupt.
• Individual enable/disable of peripheral functions for power optimization.
• 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%).



2.2.2.2 Power Supply Designing

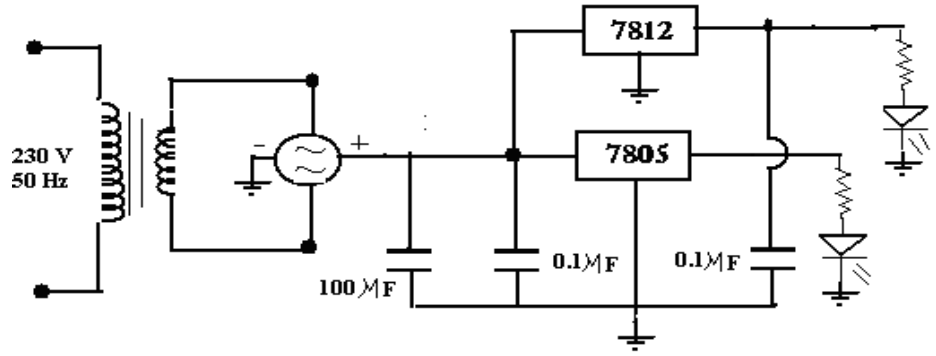


Figure 2.7 regulated power supply for +5/+12 v circuit diagram

Circuit Description:

A D.C. power supply which maintains the output voltage constant irrespective of A.C. mains fluctuations or load variations is known as regulated D.C. power supply**.** It is also referred as full-wave regulated power supply as it uses two diodes in full wave fashion with centre tap transformer.

Power Supply:

Power supply is a reference to a source of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others. Here in our application we need a 5V DC power supply for all electronics involved in the project. This requires step down transformer, rectifier, voltage regulator, and filter circuit for generation of 5V DC power. Here a brief description of all the components is given as follows:

Transformer:

Transformer is a device that transfers electrical energy from one circuit to another through inductively coupled conductors the transformer's coils or "windings". Except for air-core Transformers, the conductors are commonly wound around a single iron-rich core, or around separate but magnetically-coupled cores. A varying current in the first or "primary" winding creates a varying magnetic field in the core (or cores) of the transformer. This varying magnetic field induces a varying electromotive force (EMF) or "voltage" in the "secondary" winding. This effect is called mutual induction.

FIGURE 3.8 TRANSFORMERS

If a load is connected to the secondary circuit, electric charge will flow in the secondary winding of the transformer and transfer energy from the primary circuit to the load connected in the secondary circuit. The secondary induced voltage VS, of an ideal transformer, is scaled from the primary VP by a factor equal to the ratio of the number of turns of wire in their respective windings:

$$\frac{V_S}{V_P} = \frac{N_S}{N_P}$$

By appropriate selection of the numbers of turns, a transformer thus allows an alternating voltage to be stepped up by making NS more than NP — or stepped down, by making it.

BASIC PARTS OF A TRANSFORMER

In its most basic form a transformer consists of:

· A primary coil or winding.

· A secondary coil or winding.

· A core that supports the coils or windings.

Refer to the transformer circuit in figure as you read the following explanation: The primary winding is connected to a 60-hertz ac voltage source. The magnetic field (flux) builds up (expands) and collapses (contracts) about the primary winding. The expanding and contracting magnetic field around the primary winding cuts the secondary winding and induces an alternating voltage into the winding. This voltage causes alternating current to flow through the load. The voltage may be stepped up or down depending on the design of the primary and secondary windings.

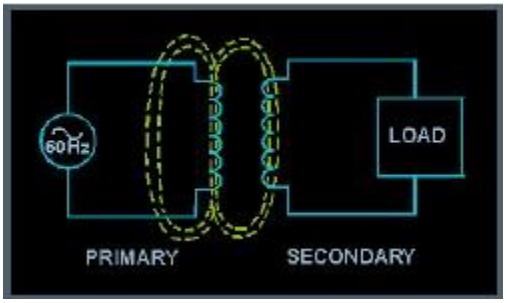


Figure 2.9 basic parts of transformer

The Components of a Transformer

Two coils of wire (called windings) are wound on some type of core material. In some cases the coils of wire are wound on a cylindrical or rectangular cardboard form. In effect, the core material is air and the transformer is called an AIR-CORE TRANSFORMER. Transformers used at low frequencies, such as 60 hertz and 400 hertz, require a core of low-reluctance magnetic material, usually iron. This type of transformer is called an IRON-CORE TRANSFORMER. Most power transformers are of the iron-core type. The principle parts of a transformer and their functions are:

• The CORE, which provides a path for the magnetic lines of flux.

• The PRIMARY WINDING, which receives energy from the ac source.

• The SECONDARY WINDING, which receives energy from the primary winding and delivers it to the load.

• The ENCLOSURE, which protects the above components from dirt, moisture, and mechanical damage.

Bridge Rectifier

A bridge rectifier makes use of four diodes in a bridge arrangement to achieve full-wave rectification. This is a widely used configuration, both with individual diodes wired as shown and with single component bridges where the diode bridge is wired internally.

Basic Operation

According to the conventional model of current flow originally established by Benjamin Franklin and still followed by most engineers today, current is assumed to flow through electrical conductors from the positive to the negative pole. In actuality, free electrons in a conductor nearly always flow from the negative to the positive pole. In the vast majority of applications, however, the actual direction of c current flow is irrelevant. Therefore, in the discussion below the conventional model is retained.

In the diagrams below, when the input connected to the left corner of the diamond is positive, and the input connected to the right corner is negative, current flows from the e upper supply terminal to the right along the red (positive) path to the output, and returns to the lower supply terminal via the blue (negative) path.

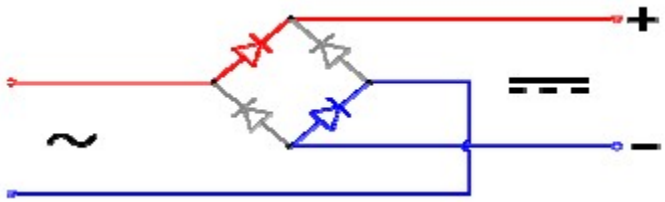


Figure 2.10 bridge rectifiers

When the input connected to the left corner is negative, and the input connected to the right corner is positive, current flows from the lower supp ply terminal to the right along the red path to the output, and returns to the upper supply terminal via the blue path.

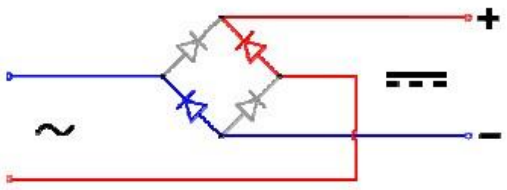


Figure 2.11 bridge rectifier

In each case, the upper right output remains positive and lower right output negative. Since this is true whether t the input is AC or DC, this circuit not only produces a DC output from an AC input, it can also provide what is sometimes called "reverse polarity protection". That is, it permits normal functioning of DC-powered equipment when batteries have been installed backwards, or when n the leads (wires) from a DC power source have been reversed, and protects the equipment from potential damage caused by reverse polarity.

Prior to availability of integrated electronics, such a bridge rectifier was always constructed from discrete components. Since about 1950, a single four-terminal component containing the four diodes connected in the bridge configuration became a standard commercial component and is now available with various voltage and current ratings.

Output Smoothing

For many applications, especially with single phase AC where the full-wave bridge input into a DC serves to convert an AC in output, the addition n of a capacitor may be desired because the bridge alone supplies an output of fixed polarity but continuously varying or "pulsating" magnitude e (see diagram above).

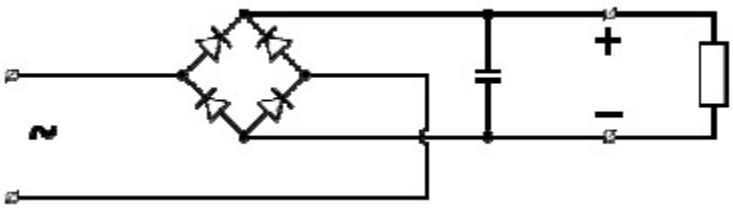


Figure 2.12 bridge rectifiers output smoothing

The function of this capacitor, known as a reservoir capacitor (or smoothing capacitor) is to lesser the variation in (or 'smooth') the rectified AC output voltage waveform from t the bridge. One explanation of 'smoothing' is that the capacitor provides a low impedance path to the AC component of the output, reducing the AC voltage across, and AC current through, the resistive load. In less technical terms, any drop in the output voltage and current of the bridge tends to be canceled by loss of charge in the capacitor. This charge flows out as additional current through the load. Thus the change of load current and voltage is reduced relative to what would occur without the capacitor. Increases of voltage correspondingly store excess charge in the capacitor, thus moderating the change in output voltage / current.

The simplified circuit shown has a well-deserved reputation for being dangerous, because, in some applications, the capacitor can retain a lethal charge after the AC power source is removed. If supplying a dangerous voltage, a practical circuit should include a reliable way to safely discharge the capacitor. If the normal load cannot be guaranteed to perform this function, perhaps because it can be disconnected, the circuit should include a bleeder resistor connected as close as practical across the capacitor. This resistor should consume a current large enough to discharge the capacitor in a reasonable time, but small enough to minimize unnecessary power waste. Because a bleeder sets a minimum current drain, the regulation of the circuit, defined as percentage voltage change from minimum to maximum load, is improved. However in many cases the improvement is of insignificant magnitude.

The capacitor and the load resistance have a typical time constant t = RC where C and R are the capacitance and load resistance respectively. As long as the load resistor is large enough so that this time constant is much longer than the time of one ripple cycle, the above configuration will produce a smoothed DC voltage across the load.

In some designs, a series resistor at the load side of the capacitor is added. The smoothing can then be improved by adding additional stages of capacitor–resistor pairs, often done only for sub-supplies to critical high-gain circuits that tend to be sensitive to supply voltage noise.

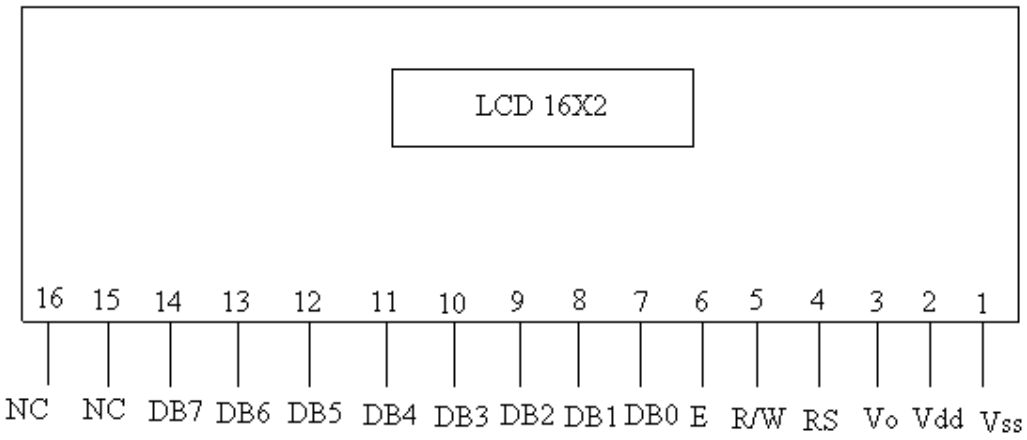
The idealized waveforms shown above are seen for both voltage and current when the load on the bridge is resistive. When the load includes a smoothing capacitor, both the voltage and the current waveforms will be greatly changed. While the voltage is smoothed, as described above, current will flow through the bridge only during the time when the input voltage is greater than the capacitor voltage. For example, if the load draws an average current of n Amps, and the diodes conduct for 10% of the time, the average diode current during conduction must be 10n Amps. This non-sinusoidal current leads to harmonic distortion and a poor power factor in the AC supply. In a practical circuit, when a capacitor is directly connected to the output of a bridge, the bridge diodes must be sized to withstand the current surge that occurs when the power is turned on at the peak of the AC voltage and the capacitor is fully discharged. Sometimes a small series resistor is included before the capacitor to limit this current, though in most applications the power supply transformer's resistance is already sufficient. Output can also be smoothed using a choke and second capacitor. The choke tends to keep the current (rather than the voltage) more constant. Due to the relatively high cost of an effective choke compared to a resistor and capacitor this is not employed in modern equipment.

Some early console radios created the speaker's constant field with the current from the high voltage ("B +") power supply, which was then routed to the consuming circuits, (permanent magnets were then too weak for good performance) to create the speaker's constant magnetic field. The speaker field coil thus performed 2 jobs in one: it acted as a choke, filtering the power supply, and it produced the magnetic field to operate the speaker.

LCD –16 X 2(LIQUID CRYSTAL DISPLAY)

Figure .LCD

Liquid crystal display (LCD) offers several advantages over traditional cathode ray tube that makes them ideal for several applications. Of course LCD's are flat and they use only a fraction of power required by cathode ray tubes. They are easier to read and more pleasant to work with for long periods of time. There are several tradeoffs as well, such as limited view angle, brightness and contrast, not to maintain high manufacturing cost. 16x2 LCD is used in this project to display data to user. There are two rows and sixteen columns. It is possible to display 16 characters on each of the 2 rows. It has registers, command and data register.



LCD pin description

Specifications of LCD

16x2 LCD is used in REDTACTON. 16 imply 16 columns and 2 imply 2 rows.

Pin 1:- Ground

Pin 2:- +5V supply

Pin 3:- Connected to potentiometer to adjust contrast

Pin 4:- Reset

Pin 5:- Read/Write. Reads data from microcontroller and writes in LCD.

Pin 6:- Enable and disable total LCD operations.

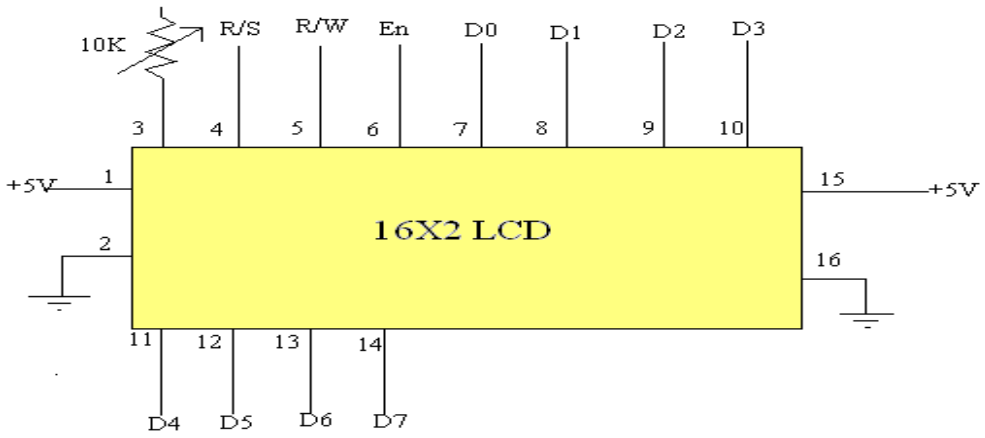
Pin 7-14:- 8-bit Data Registers

16 x 2 Alphanumeric LCD Module Features

- Intelligent, with built-in compatible LCD controller and RAM providing simple interfacing
- 61 x 15.8 mm viewing area

- 5 x 8 dot matrix format for 2.96 x 5.56 mm characters, plus cursor line
- Can display 224 different symbols
- Low power consumption (1 mA typical)
- Powerful command set and user-produced characters
- TTL and CMOS compatible.

LCD circuit diagram



Pin Diagram of LCD

The user may select whether the LCD is to operate with a 4-bit data bus or an 8-bit data bus. If a 4-bit data bus is used, the LCD will require a total of 7 data lines (3 control lines plus the 4 lines for the data bus). If an 8-bit data bus is used, the LCD will require a total of 11 data lines (3 control lines plus the 8 lines for the data bus.)

The control lines are referred to as EN, RS, and RW. The EN line is called “Enable”. This control line is used to tell the LCD that you are sending it data. To send data to the LCD, your program should first set this line high (1) and then set the other two control lines and/or put data on the data bus. When the other lines are completely ready, bring EN low (0) again.

The RS line is the "Register Select" line. When RS is low(0), the data is to be treated as a command or special instruction (such as clear screen, position cursor, etc.). When RS is high (1), the data being sent is text data which should be displayed on the screen. For example, to display the letter "T" on the screen you would set RS high.

4.3.2 PIN DESCRIPTION OF LCD:

Pin No	Function	Name
1	Ground (0V)	Ground
2	Supply voltage; 5V (4.7V – 5.3V)	Vcc
3	Contrast adjustment; through a variable resistor	V_{EE}
4	Selects command register when low; and data register when high	Register Select
5	Low to write to the register; High to read from the register	Read/write
6	Sends data to data pins when a high to low pulse is given	Enable
7	8-bit data pins	DB0
8		DB1
9		DB2
10		DB3
11		DB4
12		DB5
13		DB6
14		DB7
15	Backlight V_{CC} (5V)	Led+
16	Backlight Ground (0V)	Led-

Table 4.3.2 Pin description of LCD

The RW line is the "Read/Write" control line. When RW is low (0), the information on the data bus is being written to the LCD. When RW is high (1), the program is effectively querying (or reading) the LCD. Only one instruction ("Get LCD status") is a read command. All others are write commands—so RW will almost always be low. Finally, the data bus consists of 4 or 8 lines (depending on the mode of operation selected by the user). In the case of an 8-bit data bus, the lines are referred to as DB0, DB1, DB2, DB3, DB4, DB5, DB6 and DB7.

GPS MODULE

The **Global Positioning System** (**GPS**) is a space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites. The system provides critical capabilities to military, civil and commercial users around the world. It is maintained by the United States government and is freely accessible to anyone with a GPS receiver.

Features

- Support 32-channel GPS
- Up to 5hz update rate
- LED indicator for GPS fix or not fix.

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The GPS project was developed in 1973 to overcome the limitations of previous navigation systems, integrating ideas from several predecessors, including a number of classified engineering design studies from the 1960s. GPS was created and realized by the U.S. Department of Defense (DoD) and was originally run with 24 satellites. It became fully operational in 1995. Bradford Parkinson, Roger L. Easton, and Ivan A. Getting are credited with inventing it.

Advances in technology and new demands on the existing system have now led to efforts to modernize the GPS system and implement the next generation of GPS III satellites and Next Generation Operational Control System (OCX). Announcements from Vice President Al Gore and the White House in 1998 initiated these changes. In 2000, the U.S. Congress authorized the modernization effort, GPS III.

In addition to GPS, other systems are in use or under development. The Russian Global Navigation Satellite System (GLONASS) was developed contemporaneously with GPS, but

suffered from incomplete coverage of the globe until the mid-2000s.[4] There are also the planned European Union Galileo positioning system, India's Indian Regional Navigational Satellite System and Chinese Compass navigation system.

4.7 SERIAL COMMUNICATION

In some cases, such as printers, the information is simply grabbed from the 8 bit data bus and presented to the 8 bit data bus of the printer. This can work only if the is not too long, since long cables diminish and even distort signals. Furthermore, an 8 bit data bus is expensive. For these reasons, serial communication is used for transferring data between two systems located at distances of hundreds of feet to millions of miles apart. The fact that serial; communication uses a single data line instead of 8 bit data line of parallel communication not only makes it cheaper but also enables two computers located in two different cities to communicate over the telephone.

For serial data communication to work, the byte of data must be converted to serial bits using parallel-in-serial out shift register. Then it can be transmitted over a single line. In the receiving end there must be a serial-in-parallel out shift register to receive serial data and pack them in to bytes.

Serial data communication uses two methods, asynchronous and synchronous. The synchronous method transfers a block of data at a time, while the asynchronous method transfers a single byte at a time.

4.7.1 Half and full duplex transmission

In data transmission if the data can be transmitted and received, it is a duplex transmission. This is in contrast to simplex transmission such as with printers, in which the computer only sends the data. If data is transmitted one way at a time, it is referred to as half duplex. If the data can go both the ways at the same time, it is full duplex.

4.7.2 Asynchronous serial communication and data framing

The data coming in at receiving end of the data line in a serial data transfer is all 0s and 1s.it is difficult to make sense of the data unless the sender and the receiver agree on a set of

rules, a protocol, on how the data is packed, how many bits constitute a character, and when the data begins and ends.

Asynchronous serial data transmission is widely used for character oriented transmission, while block oriented transmission use synchronous method. In asynchronous method, each character is placed between start and stop bits. This is called framing. In data framing start bit is always one bit, but the stop bit can be one or two bits. The start bit is always a 0(low) and stop bit(s) is 1(high).When there is no transfer of data; the signal is 1(high), which is referred to as mark. The low is referred to as space. The transmission begins with a start bit followed by D0, which is LSB, then the rest of the bits until MSB (D7), and finally, one or two stop bits indicating the end of the character.

Assuming that we are transferring a text file of ASCII characters using one stop bit, we have a total of 10 bits for each character; 8bits for the ASCII code and one bit each for start and stop bits which give 20% overhead.

HALF AND FULL DUPLEX TRANSMISSION

In data transmission if data can be transmitted and received, it is a duplex transmission. This is in contrast to simplex transmissions as in printers in which only the computer sends data. Duplex transmissions can be half or full duplex, depending on whether or not the data transfer can be simultaneous. If data is transmitted one way at a time, it is referred to as half duplex. If the data can go both ways at the same time it is full duplex. Hence there are two wire conductors for Transmission and Reception.

DATA TRANSFER RATE

The rate of data transmission in serial data communication is stated in BPS (bits per second). This is commonly termed as Baud rate. The data transfer of a

given computer depends on communication ports incorporated into the system. It must be noted that in asynchronous serial data communication, the baud rate is generally limited to100, 000.

MAX 232

Serial RS-232 (V.24) communication works with voltages (between -15V to -3V are used to transmit a binary '1' and +3V to +15V to transmit a binary '0') which are not compatible with today's computer logic voltages. On the other hand, classic TTL computer logic operates between 0V to +5V (roughly 0V to +0.8V referred to as low for binary '0', +2V to +5V for high binary '1'). Modern low-power logic operates in the range of 0V to +3.3V or even lower.

So, the maximum RS-232 signal levels are far too high for today's computer logic electronics, and the negative RS-232 voltage can't be grokked at all by the computer logic. Therefore, to receive serial data from an RS-232 interface the voltage has to be reduced, and the 0 and 1 voltage levels inverted. In the other direction (sending data from some logic over RS-232) the low logic voltage has to be "bumped up", and a negative voltage has to be generated, too.

RS-232 TTL Logic

-15V ... -3V <-> +2V ... +5V <-> 1

+3V ... +15V <-> 0V ... +0.8V <-> 0

All this can be done with conventional analog electronics, e.g. a particular power supply and a couple of transistors or the once popular 1488 (transmitter) and 1489 (receiver) ICs. However, since more than a decade it has become standard in amateur electronics to do the necessary signal level conversion with an integrated circuit (IC) from the MAX232 family (typically a MAX232A or some clone). In fact, it is hard to find some RS-232 circuitry in amateur electronics without a MAX232A or some clone.

The MAX232 & MAX232A

The MAX232 from Maxim was the first IC which in one package contains the necessary drivers (two) and receivers (also two), to adapt the RS-232 signal voltage levels to TTL logic. It became popular, because it just needs one voltage (+5V) and generates the necessary RS-232 voltage levels (approx. -10V and +10V) internally. This greatly simplified the design of circuitry. Circuitry designers no longer need to design and build a power supply with three voltages (e.g. -12V, +5V, and +12V), but could just provide one +5V power supply, e.g. with the help of a simple 78x05 voltage converter.

The MAX232 has a successor, the MAX232**A**. The ICs are almost identical, however, the MAX232A is much more often used (and easier to get) than the original MAX232, and the MAX232A only needs external capacitors 1/10th the capacity of what the original MAX232 needs.

It should be noted that the MAX232 (A) is just a driver/receiver. It does not generate the necessary RS-232 sequence of marks and spaces with the right timing, it does not decode the RS-232 signal, and it does not provide a serial/parallel conversion. All it does is to convert signal voltage levels. Generating serial data with the right timing and decoding serial data has to be done by additional circuitry, or one of these small micro controllers getting more and more popular.

The MAX232 and MAX232A were once rather expensive ICs, but today they are cheap. It has also helped that many companies now produce clones. These clones sometimes need different external circuitry, e.g. the capacities of the external capacitors vary. It is recommended to check the data sheet of the particular manufacturer of an IC instead of relying on Maxim's original data sheet.

The original manufacturer (and now some clone manufacturers, too) offers a large series of similar ICs, with different numbers of receivers and drivers, voltages, built-in or external capacitors, etc. E.g. The MAX232 and MAX232A need external capacitors for the internal voltage pump, while the MAX233 has these capacitors built-in. The MAX233 is also between three and ten times more expensive in electronic shops than the MAX232A because of its

internal capacitors. It is also more difficult to get the MAX233 than the garden variety MAX232A.

A similar IC, the MAX3232 is nowadays available for low-power 3V logic.

MAX232(A) DIP Package Pin Layout

Nbr	Name	Purpose	Signal Voltage	Capacitor Value MAX232	Capacitor Value MAX232A
1	C1+	+ connector for capacitor C1	capacitor should stand at least 16V	1µF	100nF
2	V+	output of voltage pump	+10V, capacitor should stand at least 16V	1µF to VCC	100nF to VCC
3	C1-	- connector for capacitor C1	capacitor should stand at least 16V	1µF	100nF
4	C2+	+ connector for capacitor C2	capacitor should stand at least 16V	1µF	100nF

5	C2-	- connector for capacitor C2	capacitor should stand at least 16V	1µF	100nF
6	V-	output of voltage pump / inverter	-10V, capacitor should stand at least 16V	1µF to GND	100nF to GND
7	T2out	Driver 2 output	RS-232		
8	R2in	Receiver 2 input	RS-232		
9	R2out	Receiver 2 output	TTL		
10	T2in	Driver 2 input	TTL		
11	T1in	Driver 1 input	TTL		
12	R1out	Receiver 1 output	TTL		
13	R1in	Receiver 1 input	RS-232		
14	T1out	Driver 1 output	RS-232		
15	GND	Ground	0V	1µF to VCC	100nF to VCC
16	VCC	Power supply	+5V	see above	see above

Table 2.2 Max232 (A) dip package pin layout

V+ (2) is also connected to VCC via a capacitor (C3). V-(6) is connected to GND via a capacitor (C4). And GND (16) and VCC (15) are also connected by a capacitor (C5), as close as possible to the pins.

The Pin details of MAX 232:

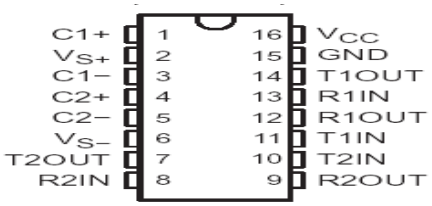


Figure 2.3 pin diagram of MAX232

TRANSMITTER SECTION

The transmitter section is divided into 5 parts

- Basic Microcontroller module.
- MAX 232 Module with DB9 connector.
- Interfacing of Microcontroller and MAX232.

- **BASIC MICROCONTROLLER MODULE**

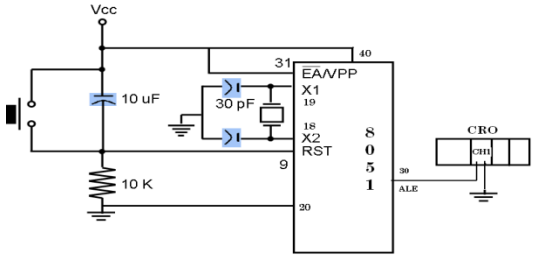


Figure 2.4 microcontroller module

- Connect a crystal across XTAL1 (19) & XTAL2 (18) pin of microcontroller with a bypass capacitor.
- Check the connection of pin no 31
  - If not connected, then connect to +VCC to use on chip ROM for programming.
  - Else connect it to ground to use external ROM.

Testing Of 8051 IC

- Insert the IC in IC slot and connect a CRO at pin 30 (ALE) of microcontroller.
- Switch ON the power supply.

Check the o/p at CRO, which should be a square wave with 1/6 the freq of crystal. I.e. a square wave with 0.6 micro seconds time interval is generated

- **MAX 232 Module with DB-9 Connector**

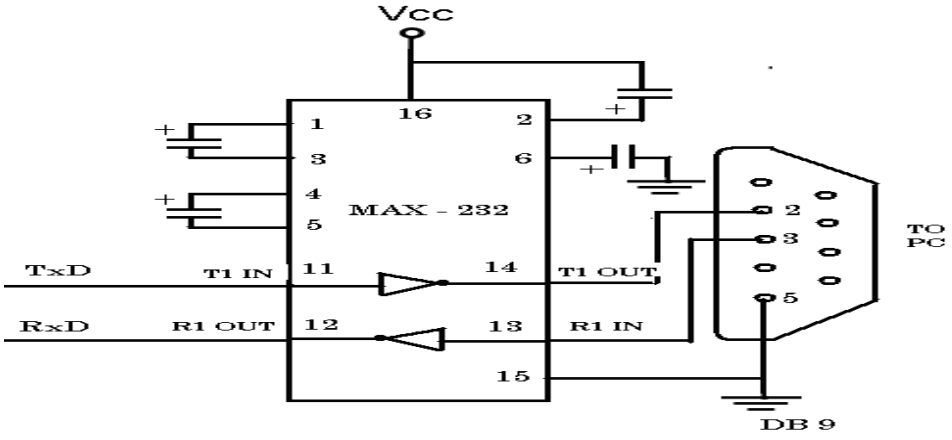


Figure 2.5 MAX 232 circuit diagram with db9

Testing Of MAX 232 Module

- Test point for MAX – 232 is to check voltage levels at pin 2 & pin 6 after voltage.
- Expected voltage at pin 2 is double of supply voltage & at pin6 is negative double of supply voltage.
- Test the transmission of data by making T1in as logic'1'=5V (TTL) and check the o/p at T1out which will be (-3 to -15) V RS232 level. Similarly give TTL Logic'0' = 0V at T1in and check output at T1out which will be (3 to 15) V RS232 level.
- Test reception by giving RS232 Logic1 level at R1in i.e. (-3 to -15) V and observe TTL Logic 1 at R1out i.e. (2 to 5) V. Similarly for logic 0.

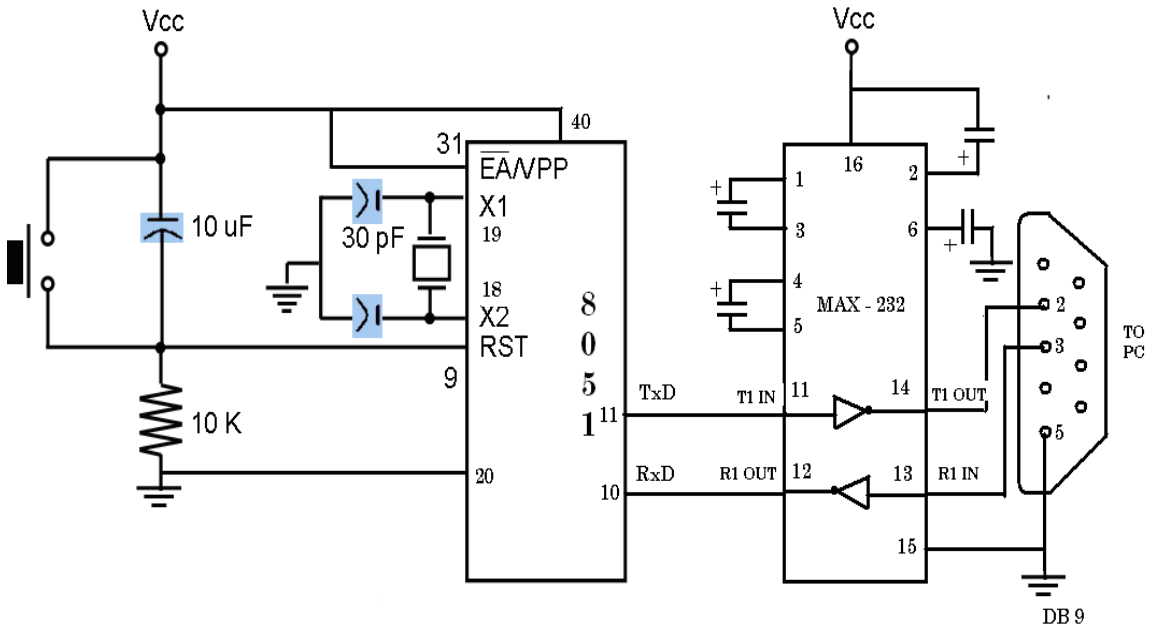


Figure 2.6 interfacing of microcontroller and MAX232

This module is used for wired communication between PC and Microcontroller for serial communication and wired load control [7].

4.9.1 LCD initialization

This is the pit fall for beginners. Proper working of LCD depend on the how the LCD is initialized. We have to send few command bytes to initialize the LCD. Simple steps to initialize the LCD

1. Specify function set: Send 38H for 8-bit, double line and 5x7 dot character format.

2. Display On-Off control: Send 0FH for display and blink cursor on.

3. Entry mode set: Send 06H for cursor in increment position and shift is invisible.

4. Clear display: Send 01H to clear display and return cursor to home position.

4.9.2 Role of LCD

The LCD module is used in the vehicle anti-collision system to display the range information which is calculated by LV Max Sonar-EZ1 and also to display one of the three zones in which the vehicle is present. If the distance displayed is above 20 inches it displays “safe” zone. If the distance is between 15 and 19 inches, then it displays “alert” zone. If the distance is below 15 inches, the LCD will display “stop” zone.

This LCD can be used to display 16 characters in 2 rows. It has the ability to display numbers, characters and graphics. It has an inbuilt refreshing circuit, thereby relieving the CPU from the task of refreshing. LCD discussed has total of 14 pins [7].

4.9.3 LCD pin Description

Pin	Symbol	I/O	Description
1	VSS	-	Ground
2	VCC	-	+5V Power Supply
3	VEE	-	Power Supply to contrast

4	RS	I	RS = 0 to select command register
5	R/W	I	RS = 1 to select data register
6	EN	I/O	Enable
7 to 14	D0 to D8	I/O	8 bit data bus

Table 4.7 LCD pin descriptions

4.9.4 LCD Command Codes

Code(HEX)	Command to LCD Instruction Register
1	Clear display screen
2	Return home
4	Decrement cursor (shift cursor to left)
6	Increment cursor (shift cursor to right)
80	Force cursor to the beginning of first line
C0	Force cursor to the beginning of second line
38	2 lines and 5x7 matrix

Table 4.8 LCD command codes

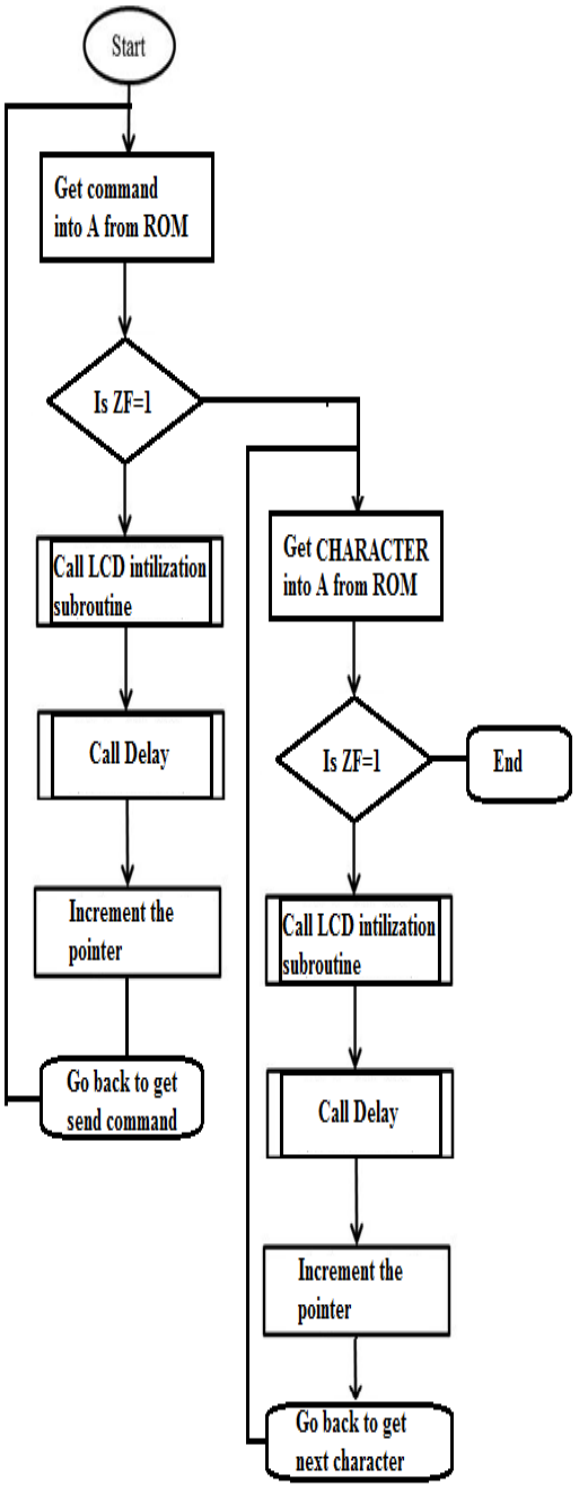
4.9.5 Algorithm to send data to LCD

- Make R/W low.
- Make RS=0; if data byte is command.
- RS=1; if data byte is data (ASCII value).
- Place data byte on data register.

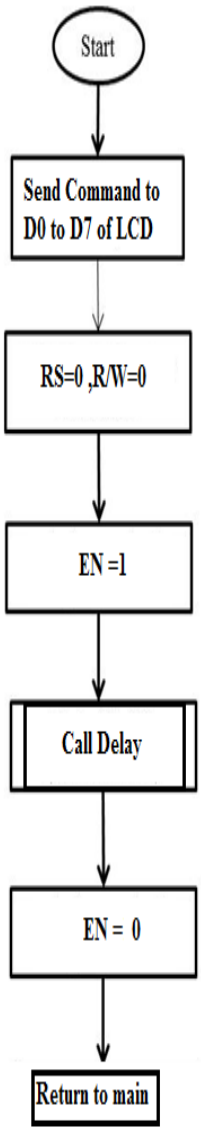
- Pulse E (HIGH to LOW).
- Repeat the steps to send another data byte.

4.9.6 LCD flow chart

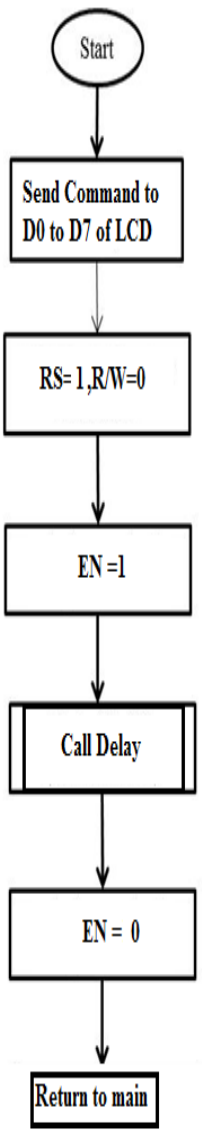
LCD FLOWCHART



LCD Intilization Subroutine



LCD character Subroutine



GSM Module (SIM 300):

Designed for global market, SIM 300 is a Tri-band GSM/GPRS engine that work on frequency EGSM (Extended GSM) 900 MHZ, DCS(Digital cellular service) 1800 MHZ and PCS (Personal Communication Services) 1900 MHZ . SIM 300 provides GPRS multi-slot class 10 capability and support the GPRS (General Packet Radio Service) coding schemes CS-1, CS-2, CS-3 and CS-4.with a tiny configuration of 40mm x 33mm x 2.85mm, SIM 300 can fit almost all the space requirement in your application, such as smart phone, PDA, phone and other mobile device. The physical interface to the mobile application is made through a 60 pins board-to-board connector, which provides all hardware interface between the module and customer's boards expect the RF antenna interface.

The keypad and LCD interface will give the flexibility to develop customized application. Two serial ports can help you easily develop your applications. Two audio channels include two micro phone inputs and two speaker outputs. This can be easily configured by AT-commands (attention commands). SIM 300 (subscriber identity module 300) provides RF antenna interface with two alternatives; antenna connector and antenna pad.

The antenna connector is MURATA MM9329-2700 by MURATA power solutions. And customer's antenna can be soldered to the antenna pad. The SIM 300 is designed with power saving technique, the current consumption to as low as 2.5 ma in SLEEP mode. The SIM 300 is integrated with TCP/IP protocol; extended TCP/IP AT commands are developed for customers to use the TCP/IP protocol easily, which is very useful for those data transfer application.

Figure 3.17 SIM 300 modules

Technical information of GSM

- Cell horizontal radius varies depending on antenna height, antenna gain and propagation conditions from a couple of hundred meters to several tens of kilometers.
- The longest distance the GSM specification supports in practical use is 35 kilometers (22 mi).
- GSM networks operate in a number of different carrier frequency ranges.
- 2G GSM networks operate in these frequency 900 MHz or 1800 MHz bands if these bands were already allocated, the 850 MHz and 1900 MHz bands were used instead. 3G networks in Europe operate in the 2100 MHz frequency band.
- GSM is divided into timeslots for individual phones to use. It is divided into 8 timeslots and made into TDMA frame.
- The channel data rate for all 8 channels is 270.833 Kbit/s.
- The transmission power in the handset is limited to a maximum of 2 watts in GSM850/900 and 1 watt in GSM1800/1900.

Features of GSM

The features of GSM system are:

- **Subscriber Identity Module**-One of the key features of GSM is the Subscriber Identity Module, commonly known as a SIM card. The SIM is a detachable smart card containing the user's subscription information and phone book. This allows the user to retain his or her information after switching handsets. The user can also change operators while retaining the handset simply by changing the SIM.

- **Phone Locking**- Mobile network operators restrict handsets that they sell for use with their own network. This is called locking and is implemented by a software feature of the phone.

- **SIM Service Security**-GSM was designed with a moderate level of service security. The system was designed to authenticate the subscriber using a pre-shared key and challenge-response. GSM only authenticates the user to the network. GSM uses several cryptographic algorithms for security. The system supports multiple algorithms so operators may replace that cipher with a stronger one

GSM modem

A **GSM modem** is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile operator perspective, a GSM modem looks just like a mobile phone.

Figure 3.18 GSM modem with antenna

When a GSM modem is connected to a computer, this allows the computer to use the GSM modem to communicate over the mobile network. While these GSM modems are most frequently used to provide mobile internet connectivity, many of them can also be used for sending and receiving SMS and MMS messages. A GSM modem can be a dedicated modem device with a serial, USB or Bluetooth connection, or it can be a mobile phone that provides GSM modem capabilities. The mobile operator charges for this message sending and receiving as if it was performed directly on a mobile phone. To perform these tasks, a GSM modem must

support an “extended AT command set” for sending/receiving SMS messages, as defined in the ETSI GSM 07.05 and 3GPP TS 27.005specifications.

The modem needed only 3 wires (TX, RX, and GND) except Power supply to interface with microcontroller/Host PC. The built in Low Dropout Linear voltage regulator allows you to connect wide range of unregulated power supply (4.2V -13V). Yes, 5 V is in between. Using this modem, you will be able to send & Read SMS, connect to internet via GPRS through simple AT commands. The GSM module which we have used in our project is SIM900, the features of SIM900 is as follows: SIM900 is a Tri-band GSM/GPRS engine that works on frequencies EGSM900Mhz, DCS 1800 MHz and PCS1900 Mhz. With a tiny configuration of 40mm x 33mm x 2.85mm, SIM300 can fit almost all the requirements in your application, such as smart phone PDA phone and other mobile device.

AT COMMANDS (ATTENTION COMMANDS)

AT commands are instructions used to control a modem. AT is the abbreviation of Attention. Every command line starts with 'AT' or 'at'. That is why modem commands are called AT commands. Many commands that are used to control wired dial up modems, such as ATD(Dial), ATA(answer), ATH(hook control) and ATO(return to online data state), are also supported by GSM/GPRS mobile phones. Besides this common AT commands set GSM/GPRS mobile phones support an AT command set that is specific to the GSM technology, which includes SMS related commands, like AT+CGMS (send message), AT+CMSS (send message from the storage), AT+CMGL (list messages) and AT+CMGR (read messages).Note that the starting "AT" prefix that informs the modem about the start of a command line. It is not the part of the AT command name. For example D is the actual AT command name in ATD and +CMGS is the actual AT command name in AT+CMGS, however some books and websites use them interchangeably as the name of an AT command.

Here are some of the tasks that can be done using AT commands with a GSM/GPRS modem or mobile phone:

- Get basic information about the mobile phone or GSM/GPRS modem.
- For example: Name of the manufacturer (AT+CGMI)

- Model number (AT+CGMM)
- IMEI number (AT+CGSN)
- Software version (AT+CGMR)

- Get basic information about the subscriber.
- For example: MSISDN (AT+CNUM)
    - IMSI number (AT+CIMI)
- Get the current status of the mobile phone or the GSM/GPRS modem.
- For example: Mobile phone activity status (AT+CPAS)
    - Mobile phone registration status (AT+CREG)
    - Radio signal strength (AT+CSQ)
- Send (AT+CMGS, AT+CMSS)
- Read (AT+CMGR, AT+CMGL)
- Write (AT+CMGW)
- Delete (AT+CMGD)
- Obtain notifications of newly received SMS messages (AT+CNMI).

TYPES OF AT COMMANDS

There are two types of AT commands:

- Basic commands and extended commands:
- Basic commands are AT commands that do not start with "+".

Extended commands are the one that start with "+". All GSM AT commands are extended commands. For example: +CMGS (Send message) and +CMSS (send message from the storage), +CMGL (List messages) and +CMGR (Read messages) are extended commands.

Either of the AT commands +CMGS (command name in text: send message) and +CMSS (command name in text: send message) +CMSS (command name in text: send message from storage) can be used to send SMS messages from a computer. The key difference between them is that the +CMGS AT command takes the SMS message to be sent as a parameter, while

the +CMSS AT command takes the index number that specifies the location of the index message in the message storage area as a parameter .

GSM, which stands for Global System for Mobile communications, reigns (important) as the world's most widely used cell phone technology. Cell phones use a cell phone service carrier's GSM network by searching for cell phone towers in the nearby area. Global System for Mobile Communication (GSM) is a globally accepted standard for digital cellular communication.

GSM is the name of a standardization group established in 1982 to create a common European mobile telephone standard that would formulate specifications for a pan-European mobile cellular radio system operating at 900 MHZ. It is estimated that many countries outside of Europe will join the GSM partnership.

2.2.2.5 .1 GSM network areas

In a GSM network, the following areas are defined:

Cell: Cell is the basic service area, one BTS covers one cell. Each cell is given a Cell Global Identity (CGI), a number that uniquely identifies t the cell.

Location Area: A group of cells form a Location Area. This is the area that is paged when a subscriber gets an incoming call.

Each Location Area is assigned a Location Area Identity (LAI). Each Location Area is served by one or more BSCs.

MSC/VLR Service Area: The area covered by one MSC is called the MSC/VLR service area.

GSM – Architecture

A GSM network consists of several functional entities whose functions and interfaces are defined. The GSM network can be divided into following broad parts.

- The Mobile Station (MS)
- The Base Station Subsystem (BSS)
- The Network Switching Subsystem (NSS)

- The Operation Support Subsystem (OSS)

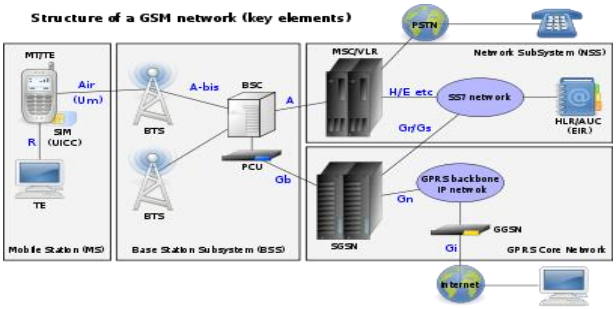


Figure 6.1 structure of GSM

The added components of the GSM architecture include the functions of the databases and messaging systems:

- Home Location Register (HLR)
- Visitor Location Register (VLR)
- Equipment Identity Register (EIR)
- Authentication Center (AUC)
- SMS Serving Center (SMS SC)
- Gateway MSC (GMSC)
- Chargeback Center (CBC)
- Transcoder and Adaptation Unit (TRAU)

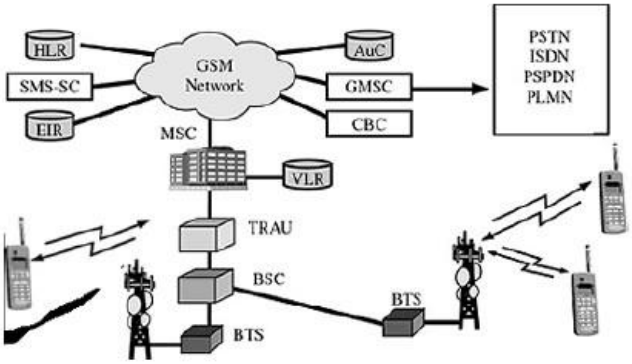


Figure 6.2 GSM network along with added elements

The MS and the BSS communicate across the Um interface, also known as the air interface or radio o link. The BSS communicates with h the Network Service Switching center across the A interface.

Mobile Station

The mobile station (MS) consists of the physical equipment, such as the radio transceiver, display and digital signal processors, and a smart card called the Subscriber Identity Module (SIM). The SIM provides personal mobility, so that the user can have access to all subscribed services irrespective of both the location of the terminal and the use of a specific terminal. By inserting the SIM card into another GSM cellular phone, the user is able to receive calls at that phone, make calls from that phone, or receive other subscribed services.

The mobile equipment is uniquely identified by the International Mobile Equipment Identity (IMEI). The SIM card contains the International Mobile Subscriber Identity (IMSI), identifying the subscriber, a secret key for authentication, and other user information. The IMEI and the IMSI are independent, thereby providing personal mobility. The SIM card may be protected against unauthorized use by a password or personal identity number.

Base Station Subsystem

The Base Station Subsystem is composed of two parts, the Base Transceiver Station (BTS) and the Base Station Controller (BSC). These communicate across the specified A-bis interface, allowing (as in the rest of the system) operation between components made by different suppliers.

The Base Transceiver Station houses the radio transceivers that define a cell and handles the radio link protocols with the Mobile Station. In a large urban area, there will potentially be a large number of BTSs deployed. The requirements for a BTS are ruggedness, reliability, portability, and minimum cost.

The Base Station Controller manages the radio resources for one or more BTS's. It handles radio channel setup, frequency hopping, and handovers, as described below. The BSC is the connection between the mobile and the Mobile service Switching Center (MSC). The BSC also translates the 13 kbps voice channel used over the radio link to the standard 64 kbps channel used by the Public Switched Telephone Network or ISDN.

Network Subsystem

The central component of the Network Subsystem is the Mobile services Switching Center (MSC). It acts like a normal switching node of the PSTN or ISDN, and in addition provides all the functionality needed to handle a mobile subscriber, such as registration, authentication, location updating, handovers, and call routing to a roaming subscriber.

These services are provided in conjunction with several functional entities, which together form the Network Subsystem. The MSC provides the connection to the public fixed network (PSTN or ISDN), and signaling between functional entities uses the ITUT Signaling System Number 7 (SS7), used in ISDN and widely used in current public networks.

The Home Location Register (HLR) and Visitor Location Register (VLR), together with the MSC, provide the call routing and (possibly international) roaming capabilities of GSM. The HLR contains all the administrative information of each subscriber registered in the corresponding GSM network, along with the current location of the mobile. The current location of the mobile is in the form of a Mobile Station Roaming Number (MSRN) which is a regular ISDN number used to route a call to the MSC where the mobile is currently located. There is logically one HLR per GSM network, although it may be implemented as a distributed database.

The Visitor Location Register contains selected administrative information from the HLR, necessary for call control and provision of the subscribed services, for each mobile currently located in the geographical area controlled by the VLR. Although each functional entity can be implemented as an independent unit, most manufacturers of switching equipment implement one VLR together with one MSC, so that the geographical area controlled by the MSC corresponds to that controlled by the VLR, simplifying the signaling required. Note that the MSC contains no information about particular mobile stations -this information is stored in the location registers.

The other two registers are used for authentication and security purposes. The Equipment Identity Register (EIR) is a database that contains a list of all valid mobile equipment on the network, where each mobile station is identified by its International Mobile Equipment Identity (IMEI). An IMEI is marked as invalid if it has been reported stolen or is not type approved. The Authentication Center is a protected database that stores a copy of the secret key stored in each subscriber's SIM card, which is used for authentication and ciphering of the radio channel.

The Base Station Subsystem (BSS)

The BSS is composed of two parts:

- The Base Transceiver Station (BTS)
- The Base Station Controller (BSC)

The BTS and the BSC communicate across the specified A-bis interface, enabling operations between components that are made by different suppliers. The radio components of a BSS may consist of four to seven or nine cells.

A BSS may have one or more base stations. The BSS uses the A-bis interface between the BTS and the BSC. A separate high-speed line (T1 or E1) is then connected from the BSS to the Mobile MSC.

The Base Transceiver Station (BTS)

The BTS houses the radio transceivers that define a cell and handles the radio link protocols with the MS. In a large urban area, a large number of BTSs may be deployed.

- Transcoding and rate adaptation
- Time and frequency synchronizing

- Voice through full-or half-rate services
- Decoding, decrypting, and equalizing received signals
- Random access detection
- Timing advances
- Uplink channel measurements

The Base Station Controller (BSC)

The BSC manages the radio resources for one or more BTS's. It handles radio channel setup, frequency hopping, and handovers. The BSC is the connection between the mobile and the MSC. The BSC also translates the 13 Kbps voice channel used over the radio link to the standard 64 Kbps channel used by the Public Switched Telephone Network (PSDN) or ISDN.

It assigns and releases frequencies and time slots for the MS. The BSC also handles inter cell handover. It controls the power transmission of the BSS and MS in its area. The function of the BSC is to allocate the necessary time slots between the BTS and the MSC. It is a switching device that handles the radio resources. Additional functions include:

- Control of frequency hopping
- Performing traffic concentration to reduce the number of lines from the MSC
- Providing an interface to the Operations and Maintenance Center for the BSS
- Reallocation of frequencies among BTSs
- Time and frequency synchronization
- Power management
- Time-delay measurements of received signals from the MS

The Network Switching Subsystem (NSS)

The Network switching system (NSS), the main part of which is the Mobile Switching Center (MSC), performs the switching of calls between the mobile and other fixed or mobile network users, as well as the management of mobile services such as authentication.

The switching system includes the following functional elements:

Home Location Register (HLR)

The HLR is a database used for storage and management of subscriptions. The HLR is considered the most important database, as it stores permanent data about subscribers, including a subscriber's service profile, location information, and activity status. When an individual buys a subscription in the form of SIM then all the information about this subscription is registered in the HLR of that operator.

Mobile Services Switching Center (MSC)

The central component of the Network Subsystem is the MSC. The MSC performs the switching of calls between the mobile and other fixed or mobile network users, as well as the management of mobile services such as such as registration, authentication, location updating, handovers, and call routing to a roaming subscriber. It also performs such functions as toll ticketing, network interfacing, common channel signaling, and others. Every MSC is identified by a unique ID.

Visitor Location Register (VLR)

The VLR is a database that contains temporary information about subscribers that is needed by the MSC in order to service visiting subscribers. The VLR is always integrated with the MSC. When a mobile station roams into a new MSC area, the VLR connected to that MSC will request data about the mobile station from the HLR. Later, if the mobile station makes a call, the VLR will have the information needed for call setup without having to interrogate the HLR each time.

Authentication Center (AUC)

The Authentication Center is a protected database that stores a copy of the secret key stored in each subscriber's SIM card, which is used for authentication and ciphering of the radio channel. The AUC protects network operators from different types of fraud found in today's cellular world.

Equipment Identity Register (EIR)

The Equipment Identity Register (EIR) is a database that contains a list of all valid mobile equipment on the network, where its International Mobile Equipment Identity (IMEI) identifies each MS. An IMEI is marked as invalid if it has been reported stolen or is not type approved.

The Operation Support Subsystem (OSS)

The operations and maintenance center (OMC) is connected to all equipment in the switching system and to the BSC. The implementation of OMC is called the operation and support system (OSS).

Here are some of the OMC functions:

- Administration and commercial operation (subscription, end terminals, charging and statistics).
- Security Management.
- Network configuration, Operation and Performance Management.
- Maintenance Tasks.

The operation and Maintenance functions are based on the concepts of the Telecommunication Management Network (TMN) which is standardized in the ITU-T series M.30.

The OSS is the functional entity from which the network operator monitors and controls the system. The purpose of OSS is to offer the customer cost-effective support for centralized, regional and local operational and maintenance activities that are required for a GSM network. An important function of OSS is to provide a network overview and support the maintenance activities of different operation and maintenance organizations.

The GSM specifications

Specifications for different Personal Communication Services (PCS) systems vary among the different PCS networks.

The GSM specification is listed below with important characteristics.

Modulation

Modulation is a form of change process where we change the input information into a suitable format for the transmission medium. We also changed the information by demodulating the signal at the receiving end.

The GSM uses Gaussian Minimum Shift Keying (GMSK) modulation method.

Access Methods

Radio spectrum is a limited resource shared by all users; a method must be devised to divide up the bandwidth among as many users as possible.

GSM chose a combination of TDMA/FDMA as its method. The FDMA part involves the division by frequency of the total 25 MHz bandwidth into 124 carrier frequencies of 200 kHz bandwidth.

One or more carrier frequencies are then assigned to each BS. Each of these carrier frequencies is then divided in time, using a TDMA scheme, into eight time slots. One time slot is used for transmission by the mobile and one for reception. They are separated in time so that the mobile unit does not receive and transmit at the same time.

Transmission Rate

The total symbol rate for GSM at 1 bit per symbol in GMSK produces 270.833 K symbols/second. The gross transmission rate of the time slot is 22.8 Kbps. GSM is a digital system with an over-the-air bit rate of 270 kbps.

Frequency Band

The uplink frequency range specified for GSM is 933 960 MHz (basic 900 MHz band only).The downlink frequency band 890 -915 MHz (basic 900 MHz band only).

Channel Spacing

This indicates separation between adjacent carrier frequencies. In GSM, this is 200 kHz.

Speech Coding

GSM uses linear predictive coding (LPC). The purpose of LPC is to reduce the bit rate. The LPC provides parameters for a filter that mimics the vocal tract. The signal passes through this filter, leaving behind a residual signal. Speech is encoded at 13 kbps.

Duplex Distance

The duplex distance is 80 MHZ. Duplex distance is the distance between the uplink and downlink frequencies. A channel has two frequencies, 80 MHz apart.

MISC

- Frame duration: 4.615 ms.
- Duplex Technique: Frequency Division Duplexing (FDD).
- Access mode previously known as WCDMA.
- Speech channels per RF channel: 8.

GSM -Addresses and Identifiers

GSM distinguishes explicitly between user and equipment and deals with them separately. Besides phone numbers and subscriber and equipment identifiers, several other identifiers have been defined; they are needed for the management of subscriber mobility and for addressing of all the remaining network elements.

The most important addresses and identifiers are presented in the following:

International Mobile Station Equipment Identity (IMEI)

The international mobile station equipment identity (IMEI) uniquely identifies a mobile station internationally. It is a kind of serial number. The IMEI is allocated by the equipment manufacturer and registered by the network operator and registered by the network operator who stores it in the EIR. By means of IMEI one recognizes obsolete, stolen or nonfunctional equipment.

International Mobile Subscriber Identity (IMSI)

Each registered user is uniquely identified by its international mobile subscriber identity (IMSI). It is stored in the subscriber identity module (SIM) a mobile station can only be operated if a SIM with a valid IMSI is inserted into equipment with a valid IMEI.

Security and Encryption

The security methods standardized for the GSM System make it the most secure cellular telecommunications standard currently available. Although the confidentiality of a call and anonymity of the GSM subscriber is only guaranteed on the radio channel, this is a major step in achieving end-to-end security.

The subscriber's anonymity is ensured through the use of temporary identification numbers. The confidentiality of the communication itself on the radio link is performed by the application of encryption algorithms and frequency hopping which could only be realized using digital systems and signaling.

Mobile Station Authentication

The GSM network authenticates the identity of the subscriber through the use of a challenge-response mechanism. A 128-bit random number (RAND) is sent to the MS. The MS computes the 32-bit signed response (SRES) based on the encryption of the random number (RAND) with the authentication algorithm (A3) using the individual subscriber authentication key (Ki). Upon receiving the signed response (SRES) from the subscriber, the GSM network repeats the calculation to verify the identity of the subscriber.

The individual subscriber authentication key (Ki) is never transmitted over the radio channel. It is present in the subscriber's SIM, as well as the AUC, HLR, and VLR databases as previously described. If the received SRES agrees with the calculated value, the MS has been successfully authenticated and may continue. If the values do not match, the connection is terminated and an authentication failure indicated to the MS.

The calculation of the signed response is processed within the SIM. This provides enhanced security, because the confidential subscriber information such as the IMSI or the individual subscriber authentication key (Ki) is never released from the SIM during the authentication process.

Signaling and Data Confidentiality

The SIM contains the ciphering key generating algorithm (A8) which is used to produce the 64-bit ciphering key (Kc). The ciphering key is computed by applying the same random number (RAND) used in the authentication process to the ciphering key generating algorithm (A8) with the individual subscriber authentication key (Ki). As will be shown in later sections, the ciphering key (Kc) is used to encrypt and decrypt the data between the MS and BS.

An additional level of security is provided by having the means to change the ciphering key, making the system more resistant to eavesdropping. The ciphering key may be changed at regular intervals as required by network design and security considerations. In a similar manner to the authentication process, the computation of the ciphering key (Kc) takes place internally within the SIM. Therefore sensitive information such as the individual subscriber authentication key (Ki) is never revealed by the SIM.

Encrypted voice and data communications between the MS and the network is accomplished through use of the ciphering algorithm A5. Encrypted communication is initiated by a ciphering mode request command from the GSM network. Upon receipt of this command, the mobile station begins encryption and decryption of data using the ciphering algorithm (A5) and the ciphering key (Kc).

Subscriber Identity Confidentiality

To ensure subscriber identity confidentiality, the Temporary Mobile Subscriber Identity (TMSI) is used. The TMSI is sent to the mobile station after the authentication and encryption procedures have taken place. The mobile station responds by confirming reception of the TMSI. The TMSI is valid in the location area in which it was issued. For communications outside the location area, the Location Area Identification (LAI) is necessary in addition to the TMSI.

Telephony Service

These services can be charged on per call basis. Only call initiator has to pay the charges and now a day, all the incoming charges are free. A customer can be charged based on different parameters like:

- International call or long distance call.
- Local call
- Call made during peak hours.
- Call made during night time
- Discounted call during weekends.
- Call per minute or per second.

Many more other criteria can be designed by a service provider to charge their customers.

SMS Service

Till the time this tutorial is written, most of the service providers are charging their customer's SMS services based on number of text messages sent from their mobile phone. There are other prime SMS services available where service providers are charging more than normal SMS charge. These services are being used in collaboration of Television Networks or Radio Networks to demand SMS from the audiences

Most of time charges are paid by the SMS sender but for some services like stocks and share prices, mobile banking facilities and leisure booking services etc. recipient of the SMS has to pay for the service.

GPRS Services

Using GPRS service we can browse Internet and can play games on the Internet, we can download movies or music etc. So a service provider will charge us based on the data uploaded as well as data downloaded on our mobile phone. These charges will be based on per Kilo Byte data downloaded/uploaded.

Additional parameter could be a Quality of Service provided to us. If we want to watch a movie then a low quality may work because some data loss may be acceptable to us but if we are downloading a zip file then a single byte loss will corrupt our complete downloaded file.

Advantages of GSM

- GSM is already used worldwide with over 450 million subscribers.
- International roaming permits subscribers to use one phone throughout Western Europe.
- CDMA will work in Asia, but not France, Germany, the U.K. and other popular European destinations.
- GSM is mature, having started in the mid-80s. This maturity means a more stable network with robust features.
- CDMA is still building its network.

Interfacing GSM with Microcontroller (89V51)

The GSM module is communicate the microcontroller with mobile phones through UART. To communicate over UART or USART, we just need three basic signals which are namely, RXD (receive), TXD (transmit), GND (common ground).

GSM modem interfacing with microcontroller for SMS control of industrial equipments. The sending SMS through GSM modem when interfaced with microcontroller or PC is much simpler as compared with sending SMS through UART.

Text message may be sent through the modem by interfacing only three signals of the serial interface of modem with microcontroller i.e., TXD, RXD and GND. In this scheme RTS and CTS signals of serial port interface of GSM Modem are connected with each other.

The transmit signal of serial port of microcontroller is connected with transmit signal (TXD) of the serial interface of GSM Modem while receive signal of microcontroller serial port is connected with receive signal (RXD) of serial interface of GSM Modem.

The SMS message in text mode can contain only 140 characters at the most. It depends upon the amount of information collected from GPS Engine that you need at the base station for tracking vehicle or person.

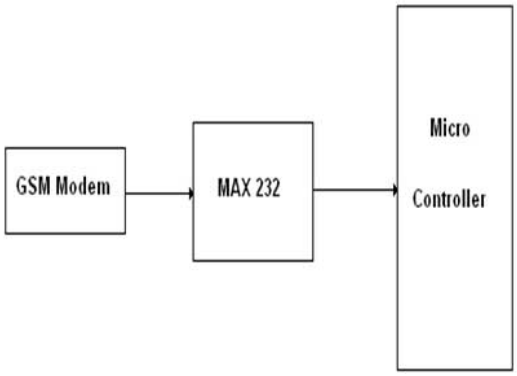


Figure 4.9 interfacing UART to microcontroller

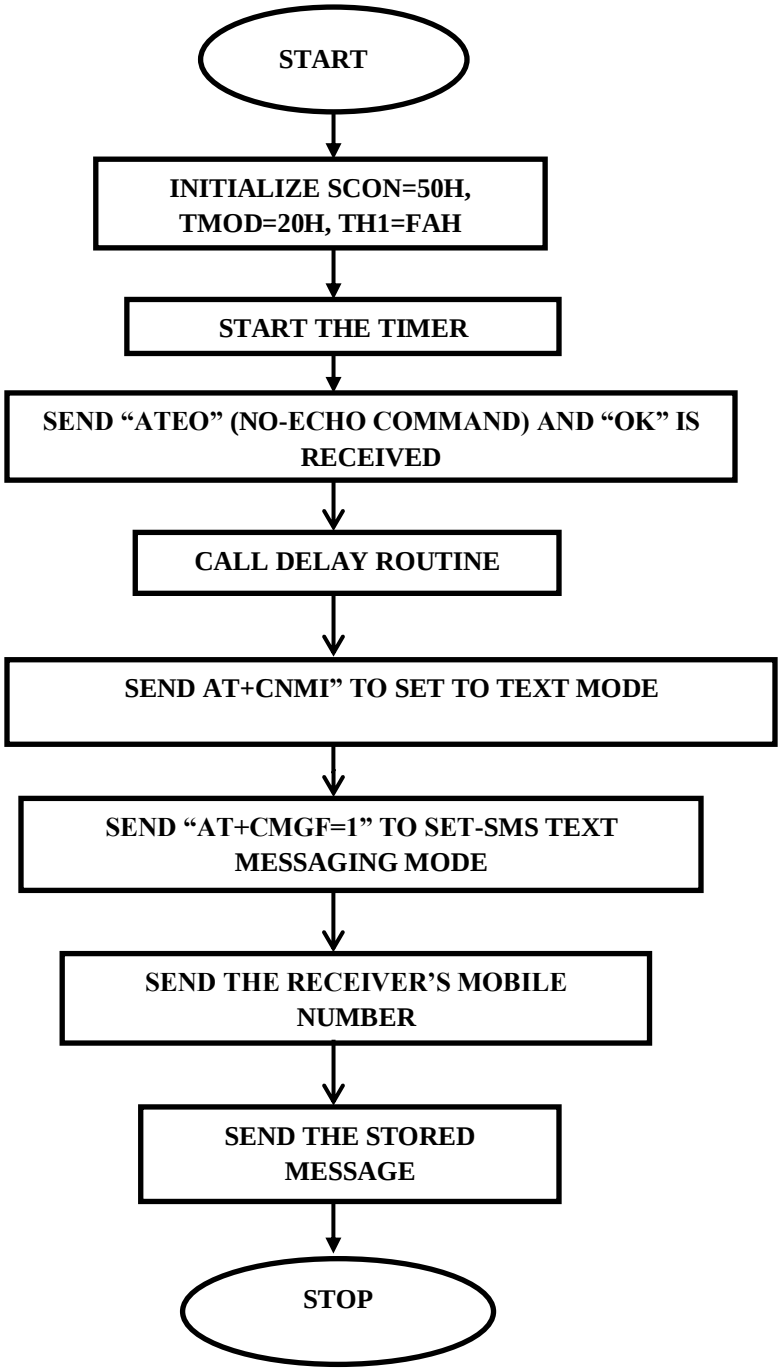
We now want to display a text in mobile from 8051 Primer Board by using GSM module through UART. In 8051 Primer Board contains two serial interfaces that are UART0 & UART1. Here we are using UART0. The GSM modem is being interfaced with the microcontroller 8051 Primer Board for SMS communication. The SMS can be sending and receiving for the data sharing and situation information and control [10].

The following Commands and sequence of events performed for sending text message to a mobile phone through GSM Modem interfaced with microcontroller:

- First select the text mode for SMS by sending the following AT Command to GSM Modem: AT+CMGF = 1. This command configures the GSM modem in text mode.

- Send the following AT Command for sending SMS message in text mode along with mobile number to the GSM Modem : AT+CMGS =+91XXXXXXXXXX . This command sends the mobile number of the recipient mobile to the GSM modem.
- Send the text message string ("GSM Modem Test") to the GSM Modem This is a test message from UART".
- Send ASCII code for CTRL+Z i.e., 0x1A to GSM Modem to transmit the message to mobile phone. After message string has been sent to the modem, send CTRL+Z to the micro-controller, which is equivalent to 0x1A (ASCII value) .

4.10.3 Flow chart for GSM



Working principle:

ARM7 microcontroller is interfacing with serial communication both GSM and GPS.

First we need to initialize the GSM, LCD and GPS .Microcontroller continuously monitoring GPS for locating current location. Here we are communicating with two serial communication GSM & GPS at a time .

As soon as vehicle get started owner will get message that engine on then owner can control his vehicle through GSM if he send control signal vehicle will get stop or vehicle will move .

If owner send one control signal vehicle will send about current location will update to the owner so that owner will got to know current location of the vehicle.

If owner send one control signal vehicle will start move and current location will update to the owner so that owner will got to know current location of the vehicle.

Depending on owner wish controller will control vehicle movement

ACCELEROMETER(3-AXIS)

The ADXL335 is a small, thin, low power, complete 3-axis accelerometer with signal conditioned voltage outputs. The product measures acceleration with a minimum full-scale range of ±3 g. It can measure the static acceleration of gravity in tilt sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration.

The user selects the bandwidth of the accelerometer using the C_X, C_Y, and C_Z capacitors at the X_{OUT}, Y_{OUT}, and Z_{OUT} pins. Bandwidths can be selected to suit the application, with a range of 0.5 Hz to 1600 Hz for X and Y axes, and a range of 0.5 Hz to 550 Hz for the Z axis.

The ADXL335 is available in a small, low profile, 4 mm × 4 mm × 1.45 mm, 16-lead, plastic lead frame chip scale package (LFCSP_LQ).

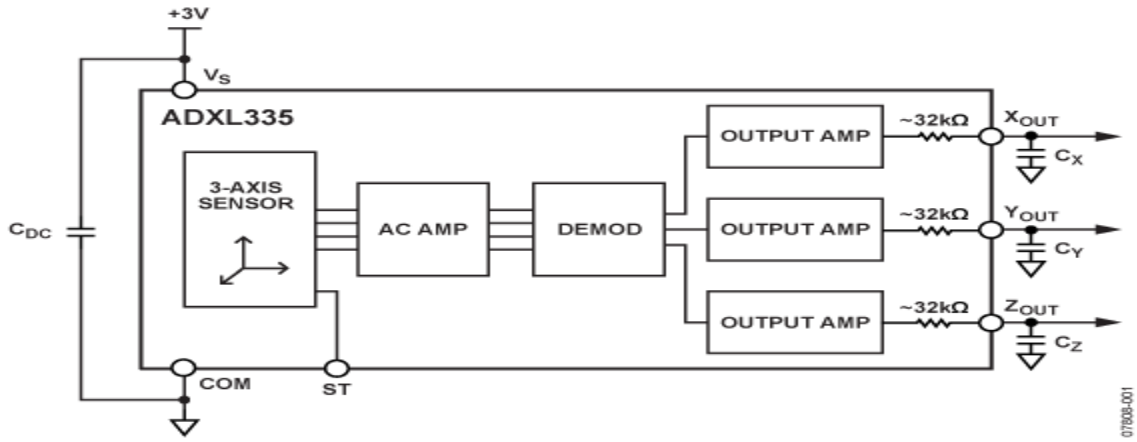
Applications

- Cost sensitive, low power, motion- and tilt-sensing applications
- Mobile devices
- Gaming systems
- Disk drive protection
- Image stabilization
- Sports and health devices

FEATURES AND BENEFITS

- 3-axis sensing
- Small, low-profile package 4 mm × 4 mm × 1.45 mm LFCSP
- Low power - 350 μA (typical)
- Single-supply operation 1.8 V to 3.6 V
- 10,000 *g* shock survival
- Excellent temperature stability
- BW adjustment with a single capacitor per axis
- RoHS/WEEE lead-free compliant

FUNCTIONAL BLOCK DIAGRAM FOR ADXL335



CONCLUSION

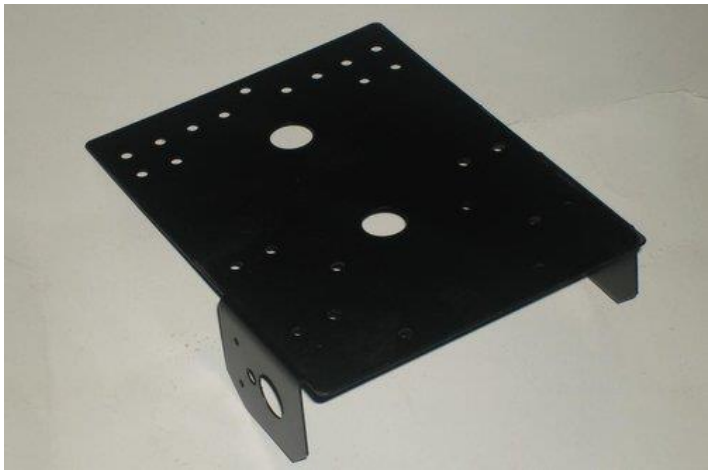
- This project is useful for reducing VEHICLE STOLE
- Owner can operate his vehicle from remote location
- It will provide more security
- Accident can be detected by using Accelerometer.

D.C.MOTORS

Specifications:

- 60 rpm to 1000 rpm 12 v dc geared motors for robotics applications
- Very easy to use and available in standard size
- Nut and threads on shaft to easily connect wheel
- 12 v dc motors with gearbox
- 6 mm shaft diameter with internal hole
- 125 gm weight
- Same size motor available in various rpm
- No-load current = 60 ma(max), load current = 300

ROBOT CHASSIS



- Sheet Metal Pressed Robotic Chassis Very easy to use with Good Guage Sheet
- Rdy made to Fix Motors and PCB Boards
- Castor Wheel for Front side fit
- Dimension 16 cm Lenght x 12cm Width x 1.5cm Dia for Motors Fixing
-

Wheel For DC Motors

- 680 mm Diameter
- 2 cm Width
- Hole Diameter 6.1 mm
- Screw for fastening on motor shaft
- Made from virgin plastic.

CASTOR WHEEL

Caster Wheel

Ball caster wheel is an omni directional wheel This wheel can be used as neutral wheel for the robot.

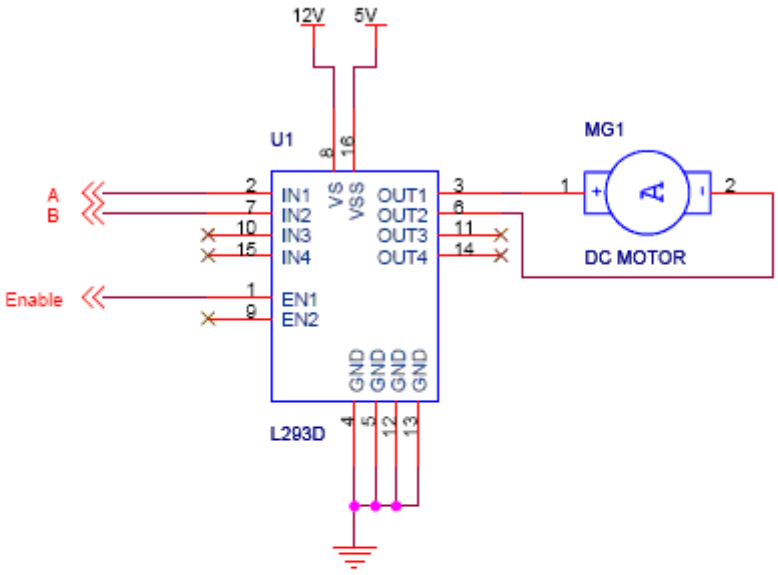
Specifications

- Base plate diameter - 27.5mm
- Caster wheel diameter - 13.5mm
- Wheel height - 18mm
- Mounting hole - Three, 120° apart, 3mm or 1/8 inch diameter

L293D Dual H-Bridge Motor Driver

L293D is a dual H-Bridge motor driver, So with one IC we can interface two DC motors which can be controlled in both clockwise and counter clockwise direction and if you have motor with fix direction of motion the you can make use of all the four I/Os to connect up to four DC motors. L293D has output current of 600mA and peak output current of 1.2A per channel. Moreover for protection of circuit from back EMF ouput diodes are included within the IC. The output supply (VCC2) has a wide range from 4.5V to 36V, which has made L293D a best choice for DC motor driver.

A simple schematic for interfacing a DC motor using L293D is shown below.



Truth Table

A	B	Description
0	0	Motor stops or Breaks
0	1	Motor Runs Anti-Cloclwise
1	0	Motor Runs Clockwise
1	1	Motor Stops or Breaks

For above truth table, the Enable has to be Set (1). Motor Power is mentioned 12V, but you can connect power according to your motors.

As you can see in the circuit, three pins are needed for interfacing a DC motor (A, B, Enable). If you want the o/p to be enabled completely then you can connect Enable to VCC and only 2 pins needed from controller to make the motor work.

As per the truth table mentioned in the image above its fairly simple to program the microcontroller. Its also clear from the truth table of BJT circuit and L293D the programming will be same for both of them, just keeping in mind the allowed combinations of A and B. We will discuss about programming in C as well as assembly for running motor with the help of a microcontroller.

ALCOHOL SENSOR