
Vehicle Management System Using RFID

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ABSTRACT. The main purpose of this study was to provide a repository area for all registered vehicle in an organized and systematic filing, archiving and reports can be printed in real time. The system can prompt the users that the validity permit of radio frequency identification tag will be expired and need for renewal. Specifically, this paper sought to design and develop the Vehicle Management System Using RFID and evaluated its level of usability and performance as perceived by the target users. A total of 189 respondents participated in the study that was composed of five experts, three employees and 181 students, faculty and staff registered for School Year 2017-2018 using a standard questionnaire International Standard Organization/International Electrotechnical Commission 25010. Descriptive research was employed on this study based on the set objectives. Findings of the study, revealed that the functionality, the level of usability and its performance were interpreted as Very Good. These findings suggested that respondents were impressed in terms of easiest registration and monitoring of the registered vehicles that enters in and out of Northern Iloilo Polytechnic State College, Main Campus.

KEYWORDS: Vehicle Management, Radio Frequency Identification Tag, Radio Frequency Identification Reader, Rapid Application Development Model

1. INTRODUCTION.

With the advance of globalization, transportation is playing an important role. Nowadays vehicles play a very big role in transportation. Also the use of vehicles has been increasing because of population growth and human needs in recent years [1]. Therefore, control of vehicles is becoming a big problem and much more difficult to solve. Vehicle management systems are used for the purpose of effective control. In present world, human population is growing bigger in its count. So the vehicle used by them will be more in number. Monitoring is becoming a big challenge [2]. Maintaining records of vehicles and data are a complicated task in manual process moreover it is difficult to generate reports. It's easier to maintain entries of vehicles in database automatically by software rather than doing it by manual process.

Nowadays Radio frequency identification (RFID) is an automatic identification method in which the data are stored in the RFID tags. The technology requires the cooperation of an RFID reader and an RFID tag. An RFID tag is an object that can be applied in to an object for the purpose of identification and tracking. This can be done by using radio waves [3]. DuruguKiranmayi [2], proposed the "Vehicle monitoring system" to manage vehicles. The feature of the proposed system is to generate daily reports monitoring of vehicles can be done automatically. Whenever vehicle entered into the organization the in time and out time is noted automatically by the RFID device. Monitoring can be done easily administrator can easily generate reports and verify the owner of the vehicle. The proposed system helps in loss of vehicles because of automated system. The records which are maintained manually are automated with this device and software. Overall this Vehicle monitoring system simplifies the task of managing vehicles by security guards and made automated system. Another method for vehicle identification is by using RFID technology. A research by Akash Sharma et al. [4] by using advanced vehicle identification system for reserved parking lots or gated communities using RFID technology. The system uses RFID technique for identification. When a vehicle carrying an RFID tag passes a checkpoint equipped with an RFID reader, the identification data of the vehicle is transmitted to the RFID reader and backend system, which associates the vehicle's ID with a pre-existing rule database entry. If the transmitted data matches with the database entry, then the vehicle is considered to be authorized and it is permitted to enter the premises otherwise not. The remarkable feature of this Vehicle Recognition System Using RFID is the easy implementation and faster response. Automatic vehicle identification can dramatically increase security and saves time. Another research that was using RFID was a vTrack, developed by MohdPouziHamzah et al. [5], for developing tracking systems for vehicles. Vehicle tracking is one way to improve company or organization efficiency, increase profitability, especially in the business of large vehicle fleets. The automatic vehicle tracking

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facility delivers the flexibility, scalability, and responsiveness that today's organizations need. vTrack requires installing RFID tags on all vehicles and RFID readers on various junctions of location for tracking. vTrack aimed to track vehicles that passing through premise's gate. vTrack provides a complete screening process for security requirements and assists the safety also can be used more easily and effectively. Based on the result of survey vTrack is useful it can assist and facilitate the process of vehicle tracking, especially for the security. The vTrack is required to assist the safety and can be used more easily and effectively and also needed to assist security officers in doing their daily tasks with easy and efficiently works. The vTrack developed according to the needs of users in the careful planning and analysis.

In light of this study, it focuses on the transformation of the current manual system used by the NIPSC in accepting the registration from the vehicle owner and monitoring of the vehicles that enter the NIPSC Main Campus. The purpose of the system is to provide a repository area of all registered vehicle owners of Northern Iloilo Polytechnic State College Main Campus in an organized and systematic filing, archiving and reports can be printed in real-time. Whenever vehicle entered into the organization the in time and out time is noted automatically by the RFID device which the registered RFID tag serve as their car pass. It is in this context that this paper sought to design a prototype and develop a computer-based system that is able to provide real-time information through RFID technology to students, faculty and staff regarding of their registration and monitoring of registered vehicles that enters in and out of Northern Iloilo Polytechnic State College Main Campus. It further aimed to determine the level of usability of the developed features of the Vehicle Management System Using RFID and also evaluate the performance of the Vehicle Management System Using RFID in terms of reliability, functionality, and efficiency of the information provided to clientele.

2. METHODOLOGY

2.1 Software Development Life Cycle

This study employed the Rapid Application Development (RAD) model as the software development life cycle for the software development process. The RAD model is based on prototyping and iterative development with no specific planning involved. The process of writing the software itself involves the planning required for developing the product. Rapid Application development focuses on gathering customer requirements through workshops or focus groups, early testing of the prototypes by the customer using iterative concept, reuse of the existing prototypes (components), continuous integration and rapid delivery [6].

The RAD model is consist of four phases namely requirements planning phase, user design phase, rapid construction phase and implementation phase [8]. At each phase, the researcher performs specific activities leading to the phase's deliverable. Since the RAD model heavily relies on the involvement of the users, the deliverables are presented to them to further refine the final product. Figure 1 shows the RAD model.



Figure 1. The Rapid Application Development Model

3.2. Logical Architecture Model

The logical architecture models is a structural design that gives as much detail as possible without constraining the architecture to a particular technology or environment [7]. In this study, the three tier architecture was employed. The three-tier architecture is a type of software architecture which is composed of three "tiers" or "layers" of logical computing. They are often used in applications as a specific type of client-server system [9]. There were three tiers included in the design composed of presentation layer, application layer, and data layer. The presentation or GUI layer is the front end layer in the 3-tier system and

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consists of the user interface. The application layer contains the functional business logic which drives an application's core capabilities. Under of this layer where the various modules and sub modules of the developed system. The data layer comprises of the database/data storage system and data access layer. Figure 2 shows the logical architecture model of the developed system.

Presentation Layer

GUI

Application Logic Layer

- Vehicle Information Module
- Vehicle Owner's Information Module
- Registration Module
- Report

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Data Layer

- MySQL
- Databases
- Tables
- Fields
- Record

Figure 2. The Logical Architecture Design of the Developed System

2.2 Physical Network Topology

The physical network topology visualizes the communication schemes of physical networks and its networks arrangement. The physical network topology illustrates the placement of the components in the network. It shows the configuration of cables, computers, and other devices. Since the developed system is vehicle management system using RFID. The vehicle owner has a registered RFID tag, these pre-coded tags contain unique ID code. When the vehicle owner approaches the gate, the vehicle owner tap the RFID tag to the RFID reader then the RFID reader detects and collects information from the tag, then sends it to the server system for verification. The system matches the RFID tag information against database records and signals to open gate if it is an authorized vehicle, otherwise alert message will pop up on the screen as well as for the expired registration. System records date and time stamp of every tag detection. Figure 3 shows the Physical Network Topology of the developed system.



Figure 3. Physical Network Topology of the Developed System

3.4. Proposed System Prototype

Prototype is a rudimentary working model of a product or information system, usually built for demonstration purposes or as part of the development process. Figure 4.0 shows the main interface of the system. This form is used to navigate the whole system and composed of three (3) tabs namely, File, Manage and Report.

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Figure 4. The Main Interface of the Developed System

On the other hand, Figure 5.0 shows the screen for the registration form, it display the registration information such as the RFID, Owner, Plate Number, Log-in and the Status as well as it will show the profile of the owner. This form will serve as monitoring for the registered vehicle and authorized owner that enters the campus.

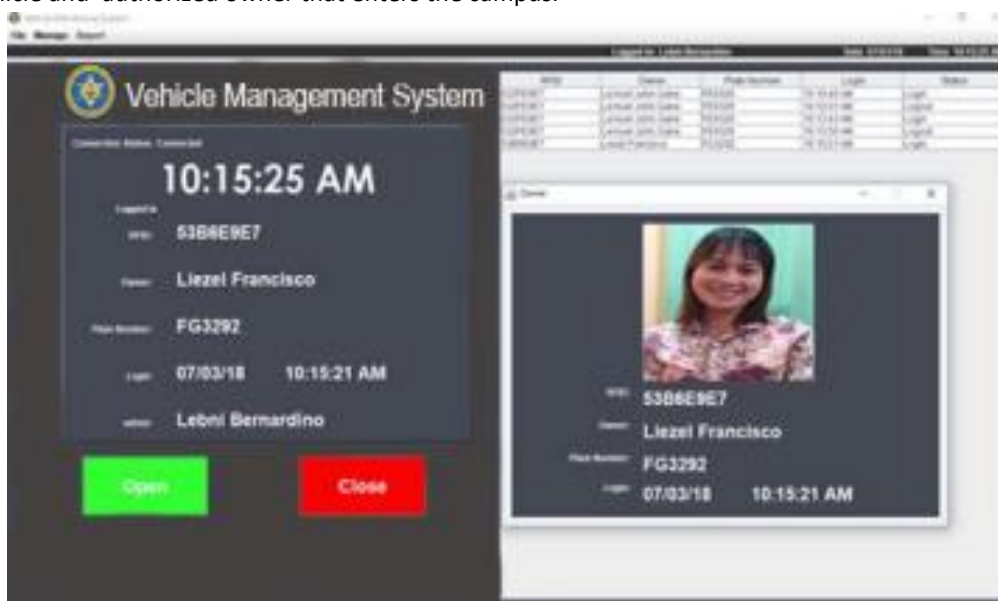


Figure 5. The Registration Form of the Developed System

3. RESULTS AND DISCUSSIONS

3.1 Functionality of the System Product

The table below shows the result of the respondent's feedback on the functionality of the system product in terms of functional appropriateness, functional correctness, and functional completeness. In registration and monitoring of the registered vehicles, the functional completeness (M=4.67), functional correctness (M=4.76), functional appropriateness (M=4.72) were interpreted as "Very Good".

The findings implied that using the Vehicle Management System Using RFID was very good it is greatly needed by the users. The transactions involve by registration of vehicles either in new/renewal, monitoring of authorized vehicle, also the automatic prompt of the system if the validity permit of the RFID tag will be expired or already expired and need for renewal. The user can be able to perform their tasks as expected from them, especially in accepting registration from the vehicle owners in easiest and efficiently manner. Table 1 shows the result of the functionality of the system.

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Table 1. Respondent's Feedback on the Functionality of the System Product

Implementation Indicators	Mean	Verbal Interpretation
Functional completeness	4.67	Very Good
Functional correctness	4.76	Very Good
Functional appropriateness	4.72	Very Good

3.2 Level of Usability

Usability characteristics is the capability of the software product that describes its ease of use. The level of usability of the developed system was evaluated in terms of learnability, operability and accessibility. The respondent's feedback for the level of usability in terms of learnability (M=4.78), operability (M=4.75), and for the accessibility (M=4.77) were described as "Very Good".

The findings implied that the developed system, it can be easily operated and monitored by the user that is very greatly needed in the day to day transactions. Also, the interface of the system can be easily too learned. It showed that the user and the vehicle owners believed that the system would be a great help in serving its clientele. Table 2 shows the result of the level of usability of the developed system.

Table 2. The level of the Usability of the System Product

Implementation Indicators	Mean	Verbal Interpretation
Learnability	4.78	Very Good
Operability	4.75	Very Good
Accessibility	4.77	Very Good

3.3 Performance Evaluation of the System Product

The performance of the developed system showed the result in terms of time efficiency (M=4.72) and the reliability (M=4.50) were interpreted as "Very Good".

The findings implied that the evaluation of the performance of the system, the respondent's believed that the response time and throughput process were impressive. The system was able to provide real-time information through managing of records of the vehicles in the day to day transactions. It also provided the correct result with utmost precision and was able to accomplish the specific tasks they wanted for the system to perform. Moreover, in terms of reliability of the developed system, the respondents agreed that it is operational, accessible and responsive every time that respondents could easily registered their vehicle and the validity permit of their RFID tag if it is expired and need for renewal. Table 3 shows the result of the performance evaluation of the system.

Table 3. The Performance Evaluation of the System Product

Implementation Indicators	Mean	Verbal Interpretation
Time execution	4.72	Very Good
Reliability	4.50	Very Good

4. CONCLUSION

Based on the interpretation of the findings of the study, the following conclusion were arrived:

The Vehicle Management System Using RFID was able to accept registration easily and monitored authorized vehicles as well as the automatic prompt of the system to the user if the RFID tag will be expired or already expired. It provided the user requirements and needs with a high level of functionality.

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The Vehicle Management System Using RFID was able to provide an acceptable level of usability due to its simple interface that is easy to learn and operate as well as easy access.

The performance evaluation of the Vehicle Management System Using RFID in terms of time efficiency and reliability were impressive. It provides real-time information to users. It provides the correct result with utmost precision and was able to accomplish the specific tasks. It is reliable where the respondents agreed that it is operational, accessible and responsive every time.

5. RECOMMENDATIONS

From the findings and conclusions of the study, the following recommendations were strongly suggested. Since automation and computerization is adapted in school, it may be suggested that the Vehicle Management System Using RFID be implemented and used by Northern Iloilo Polytechnic State College to help the resource generation officer in registration and the security guards for monitoring the vehicles.

The institution may conduct trainings to the intended users for the familiarization of the system, especially during data entry of important inputs for the system to work.

The school may continue to update the system which may help to maximize its potential and improve its functionalities, reliability and efficiency.

A similar study should be made using the integration of Short Messaging System (SMS) to notify the expiration date of their RFID car pass and highly recommended the RFID high end.

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