Contents

List of Figures

Chapter 1

Introduction

Global Positioning System (GPS) is a space-based global navigation satellite system (GNSS) that provides reliable location and time information in all weather and at all times and anywhere on or near the Earth when and where there is an unobstructed line of sight to four or more GPS satellites. It is maintained by the United States government and is freely accessible by anyone with a GPS receiver. The GPS project was started in 1973 to overcome the limitations of previous navigation systems, integrating ideas from several predecessors, including a number of classified engineering design studies from the 1960s. GPS was created and realized by the U.S. Department of Defense (USDOD) and was originally run with24 satellites. It became fully operational in 1994. In addition to GPS, other systems are in use or under development. The Russian Global Navigation Satellite System (GLONASS) was developed contemporaneously with GPS, but suffered from incomplete coverage of the globe until the mid-2000s.[4] There are also the planned European Union Galileo positioning system, India's Indian Regional Navigation Satellite System, and the Chinese Beidou Navigation Satellite System.

The device consists of a GPS receiver which will receive coordinates from satellite.Device works in real time.The coordinates will be stored in SD card.Moreover with the help of this logged coordinates google maps , the exact location of vehicle along with the route can be tracked.

Device Can Be used in Following Ways:

- To Track Public Transportation Vehicles
- Surveillance
- Transit tracking
- Device can be used to track public busses, school busses,ambulance.
- We can monitor some parameters of vehicle like or speed.
- We can dial an emergency call if the vehicle goes out of a certain / pre-decided track.

1.1 Problem Formulation

- Presently there is no technology to track public transport like Buses ,Long distant trains, Logistics ,Private Transport vehicle,Goods carrying Automotive,School Buses,Ambulance.etc, in real time.

- Currently many accidents and Vehicle Theft takes place.In such case tracking of vehicle becomes difficult.Alternate tracking devices just gives us the longitudes and Latitudes of vehicle but it is not convenient;Instead the device will Compare the coordinates with Some reference coordinates that are predefined and will provide approximate nearby place name along with coordinate.

- In case of an accident it is difficult to find driver's information or car details like Cars Registration no,Blood Group,Contact Details etc;

The Prime objective of project is to track automobile .The **GPS** data logger can be helpful to find the current location of vehicle and provide vital information regarding the driver and the vehicle at the time of accidents. The device is meant to be strong so it can survive during severe accidents.it must be compact and capable of providing accurate information in less time. Moreover it must be cost efficient.

1.2 Organization of report

Chapter 2 includes the literature survey, chapter 3 discusses the system design, chapter 4 includes system Implementation, chapter 5 Describes the project schedule in dead time, chapter 6 involves Conclusion of project.

Chapter 2

Literature Survey

2.1 History of GPS tracking

The design of GPS is based partly on the similar ground based radio navigation systems, such as LORAN and the Decca Navigator, developed in early 1940s and were used in World War 2. Additional inspiration for the GPS system came when Soviet Union launched the first Sputnik in 1957. A team of US scientists led by Dr. Richard B. Kershner were monitoring Sputnik radio transmissions. They discovered that, because of Doppler Effect, the frequency of the signal being transmitted by Sputnik was higher as the satellite approached and lower as it continued away from them. They realized that since they knew their exact location on the globe, they could pinpoint where the satellite was along its orbit by measuring the Doppler distortion.

2.2 Classification of GPS Tracking:

Typically they are classified as **passive** and **active**.
Passive devices store GPS locations, speed, heading and sometimes a trigger event such as key on/off, door open/closed. Once the vehicle returns to a predetermined pint, the device is removed and data is downloaded to a computer for evaluation. Passive system include auto download type that transfer data via wireless download.
Active devices also collects same information but usually transmits data in near-real-time via cellular or satellite networks to a computer or data center for evaluation.
Many modern vehicle tracking systems combine both active and passive tracking abilities: when cellular network is available and tracking device is connected it transmits data to the main server; when network is not available it will store data in the memory card and transmits data once the network becomes available again.
Historically, vehicle tracking is accomplished by installing a box into the vehicle, either self-powered or wired into the vehicles power system. For detailed vehicle locating and tracking is predominant method; with advent of cell phones technologies that provide tracking of multiple entities, such as both a sales-person and their vehicles. This system is feasible of getting continuous and comprehensive data of entire day for a person whose vehicle is on lease.
Cloud Computing
Cloud computing is offline computing in which large groups of remote servers are net-

worked to allow the centralized data storage, and online access to computer services or resources. Clouds can be classified as public, private or hybrid. Cloud is managed by servers.Device will store the Coordinates from Receiver directly into cloud which can be accessed from anywhere.

2.3 Different Traditional Tracking System

2.3.1 Automatic Vehicle Location (AVL)

AVL system is an advanced method to track and monitor any remote vehicle with the device that receives and sends signals through GPS satellites. AVL comprises of Global Positioning System (GPS) and Geographic Information System (GIS) in order to provide the real geographic location of the vehicle. AVL system consists of PC-based tracking software to dispatch, a radio system, GPS receiver on the vehicle and GPS satellites. Among the two types of AVL, GPS-based and Signpost-based, GPS-based system is widely used.

The tracking method

GPS satellite is used to locate the vehicle equipped with GPS modem by sending satellite signals.

The accuracy of this tracking method:

AVL system provides the vehicle location with the accuracy of about 5m to 10m.

The information delivered by the tracking system The information transmitted to the base station is location, speed, direction, mileage, start and stop information, status of vehicle and asset in the vehicle. The information of the vehicle is often transmitted to the base station every 60 seconds. If the base station receives the data, it displays it on a computerized map. The method of data transmission from vehicle to centre GPS receiver on the vehicle receives the signals of its geographic location. Then the receiver sends that data plus speed, direction, etc. to the base station via a radio system. The system can provide further more services: vehicle route replay facility, external sensor data, speed alerts.

Limitations of this system:

AVL system cannot get accurate, complete and sufficient satellite data in dense urban areas or indoors and when transmission is blocked by natural obstructions (heavy tree cover) or many buildings. It can also occur in RF-shadowed environments and under unfriendly RF conditions. Sometimes, a position fix can be impossible.

2.3.2 Assisted GPS (AGPS)

In AGPS system, a terrestrial RF network is used to improve the performance of GPS receivers as it provides information about the satellite constellation directly to the GPS receivers. AGPS uses both mobiles and cellular networks to locate the accurate positioning information. AGPS is used to overcome some limitations of GPS. With unassisted GPS, locating the satellites, receiving the data and confirming the exact position may take several minutes.

The tracking method:

AGPS uses GPS satellites to track the vehicles. A GPS receiver in vehicle is always in contact with 4 satellites (3 satellites determine latitude, longitude and elevation ad the fourth provides element of time). And so it never fails to detect the location of a vehicle.

The accuracy of this tracking method:
Location of the vehicle is provided with accuracy of between 3m and 8m, and speed of 1km. The information delivered by the tracking system are vehicle location, average speed, direction, path traversed in a selected period and alerts (Engaged/Unengaged, speed limit, vehicle breakdown and traffic jam). The system provides continuous 10 second updates while the vehicle is in motion. It also provides data storage for up to 1 year.The location is retrieved from the GPS device and relayed as an SMS using the cell phone by the Client Node to the Base station.
Additional services that this system can provide
The system can provide atomic time (Accurate Time Assistance). There is a "panic" button. When pressed, you can contact an operator and he or she will help you out or keep you safe from accidents or hijacks.
Limitations of this system:
As GSM network is used to transmit data from the vehicle to the base station, the cost of sending SMS can be a major concern to be considered.

2.3.3 RFID system

RFID is an automatic identification method using devices called tags to store and remotely retrieve data. RFID uses radio waves to capture data from tags.
The tracking method:
RFID comprises of three components: tag (passive, semi passive and active), reader (antenna or integrator) and software (middleware). RFID tag which contains micro electronic circuits sends the vehicle information to a remote RFID reader.
The accuracy of this tracking method:
This system provides the location of the vehicle with the accuracy of 4m to 6m. The information delivered by the tracking system Location of the vehicle, mileage and speed are delivered to the centre. The information is updated every one minute.The information is sent to and received from RFID tags by a reader using radio waves. RFID reader, basically a radio frequency (RF) transmitter and receiver, is controlled by a microprocessor or digital signal processor (DSP). RFID reader with an attached antenna reads data from RFID tags. Then, it forwards the data to the computer for further processing. Additional services that the system can provide.Additional services are external sensor providing status and equipment of vehicle and alert systems.
Limitations of this system:
The limitation of the RFID system is short range. The system is only available in short distances.

We have chosen **Assisted GPS (AGPS)** technology for implementation of our project because of its **Accuracy and Long range.**

Chapter 3

System Design

3.1 Block Diagram

The Following figure shows the Block Diagram of the system

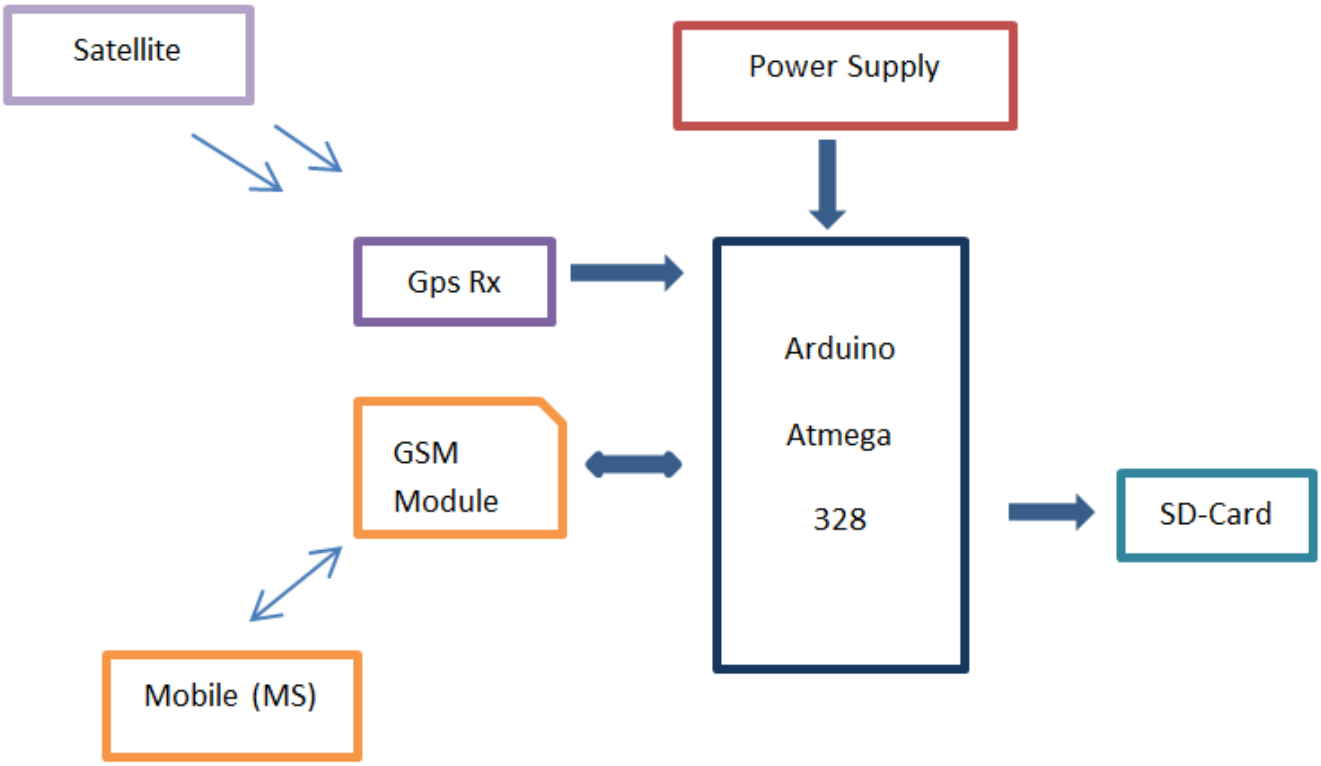


Figure 3.1: Block Diagram of Vehicle tracking and Data Logger

3.2 Components used

- Arduino Uno(ATMEGA 328)
- GSM SIM900A shield
- GPS Module
- SD Card Module
- IC7805,IC4050,IC7812

Power Source: The device is connected to 12V/15A battery Used in the vehicle.Using IC-7805 12V is converted into 5V/1A, which is required by arduino and Using IC7812 12/15A is converted to 12V/1A supply is directly connected to GSM module. Arduino provide 5V power supply directly to GPS module.5V from Arduino is converted is converted to 3.3V using IC-4050 for SD card module.

Micro-Controller: Micro-controller **ATMEGA-328** is used as main control unit of device, it controls and process entire system.Programming of Micro-controller is done with the help of Arduino IDE.

3.3 Working

The Working can be divided into two parts

1. Data Logging
2. Live Tracking using Cellular Device.

Data Logging

- Primarily during calibration Arduino will check the presence of micro SD card.If SD card is absent it will revert back to user through Serial Monitor.
- GPS shield will receive Real Time coordinates from GPS Receiver in raw format.
- The coordinates received are converted into readable format by program using input library "TINY GPS" in program.
- Now, the received coordinates along with date,time and speed is stored in SD card.

Live Tracking Using Cellular Device

- A GSM simcard is inserted in the SIM900A GSM/GPRS Module.Arduino constantly monitors the Cellular module for call.
- When Someone calls the GSM module,Arduino detects the Call.It Disconnects the Call after 2-3 Rings.
- Arduino program call the function from Tiny Gps library which receives the current coordinates from GPS Rx,converts it into readable format and the co-ordinates(Longitude and Latitude) are reverted back to owner whose contact no. is already predefined in the program using SMS send through GSM module

- In Case of Public Transportation Tracking,the program can be modified accordingly,so that the person who dials the no. will receive coordinated from device.
- The received message will be in the form of:"you coordinates are latitude: 19.154 and longitude: 54.98"

3.4 Hardware Description

The Following Hardware are used in the Device.

3.4.1 Arduino

The arduino consist of ATmega-328 micro-controller.Arduinois easy DIY kit which can be easily programmed and interfaced with other components. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset but- ton. It contains everything needed to support the micro-controller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. It has Flash Memory of 32kb,SRAM of 2kb and EEPROM of 1 KB.

Figure 3.2: Arduino

3.4.2 IC-7805

It is a voltage Regulator.It converts input voltage from (8-12 V) into 5V

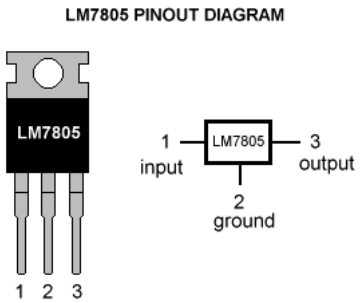


Figure 3.3: Pin Diagram of IC-7805

3.4.3 GPS Receiver (EM-506 48 channel)

The GPS(Global Positioning System) receiver receives coordinates in form of longitudes and latitude from satellite in real time.

Figure 3.4: Pin Diagram GPS Rx

3.4.4 GSM/GPS shield SIM900

It consists of gsm card slot along with gps shield. gps module is connected to this shield.

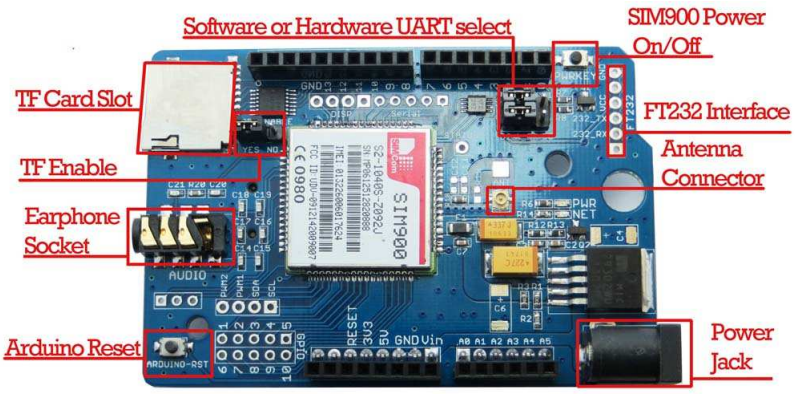


Figure 3.5: Pin Diagram of SIM-900

3.5 Algorithm

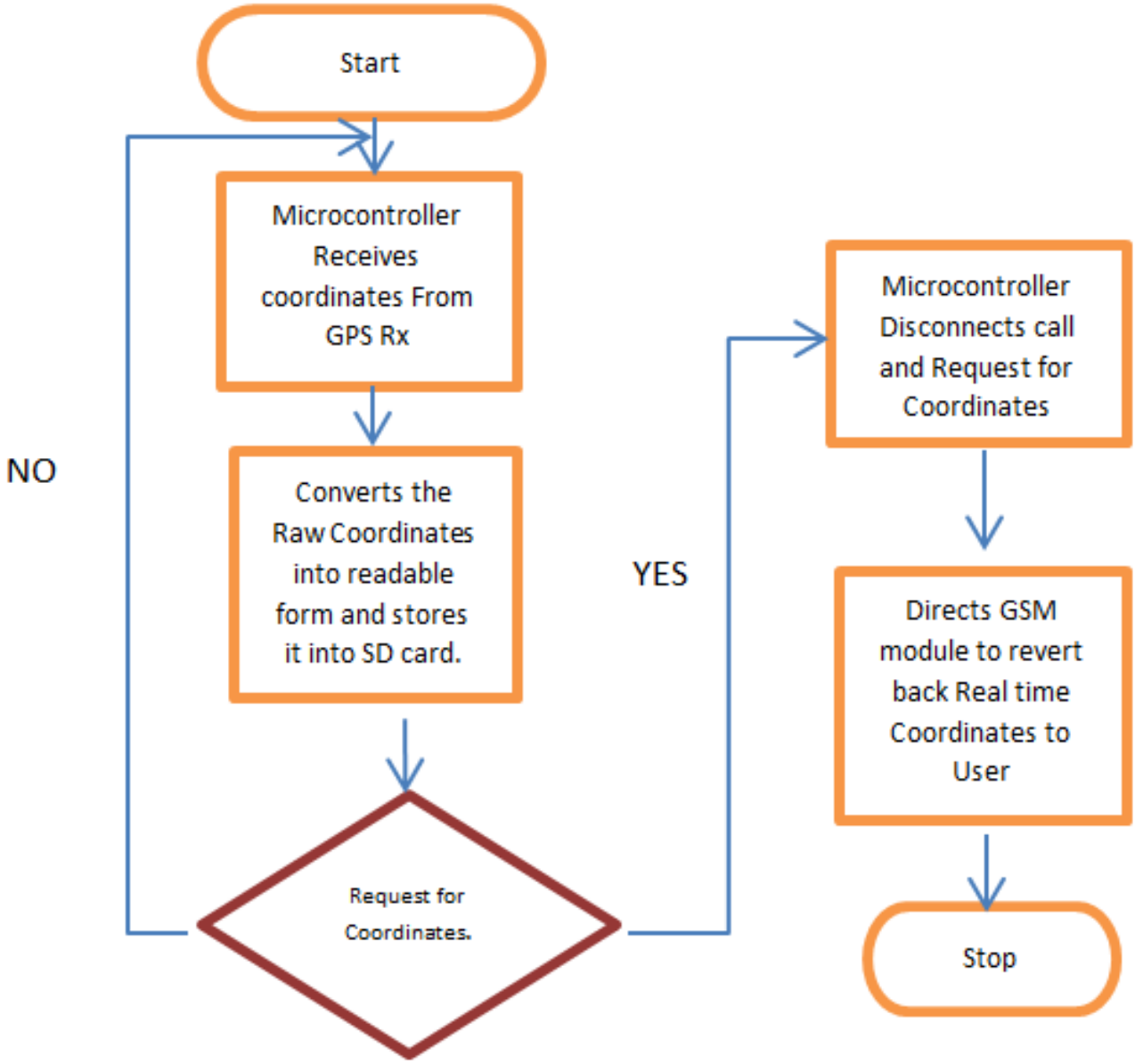


Figure 3.6: Algorithm

Chapter 4

System Implementation

4.0.1 Hardware Implementation

The Following figure are the Components used in Device.

4.1 Circuit Diagram

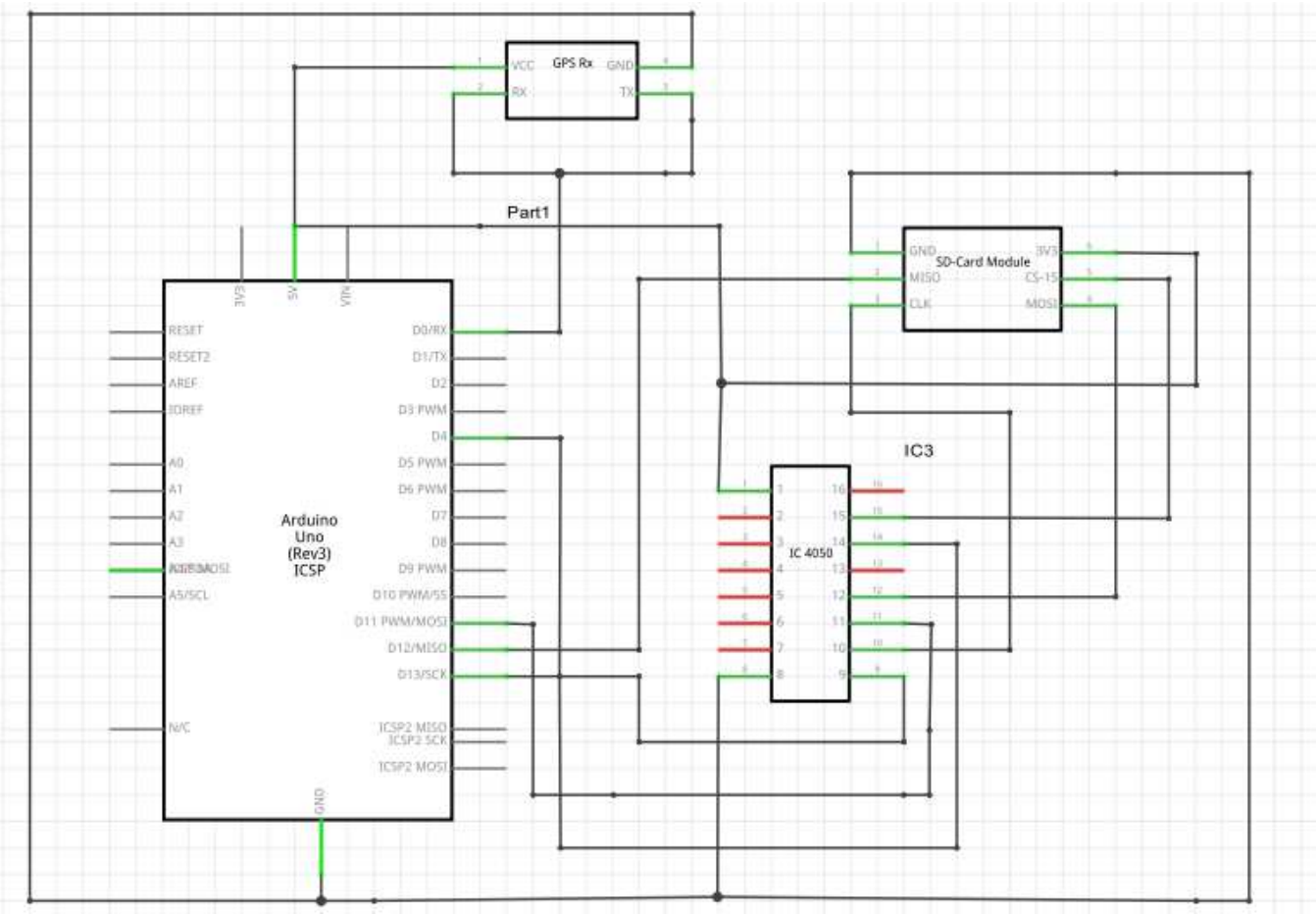


Figure 4.1: Circuit Diagram

4.2 Components Used

The Following are the Components used in Device.

Figure 4.2: Components

4.3 Circuit Connection

- Sim900 GSM module is connected to Arduino board at pin no 2,3 respectively.It is powered through 12v/1A power jag and a DB9 connector.
- SD card is connected to Arduino board at pin numbers 8,11,12,13 through IC4050.It is powered at 3.3V through Arduino board.
- The GPS Receiver is connected to pin no 0 of Arduino.

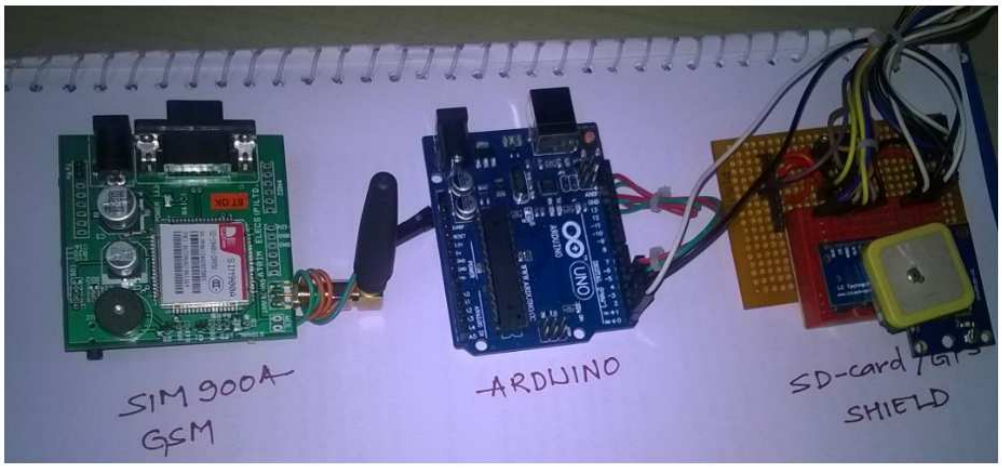


Figure 4.3: Components

4.3.1 Software Implementation

- The Code is written In arduino IDE.
- It is further Compiled and checked for errors.
- Finally the code is being uploaded.

The following Fig shows the Arduino IDE.

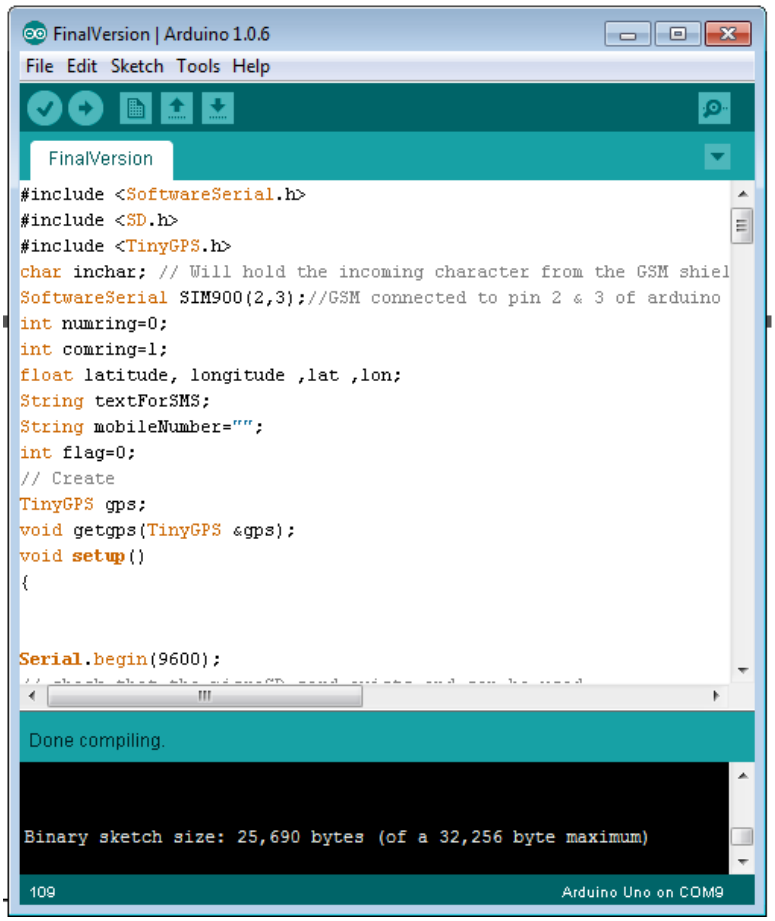


Figure 4.4: Program on Arduino IDE

.

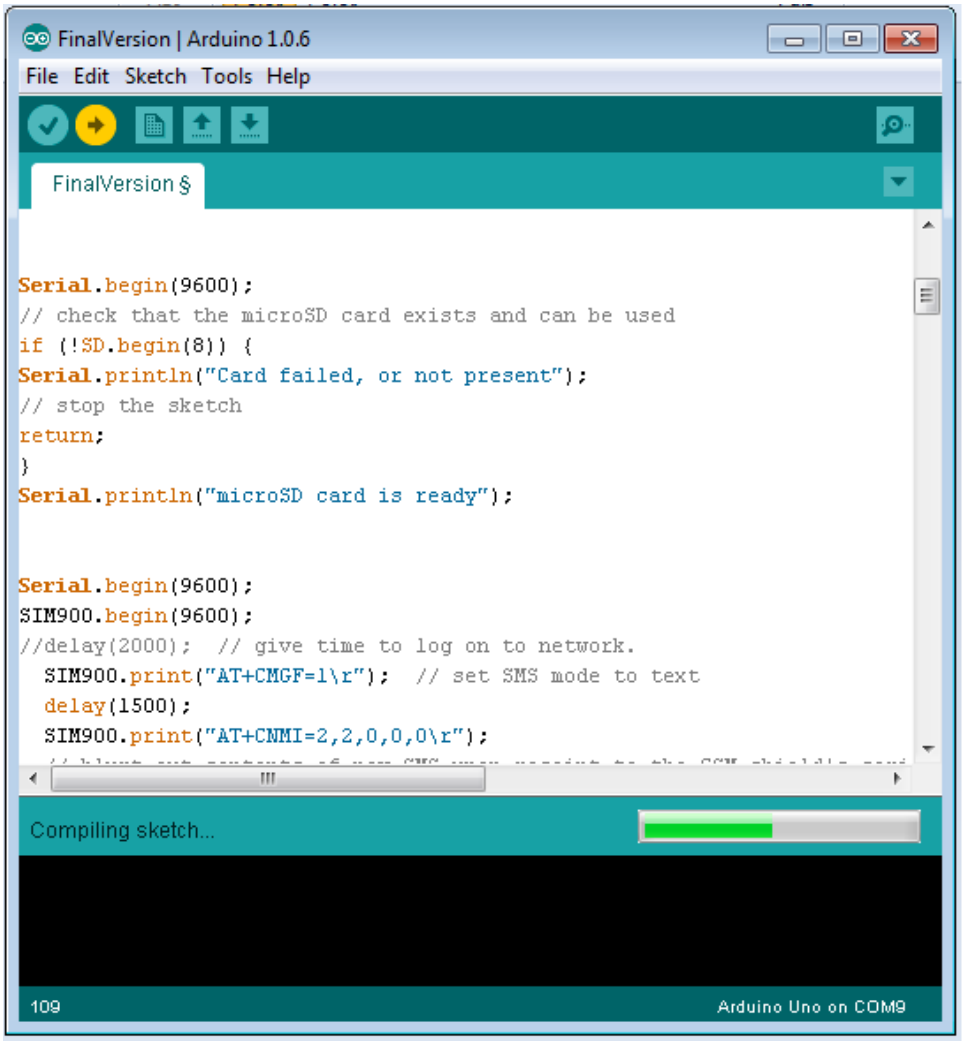


Figure 4.5: Code Being Uploaded

Chapter 5

Results

The following figure shows the Serial Monitor of Arduino IDE.
It helps us to Monitor the ongoing process of device.It also displays dialler's mobile number.

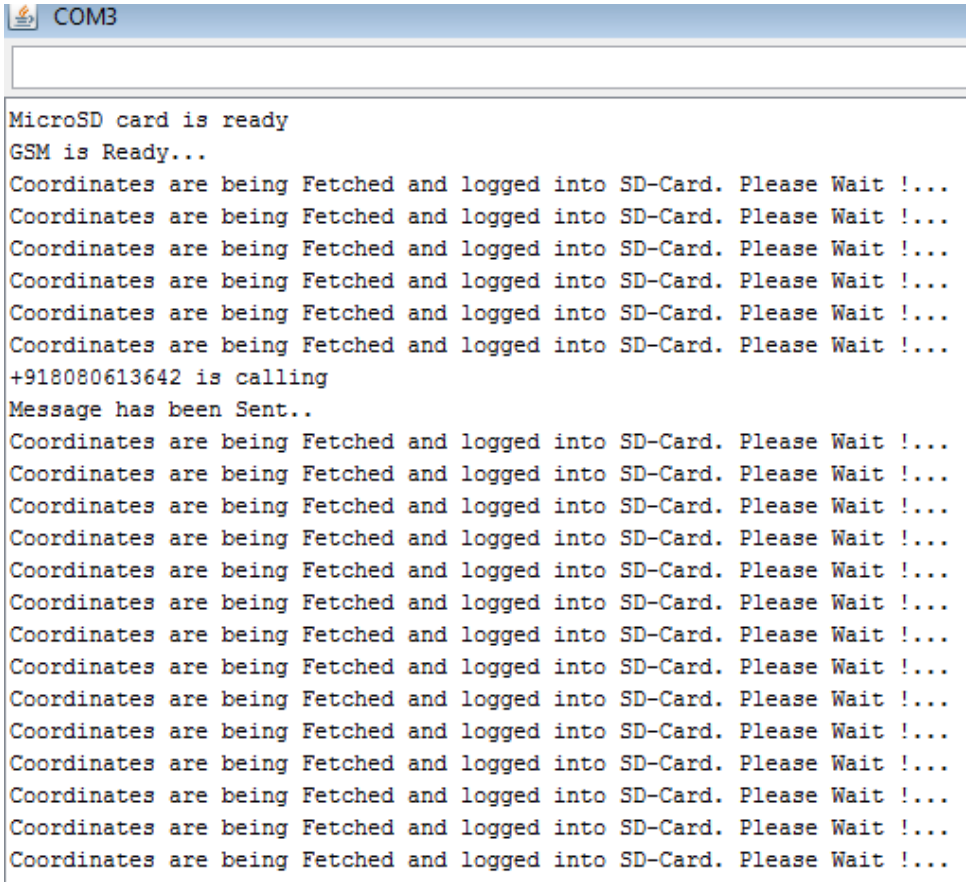
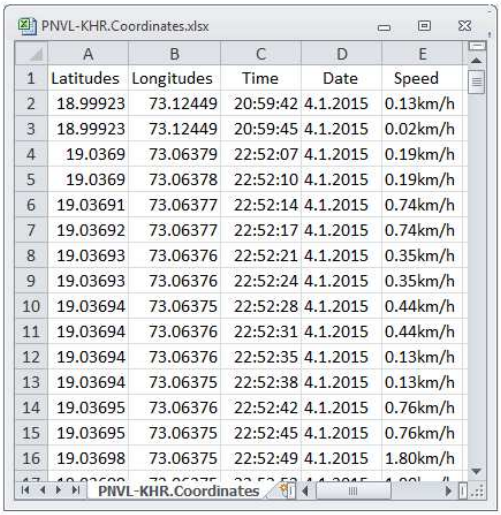


Figure 5.1: Serial Monitor of Arduino IDE

- The Co-ordinated stored in SD-card are converted to .xlsx format using MS-Excel.
- When the .xlsx file is uploaded uploaded on http://www.gpsvisualizer.com/ the graphical path is obtained.
- A test run from Panvel to Kharghar was being conducted.Parameters like Speed,Date,time were verified.
- the following image shows the Co-ordinates between Panvel and Kharghar.



PNVL-KHR.Coordinates.xlsx

	A	B	C	D	E
1	Latitudes	Longitudes	Time	Date	Speed
2	18.99923	73.12449	20:59:42	4.1.2015	0.13km/h
3	18.99923	73.12449	20:59:45	4.1.2015	0.02km/h
4	19.0369	73.06379	22:52:07	4.1.2015	0.19km/h
5	19.0369	73.06378	22:52:10	4.1.2015	0.19km/h
6	19.03691	73.06377	22:52:14	4.1.2015	0.74km/h
7	19.03692	73.06377	22:52:17	4.1.2015	0.74km/h
8	19.03693	73.06376	22:52:21	4.1.2015	0.35km/h
9	19.03693	73.06376	22:52:24	4.1.2015	0.35km/h
10	19.03694	73.06375	22:52:28	4.1.2015	0.44km/h
11	19.03694	73.06376	22:52:31	4.1.2015	0.44km/h
12	19.03694	73.06376	22:52:35	4.1.2015	0.13km/h
13	19.03694	73.06375	22:52:38	4.1.2015	0.13km/h
14	19.03695	73.06376	22:52:42	4.1.2015	0.76km/h
15	19.03695	73.06375	22:52:45	4.1.2015	0.76km/h
16	19.03698	73.06375	22:52:49	4.1.2015	1.80km/h

PNVL-KHR.Coordinates

Figure 5.2: .xlsx file of PNVL-KHGR trial run.

- Above .xlsx file of trial run was uploaded on http://www.gpsvisualizer.com/.
- Route was traced automatically with the help of Google maps.
- The picture below represents the graphical route of our trial run.

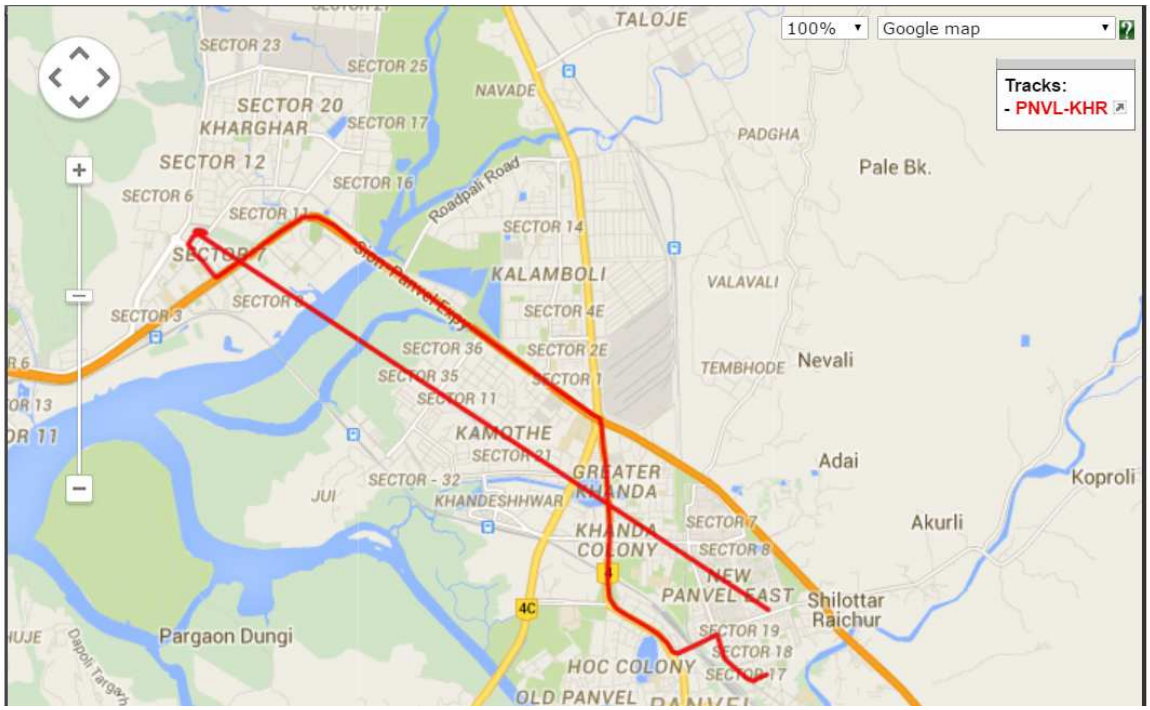


Figure 5.3: Route Traced Using Google Maps

- When a user wants to Know the location of vehicle ,he simply dials the corresponding number.The call automatically gets disconnected after 1-2 rings.
- After 1-2 seconds the user receives SMS showing Coordinates of Vehicle.
- Using Google maps the exact location can be traced.

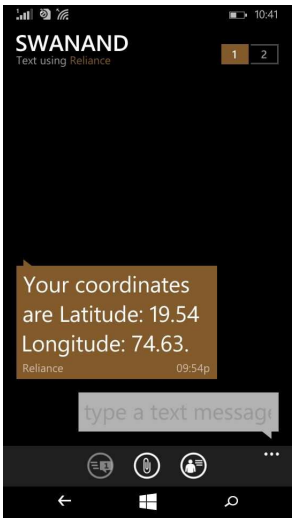


Figure 5.4: SMS Send Through GSM module

Chapter 6

Project Schedule and Implementation

Sr.No	Description	Duration	Status
1.	Literature Survey of topics based on GSM/GPS	1 week	Done
2.	Research on earlier projects on GSM/GPS.	1 week	Done
3.	View of the guide and finalization of topics	2 weeks	Done
4.	A detailed study of project regarding its hardware and software requirements and its availability in the market	2weeks	Done
5.	Hardware and software collection, circuit study and analysis	2weeks	Done
6.	Circuit designing and workflow preparation.	1week	Done
7.	Hardware installation (Fitting,Soldering, Wiring, Connecting)	2weeks	Done
8.	Preparation of partial report and presentation	2weeks	Done
9.	Study of software languages tools (Arduino, Embedded C)	3weeks	Done
10.	Interfacing the hardware with the software	2weeks	Done
11.	Testing Error Detection and debugging	2weeks	Done
12.	Preparation of final Report (Black Book) and final presentation	2weeks	Done

Chapter 7

Future Scope

7.1 Various Application of this Device

- **Public Transportation Tracking**:
  A tracker may befitted on a Public Vehicle like Buses,Cars,Trains.Any Person can know the current Position of Vehicle with just a miss call.

- **Transit tracking**:
  It can be used for temporary tracking of assets or cargoes from one point to another. User will ensure that the assets do not stop on route or being tampered in order to ensure the security of assets.

- **Logistics Tracking**:
  With the Help of this Device cargoes,Packers and Movers can be traced.

- **Distance calculations:**
  This is an important usage of vehicle tracking to calculate distance traveled by the fleet.

- **Industrial use:**
  Industries not traditionally knows to use vehicle tracking system (Logistics and Transportation industries are the ones that have traditionally incorporated vehicle tracking systems into their operations) have started to use in creative ways to improve their processes or businesses. Hospitality industries have caught on this technology to improve customer service. For example, a luxury hotel in Singapore has installed vehicle tracking systems in their limousines to ensure they can welcome their VIPs when they reach the hotel.

- **At the Time of Accidents:**
  Sd-card in this device will contain the vital information regarding the Driver,Vehicle and Emergency Contact nos; Police Officials can easily trace the route of car and the vital information is readily available so no time is wasted in investigation.

- It can be used on Rental vehicle Services

- Device can be also used to track school busses,ambulance,etc.

- We can monitor some parameters of vehicle like speed.

- We can dial an emergency call if the vehicle goes out of a certain / pre-decided track.

7.2 Limitations of this Device

- Weak Reception
  The Device has a very weak GPS Rx.So in close environment the device doesn't Receives any coordinates. It can be Overcome using a Powerful Long range Antenna.
- Device can be made More Robust so as to Survive dangerous Accidents.
- The Device can be further developed so that it can connect with internet using cellular package data and the data can also be logged on cloud.Which can be accessed anytime anywhere.
- The power consumption of the device can be reduced.
- The Tracking System Depends on Cellular Network,So there can be issue of network coverage in remote places during Roaming.
- Device could be developed to make it tampered proof.It must notify the concerned immediately if its being tampered

Chapter 8

Conclusion

The device will help to ease the tracking of any Vehicle.It can be used at private as well as professional level. It will also ease the life of common man traveling by any public transport.During this Project we learned a lot about practical application of electronics. But as every coin has two sides, the project also have some unresolved issues due to lack of time and resources.But we believe the issues can be resolved and overcome and further the device can be modified to suit particular needs.

Bibliography

[1] Getting Started with Arduino by Massimo Banzi

[2] Arduino Cookbook, 2nd Edition by Michael Margolis

[3] Online videos on Arduino By Massimo Banzi [

[4] Arduino + Android Projects for the Evil Genius by Simon Monk

[5] Arduino Workshop by John Boxall

[6] http://www.arduino.cc

[7] http://www.adafruit.com

[8] http://www.electronicshub.org

[9] http://www.instructables.com

[10] http://www.sparkfun.com

Chapter 9

Appendix

9.1 Atmega 328

- High Performance, Low Power AtmelAVR 8-Bit Microcontroller Family Advanced RISC Architecture
- 131 Powerful Instructions Most Single Clock Cycle Execution
- 32 x 8 General Purpose Working Registers
- Up to 20 MIPS Throughput at 20MHz
- On-chip 2-cycle Multiplier High Endurance Non-volatile Memory Segments
- 4/8/16/32KBytes of In-System Self-Programmable Flash program memory
- 256/512/512/1KBytes EEPROM
- 512/1K/1K/2KBytes Internal SRAM
- Data retention: 20 years at 85degreeC/100 years at 25degreeC
- Two 8-bit Timer/Counters with Separate Prescaler and Compare Mode
- One 16-bit Timer/Counter with Separate Prescaler, Compare Mode, and Capture Mode
- Real Time Counter with Separate Oscillator
- Six PWM Channels
- 8-channel 10-bit ADC in TQFP and QFN/MLF package
- Temperature Measurement
- 6-channel 10-bit ADC in PDIP Package
- Programmable Serial USART
- Master/Slave SPI Serial Interface

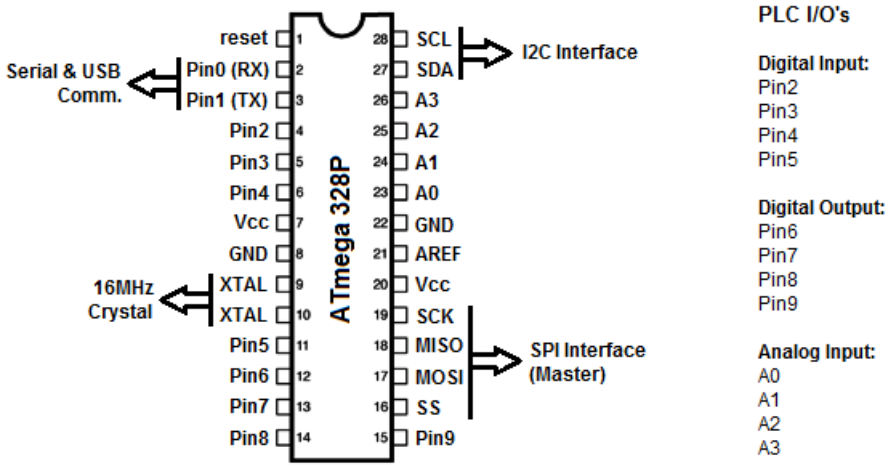


Figure 9.1: AT-mega 328 pin diagram

- Byte-oriented 2-wire Serial Interface (Philips I2 C compatible)
- Programmable Watchdog Timer with Separate On-chip Oscillator
- On-chip Analog Comparator
- Interrupt and Wake-up on Pin Change

  Special Microcontroller Features
- Power-on Reset and Programmable Brown-out Detection
- Internal Calibrated Oscillator
- External and Internal Interrupt Sources
- Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby, and Extended Standby
- Operating Voltage
  1.8 - 5.5V

- Temperature Range:
  -40degreeC to 85degreeC
- Power Consumption at 1MHz, 1.8V, 25degreeC.
  Active Mode: 0.2mA
  Power-down Mode: 0.1A
  Power-save Mode: 0.75A (Including 32kHz RTC)

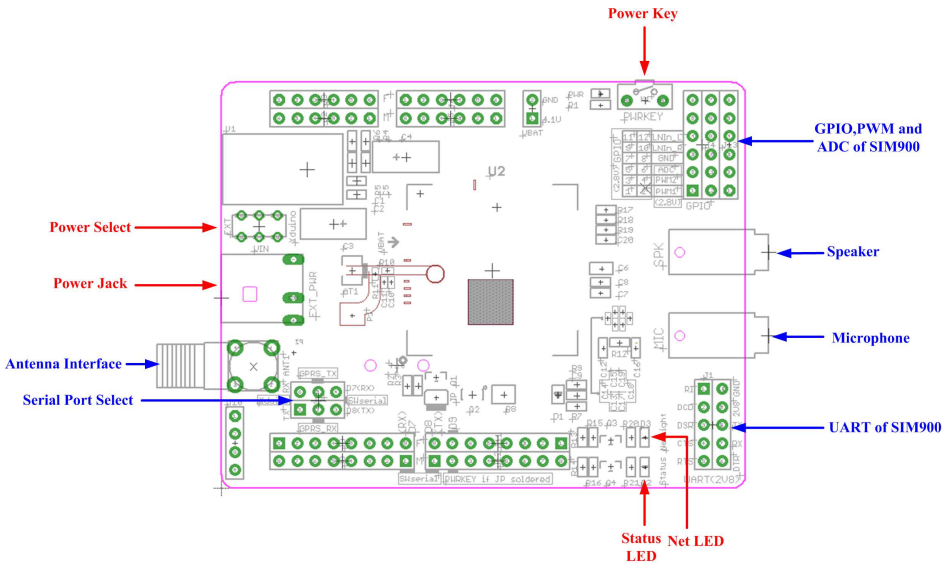


Figure 9.2: SIM900

9.2 SIM 900

- Power select - select the power supply for GPRS shield(external power or 5v of arduino)
- Power jack - connected to external 4.8 5VDC power supply
- Antenna interface - connected to external antenna
- Serial port select - select either software serial port or hareware serial port to be connected to GPRS Shield
- Hardware Serial - D0/D1 of Arduino/Seeeduino
- Software serial - D7/D8 of Arduino/Seeeduino only
- Status LED - tell whether the power of SIM900 is on
- Net light - tell the status about SIM900 linking to the net
- UART of SIM900 - UART pins breakout of SIM900
- Microphone - to answer the phone call
- Speaker - to answer the phone call
- GPIO,PWM and ADC of SIM900 - GPIO,PWM and ADC pins breakout of SIM900
- Power key - power up and down for SIM900
- Pins usage on Arduino
  D0 - Unused if you select software serial port to communicate with GPRS Shield
  D1 - Unused if you select software serial port to communicate with GPRS Shield
  D7 - Used if you select software serial port to communicate with GPRS Shield
  D8 - Used if you select software serial port to communicate with GPRS Shield

9.3 Schematics of Arduino UNO

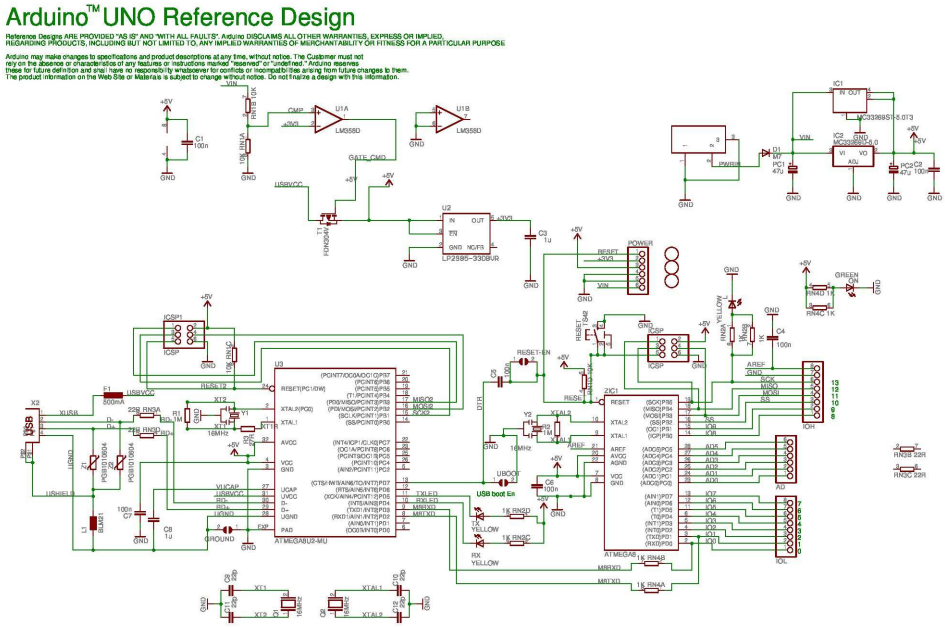


Figure 9.3: Schematics of Arduino uno

D9 - Used for software control the power up or down of the SIM900

Acknowledgments

I would like to thank my H.O.D sir Dr M.D Patil and our project guide and Project Coordinator Prof. Poornima Talwai for their encouragement and tremendous guidance during the course of this project. I would also like to thank my colleagues for their support and help. I have been fortunate enough to have received many useful suggestions from my colleagues which have greatly improved the clarity of my project and report. At the end I would specially thank our Principal sir Dr Ramesh Vasappanavara for providing us necessary infrastructure. I would love to appreciate and accept suggestions and criticisms about my project and the report from the readers.

_____ _____

Date Signature