

Online System for Vehicle Ownership Tracking and Theft Alert With Community Participation

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ABSTRACT

Vehicle theft in Nigeria is a societal vice that even the effort of the police has failed to curtail. Not all of the reported stolen cars are recovered, and those recovered in another jurisdiction rarely make its way back to the rightful owner. This is due to lack of a tangible information system where history, status or information of the stolen automobiles can be checked or accessed. Vehicle tracking hardware has been helpful but fails sometimes. This paper presents the design and development of a web based information system called "Online Vehicle Ownership and Theft Alert System" (VOTAS) as an alternative or complementary to vehicle tracking hardware. The application provides a platform for community participation where vehicle owners can register their personal and vehicle profiles and maintain an electronic account on the system. It also provides access to a discussion forum and dissemination of vehicle theft alert on the system, social networking sites, and SMS alerts for possible quick location and recovery of the stolen vehicles.

Keywords: Stolen vehicle, theft alert, ownership, theft, vehicle recovery system, web-based information systems.

Aims Research Journal Reference Format:

Mejabi, O.V., Abdulrahman, D.M., Adeshina, M.A., Oyekunle, R.A. & Sadiku, J.S. (2017): Online System for Vehicle Ownership Tracking and Theft Alert With Community Participation. *Advances in Multidisciplinary & Scientific Research Journal*. Vol. 3. No.1, Pp 157-168.

1. INTRODUCTION

In Nigeria and other parts of the world today, statistics shows that the number of vehicles being stolen is quite high. An online news website (Business Day, 2016), reported that the National Bureau of Statistics (NBS) record shows that in Nigeria, 2,544 vehicles were stolen between 2013 and 2015, out of which 1,377 vehicles were recovered. This report brings the national recovery rate to 54 percent for that period. As contained in the summary of statistics released by the police during the 2013 Town Hall Security Meeting in Lagos, of the 1,130 stolen vehicles recorded in Lagos state between November 2012 and October 2013, 919 were recovered (Balogun, 2013), which is about 81 percent. Similarly, according to Osunbor (2012), out of the 907 and 669 cases of car theft recorded in Lagos for 2007 and 2008, only 231 and 282 respectively, were recovered. These facts show that despite the good works being done by the police in Nigeria, the issue of vehicle theft is still very much common in the society.

Vehicle theft issue could be as a result of the carelessness of the owners or because thieves are not relenting in their efforts in searching for new methods or techniques of carrying out their nefarious activity (Chris, 2013). Despite the efforts of police, media houses (television/radio stations and newspapers) and the implementation of global positioning system (GPS) based vehicle tracking systems (hardware and software) (Sorfuddin, 2013), vehicle theft is still common. Police alone could not prevent or recover all the vehicles and the GPS based tracking system also fails at times due to lack of telephone network coverage, GPS signal distortion or lack of power source to the trackers in the vehicle (Jeremy, 2016). More importantly, the Nigeria Police Force does not have a system where all the missing vehicle complaints lodged in different local police stations across Nigeria could be lodged and accessed. This causes delay or failure of a recovered vehicle getting to the owner, since most of the stolen vehicles are recovered in another jurisdiction different from where the vehicle was stolen or snatched (Adedeji, 2016). Also, with no centralized information base, people have unknowingly bought stolen vehicles, and data of recovered or suspicious unattended vehicles cannot be searched either with the Vehicle Identification Number (VIN) or Chassis Number or with other details (Samguine, 2016).

Hence, there is need for a single database where all the stolen vehicle complaints in all the police stations across Nigeria can be managed and monitored. The general public as well should have access to such an information system so that they can actively participate in the recovery process. What is available, such as *Policevrp.com* (CP-Africa, 2011), is not free, is individualized and lacks the openness for community participation.

Therefore, inability of the existing systems or methods to totally prevent or recover all the missing vehicles show that there is still more work to be done and development of a system with different techniques and methods becomes imperative. Thus, the Online Vehicle Ownership and Theft Alert System (VOTAS) is meant to minimize if not totally eradicate the issue of vehicle theft. It is aimed at tackling delay in the recovered vehicles getting to their owners as it will serve as an information system for police and the vehicle owners. The system is designed to involve the general public in active participation by using the power of social media such as Facebook and Twitter as well as E-mail and Short Message (SMS) services similar to the android application by Arunthavanathan and Navod (2016). These channels are used to broadcast information about missing or recovered vehicles, since they are widely used today, most especially on mobile devices. This allows for real time information (as an alert) for timely recovery of the missing vehicles (Center for Parent Information and Resources, 2014). This project is useful for agencies as well as individuals who are interested or want to venture into missing vehicle recovery as a business.

The main objective of this work is to develop a web based system that is capable of providing vehicle ownership registration functionality to all legally-owned vehicles and provides alert features in case of vehicle theft on phones, emails, and social media accounts on the system, in order to incorporate community participation. This helps to spread the information, speed up the location of missing automobiles and prevent delays in the recovered vehicles getting to the real owners.

2. DESIGN OF THE SYSTEM

The system was designed to have the following functionalities:

1. vehicle ownership registration functionality to a vehicle owner
2. users (vehicle owners) can create and maintain profiles of their vehicles online
3. a query functionality where recovered or suspicious vehicles can be searched either with the Vehicle Identification Number/Chassis Number or other details; and people can check whether a vehicle to be bought is a stolen one or not
4. alert people about the stolen vehicle on the website when logged in and on common social media such as Facebook and Twitter as well as via e-mail and SMS once it is reported missing, found or recovered
5. and secure administrative functionalities.

The system (vehicle ownership and theft alert system) was conceptualized and designed to consist of three basic elements, namely:

- a) Application System to provide Graphical User Interface (GUI)
- b) Database for storing information
- c) Technology platform used to deliver the services

Use-case (Figure 1) and data flow diagrams (Figures 2 and 3) were used to model user interaction with the system processes.

The system was designed using three (3) tiers approach with the system application providing the GUI for the users as the first (1st) tier, which can be thought of as the front-end, Application server as the second (2nd) tier while Database management system (DBMS) serves as the third (3rd) tier which controls the back-end (Database) of the system.

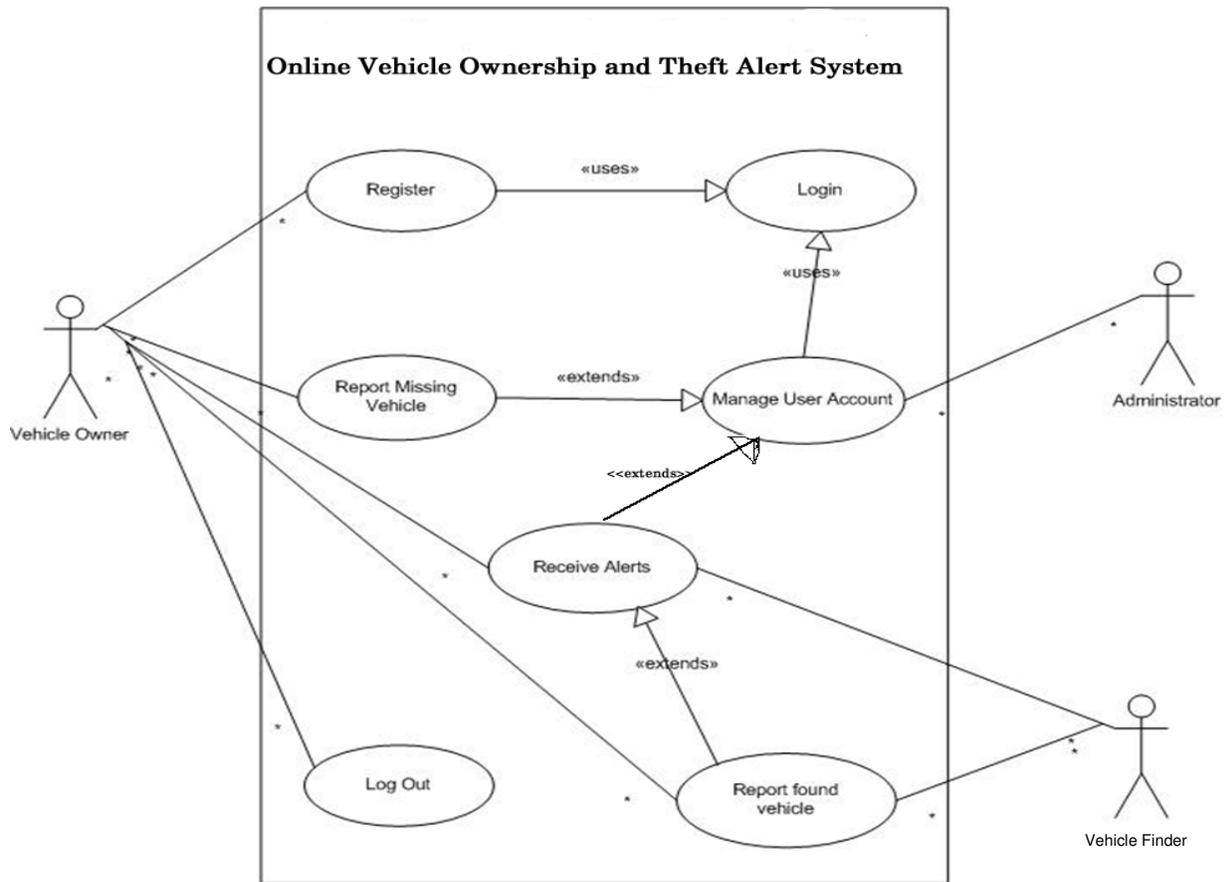


Figure 1: Use Case Diagram of the VOTAS system

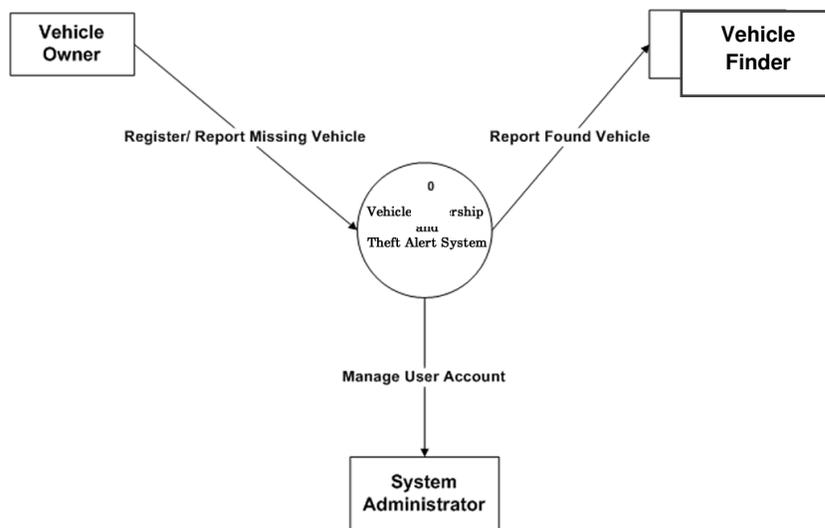


Figure 2: Context Diagram

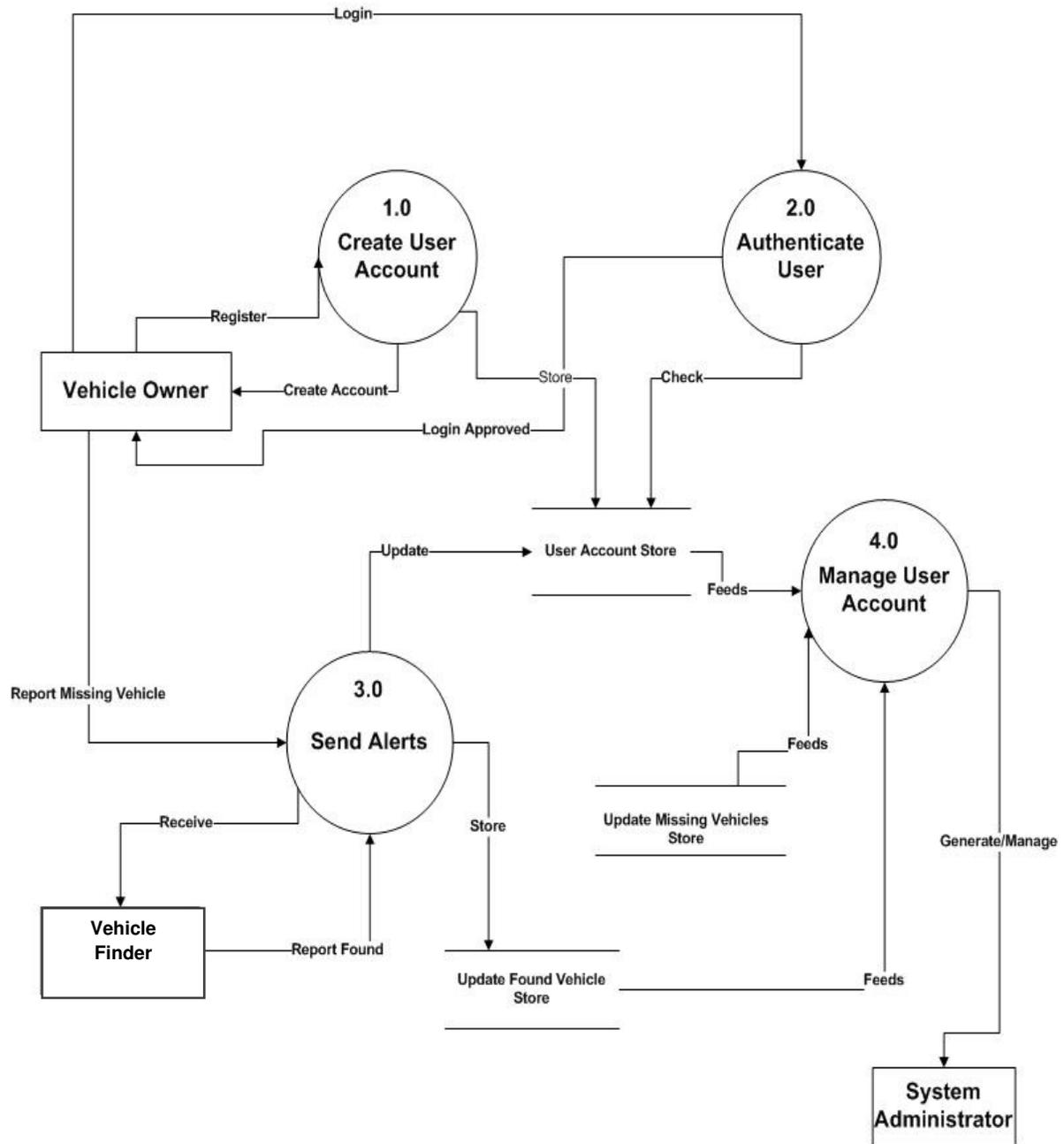


Figure 3: Level 0 diagram

3. IMPLEMENTATION

For the development of an interactive web based information system the following technologies were used:

HTML: Hypertext Markup Language (HTML) is client side markup language which the web understands. For this work an XHTML (Extensible Hypertext Markup Language) was used due to the fact that it is a clean, powerful, and reliable language used for programming websites. It improves some of the shortcomings of HTML especially on cell phones, PDAs, XML readers, and other new technologies that can access the Internet.

CSS: Cascading Style Sheets, fondly referred to as CSS, is a simple design language intended to simplify the process of making web pages presentable. CSS was used to control the color of the text, the style of fonts, the spacing between paragraphs, and to design the entire layout of the system (i.e. a table less website), specified the background images or colors, as well as a variety of other effects.

JavaScript: JavaScript is an interpreted language with a C like syntax. JavaScript is a lightweight scripting language designed to add interactivity to HTML pages. It is usually embedded directly into HTML pages and it is also an interpreted language (means that scripts execute without preliminary compilation). More importantly, JavaScript is used in millions of Web pages to add functionality, validate forms, detect browsers, create cookies, put dynamic text into an HTML pages and useful I the area of web analytics.

Wow Slider: This is a plugin technology in form of graphics that generates JQuery image slides which produce visual effects as animation to provide interactivity on the web.

PHP: stands for Hypertext Preprocessor. It is a popular high-level scripting language used by a range of organizations and developers. PHP provides a solid support for object-orientated programming, conditions, file handling, arithmetic, and more and it includes extensive support for a wide array of needs, such as cookies, forms, sessions including files, network sockets, e-mail, and more. Its database support covers not only MySQL but many others, including but not limited to PostgreSQL, Oracle, MS SQL, dBase, Sybase, and DB2. This flexible database support is useful if there is need to port the application to different databases.

SQL: Structured Query Language (SQL) is a standard relational querying language that provides a means to insert, update, and query information in the database. This querying functionality can be provided using a database software program called Database Management System (DBMS) such as MySQL, Microsoft SQL server, Postgre SQL, Dbase, Oracle, etc.

The implementation of the system was done using the following tools and techniques:

- 1) **WAMP Server** (Windows, Apache, MySQL and PHP): This an open source all in one package that provides the following features useful for designing web based application.
 - **Windows:** This is the Operating System which the application depends on
 - **Apache:** This serve as a server application that allows communication between the application program (user interface) and the database
 - **MySQL:** This is a relational DBMS that controls the collection, storage, manipulation and retrieval of data in the database. For the purpose of this PhpMyadmin feature was used to create the database, tables, relationships and other constraints on the data in the database.
 - **PHP:** this provides the support for web application to interact with the server using PHP as a programming language
- 2) **Adobe Dreamweaver:** This is a web development tool that provides environment to create web pages which embedded technologies such as HTML, CSS, PHP, etc.
- 3) **Adobe Fireworks:** Some of the graphical aspects (such as editing and cropping of images) of the design were done with the use of Fireworks which is one of the software applications from Adobe suits.

The developed system was setup and tested on a local server by typing the address of the website using the term "localhost/vehicle_ownership". Note that "localhost" signifies that a local server is being used while "vehicle_ownership" is the directory (folder) on which the website is stored. By default, this address will load the homepage (index page) of the application.

4. SYSTEM TESTING

The following key interfaces are presented based on the testing carried out on the front and back ends of the developed “Vehicle Ownership and Theft Alert System”. Unit and integration tests (Hughes, 2014) of the user pages and administrative pages were done.

4.1 Home page of the application

The home page of the system shows various menus of the application. It also shows login form for already existing users and link for new vehicle owner to quickly register. It also presents the Facebook and Twitter widgets of the application. The number of the menu depends on the role of the user.



Figure 4: Home page of The Application

4.2 About Us page

The About Us page shown in Figure 5 provides information about the objectives of the website and its features and use conditions.



Figure 5: About Us page

4.3 Create Account page

The Figure 6 shows Create Account Page where a vehicle owner as a user can create a quick account. The page shows form fields for Surname, Other name, Username, Password and Confirm Password. The account created here will be used to log into the account on subsequent visits.



Figure 6: Create Account Page

4.4 User Profile Registration page

The Figure 7 shows the User Registration Page. Once an account has been created, the system automatically links the user to this page where he/she will enter his/her profile. This is important in order to ensure that all important details of a vehicle owner are captured and made available when necessary. It consists of surname, other name, username (these fields will be automatically filled based on what was entered when the account was created). Others are contact address, phone number, email, occupation, city or town of residence, state, country (Nigeria or other), vehicle owner's picture for identification.



Figure 7: User Profile Registration Page

4.5 Vehicle Profile Registration page

The Figure 8 shows vehicle profile registration where details of the vehicle are provided. The message at the top of the form shows the serial number of the vehicle being registered by the user, because a user may have more than one vehicle. The form captures the username and vehicle serial number (which are loaded automatically from the user registration data table). Other data captured include vehicle make, model series, year manufactured, interior color, exterior color, engine number, chassis number, plate number, vehicle pictures (front and back views) and vehicle status (Missing or Not Missing).

Figure 8: Vehicle Profile Registration Page

4.6 Logged in User home page

Figure 9 shows the home page of a registered user when logged into his/her account. The page shows the picture of the logged in user and some other functionalities. The left menu shows the various actions available to the user, such as: Home, My Profile, My Vehicle Profile, Add More Vehicle, Forum, Report Vehicle Issues, Inbox, Report Recovered Vehicle and Logout links.

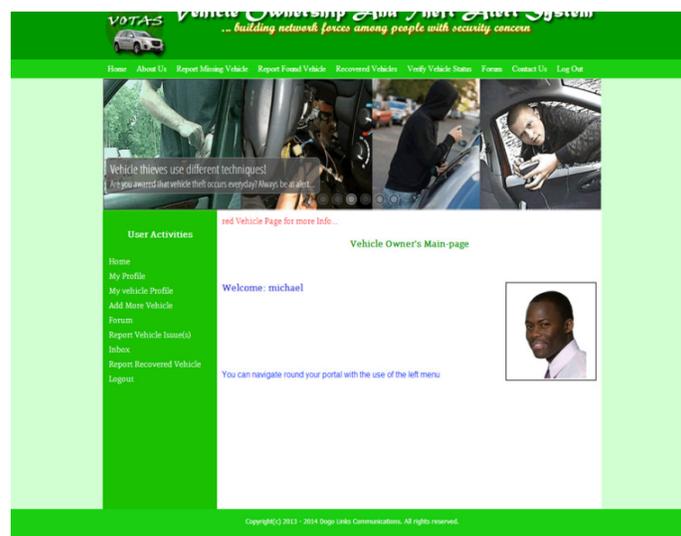


Figure 9: Logged in User Home Page

4.7 Administrator Login page

The Figure 10 shows the administrator Login Page. The login form shows the fields for admin username and password and a login button. Once these parameters are right, he/she will be directed to admin home page where user managements can be done. The login form is validated so that anybody can not just login into the account.



Figure 10: Administrator Login Page

4.8 Administrator home page

The main Administrator Home Page is shown in Figure 11. Various functionalities of an administrator are available through the links both in the top menu and the left menu. Some of the admin activities include Search Vehicle Owner, Update Owner's Profile, Update Vehicle Profile, Check Missing Vehicle Reports, Update Missing Vehicle, Found Vehicle Report, Recovered Vehicle Report, Contact Messages, Post Alert, Post Message, Forum, Report Recovered Vehicle and Logout of the system.



Figure 11: Administrator Home Page

4.9 Forum Home page

A discussion forum meant to build a community of vehicle owners where they can share important information about their vehicles and other related matters is included as shown in Figure 12. The forum consists of a link to a dedicated page where a new thread can be created. Also on the page are the latest and most popular threads that represent the recently added threads and the thread that is more popular which has more comment. On each of the thread appears the name of the person that posted the thread, the time, date, number of comments and the tag name(s) that can be used to search a thread.



Figure 12: Forum Home Page

4.10 Alerts

In order to ensure proper dissemination of information about vehicle theft and recovery, this application implemented different alert channels such as SMS, Email, Facebook and Twitter. These are done on “**Post Message**” page from the Admin side of the application from a link on the left side of the Administrator Home page (Figure 11). In addition, a scrolling text on the VOTAS website is also available. The scrolling text is provided as a means of alerting website visitors to priority information on vehicle theft and vehicle recovery. The Admin posts any alert for text scrolling by bringing up the “**Post Alert**” page available from the Post Alert link on the left side of the Administrator Home page (Figure 11).

SMS Alert uses an SMS Application Programming Interface (API) as a gateway to implement SMS alert. As soon as the system administrator triggers an alert, a message is sent to all the registered members on their phones via SMS. **Facebook Alert** uses a Facebook page called VOTAS where the system administrator can interact with Facebook users. Whoever Likes the page will automatically receive updates from the Admin. Facebook was integrated with the application via Facebook API that is located at the application’s home page (Figure 4). The Facebook icon shows the LIKE button with the number of followers that have Liked the page. A SHARE button is also provided for visitors to share news on the page. **Twitter Alert** works through the Twitter handle of the application which was integrated via the Twitter API and is located at the application’s home page (Figure 4). It shows the alerts (as tweets) and also the reactions from followers. **Email alert** works just like the SMS alert. As soon as Admin sends an alert message, the registered users that provided email addresses will receive the alert in their email box.

5. CONCLUSION

This work provides an affordable way of tracking vehicles through ownership to alert to recovery. The developed system’s effectiveness is made possible by community participation through the discussion forum and alert module included. Use of this system would address the problem of delay in returning recovered automobiles to their owners, as it will make reporting of missing, found and recovered vehicles easier and faster. It provides a platform where people can provide timely and adequate information with respect to vehicles they might have sighted somewhere, thus encouraging public participation in recovering a stolen vehicle.

6. RECOMMENDATIONS

Being an application aimed at addressing vehicle theft and serve as a catalyst for its recovery, it means that the application, VOTAS, will be a useful tool for the police, so adoption of the system by the Nigeria Police Force is recommended for their police website. The application is also recommended for government, agencies or any organization that is in the business of managing a fleet of vehicles and/or is into the recovery of stolen vehicles.

Generally, this system is recommended for its full adoption and implementation because it is an important tool that is capable of curbing vehicle theft and removing the delay and difficulties in getting recovered vehicles back to their owners while also preventing the purchase of a stolen vehicle and enhances collaboration among vehicle owners and society at large. For future enhancement, it is recommended that the system should be integrated with GPS capability for automatic location tracking of any stolen vehicle. Also, the system should be integrated with more social networks to increase awareness of people about the stolen vehicle. Finally, cloud server system should be implemented instead of centralized server system so as to allow it cope with ever growing users and solve bandwidth bottleneck as a result of increase in the number of registered users.

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