An Industry Oriented Mini Project (CS653PC)

on

LEGAL OUTCOME PREDICTION USING MACHINE LEARNING

by

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Introduction

- The Indian legal system is complex and difficult to navigate.
- Predicting legal outcomes is traditionally based on expert experience.
- Manual analysis is time-consuming and inaccessible to the public.
- This project uses Machine Learning to:
  - Predict case outcomes (Win/Lose)
  - Suggest relevant legal precedents
  - Estimate compensation or sentencing
- Aims to make legal insights transparent, accessible, and efficient for both lawyers and citizens.

Problem Statement

- Indian legal system is vast and difficult to interpret for common people.
- Legal professionals rely on manual research and experience.
- No effective tools exist for:
  - Predicting case outcomes accurately
  - Estimating compensation or sentencing
  - Suggesting relevant precedent cases
- Existing models lack support for Indian legal context and non-expert users.

Objectives

- Build a legal outcome prediction system using Machine Learning
- Fine-tune Legal-BERT on Indian legal data to predict case outcomes
- Estimate numerical outcomes like fines, imprisonment, and compensation
- Use Explainable AI (SHAP/LIME) to ensure transparent and interpretable predictions
- Provide relevant legal precedents for case support
- Design a user-friendly web interface for both lawyers and citizens

Literature Survey:

S.NO	AUTHORS	TITLE	YEAR	MERITS	DEMERITS
1	N. Z. Dina et al.	Legal judgment prediction using NLP and ML methods: A systematic literature review	2025	Comprehensive ; identifies trends in LJP	Limited to published studies
2	R. Bharati	Predictive Justice in Indian Courts: ML Approaches to Case Outcome Forecasting	2025	India-specific; practical ML use	Not peerreviewed
3	D. Shu et al.	LawLLM: A large language model for the U.S. legal system	2024	Large-scale LLM for U.S. law	U.S.-centric; no Indian benchmarking
4	S. K. Nigam et al.	TathyaNyaya & FactLegalLlama : Factual Judgment Prediction in Indian Legal Domain	2025	High performance; Indian focus	Limited benchmarks
5	B. D. Patnaik et al.	NyayaAnumana & INLegalLlama: InstructionTuned Legal LLMs for India	2024	Open-source; large dataset	Resourceintensive models

Literature Survey:

S.NO	AUTHORS	TITLE	YEAR	MERITS	DEMERITS
6	M. Azmi et al.	Legal judgment prediction via argument analysis	2024	Combines reasoning & ML	Complex annotation needed
7	J. Zelezniko w	Benefits and dangers of using ML for legal predictions	2023	Highlights ethical & bias risks	No empirical testing
8	P. Y. Dharma et al.	Legal judgment prediction: A systematic literature review	2023	Recent review of models	Limited scope
9	J. Mumford et al.	Reasoning with legal cases: A hybrid ADFML approach	2022	Blends symbolic and statistical reasoning	Complexity in implementation
10	H. Silva et al.	Rapid Semiautomated Literature Review on Legal Precedents Retrieval	2022	Accelerated literature analysis	Keyworddependence

Existing systems

Several systems exist that attempt to predict legal outcomes using machine learning models. Notable models, such as Legal-BERT, have been pre-trained on large legal corpora to aid in tasks like case classification, document retrieval, and decision prediction.

DRAWBACKS

- Localized Focus
- Lack of Numerical Predictions
- Complexity

PROPOSED SYSTEM

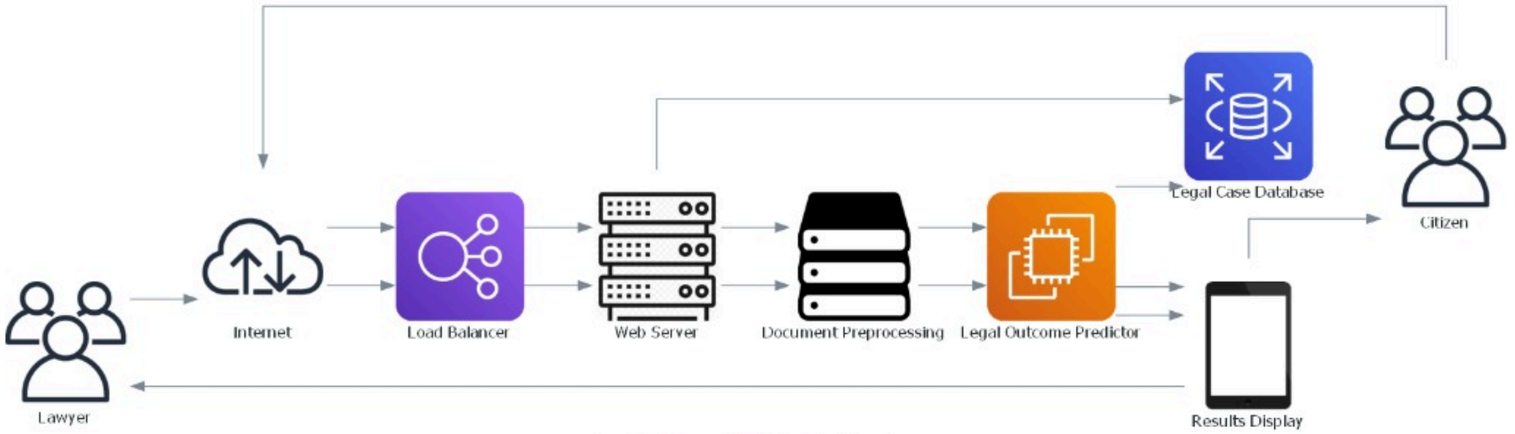
The proposed system tailors a solution for the Indian legal context, aiming to make legal predictions more accessible:

- **Localized Indian Data:** Fine-tuning Legal-BERT with Indian legal data for accurate predictions.
- **Numerical Predictions:** Predict case outcomes (win/lose) and estimate compensation and sentencing.
- **User-Friendly Interface**: Simple web interface for both legal professionals and ordinary citizens.
- **Explainable AI:** Transparent predictions using SHAP and LIME techniques.
- **Comprehensive Resources:** Recommend legal precedents to aid in case preparation.

ADVANTAGES

- Higher Accuracy
- Increased Usability
- Transparency
- Comprehensive Prediction

System Architecture

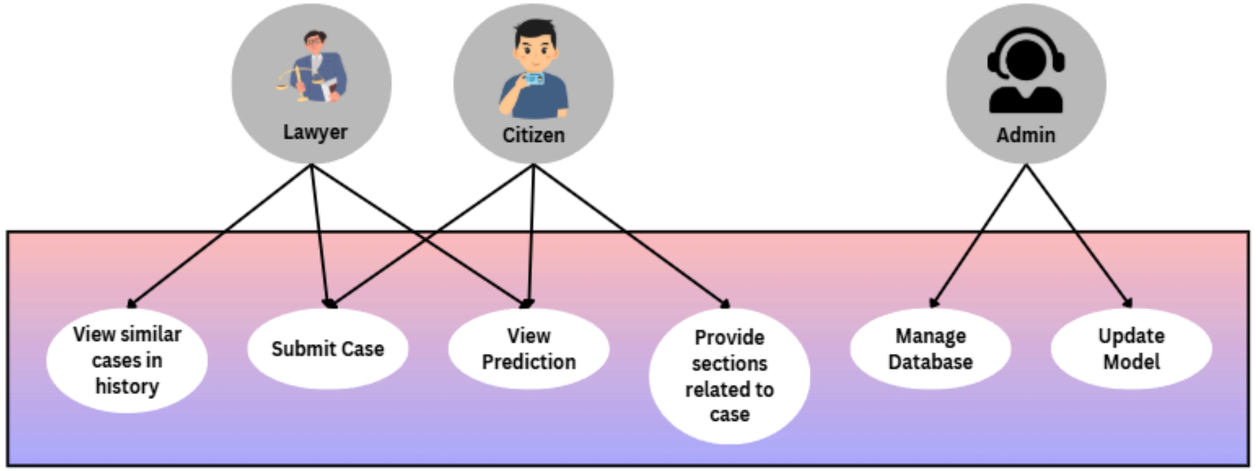


Legal Outcome Prediction Architecture

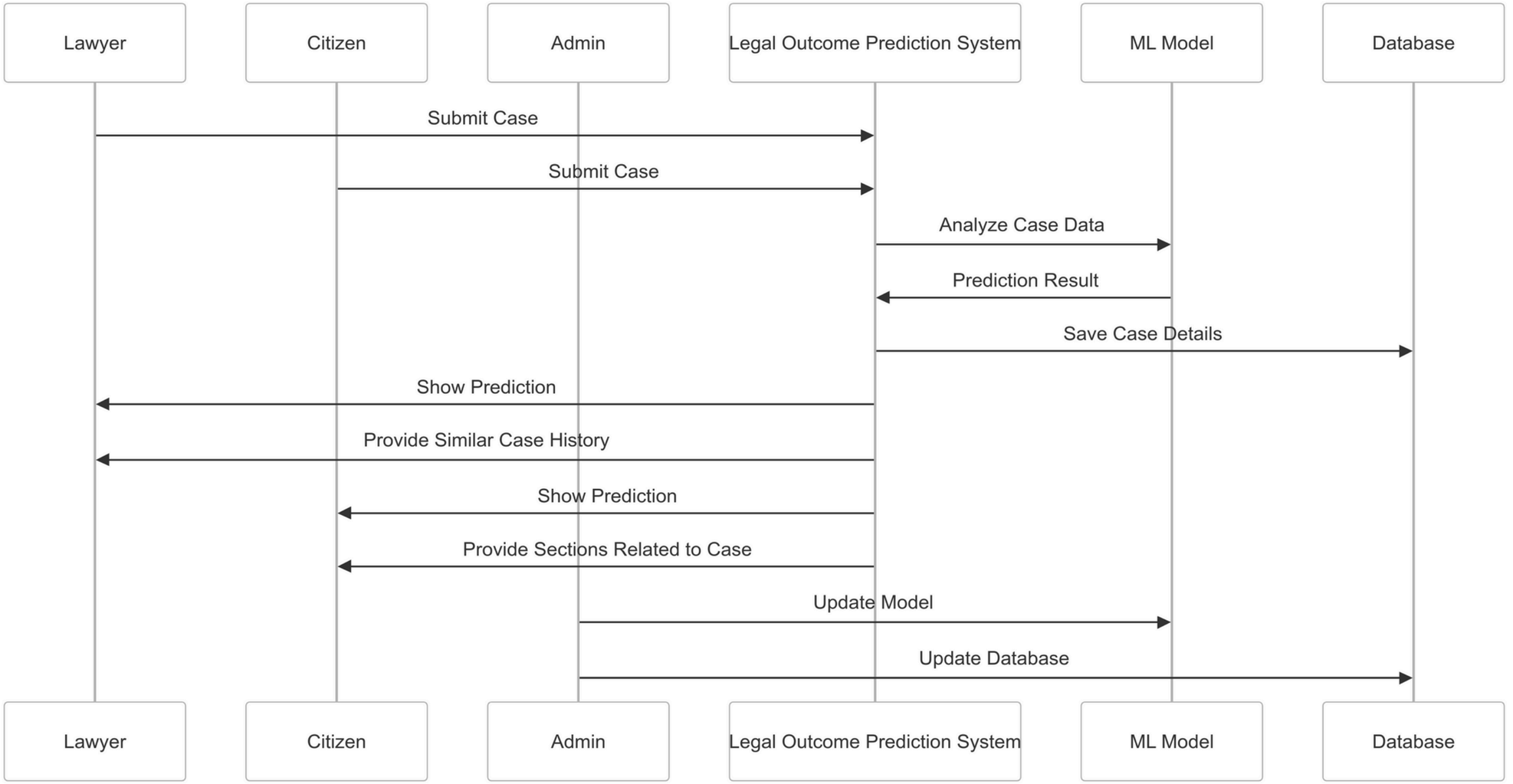
- **Actors (Users):** Lawyers & citizens submit case details via a web interface.
- **Internet & Load Balancer:** Ensures smooth user request handling and system availability.
- **Web Serve**r: Manages user interactions and forwards data for processing.
- **Document Preprocessing**: Extracts key features, cleans legal text for ML analysis.
- **Legal Outcome Predictor (ML Model):** Uses historical data to predict case outcomes, compensation, and sentencing.
- **Legal Case Database**: Stores past cases & legal precedents for reference.
- **Results Output:** Displays predictions with explanations on the user's interface.
- **Data Flow**: User inputs → Processing → ML model prediction → Output to user.

Use Case Diagram

Actors: Lawyer, Citizen, and Admin.
Lawyer:
Submit legal cases for analysis.
View predicted outcomes.
Access similar past cases for reference.
Citizen:
Submit cases for legal outcome prediction.
View predicted case results.
Get relevant legal sections and acts.
Admin:
Manage and update the case database.
Update the ML model with new legal data.
Purpose: Enhances legal decision-making by providing AI-driven case predictions and relevant legal insights.



Sequence Diagram

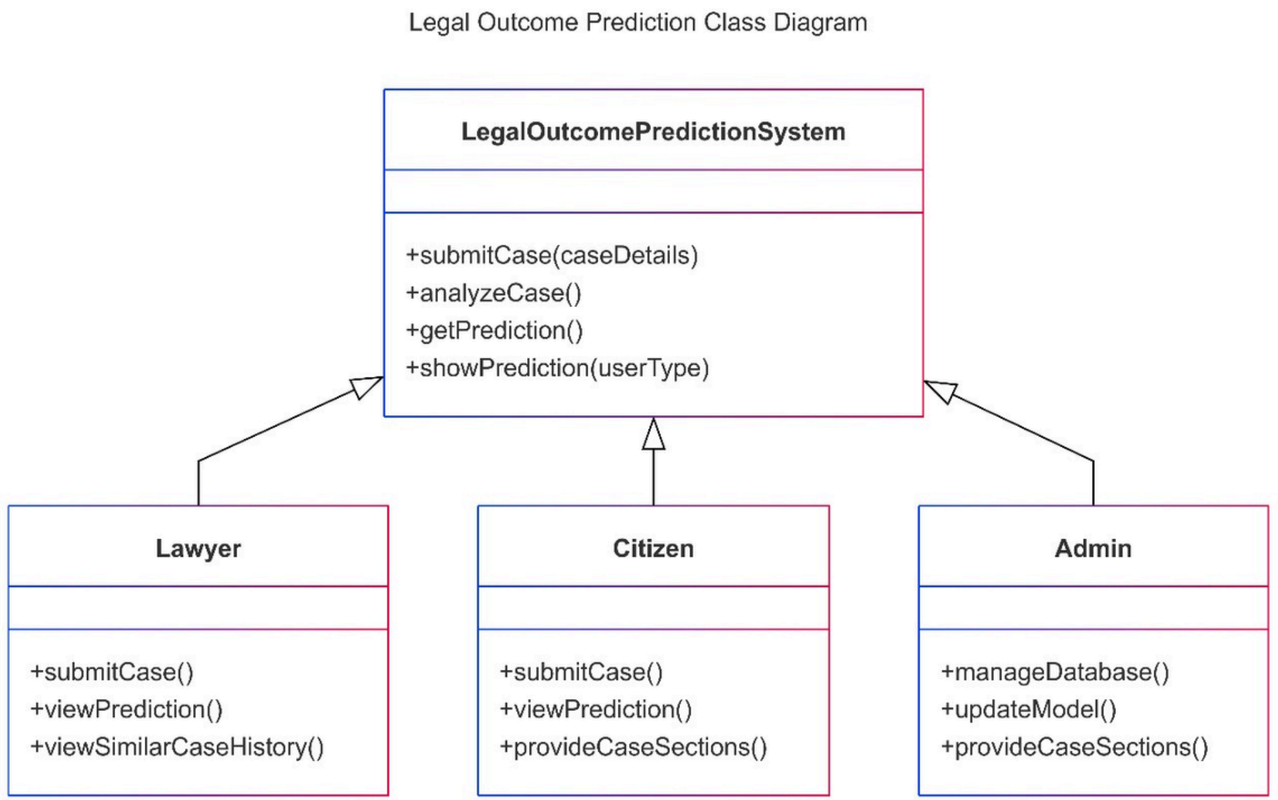


Sequence Diagram

- Lawyers and Citizens submit cases to the Legal Outcome Prediction System.
- System analyzes case data using the ML model.
- ML model generates predictions based on historical legal cases.
- Predicted outcomes are displayed to lawyers and citizens.
- Similar past cases are retrieved for reference.
- Admin manages the database and updates the ML model.
- Legal sections related to the case are provided to citizens for better understanding.

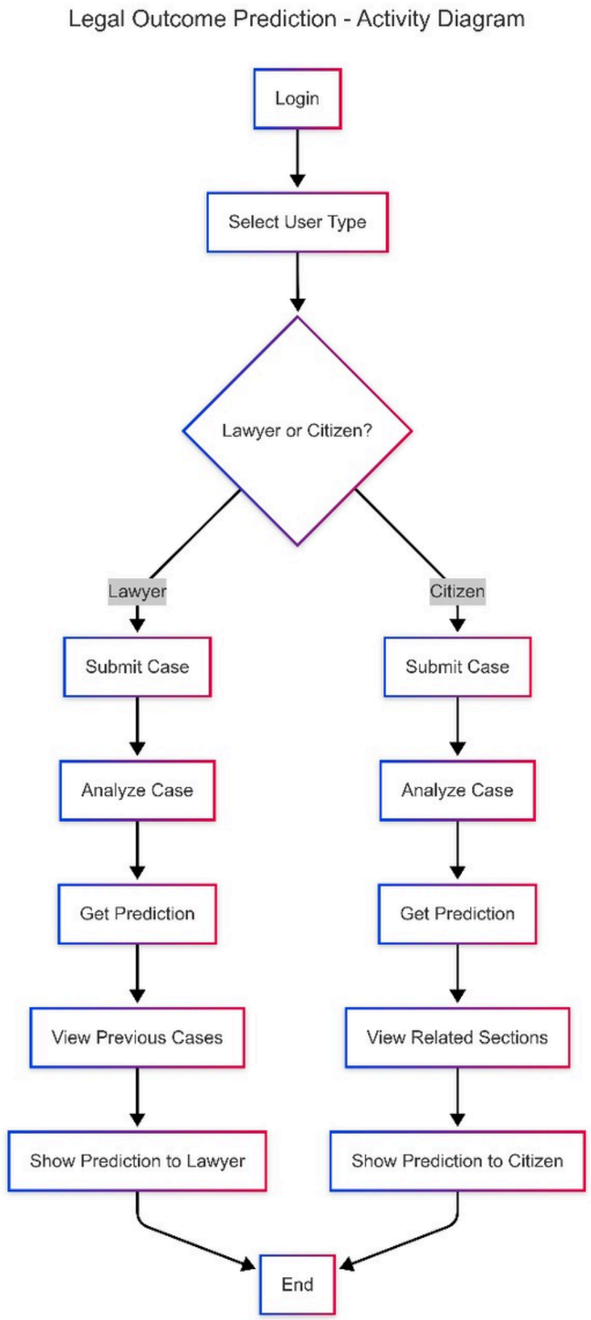
Class Diagram

- Represents the structure of the Legal Outcome Prediction System.
- Contains three main classes: Lawyer, Citizen, and Admin.
- Lawyer & Citizen can submit cases and view predictions.
- Admin manages the database and updates the ML model.
- Case data and legal sections are stored in the system.
- ML Model class processes case details and generates predictions.
- Database class stores historical cases and user-submitted data.



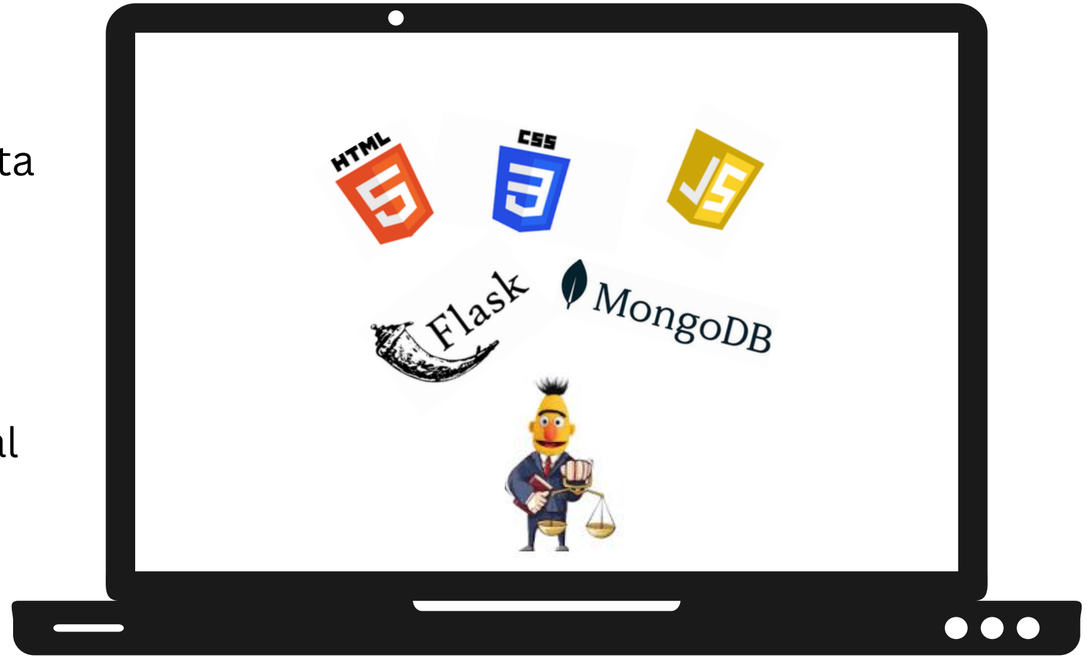
Activity Diagram

- Users (Lawyer/Citizen) submit a case to the system.
- System preprocesses case details before prediction.
- ML Model analyzes case data and predicts the outcome.
- Prediction is displayed to the user.
- Lawyers can view similar past cases for reference.
- Citizens receive related legal sections for better understanding.
- Admin updates the database and retrains the ML model for accuracy.



Implementation

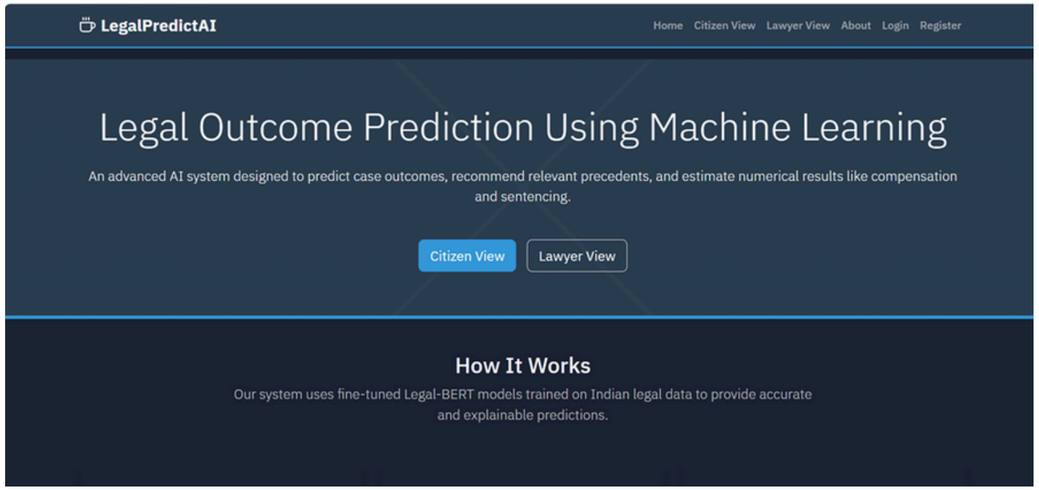
- **Frontend:**
  - HTML/CSS, Bootstrap – Interface & design
  - JavaScript (jQuery) – Dynamic interactions
  - Flask Templates – Render predictions & precedent data
  - Chart.js / SHAP – Model explainability visuals
- **Backend:**
  - Python (Flask) – Routing & logic
  - Legal-BERT (HuggingFace) – Outcome classification
  - Sentence Transformers + FAISS – Similar case retrieval
  - MongoDB – Case data & embedding storage
  - Regex – Extracts fine, jail, compensation data



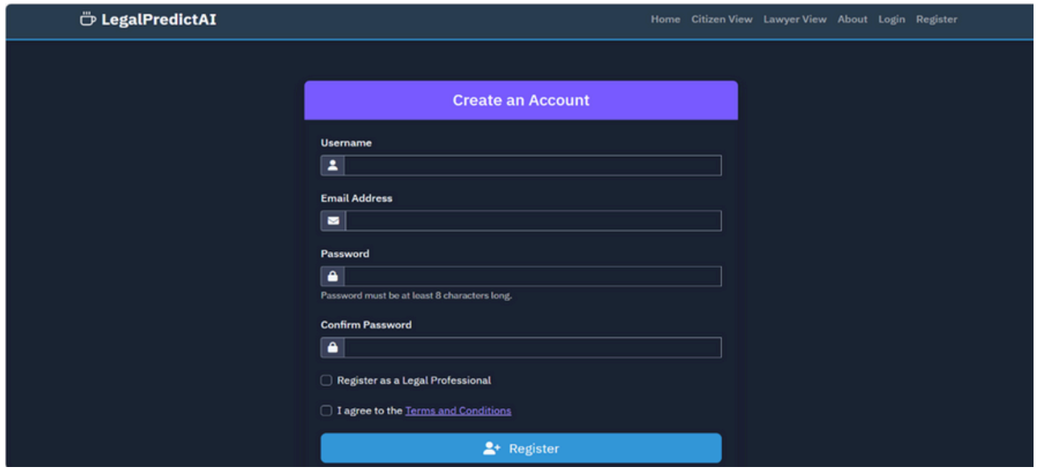
Key Functionalities

- **Input & Preprocessing:**
- Users submit case summaries; system tokenizes & prepares input
- **Outcome Prediction:**
- Legal-BERT predicts Allowed/Dismissed using balanced training
- **Precedent Retrieval:**
- FAISS fetches top-5 semantically similar court cases
- **Numerical Estimation:**
- Estimates fine, imprisonment, compensation using similar cases
- **Explainability:**
- SHAP/LIME highlight important words influencing the prediction
- **Security:**
- Login system with encryption & Flask session handling

Results

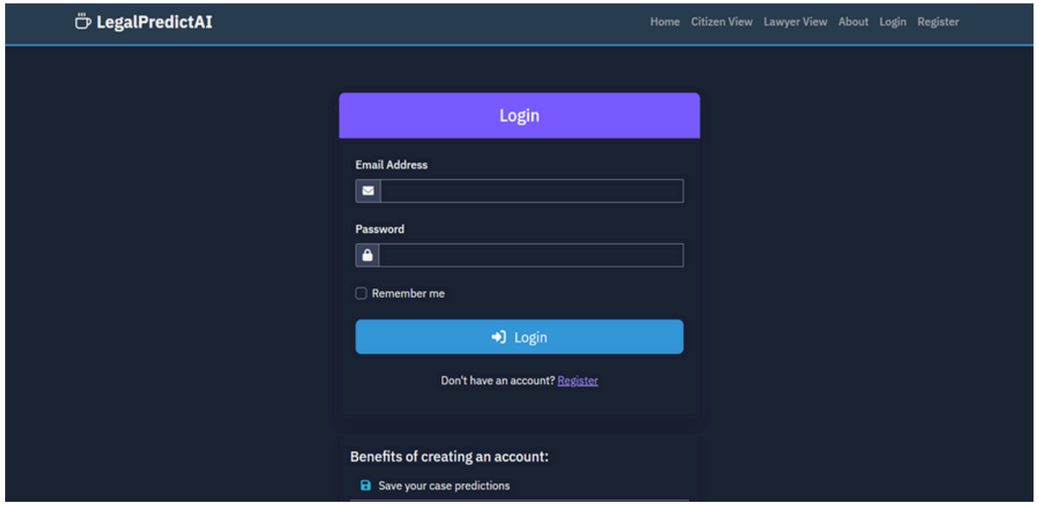


Home Page

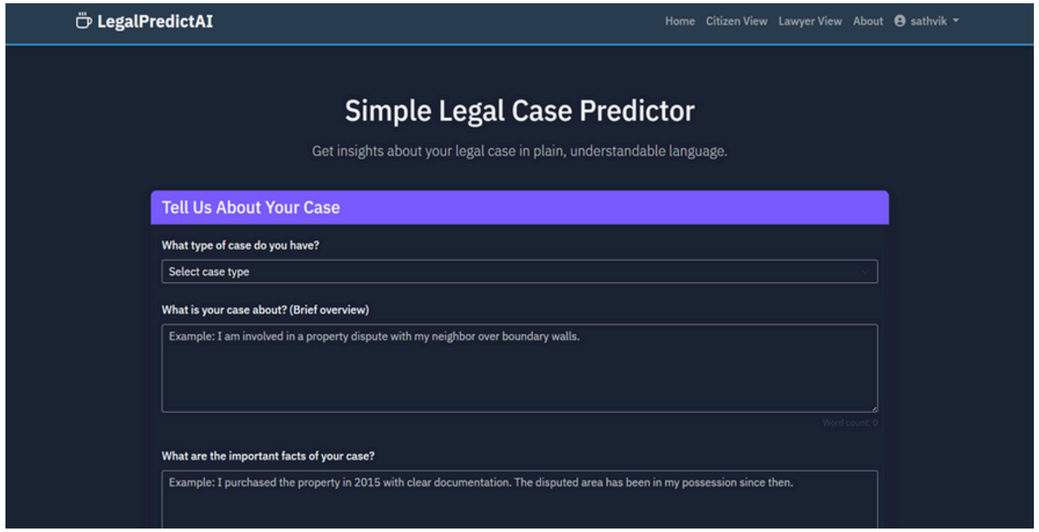


Register page

Results



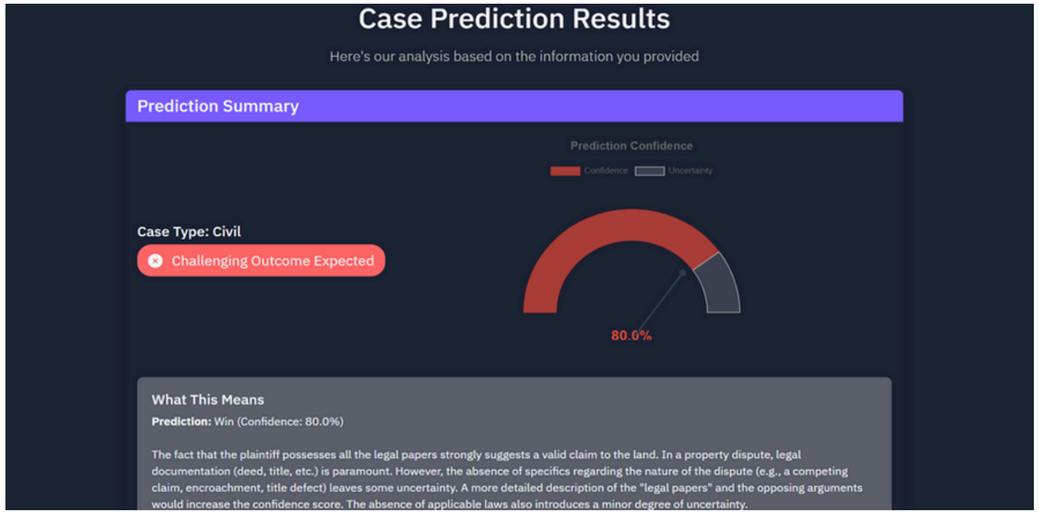
Login page



Citizen view

Results

Lawyer view



Prediction page

Conclusion

"Legal Outcome Prediction Using Machine Learning" enhances legal decision-making by leveraging AI and data-driven insights.

Key Takeaways:

- Predicts case outcomes (win/lose) with machine learning.
- Recommends relevant legal precedents.
- Estimates compensation, sentencing, and damages.
- Uses Legal-BERT, NLP, and Explainable AI for transparency.
- Provides a user-friendly web interface for accessibility.

Impact & Future Scope:

- Empowers legal professionals & citizens with legal insights.
- Reduces research time & improves case preparation.
- Can be expanded to include more legal domains and languages.
- Potential for real-time legal assistance & integration with court databases.

Bringing AI & Law Together for a Smarter Legal System!

THANK YOU