Vehicle Tracking Model for Efficient and Secured Information System for Law Enforcement Agents in Nigeria

Siman Emmanuel
Assistant Lecturer, Department of Computer Science, Federal University Nigeria
Odey Abinya John
Lecturer, Department of Computer Science, Federal University, Nigeria
Okwori Okpe Anthony
Assistant Lecturer, Department of Computer Science, Federal University, Nigeria

Abstract:
This paper discusses the relevance for efficient and secured information system for Nigerian's law enforcement agents using SMS technology. The necessary technologies used to develop the model of vehicle tracking system are discussed in other to help the Law Enforcement Agents particularly the Nigeria Police Force to recover and or search for stolen vehicles around the country with other law enforcement agencies. Also, related literatures were discussed and summarized to buttress the findings. Recommendations were proffered as the way forward.

Keywords: Vehicle, tracking, SMS Technology, mcorelib law enforcement agents, Nigeria

1. Introduction

A model of vehicles tracking system for Nigerian police force is an electronic network database application which enables the law enforcement agents to track vehicle theft using SMS technology. Law enforcement officers in the country can access the database for information or send information to the database by simple processing. The system keeps picture, and information data of drivers and vehicles. Access to the system allows the vehicle owner to send significant amounts of information which is process timely and for easy recovery of stolen vehicle.

Nigeria has a very verse tropical area whereby internet service cannot be easily access. The GSM mast is located mostly in the urban areas and a little in the rural areas separated by a wide tropical desert or forest. In most cases the GSM mast only provide audio and SMS services which makes it impossible to rely on web-based vehicle tracking system to track vehicle theft in the country.

The merging of GPS and satellite technology to track vehicle theft would have been the best options, which implies that all the vehicle must be imbedded with a microchip to enable the law enforcements agents monitor the movement and or location of the stolen vehicle for easy tracking. But, the ratio of new vehicles to old vehicles is 1:131 [1], on Nigeria road. The second hand used vehicles are from other countries like the USA, and Japan, due to the recession in the country. These vehicles are not the new or latest manufactured in the world and therefore, are not embedded with the vehicle tracking system microchip.

In this scenario, the use of SMS technology for timely and easy tracking of vehicle thief by the law enforcement agent in the country is inevitable.

The security of the Nigeria roads in the mid-1980 sreduces crime due to the application of satellite communications on tracking vehicle theft. There is an increasing research on the satellite communications technology in other to curb vehicle theft. However, this has been the subject of government reports and legislative mandates. Implementations has been sponsored by motor carrier industry for efficient management of different heavy vehicles and their Drivers [2].

1.1. Statistics of Motor Vehicle Thefts in Lagos, Nigeria

Statistics made available to THISDAY of 3rd August, 2012, showed that from January to July, 2012 more than 600 cars were stolen in Lagos state along. However, only 400 of the stolen cars were recovered. The statistics of cars recovered from January to July, 2012 is: January (49), February (41), March (84), April (75), May (67), June (102) and July (88), to talling 414. In 2007 and 2008, 907 and 669 cars were stolen only 321 and 282 cars recovered in 2007 and 2008 respectively. In 2011 [3].

2. Review of Related Literature

The Nigeria Police Force (NPF) was constitutional instituted by Section 194 of the 1979 constitution as the Nigeria national police to carry out her functional duties in the country. Police force are responsible for internal security in the country; their functions involves supports to custom, immigration, prison and to perform military task if needed both inside and outside the country, as the Nigeria Police Force continuous to grow in numbers base on Nigeria's budget [4].

The National Exchange for Vehicle and Driver Information System (NEVDIS) in Australia, is an electronic data interchange (EDI) based network computing application that gives access to different jurisdictions on license and vehicle information held by vehicle owners in their jurisdictions. NEVDIS contains sub-set of data from different jurisdictions and these jurisdictions can access timely data from NEVDIS which contains 90% of the general enquiries in Australia [5].

The NEVDIS application uses an Oracle database and is hosted on an IBM RS/6000. The NEVDIS key component is IBM's message management software called MQ Series. This system manages the queries. In central NEVDIS database, each of the jurisdictions must have a local system that acts as a translator between NEVDIS and in-house systems [5].

The Texas Recovery and Identification Program (TRIP) which is implemented by the Texas Department of Public Safety (DPS)in other to reduce theft in commercial and farm equipment. The individual and company registered with the state of Texas, in which the information to recover stolen equipment is used by Law enforcement agents [6].

A vehicle tracking system known as Automatic Vehicle Location (AVL) systems are computer based. Which works through geographic information system (GISs by the means of common set of locational coordinates in a trans it application and respond in real-time to passenger inquiries regarding vehicle location [7]. However, Automatic Vehicle Location (AVL), when combined with other technologies provide some benefits, especially, Advanced Traffic Information System (ATIS) and signal priority for public transit vehicles. Also, during transit it dispatches information from the centre [8].

After Theft Systems for Vehicle Recovery (ATSVR) is a Vehicle tracking systems under European Standards development, by use of communications technology in a real time to identify a stolen vehicle and its location and to present the information to a Systems Operating Centre (SOC) or to the police. The systems also update the data on stolen vehicle and the others not stolen. The systems may be a facility within fleet management or part of services called vehicle telematics [9].

In a case of vehicle theft, engine failure and crash reporting, an efficient automotive security system is implemented using an embedded system occupied with Global Positioning System (GPS) and Global System of Mobile (GSM). The vehicle owner communicates by sending Short Message Service (SMS) through GSM networks to determine their current status and locations using Google Earth. Using discrete Kalman filter enables the coordination and correction of GPS. The vehicle owner can turn off the vehicle whenever an intrudertries to fleet with the vehicle [10].

In a situation where almost, everybody owns a vehicle is certain that these vehicles are vulnerable to vehicle theft either parked or on the way in a location which is not secure The Global Positioning system (GPS) and Global system mobile communication (GSM) are used. A microcontroller is planted in the vehicle such that in case of vehicle theft the vehicle owner sends an SMS to the microcontroller which issue control signals to stop the engine motor and even lock the vehicle doors [11].

The problems of organised crime cause the Law enforcement agencies (LEAs) to constantly seek new technological information for retrieving and monitoring solutions that would improve their fight against organized crime. This involves satellite-based tracking sensors, the mobile monitoring stations and their associated communication channels for Law enforcement agencies to understand and designed a system, taking into account the monitoring and legality in their requirements [12].The model-checker UPPAA Land its modelling language gives additional features as bounded integer variables.

A microchip is embedded in a vehicle number plate integrated with vehicle tracking GPS, which its analysis and design is presented. The microchip contains the vehicles and the vehicle owners detail information which is used to track vehicle illegally on road, eliminate vehicle theft and detect uninsured and unlicensed vehicles. This allows road law enforcement agent to trace and follow the vehicle even when the law enforcement officer is at a mile distance[13].

Efficiency of GPS and GIS on monitoring and tracking of vehicle create a positive impact in government institution, department and also private sector which GPS utilization has been applied, bearing efficiency of gadgets, resulted on increment of the interest and focus towards information technology and multitasking utensils in different areas. GIS provides monitoring functions, while GPS presents clear, accurate and precise information on the position and navigation of monitored or timely tracking of vehicle [14].

The Federal and state governments, since 2002, continued in their quest to fund on research for new policing strategies in technology innovations with names like problem-oriented policing, community-oriented policing, predictive policing and intelligence-led policing [15].

This makes tracking of vehicle either by the owner or third party seamless because data can be collected and delivered to the base of operation. GLONASS (Global Orbiting Navigation Satellite System) technology are used for tracking vehicle. To view vehicle information on electronic maps via the specialized software in one or more operational base. The combination of electronic device installed in a vehicle with a computer software is Vehicle tracking system [16].

3. Methodology

The SMS technology used is the mcorelib, objs end SMS is a function that sends SMS to stations and retrieves information or messages from the Vehicle Server database.

During vehicle registration, a short code is given to vehicle owners to use to send their vehicle registration number in case of any theft. When a vehicle is stolen, the owner sends his vehicle registration number <Reg No Stolen> to a short code given to him, which in turn, send the vehicle details to all police stations around, including police on check points and on patrol. Within a minute, the information is circulated to all police check point around the theft location via SMS showing the description of the vehicle. When the vehicle is recovered, the law enforcement officer immediately sends the vehicle registration number <Reg No Recovered> to a short code given to them, which is received by other law enforcement officers to be informed and the tracking of the vehicle stop. This information is finally sent to the vehicle owner through the vehicle owner detail and vehicle information in the database. The new system uses a push and pulls system where a request is send to the server and a response is received from the server. The police database administrator only has access to the database.

4. Architecture of the Model

The architecture of the proposed system has three major players the user, the police, and the server. When a user sends an SMS to a short code <Reg No Stolen> in server via his phone on vehicle theft, a message (SMS) is broadcasted to all police stations within and around the theft location. When the car is recovered, the low enforcement too sends an SMS to a short code <Reg No Recovered> in server via his phone, a message (SMS) is broadcasted to all police stations sends an SMS to a short code <RegNo Stolen> in server via his phone on vehicle theft, a message (SMS) is broadcasted to all police stations within and around the theft location around the theft location This helps the police to track the vehicle easily.
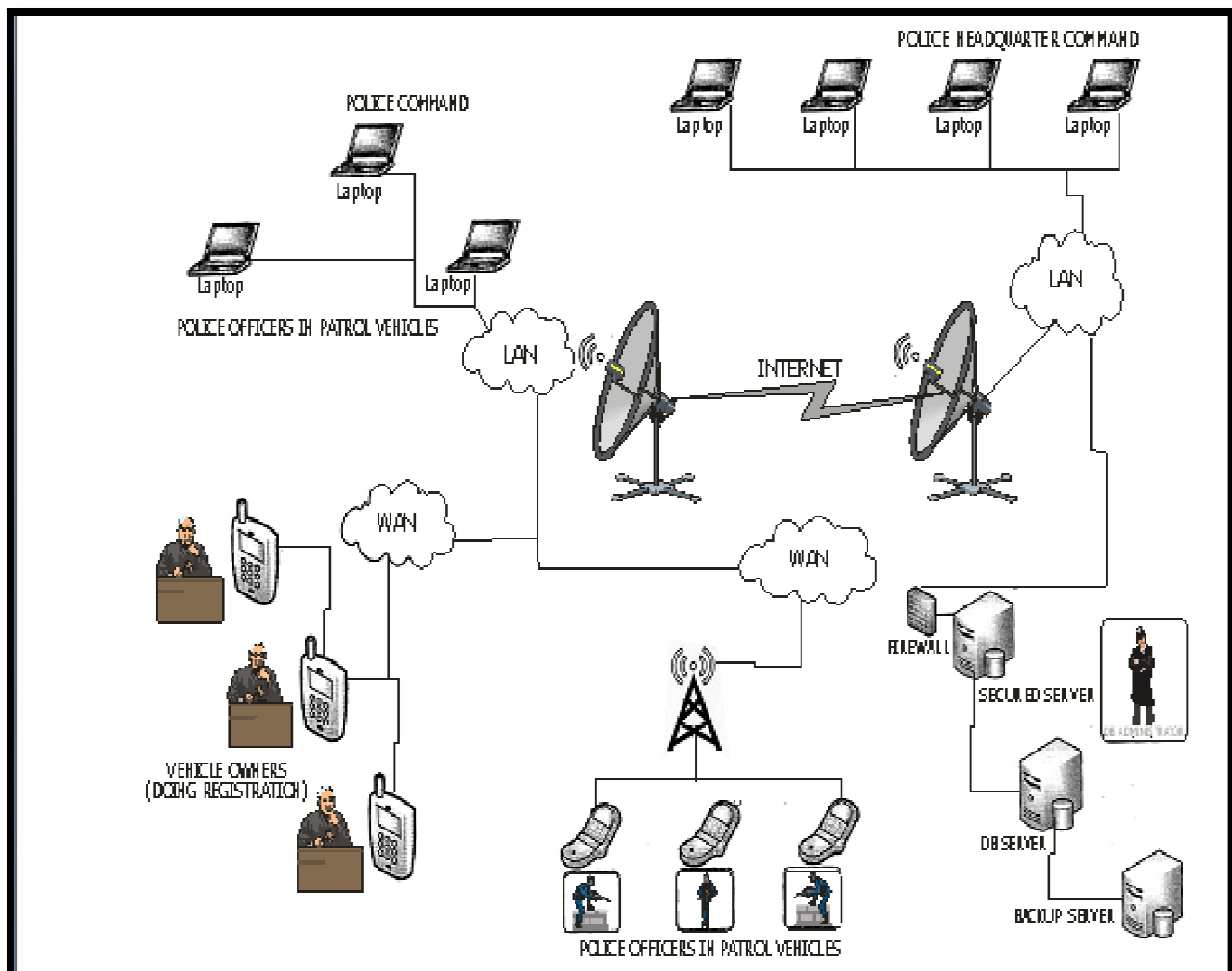

Figure 1: Architecture of the Model

4.1. Use Case Diagram

A use case diagram is a simple diagram that shows who (actors) using the system and what processes (actions) they will perform in the system.
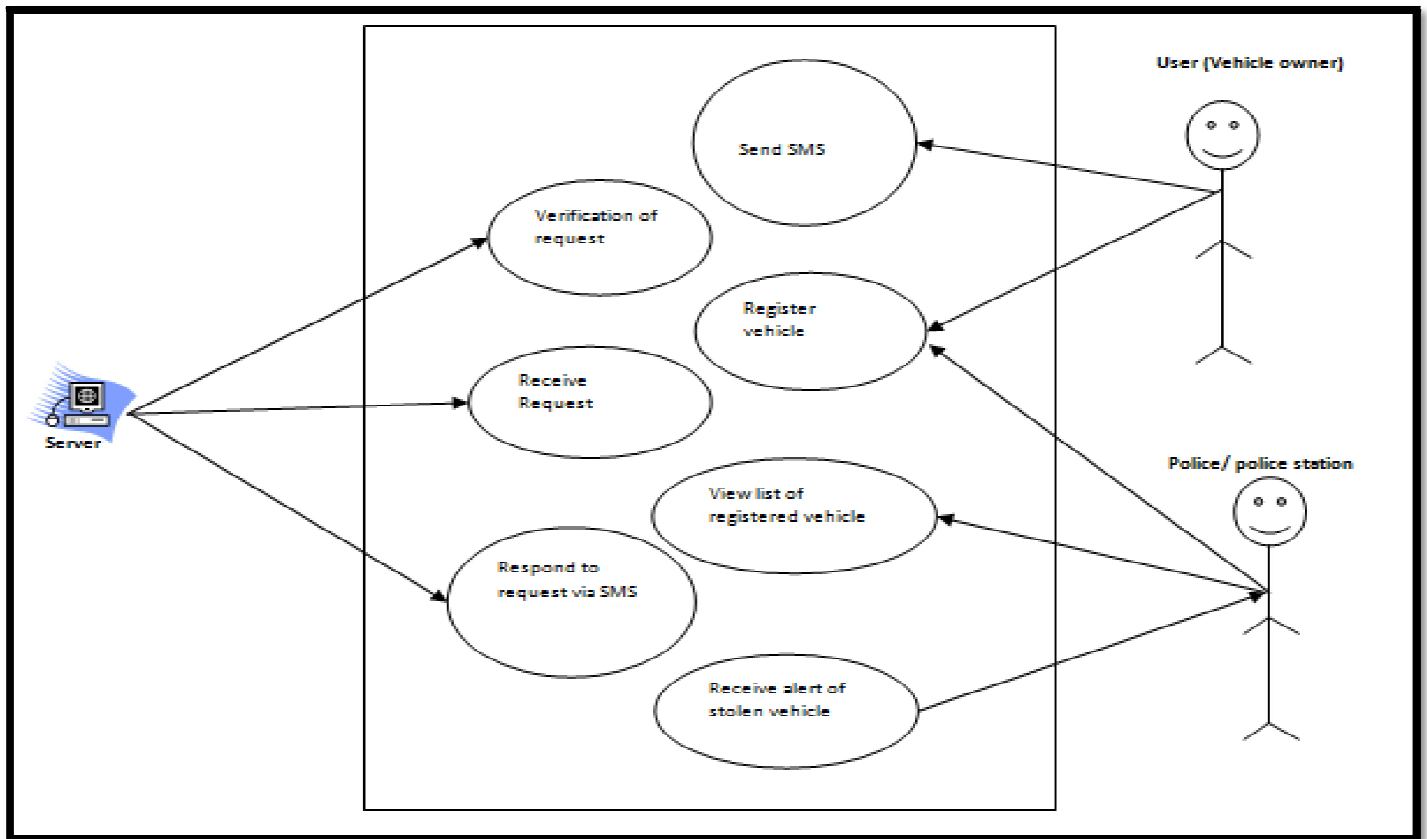
- Example

Figure 2: Use Case Diagram of the Model

5. Result and Discussion
       In this research, a model for tracking automobile theft in Nigeria was developed for efficient and secure integrated information system for law enforcement agents in Nigeria. Different segments of this work were summed up to perform a brief integration exercise that highlights the basic achievements of this study. The results of a stolen vehicle with a registration number <TR555AA> are discussed as follows:
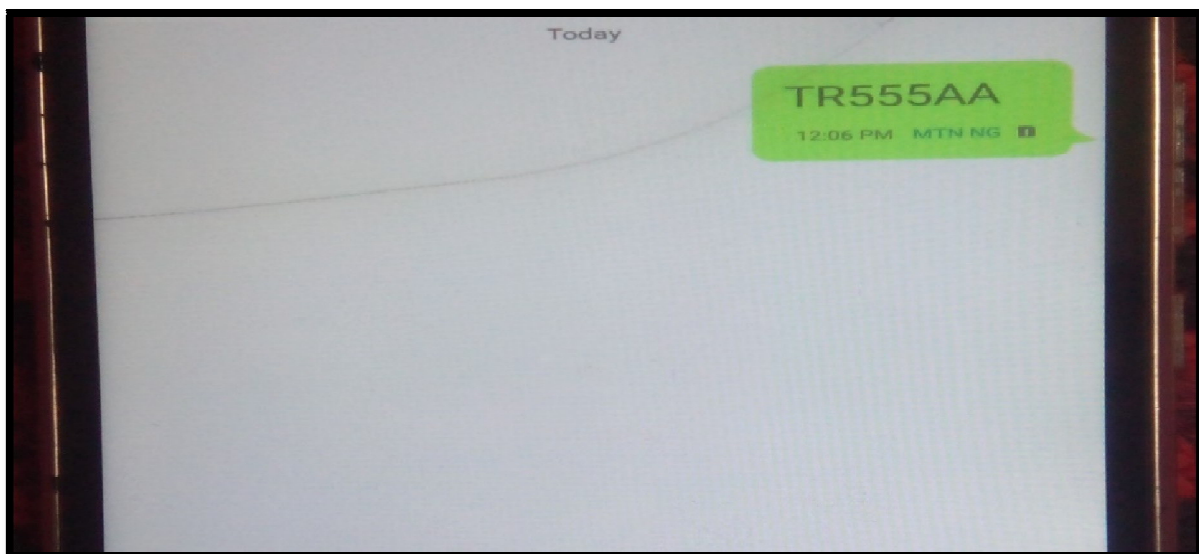

Figure 3: A Vehicle Owner Whose Vehicle Is Stolen Sends His Vehicle Registration
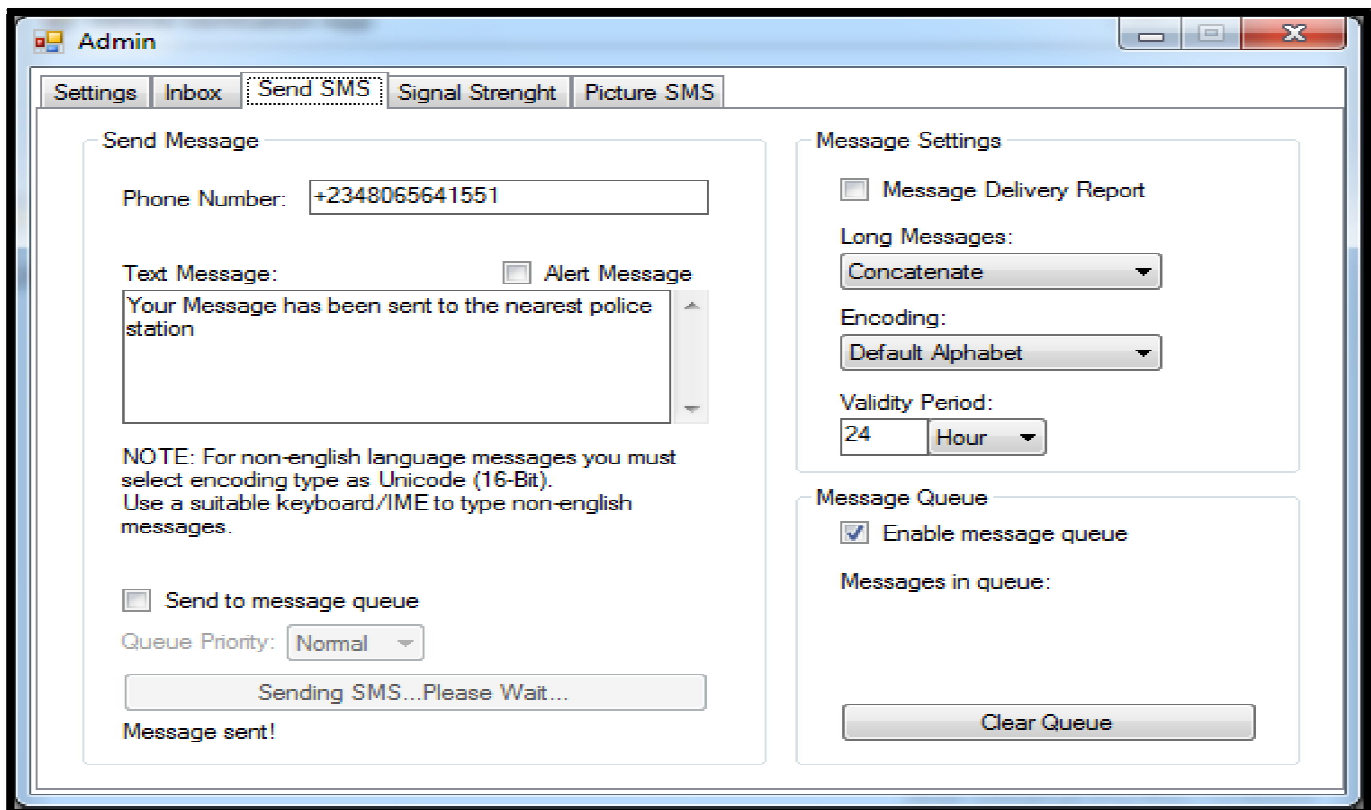*Number to a Shot Code in a Server Using a Mobile Phone*

Figure 4: SMS Configuration Panel from the Server Shows When the Server Received the Text Message and Automatically Reply to the GSM Number That Sent the Message That "The Message Is Sent to the Nearest Police Station"
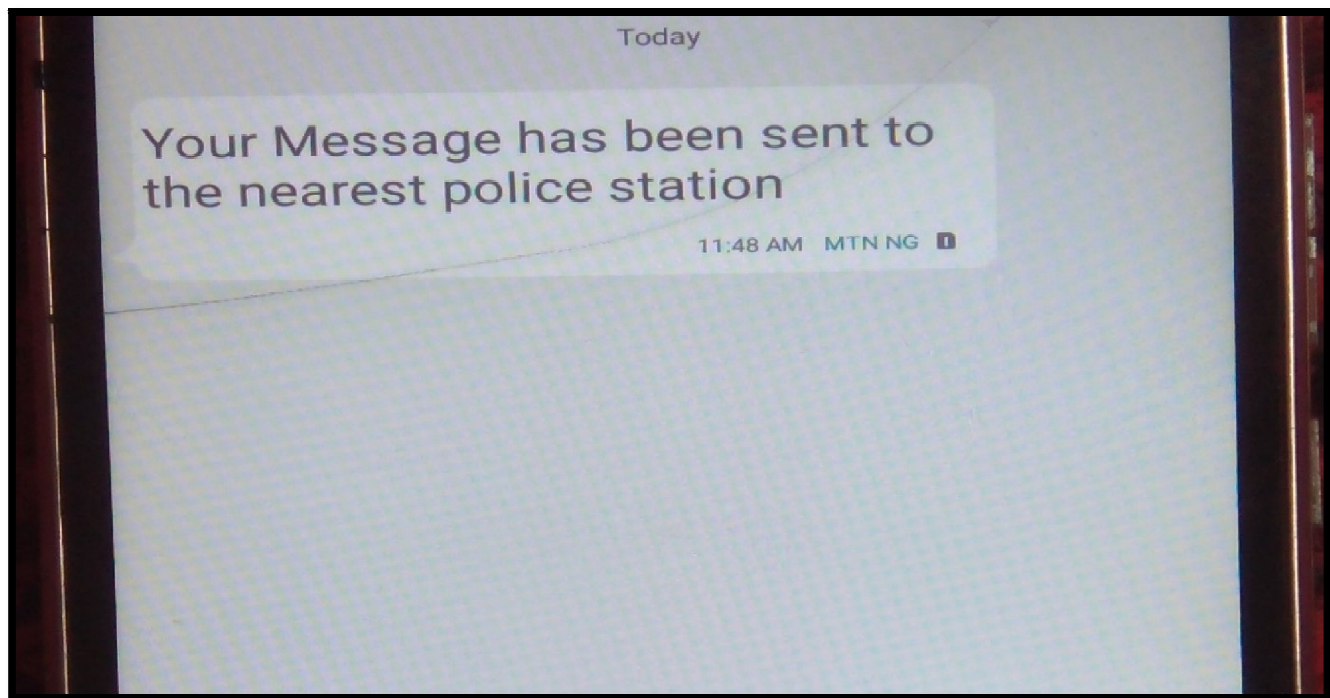

Figure 5: The Vehicle Owner Immediately Receives a Reply in His Mobile Phone from the Server That the Message Is Sent to the Nearest Police Station
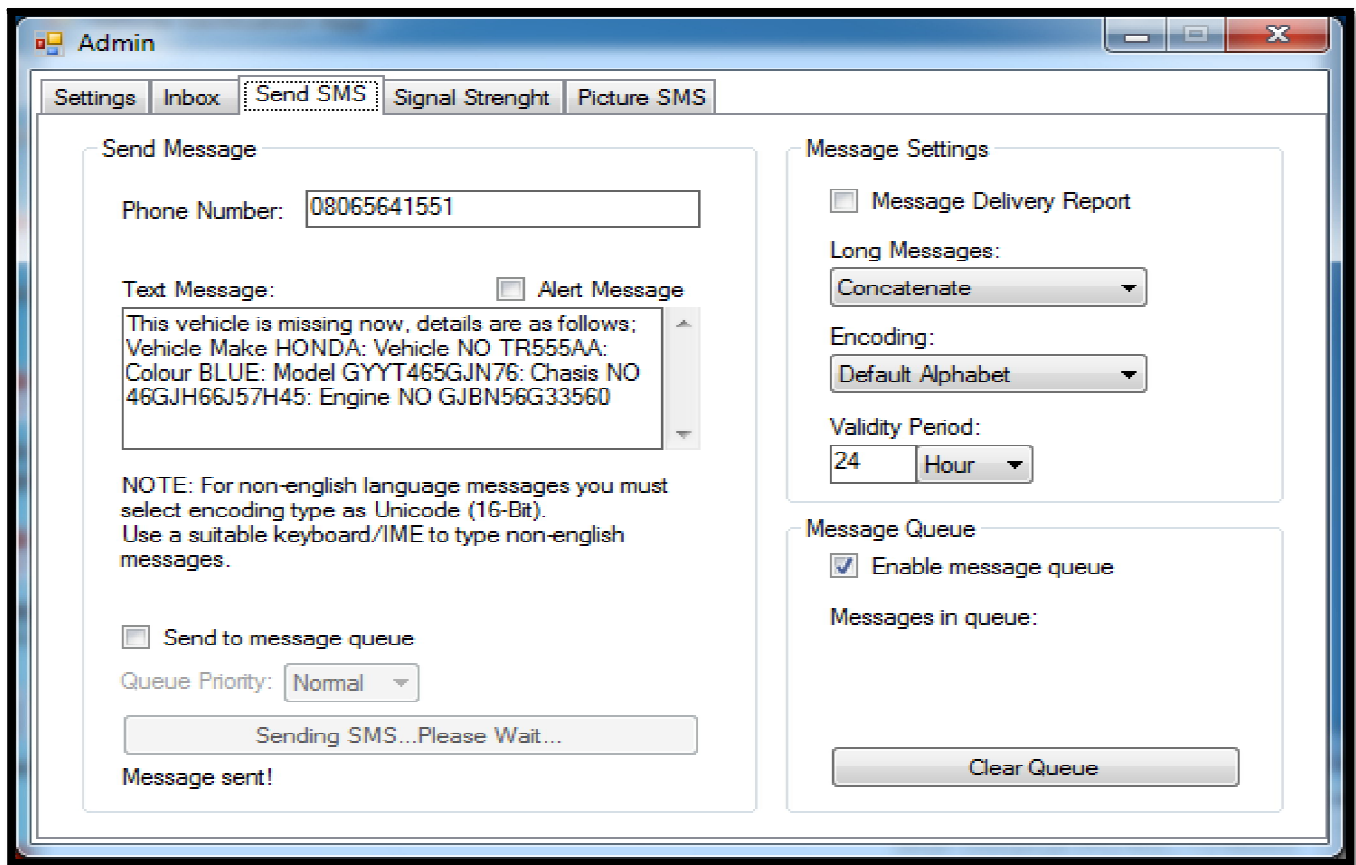
Figure 6: SMS Configuration Panel from the Server Processes the SMS Text Message Sent to the Server Automatically by Sorting the Vehicle Details from the Database and Automatically and Immediately Sends to the Nearest Police Stations around the Vehicle Theft Location
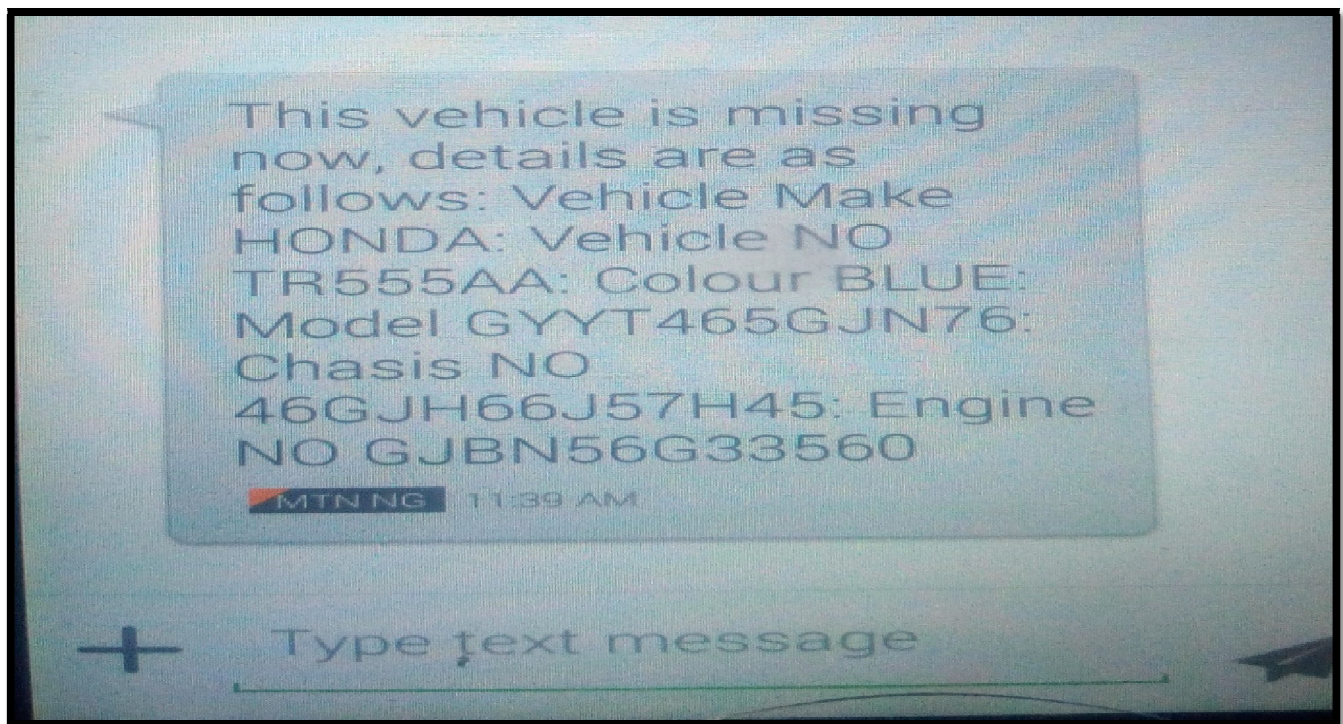

Figure 7: The Police Stations around the Vehicle Theft Location Receive the SMS Text Message Showing the Details of the Stolen Vehicle This Message in Turn Is Sent to All the Police Officers on Duty Includes: Officers on Patrol and Check Points

6. Conclusion

The advent of vehicle and its importance on Nigeria road is inevitable. At the same time the security of these vehicles on Nigeria road are efficient for easy and timely tracking of vehicle theft using SMS technology by the law enforcement agents. Therefore, the Nigerian police duties have an increased efficiency by managing vehicle information, reduce unsolved vehicle theft cases, help in decision making process and produce accurate and timely data for immediate responses and actions. The necessary technologies used to develop the model for Tracking Automobile Theft in Nigeria are discussed in order to help the Nigeria police force (NPF) with other law enforcement agents to recover and or search for stolen vehicles around the country. Also, related literatures were discussed and summarized to buttress the points given.
 If this model is incorporated by the law enforcement agents into its organization, where the system meets the cutting edge of this era technology the result will be immeasurable.

7. References

i. "Nairametrics", No 16 Irewole Street, by Opebi Link Road beside Emzor Building, Ikeja, Lagos State, © Copyright 2017 – Nairametrics, Retrieved 18th November, 2017 from <https://nairametrics.com/report-there-are-14-million-cars-on-nigerian-roads/>

ii. J. Bentley, "Software Testing Fundamentals—Concepts, Roles, and Terminology", Corporate Data Management and Governance, Wachovia Bank 201 S. College Street, NC-1025 Charlotte NC 28210, p. 8. Retrieved 5th September 2017 from <http://www2 .sas.com/proceedings /sugi30/141-30.pdf>

iii. C. Ezeobi, "In Lagos, 600 Cars Snatched in Seven Months", in This day newspaper, 3 Aug 2012, Retrieved 7th September 2017 from <http://www.thisdaylive.com/articles/in-lagos-600-cars-snatched-in-seven-months/121453/2015>

iv. "Nigeria police force", Wikipedia 2007, the free encyclopedia, [Accessed 28 May 2015] Available at: <en.wikipedia.org/wiki/Nigeria_ Police_ Force>

v. G. Forbes, "National Exchange of Vehicle and Driver Information System (NEVDIS)", Internet, 12 Dec, 2011;

vi. DPS, "Texas Recovery and Identification Program (TRIP)", Site User Manual Version 1.2,: https://records.txdps.state.tx.us/dpswebsite/Trip/Documents/trip.pdf [Accessed April 20, 2014].

vii. L. Watson, Communicating with Persons with Disabilities in a Multimodal Transit Environment a Synthesis of Transit Practice, Washington D.C: National Academy Press, 2001, pp.8-26.

viii. F. Zhao and L. David Shen "Planning and Implementation of Automatic Vehicle Location Systems for Public Transit", Reproduced by: U.S Department of Commerce NTIS, June, 1997, p. 11-91. Springfield, Virginia 22161.

ix. M. Gardner, R. Hartley "Stolen Vehicle Tracking ACPO and Home Office Guidance to Companies on Police Policy", Home Office Police Scientific Development Branch Sandridge, St Albans Hertfordshire AL4 9HQ United Kingdom, 2002, p. 10. Publication No 14/02. Retrieved 7th September 2017 from <http://www.securedbydesign.com/pdfs/stolen vehicle book.pdf>.

x. N. Montaser, A. Mohammad, and S. Al-Kheder"Intelligent Anti-Theft and Tracking System for Automobiles" International Journal of Machine Learning and Computing, Vol. 2, No. 1, February 2012. P.1-5. Retrieved 7th September 2017 from <http://www.ijmlc.org/papers/94-T043.pdf >

xi. R.Ramani, S.Valarmathy,N.Suthanthira, S.Selvaraju, M.Thiruppathi, R.Thangam, "Vehicle Tracking and Locking System Based on GSM and GPS" ,Published Online, August 2013 in MECS (http://www.mecs- press.org/) DOI:10.5815/ijisa.2013.09.10; p.1-8. Retrieved 13th August 2017 from <http://www.mecs-press.org/ijisa/ijisa-v5-n9/IJISA-V5-N9-10.pdf>

xii. Rajamäki, Jyri, "Studies of satellite-based tracking systems for improving law enforcement: Comprising investigation data, digital evidence and monitoring of legality", Jyväskylä: University of Jyväskylä, 2014, 166 p. (+included articles) (Jyväskylä Studies in Computing. Retrieved 7th September 2017 from <https://jyx.jyu.fi/dspace/bitstream/handle/ 123456789/ 44087 /978-951-39-5789-6_vaitos06092014.pdf?sequence=1>

xiii. B. K. Ayeni, S. O. Yisah," Modelling and Analysis of Microchipped Equipped Number Plate for Car Tracking System Using", 'UPPAAL 'British Journal of Mathematics & Computer Science 12(6): 1-11, 2016, Article no.BJMCS.19957, p. 4-5

xiv. ISSN: 2231-0851, Science Do Main international. Retrieved 2nd September 2017 from <www.sciencedomain.org>

xv. A. Qekaj-Thaqi," Integration of GIS & GPS Systems on Vehicle Monitoring" ,Copyright © 2015, Proceeding of the 7th International Conference on Information and communication Technologies in Agriculture, Food and Environment (HAICTA 2015), Kavala, Greece, p 49-50, September, 2015. Retrieved 12th September 2017 from <http://ceur-ws.org/Vol-1498/HAICTA_2015_paper6.pdf>

xvi. S. Alzou'bi, Dr. H. Alshibly, Dr. M. Al-Ma'aitah, "Artificial Intelligence in Law Enforcement", A Review, Al-Balqa' Applied University, International Journal of Advanced Information Technology (IJAIT) Vol. 4, No. 4, August 2014. Retrieved 12th September 2017 from <https://jyx.jyu.fi/dspace/bitstream/handle/123456789/44087/978-951-39-5789-6_vaitos06092014.pdf?sequence=1>