



TRIBHUVAN UNIVERSITY

INSTITUTE OF SCIENCE AND TECHNOLOGY

MADAN BHANDARI MEMORIAL COLLEGE

A PROJECT REPORT ON

‘Rastriya License Portal’

*In partial fulfillment of the requirement for Bachelor of Science in
Computer Science and Information Technology*

Submitted by:

Firoj Paudel (79011003)

Nilima Mainali (79011011)

Priyanka Thapa (79011017)

Subodh Ghimire (79011027)

SUBMITTED TO:

Ramesh Pokhrel

E-GOVERNANCE

(CSC 377)

December 31, 2025

CERTIFICATE OF APPROVAL

This is to certify that the project entitled “**Rastriya License Portal**” prepared by **Firoj Paudel, Nilima Mainali, Priyanka Thapa, Subodh Ghimire** as a part of the coursework in the Department of Computer Science and Information Technology is a record of original work carried out under our supervision.

External Examiner
Institute of Science and Technology
Tribhuvan University

Ramesh Pokhrel
Supervisor
Madan Bhandari Memorial College

Acknowledgment

We would like to express our sincere gratitude to the Department of Computer Science and Information Technology, Madan Bhandari Memorial College, for providing an encouraging academic environment that fostered our growth in the field of Information Technology. The resources and mentorship offered by the department played a crucial role in the successful completion of this project.

We are especially thankful to our supervisor, **Ramesh Pokhrel**, for his continuous guidance, constructive feedback, and encouragement throughout the development of the project. His expertise in software development and system design was instrumental in shaping the technical and conceptual direction of the project.

This project provided us with valuable hands-on experience in designing and implementing a modern web-based e-governance system. Through this work, we strengthened our understanding of full-stack web development, secure authentication mechanisms, database management, and the practical challenges of digitizing public service delivery systems.

We would also like to thank our Head of Department, **Phul Babu Jha**, for their administrative support and encouragement. Our special thanks go to all staff members of the CSIT department who directly and indirectly extended their hands in making this project a success.

With respect,
Firoj Paudel
Nilima Mainali
Priyanka Thapa
Subodh Ghimire

Abstract

This project presents the practical development of ‘**Rastriya License Portal**’, a modern e-governance web application prototype envisioned to streamline driving license administration under Nepal’s **Department of Transport Management**. The system offers a unified digital platform for core services such as new license applications, renewals, and application status tracking, thereby enhancing accessibility, transparency, and operational efficiency while minimizing manual processes and physical visits to transport offices.

The application is developed using a contemporary full-stack architecture based on *Next.js 15*, incorporating secure citizen authentication through National ID (NID) with Bcrypt-based password hashing, comprehensive license management dashboards, and integrated digital payment interfaces supporting popular Nepali platforms such as ConnectIPS, eSewa, and IME Pay. A dedicated administrative module with role-based access control enables application review, document verification, approval workflows, and basic analytics for monitoring system performance.

The project demonstrates practical knowledge in modern web application development, e-governance system design, secure authentication and authorization mechanisms, and type-safe database management using *PostgreSQL* and *Prisma* ORM. The **Rastriya License Portal** serves as a secure, paperless, and user-centric model for digital public service delivery, highlighting the potential of modern technologies in improving governance systems in Nepal.

Table of Contents

Acknowledgment	ii
Abstract	iii
List of Figures	v
1 Introduction	1
1.1 Introduction	1
1.2 Problem Statement	1
1.3 Objectives	2
1.4 Proposed System	2
2 Requirement Analysis	3
2.1 Functional Requirements	3
2.2 Non-Functional Requirements	4
2.3 Hardware Requirements	5
2.4 Software Requirements	6
3 System Models	7
3.1 Use Case Diagram	7
3.2 Class Diagram	9
4 Implementation and Testing	11
4.1 Implementation	11
4.1.1 Implementation Tools	11
4.1.2 Website Interface Overview	12
4.2 Testing	19
4.2.1 System Testing	19
4.2.2 Unit Testing	20
4.2.3 Integration Testing	20
4.2.4 User Acceptance Testing	20
5 Conclusion and Future Enhancements	21
5.1 Conclusion	21
5.2 Future Enhancements	21
References	22

List of Figures

1	Use Case Diagram for Rastriya License Portal (RLP)	7
2	Class diagram of Rastriya License Portal (RLP)	9
3	Home Page	12
4	ALL Services	13
5	Registration Page	14
6	User Login Page	15
7	Admin Login Page	15
8	License Renewal Application Process	17
9	Application Status	17
10	User Dashboard	18
11	Admin Dashboard	19

1 Introduction

1.1 Introduction

Government agencies worldwide are increasingly adopting digital technologies to improve public service delivery, transparency, and administrative efficiency. In Nepal, driving license administration remains a critical public service; however, traditional processes often involve manual paperwork, long queues, repeated office visits, and limited access to real-time application information, creating inconvenience for both citizens and authorities.

Rastriya License Portal (RLP) is a modern e-governance web application prototype developed to address these challenges. The system envisions a unified digital platform for managing driving license services, including new license applications, renewals, and application status tracking, under the Department of Transport Management.

Built using contemporary full-stack web technologies, the platform provides a secure and user-friendly interface for citizens to authenticate using National ID (NID), submit applications, upload required documents, complete digital payment processes, and monitor application progress. Additionally, a dedicated administrative module supports efficient application review, document verification, approval workflows, and system monitoring.

Overall, **Rastriya License Portal** demonstrates the practical application of e-governance principles by offering a secure, transparent, and paperless solution that improves accessibility, reduces administrative burden, and enhances the overall efficiency of driving license service delivery in Nepal.

1.2 Problem Statement

Despite the introduction of online services, driving license administration in Nepal continues to face several operational and user-centric challenges. The key problems addressed by the Rastriya License Portal are outlined below:

- **Manual and Time-Consuming Processes:** Traditional license application and renewal procedures rely heavily on physical documentation and in-person visits, leading to long queues, processing delays, and increased administrative workload.
- **Limited Service Accessibility:** Citizens, especially those residing outside urban centers, experience difficulty accessing transport offices and obtaining timely updates on their application status.
- **Lack of Real-Time Transparency:** Existing systems often fail to provide clear and real-time tracking of application progress, resulting in uncertainty and repeated follow-up visits.
- **Inefficient Data Management:** Fragmented record-keeping and inconsistent data handling increase the risk of errors, duplication, and identity mismatches.

This project addresses these challenges by developing the **Rastriya License Portal**, a centralized and user-centric e-governance system that digitizes license-related services, streamlines administrative workflows, and enhances transparency, security, and operational efficiency.

1.3 Objectives

The primary objectives of the **Rastriya License Portal** project are as follows:

- To design and develop a secure, user-friendly e-governance web application for managing driving license services under Nepal's Department of Transport Management.
- To digitize core driving license processes, including new license applications, renewals, and application status tracking, in order to reduce manual paperwork and physical office visits.
- To implement a responsive and intuitive web interface that ensures seamless access to services across desktop and mobile devices.
- To provide role-based access control by separating citizen and administrative functionalities, ensuring data security and efficient workflow management.

1.4 Proposed System

The proposed system, **Rastriya License Portal (RLP)**, is a modern e-governance web application prototype developed using contemporary full-stack web technologies. The platform is designed to provide a centralized and transparent digital solution for driving license administration in Nepal.

Key components and features of the proposed system include:

- **Citizen Dashboard:** Secure login using National ID, allowing users to view active licenses, submit renewal requests, upload documents, and track application status in real time.
- **Digital Payments:** Integration with Nepali payment gateways (ConnectIPS, eSewa, IME Pay) for fee submission, along with digital workflows and audit trails.
- **Administration Module:** Role-based access for admins to review applications, verify documents, approve or reject requests, and manage citizen records.
- **Application History:** Citizens can access a complete log of their applications, renewals, and status updates, ensuring transparency and easy reference.
- **Feedback and Helpdesk:** Citizens can submit queries or complaints directly through the portal for better communication with administrators.
- **Performance and Security:** Secure authentication, reliable database storage with PostgreSQL and Prisma ORM, and optimized frontend for fast and scalable performance.

The system is designed as a web-based prototype and is thoroughly tested for functionality, usability, and responsiveness. The **Rastriya License Portal** serves as a practical implementation of e-governance concepts, demonstrating how modern web technologies can be applied to improve public service delivery, transparency, and administrative efficiency.

2 Requirement Analysis

Requirement analysis is the process of identifying, documenting, and analyzing the functional and non-functional needs of a system. It forms the foundation for system design and development by ensuring that the solution meets user expectations and fulfills administrative and academic objectives.

2.1 Functional Requirements

The functional requirements outline the core features that the **Rastriya License Portal** system must provide to deliver an efficient, and transparent experience. These requirements are derived from citizen needs, administrative workflows, and standard e-governance best practices. The key functional requirements are:

1. **Secure User Authentication**

Citizens can register and log in using their National ID (NID) and a Bcrypt-hashed password, ensuring secure access to personal license services.

2. **Citizen Dashboard**

Provides a unified interface for viewing active licenses, linked records, personal details, expiration status, and other relevant information.

3. **Online License Renewal**

Users can submit renewal requests, update demographic details, upload medical reports, simulate biometric verification, and pay fees digitally.

4. **Application Status Tracking**

Citizens can monitor the progress of new applications and renewals in real time, with clear status updates and guidance on required actions.

5. **Digital Payment Integration**

Supports secure payment of application and renewal fees through Nepali payment gateways including ConnectIPS, eSewa, and IME Pay.

6. **Application History and Audit Trail**

Maintains a complete log of all user interactions, applications, payments, and status changes for transparency and record-keeping.

7. **Administrative Role-Based Access**

Transport officials log in with dedicated credentials and access modules based on assigned permissions.

8. **Application Processing and Verification**

Administrators can review applications, verify uploaded documents, approve or reject requests, and provide feedback.

9. **Responsive Design**

Ensures full functionality and usability on desktops, tablets, and mobile devices for both citizens and administrators.

2.2 Non-Functional Requirements

Non-functional requirements define the quality attributes and constraints of the **Rastriya License Portal (RLP)**. These ensure the system performs securely, reliably, and efficiently while providing a seamless user experience for citizens and administrators. The key non-functional requirements are:

1. Performance

The portal should load pages within 3 seconds under normal traffic and handle up to 500 concurrent users without noticeable delays.

2. Scalability

The system must support future growth, including additional users, more license types, and higher traffic, by optimizing database queries and implementing caching.

3. Reliability

The portal should maintain 99% uptime, with automatic error handling for failed payments, system crashes, or server issues.

4. Usability

The interface must be intuitive and easy to navigate for users with varying technical skills, including clear menus, consistent design, and mobile-friendly layout.

5. Security

The system must protect sensitive user data using HTTPS encryption, secure authentication via NID and Bcrypt hashing, safeguard against common vulnerabilities (e.g., SQL injection, XSS), and comply with data privacy standards.

6. Maintainability

The codebase (Next.js + TypeScript + Prisma) should be well-structured, documented, and easy to update or extend by developers.

7. Portability

The portal should run on standard hosting environments or Docker containers and be compatible with major browsers (Chrome, Firefox, Safari, Edge).

8. Availability

The system should be accessible 24/7, with minimal downtime for maintenance, and include automatic recovery mechanisms for common failures.

9. Compatibility

The portal must function consistently across devices (desktop, tablet, mobile) and screen sizes without layout or functionality issues.

10. Backup and Recovery

Regular automated backups of the database and files should be performed, with a recovery time objective (RTO) of less than 4 hours in case of data loss.

2.3 Hardware Requirements

The following hardware specifications are recommended to ensure smooth development, deployment, and operation of the **Rastriya License Portal (RLP)** e-governance system.

Web Server (Hosting Environment)

A server or cloud instance with adequate resources to handle user traffic, database operations, authentication processes, payment gateway integrations, and administrative analytics.

Component	Minimum Specification	Recommended Specification
Processor	Intel Core i5 (10th Gen) or AMD Ryzen 5 equivalent	Intel Core i7/i9 (12th Gen+) or AMD Ryzen 7/9
RAM	8 GB	16-32 GB (for moderate to high traffic)
Storage	50 GB SSD	100 GB+ NVMe SSD
Operating System	Linux (Ubuntu 22.04 LTS or AlmaLinux 9)	Linux (Ubuntu 24.04 LTS or latest stable)
Bandwidth	100 Mbps shared connection	1 Gbps or higher

End-User Device

For citizens and administrators accessing the Rastriya License Portal via web browser, standard modern hardware is sufficient.

Component	Minimum Specification	Recommended Specification
Device	Any modern laptop, desktop or smartphone	Any modern laptop or desktop
RAM	4 GB	8 GB or higher
Browser	Chrome, Firefox, Edge (latest)	Chrome, Firefox, Edge (latest)
Internet Connection	Stable broadband or mobile data (3G/4G/5G)	High-speed broadband (20 Mbps+)

Backup Storage

Regular backups are critical to safeguard citizen records, application data, payment logs, and audit trails.

- **Backup Storage:** Secure cloud storage (e.g., AWS S3, Google Cloud Storage) or encrypted external drives with automated off-site backups.

2.4 Software Requirements

The following software specifications are required to develop, deploy, and operate the **Rastriya License Portal (RLP)** e-governance system efficiently and securely.

Server-Side Requirements

The main software components needed for the server-side of the **RLP** e-governance platform are as follows:

Software Component	Specification	Purpose
Local Development Environment	Node.js 20+, Docker Desktop	Supports local development, testing, and containerized runs.
Operating System	Linux Ubuntu 22.04 LTS	Provides stable and secure production environment.
Web Server	Nginx 1.24+ (as reverse proxy)	Serves static files, proxies requests, and enforces HTTPS.
Database Management System	PostgreSQL 15+	Securely stores user data, licenses, applications, and logs.
ORM	Prisma 5.x	Enables type-safe database operations and migrations.
Framework	Next.js 15 (App Router)	Manages routing, SSR, API endpoints, and server components.
Authentication	Bcrypt + Custom Session Management	Secures NID-based login and user sessions.
Containerization	Docker	Ensures consistent deployment across environments.
Payment Gateways	ConnectIPS, eSewa, IME Pay SDKs/APIs	Handles secure online payment processing.

Client-Side Requirements

The client-side software components required on the user side for accessing the Rastriya License Portal are as follows:

Software Component	Specification	Purpose
Web Browser	Latest stable versions of Google Chrome, Mozilla Firefox, Microsoft Edge	Renders interface and supports interactive features.
JavaScript	Enabled in browser	Enables dynamic functionality like form validation and updates.
Cookies	Enabled in browser	Maintains secure sessions and user preferences.
Internet Connection	Stable broadband or mobile data (3G/4G/5G or higher)	Supports smooth page loading, uploads, and payments.

3 System Models

The process of creating abstract representations of a system, where each model provides a distinct perspective of the system, is known as system modeling. This process can also be described as depicting a system using graphical notations in the UML. The UML notations employed to represent **Rastriya License Portal (RLP)** are outlined as follows:

3.1 Use Case Diagram

A Use Case Diagram is a behavioral diagram in uml that illustrates a system's functional requirements from the perspective of its users. It depicts the interactions between actors and the system, focusing on what the system should accomplish rather than how it will be implemented. Use case diagrams are useful for identifying key functionalities, defining system boundaries, and ensuring that all user requirements are captured prior to the design phase.

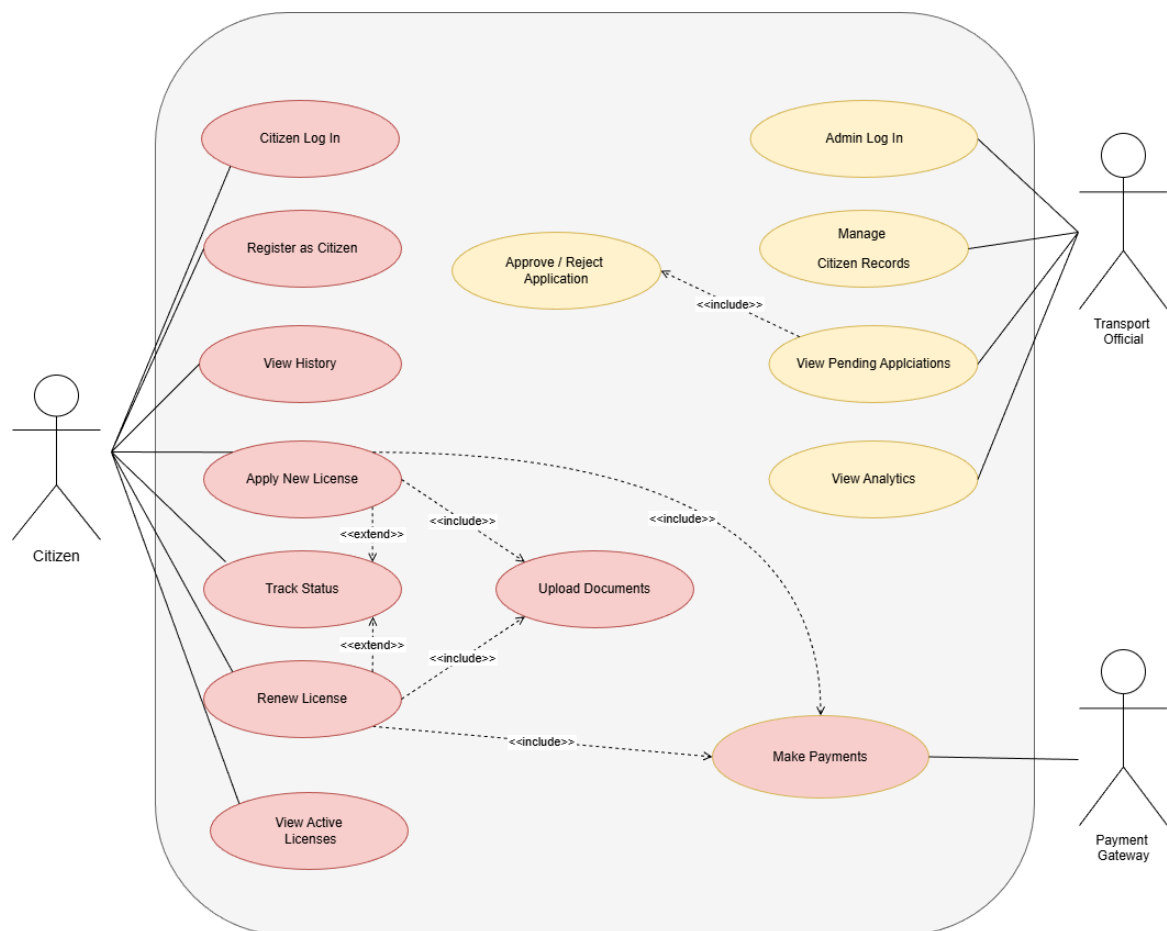


Figure 1: Use Case Diagram for Rastriya License Portal (RLP)

Description:

The following table describes the main use cases of the **Rastriya License Portal (RLP)** and their responsibilities within the overall architecture:

Use Case	Actors	Description
Register as Citizen	Citizen	Enables new users to create an account linked to their National ID for future access to the portal.
Citizen Log In	Citizen	Secure login using National ID and password to access personal license services.
View Active Licenses	Citizen	Displays the citizen's current valid licenses, including category, issue date, and more.
Apply New License	Citizen	Guides the citizen through submitting a new driving license application, including form filling and scheduling.
Renew License	Citizen	Allows the citizen to submit a renewal request for an expiring or expired license with updated information.
Upload Documents	Citizen	Enables uploading of required supporting documents (e.g., medical report, citizenship proof). Included in Apply New License and Renew License.
Make Payment	Citizen, Payment Gateway	Processes application or renewal fees securely through integrated Nepali gateways (ConnectIPS, eSewa, IME Pay). Included in Apply New License and Renew License.
Track Status	Citizen	Provides real-time updates on the progress of submitted applications or renewals. Extended from Apply New License and Renew License.
View History	Citizen	Displays a complete history of past applications, renewals, payments, and status changes.
Admin Log In	Transport Official	Allows transport officials to securely authenticate using staff credentials for administrative access.
View Pending Applications	Transport Official	Displays a list of applications awaiting review, verification, or approval.
Verify Documents	Transport Official	Enables officials to examine and validate uploaded documents for authenticity and completeness. Included in View Pending Applications.
Approve / Reject Application	Transport Official	Allows officials to approve or reject applications with optional feedback/reasons. Included in View Pending Applications.
View Analytics Dashboard	Transport Official	Provides statistical insights into application volume, processing times, approval rates, and revenue trends.

3.2 Class Diagram

A class diagram represents the static structure of a system by showing its classes, attributes, methods, and the relationships between them. In the **Rastriya License Portal (RLP)**, the class diagram illustrates how citizen management, license records, application processing, document handling, payment integration, and administrative functions are organized and interconnected.

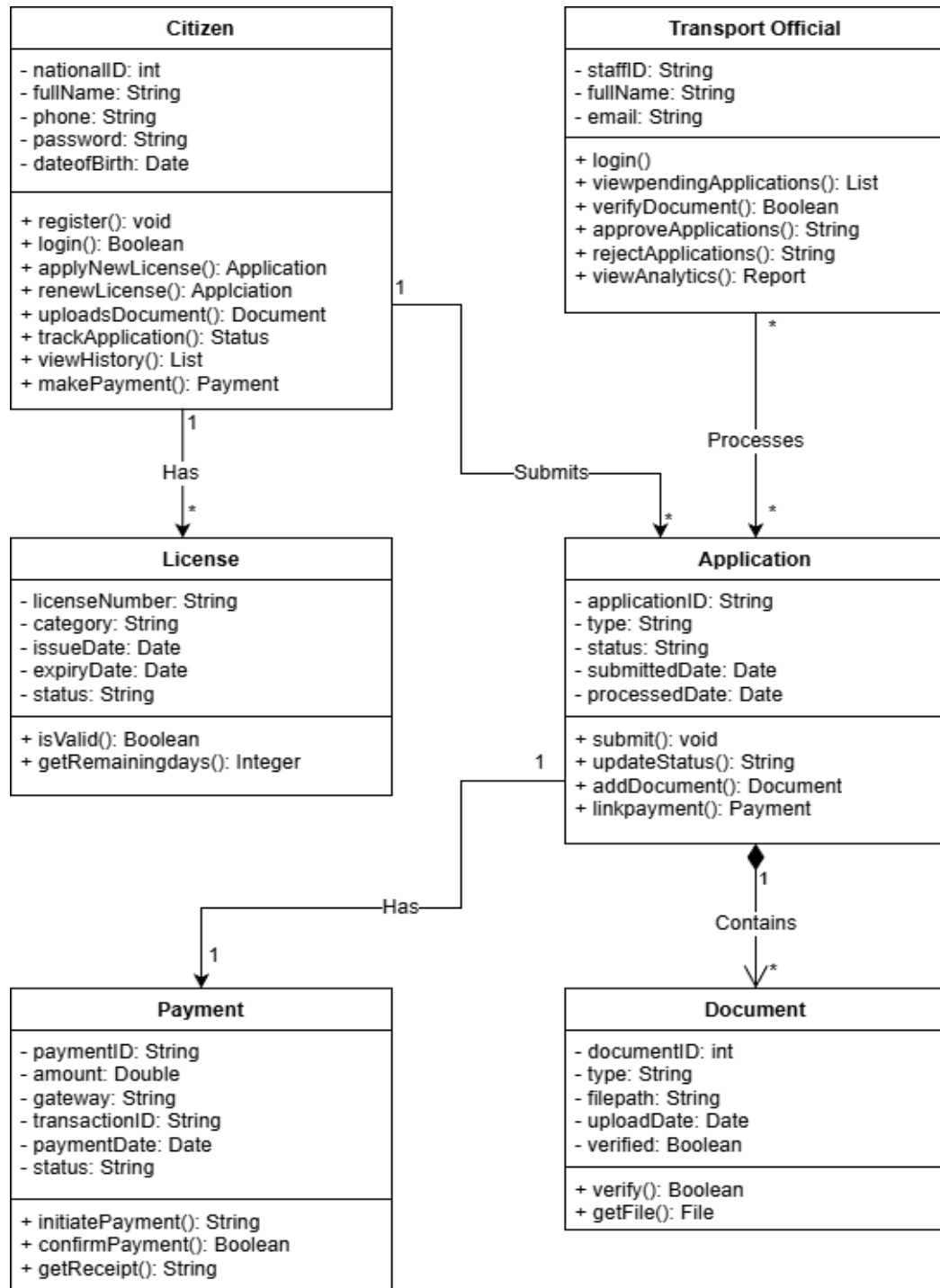


Figure 2: Class diagram of Rastriya License Portal (RLP)

Description:

The following table describes the main classes used in the Rastriya License Portal (RLP) and their responsibilities within the overall architecture:

Class Name	Description
Citizen	Represents a citizen using the portal. Handles registration, secure login using National ID, viewing active licenses, submitting new or renewal applications, uploading documents, making payments, tracking application status, and viewing application history.
TransportOfficial	Represents a staff member of the Department of Transport Management. Manages secure admin login, viewing pending applications, verifying uploaded documents, approving or rejecting applications, and accessing analytics dashboard. Supports role-based access control.
License	Represents a driving license issued to a citizen. Stores license number, category, issue date, expiry date, and status. Provides methods to check validity and remaining days until expiry.
Application	Represents a new license application or renewal request submitted by a citizen. Stores application type, status, submission and processing dates. Manages linking of documents and payment, and status updates during administrative review.
Document	Represents supporting documents uploaded by the citizen (e.g., citizenship certificate, medical report, photo). Stores document type, file path, upload date, and verification status. Supports verification by transport officials.
Payment	Manages fee transactions for applications and renewals. Integrates with external Nepali payment gateways (ConnectIPS, eSewa, IME Pay) to initiate, confirm, and record payments. Stores transaction details and status.

4 Implementation and Testing

4.1 Implementation

The **Rastriya License Portal** is implemented as a modern full-stack web application that integrates secure authentication, citizen-facing services, administrative workflows, digital payment processing, and data management into a cohesive, scalable e-governance platform.

4.1.1 Implementation Tools

The project employs the following contemporary, type-safe technologies and tools:

Category	Tool / Technology	Purpose / Description
Programming Language	TypeScript	Primary language for both frontend and backend, providing static typing for enhanced reliability, maintainability, and developer productivity in a large-scale application.
Web Framework	Next.js 15 (App Router)	Handles server-side rendering, client-side navigation, API routes, React Server Components, and optimized image/static asset delivery for a fast and secure user experience.
Database	PostgreSQL	Relational database used to store citizen profiles, license records, application data, payment logs, and audit trails with strong data integrity and transactional support.
ORM	Prisma	Type-safe Object-Relational Mapper that simplifies database interactions, schema management, migrations, and query building.
Authentication	Bcrypt + Custom Session Management	Secures National ID-based login through password hashing and session handling to protect sensitive personal data.
Payment Integration	ConnectIPS, eSewa, IME Pay APIs	Facilitates secure digital payment processing for license application and renewal fees using widely adopted Nepali payment gateways.
Containerization	Docker	Packages the application and its dependencies into containers for consistent development, testing, and deployment across environments.
Web Server / Reverse Proxy	Nginx	Serves static assets, acts as a reverse proxy to the Next.js server, handles load balancing, and enforces HTTPS in production.

4.1.2 Website Interface Overview

1. Home Page

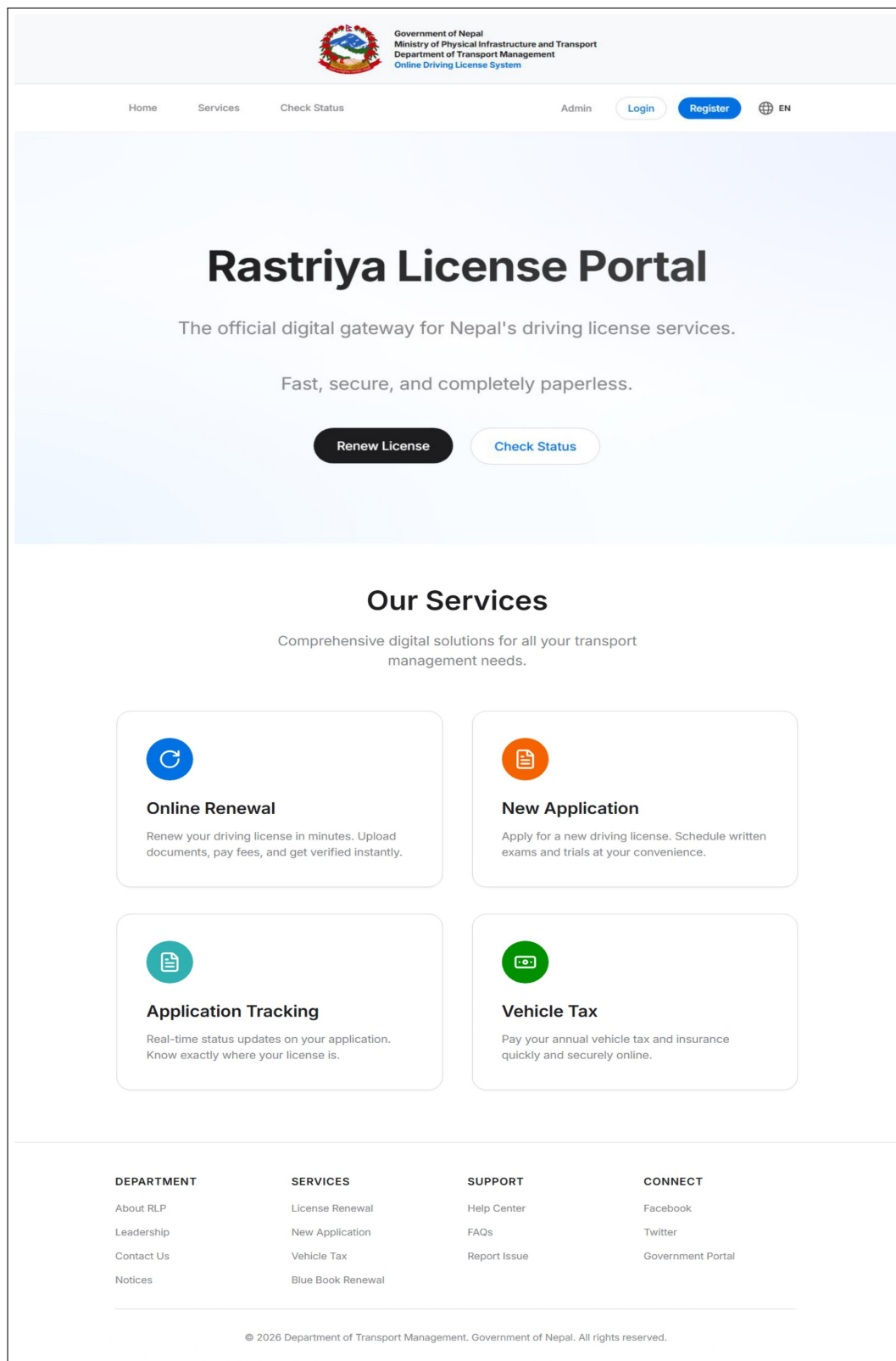


Figure 3: Home Page

2. Services Page

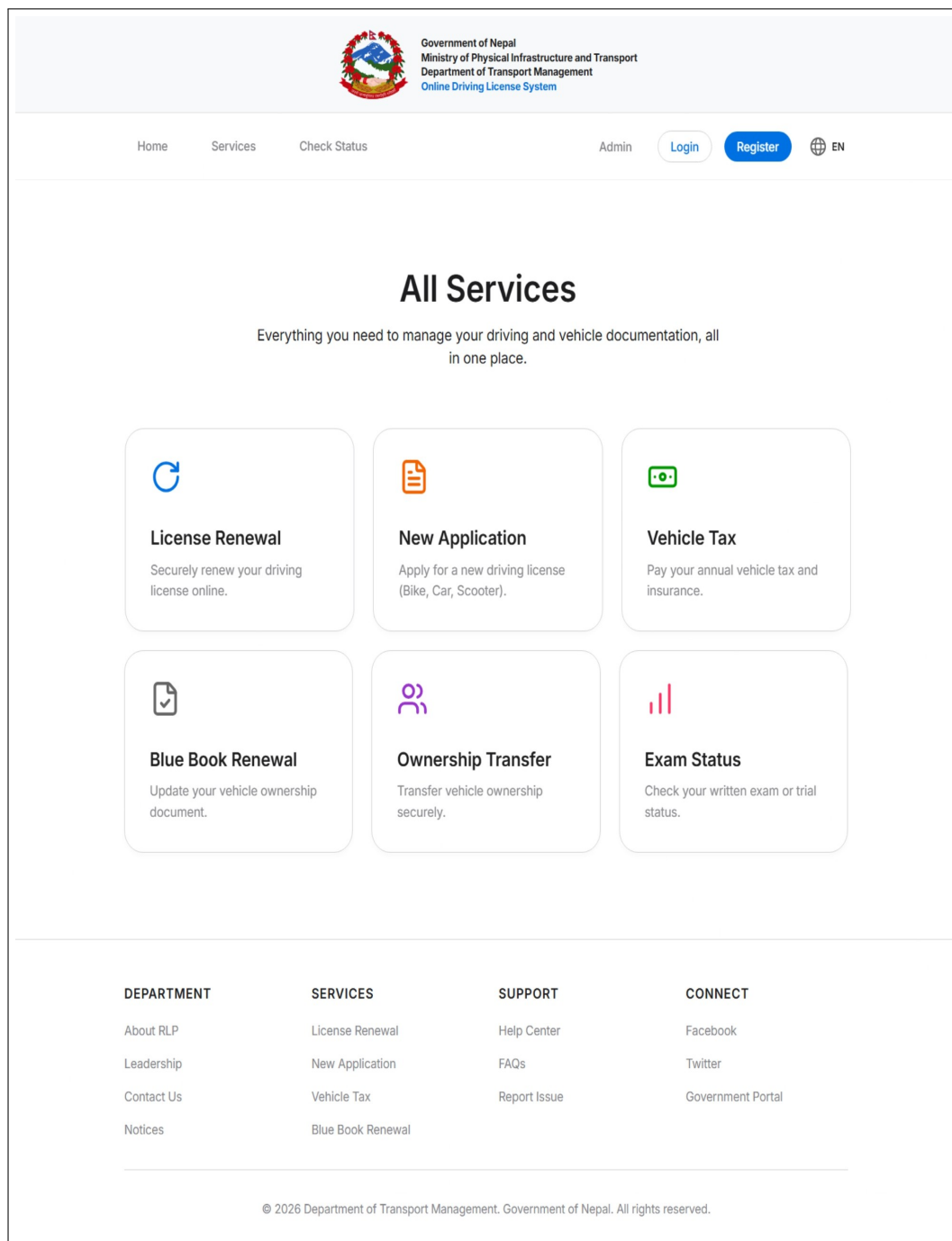



Figure 4: ALL Services

3. Registration Page



Government of Nepal
Ministry of Physical Infrastructure and Transport
Department of Transport Management
Online Driving License System

गृहपृष्ठ

सेवाहरू

स्थिति हेर्नुहोस्

प्रशासक

लमइन

दर्ता

NP

खाता सिर्जना गर्नुहोस्

ई-सेवाहरू प्रयोग गर्न आफ्नो विवरण दर्ता गर्नुहोस्

पूरा नाम

नागरिकता अनुसार

राष्ट्रिय परिचयपत्र (NID)

तपाईंको NID नम्बर प्रविष्ट गर्नुहोस्

जन्म मिति (वि.सं.)

२०XX-XX-XX

नागरिकता नम्बर

XX-XX-XX-XXXX

जारी जिल्ला

लाइसेन्स नम्बरहरू

लाइसेन्स नं. 1

+ अर्को लाइसेन्स थप्नुहोस्

आफ्ना सबै लाइसेन्स नम्बरहरू थप्नुहोस्

मोबाइल नम्बर

पासवर्ड

खाता दर्ता गर्नुहोस्

पहिले नै खाता छ? [यहाँ लमइन गर्नुहोस्](#)

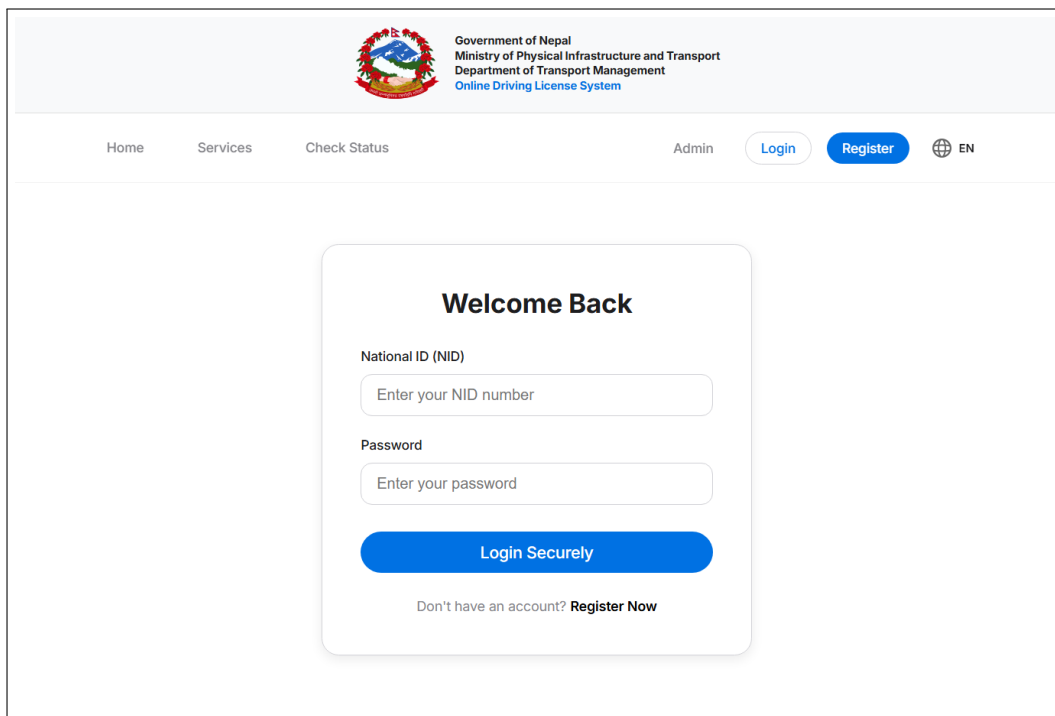
विभाग	सेवाहरू	सहयोग	जोडिनुहोस्
RLP को बारेमा	लाइसेन्स नवीकरण	मद्दत केन्द्र	फेसबुक
नेतृत्व	नयाँ आवेदन	सामान्य प्रश्नहरू	ट्विटर
सम्पर्क	सवारी कर	समस्या रिपोर्ट	सरकारी पोर्टल
स्वनाहरू	ब्लुबुक नवीकरण		

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Figure 5: Registration Page

4. Login Page

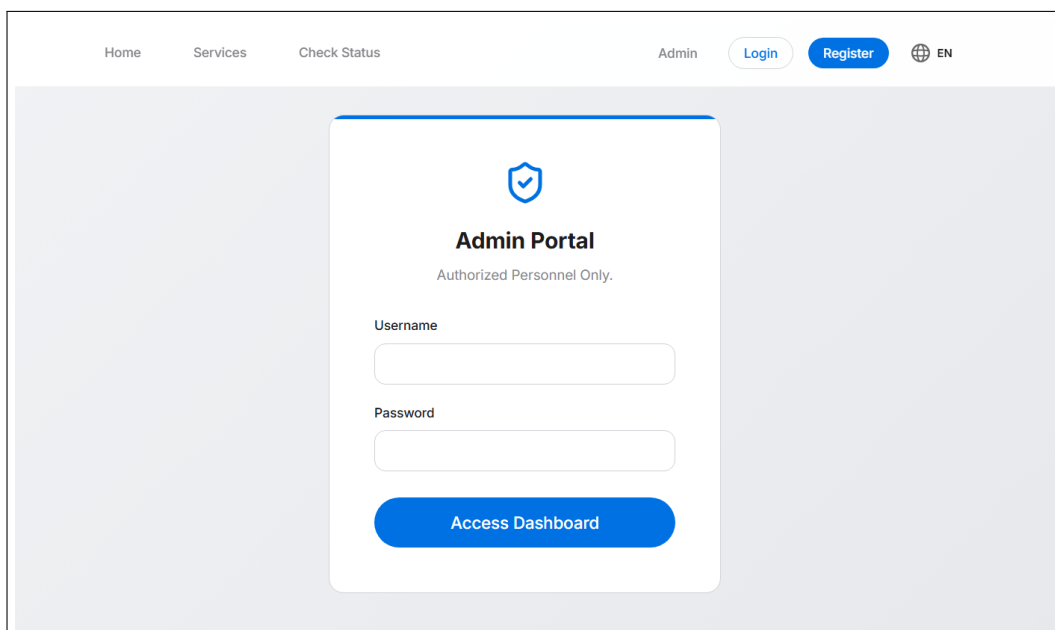
a. User Login



The screenshot shows the user login page of the Online Driving License System. At the top, there is a header with the Government of Nepal logo and text: "Government of Nepal, Ministry of Physical Infrastructure and Transport, Department of Transport Management, Online Driving License System". Below the header is a navigation bar with links: "Home", "Services", "Check Status", "Admin", "Login", "Register", and a language selector "EN". The main content area features a "Welcome Back" message and a login form. The form has two input fields: "National ID (NID)" with a placeholder "Enter your NID number" and "Password" with a placeholder "Enter your password". Below the fields is a blue "Login Securely" button. At the bottom of the form, there is a link: "Don't have an account? Register Now".

Figure 6: User Login Page


b. Admin Login



The screenshot shows the admin login page of the Online Driving License System. At the top, there is a header with the Government of Nepal logo and text: "Government of Nepal, Ministry of Physical Infrastructure and Transport, Department of Transport Management, Online Driving License System". Below the header is a navigation bar with links: "Home", "Services", "Check Status", "Admin", "Login", "Register", and a language selector "EN". The main content area features an "Admin Portal" message with a shield icon and the text "Authorized Personnel Only.". Below the message is a login form. The form has two input fields: "Username" and "Password". Below the fields is a blue "Access Dashboard" button.

Figure 7: Admin Login Page

5. License Renewal Page



Government of Nepal
Ministry of Physical Infrastructure and Transport
Department of Transport Management
Online Driving License System

HomeServicesCheck Status

Rita ThapaEN

License Renewal Application

Complete the form below to renew your driving license

1

2

3

Personal DetailsCitizenship/NIDReview & Pay

Personal Details

Select License to RenewMobile Number

LIC-957211 (A)980444444

Full NameDate of Birth (BS)

Rita Thapa2000-01-01

Blood GroupGuardian Name

A Ramesh Thapa

BackNext Step

✓

2

3

Personal DetailsCitizenship/NIDReview & Pay

Identity Verification


Citizenship NoIssue District

30-01-73-22222Chitwan

National ID (NID)

123-456-789

Upload Scanned Citizenship (Both Sides)


Index.pdf
File selected

Please ensure that the scanned copies are clear and all details are visible to avoid delays in processing your application.

BackNext Step

✓Personal Details

✓Citizenship/NID


3Review & Pay


Review & Pay


Summary

Service: Class A, B License Renewal
Fee: NPR 1500.00
Tax: NPR 0.00
Total: NPR 1500.00

Select Payment Method


ConnectIPS


eSewa



IME Pay


[Back](#)[Confirm & Pay](#)

Figure 8: License Renewal Application Process

6. Check Status Page

[Home](#)[Services](#)[Check Status](#)

 Rita Thapa

 EN

Track Application Status

Enter your Reference Number to check current status.

[Track Status](#)

Application #REF-2025-6704

PENDING

Applicant	Rita Thapa
Service	LICENSE_RENEWAL
Submission Date	2025-12-25

Figure 9: Application Status

17

7. Dashboard Page

a. User Dashboard

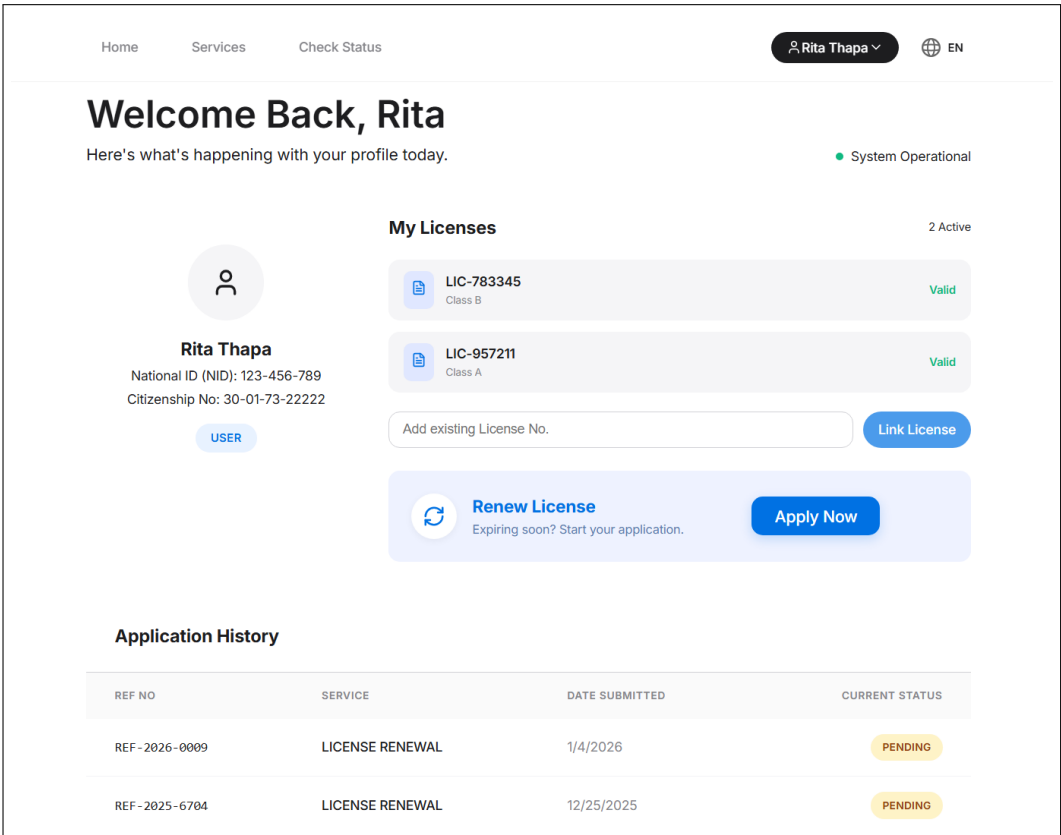
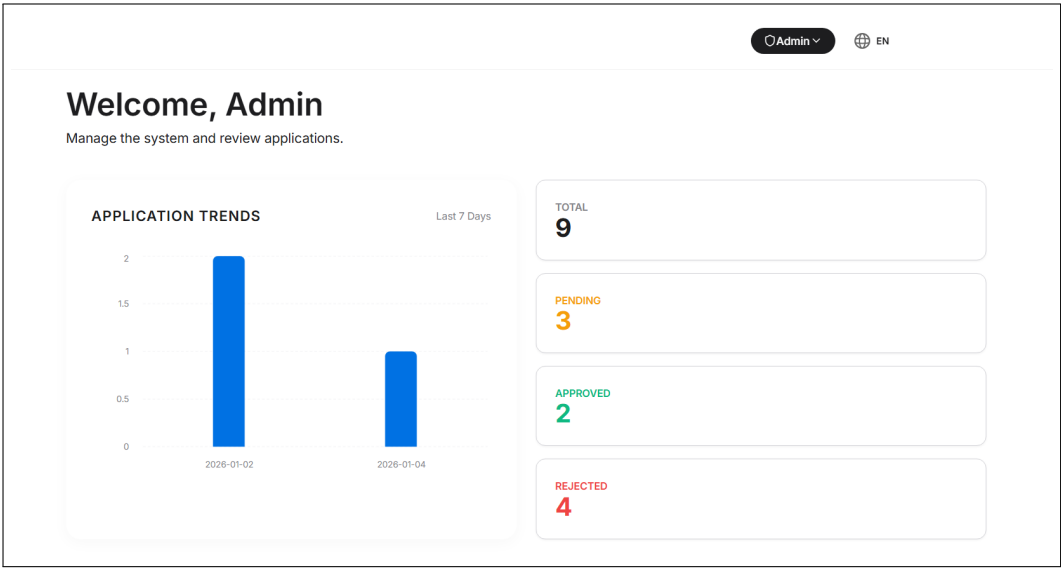


Figure 10: User Dashboard

b. Admin Dashboard









Applications				
REF NO	APPLICANT	SERVICE	STATUS	ACTIONS
REF-2026-0009	Rita Thapa 30-01-73-22222	LICENSE RENEWAL	Pending Review	 
REF-2026-0008	1111 1111	LICENSE RENEWAL	Rejected	Resolved
REF-2026-0007	1111 1111	LICENSE RENEWAL	Rejected	Resolved
REF-2025-0006	Ram Kumar Basnet 12345678901	LICENSE RENEWAL	Approved	Resolved
REF-2025-0005	Ram Kumar Basnet 12345678901	LICENSE RENEWAL	Rejected	Resolved
REF-2025-6704	Rita Thapa CTZ-5957	LICENSE RENEWAL	Pending Review	 
REF-2025-1776	Shyam KC CTZ-5503	LICENSE RENEWAL	Rejected	Resolved
REF-2025-3164	Gita Rai CTZ-6327	LICENSE RENEWAL	Pending Review	 
REF-2025-9214	Sita Sharma CTZ-6671	LICENSE RENEWAL	Approved	Resolved

Figure 11: Admin Dashboard

4.2 Testing

The **Rastriya License Portal (RLP)** has been thoroughly tested to ensure reliability, security, accuracy, and performance. The following tests have been performed across different levels to validate both individual components and the overall system behavior.

4.2.1 System Testing

System testing ensures that all components of the Rastriya License Portal work together seamlessly. End-to-end workflows were tested for both citizen and administrative users, covering authentication, application submission, payment simulation, status tracking, and administrative processing.

Test Case ID	Input	Expected Output
TC-ST-01	Citizen login with valid National ID and password	Successful authentication and dashboard displayed with license details
TC-ST-02	Submit complete license renewal application with mock document upload	Application recorded, payment initiated, and status updated to “Pending Review”
TC-ST-03	Admin approves a pending application	Status updated to “Approved” and visible in citizen dashboard

4.2.2 Unit Testing

Each major module—authentication, database operations, payment gateway integration, and dashboard rendering was individually tested using unit tests in TypeScript (with Jest or Vitest framework). This ensured isolated correctness of core functions.

Test Case ID	Function / Input	Expected Output
TC-UT-01	authenticateUser() with correct NID and password	Returns valid session token
TC-UT-02	hashPassword() using Bcrypt	Password securely hashed and verifiable
TC-UT-03	createApplication() with valid payload via Prisma	New application record created in database

4.2.3 Integration Testing

Integration testing verified the interaction between modules, including frontend components with API routes, database operations via Prisma, session management, and external payment gateway mock responses.

Test Case ID	Scenario / Input	Expected Output
TC-IT-01	Citizen submits renewal form through web interface	Data saved in database, payment redirect triggered, and audit trail updated
TC-IT-02	Admin views and processes pending application	Application details loaded correctly, approval updates database and reflects in citizen view
TC-IT-03	Payment callback from sandbox gateway	Transaction status recorded and application advanced accordingly

4.2.4 User Acceptance Testing

User acceptance testing was conducted with sample users representing citizens and transport office staff. Feedback focused on usability, workflow clarity, response time, and overall satisfaction with the digital experience.

Test Case ID	Scenario	Expected Output
TC-UAT-01	Citizen completes renewal application	Process finished within acceptable time (<2 minutes excluding payment)
TC-UAT-02	Non-technical user navigates portal	User finds interface intuitive, forms easy to fill, and status tracking clear
TC-UAT-03	Admin reviews multiple applications	Dashboard and tools support efficient processing without confusion

5 Conclusion and Future Enhancements

5.1 Conclusion

The **Rastriya License Portal (RLP)** was successfully developed as a modern e-governance prototype to digitize and streamline driving license services under Nepal's Department of Transport Management. The system provides citizens with a secure and unified platform to manage driving license applications, renewals, status tracking, and fee payments online. For administrators, it offers role-based access, application processing tools, document verification support, and real-time analytics.

Built on a robust technology stack including *Next.js 15*, *TypeScript*, *PostgreSQL*, *Prisma*, and *Docker*, the portal ensures security, scalability, and maintainability. Key features such as National ID-based authentication, Bcrypt-hashed credentials, integration with Nepali payment gateways (ConnectIPS, eSewa, IME Pay), and comprehensive audit trails demonstrate a practical approach to replacing traditional manual processes with an efficient digital workflow.

Overall, RLP achieves its primary objectives by providing a transparent, paperless, and citizen-centric system for driving license management. While currently functioning as a fully operational prototype, it establishes a solid foundation for future development and real-world adoption.

5.2 Future Enhancements

The RLP can be further improved by implementing additional services and features to enhance user convenience, administrative efficiency, and overall functionality:

1. **Integration with Government Databases**

Link the portal with official National ID, DoTM records, and vehicle registration databases for automatic verification and data synchronization.

2. **Live Biometric Verification**

Add fingerprint, facial recognition, or iris scanning to reduce manual identity checks and increase security.

3. **Vehicle Registration Services**

Extend the portal to allow citizens to apply for new vehicle registration, transfer ownership, or renew vehicle documents digitally.

4. **Fines and Violation Management**

Integrate traffic fine tracking, violation notifications, and online payment of penalties to provide a centralized system for traffic law compliance.

5. **Mobile Applications**

Develop native iOS and Android apps with push notifications for application status updates, fee reminders, and appointment scheduling.

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