

A Web-Based Road Traffic Offenders Information Management System for Federal Road Safety Corps in Ebonyi State, Nigeria

Nwenyim Onyebuchi^{1*}; Agbom Jacinta Ndidi²; Ezeano Nnaemeka Prince³

¹Department of Computer Science, David Umahi Federal University of Health Sciences, P.M.B 211, Uburu, Ebonyi State, Nigeria

²Department of Science Laboratory Technology, Federal College of Agriculture Ishiagu, Ebonyi State,

³Department of Computer Science, Federal polytechnic Ngodo, Isuochi, Abia state

Corresponding Author: Nwenyim Onyebuchi^{1*}

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Abstract: Managing road traffic offence information isn't about paperwork. It's key for catching offenders, enforcing penalties, organizing evidence, and making decisions about road safety. This project examined current practices and identified gaps: no offender photos, scattered records, limited access to information, and a lack of a structured way to present offences and penalties as evidence. To fix these issues, the researcher built a system. It uses a layered structure: a user interface, a PHP backend, and a MySQL database, running on Apache/WAMP. The database holds personal details, vehicle info, offences, enforcement officials, dates, and images. The system includes secure login, offender registration, searching, past-record checks, user settings, and reporting. They ran unit and system tests, tried out test data, and did a small beta run. These tests showed the basics work: logging in, searching for offenders, viewing past cases, and adding new ones. So, this prototype proves you can centralize road traffic offence management. Still, the system hasn't been tested at real-world scale, and questions around security, ease of use, or its impact on reducing crashes are unanswered. Before rolling this out officially or using it as evidence, it needs solid testing in the field.

Keywords: Centralized Database, Federal Road Safety Corps, Information Management System, Offender Identification, Road Safety, Road Traffic Offences, Web-Based Application.

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I. INTRODUCTION

➤ Background of the Study

In any given society, laws are made for the peaceful co-existence of the citizenry. Road traffic laws are very pertinent for drivers/road users to practice and adhere to. Rules and regulations are made in order to curb the excesses of our willful, destructive nature in all human endeavors. Laws are mostly codified, and punishments are attached to them as a warning to other cadres of society or intending offenders. Rules and regulations are very pertinent in all facets of human endeavors, ranging from how we choose to live to how others should choose to accept our way of living. All human endeavors require that people enjoy their rights regarding access to public infrastructure and facilities. Law enforcement agents all over the world are tasked with this responsibility and work diligently to maintain law and order. One of the public infrastructures is roads, which facilitate automobile transport. Although everyone is entitled to use the

roads, they should not encroach on the rights of others. However, sometimes road users do not do this, thus inviting the attention of law enforcers (Mubarak et al, 2013).

Traffic offences are violations of traffic rules and regulations such as speed offences, driving under the influence of alcohol or other drugs, driving with defective and worn-out tyres or no spare tyre, light/sign violation, and violation of stop signs. Stopping for a stop sign infraction requires drivers to come to a complete stop. There is no provision for reversing or slowing down. They should bring their vehicles to a halt at the stop line or before a marked crosswalk or before the intersection (Mubarak et al, 2013).

Consequently, Nigerians and their government are concerned with the constant violation of these rules and regulations, resulting in increased road crashes and the inevitable damage to lives and property. What is worrying is that the government in Nigeria is recording an increasing rate

of deaths of citizens due to road traffic accidents per population, which shows that despite the numerous interventions over the years to address this issue, the situation is not improving. This goes to show that there is still a lot to be done to reduce these deaths. Thus, this research is aimed at reviewing the existing road safety measures in Nigeria to uncover their shortcomings, inadequacies, and limitations in managing the road traffic problem in the country (Oyeyemi et al, 2003).

Nigeria was among the top countries in Africa with the highest road networks in 2011. The country's population density in urban and rural areas is 51.1% and 48.3%, respectively, which implies a population-to-road ratio of 860 persons per square kilometer, with extreme traffic congestion in most cities in Nigeria contributing to the high rate of road traffic offences (FRSC, 2012).

In Nigeria, transportation is one of the major human activities, which makes use of roads as the easiest means of transportation for both goods and passengers to promote trading within the country and to neighboring countries. Despite the benefits of road transportation in Nigeria, it has had its challenges as a result of traffic management problems, resulting in increased road accidents. Road accidents caused by reckless driving, speeding, and other related offences have resulted in the deaths of many people and the destruction of property, causing great challenges in Nigeria.

The deaths of productive members of society are very challenging because, apart from the loss of a family man/widow, it leads to family insecurity with lasting effects on the children and the community at large. The poor traffic offence information management in Nigeria has reached the stage of despair and frustration, both in the civil and formal societies. Many developed and developing countries have made tremendous efforts to reduce road traffic offences by adopting improved traffic information management using information and communication technology. However, Nigeria is still challenged with traffic management problems. The global trends of road transportation are an indication that an efficient and effective transportation management system relies greatly on the use of information and communication technology.

There is a need for Nigeria to invest more in information technology to manage traffic offences and the resulting effects of these offences, which include road accidents. Road safety is a global concern due to its enormous impact on public health, safety, and well-being. Moreover, it promotes effective road traffic management. Adoption of information and communication technology in the Web-based Federal Road Safety Corps Mobile Offenders System will enhance the attainment of the much-needed reduction of road traffic offences and accidents in Nigeria (Fourie et al., 2009).

The present work suggests ways in which road safety services could be improved using web-based technology and makes recommendations for further improvements in road traffic management.

➤ *Statement of the Problem*

The manner in which drivers use the roads should be a matter of great concern to us all. Motorists take advantage of wrong lanes and misinterpret rules and regulations relating to other road users, causing hindrance in the use of traffic and sometimes even leading to congestion and accidents on our roads. This has resulted in a large number of road traffic accidents on our roads, especially in the developed towns, which has resulted from poor management of the roads. An improved computerized Web-Based Federal Road Safety Corps Mobile Offenders System is the basis and the principles upon which Information management in the mobile offender system will be carried out.

Due to the huge development in information technology, there is a need for all sectors of the economy to comply with information technology. The road traffic offence information sector cannot be an exception to this because, due to technological advancement, the method of collecting, processing, storing, retrieving, and disseminating information for the planning, controlling, and decision-making purposes for road traffic offences is not keeping pace with time. There is a need to review the existing system of managing road traffic offence information so as to allow room for road traffic offences. The problems which prompted this study are highlighted as follows:

- There is no room for pictorial identification of offenders. Hence, the wrong person could be accused.
- The system of managing road traffic offence information is decentralized, leading to difficulty in accessing the road traffic offence information database and manipulation of the database.
- There is no pictorial representation of the offence committed and the penalty of the offence as evidence to aid prosecution. Hence, the offenders see the fault as being compelled.

➤ *Aim and Objectives of the Study*

This project aims to develop a web-based Federal Road Safety Corps Mobile Offenders System that enables authorized personnel to access and retrieve information on habitual traffic offenders using a personal computer.

➤ *The Specific Objectives Were to:*

- Develop a web-based system through which authorized personnel can search for habitual traffic offenders using a personal computer;
- Reduce errors in offender identification by incorporating pictorial identification into offender records;
- Develop a centralized road traffic offender database for easier access to relevant information;
- Provide an interactive user interface with straightforward navigation; and
- Support direct access to specific offender and offence information required for enforcement and reporting.

➤ *Significance of the Study*

- The study will add value to the Federal Road Safety Commission and other organizations handling traffic offence management and control:
- The proposed model is expected to contribute an excellent way of tracking down offenders and providing forensic evidence for prosecution.
- It is expected that the model will promote transparency and accountability, leading to an enhancement in road safety in carrying out their mandate.
- It also helps to highlight the best and most efficient way of tracking road traffic offenders, which will ultimately reduce the road traffic accident rate. Moreover,
- It will also help eliminate paperwork for records or tracking information of offenders, which involves passing of information from one section to another within the traffic department, since all information will be stored in the database and retrieval of information will be done easily and directly.

➤ *Scope of the Study*

The scope of this project work is narrowed down to the Web-Based Federal Road Safety Corps Mobile Offenders System. It also involves the development of a database programme to aid storage and retrieval of traffic offenders' data/information in the offence section of FRSC Ebonyi State.

II. LITERATURE REVIEW

Data and information provided by the United Nations on Road Safety indicate that approximately 1.3 million people in the world population lose their lives in road accidents yearly, whereas 20 to 50 million of the world population are injured in road accidents, with most of the cases occurring in underdeveloped countries worldwide. Statistics show that less-developed countries have 32% of the world's vehicles, while they record 75% of global fatalities on the roads (www.nigerianmonitor.com).

Information and Communication Technology in road traffic safety management is used for data collection and storage, processing, and analyzing electronic data, including accident location records and weather conditions (O'Brien, 2001).

The use of Information and Communication Technology in road traffic safety management ensures safe transportation by facilitating effective distribution of traffic data, easy handling of road equipment, improved traffic signs/alerts, efficient road accident response mechanisms, and effective management information systems that support monitoring and forecasting of road conditions and traffic trends. Agencies cannot monitor, manage, or allocate resources without information. The road safety agencies require such data and information to determine whether they are performing efficiently and providing value for money. A management information system (MIS) in the road sector is a set of processes and procedures used by an organization to support the production of information and data to aid in

planning, programming, and implementation of road maintenance and construction. It comprises standardized practices and formalized procedures that generate and evaluate other processes that promote the advancement of highway maintenance, construction, and traffic management functions. It involves establishing the needs of road maintenance and construction in relation to their traffic and load potential. This system can provide information on works' programmed levels based on the road's physical and economic performance, and management needs. The management information system contains a set of policies that provide guidelines when making decisions in various aspects of road traffic management that are mostly controlled by any of the agencies. Information and Communication Technology (ICT) plays a significant role in promoting road traffic safety management in developed and developing countries through proper handling and management of traffic offenses.

For instance, the author witnessed firsthand that in Bangalore, the metropolitan police reported that traffic offense cases dropped from 1.4 million in 2007 before introducing technology to 3.3 million by 2010. However, the fatal crashes recorded decreased from 957 in 2007 to 816 in 2010, while personal injury crashes also dropped from 6,591 to 5,343 with acceptable compliance in managing traffic offenses (Bennett & Coleman, 2011).

United Nations Agency and International Telecommunication Union's (ITU) ICT and transport initiatives were launched to foster sustainable development and promote Intelligent Transportation Systems (ITS).

Intelligent Transportation Systems use Information and Communication Technologies to improve road traffic safety and efficiency. Amongst other Intelligent Transportation Systems, the Driver Assistance System (DAS) is used in the transportation sector to promote road safety. It uses a number of electronic components embedded in a vehicle to assist or improve driver capabilities and promote traffic efficiency in the driver's task of driving. For example, a vehicle with DAS has a Global Positioning System that uses satellites to give updated traffic information. Night-vision and lane change assistance, Drowsiness and blind spot detection, and a collision avoidance system that uses in-car radars can be experienced with the use of DAS. Speed cameras can be used to control the driver from over-speeding. An optical device consisting of a lens or something similar will be used to check out precisely the speed of the vehicle and is connected to the computer to identify the vehicle's registration number. Roadworthiness of vehicles can be examined using computer software. For example, to examine seat belts and the brake system. A certain application is used to identify accurately if the information is in line with the rules and regulations of the country. Digital photographs or cameras and Laser scanners can be used to detect potholes, cracks, and faulty bridges when conducting road safety inspections. It has been established that Intelligent Transportation Systems cut down the number of road crashes that are caused by humans by 95%. It uses ICT gadgets to prevent crashes or notify the driver of the crash ahead.

The author reports that the use of ICT gadgets in smart cars is designed to provide safe speed, enhanced vision while driving, pedestrian protection, lane-keeping support, driver monitoring, and intersection safety. According to the author, two of the most crucial functions of intelligent car safety systems are to prevent crashes while changing lanes or pulling out, and to provide vehicles with an automatic emergency call. The eCall is an information and communication technology gadget that is fitted in all vehicles and, in case of a road crash, it will automatically call 112 and notify the relevant authorities by transmitting information on airbag deployment and impact, and the GPS location of the vehicle. eCall goes further to mention that it is an evolution of E112. It has been reported that, according to some estimates, eCall can cut down emergency response time by 40% in urban areas and 50% in rural areas. Emergency call technology can be connected to a safety website to offer extended coverage beyond the reach of cellular networks. The emergency call system can be set to be activated by both passengers in the vehicle or automatically triggered by sensors inside and outside the vehicle. When the emergency call is activated, it connects the vehicle's passengers to the nearest Public Safety Answering Point or PSAP. Emergency call offers faster help and increases the survival chances of the vehicle's passengers during an emergency. Speed Alert technology reminds drivers when they exceed a preset speed limit that is suitable for the vehicle they are driving or a specific speed limit that the driver sets for the vehicle. At this point, the driver reduces speed after being alerted about the illegal speed, and this minimizes road accidents because the vehicle's speed is controlled. Automated vehicles are the latest in road traffic systems today. These are computerized vehicles that require less human input due to the presence of sensors in them.

Intelligent Traffic Systems utilize ICTs in regulating traffic, driving, and other traffic-related activities. ITS technologies can be integrated into vehicles or built outside the vehicle to interact with road infrastructure hardware. Warning and control systems are another road safety technology that utilizes ITS.

Intelligent Transport Systems are different from the ones mentioned above; car navigation systems, variable message signs, traffic light control systems, automatic number plate recognition systems, and speed cameras are monitoring systems. One example of a monitoring system is Closed-Circuit Television, or CCTV, and other enhanced systems that use a live feed from monitors and other sources, like parking guidance information systems. Other Intelligent Transport Technologies include:

➤ *Internet Protocol-based CCTV and Surveillance Cameras:*

An Internet Protocol camera, or IP camera, is a type of digital video camera commonly used for surveillance, and unlike analog closed-circuit television (CCTV) cameras, this particular type of camera can transmit and receive data over a computer network and the Internet. While many such cameras are used as webcams, IP cameras or "netcams" typically refer to surveillance cameras.

➤ *Speed Sensors:*

These are bidirectional telecommunication devices that track the relative distance of vehicles and cross-relate with the permissible speed of the vehicles. In advanced applications, any excess speed beyond the permissible speed triggers a zoom-in from the next camera, and the vehicle is immediately searched for, while interactive video capturing/recording is simultaneously activated.

➤ *Web Portals:*

Web portals are also referred to as the web. The web consists of a huge amount of information such as graphics, images, video clips, text, animation, interactive applications, and databases available on the Internet that can be accessed through web browsers and other software using interconnected networks. Road safety web portals aid efficient dissemination of interactive information, which could provide authorities with vital information on actual on-ground traffic situations, including hot spots, hospitals, and emergency services accessible in the locality.

➤ *Automatic Road Enforcement System:*

Automatic speed enforcement (ASE) comprises technological recording devices that are triggered upon traffic violation, thus capturing license plate information of the offending vehicle, which aids quick identification of the driver for sanctioning purposes. This technology works in a similar manner to mobile police patrols. Automatic road enforcement is composed of a vehicle monitoring unit and camera system and is used to monitor and record violations of maximum speed limits, or other roadway usage regulations by motorists, and to identify and record the license plate of the offending vehicle, for issue of a traffic fine. This technology has been in use globally in the Western world, America, and parts of Europe. The offender is tracked down, and his or her particulars are mailed to the appropriate address.

• *Uses of Automatic Road Enforcement are:*

- ✓ Speed cameras: Used to enforce speed limits for motorised and pedestrian traffic. These work by using radar to measure the speed of a vehicle or using electromagnetic induction sensors embedded in the road surface.
- ✓ Red light cameras: Used to enforce traffic signals for cars or pedestrians. These cameras are typically triggered when a vehicle enters an intersection after the traffic light has turned red.
- ✓ Bus Lane (BRT) cameras: These are used to record illegal use of Bus Lanes by motorists. In some jurisdictions, bus lanes are also available for taxis and car-pooling vehicles.

➤ *Point-to-Point Connectivity:*

This enables road safety officers to communicate effectively using high-speed radio communication channels to relay information from one point to another (vehicle-to-vehicle communication). The communication channels are designated by the appropriate Telecommunications regulatory bodies, e.g., Nigeria Communications

Commission (NCC), and are used for one-to-one communication between different mobile devices by users.

➤ *Wireless Networks (Wifi and WiMAX):*

Handheld devices are portable electronic devices that use private wireless networks and existing cellular networks to provide one-touch access to traffic information, weather, and other relevant information. The effectiveness of these devices is determined by the traffic information uploaded onto the system, which is continuously updated and accessible to web applications through smartphones and other mobile devices such as iPads, Androids, Blackberries, and other related gadgets. The wireless network standards mostly used are: Wireless Fidelity (Wifi) and Worldwide Interoperability for Microwave Access (WiMAX), with their various platforms (802.11b, 802.11n, 802.11ac, 802.16e, etc).

➤ *Car Navigation Systems, Driver Support Systems*

Car navigation systems are Driver support systems that warn drivers based on information received from a central information database or other sources of information about imminent danger that may cause a critical situation if not avoided. The warnings could be based on bad weather, obstacles on the road, speed limits, and inappropriate routes, among others.

Information and Communication Technology enables drivers and motorists to be informed based on the traffic conditions. The role of ICT in monitoring and addressing transportation issues recommends a system that taps into the capacity of handheld devices to upload real-time traffic information and related issues affecting the road. The application is designed in a way that it is synchronized with web applications and mobile phone software; both use the same database. Notably, it is only by using this application that the user can upload information regarding traffic conditions on specific routes and also report on particular incidents. The users of the handsets and web application keep track of regular traffic and report any challenges they encounter on the road. Besides, the application has Google Maps that helps locate reported road accidents. The utilization of ICT in this context will significantly reduce gas emissions and traffic accidents.

In 2013, a global positioning system (GPS) was introduced to track school transportation movements in real-time to address the dangerous and reckless driving of school buses. The application monitors the school buses that are GPS-tracked by transmitting information and data to the authorities in charge of monitoring and managing traffic. The proposed model highlights the potential of GPS in monitoring and controlling reckless driving in the management of traffic offenses with automatic email and SMS alerts. In 2014, a proposed model was suggested for monitoring the movement of buses in real-time continuously. This application has the ability to raise alerts automatically once over-speeding speeds are detected to address the problem of over-speeding and encourage compliance with the speed limit. The information and data analyzed from the database can be used as evidence in prosecuting traffic offenses. The system could track down drivers prone to reckless driving and over-speeding and initiate sanctions such as license suspension to compel adherence to the traffic regulations. The proposed application uses the Global Positioning System (GPS), Global Positioning Satellites, and Global System for Mobile Communications (GSM network) in delivering its services.

In all the above control measures proposed in addressing traffic offenses, none of them focuses on capturing images of the offenders as evidence to prove guilt for the traffic offenses committed. Besides, the need for a centralized database for all traffic offenses was identified as the major concern in managing traffic offenses in Nigeria.

Hundreds of thousands of motorists are arrested and prosecuted daily for various traffic offenses in Nigeria, despite stringent punishments in transportation regulations and the existence of appropriate road traffic offense information and communication technology. Federal Road Safety Corps (FRSC) is an agency responsible for enforcing road traffic regulations and guidelines for motorists in Nigeria. They impose penalties on motorists involved in traffic offenses to serve as a warning to other drivers. According to www.frsc.gov.ng, the table below shows some road traffic offenses and penalties imposed on them.

Table 1 Federal Road Safety Corps Offences & Penalties

S/NO	TICK INFRINGEMENT (S)	CODE	POINTS	PENALTY	CATEGORY
1	LIGHT/SIGN VIOLATION	LSV	2	2,000	2
2	ROAD OBSTRUCTION	ROB	3	3,000	1
3	ROUTE VIOLATION	RTV	5	5,000	1
4	SPEED LIMIT VIOLATION	SLV	3	3,000	1
5	VEHICLE LICENCE VIOLATION	VLV	3	3,000	2
6	VEHICLE NUMBER PLATE VIOLATION	NPV	3	3,000	1
7	DRIVER'S LICENCE VIOLATION	DLV	10	10,000	2
8	WRONGFUL OVERTAKING	WOV	3	3,000	1
9	ROAD MARKING VIOLATION	RMV	5	5,000	1
10	CAUTION SIGN VIOLATION	CSV	3	3,000	3
11	DANGEROUS DRIVING	DGD	10	50,000	1
12	DRIVING UNDER ALCOHOL OR DRUG INFLUENCE	DUI	5	5,000	2

13	OPERATING A VEHICLE WITH FORGED DOCUMENTS	OFD	10	20,000	2
14	UNAUTHORIZED REMOVAL OF OR TAMPERING WITH ROAD SIGNS	UTS	5	5,000	1
15	DO NOT MOVE VIOLATION	DNM	2	2,000	2
16	INADEQUATE CONSTRUCTION WARNING	ICW	-	50,000	1
17	CONSTRUCTION AREA SPEED LIMIT VIOLATION	CAV	3	3,000	1
18	FAILURE TO MOVE OVER	FMO	3	3,000	1
19	FAILURE TO COVER UNSTABLE MATERIALS	FCM	5	5,000	1
20	OVERLOADING	OVL	10	10,000	1
21	DRIVING WITH WORN-OUT TYRE OR WITHOUT SPARE TYRE	TYT	3	3,000	1
22	DRIVING WITHOUT OR WITH SHATTERED WINDSCREEN	VWV	2	2,000	1
23	FAILURE TO FIX RED FLAG ON PROJECTED LOAD	FFF	3	3,000	1
24	FAILURE TO REPORT ROAD ACCIDENT	FRC	10	20,000	1
25	MEDICAL PERSONNEL OR HOSPITAL REJECTION OF ROAD ACCIDENT VICTIM	RAV	-	50,000	1
26	ASSAULTING MARSHAL ON DUTY	AMD	10	10,000	2
27	OBSTRUCTING MARSHAL ON DUTY	OMD	2	2,000	2
28	ATTEMPTING TO CORRUPT MARSHAL	ACS	10	10,000	2
29	CUSTODY FEE	N200 per day after 24 hours			-
30	DRIVING WITHOUT SPECIFIED FIRE EXTINGUISHER	FEV	3	3,000	3
31	DRIVING A COMMERCIAL WITHOUT PASSENGER MANIFEST	PMV	10	10,000	2
32	DRIVING WITHOUT SEAT BELT	SUV	2	2,000	1
33	USE OF PHONE WHILE DRIVING	UPD	4	4,000	1
34	DRIVING A VEHICLE WHILE UNDER 18 YEARS	UDR	-	2,000	1
35	RIDING MOTORCYCLE WITHOUT A CRASH HELMET	RMH	2	2,000	1
36	EXCESSIVE SMOKE EMISSION	ESE	5	5,000	1
37	MECHANICALLY DEFICIENT VEHICLE	MDV	5	5,000	1
NOTE: Custody fee on impounded Motor vehicle and Motorcycle/Tricycle is N200.00 per day payable after initial 24 hours of grace					

Source: www.frsc.gov.ng/offence and penalty

III. SYSTEM ANALYSIS AND METHODOLOGY

➤ System Analysis

System analysis focuses on developing and designing information systems by thoroughly understanding and documenting what a system should do and how the system components should be implemented together to perform specific functions. System analysts address business issues by carrying out an analysis of system requirements and designing processes using analysis and design methods. System Analysis focuses on organizational structure and enhancement of production to meet objectives of profit and growth. The analysis focuses on the system being studied, the interrelation between subsystems, and their relationship in achieving the standard.

• Analysis was Carried Out to Achieve the following Objectives:

To establish user requirements, Assessment of the system's effectiveness, feasibility, and cost-benefit analysis of the proposed system.

- ✓ To come up with the allocation of the software and hardware components.
- ✓ To develop a system model or platform upon which other aspects of the project will be added (Pressman,1997).
- ✓ The analysis of the existing system was done to identify the current situation and problems facing it; this would help the analyst to either add or remove aspects of the current system. If the analysis revealed many weaknesses, the analyst would consider developing a new system after having established the existing system as not satisfactory or fit for use.

• Information Gathering

Information gathering is a technique used to collect information on a certain topic or subject matter to facilitate analysis, which leads to the generation of useful information for an improved system.

The information gathered for this project consists of primary information from secondary sources, including online resources, newspapers, and reports published by

relevant agencies such as the Federal Road Safety Corps. Information relevant to the research question was extracted from the documents, including traffic crash statistics, organizational structure, policies, programs, rules, and regulations relevant to the Federal Road Safety Corps, penalties for traffic offences, and the data management system.

The author reviewed reports by agencies handling traffic offences, research articles, and newspaper reports on the importance of information and communication technology in managing safety control to identify information needs. This would facilitate examining the current state of the Federal Road Safety Corps in terms of information and communication technology Compliance strategies.

- *Analysis of the Existing System*

In 2013, the FRSC, through an electronic reporting system, came up with three online report portals:

- ✓ *E-Dashboard:*

This dashboard provides insight into weekly activities, including programmes and policies from the field (units, sectors, and zonal commands) to the headquarters. It hosts dynamic management information system-based dashboards that offer real-time analysis and reporting to aid in situational awareness and decision-making support at the strategic level.

- ✓ *E-Ticketing:*

The Corps rolled out an e-ticketing portal as a tool to boost traffic enforcement capabilities. This portal allows online authentication of vehicles and drivers and also offers a new platform for Driver's License and Number Plate Transactions.

This will ease transactions for the public and provide transparency. The FRSC will also be able to monitor and track all vehicle movements in the Nation to ensure compliance with its goals, vision, and mission.

- ✓ *FRSC Intranet:*

The Corps makes use of Twitter, Facebook, Instagram, WeChat and YouTube accounts to share data and its programmes with the public. It updates information on its

social media site. The portal ensures situation reports are disseminated weekly, monthly and quarterly from Field Commands to National Headquarters in Abuja.

- *Merits of the Existing System*

There is prompt reporting of situational reports from FRSC field commands as situation reports are sent on a weekly, monthly and quarterly basis.

The system makes use of social media networks such as Twitter, Facebook, Instagram and WeChat accounts to share information relating to its programme with the people. Whereby updating information hourly.

The system enables online verification of vehicles and drivers with the use of new Driver's licenses and Number Plates through the e-ticketing process.

- *Demerits of the Existing System*

The system does not allow pictorial identification of offenders. Therefore, wrong people can be charged.

The system is a decentralized system, where traffic offence information is easy to manipulate and access the database.

The manual system does not allow pictorial display of the offence committed, as well as the penalty of the offence, as evidence to prosecute the offender. Hence, the offender feels like being forced to accept the penalty.

- *High Level Model of the Proposed System*

HLM documentation consists of database structure, application structure (layers), application flow (navigation), and technological design of a given system. The HLM is developed by using technical/non-technical terms that are easily understood by the system administrators. It illustrates the overall framework of the proposed system, that is, the main aspects or components of the system. The figure below is a high-level model of the new system under development;

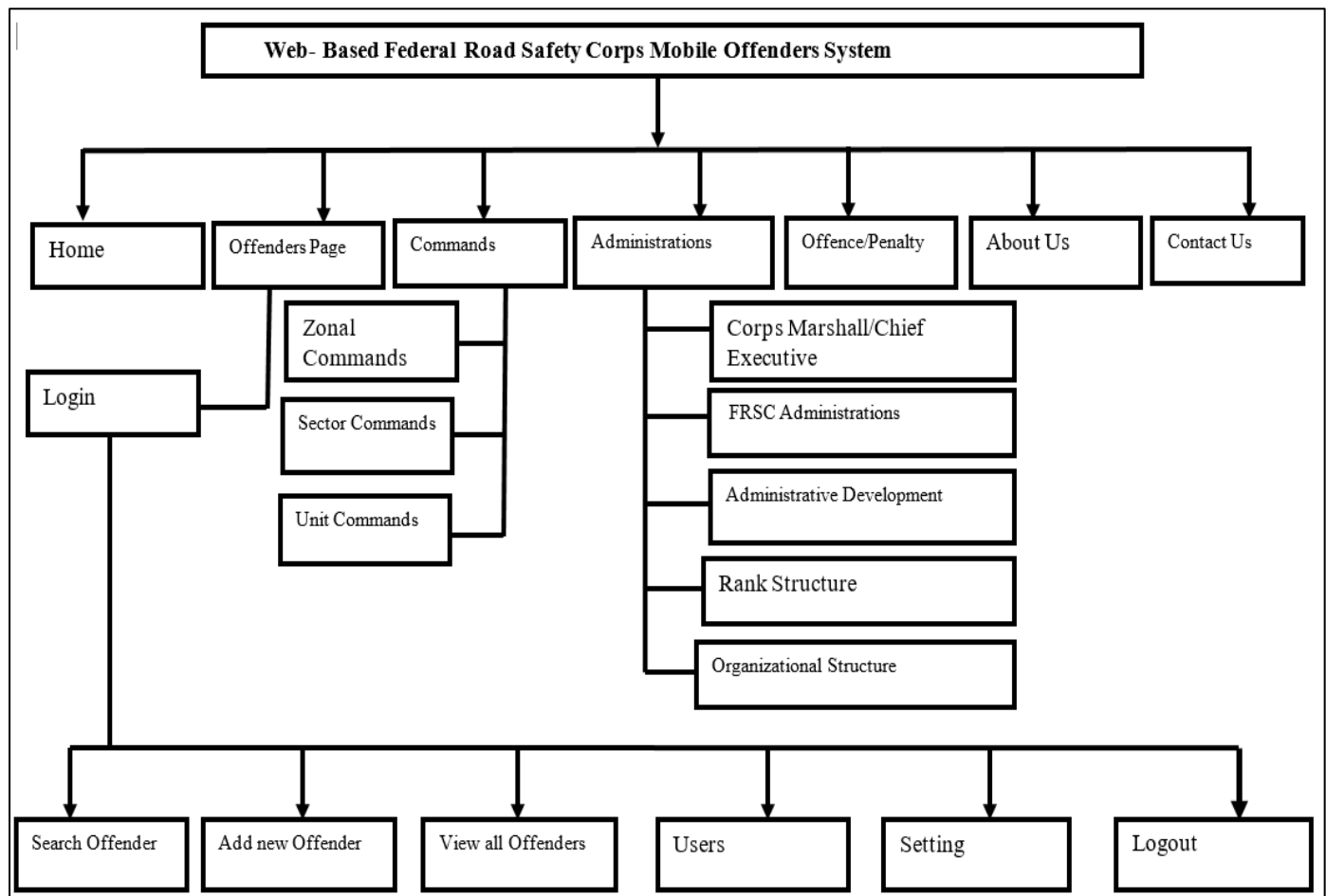


Fig 1 High-Level Architecture of the Proposed System

• Analysis of Proposed System

The proposed system is a web application that captures offenders' information on the spot and uploads it to the central database. The system is able to identify offenders based on their picture. It also indicates the type of offence committed and the penalty incurred. Prior to uploading offenders' information to the database, the system gives the offender an option of accepting his offence without being forced to do so.

The analyzed information from the central database can be used as evidence in case of any other offence committed by the offender.

• Merits of The Proposed System

- ✓ The Web-based Federal Road Safety Corps Mobile Offenders System is an information system which comprises collection, processing, storage, retrieval, and dissemination of road traffic offence information for planning, controlling, coordinating, and decision-support based on improved information technology.
- ✓ The Web-based Federal Road Safety Corps Mobile Offenders System provides for the security and protection of road traffic offence information, which helps the organization achieve information confidentiality. The system allows only staff members with the right password to access the central database.

- ✓ The Web-based Federal Road Safety Corps Mobile Offenders System improves productivity by ensuring timely and accurate road traffic offence information, as well as managing road traffic information promptly.
- ✓ There is a centralized database for managing information on road traffic offences, which facilitates easy accessibility and avoids data duplication and data redundancy that would be inevitable with a decentralized database.
- ✓ The road traffic offence information system captures the offenders' pictures to facilitate easy and reliable identification.
- ✓ We are human beings and, as such, we tend to believe more in what we can see and feel. With a Web-based Federal Road Safety Corps Mobile Offenders System, we can have a pictorial representation of the offender as well as the penalty incurred as evidence for prosecution purposes.

• Demerits of the Proposed System

The Web-based Federal Road Safety Corps Mobile Offenders System is not an exception to the saying that nothing is perfect; there are some demerits associated with the system:

- ✓ To capture road traffic offence information at the scene of the offence, the system relies on the staff members,

instead of using the Global Positioning System technology.

- ✓ Registration of offenders' information cannot be done using a mobile device; thus, registration can only take place at the FRSC office with the use of a desktop computer having the road traffic offence information system application installed on it.

• Use Case Diagram

Use case diagrams will be discussed within the scope of the requirement collection and analysis. It is a diagram that captures the functions of the system as specified within the system requirements. The use cases can be captured during specification and data collection, and will also involve processing and refining during system analysis by the stakeholders.

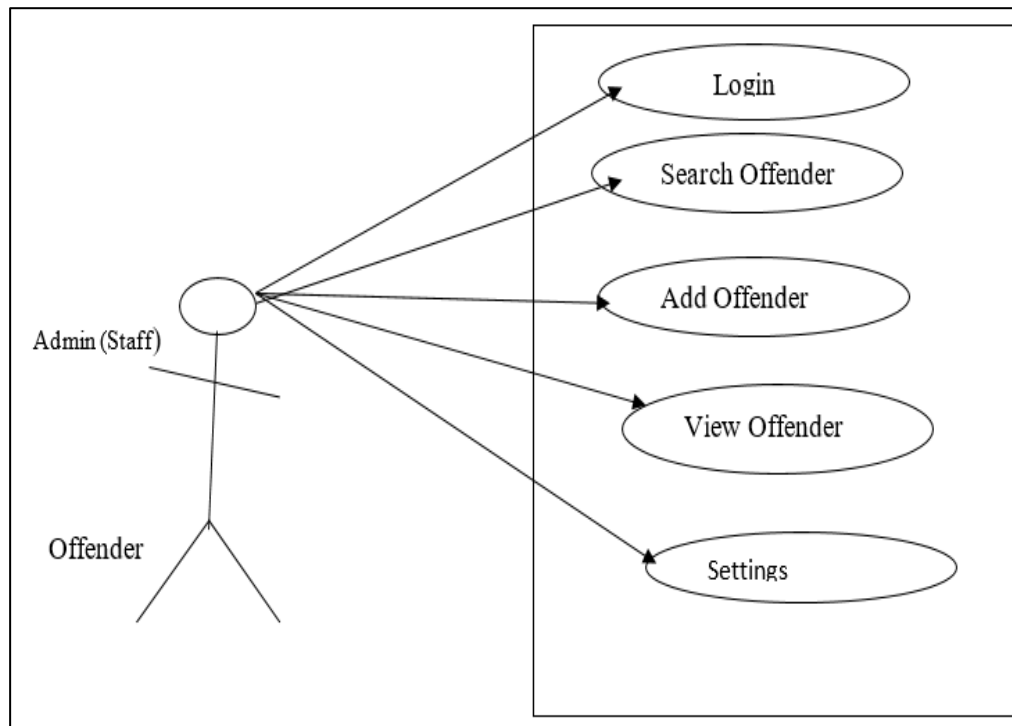


Fig 2 Use Case Diagram

➤ Justification of the Proposed System

It is anticipated that the new system to be implemented in the Federal Road Safety Commission would result in numerous benefits. Most of the challenges associated with the decentralized system would be minimized, if not eradicated.

Management officers who were not able to carry out their responsibilities efficiently in the past would rejoice and perform their duties with more zeal and enthusiasm; this would definitely increase productivity in the organization, the Federal Road Safety Corps.

• Methodology

The Object-Oriented Analysis and Design (OOAD) methodology was used in carrying out the project.

This methodology, which is a well-documented technical approach to system analysis and design, uses the object-oriented model and visual modeling throughout the development process to facilitate maximum stakeholder communication and to produce quality products. Object-Oriented Analysis and Design methodologies are modeling languages that describe the object-oriented system at different levels of abstraction, such as structure and behavior. Object-Oriented Analysis and Design each contain two phases of activity: the Object-Oriented Analysis and the

Object-Oriented Design. The UML (Unified Modeling Language) was used as the design notation. The UML used in this project includes use case and class diagrams.

Using the methodology will ensure a quality software product is produced in the Federal Road Safety Commission, with excellent documentation, user acceptance, maintainability, and consistency of the implementation. It also emphasizes capturing and recording requirements accurately from the user and modeling the class hierarchy from which all the object classes in the system can be derived and the relationship among entity classes. The Object-Oriented Analysis and Design has several phases that correspond to the System Development Life Cycle (SDLC) phases listed below;

IV. SYSTEM DESIGN AND IMPLEMENTATION

➤ System Design

The design starts where analysis stops. The information collected in the last chapter is used to accomplish the logical design of the Web-based Federal Road Safety Corps Mobile Offenders System. Essentially, every software project has two components, namely the user interface and the database. The user interface includes the modules or forms which

enable the user to interact effectively with the system. Conversely, the database includes the structures or tables which store data and information keyed in by the user or generated by the system.

These two components are indispensable and join together to make this project.

➤ Objectives of the Design

- To develop a system that will provide a common way(s) of identifying habitual offenders in the database.
- To develop a system that will consist of the picture of an offender at any point of booking.
- To develop a system that will consist of direct access to the specific and required information in the database.
- To develop a system that will consist of generating queries and real-time report.

➤ Database Design

The relational database model was adopted to design the database. The relational database server which was used to design the database is MySQL. The database architecture of the project will carry out two functions:

- Allocating a name to the database file.
- Designing the database file. The database for this project was designed using MYSQL. MySQL is an open-source relational database management system that stores information in related tables. MySQL is based on Structured Query Language (SQL) and runs on almost all operating systems, including MACOS, Linux, UNIX, and Windows. Despite its wide-ranging applications, MySQL is mostly used in web-based applications and online publications. It was chosen for this project mainly due to its consistency and ease of generating reports from it in an application.

Table 3 Offender Registration

Field Name	Field Type	Field Width	Null	Key	Default	Extra
Id	Int	11	No	Primary	Null	Auto-increment
First Name	Varchar	45	No			
Last Name	Varchar	45	No			
Gender	Varchar	12	No			
City	Varchar	45	No			
LGA	Varchar	25	No			
State	Varchar	30	No			
Nationality	Varchar	20	No			
Phone NO	Varchar	15	No			
License No	Varchar	18	No			
Car Plate NO	Varchar	18	No			
Engine NO	Varchar	18	No			
Offence Code	Varchar	20	No			
Offence Point	Varchar	20	No			
Offence Category	Varchar	40	No			
Offence Name	Varchar	40	No			
Penalty	Varchar	40	No			
Marshall ID	Varchar	20	No			
Marshall Name	Varchar	20	No			
Date	Varchar	20	No			
Image Name	Varchar	30	No			
Size	Varchar	12	No			
Type	Varchar	30	No			

➤ Architecture of Proposed System

The proposed system architecture of the new system was designed by structuring and designing an architecture that accommodates various components that were not found in the existing system. The architecture of the system design consists of three major components, such as: Search offender, display previous offender, and add new offender. Search

offender is a user interface that allows the computer operator to search for an offender in the central database. Display previous offender is an interface in the system that, when clicked on, displays all the previous offenders that were recorded in the database. Add new offender is also a user interface that allows the user to add a new offender to the central database.

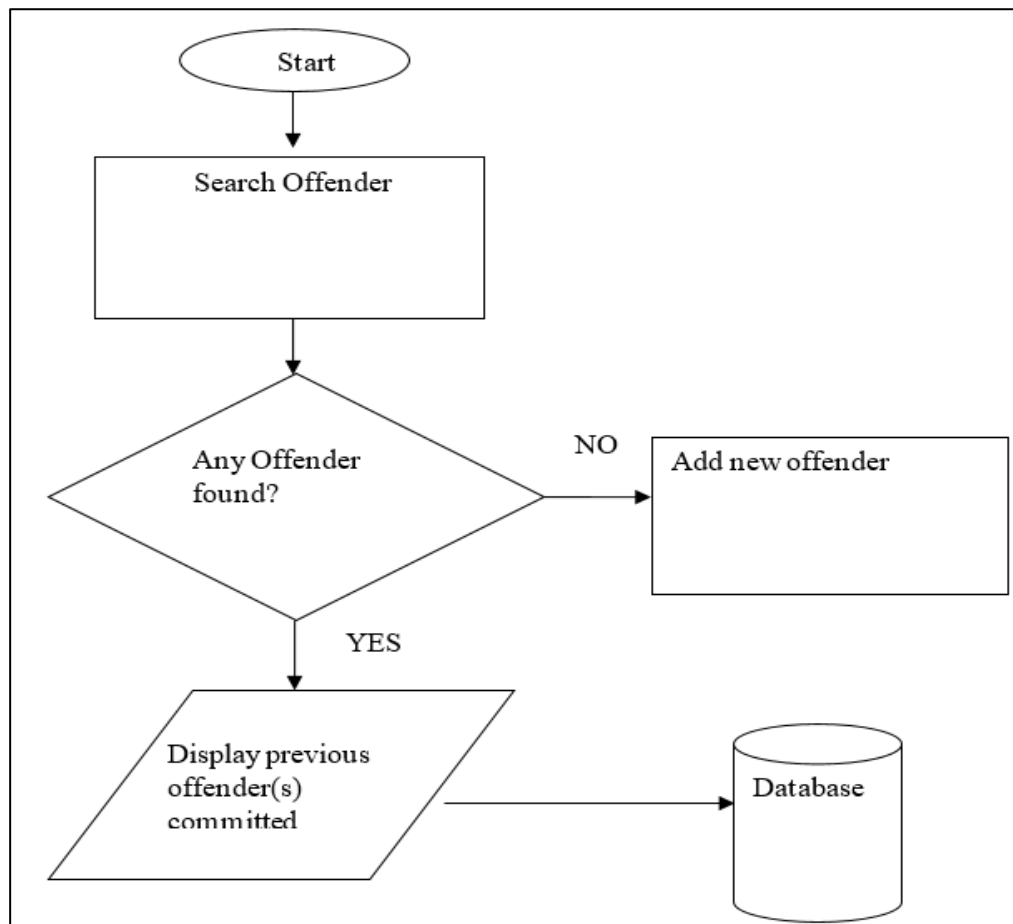


Fig 3 Architecture of Proposed System

- *Input Form Design*

The input Form provides users with a graphical user interface to feed data into the computer system.

The login form is where an authorized user types in their username and Password.

Enter Login Details

User Name:

Password:

Fig 4 Login Input Form

- *Offenders Registration Form*

PERSONAL DETAILS	
FIRST NAME:	
LAST NAME:	
GENDER :	
CITY :	
LGA:	
STATE:	
NATIONALITY:	
PHONE NO:	
VEHICLE INFORMATION & OFFENCE DETAILS	
LICENSE NO:	
CAR PLATE NO:	
ENGINE NO:	
OFFENCE CODE:	
OFFENCE POINT:	
OFFENCE CATEGORY:	
OFFENCE NAME:	
PENALITY:	
OFFICIALS ON DUTY:	
MARSHALL ID NO:	
MARSHALL NAME:	
OFFENDERS PASSPORT: Choose file NO of File Chosen	
Submit Record Clear	

Fig 5 Input Form Design for Offenders' Registration

- *Search Offender Form*

SEARCH OFFENDER	
Search Criteria	
License NO:	
SEARCH Clear	

Fig 6 Search Offender Form

- *Output Specification Design*



Fig 7 Output Design

➤ *Program Design*

The program was developed using a top-down approach. The entire system was broken down into its parts and designed in modules.

- *Program Procedure Chart*

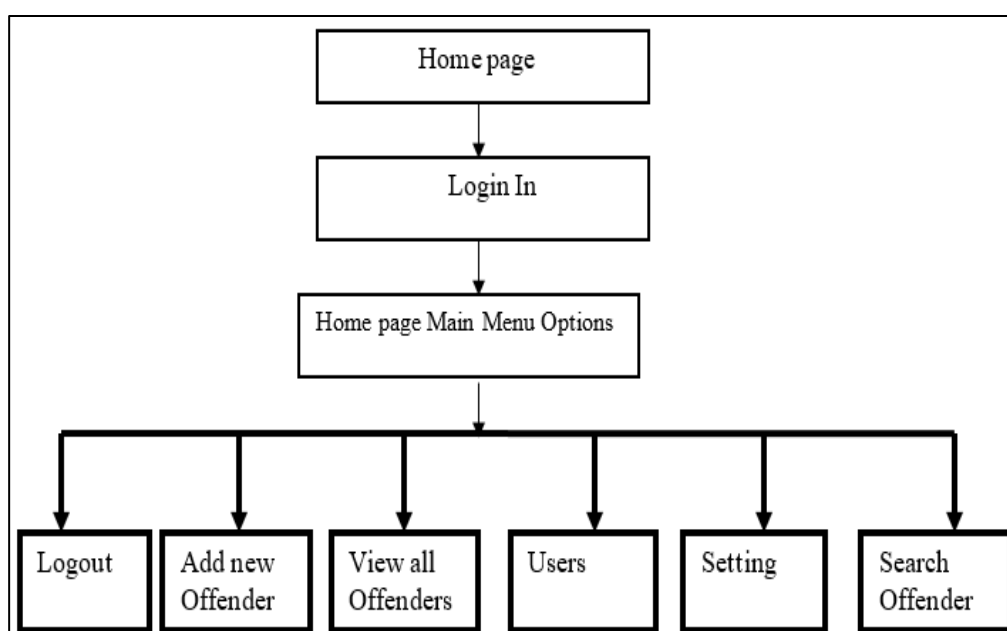


Fig 8 Program Procedure Chart

- Program Flowchart

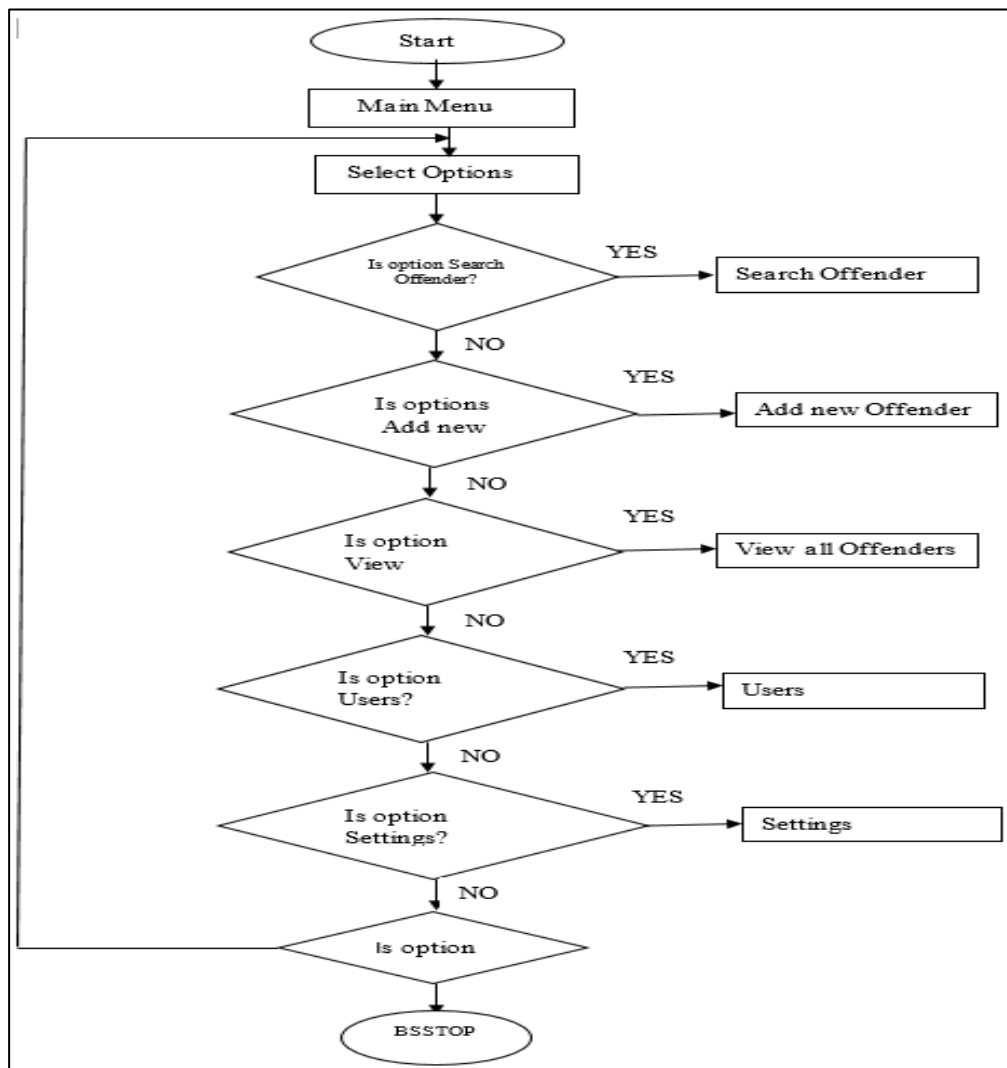


Fig 9 Program Flowchart

- Flowchart to Search Offender

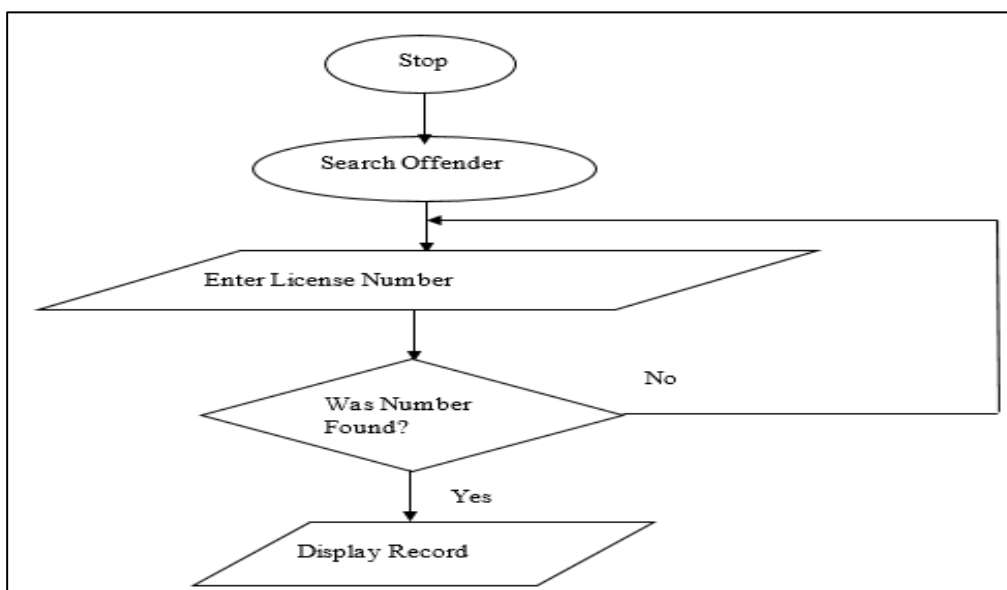


Fig 10 Program Flowchart to Search Offender

- *Flowchart to Register Offender*

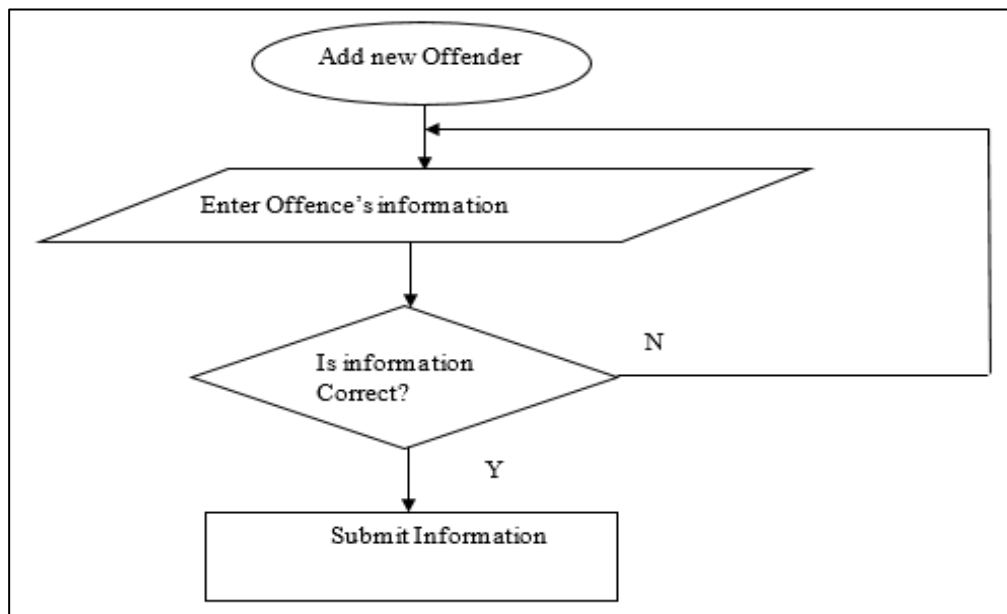


Fig 11 Flowchart to Register Offender

- *Flowchart to View Offenders*

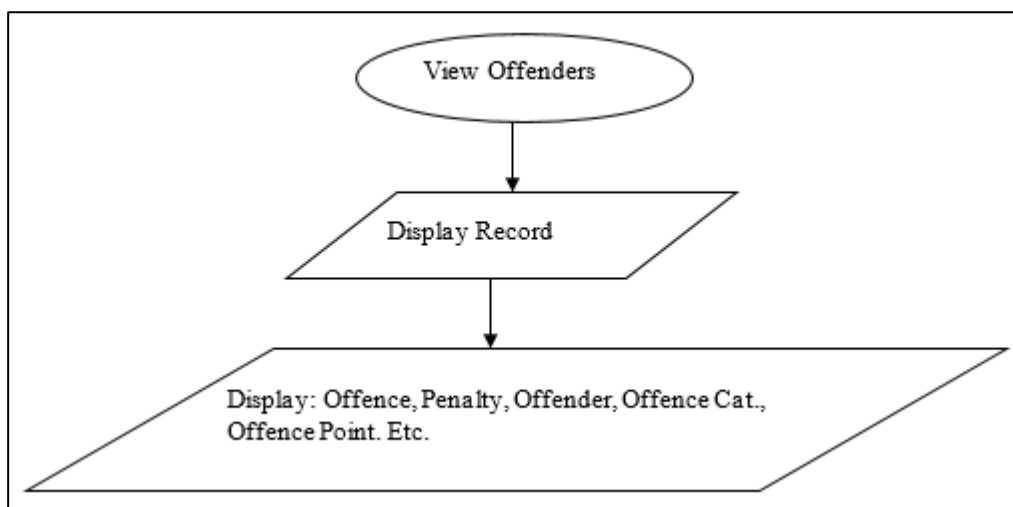


Fig 12 Flowchart to View Reports

➤ *System Implementation*

Implementing the system involves assembling all the components—hardware, software, everything required to ensure the new system functions correctly. This phase involves configuring those resources, examining them to ensure they effectively achieve all the targets you defined, and then transitioning to the latest system.

➤ *Choice of Development Environment*

In this project, I chose Rapid PHP as the core development tool. Rapid PHP covers a lot: PHP along with HTML, CSS, and JavaScript, plus other languages you might need for web development. What distinguishes this software is its extensions—it includes tools for debugging, verification, source navigation, code formatting, and a variety of intelligent features to enhance productivity. You will

discover CSS code intelligence, an efficient search-and-replace tool, and utilities to navigate from (X)HTML to HTML5. There is a code formatter for more readable scripts, integrated FTP Explorer (FTP/SFTP/FTPS), file and database browsers, snippets of code, and built-in evaluators and debuggers. The editor works fast and supports several frameworks out of the box.

Rapid PHP lets you manage and view multiple pages at once, making it pretty flexible in complex projects. I've found the code analysis tool especially useful—it thoroughly examines your code and identifies all elements ranging from functions to classes and variables. The small assistants accelerate the process as well, allowing you to quickly create Cascading Style Sheets summaries or establish the framework for an HTML document.

Regarding the primary server-side scripting, I chose PHP (Personal Home Page Preprocessor). PHP stands out for its flexibility, strong community support, compatibility with web technologies, and solid performance when handling database-driven applications.

➤ Implementation Architecture

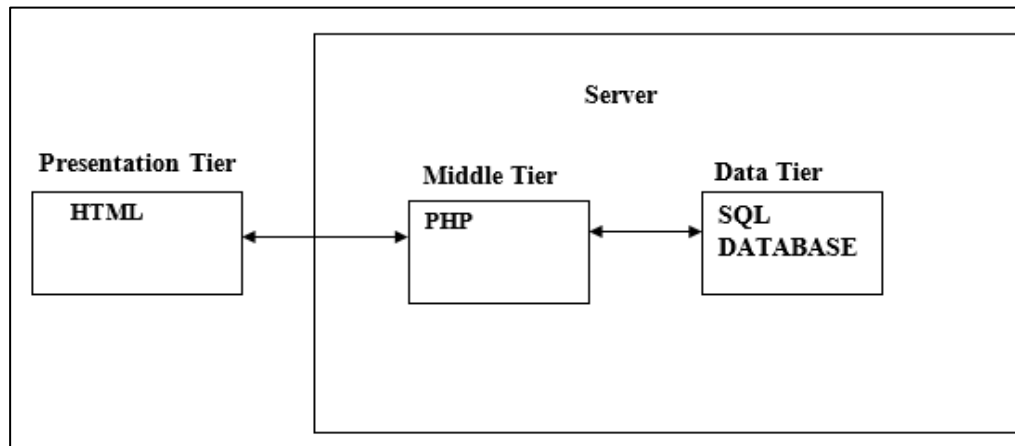


Fig 13 Implementation Architecture

The architectural plan of this research breaks down the system into three separate layers. Firstly, HTML functions as the presentation layer, providing the user interface. Second, PHP serves as the application layer, managing server-side logic. In conclusion, a MySQL data repository—controlled through the WAMP interface—functions as the data layer, holding all required data. The computing system captures traffic offences and stores that information within the road traffic offence database. All computer systems across the network are able to access and retrieve this database data when necessary.

V. SYSTEM TESTING, INTEGRATION AND DEPLOYMENT

➤ System Testing

Testing plays an important role in software development. Not only is it required to ensure the logic of the program is strongly adhered to, but also to ensure that the output aligns with the expected result. Apart from software testing, it is also advisable to test the various hardware components for optimal performance.



Fig 14 Search form

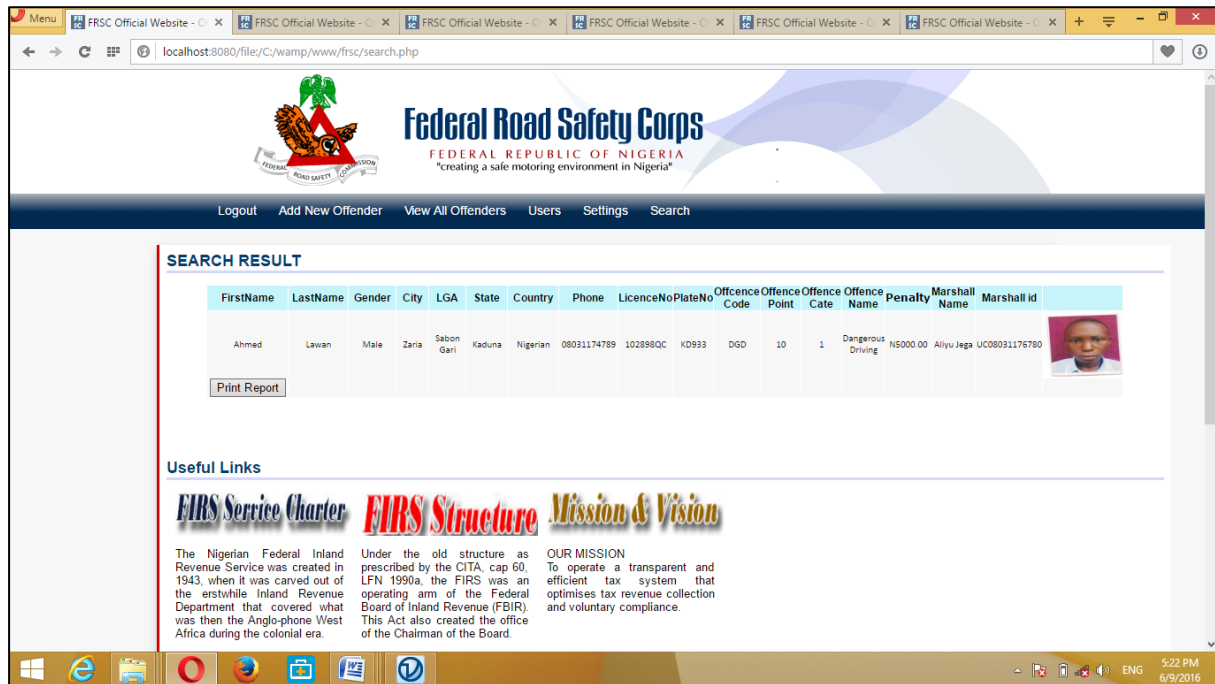


Fig 15 Seach Result

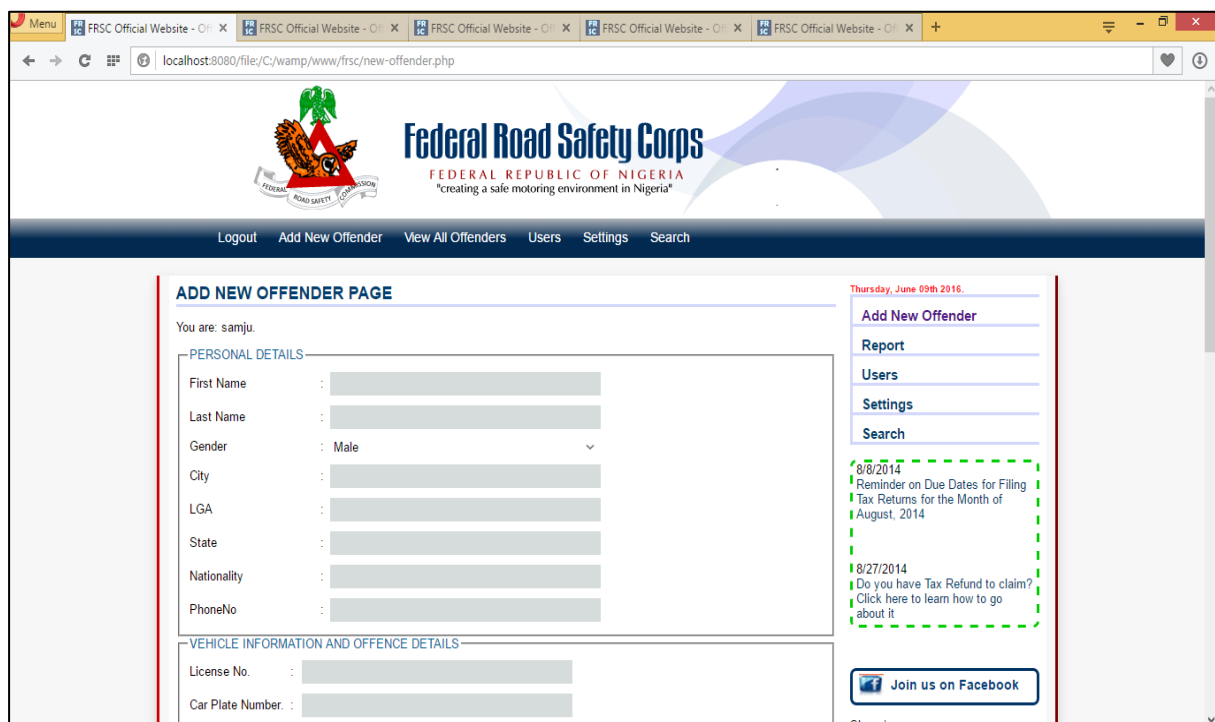


Fig 16 Add new Offender

• Test Plan

The test plans adopted in this project work are categorized into two.

Unit testing: Here, each unit or modules that makes up the system are coded and tested before integration.

System Testing: This test is carried out to ensure those application programs written and tested in isolation are working properly when they are integrated into the entire system. This testing is also known as product testing.

• Test Data

The test data employed for A Web-based Federal Road Safety Corps Mobile

✓ *Offenders System Could be Categorized Into:*

- Verification testing: it involves the process of running the program in a simulated environment by using simulated data. Here, hypothetical data input and values are used to carry out the test. The reason for this test is mainly to find errors and omissions as it concerns end-user requirements

that were specified in the design phase but not implemented when coding.

- Beta test: This type of test data implies running the application in a live environment using real data. To validate the correctness of the proposed system, I had to use myself as an example.

• Test Result (Expected vs Actual)

The result of any data processing exercise can be adjudged to be ineffective and a waste of time if the results obtained are incorrect, untrustworthy, and error-prone. To prevent this, the computer result is most often compared with the result obtained.

Table 5 Test Result

Test Conducted	Expected Result	Actual Result
Login	Grant access to the user	User was granted access
Search Offender	Able search to Offender	Offender was searched
View all Offenders	Able to view all offenders	Offenders were viewed
Add new offender	New offender was added	Able to add new offender

➤ System Integration

System integration usually involves the analyst, software developer, owner, and the users. However, the system owners and users hold the ultimate authority on whether or not the system is working correctly. It guarantees that the software that works when isolated is compatible with subsystems to form a complete system. The essence of this is to determine whether the product satisfies the specification document by subjecting the software to robustness testing, i.e. how well it reacts to stresses such as incorrect data input. Others include running the product with huge files as well as several terminals trying to log on at the same time.

➤ System Deployment

All the steps, measures, and activities that make software available to users for use are known as software deployment. These measures can be taken by the producer or the user, or both. There is no precisely defined process between one activity and another due to the fact that every software is unique, and for this reason, deployment is regarded as a general way of getting your application ready for marketing. A newly designed application may work well on your personal computer, but that doesn't mean it is really fit for others to use. There are some additional application features you may not need for yourself, but ought to be providing if the application will be used by others. The following can make your application fit to be used by others: Help Document, License

Agreement, Executable file, Code Obfuscation, Icon Library, Experimental Version, Installation Wizard, Uninstall Program. Annette, 2011.

System deployment is a critical aspect of the software development life cycle (SDLC), which presents the software to users with the aid of deployment software. This stage ensures that the system gets to the users. Scott, 2014. The author used InnoSetup for the deployment of the system.

• Hardware Requirement:

To run the software application effectively, you will require some specific hardware:

- ✓ Pentium IV system and above
- ✓ A main memory with at least 2 GB capacity
- ✓ Enhanced keyboard
- ✓ A hard disk with at least 10GB of space

- ✓ Colored monitor
- ✓ Uninterruptible Power Supply (UPS)
- ✓ Either a LaserJet or DeskJet printer
- ✓ Voltage stabilizer

• Software Requirements:

To get this system running, these software components are necessary:

- ✓ Operating system: Windows XP, Vista, or Windows 7
- ✓ Structured Query Language (MySQL)
- ✓ nuspherePHP
- ✓ HTML
- ✓ Apache server

Before launching the application, the user needs to boot up the computer. After that, install the nuspherePHP IDE and WAMP applications onto the system. For installation of the Road Traffic Offence System software, insert the CD into a compatible CD-ROM drive, making sure the system already meets all the hardware and software requirements listed above. Here's what to do next:

- ✓ Open the Run command
- ✓ In the Run dialog box, click the Browse button
- ✓ Navigate to your CD-ROM drive and open it to view its contents
- ✓ Double-click on the setup item to begin the software installation
- ✓ Follow all on-screen instructions to finish up the setup

➤ Performance Evaluation

The performance of this system was excellent. On testing the system with some test data, the actual result generated was the expected output. Since the actual result satisfies the expectation, it means that the objective is achieved. With the remark statements which were embedded in the code, the software maintenance will be easy.

➤ System Maintenance

Once the system is working, the job is not finished. Routine maintenance makes sure everything is performing as anticipated. Users modify the system, sometimes adding new features or modifying existing ones. Technology advances rapidly—updated software editions are released constantly—so remaining up-to-date requires consistent updates and modifications to comply with industry norms.

File maintenance matters, too. This implies modifying the database, increasing file size, and at times modifying how the data is arranged when the organization's requirements change. All these measures ensure the setup stays functional and reliable in the long run.

VI. SUMMARY, CONCLUSION AND RECOMMENDATION

➤ Summary

Currently, the Federal Road Safety Corps Mobile Offenders System, which is decentralized and web-based, simply isn't sufficient. Adopt a single consolidated platform, and everything changes—road traffic violation details move faster, it's secure, and the agency is able to make informed decisions using accurate data. Relying on minimal offender facts for identifying persons cannot be trusted; utilizing genuine pictures enhances the reliability of documentation and stops law enforcement from filing charges against incorrect persons. The new system specifically tackles the challenges traffic enforcement officers encounter when tracking habitual offenders. When put into effect, it enhances transparency and accountability and strengthens road safety operations considerably.

The current system relies on an object-oriented analysis and design approach, with Unified Modelling Language bringing the structure into focus. Regarding implementation, I divided everything one step at a time, starting with subsystems, then into workable modules, making it simple to understand. The system architecture comprises three main sections: the frontend, developed with PHP, HTML, and JavaScript, provides the user interface; the backend hosts the server and database tables; between them, there is the application server running on Apache, which connects all parts. The interface itself is interactive and designed to protect data. It's sufficiently straightforward so that users do not require extensive IT knowledge to get going.

And it doesn't end there; the system is reusable. As needs change, you have the option to enlarge it or add new features to make it even better.

➤ Contributions to Knowledge

In this study, I demonstrated that a primary contributor to vehicle accidents in Nigeria originates from deficiencies in the existing frameworks and inadequate communication technology within road safety procedures. To resolve this, I put forward and built an enhanced online Federal Road Safety Corps Mobile Offenders System, which includes a centralized traffic offence database and a reliable method to identify offenders.

➤ Recommendations

The Road Safety Commission remains the primary agency handling traffic control and management in Nigeria. They are the foundation of traffic safety within the transportation industry, collaborating with organizations such as Vehicle Inspection Officials, Transport Control Authorities, Nigeria's Police Force, and the National Road Transport Workers' Union, amongst others. FRSC supervises

these bodies so as to improve the way road safety is handled across the country.

• The Researcher Puts Forward the Following Recommendations:

- ✓ FRSC personnel are required to attend periodic workshop sessions as well as refresher training related to information and communication technology. This involves more than simply acquiring new skills — it means they'll stay in sync with global road safety regulations that are constantly changing.
- ✓ Public awareness about the risks of traffic violations, together with the related sanctions, has to become a mainstay in media outlets — not simply occasional alerts, but a continuous feature. Telecom providers must also take action and support educating their subscribers, explaining the risks and effects for all users across their platforms.
- ✓ All concerned parties are encouraged to support and advocate studies focused on enhancing the Web-enabled Federal Road Safety Corps Mobile Offenders System. There is always space to enhance it, make it more trusted, and quicker to respond to the demands of road users as well as officials.
- ✓ The author advises conducting research to create a new system which employs various photoelectric materials: some integrated into asphalt, some affixed to road signs and concealed within traffic lights, and others carefully positioned on main roads and at crucial intersections. These gadgets would collect information about traffic movement and concentration, and the system would capture images of traffic violations, transmitting the images wirelessly to central computer systems. Users could then access this information using PDAs, handsets, or the internet. The true breakthrough in this situation is that the system will not only record violations — it will furthermore have the capability to anticipate road conditions a few hours ahead of time, providing all users with a more intelligent and secure method to travel.
- ✓ Research to develop a system that allows documentation of road traffic offences to be done via mobile applications. The mobile application system will allow the use of mobile devices to capture and document offence information, as well as allowing accessibility through mobile devices; GPS, WiFi, GSM, and Google Maps will be used as development technologies to create the application. It will be called Web-based Federal Road Safety Corps Mobile Offenders System on the "palm". The application will be able to display road traffic offence reports that are presently happening on the main pathways. It will enable users of the system to find out the present location of an accident using GPS and display the location on the screen. The location is to be displayed on the Google Maps package. After the presentation of the user's location on the map, a marker will be drawn on the map, depending on what kind of event is in question. By

clicking on the screen where the event is, users can get road traffic details, whether there is a road traffic accident or a violation of traffic laws. This application will help users to be instantly informed about the working zones, road traffic accidents, and road traffic offences, which brings down the risk of downtime and significantly reduces the hours needed for identifying and solving road traffic incidents.

Incorporating the above functionalities with the Web-based Federal Road Safety Corps Mobile Offenders System will reduce to the barest minimum the rate of road traffic offences in Nigeria.

➤ Conclusion

FRSC plays the role of a coordinating and leading agency for safety management in our country. Regrettably, it has become unachievable due to its present commitment in ensuring road safety at the operational level. A position it handles with many organizations duly authorized to carry out the same similar functions. Though sharing of road safety functions makes it possible for wider coverage, where cross-functional disparities exist. It presages danger in role suppression and clash that may arise as a result of competition. It is disturbing to know that such a clash characterized the existing system of safety management in Nigeria. The main challenge of implementing Web-based Federal Road Safety Corps Mobile Offenders System in any developing country is that citizens have yet to embrace improved information and communication technology in road traffic offence management, especially regarding offence management.

The research shows that a significant reduction of road crashes can be achieved by the prudent management of road traffic offence information through application of adequate ICT infrastructure, increasing access to road safety information. It is not just gathering together huge data for road safety management; every electronic data, including sensitive road traffic offence information, is useless if it is not accessible and properly identifies traffic offenders during documentation to ensure reliability and credibility of the process.

The way in which all officials involved would use the technology and mechanisms provided will determine the system's effectiveness in enforcing road traffic offence management control. The integrity and dedication of these officials are among important factors in our struggle against road traffic offences. It is hoped that the efforts and investment of the Web-based Federal Road Safety Corps Mobile Offenders System will result in the much-needed positive benefits toward road traffic offences and accident reduction in Nigeria.

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