A Project Report

On

"GPS AND GSM BASED VEHICLE TRACKING SYSTEM"

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CERTIFICATE

This is to certify that the project entitled "**GPS AND GSM BASED VEHICLE TRACKING SYSTEM** “submitted by **SYED AKRAMUDDIN(160111735129), M.HARISH KUMAR(160111735315), N.NITISH KUMAR (160110735318)** in partial fulfilment for the degree of **"BACHELOR OF ENGINEERING"** in **ELECTRONICS AND COMMUNICATION ENGINEERING**, Osmania University is a Bonafide record of work carried out under the supervision of **DR N.V.KOTESWARA RAO** and this has not been submitted to any other university or institute for award of degree or diploma.

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DECLARATION

I hereby declare that the results embodied in this dissertation titled **"GPS AND GSM BASED VEHICLE TRACKING SYSTEM"** is carried out by me during the year 2014 –2015 in partial fulfillment of the award of B.E. (ELECTRONICS AND COMMUNICATION ENGINEERING) from **"CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY".** I have not submitted the same to any other university or organization for the award of any other degree.

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ABSTRACT

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. Main objective is to design a system that can be easily installed and to provide platform for further enhancement.

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LIST OF ACRONYMS

VTS	Vehicle Tracking System
GSM	Global System for Mobile Communication
GPS	Global Positioning System
RI	Ring Indicator
Tx	Transmitter
Rx	Receiver
SFR	Special Function Register
LCD	Liquid Crystal Display
RAM	Random Access Memory
ROM	Read Only Memory
RS-232	Recommended Standard
TTL	Transistor Transistor Logic
CMOS	Complementary Metal Oxide Semi-Conductor
UART	Universal Asynchronous Receiver Transmitter
RST	Reset
ALE	Address Latch Enable
PSEN	Program Store Enable
WDT	Watch Dog Timer

CHAPTER 1

INTRODUCTION TO VEHICLE TRACKING SYSTEM

1.1 Introduction

Vehicle Tracking System (VTS) is the technology used to determine the location of a vehicle using different methods like GPS and other radio navigation systems operating through satellites and ground based stations and it also used to stop and start the vehicle by sending commands through a mobile. By following triangulation or trilateration methods the tracking system enables to calculate easy and accurate location of the vehicle. Vehicle information like location details, speed, distance traveled etc. can be viewed on a digital mapping with the help of a software via Internet. Even data can be stored and downloaded to a computer from the GPS unit at a base station and that can later be used for analysis. This system is an important tool for tracking each vehicle at a given period of time and now it is becoming increasingly popular for people having expensive cars and hence as a theft prevention and retrieval device.

i.. This vehicle tracking system consists of mainly two parts mobile vehicle unit, hand set(phone)

ii. **Vehicle Unit:** It is the hardware component attached to the vehicle having either a GPS/GSM modem. The unit is configured around a primary modem that functions with the tracking software by receiving signals from GPS satellites or radio station points with the help of antenna. The controller modem converts the data and sends the vehicle location data to the server.

iii. **Hand set(mobile):**It is used to receive co-ordinates of the vehicle, that is longitude and latitude of the vehicle.

1.2 Vehicle Security using VTS

Vehicle Security is a primary concern for all vehicle owners. Owners as well as researchers are always on the lookout for new and improved security systems for their vehicles. One has to be thankful for the upcoming technologies, like GPS systems, which enables the owner to closely monitor and track his vehicle in real-time and also check the history of vehicles movements. This new technology, popularly called Vehicle Tracking Systems has done wonders in maintaining the security of the vehicle tracking system is one of the biggest technological advancements to track the activities of the vehicle. The security system uses Global Positioning System GPS, to find the location of the monitored or tracked vehicle and then uses satellite or radio systems to send to send the coordinates and the location data to the mobile. After receiving coordinates it have to be manually searched in google maps. In this way the Vehicle owners are able to track their vehicle on a real-time basis. Due to real-time tracking facility, vehicle tracking systems are becoming increasingly popular among owners of expensive vehicles.

The vehicle tracking hardware is fitted on to the vehicle. It is fitted in such a manner that it is not visible to anyone who is outside the vehicle. Thus it operates as a covert unit which continuously sends the location data to the monitoring unit.

When the vehicle is stolen, the location data sent by tracking unit can be used to find the location and coordinates can be sent to police for further action. Some Vehicle tracking System can even detect unauthorized movements of the vehicle and then alert the owner. This gives an edge over other pieces of technology for the same purpose

As we have seen the vehicle tracking system is an exciting piece of technology for vehicle security. It enables the owner to virtually keep an eye on his vehicle any time and from anywhere in the world.

A computer software GPS GLONASS automatic vehicle location vehicle tracking system combines the installation of an electronic device in a vehicle, or fleet of vehicles, with purpose-designed at least at one operational base to enable the owner or a third party to track the vehicle's location, collecting data in the process from the field and deliver it to the base of operation. Modern vehicle tracking systems commonly use or technology for locating the vehicle, but other types of technology can also be used. Vehicle information can be viewed on electronic maps via the Internet or specialized software. Urban public transit authorities are an increasingly common user of vehicle tracking systems, particularly in large cities. Vehicle tracking systems are popular in consumer vehicles as a theft prevention and retrieval device. Police can simply follow the signal emitted by the tracking system and locate the stolen vehicle. When used as a security system, a Vehicle Tracking System may serve as either an addition to or replacement for a traditional car alarm. Some vehicle tracking systems make it possible to control vehicle remotely, including block doors or engine in case of emergency. The existence of vehicle tracking device then can be used to reduce the insurance cost, because the loss-risk of the vehicle drops significantly.

Vehicle tracking systems are an integrated part of the "layered approach" to vehicle protection, recommended by the National Insurance Crime Bureau motor vehicle theft (NICB) to prevent . This approach recommends four layers of security based on the risk factors pertaining to a specific vehicle. Vehicle Tracking Systems are one such layer, and are described by the NICB as “very effective” in helping police recover stolen vehicles.

Some vehicle tracking systems integrate several security systems, for example by sending an automatic alert to a phone or email if an alarm is triggered or the vehicle is moved without authorization, or when it leaves or enters a geofence.

1.3 Types of GPS Vehicle Tracking

There are three main types of GPS vehicle tracking, tracking based mobile, wireless passive tracking and satellite in real-time GPS tracking. This article discusses the advantages and disadvantages to all three types of GPS vehicle tracking circumference.

i) Mobile phone based tracking

The initial cost for the construction of the system is slightly lower than the other two options. With a mobile phone-based tracking average price is about $ 500. A cell-based monitoring system sends information about when a vehicle is every five minutes during a rural network. The average monthly cost is about thirty-five dollars for airtime.

ii) Wireless Passive Tracking

A big advantage that this type of tracking system is that there is no monthly fee, so that when the system was introduced, there will be other costs associated with it. But setting the scheme is a bit 'expensive. The average is about $ 700 for hardware and $ 800 for software and databases. With this type of system, most say that the disadvantage is that information about where the vehicle is not only can exist when the vehicle is returned to the base business. This is a great disadvantage, particularly for companies that are looking for a monitoring system that tells them where their vehicle will be in case of theft or an accident.

However, many systems are now introducing wireless modems into their devices so that tracking information can be without memory of the vehicle to be seen. With a wireless modem that is wireless passive tracking systems are also able to gather information on how fast the vehicle was traveling, stopping, and made other detailed information. With this new addition, many companies believe that this system is perfect, because there is no monthly bill.

iii) Via satellite in real time

This type of system provides less detailed information, but work at the national level, making it a good choice for shipping and trucking companies. Spending on construction of the system on average about $ 700. The monthly fees for this system vary from five dollars for a hundred dollars, depending on how the implementation of a reporting entity would be.

Technology

Over the next few years, GPS tracking will be able to provide businesses with a number of other benefits. Some companies have already introduced a way for a customer has signed the credit card and managed at local level through the device. Others are creating ways for dispatcher to send the information re-routing, the GPS device directly to a manager. Not a new requirement for GPS systems is that they will have access to the Internet and store information about the vehicle as a driver or mechanic GPS device to see the diagrams used to assist with the vehicle you want to leave. Beyond that all the information be saved and stored in its database.

1.4 Typical Architecture

Major constituents of the GPS based tracking are

i. GPS tracking device

The device fits into the vehicle and captures the GPS location information. Sends to mobile.

ii. Handset(mobile)

This receives the co-ordinates of vehicle send by the gps located in vehicle tracking system module ,which is fitted to vehicle.

1.5 History of Vehicle Tracking

GPS or Global Positioning Systems were designed by the United States Government and military, which the design was intended to be used as surveillance. After several years went by the government signed a treaty to allow civilians to buy GPS units also only the civilians would get precise downgraded ratings.

Years after the Global Positioning Systems were developed the military controlled the systems despite that civilians could still purchase them in stores. In addition, despite that Europe has designed its own systems called the Galileo the US military still has complete control.

GPS units are also called tracking devices that are quite costly still. As more of these devices develop however the more affordable the GPS can be purchased. Despite of the innovative technology and designs of the GPS today the devices has seen some notable changes or reductions in pricing. Companies now have more access to these devices and many of the companies can find benefits.

These days you can pay-as-you go or lease a GPS system for any company. This means they do not have to worry about spending upfront money, which once stopped companies from installing the Global positioning systems at one time.

Today’s GPS applications have vastly developed as well. It is possible to use the Global Positioning Systems to design expense reports, create time sheets, or reduce the costs of fuel consumption. They can also use the tracking devices to increase efficiency of employee driving. The GPS unit allows them to create Geo-Fences about a designated location, which gives you alerts once your driver(s) passes through. This means that they have added security combined with more powerful customer support for thier workers.

Today’s GPS units are great tracking devices that help fleet managers stay in control of their business.

The applications in today’s GPS units make it possible to take full control of their company. It is clear that the tracking devices offer many benefits to companies, since they can build automated expense reports anytime.

GPS units do more than just allow companies to create reports. These devices also help to put an end to thieves. According to recent reports, crime is at a high, which means that car theft is increasing. If anyone have the right GPS unit, they can put an end to car thefts because they can lock and unlock your car anytime you choose.

The chief reason for some companies to install tracking devices is to monitor their mobile workforce. A preventive measure device allows companies to monitor their employees’ activities. Company workers can no longer take vehicles to unassigned locations. They will not be able to get away with unauthorized activities at any time because they can monitor driver’s every action on a digital screen.

1.5.1 Early Technology

In the initial period of tracking only two radios were used to exchange the information. One radio was attached to the vehicle while another at base station by which drivers were enabled to talk to their masters. Fleet operator could identify the progress through their routes.

The technology was not without its limits. It was restricted by the distance which became a hurdle in accuracy and better connectivity between driver and fleet operators. Base station was dependent on the driver for the information and a huge size fleet could not have been managed depending on man-power only.

The scene of vehicle tracking underwent a change with the arrival of GPS technology. This reduced the dependence on man-power. Most of the work of tracking became electronic. Computers proved a great help in managing a large fleet of vehicle. This also made the information authentic. As this technology was available at affordable cost all whether small or big fleet could take benefit of this technology

Because of the cheap accessibility of the device computer tracking facilities has come to stay and associated with enhanced management. Today each vehicle carries tracking unit which is monitored from the base station. Base station(phone) receives the data from the unit.

All these facilities require a heavy investment of capital for the installation of the infrastructure of tracking system for monitoring and dispatching.

1.5.2 New development in technology

New system costs less with increased efficiency. Presently it is small tracking unit in the vehicle with web-based interface, connected through a mobile phone. This device avoids unnecessary investment in infrastructure with the facility of monitoring from anywhere for the fleet managers. This provides more efficient route plan to fleet operators of all sizes and compositions saving money and time.

Vehicle tracking system heralded a new era of convenience and affordability in fleet management. Thus due to its easy availability it is going to stay for long.

1.6 Vehicle Tracking System Features

Monitoring and managing the mobile assets are very important for any individuals or company dealing with the services, delivery or transport vehicles. Information technologies help in supporting these functionalities from remote locations and update the managers with the latest information of their mobile assets. Tracking the mobile assets locations data and analyzing the information is necessary for optimal utilization of the assets.

CHAPTER 2

Block Diagram of VTS

2.1 Block Diagram of Vehicle Tracing Using GSM and GPS Modem

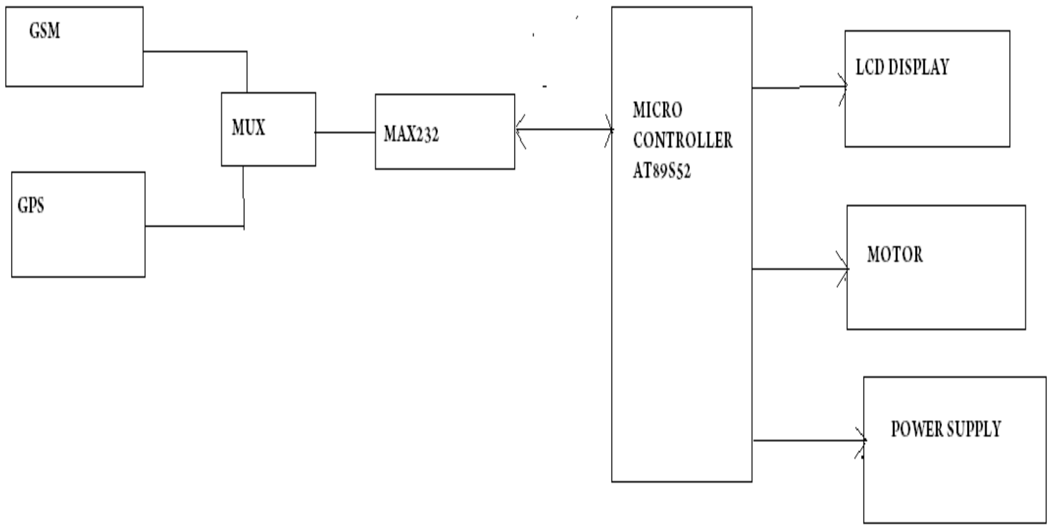
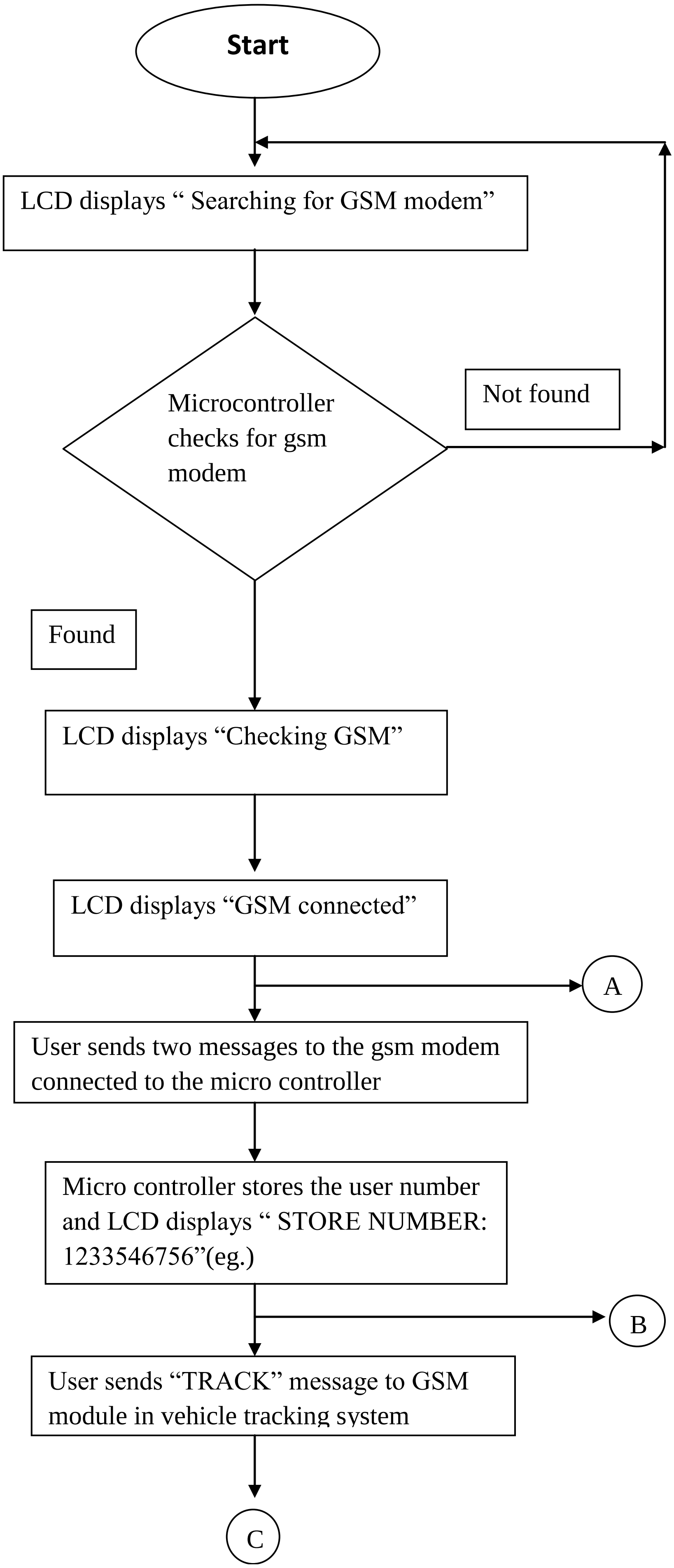


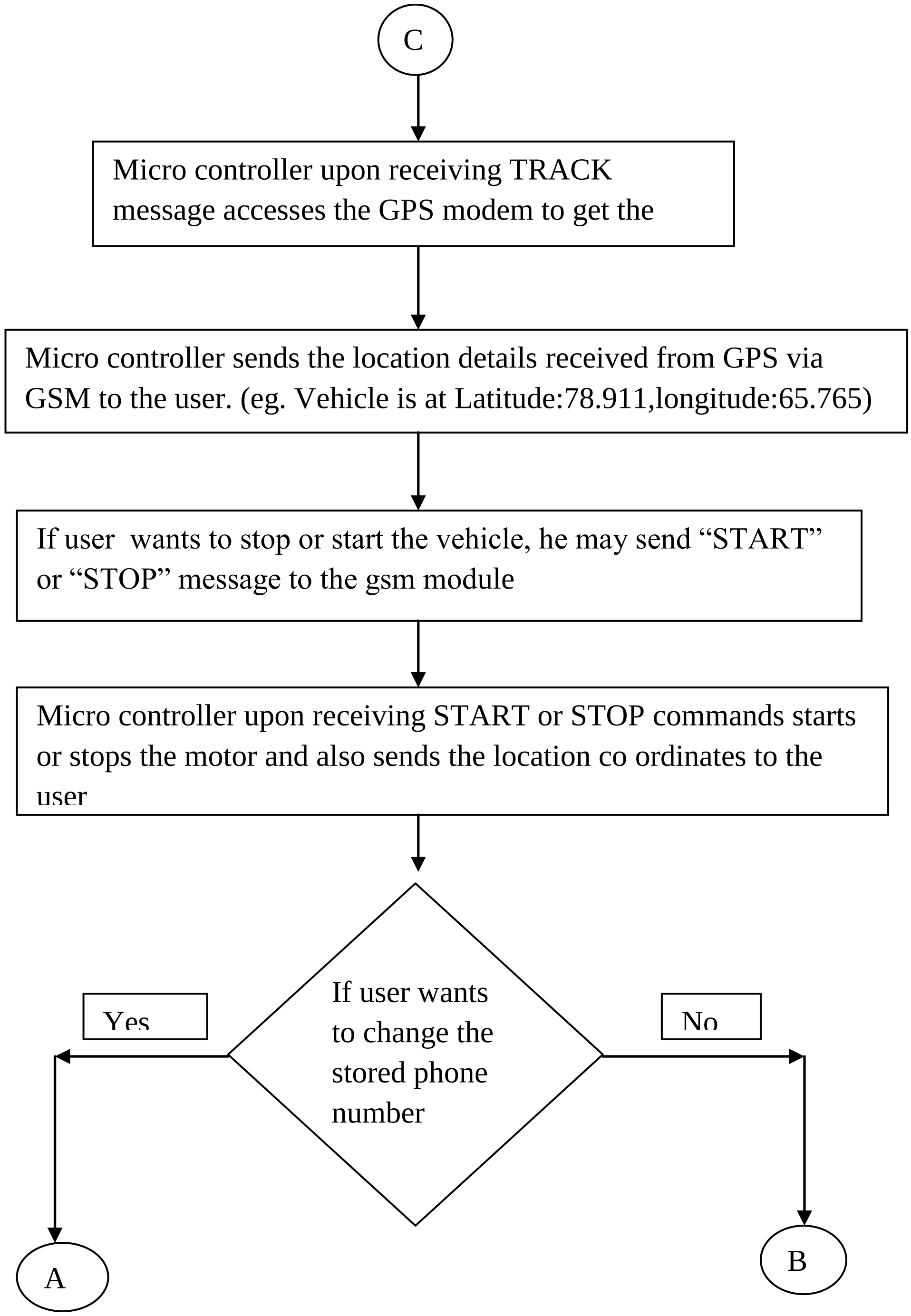
Fig 2.1: Block diagram of vehicle tracking system

2.2 Hardware Components

- AT89S52
- GPS MODULE
- GSM MODULE
- RS232
- MAX 232
- LCD

2.3 Flow chart




C
Micro controller upon receiving TRACK message accesses the GPS modem to get the
Micro controller sends the location details received from GPS via GSM to the user. (eg. Vehicle is at Latitude:78.911,longitude:65.765)
If user wants to stop or start the vehicle, he may send “START” or “STOP” message to the gsm module
Micro controller upon receiving START or STOP commands starts or stops the motor and also sends the location co ordinates to the user
If user wants to change the stored phone number
Yes
No
A
B

CHAPTER 3

INTRODUCTION TO EMBEDDED SYSTEMS

If we look around, we will find ourselves to be surrounded by computing systems. Every year millions of computing systems are built destined for desktop computers (Personal Computers, workstations, mainframes and servers) but surprisingly, billions of computing systems are built every year embedded within larger electronic devices and still goes unnoticed. Any device running on electric power either already has computing system or will soon have computing system embedded in it.

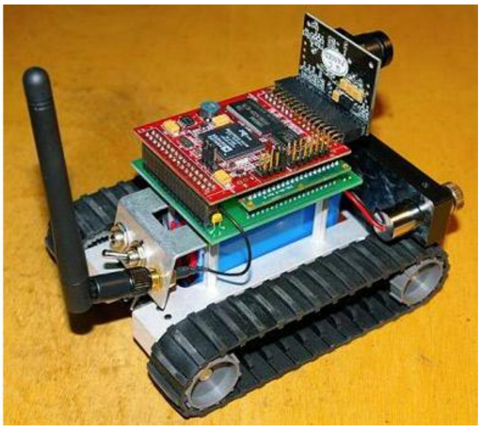


Fig 3.1: Robot- An Embedded System

Today, embedded systems are found in cell phones, digital cameras, camcorders, portable video games, calculators, and personal digital assistants, microwave ovens, answering machines, home security systems, washing machines, lighting systems, fax machines, copiers, printers, and scanners, cash registers, alarm systems, automated teller machines, transmission control, cruise control, fuel injection, anti-lock brakes, active suspension and many other devices/ gadgets.

3.1 WHAT IS EMBEDDED SYSTEM?

A precise definition of embedded systems is not easy. Simply stated, all computing systems other than general purpose computer (with monitor, keyboard, etc.) are embedded systems.

System is a way of working, organizing or performing one or many tasks according to a fixed set of rules, program or plan. In other words, an arrangement in which all units assemble and work together according to a program or plan. An embedded system is a system that has software embedded into hardware, which makes a system dedicated for an application (s) or specific part of an application or product or part of a larger system. It processes a fixed set of pre-programmed instructions to control electromechanical equipment which may be part of an even larger system (not a computer with keyboard, display, etc).

A general-purpose definition of embedded systems is that they are devices used to control, monitor or assist the operation of equipment, machinery or plant. “Embedded” reflects the fact that they are an integral part of the system. In many cases, their “embeddedness” may be such that their presence is far from obvious to the casual observer. Block diagram of a typical embedded system is shown in fig.

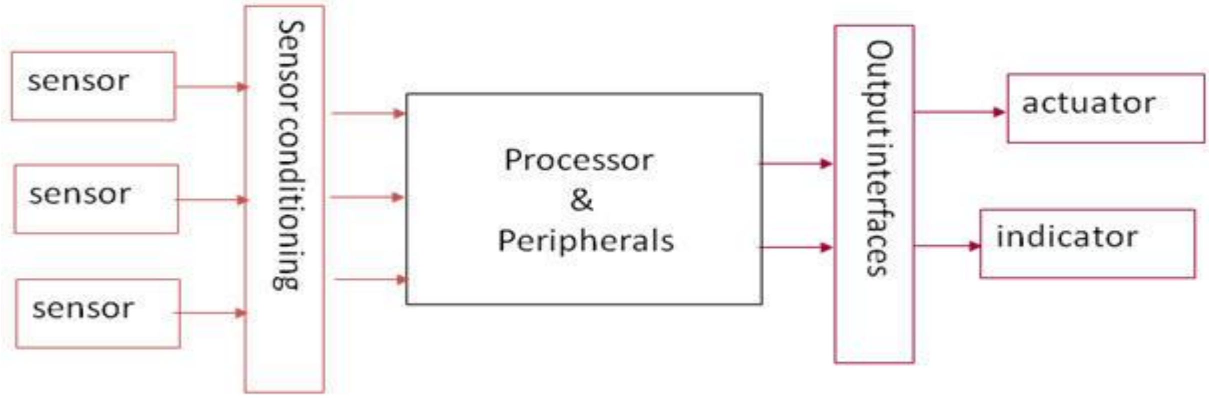


Fig 3.2: Block Diagram of a typical Embedded System

An embedded system is an engineering artefact involving computation that is subject to physical constraints (reaction constraints and execution constraints) arising through interactions of computational processes with the physical world. Reaction constraints originate from the behavioural requirements & specify deadlines, throughput, and jitter whereas execution constraints originate from the implementation requirements & put bounds on available processor speeds, power, memory and hardware failure rates. The key to embedded systems design is to obtain desired functionality under both kinds of constraints.

3.2 CHARACTERISTICS

a) Embedded systems are application specific & single functioned; application is known apriori, the programs are executed repeatedly.

b) Efficiency is of paramount importance for embedded systems. They are optimized for energy, code size, execution time, weight & dimensions, and cost.

c) Embedded systems are typically designed to meet real time constraints; a real time system reacts to stimuli from the controlled object/ operator within the time interval dictated by the environment. For real time systems, right answers arriving too late (or even too early) are wrong.

d) Embedded systems often interact (sense, manipulate & communicate) with external world through sensors and actuators and hence are typically reactive systems; a reactive system is in continual interaction with the environment and executes at a pace determined by that environment.

e) They generally have minimal or no user interface.

3.3 Applications of Embedded System

- Military and Aerospace Software Applications
- Communication Applications
- Electronics and Consumer devices
- Industrial Automation and Process Control Software

And many more…

CHAPTER 4

GSM & GPS

4.1 Introduction to GSM

GSM (Global System for Mobile communications: originally from Groupe Spécial Mobile) is the most popular standard for mobile phones in the world. Its promoter, the GSM Association, estimates that 80% of the global mobile market uses the standard.[1] GSM is used by over 3 billion people across more than 212 countries and territories.[2][3] Its ubiquity makes international roaming very common between mobile phone operators, enabling subscribers to use their phones in many parts of the world. GSM differs from its predecessors in that both signaling and speech channels are digital, and thus is considered a second generation (2G) mobile phone system. This has also meant that data communication was easy to build into the system. GSM EDGE is a 3G version of the protocol.

The ubiquity of the GSM standard has been an advantage to both consumers (who benefit from the ability to roam and switch carriers without switching phones) and also to network operators (who can choose equipment from any of the many vendors implementing GSM[4]). GSM also pioneered a low-cost (to the network carrier) alternative to voice calls, the short message service (SMS, also called "text messaging"), which is now supported on other mobile standards as well. Another advantage is that the standard includes one worldwide emergency telephone number, 112.[5] This makes it easier for international travellers to connect to emergency services without knowing the local emergency number.

Newer versions of the standard were backward-compatible with the original GSM phones. For example, Release '97 of the standard added packet data capabilities, by means of General Packet Radio Service (GPRS). Release '99 introduced higher speed data transmission using Enhanced Data Rates for GSM Evolution (EDGE).

4.2 Technical details

4.2.1 Cellular radio network

GSM is a cellular network, which means that mobile phones connect to it by searching for cells in the immediate vicinity. There are five different cell sizes in a GSM network—macro, micro, pico, femto and umbrella cells. The coverage area of each cell varies according to the implementation environment. Macro cells can be regarded as cells where the base station antenna is installed on a mast or a building above average roof top level. Micro cells are cells whose antenna height is under average roof top level; they are typically used in urban areas. Picocells are small cells whose coverage diameter is a few dozen metres; they are mainly used indoors. Femtocells are cells designed for use in residential or small business environments and connect to the service provider's network via a broadband internet connection. Umbrella cells are used to cover shadowed regions of smaller cells and fill in gaps in coverage between those cells.

Cell horizontal radius varies depending on antenna height, antenna gain and propagation conditions from a couple of hundred meters to several tens of kilometres. The longest distance the GSM specification supports in practical use is 35 kilometres (22 mi). There are also several implementations of the concept of an extended cell[12], where the cell radius could be double or even more, depending on the antenna system, the type of terrain and the timing advance.

Indoor coverage is also supported by GSM and may be achieved by using an indoor picocell base station, or an indoor repeater with distributed indoor antennas fed through power splitters, to deliver the radio signals from an antenna outdoors to the separate indoor distributed antenna system. These are typically deployed when a lot of call capacity is needed indoors; for example, in shopping centers or airports. However, this is not a prerequisite, since indoor coverage is also provided by in-building penetration of the radio signals from any nearby cell.

The modulation used in GSM is Gaussian minimum-shift keying (GMSK), a kind of continuous-phase frequency shift keying. In GMSK, the signal to be modulated onto the carrier is first smoothed with a Gaussian low-pass filter prior to being fed to a frequency modulator, which greatly reduces the interference to neighboring channels (adjacent-channel interference).

4.2.2 GSM frequencies

GSM networks operate in a number of different frequency ranges (separated into GSM frequency ranges for 2G and UMTS frequency bands for 3G). Most 2G GSM networks operate in the 900 MHz or 1800 MHz bands. Some countries in the Americas (including Canada and the United States) use the 850 MHz and 1900 MHz bands because the 900 and 1800 MHz frequency bands were already allocated. Most 3G GSM networks in Europe operate in the 2100 MHz frequency band.

The rarer 400 and 450 MHz frequency bands are assigned in some countries where these frequencies were previously used for first-generation systems.

GSM-900 uses 890–915 MHz to send information from the mobile station to the base station (uplink) and 935–960 MHz for the other direction (downlink), providing 124 RF channels (channel numbers 1 to 124) spaced at 200 kHz. Duplex spacing of 45 MHz is used.

In some countries the GSM-900 band has been extended to cover a larger frequency range. This 'extended GSM', E-GSM, uses 880–915 MHz (uplink) and 925–960 MHz (downlink), adding 50 channels (channel numbers 975 to 1023 and 0) to the original GSM-900 band. Time division multiplexing is used to allow eight full-rate or sixteen half-rate speech channels per radio frequency channel. There are eight radio timeslots (giving eight burst periods) grouped into what is called a TDMA frame. Half rate channels use alternate frames in the same timeslot. The channel data rate for all 8 channels is 270.833 kbit/s, and the frame duration is 4.615 ms.

The transmission power in the handset is limited to a maximum of 2 watts in GSM850/900 and 1 watt in GSM1800/1900.

4.2.3 Voice codecs

GSM has used a variety of voice codecs to squeeze 3.1 kHz audio into between 6.5 and 13 kbit/s. Originally, two codecs, named after the types of data channel they were allocated, were used, called Half Rate (6.5 kbit/s) and Full Rate (13 kbit/s). These used a system based upon linear predictive coding (LPC). In addition to being efficient with bitrates, these codecs also made it easier to identify more important parts of the audio, allowing the air interface layer to prioritize and better protect these parts of the signal.

GSM was further enhanced in 1997[13] with the Enhanced Full Rate (EFR) codec, a 12.2 kbit/s codec that uses a full rate channel. Finally, with the development of UMTS, EFR was refactored into a variable-rate codec called AMR-Narrowband, which is high quality and robust against interference when used on full rate channels, and less robust but still relatively high quality when used in good radio conditions on half-rate channels.

4.2.4 Network structure

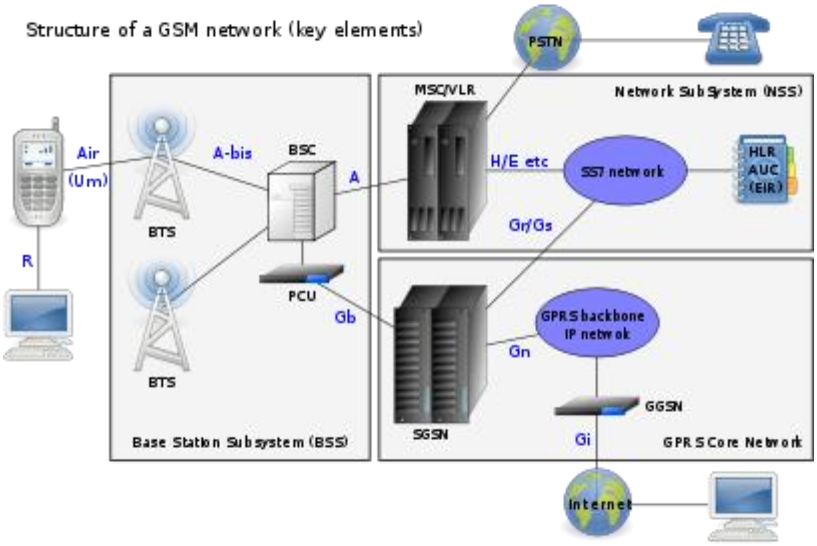


Fig 4.1: The structure of a GSM network

The network behind the **GSM** seen by the customer is large and complicated in order to provide all of the services which are required. It is divided into a number of sections and these are each covered in separate articles.

- **the Base Station Subsystem (the base stations and their controllers).**
- **the Network and Switching Subsystem (the part of the network most similar to a fixed network). This is sometimes also just called the core network.**
- **the GPRS Core Network (the optional part which allows packet based Internet connections).**
- **all of the elements in the system combine to produce many GSM services such as voice calls and SMS.**

4.2.5Subscriber Identity Module (SIM)

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. Alternatively, the user can also change operators while retaining the handset simply by changing the SIM. Some operators will block this by allowing the phone to use only a single SIM, or only a SIM issued by them; this practice is known as SIM locking, and is illegal in some countries.

4.2.6 Phone locking

Sometimes mobile phone operators lock mobiles which they sell to their own network. This is done because the price of the mobile phone is typically subsidised with revenue from subscriptions, and operators want to try to recoup this investment before a subscriber leaves for another operator.

A subscriber can usually contact the provider to remove the lock for a fee, utilize private services to remove the lock, or make use of software and websites available on the Internet to unlock the handset themselves. While most web sites offer the unlocking for a fee, some do it for free. The locking applies to the handset not to SIM card.

In some territories (e.g. Bangladesh, Hong Kong, Pakistan and others) all phones are sold unlocked. In others (e.g. Belgium, Finland, New Zealand and others) it is unlawful for operators to offer any form of subsidy on the phone's price.

4.2.7 GSM security

GSM was designed with a moderate level of security. The system was designed to authenticate the subscriber using a pre-shared key and challenge-response. Communications between the subscriber and the base station can be encrypted. The development of UMTS introduces an optional USIM, that uses a longer authentication key to give greater security, as well as mutually authenticating the network and the user - whereas GSM only authenticates the user to the network (and not vice versa). The security model therefore offers confidentiality and authentication, but limited authorization capabilities, and no non-repudiation.

GSM uses several cryptographic algorithms for security. The A5/1 and A5/2 stream ciphers are used for ensuring over-the-air voice privacy. A5/1 was developed first and is a stronger algorithm used within Europe and the United States; A5/2 is weaker and used in other countries. Serious weaknesses have been found in both algorithms: it is possible to break A5/2 in real-time with a ciphertext-only attack, and in February 2008, Pico Computing, Inc revealed its ability and plans to commercialize FPGAs that allow A5/1 to be broken with a rainbow table attack. The system supports multiple algorithms so operators may replace that cipher with a stronger one.

On 28 December 2009 German computer engineer Karsten Nohl announced that he had cracked the A5/1 cipher. According to Nohl, he developed a number of rainbow tables (static values which reduce the time needed to carry out an attack) and have found new sources for known plaintext attacks. He also said that it is possible to build "a full GSM interceptor ... from open source components" but that they had not done so because of legal concerns.

In 2010, threatpost.com reported that "A group of cryptographers has developed a new attack that has broken Kasumi, the encryption algorithm used to secure traffic on 3G GSM wireless networks. The technique enables them to recover a full key by using a tactic known as a related-key attack, but experts say it is not the end of the world for Kasumi." Kasumi is the name for the A5/3 algorithm, used to secure most 3g GSM traffic.

4.3 GPS (Global Positioning System)

The **Global Positioning System** (**GPS**) is a U.S. space-based global navigation satellite system. It provides reliable positioning, navigation, and timing services to worldwide users on a continuous basis in all weather, day and night, anywhere on or near the Earth.

GPS is made up of three segments: Space, Control and User. The Space Segment is composed of 24 to 32 satellites in Medium Earth Orbit and also includes the boosters required to launch them into orbit. The Control Segment is composed of a Master Control Station, an Alternate Master Control Station, and a host of dedicated and shared Ground Antennas and Monitor Stations. The User Segment is composed of hundreds of thousands of U.S. and allied military users of the secure GPS Precise Positioning Service, and tens of millions of civil, commercial and scientific users of the Standard Positioning Service (see GPS navigation devices). GPS satellites broadcast signals from space that GPS receivers use to provide three-dimensional location (latitude, longitude, and altitude) plus precise time.

GPS has become a widely used aid to navigation worldwide, and a useful tool for map-making, land surveying, commerce, scientific uses, tracking and surveillance, and hobbies such as geocaching and waymarking. Also, the precise time reference is used in many applications including the scientific study of earthquakes and as a time synchronization source for cellular network protocols.

GPS has become a mainstay of transportation systems worldwide, providing navigation for aviation, ground, and maritime operations. Disaster relief and emergency services depend upon GPS for location and timing capabilities in their life-saving missions. The accurate timing that GPS provides facilitates everyday activities such as banking, mobile phone operations, and even the control of power grids. Farmers, surveyors, geologists and countless others perform their work more efficiently, safely, economically, and accurately using the free and open GPS signals.

4.3.1 Basic concept of GPS

A GPS receiver calculates its position by precisely timing the signals sent by the GPS satellites high above the Earth. Each satellite continually transmits messages which include

- **the time the message was sent**
- **precise orbital information (the ephemeris)**
- **the general system health and rough orbits of all GPS satellites (the almanac).**

The receiver utilizes the messages it receives to determine the transit time of each message and computes the distances to each satellite. These distances along with the satellites' locations are used with the possible aid of trilateration to compute the position of the receiver. This position is then displayed, perhaps with a moving map display or latitude and longitude; elevation information may be included. Many GPS units also show derived information such as direction and speed, calculated from position changes.

Three satellites might seem enough to solve for position, since space has three dimensions and a position on the Earth's surface can be assumed. However, even a very small clock error multiplied by the very large speed of light[20]—the speed at which satellite signals propagate—results in a large positional error. Therefore receivers use four or more satellites to solve for the receiver's location and time. The very accurately computed time is effectively hidden by most GPS applications, which use only the location. A few specialized GPS applications do however use the time; these include time transfer, traffic signal timing, and synchronization of cell phone base stations.

Although four satellites are required for normal operation, fewer apply in special cases. If one variable is already known, a receiver can determine its position using only three satellites. (For example, a ship or plane may have known elevation.) Some GPS receivers may use additional clues or assumptions (such as reusing the last known altitude, dead reckoning, inertial navigation, or including information from the vehicle computer) to give a degraded position when fewer than four satellites are visible (see,[21] Chapters 7 and 8 of,[22] and [23]).

4.3.2 Position calculation introduction

To provide an introductory description of how a GPS receiver works, errors will be ignored in this section. Using messages received from a minimum of four visible satellites, a GPS receiver is able to determine the times sent and then the satellite positions corresponding to these times sent. The x, y, and z components of position, and the time sent, are designated as $[x_i, y_i, z_i, t_i]$ where the subscript *i* is the satellite number and has the value 1, 2, 3, or 4. Knowing the indicated time the message was received t_r, the GPS receiver can compute the transit time of the message as $(tr - t_i)$. Assuming the message traveled at the speed of light, c, the distance traveled, p_i can be computed as $(tr - t_i)c$.

A satellite's position and distance from the receiver define a spherical surface, centered on the satellite. The position of the receiver is somewhere on this surface. Thus with four satellites, the indicated position of the GPS receiver is at or near the intersection of the surfaces of four spheres. (In the ideal case of no errors, the GPS receiver would be at a precise intersection of the four surfaces.)

If the surfaces of two spheres intersect at more than one point, they intersect in a circle. The article trilateration shows this mathematically. A figure, *Two Sphere Surfaces Intersecting in a Circle*, is shown below.

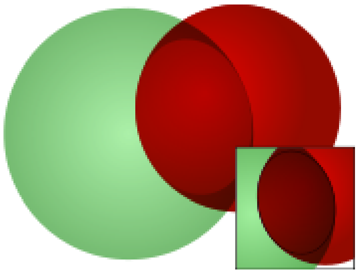


Fig 4.2: Two sphere surfaces intersecting in a circle

The intersection of a third spherical surface with the first two will be its intersection with that circle; in most cases of practical interest, this means they intersect at two points.[24] Another figure, *Surface of Sphere Intersecting a Circle (not disk) at Two Points*, illustrates the intersection. The two intersections are marked with dots. Again the article trilateration clearly shows this mathematically.

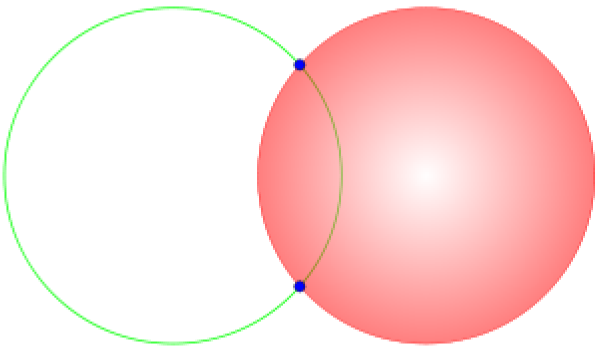


Fig 4.3: Surface of sphere Intersecting a circle (not disk) at two points

For automobiles and other near-earth-vehicles, the correct position of the GPS receiver is the intersection closest to the Earth's surface. For space vehicles, the intersection farthest from Earth may be the correct one.[25]

The correct position for the GPS receiver is also the intersection closest to the surface of the sphere corresponding to the fourth satellite.

4.3.3 Correcting a GPS receiver's clock

The method of calculating position for the case of no errors has been explained. One of the most significant error sources is the GPS receiver's clock. Because of the very large value of the speed of light, *c*, the estimated distances from the GPS receiver to the satellites, the pseudoranges, are very sensitive to errors in the GPS receiver clock. This suggests that an extremely accurate and expensive clock is required for the GPS receiver to work. On the other hand, manufacturers prefer to build inexpensive GPS receivers for mass markets. The solution for this dilemma is based on the way sphere surfaces intersect in the GPS problem.

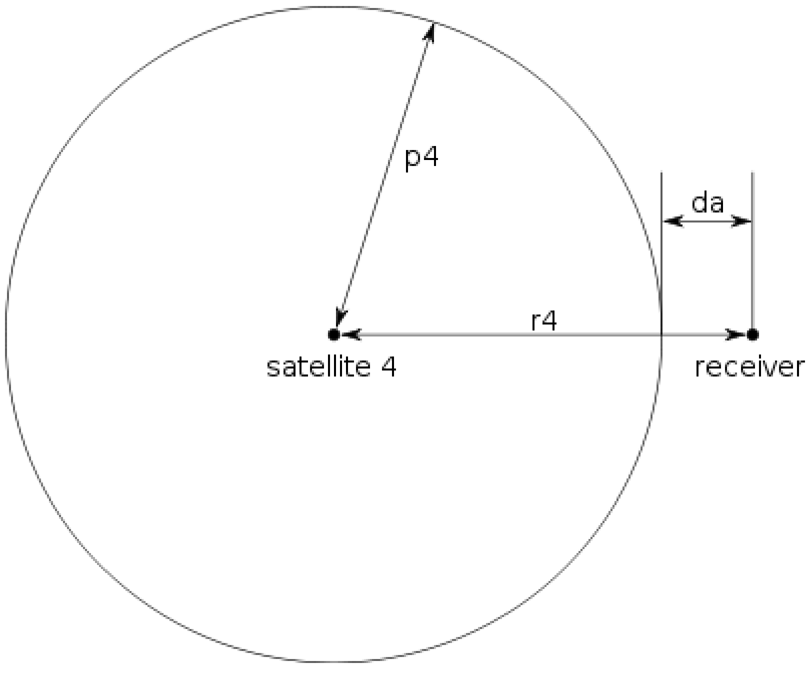


Fig 4.4: Diagram depicting satellite 4, sphere, p4, r4, and da

It is likely that the surfaces of the three spheres intersect, since the circle of intersection of the first two spheres is normally quite large, and thus the third sphere surface is likely to intersect this large circle. It is very unlikely that the surface of the sphere corresponding to the fourth satellite will intersect either of the two points of intersection of the first three, since any clock error could cause it to miss intersecting a point. However, the distance from the valid estimate of GPS receiver position to the surface of the sphere corresponding to the fourth satellite can be used to compute a clock correction. Let $r_4$denote the distance from the valid estimate of GPS receiver position to the fourth satellite and let $p_4$denote the pseudorange of the fourth satellite. Let $da=r_4-p_4$. Note that $da$is the distance from the computed GPS receiver position to the surface of the sphere corresponding to the fourth satellite. Thus the quotient, $b=da/c$, provides an estimate of

(correct time) - (time indicated by the receiver's on-board clock),

and the GPS receiver clock can be advanced if $b$is positive or delayed if $b$is negative.

4.3.4 Applications

The Global Positioning System, while originally a military project, is considered a dual-use technology, meaning it has significant applications for both the military and the civilian industry.

4.3.4.1 Military

The military applications of GPS span many purposes:

- **Navigation: GPS allows soldiers to find objectives in the dark or in unfamiliar territory, and to coordinate the movement of troops and supplies. The GPS-receivers that commanders and soldiers use are respectively called the Commanders Digital Assistant and the Soldier Digital Assistant.**
- **Target tracking: Various military weapons systems use GPS to track potential ground and air targets before they are flagged as hostile. These weapon systems pass GPS co-ordinates of targets to precision-guided munitions to allow them to engage the targets accurately. Military aircraft, particularly those used in air-to-ground roles use GPS to find targets (for example, gun camera video from AH-1 Cobras in Iraq show GPS co-ordinates that can be looked up in Google Earth).**
- **Missile and projectile guidance: GPS allows accurate targeting of various military weapons including ICBMs, cruise missiles and precision-guided**

munitions. Artillery projectiles with embedded GPS receivers able to withstand accelerations of 12,000g's or about 117,600 meters/second^2 have been developed for use in 155 mm howitzers.

- **Search and Rescue: Downed pilots can be located faster if they have a GPS receiver.**
- **Reconnaissance and Map Creation: The military use GPS extensively to aid mapping and reconnaissance.**
- **The GPS satellites also carry a set of nuclear detonation detectors consisting of an optical sensor (Y-sensor), an X-ray sensor, a dosimeter, and an electromagnetic pulse (EMP) sensor (W-sensor) which form a major portion of the United States Nuclear Detonation Detection System.**

4.3.4.2 Civilian

This antenna is mounted on the roof of a hut containing a scientific experiment needing precise timing.

Many civilian applications benefit from GPS signals, using one or more of three basic components of the GPS: absolute location, relative movement, and time transfer.

The ability to determine the receiver's absolute location allows GPS receivers to perform as a surveying tool or as an aid to navigation. The capacity to determine relative movement enables a receiver to calculate local velocity and orientation, useful in vessels or observations of the Earth. Being able to synchronize clocks to exacting standards enables time transfer, which is critical in large communication and observation systems. An example is CDMA digital cellular. Each base station has a GPS timing receiver to synchronize its spreading codes with other base stations to facilitate inter-cell hand off and support hybrid GPS/CDMA positioning of mobiles for emergency calls and other applications. Finally, GPS enables researchers to explore the Earth environment including the atmosphere, ionosphere and gravity field. GPS survey equipment has revolutionized tectonics by directly measuring the motion of faults in earthquakes.

The U.S. Government controls the export of some civilian receivers. All GPS receivers capable of functioning above 18 km (60,000 ft) altitude and 515 m/s (1,000 knots) [90] are classified as munitions (weapons) for which U.S. State Department export licenses are required. These parameters are clearly chosen to prevent use of a receiver in a ballistic missile. It would not prevent use in a cruise missile since their altitudes and speeds are similar to those of ordinary aircraft.

This rule applies even to otherwise purely civilian units that only receive the L1 frequency and the C/A code and cannot correct for SA, etc.

Disabling operation above these limits exempts the receiver from classification as a munition. Different vendors have interpreted these limitations differently. The rule specifies operation above 18 km and 515 m/s, but some receivers stop operating at 18 km even when stationary. This has caused problems with some amateur radio balloon launches as they regularly reach 100,000 feet (30 km).

GPS tours are also an example of civilian use. The GPS is used to determine which content to display. For instance, when approaching a monument it would tell you about the monument.

GPS functionality has now started to move into mobile phones en masse. The first handsets with integrated GPS were launched already in the late 1990’s, and were available for broader consumer availability on networks such as those run by Nextel, Sprint and Verizon in 2002 in response to U.S. FCC mandates for handset positioning in emergency calls. Capabilities for access by third party software developers to these features were slower in coming, with Nextel opening up those APIs upon launch to any developer, Sprint following in 2006, and Verizon soon thereafter.

CHAPTER 5

SOFTWARE DESCRIPTION

The software tools that are used in the project are:

1. Keil Microvision4
2. Proteus 7.6 SP0

5.1 KEIL

5.1.1 INTRODUCTION TO KEIL

Embedded system means some combination of computer hardware and programmable software which is specially designed for a particular task like displaying message on LCD.

Some real life examples of embedded systems may involve ticketing machines, vending machines, temperature controlling unit in air conditioners etc. Microcontrollers are nothing without a Program in it.

One of the important part in making an embedded system is loading the software/program we develop into the microcontroller. Usually it is called "burning software" into the controller. Before "burning a program" into a controller, we must do certain prerequisite operations with the program. This includes writing the program in assembly language or C language in a text editor like notepad, compiling the program in a compiler and finally generating the hex code from the compiled program. Earlier people used different softwares/applications for all these 3 tasks. Writing was done in a text editor like notepad/wordpad, compiling was done using a separate software (probably a dedicated compiler for a particular controller like 8051), converting the assembly code to hex code was done using another software etc. It takes lot of time and work to do all these separately, especially when the task involves lots of error debugging and reworking on the source code.

Keil MicroVision is a free software which solves many of the pain points for an embedded program developer. This software is an integrated development environment (IDE), which integrated a text editor to write programs, a compiler and it will convert your source code to hex files too.

Here is simple guide to start working with Keil µVision which can be used for

- Writing programs in C/C++ or Assembly language
- Compiling and Assembling Programs
- Debugging program
- Creating Hex and Axf file
- Testing your program without Available real Hardware (Simulator Mode)

This is simple guide on Keil µVision 4 though also applicable on previous versions also.
These are the simple steps to get off the mark your inning!
Step 1: After opening Keil µV4, Go to Project tab and
Create new µVision project
Now Select new folder and give name to Project.

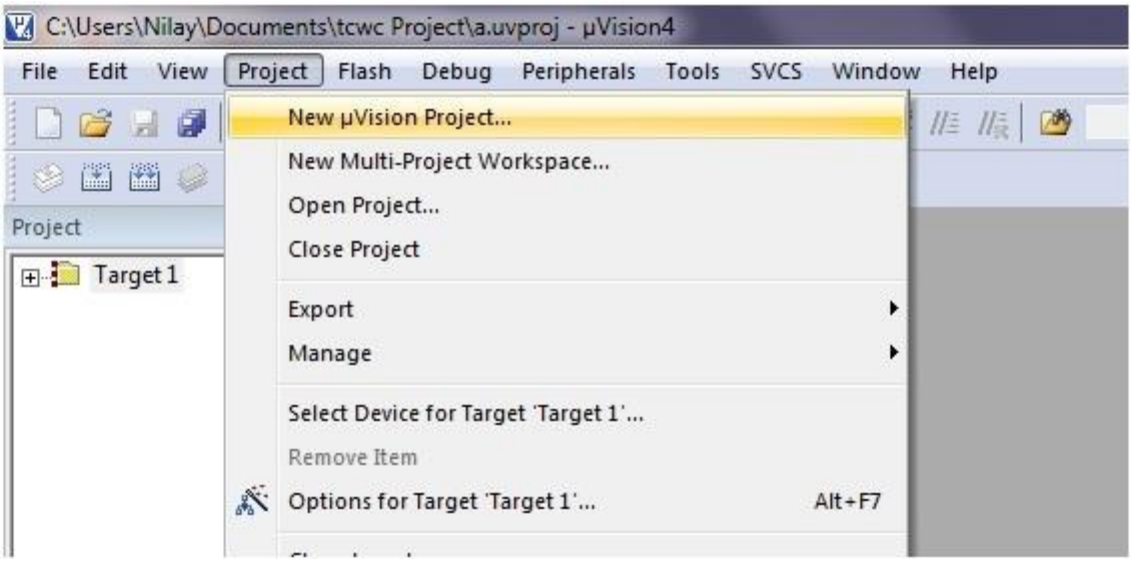


Fig 5.1: Creating a new project in keil

Step 2: After Creating project now **Select your device model**. Example.NXP-LPC2148
[You can change it later from project window.]

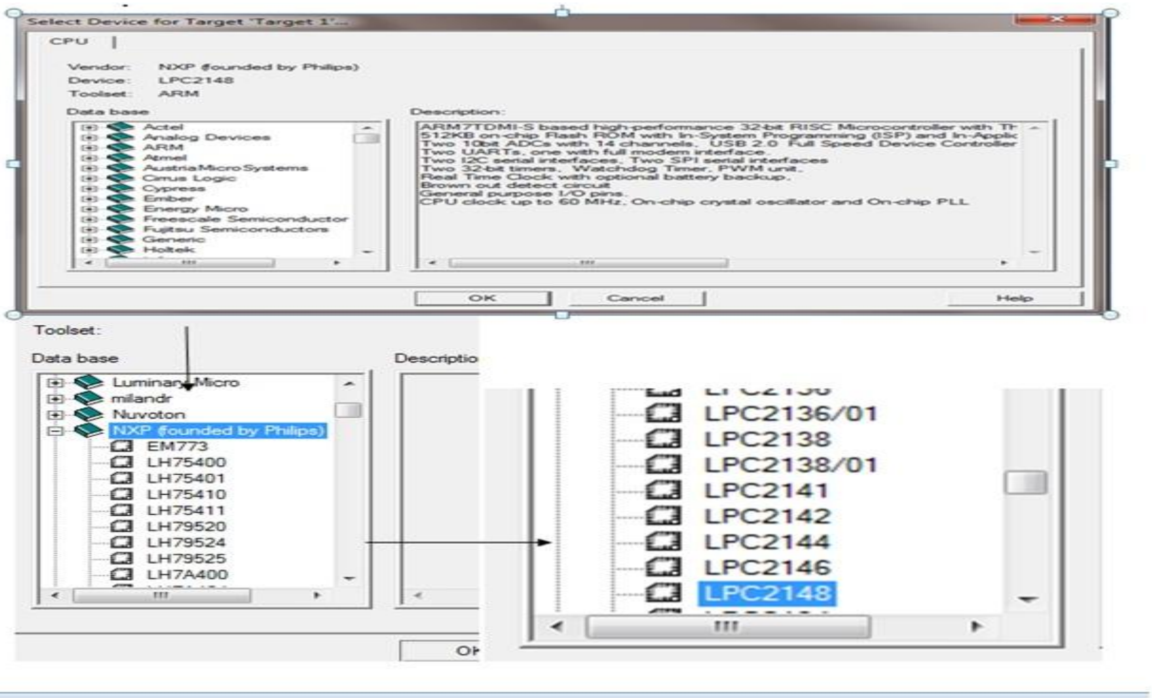


Fig 5.2: Selecting device in keil

Step 3: so now your project is created and **Message** window will appear to add startup file of your Device click on **Yes** so it will be added to your project folder

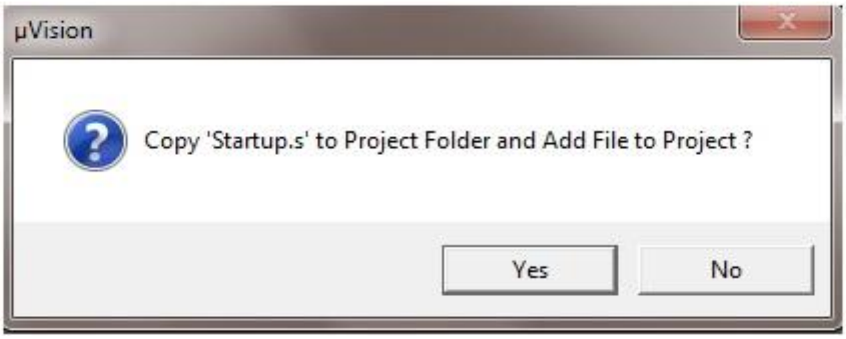


Fig 5.3: Copying startup file

Step 4: Now go to File and create new file and save it with **.C** extension if you will write program in C language or save with **.asm** for **assembly** language.i.e., **Led.c**

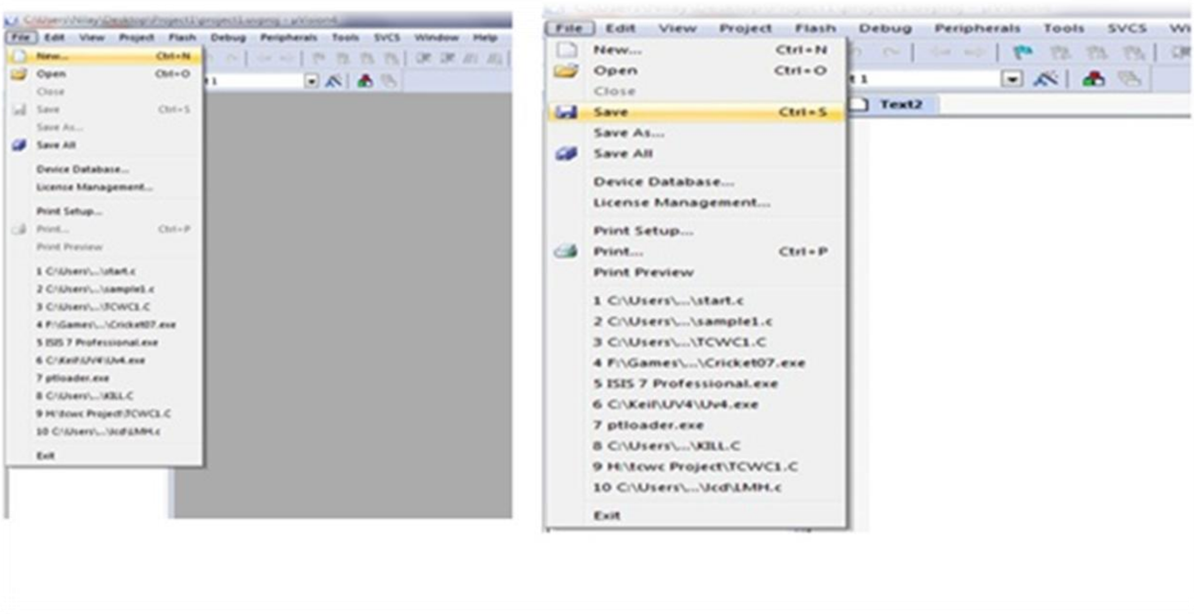


Fig 5.4: Creating and saving file

Step 5: Now write your program and save it again. You can try example given at end of this tutorial.

Step 6: After that on left you see project window [if it's not there….go to View tab and click on project window]

Now come on Project window.

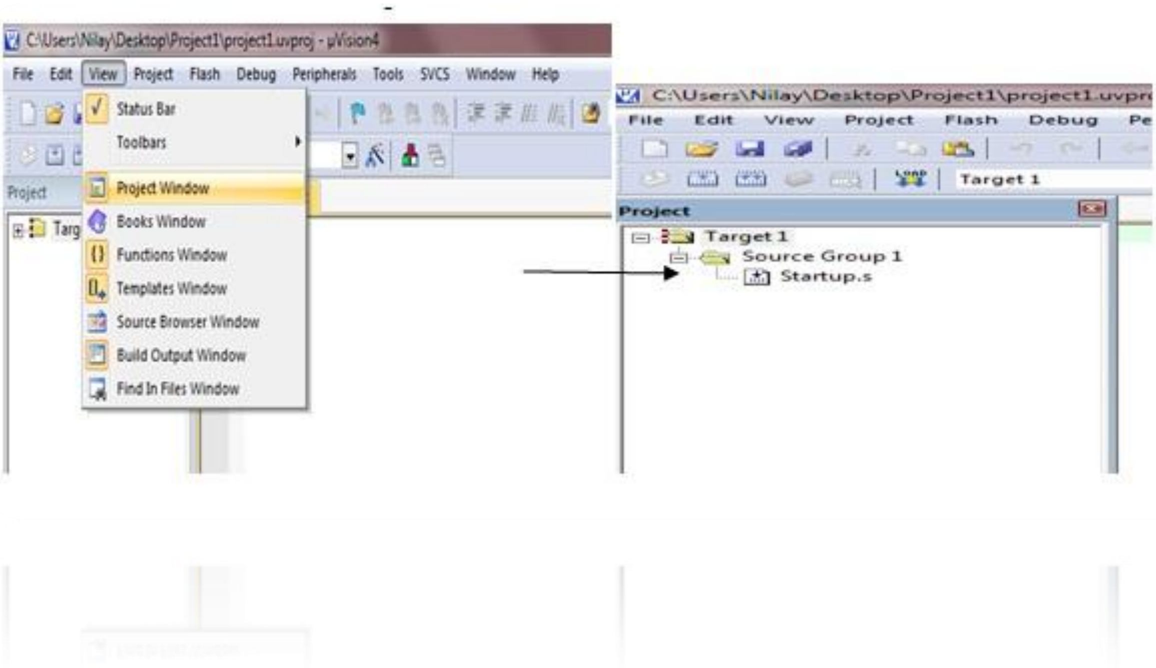


Fig 5.5: Opening Project

Right click on target and click on **options for target**

Here you can change your device also.

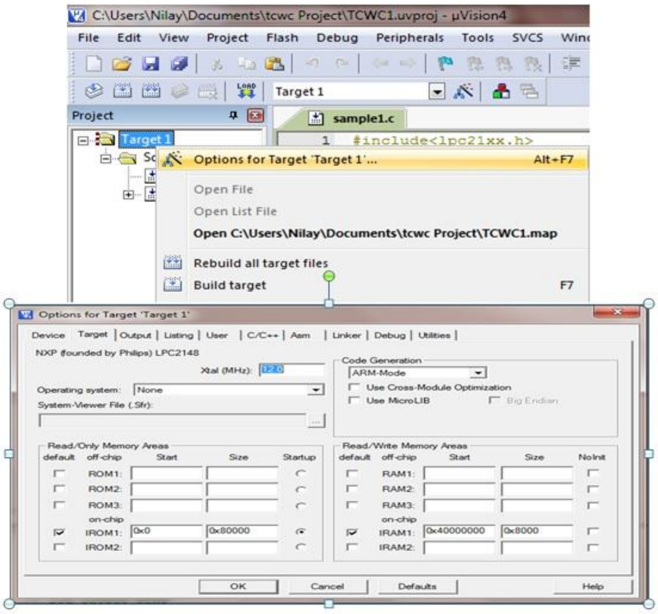


Fig 5.6: Selecting options for target

Click **output** tab here & check **create Hex file** if you want to generate hex file

Now click on ok so it will save changes.

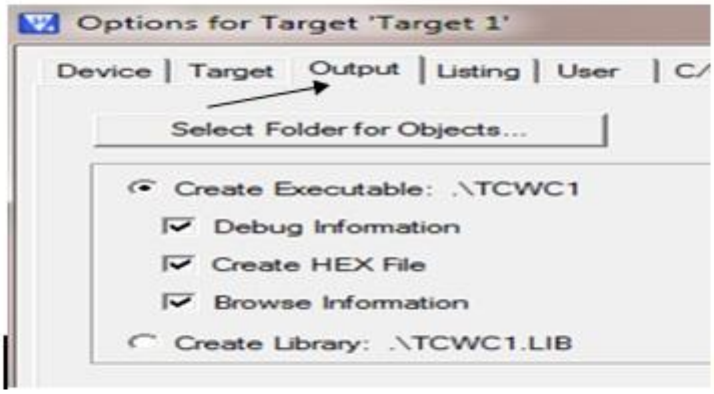


Fig 5.7: Selecting options to create a hex file

Step 7: Now Expand target and you will see source group

Right click on group and click on **Add files to source group**

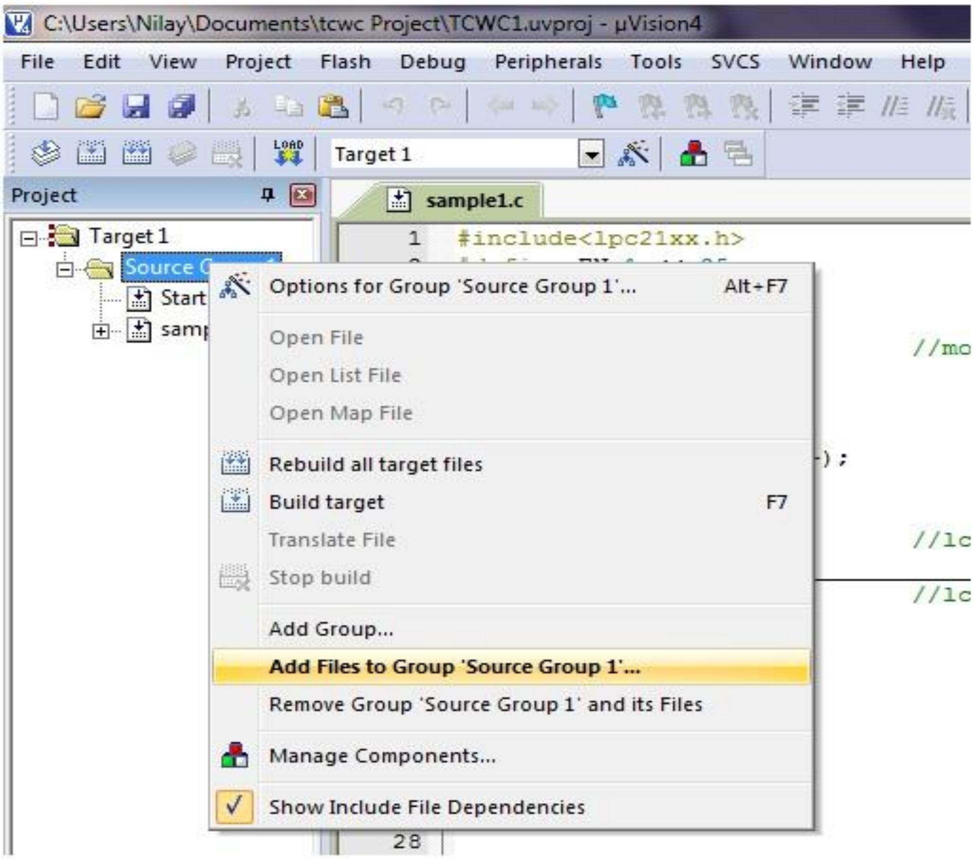


Fig 5.8: Adding files to Source group

Now add your program file which you have written in C/assembly.

You can see program file added under source group.

Step 8: Now Click on **Build target**.You can find it under Project tab or in toolbar.It can also be done by pressing **F7** key.

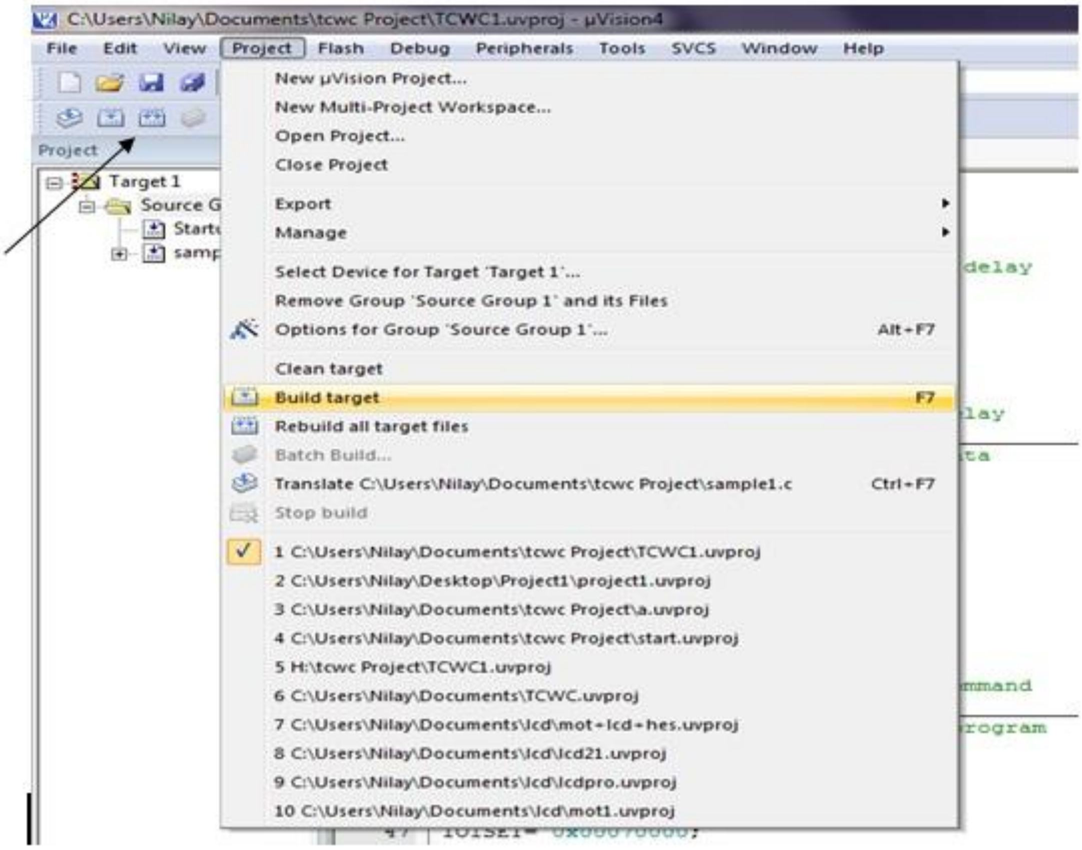


Fig 5.9: Building target

Step 9: you can see Status of your program in **Build output** window

[If it’s not there go to view and click on Build output window]

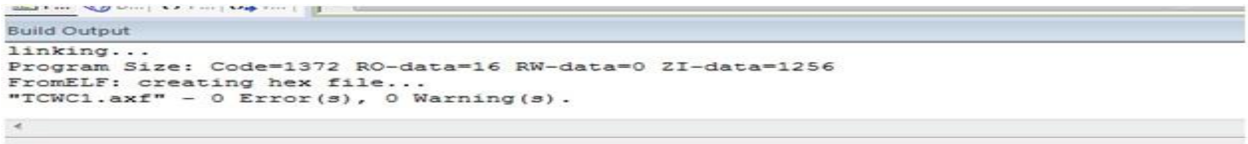


Fig 5.10: Checking Program Status

Now you are done with your program.

5.2 PROTEUS

Proteus is a software for microprocessor simulation, schematic capture and printed circuit board (PCB) design. It is developed by Labcenter Electronics. There are so many versions of Proteus. We used Proteus 7.6 SP 0 in this project. Proteus ISIS professional software is a PCB design software integrated with the simulation of the circuit you design. It is integrated with real time simulation of the electronic circuit and test whether your designed circuit is working properly or not. If you have previously worked on basic and easy tools to design circuit, this software will also look more easy to use for your analysis work at next level.

In this software you can test your test code by loading the hex file in the circuit and test the circuit proper functioning. All Proteus PCB design products include an integrated shape based auto router and a basic SPICE simulation capability as standard. More advanced routing modes are included in Proteus PCB Design Level 2 and higher whilst simulation capabilities can be enhanced by purchasing the Advanced Simulation option and/or micro-controller simulation capabilities.

When you save Proteus file, it will be saved in two extension- PWI file and DBK file and whenever you save your file after little changes, Proteus software automatically creates a file with "last loaded" prefix adding before the name of a file. For example, if one saves Proteus circuit file with name "example", and when next time you open do little changes and press ctrl+s to save file, it will be automatically saved as "last loaded example".

5.2.1 SYSTEM COMPONENTS

- **ISIS Schematic Capture** - a tool for entering designs.
- **PROSPICE Mixed mode SPICE simulation** - industry standard SPICE3F5 simulator combined with a digital simulator.
- **ARES PCB Layout** - PCB design system with automatic component placer, rip-up and retry auto-router and interactive design rule checking.
- **VSM** - Virtual System Modeling lets co simulate embedded software for popular micro-controllers alongside hardware design.

- **System Benefits** Integrated package with common user interface and fully context sensitive help.

5.2.2 ADVANTAGES

- Easy to simulate.
- Provides users with practical feedback when designing real world systems.
- Permits System designers to study a problem at different levels of abstraction
- Reduces product/project development time period.
- Cheaper and Faster.
- Easy Verification and Testing.
- Saves money.

5.2.3 LIMITATIONS

- Not all the hardware components can be mimicked.
- Requires intensive processing for complex circuitry which may cause delay in results.

5.2.4 STEPS TO CREATE AND SIMULATE A DESIGN IN PROTEUS

1. Click on Start on desktop and search for ISIS 7 Professional and open it.

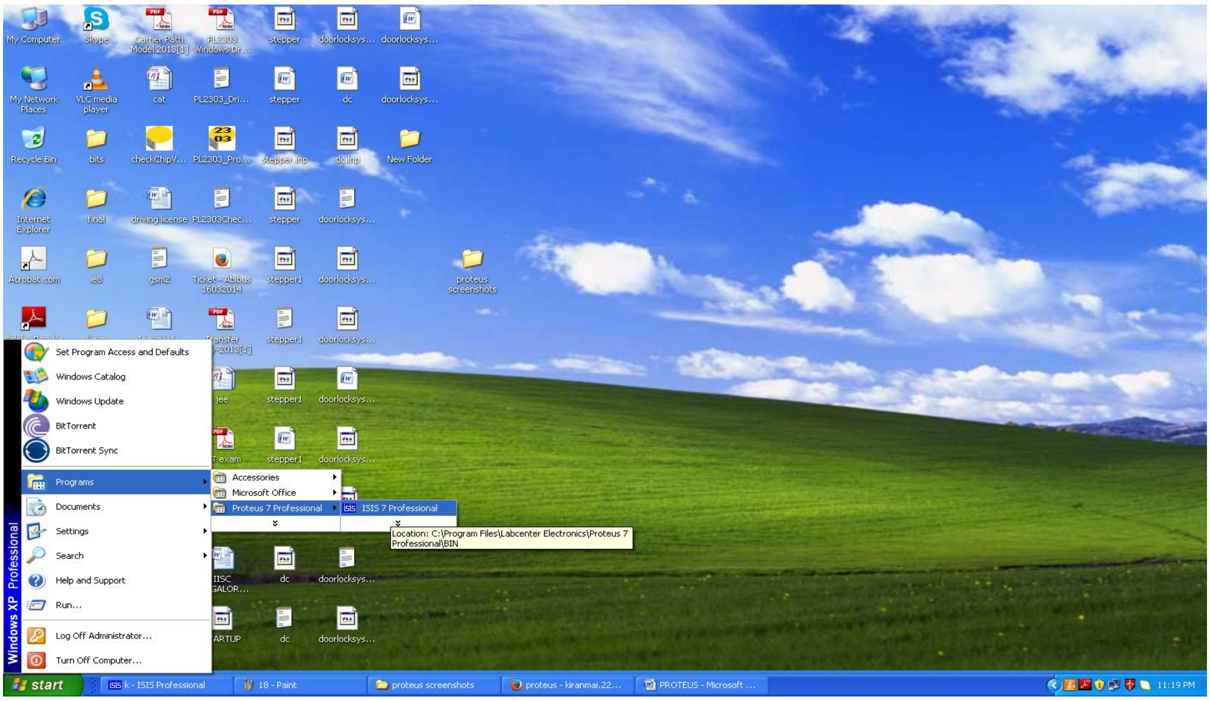


Fig 5.11: Opening ISIS 7 professional

2. Select component mode and pick the components from the available libraries

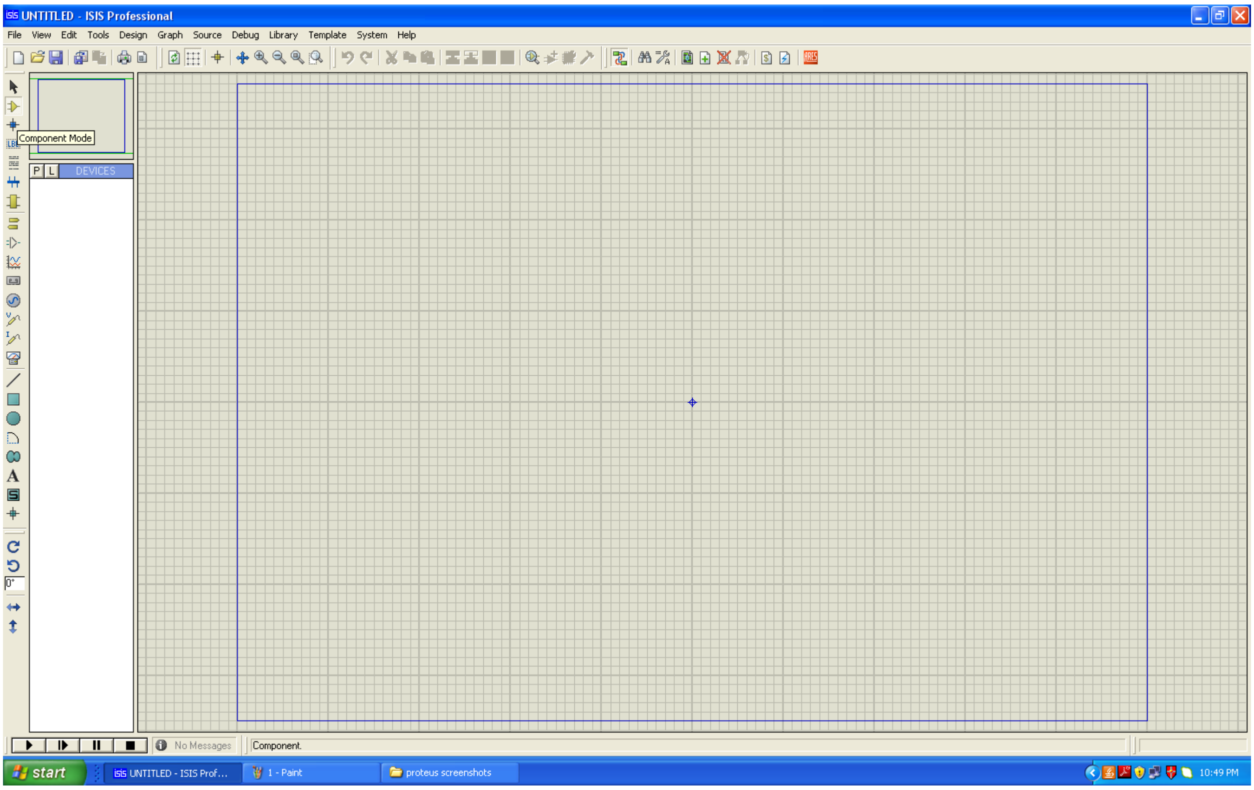


Fig 5.12: Selecting Component mode

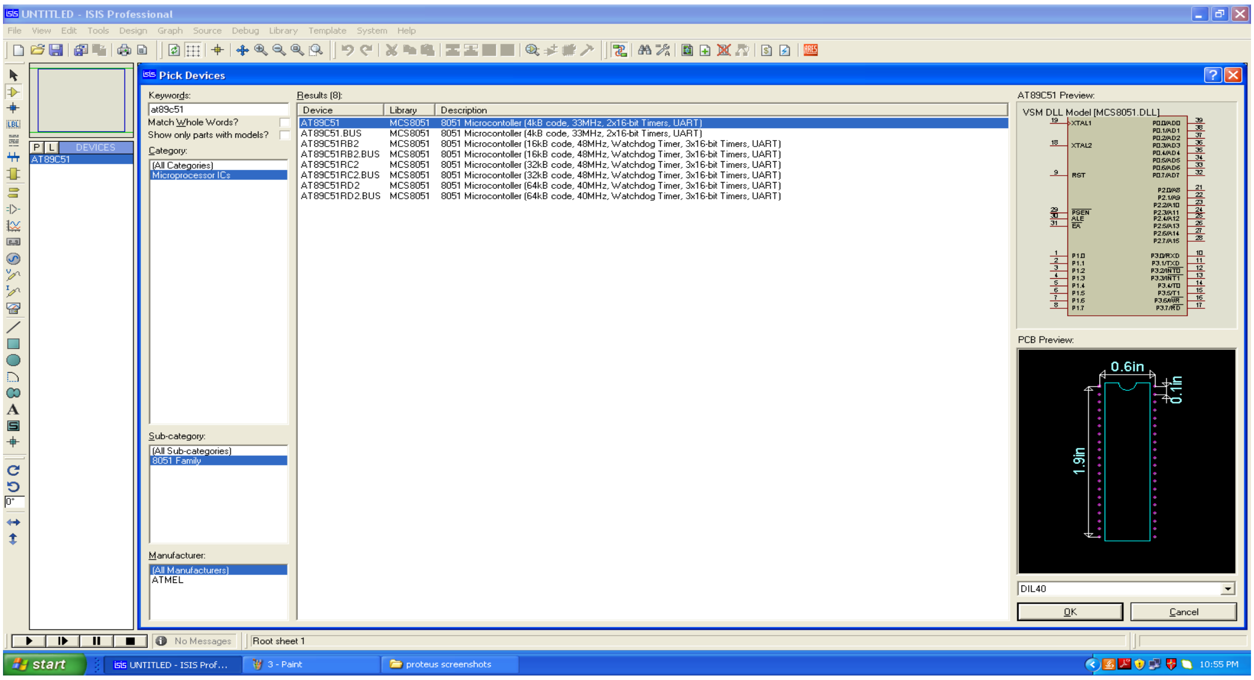


Fig 5.13

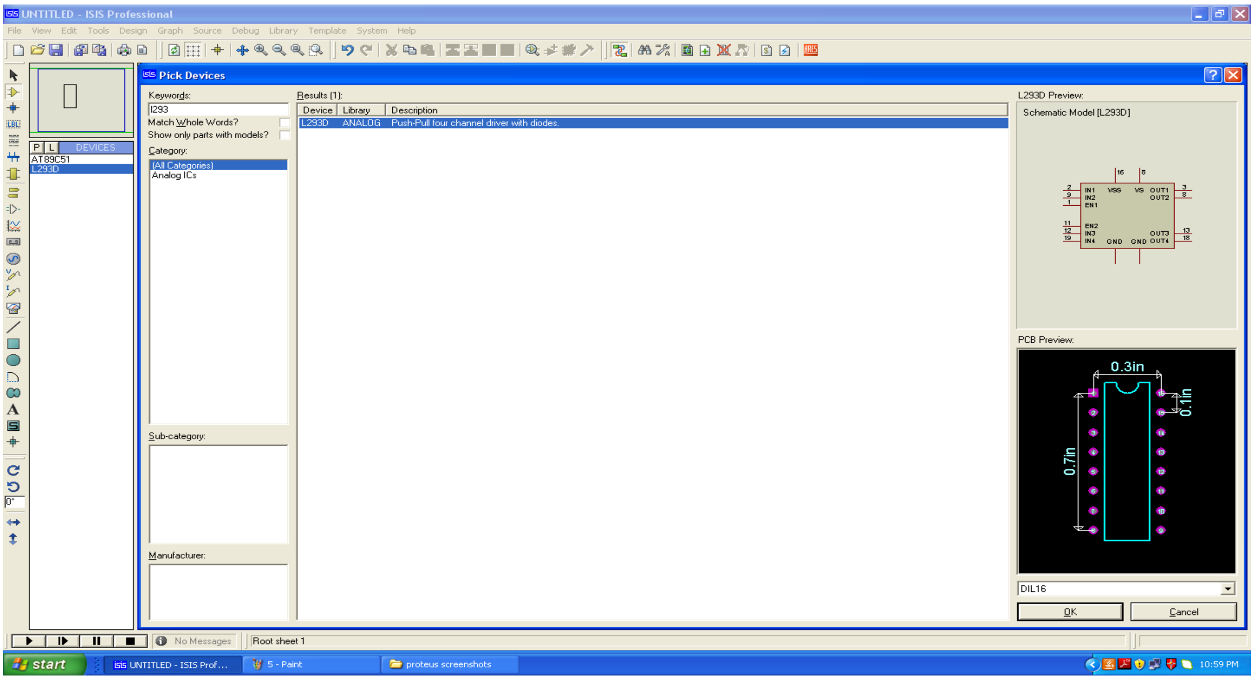


Fig 5.14

Fig 5.13 and Fig 5.14: Selecting devices from library

3. Connect the components as required.

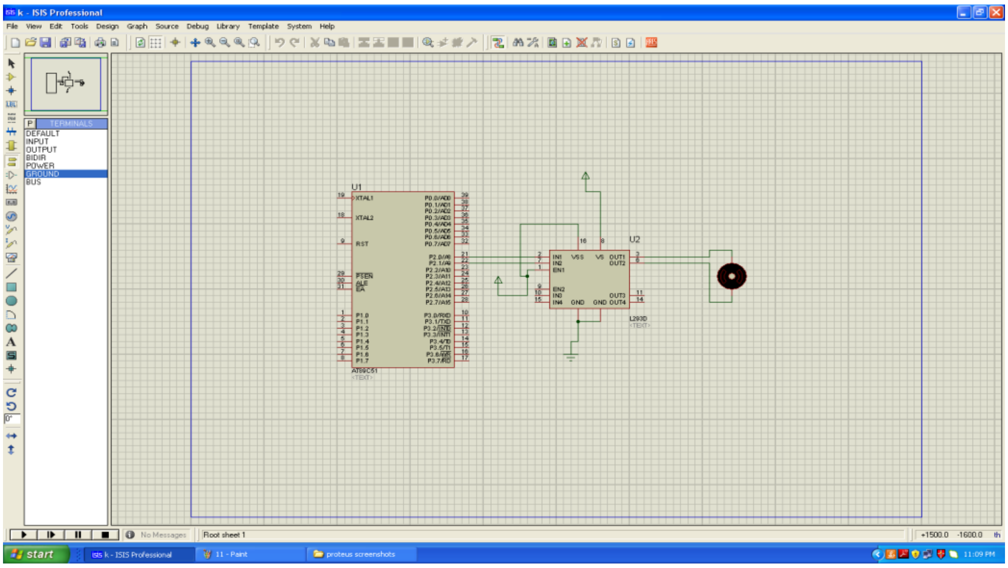


Fig 5.15: Connecting the circuit

4. Once the connections are competed dump the hex file of your design code. The steps to burn hex file are explained below in detail

5. Save the file for further use.

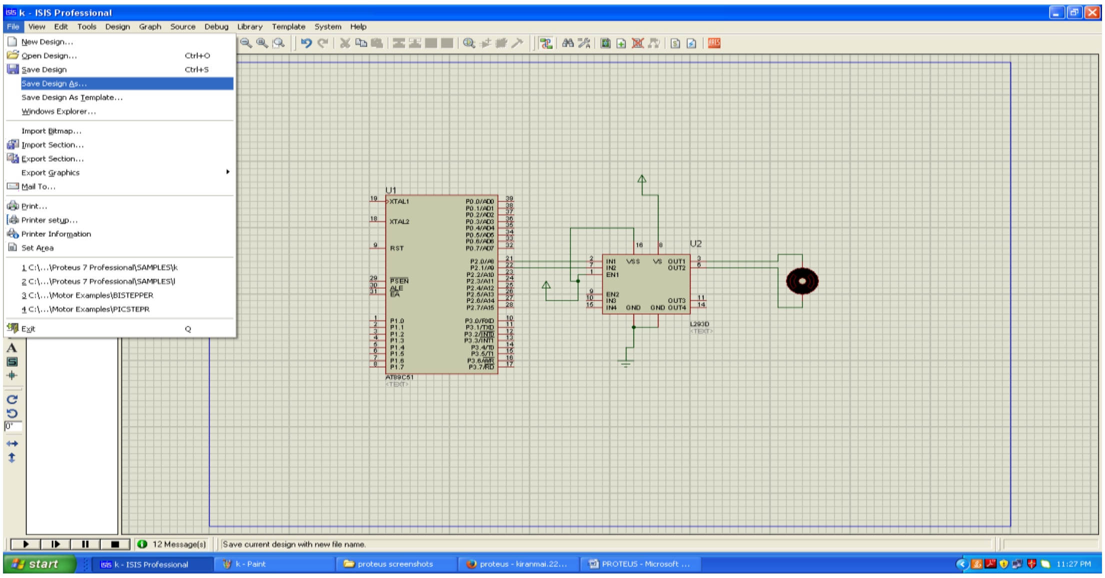


Fig 5.16: Saving file

6. Click on play to see the simulation results.

5.2.5.1 HOW TO BURN HEX FILE IN CIRCUIT IN ISIS PROFESSIONAL

You can test your program code by uploading the .hex file generated by any Embedded software or Keil µvision. It gives the idea of proper execution of your code before testing and implementing on your hardware. Follow the following steps to test the code of your project using Proteus ISIS professional.

Steps:-

1. Open your DBK file as mentioned earlier their will be creation of two types of file with extension PWI and DBK.

2. Double click on the microcontroller or main component of your circuit diagram.

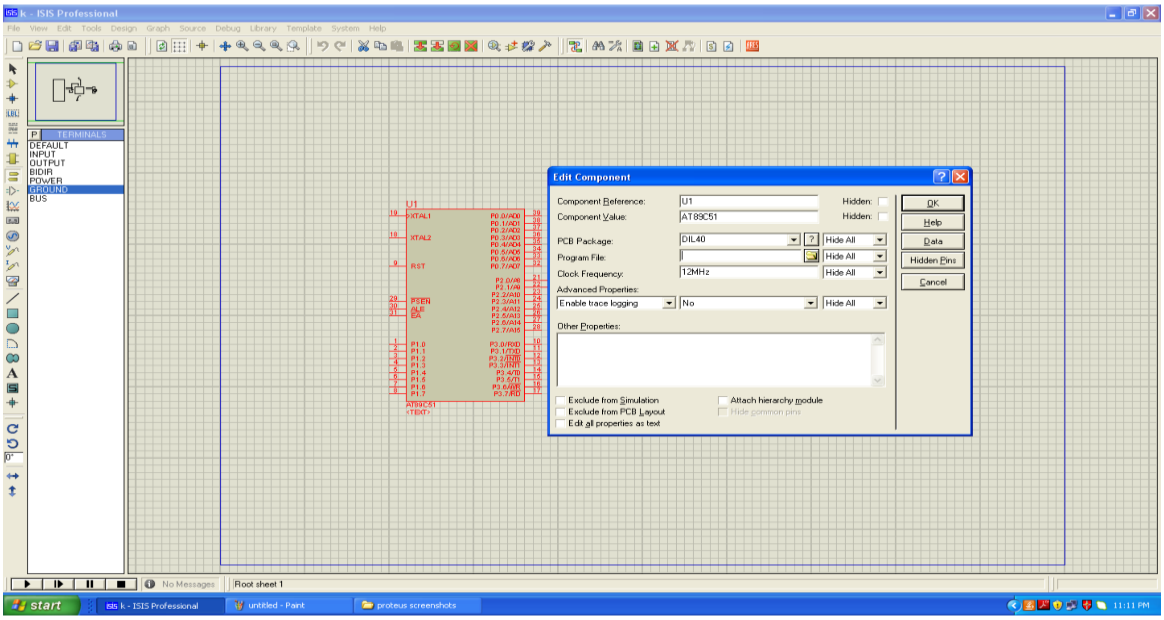


Fig 5.17: Dumping Hex file

3. Edit component window will be emerged immediately on the screen. See the fourth option-Program file in this window. There is an option to select and load the .hex file created by your Embedded software used to write the program. In Keil µvision, it is generated every time whenever you create new project and save it.

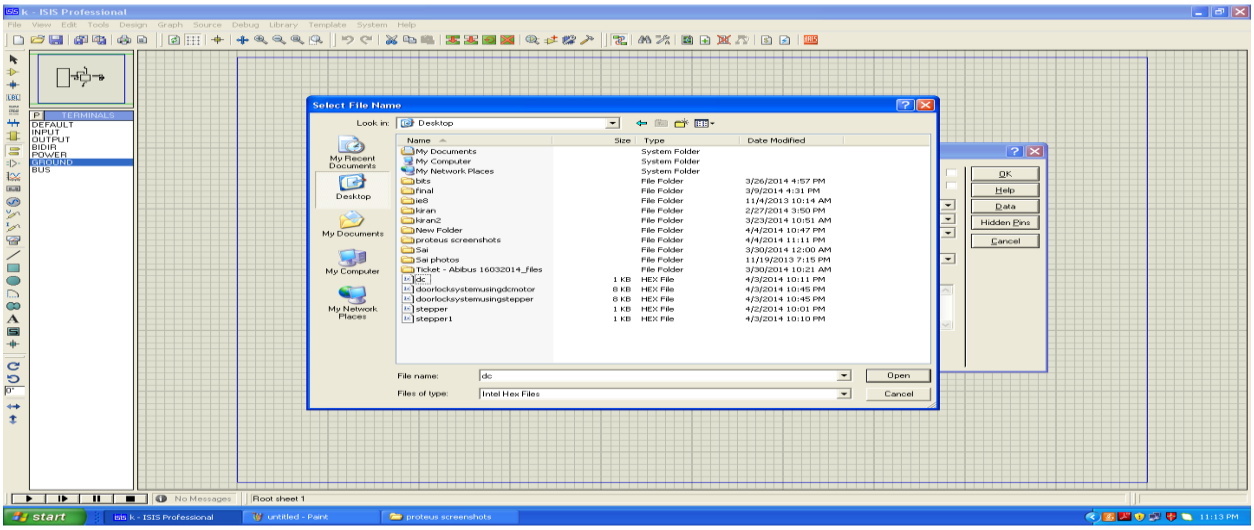


Fig 5.18: Editing component properties

4. Now, the simple step to execute the program. Click on the play icon situated left-bottom corner to run the circuit loaded with hex file. If your circuit is correct, output will be displayed.

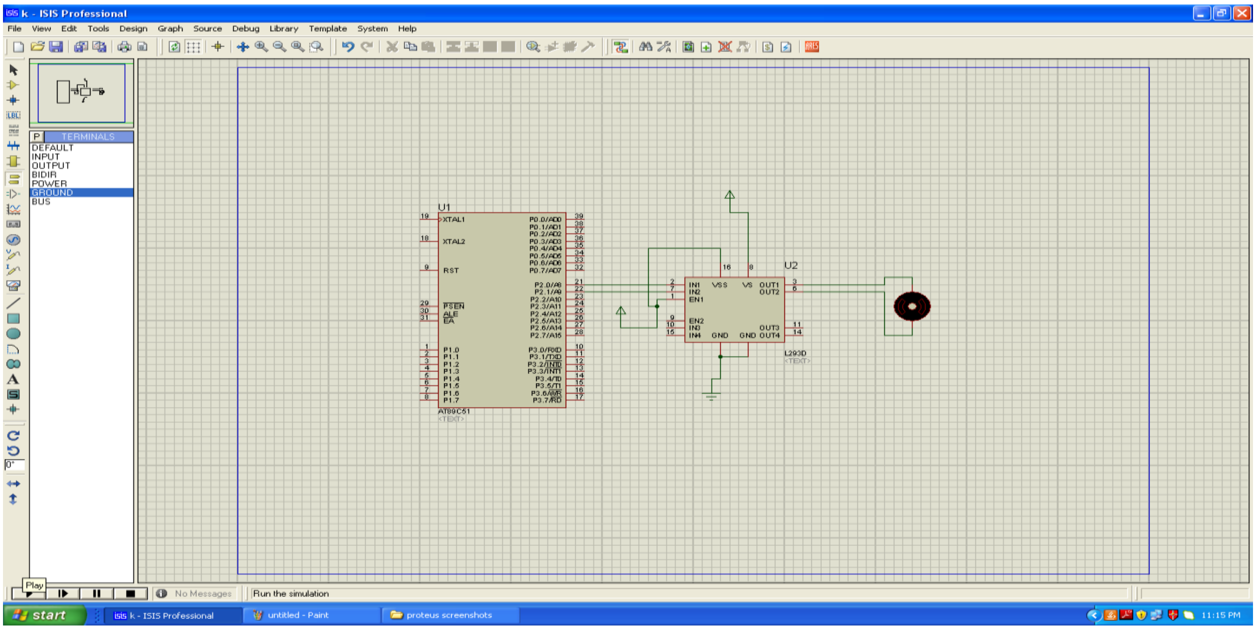


Fig 5.19: Playing the Simulation results.

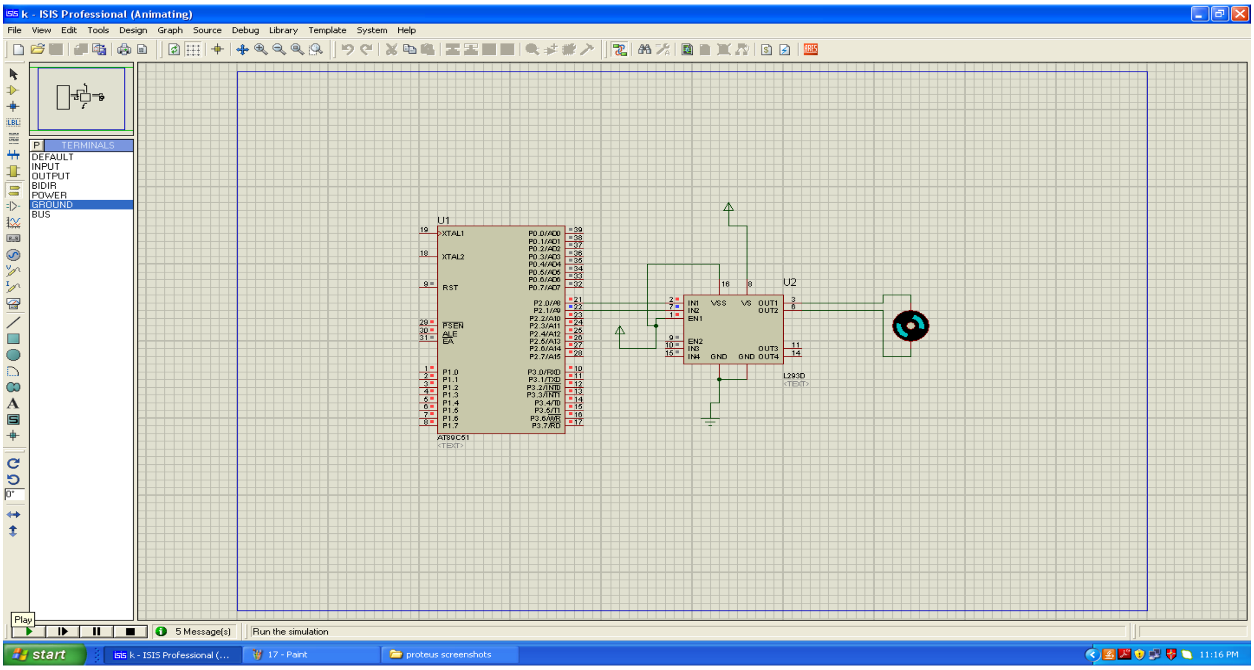


Fig 5.20: Simulation Results

CHAPTER 6

HARDWARE DESCRIPTION

The hardware used in this project are:

1. AT89S52 Microcontroller
2. LCD
3. GSM Modem
4. GPS Modem
5. Serial Communication Units (RS 232 and MAX 232)
6. DC Motor and its interfacing circuit L293 D
7. Mobile Phone
8. 8051 Development Kit

6.1 AT89S52 MICROCONTROLLER

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications.

The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM con-tents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset.

Fig 6.1: AT89S52 Microcontroller

6.1.1 FEATURES

- Compatible with MCS-51 Products
- 8K Bytes of In-System Programmable (ISP) Flash Memory – Endurance: 10,000 Write/Erase Cycles
- 4.0V to 5.5V Operating Range
- Fully Static Operation: 0 Hz to 33 MHz
- Three-level Program Memory Lock
- 256 x 8-bit Internal RAM
- 32 Programmable I/O Lines
- Three 16-bit Timer/Counters
- Eight Interrupt Sources
- Full Duplex UART Serial Channel
- Low-power Idle and Power-down Modes
- Interrupt Recovery from Power-down Mode
- Watchdog Timer
- Dual Data Pointer
- Power-off Flag
- Fast Programming Time
- Flexible ISP Programming (Byte and Page Mode)
- Green (Pb/Halide-free) Packaging Option

6.1.2 PIN DIAGRAM

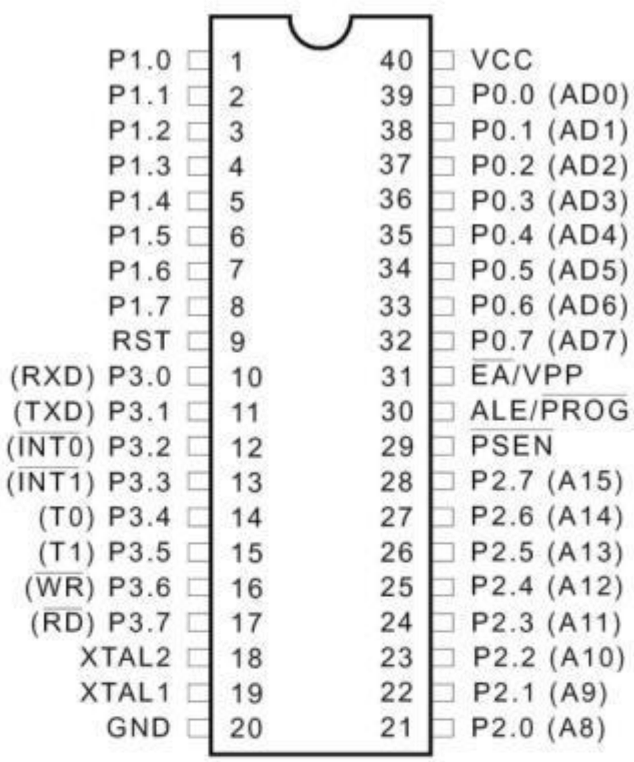


Fig 6.2: Pin Diagram of AT89S52

6.1.3 PIN DESCRIPTION

VCC: Supply voltage.

GND: Ground.

Port 0: Port 0 is an 8-bit open drain bidirectional I/O port. As an output port, each pin can sink eight TTL inputs. When 1s are written to port 0 pins, the pins can be used as high-impedance inputs. Port 0 can also be configured to be the multiplexed low-order address/data bus during accesses to external program and data memory. In this mode, P0 has internal pull-ups. Port 0 also receives the code bytes during Flash programming and outputs the code bytes during program verification. External pull-ups are required during program verification.

Port 1: Port 1 is an 8-bit bidirectional I/O port with internal pull-ups. The Port 1 output buffers can sink/source four TTL inputs. When 1s are written to Port 1 pins, they are pulled high by the inter-nal pull-ups and can be used as inputs. As inputs, Port 1 pins that are externally being pulled low will source current (IIL) because of the internal pull-ups. In addition, P1.0 and P1.1 can be configured to be the timer/counter 2 external count input (P1.0/T2) and the timer/counter 2 trigger input (P1.1/T2EX), respectively, a Port 1 also receives the low-order address bytes during Flash programming and verification.

P1.0 T2 (external count input to Timer/Counter 2), clock-out

P1.1 T2EX (Timer/Counter 2 capture/reload trigger and direction control)

P1.5 MOSI (used for In-System Programming)

P1.6 MISO (used for In-System Programming)

P1.7 SCK (used for In-System Programming)

Port 2: Port 2 is an 8-bit bidirectional I/O port with internal pull-ups. The Port 2 output buffers can sink/source four TTL inputs. When 1s are written to Port 2 pins, they are pulled high by the inter-nal pull-ups and can be used as inputs. As inputs, Port 2 pins that are externally being pulled low will source current (IIL) because of the internal pull-ups. Port 2 emits the high-order address byte during fetches from external program memory and dur-ing accesses to external data memory that use 16-bit addresses (MOVX @ DPTR). In this application, Port 2 uses strong internal pull-ups when emitting 1s. During accesses to external data memory that use 8-bit addresses (MOVX @ RI), Port 2 emits the contents of the P2 Special Function Register. Port 2 also receives the high-order address bits and some control signals during Flash program-ming and verification. Port Pin Alternate Functions

Port 3: Port 3 is an 8-bit bidirectional I/O port with internal pull-ups. The Port 3 output buffers can sink/source four TTL inputs. When 1s are written to Port 3 pins, they are pulled high by the inter-nal pull-ups and can be used as inputs. As inputs, Port 3 pins that are externally being pulled low will source current (IIL) because of the pull-ups. Port 3 receives some control signals for Flash programming and verification. Port 3 also serves the functions of various special features of the AT89S52, as shown below:

P3.0 RXD (serial input port)

P3.1 TXD (serial output port)

P3.2 INT0 (external interrupt 0)

P3.3 INT1 (external interrupt 1)

P3.4 T0 (timer 0 external input)

P3.5 T1 (timer 1 external input)

P3.6 WR (external data memory write strobe)

P3.7 RD (external data memory read strobe)

RST: Reset input. A high on this pin for two machine cycles while the oscillator is running resets the device. This pin drives high for 98 oscillator periods after the Watchdog times out. The DISRTO bit in SFR AUXR (address 8EH) can be used to disable this feature. In the default state of bit DISRTO, the RESET HIGH out feature is enabled.

ALE/PROG: Address Latch Enable (ALE) is an output pulse for latching the low byte of the address during accesses to external memory. This pin is also the program pulse input (PROG) during Flash programming. In normal operation, ALE is emitted at a constant rate of 1/6 the oscillator frequency and may be used for external timing or clocking purposes. Note, however, that one ALE pulse is skipped dur-ing each access to external data memory. If desired, ALE operation can be disabled by setting bit 0 of SFR location 8EH. With the bit set, ALE is active only during a MOVX or MOVC instruction. Otherwise, the pin is weakly pulled high. Setting the ALE-disable bit has no effect if the microcontroller is in external execution mode. Port Pin Alternate Functions P3.0 RXD (serial input port)

PSEN: Program Store Enable (PSEN) is the read strobe to external program memory. When the AT89S52 is executing code from external program memory, PSEN is activated twice each machine cycle, except that two PSEN activations are skipped during each access to exter-nal data memory.

EA/VPP: External Access Enable. EA must be strapped to GND in order to enable the device to fetch code from external program memory locations starting at 0000H up to FFFFH. Note, however, that if lock bit 1 is programmed, EA will be internally latched on reset. EA should be strapped to VCC for internal program executions. This pin also receives the 12-volt programming enable voltage (VPP) during Flash programming.

XTAL1: Input to the inverting oscillator amplifier and input to the internal clock operating circuit.

XTAL2: Output from the inverting oscillator amplifier.

6.1.4Special Function Registers (SFR)

Not all addresses in the area where there are special function registers are occupied and the unoccupied may be absent on the chip. Access to read from these addresses will in general return random data and write access to will have an effect indefinitely. Programmers should avoid writing in these locations, because these locations can be used in future for new features. In this case the reset or inactivation of these new bits will always be 0.

Timer Registers: Control and status bits are contained in registers T2CON and T2MOD for timer 2. The pair of registers (RCAP2H, RCAP2L) are registers purchase or reload timer 2 for 16-bit mode and 16-bit acquisition mode auto reload. Registers of interruptions: Individual interrupt enable bits are in register IE. For the six types of interrupt sources can be set two levels of priority in the IP register

6.1.5 Memory Organization

MCS-51 family devices have separate address and data program. Up to 64K bytes each program or data memory can be addressed.

a) Program memory

If EA is pin # connected the GRD program calls are directed to external memory. If EA # is connected to Vcc, calls the program at address 0000H to 1FFFH are directly to internal memory, while those at 2000H up to FFFFH are directed to external memory.

b) Data memory

AT89S52 has a RAM of 256 bytes. The 128 Bytes additional to the 128 basic families occupies an address space parallel to the Registrar of Special Functions, and that these additional bytes of special function registers are accessible addresses, but physically they are in different spaces. When an instruction accesses an internal location in 7fh address, addressing mode used in the instruction specifies that the CPU accesses the upper 128 bytes of RAM or the RFS. It uses direct addressing to access the RFS space, and indirect addressing the senior access bytes RAM.

6.1.6 Watch Dog Timer

Watchdog Timer (WDT) is used as a recovery method in situations where the CPU is under software problems. The WDT counter consists of a 14-bit Watchdog Timer and Reset (WDTRST) which is in RFS. By default, the WDT is disabled, for activation, the user successively 0E1H 01EH and WDTRST register, i.e. the RFS's location 0A6H. Cans WDT is active, it will increment every machine cycle, while the oscillator will run. Rest period is dependent on the external clock frequency. The only way to disable the WDT is reset site. When WDT exceeds the maximum limit will send a reset pulse RST pin HIGH.

Watchdog Timer for both modes of operation

Power-down mode means stopping off WDT's oscilloscope. During Power-down mode of operation, the user must not maintain the WDT. There are two ways to exit Power-down mode: by a hard reset or via an external interrupt is Priority Power-down mode. When Power-down exits through a hardware reset, WDT service should act as if AT89S52 is reset. Power-down Exit through an interrupt is significantly different behavior. Interruption is maintained sufficiently long as the oscillator to stabilize. When termination is carried high, it is served. To prevent the WDT from resetting the device interrupt pin is held low, the WDT will not start until the interrupt will not be extended to a high level. This means, that the WDT will be cleared during the interrupt function to exit Power-down mode. To ensure that the WDT will not be exceeded during some states out of Power-down, it is better to be reset before entering

Power-down mode. Before entering the Idle mode, bit WDIDLE the RFS is used to determine where to continue the WDT when it becomes active. The WDT continues to count during Idle mode as the default state. To prevent the WDT to reset the AT89S52 during Idle mode, the user should always set a timer that will periodically exit Idle, will service the WDT and enter Idle mode again. The WDT enabled WDIDLE bit will stop the count in Idle mode and continue counting out of the way.

a) Switches

AT89S52 is a vector of six stops: two external interrupts (INT0 # and #, INT2), three timers interrupts (Timer 0, 1 and 2) and serial port interrupt. Each of these interrupt sources can be individually enabled and disabled by setting or deleting a bit of special function registers IE. IE also contains a global disable bit, EA, which disables all interrupts at the same time. Bit position 6 is not implemented. But the programmer should not use this bit; it can be used in future AT89 products family. Interruption of Timer 2 is generated by "or logic" between bits TF2 and EXF2 you register T2CON.None of these indicators is not deleted when routine hardware orders indicate that area. In fact, routine order to determine which of the two bits TF2 or EXF2 generated interrupts, and that bit will be set in software.

b) The idle

In Idle mode, CPU is put into hibernation, while all peripherals remain active. The mode is invoked by software. Content on chip RAM and all special function registers remain unchanged while this mode is set. Idle mode can be enabled over any break or hardware reset.

c) The power-down

Power-down mode, the oscillator is set and instructions for calling Power-down mode is the last instruction executed. Track RAM on chip and special function registers retain their values until the Power-down mode ends. Exit Power-down can be initiated both by activating a hardware reset or external interrupt. Reset registry values change with special but not modify RAM on chip. Reset can be activated before VCC to return to its operating level and must remain active long enough to allow the oscillator resetting and stabilization. When idle mode is terminated by a hardware reset, the device normally resumes program execution from where it was interrupted by two machine cycles before the internal reset algorithm to take control. The hardware on the same plate to prevent access to internal RAM during this event, but access to ports is blocked. To eliminate the possibility of unexpected writings of a port pin when idle mode is terminated by reset, the instruction as it is one that invokes idle mode should not write to a port pin or external memory. .

6.2 LIQUID CRYSTAL DISPLAY

LCD stands for **L**iquid **C**rystal **D**isplay. LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on. LCD is finding wide spread use replacing LEDs (seven segment LEDs or other multi segment LEDs) because of the following reasons:

1. The declining prices of LCDs.
2. The ability to display numbers, characters and graphics. This is in contrast to LEDs, which are limited to numbers and a few characters.
3. Incorporation of a refreshing controller into the LCD, thereby relieving the CPU of the task of refreshing the LCD. In contrast, the LED must be refreshed by the CPU to keep displaying the data.
4. Ease of programming for characters and graphics.

These components are "specialized" for being used with the microcontrollers, which means that they cannot be activated by standard IC circuits. They are used for writing different messages on a miniature LCD.

Fig 6.3: LCD

A model described here is for its low price and great possibilities most frequently used in practice. It is based on the HD44780 microcontroller (*Hitachi*) and can display messages in two lines with 16 characters each. It displays all the alphabets, Greek letters, punctuation marks, mathematical symbols etc. In addition, it is possible to display symbols that user makes up on its own.

Automatic shifting message on display (shift left and right), appearance of the pointer, backlight etc. are considered as useful characteristics.

6.2.1 LCD SCREEN

LCD screen consists of two lines with 16 characters each. Each character consists of 5x7 dot matrix. Contrast on display depends on the power supply voltage and whether messages are displayed in one or two lines. For that reason, variable voltage 0-Vdd is applied on pin marked as Vee. Trimmer potentiometer is usually used for that purpose. Some versions of displays have built in backlight (blue or green diodes). When used during operating, a resistor for current limitation should be used (like with any LE diode).

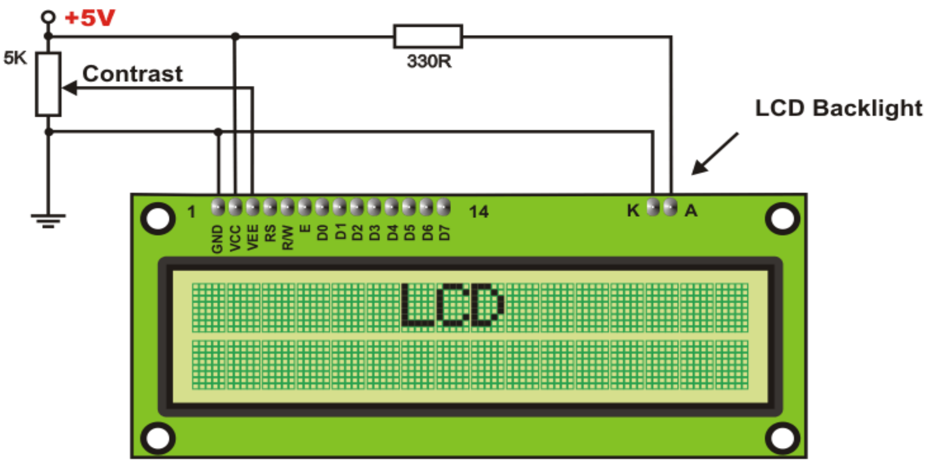


Fig 6.4: LCD power supply and ground connections

6.2.2 LCD PIN DESCRIPTION

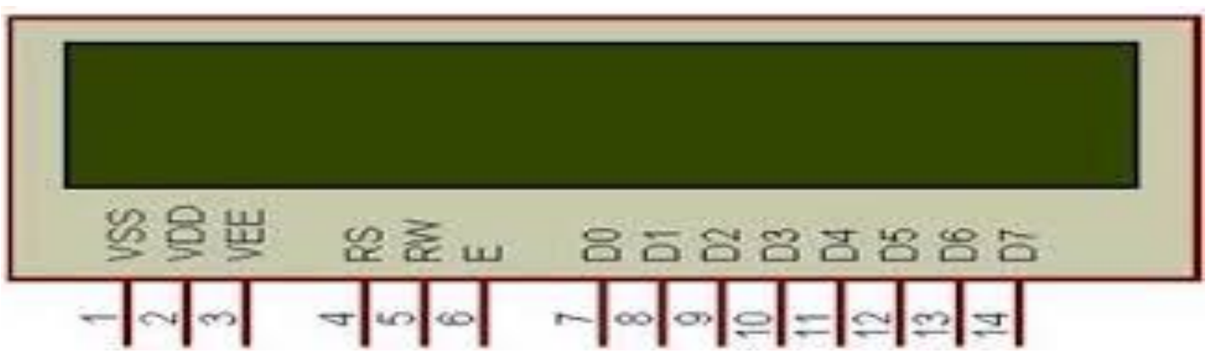


Fig 6.5: LCD pin diagram

The pin descriptions are given in table below:

PIN	SYMBOL	I/O	DESCRIPTION
1	Vss	--	Ground
2	Vcc	--	+5V power supply
3	Vee	--	Power supply to control contrast
4	RS	I	RS=0 to select command register RS=1 to select data register
5	R/W	I	R/W=0 for write R/W=1 for read
6	EN	I/O	Enable
7	DB0	I/O	The 8-bit data bus
8	DB1	I/O	The 8-bit data bus
9	DB2	I/O	The 8-bit data bus
10	DB3	I/O	The 8-bit data bus
11	DB4	I/O	The 8-bit data bus
12	DB5	I/O	The 8-bit data bus
13	DB6	I/O	The 8-bit data bus
14	DB7	I/O	The 8-bit data bus

TABLE 6.1: PIN DESCRIPTIONS OF LCD

Vcc, Vss and Vee

While Vcc and Vss provide +5V and ground respectively, Vee is used for controlling LCD contrast.

RS, register select

There are two very important registers inside the LCD. The RS pin is used for their selection as follows.

a) If RS=0, D0 – D7 are interpreted as commands. The instruction command code register is selected, allowing the user to send a command such as clear display, cursor at home, etc.,

b) If RS=1 D0 – D7 are interpreted as data .The data register is selected, allowing the user to

send data to be displayed on the LCD.

R/W, read/write

R/W input allows the user to write information to the LCD or read information from it.

R/W=1 Read data (from LCD to controller);

R/W=0 Write data (from controller to LCD)

EN, Enable

The enable pin is used by the LCD to latch information presented to its data pins. When data is supplied to data pins, a high-to-low pulse must be applied to this pin in order for the LCD to latch in the data present at the data pins. This pulse must be a minimum of 450ns wide.when enable is 0 Access to LCD disabled. when enable=1 normal operating

D0-D7

The 8-bit data pins, D0-D7, are used to send information to the LCD or read the contents of the LCD's internal registers. To display letters and numbers, we send ASCII codes for the letters A-Z, a-z, and numbers 0-9 to these pins while making RS=1.

We also use RS=0 to check the busy flag bit to see if the LCD is ready to receive information. The busy flag is D7 and can be read when R/W=1 and RS=0, as follows: if

R/W=1, RS=0. When D7=1 (busy flag=1), the LCD is busy taking care of internal operations and will not accept any information.

6.2.3 INTERFACING LCD TO AT89S52 USING PROTEUS

LCD data pins D0-D7 are connected to port 2 of the microcontroller. VSS and VEE are connected to power supply. RS pin is connected to P1.0. E pin is connected to P1.2. R/W pin is connected to P1.1. VDD is connected to ground. The design is shown in the below figure.

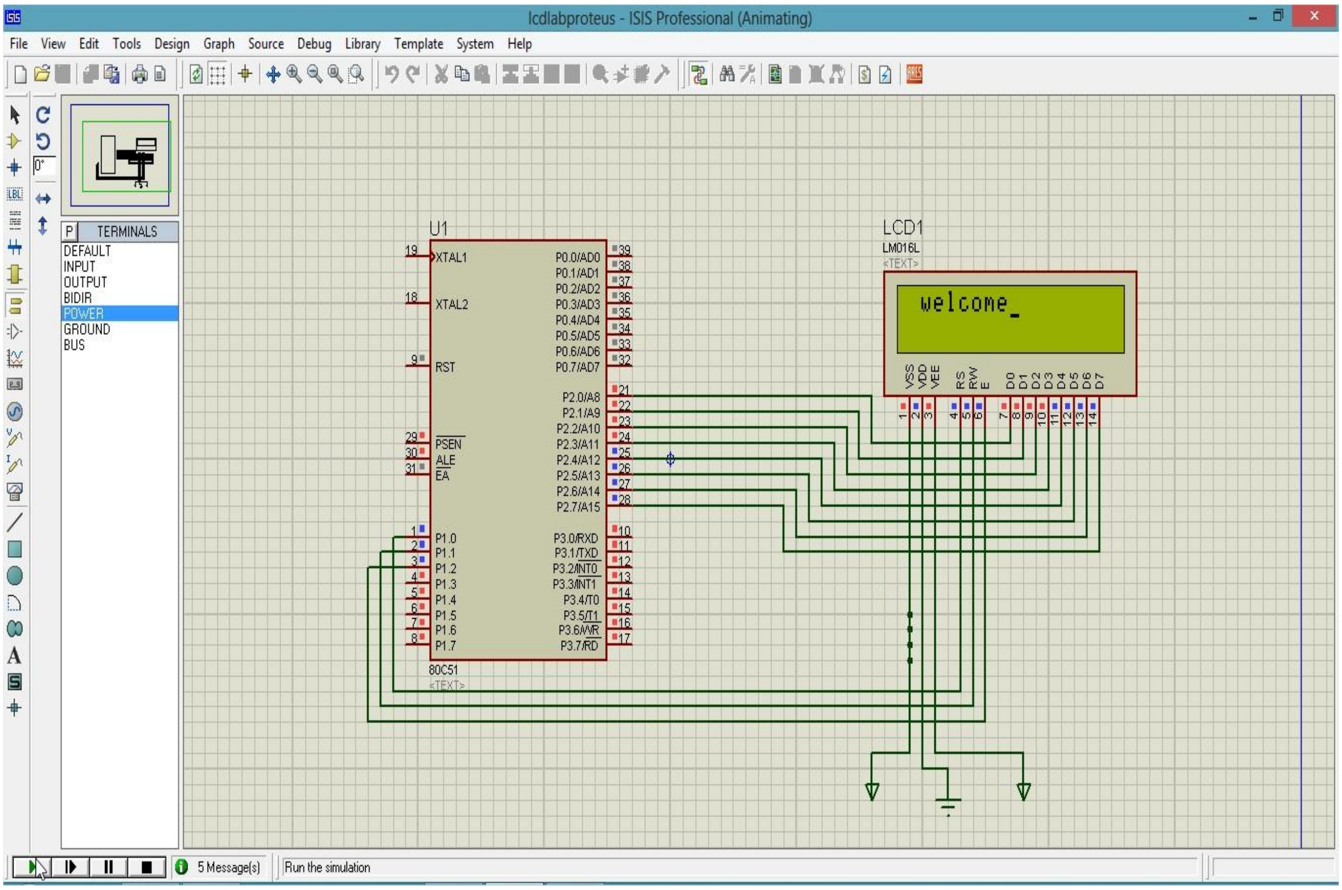


Fig 6.6: Interfacing diagram of LCD and microcontroller in proteus

6.3 GPS MODEM

6.3.1Working and Operation

When people talk about "a GPS," they usually mean a GPS receiver. The Global Positioning System (GPS) is actually a constellation of 27 Earth-orbiting satellites (24 in operation and three extras in case one fails). The U.S. military developed and implemented this satellite network as a military navigation system, but soon opened it up to everybody else.

Each of these 3,000- to 4,000-pound solar-powered satellites circles the globe at about 12,000 miles (19,300 km), making two complete rotations every day. The orbits are arranged so that at anytime, anywhere on Earth, there are at least four satellites "visible" in the sky.

A GPS receiver's job is to locate four or more of these satellites, figure out the distance to each, and use this information to deduce its own location. This operation is based on a simple mathematical principle called trilateration. GPS receiver calculates its position on earth based on the information it receives from four located satellites. This system works pretty well, but inaccuracies do pop up. For one thing, this method assumes the radio signals will make their way through the atmosphere at a consistent speed (the speed of light). In fact, the Earth's atmosphere slows the electromagnetic energy down somewhat, particularly as it goes through the ionosphere and troposphere. The delay varies depending on where you are on Earth, which means it's difficult to accurately factor this into the distance calculations. Problems can also occur when radio signals bounce off large objects, such as skyscrapers, giving a receiver the impression that a satellite is farther away than it actually is. On top of all that, satellites sometimes just send out bad almanac data, misreporting their own position.

Differential GPS (DGPS) helps correct these errors. The basic idea is to gauge GPS inaccuracy at a stationary receiver station with a known location. Since the DGPS hardware at the station already knows its own position, it can easily calculate its receiver's inaccuracy. The station then broadcasts a radio signal to all DGPS-equipped receivers in the area, providing signal correction information for that area. In general, access to this correction information makes DGPS receivers much more accurate than ordinary receivers.

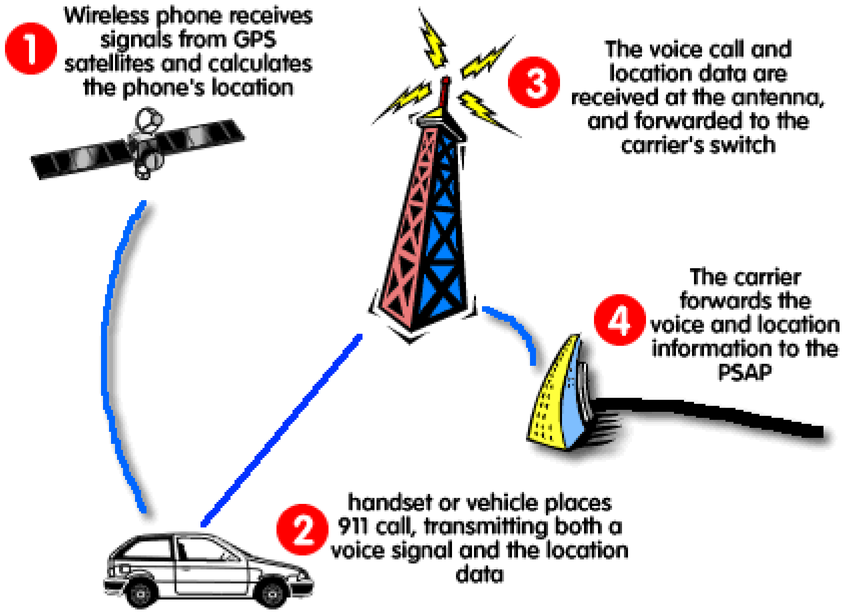


Fig 6.7 G.P.S receiver communicating with the satellite and sending information through the wireless mobile phone

6.3.2 GPS Data Decoding

G.P.S receiver continuously sends data and the microcontroller receives the data whenever it requires. The data sent by the G.P.S is a string of characters which should be decoded to the standard format. This is done by the program which we implement in the controller.

6.4 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.

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. A GSM modem exposes an interface that allows sending and receiving messages over the modem interface. 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 and 3GPP TS 27.005 specifications.

GSM modems can be a quick and efficient way to get started with SMS, because a special subscription to an SMS service provider is not required. In most parts of the world, GSM modems are a cost effective solution for receiving SMS messages, because the sender is paying for the message delivery.

A GSM modem can be a dedicated modem device with a serial, USB or Bluetooth connection, such as the Falcom Samba 75. (Other manufacturers of dedicated GSM modem devices include Wavecom, Multitech and iTegno. We’ve also reviewed a number of modems on our technical support blog.) To begin, insert a GSM SIM card into the modem and connect it to an available USB port on your computer.

A GSM modem could also be a standard GSM mobile phone with the appropriate cable and software driver to connect to a serial port or USB port on your computer. Any phone that supports the “extended AT command set” for sending/receiving SMS messages, as defined in ETSI GSM 07.05 and/or 3GPP TS 27.005, can be supported by the Now SMS & MMS Gateway. Note that not all mobile phones support this modem interface.
Due to some compatibility issues that can exist with mobile phones, using a dedicated GSM modem is usually preferable to a GSM mobile phone. This is more of an issue with MMS messaging, where if you wish to be able to receive inbound MMS messages with the gateway, the modem interface on most GSM phones will only allow you to send MMS messages. This is because the mobile phone automatically processes received MMS message notifications without forwarding them via the modem interface.

It should also be noted that not all phones support the modem interface for sending and receiving SMS messages. In particular, most smart phones, including Blackberries, iPhone, and Windows Mobile devices, do not support this GSM modem interface for sending and receiving SMS messages at all at all. Additionally, Nokia phones that use the S60 (Series 60) interface, which is Symbian based, only support sending SMS messages via the modem interface, and do not support receiving SMS via the modem interface.

6.4.1 SIM 900

In this project we are using GSM SIM 900A. SIM 900 is a quad-band GSM/GPRS engine. It has a RS-232 through D-TYPE 9 pin connector. Its technical specifications are:

1. Power Supply : 3.4v-4.5v
2. Power saving : Power consumption in sleep mode is 2.5 A
3. Temperature Range :
    a. Normal : -30 to 80 degree Celsius.
    b. Storage : -45 to 90 degree Celsius.
4. SMS storage : SIM card.
5. Baud Rate : 1200bps to 115200bps
6. SIM Interface : 1.8V, 3V

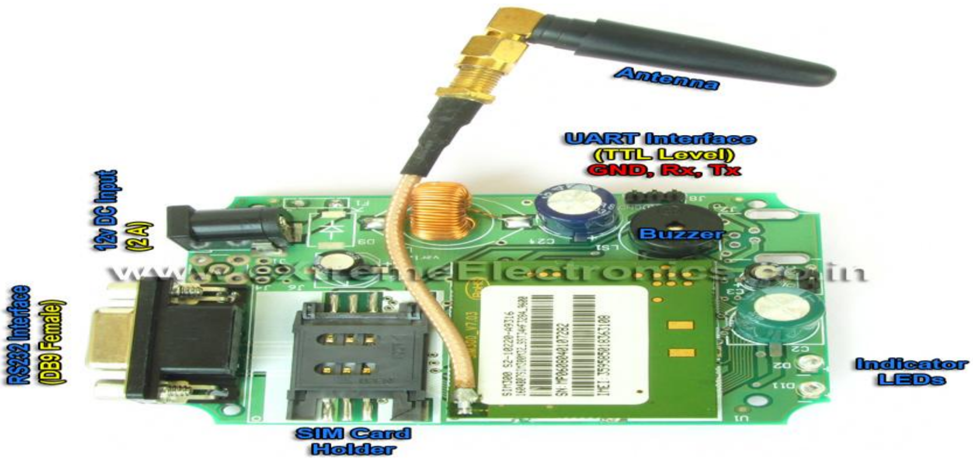


Fig 6.8: SIM 900A GSM Modem

6.4.2 AT COMMANDS

The operations like reading, writing, sending and deleting the messages, monitoring the signal strength, etc are performed using the commands called as the AT (Attention) Commands.

6.4.2.1 List of AT commands:

The AT commands for both, GSM module and the mobile phone, are listed below. Some of these commands may not be supported by all the GSM modules available. Also there might be some commands which won't be supported by some mobile handsets.

A Few AT commands are listed below:

Testing :

Command	Description
AT	Checking communication between the module and computer.

Phone control:

Command	Description
AT+CBC	Battery charge
AT+CGSN	Request product serial number identification
AT+CPBS	Select phone book memory storage
	Write phone book entry
AT+CSCS	Select TE character set
AT+CSQ	Signal quality

SMS Text mode:

Command	Description
AT+CSMS	Select message service
AT+CMGF	Message format
AT+CSCA	Service centre address
AT+CSCB	Select cell broadcast message types
AT+CRES	Restore settings
AT+CNMI	New message indications to TE
AT+CMGL	List messages
AT+CMGR	Read message
AT+CMGS	Send message
AT+CMGW	Write message to memory

SMS PDU Mode:

Command	Description
AT+CMGL	List Messages
AT+CMGR	Read message
AT+CMGS	Send message
AT+CMGW	Write message to memory

Table 6.2: AT Commands

6.4.2.2 AT COMMANDS USED IN THE PROJECT

The AT Commands which we used in our project are described below:

Initial Set up Commands:

1. AT : Returns a “OK” to confirm that modem is working.
2. AT+CPIN=”XXXX” : To enter the pin for your SIM.
3. AT+CREG? : A “0,1” reply confirms your modem is connected to GSM network.
4. AT+CSQ : Indicates signal strength, 31.99 is maximum.

Steps for Sending SMS in Text mode:

1. AT+CGMF=1 Press Enter (To format SMS as a Text message)
2. AT+CMGS=”Mobile No.” Press Enter (To send SMS to the Mobile no.)
3. To send SMS from the modem, type the message. After typing the message press “Ctrl+z” to send the SMS.

Steps for Reading SMS in Text mode:

1. AT+CMGF=1 Press Enter
2. AT+CMGR=No. Press Enter

Here No. is the message index number stored in the SIM card.

Note: The modem automatically sets to the baud rate of the first command sent by the host system after it is powered up. So there is no need for setting the baud rate using commands.

Other Commands for Sending and Reading SMS:

1. AT+CSCA=”+xxxxx” Set your SMS center’s number. Check with your provider.
2. When a SMS is received, the SMS details are immediately sent to the microcontroller via the +CMT command.
3. AT+CMGR=<number> AT command used to read received messages from modem at respective message number
4. AT+CMGD=<number> AT command used to delete received SMS to modem

After reading and parsing the new message, the microcontroller should send an AT command to clear the memory location in the SIM card in the GSM modem.

6.5 Serial Communication Units

Several devices collect data from sensors and need to send it to another unit, like a computer, for further processing. Data transfer/communication is generally done in two ways: parallel and serial.

In the parallel mode, data transfer is fast and uses more number of lines. This mode is good for short range data transfer. When a microprocessor communicates with the outside world, it provides data in byte-sized chunks. 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 cable is not too long, since long cables diminish and even distort signals. Furthermore, an 8-bit data path is too 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.

Serial communication is a form of I/O in which the bits of a byte begin transferred appear one after the other in a timed sequence on a single wire. Serial communication has become the standard for intercomputer communication.

The microcontroller AT89S52 has an inbuilt UART for carrying out serial communication. The serial communication is done in the asynchronous mode. A serial port, like other PC ports, is a physical interface to establish data transfer between computer and an external hardware or device. This transfer, through serial port, takes place bit by bit.

6.5.1 RS-232

To allow compatibility among data communication equipment made by different manufacturers, an interfacing standard called RS232 was set by the Electronics Industries Association (EIA) in 1960. Later RS232A, RS232B and RS232C were introduced with slight modifications

IBM introduced the DB-9 RS-232 version of serial I/O standard, which is most widely used in PCs and several devices.

This standard was developed to allow individuals to use remote computer systems over dialup telephone lines with remote terminals. The standard includes provisions for a remote terminal that is connected to a modem that places a telephone call, a modem that answers the telephone call, and a computer that is connected to that modem. The terminal can be connected directly to the computer, eliminating the need for two modems, through the use of a special device called a null modem adapter. Sometimes this device is built directly into a cable, in which case the cable is called a null modem cable.

A terminal and a computer connected by two modems

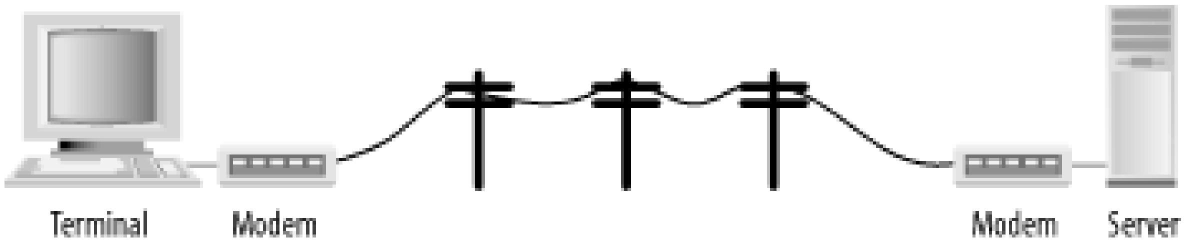


Fig 6.9: Computer and Terminal connections

The computer and terminal are called data terminal equipment (DTE), while the modems are called data communication equipment (DCE). The standard RS-232 connector is a 25-pin D-shell type connector; only 9 pins are used to connect the DTE and DCE sides together.

Of these nine pins, only transmit data (pin 2), receive data (pin 3), and signal ground (pin 7) are needed for directly wired communications. Five pins (2, 3, 7, 8, and 20) are needed for proper operation of modems (although most also use pins 4 and 5). Frame ground (pin 1) was originally used to connect electrically the physical frame (chassis) of the DCE and the frame of the DTE to reduce electrical hazards and static.

Because only 8 pins of the 25-pin RS-232 connector are used, the computer industry has largely moved to smaller connectors that follow the 9-pin RS-232-C standard. Most PCs are equipped with this 9-pin RS-232-C connector, shown in the below figure.

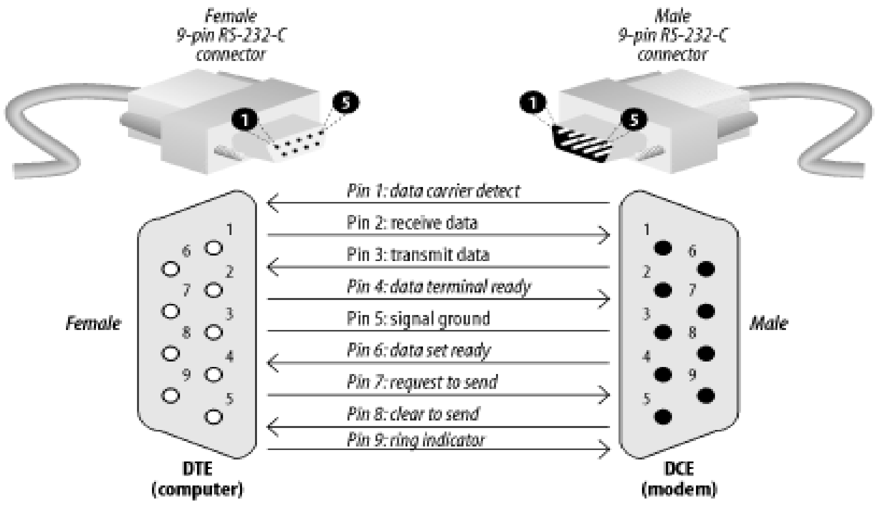


Fig 6.10: The standard 9-pin RS-232-C connector

6.5.1.1 PIN DESCRIPTION

Pin NO.	Code	Name	Description
1	DCD	Data Carrier Detect	Tells the computer that the modem is connected by telephone with another modem. Unix may use this signal to tell it when to display a login: banner.
2	RD (or RxD)	Receive Data	Data transmitted from the modem to the computer.
3	TD (or TxD)	Transmit Data	Data transmitted from the computer or terminal to the modem.
4	DTR	Data Terminal Ready	Tells the modem that the computer is turned on and ready to accept connections. The modem should not answer the telephone—and it should automatically hang up on an established conversation—if this signal is not present.
5	SG	Signal Ground	Reference point for all signal voltages.
6	DSR	Data Set Ready	Tells the computer that the modem is turned on. The computer should not send the modem commands if this signal is not present.

7	RTS	Request to Send	Tells the modem when it can transmit data. Sometimes the computer is busy and needs to have the modem wait before the next character is transmitted. Used for "hardware flow control."
8	CTS	Clear to Send	Tells the computer when it's OK to transmit data. Sometimes the modem is busy and needs to have the computer wait before the next character is transmitted. Used for "hardware flow control."
9	RI	Ring Indicator	Tells the computer that the telephone is ringing.

Table 6.3: RS 232 Pin Description

6.5.1.2 LIMITATIONS

The limitations are listed as follows:

a) Increased power consumptions.

b) Limit the noise immunity and transmission distance.

c) Limit in speed and compatibility.

d) The connector is large by current standards.

e) The use of handshaking lines for flow control is not reliable in many devices.

6.5.2 MAX 232

In RS232, high and low bits are represented by flowing voltage ranges:

Bit	Voltage Range (in V)	
0	+3	+25
1	-25	-3

Table 6.4: Voltage ranges for RS 232

The range -3V to +3V is undefined. The TTL standards came a long time after the RS232 standard was set. Due to this reason RS232 voltage levels are not compatible with TTL logic. Therefore, while connecting an RS232 to microcontroller system, a voltage converter is required. This converter converts the microcontroller output level to the RS232 voltage levels, and vice versa. IC MAX232, also known as line driver, is very commonly used for this purpose.

The simplest connection between a PC and microcontroller requires a minimum of three pins, RxD (receiver, pin2), TxD (transmitter, pin3) and ground (pin5) of the serial port of computer.

TxD pin of serial port connects to RxD pin of controller via MAX232. And similarly, RxD pin of serial port connects to the TxD pin of controller through MAX232.

MAX232 has two sets of line drivers for transferring and receiving data. The line drivers used for transmission are called T1 and T2, where as the line drivers for receiver are designated as R1 and R2. The connection of MAX232 with computer and the controller is shown in the circuit diagram.

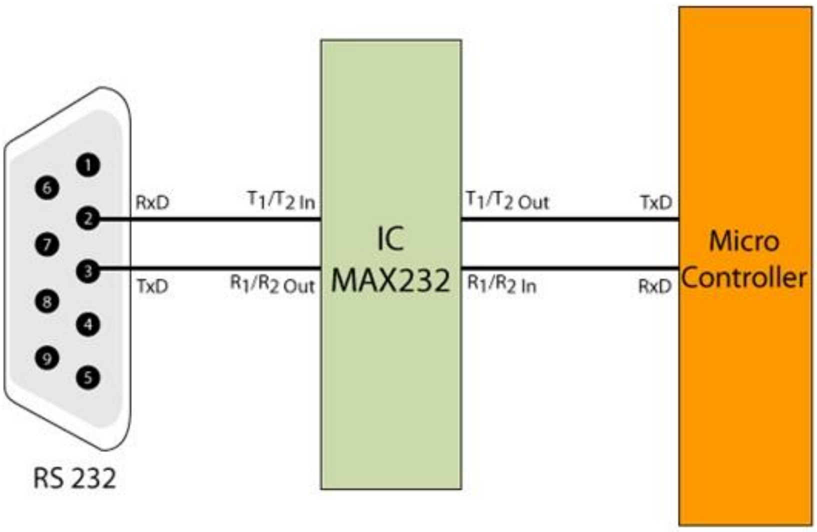


Fig 6.11: RS 232 and MAX 232

6.5.3 SERIAL PORT PROGRAMMING

An important parameter considered while interfacing serial port is the Baud rate which is the speed at which data is transmitted serially. It is defined as number of bits transmitted or received per second. It is generally expressed in bps (bits per second). AT89S52 microcontroller can be set to transfer and receive serial data at different baud rates using software instructions. Timer1 is used to set the baud rate of serial communication for the microcontroller. For this purpose, Timer1 is used in mode2 which is an 8-bit auto reload mode. To get baud rates compatible with the PC, TH1 should be loaded with the values as shown:

Baud Rate (bps)	TH1 (Hex value)
9600	FD
4800	FA
2400	F4
1200	E8

In this project baud rate 9600bps is used.

For serial communication AT89C51 has registers SBUF and SCON (Serial control register). SBUF is an 8-bit register. For transmitting a data byte serially, it needs to be placed in the SBUF register. Similarly whenever a data byte is received serially, it comes in the SBUF register, i.e., SBUF register should be read to receive the serial byte.

SCON register is used to set the mode of serial communication. The project uses Mode1, in which the data length is of 8 bits and there is a start and a stop bit. The SCON register is bit addressable register. The following table shows the configuration of each bit.

SCON (Serial Control) Register

SM0	SM1	SM2	REN	TB8	RB8	TI	RI
D7	D6	D5	D4	D3	D2	D1	D0

SM0	SM1	
0	0	Serial mode 0
0	1	Serial mode 1, 8-bit data, 1 start bit, 1 stop bit
1	0	Serial mode 2
1	1	Serial mode 3

TI (transmit interrupt) is an important flag bit in the SCON register. The controller raises the TI flag when the 8-bit character is transferred. This indicates that the next byte can be transferred now. The TI bit is raised at the beginning of the stop bit.
RI (receive interrupt) is also a flag bit of the SCON register. On receiving the serial data, the microcontroller skips the start and stop bits, and puts the byte is SBUF register. The RI flag bit is then raised to indicate that the byte has been received and should be picked up.

6.6 DC MOTOR

Almost every mechanical movement that we see around us is accomplished by an electric motor. DC Motor or Direct Current Motor is a device that converts DC electrical energy to a mechanical energy.

6.6.1 CONSTRUCTION

A simple motor has the following basic parts:

- **Armature:**It consists of a large number of turns of insulated copper wire around over a laminated soft iron core. The coil can be rotated about the central axis.
- **Commutator:** A commutator is used to reverse the direction of flow of current. Commutator is a copper ring split into two parts C1 and C2. The split rings are insulated form each other and mounted on the axle of the motor. The two ends of the coil are soldered to these rings. They rotate along with the coil. Commutator rings are

connected to a battery. The wires from the battery are not connected to the rings but to the brushes which are in contact with the rings.

- **Brushes:** Brushes are two flexible metal plates of carbon rods. They are fixed. The purpose of brushes is to pass on current from the armature coil to the external load resistance R.
- **Field magnets:** N and S are the pole magnet pieces of a strong Electro magnet in which the armature coil is related. Axis of rotation is perpendicular to the magnetic field lines. The magnetic field intensity is of the order of 1 to 2 Tesla.

Altogether,the basic construction of a dc motor contains a current carrying armature which is connected to the supply end through commutator segments and brushes and placed within the north south poles of a permanent or an electro-magnet as shown in the figure. The input of a DC motor is current/voltage and its output is torque (speed).

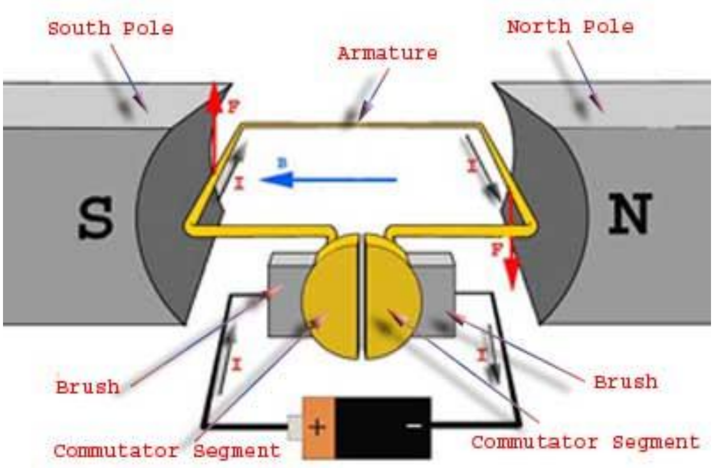


Fig 6.12: DC Motor Construction

6.6.2 PRINCIPLE

The DC motor works on the principle, when a current carrying conductor is placed in a magnetic field, it experiences a torque and has a tendency to move. This is known as motoring action. If the direction of electric current in the wire is reversed, the direction of rotation also reverses.

The direction of rotation of a this motor is given by Fleming's left hand rule, which states that if the index finger, middle finger and thumb of your left hand are extended mutually perpendicular to each other and if the index finger represents the direction of magnetic field, middle finger indicates the direction of electric current, then the thumb represents the direction in which force is experienced by the shaft of the dc motor.

Fig 6.13: DC Motor

6.6.3 APPLICATIONS

- Lathes
- Spinning and Weaving machines.
- Electric traction
- Cranes
- Elevators

We used a DC motor in our project to unlock and lock the door. But the port pins cannot drive the motor. So we used an interfacing circuit L293d to drive the motor.

6.6.4 DC MOTOR INTERFACING CIRCUIT-L293 D

L 293 D is a typical motor driver or motor driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D IC. The L293D can drive small and quiet big motors as well.
It works on the concept of H-bridge. H-bridge is a circuit which allows the voltage to be flown in either direction. As we know voltage need to change its direction for being able to rotate the motor in clockwise or anticlockwise direction. Hence H-bridge IC are ideal for driving a DC motor.

In a single L293d chip there two h-bridge circuit inside the IC which can rotate two dc motors independently. Due to its size it is very much used in robotic application for controlling DC motors.

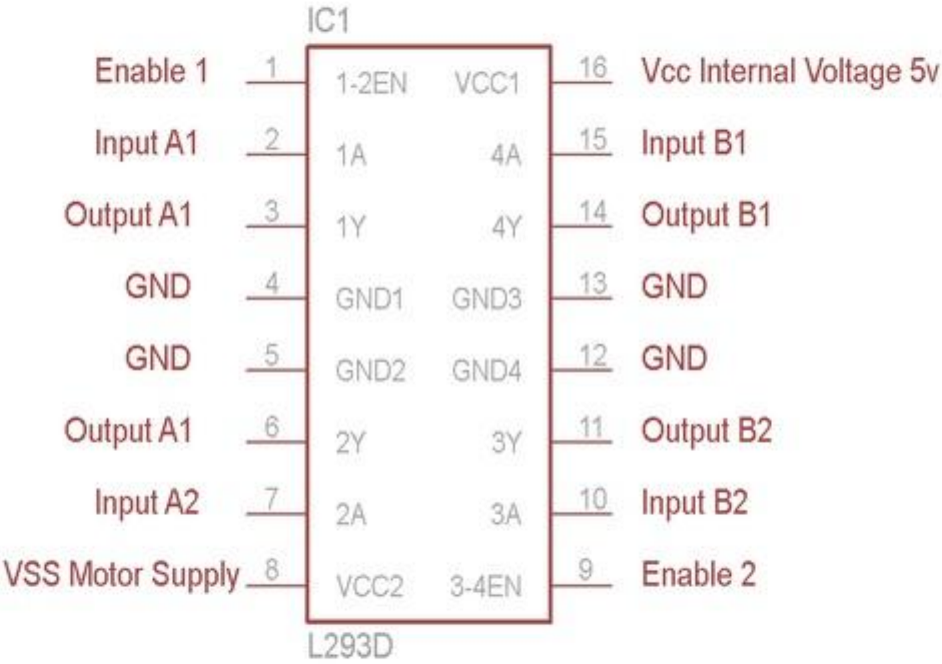


Fig 6.14: Pin diagram of L293d

There are two enable pins on l293d, Pin 1 and pin 9. They need to be high to drive the motor. For driving the motor with left H-bridge we need to enable pin 1 to high. And for right H-bridge we need to enable pin 9 to high. If anyone of the either pins 1 and 9 goes low then the motor in the corresponding section will suspend working. It's like a switch.

6.7 Mobile Phone

A **mobile phone** (also known as a **cellular phone**, **cell phone**, and a **hand phone**) is a phone that can make and receive telephone calls over a radio link while moving around a wide geographic area. It does so by connecting to a cellular network provided by a mobile phone operator, allowing access to the public telephone network. By contrast, a cordless telephone is used only within the short range of a single, private base station.

In addition to telephony, modern mobile phones also support a wide variety of other services such as text messaging, MMS, email, Internet access, short-range wireless communications (infrared, Bluetooth), business applications, gaming and photography. Mobile phones that offer these and more general computing capabilities are referred to as smart phones.

6.7.1 FEATURES

All mobile phones have a number of features in common, but manufacturers also try to differentiate their own products by implementing additional functions to make them more attractive to consumers. This has led to great innovation in mobile phone development over the past 20 years.

The common components found on all phones are:

- A battery, providing the power source for the phone functions.
- An input mechanism to allow the user to interact with the phone. The most common input mechanism is a keypad, but touch screens are also found in some high-end smartphones.
- A screen which echoes the user's typing, displays text messages, contacts and more.
- Basic mobile phone services to allow users to make calls and send text messages.
- All GSM phones use a SIM card to allow an account to be swapped among devices. Some CDMA devices also have a similar card called a R-UIM.
- Individual GSM, WCDMA, iDEN and some satellite phone devices are uniquely identified by an International Mobile Equipment Identity (IMEI) number.

Low-end mobile phones are often referred to as feature phones, and offer basic telephony. Handsets with more advanced computing ability through the use of native software applications became known as smartphones.

6.7.2 TEXT MESSAGING

The most commonly used data application on mobile phones is SMS text messaging. The first SMS text message was sent from a computer to a mobile phone in 1992 in the UK, while the first person-to-person SMS from phone to phone was sent in Finland in 1993.

Fig 6.15: Mobile phone

In Our project, we used a mobile phone to send messages to the GSM modem.

CHAPTER 7

RESULTS AND CONCLUSIONS

7.1 IMPLEMENTATION RESULTS

Our project module is shown in the figure 7.1

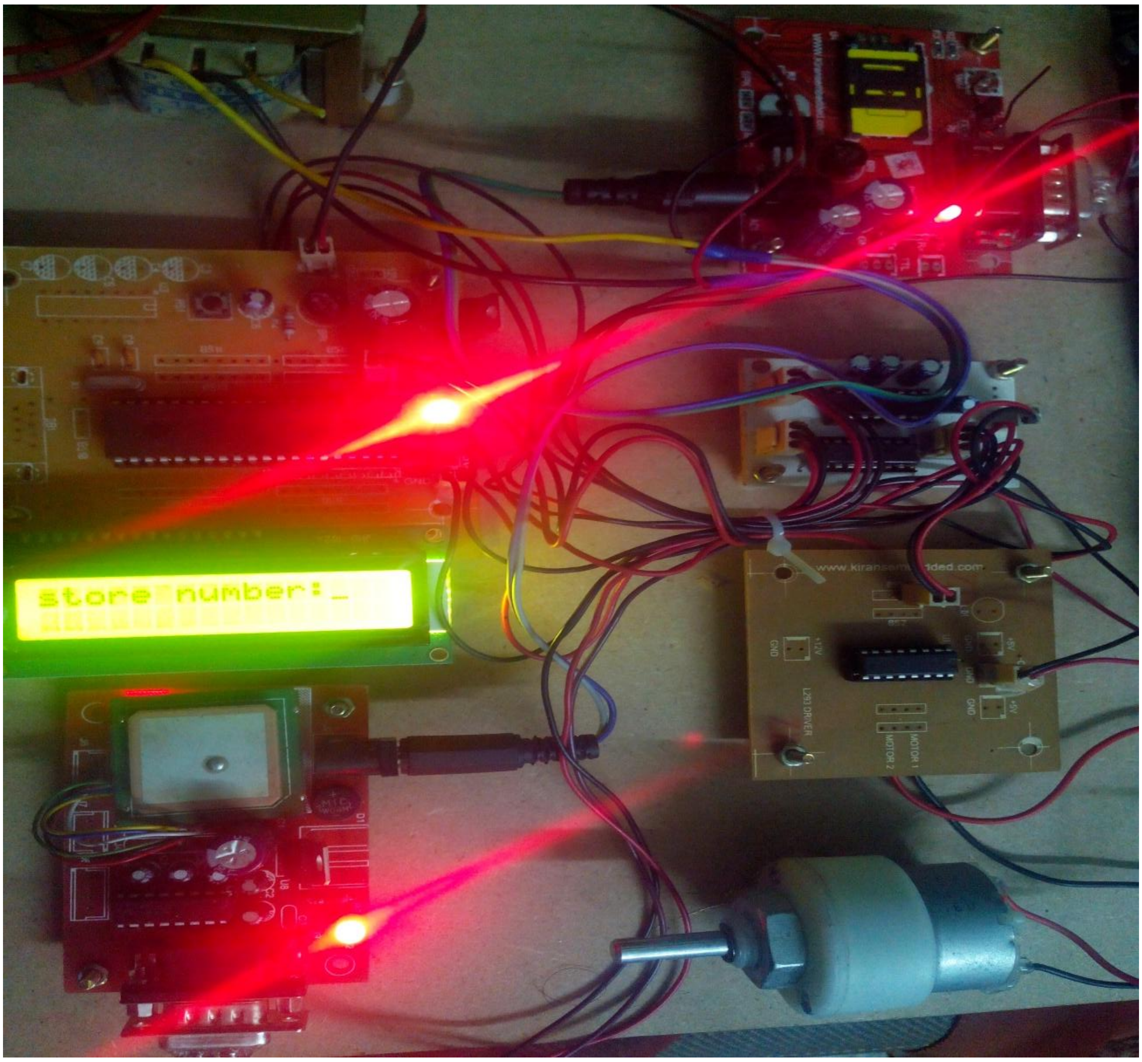


Fig 7.1: Project module

After the initial setup the LCD displays “STORE NUMBER” as shown in figure 7.2.

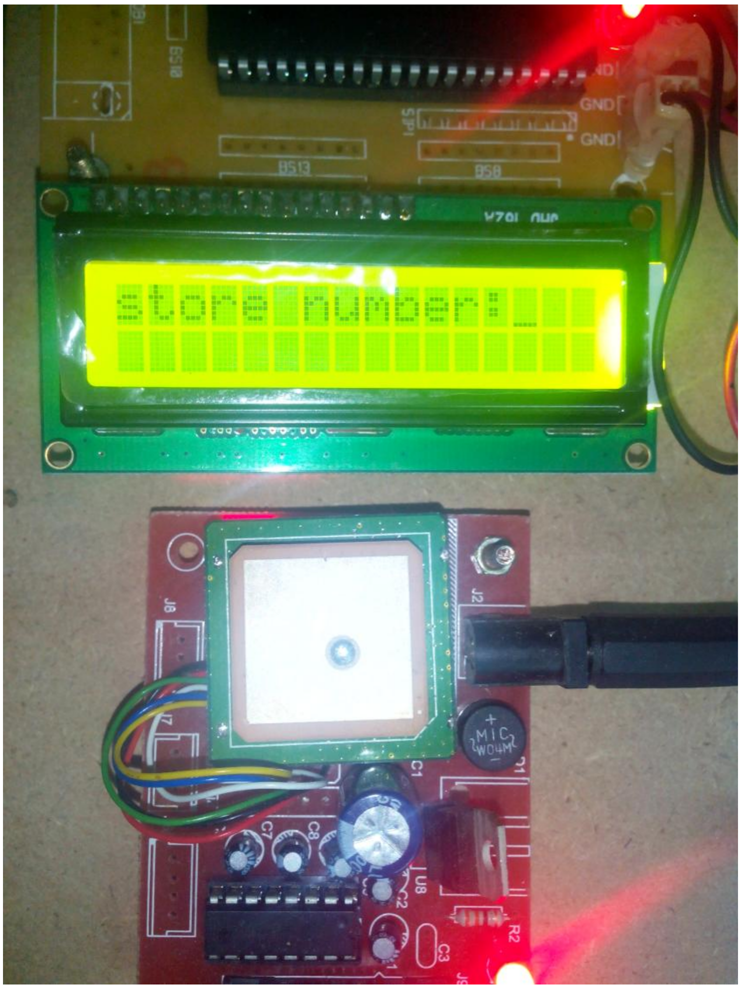


Fig 7.2: Store number

Then we have to send any random message to the gsm module in the kit from our mobile as shown in figure 7.3

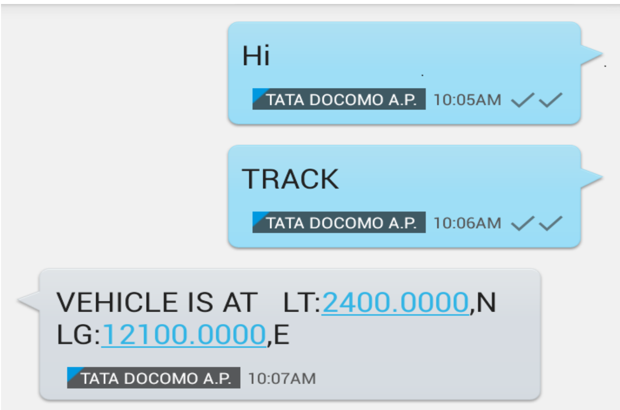


Fig 7.3: Initialization message

After sending a message for example"Hi", then our number will be stored as the user number.

Now, the kit is ready to be operated.

It can be operated using three commands:

a) **TRACK**: When Track message is sent from our mobile to the GSM module in the kit. It will access the current location details from the GPS module in the kit and sends the co-ordinates to our mobile.
b) **START**: If we want to start the vehicle engine ,we can send "START" message. It will start the motor present in the kit and sends us the location co-ordinates at which the vehicle started.
c) **STOP**: If we want to stop the vehicle engine, we can send "STOP" message. It will stop the vehicle and send us the location co-ordinates at which the vehicle is stopped.

The following actions can be noticed in figure 7.4

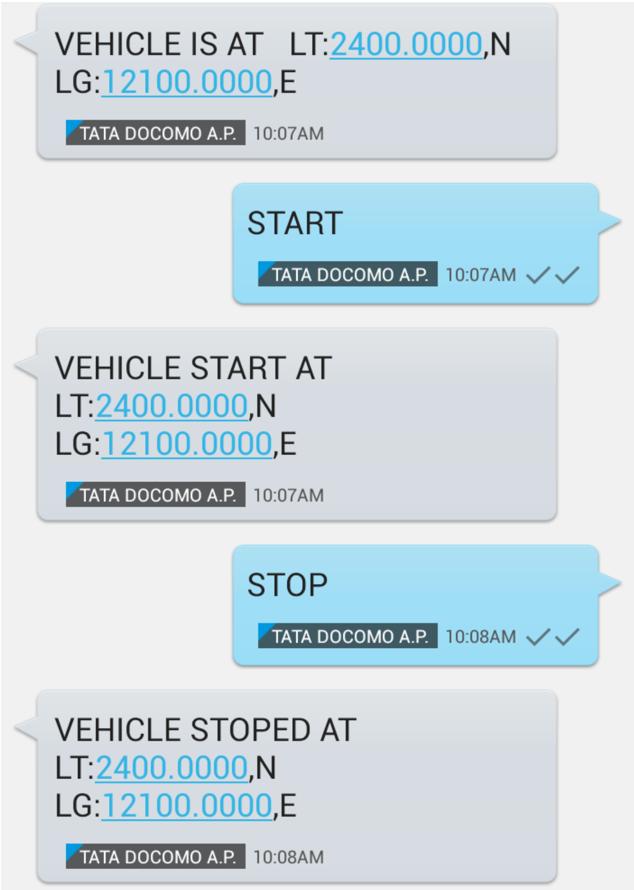


Fig 7.4: Messages displayed

7.2 APPLICATIONS

When some technology comes to be used at practical level it happens to cherish both plus as well as minus points of its own. But sometimes technology may be positive in itself but its application can be misused. Before we go ahead to give space to any technology in our house or work place we should have pre-estimates of its fall outs.

The positive aspects of the tracking system can be summarized as follows:

i. Core benefit of tracking vehicle is that one can monitor one's vehicle from a distance whether on individual or commercial level. It helps busy parents to keep a watch on the children even from their office and control their roaming here and there. Thus can put a check on their rash driving. This gives immense relief to business owners as it gives them information about the misuse of company vehicle or delay in delivering services or driver's violation of speed code, if any. All this keeps a check on wastage of fuel, time and ensures the better services. With the use of this technology one need not enquire the location of the vehicle by phone again and again. One can get all the required details just by a click on the internet. Map on the screen displays the position of vehicle at a particular time.

ii. In view of long journeys and night journeys by car the technology can provide a safety network to the person in condition of emergency. It can cut time of journey short by providing the information regarding location, speed, distance from the destination leading to best route planning.

iii. Best feature of the technology is that it is easy to use. just an automated unit is needed to be installed in the vehicle and connected to the centre which may be provided by some company. This instrument is monitored by the GPS tracking company which keeps all the records or its customer's locations. All details of location etc are communicated to the user by cell phone or internet connection. Increasing productivity of your mobile workers.

iv. It helps monitoring employee driving habits and activities.

v. Helps you locate your employees are on-the-road.

vi. Helps you verify the employee time sheet.

vii. Helps you in monitoring all your vehicles.

viii. Helps you in timely delivery of the consignments

ix. Helps you monitor the vehicle speeds

x. Helps you in tracking the movement of vehicles on the road

The negative aspects of the tracking system can be summarized as follows:

No technology is free from dark areas. This technology helps monitoring vehicles and children as well and ensures increased productivity at commercial level and safety at personal level. But at the same time it encroaches the privacy of the individual. The liberty of the person gets restricted. This may lead to business owner to measure the performance of the employee by these stats only and there leaves no room for human analysis.

Thus technology carries its whites and blues. It depends on the user how to make it.

Applications

Commercial fleet operators are by far the largest users of vehicle tracking systems. These systems are used for operational functions such as routing, security, dispatch and collecting on-board information.

These systems are also used in consumer vehicles as devices for preventing theft and retrieving stolen/lost vehicles. The signal sent out by the installed device help the police to track the vehicle. These tracking systems can be used as an alternative for traditional car alarms or in combination with it. Installing tracking systems can thus bring down the insurance costs for your vehicle by reducing the risk factor. Vehicle Tracking systems often have several alternatives, like sending automatic alerts to a phone or email if the vehicle is moved without due authorization. They can also work as one layer of several combined security measures. Apart from security concerns, the tracking systems can also help users such as taxi services to improve their customer service. The systems enable the operators to identify the empty taxis and direct the nearest one to pick up the customer.

Vehicle tracking systems can also be applied for monitoring driving behavior for both commercial and individual situations. Parents for instance can use tracking devices to keep an eye on their teenage son’s driving. The applications for this project are in military, navigation, automobiles, aircrafts, fleet management, remote monitoring, remote control, security systems, teleservices, etc.

Some main advantages of implementing this system are as follows:

- Fleet monitoring
- Vehicle scheduling
- Route monitoring
- Driver monitoring
- Accident analysis
- Geo-fencing geo-coding

7.3 LIMITATIONS

This program is highly sensitive to the camera position and the environment, so a considerable amount of tuning has to be done each time a new video is taken or camera position is changed and even more so if the video is of an entirely new environment.

- The other limitation is the traffic problem, the program will not able to detect which vehicle to track if it finds some vehicle in the -6*step_y and +6*step_y of the current guess. If the nearby vehicle is same as the one in the model. As in our data images if we bring maruti-800 near the car than the probability of error increases manifolds.
- If there is noise in the edge detected image, we can't really track the vehicle. What is meant by noise is that if some humans are coming near to the car then the edge detected image will have the edges of that human or animal or tree, then the program will try to match those edges with the car model. The program might treat this match as a success but really it will be off the track.
- We could not model the curves in the maruti-800, like in some images the driver and the steering can be seen, but we could not find a solution for that. Also the body of the Maruti can be best modeled as combination of curves and the lines.
- Also if distance between the vehicle positions in the two consecutive frames is too much then this tracking program can't detect the vehicle in the second frame and will try to track it in the subsequent frame.
- The main limitation of the software is the real time implementation, this can't be implemented with this much time efficiency in any of the real time applications. This limitation is mainly due to the processing time.

7.4 FUTURE SCOPE

We can use the EEPROM to store the previous Navigating positions up to 256 locations and we can navigate up to N number of locations by increasing its memory.

- We can reduce the size of the kit by using GPS+GSM on the same module.
- We can increase the accuracy up to 3m by increasing the cost of the GPS receivers.
- We can use our kit for detection of bomb by connecting to the bomb detector.
- With the help of high sensitivity vibration sensors we can detect the accident.

- Whenever vehicle unexpectedly had an accident on the road with help of vibration sensor we can detect the accident and we can send the location to the owner, hospital and police.
- We can use our kit to assist the traffic. By keeping the kits in the entire vehicles and by knowing the locations of all the vehicles.
- If anybody steals our car we can easily find our car around the globe. By keeping vehicle positioning vehicle on the vehicle.

7.5 CONCLUSION

The project titled "tracing down the vehicle using GSM and satellite communication" is a model for vehicle tracking unit with the help of gps receivers and GSM modem. Vehicle Tracking System resulted in improving overall productivity with better fleet management that in turn offers better return on your investments. Better scheduling or route planning can enable you handle larger jobs loads within a particular time. Vehicle tracking both in case of personal as well as business purpose improves safety and security, communication medium, performance monitoring and increases productivity. So in the coming year, it is going to play a major role in our day-to-day living.

We have completed the project as per the requirements of our project. Finally the aim of the project i.e. to trace the vehicle is successfully achieved.

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