

Research Paper



A technological perspective to the challenges in vehicle registration system in Nigeria

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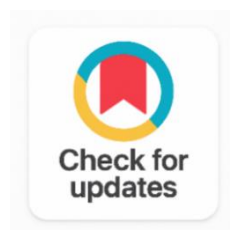
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ABSTRACT

The system of vehicle registration has been manual basic in Nigeria and other African countries; the evolution of innovative solutions aimed at enhancing the efficiency and security of vehicle data. Vehicle registration systems face limitations in efficiency, data accessibility, and real-time updates. Traditional paper-based registration processes are prone to errors, delays, and forgery. Existing electronic systems lack real-time data management capabilities and user-friendly interfaces, hindering functionalities crucial for security management in Nigeria. However, this research introduces a technological perspective showing procedures to address these challenges in vehicle management systems. To carryout analysis of this process, data is collected from local vehicle registration authorities and transportation departments in Nigeria, which includes Primary, and Secondary method of data collection and the solution development process describing several programming tools to achieving a process for real-time smart vehicle registration system.

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1. INTRODUCTION

Transportation systems are gradually changing with the development of technology, this has brought a great advancement in transportation sector in the way people, goods and services are transported. With

the coming of new technology traditional method of transportation is witnessing significant changes. In a paper by [1], describe Internet of Things (IOT) and Cloud Computing as technologies transforming the transportation sector. However advanced countries utilize the invent of smart system in vehicle management in several ways with tremendous improvement, challenges in conventional vehicle registration systems are plagued by several challenges in Africa, which includes inefficiencies in data collection, authentication, real-time data security, network and accessibility. Poor network tends to affect the management of vehicle data registration due to manual data inputs. However advanced countries utilize the use of smart system in vehicle registration, challenges in manual vehicle registration are faced by several challenges in Africa, such as inefficiencies in data collection, authentication, Document security, network accessibility. Poor network and manual processes are prompt to errors affecting vehicle management and transportation sector. [2] Derived the need for smart solutions to address the problems in vehicle registration systems. This paper discuss the challenges in vehicle registration system, considering a technological perspective to address these challenges in Nigeria.

2. RELATED WORK

The process of obtaining vehicle data and registrations has experienced increasing problems due to the incremental structure of vehicle information. The development of more cities which lead to an increase in vehicles daily causing congestion of traffic, rules violations, and vehicle theft are the challenges faced in vehicle management system within Nigeria and African regions. [3] Highlighted four steps of vehicle automation processes which are license plate extraction, image preprocessing, character segmentation and character recognition. [4] Presented an image processing technique for Indian vehicle license plate detection and validation which used pre-processing techniques.

Furthermore, in a study [5] evaluated on database management to vehicle system. Their research focus on development of a web-based platform for vehicle licensing and management [6]. Development of a client-server distributed vehicle management system to improve system performance and efficiency, the study evaluated on developing vehicle management system using Hypertext Preprocessor (PHP) scripting, Hypertext Markup Language (HTML), Structured Query Language (SQL) server, to test and validate data. [7] Developed a database system for information storage and registration of vehicles to help in management of vehicles registration and licenses process to minimizing stress of manual effort. The manual paper road check method remains a practicing method of vehicle inspection by law enforcement agencies in Nigeria.

2.1 Vehicle Management System

Nigerian vehicle inspection process involves screening of vehicle papers to show proof of ownership by vehicle owners where profile papers of vehicle owners are presented to vehicle inspection officers for verification in validating actual data and are prone to error causing poor data management which ranges from network challenges, slow data processing. However, this research seeks to resolve these issues ranging with new age technology. [8] In a study established that inadequate transportation and infrastructure had crippled vehicle transportation development of Nigeria and this has put the country in a chaotic and complex situation. Alongside when [9] supported the view that vehicle transportation system in Africa has been described as the easiest way of movement from one place to another within Nigeria. According to [10] described that manual registration processes will become tedious for registering private, commercial and government vehicles, this shows that within the coming years if digital methods are not employed, number of vehicles will increase, while registering and validating vehicle will be enlarged, wears a technological system needs to be employed. [11] Explores the benefits of real-time vehicle management system.

2.2 Manual and Digital Vehicle Registration Systems

Table 1. Comparison of Manual and Digital Vehicle Registration System

Criteria	Manual System	Digital/Smart System
Processing Time	3-7 days	Real-time to 24 hours

Error Rate	15-25%	2-5%
Data Accessibility	Physical location only	Remote access 24/7
Security Level	Low (paper-based)	High (encrypted digital)
Document Forgery Risk	High	Very Low
Retrieval Speed	Hours to days	Seconds
Storage Cost	High (physical space)	Low (cloud-based)
Scalability	Limited	Highly scalable

Table 1 shows the differences between the manual vehicle registrations with the digitalized vehicle registration system.

2.3 Overview of Transport System

The researchers discuss the need for a technological method in registering and validating vehicle owners' information digitally for prompt retrieval and Realtime access to meet current developing technology [12]. Therefore, it is mandatory for each vehicle to have a registered license vehicle identification number, which serves as their primary identifier after registration [13]. Vehicle registration system in Africa involves collecting data, saving vehicles information based on the type of vehicle, owner's information, and vehicles model [14]. These data can be tempered with easily as it contains no digital mapping during storage and processing time. Integrating real time smart systems in registration process of vehicle registration will be a step to ensuring efficiency in registration of vehicles in Africa which will improve management and processing of large data in vehicle registration. In Africa, the Nigerian government authorizes government agencies such as the Federal Road Safety Commission, state Vehicle Inspection Office and the Board of Internal Revenue to be responsible for vehicle registration and licensing control. Vehicle owners visit these offices for registration and validation of vehicle documents [15]. Manual process of vehicle registration is prone to errors due to limitations to meet current technology [16].

2.4 Types of Transport System in Nigeria

Transportation is the movement of people, goods and services from one place to another. In Nigeria we can differentiate the common types of transportation in four categories such as Air, water, land and Railway transportation.

Land transportation is the common means of transportation in Africa used by the rich and common man using Cars, buses, cycles, motorcycles, Railways etc. It involves the movement of people, goods and services from one place to another [17]. With the coming of new technology vehicle registration system needs improvement which requires introducing smart system to address the challenges encountered in vehicle management system in Nigeria. Smart systems in vehicle registration will help to improve and enhanced vehicle management systems [18].

Railways in Nigeria are seen as the safest means of transportation. Railway transportation in Nigeria is also seen as a suitable means for the movement of large numbers of goods such as cargo or bulk goods and services and agricultural produce from one location to another. This system of transportation also faces challenges despite its reliability and security to Africans, other facilities and features requires improvement to meet current technological trends [19].

The use of Ships, boats, canoes, ferries, etc. are means used in water transportation. This paper evaluates challenges in Nigeria's water transportation sector. [20], The Niger and Benue Rivers is one of the channels in water transportation in Nigeria. [21] Water transportation in Nigeria also faces challenges affecting major ports such as Warri, Lagos, Benue etc. sea ports in Nigeria. [22] Discussed the efficiency from these ports and identified lingering challenges affecting them.

Air transport is a means of movement of people goods and service using airplanes. Using Airplane, helicopter, etc. [23] discuss the services model innovation in airline management processes, [24] discussed the use of sensor technologies to improve the security of airline transport. [25] highlighted the need to improve the security systems in airline transportation system, [26] identified regional development in airplane applications stressing its improvement needs. [27] Discussed the risk management methods to

airline transportation. [28] Discussed on how new technology will transform airline transportation system. [29] The need to strengthen the signal strength around the route covering airline services is important. [30] That new technology innovation will improve airline systems matching new technology.

2.5 Modes of Transportation in Nigeria

Table 2. Transportation Mode Practice in Nigeria and Other African Countries

Transport Mode	Primary Usage	Infrastructure	Challenges
Land (Road)	Passengers and goods	Poor security system	Congestion, poor maintenance, security
Rail	Limited cargo and inter-city	Limited Development	Limited coverage, outdated systems
Water	Coastal and river transport	Limited Development	Poor navigable routes, security
Air	Long-distance passengers	Good	High costs, limited airports

Table 2 shows the structure of various transport system in Nigeria and other African countries showing their usage, infrastructure, challenges they face and their mode of technology integration.

2.6 Transportation System and the Future

Land transportation in the coming days with smart cities innovation technology will be interconnected access roads controlled using artificial intelligence, internet of things and other technologies as such, the need of a smart vehicle registration system is required to meet technological innovations [31]. Vehicles powered by hydrogen are considered by international energy agency, as fuel of the future, whose biggest challenge is the production of clean hydrogen on a large scale will be refined with new technologies [32].

Despite the advantages offered by these systems, the reliance on manual processes makes these systems susceptible to errors and fraudulent activities, compromising the overall integrity of transportation infrastructure. The absence of smart systems can bridge the integration new technologies and reduce security strength to vehicle management. [33] Highlights stress the need of integrating smart systems to enable real-time data management in vehicle registration system.

2.7 Theoretical Framework

The movement of people, goods and services from one place to another has been a priority in human daily leaving simply know as transport system or transportation. In early days transportation started on foot, moving from one location to another taking several numbers of days, weeks, months, and sometimes years to arrive at certain destinations, travelers lost in transit due to bandits or hardship. However, horses, camels, donkeys and other means of local transportation hardship and foot trekking, hence this was still affordable to the rich. As development continues vehicles of various brands are launched which reduces a number of several challenges attached to transportation and vehicle registration process. In a study [34]. Discussed the evaluation of Global system for mobile communication in Nigeria (GSM). According to them, registration of vehicle particulars which include plate number, insurance, road worthiness, and others began years ago and the method has been predominantly manual without documents renewal reminder which lacks ownership validation process which has affect automobile services [35].

The concept of manual process outlines basic ways to improving vehicle registration process. The manual method provides physical documents for authorized user to access and manage vehicle information to law enforcement officers, and government agencies to access successfully registered vehicle in real-time vehicle scenario is a challenge to this process, while this method continues, the increasing number of vehicles on the leads to the need of replacing the manual process in executing registration of vehicles to match current Technology.

3. METHODOLOGY

The existing system for vehicle registration process are; Manual form filling, reviewed, archived in physical storage and Paper Based Registration model this process faces a lot of challenges which includes errors in manual entries, Risk of document loss or damage, Delays in processing and retrieving data, and Forgery of documents increases security concerns, and poor networking capabilities leveraging on localized storage dependences.

3.1 Primary Data Collection

This method includes conducting surveys, with vehicle owners, registration officials, and local authorities to collect qualitative data on vehicle registration process. Including review from textbooks, dictionary, journals, newspapers, and internet search. Examining vehicle registration and record processes to identify practical challenges and opportunities for improvement, Field visits to vehicle registration centers allowed direct observation of the processes.

3.2 Secondary Data Collection

Reviewed existing research to understand global and regional challenges in vehicle registration systems in Nigeria, Analysis of Past Systems to examined historical records of paper-based registration systems and identifies errors and issues related.

3.3 Data Analysis and Programming Tools

This shows the various tools that can be used for developing a real-time smart vehicle registration system.

Table 3. Data Analysis and Programming Tools

S/N	Tools	Description
1.	MySQL	Database management and query execution to handle large datasets
2.	PHP	server-side scripting and developing the web-based components system
3.	JavaScript	Client-side scripting to enhance user interaction with the system

A database control system such as Structured Query Language, MongoDB, or Microsoft Access can be used, alongside server-side scripting tools like Hypertext Preprocessor (PHP) and JavaScript for building user interactions. These tools, along with their applications in data analysis and programming, are described as shown in Table 3.

4. RESULTS AND DISCUSSION

The Design process is a movement from the logical to physical stage of a system this can be classified into two phases, the system design and detail design. The system requirement identified in the analysis stage of the developing a smart system from principal input into the design phase. A system refers to an integrated collection of components that work together to accomplish specific functions or goals. This involves the abstraction, from hardware configurations to software architectures or is a set of interrelated components that interact toward achieving a purpose Systems can be physical (hardware), logical (software), or a combination of both. Example are information system, embedded system, security systems, distributed system and operating systems.

The design development employs a standard Object-Oriented Programming (OOP) language, Hypertext Preprocessor (PHP), Hypertext Markup Language (HTML), for frontend and Structured Query Language (SQL) for database and backend development for a smart vehicle registration system. The development can run on intel core i5 processor and at least an operating system of window 7,8, and higher version considering the platform of for development and configuration process.

This shows the stages carried out to achieve the review and development of a smart vehicle registration system process from initial inputs to determine its output results.

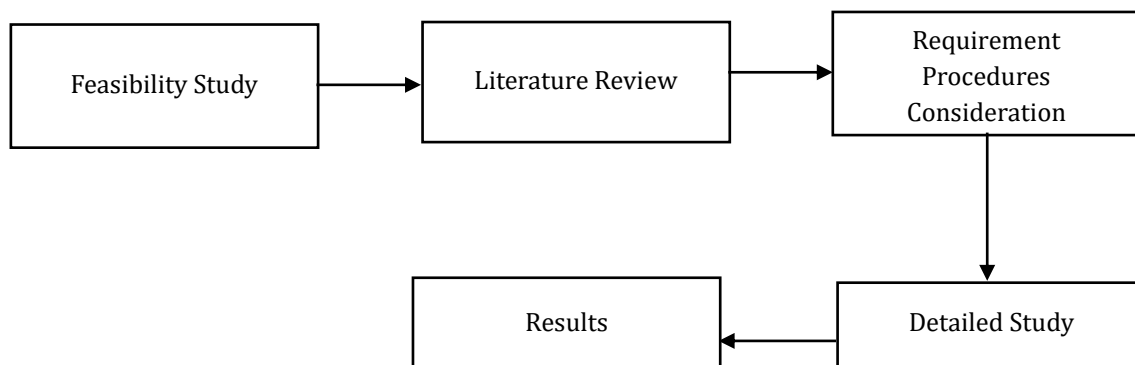


Figure 1. Process Diagram for Vehicle Registration System

Figure 1 shows the procedures to achieve the development of a smart vehicle registration system with enhances clarity, optimizes processes, facilitates documentation and communication. From the feasibility study to a detailed review work, considering requirement processes, performing detailed study and results validation.

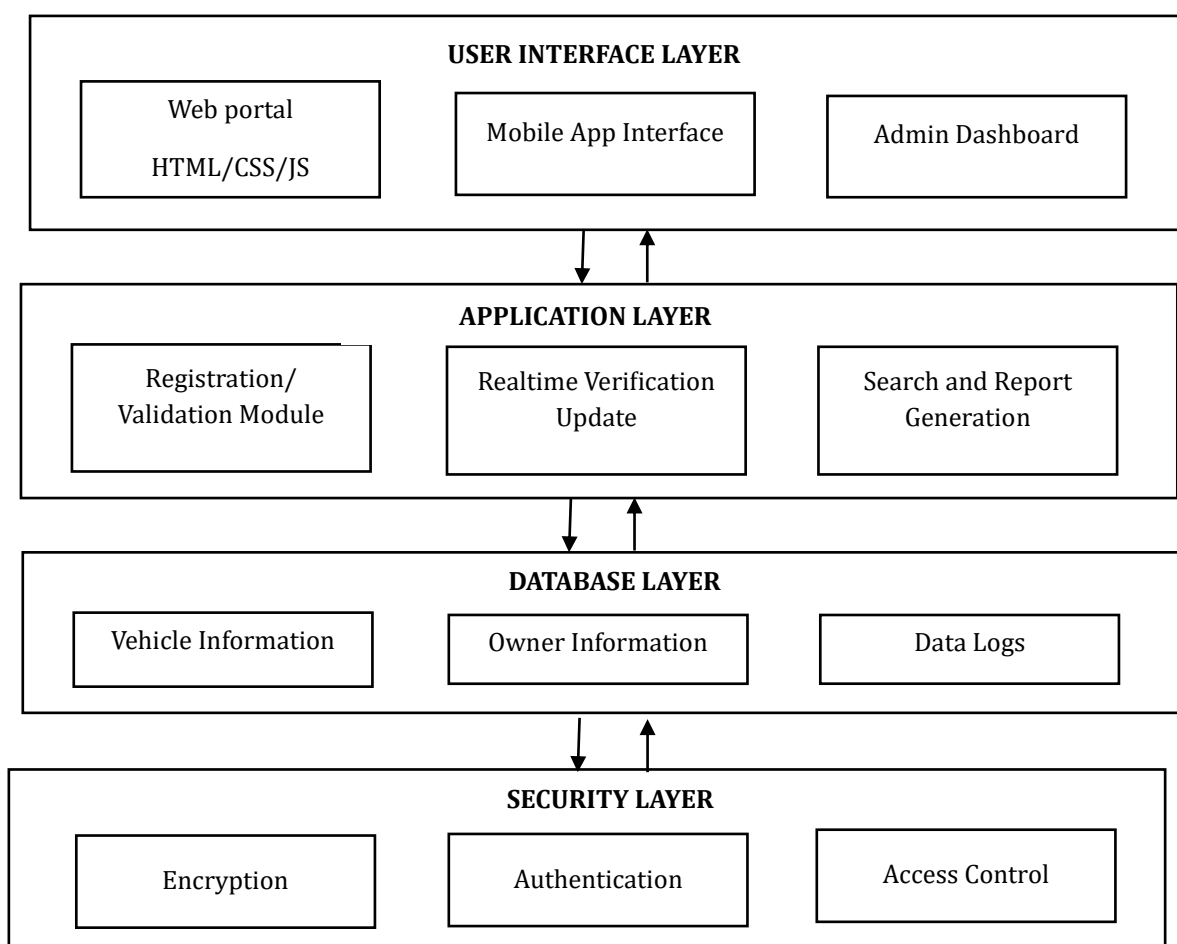


Figure 2. Smart Vehicle Registration System Architecture Process

Figure 2 describes the process flow in smart vehicle registration system considering challenges to a detailed review of current method to vehicle registration process, considering it requirements procedures

to develop a smart system to meet Technological advancement performing data validation and analysis with current methods and select best recommended principles to be used that will aid in requirement analysis, and ultimately improves vehicle registration process.

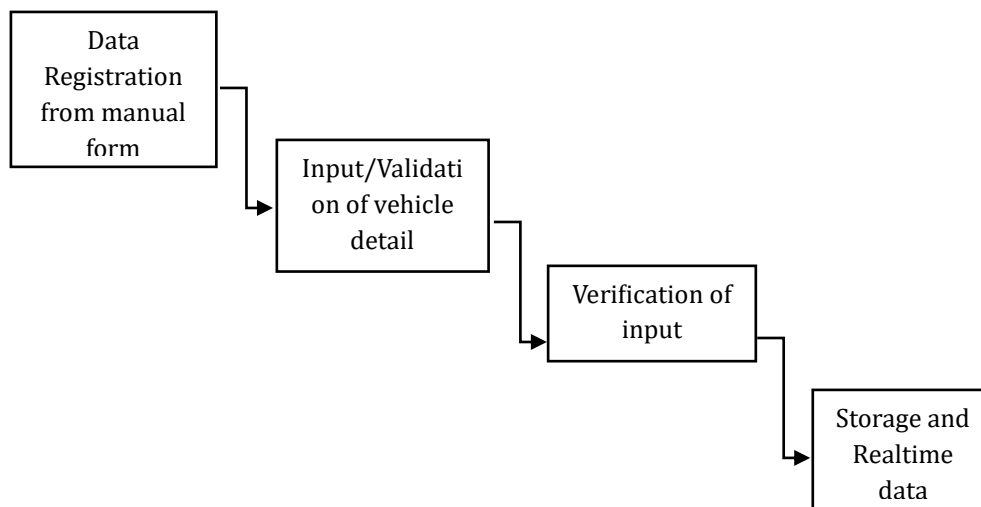


Figure 3. Data Flow Diagram of a Smart Vehicle Registration System

Figure 3 Shows the flow of data demonstrates significant improvements over manual systems to a Realtime smart data processing and retrieval methods

5. CONCLUSION

The existing vehicle registration system involves manual recording of vehicles information ranging from the date of vehicle purchase. Vehicle registration management in Nigeria have been essentially manual which has led to poor vehicle data and information processing. Nigeria and other countries in Africa practice paper presentation of vehicle license to road officers as a clearance pass without any real-time measures at Government registration agencies. The fear of stolen vehicle owners in case of theft with no traces is a traced concern. This process lacks real-time vehicle data retrieval with the emerging technology. This research addresses this problem considering challenge which leads to the need of replacing the manual process of vehicle management in executing registration process of vehicles to match current Technological challenges using a redefined methodology.

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Authors Contribution Statement

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Divine Mark	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓
Etemi Joshua Garba		✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	

C : Conceptualization	I : Investigation	Vi : Visualization
M : Methodology	R : Resources	Su : Supervision
So : Software	D : Data Curation	P : Project administration
Va : Validation	O : Writing - Original Draft	Fu : Funding acquisition
Fo : Formal analysis	E : Writing - Review & Editing	

Conflict of Interest Statement

That the authors of this research on "A Technological Perspective to the Challenges in Vehicle Registration System in Nigeria" declare that they have no competing financial interest or personal relationships that could have appeared to influence the work reported in this paper. That if there are any affiliations or funding sources that might be perceived as a conflict, it would be disclosed here. The authors have no other affiliations that could be seen as creating a conflict of interest.

Informed Consent

The informed consent of this research is obtained from all individual participants included in the research paper work. Participant were provided with detailed information about the purpose, procedures, potential risks and benefits of the research and voluntarily agreed to participate. All procedures followed were in accordance with the ethical standards of the institutional research committee and its declarations as amendments.

Ethical Approval

The research did not involve any ethics and therefore did not require ethical approval.

Data Availability

The research did not require or make use of any dataset or analysis tool during the current study.

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