INTERACTIVE GPS VEHICLE TRACKING SYSTEM AND SECURITY SYSTEM FOR AUTOMOBILES

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ABSTRACT: *In this modern, fast moving and insecure world, it becomes a necessity to be aware of one's safety. Travelling indeed is a pleasure for most of us. Unwary tourists can make easy targets for thieves because they stand out in a crowd, are unused to their surroundings, and generally carry money, credit cards and carry valuables. What if there is a system if the person/ people travelling can be tracked and made secure in the case of an emergency? Of course, there is one and this paper discusses on such a system that functions as a tracking, monitoring and a security system - Interactive GPS System (i-GPS) that uses GPS and GSM as main modules.*

Key Words: Interactive GPS System,GPS (Global Positioning System), GSM (Global System for Mobile Communication)

I. INTRODUCTION

The interactive GPS system is a GPS based vehicle monitoring and security system. The system uses two main underlying concepts - GPS (Global Positioning System) and GSM (Global System for Mobile Communication). The main application of this system in this context is tacking the vehicle to which the GPS is connected, giving information about its position whenever required and for the security of each person travelling by the vehicle, and assist the user by server data whenever requested. This is done with the help of the GPS satellite and the GPS module attached to the vehicle which needs to be tracked. The GPS antenna present in the GPS module receives the information from the GPS satellite in NMEA (National Marine Electronics Association) format and thus it reveals the position information. This position details are transferred to the server station whenever required. For this we use the GSM Module.

The system also contains advanced vehicle monitoring sensors, user interactive buttons and displays, voice/data transfer facility by the help of GSM/GPRS modem and an accident alert system and anti-theft system too. This is a PIC16f877A based travel aiding device. The user interactive module alerts the low fuel level of the vehicle and informs the nearest fuel station. User can also get the details of hospitals and hotels by pressing buttons.

The server uses Google Map API and VB based application with GSM/GPRS Modem. Server records all the parameters from i-GPS device and interacts with thei-GPS user over network.

II. LITERATURE REVIEW

Ahmed El-Rabbany et al discussed about GPS satellite orbit and new coverage of today's hottest issues, such as precise point positioning and location based services. It addresses all aspects of the GPS, emphasizes GPS applications, examines the GPS signal structure, and covers the key types of measurement being utilized in the field today.

The paper presented by EI-Medany, W.; AL-Omaray et al describes a real time tracking system that provides accurate localization of the tracked vehicle with low cost.GM862 cellular quad band module is used for implementation. A monitoring server and a graphical user interface on a website is also developed using Microsoft SQL Server 2003 and ASP.

Dinesh Suresh Bhadane, PritamB.Bharati, Sanjeev A.Shukla, MonaliD.Wani, Kishor&AmbekarA.et al described about a GPS-GSM based tracking system that informs where your vehicle is and where it has been, how long it has been. The system fetches the geographic location and time information from the Global

Positioning Satellites. During vehicle motion, its real-time parameters such as location are reported by SMS message. The system takes advantage of wireless technology in providing powerful management transportation engine.

Abhilash R. Lomate, ShilpaMahore, Bhavesh S. Bhopale&Prof. Nilima R. Kharsanet al investigated on a GSM/ GPS based vehicle tracking and anti-theft system using web camera and microcontroller.

III. METHODOLOGY

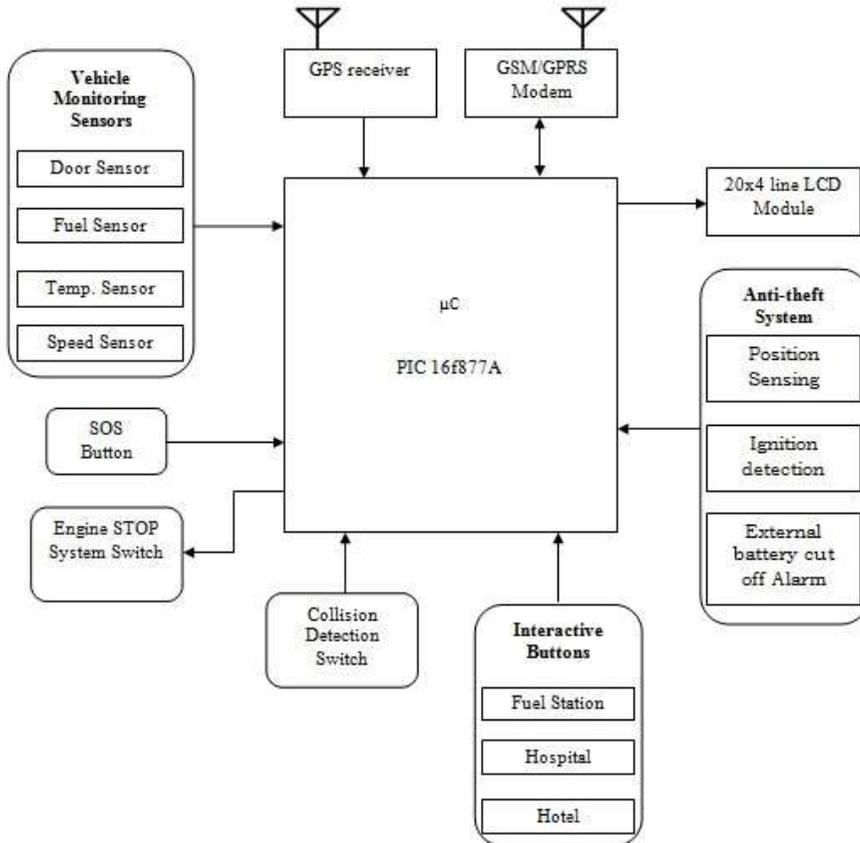The block diagram indicating main components of i-GPS system and server is shown below
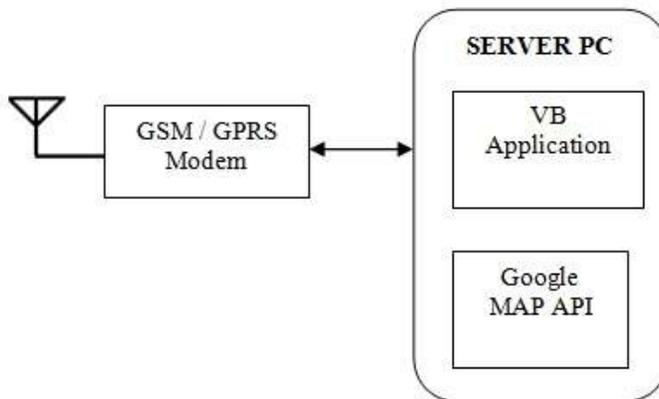

Figure 1: i- GPS Block Diagram

Figure 2: Server System Block Diagram

1.1 Working Principle

i-GPS system consists of a PIC microcontroller unit, a GPS receiver, GSM/GPRS modem, vehicle monitoring sensors, anti-theft system, interactive buttons, an SOS button, an engine stop system, a collision detection switch and 20x4 line LCD modules.

The server system consists of a GSM/GPRS modem and a server PC. The server PC runs Google map software and a VB based application, for serving the user with internet search results.

The vehicle monitoring sensors include a fuel sensor, a temperature sensor and a speed sensor. Here a floating ball type sensor is used. The temperature sensor used is LM35.It is placed in contact with the engine for measuring its temperature. The speed sensor used is MOC7811.It is connected to the motor shaft of the tyre.

The anti-theft system consists of three functional blocks, position sensing, ignition detection, and an external battery cut off alarm. Position sensing is performed by the GPS module and ignition is detected by the microcontroller. If the external battery is cut off, then the theft attempt is detected and the alarm rings.

Interactive buttons are used for getting information of the nearest fuel station, hospital or hotel. LCD module is used to display the vehicle parameters, position information from GPS and reply from server. Under panic situations SOS button is pressed and position information is passed to the server system, and friends. Engine can be stopped by the server system remotely using voice call. Accident is detected by the collision detection switch.

1.2 Circuit Diagram

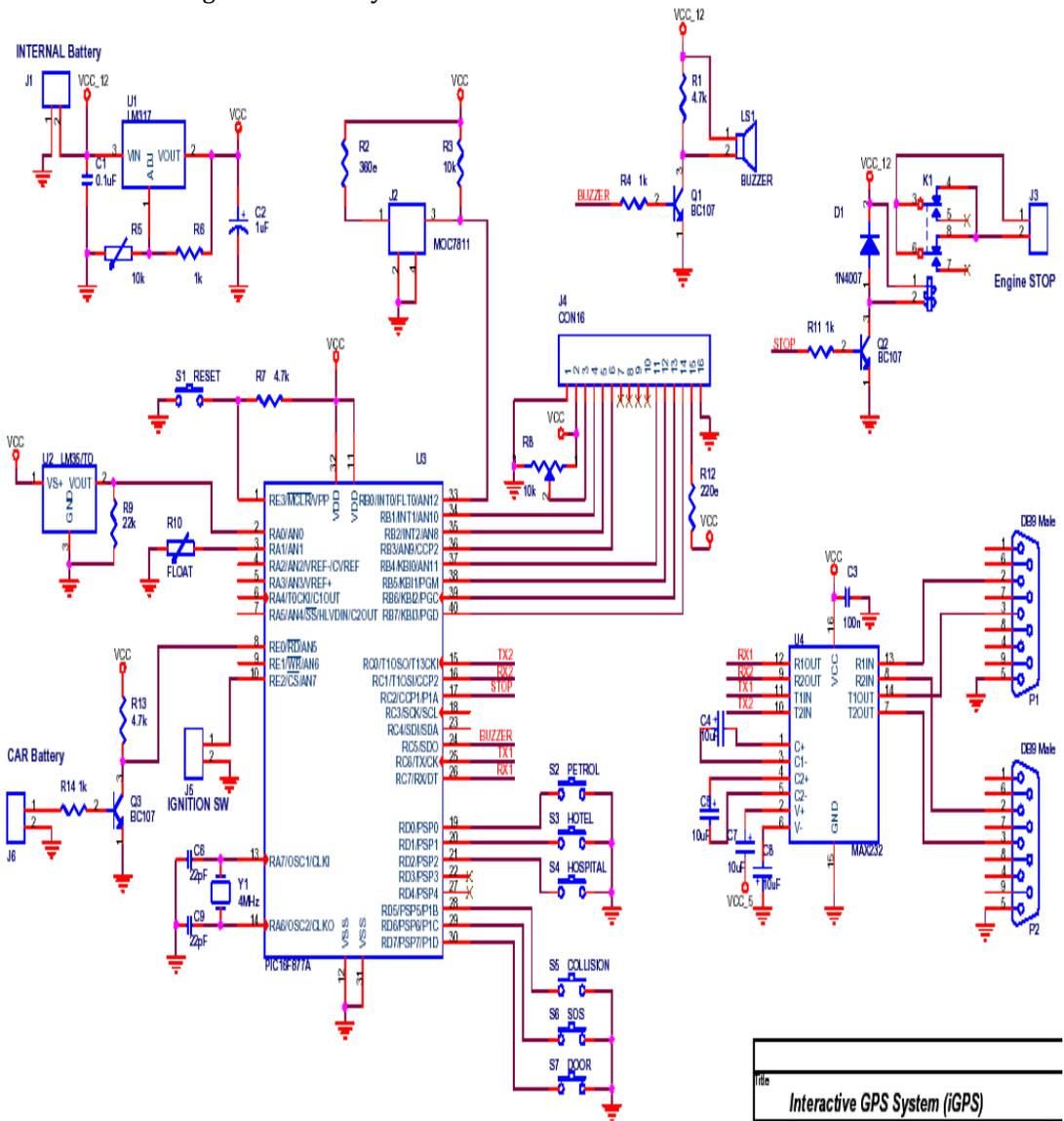The schematic circuit diagram of i-GPS System is detailed below:

Figure 3: Interactive GPS Schematic Circuit diagram

1.3 Circuit Description

A block of sensors are used for monitoring the vehicle parameters. These sensors include speed sensor, fuel level sensor and temperature sensor. The MOC7811 opto coupler is configured as speed sensor.
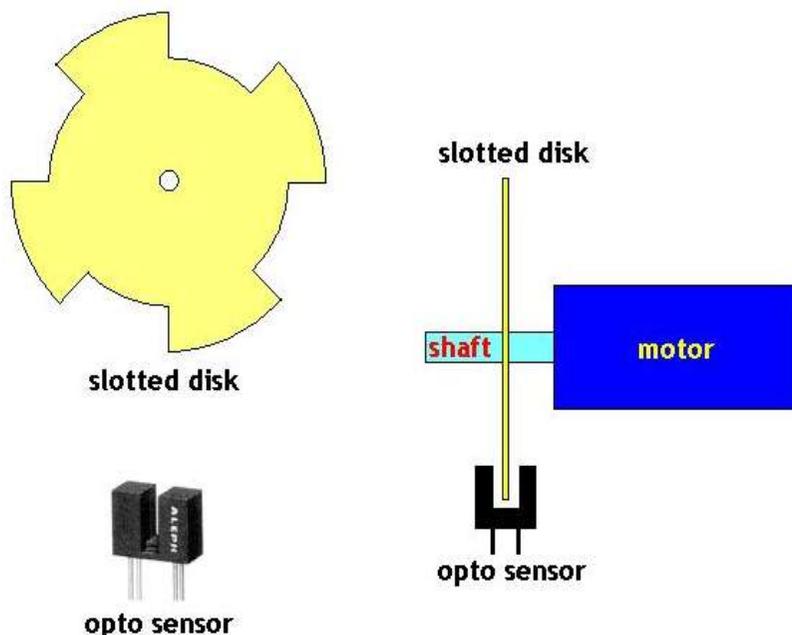

Figure 4: MOC7811 configuration

The opto sensor and a slotted disk are placed as in the figure. This arrangement can be used to measure the number of revolutions per second, and thus the speed.

Lm 35 temperature sensor is used for measuring engine temperature. It is placed in contact with the engine, and the readings are given to the ADC (Analog to Digital Converter). Engine temperature is displayed on LCD.

A simple floating ball type fuel level sensor is used as fuel level sensor. The sensor measures the fuel level by creating an electrical resistance representing the current fuel level in the tank. The float arm armature uses a floating ball that indicates the fuel level with a resistance created where the arm with the floating ball connects to the armature.

If the fuel level is low, then the user can press the button PETROL. The server will send the location of nearest petrol pump to the base station and is displayed in the LCD module.

The anti-theft system consists of position sensing, ignition switch, external battery cut off alarm, engine stop system. Position sensing is performed by the GPS module. Ignition detection system is for detecting engine ignition. If a position change occurs while the ignition is off, it is detected as a theft attempt. Another possibility is to move vehicle without starting the engine. Under such condition, speed sensor is used to detect theft attempt. If vehicle is moved velocity will change, and will activate engine stop system and buzzer. Some modern cars have in built security system working with the help of car battery. In this case if an outsider cut off the battery to break the security system, it is detected as theft attempt and a buzzer alarms. Thus the system offers complete security for the vehicle.

A set of interactive buttons are provided namely PETROL, HOTEL, and HOSPITAL. When these buttons are pressed the current position information together with the key word (PETROL, HOTEL, or HOSPITAL) is sent to the server station. Upon receiving the request server station running VB application will search for the keyword by entering the position details in Google Map API. From the search results, name, distance and direction are filtered and sent it back to the user. The collision detection switch is provided as substitute for accident detection system, upon pressing this button position information is automatically send to the server station, and automatic call for ambulance is activated.

If the panic button is pressed then position information is send to the server, and friends indicating an emergency condition.

IV. PCB DESIGN

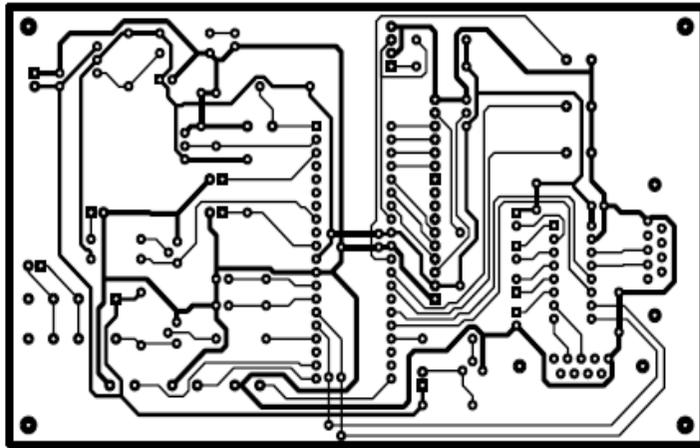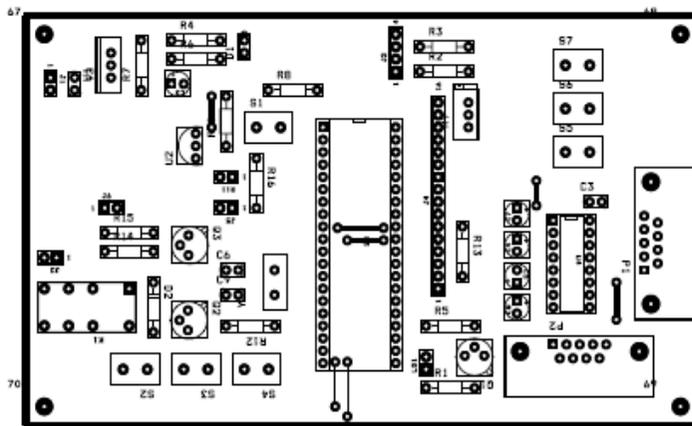The PCB design of i-GPS system is as follows:
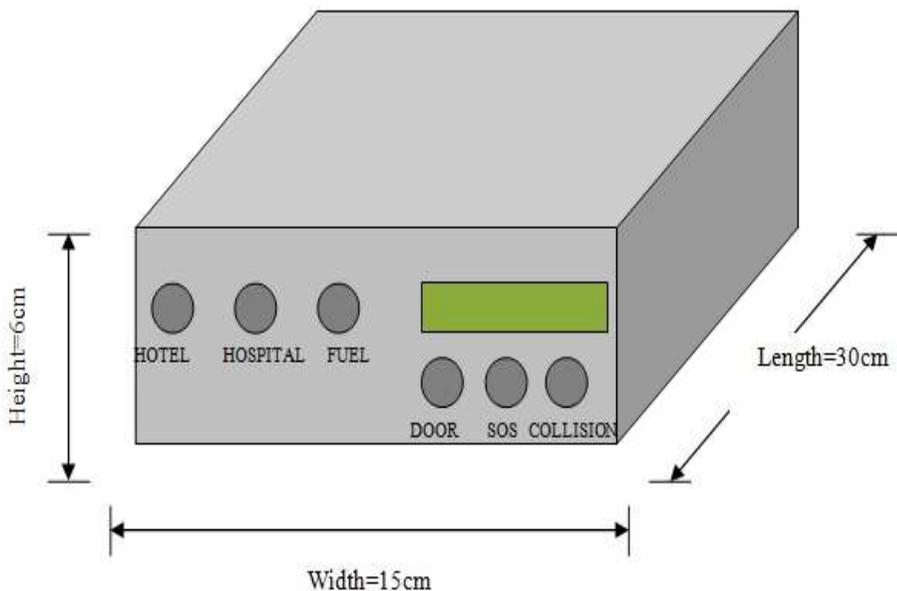

Figure 5: PCB Bottom

Figure 6: PCB Top

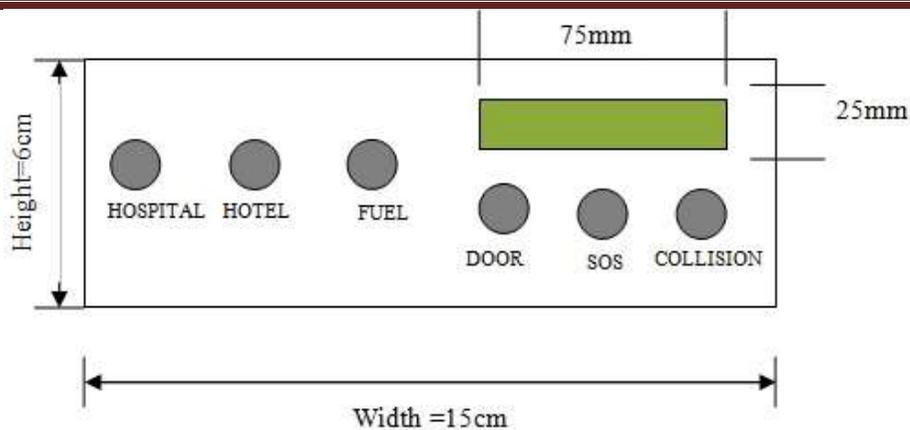*Figure 7: 3D View of Front End design*
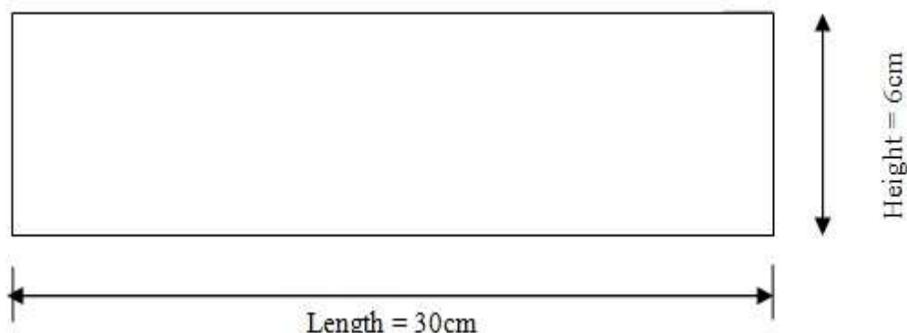
Figure 8: Front View

Figure 9: Side view

V. ALGORITHM

Algorithm of the system is detailed below:

1. START
   a. Server start
   b. Vehicle start
2. Check the ignition switch
3. Check the external battery cut-off
4. i-GPS check and display following parameters on LCD
   a. Fuel sensor
   b. Temperature sensor
   c. Speed sensor
5. Initialize the GPS device
6. Initialize the GSM/GPRS modem
7. Connecting to server using TCP/IP communication
8. If any position change occurred, then send the details to server
9. i-GPS device scanning the following devices
   a. SOS button
   b. Collision detection switch
   c. Interactive buttons
   d. Vehicle monitoring sensors
   e. And server commands
10. If any interactive buttons pressed
   a. Send data to server
   b. Wait for the server replay
   c. Display the result on LCD
11. If SOS button is pressed
   a. Send data to server
   b. Server alert to the relatives and friend
   c. Server alert to the police

12. STOP
   a. Engine stop
   b. Server stop

VI. FABRICATION

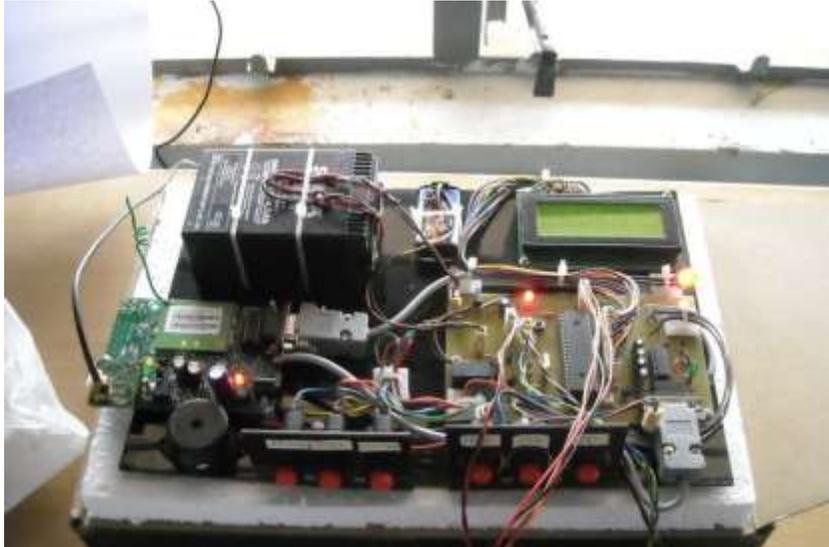The i-GPS system was fabricated using the components designed and specified. The model is shown below:

Figure 10: Fabricated model of Interactive GPS System

6.1 Product Specification

Table indicating the product specification is as follows:

Table 1: Product Specification

FEATURE	CHARACTERISTICS
LED	DC 12 V
Inner lithium battery	DC 3.8V -- 4.2V
Exterior GSM antenna	Receive GSM signal
Exterior GPS antenna	Receive GPS signal
Power Consumption when exterior voltage is 12V	Active mode(avg.) < 100mA
Operating Temperature Range	-20 ℃to +60 ℃
Humidity	Up to 75% non-condensing
Position accuracy	10 --15 meters
GSM chip	SIMCOM, support 3 frequency GSM 900/1800/1900MHZ
GPS chip	Sirf-Star III (super-sensitivity and high accuracy)
LED	3 LED s indicates GSM, GPS signal, and POWER status

VII. RESULTS & DISCUSSION

A Vehicle tracking unit that remotely transmits the latitude and longitude of a location on earth was designed and fabricated, which has a number of additional features such as a user interactive module, accident/ collision detection system, over speed alarm, anti-theft system, remote engine stop system and a low fuel detection system. All possible means of theft of vehicle were studied and a more effective system at a much lower cost was implemented.

7.1 Applications

1. In industries
   1.1. For the security of goods carriers/trucks
   1.2. Remote control on company vehicles

2. For transportation system which require extreme security
3. General applications- in vehicle
   3.1. For complete security of the vehicle
   3.2. The driver can request for any help from a remote server
4. Complete protection against theft

7. 2Advantages

1. Automatic call on accident.
2. Advanced anti-theft system.
3. User interactive.
4. Accurate positioning of vehicle

VIII. CONCLUSION

The implementation of i-GPS system can on a whole be regarded as a success. Even though the accuracy is limited by the atmospheric conditions, the system performance exceeded our expectations. When a complete positioning was made using real data in the correct format, the retrieved position was within the required margin of error. During the early stages of the project the purpose of the application part was more or less arbitrary. Consequently, it was decided that a map display and positioning was to be implemented in the server station to respond to requests from the user with search results. The server station consists of a web application and a VB application. The communications between i-GPS system and server is implemented successfully.

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