

A PROJECT BASED SEMINAR REPORT

on

**AI-POWERED LEGAL ASSISTANCE AND
JUDICIAL INFORMATION SYSTEM**

Submitted towards the
Partial Fulfilment of the Requirements of

**Bachelor of Technology in
Computer Engineering**

By

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Under the guidance of

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CERTIFICATE

This is to certify that the seminar report entitled

AI-POWERED LEGAL ASSISTANCE AND JUDICIAL INFORMATION SYSTEM

being submitted by

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is a bonafide work carried out by students under the supervision of Dr. Y. D. Bhise and it is submitted towards the partial fulfilment of the requirement of Bachelor of Technology (Computer Engineering) during academic year 2024-2025.

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Abstract

The AI-Powered Legal Assistance and Judicial Information System aims to improve the accessibility, accuracy, and efficiency of legal services in India. It consists of two main modules: an AI-based Interactive Chatbot for citizens and an AI-powered FIR Drafting Assistance System for police stations. The chatbot will help citizens easily access judicial information such as case status, court appointments, e-filing procedures, fine payments, and hearing schedules. Using Natural Language Processing (NLP), it will provide real-time responses to user queries and reduce the need for physical visits. It will also be integrated with judicial databases like NJDG to give updated and accurate case information. The FIR Drafting Assistance System will help police officers draft complete and legally accurate FIRS by analyzing incident descriptions and suggesting appropriate legal sections and templates, reducing errors and delays.

Additionally, the system will offer real-time case and FIR tracking, so citizens and officers can monitor progress and receive timely notifications. A centralized role-based portal will allow secure access to information for citizens, police, and judicial authorities. Overall, this AI-based system will enhance transparency, speed, and accuracy in the legal process, reduce manual effort, and make justice more accessible to everyone.

Keywords: AI Chatbot, FIR Drafting, Legal Assistance System, Judicial Information Access, NLP, Court Case Status, e-Governance, Legal Tech Solutions.

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Chapter 1

Introduction

1.1 Project Idea

Access to legal assistance remains a pressing challenge in India due to complex judicial processes, manual inefficiencies, and limited digital reach, particularly in rural areas. Our proposed project aims to build an AI-powered legal assistance and judicial information system that integrates Natural Language Processing (NLP), intelligent automation, and secure digital infrastructure to streamline legal services for both citizens and officials. By utilizing AI to automate repetitive tasks and provide accurate legal information, this system will serve as a bridge between citizens and the judiciary.

The project focuses on four major modules: 1) An AI-based legal chatbot for public interaction, 2) A smart FIR drafting assistant for police departments, 3) A centralized role-based portal for information flow between stakeholders, and 4) A real-time notification engine for legal and case updates.

These modules work in unison to reduce delays, ensure transparency, and increase accessibility to justice. Integration with platforms like the National Judicial Data Grid (NJDG) allows the system to provide up-to-date case and hearing information directly to the user in their preferred language.

In addition to backend automation, the system will feature a secure, user-friendly web portal built using responsive UI tools and role-based access protocols. Citizens will be able to track their FIRs and cases, police officers can manage documentation and updates, and judicial authorities can monitor progress with administrative oversight. The interface will include AI-driven dashboards that show pending actions, upcoming hearings, and legal recommendations—enabling smarter and faster decision-making.

The main technologies that power the project include:

- **Natural Language Processing (NLP):** Enables the AI chatbot to understand and

respond to legal queries in multiple languages, supporting inclusivity across India.

- **AI-Powered FIR Drafting Engine:** Automatically analyzes case descriptions and suggests suitable legal sections using trained models and rule-based logic.
- **Role-Based Web Portal:** Ensures secure access for citizens, police, and judiciary with dedicated views and tools for each user type.
- **Real-Time Notification System:** Sends automated alerts for hearing dates, fines, case progress, and legal reminders via email or SMS.

By offering a secure, intelligent, and scalable digital ecosystem, this project holds the potential to transform India's legal landscape. It reduces the dependency on physical processes, increases legal awareness among citizens, and strengthens administrative transparency—all key pillars in advancing digital governance and judicial reforms in the country.

1.2 Motivation of the Project

Access to justice is a fundamental right, yet millions of citizens in India struggle with legal inaccessibility due to complicated procedures, lack of legal literacy, and delays caused by manual systems. Traditional methods of delivering legal services are often slow, fragmented, and heavily reliant on human intervention, which introduces subjectivity and inconsistency. These inefficiencies create a digital divide between the legal system and the common citizen. Motivated by the need to modernize and democratize the legal ecosystem, this project integrates AI, NLP, and secure web technologies to create a unified, intelligent platform for legal assistance and judicial transparency.

The motivation behind the development of this project is to solve these pervasive problems. Here are the key motivating factors that led to the creation of this project:

1. **Legal Inaccessibility in Rural and Underserved Regions:** Due to factors like lack of information, cost, and distance, many residents, particularly those in rural and semi-urban areas, may not have access to legal aid. This gap can be filled by a digital solution that uses AI-powered technologies to offer on-demand legal support.
2. **Manual and Prolonged Legal Procedures:** Multiple visits and documentation are required for the current procedures for filing FIRs, reviewing the status of cases, and

getting hearing information. AI and automation can greatly lessen the workload for both the public and the government.

3. **Lack of Real-Time Legal Updates and Notifications:** Inadequate communication or timely updates frequently result in delays and missing court appearances. Automated case alert and reminder systems guarantee that citizens stay informed and engaged.
4. **Need for Structured and Legally Accurate FIR Drafting:** Incorrectly drafted FIRs lead to procedural issues and delays in justice. An AI-based FIR assistant can ensure legal correctness and save valuable time for police officers.
5. **Rising Role of AI in Public Service Delivery:** AI has proven its potential in transforming public services like healthcare and education. Leveraging it in legal services enables faster, unbiased, and smarter assistance for users at scale.
6. **Commitment to Digital India and e-Governance:** As India moves toward a digitally inclusive society, the judicial system must also adapt to deliver transparent and efficient services. This initiative supports national objectives of fostering paperless governance and citizen-focused platforms.
7. **Absence of Unified Legal Assistance Platforms:** Current systems are disjointed—tracking FIRs, obtaining legal advice, and accessing court data are managed through separate platforms. A centralized, role-based portal would create a more integrated experience for citizens, law enforcement, and the judiciary.

The existing legal framework underscores the pressing demand for smart and user-friendly solutions that simplify procedures and enhance legal accessibility. This initiative is motivated by the goal of creating a transparent, efficient, and AI-supported judicial environment that empowers individuals, aids officials, and fosters India's progression towards digital justice.

1.3 Literature Survey

Role-Based Access Control (RBAC) has emerged as a fundamental mechanism for enforcing security policies within enterprise systems, particularly as organizations scale and migrate to distributed and cloud-based infrastructures. The RBAC model simplifies permission management by associating users with roles rather than assigning permissions individually. This survey summarizes significant advancements in RBAC, focusing on its features, real-world applications, and enhancements made for flexible and scalable

deployment.

Foundational Concepts of RBAC : Ferraiolo et al. introduced the core idea of RBAC, where access permissions are assigned to roles, and users acquire permissions by being assigned to these roles[13]. This model reduces complexity in access control administration and aligns well with organizational job functions. The system supports constraints such as least privilege, separation of duties (both static and dynamic), and role hierarchies that allow roles to inherit permissions from subordinate roles, making it highly adaptable to enterprise structures.

RBAC in Intranet and Web Environments: In traditional corporate intranets, managing user permissions through access control lists (ACLs) was cumbersome and error-prone. The NIST RBAC/Web implementation enabled centralized management of user-role-permission relationships while supporting organizational constraints like role cardinality and operational limits. This enhanced administrative interface drastically reduced residual privileges when users changed job functions and improved security assurance across web applications.

Efficient and Flexible RBAC for Cloud Computing: Cloud environments introduce challenges such as user anonymity, dynamic access needs, and multi-tenant architecture. To address these, Harnal and Chauhan proposed an Efficient and Flexible RBAC (EF-RBAC) model tailored for cloud services[11]. Their model incorporates features like session constraints (e.g., number of transactions per day), borrowing/gifting of permissions among same-role users, and integration with cloud specific mobility and auditing needs. EF-RBAC enhances traditional RBAC by providing adaptability and scalability while maintaining strict access controls .

RBAC in Enterprise Systems – Practical Implementations: Upadhyay et al. emphasized practical aspects of RBAC implementations, especially for systems where Active Directory (AD) users coexist with external users[12]. Their work proposed role-based frameworks supporting both AD and non AD users while incorporating permission-level security and database-independent architectures. Key functionalities such as session handling, authentication, audit control, and persistence schemas further cement RBAC's role as a backbone for secure information systems.

Gaps and Integration Needs: Despite its strengths, RBAC models still face challenges in dynamic environments like federated cloud systems or zero-trust networks. Future work may include combining RBAC with attribute-based access control (ABAC) or

machine learning to make access decisions context-aware. Enhancing inter-operability and migration support across providers, as proposed in EF-RBAC, is another ongoing research area crucial for modern multi-cloud ecosystems

Chapter 2

Problem Definition and Scope

2.1 Problem Statement

India's legal system faces persistent challenges such as complex procedures, manual inefficiencies, and limited digital accessibility, especially in rural regions. This project, AI-Powered Legal Assistance and Judicial Information System, leverages AI, NLP, and secure digital infrastructure to automate FIR drafting via an AI chatbot, enable role-based access for judicial tracking, and provide real-time legal updates—empowering citizens and streamlining justice delivery.

2.2 Problem Description

Traditional legal processes, such as filing First Information Reports (FIRs), obtaining case updates, attending court hearings, or accessing basic legal guidance, often require in-person visits to police stations, legal aid centers, or courts. These procedures are not only time-consuming but are also subject to administrative delays, miscommunication, and legal inconsistencies. Moreover, citizens who are unfamiliar with legal terminology or procedure—especially those speaking regional languages—find it difficult to navigate the system without external legal support.

While some initiatives have attempted to digitize legal services, most existing solutions are fragmented and limited in scope. Static legal portals lack real-time updates, chatbot interfaces are usually rule-based and unidirectional, and FIR filing remains largely manual or template-driven without intelligent section suggestions or validation. Additionally, sensitive legal data is often not adequately protected, and access control systems fail to distinguish roles such as citizen, police, or judge, leading to either restricted usability or potential privacy risks.

To address these pressing challenges, there is a need for an integrated, intelligent, and secure platform that combines AI, NLP, role-based access control, and real-time data synchronization. This project proposes the development of an AI-Powered Legal Assistance

and Judicial Information System that offers multilingual chatbot-based legal interaction, intelligent FIR drafting assistance, real-time case tracking, and a centralized portal with role-specific features. By automating routine tasks, improving legal document accuracy, and empowering citizens with timely legal information, the system aims to make the Indian legal system more transparent, accessible, and efficient for all stakeholders.

2.2.1 Goals and Objectives

The present project focuses on designing and implementing an AI-powered legal assistance and judicial information platform to improve transparency, accessibility, and efficiency in India's legal system. The aim is to leverage Artificial Intelligence (AI), Natural Language Processing (NLP), and secure cloud infrastructure to automate key legal workflows such as FIR drafting, case status tracking, and legal guidance delivery through multilingual chatbots.

- **Goals**

1. To Develop a scalable and secure AI-powered platform that offers role-based access to legal services for citizens, police officers, and judicial authorities.
2. To Integrate NLP-enabled multilingual chatbot support to provide real-time responses to citizens' legal queries and procedural doubts.
3. To Automate the FIR drafting process through intelligent section recommendation and template generation using NLP and legal knowledge bases.
4. To Provide real-time case status updates, hearing schedules, and legal notifications via integrated sync with platforms like the National Judicial Data Grid (NJDG).
5. To Empower citizens in rural and underserved areas by improving legal literacy and reducing dependency on intermediaries.

- **Objectives**

1. **Multilingual Chatbot Integration:** Design and deploy an NLP-based chatbot capable of handling legal questions and procedural support in English and regional languages.
2. **Intelligent FIR Drafting Assistant:** Build an AI system that automatically analyzes incident descriptions and recommends IPC sections and prebuilt FIR templates.

-
3. **Centralized Role-Based Portal:** Implement a secure web platform with separate login flows and dashboards for citizens, police personnel, and judicial officers.
 4. **Real-Time Case Update System:** Integrate with NJDG APIs to deliver automated alerts and status updates on court proceedings, hearings, and fines.
 5. **Data Security and Access Control:** Apply robust role-based access control (RBAC) models to ensure user-specific data access and protection of sensitive information.
 6. **Accuracy Validation and User Testing:** Evaluate chatbot accuracy, FIR section predictions, and portal usability through controlled user feedback and iterative refinement.
 7. **Insightful Reporting Tools:** Generate structured outputs such as downloadable FIRs, case summaries, and legal guidance reports to support informed decision-making by all stakeholders.

2.2.2 Assumption and Scope

- **Assumption**

- ◇ **Data Accessibility:** It is assumed that access to the National Judicial Data Grid (NJDG), public FIR repositories, and other legal datasets will be granted for the purpose of training, testing, and integration into the system.
- ◇ **Language Support:** The project assumes availability of appropriate Natural Language Processing (NLP) libraries and translation datasets for regional language support beyond English and Hindi.
- ◇ **Infrastructure Availability:** It is assumed that necessary hardware and software infrastructure—such as cloud hosting, AI model deployment environments, and secure databases—will be available for development and testing.
- ◇ **User Role Consistency:** It is assumed that users (citizens, police officers, and judicial staff) will follow standard digital access protocols and responsibilities as defined within their system roles.
- ◇ **Legal and Ethical Compliance:** The project assumes adherence to all existing IT laws, data protection regulations, and government standards related to digital legal services in India.

• Scope

- ◇ The project aims to design and implement a unified AI-powered judicial information platform that supports FIR automation, real-time legal tracking, and multilingual legal assistance through a chatbot interface.
- ◇ The scope includes the development of a centralized, role-based portal providing secure access and dashboards tailored for citizens, law enforcement, and judicial personnel.
- ◇ The system emphasizes backend intelligence and process automation—particularly FIR drafting, IPC section prediction, and real-time legal updates—rather than front-end visual analytics or mobile apps.
- ◇ The chatbot component will support regionally relevant legal queries and procedures, but will not provide personalized legal advice or representation.
- ◇ While the platform integrates real-time NJDG syncing, it is limited to non-sensitive public records and does not include classified or sealed judicial documents.
- ◇ Data security, role segregation, and compliance with Indian cybersecurity frameworks are integral to the system's architecture but implementation of blockchain or biometric authentication is beyond the scope of this phase.
- ◇ The project does not address court automation, case outcome prediction, or detailed evidence management. Future phases may explore these advanced capabilities.

By clearly defining these assumptions and the scope of work, the project aims to establish a technically feasible, legally compliant, and scalable solution for transforming legal assistance and judicial information delivery in India through the use of intelligent automation and secure access systems.

Chapter 3

Methodology

3.1 Methodology

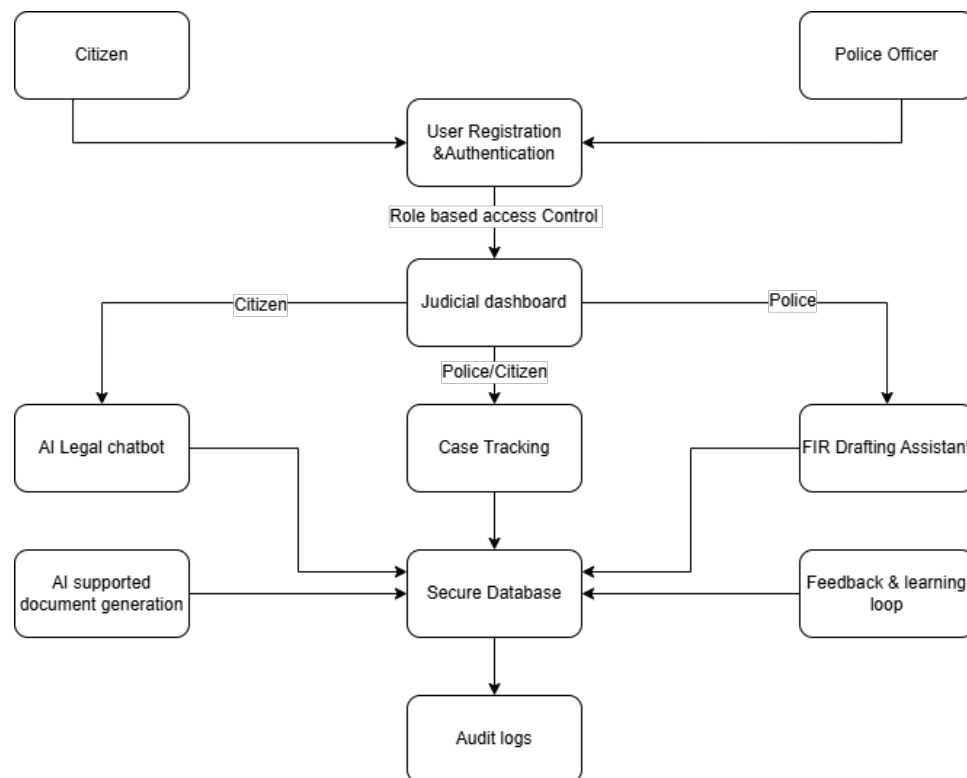


Figure 3.1: System Architecture of AI-Powered Legal Assistance and Judicial Information System

Refer to Fig. 3.1 which illustrates the system architecture and data flow

for the AI-Powered Legal Assistance and Judicial Information System. The system uses a combination of NLP, secure authentication, backend processing, and structured visualization to enable a seamless, multilingual, AI-assisted legal experience for citizens and law enforcement officers.

- 1. User Registration and Authentication:**

Users (citizens or police officers) initiate their interaction through a secure login portal. Authentication is performed using OTP, email, or optionally, Aadhaar/Digital ID. A role is assigned upon login, enabling RBAC (Role-Based Access Control) throughout the system.[12]

- 2. Multilingual Legal Chatbot Interface:**

The user interacts with a trained multilingual NLP-based chatbot capable of answering basic legal queries. It provides support in English, Hindi, and other regional languages using transformers or sentence embeddings and translation APIs.[2][10]

- 3. FIR Drafting and IPC Section Mapping:**

Once the chatbot confirms that the user intends to file an FIR, a structured template is launched. The user inputs an incident description in natural language. An AI model extracts legal entities and facts and recommends relevant IPC sections (e.g., theft, assault, cybercrime) using a knowledge-mapped ruleset and trained models like BERT.[3][4]

- 4. Case Tracking and Status Sync:**

After submission, the FIR is digitally signed and stored. Simultaneously, the system queries the National Judicial Data Grid (NJDG) via API to fetch or register the FIR for tracking. Updates like hearing schedules, judgments, or payment links for fines are pushed back to the user.[5][10]

- 5. Secure Role-Based Dashboard Interface:**

Role-specific dashboards are provided: citizens view filed FIRs and responses; police view assigned FIRs and respond; admins may monitor system usage. Dashboards are dynamic and designed using React.js and TailwindCSS for usability.[8][13]

- 6. Structured Document Generation:**

Auto-generated PDFs of FIRs, summaries, or hearing notices are prepared using LaTeX or HTML-to-PDF converters. These are downloadable and time-stamped for legal validity.[7][10]

- 7. Data Storage and Audit Logs:**

FIRs and chatbot logs are securely stored in an encrypted PostgreSQL/MongoDB hybrid. All system events are recorded with audit trails and timestamps to ensure

traceability and accountability.[6][12]

8. Feedback Loop and Model Improvement:

Incorrect or modified chatbot responses and IPC suggestions are collected as feedback. This helps retrain AI/NLP models periodically to improve accuracy and reduce bias using fine-tuned language models.[4]

9. Frontend Visualization and Admin Analytics:

An admin dashboard aggregates usage statistics such as top FIR categories, chatbot queries, unresolved cases, and role-wise login analytics. Graphs and heatmaps assist administrators in optimizing the system[8][11]

3.2 Storage and Visualization Module

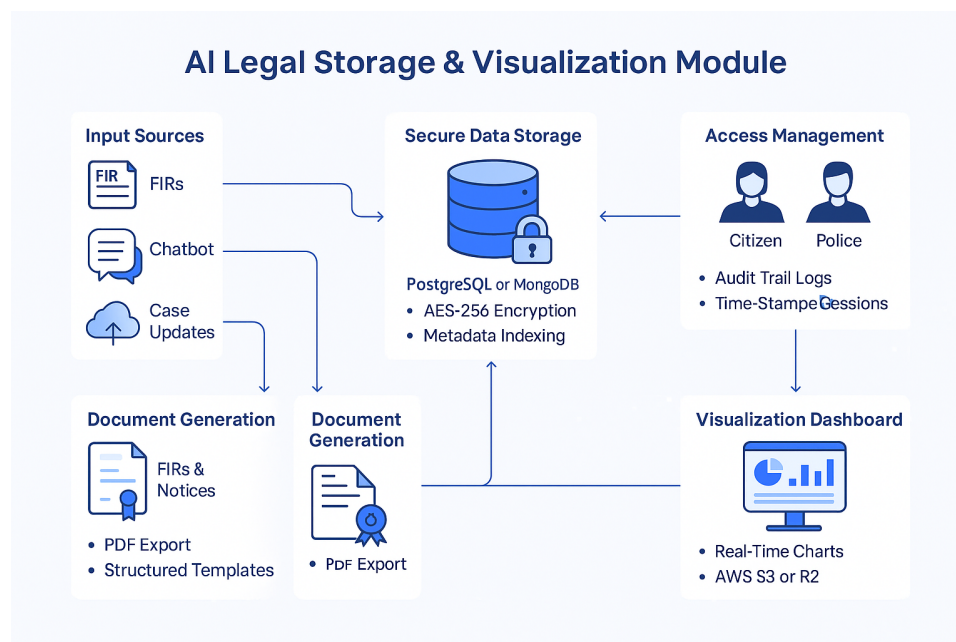


Figure 3.2: Storage and Visualization Module of AI-Powered Legal System

Refer to Fig. 3.2 which shows how data is processed, encrypted, and visualized in a secure and role-specific manner.

1. Encrypted Legal Data Storage:

FIRs, case summaries, user queries, and documents are stored in an encrypted backend using AES-256 encryption. Metadata is indexed for fast retrieval.

2. Audit Trails and Role Access:

Every access or update operation is logged and linked to user roles. Forensic logs support future audits and accountability.

3. Dynamic Document Output:

The system supports downloading PDFs of legal drafts, FIRs, and case summaries. Templates ensure judicial compliance and presentability.

4. Visual Analytics Dashboards:

Dashboards show metrics like FIR filing frequency, AI prediction accuracy, case resolution timelines, and usage heatmaps.

5. Cloud Backup Archival:

Daily backups are stored securely in a cloud bucket (e.g., AWS S3 or R2). Older data is archived and retrievable via query interfaces.

Chapter 4

Outcome

4.1 Type of Project

The AI-Powered Legal Assistance and Judicial Information System is a hybrid project combining both application and research orientations. It delivers a practical digital solution while contributing significantly to the study and development of AI, NLP, and legal informatics.

Application-Oriented:

The project is designed as a practical, real-time solution for legal automation, assistance, and transparency using modern AI tools. It helps bridge the gap between citizens and the justice system.

- ◇ **Citizen Empowerment:** Offers instant legal assistance, multilingual support, and guided FIR filing, reducing dependency on legal intermediaries and increasing access to justice in underserved areas.
- ◇ **Integrated Case Management:** Provides real-time case status updates via NJDG integration and delivers structured legal outputs including FIRs, legal notices, and case summaries.
- ◇ **Secure Role-Based Access:** Supports distinct user interfaces and privileges for citizens and police officers with audit trails, encryption, and privacy compliance.
- ◇ **User-Friendly Dashboard:** The platform includes an intuitive dashboard for both users and admins, offering downloadable reports, hearing notifications, and real-time

tracking accessible even to non-technical users.

Research-Oriented:

The system is the result of deep research in legal NLP, real-time FIR automation, and secure judicial information systems.

- ◇ **Advances in Legal NLP:** The project investigates the application of named entity recognition (NER), text summarization, and IPC section mapping to transform unstructured legal queries into actionable insights.
- ◇ **AI in Legal Drafting:** FIR generation, IPC classification, and intelligent section suggestion are backed by transformer-based AI models, showcasing progress in machine-supported legal documentation.
- ◇ **Digital Governance Framework:** Contributes to the development of digital justice infrastructure aligned with e-Governance and LegalTech policies by ensuring data privacy, auditability, and transparency.
- ◇ **Human-AI Collaboration in Law:** The project studies how citizens and legal actors interact with AI systems for co-drafting legal texts, improving system adaptability, fairness, and trust.

Chapter 5

Project Plan

5.1 Project Timeline

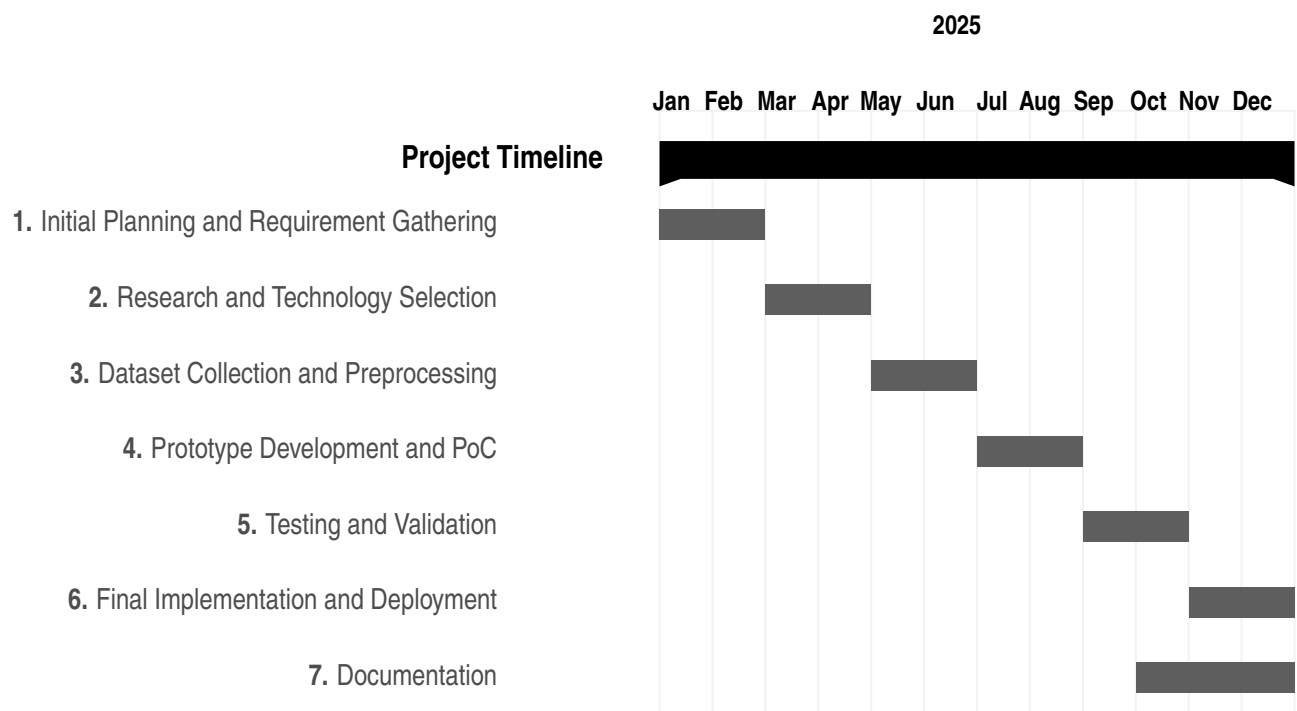


Table 5.1: Project Timeline

5.2 Team Organization

The project is executed by a dedicated team of four members. Each member is assigned a distinct functional role to ensure modular development, parallel execution, and clear accountability.

5.2.1 Team Structure

1. Satkar – AI Chatbot & NLP Development Lead

Satkar leads the design and development of the AI chatbot system, enabling multilingual support and real-time legal guidance for citizens.

Key Responsibilities:

- ◇ Building conversational flows and query handling in multiple languages
- ◇ Training NLP models for legal domain-specific dialogue
- ◇ Integrating transformer models for contextual understanding
- ◇ Ensuring accuracy and personalization in chatbot responses
- ◇ Testing chatbot outputs and managing feedback loops

2. Niranjan – FIR Drafting & IPC Prediction Lead

Niranjan manages the automated FIR creation module and IPC section recommendation system using NLP classification techniques.

Key Responsibilities:

- ◇ Extracting legal facts and named entities from user input
- ◇ Designing IPC classification models based on incident context
- ◇ Structuring FIR templates and autofill logic
- ◇ Ensuring legal format compliance and clarity
- ◇ Validating suggestions with legal experts/test cases

3. Preet – Case Tracking Integration & Backend API Lead

Preet is responsible for backend logic, case tracking module, and API communication with the National Judicial Data Grid (NJDG).

Key Responsibilities:

- ◇ Connecting with NJDG APIs for real-time case updates
- ◇ Structuring case dashboards and hearing status modules
- ◇ Managing data flow between modules and user dashboards
- ◇ Securing data transmission with tokenized APIs
- ◇ Testing real-time notification and data sync flows

4. Param – Dashboard Design, Reporting & Final Integration Lead

Param oversees frontend dashboard development, report generation, and integration of all modules into a unified platform.

Key Responsibilities:

- ◇ Designing role-based dashboards using React + Tailwind CSS
- ◇ Visualizing chatbot logs, case summaries, and user statistics
- ◇ Generating FIR PDFs, legal briefs, and hearing summaries
- ◇ Creating UI mockups for evaluation and demonstration
- ◇ Preparing final documentation and deployment packaging

Chapter 6

Experimental Setup

A controlled experimental setup was established to evaluate the functionality and performance of the AI-Powered Legal Assistance and Judicial Information System. The system integrates modern Natural Language Processing, intelligent legal mapping, secure backend APIs, and real-time case tracking with Indian judicial data sources. The goal of the setup is to simulate realistic user interactions and validate the accuracy, efficiency, and reliability of automated legal services.

6.1 Datasets

The development of the AI-Powered Legal Assistance and Judicial Information System relies on multiple structured and unstructured datasets. These datasets serve various modules such as FIR drafting, IPC classification, chatbot training, and judicial metadata analysis. Below is a curated list of datasets used in this project, including both custom-built and publicly available sources.

1. Indian Kanoon Case Law Dataset

- **Source:** <https://indiankanoon.org>
- **Contents:** Legal case judgments from Supreme Court, High Courts, and Tribunals.
- **Usage:** Training models for legal summarization and precedent-based recommendations.

2. National Judicial Data Grid (NJDG)

- **Source:** <https://njdg.ecourts.gov.in>

-
- **Contents:** Real-time metadata of ongoing and disposed cases, including hearing dates, case types, and courts.
 - **Usage:** Case tracking dashboard, real-time status updates.

3. FIR Samples Dataset (Simulated and Public)

- **Source:** Simulated from public templates, Delhi Police e-FIR portal, and open legal NLP repositories.
- **Contents:** Sample FIR texts including crime descriptions, locations, and involved sections.
- **Usage:** Training the AI assistant for FIR drafting and IPC section prediction.

4. IPC Section Mapping Dataset

- **Source:** Compiled from India Code and GitHub repositories.
- **Contents:** Over 600+ IPC sections with section numbers, bailability, punishment, and category.
- **Usage:** Supervised classification models for mapping user-input incidents to relevant IPC sections.

5. Legal Chatbot Intent and Entity Dataset

- **Source:** Custom-built using FAQs from NALSA and other government legal portals.
- **Contents:** 1,200+ labeled queries with intent tags like ‘file FIR’, ‘check case’, and named entities like location, case type.
- **Usage:** Training the NLP engine to support multi-intent legal queries.

6. Supreme Court Judgment Corpus

- **Source:** Supreme Court of India Portal
- **Contents:** Historical and recent court decisions (PDF format, extractable text).
- **Usage:** Training models for document understanding, summarization, and similarity matching.

Data Characteristics:

- **Languages Supported:** English, Hindi, and regional dialects (translated via IndicNLP tools).
- **Text Formats:** Plain text (.txt), JSON logs, and CSV tables.
- **Label Types:** Multi-class IPC tags, intent categories, named entities, and section mappings.
- **Dataset Size:** Over 5,000 legal queries, 2,000+ FIR samples, and 150+ full case summaries.

6.2 Technology Used

- **Natural Language Processing and AI:**
 - ◇ **spaCy, Transformers (HuggingFace):** Used for named entity recognition (NER), IPC prediction, and multilingual support.
 - ◇ **BERT / DistilBERT Models:** Fine-tuned for classifying user queries and generating FIR section recommendations.
 - ◇ **T5 for Text Summarization:** Used to summarize long case judgments into brief insights for judicial users.
- **Backend Services and API Integration:**
 - ◇ **FastAPI (Python 3.10):** Backend framework for creating secure, high-performance REST APIs for the system.
 - ◇ **PostgreSQL + Supabase:** Database and auth system used for storing users, FIRs, roles, and metadata.
 - ◇ **NJDG API Integration:** Simulated via mock endpoints and real-case ingestion for tracking hearing status.
- **Frontend and Dashboard Development:**
 - ◇ **React.js with Tailwind CSS:** Frontend framework used to create citizen and police dashboards.

- ◇ **Chart.js and ApexCharts:** For plotting visual statistics of FIR distribution, IPC usage, and chatbot analytics.
- ◇ **PDFKit / jsPDF:** To generate downloadable FIRs and reports.

- **Deployment and Infrastructure:**

- ◇ **Docker:** Used to containerize each module (chatbot, FIR API, frontend, database) for smooth deployment.
- ◇ **GitHub Actions + CI/CD:** Ensured reliable testing and delivery pipelines during development phases.
- ◇ **Cloudflare R2 / AWS S3 (Optional):** Storage layer for archival of old FIRs and documents.

- **Security and Access Control:**

- ◇ **JWT Tokens:** Used for secure role-based access control (citizen, police, admin).
- ◇ **AES-256 Encryption:** Applied to FIR content and private metadata during storage and transfer.
- ◇ **HTTPS REST APIs:** Ensured secure data communication between frontend and backend services.

6.3 Performance Parameters

The following performance parameters have been identified to guide future evaluation of each module in the system. These metrics are designed to assess accuracy, responsiveness, efficiency, and reliability of the proposed AI-powered legal assistance platform after full-scale implementation and testing.

- **Chatbot Intent Recognition Accuracy:**

- To be evaluated using a labeled dataset of legal user queries.

- **IPC Section Prediction F1-Score:**

- To be measured by comparing predicted sections with expert-validated mappings.

- **Named Entity Recognition (NER) Accuracy:**

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- Evaluate ability to extract entities like location, time, victim, and crime type from input.
 - **Case Status API Sync Reliability:**
 - Assess backend success in retrieving live case data from NJDG APIs.
 - **FIR Draft Generation Time:**
 - Measure time taken to convert structured user input into a prefilled FIR PDF.
 - **Dashboard Latency:**
 - Evaluate frontend responsiveness under typical user interactions.
 - **Chatbot Response Time:**
 - Measure time between user query and chatbot reply.

Chapter 7

POs & PSOs Mapping

7.1 Program Outcome (PO) Mapping

PO	Description	Level	Remarks (Justification for Level)
PO1	Engineering Knowledge: Applied AI, ML, and NLP to build a legal support system for FIR automation and judicial updates.	3	Full integration of domain-specific models for structured legal document generation and backend synchronization justifies expert-level application.
PO2	Problem Analysis: Identified gaps in digital legal access and slow manual workflows.	3	Detailed analysis of existing issues (e.g., FIR delays, lack of case info) shaped our AI-first solution design.
PO3	Design & Development of Solution: Developed an AI-assisted system with chatbot, backend sync, and auto-FIR logic.	2	Solution design was implemented as MVP, though full deployment is pending—hence, moderate depth.
PO4	Investigation of Complex Problems: NLP for legal understanding, case classification, IPC mapping.	3	Legal document interpretation and IPC suggestion required multi-model experimentation and deep NLP reasoning.
PO5	Modern Tool Usage: Used state-of-the-art LLMs, REST APIs, NJDG sync, and Streamlit/Dashboards.	3	End-to-end toolchain with modern ML, cloud DB, React-based dashboard makes this outcome highly justified.

PO6	Engineer & Society: Democratized legal help for citizens unfamiliar with judicial processes.	3	Chatbot and FIR automation target real societal need—especially for low-income or digitally excluded groups.
PO7	Environment & Sustainability: Digital workflows reduce paperwork and commute for court visits.	2	While indirect, digital legal assistance cuts paper use and travel, supporting SDG goals.
PO8	Ethics: Maintained transparency, privacy compliance, and inclusive design.	3	Used AES encryption, access control, and fair chatbot logic for non-bias and user safety.
PO9	Individual & Team Work: Modular ownership of chatbot, FIR, backend, and frontend with GitHub sync.	3	Efficient collaboration and task ownership with good communication tools and planning.
PO10	Communication: Delivered demos, presentations, and formal report documentation.	3	Created visual dashboards, mock hearings, and structured output for different audiences.
PO11	Project Management: Task breakdown and iterative testing, minor budgeting elements.	2	Well-planned sprint execution and documentation, although financial planning was minimal.
PO12	Lifelong Learning: Gained experience in BERT, token classification, NJDG APIs, Docker.	3	Substantial exploration into new tools, with skill development beyond curriculum.

Table 7.1: PO Mapping – AI-Powered Legal Assistance and Judicial Information System

7.2 Program Specific Outcome (PSO) Mapping

PSO	Description	Level	Remarks (Justification for Level)
PSO1	Interpret data, use software tools to conduct experiments, and apply AI & machine learning techniques to solve multi-disciplinary problems: Used AI to classify IPCs, parse legal language, and automate document flow.	3	Complex AI-based legal information systems were built and tested successfully using real-world data.
PSO2	Apply standard practices and appropriate models of data analytics to discover knowledge: Extracted insights from legal documents and public court data using structured analytics.	3	Applied classification pipelines, analytics dashboards, and knowledge graphs to represent domain knowledge.

Table 7.2: PSO Mapping – AI-Powered Legal Assistance and Judicial Information System

Chapter 8

Summary

The AI-Powered Legal Assistance and Judicial Information System is a proposed solution aimed at improving access to justice, automating routine legal processes, and strengthening communication between citizens and the judicial system. Based on recent literature and technological developments in Artificial Intelligence (AI) and Natural Language Processing (NLP), the system is designed to offer multilingual legal assistance, AI-driven FIR drafting, and real-time case tracking through NJDG data integration [2].

The proposed architecture includes core modules such as an AI chatbot trained on legal FAQs and procedural logic, an FIR drafting assistant that recommends relevant IPC sections based on user input, and a case-tracking dashboard connected to live court data through public APIs. The use of transformer-based language models like BERT and T5 is considered for text classification and generation tasks [1][5]. The backend is planned using FastAPI for rapid development and modular APIs, while the frontend is expected to be developed in React for intuitive visualization. Supabase/PostgreSQL will provide secure, role-based data storage. Security features such as AES-256 encryption and JWT-based authentication are incorporated to ensure legal data privacy and access control[12][13].

The overall system is designed with modularity and scalability in mind, using Docker for containerized deployment to allow seamless upgrades and testing. Each module—chatbot, FIR generator, and case tracking—will be tested independently before integration into a unified portal for citizens, police, and administrators. Performance metrics such as response time, FIR generation latency, and classification accuracy are proposed to benchmark system effectiveness during development [6][15].

In summary, the project demonstrates a forward-looking application of AI and web technologies to enhance public access to legal support and reduce the burden on law enforcement and judicial staff. Drawing from established literature and emerging research, this proposed system aligns with India’s digital justice initiatives and reflects the feasibility and social importance of intelligent legal assistance tools [9][15].

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