Tribhuvan University Faculty of Humanities and Social Science

A PROJECT REPORT

on

Vehicle Verification and Traffic Support System

Submitted to Department of Computer Application

United College

In partial fulfillment of the requirements for the Bachelors in Computer Application

Submitted by:

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BCA 8th semester, 2018 Batch

October 2023

Under the Supervision of

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Faculty of Humanities and Social Sciences

United College

SUPERVISOR'S RECOMMENDATION

I hereby recommend that this project prepared under my supervision **by Samrat Dhakal** (6-2-421-2-2018) entitled "**Vehicle Verification System and Traffic Support System**" in partial fulfillment of the requirements for the degree of Bachelor of Computer Application is recommended for the final evaluation.

……..

Mr. Hikmat Rokaya

Supervisor

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Faculty of Humanities and Social Science

United College

LETTER OF APPROVAL

This is to certify that this project prepared by **SAMRAT DHAKAL** entitled "**Vehicle Verification System and Traffic Support System**" in partial fulfillment of the requirements for the degree of Bachelor in Computer Application has been evaluated. In our opinion it is satisfactory in scope and quality as a project for the required degree.

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ABSTRACT

The Vehicle Verification and Traffic Support System (VVTS) addresses the challenges arising from the increasing number of vehicles on the roads in Nepal. The system aims to streamline processes related to vehicle verification, ownership transfer, and traffic support. By integrating features such as online verification of vehicle documents, number plate scanning for owner identification, and facilitating tax clearance requests, VVTS seeks to enhance efficiency and reduce manual processes. The proposed system not only aims to benefit individual users by providing a user-friendly platform but also contributes to overall road safety by promoting awareness of traffic rules and regulations.

The project utilizes a waterfall methodology for development, ensuring a systematic approach to design, implementation, and testing. The system architecture incorporates modern technologies, including HTML, CSS, Java (Spring Boot), and Postgres Database. The feasibility study indicates technical, operational, and economic viability. Testing, including unit testing and system testing, ensures the reliability and performance of the VVTS.

In conclusion, the VVTS emerges as a comprehensive solution to the current challenges in vehicle verification and traffic management in Nepal. It not only fulfills its objectives in providing a user-friendly platform for online verification but also serves as a valuable tool for promoting road safety. The lessons learned from the project development process and its outcomes contribute to the enhancement of vehicle-related services and traffic management systems. Future recommendations may include addressing integration challenges, raising awareness, and expanding the system's capabilities to further meet evolving needs in the domain.

Keywords: Java, Angular, OCR, OpenCV, Spring boot, Rest API

ACKNOWLEDGEMENT

This is to acknowledge all those without whom this project would not have been reality. I would like to express my gratitude to my project supervisor Mr. Hikmat Rokaya who took keen interest on my project and guided me throughout the project by providing all the necessary ideas, information and knowledge for the development of a web application. I am also appreciative of the efforts of Mr. Kul Poudel, without his supporting role, the
the project would have been nowhere near completion.

I am thankful and fortunate enough to get constant support from my faculty members of the BCA department who helped me to successfully complete my project. I would also like to extend my regards to all the non-teaching staff of the BCA department for their timely support. Last but not the least, my thanks and appreciation also go to each and every one of my colleague's encouragement and help in designing and making my project creative.

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LIST OF ABBREVIATIONS

API	Application Programming Interface
CSS	Cascading Style Sheet
HTML	Hypertext Markup Language
IDE	Integrated Development Environment
JS	JavaScript
MVC	Model View Controller
REST	Representational state transfer
UI	User Interface
VS	Code Visual Studio Code
OCR	Optical Character Reading/Reader

CHAPTER 1: INTRODUCTION

1.1 Background

The rise in the number of vehicles on the road has led to several traffic-related issues, including accidents, vehicle theft and traffic rule violations. A proper vehicle verification and traffic support system can help address these problems by providing a platform for online vehicle verification, traffic support, and transfer of vehicle ownership. The proposed system aims to offer a solution to these issues, making it easier for users to get their vehicle documents verified and learn about traffic rules and regulations.

The proposed Vehicle Verification and Traffic Support System aims to provide a range of features to users. These features include verifying the owner of the vehicle through the vehicle number plate, verifying vehicle documents such as bluebook and insurance certificate online through the license number or vehicle number plate, providing license written exam support and traffic rule knowledge to users, enabling users to pay process and verify their tax clearance of vehicle.

The proposed system is expected to provide several benefits to users. The system will reduce the time required for vehicle verification and make it easier for users to check vehicle information throughout the number plate detection. Furthermore, the system will provide a mechanism for process tax clearance. The system will also help reduce traffic violations and accidents on the road by providing support for users to learn about traffic rules and regulations, making it a useful tool for promoting road safety.

1.2 Problem Statement

Nepal is witnessing a significant increase in the number of vehicles on the road. However, the lack of an efficient vehicle verification and traffic support system has led to several issues such as frequent road accidents, traffic congestion, and violation of traffic rules. The current manual-based tax clearance process is cumbersome, time-consuming, and prone to errors. Additionally, it requires the physical presence of both parties, resulting in inconvenience to the public.

Furthermore, the existing system for verifying the owner of the vehicle and the vehicle-related documents is also outdated and lacks effectiveness. It is a time-consuming and manual process that requires the submission of all relevant documents such as blue book, license etc. This often results in delays and leads to frustration among the public.

Therefore, there is a need for a modern, efficient, and user-friendly vehicle verification and traffic support system that can overcome these issues. The proposed system will provide real-time verification of vehicle ownership, vehicle documents, and license of the driver.

1.3 Objective

- Verify the ownership of vehicles through their number plates scan to prevent vehicle theft and misuse.
- Provide online platform to view vehicle document such as blue book, license etc.
- Enable the process tax clearance request through online.

1.4 Scope

- This platform allows traffic police to verify vehicle ownership through number plates or license numbers.
- This platform enables users to view their vehicle documents, such as bluebook and license.
- This platform enables users to process and verify their vehicle tax clearance.

1.5 Limitation

- Integration challenges and data reliability may arise.
- Compliance and legal hurdles in online ownership transfer.
- Adoption and accessibility require awareness campaigns.

1.6 Report Organization

The main report is organized in a chapter-wise manner. The report consists of five different chapters.

Chapter 1: Introduction

Here, I briefly introduced my project, its existing problems, my solution to that problem and its scope and limitations.

Chapter 2: Background Study and Literature Review

This chapter includes project related theories, general concepts and study of preexisting similar projects.

Chapter 3: System Analysis and Design

All the documentation of actual project development activities like requirement gathering feasibility study modeling and designing are included in this chapter.

Chapter 4: Implementation and Testing

In implementation part, I have defined the tools used to implement my project like CASE tools

and testing is performed for each function of the product.

Chapter 5: Conclusion and Future Recommendations

This chapter includes the conclusion and recommendations of the project.

CHAPTER-2 BACKGROUND STUDY AND LITERATURE REVIEW

2.1 Background Study

The background study aims to provide an overview of the existing situation related to vehicle verification and traffic support systems. It involves understanding the current challenges faced by the transportation sector, the rise in the number of vehicles on the road, and the associated issues such as accidents, vehicle theft, and traffic rule violations. The study also examines the manual-based processes for vehicle ownership transfer and verification of vehicle-related documents, which are time-consuming, prone to errors, and inconvenience to the public. Additionally, it explores the outdated methods of verifying vehicle ownership and documents and the need for a modern, efficient, and user-friendly system to address these issues.

2.2 Study of Existing System

During my research, I analyzed two existing systems that provide similar services to my proposed Vehicle Verification and Traffic Support System. By studying these systems, I gained valuable insights and identified areas for improvement in order to enhance the functionality and user experience of my system.

- **Department of Transportation Management (DOTM):**

The DOTM system primarily focuses on facilitating the scheduling of license exams for users. It allows individuals to upload their personal details and select a suitable date for their exams. However, the system lacks comprehensive features for vehicle verification and online transfer of ownership. I recognized the need to expand beyond exam scheduling and incorporate additional functionalities to address the broader challenges faced by vehicle owners and traffic management.

- **Nagarik App:**

The Nagarik App is designed to enable users to store important documents such as citizenship certificates, driving licenses, and vehicle bluebooks digitally. While this feature provides convenience, the app primarily serves as a personal document storage platform

and does not offer a tax clearance process. My proposed system builds upon the concept of digital document storage but goes a step further by integrating the tax process system and facilitating number plate detection to identify the vehicle ownership.

By examining these existing systems, I identified their limitations and refined my approach to create a more comprehensive and user-friendly Vehicle Verification and Traffic Support System. My system aims to provide a robust solution that encompasses features such as real-time document validation, online ownership transfer, and access to traffic rules and regulations, addressing the diverse needs of vehicle owners and promoting road safety.

2.3 Data Collection

2.3.1 Source of Data

I. Primary Source

Observation:

● **Description**: Observation of current challenges in Nepal's traffic management and vehicle verification system.

Context: The rise in the number of vehicles on the road has resulted in issues such as accidents, vehicle theft, and traffic violations.

Issue Identification: Lack of a proper vehicle verification and traffic support system exacerbates problems, with manual processes causing delays, inconvenience, and contributing to road safety issues.

● **Interview**:

Description: Interviews conducted with stakeholders, including colleagues, seniors, and relevant faculty members.

Feedback: Consistent feedback highlighted issues like frequent road accidents, traffic congestion, and violations of traffic rules.

Issue Details: The existing manual tax clearance process is cumbersome, time-consuming, and prone to errors. Verification of vehicle ownership and related documents is outdated, leading to delays and frustration among the public.

CHAPTER 3: SYSTEM ANALYSIS AND DESIGN

I am going to use the waterfall methodology while building the website. This project has specific documentation, sample time, fixed requirements, well-understood technology so in order to build this system, waterfall methodology can be used.

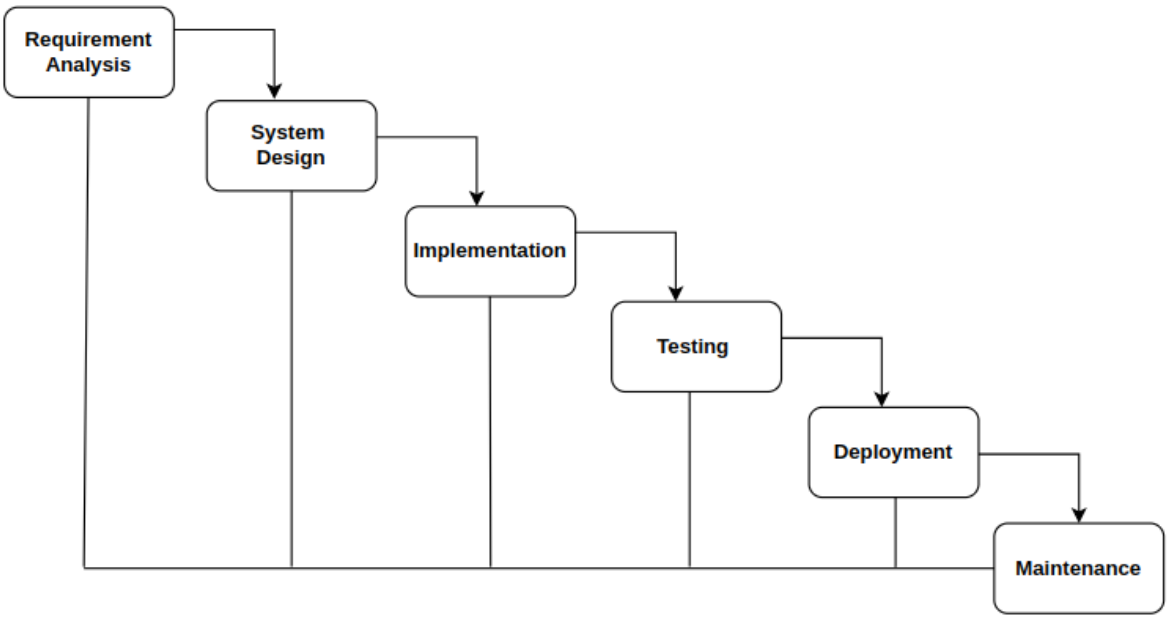

Figure 3.1: Methodology used in VVTS

The Waterfall Model was the first Process Model to be introduced. It is also referred to as a linear-sequential life cycle model. It is very simple to understand and use. In a waterfall model, each phase must be completed before the next phase can begin and there is no overlapping in the phases. It is easy to arrange tasks and clearly defined stages.

3.1 System Analysis

It is a process of collecting and interpreting facts, identifying the problems, and decomposition of a system into its components. System analysis is conducted for the purpose of studying a system or its parts in order to identify its objectives. It is a problem solving technique that improves the system and ensures that all the components of the system work efficiently to accomplish their purpose.

3.1.1 Requirements Identification:

This system needs to fulfill following functional and non-functional requirements.

I. Functional Requirements:

Title	**Login**
Description	Admin and user should be able to login with their username and password.
Input Data	Username and password
Source of Input	Login form
Result	In case of valid credentials, it should be redirected to the respective database as per role. If credentials are not valid they should be redirected back to the login page with a proper error message.
Validation	-
Precondition	The username and password must be registered

Table 3.1.1: Functional Requirement of Login Module

Title	User Register
Description	Users should be able to register with their information.
Input Data	Name, email, mobile number and password
Source of Input	register form
Result	In case of complete data, it should be redirected to the login page with a success message. If data are incomplete then it should show the exact error message on register page
Validation	- All field are required - password must be match
Precondition	Email and mobile number must be unique

Table 3.1.2: Functional Requirement of Register Module

Title	Add new bluebook
Description	Admin should be able to create new bluebook details of any vehicle.
Input Data	Citizenship no, vehicle type, vehicle identification no, number plate
Source of Input	Bluebook addition form
Result	If all the given inputs are valid, then a new bluebook should be created and shown into the list instantly. If input data is not valid, it should show the proper message.
Validation	All fields must be required. Citizenship no and vehicle identification no must be valid.
Precondition	The login user must be admin

Table 3.1.3: Functional Requirement of Bluebook Module

Title	Add new License
Description	Admin should be able to add new license details of users.
Input Data	Citizenship no , valid date , license category and district
Source of Input	license addition form
Result	If all the given inputs are valid, then a new license should be added and shown into the list instantly. If input data is not valid, it should show the proper message.
Validation	All fields must be required. Citizenship no. be valid.
Precondition	The login user must be admin

Table 3.1.4: Functional Requirement of License Module

Title	Action on user Kyc Request
Description	Admin should be able to take action on user kyc requests.
Input Data	Action command such as accept and reject
Source of Input	Command button
Result	If the Admin clicks on the accept button then it should change the user kyc status to verified. If the admin clicks on the reject button then it should change the user kcy status to rejected.
Validation	-
Precondition	The login user must be admin

Table 3.1.5: Functional Requirement of User Kyc Module

Title	**Number plate scanning**
Description	Admin should be able to scan the number plate of a vehicle and find out the owner of that vehicle.
Input Data	Number plate image
Source of Input	Number plate scan form
Result	When the user chooses an image and clicks the process button then it should do the below work. if a user exists on the given number plate on the system it should display the details of the user otherwise it should display the number plate on text and proper message.
Validation	-
Precondition	The login user must be admin

Table 3.1.6: Functional Requirement of Number plate scanning Module

Title	**Action on Tax Clearance Request**
Description	Admin should be able to take action on ownership requests.
Input Data	Action command such as accept and reject
Source of Input	Command button
Result	If Admin clicks on the accept button then that tax clearance request should be verified. If Admin clicks on the reject button then the tax clearance request should be declined.
Validation	-
Precondition	The login user must be admin

Table 3.1.7: Functional Requirement of Tax Clearance Module

Title	**Add new Vehicle**
Description	Admin should be able to add new vehicle information.
Input Data	Manufacture year, vehicle type, company code, company name
Source of Input	Vehicle add form
Result	If all the given inputs are valid, then new vehicles should be added and shown into the list instantly. If input data is not valid, it should show the proper message.
Validation	-
Precondition	The login user must be admin

Table 3.1.8: Functional Requirement of Vehicle Module

Title	**Update KYC**
Description	Users should be able to update their KYC.
Input Data	Name, email, contact, address, pp, citizenship no, citizenship photo
Source of Input	KYC update form
Result	If all the given inputs are valid, then a new user kyc request should be sent to the admin for verification. If input data is not valid, it should show the proper message.
Validation	-
Precondition	The login user must be user

Table 3.1.9: Functional Requirement of Update Kyc Module

Title	**Process Tax**
Description	Users should be able to process their tax clearance request.
Input Data	Citizenship no, vehicle type, vehicle identification no, number plate, paid amount, tax paid doc
Source of Input	Tax clearance form
Result	If all the given inputs are valid, then a new tax clearance request should be sent to the admin for verification. If input data is not valid, it should show the proper message.
Validation	-
Precondition	The login user must be user

Table 3.1.10: Functional Requirement of Process Tax Module

Use Case Diagram:

Figure 3.1.1: Use Case Diagram

II. Non-Functional Requirement

- **Scalability:**

Since the project Backend and Frontend are separate. Later this project can be easily extended to Mobile Application using the same Backend API.

- **Security**

Sensitive information like passwords are encrypted and proper user authentication is required to access API endpoints, hence making this platform more secure.

- **Availability**

Vehicle verification and traffic support system is a web-based application, anyone with internet access can easily access and use this site.

- **User Friendly**

Both admin and user will be able to access and work around the system easily due to its simple user interface

3.1.2 Feasibility Study

Feasibility study is conducted to make sure the end product is feasible regarding different factors like technical, operational and economical.

Technical Feasibility:

To design this platform, we don't need high performance hardware and software. IDEs like IntelliJ IDEA and Visual Studio Code, which are freely available, can be used to develop this platform.

Operational Feasibility:

Since the users are already exposed to many management systems, they can easily navigate around my system. As every student and teacher has a smartphone and laptop in their hands and are very familiar with online platforms, they can easily access my project management system. The interface of this platform is very understandable and easy to use.

Economic Feasibility:

The cost of the development is very minimal. Similarly, the system can generate revenue by selling the system to various colleges and organizations.

3.1.3 Class Diagram

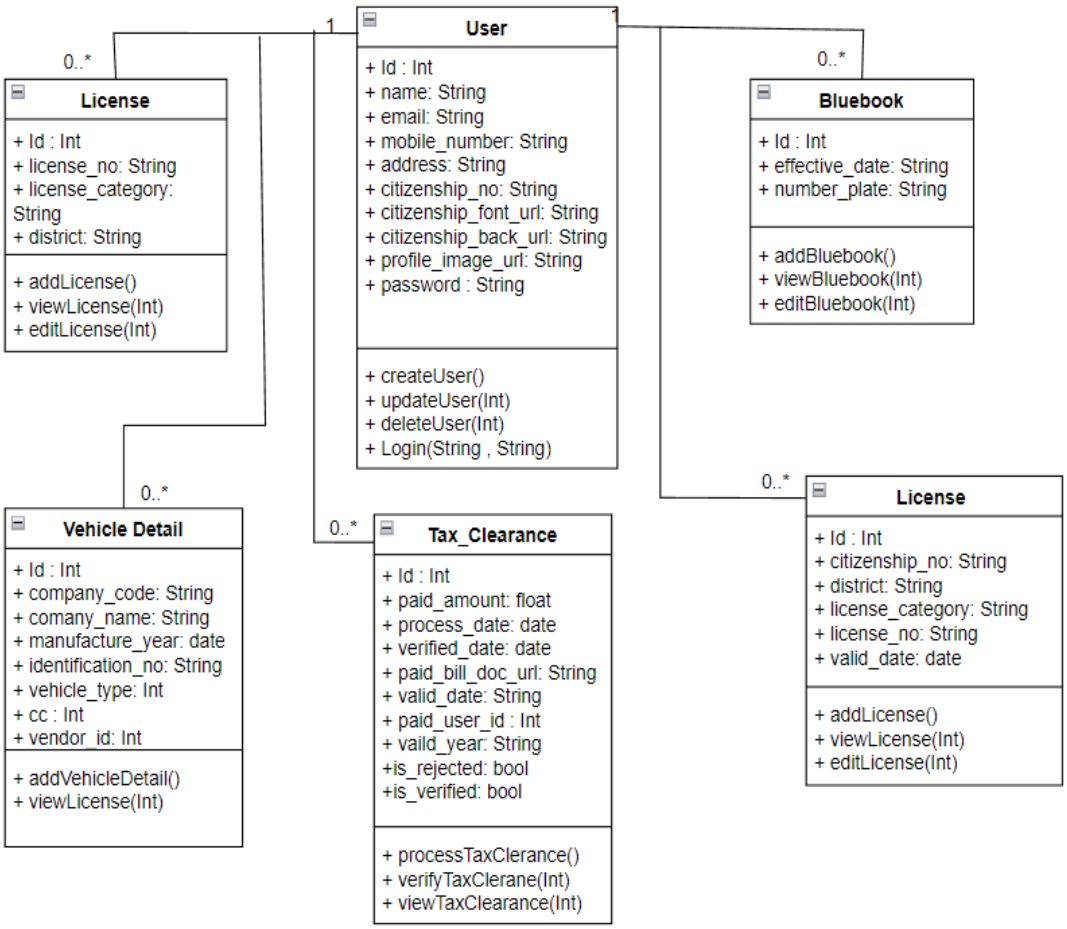

Figure 3.1.2: Class Diagram

3.1.4 Sequence Diagram

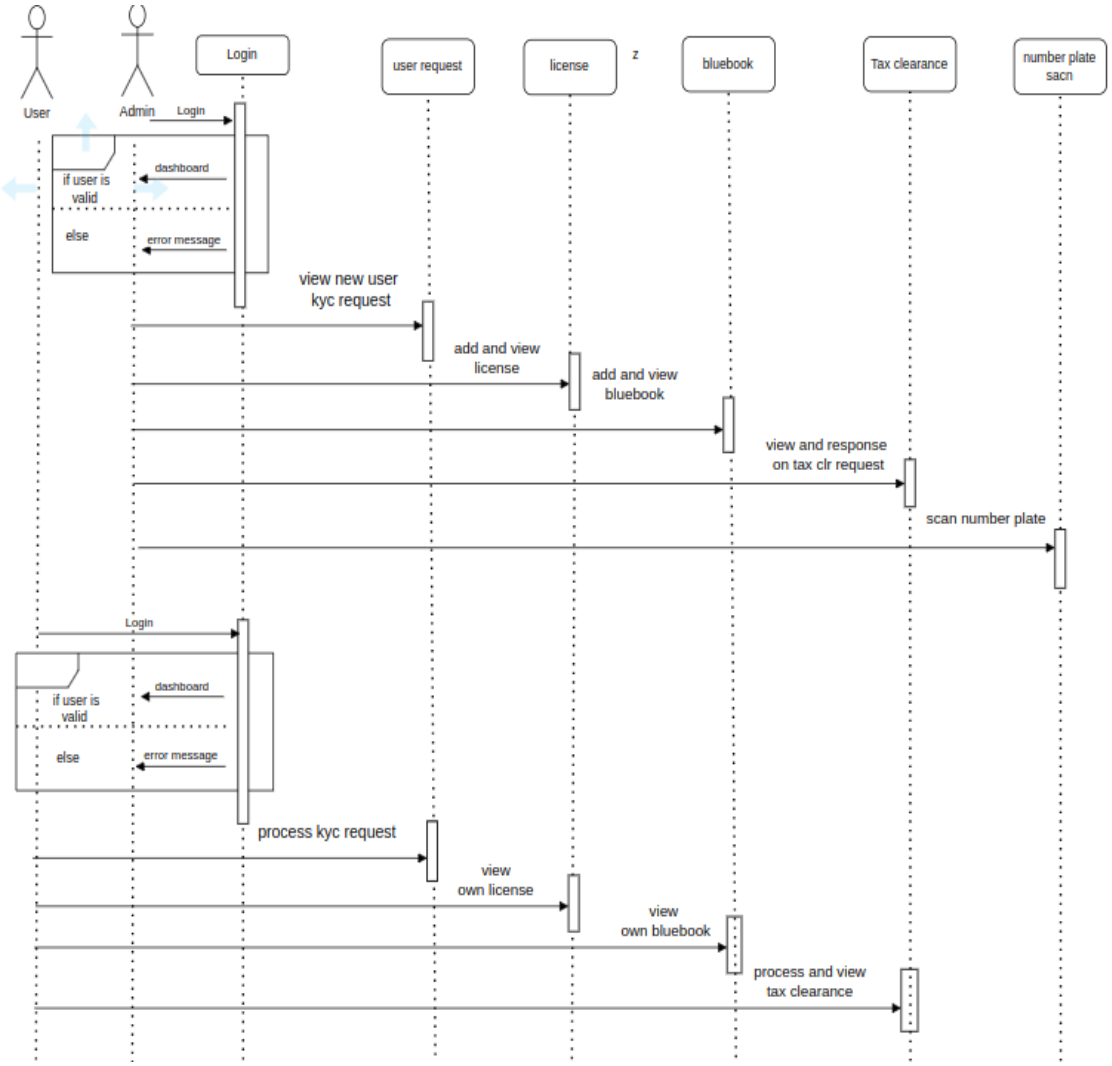

Figure 3.1.3: Sequence Diagram

3.1.5 Activity Diagram

1. Admin

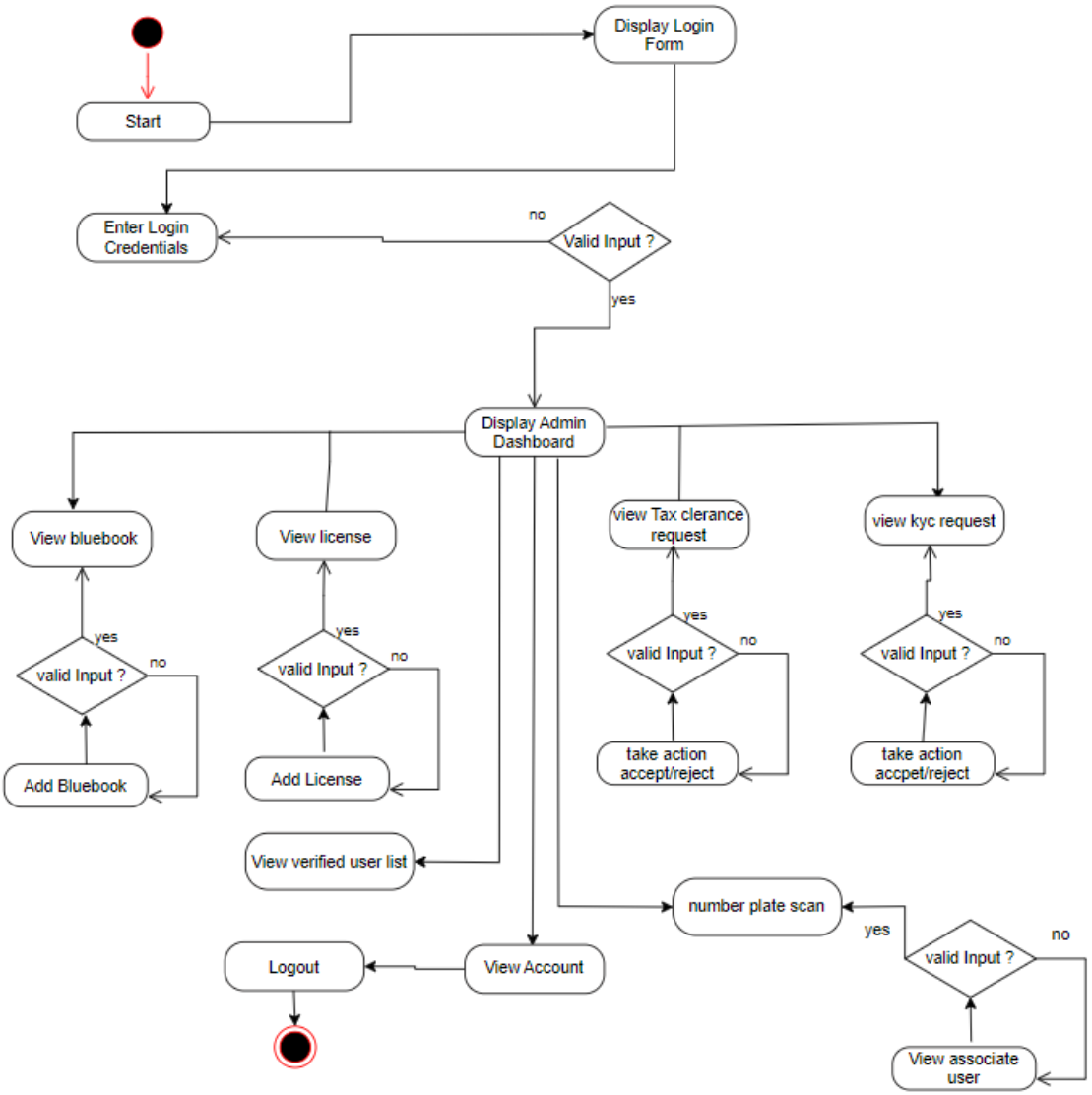

Figure 3.1.4: Activity Diagram of Admin

2. User

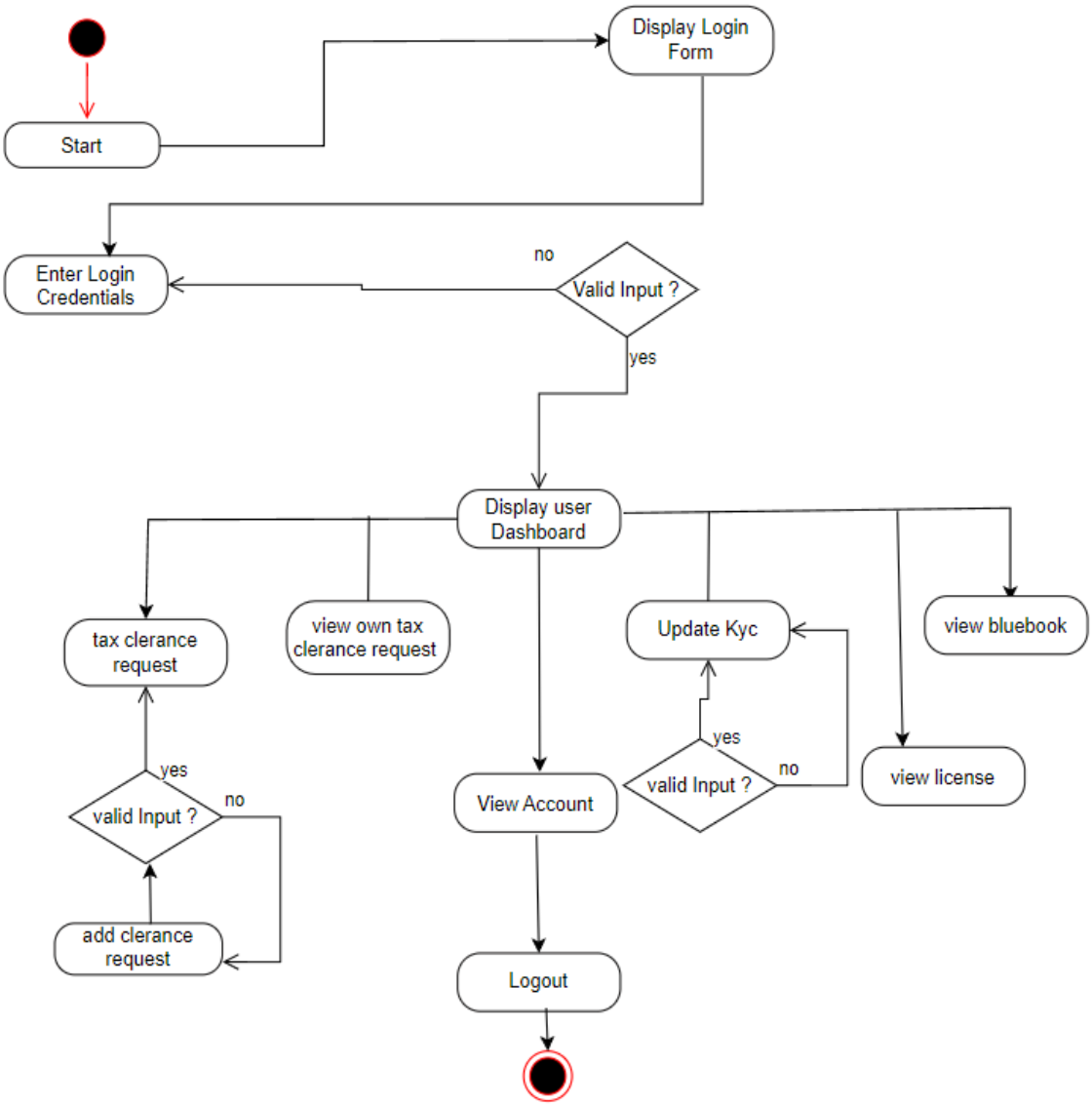

Figure 3.1.5: Activity Diagram of User

3.2 System Design

3.2.1 Architectural Design

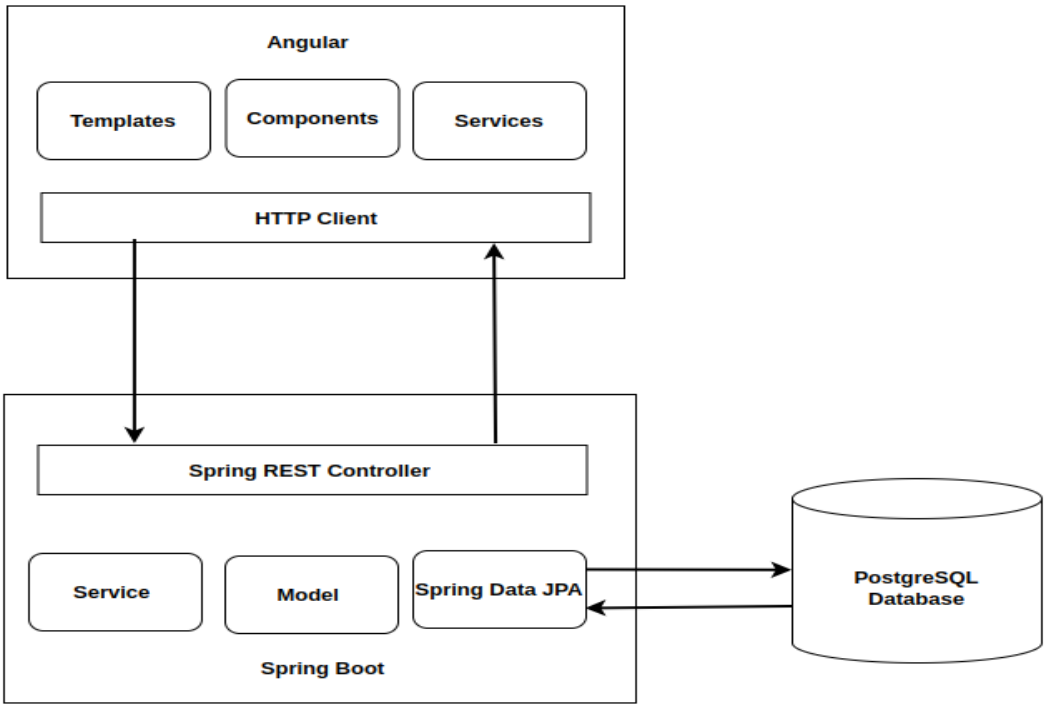

Figure 3.2.1: System Architecture

3.3 Algorithm Implementation

Detection Algorithm (OCR):

OCR stands for Optical Character Recognition. It is a technology that converts different types of documents, such as scanned paper documents, PDF files, or images captured by a digital camera, into editable and searchable data. The OCR algorithm is the core component responsible for the recognition process. It involves the following steps:

a. Pre-processing:

The input image is processed to enhance the quality, correct orientation, and remove noise or artifacts.

b. Text Detection:

The algorithm identifies regions in the image that contain text.

c. Text Segmentation:

The algorithm separates individual characters or words from the detected text regions.

d. Feature Extraction:

The algorithm extracts relevant features from each character or word, such as lines, curves, or corners.

e. Character Recognition:

Based on the extracted features, the algorithm matches the characters against a pre-trained model to recognize the text.

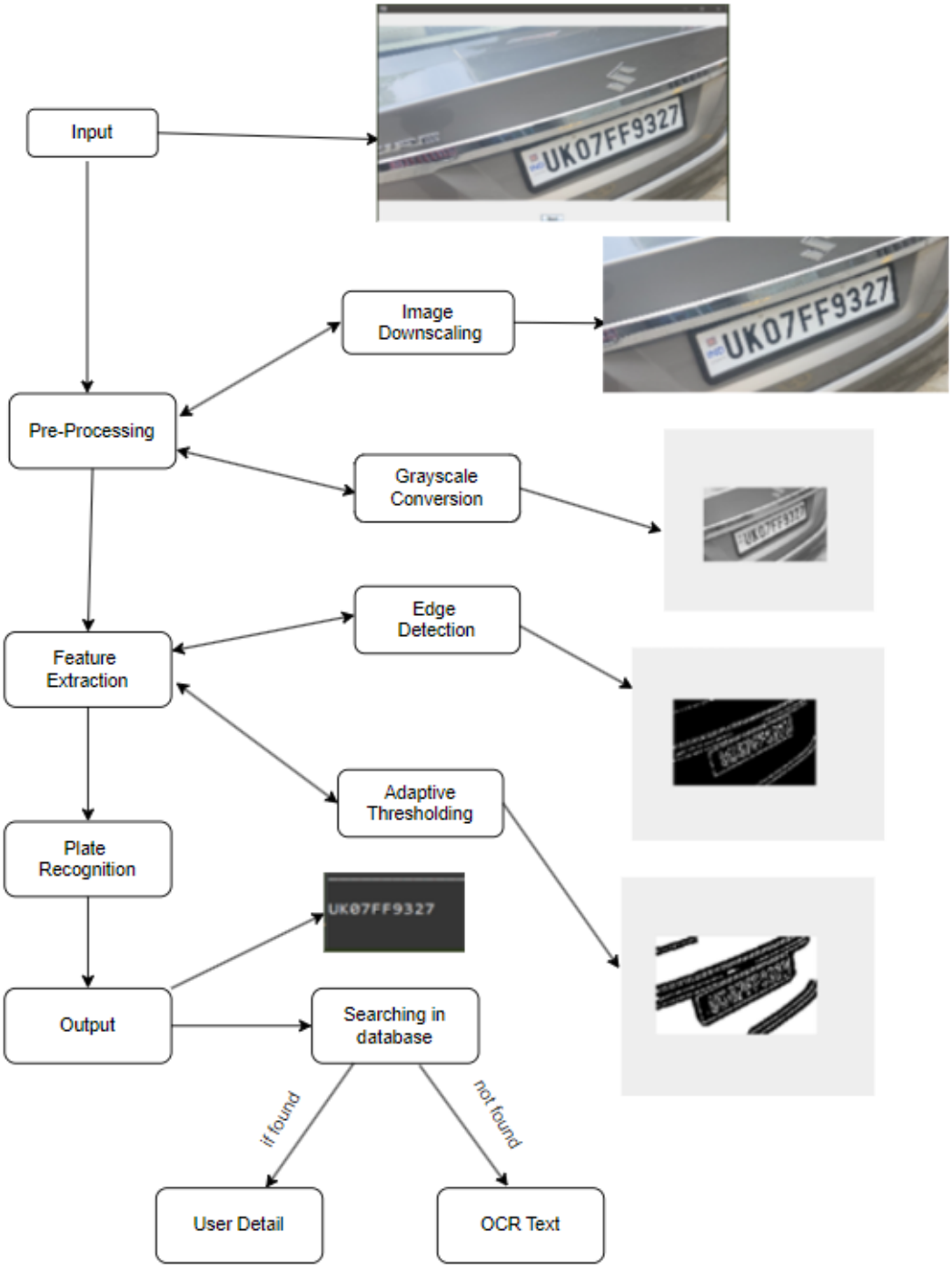

Figure 3.3.1: Number plate detection process

CHAPTER 4: IMPLEMENTATION AND TESTING

4.1 Implementation

4.1.1 Tools Used

We have used different tools for vehicle verification and traffic support system web application developments. These tools help a lot from starting to ending of the project.

• Front end

Front end is the part of the system where normal users communicate with the system. Front is related to the user interface. It consists of different coding tools where codes are written to develop the system. My system uses the following front end development tools. HTML5, CSS, JavaScript and Angular were used for building user interfaces and UI Components.

• Back end

Back end is the part of the system that contains the actual business logic. It consists of different coding tools. My system uses the following backend development tools.

Java (Spring Boot Framework): Spring Boot v2.7 and Java 11 used for business logic.

Postgres: Postgres Database v14.5 was used for storing data.

The OCR (Optical Character Recognition) algorithm in Java for number plate scanning involved several steps. Firstly, a Java library like Tesseract, supporting OCR and able to extract text from images, was needed. The library was imported into the Java project, and image input/output was handled. The number plate image was preprocessed to enhance text recognition by adjusting contrast, resizing, and converting to grayscale. Then, the preprocessed image was passed to Tesseract to perform OCR. Finally, the recognized text was extracted from the output and used as needed. This process involved leveraging Tesseract's functionalities and integrating them into the Java code for efficient number plate scanning.

• CASE Tools

Drow.io: This was used as a visual collaboration tool for creating use cases, ER, DFD, Database schema.

4.2 Testing

4.2.1: Test Cases for Unit Testing

In unit testing, individual components like login, register, add license and bluebook, number plate scan, and other components are tested.

Test Case ID	Test Scenario	Test Case	Test Data	Expected Data	Actual Result	Pass / Fail
T1	Test Login Functionality	Check login with valid data	Mobile number and password	Redirect to Dashboard	As Expected	Pass
T2	Test Login Functionality	Check login with invalid data	Mobile number and password	Shows error message	As Expected	Pass
T3	Test User Register Functionality	Registering user with required data	Name, email, phone, password	Shows message and redirect to login	As Expected	Pass
T4	Test User Register Functionality	Registering user with incomplete data	Incomplete data	Shows error	As Expected	Pass
T5	Test Kyc Update Functionality	Submit with required data	address, citizenship, pp photo, doc photo	Show success message	As Expected	Pass

T6	Test Kyc Update Functionality	Submit with incomplete data	address, citizenship	Show error or required data message	As Expected	Pass
T7	Test Tax Clearance Functionality	Process tax with valid data	Citizenship, vehicle number, amount, paid bill doc	Show success message	As Expected	Pass
T6	Test Tax Clearance Functionality	Process tax with invalid data	Citizenship, vehicle number	Show error message	As Expected	Pass
T8	Test Add license Functionality	Process with required data	Citizenship no , valid date , license category, district	Show success message	As Expected	Pass
T9	Test Add license Functionality	Process with incomplete data	Citizenship no , valid date	Show error message	As Expected	Pass
T10	Test Add bluebook Functionality	Process with required data	Citizenship no, vehicle type , vehicle no , number plate	Show success message	As Expected	Pass

T11	Test Add bluebook Functionality	Process with incomplete data	Citizenship no, vehicle type	Show error message	As Expected	Pass
T12	Test Number plate scan Functionality	Process image with already exit data	Vehicle image	Show owner details	As Expected	Pass
T13	Test Number plate scan Functionality	Process image with already does not exist	Vehicle image	Show vehicle number plate and some message	As Expected	Pass

Table 4.2.1: Test case

4.2.2 Test cases for System Testing

The software is compiled as a product and then it is tested as a whole. This can be accomplished

using one or more of the following tests

• Functionality testing - Tests all functionalities of the software against the requirement.

• Performance testing - This test proves how efficient the software is. It tests the

effectiveness and average time taken by the software to do desired tasks. Performance testing

is done by means of load testing and stress testing where the software is put under high user

and data load under various environment conditions.

• Security & Portability - These tests are done when the software is meant to work on various

platforms and accessed by a number of persons.

CHAPTER 5: CONCLUSION AND RECOMMENDATION

5.1 Lesson Learned / Outcome

The project overall justifies all the objectives described for project proposal and initial planning. The concept of making a web-based vehicle verification and traffic support system has been fulfilled. Since the project has limited objectives at this stage, the project may not serve at its best but the project overall serves all the mentioned objectives which were supposed to be completed.

5.2. Conclusion

In conclusion, the Vehicle Verification and Traffic Support System is a comprehensive solution aimed at improving and optimizing vehicle verification and traffic management procedures in Nepal. It not only enables users to verify vehicle ownership and authenticate documents online but also assists in license exams, imparts traffic rule knowledge, and streamlines tax clearance. The inclusion of advanced features like number plate detection ensures precise verification of ownership details. The primary objective is to simplify the verification process, minimize instances of vehicle misuse, and more efficient traffic management in Nepal.

5.3 Future Recommendation.

- The platform should be extended as a mobile application.
- The system can later be integrated with payment systems like e-sewa for tax clearance.
- The system can later be integrated with government application access real time valid data.

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APPENDICES

Screenshots

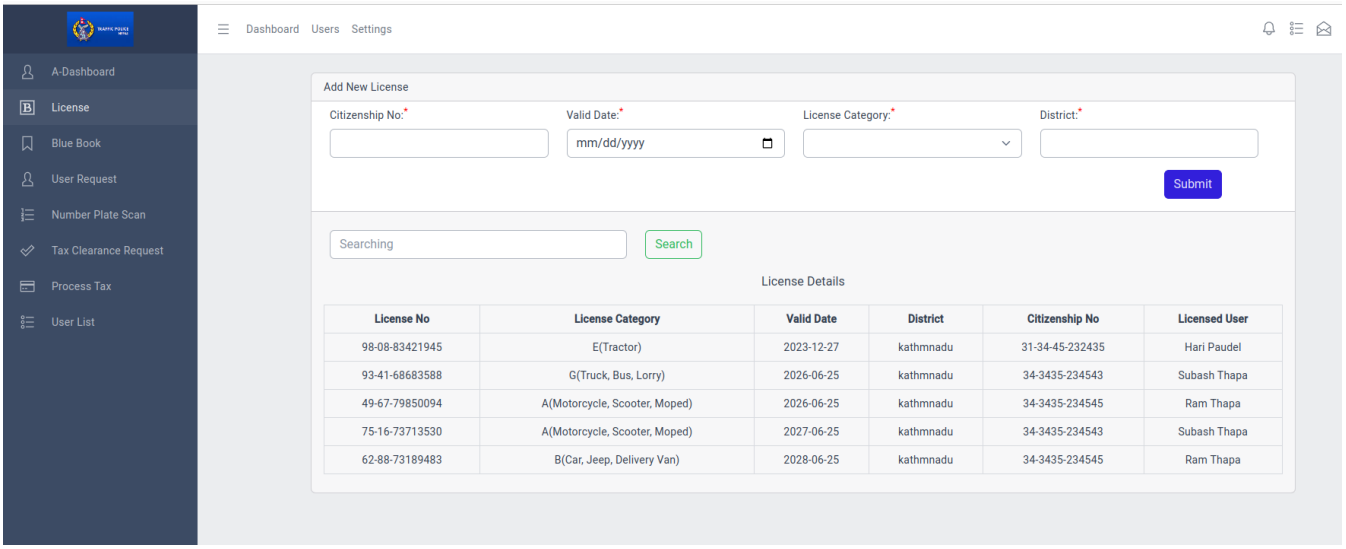


Figure 7: License add page

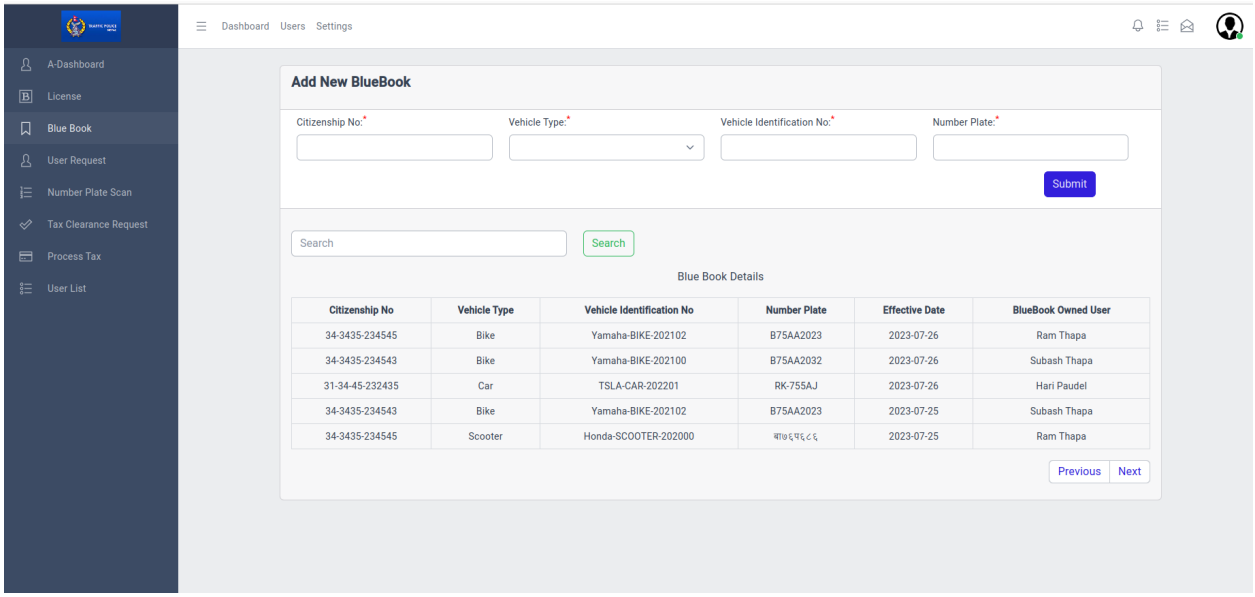


Figure 8: Blue Book Add page

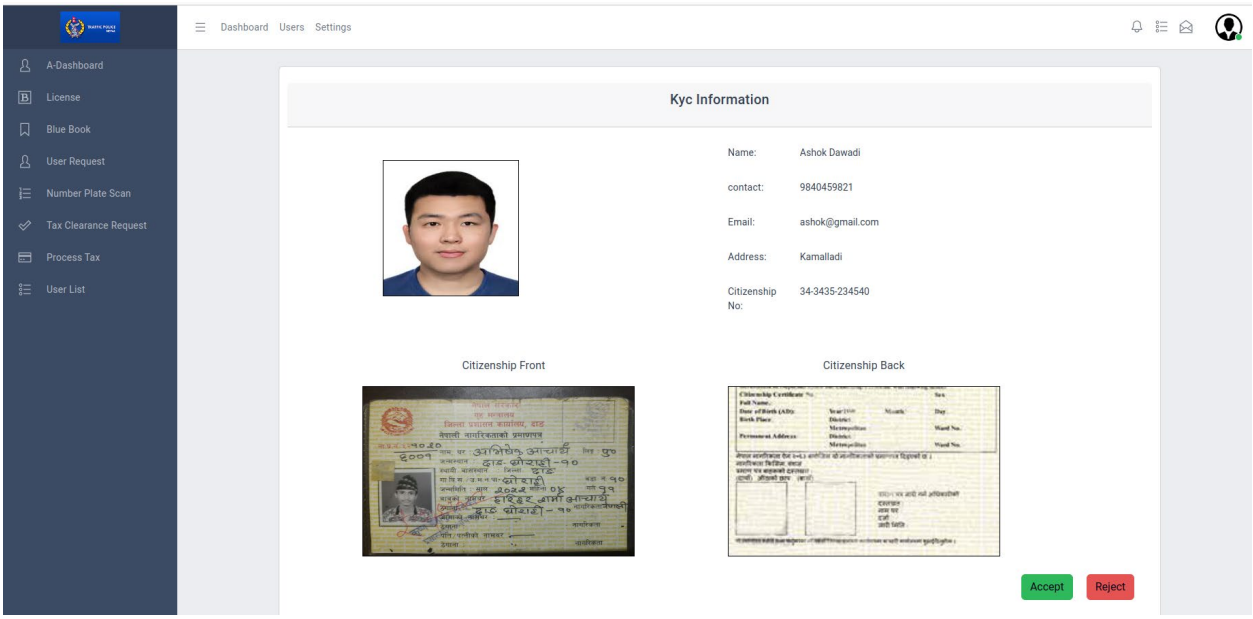


Figure 9: User view page

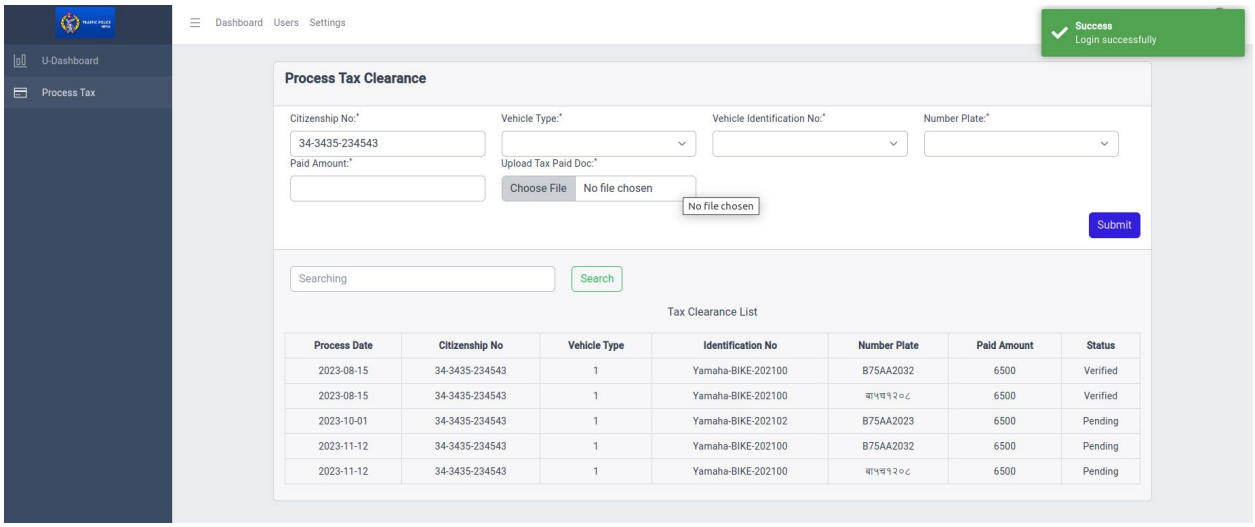
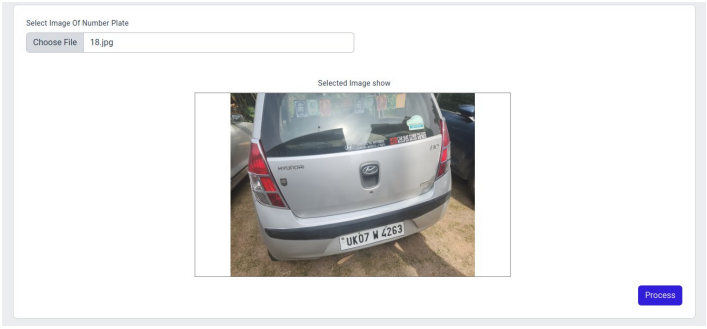
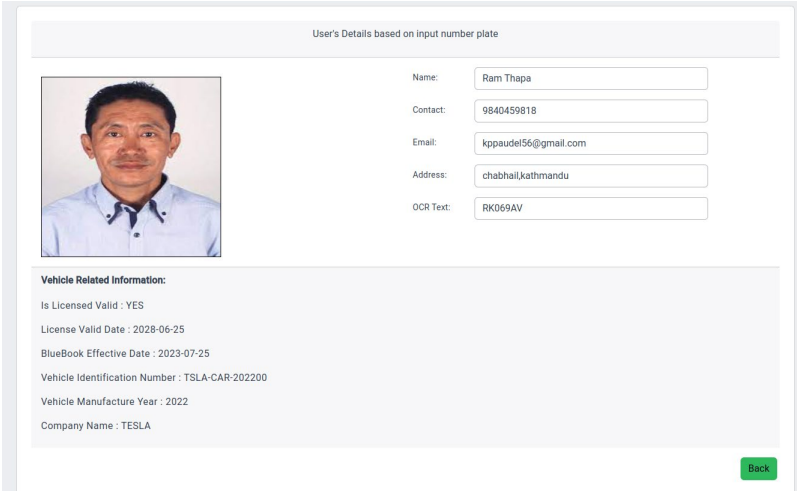


Figure 10: Tax Clearance process page





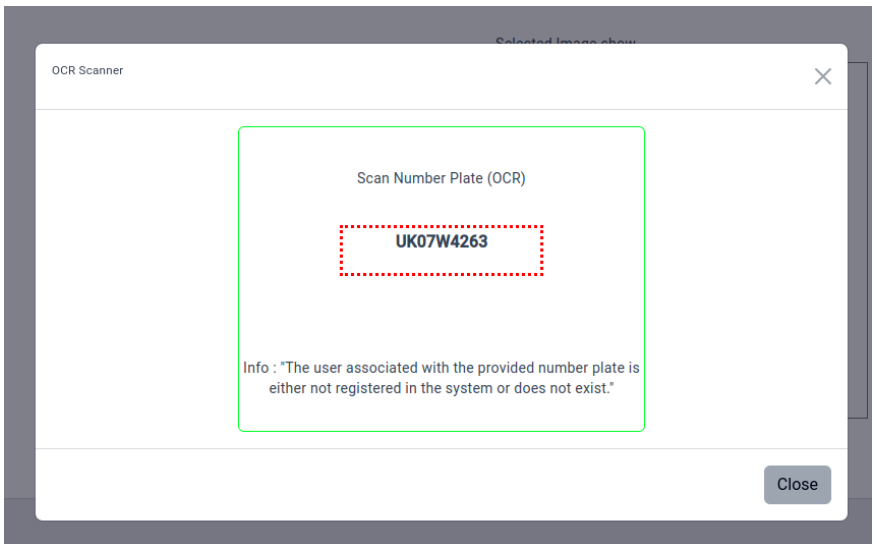


Figure 11: Number plate Scanning Pages and with success and failure response

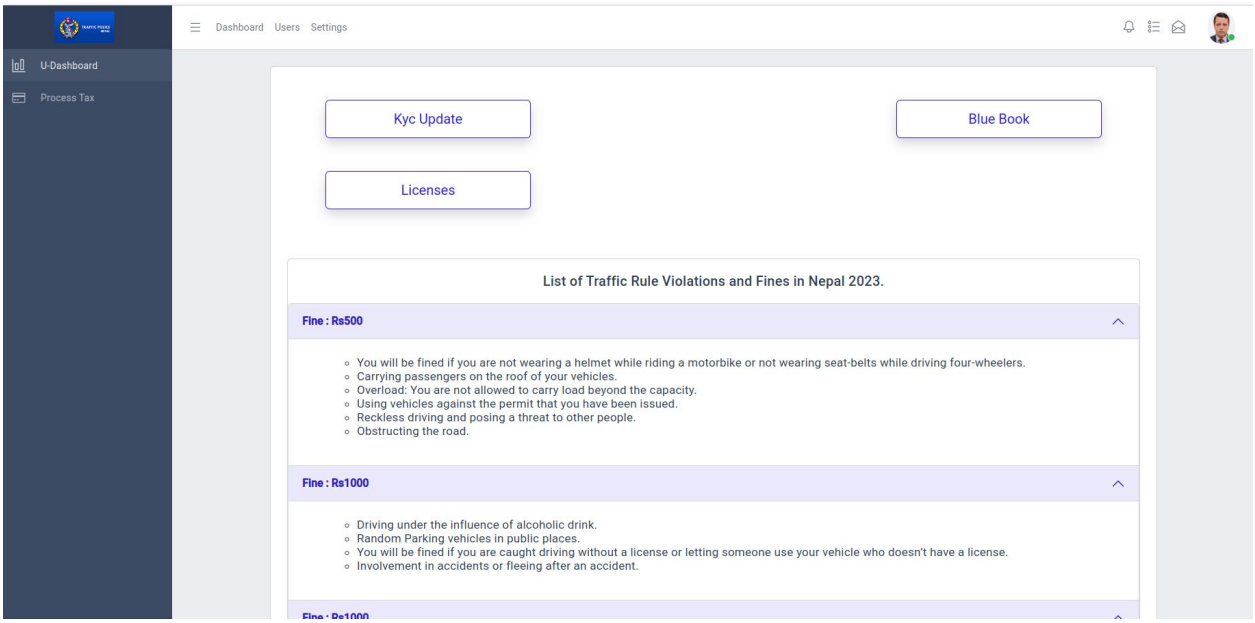


Figure 12: User Dashboard

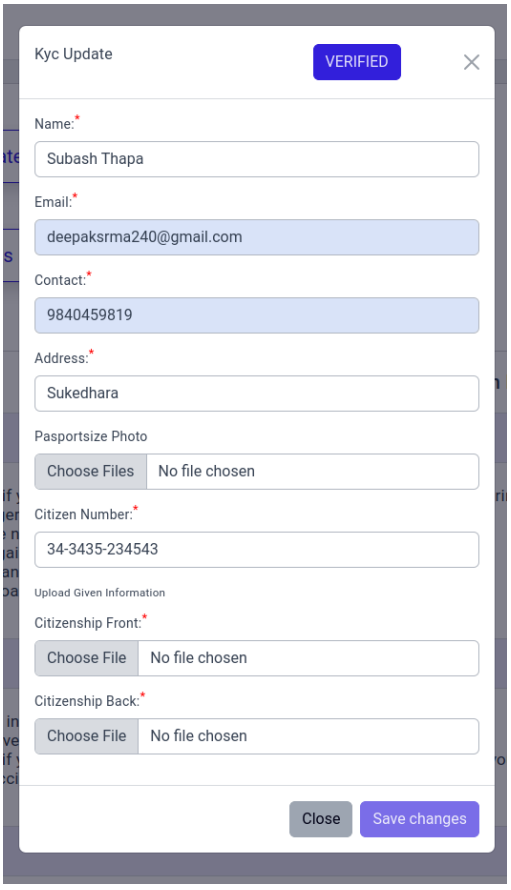


Figure 13: User Kyc Update request Page