Vehicle Records Registration and Management System for Organisations

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Abstract: The purpose of this article was to develop a web-based vehicle records registration and management system for organization. This system allows Babcock University as an academic institution and other subsidiary organisations to manage employee vehicles effectively. The article incorporates Quick Response (QR) code scanning at the gate to display vehicle and owner details, providing a seamless and secure process. The system leverages on Application Program Interface (API) which was developed with Laravel for data storage and retrieval. The software was tested and found useful in improving the security structure of Babcock University and other organisations by identifying all vehicle owners' at a glance. The Software will also enhance the general vehicle registration of the country with a reminder.

Keywords: Application Programming Interface, Babcock University, Vehicle Inspection Officer, Vehicle Management System, QR Code

1. INTRODUCTION

Transportation is as old as humanity and it can be defined as the movement of persons, goods, and services from one location to another. It was established that transportation started on foot (trekking), moving from one location to another though it could take days, weeks, months, and sometimes years to arrive at destinations and most times, travelers may be lost in transit due to bandits and other unforeseen hardships. These challenges of transpiration improved from one country to another depending on their technological advancement. Eventually; horses, camels, donkeys and other means of local transportation reduced trekking, and other hardship experienced on the road. Centuries later, vehicles of various brands were launched which reduces a number of aforementioned challenges.

The Nigerian inspection system has always been done manually, except for the work of [1] who concentrated on GSM-based evaluation in Nigeria. According to him, registration of vehicle particulars which include plate number, insurance, road worthiness, tainted permit among others began years ago and the method has been predominantly manual without documents renewal reminder and this also lacks ownership validation checks. This method has not only reduced the income generated to the government but it has also helped reduced the efficiency of automobile services in recent years. The hijacking of vehicles has also been assisted by this primitive method which has skyrocketed to kidnapping, killing, increased in morbidity and mortality among others within the country.

Besides the danger that this poses to individuals, it also gives room for corruption at all levels of licensing. Few months back, two vehicles were stolen in the premises of Babcock University belonging to staff. These explained challenges led the team to see the need to come together and proffer a timely solution to the aforementioned challenges. Therefore, the aim of this article was to develop a vehicle record monitoring and management system that is capable of generating a quick response code (QR CODE) that can display the vehicle registration details of the owners on demand, produced alternative drivers if such has been created on the database as a permanent or temporarily daily assistance. The software also has the capacity to remind the vehicle owners when document renewals are due via email, it can also reduce the rate of human trafficking if all vehicles are registered.

2. LITERATURE REVIEW

This literature review focuses on the key concepts of vehicle record, management system and vehicle record management system. The literature search was undertaken by the team members using the following search engines: google scholar, and science direct. Three searches were done, the first involved vehicle record, the second procedure was the management system and the third was the combination of the two key terms (vehicle record management system).

The literature search was confined to texts published in English language between 2019 till date even though some vital information were relevant though obsolete as defined. The team also assessed abstracts, technical papers as well as web pages. The team adopted a matrix method of review and used a review matrix for the review of documents which were examined carefully.

2.1 Transportation and Developing Countries

The most related work carried out before now was the research of [1] which described how insecurity can be reduced on the highway. As mentioned, the Nigerian vehicle inspection system has been done manually with the use of screening papers to show the proof of ownership which is prone to errors of omission or commission. [1] implemented the first published GSM-based vehicle security information management system that sends short messages to a designated domain, which in turn revert the profile of the vehicle owners to the vehicle inspection officers for verification. There are few sets back to this technology which ranges from network challenges, slow throughput among others which this research is out to resolve.

However, there were other papers that are indirectly linked with the topic of discussion. [2] established that inadequate transportation and infrastructure had crippled the development of Nigeria and this has put the country in a chaotic and complex situation. This was not surprising when [3], [4], and [5] supported the view that transport has been described as the basis of how cities work. I think this is logical in the African proverb that says *show me your friend and I will tell you who you are*. The mode of the technology that drives the transportation systems will certainly describe the orderliness and security nature of the country.

According to the research of [6] that described that although the registration of vehicles in Lagos State within the ten years period of investigation was still manual, however, their projection that the number of registered vehicles within the three tiers (private, commercial and government) will be increased failed with respect to their result. Despite the failure of the projection, they instead discovered that the registration fluctuated over the periods investigated. This research was supposed to help Lagos State against fraudulent acts such as kidnapping and other vices provided that the private vehicles were reduced on the road.

### 2.2 Automatic Service Needs and Auto Vehicles

[7] established the need for a computerized auto repair. Before this research, things had been done manually, however with the new system, customers and car garages will both profit from the system's installation. This will also expand, and improve operational efficiency. Customers will perform business for car service easily and comfortably. In addition, [8] developed an energy efficient machine learning based smart-able implemented and wireless battery management system for both hybrid electric vehicle and battery electric vehicle. The battery helped in the monitoring of current, voltage and temperature data to trigger control algorithms like cell balancing and thermal management using wired communication which is then sent to the cloud. You will agree with the researchers that this is the recent global direction of technology.

3. MATERIALS AND METHODS

The project followed a structured methodology to ensure a systematic approach to development and deployment. The following steps were followed in carrying out the research:

     i.   Requirement Analysis: Gathered detailed requirements through interviews and discussions with stakeholders

     ii.   System Design: Developed the system architecture, database structure, and user interface design

     iii.   Development: Implemented the system functionalities based on the defined requirements.

     iv.   Testing and Quality Assurance: Conducted comprehensive testing to ensure system reliability and functionality

     v.   Deployment and Training: Deployed the system to the production environment and provided user training and support.

     vi.   Maintenance and Support: Established a maintenance plan for ongoing system updates and support

The Vehicle Management System was developed using modern web technologies, including HTML, CSS, JavaScript, and PHP as seen in fig 1. The system leverages a MySQL database for data storage and retrieval. The key features of the system include: user registration and authentication for Babcock University employees, QR code generation and scanning functionality for quick access to vehicle details, vehicle registration and profile management with comprehensive owner information, real-time display of vehicle and owner details at the gate for enhanced security, reports and analytics for monitoring vehicle usage and generating insights as displayed in most significant features (fig. 1 to fig 5).
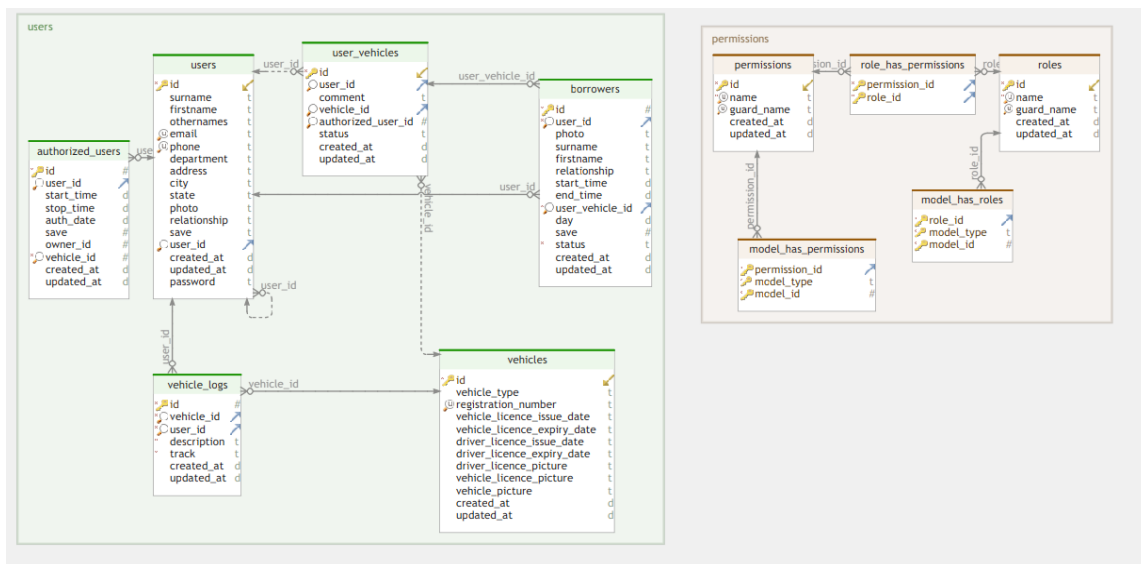
Figure 1. Database Entity Relation Diagram

Entity-Relationship (ER) diagrams were used to visualize the relationships between entities in a database. Based on the provided SQL dump, here is a report on the entity relationships:

3.1 Users

- The "users" table contains information about individual users in the system.

- Each user has a unique identification ("id") and is associated with a "name," "email," and a "password."

- Other columns may include additional user information such as "avatar" (profile picture), "phone_number," etc.

- The "created_at" and "updated_at" columns represent the timestamps for when the record was created and last updated.

3.2 Borrowers

- The "borrowers" table contains information about individuals borrowing vehicles.

- Each borrower has a unique "id" and is associated with a "user_id" and a "user_vehicle_id."

- The "photo" column stores the photo of the borrower.

- The "surname," "firstname," and "relationship" columns store personal information about the borrower.

- The "start_time" and "end_time" columns indicate the start and end times of the borrowing period.

- The "day" column represents the date of borrowing.

- The "save" column indicates whether the borrowing information is saved or not.

- The "created_at" and "updated_at" columns represent the timestamps for when the record was created and last updated.

3.3 Permissions

- The "permissions" table stores information about specific permissions or actions that can be granted to users or roles.

- Each permission has a unique "id" and is associated with a "name" and a "slug" (a unique identifier).

- The "created_at" and "updated_at" columns represent the timestamps for when the record was created and last updated.

3.4 Roles

- The "roles" table represents different roles or groups that users can be assigned to.

- Each role has a unique "id" and is associated with a "name" and a "slug" (a unique identifier).

- The "created_at" and "updated_at" columns represent the timestamps for when the record was created and last updated.

3.5 Migration

- The "migrations" table tracks the migrations executed on the database.

- Each migration has a unique "id" and is associated with a migration "name" and a "batch" number.

- The "name" column stores the name of the migration file.

- The "batch" column represents the batch number to which the migration belongs.

3.6 Failed Jobs

- The "failed_jobs" table records information about failed job attempts.

- Each failed job has a unique "id" and is associated with a "uuid."

- The "connection" and "queue" columns store details about the connection and queue used for the job.

- The "payload" column contains the serialized data of the job payload.

- The "exception" column stores information about the exception that caused the job to fail.

- The "failed_at" column represents the timestamp when the job failed.

These tables were commonly used in systems that implement Role-Based Access Control (RBAC) for managing user permissions and access rights. The relationships between these tables were typically established using additional intermediary tables such as "role_user" or "permission_role" to define which roles have certain permissions or which users belong to specific roles.

By associating users with roles and granting permissions to roles, system administrators can easily manage and control user access levels. For example, a user with an "admin" role may have more permissions and access to certain functionalities compared to a user with a "guest" role.

4. REPORT AND DISCUSSION OF FINDINGS

The screen shot of various outputs before the discussion were labelled as fig 2. to fig 5 respectively.
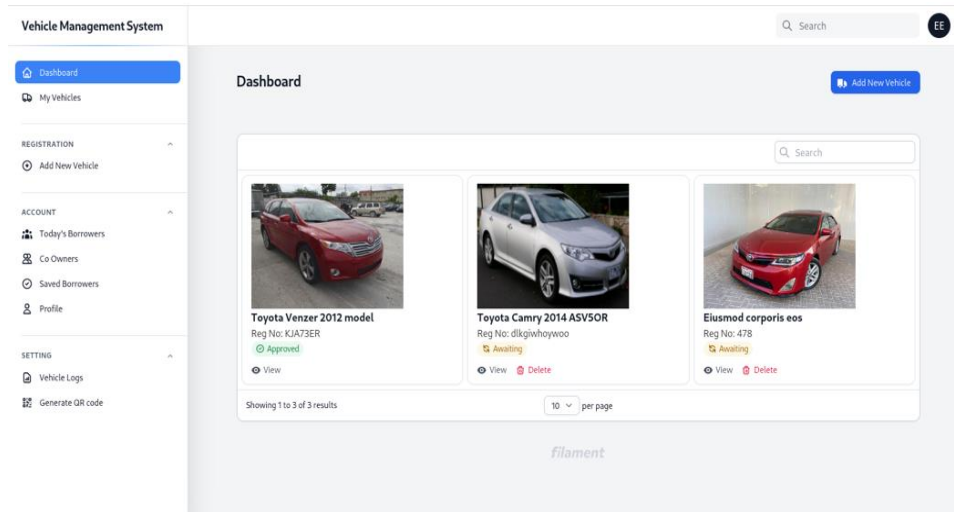
Figure 2. Employee's dashboard displaying list of employee's vehicle

Figure 2 shows the details of employee records extracted from the human resources database department. This means that non staff members cannot have their records and vehicles displayed.
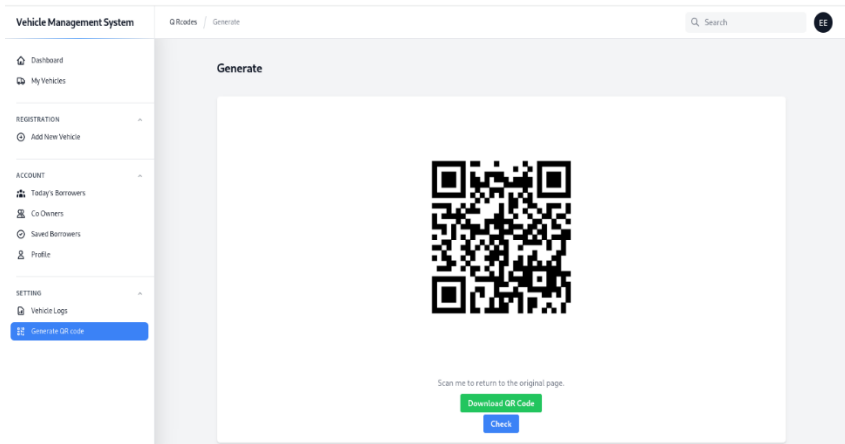

Figure 3. Generated Qr code for a vehicle

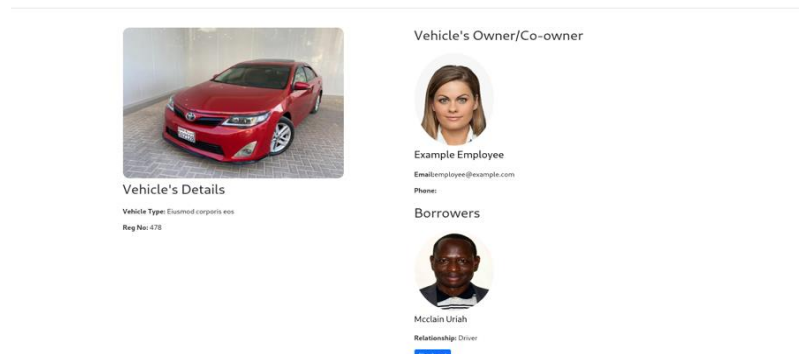Figure 3 shows an authorized QR code designed to show the details of the authorized vehicle owners.

Figure 4 shows the detailed result of the scan

1200

Figure 4. Real-time vehicle details after security scan the Vehicle's Qr code

5. DISCUSSION OF FINDINGS

The Vehicle Management System mobile application was designed using Figma and currently developed with Flutterwave. The system leverages on Application Program Interface (API) which was developed with Laravel for data storage and retrieval. The key features were displayed in fig 1 to fig 14.
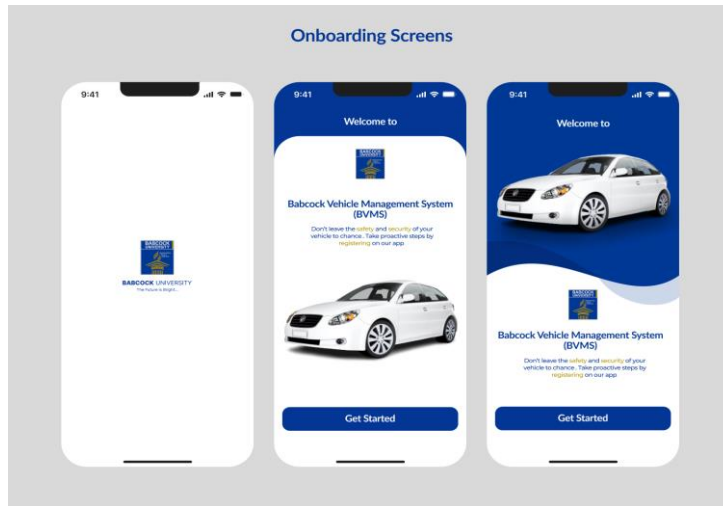
Figure 5. Onboarding Screen

CONCLUSION AND RECOMMENDATIONS

Design and deployment of vehicle management systems for Babcock University employees was developed and deployed using Figma and Flutterwave. The system leverages on Application Program Interface (API) which was developed with Laravel for data storage and retrieval. The software was tested and found useful in improving the security structure of Babcock University by identifying all vehicle owners at a glance. It was therefore recommended that the vehicle inspection officers in Nigeria through the Lagos State Government, should adopt this software which will reduce human trafficking, robbery and other associated vices in Nigeria. The article could not accommodate the validation of vehicles of visitors (guests) of the university and we look forward to other researchers who will be willing to take this up.

Acknowledgment

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