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Development and Implementation of Vehicle Movement Notification and Location using GSM, GPS and Web based Information System

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***Abstract*—**The issue of Crimes been committed in our society these days has become an issue that every government and the society in general has to be concerned with. Stolen of vehicle has increased tremendously and sometimes such vehicle are used in committing criminal activities such as armed robbery, kidnapping and of recent insurgency as it is been witness in some part of Nigeria. In view of these challenges, adequate provision or records of stolen, identified and recovered vehicle are not readily available and as such very important. The development of vehicle movement notification and location is one of the solutions to vehicles owner in order to ensure speedy notification, identification and recovery of their vehicles and as well reduce criminal activities in the society. The system uses a developed application installed in a mobile phone device which will be embedded in a vehicle to notify the owner when the vehicle is driven by unauthorized user. A GSM mobile phone was used to communicate with the vehicle owner whereby the user sends SMS to communicate with the mobile phone sensor installed in the vehicle. A web application was also developed to determine the real-time vehicle location and as well as record of database information system of found or missing vehicles. The system was test run and the results obtained shows how effectiveness is it in determining vehicle movement, location and notification as it is been driven within or outside its jurisdiction.

***Index Terms*—**Identification, Location, Notification, Record, security, Theft.

I. Introduction

Due to increasing development in the national economy and subsequently technological advancement, the use of automobiles in human activities has greatly increased as human finds vehicles very useful in their daily routine activities. However, it is the advancement in technology which has made those committing criminal activities to find a sophisticated method of stealing vehicles. Despite the efforts of police, Media houses (TV/Radio Stations and News Papers) and the use of GPS based Vehicle Tracking Systems; the issue of vehicle theft is still rampant. The Police or security agencies alone could not prevent, identify or recover all the vehicles stolen. Delay in reporting stolen, identified or recovered vehicle are also there which sometimes resulted to vehicle not getting to the real owner at the right time. Due to lack of adequate information people could not assist in providing timely and adequate information as regard locating and reporting the vehicle they might have sighted elsewhere. Therefore, inability of the existing systems or methods to totally ensure quick and urgent notification, location and prompt recovery of all the unauthorised usage or missing vehicles will be examined in this paper, which added to security system of the vehicle and the society at large. This assertion was collaborated by [12] that security is a primary concern everywhere to any one and every system requires being secured.

The Crime rate in the society these days has become a frightening matter such that numerous approaches are been used including useage of vehicle in committing criminal activities. The issue of vehicle getting stolen has increased extremely; whereby adequate information or records of stolen, recovered or identified vehicle are not readily available to the public. In view of these challenges posed by using vehicles for criminal activities, the development of vehicle movement notification and location is also a solution to vehicles owner in order to ensure speedy notification, identification and recovery of their vehicles. The system will make use of a designed and developed application installed in a mobile phone device which will be embedded in a vehicle to notify the owner when the vehicle is driven by unauthorized user.

Aim and Objective(s) of the Study:

The aim of this research work is to develop and implement a Vehicle Movement Notification and Location Using GSM, GPS and Web Based Information System, which will be achieved by implementing and carryout a test on some selected vehicles in different locations to determine its workability and effectiveness on the vehicle's movement, notification and location.

II. Related Works

Vehicle tracking systems uses combination of technologies to keep real-time of the vehicles position or to construct a profile of where a vehicle has been over a period. These tracking systems are commonly used in a variety of industries, and they are also a key part of most stolen vehicle recovery strategies [1].

As a result of importance and useage of GSM; [13] developed a system that integrated sensor of main server and GSM global system for mobile such that the system is able to send data and IP addresses through SMS message which facilitate the identification of the unknown person embedded in real-time form. In furtherance to GSM useage, [14] proposed a data transaction method based on encoded Short Message Service (SMS) over Global System for Mobile Communication (GSM). The method guarantees the functionality of the system in case of inaccessibility to GPRS which may be not always available due to measures such as attacks that affect its availability

[3] designed a vehicle theft intimation using GSM. The system uses a wireless technology which uses a GSM modem that stops the engine of the vehicle when someone tries to drive or steal it. This is achieved by sending SMS to the owner, while the owner can also send SMS in order to disable the ignition. It also has the capabilities for informing the vehicle owner of any user that is not allow to use the vehicle whenever trying to get entry into the vehicle through the door.

[7] designed a vehicle tracking and locking system based on GSM and GPS using GSM Modem SIM300 V7.03 This GSM modem was designed in such a way that it uses SIM card in its operation. The designed system is arranged such that it will go into sleeping mode when the vehicle is been driven by the vehicle owner, while on the other hand it will be in active position. Similarly, the system has the capability in such a way that when message (SMS) is directed to the controller, it has the functions of directing signals to the engine of a vehicle which will enable the engine of the vehicle to drop gradually and then off, thereafter, the system will locked all the doors and the engine has to be restarted again before the door can be opened by entering the password given to the rightful owner of the vehicle.

Furthermore, [4] developed a car authentication and accident intimation system which uses GPS and GSM in saving lives. The system has three modules. Module one was used to send the vehicle numbers and the coordinates to a nearby hospital, module two was used to direct message to the owner of the vehicle at any time the vehicle got crank, whereby, it will notify the status of the vehicle so that the owner will take action while module three was used to notify a nearby service centre for necessary action based on the error messages or signals and coordinates that shows on the dash-board of the vehicle

According to [8], vehicle tracking system is the installation of an electronic device inside a vehicle or fleet of vehicles, with a designed application or software in one operational centre so as to enable the owner or a third party to track the vehicle's movement, collecting relevant data as related to the vehicle, process it and send it to the operation centre for processing. Meanwhile, most vehicle tracking systems commonly use GPS technology for locating a vehicle but other types of automatic vehicle location technology can also be deployed for vehicle tracking, which also has the facility for vehicle information to be viewed through electronic map through the internet.

On the other hand [16] designed a traffic accidents are one of the leading causes of fatalities in most of the countries. Since the rate at which vehicle increase so also the rate of road accidents increase, in view of this and to find measure to reduce road accidents and find means of attending to road accident victim, the researcher look at how accident can be notified automatically whenever it occurs by using a sensors which look at the health condition of the passengers and then sent as a video through the GSM to the nearest Police station for urgent response and rescue.

[6] develop a massive vehicle security system using Embedded and Mobile technologies. The system has two modules; the first one is an android module that uses GPS system to get the coordinates of the vehicles which assist the owner to track the vehicle while the second module is used to interact with the vehicle owner by using SMS message for receiving and sending messages which uses GSM as a communication means in assisting the vehicle owner in tracking the vehicle.

In addition, [2], uses the technology of GPS and Radio Frequency Identification (RFID) for the design and its implementation. The system uses RFID because of its usage in various applications such as tools for gate system in railway and enquiry to identify vehicles location. The system uses the techniques of GPS and RFID to track a vehicle which consists of buzzer in locating the vehicle position and also to give notification to the vehicle owner.

Also, [15] proposed the design and development of Global positioning system and Global system for mobile communications based vehicle tracking in a real time. The designed system gives an alert which is used for reporting any events that happens to the vehicle as it moves. The proposed system also consists of an embedded system with ARM processor which is installed in the vehicle. The system has the ability to send an SMS which consist of latitude and longitude of the vehicle by using AT commands after pressing the emergency key if there is any problem that is associated with the vehicle

According to [5] many people make the assumption that vehicle theft only occurs in seedy areas of town, but

vehicle theft can occur anywhere in any area of town. The researchers also asserted that theft is among the common attitudes exhibited by people where the ownership of property such as vehicle, land, and other physical properties can be altered without the knowledge of the owner.

[11] developed a framework using JAVA with an Eclipse IDE, using MySQL as database and Google maps API to get locations. The system was designed to solves the burgeoning issue of password theft and unauthorized access into a password-protected database or environment by ensuring that the location of the user is taken upon registration and enforced for all other subsequent usage of the system.

In view of the importance and efficiency of smartphone [9] designed an android application that enables users to communicate with each other in a safe way and provides them with end to end security communication. The communication process was done through data encryption and submitted to the internet server in an encrypted format which is then retrieved by using queries and then decrypted which later is shown to the recipient user.

Mobile technology has gain unprecedented success in last few years with its useage and application in various field of human endeavours. [10] asserted that as the mobile devices are widely used in this world and with the increasing number of users, so also the numbers of customized applications are developed and introduced to users based on their own requirements, hence there is a need for a system to be able to conserve energy.

III. Methodology

This system consists of power supply, GSM mobile phone with GPS/GPRS facilities with a SIM card slot, Vehicle (ignition system) and GSM network transmitter.

The system will be dependent on Software application to be developed using JAVA application software which has capabilities in programming GSM mobile phone in alerting the owner of a vehicle when stolen or used by unauthorized person.

In this system the application was designed and installed in the GSM mobile phone to be attached in a vehicle such that it can send and receive SMS when the vehicle ignition is ON. The application has the features of allowing the vehicle owner to send an SMS to any additional numbers such as security agencies so as to ensure or allow real time/urgent participation in the recovery of the vehicle.

The developed application will be hosted on a GPS enabled GSM mobile phone, it has facility which enables the vehicle owner to determine or locate the present location of the vehicle; it also has or hosts a digital and dynamic map that will enable the vehicle owner to view the location of the vehicle.

Fig 1 shows the communication architecture of the system. The Server makes up the components (database) which in turns uses the network component (protocols) of the system so as to enable the web application to be accessed and at the same time ensure communication between the device installed in the vehicle and the vehicle owner. The server serves as database for the vehicle owner's information (such as name, phone number, vehicle details etc.), vehicle movement and location status, record of missing and found vehicles. The vehicle owner access the web application from the phone or a computer system (laptop or desktop) using the web browser software to interact with the application developed so as to locate the vehicle from the server.

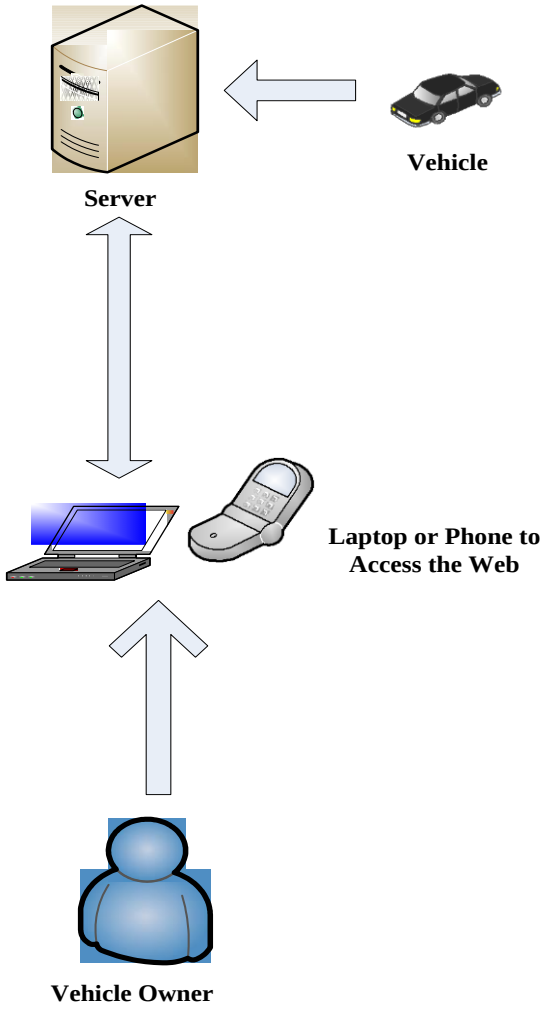

Fig.1. Communication Architecture for Application Developing the Application for the System

The approach adopted in the development of this system is an integration of database, programming/open source solutions, web based technology. PHP version 5.0 was used for the development of the applications;

MYSQL was used to create the database that keep the current location of the vehicle and also update the vehicle location from time to time, records of found and missing vehicles. In addition, it was used to create a link between the device and the web page to locate the vehicle.

The block diagram of the system developed is shown in Fig. 2. It consists of all the components of the developed and implemented system:

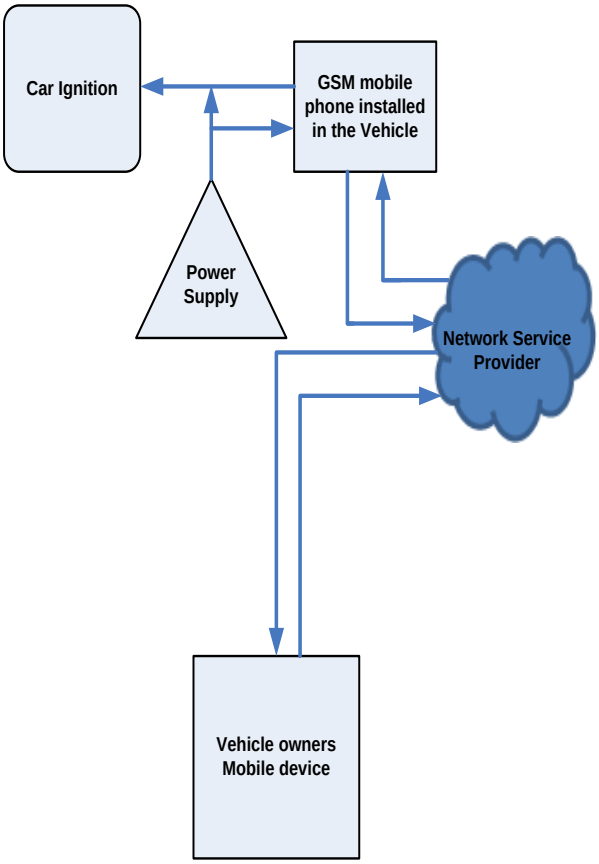

Fig.2. Block Diagram of the System

A. GSM Mobile Phone

Global System for Mobile communication (GSM) is a worldwide standard that is used by GSM modules in cell phones which allows communication with a mobile network within or outside a country, continent or worldwide in general. Some system uses microcontroller systems which have to be connected with the GSM network so as to allow users to control system by making calls, send SMS, send alert messages based on the instructions set.

In this system, a GSM mobile phone was used which consist of components that enhances or facilitate programming to be incorporated into it. The device is programmed through a USB, implemented by using a USB serial adapter chips.

The system uses a GSM mobile phone as an interface which is a specialized device that allows SIM card to be used, which can respond to mobile number subscribers. The GSM board enables communication between two or more devices so far they are connected. The GSM model is tailored along the services it offers such as SMS, phone calls etc.

The features of GSM mobile phone used for this system are:

- Android OS, v4.1 (Jelly Bean)
- CPU Quad-core 1.5 GHz Krait GPU
- Adreno 320
- Applicable SIM card

B. Vehicle Ignition System

This is the part of the vehicle that is used to start the vehicle engine. It is through this that the developed application installed in the board will communicate with; such that once the ignition is ON, the board will initiate the SMS. Since the vehicle needs power to start up, whenever the ignition is ON, it also provides power to the GSM mobile phone installed in the vehicle so as to charge it in order to make it active always.

C. Vehicle owner's Mobile Device

This is a mobile phone with a SIM card that the owner uses to communicate with the device installed in the vehicle based on the application developed. It is through this mobile phone the car owner will be receiving SMS when the vehicle engine is ON and or on motion. It is the same mobile phone device that the owner will use to if desires to locate the location of the vehicle using GPS/GPRS facilities.

D. Power Supply

Power supply is very important for electronics and electrical devices. Since power is needed to start up the vehicle and as well as ignition, the installed GSM mobile phone also need power to charge so as to assist in sending SMS to the vehicle owner when the ignition is ON.

Input Database Design

Inputs are raw data that needs to be processed in other to produce output. Inputs are majorly designed based on the output required.

Input makes data entry into the system easy and with a well-defined input design; it helped in getting data into the computer system at the appropriate time and as accurate as possible.

The database designed used by this system are shown in Table 1 to Table 4.

Table 1. Showing Input Database Design of all Registered Vehicle.

Column	Type	Null	Default
Id	int(11)	No	
Joined	Date	No	
tracker_id	varchar(50)	No	
Username	varchar(50)	No	
Password	varchar(100)	No	
password2	varchar(25)	No	
Names	varchar(100)	No	
Mobile	varchar(25)	No	
Chassis	varchar(100)	No	
Vnumber	varchar(100)	No	
Colour	varchar(100)	No	
Model	varchar(100)	No	
Position	varchar(100)	No	
Lastposition	Timestamp	No	CURRENT_TIMESTAMP
status_report	int(11)	No	
Status	int(11)	No	

Table 2. Showing Database Design of Missing and Identified or Found Vehicles.

Column	Type	Null	Default
Id	int(11)	No	
missing_date	Date	No	
tracker_id	varchar(100)	No	
Found	int(11)	No	
found_date	Date	No	0000-00-00
Status	int(11)	No	

Table 3 shows whenever a vehicle is on tracking mode it will keep updating the table with the information of the latitude and longitude of the vehicle at given interval.

Table 3. Showing Database Design of Registered Vehicle Tracking Mode.

Column	Type	Null	Default
Id	int(11)	No	
tracker_id	varchar(50)	No	
Dated	Timestamp	No	CURRENT_TIMESTAMP
Lat	varchar(25)	No	
Lon	varchar(25)	No	

Table 4. Showing Database Design Index of Registered Vehicle Tracking Mode

Keyname	Type	Unique	Packed	Cardinality	Null
PRIMARY	BTREE	Yes	No	139938	No

System Flowchart

The flowchart is used to describe the behavior of the system from an external point of view, besides the drawing, it displayed the links between the vehicle as it is been started and then message that the GSM mobile phone installed in the vehicle respond to. The authentication of the vehicle by the owner is based on the message received inorder to know whether to respond to the message and then proceed in finding the vehicle or ignored the message. The flowchart diagram for the proposed system is shown in fig. 3.

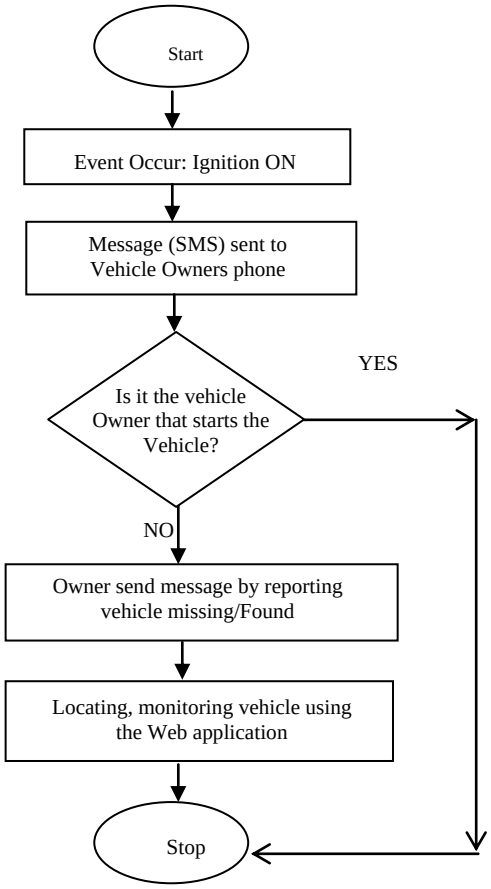

Fig.3. System Flowchart Diagram

IV. Results and Discussion

This system was to enhance the effectiveness and useage of mobile phone for vehicle movement, notification and locations. The implementation was carried out and it was found to be economical and easy to use. The system was installed in a vehicle which allow vehicle owner to monitor and able to locate where about of his or her vehicle as it is been driven by authorised or unauthorised person.

The features of the implemented system are as follows:

Registration Form

As shown in fig. 4 and 5, this is the platform that any new user of the application has to enter personal data to be registered. The user need to enter, name, user name, password, mobile phone to communicate with the device, chassis number, model, colour. After completing the form, the user then click on SAVE tab to save the details. Thereafter, the user click on the Register Car to authenticate the information filled in order to register the details so that the vehicle owner can have access to the web application. This form links to the web application such that it validates the information saved.

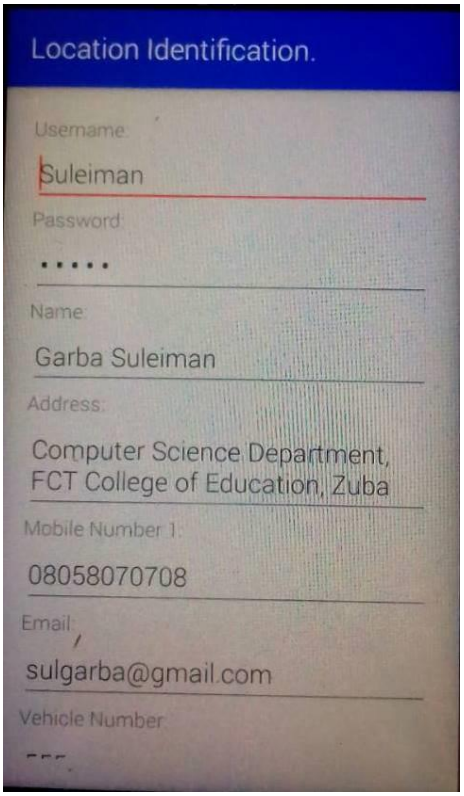

Fig.4. Vehicle Owners Details Setting in the Mobile Device

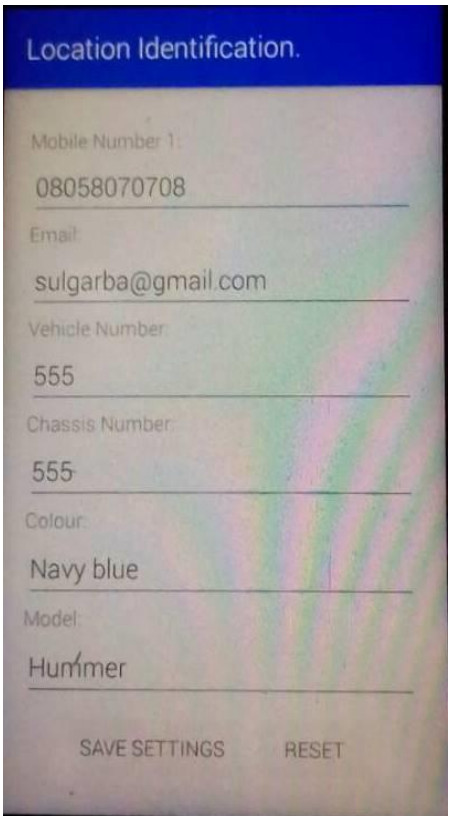

Fig.5. Vehicle Owners Details Setting in the Mobile Device

Start and Stop Interface

Fig. 6 is for the start interface. On receiving the "START" message a "GREEN" button appears at the middle showing that the application has started and ready for tracking and sending necessary information about the vehicle, while fig. 7 shows the Stop interface, in this case whenever a "STOP" messages is sent, a "RED" button at the middle appears showing that the application has been stopped from responding and sending of any information about the vehicle movement and location.

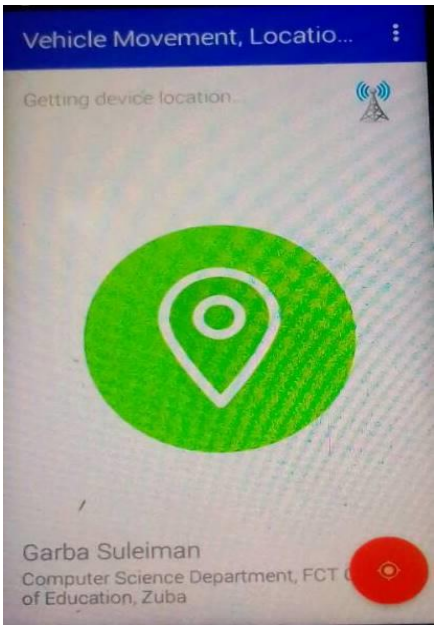

Fig.6. Start Interface

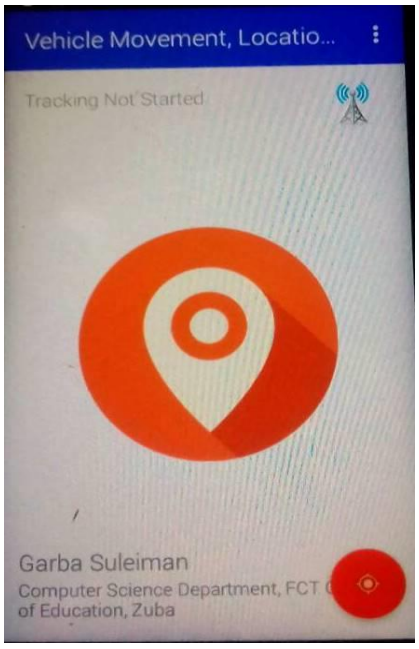

Fig.7. Stop Interface

Web Application

Login Page Input Form

Fig. 8 is the first page the application shows whenever the web application is loaded, the user has to enter the username and password that was used to registered the

device, that is the username and password has to tally before the user can log in, while the security agency on their part need to have a unique username and password which has to be created since their tracking will be based on report of any missing vehicle is made to them.

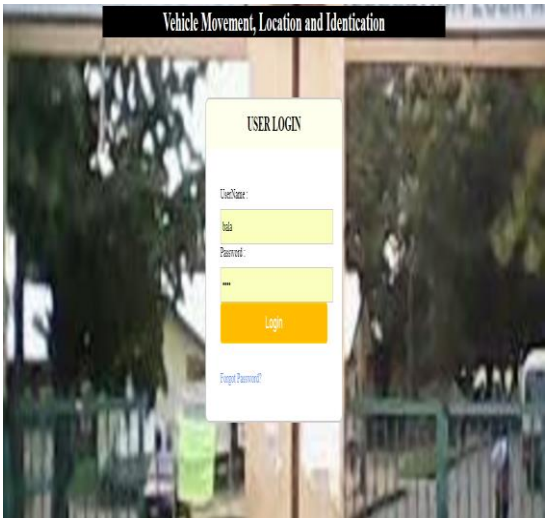

Fig.8. User Login Page

Vehicle Movement. Location and identification Image

As shown in fig 9, it represents an image showing the location of the vehicle. The location will continue changing as the vehicles move which gives the real time location of the vehicle for easy location and monitoring, in addition a vehicle can be reported by sending a message through the report missing button. Also when found the found button can be used which notify missing or found vehicle to any of the assigned phone number such as the security agencies.

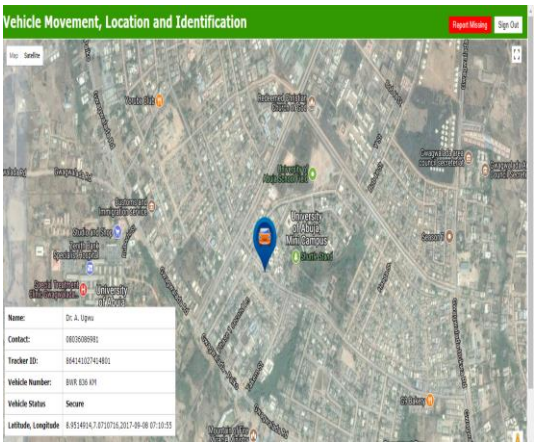

Fig.9. An Image Showing a Vehicle Location and Movement

V. Conclusion and Recommendations

Conclusion

This paper works on movement, notification and location of vehicle as an effort towards assisting the vehicle owner in locating and monitoring the vehicles movement with or outside its jurisdiction. Some literatures were consulted which shows how various technologies have been used in monitoring, tracking and identifying vehicle movement. This paper developed and implemented the use of GSM, GPS, and the Web technology.

This research work was implemented in order to ensure that vehicle movements could be easily located and identified by the owner whenever used by unauthorized user or stolen. The system helps the vehicle owner to have the belief that a stolen or missing vehicle can be located, identified and recovered in a real time situation whereby the owner can be at any location and monitored the vehicle's movement. In addition, the system ensure there is an assistance to be rendered in notifying the well-wisher or friends to assist in the recovery effort and also the security agency in helping locating the vehicle and also there is provision of having an accurate data and information of missing, identified or recovered vehicle which will help them in their documentation and further investigation.

Recommendations

After studying the existing and the proposed system, the recommendation is that the proposed system should be used because of its simplicity, efficiency and accessibility towards locating and identifying and possible recovering of missing vehicles.

The system also provides the security agency in having a repository record of missing and found vehicles such that any vehicle can be secured and ensure promptness of recovery. Also, taking decision would be greatly enhanced and improved upon because of the system way of processing information, since data collection from computer takes much less time than that of manual method such as records of missing, identified and recovered vehicles.

VI. Further Work

Further research could be carried out on this system to further enhance its functionalities by applying the use of camera in capturing the image of the unauthorized or authorised person driving or inside the vehicle which can be linked to the web application for the real apprehension of the unauthorised person and those in the vehicle.

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References

[1] Jeremy, L. (2013). What is Lojack, and How Does it Work?. Retrieved on 15th March 2015 From:http://cartech. about.com/od/Security/a/What-Is-Lojack-And-How-Does-It-work.htm

[2] Kumar, C. R, Vijayalakshmi, B., Ramesh, C., & Pandian, S.C. (2013). Vehicle Theft Alarm and Tracking the Location using RFID and GPS. *Journal of Emerging Technology and Advanced Engineering (IJETAE)*, 3 (12), 525 – 528.

[3] Kumari, M., & Singh, M. (2014). Vehicle Theft Intimation using GSM. *International Journal of Computational Engineering Research (IJCER)*, 4, (8), 42 – 47.

[4] Monisha, R., Joseph, J. L., & Tharani, B.T. (2014). Car Authentication and Accident Intimation System using GPS and GSM. *International Journal of Innovative Research in Computer and Communication Engineering.* Special issue 2(1), 219-225. Retrieved on 9th August 2016 from: http://ijircce.com/upload/2014/icgict14/219_832.pdf

[5] Powale, P. K., & Zade, G.N. (2014). Real Time Car Antitheft System with Accident Detection using AVR Microcontroller: A Review. *International Journal of Advance Research in Computer Science and Management Studies (IJARCSMS)*, 2(1), 509-512.

[6] Pranesh, S.I., & Saravana, K. P. (2014). A Massive Vehicle Theft Control System using Embedded and Mobile Technologies. *International Journal of Advanced Research (IJAR)*, 2 (4), 53-59.

[7] Ramani, R., Valarmathy, S., Sutanthira, V. N., Selvaraju, S., Thiruppati, M., & Thangam, R. (2013). Vehicle Tracking and Locking System based on GSM and GPS. *International Journal for Intelligent Systems and Application (IJISA)*, 9, 86-93. DOI: 10.5815 /ijisa. 2013.09.10

[8] Ramesh, C. G., Ankita, C., Reema, S., & Sujata, K. (2012). Land Vehicle Tracking Application on Android Platform. *International Journal of Engineering Research and Application*, 2 (3), 1978 – 1982.

[9] Ammar, H.A., & Ali, M.S.(2017). Design of an Android Application for Secure Chatting *I. J. Computer Network and Information Security*, 2017, 2, 29-35 Published Online February 2017 in MECS (http://www.mecs-press.org/)

[10] Ambrin H.A., Muhammad A.S., Muhammad, S. & Mussarat, Y. (2017). Energy Consumption in Mobile Phones. *I. J. Computer Network and Information Security*, 2017, 12, 18-28 Published Online December 2017 in MECS (http://www.mecs-press.org/)

[11] Victor, L.Y., Baba, M., Oluwafemi, O. & Anthony, S. (2018). Application of Geo-Location-Based Access Control in an Enterprise Environment. *I. J. Computer Network and Information Security*, 2018, 1, 36-43 Published Online January 2018 in MECS (http://www.mecs-press.org/)

[12] Baidaa A. Atya, Abdul Monem S. Rahma, Abdul Mohssen J. Abdul Hossen (2017) ," Design and Implementation of Secure Building Monitoring System using Programmable Wireless Mobile Camera", *International Journal of Computer Network and Information Security(IJCNIS)*, Vol.9, No.3, pp.29-35, 2017.DOI: 10.5815/ijcnis.2017.03.04

[13] Seelam Vasavi Sai Viswanada Prabhu Deva Kumar, Shyam Akashe (2017)."Implementation of GSM Based Security System with IOT Applications", *International Journal of Computer Network and Information Security(IJCNIS)*, Vol.9, No.6, pp.13-20, 2017.DOI: 10.5815/ijcnis.2017.06.02

[14] Mohammed Baqer M. Kamel, Loay E. George (2016),"Secure Model for SMS Exchange over GSM", *International Journal of Computer Network and Information Security(IJCNIS)*, Vol.8, No.1, pp.1-8, 2016.DOI: 10.5815/ijcnis. 2016.01.01

[15] Shaikh J.A.I and Subhangi A. M. (2014): Advanced Authentication and Security System for Call Centre Employee's with Live GPS Tracking. *International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering (IJAREEIE)*, 3 (7), 10533 – 10536.

[16] Sriram A and Ramya P (2013).*:* Automatic Accident Notification System using GPS and GSM with 3G Technology for Vision Monitoring. *International Journal of Emerging Trends in Electricals and Electronics (IJETEE)*,1(2), 11–13.

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