Rudiments of Global Positioning System - A Review

Dr. A.Chandrabose[1],
Associate Professor,
Department of Computer Science,
Edayathangudy G.S.Pillay Arts &Science College,
Nagapattinam-611 002,India

T. Manivannan [2]
Research Scholor
Edayathangudy G.S.Pillay Arts &Science College,
Nagapattinam-611 002,India

M. Jayakandan [3]
Research Scholor
Edayathangudy G.S.Pillay Arts &Science College,
Nagapattinam-611 002,India

P. ANANTHI [4]
Research Scholor
Edayathangudy G.S.Pillay Arts &Science College,
Nagapattinam-611 002,India

Abstract - **Global Positioning System (GPS) is globally used for the tracking and navigation purpose. GPS is mainly used in the military, farming, civil, transportation and commercial users around the world. This review paper addresses the rudiments of satellite based navigation systems at length. Here we describe how GPS Tracking System works and where it is useful in real world environment. Further this paper outlines the working of GPS tracking system and its usefulness in actual world environment. Some of the well-known algorithms like Localisation algorithm, Kalman filter algorithm have been discussed in this paper.** *Keywords:* **Kalman algorithm, Localisation, Improvement Algorithm.**

I. INTRODUCTION

1.1 Global Positioning System

The Global Positioning System (GPS) is a satellite-based Navigation system developed and operated by the US Department of Defense. GPS Permits land, sea and airborne users to determine their three-dimensional position, velocity and time. This service is available to military and civilian users around the clock, in all weather, anywhere in the world.

This allows the asset's location to be displayed against a map backdrop either in realtime or when analysing the track later, using customizedsoftware.A GPS tracking system uses the GNSS (Global Navigation Satellite System) network.

Location awareness (Object Tracking) and navigation are becoming one of the most important requirements of the people . Personal navigation and location based services are provided by the GPS. The GPS project was developed in 1973 to overcome the limitations of previous navigation systems], integrating ideas from several predecessors, including a number ofclassified engineering design studies from the 1960s. GPS was created and realized by the U.S. Department of Defense (DOD) and was originally run with 24 satellites .
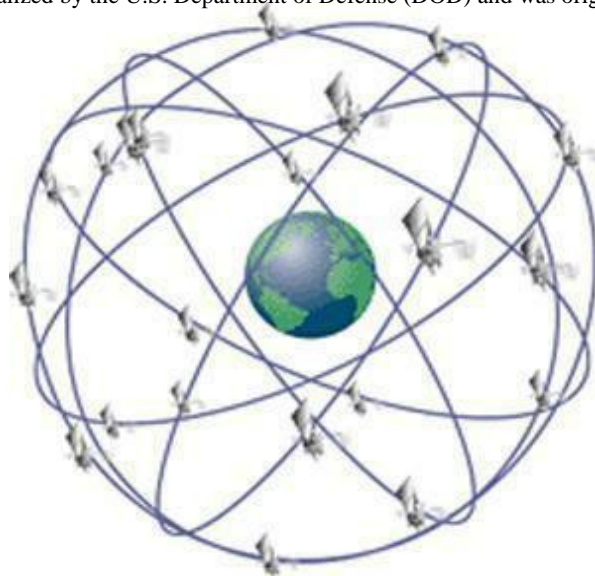

Fig1.1Global positioning system

1.2 In GPS 24 satellites around the Earth

The Global Positioning System (GPS) technology is a satellite-based navigation system that has been use since forty years. It was designed for military purposes. It is being used for geology, navigation, farming, precision mapping, surveying, and additional applications are on stand growing .

Fig 1.2 In GPS 24 satellites around the Earth

1.3 Object Track by 3 GPS satellites

GPS is a Global Navigation Satellite System (GNSS). GNSS is a system for location or position determination – so it's called as a geo positioning. Using a special receiver, a geo position in space and time can be calculated based on the reception of satellite signals

Fig 1.3 Object Track by 3 GPS satellites

1.4 Object Tracking System using GPS & GSM

Now a days, also smart phone provide the built in facilities for the navigation and tracking. So there is reduction in the size of the GPS receivers and the integration of GPS with mobile phones.
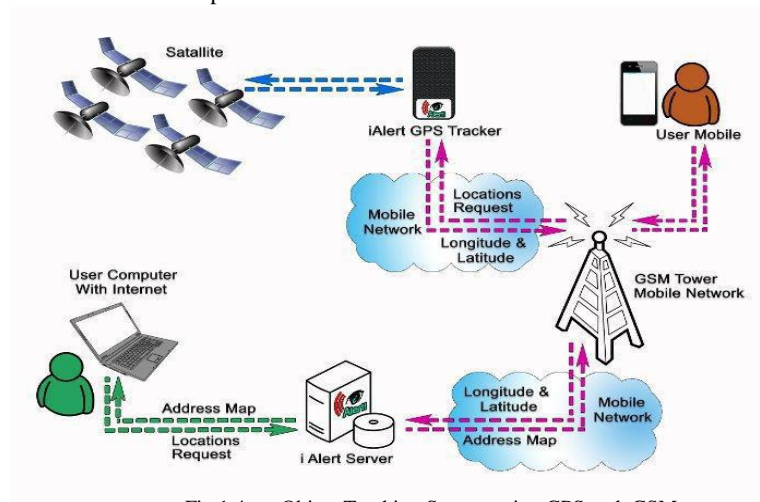

Fig 1.4   Object Tracking System using GPS and GSM
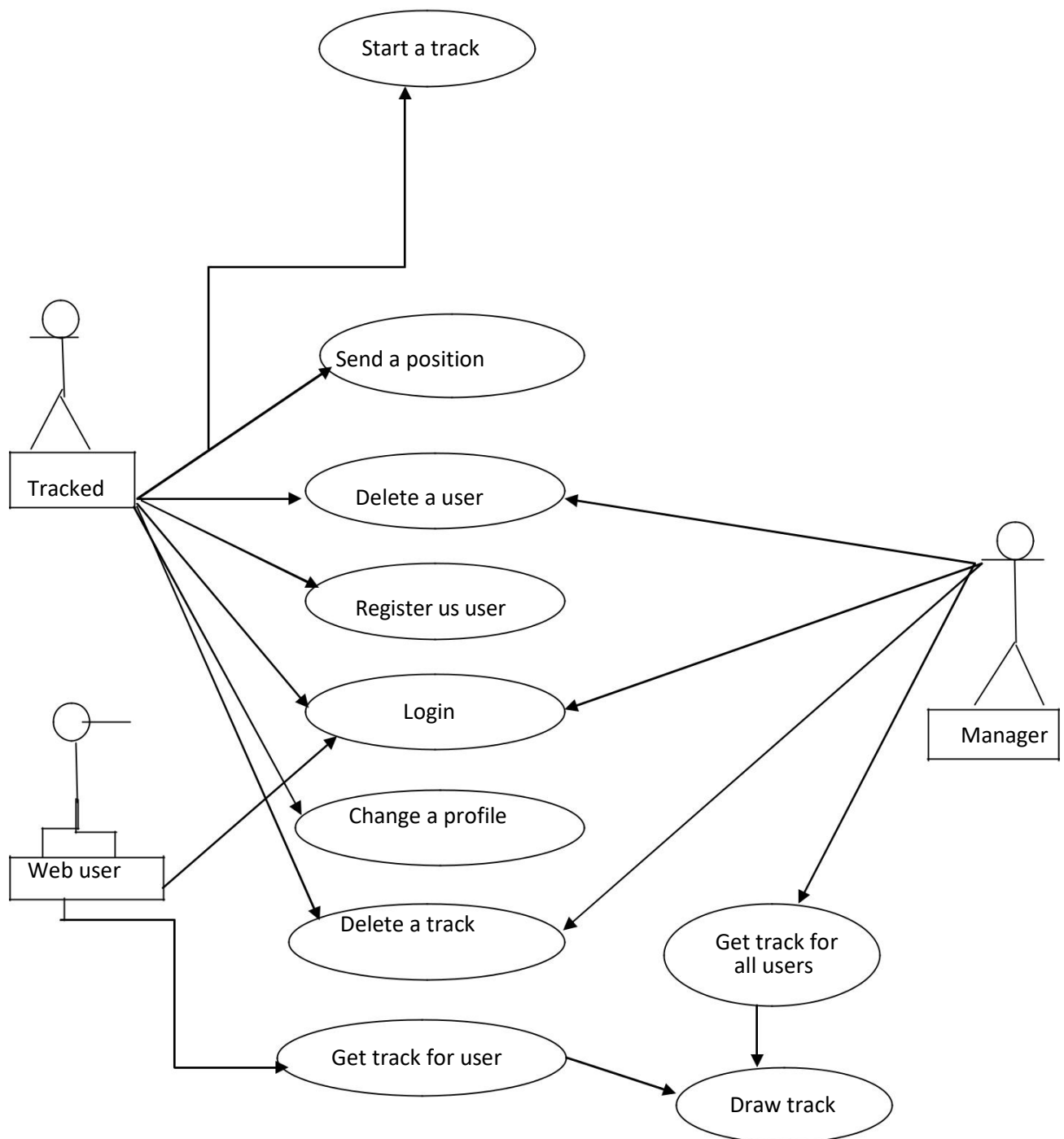
II. USE CASE APPLICATION

Fig2.1 Use Case of an Application

2.1 Object Track by 3 GPS satellites

GPS is a Global position determination – space Navigation Satellite System (GNSS). GNSS is a system for location or so it's called as a geo positioning. Using a special receiver, a geo position in and time.

2.2 Object Tracking System using GPS & GSM

Now a days, also smart phone provide the built in facilities for the navigation and tracking. So there is reduction in the size of the GPS receivers and the integration of GPS with mobile phones.

III. STRUCTURE OF ANTI-THEFT SYSTEM

They use kalman algorithm to recognize the actual location of object. While vehicle is running, SMS is passed to the authenticated person. Model has tracking unit, which track the movement of vehicle and after certain period of time the data is send to the authenticate person The device will collect position and display on Google Earth and so the current position of the car can be known. The advantage of this model is, we can easily identify the theft vehicle and also improve routing and tracking in transportation, they use hardware which has arm processor. And Limitation is that when the movement occurs at that time we will get the location, so data may not come by the GPS Unit. GPS based low-cost vehicle tracking and monitoring system is proposed in the figure, it includes a transmitting of retrieve location and vehicle status information and then send it to the other stationary module; the second part is the receiving module which collects the transmitted information by **SMS** and process it to a compatible format to Google Earth to view the location and vehicle status online.
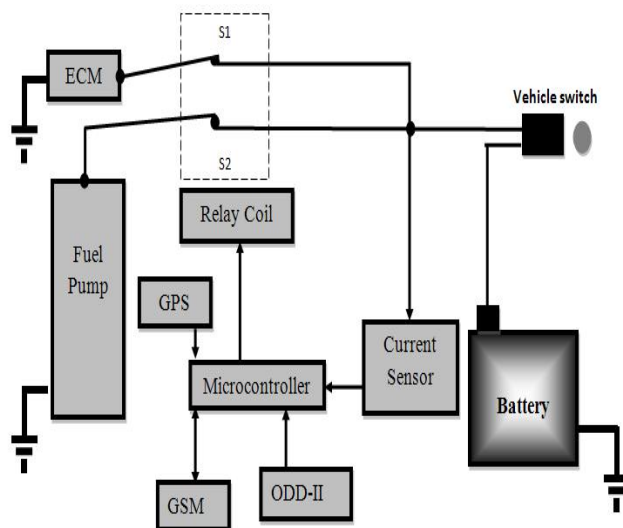

Fig3.1 Structure of Anti-Theft System

The advantages of this system are that it is inexpensive and light weight, and disadvantage is that if the authenticated person is unavailable then the problem may arise. The uses of GPS technology incorporated with road mapping are in. The GPS data receiver application and traffic analysis system was developed which collects the GPS traffic data and provides the ability for monitoring and analyzing traffic scenarios on the roads.
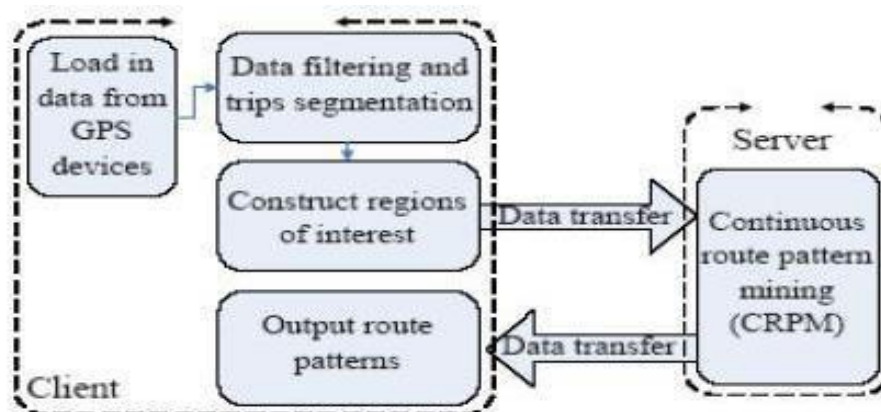

Fig 3.2 Some traffic management measures use sophisticated systems.

For Remote control of the vehicle tracking location through GPS tracking & detection of object to avoid collision is available in following figure.AVL is an advanced method used to track and monitor any remote vehicle equipped through GPS satellite. AVL is a combination of GPS and GIS that provides actual geographical real time position of each vehicle.

Main Benefits of this AVL is that it contains execution of Startup routine, Logs of Tracking Server and Pointing out current location of vehicle so we can easily track and get detail of the vehicle. But in case of long distance between vehicles RFID is not applicable. Location awareness and navigation is becoming one of the most important features in mobile phones and smartphones. Mobile phones and smartphones usually have relatively low cost GPS chips.

It proposes the LBS in GPS interfering spots by integrating information of multiple sensors such as gyroscope and compass in smartphones. Localization improvement algorithm implemented in smartphone and test in campus.

This algorithm gives GPS positioning error in a smartphone when the user is nearby high rise building.

3.1 AVL Tracking

Fig 3.3 AVL Tracking

Main Benefits of this AVL is that it contains execution of Startup routine, Logs of Tracking Server and Pointing out current location of vehicle so we can easily track and get detail of the vehicle. But in case of long distance between vehicles RFID is not applicable. Location awareness and navigation is becoming one of the most important features in mobile phones and smartphones. Mobile phones and smartphones usually have relatively low cost GPS chips.

It proposes the LBS in GPS interfering spots by integrating information of multiple sensors such as gyroscope and compass in smartphones. Localization improvement algorithm implemented in smartphone and test in campus.

This algorithm gives GPS positioning error in a smartphone when the user is nearby high rise building.

3.2 Conceptual Models
They conclude that to solve the traffic problem in the cities, following concept can be used:

1. Any Nation intending to adopt the model must put in place a policy and/or law prompting all vehicle owners to fit their vehicles with GPS trackers.

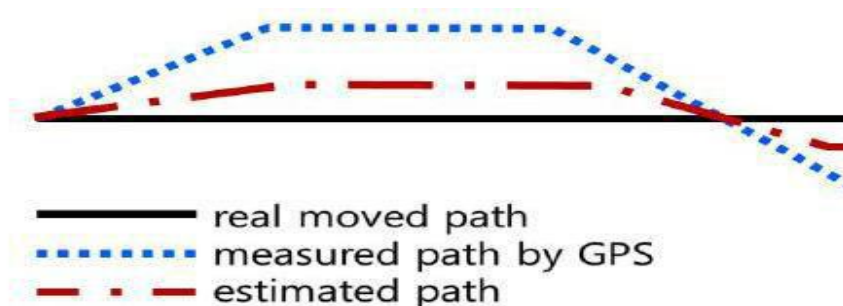2. GPS traffic management is considered as a priority traffic management.

Fig 3.4 Conceptual Models

The experimental results in the GPS interfering spot. The GPS location information deviates from the real path moved. On the other hand, the adjusted location information through the proposed algorithm can trace the movement path more accurately.
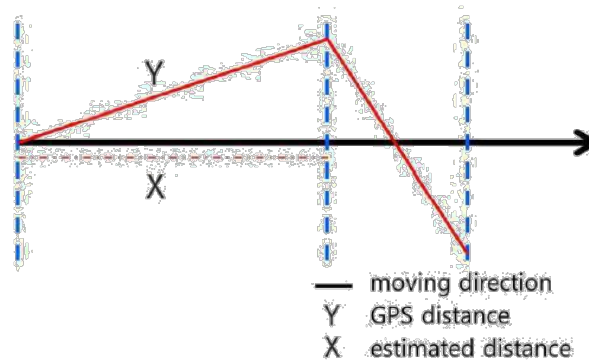

Fig 3.5 Result of Localization Algorithm by Trigrometric Function

The proposed algorithm has better performance than the GPS location information in GPS interfering spots and maintains reasonable performance in open spaces where the GPS receiver is accurate. Combination of GPS and GSM is used in .

In this system CMOS-8bit Microcontroller is used and it is based on RISC architecture. It uses the MAX232 for serial communication for GPS, GSM and Microcontroller, 16x2 LCD is used to display the location value.

IV.PROPOSED SYSTEM

The paper describes position detection and tracking systemwhich has the following three objectives:

➢ Develop an android application which can be used to locate the position of the friends and family members.

➢ This application has an alert mechanism to send a popup SMS to the user when his friends or family members are nearby the data can be shared online.

Fig4.1 System Architecture

V.ALGORITHMS

During literature review studies the basic algorithm for the Object Tracking on the Global Positioning System; this entire algorithm is described as bellow:
Recurrence Processing Function of Compass Heading $x_0 = a_0$

x1 = (x0 + a1)/2

xn =(xn-1 + an)/(n + 1)

xi: accumulated heading value ai : a new compass
value

5.1 First Equation of the Recursive function

The measurements of the compass in Smartphone are highly dependent on the ambient magnetic field so its accuracy is low. For this reason, here stabilize the measurements of the compass by averaging. The heading value of the compass can be stabilized. But as the user moves the real heading changes continuously. To fix this value, here apply the difference between the previousheading and current heading and process it recursively.

x0 =a0

x1 = (x0 + d1 + a1)/2

xn =(xn-1 + dn + an)/(n + 1)

xi: accumulated heading value ai : a new compass
value

di : difference of heading

Second Equation of the Recursive function

5.2 Kalman Filter Algorithms

Kalman filtering, also known as linear quadratic estimation (LQE).Kalman filter is implemented to reduce GPS errors and thus it increases the accuracy of the localization system. The algorithm works in two-step process.

1. In the prediction step, the Kalman filter produces estimates of the current state variables, along with their uncertainties.

2. Once the outcome of the next measurement (necessarily corrupted with some amount of error, including random noise) is observed, these estimates are updated using a weighted average, with more weight being given to estimates with higher certainty.
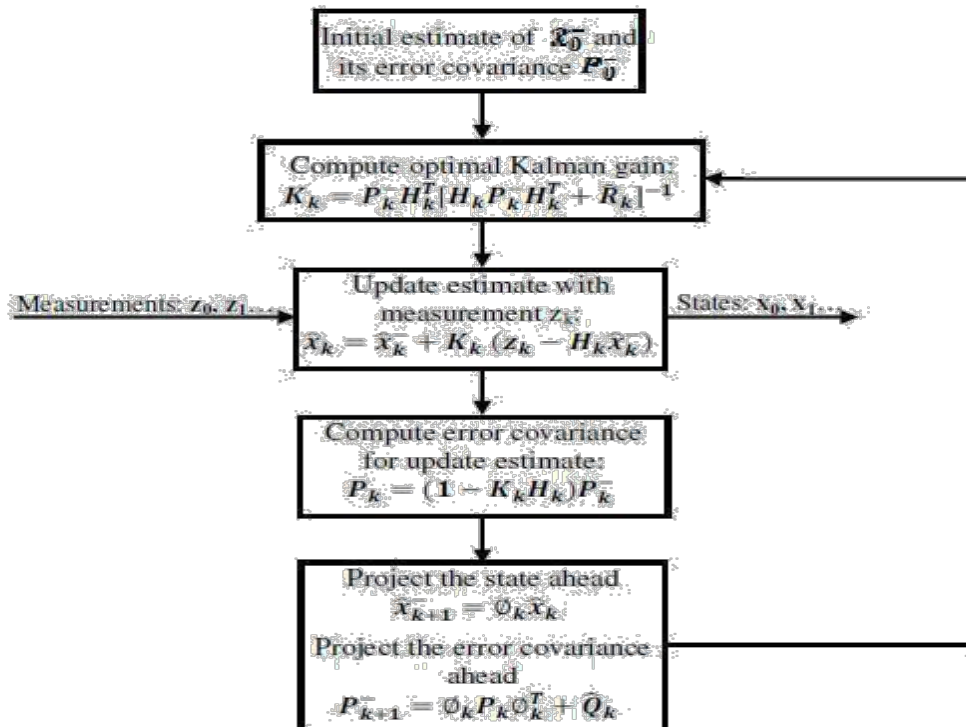

Fig 5.3   Kalman Filter Procedure for estimating of GPS receiver coordinates [23].

The algorithm's recursive nature, it can run in real time using only the present input measurements and the previously calculated state and its uncertainty matrix; no additional past information is required.

VI. IMPLEMENTATION

Register/Login moduleis used to provide registration ofnew user and login to the system. Register interface takes user information and after the registration is successful, user can login to the system. The user is validated using validate User().

GPS moduledeals with position based services. Using thismodule, user can find his/her own position, friend position andfamily member position. The position tracker tracks the position using track Position() method. The position trackercan be set for a particular friend using set Tracker() and the tracker can be switched off using cancel Tracker(). The location of a particular friend who is tracked can be found by get Location().

Notification modulesends a notification to the user whenhis/her friends or family members come around the user's areaof direction. A notification is given to the user in the form of apopup message having the location information along withlight or sound or vibration using Notification().

Data sharing moduledeals with sharing the data such asImage, Text, Audio and Video. The user desired files can be up loaded using image Upload(), upload Video(), upload Document(). The desired files can be downloaded using download Doc(), download Video(). The image files can be saved using save Image().
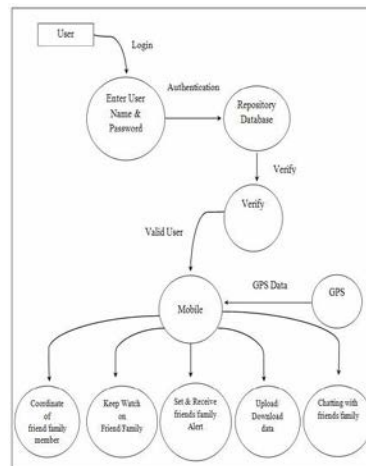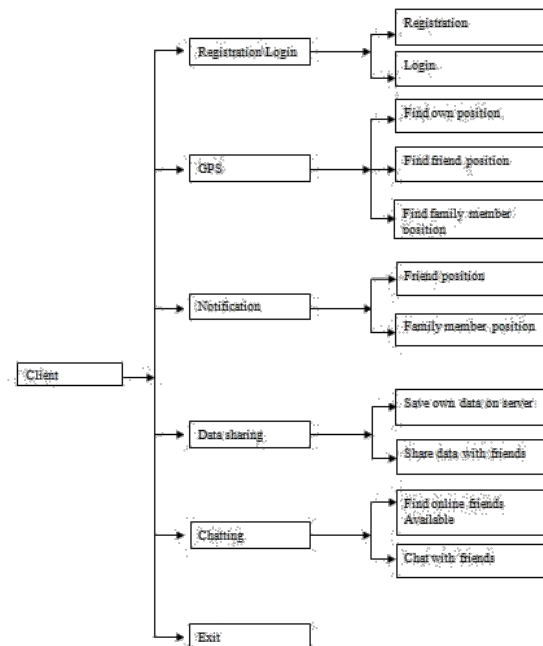

Fig 6.1Data Flow Diagram of the proposed system

Fig 6.2 Functional module of system

VII.CONCLUSION AND FUTURE ENHANCEMENT

The proposed system uses GPS and Web Technology inorder to enhance the positioning experience. The positiondetection and tracking system effectively alerts the user aboutthe position of a person using mobile phone. This location andposition of person information can be shared online. As afuture work, the proposed system can be implemented to update the tracked position details to the social networkingwebsites such as Facebook, Twitter etc.

From all this research paper we get some problem like signal multipath, receiver and orbital clock error ,environmentalproblem like ionosphere delay, troposphere delay, delay because of the distance and time, low accuracy in result.

Everylife is important and due to theft and accidents in transportation system we loss them. To make better the safety, securityand efficacy of the transportation systems Useful for the travelling people. They can take full advantage of advancedmobile services.

It is proven that the practical implementation of this paper will be very efficient, cheaper and reliable system for security,and to optimize the localization of object and resulting location.

VIII.FUTURE ENHANCEMENT

1. For Optimization of the hardware system, we can choose a GPS receiver suitable for the system, compass and for more accuracy one can go for Differential global positioning system (DGPS) by using DGPS accuracy can be increased to 1.4 meters whereas in GPS it is 5.10 meters.
2. Remote door looking system to capture the thief.
3. Accident detection and generating message which will inform the family members or owner about the location of accident.
4. The owner can switch on the digital camera recorder to record the face of the thief for identification of the theif.

IX. REFERENCES

[1] Noppadol Chadil, ApiraRussameesawang, PhongsakKeeratiwintakorn, *RealTime Tracking Management SystemUsing GPS, GPRS and Google Earth* ECTICON2008.5th International Conference, ISBN: 978-1-4244-2101-5, 14-17

[2] E. D. Kaplan, *Understanding GPS Principles and Applications*, ArtechHouse Publishers, ISBN 0890067937,February 1996

[3] R. J. Bates, GPRS: General Packet Radio Service, McGraw-Hill Profession, ISBN 0071381880, November 12,2001.

[4] M. Mcdonald, H. Keller, J. Klijnhout, and V. Mauro, *Intelligent TransportSystems in Europe: Opportunities forFutureResearch*, World Scientific Publishing Company, ISBN 981270082X 2006.

[5] Montaser N. Ramadan, Mohammad A. Al-Khedher and Sharaf A. Al-Kheder, Intelligent Anti-Theft and TrackingSystem for automobiles, International Journal of Machine Learning and Computing, Vol. 2, No. 1, February 2012.

[6] http://en.wikipedia.org/wiki/GNSS_applications . Date: 10/12/2014

[7] http://goo.gl/McV0AH . Date: 10/12/2014

[8] http://goo.gl/4XrbtQ . Date: 10/12/2014

[9] http://goo.gl/0KVFPL . Date: 10/12/2014

[10] Obuhuma, J. I., Moturi, C. A., " Use of GPS With Road Mapping For Traffic Analysis**"**, International Journal of Scientific and Technology Research ,Volume 1,Issue 10,ISSN 2277-8616,10 November 2012.

[11] Devyani Bajaj, Neelesh Gupta,**"** GPS Based Automatic Vehicle Tracking Using RFID**"**, International Journal of Engineering and Innovative Technology (IJEIT) Volume 1, Issue 1, January 2012.

[12] Soyoung Hwang and Donghui Yu,**"** GPS Localization Improvement of Smartphones Using Built-in Sensors**"**, International Journal of Smart Home Vol. 6, No. 3, July, 2012.

[13] PankajVerma, J.S Bhatia,**"** Design and Development of GPS_GSM Based Tracking System with Google Map Based Monitoring **"**, International JouRrnal of Computer Science, Engineering and Applications (IJCSEA) Vol.3, No.3, June 2013.

[14] Akin ode J. L1, Alamode A. J2 and Ojuawo O. O3. Nigeria, "Improving National Security using GPS Trackinsystem Technology**"**. Proceedings of the 1st International Technology, Education and Environment Conference(c) African Society for Scientific Research (ASSR).

[15] AmbadeShrutiDinkar, S.A.Sackh, "Design and implementation of Vehicle tracking system using GPS", Journal of Information Engineering and Applications, Vol 1, No. 3, 2011.

1 .Dr.A.CHANDRABOSE received his Ph.D
Degree from Madurai kamarajar university, having
20   years of experience in academic and industry.He
has published FOUR international journels and TWO
nternational paper presented to his credit.

2.Mr.T.MANIVANNAN received his M.C.A
degree from Anna university, having 10 years
of experience in academic.He has published
THREE international journels presented to his credit.

3.M.JAYAKANDAN received his M.Sc.,M.Phil
degree from Bharathidasan University, having 11 years
of experience in academic. .He has published
ONE international journels presented to his credit.

4.P.ANANTHI received his M.C.A degree from
Sastra University, having 7 years of
experience in academic..He has published ONE
international journels presented to his credit.