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Development of a Software for Car Tracking Device

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Abstract

Live has been made more interesting and progressive in the twenty –first century with improved technology. This shows the power of the country (Nigeria) but like double - edged sword this development has given rise to a most jeopardizing crime that is, "car theft". There has been gradual increase in the incidents of car theft but declining trends in tracking these vehicles. The stolen cars are sometimes sold out by changing their chassis number in another city or neighboring countries. But as the technology is advancing, more and more security systems are also flourishing in the market. Now by the use of satellite or mobile phone it is easy to track the mobile vehicles. This device is known as GPS (Global Positioning System) tracking service. Generally, the tracking of vehicles is done by connecting to the vehicle's tracker through the use of GPS (Global Positioning System) while mostly, the vehicle is brought to halt or probably by passage of notification message to the current handler. A model is developed using matlab simulink whereby only the vehicle's current location is being tracked. After checking for the validity of the vehicle's tracker identification in the previous section, will then proceed into the simulink design to get the vehicle's current location. In locating the vehicle with the proposed software, there is a need for hardware both in the vehicle (transmitter with a GPS locator) and a receiver which is connected to the computer system. After many simulation trials, the vehicle's data collected was used to show proper analysis, assessment and evaluation of the entire system at a glance after the simulation. Once the source code is accepted and access is being granted, the car tracker simulator using matlab and a road map was popped - up which gives more details about the ongoing or prevailing conditions of the car. A red indicator showing the location of the vehicle and the various conditions surrounding is seen which in turns gives all necessary details required. This research work is a model in which if all the necessary measures is taken into consideration will give effective result in the apprehension of the car theft and at the same time the car itself. These will also prevent the destruction of the car by the thieves, can also help to track the thief and also assist in improvising adequate solution to car theft in Nigeria.

1. Introduction

Nigerians are now part of the twenty –first century. This is good in many ways because a lot has been learnt from the past and lives are being transformed with technological advancement. This has made life more interesting and progressive. But the downside of this century is that as the world grows people are more prone to risk with all their surroundings and their properties.

As Nigeria (a very industrious country) is emerging as an economic power country in West Africa, many people can now afford cars. People spend their hard earned money and endure the stress of the daily grind to buy one of the world's greatest assets "a Lamborghini" or the latest "SUV". Everyone aspires to own the coolest, most expensive vehicles that will turn heads whenever it passes by the roads in big cities. This shows the power of the country but like double - edged sword this development has given rise to a most jeopardizing crime that is "car theft".

There has been gradual increase in the incidents of car theft but declining trends in tracking these vehicles. The stolen cars are sometimes sold out by changing their chassis number in another city or neighboring countries. Thieves also find it profitable to sell expensive car parts and accessories such as batteries, brain box, stereos and other decorative tools of the car stolen.

Many vehicle owners are worried about the occurrence of car theft and are preoccupied with the cost involved in recovering the stolen car. Without any method of tracking the cars, it has been proven from statistics that only 10% of total stolen vehicles were recovered in 2009 for instance (Interpol).

WSN is an emerging technology, which has revolutionized the data collection in real time from the field (location), which will help to improve the decision–making process to a large extent and help user to draw contingent measures in real - time manner. IVTrace consist of XBee (modules series 2) WSN system (catalinbujdei) for traffic management and real - time navigation information in IIT Bombay. (Sudharsan and Sudheer 2012)

1.1. Car Theft Data in Nigeria

According to official sources of Interpol general secretariat, a body working to provide up to date useful information on stolen vehicles, an Automated Search Facility - Stolen Motor Vehicle (ASF - SMV) database was developed to support police and countries affiliated with it. Countries which include: Belgium, Finland, Japan, Zimbabwe, Nigeria among others (Interpol, 2001).

From the database, it was discovered that the rate of car hacking/theft is increasing year by year in Nigeria. In the year 2003, the total 68, 945 cases of car theft were registered while it became 80, 750 cases in 2004. In 2005 and 2006, the number of cases that came to lime - light were 84, 150 and 89, 375 respectively (Interpol, 2007).

At the end of 2010, the database held more than 7. 15 millions of reported stolen vehicles (close to 188 countries use the data base regularly). In the stolen car cases very few recoveries can be made due to lack of technology used by the car owners. Many times vehicles are found in the different forms (damaged).

Only 32. 8% were recovered in 2003, whereas it was only 30. 5% in 2004. In 2005 it further dipped and only 29. 3% of the total recoveries were done (Interpol, 2007). That's why the government is extremely worried about the vehicle crime theft and appeals to owners to utilize the advanced techniques of the GPS and other technique available in the market to reduce the car theft cases.

1.2. Techniques That Could Be Used

In the market, there are basically different types of security systems available such as;

- Centralized locking systems in which the car is locked or unlocked by its remote controlling system. This is the most commonly security system. A special types of sensor is applied in these device that begins beeping loudly if someone tries to forcefully open the car, and the security main unit is hidden somewhere inside the car, which a thief cannot find or deactivate easily.
- Another technique is gear lock in which the system locks the gear of the car, so that if the thief manages to get into the car, he cannot drive it away.
- Steering lock is also available in the form of other security.
- Besides these, some other means includes clutch lock, brake lock, steering wheel lock which helps in the prevention of steeling the car as these lock the clutch and brake of the car manually respectively.

As technology is advancing, more and more security systems are flourishing in the market. Now by the use of satellite or mobile phone it is easy to track the mobile vehicles. This device is known as GPS (Global Positioning System) tracking service.

GPS is a compact handy device like mobile phone that enables combination of the GPS and GPRS that track mobile vehicles through using four visible satellites. The satellites send the signal to the GPS receiver and it calculate the signals and gives information about the exact position of the vehicle on the earth. The device provides the complete data about your vehicle like its status, maximum speed, motion hours, distance covered and stationary timing and duration (Lamar, 2010).

Aim And Objectives Of The Research Work

The sole aim of this research is to assist in improvising adequate solution to car theft in Nigeria and the objectives are;

1) to investigate anti - theft tracking device adopted in Nigeria.
2) to investigate the effectiveness of GPS tracking device over all other tracking devices
3) to develop a software and computer aided car tracking device that make use of GPS

The first documented case of car theft was in 1896, only a decade after gas - powered cars were first introduced (Wikipedia, 2011). From that early era till today, cars have been a natural target for thieves: They are valuable, reasonably easy to resell and they have a built - in get - away system. Some studies claim that a car gets broken into every 60 seconds in Nigeria alone (Interpol, 2007).

In the light of this startling statistic, it's not surprising that millions of Nigerians have invested in expensive alarm systems and other anti - theft devices to prevent their cars from being stolen. Today, it seems like every car is equipped with sophisticated electronic sensors, blaring sirens and remote - activation systems etc, but it's even more remarkable that car thieves still find a way to get past them. Some of the already available devices in existence include: Car Alarm, Centralized locking system, Keyless Go Application, Ignition Kill switch, Brake or clutch pedal locking device, Steering column lock, and Global positioning system (GPS)

Software is usually designed and created (coded/written/programmed) in integrated development environments (IDE) like Eclipse, Emacs and Microsoft Visual Studio that can simplify the process and compile the program, as noted in different section, software is usually created on top of existing software and the application programming interface (API) that the underlying software provides like GTK+, JavaBeans or Swing. Libraries (APIs) are categorized for different purposes. For instance, JavaBeans library is used for designing enterprise applications, Windows Forms library is used for designing graphical user interface (GUI) applications like Microsoft Word, and Windows Communication Foundation is used for designing web services. (Adekunle et al, 2014)

1.3. Car Alarm

One popular method to prevent auto - theft is an Anti - tampering alarm system. Many newer cars have alarm activated by key chain remotes. A car alarm is an electronic annoyance device installed in a vehicle in an attempt to discourage theft of the vehicle itself, its contents, or both. It works by emitting high - volume sound (usually a siren, klaxon, pre - recorded verbal warning, the vehicle's own horn, or a combination thereof) when the conditions necessary for triggering are met, as well as by flashing some of the vehicle's lights, and (optionally) notifying the car's owner via a paging system and interrupting various electrical circuits necessary for the car to start (Wikipedia, 2011).

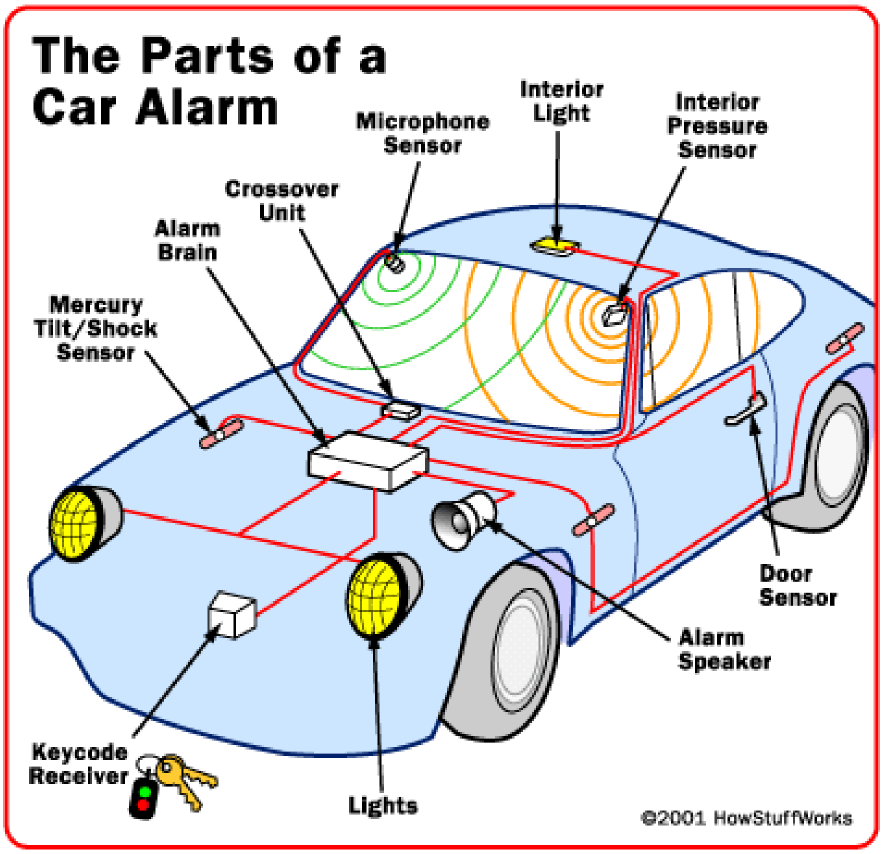
Car alarms should not be confused with immobilizers; although the purpose of both may be to deter car theft, they operate in a dissimilar fashion. An immobilizer generally will not offer any audible or visual theft deterrence, nor require any additional input from the driver than from the driver of a non - immobilizer car.

Ever since the first gas - powered vehicle was introduced, car owners have had to deal with the possibility of someone stealing their vehicle. Car alarms are a device created to help protect cars from theft. Many cars come with anti - theft systems and you can choose to add an alarm for extra protection. The more sophisticated the alarm system, the more it will cost to purchase and install. Some of the technologies used to manufacture car alarms are sensors, sirens, radio receivers, auxiliary batteries and computer control units.

Source: Car - theft. org/car alarm, 2011.

Fig. 1. *Car Alarm.*

Many pieces are installed in different parts of the car to make up the complete car alarm system. It starts with the small computer working as the brain of the system. Its responsibility is to communicate with the horn, headlights and siren when the system has been triggered or disengaged. It is connected to the battery of the car and has a hidden battery just in case the main battery is disabled.



Source: how stuff works, 2001.

Fig. 2. *Parts of car alarm.*

Sensors are located throughout the car that works as detection devices. The most common one is the sensor connected to the doors. When the system is engaged and any of the doors of the car opens, the sensor communicates this to the brain. The brain then communicates with the other elements that make up the alarm system (the horn, lights and sirens) to alert the owner of a possible break in.

To understand the mechanism behind detecting whether doors are open or elements of the car have been tampered with, Erika compares a jewelry box that plays a tune every time the lid is opened with an alarm system installed in a car. There is a spring and every time pressure is released, it alerts the "brain" of the jewelry box to start playing the music. This is the same for the car alarm system. A spring is connected to a spring - activated button. As long as the spring and button do not touch, the circuit is closed and there is no power to the brain. As soon as an action (like opening the doors) occurs, power is restored to the brain and the system reacts in the appropriate way. (Erica, 2006)

According to Jeannie, 2002, other elements of the car alarm system are the keyless - entry remote and key - code receiver. These inventions make it possible to engage and disengage the alarm system from a set distance. The key - code receiver is used to first connect the remote to the car so that it can respond with the sensors and the brain; and it also continues to allow the remote to gain access to the brain. Think of the remote as the log - in information that gains you entry into the alarm system; much like typing in the user name and password used to get into your email account. The key - code receiver is the network gateway that checks the log - in information and verifies its validity. Alarms come with a mix of features. Remote car alarms typically consist of an additional radio receiver that allows the owner to wirelessly control the alarm from a key fob. Remote car alarms typically come equipped with an array of sensors along with immobilizers and motion detectors.

1.4. Types of Car Alarm

Car alarms can be divided into two categories namely Original Equipment Manufacturer ([OEM] - built - in to the vehicle at the factory) and aftermarket (installed at any time after the car has been built, such as by the new car dealer, an auto accessories store, or the vehicle's owner)

(i) Original Equipment Manufacturer (Oem) Alarms

Almost all OEM alarms are typically armed and disarmed with the vehicle's keyless entry remote. These devices often allow owner to honk or make other high frequency noises for no apparent reason. On many vehicles the key cylinders in the driver or front passenger door activate switches, so that when a key is used in the door the alarm will arm or disarm. Some vehicles will arm when the power door lock switch is pressed with the driver's door open, and the door is subsequently closed. Some vehicles will disarm if the ignition is turned on; often when the vehicle is equipped with a key - based immobilizer and an alarm, the combination of the valid key code and the ignition disarms the system.

(ii) Aftermarket Alarms

Like OEM alarms, aftermarket systems are usually armed and disarmed via remote. Usually they do not have provisions for external disarming from the key cylinder, but will typically have an override switch mounted in a hidden location.

The individual triggers for a car alarm vary widely, depending on the make and model of the vehicle, and the brand and model of the alarm itself. Since aftermarket alarms are designed to be universal (i. e., compatible with all 12 volt negative ground electrical systems as opposed to one carmaker's vehicles), these commonly have trigger inputs that the installer/vehicle owner chooses not to connect, which additionally determines what will set the alarm off.

The simplest aftermarket alarms are one - piece units with a siren and control module. Such a unit will typically contain a shock sensor and two wires (12 volt constant power and ground) which are connected to the car's battery. This type of alarm is triggered by vibration transferred to the shock sensor, or by voltage changes on the input (the alarm assumes that a sudden change in voltage is due to a door or trunk being opened, or the ignition being turned on); however it is very prone to false triggers on late - model vehicles with many electronic control modules, which can draw current with the ignition off. For this last reason these alarms are increasingly becoming obsolete.

(Wikipedia, 2011).

1.5. Short Comings

Since most car alarms are triggered accidentally (frequently because of high sensitivity settings), people often ignore alarms. The Nigerian Police Department claims that car alarms are actually making the crime problem worse because false alarms are so common that people simply ignore them.

Because of the large number of false alarms with car alarms, many vehicle manufacturers no longer factory - fit simple noise - making alarms. Frequently, false alarms occur because car alarm owners use high sensitivity settings. This is the main reason why loud bass frequency sound (loud music, other cars or motorcycles with loud exhaust systems, thunderstorms, etc.) can set off car alarms.

The second possible reason is that some parts of the alarm system may be improperly installed.

A third possible reason is that the shock sensor is mounted to a bad surface, where all the vibrations caused by sound leads to shock sensor.

1.6. Centralized Locking System

One of the most commonly used security systems in cars in recent times is Centralized Locking system, in which the car is locked or unlocked by its remote control system. In this system, a special type of sensors applied in this device in which the main unit is hidden somewhere inside the car, which a thief cannot find or deactivate easily. The connection is done in such a way that it begins to beep loudly if someone tries to open it forcefully (Wikipedia, 2011).

1.7. Keyless Go Application

Initially, car access and car mobilising systems were two completely independent car functions. They were realised in the form of mechanical locks in the doors and the ignition, respectively. Locking systems were later augmented to become electromechanical central locking systems. Remote - control entry was a further extension of the central locking system via an infrared or radio frequency (RF) link to a new electronic - mechanical transmitter key. It allowed remote - controlled opening and closing of the car from a distance of a few metres to a few tens of metres by pressing a button on a hand - held key. To improve anti - theft protection, the mechanical ignition locks have been augmented by immobilisers in that the key incorporates a passive transponder which transmits signals automatically when it receives predetermined signals. When the key is put into the mechanical ignition lock, the car powers up the key transponder electronics and exchanges codes mainly via a magnetic low - frequency transmission to authenticate the key.

(Schultes, 2003).

1.8. The Keyless Go Principle

The consequent evolution to completely avoid handling of the electronic key is realised in the concept of 'Keyless Go'. The car automatically detects and authenticates the electronic key if it is in an entry zone of within a few metres of the car. The car unlocks the door at the side from which the user wishes to enter. If the key is detected somewhere inside the car and the starting button is pressed, the car automatically mobilises and starts the engine. If the key is not found inside the car when the starting button is pressed, there is no action from the car other than signalling a warning message. With this concept, no user interaction is required and there is no mechanical contact between car and electronic key required. The whole car - electronic key interaction runs fully automatically using radio communications. The first automotive manufacturer to demonstrate this concept in a limited number of its S - Class models was Daimler Chrysler (2000).

1.9. Short Comings of Keyless Go System Are

a. The overall reliability of the Keyless Go when comparable to that of previous mechanical systems is minimal;
b. A reaction time below 100 milliseconds (ms) must be guaranteed to avoid user confusion
- They have accuracy of within a few centimetres which is achievable independently of type, size, material and loading situation of a car

c. Systems are very costly when compared with other mechanical systems.

1.10. Kill Switch

Kill switch, also called an e - stop, is a security measure used to shut off a device in an emergency situation in which it cannot be shut down in the usual manner. Unlike a normal shutdown, which shuts down all systems naturally and turns the machine off without damaging it, a kill switch is designed to completely abort the operation at all costs, and be configured so that it is quick to operate, and relatively obvious to someone other than the usual operator. It might have some protection to prevent accidental operation, but which can be quickly moved out of the way. Often, they are used to protect people from sustaining an injury or being killed, in which case damaging the machine may be considered to be acceptable (Wikipedia, 2011).

Kill switches are also used on land vehicles as an anti - theft system and as an emergency power off. Such devices are often equipped into bait cars and set up so that observing police can trigger the switch remotely.

Source: car - theft/Kill switch, 2011.

Fig. 3. *Kill switch*

1.11. Short Coming

One major demerit of kill switch is that while thieves are trying to escape with the car, if the engine is shut down by an external source unknown to them, they may try to damage the car or even steal some components of the car. For example, according to a local publication (The Punch), some set of thieves destroyed a particular car all because the owner made use of kill switch. Not only the car was destroyed but they also came back and killed the owner of the car.

1.12. Brake or Clutch Pedal Locking Device

Automotive theft is a major worldwide problem. The proliferation of mechanical type anti - theft devices for the motor vehicles has resulted in commercial availability of different types of anti - theft devices. One type of prior art system mechanically locks the brake and accelerator by means of two independent or articulated shoes which locks the pedal device. This system relates to device which prevents the brake or clutch from being depressed, thereby rendering the vehicle inoperable.

It is a device to lock a brake or clutch pedal of a vehicle so as to deter theft of the floor of the vehicle beneath the pedal of the vehicle and a pedal shaft supporting the pedal; a general u - shaped housing having a second leg attached to the base member, a first leg shorter than the second leg, and a cross member connecting the first and second leg, and to define an opening between the first leg and the base and a slot being sufficiently large to receive the pedal shaft and permit travel of the pedal shaft through the slot; a locking pin selectively movable on the u - shaped housing between a raised position sufficiently close to a lower side the pedal shaft to prevent the pedal shaft from being depressed sufficiently to enable the vehicle to be started and a retracted position to permit travel of the pedal shaft through the slot and opening; and a lock coupled to the u - shaped housing and operably connected to the locking pin to fix the locking pin in at least the raised position, the lock having an upper face facing substantially oppositely away from the base (Robert, 1999).

Source: car - theft brake or clutch, 2011.

Fig. 4. *Brake or clutch pedal locking device.*

1.13. Short Comings

1. 1. One of the major problem stemming from the use of such devices is the driver has to reach out for the pedal area or actually get down on his or her knees in order to operate the locking device
2. Device of this nature actually have a poor record against theft. Indeed, it is relatively easy to cut the rim of the steering wheel by means of saw or the like. The rim of the steering wheel is usually not a liable obstacle for thieves and the anti - theft device can be disengaged merely pulling apart the two ends of the rim.

1.14. Steering Column Lock

This system is an improved anti - theft device for automobiles. When in place, the device protects a steering column ignition lock from tampering. In addition, the device prevents the operation of the gear shift lever so that, even if the lock is by - passed, the car cannot be driven.

Source: car - theft steering column lock, 2011.

Fig. 5. *Steering column lock.*

This device includes a cover having a hollow interior space open on one side. The open side is defined by laterally separated sidewalls, having accurate edge surfaces spacing opposite ends of the cover, thereby being adapted to fit over a portion of the steering column containing an ignition lock. A tension bearing element is attached to end the cover, wraps around the steering column and is realisably attached to the other end of the cover. In addition, a gear shift lock bar is attached to one sidewall and projects laterally from the cover a distance sufficient to interfere with the movement of the gear shift lever out of the ‘park’ position (Joseph & Plainview, 1987).

Preferably, the gear and shift lock bar includes a U - shaped portion sized to fit around the gear shift lever, and a free end that extends back toward the cover and under the tension bearing element such that the element holds the free end of the bar securely.

1.15. Short Coming

Most present day automobiles contain an ignition lock mounted in the steering column below the steering wheel. The lock function both as an ignition cut - off and to prevent turning of the steering wheel. But in practice, however thieves can readily defeat an ignition lock by using a master key or a device which pulls the lock, such as a dent puller, to expose the ignition wires.

While this device protects the ignition lock, determined automobile thieves have found that it is sometimes possible to by - pass the ignition locks altogether, and gain access to the ignition wires from the side the steering column opposite the lock (Richard, 2003).

1.16. Global Positioning System (GPS)

Vehicle security technology has gone far beyond a selection of auto alarms. While they are good at providing safety for cars they are not foolproof; the smart car thieves can run away with your car under your nose by cracking even the most sophisticated security systems. Even before the police can reach out to the thief, various parts of your car may already have been shipped to countries. With a GPS (Global Positioning System) car tracking system, a car can be tracked on a computer map at a central monitoring station. Some of the systems come with the feature of verbal communication with the operator at the central station

The birth of modern vehicle tracking devices has proven more effective in reducing the prevalence of car theft and other related crimes. A car tracking device is installed in a vehicle and uses GPS technology that is programmed to trace the vehicle's exact location. It sends automatic phone or e - mail alerts to the owner. With the use of GPS technology, Internet, and mobile networks, it will be easier for you to report a stolen car to the police or track your delinquent teens (Lamar, 2010).

1.17. Operation of the Global Positioning System

According to Sudharsan and Katta (2012), the main advantage of the developed web based tracking system allows user to log in and track the service/own vehicle in real - time manner and Navigation information (in the vehicle) obtain over the Google Earth/Google Maps etc. This systek allows users to locate their service/own vehicle in dynamic manner. Also, the user can obtian the past trace history of the vehicle which could be useful to map the vehicle traveld informtion in Geographical Information System (GIS) interface.

Source: Global Positioning System, 2009.

Fig. 6. *Global Positioning System.*

The Global Positioning System (GPS) is distributed in six orbital planes equally spaced in angle. Each satellite carries an operating atomic clock (along with several backup clocks) and emits timed signals that include a code telling its location. By analyzing signals from at least four of these satellites, a receiver on the surface of Earth with a built - in microprocessor can display the location of the receiver (latitude, longitude, and altitude)

The GPS or Global Positioning System does wonders in vehicle tracking solutions. According to Clifford, (2009), GPS vehicle tracker is composed of 24 satellites that orbit the earth. The satellites allow the GPS receivers to capture the signals from three or more satellites, known as the trilateration. The GPS receivers calculate the distance of each satellite and send the data to the Internet and mobile phones. By logging online, the GPS system feeds you information about the vehicle's speed, direction, and fuel consumption. For example, if the car is heading from North to South Africa, you will receive an e - mail or text message showing the car's route from north to south.

There are two types of GPS tracking device: passive and active. A passive device requires you to download the data stored by the GPS satellites; meanwhile, the active device transfers the GPS data through mobile and Internet networks. However, most advanced vehicle tracking devices today are using both passive and active uniformly to broaden the data transfer and GPS connection.

The goal of the Global Positioning System (GPS) is to determine one's position on Earth in three dimensions: east - west, north - south, and vertical (longitude, latitude, and altitude). Signals from three overhead satellites provide this information. Each satellite sends a signal that codes where the satellite is and the time of emission of the signal. The receiver clock times the reception of each signal, then subtracts the emission time to determine the time lapse and hence how far the signal has traveled (at the speed of light). This is the distance the satellite was from the car when it emitted the signal. In effect, three spheres are constructed from these distances, one sphere centered on each satellite. The car is located at the single point at which the three spheres intersect. Of course there is a wrinkle: The clock in one's hand - held receiver is not nearly so accurate as the atomic clocks carried in the satellites. For this reason, the signal from a fourth overhead satellite is employed to check the accuracy of the clock in your hand - held receiver. This fourth signal enables the hand - held receiver to process GPS signals as though it contained an atomic clock.

Signals exchanged by atomic clocks at different altitudes are subject to general relativistic effects described using the Schwarzschild metric. Neglecting these effects would make the GPS useless.

2. Methodology

In this research, MATLAB software (a language of technical computing) was used to develop a vehicle tracker system simulator that contains the desired input and output pairs of system.

Various stages involved were:

1. Simulating of the MATLAB code
2. Input the correct Tracker Identification Number or Configuration.
3. View the Graphical User Interface (GUI) showing the map, and text boxes showing traffic details like vehicle's velocity, vehicle's speed, the street name the navigation pane and a push button for automatic control of the tacking system.
4. Tracking the vehicle Choose by clicking the right push button either the automatic control or the navigation pane control which indicates the direction for the vehicle to move
5. Displaying of the vehicle's details. Location, Speed, Lane number and the street name.

The interface design used in this research makes use of some toolboxes in MATLAB

3. Designing the Vehicle

The vehicle (a car) was designed using the Simulink 3D animation tool box, that is, V - Realm Builder which uses the concept of Virtual Reality Modeling Language (VRML). V - Realm Builder is a powerful three dimensional authoring package for the creation of 3D objects and "worlds" to be viewed with V - Realm Browser or any other VRML 2. 0 compliant browser.

The vehicle was designed with the representation of most of the basic external features of a typical vehicle such as the wheels, the body structures, front and back screens etc.

4. Result and Discussion

Results

According to Deepak *et al* (2012)*,* there are many tracking applications available in the market for tracking of various public vehicles. One of the cost - effective technique for vehicle tracking is the 'vehicle card' technique, which uses STD phone booths and a specially designed vehicle - card. Vehicle owner is required to carry a card to the nearest tracking point, basically a designated STD booth on vehicle routes, at major vehicle stops and petrol bunks. The card is coded with details of the vehicle; these details and a simple numbered message are transferred to a local telephone number. The receiver uploads all incoming messages by email to a central server, where it is processed and placed on a website. In this way a vehicle can be tracked. But this scheme is not so useful for a large scale implementation of a fully automated real - time system. Another scheme for tracking has been proposed using odometer and inertial sensors (Rus *et al* 2004). But this technique has been proposed specifically for train transport. It does not gives a generalized solution for all the public transports. Similarly, there is one more technique employing distance - meter (odometer) and cellular infrastructure which is used for tracking vehicles in public domain (Ernest *et al* 2004)

In order to track the vehicle without stopping it or notifying the driver or the wrong user, the methods used here was a model developed using the MATLAB Simulink whereby the vehicle's current location, its velocity and speed is being tracked. This method is beter off compared to the one discussed above with respect to locating the vehicle's current location and tracking down the car instantly.

The car tracking simulator shows the car tracker identity and an input text box in which the tracker I. D will be inserted. It also shows the car tracking information of the car

The first stage of the tracking process involves the input of the tracker I. D which grants access to the Road Map and the vehicles tracker simulation output.

In other to make available all the side views of the vehicle, the vehicle was designed in such a way that it can be viewed from different viewing angles asshown below:

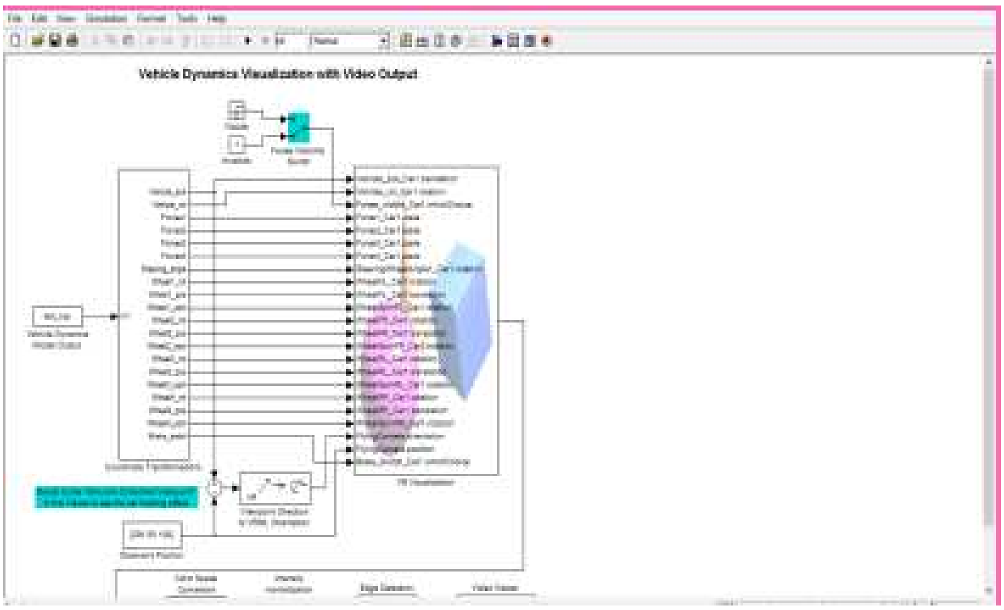


Fig. 7. *Simulink Visualization.*

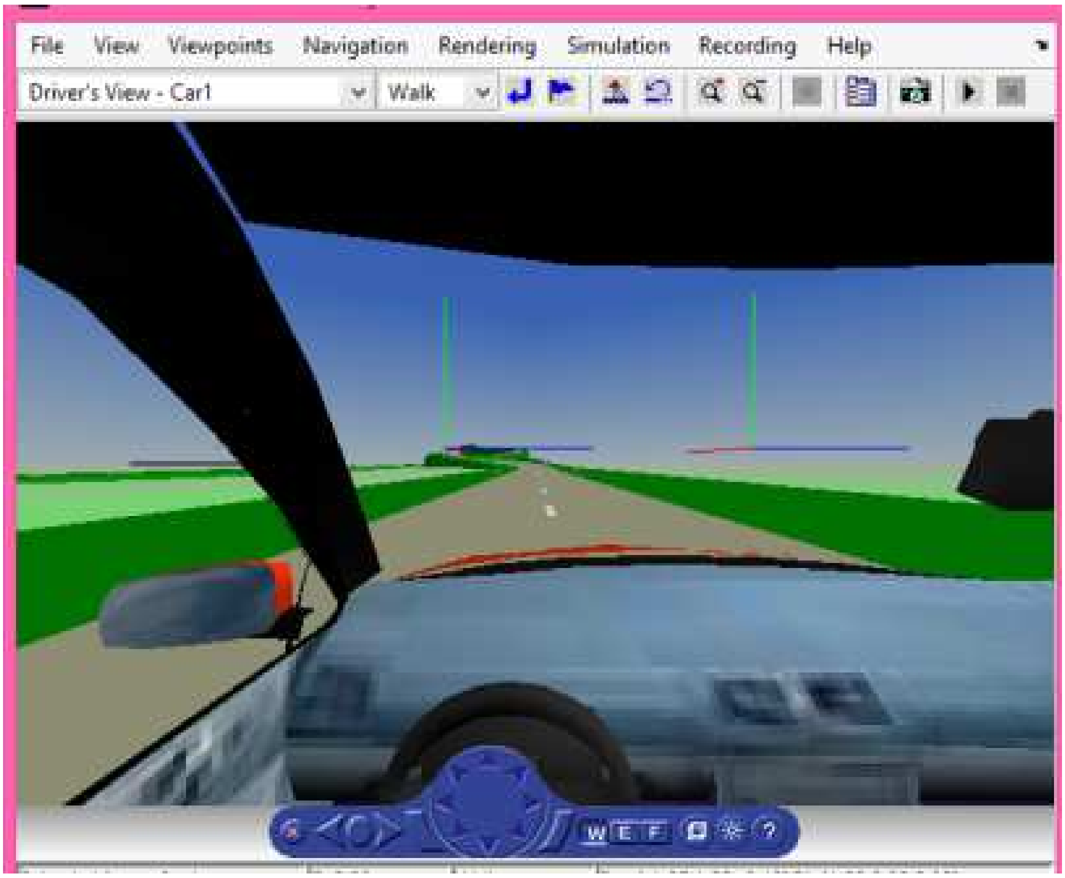


Fig. 8. *Driver's view.*

Fig. 9. *View from right above head.*

Fig. 10. *View from behind.*

Stepwise Algorithm Of The Simulation

Fig. 11. *View from front.*

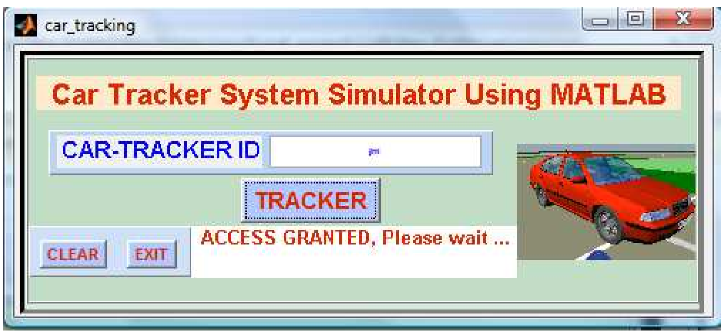


Fig. 12. *Car tracker system simulator.*

Input the correct Tracker Identification Number or Configuration.

With the correct Car tracker Identification number (ID) of configuration, the inputted configuration triggers the car tracker simulator by displaying '*ACCESS GRANTED, Please wait …*' while processing. As shown in *Fig 12*

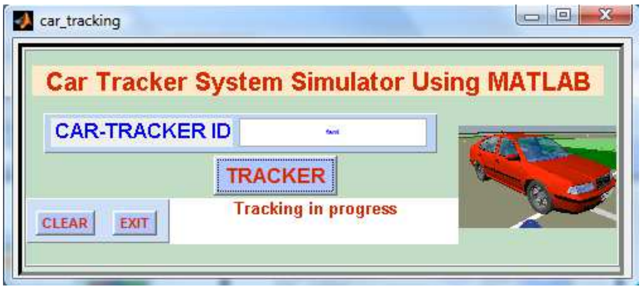


Fig. 13. *Car tracker system simulator.*

The Graphical User Interface (GUI) showing the map and text boxes which display the traffic details like vehicle's velocity, vehicle's speed, the street name the navigation pane and a push button for automatic control of the tacking system. And tracking begins after initiating or clicking either the navigation pane or the Auto - control navigation button, after which a pop - up comes up with the display '*Tracking in Progress*'

Fig. 14. *Car tracker system simulator.*

With incorrect vehicle configuration or ID, the access of the user will not be granted, with this inscription *"You don't have access to the database, See the admin. For help"*.

Fig. 15. *Access denied.*

5. Discussion

After the simulation of the program for the number of trials, the vehicle's data under consideration result is necessary in order to show proper analysis, assessment and evaluation of the entire system at a glance after the simulation. Once the source code is accepted and access is being granted, the car tracker simulator using matlab and a road map is popped - up which gives more details about the ongoing or prevailing conditions of the car. A red indicator showing the location of the vehicle and the various conditions surrounding will be seen which in turns gives all necessary details required.

Hence Five of the output interface are been generated showing different location of the car on different lane and different parameters. The content of each output interface is as a result of the prevailing vehicle's condition as presented by random generation using the navigation pane to display the vehicle's location, speed, lane and street name.

Interface One

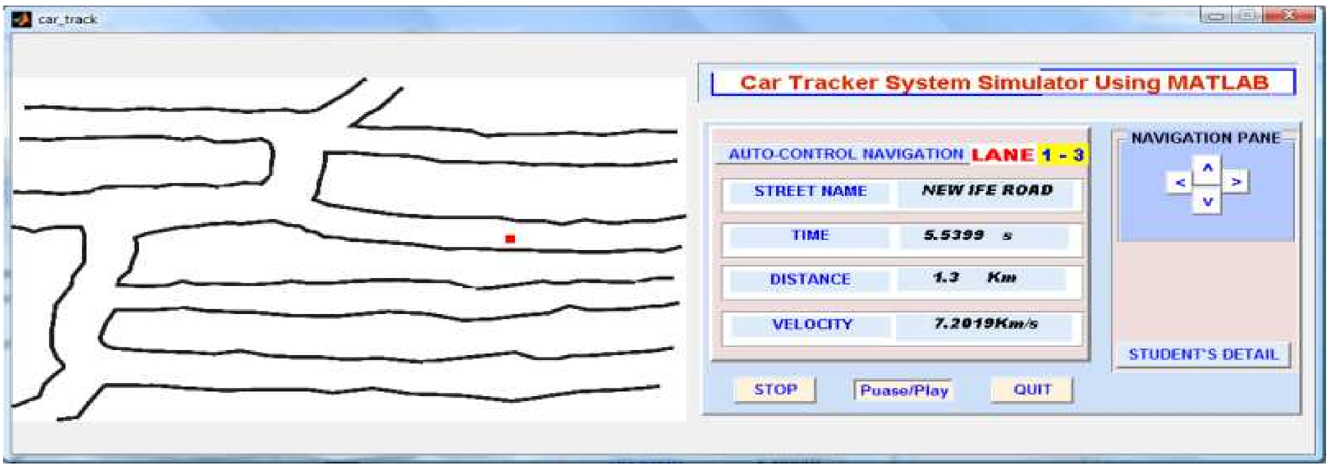


Fig. 16. *This Shows the Vehicle Moving Along Lane 1 - 3, Street Name of New Ife Road, at 7. 2019 Km Per Hour And 1. 3 Km From The Reference Point. The red spot on the street indicating the vehicle.*

Table 1. *Showing the Details of the Location of The Stolen Vehicle.*

PARAMETERS	OUTPUT
LANE	1 – 3 (A cross over)
STREET NAME	NEW IFE ROAD
TIME	5. 53 s
DISTANCE	1. 3 Km
VELOCITY	7. 209Km/s

From the output interface shown in fig 16, the location of the car on lane 1 - 3 and its different parameters are being shown in table 1.

Interface Two

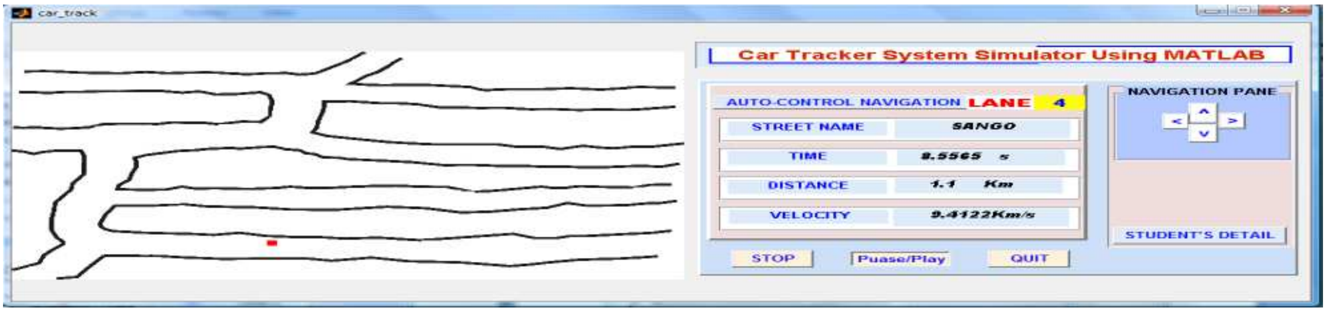


Fig. 17. *This shows the Vehicle moving along lane 4, Street name of Sango, at 9. 4122 Km per Hour and 1. 1 Km from the Reference Point. The red spot on the street indicating the vehicle.*

Table 2. *Showing the details of the Location of the stolen Vehicle along Sango.*

PARAMETERS	OUTPUT
LANE	4
STREET NAME	SANGO
TIME	8. 55 s
DISTANCE	1. 1 Km
VELOCITY	9. 412 Km/s

From the output interface shown in fig 17 the location of the car on lane 4 and its different parameters are being recorded in table 2.

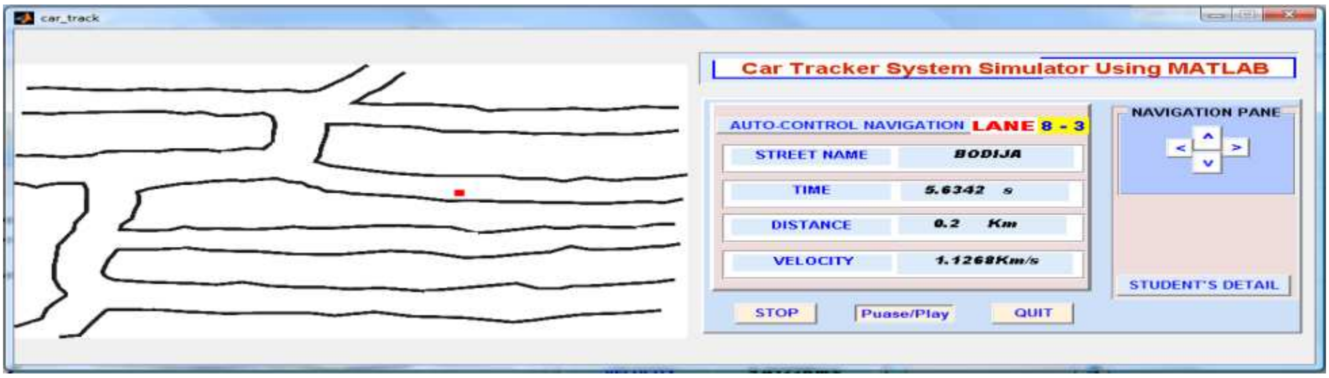


Fig. 18. *This shows the Vehicle moving along Lane 8 - 3, Street name of Bodija, at 1. 1268 Km per Hour and 0. 2 Km from the Reference Point. The red spot on the street indicating the vehicle.*

Table 3. *Showing the details of the location of the stolen Vehicle along Bodija.*

PARAMETERS	OUTPUT
LANE	8 – 3 (A cross over)
STREET NAME	BODIJA
TIME	5. 63 s
DISTANCE	0. 2 Km
VELOCITY	11. 268Km/s

From the output interface shown in fig 18, the location of the car on lane 8 - 3 and its different parameters are being recorded in table 3.

Interface Four

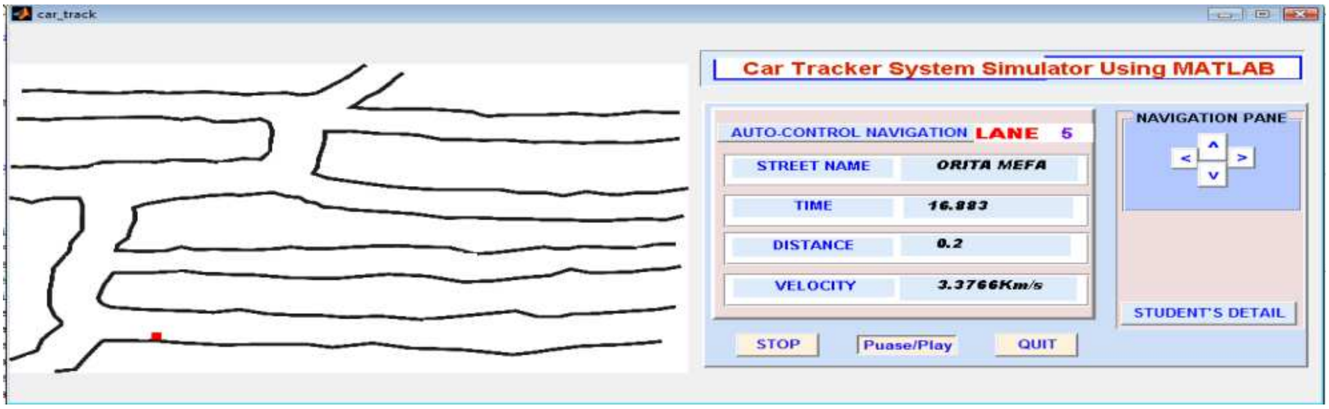


Fig. 19. *This shows the Vehicle moving along Lane 6, street name of Orita Mefa, at 3. 3766 Km per Hour and 0. 2 Km from the Reference Point. The red spot on the street indicating the vehicle.*

Table 4. *Showing the details of the location of the stolen Vehicle along Orita - Mefa.*

PARAMETERS	OUTPUT
LANE	6
STREET NAME	ORITA MEFA
TIME	16. 883 s
DISTANCE	0. 2 Km
VELOCITY	3. 3766Km/s

From the output interface shown in fig 19, the location of the car on lane 6 and its different parameters are being recorded in table 4.

Interface Five

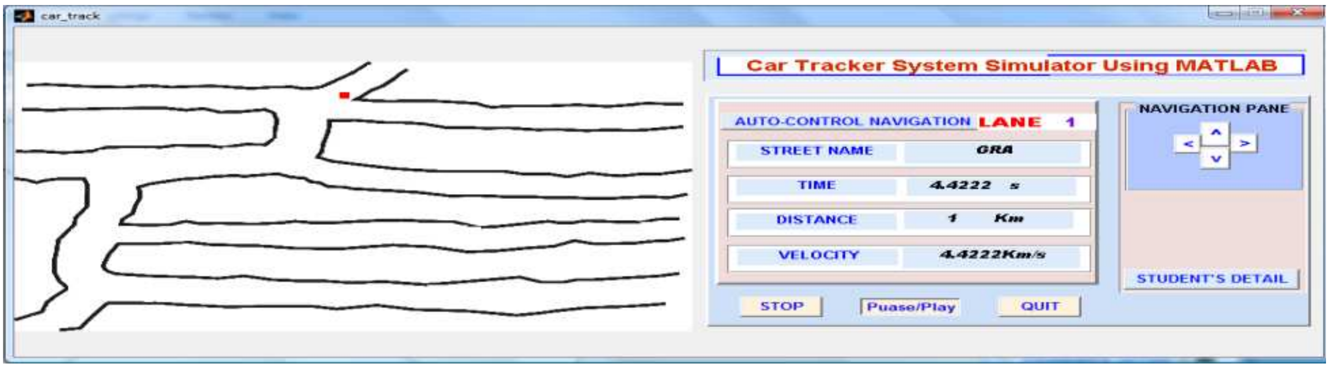


Fig. 20. *This shows the Vehicle moving along Lane 1, street name of GRA, at 4. 4222 Km per Hour and 1 Km from the Reference Point. The red spot on the street indicating the vehicle.*

Table 5. *Showing the details of the location of the stolen Vehicle along GRA.*

PARAMETERS	OUTPUT
LANE	1
STREET NAME	GRA
TIME	4. 4222s
DISTANCE	1 Km
VELOCITY	4. 42222Km/s

From the output interface shown in fig. 20, the location of the car on lane 1 and its different parameters are being recorded in table 5.

6. Conclusion

The tracking of the vehicle was designed in such a way that the only input required of the user is to input the vehicle tracker identification number, which was done using the MATLAB GUI.

Generally, the tracking of a vehicle is done by connecting to the vehicle's tracker through the use of GPS (Global Positioning System) while mostly the vehicle is brought to halt or probably by passage of notification message to the current handler (Lamar, 2010). But what this research work emphasis is to track the vehicle without stopping it or notifying the driver or the wrong user. The methods used here was a model developed using the MATLAB Simulink whereby the vehicle's current location, its velocity and speed is being tracked. Some notable area where the car passed were gotten and recorded, the distance covered was taken and the time to cover the distance was recorded as well, noting the velocity at which it was travelling at that particular distance.

After checking for the validity of the vehicle's tracker identification in the previous section, it will then proceed into the Simulink design to get the vehicle's current location.

References

[1] Adekunle Adefemi Adeyemi, Adejuyigbe Sam B., and Faluyi Olufemi (2014) "Material Selection for Computer Aided Design Software for Crankshaft Design" International Journal of Scientific and Research Publications, Vol. 4 Issue 8 ISSN - 2250 – 3153.

[2] Clifford Will. (2009). 'Global Positioning System'. Second Edition, Basic Books/Perseus Group, New York, 4, pages 49–50.

[3] Complete GPS Maps (2010). 'Managing Your Garmin GPS Unit'. Retrieved from http: //www. Garmap. Co. Za.

[4] Dr. Schultes, Gerhard (2003). 'Low - power Three - dimensional Activational Receiver AS3931 for Keyless Go Applications'. from http: //www. austriamicrosystems. Com.

[5] Erika, V. C. (2006). 'Best Ways to Prevent Auto Theft'. Retrieved from Yahoo! Contributor Network.

[6] Ernest, P., Mazl, R., and Preucil, L., (2004) "Train locator using inertial sensors and odometer", *IEEE Intelligent Vehicles Symposium* 14– 17, June 2004, pp. 860–865 (2004).

[7] Deepak Mishra1, Apurv Vasal and Puneet Tandon (2012) "A Novel And Cost Effective Approach to Public Vehicle Tracking System" International Journal of UbiComp (IJU), Vol. 3, No. 1, January 2012.

[8] D. Sudharsan and Sudheer Katta (2012) "IVTrace: A Cost - Effective Vehicle Tracking System - A Prototype "International Journal of Engineering and Technology Volume 2 No. 7, July, 2012.

[9] Fraser, M. A. (2011). Guidelines for Car Alarms, Safety & Security systems. From http: //www. cararticle. co. uk.

[10] Gerald J. S. (1994). "Remedy by engineering ?" Psyc. queensu. ca. http: //psyc. queensu. ca/target/chapter 07. html. Retrieved 2010 - 12 - 07.

[11] Great house, John (2008). "Reinvent The Wheel – A Nonstandard Look at Standards". infoChachkie. http: //www. infochachkie. com/wheel/. Retrieved 2011 - 01 - 04.

[12] Interpol, G. S, (2007). 'Highway Loss Data Institute'. From http: //www. google. com/interpol/car - theft=a.

[13] Jeannie, Davice (2002). '10 Ways to Prevent Auto Theft'. http: //Ezine Articles. com/?expert=Jeannie _ Davila. Retrieved 2011 - 05 - 07.

[14] Joseph E. A. (2000). 'Vehicle Clutch Locking Device'. Chugiak, AK (US), Pages 141 – 152.

[15] Joseph, E. S and Plainview, N. Y (1987). 'Automobile Anti - Theft Device'. Wolo Manufacturing Corporation Deer Park, N. Y.

[16] Josienita, Borlongan. (2011) 'How Does a Car Tracking System Work?' Retrieved from http: //www. eHow. com/car tracking system.

[17] Junos, Pulse. 'The Integrated Mobile Solution'. Retrieved April 5, 2011. From http: //www. Juniper. net/Puls.

[18] Lamar, stonecypher. (2010). 'How does GPS works?'.

[19] Microsoft Encarta, (2008). 'Quartz'. Retrieved from http: //www. google/encarta/Quartz.

[20] Mitchell Beazlex (1998). The Joy of Knowledge, (Oriole publishing limited, griffin house, 161 Bammersmith road, London, W 685 D). Pg 99 - 496.

[21] Nice, Karim. (2010). 'How Anti - Lock Brake Works'. Retrieved from http: //www. howstuffworks. Com.

[22] Orange wheel cars, (2009). 'Advice & Practical solution on deterring and preventing car crime'. From http: //www. car - theft. org.

[23] Pedro, Albanes. (1996). Anti - Theft Lock for Automotive Vehicle Which Locks An Automotive Transmission. S. Coconut La, Miami Beach. Pages 45 – 67.

[24] Popular Science, (2011) 'How Your Home Lock Works'. From http: //www. ocatt. org/prevention. html.

[25] Richard K. R. (2003). 'Anti - Theft Steering Lock'. Edmund P. A. Delphi Technologies, Inc. Bay City, MI (US). Pages 56 - 78.

[26] Robert A. V. (1999). 'Anti - Theft Brake or Clutch Locking Device'. Sugar town Road, Berwyn, Pa 19312. Pages 191 – 209.

[27] Rus, C., Bilcu, R. C., Egiazarian, and K., Rusu, C., (2004) "Scanned maps processing using wavelet domain hidden Markov models", *First International Symposium on Control, Communications and Signal Processing*, pp. 451–454. IEEE, (2004) Staff, Writer (2004). 'How Vehicle Tracking Devices Work'. http: //www. abs - education. org/faqs/faqindex. htm. Retrieved 2011 - 05 - 22.

[28] Tom Harris, (1998). 'An article on how car alarms work'. How Stuff Works, Inc, 10, 224 - 567.

[29] Tracking the World, (2009). 'track anyone, anywhere, anytime' and 'using a GPS tracking device on a car'. Retrieved from http: //www. traking the world. com/GPS tracking.

[30] Transalt. org article (2011) 'car alarms ineffectiveness'. From http: //www. Transalt. org/car alarm /article - auto.

[31] Vehicles, (2010.) 'Kill switches'. Retrieved from "http: //en. wikipedia. com/wiki/Kill _ switch".

[32] 'Warning! Strange behavior'. Articles from New Scientist, Retrieved 11 December 1999, http: //www. New Scientist. com/RBI/car theft.