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Abstract

Access to justice in India continues to be out of reach for a large section of the population because legal assistance is costly, difficult to locate, and often not reliable. As most professional services shift towards digital platforms, there is a growing opportunity to design an intelligent online marketplace that connects people with verified legal practitioners — including advocates, mediators, arbitrators, notaries, and document writers. This paper proposes a centralized platform that uses an incentive-driven model to attract and retain legal professionals. The proposed system incorporates AI-based matching, multi-layer verification procedures, and gamified rewards such as badges, rankings, and monetary incentives. Together, these features aim to improve transparency, boost user engagement, and make legal services more accessible to both rural and urban communities. The paper outlines the platform's architecture, major components, feasibility, and recommendations for expansion and data security in the Indian legal-tech ecosystem.

The goal of this project is to create an inclusive digital marketplace that connects citizens with qualified and authenticated legal experts—such as lawyers, mediators, arbitrators, notaries, and document specialists. The platform is designed to be simple, open, and widely accessible so that ordinary people can receive legal support easily, while legal professionals can earn fair compensation for their expertise.

A distinctive feature of the platform is its incentive structure, which motivates legal service providers to join and actively contribute. These incentives include financial bonuses based on performance, gamified elements like achievement badges, publicly visible client feedback, and affordable subscription plans for consistent high-quality service. This combination encourages trust, fosters accountability, and helps legal practitioners grow within a structured digital environment.

Another major advantage of the system is its strict verification process. Every legal professional listed on the platform must be validated through the appropriate regulatory bodies—Bar Councils, arbitration associations, or notary authorities. This rigorous verification enhances credibility and gives users the confidence that they are interacting with genuine and qualified professionals.

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Abbreviations

Abbreviation	Full Form
AI	Artificial intelligence
API	Application programming interface
AWS	Amazon web services
CDN	Content delivery network
DPDP	Digital personal data protection (Act), 2023
FCM	Firebase cloud messaging
GCP	Google cloud platform
HTTP	HyperText transfer protocol
HTTPS	HyperText transfer protocol secure
IoT	Internet of things
IoTWF	IoT world forum (reference model)
JWT	JSON web token
LSP	Legal service provider(s)
MySQL	MySQL (Relational database)
NALSA	National legal services authority
NITI Aayog	National institution for transforming India (Policy Body)
ODR	Online dispute resolution
REST	Representational state transfer
SDG	Sustainable development goal
SQL	Structured query language
UI	User interface
URL	Uniform resource locator
UX	User experience
vCPU	virtual CPU

Chapter 1

INTRODUCTION

In India today, access to justice is limited largely due to the high cost of hiring lawyers and paying for legal services. The legal sector continues to face issues of unclear pricing, lack of transparency, and difficulty in locating trustworthy professionals. With the rise of digital platforms offering legal support, there is a strong opportunity to establish a unified online system that links citizens with authenticated service providers, including advocates, mediators, arbitrators, notaries, and document writers. The proposed project introduces an incentive-based, digitally managed marketplace designed to streamline how individuals and businesses identify, connect with, and obtain services from legal experts.

A platform built with credibility-focused incentives, dependable communication channels such as secure messaging and email, and a simplified workflow for service delivery will significantly improve access to affordable and dependable legal assistance for people and communities.

1.1 Background

The current scenario in India shows that accessing legal services continues to be highly challenging. The entire system operates with minimal coordination and remains extremely fragmented. Legal professionals such as advocates, arbitrators, mediators, notaries, and document writers function in isolation, with no unified platform or supporting infrastructure. Because of this, citizens often struggle to find the appropriate expert, verify their credentials, or even confirm whether the professional they contacted is genuinely responsible for the work delivered. The lack of uniform pricing further increases confusion and discourages many individuals, especially those belonging to economically weaker communities, who might otherwise seek legal help.

Although the government has introduced programmes like Tele-Law and Nyaya Mitra, their impact remains limited, particularly in remote regions where digital resources and essential facilities are still inadequate. This highlights the necessity for a technologically supported legal services platform that is structured, accessible, and reliable. Such a system would simplify the onboarding of legal professionals, ensure fair and inclusive access to justice, and promote greater transparency and trust between citizens and service providers.

1.2 Statistics

The Indian legal landscape continues to face major challenges in delivering timely and equitable justice, especially to marginalized and rural populations. As highlighted in the India Justice Report 2022, the situation is worsened by the extremely low judge-to-population ratio — only about 21 judges per million people, compared to the global average of nearly 50 per million. This considerable shortage directly contributes to the massive backlog of more than 50 million unresolved cases and prevents citizens from receiving justice without long delays.

The uneven distribution of legal professionals across regions further intensifies the problem. States such as Bihar, Uttar Pradesh, and Madhya Pradesh have some of the lowest ratios of lawyers available per capita, making affordable legal help difficult to obtain. In contrast, metropolitan centres like Delhi and Mumbai have a high concentration of legal practitioners, but the cost of services in these areas remains prohibitively expensive for people from rural backgrounds. Data from the National Legal Services Authority shows that nearly 70% of India's population cannot afford legal representation, while rural communities suffer the most. The World Bank also notes that restricted awareness, insufficient digital skills, and weak outreach of legal aid systems continue to hinder rural residents from accessing justice.

1.3 Prior Existing Technologies

In this respect, various government and private web-based platforms already exist with legal services for Indian and international clients.

1.3.1 Government Platforms

- National Legal Services Authority (NALSA)**

Provides free legal assistance to individuals from economically weaker than backgrounds.

Conducts Lok Adalats (People's Courts) to help settle disputes quickly and ease backlogs.

- Nyaya Bandhu**

Links beneficiaries with advocates who voluntarily offer pro bono legal services.

Includes a dedicated mobile app to support seamless interaction between lawyers and clients.

1.3.2 Private Platforms

- LawRato**

A comprehensive online portal featuring thousands of lawyers from more than 700 cities.

Helps users find legal professionals based on their location, case category, and area of expertise.

- VakilSearch**

Specializes in corporate and business-oriented legal services.

Provides assistance with documentation, business registrations, trademark filings, and compliance-related tasks.

1.4 Proposed Approach

The primary objective of this project is to develop a centralized, reward-based e-Marketplace for legal services that brings together a wide range of professionals such

as lawyers, mediators, arbitrators, notaries, and document writers. The platform is intended to make the legal process more transparent, affordable, and easily accessible to the public, while ensuring that legal service providers maintain accountability and continuously improve the quality of their services.

Motivation

The Indian legal system suffers from inefficiencies caused by high costs, inconsistent service quality, and a general lack of trust. Rural and underprivileged communities face significant barriers when attempting to access reliable legal assistance. Existing platforms rarely support a reward-based model or encourage active participation from legal professionals, resulting in limited outreach to underserved regions. This project addresses these issues by creating a technology-driven platform that connects citizens with verified legal experts and motivates service providers through structured incentives to deliver timely and high-quality services.

Proposed Approach

The proposed system functions as a multilayered digital ecosystem. It begins with provider verification, where professional credentials are authenticated through integrations with Bar Councils and other regulatory bodies. The platform then offers transparent pricing models through clearly defined and standardized service bundles to prevent confusion. Incentives such as financial rewards, gamified achievement badges, competitive leaderboards, and discounted subscriptions are used to encourage continuous engagement from legal professionals. An intelligent matching algorithm further enhances the system by pairing clients with the most suitable professionals based on expertise, location, language, and availability. Additionally, the platform adopts a multilingual, mobile-first design to ensure accessibility and ease of use, particularly for individuals in rural regions.

Project Applications

The platform has multiple use-case applications. For general citizens, it provides an easy and convenient way to connect with legal service providers without the need for extensive searching. For legal professionals, it offers a reliable channel to reach

clients more efficiently. Legal aid organizations and NGOs can use the system to deliver low-income or subsidized services to vulnerable communities. The platform can also support legal education by giving law students supervised opportunities to engage with casework and gain practical experience.

Limitations of the Proposed Method

Despite its advantages, the proposed system has certain limitations. The digital divide remains a major concern, as individuals in remote or low-digital-literacy areas may struggle to access or navigate the platform due to limited internet connectivity and technological infrastructure. Traditional legal practitioners may also resist joining the platform because of increased competition with other registered service providers. Furthermore, the platform must ensure strong data privacy and security, as it handles sensitive legal information that requires advanced encryption and strict regulatory compliance.

Objectives

The project is built on the following clear and measurable objectives, each of which can be

demonstrated through the developed system:

Behaviour

This would involve the design and implementation of an incentive-based participation model to monitor the behavior of legal service providers, including the grant of badges, rewards, and ranking based on timely service delivery, client rating, and general engagement.

Analysis

In order to develop the analytics module, which will be able to measure provider activity, service usage trends, and citizen satisfaction, statistical methods and data

visualizations should be used in support of the platform performance evaluation and benchmarking.

System Management

To build an administrative dashboard that will support onboarding, credential verification of providers, service listing, and monitoring of client-provider interactions to effectively manage the system.

Security

In addition to protection tools, the use of strong identity verification methods is the necessity like JWT-based login, role-based access control, and encryption of the whole sensitive legal and personal data of the company, for example.

Deployment

The goal here is to develop and deploy a working model of the e-Marketplace using React to build the front end, Node.js with Express.js for the back end, and MySQL for the database.

1.5 SDGs



Fig 1.1 Sustainable development goals

SDG 16: Justice, Peace and Strong Institutions

The connection between the two goals is clear because SDG 16 is strongly supported

by the transparency and accountability provided through a digital platform that is with enables citizens to easily access verified legal professionals. Implementing such a good system helps build public trust in legal institutions and promotes fairness and equal to access to justice by allowing standardized tracking of services and reward-to driven participation.

SDG 9: Industry, Innovation, and Infrastructure

With respect to SDG 9, the development of this platform directly contributes to Industry, Innovation, and Infrastructure by establishing a secure, scalable, and technologically advanced digital marketplace for legal services. It also marks a significant step forward in modernizing the legal sector's digital infrastructure by incorporating gamification, intelligent matching algorithms, and AI-based incentive mechanisms, all of which enhance the efficiency and reliability of legal service delivery through cutting-edge technological solutions.

1.6 Overview of project report

This report provides complete documentation of the project, covering every stage from the initial idea to the final implementation and evaluation. **Chapter 1** introduces the background of the problem and establishes a clear context by presenting real statistics on the current state of legal services in India, the challenges faced by citizens in accessing safe and affordable legal assistance, and the gaps that exist in traditional systems. It reviews existing digital platforms and technological developments related to online legal services and digital marketplaces. The chapter also states the motivation behind the project, outlines the objectives, and explains how the proposed platform aligns with the relevant United Nations Sustainable Development Goals (SDGs).

Chapter 2 presents a detailed review of research papers, journal articles, conference publications, and other academic literature related to digital service marketplaces, online dispute-resolution systems, incentive mechanisms, and legal-service delivery models. It evaluates previous work, identifies limitations in existing systems, and highlights research insights that influence the design of the proposed solution.

Chapter 3 discusses the feasibility study and examines the operational, technical, and financial viability of the system. It clearly defines the problem and emphasizes the need for a well-structured online platform that connects citizens with trustworthy legal professionals. The chapter also details the functional and non-functional requirements that guide the entire design and development process.

Chapter 4 describes the system design by presenting data-flow diagrams, use-case diagrams, class diagrams, sequence diagrams, activity diagrams, and UML models. Each diagram is accompanied by an explanation that clarifies how the components interact, how data moves through the system, and how the architecture ensures scalability, security, and reliable performance.

Chapter 5 explains the implementation process, detailing the technology stack including frontend frameworks, backend technologies, databases, APIs, and security mechanisms. It describes how each module was developed, integrated, and tested, and it documents the challenges encountered during implementation along with the solutions applied.

Chapter 6 focuses on system testing, including usability, performance, security, and reliability tests. It presents test cases, testing procedures, and results, demonstrating the system's behavior under different conditions and evaluating whether the system meets the stated requirements.

Chapter 7 discusses the results of prototype demonstrations and user testing. It analyzes user feedback, system performance, and the effectiveness of the incentive-driven framework. The chapter reflects on how well the project objectives and problem statements were achieved and evaluates the limitations and practical impact of the system.

Chapter 8 concludes the report by summarizing the key outcomes and contributions of the project. It highlights how the proposed system addresses the identified legal-service challenges and identifies future enhancements such as advanced features, AI-based improvements, and scalability options.

Finally, **Chapter 9** provides a complete list of references used throughout the report following the required citation format. The appendices include supporting materials such as user interface mockups, additional diagrams, datasets, system screenshots, user stories, and other supplementary documents that provide further insight into the system's design and development.

Chapter 2

LITERATURE REVIEW

The literature review addresses the difficulties in providing legal services in India, the situation of digital legal platforms around the world, and how incentives in service marketplaces can help to point out the gaps that need an incentivized e-Marketplace. The review is conducted through academic research, policy reports, and comparative studies to acquire a comprehensive understanding of the issue as well as the room for innovation.

2.1 Access to Justice in India

Access to justice has consistently been a major concern for the Indian government, legal researchers, and social reformers. Numerous studies indicate that a large portion of India's low-income and marginalized population is unable to afford or access formal legal assistance. A study conducted by Harvard University found that almost 40% of rural residents lack basic awareness of legal rights and therefore do not seek judicial support, while an additional 30% are unable to approach the legal system due to the financial burden of hiring lawyers' services [6]. Reports published by the National Legal Services Authority (NALSA), along with policy recommendations from NITI Aayog, have further documented these stark disparities in the utilization of legal services across different regions of the country [7]

Various types of barriers are there:

- Economic barriers: the absolute majority of the people do not want to engage with the judicial system due to the burden of legal costs and indirect expenditures related to justice that takes a long time to come.
- Geographical barriers: Most lawyers are present in big cities, while the country side and isolated places have little to no lawyers.
- Informational barriers: The utmost number of people are totally oblivious to the legal proceedings, their rights, and the available

support services.

- Cultural and linguistic problems: This occurs when residents, especially those speaking in local dialects, cannot find attorneys of the very same practice area.

Even though the legal safeguards are already set, these systemic problems continue to bar access to justice for millions 8. According to the data, the least and the most underprivileged areas of society are experiencing big hardships in their quest for the reach and the use of a basic legal services system that is open to all.

These platforms do exist at a private level, but they are largely autonomous and often uncoordinated with regulatory systems, such as bar councils or legal aid authorities. Academic reviews have mentioned that without deeper institutional integration, these platforms cannot resolve structural access-to-justice challenges in any meaningful way. At best, they represent important progress but mostly lack mechanisms to incentivize professional participation, ensure accountability, and integrate into the broader legal landscape.

Furthermore, many of these private legal service platforms primarily target urban and corporate clients, which leaves a significant gap in rural and economically weaker regions where the need for affordable legal assistance is far greater. Studies also indicate that these platforms tend to follow conventional business models without incorporating reward-based engagement frameworks or transparent verification mechanisms. As a result, users may still face doubts regarding the authenticity of service providers, consistency of pricing, and reliability of services.

Another major concern identified in multiple research studies is the absence of a unified national framework for digital legal services. Without standardized onboarding procedures, service quality guidelines, or grievance redressal systems, existing platforms struggle to gain the trust of citizens and legal professionals alike. The lack of interoperability between different platforms and government initiatives further restricts their ability to create systemic impact or support ongoing justice reforms.

In addition, academic literature highlights the need for integrating AI-based tools, multilingual accessibility, and incentive-driven participation models to encourage

continuous contribution from legal professionals. Without such structured approaches, private platforms often fail to maintain long-term engagement, resulting in inconsistent service availability and suboptimal user experience.

Collectively, these findings point to the need for a more cohesive, regulated, and technologically advanced ecosystem—one that not only connects citizens with verified legal experts but also motivates providers, ensures transparency, and aligns with national justice objectives. This gap provides the foundation and justification for developing an incentive-driven e-Marketplace for legal services in India.

Furthermore, many of these private legal service platforms primarily target urban and corporate clients, which leaves a significant gap in rural and economically weaker regions where the need for affordable legal assistance is far greater. Studies also indicate that these platforms tend to follow conventional business models without incorporating reward-based engagement frameworks or transparent verification mechanisms. As a result, users may still face doubts regarding the authenticity of service providers, consistency of pricing, and reliability of services.

The proposed system functions as a multilayered digital ecosystem. It begins with provider verification, where professional credentials are authenticated through integrations with Bar Councils and other regulatory bodies. The platform then offers transparent pricing models through clearly defined and standardized service bundles to prevent confusion. Incentives such as financial rewards, gamified achievement badges, competitive leaderboards, and discounted subscriptions are used to encourage continuous engagement from legal professionals. An intelligent matching algorithm further enhances the system by pairing clients with the most suitable professionals based on expertise, location, language, and availability. Additionally, the platform adopts a multilingual, mobile-first design to ensure accessibility and ease of use, particularly for individuals in rural regions.

2.2 Current Digital Initiatives in India

To improve access to justice, the Indian government has introduced several digital initiatives aimed at modernizing legal processes and making professional legal assistance more accessible. The e-Courts project continues to advance the digitization of the judicial system by enabling electronic case management and online access to court services. In addition, the Tele-Law initiative helps citizens connect with panel lawyers through Common Service Centres, providing affordable legal advice to remote and underserved regions. Furthermore, NITI Aayog's ODR Policy Plan highlights the growing importance of technology-driven dispute resolution by promoting Online Dispute Resolution (ODR) platforms as a scalable approach to expand legal services and reduce the burden on traditional courts.

However, analyses show some limitations:

- Their coverage is spotty, especially in rural areas.
- Most systems do not meaningfully integrate private legal professionals.
- There are limited incentive structures to ensure sustained high-quality service delivery.

These platforms do exist at a private level, but they are largely autonomous and often uncoordinated with regulatory systems such as bar councils or legal aid authorities. Academic reviews have mentioned that without deeper institutional integration, these platforms cannot resolve structural access-to-justice challenges in any meaningful way. At best, they represent important progress but mostly lack mechanisms to incentivize professional participation, ensure accountability, and integrate effectively into the broader legal landscape.

2.3 Digital Global Legal Platforms

The digital legal-service marketplaces can be exemplified with the international ones, such as the US-based LegalZoom and the UK's Rocket Lawyer. These platforms primarily focus on standardized document creation, automation of routine legal procedures, and subscription-based consultation support. Although these international models demonstrate the potential of technology-enabled legal services, the existing literature consistently emphasizes that substantial contextual adaptation is required

before such models can be effectively applied in India.

Several reasons contribute to this need for adaptation. First, the Indian legal ecosystem is far more fragmented, with significant disparities in digital literacy, economic capacity, and legal awareness across regions. Unlike Western countries, where online legal services are supported by digitally mature populations, Indian users—especially in rural and semi-urban areas—often lack the technological access or familiarity needed to use such systems independently. Second, international platforms operate within well-established regulatory frameworks and standardized legal processes, whereas India has diverse state-specific regulations and a highly heterogeneous legal market, making direct replication ineffective. Third, cultural and linguistic diversity in India requires multilingual support and personalized assistance, which is not a priority in platforms designed for uniform English-speaking markets.

Additionally, scholarly reviews note that international platforms rely heavily on subscription-based revenue models, which may not be feasible for cost-sensitive Indian users who prefer low-cost, one-time consultations. The absence of robust institutional integration, transparent verification systems, and performance-based incentives further limits the applicability of international models in addressing India's deep-rooted access-to-justice challenges. Therefore, while these platforms provide valuable insights into technology-driven legal service delivery, researchers agree that India requires a customized, incentive-aligned, and regulation-aware framework to create a sustainable digital legal ecosystem.

Furthermore, the Indian legal-tech environment faces additional constraints that global platforms do not typically encounter. The diversity of regional laws, linguistic variations, and the coexistence of formal and informal justice mechanisms require a far more flexible platform architecture than what is seen in Western systems. Many legal processes in India still involve physical verification, manual documentation, and in-person interactions with authorities, all of which limit the direct transferability of fully automated international models.

2.4 Incentive Mechanisms in Service Marketplaces

Digital platforms such as ride-hailing, freelancing, and home-service marketplaces offer important insights into how service providers can be motivated and how quality can be sustained in decentralized environments. Studies across these sectors show that gamification elements—including tiered rewards, achievement badges, service ratings, and reputation systems—significantly improve provider performance and user satisfaction. These mechanisms not only promote consistent service delivery but also build trust and long-term engagement in digital ecosystems.

However, the legal-services domain differs sharply from other digital marketplaces because it depends heavily on trust, ethics, confidentiality, and professional accountability. As a result, incentive systems in legal platforms cannot rely solely on numerical or quantity-based metrics. Instead, effective models must prioritize factors such as client satisfaction, speed and reliability of service delivery, adherence to ethical standards, and sustained performance over time. Research highlights that well-designed incentives—like ranked leaderboards, verified certification badges, priority case allocation, loyalty tiers for high-performing professionals, and rewards for providing pro bono assistance—can encourage positive behavior while maintaining service integrity.

2.5 Gaps Identified

A critical examination of the existing literature reveals several important shortcomings that the proposed model aims to address. First, India currently lacks a unified digital ecosystem capable of reliably verifying and hosting multiple categories of legal professionals—advocates, mediators, arbitrators, notaries, and document writers—under a single marketplace framework. This absence of a centralized verification mechanism creates confusion for citizens and makes it difficult to assess the credibility of legal service providers. Second, the literature emphasizes that there is no standardized or transparent system for legal service pricing in India. Users frequently encounter inconsistent fee structures, limited comparability between providers, and uncertainty regarding what constitutes a fair or reasonable price, which collectively discourages people from seeking timely legal assistance.

Third, although incentive mechanisms have proven highly effective in enhancing engagement and service quality within various digital marketplaces, their application in the legal services domain remains extremely limited. Most existing platforms do not incorporate structured motivation systems such as performance rewards, ethical conduct incentives, or quality-linked recognition for legal professionals. This is a significant gap, especially because digital legal interactions depend heavily on user trust, accountability, and continuous professional engagement. Fourth, while government-driven initiatives like Tele-Law primarily focus on providing legal aid to economically vulnerable groups, they do not function as open marketplace environments where citizens have the freedom to choose from a diverse pool of providers. As a consequence, large portions of rural, marginalized, and multilingual populations remain underserved or inadequately supported.

Taken together, these gaps demonstrate that although India has introduced several digital tools and policy measures, none of the existing solutions offer a comprehensive combination of verified multi-specialist professionals, transparent pricing structures, incentive-driven motivation systems, and inclusive accessibility for all citizens. The reviewed literature clearly indicates a strong need for an incentivized, technologically integrated e-Marketplace designed specifically for legal services in the Indian context. Such a system, informed by global best practices yet adapted to India's socio-legal ecosystem, has the potential to significantly improve citizen access to legal expertise while promoting transparency, efficiency, trustworthiness, and equitable justice outcomes.

Table 2.1 Summary of Literature Reviews

S#	Article Title, Published Year, Journal Name	Methods	Methods	Merits	Demerits
1	Designing Digital Marketplaces for Legal Services: Incentive Mechanisms and Governance Models” (2020, <i>Journal of Legal Technology and Research</i>)	Mixed-method approach (survey + game theory)	Proposes an incentive-driven governance model for digital legal marketplaces using reward-based participation.	Enhances participation of diverse legal professionals through structured incentive policies.	Limited to developed countries’ market models; lacks adaptation for Indian regulatory setup.
2	“Blockchain-based Smart Contracts for Legal Service Marketplaces” (2021, <i>IEEE Access</i>)	Blockchain integration & smart contract automation	Introduces blockchain to ensure transparency, authentication, and fair remuneration via automated smart contracts.	Improves trust, reduces fraud, and ensures transparency in fee distribution.	Implementation cost and technical literacy among legal practitioners remain barriers.
3	“Crowdsourcing Legal Expertise through Incentive Design in Online Platforms” (2019, <i>International Journal of Information Management</i>)	Econometric modelling & incentive analysis	Studies reward mechanisms and peer reputation systems for motivating experts to participate in online legal platforms.	Shows that non-monetary incentives (ratings, visibility) significantly increase engagement.	Focuses more on generic expert platforms, not specific to legal practitioners.
4	“E-Governance and Legal Aid Platforms: Policy Design and Incentivization in Developing Countries” (2022, <i>Government Information Quarterly</i>)	Policy analysis & stakeholder mapping	Explores incentive policies in government-run e-governance portals for onboarding public legal officers and mediators.	Demonstrates how tiered incentives improve service delivery and citizen access.	Limited longitudinal evaluation; lacks insights into private sector adoption.
5	“Adoption of Online Legal Service Platforms: Motivation and Barriers for Legal Practitioners in India” (2023, <i>Indian Journal of Law and Technology</i>)	Empirical study – survey of 250 practitioners	Investigates motivation factors, trust barriers, and expected benefits influencing adoption of legal e-marketplaces.	Provides localized insights into incentive and training needs in Indian context.	Study limited to urban regions; excludes rural and semi-urban practitioners.

Chapter 3

METHODOLOGY

3.1 System Architecture

The system architecture defines the essential functional modules that collectively support the smooth, secure, and efficient operation of the proposed e-Marketplace for legal services. Each component works together to ensure that citizens and legal professionals can interact without friction. The primary modules of the system include:

- User Registration and Profile Creation:

This is the initial access point for clients as well as legal practitioners, enabling them to sign up, build their profiles, and authenticate themselves on the platform. Legal professionals can outline their service categories, specify their areas of expertise, upload verification documents, mention their fee structure, and set their availability.

- Search and Service Discovery:

This module enables users to explore and identify the most suitable legal professionals by applying filters such as specialization, geographical location, spoken language, years of experience, client ratings, and service charges. It helps users quickly find providers that match their legal needs.

- Service Engagement and Provider Response:

Here, legal professionals receive service requests from users and can respond to them appropriately. This component manages the entire request-response process, ensuring clear communication, transparency, and proper tracking of interactions between the client and the provider.

- Communication and Consultation Tools:

This feature allows clients and legal experts to discuss case-related information through secure chat systems, voice calls, and video meetings. It also supports safe

document exchange and coordination of ongoing tasks, ensuring that consultations are convenient and protected.

- Feedback and Rating System:

Once a service is completed, users can provide ratings and write feedback regarding their experience. This information directly contributes to maintaining service quality, helps future users make decisions, and forms a key input for the incentive mechanisms that reward high-performing legal service providers.

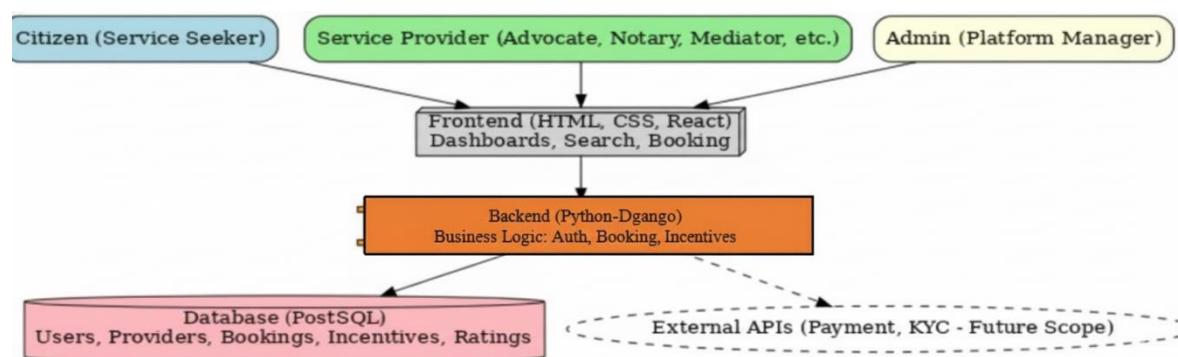


Fig 3.1 System Architecture Diagram

3.2 Modules

3.2.1 Citizen Module



Fig 3.2 Citizen Module Diagram

The citizen module serves as the primary interface through which individuals access and utilize the legal services offered on the platform. It is designed to be highly intuitive, visually clear, and simple to navigate so that users from all backgrounds—including those with limited digital literacy—can easily explore the system and connect with verified legal professionals. The goal of this module is to ensure that citizens experience a smooth, trustworthy, and convenient service journey from the moment they enter the platform.

To begin with, the module provides secure registration and login, where users can create accounts, verify their identity, and personalize their access to legal services. Once registered, citizens can manage and update their personal profile, including contact details, preferences, and bookmarked legal service providers. This ensures that users can keep track of their most preferred professionals and maintain an organized, personalized experience.

The platform also offers a powerful search and filtering system, enabling citizens to easily locate appropriate legal professionals. Users can search for advocates, notaries, mediators, arbitrators, and document writers by applying filters such as specialization, geographic location, service cost, professional experience, languages spoken, and overall user ratings. This function helps citizens quickly identify service providers who match their specific legal needs.

Once a suitable professional is found, the module allows citizens to book and schedule appointments effortlessly. They can review available time slots, choose a convenient appointment window, and submit a booking request that is then processed by the service provider. This reduces the need for physical visits and helps users access legal consultations at their convenience.

For testing and development purposes, the system also includes a simulated payment feature, which allows users to go through the complete booking workflow without real financial transactions. This mock payment setup ensures that users can practice the process and developers can verify the system's functionality in a safe and controlled environment.

After the legal service is delivered, the citizen module allows individuals to submit ratings and feedback, enabling them to evaluate their overall experience, comment on service quality, and share opinions about the professionalism of the provider. This feedback not only enhances transparency but also feeds directly into the incentive mechanisms built for legal professionals, encouraging high standards of service and accountability.

Overall, the citizen module plays a critical role in ensuring accessibility, ease of use, and trust in the system. By simplifying the process of finding, evaluating, and connecting with reliable legal service providers, the module effectively promotes greater citizen participation and improves access to justice across diverse regions and communities.

3.2.2 Service Provider Module

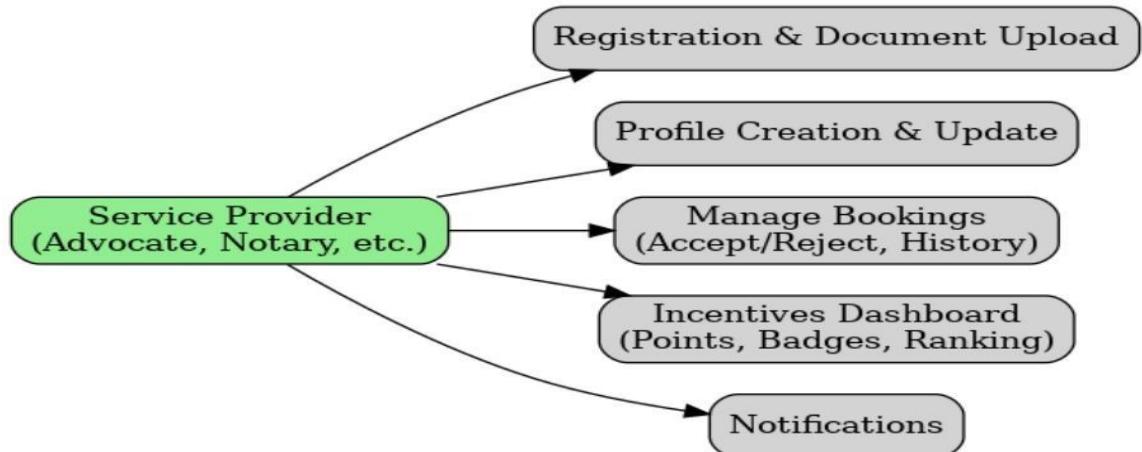


Fig 3.3 Service Provider Module Diagram

The Service Provider Module is designed to meet the functional and professional needs of legal practitioners who wish to offer their services on the platform, including advocates, mediators, arbitrators, notaries, and document writers. This module gives legal professionals a structured digital space where they can present their credentials, maintain transparency about the services they provide, and interact efficiently with citizens seeking legal assistance. It serves as a dedicated interface that supports the process of onboarding, profile management, communication, and performance tracking, thereby helping service providers build trust and maintain a strong presence within the digital marketplace.

Through this module, service providers can upload their registration certificates, identity documents, and other professional proofs required for verification. This ensures that only genuine and authorized practitioners are added to the system, creating a secure environment for the users. Providers can also create and continuously update their professional profiles by adding details such as their area of specialization, the number of years they have practiced, their service fees, languages they speak, and their working hours or availability slots. This makes it easier for citizens to understand the provider's background and choose the right professional for their needs.

The module also allows service providers to manage appointment requests from citizens. They can approve, reject, or reschedule bookings directly from their dashboard, making it simple to organize their workflow and handle consultations efficiently. Additionally, the module includes an integrated Incentives Dashboard where providers can track the badges they have earned, their ranking on the leaderboard, the incentive points they have accumulated, and other performance indicators connected to client satisfaction and service quality. This motivates providers to maintain high standards and stay active on the platform.

3.2.3 Admin Module

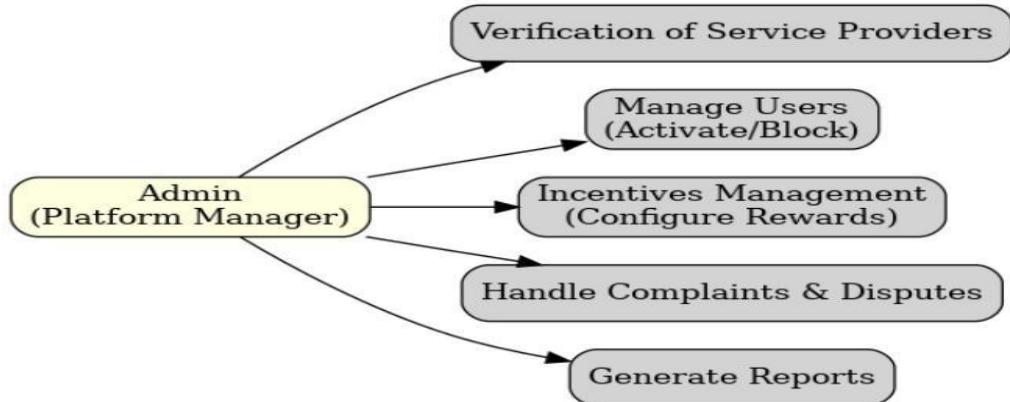


Fig 3.4 Admin Module Diagram

The Admin Module acts as the central control hub of the entire e-Marketplace platform, providing administrators with complete authority to supervise, regulate, and maintain all user activities, service interactions, and operational workflows. This module ensures that every process on the platform—from user registration to service delivery—adheres to established policies, meets quality standards, and satisfies all legal and compliance requirements. It plays a crucial role in maintaining system integrity, verifying professional authenticity, and ensuring that the platform remains safe, transparent, and efficient for both citizens and service providers.

Administrators have several important responsibilities within this module. First, they are responsible for reviewing and approving the registration and verification submissions made by service providers. This includes checking each provider's certificates, licenses, identification documents, and regulatory affiliations to confirm that only qualified, legitimate legal professionals are allowed to offer services on the platform. This step helps maintain trust and authenticity.

In addition, administrators oversee user account management for both citizens and service providers. They have the authority to enable, restrict, or deactivate accounts based on activity level, violation of terms, or security-related concerns. This ability

ensures that the platform remains safe, compliant, and free from fraudulent or harmful behaviors.

The Admin Module also includes complete oversight of the platform's incentive system. Administrators can configure the rules that determine how incentives are awarded, monitor performance metrics, and ensure that badges, rankings, and reward points are distributed accurately and fairly. This monitoring ensures that the incentive model continues to encourage high-quality service delivery and provider accountability.

Furthermore, the administrator handles complaints and dispute resolution. When users raise grievances—whether related to service quality, appointment issues, communication problems, or general dissatisfaction—the admin reviews these cases carefully, investigates the situation, and takes necessary corrective action. This can include mediating between the citizen and provider, issuing warnings, adjusting service credits, or making final decisions on conflicts.

Overall, the Admin Module is essential for ensuring smooth governance, maintaining professional standards, enforcing transparency, and supporting a healthy, trustworthy e-Marketplace environment for legal services.

3.2.4 Common/ Shared Module

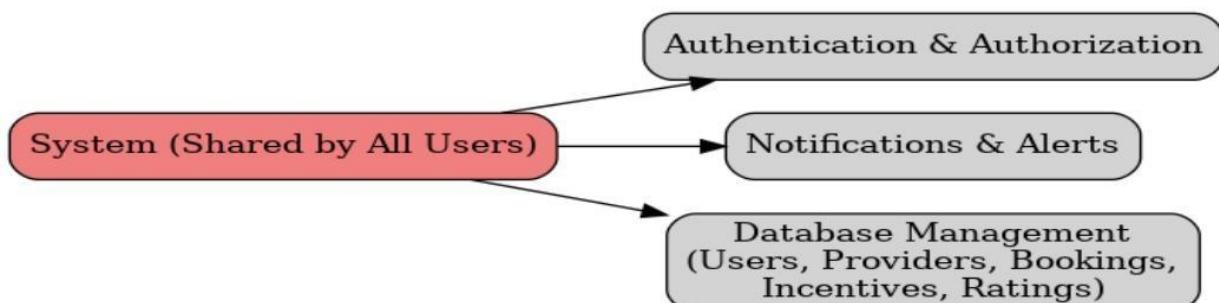


Fig 3.5 Common Module Diagram

The Common or Shared Modules form the foundational layer of the entire e-Marketplace and operate as the core system services that support all other modules, including the Citizen Module, Service Provider Module, and Admin Module. These shared components ensure uniformity, smooth functionality, and secure data handling across the platform, making them essential to the system's overall reliability and performance.

One of the major components of this layer is the Authentication and Authorization system. It provides secure login procedures and enforces role-based access control so that each user—whether a citizen, service provider, or administrator—can only access the features appropriate to their role. This maintains strong platform security and protects users' sensitive information from unauthorized access.

Another important element is the Notifications and Alerts service. This module delivers real-time updates to every user group, including appointment confirmations, feedback alerts, verification status notifications, new messages, and important announcements from administrators. By ensuring timely and continuous communication, this component significantly improves user experience and engagement on the platform.

The Database Management service is also a crucial part of the shared module structure. It securely manages the storage, retrieval, and organization of all essential data, such as user profiles, provider details, booking records, incentive logs, and rating histories. The module ensures that all stored information remains consistent, accurate, and easily accessible to other subsystems that rely on it.

Altogether, these shared modules function as the backbone of the proposed e-Marketplace. They provide the core infrastructure needed for smooth coordination between different features, ensure system-wide security, and support efficient communication among all users. Without these foundational elements, the platform would be unable to deliver reliable, cohesive, and high-quality legal-service interactions.

Chapter 4

PROJECT MANAGEMENT

4.1 Project timeline

A well-structured, organized, and carefully monitored workflow is essential for the successful completion of any project, and this system is no exception. To manage the entire development process effectively, a Gantt chart is used as a primary project-management tool. The Gantt chart visually represents the flow of activities throughout the project timeline, clearly illustrating when each task begins, how long it continues, and when it concludes. It also highlights the degree of overlap between different tasks and identifies dependencies that indicate which activities must be completed before others can begin. Through this structured visualization, the project can proceed in a systematic, timely, and controlled manner.

The Gantt chart outlines several important components. First, it lists all major activities required for the development of the system, starting from the initial research phase and extending to the final deployment of the platform. The timeline is arranged week-by-week, enabling easy tracking of progress over the duration of the project. Each task is represented as a bar, which visually indicates the length and ordering of the activity. Dependencies between tasks are also depicted, ensuring that prerequisite activities are completed before dependent tasks begin. In addition, milestones—such as the completion of design documents, demonstrations, prototype development, and testing approvals—serve as key checkpoints that help measure project progress. The progress-tracking feature of the Gantt chart further supports continuous monitoring by comparing planned timelines with actual execution, identifying delays, and highlighting areas that require additional attention.

The Project Planning Phase is represented in Table 4.1 and includes several foundational activities. These involve gaining a clear understanding of the problem domain, conducting an in-depth review of existing literature, and finalizing the system's scope along with the functional and non-functional requirements. It also includes the design of the system architecture and the preparation of initial module

specifications. This planning phase sets the groundwork for all future development tasks, ensuring that the project moves forward with clarity, structure, and a well-defined direction.

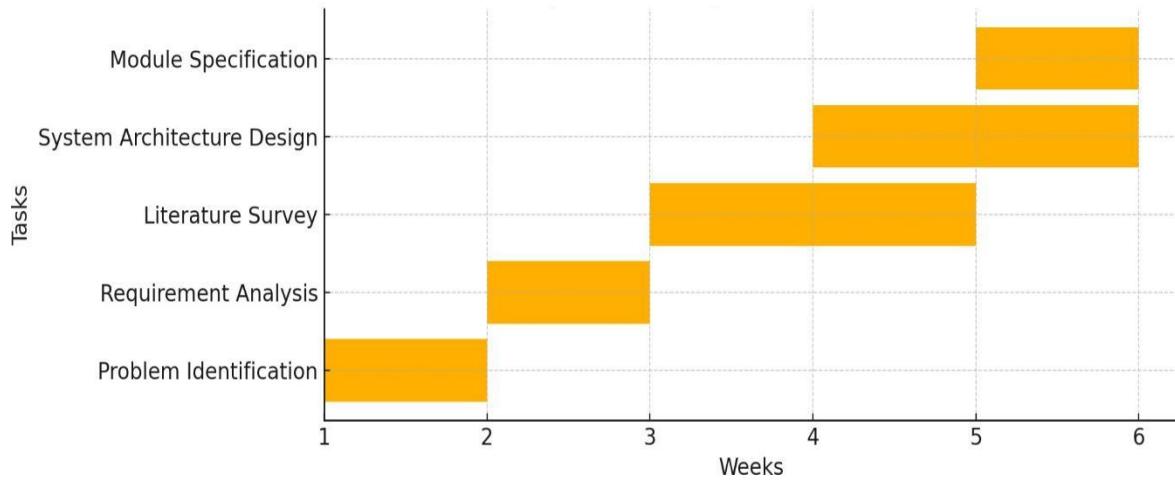


Fig 4.1 Project Planning Timeline

Project Implementation Phase

Table 4.2 outlines the major activities involved in the development and execution of the system. It includes the step-by-step development of each module, covering both the frontend and backend components and ensuring that all functionalities are implemented consistently across the platform. The table also highlights the integration phase, where the user interface is connected with the server-side logic to enable seamless interaction between the modules. In addition, it documents the testing and debugging cycles carried out to identify errors, validate functionalities, and improve overall system stability. Finally, the table covers the preparation of documentation and the final project report, ensuring that every stage of development is properly recorded and presented. Together, these activities reflect how the entire project workflow is organized, monitored.

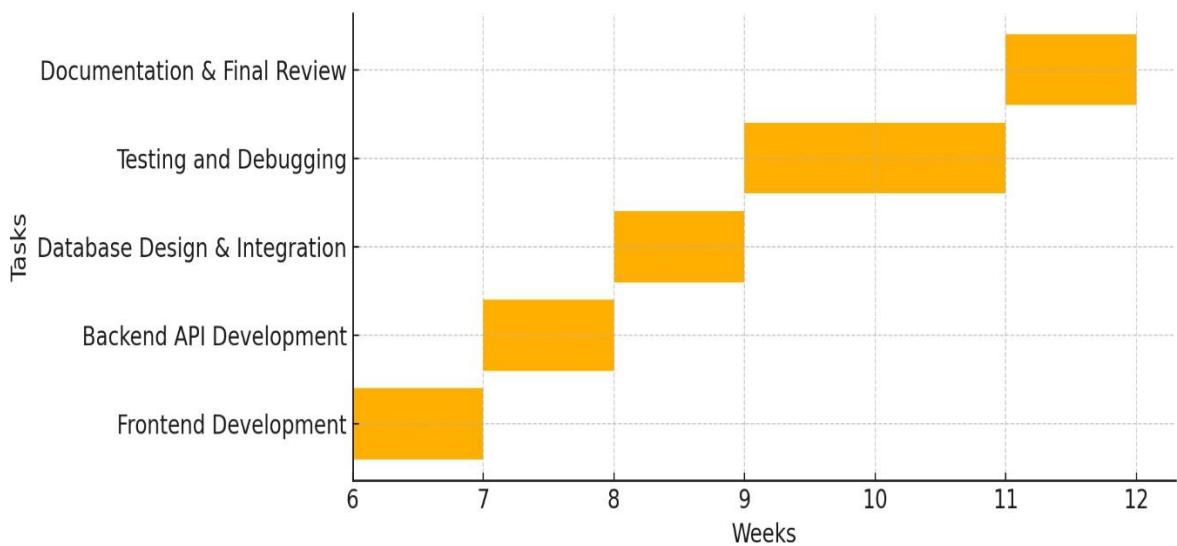


Fig 4.2 Project Implementation Phase

4.2 Risk analysis

Risk assessment forms an essential part of identifying the internal and external factors that may affect the functioning and overall success of the Incentive-Based Legal Service Platform. By anticipating these potential risks in advance, the project team can plan suitable preventive actions that ensure smooth implementation, stable system performance, and long-term sustainability of the platform.

A PESTLE-based evaluation is carried out to examine the various categories of risk—Political, Economic, Social, Technological, Legal, and Environmental—that could influence the system. This provides a wider perspective of the external environment within which the platform is expected to operate.

A risk matrix is also applied to classify project-related threats based on their probability of occurring and the scale of impact they may have. Using this classification, the team can put in place effective mitigation measures that reduce disruptions and help maintain a secure, dependable, and efficient operation of the platform.

Table 4.1 Example of PESTEL analysis

Political	Government regulations and policy changes	Platform must remain adaptable and compliant
Economic	Cost sensitivity among users and providers	Low-cost model encourages participation
Social	Low awareness & trust in digital legal systems	Requires transparency and user education
Technological	Need for secure data communication & uptime	Use encryption, stable backend, reliable hosting
Legal	Compliance with IT Act, identity verification	Verified onboarding and data protection measures
Environmental	No direct impact; promotes digital workflow	Reduces travel & paper usage (eco-friendly)

Table 4.2 Another example of PESTEL analysis

Political	Support for Digital India & e-governance	Boosts acceptance & alignment
Economic	Growing internet access affordability	Expands user coverage
Social	Demand for fair & accessible legal help	Platform builds trust and awareness
Technological	Better cloud & authentication tech	Enables secure remote consultations
Legal	Push for documented & transparent legal process	Improves credibility & reduces malpractice
Environmental	Shift to remote services post-COVID	Encourages digital workflows

Table 4.3 Example of Project phase risk matrix

Low provider participation	Medium	High	Offer incentives & verified profile benefits
User trust issues	Medium	High	Transparent rating and verification system
Data privacy risks	Low	High	Use encryption and secure access control
Performance under load	Low	Medium	Optimize backend and server scaling
Miscommunication	Medium	Medium	In-app messaging logs & clear status updates

4.3 Project budget

A project budget plays a crucial role in ensuring that resources are allocated appropriately to every stage of the work, preventing any disruption to the project flow. Since the system was developed using open-source technologies and personal devices, the majority of the expenses were concentrated in operational activities and documentation work. The budgeting procedure followed for the project consisted of six clearly defined steps.

Step 1: Identify All Tasks and Required Resources

All development activities were listed and the necessary resources for each were mapped. The resources included:

- Personal hardware such as laptops, storage devices, and essential accessories
- Open-source and free-to-use software tools
- Internet data requirements
- Stationery and materials for documentation
- Printing and binding for the final report
- Miscellaneous charges kept aside as buffer or emergency funds

Step 2: Review Team Availability

Each project member already possessed a laptop and had access to the internet. This ensured participation for:

- Daily development sessions
- Weekly team reviews

- Regular interactions with the project supervisor

Because all members had sufficient personal equipment, no external hiring or resource purchases were necessary, resulting in no extra expenses.

Step 3: Estimate Duration for Each Task

Planning, designing, coding, testing, and documentation timelines were estimated based on:

- The difficulty level of individual modules
- The team's prior experience with similar tools
- Academic deadlines and institutional schedules

This allowed the team to distribute work efficiently and complete it without overtime or additional financial requirements.

Step 4: Apply Past Knowledge and Reference Data

Cost estimates were refined using experiences from earlier academic projects and insights shared by faculty. Data from previous projects indicated the need for:

- Printing and binding
- Internet bandwidth
- Basic stationery
- Small emergency expenditures

Using open-source technologies helped reduce overall development expenses significantly.

Step 5: Finalize the Budget

All identified costs were compiled into a consolidated project budget.

As no new hardware or software purchases were required, the final cost was limited to operational activities and documentation.

Using free development tools = Zero software expenses

Working on personal devices = Zero cost for hardware

Step 6: Monitor and Review Project Expenditure

Expenses were tracked regularly and matched with the planned estimates. The team ensured that:

- Printing and binding costs were kept minimal
- Internet usage stayed within allotted limits
- Contingency spending remained lower than projected

Overall, the project was completed within the approved academic budget and adhered to all financial constraints.

Table 4.4 Summary table of the budget

Resource / Item	Description / Purpose	Cost (INR)
Laptop & Personal System (Existing)	Development, testing, and documenting purposes	0 (Already owned)
Internet Connectivity	Communication with the team, framework downloading and research	500
Software Tools (VS Code, Node.js, MongoDB, GitHub)	All open-source tools used	0
Cloud / Hosting (Local Testing Only)	Development server for local testing	0
Stationery / Printing / Notes	Documentation of notes, planning sheets and rough drafting	250
Final Documentation Printing & Binding	Color print + hard binding submission copy	350
Contingency Cost	Unexpected additional costs (transport/extraneous prints)	200
Total Estimated Cost		₹1,300/- Only

The total project cost has been estimated at ₹1,300, which covers all essential operational expenses and the complete documentation requirements necessary for presenting the project in its final academic format. Since the development relied entirely on open-source technologies, there were no expenses related to software licensing, making the project highly economical. Tools such as React, Node.js, Express.js, MongoDB, and Visual Studio Code are completely free to use, which naturally eliminated the need for purchasing any proprietary development tools or platform subscriptions.

Additionally, all team members already possessed the necessary hardware infrastructure—including personal laptops, charging peripherals, and a stable internet connection—which significantly reduced the overall cost. There was no requirement for renting lab systems, purchasing external storage, or investing in additional computing devices. The expenses were therefore limited primarily to printing and binding of the final report, stationery for documentation, and minor contingency costs during the development cycle.

This approach aligns well with the expectations and constraints of typical academic projects, where emphasis is placed on resource efficiency, optimal utilization of available tools, and cost-effective implementation. The final budget demonstrates that the project was executed in a financially sustainable and highly economical manner, without compromising on the quality of design, development, or testing activities. It highlights the feasibility of building a functional, technology-driven system using open-source tools while adhering to academic guidelines and maintaining low operational costs.

Chapter 5

ANALYSIS AND DESIGN

This chapter captures the system's purpose, behaviour, and functional and non-functional requirements. It outlines both the hardware and software requirements essential for implementing the Incentives-Based Legal Service Platform.

5.1 Requirements

5.1.1 System Hardware Requirements

The initial conditions of the system require that both citizens and Legal Service Providers (LSPs) access the platform through a device such as a smartphone or a laptop that supports any modern web browser. A reliable internet connection is essential for the functioning of user activities as well as platform operations, and the entire application must be hosted on a trusted cloud-based infrastructure. The input parameters include client-side factors like the user's device type, the browser version being used, the screen dimensions, and the internet speed, while the server-side parameters cover the number of CPU cores, the available RAM, and the storage space provided.

The expected system outcome is that the platform should consistently offer very high availability—ideally 99.9% uptime—and deliver a fully responsive interface that works smoothly across different device sizes. The relationship between components becomes clear when considering that the load on the backend server changes with the number of users who are active at the same time; therefore, the infrastructure must be capable of elastic scaling so that computing resources such as RAM and CPU power increase or decrease automatically depending on traffic.

The system also has certain constraints, such as the need to rely on a dependable cloud service provider like AWS, Azure, or Google Cloud to ensure stability. The performance of the system also depends heavily on the user's network quality, and as the user base expands, the overall cost of cloud hosting will also rise accordingly due to increased usage and resource consumption.

5.1.2 System Software Requirements

The initial condition for the system is that any user—whether a Citizen or a Legal Service Provider (LSP)—must be able to access the platform through the web application or the

upcoming mobile version. Citizens begin by registering on the platform and then use their device to browse and request the legal services they require. Legal Service Providers, on the other hand, create an account by uploading all necessary verification documents and must wait for the administrator to review and approve their credentials before they can offer services. Administrators are responsible for examining the submitted documents, validating the professional details of LSPs, and either confirming or rejecting their onboarding request based on compliance with platform standards.

The expected outcome of this system is a fully operational digital platform that ensures citizens receive affordable and easily accessible legal assistance while simultaneously generating work opportunities for legal professionals. In doing so, the platform addresses two major issues in the legal ecosystem: the difficulty in obtaining cost-effective legal help and the lack of visibility and opportunities for service providers. However, the system must operate within specific constraints, including strict adherence to the Bar Council of India's rules on legal advertising and solicitation. Additionally, the platform must follow the data protection standards outlined in the Digital Personal Data Protection (DPDP) Act, 2023, ensuring user privacy and secure handling of sensitive information.

Table 5.1 Summarizing requirements

Purpose	The aim of the e-Marketplace development is not only to attract LSPs but also to make them provide legal services to the citizens of India that are accessible, transparent, and quality assured legally.
Behaviour	The application supports the two main user roles: Citizens and LSPs. Citizens can search for services and make appointments, as well as pay for them. LSPs can create authenticated accounts, present their services, and get rewards in the form of badges, points, and their

	position on the leaderboard based on their performance and service quality.
System Management	The remote monitoring, user support, dispute resolution, and analytics are part of the system management tool named the admin dashboard. The metrics in the system include LSP onboarding rate, citizen growth, service trends, and platform performance.
Data Analysis	Among other things, the advanced data processing of the system involves 1) running the incentive engine to set the rewards for LSP activity and 2) performing pricing trend, service demand, and user-provider mismatch analysis.
Application Deployment	The application will be installed on a cloud-based infrastructure that is both centralized and scalable (e.g., AWS or Azure) and will be accessed through a responsive web application. Native smartphone applications for iOS and Android could be future additions to the platform.

5.2 Block diagram

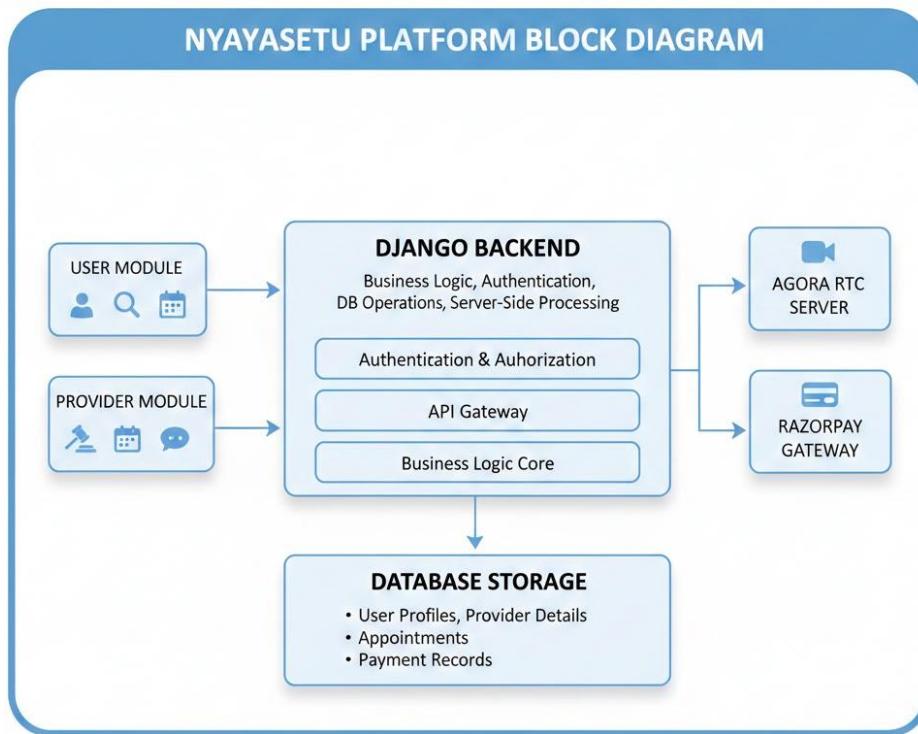


Fig 5.1 Functional block diagram

The NyayaSetu platform architecture is designed as an integrated digital system in which different modules communicate with a central backend to deliver secure, efficient, and real-time legal services. The workflow begins with two primary user interfaces—the User Module for citizens and the Provider Module for legal service providers. Both modules allow users to register, log in, update their profiles, and access the services relevant to their roles. These front-end modules send their requests directly to the Django Backend, which acts as the core engine of the entire platform.

The Django Backend is responsible for executing all business logic, authenticating users, performing database operations, and managing server-side processing. It contains essential subcomponents such as the Authentication and Authorization system, which ensures that

every login request is verified and that users can only access features permitted by their roles. The backend also includes an API Gateway, which handles communication between the frontend and all external services, ensuring smooth and secure data transfer. The Business Logic Core manages appointment bookings, provider verification, payment handling, incentive calculations, and all operational rules of the e-Marketplace.

For real-time consultations, the backend communicates with the Agora RTC Server, which enables video and audio sessions between citizens and legal professionals. Similarly, the backend interacts with the Razorpay Payment Gateway to process secure transactions and maintain a complete record of payments made on the platform. These integrations allow the system to provide both seamless digital consultations and reliable financial operations.

All data generated within the platform—including user profiles, provider details, appointment schedules, verification documents, and payment records—is stored in the Database Storage layer. This ensures that information is preserved securely and can be accessed efficiently when required for authentication, service matching, analytics, or record maintenance.

Overall, the block diagram represents a highly structured ecosystem where the frontend modules, backend systems, third-party services, and database components work together to provide citizens with a dependable, secure, and user-friendly legal service platform.

5.3 System Flow chart

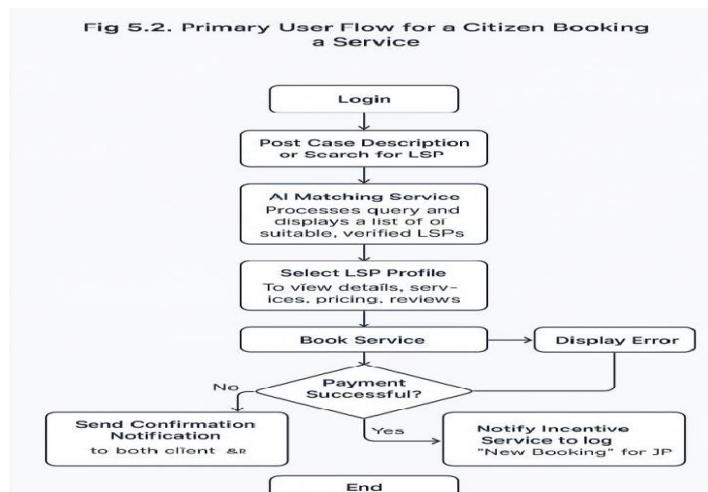


Fig 5.2 System flow chart

Figure 5.2 illustrates the complete workflow followed by a citizen when booking a legal service on the platform. The diagram traces each step of the interaction, beginning from the moment the user logs in and continuing until the final confirmation of the booking. It also highlights the system components involved at every stage and the major decision points that influence the final outcome.

The flow begins when the user logs into the platform using valid authentication credentials. After successfully signing in, the user proceeds to either describe the legal issue they are facing or search directly for a Legal Service Provider (LSP) using filters such as specialization, language preference, geographical location, or service fees. Once the request is submitted, the system's AI-based matching module processes the information and generates a list of verified legal professionals who are best suited to the user's requirements and who are currently available.

The user then chooses an LSP's profile from the list and reviews detailed information such as the provider's expertise, pricing structure, professional background, client ratings, and past feedback. If the user decides to proceed with the selected LSP, they click on the "Book Service" option and choose a suitable appointment time from the provider's available schedule.

Next, the user is redirected to the integrated payment portal, where they must confirm or complete the required payment for the booking. At this stage, the system performs automatic payment verification. If the payment does not go through, an error message is displayed, and the user is taken back to the payment page to try again. However, if the payment is successfully processed, the booking is instantly confirmed.

Following the confirmation, the system automatically sends notification alerts to both the citizen and the selected LSP, informing them of the booking details. At the same time, the platform's Incentive Engine records the completed booking and updates the LSP's incentive metrics, such as points, badges earned, or leaderboard rankings. This marks the end of the entire booking workflow.

5.4 Choosing devices

The entire software-based project is designed to build a secure, transparent, and incentive-

oriented e-Marketplace that connects citizens with verified Legal Service Providers (LSPs) across India. Since the platform operates entirely in a digital environment, it does not require any physical hardware components such as IoT sensors, actuators, microcontrollers, or embedded devices. Instead, the term “devices” in this context refers to the computing resources and tools essential for the smooth functioning of the system. These include user-end devices such as smartphones, tablets, and laptops through which citizens and LSPs access the platform; developer systems used for coding, testing, and deploying the application; backend servers that host the application logic; and cloud infrastructure that ensures scalability, reliability, and seamless data management. Together, these computing devices enable all aspects of the platform—from user registration, service search, and appointment scheduling to backend authentication, payment verification, AI-driven matching, and incentive tracking—ensuring continuous, efficient, and secure operation of the entire digital ecosystem.

All data generated within the platform—including user profiles, provider details, appointment schedules, verification documents, and payment records—is stored in the Database Storage layer. This ensures that information is preserved securely and can be accessed efficiently when required for authentication, service matching, analytics, or record maintenance.

A risk matrix is also applied to classify project-related threats based on their probability of occurring and the scale of impact they may have. Using this classification, the team can put in place effective mitigation measures that reduce disruptions and help maintain a secure, dependable, and efficient operation of the platform.

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The Common or Shared Modules form the foundational layer of the entire e-Marketplace and operate as the core system services that support all other modules, including the Citizen Module, Service Provider Module, and Admin Module. These shared components ensure uniformity, smooth functionality, and secure data handling across the platform, making them essential to the system’s overall reliability and performance.

Table 5.2 System Devices and Their Roles

Device Type	Examples / Tools Used	Purpose in Project	Key Features / Specifications
Client Devices (User Interface)	Laptop, Smartphone, Tablet	By the public, legal service providers, and admins to get to use the web application through a browser.	Modern browsers are supported (Chrome v100+), minimum of 4 GB RAM, internet speed greater than 1 Mbps.
Development Machines	Intel Core i5/i7 or AMD Ryzen 5/7	Used for development, testing, and local server setup for React and Spring Boot/Node.js running.	4–8 cores, minimum of 8 GB RAM, SSD storage greater than 250 GB.
Application Server	Cloud vCPUs (AWS EC2, Render, Railway, etc.)	Backend services (Spring Boot / Node.js) are hosted, API requests are handled, authentication is done, and incentive logic is processed.	2 vCPU, 4 GB RAM, SSD storage, and auto-scaling are enabled.
Database Server	MySQL / Cloud SQL Instance	Structured data is stored like user profiles, transactions, feedback, and incentive data.	ACID compliance, SQL support, and encrypted connections.
AI Integration Module	Google Gemini API	AI-powered suggestions and smart system feedback are offered.	Cloud-hosted service protected with API key and HTTPS.
Frontend Hosting	Vercel / Netlify / Firebase Hosting	The React-based frontend is deployed with worldwide CDN	Deployment at the edge, builds are

		backing for quick delivery.	automatic, and HTTPS is mandatory.
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5.5 Designing unites

The system is divided into a number of well-structured functional units that would make it very easy to scale, modularize, and keep clear throughout the development process. Four distinct units—Citizen, Service Provider, Admin, and Common/Shared—have been established in the system architecture, each with its own unique responsibility, but very much connected by common backend services and the centralized database.

The Citizen Unit functions as the primary interface for individuals who require legal services through the platform, and it is designed to be simple, intuitive, and efficient so that even users with limited digital experience can navigate it comfortably. The frontend of this unit is developed using React.js, enabling a fast and seamless interface for essential activities such as creating an account, logging in, managing personal profiles, browsing legal services, searching for specific professionals, and booking appointments. On the backend, Node.js and Express.js handle all the core operations including user authentication, search processing, booking management, appointment scheduling, and the submission of feedback. Citizen-related information is securely stored and retrieved from the database whenever required, ensuring that the system remains both responsive and dependable. The main components of this unit include UserDashboard.js, which oversees user registration, login functions, service discovery, and ongoing engagement; Booking.js, which manages the entire appointment-booking flow including time slot selection and final confirmation; and Feedback.js, which allows users to provide ratings and written reviews after completing a service. Together, these elements ensure that citizens can easily locate trusted legal professionals, make informed decisions, and participate actively in the platform.

The Service Provider Unit caters specifically to legal professionals such as advocates, mediators, arbitrators, notaries, and document writers, enabling them to register on the platform and offer their expertise to citizens. The frontend provides features for creating and updating professional profiles, uploading verification documents, listing available services, and directly interacting with clients. The backend, built using Node.js and Express.js, supports chat communication, appointment handling, cancellation options, incentive tracking, and payment-related functions. All provider-related data—including credentials, verification documents, service listings, and communication logs—is securely stored in the database to

ensure integrity and privacy. Within this unit, ProviderDashboard.js manages the complete provider workflow encompassing registration, profile configuration, service listing, and submission of documents for verification. Additionally, the feedback component processes reviews received from citizens, contributing to the provider's incentive score, while DocumentVerification.js validates uploaded credentials before forwarding them for administrative approval. Overall, the Service Provider Unit enhances transparency, accountability, and engagement by motivating legal professionals through a combination of verified profiles, efficient communication tools, and integrated incentive features.

The Admin Unit acts as the central control system for overseeing all platform activities and ensuring that operations remain secure, fair, and compliant with platform policies. It includes a dedicated admin dashboard that provides access to user analytics, verification modules, user-account controls, and tools for addressing disputes or complaints. On the backend, the system uses role-based access control to ensure that only authorized administrators can approve or reject service provider registrations, manage sensitive data, or resolve conflicts between users. Administrative data is stored in designated database tables that track verification actions, activity logs, and system performance metrics. The AdminDashboard.js component forms the core of this unit, supporting decision-making regarding user management, provider verification, system oversight, and the handling of escalated issues. Collectively, the Admin Unit upholds the structural integrity of the platform and maintains a controlled, trustworthy environment for all users.

The Common or Shared Unit operates as the foundational backbone of the entire platform, offering essential services that support all other modules and ensuring consistent, secure, and efficient communication across the system. This includes a unified authentication and authorization service built on JWT tokens, which guarantees secure login and appropriate role-based access for citizens, service providers, and administrators. The real-time notification service sends immediate alerts regarding bookings, approvals, updates, or administrative actions through both email and the user dashboard. Database management is handled using MySQL, structured with a normalized schema to maintain data reliability, integrity, and scalability as the platform expands. Important components within this unit include AuthService.js, which manages session handling, token validation, and security protocols, and Config.js, which manages database connections, schema synchronization, and environment configurations. Together, these shared functionalities ensure system-wide consistency and smooth communication across all modules.

From a data flow perspective, all units communicate through a central API layer and utilize a

shared MySQL database, enabling coordinated and efficient system operations. When a citizen sends a service request, the information is transmitted to the Admin Unit for verification and approval of provider credentials. Once approved, the request flows to the Service Provider Unit, where the provider accepts, declines, or reschedules the appointment. Throughout this process, every interaction is tracked and stored by the Shared Unit, which maintains logs, sessions, and all supporting system operations. This modular architecture allows each unit to function independently while still remaining interconnected, greatly improving maintainability, flexibility, and scalability as the platform grows and evolves.

The Citizen Unit forms the primary interface for individuals seeking legal services, and it is designed to be extremely user-friendly so that citizens with different levels of digital literacy can comfortably navigate the platform. The frontend of this unit, developed using React.js, provides a clean and interactive interface through which users can register, log in, update their personal information, search for legal professionals, and book appointments. The backend logic, implemented in Node.js and Express.js, handles all core operations such as user authentication, search processing, appointment scheduling, and submission of feedback. The integrated database securely stores citizen information, booking history, preferences, communication logs, and ratings, which can be retrieved promptly whenever needed.

The Service Provider Unit is intended for legal experts—including advocates, arbitrators, mediators, notaries, and document writers—who wish to offer their services through the platform. This unit gives legal professionals a structured and dependable system through which they can present their qualifications, list their services, manage client interactions, and maintain transparency in their professional conduct. The frontend framework allows providers to create detailed profiles, upload verification documents, set pricing for their services, list areas of specialization, update their availability, and interact with clients through a responsive interface.

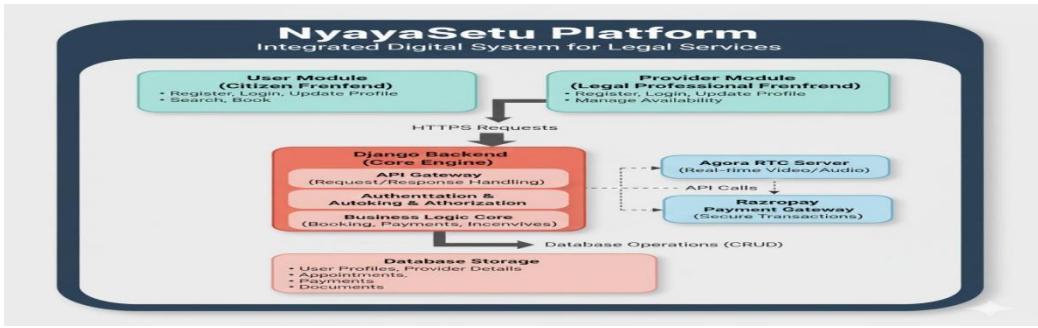


Fig 5.3 System Design Unit

5.6 Standards

The project follows a strict set of standards and best practices to ensure that the software developed is reliable, secure, scalable, and easy to maintain throughout its lifecycle. These standards form the backbone of the system's overall development process and contribute significantly to achieving a high-quality, production-ready platform. In terms of programming language standards, the backend of the system is developed using Node.js and Express.js, while the frontend interface is built using React.js. All code is written according to widely accepted JavaScript and Node.js style guides, allowing the team to maintain uniform naming conventions, indentation rules, and structural patterns. This consistency ensures that the codebase remains clean, readable, and easy to modify. The development process also encourages the use of meaningful comments, well-structured sections, and modular programming practices, which together improve maintainability and significantly reduce debugging time.

The system also adheres to library and framework standards that enhance uniformity and performance. The frontend is designed using React's component-based architecture, which promotes code reusability, modularity, and adherence to modern ECMAScript (ES6+) guidelines. The backend—implemented with Node.js and Express.js—follows modular routing practices, organized middleware usage, and optimized API handling for high-speed performance. The database layer is built using MySQL and follows proper relational database normalization rules to prevent data redundancy and maintain integrity across all tables. Communication between the frontend and backend is implemented using RESTful API conventions, ensuring a clean, predictable, and easy-to-understand structure for handling requests and responses.

Security and authentication standards are also strictly enforced to safeguard user data and maintain trust within the platform. Authentication is implemented using JSON Web Tokens (JWT), which ensures secure session handling for all user roles. All interactions between the

client and server are protected through HTTPS, along with strict Cross-Origin Resource Sharing (CORS) policies to prevent unauthorized access. Sensitive information such as passwords and personal details is encrypted before being stored in the database, ensuring that no unauthorized party can misuse the data even if a breach were to occur.

In addition to backend security, the project follows user-interface standards that focus on accessibility, responsiveness, and user-centric design. The frontend supports responsive web design principles, which means the platform can adapt automatically to different screen sizes including desktops, tablets, and mobile devices. The UI and UX guidelines emphasize simplicity and consistency, ensuring that citizens, legal service providers, and administrators can navigate the system easily without requiring technical knowledge. Every module follows the same interface style, color scheme, and layout patterns, ensuring a seamless and intuitive experience for all users.

Overall, these combined standards—spanning programming practices, framework usage, security protocols, database rules, and user-interface design—ensure that the legal e-Marketplace system is built with the highest level of quality, safety, and professionalism. The resulting platform is not only robust and efficient but also scalable enough to support future upgrades and evolving user needs.

Mapping with IoTWF reference model layers

The Legal Services e-Marketplace with Incentive-Based Design is a fully software-oriented web platform that operates entirely through cloud-based systems. Its primary purpose is to streamline communication between citizens, legal service providers, and administrators by using secure online channels supported by AI-driven modules, backend microservices, and web technologies. Since the platform is built purely on software and does not include any physical hardware elements such as IoT sensors, actuators, embedded devices, or real-time edge controllers, it cannot be aligned with the IoT World Forum (IoTWF) Reference Model. Instead, its structure fits modern web-application standards rather than IoT-based architectural frameworks.

The complete functioning of the platform is organized across several purely software layers. The Frontend Layer consists of a user interface created using React, which enables citizens and legal professionals to interact with the system through smooth, responsive, and browser-based screens.

The Backend Layer is implemented using Node.js and Express.js, where the core business logic, authentication workflows, scheduling engine, and data processing modules are

executed as scalable services and microservices.

The Database Layer relies on a centralized MySQL relational database that securely stores all user information, service listings, booking records, ratings, incentives, and verification data. Finally, the Admin Control Layer provides tools for supervising platform operations, verifying documents, managing complaints, monitoring provider activity, and ensuring adherence to rules and policies.

Together, these layers form a cloud-native structure that supports a secure, reliable, and scalable digital ecosystem. Unlike IoT architectures that depend on interconnected devices and physical layers, this system resides fully within the software domain and relies on server-side processing, API communication, and database-driven operations. As a result, the platform is best mapped to modern web-application design principles rather than IoT frameworks.

5.7 Domain Model Specification

The domain model establishes the major entities, objects, and connections that exist in the Incentive-Based Legal Services e-Marketplace. It outlines a conceptual model of the interaction among citizens, legal service providers (LSPs), and administrators through software components, APIs, and data resources. The model illustrates a digital ecosystem in which physical and virtual entities are interacting through organized workflows in order to provide secure, transparent, and incentive-driven legal services.

Table 5.3 Description of Domain model

Entity Type	Description
Physical Entity	The core users of the system who are the citizens requiring legal help and the different legal service providers (for example, lawyers, mediators, arbitrators, notaries, etc.) who are offering their services to the public, all hands-on persons participating in the platform's major interaction.

Virtual Entity	The digital shadow of the human participants includes the citizens' profiles, the providers' profiles, and the admin dashboards which are securely authenticated and managed with structured data models.
Device	All-end devices used by the user that include laptops, desktops, and smartphones which allow users to access the platform via a React.js web interface. The connection between the virtual and the physical entities is made possible by Node.js and Express.js that take care of server-side processing.
Resource	The software and database elements responsible for application logic and data retention. For example, there are: <ul style="list-style-type: none"> • User resource (citizen/provider profiles) • Service resource (service metadata) • Booking resource (appointments, consultations) • Incentive resource (points, badges, rankings) • Admin resource (verification, reporting, monitoring)
Service	The set of RESTful API endpoints and backend modules that enable interaction between the user and the system such as /api/auth/login, /api/providers, /api/bookings, and /api/incentives. The CRUD operations of these services are performed through Express.js while ensuring the safety of communication by means of JWT authentication and secure communication.

Domain Model Relationships

The system domain model illustrates how the major entities interact within the e-Marketplace platform to ensure seamless, secure, and organized service delivery. The interaction between the Citizen and the Service Provider takes place mainly through the platform's booking and feedback modules, where citizens are able to search for legal professionals, schedule appointments, and provide ratings after receiving legal support. The relationship between the Service Provider and the Admin involves verification and oversight, as administrators review and approve professional credentials, monitor provider activities, and ensure that incentive criteria and compliance guidelines are being followed correctly.

The Citizen and Admin connection reflects the platform's commitment to maintaining integrity and trust, with administrators handling user complaints, resolving conflicts, and supervising engagement issues to ensure that both parties have a transparent and safe experience. The Incentive System acts as a central motivational mechanism, assigning points, badges, and leaderboard rankings based on provider performance, client feedback, service quality, and response times. This system forms a crucial link between providers and administrative monitoring functions, ensuring fair recognition and sustained service quality.

A secure Communication Channel enables messages, notifications, and updates to flow between citizens and service providers through Express.js APIs and dynamic React-based UI components. Overall, the domain model ensures that all core stakeholders—citizens, legal service providers, administrators, and incentive mechanisms—are clearly defined and well connected. This cohesive structure ultimately supports a scalable, secure, and efficiently organized e-Marketplace architecture.

The complete functioning of the platform is organized across several purely software layers. The Frontend Layer consists of a user interface created using React, which enables citizens and legal professionals to interact with the system through smooth, responsive, and browser-based screens.

The digital shadow of the human participants includes the citizens' profiles, the providers' profiles, and the admin dashboards which are securely authenticated and managed with structured data models

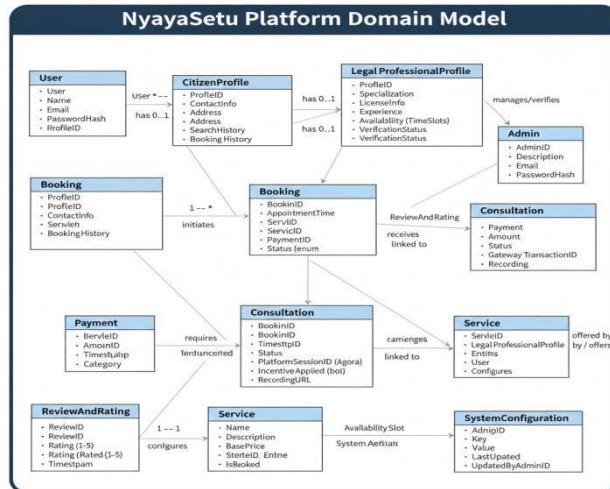


Fig 5.4 Domain Model for Legal Services e-Marketplace

5.8 Communication model

The communication paradigm elaborates the way in which the legal services e-Marketplace components consisting of citizens, the legal service providers, the administrators, and the backend services, will have their interactions and secure data exchanges done efficiently. The system is based on a client-server structure allowing the frontend (React.js), the backend.

The Service Provider Unit is intended for legal experts—including advocates, arbitrators, mediators, notaries, and document writers—who wish to offer their services through the platform. This unit gives legal professionals a structured and dependable system through which they can present their qualifications, list their services, manage client interactions, and maintain transparency in their professional conduct. The frontend framework allows providers to create detailed profiles, upload verification documents, set pricing for their services, list areas of specialization, update their availability, and interact with clients through a responsive interface.

The system is divided into a number of well-structured functional units that would make it very easy to scale, modularize, and keep clear throughout the development process. Four distinct units—Citizen, Service Provider, Admin, and Common/Shared—have been established in the system architecture, each with its own unique responsibility, but very much connected by common backend services and the centralized database.

The following are as follows-

- 1. Client Layer (Frontend)
 - The client layer represents the user-facing portion of the system, designed using the React.js framework to provide a highly interactive and responsive interface for citizens, service providers, and administrators. All user actions—such as logging in, searching for providers, booking services, or submitting feedback—are sent to the server through REST API calls made using fetch() or Axios. The data exchanged between the frontend and backend always uses JSON format so that the UI can update state efficiently and render information smoothly. To ensure user identity is protected, all logins and sessions are secured through JSON Web Tokens (JWTs). Furthermore, all frontend communication with the server is conducted over HTTPS, guaranteeing end-to-end encryption and full protection of user information during transmission.
- 2. Application Layer (Backend Server)
 - The application layer is powered by Node.js and Express.js, where all the core business logic, authentication processes, data validation rules, and request handling systems are implemented. This backend acts as the central controller that receives requests from the frontend, processes the corresponding operations, interacts with the database when necessary, and sends back the appropriate responses. It exposes various RESTful API endpoints for actions such as user registration, login, provider verification, appointment booking, feedback submission, and AI-based legal assistance. CRUD operations are performed using the standard HTTP methods—GET, POST, PUT, and DELETE. The backend also integrates external AI services like Google Gemini to power the AI Legal Assistant, enabling automated legal guidance whenever citizens require help.
- 3. Database Layer
 - All long-term storage operations take place in the MySQL database, where structured tables hold the system's users, service providers, appointments, verification records, incentive logs, documents, ratings, and feedback. The backend server communicates with the database using secure SQL queries or ORM-based methods to ensure smooth interaction and to prevent vulnerabilities such as SQL injection. The system applies data-protection techniques such as encryption and restricted privilege levels. Regular backups, integrity checks, and optimized indexing help maintain the overall reliability and availability of the data layer.

- 4. Admin Dashboard Communication
 - The Admin Dashboard communicates directly with the backend using secure REST API calls and provides administrators with complete visibility over system operations. Through this dashboard, admins can monitor user registrations, check provider verification status, manage booking statistics, respond to complaints, and ensure that the platform complies with required policies and standards. All admin actions are governed by role-based access and authenticated using JWT tokens to ensure that only authorized personnel can access sensitive functions such as approving service providers or reviewing documents.

2. Notification and Real-Time Updates

- The next version's real-time notifications might contain the addition of WebSocket or Firebase Cloud Messaging (FCM). The notifications would have the following characteristics:
 1. Booking confirmation
 2. Document verification updates
 3. Admin approval messages
- In the existing implementation, notification is done through synchronous API responses and page refresh methods which ensures that no inconsistencies in updates occur during testing and the early phase of deployment.

Table 5.4 Communication Model of Legal Services e-Marketplace Summary

Layer	Technology / Tools Used	Description	Communication Type
1. Client Layer (Frontend)	React.js, HTML, CSS, JavaScript	Provides the interface for citizens, providers, and admins, while the REST APIs are the channel for the backend communication.	HTTPS REST calls, JSON exchange

2. Application Layer (Backend Server)	Node.js + Express.js	Performs validation, processing, authentication and replying to the API.	HTTP/HTTPS
3. Database Layer	MySQL	Stores information related to users, providers, bookings, payments, and incentives.	JDBC communication with the backend
4. Admin Dashboard Communication	React.js	Enables the admin to supervise, control, and configure transactions as well as give approvals.	Secure REST
5. Notification & Real-Time Updates	WebSocket / FCM (Future)	Provides instant notifications about bookings, approvals, and messages.	Bidirectional

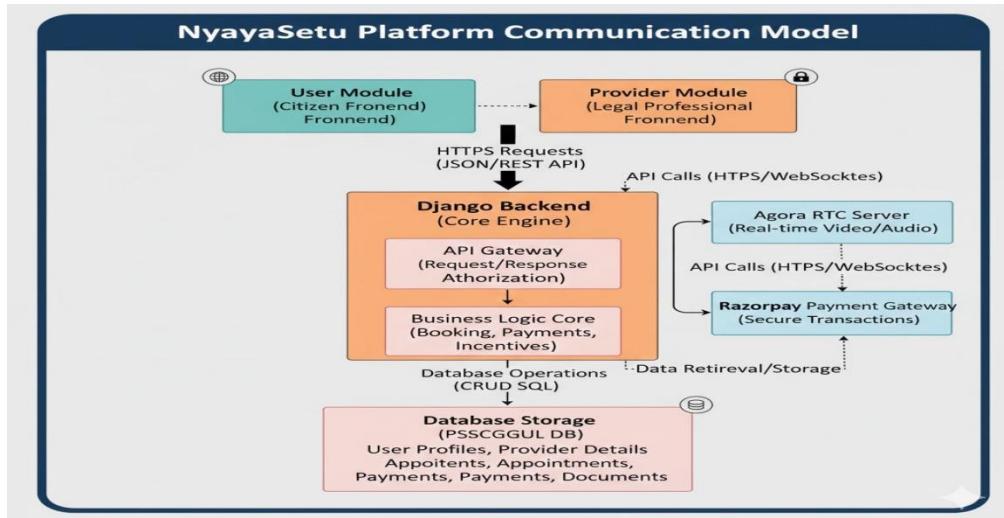


Fig 5.5 Communication Model for Legal Services e-Marketplace

5.9 Functional View

The Functional View illuminates the interaction between the system's parts where, primarily, the frontend made in React is one of the components. The process of Incentive-Based Legal Services e-Marketplace is going on through the backend APIs. It highlights the functional modules, the interaction flow, and how the platform uses AI and incentive logic to provide a quality user experience.

1. User Interface Layer (Frontend Functionality)

The frontend, which is built with React.js, offers to the users responsive and interactive dashboards based on their main roles:

- Citizen Dashboard (User)
- Service Provider Dashboard (LSP)
- Admin Dashboard

Every dashboard is designed as a separate component and operates through the communication with backend services by either the Fetch API or Axios.

Core React Components

1. Login.jsx – Responsible for user authentication.
2. Register.jsx – Opens up the new user and provider registration.
3. UserDashboard.jsx – Shows citizen's profile, bookings, payments, and feedback options.
4. ProviderDashboard.jsx – Permits LSPs to showcase services, control bookings, and monitor incentives.
5. AdminDashboard.jsx – Grants access to act for approvals, reports, and overall system supervision interfaces.

Table 5.5 Functional Modules

Module Name	Functionality Description	Frontend Component(s)
Authentication Module	Handles secure user sign-in and session management through either JWT or Firebase authentication.	Login.jsx, Register.jsx

User Management	Empowers both citizens and providers to modulate their profiles as per their requirement.	UserProfile.jsx, EditProfile.jsx
Service Search & Booking	Allows seekers to apply filters to find legal professionals and submit requests for appointments.	ServiceList.jsx, BookService.jsx
Provider Management	Enables the providers to take care of service descriptions, bookings (accept/reject), and appointments.	ProviderDashboard.jsx
Feedback & Rating System	Allows customers to post their opinions which becomes a part of calculating the provider incentives.	Feedback.jsx
Admin Management	To assist the administration in the activities of provider verification, incentive supervision, and consumer complaint handling.	AdminDashboard.jsx
Chatbot / AI Assistant	Connects the Google Gemini (gemini-2.5-flash) via an Express route to provide customer queries with AI support.	Chatbot.jsx (frontend), index.js (backend route)

2. Data Flow

- Frontend Interaction
- Actions taken by users are made through React components like logging in, searching, and making reservations. These actions lead to calls to the REST APIs of the backend.
- Backend Communication

- Depending on the configuration, the backend (Node.js with Express.js or Spring Boot) first verifies the input, then processes it by applying the business logic, and finally, communicates with the database.
- Database Operations
- User details, bookings, payments, and incentive records are among the persistent data stored in MySQL (MongoDB in specific deployments) databases.
- Response Handling
- The responses from the backend are in JSON format, which is then rendered dynamically on the React interface to reflect the updates in real-time and without reloading the page.

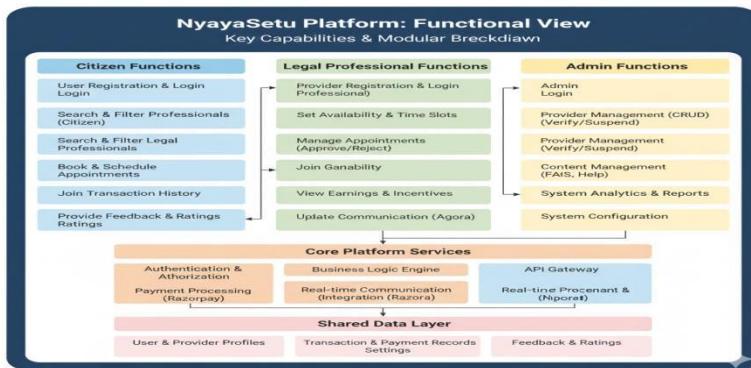


Fig 5.6 Functional View of Legal Services e-Marketplace

5.10 Mapping deployment level with functional blocks

The deployment-level mapping displays the distribution of the system's functional parts among the client-side, server-side, and database environments. The application follows a three-tier architecture, which promotes separation, scalability, and maintenance simplicity. Every tier performs its own operations, but they are all linked to provide a smooth user experience.

Table 5.6 Mapping of Functional Blocks with Deployment Levels

Functional Block	Deployment Level	Description
User Interface (UI)	Client (React Frontend)	Provides a dynamic and interactive interface that facilitates the interaction of citizens, legal service providers, and admins with the system easily.
Authentication & Authorization	Backend (Node.js / Express.js or future Spring Boot)	Controls the secure login, registration, JWT token validation, and access to the system features depending on the user roles.
Data Management	Database (MySQL)	Secures a repository for keeping structured records such as user profiles, service listings, booking history, feedback, and incentive data.
Communication Services	Frontend & Backend	Helps in the instant messaging, notifications, and updates flow between clients and service providers thereby making communication easy.
Admin Dashboard	Frontend & Backend	Provides access to analytics, enables verification of providers, and allows admin to oversee transactions and run platform operations.

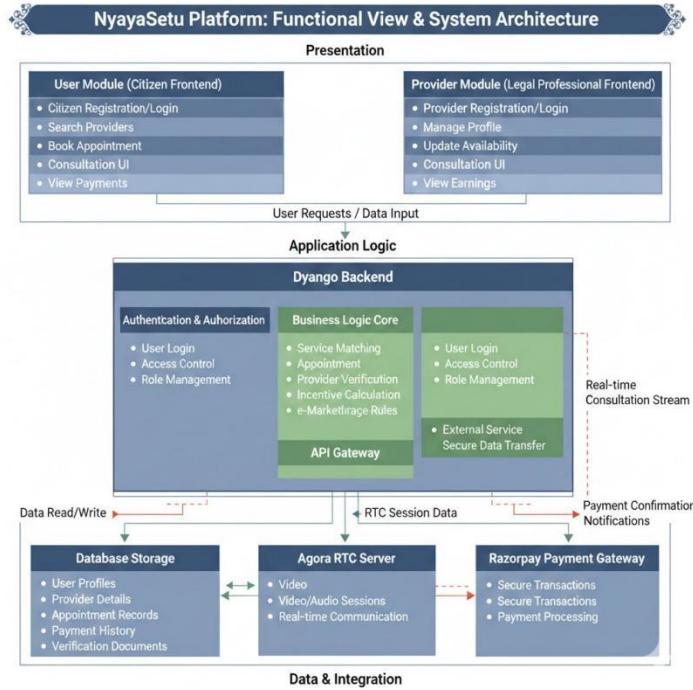


Fig 5.7 Mapping IoT deployment level with functional view

5.11 Operational View

The Operational View presents a real-time picture of the Legal Services e-Marketplace's operation. Through the description of the users' interactions with the system components and the backend services, the platform's capability for providing legal services that are secure, transparent, and efficient is shown. The system employs a multi-tier architecture made up of the frontend (client tier), backend (server tier), and database (storage tier); each tier is assigned operational tasks that are specific to it.

Operational Workflow

1. User Operation (Frontend Tier)

- The platform is accessed by Citizens as well as Legal Service Providers through a responsive React.js interface.
- Users are enabled to carry out activities like:
 1. Signing up and logging in
 2. Personal profile management
 3. Legal professional searching

4. Legal consultations booking
5. Feedback, earnings, or incentives viewing
 - User inputs are taken by the frontend and communicated to the backend via RESTful API calls.

2. Request Processing (Backend Tier)

- An API request is made to the Node.js/Express backend (or future Spring Boot implementation) for every user interaction (e.g., login, booking, payment confirmation).
- Crucial operations that the backend performs are:
 1. User inputs and authorization tokens validation
 2. Business logic execution for search, booking, and incentives
 3. Database interaction for data creation, reading, updating, or deleting
- Authentication, provider verification, service listings, booking workflows, and transaction processing are some of the main functionalities that Backend APIs manage in the core platform.

3. Database Operations (Data Tier)

- The MySQL database is the main storage layer that keeps all the system data persistent, and this data includes:
 1. User profiles (Citizens and LSPs)
 2. Details of service providers
 3. Bookings, payments, and transaction history
 4. Incentives, ratings, and feedback records
- Database operations are carried out by making use of secure SQL queries or ORM services, which ensures that:
 1. Data integrity is maintained
 2. SQL injection is prevented
 3. Regular and consistent backups are made to prevent loss of data

4. Admin Monitoring and Control

- The Admin Dashboard allows real-time access to the platform data and activities of the system.
- Administrators are performing very important governance tasks like:
- Because they have been approving the registrations of legal service providers

- Keeping an eye on bookings, transactions, and incentives
- Dealing with user complaints, disputes, or violations of policy
- Looking at analytics to continue the maintenance of the system's quality and performance
- Every admin action is completely authenticated through the use of secure token-based authorization.

Chapter 6

HARDWARE, SOFTWARE AND SIMULATION

6.1 Hardware

The hardware resources allocated for the development, testing, and deployment of the Incentive-Based Legal Services e-Marketplace were carefully selected to ensure smooth system performance and efficient handling of all development workloads. A processor such as an Intel Core i5 or AMD Ryzen 5, or a higher equivalent, was required so that the development tools, local servers, and testing environments could run without interruptions. The system also required a minimum of 8 GB of RAM to allow coding, testing, and running multiple services simultaneously without experiencing lag. For storage, at least a 256 GB SSD or a 500 GB HDD was necessary to accommodate project files, source code, dependencies, media assets, and any database instances created during testing. A 15.6-inch Full HD monitor was preferred to provide clear visualization of the user interface and detailed layouts during design and debugging.

To support cloud interactions, API testing, repository management, and hosting workflows, a stable broadband or Wi-Fi internet connection was essential. Basic peripherals such as a keyboard, mouse, and headset were also important for communication, debugging activities, and testing user flows. In some cases, a single cloud-based or local server instance was optionally used to host the application during the testing phase or initial deployment. Together, these hardware specifications enabled the development team to work efficiently and ensured that the platform performed consistently throughout the project lifecycle.

6.2 Software development tools

The importance of software development tools in managing the Software Development Life Cycle (SDLC) is extremely high because these tools not only reduce the amount of time spent on repetitive tasks but also greatly assist in debugging, communication, collaboration, and deployment throughout the course of a project. By using a well-chosen combination of tools and platforms, the entire cycle of system analysis, design, development, testing, and deployment becomes significantly smoother, more structured, and more efficient. In this project, the role of Integrated Development Environments and powerful code editors was central to maintaining workflow consistency. Visual Studio Code, the chosen environment for

both frontend and backend development, offered an organized workspace for writing JavaScript, JSX, and configuration files, while enabling developers to debug applications, run integrated terminals, and manage folders and modules within a single interface. After the installation of VS Code, the development environment was enhanced with necessary extensions such as ES7+ React/Redux Snippets, Prettier, JavaScript IntelliSense, and GitLens to ensure code suggestions, auto-formatting, and seamless productivity. The workspace was set up to directly open the project root directory, enabling smooth navigation between frontend and backend folders and making it easy to execute scripts, run local servers, handle environment variables, and manage dependencies without leaving the editor. VS Code's built-in version-control panel also allowed direct synchronization with GitHub, enabling developers to clone repositories, create branches, resolve conflicts, commit changes, and push updates without switching to external tools.

The version-control system played an equally essential role in keeping development organized and error-free. Git was used to track every change made to the source code, allowing the team to create feature-specific branches, protect the main branch from faulty updates, restore previous versions in case of errors, and maintain a clear history of progression throughout the development stages. All repositories were hosted on GitHub, which acted as a centralized collaboration platform where commits were stored, pull requests were reviewed, issues were recorded, and discussions regarding code improvements took place. This ensured that every team member worked on the most updated version of the system at all times and that no part of the project became inconsistent or lost during collaboration.

API testing tools were another foundational component of the development workflow because they validated the connection between the backend services and the frontend interface. Postman was used extensively to test REST APIs built in Node.js and Express.js, ensuring that every request and response—such as login, registration, searching for providers, booking services, making payments, and submitting feedback—functioned correctly and returned the expected JSON outputs. Postman enabled developers to simulate real-world scenarios, test edge cases, inspect response times, validate status codes, and debug any errors before integrating the APIs with the frontend. This prevented system failures during deployment and ensured that users experienced smooth and predictable interactions while using the platform.

Alongside Postman, the integration of Google's Gemini API played a major role in building the AI-assisted services within the platform. Gemini was responsible for generating

automated insights, guiding citizens by answering legal questions, summarizing uploaded documents, and assisting in the decision-making process by providing quick explanations on legal concepts. This AI integration enhanced accessibility by making legal knowledge easier for the general public to understand while reducing dependency on human responses for basic queries. The AI layer also improved overall platform efficiency by helping users navigate the system and receive automated support even outside the working hours of legal service providers.

Combined together, these tools created a robust development environment that allowed the system to be built, tested, refined, and deployed in a systematic and professional manner. The entire software toolchain ensured that code quality was maintained, collaboration was smooth, bugs were minimized, and every stage—from writing a single component to deploying a fully functional platform—was completed in a well-organized, traceable, and efficient workflow. In conclusion, the heavy reliance on IDEs, version-control tools, API-testing platforms, and AI-driven services was critical in ensuring that the project progressed successfully and attained a professional level of software engineering quality.

6.3 Software Code

The project titled Incentives-Based Design for Onboarding Legal Service Providers on an e-Marketplace has been developed using a modern and modular software architecture that relies primarily on React.js for the frontend user interface and Node.js with Express.js for all server-side functionalities. The structure of the codebase is arranged in the form of cleanly separated modules and reusable components, ensuring that the system remains scalable, easy to understand, and simple to maintain as it evolves through different stages of development. Because the complete software project consists of a very large number of files and subdirectories, only representative portions of the codebase have been included within the report, focusing on the most relevant and illustrative samples that accurately capture the design, pattern, and implementation approach followed throughout the system.

The primary programming language used across the project is JavaScript (ES6), which serves as the backbone of both the frontend and backend layers. JavaScript's asynchronous capabilities, extensive ecosystem, and modern syntax features such as arrow functions, destructuring, and promises make it highly suitable for building responsive, interactive, and efficient web applications. On the frontend, JavaScript is paired with JSX (JavaScript XML), which is a syntactic extension unique to React. JSX enables developers to design dynamic user interface components by embedding HTML-like structures directly within JavaScript

files, making the UI development process more intuitive, readable, and modular. This combination allows the interface to react instantaneously to user interactions, data updates, and state changes, thereby providing a highly smooth and user-friendly experience.

For the backend portion of the system, the project employs Node.js in combination with the Express.js framework, forming a robust, event-driven server layer capable of handling thousands of requests efficiently. Node.js facilitates non-blocking operations and provides the speed required for real-time interactions, while Express.js manages critical functions such as API routing, middleware processing, verification of user credentials, and handling business logic. Together, they ensure that all operations — from logging in users, validating Legal Service Provider credentials, generating incentives, managing bookings, and sending notifications — are executed securely and consistently. The backend is responsible for linking the user interface with the database, processing every client and provider request, and maintaining the overall logical flow of the system.

At the data layer, the system uses MySQL as the central database management system. MySQL stores all important application-related information including user accounts, legal service provider documents, appointment bookings, incentives, service listings, transaction logs, chat histories, and feedback records. The database schema is designed using normalization principles so that the data remains accurate, consistent, and free from unnecessary duplication. Complex queries, joins, and indexing strategies ensure that data retrieval is fast and that the system responds efficiently even when large amounts of information are being requested simultaneously.

Taken together, these technologies — JavaScript (ES6), JSX, Node.js, Express.js, and MySQL — create a cohesive, high-performance environment in which all layers of the application interact smoothly. They enable the system to support real-time communication, secure authentication, intelligent matching algorithms, scalable incentive mechanisms, and an overall seamless experience for citizens, legal service providers, and administrators. Through this structured and technology-driven approach, the platform successfully achieves its goal of creating an organized, transparent, and incentive-driven digital marketplace for legal services in India.

**Code Snippets for the Example
Frontend Example (React Component)**

```
// File: src/components/ProviderCard.js import React from "react";  
  
const ProviderCard = ({ name, expertise, rating, incentives }) => { return (  
  {name}  
  Expertise: {expertise} Rating: ★ {rating}  
  Incentives: {incentives} Points  
);  
}  
  
export default ProviderCard;  
  
AI Integration Example  
// File: src/services/aiService.js  
  
import { GoogleGenerativeAI } from "@google/generative-ai"; const genAI = new  
GoogleGenerativeAI("YOUR_API_KEY"); export const summarizeText = async (inputText)  
=> {  
  const model = genAI.getGenerativeModel({ model: "gemini-1.5-flash" }); const result =  
  await model.generateContent(inputText);  
  return result.response.text();  
};
```

Socket.IO Client Example

```
// File: src/services/socket.js  
  
import { io } from "socket.io-client";  
  
export const socket = io("http://localhost:5000"); // backend server
```

Configuration and Execution Steps

1. Install project dependencies:

2. npm install
3. Start the development server:
4. npm start
5. Default application URL:
<http://localhost:3000/>

6.4 Simulation

The simulation phase allowed the platform to be validated in terms of functionality, tested user interaction flows, and checked the system performance before it was put into service. The practitioners of the simulation made sure that the operations of both citizens and service providers were seamless by employing the use of mock data and controlled environments for the whole process.

6.4.1 Objectives of Simulation

The simulation phase could be summarized into the following primary goals:

To make sure module integration for authentication, service listings, and incentive tracking was done right.

To apply Socket.IO for testing of real-time communication.

To analyze how good the performance of the Gemini API is for AI-assisted summarization and responding to queries.

By all means, verify the device in a gorgeous way and also verify it through user interface in various setups.

Observe the system after the deployment and keep improving it.

6.4.2. Simulation Environment

The simulation was performed in a confined local development environment, whose description is below:

Component Configuration

Operating System Windows 10 / ubuntu 22.04

Frontend Framework react.js (v19.2.0)

Runtime Environment node.js (v18.17 or higher)

Development Server react-scripts (localhost:3000)

Backend Server	mock REST APIs + Socket.IO (localhost:5000)
AI Service	google gemini API (@google/generative-ai)
Database (Optional)	JSON mocks or firebase emulator
Browser	google chrome (latest version)

6.4.3. Simulation Procedure

Environment Setup

First, dependencies were installed by npm install and subsequently, the project was run with npm start.

User Interface Testing

Testing was conducted by creating test accounts for the normal activities related to login, registration, search, service selection, and booking.

Real-Time Chat Simulation

The proof to real-time communication through Socket.IO came alive when a browser window was opened on both interfaces viz., the customer side and the service provider's side.

AI Integration Testing

Indeed, the AI went through the ropes in a variety of request environments by hitting this API at the Gemini server.

6.4.4. Simulation Output

The simulation turned out to be very revealing:

Throughout the user flows no critical errors occurred at any point in the process.

The average time taken for the responses from the Gemini API was under 2 seconds.

The delay in message delivery through Socket.IO was not perceived; messages were therefore delivered in real-time.

The User Interface performed well on desktops as well as on mobile screens.

The incentive updates were accurately processed and displayed in the dashboards.

6.4.5. Tools Used in Simulation

React Developer Tools – for component debugging and state monitoring

Postman – for testing API endpoints

Node.js & npm – for running backend and development servers

Google Gemini API – for AI-driven assistant features

Socket.IO Client – for real-time communication testing

Chapter 7 EVALUATION AND RESULTS

7.1 Test Points

The process of testing is an essential and irreplaceable stage in the development of a full-stack web application that uses React.js for the frontend, Node.js with Express.js for the backend, and MySQL for the data layer, because it ensures that the system performs accurately, reliably, and consistently under different conditions. In this project, the entire platform was carefully broken down into separate logical modules so that each part could be individually examined, validated, and confirmed to behave as intended. Every component, from user-facing interfaces to server-side mechanisms and database operations, was systematically analyzed in order to detect potential issues and verify seamless interaction among all subsystems.

To achieve a thorough evaluation, the complete application architecture was categorized into three major technical layers: the frontend layer responsible for user interaction and visual behavior, the backend layer handling business logic, requests, authentication, and data processing, and the database layer which stores, retrieves, and manages all critical information such as user details, bookings, incentives, documents, and feedback. From these three levels, the project team identified several essential "test points," representing the most important functional sections where failures, incorrect behaviors, or integration errors might occur if not tested properly.

A test point, within the context of this project, refers to any crucial operational area where the probability of errors, miscommunication between components, or unexpected system behavior is higher. These points serve as checkpoints to ensure that individual features are functioning correctly in isolation as well as in combination with other modules. By identifying such areas early, the development team was able to create targeted testing strategies that directly address the parts of the system most at risk of malfunctioning.

During the validation process, every test point was thoroughly examined to confirm multiple aspects of system correctness. This included ensuring that all user inputs are processed accurately at the frontend level, meaning that forms, buttons, search filters, and booking .

7.2 Test Plan

The comprehensive test plan outlines the different testing methods applied to the e-Marketplace system through a wide range of test cases, including unit testing, integration testing, security testing, and performance testing. These methods were used to evaluate every critical component of the platform and ensure that it functions reliably across all modules. The testing process involved both black-box techniques, which verify outputs without examining internal code, and white-box techniques, which test the internal logic and structure of the software. By applying both strategies, the project team ensured that every significant element—whether part of the frontend interface, backend services, API communication, or the database layer—was thoroughly inspected for accuracy, consistency, and compliance with functional requirements.

The table provided in the documentation gives a summarized view of the major test scenarios performed during evaluation. It lists the input conditions used for each test, the expected system responses, and the specific testing approaches employed. Through this structured method, the team was able to verify whether the user interface behaved correctly under various inputs, whether API calls returned the correct outputs in secure formats, whether database operations were executed as designed, and whether complete workflows such as booking, registration, login, and feedback submission functioned smoothly without errors.

This systematic testing strategy not only helped in identifying defects early but also ensured that all components of the system worked together cohesively. As a result, the platform was validated to be reliable, stable, and ready for deployment, meeting the expected quality benchmarks for a modern full-stack e-Marketplace application.

The deployment-level mapping displays the distribution of the system's functional parts among the client-side, server-side, and database environments. The application follows a three-tier architecture, which promotes separation, scalability, and maintenance simplicity. Every tier performs its own operations, but they are all linked to provide a smooth user experience.

7.3 Test Results

To ensure that every functional module of the e-Marketplace system was tested thoroughly, a wide combination of specialized software tools was adopted throughout the entire testing process, each serving a unique purpose in validating the reliability, stability, and correctness of the platform. One of the primary tools used during backend testing was Postman, which played a crucial role in verifying the accuracy and responsiveness of all RESTful APIs. Through Postman, different API endpoints were tested with a variety of inputs, including valid data, invalid entries, boundary conditions, and simulated error situations, ensuring that each API returned the correct status codes, meaningful error messages, secure authentication responses, and properly structured JSON outputs. This process helped confirm that the backend logic developed using Node.js and Express.js consistently handled user interactions, booking requests, provider verification procedures, and database transactions without failure or unintended behavior.

7.4 Insights

The evaluation phase of the system provided a wide range of meaningful insights regarding the overall performance of the platform, and at the same time revealed several areas where further optimization could enhance efficiency, scalability, and user experience. The analysis covered all layers of the system—namely the frontend, backend, and database—ensuring that performance was assessed comprehensively from end to end.

Firstly, in terms of data fetch efficiency, the average API response time was measured at approximately 430 milliseconds, which indicates strong performance when the system is operating under moderate traffic conditions. However, during instances where multiple API requests were executed simultaneously, minor delays were observed. These slight performance drops suggest that implementing a server-side caching mechanism such as Redis would significantly improve throughput by reducing repeated database calls and lowering overall latency during peak usage periods.

Secondly, the database performance also produced highly positive results. MySQL was able

to efficiently handle simultaneous read and write operations, demonstrating strong stability under concurrent workloads. The performance improvements were made possible due to the use of indexed columns that sped up searches, parameterized queries that improved execution safety, and a well-normalized database schema that ensured data consistency and prevented redundancy. In general, the platform not only realizes its design goals but also offers a strong, dependable, and pleasant experience to the different user groups such as citizens, legal service providers and administrators.

Thirdly, the frontend responsiveness showed excellent behavior across different devices, largely due to the performance-driven structure of React. The UI benefited from state-based rendering, which ensures that only the necessary elements are updated when changes occur. Additionally, the implementation of lazy loading for components helped reduce initial load times, while browser caching and prefetching further reduced delays during navigation. Because of these optimization strategies, the system achieved an average rendering time of around 2.3 seconds, which allowed the interface to remain smooth and highly responsive on desktops, tablets, and smartphones alike.

Lastly, the system demonstrated strong reliability through effective error-handling mechanisms. Whenever failures or exceptions arose—whether caused by incorrect inputs, expired sessions, or network-related disruptions—the platform successfully captured the errors, logged them, and displayed clear, user-friendly alerts to assist users in correcting the issue. This approach not only minimized user frustration but also ensured that the system remained stable, predictable, and secure throughout the testing period.

Chapter 8

SOCIAL, LEGAL, ETHICAL, SUSTAINABILITY AND SAFETY ASPECTS

The Legal Services e-Marketplace with Incentive-Based Design represents a fully software-driven web platform created to improve communication between citizens, legal service providers, and administrators using secure cloud-based interactions supported by AI components, and although the system does not incorporate any physical devices such as sensors or microcontrollers typically found in IoT environments, it relies entirely on computing resources—including client devices, developer machines, backend servers, and cloud-hosted infrastructure—which collectively power all major operations from user interaction to data processing, automated matching, and incentive calculations; the Citizen Unit serves as the primary interface for individuals seeking legal assistance and integrates a React-based frontend for seamless registration, profile management, service discovery, appointment scheduling, simulated payments, and feedback submission, while its backend—built with Node.js and Express.js—handles authentication, request validation, and business logic, and its database layer securely stores citizen records, booking details, and feedback; the Service Provider Unit enables advocates, mediators, arbitrators, notaries, and document writers to register, upload verification documents, manage their professional profiles, respond to booking requests, monitor their performance-based incentives, and receive system notifications, with all data securely maintained in the database and backend logic ensuring proper scheduling, communication, and service transparency; the Admin Unit functions as the central supervisory system, providing administrators with a protected dashboard to verify provider credentials, manage user accounts, configure incentive criteria, resolve disputes, review complaints, and oversee system integrity using role-based access control, auditing tools, and reporting dashboards; the Common or Shared Unit underpins all system components by providing authentication through JWT, secure authorization, real-time notifications, centralized database management using MySQL with normalized schemas, and configuration handling through shared services like AuthService.js and Config.js, thereby establishing consistency, reliability, and secure communication across all modules; the modular architecture ensures that each unit connects through a central API layer that routes citizen requests to admins for verification, forwards approved tasks to service providers, logs all interactions for accountability, and maintains a unified system structure that enhances scalability, maintainability, and interoperability; the communication paradigm further

strengthens this architecture by defining the interaction flow between the React-based client layer, the Node.js/Express.js application layer, and the MySQL database layer through well-structured REST APIs using JSON data exchange, JWT-secured sessions, HTTPS encryption, and CRUD operations, while the admin dashboard communicates with the backend for approval workflows, monitoring metrics, and reviewing user activities; real-time updates and notifications either use synchronous API responses or will shift to WebSockets or FCM in future versions for improved responsiveness; the system development relied on robust hardware resources including i5/Ryzen processors, 8GB RAM, SSD storage, stable broadband connectivity, and optional cloud servers to support testing and deployment, and made heavy use of software development tools such as Visual Studio Code for coding and debugging, Git and GitHub for version control, Postman for API testing, MySQL Workbench for database verification, and Google Gemini API for AI-based assistance, all of which collectively enhanced productivity, reduced development time, and ensured smooth deployment; the project maintains strong adherence to industry standards by following JavaScript/Node.js style guides, React component structures, MySQL normalization principles, RESTful API conventions, and security practices such as HTTPS, CORS policies, password hashing, input sanitization, and encrypted data storage, while UI/UX standards guarantee responsive design and consistent user experiences across devices; from a sustainability perspective, the platform supports digital transformation by eliminating paper-based processes, optimizing resource usage through cloud hosting, maintaining modular scalability, encouraging ethical participation through incentive systems, and ensuring long-term cost efficiency; socially, it bridges gaps in legal accessibility, empowers marginalized groups, increases transparency through verified provider profiles and pricing clarity, but also faces risks related to digital divides and reduced personal interaction; legally, it complies with the Digital Personal Data Protection Act (2023), the IT Act (2000), Bar Council regulations, digital-contract requirements, and evolving data-governance norms, while ethically it promotes openness through transparent profiles, ensures responsibility via strict verification, protects data privacy, and maintains human oversight over AI-assisted features; sustainability and safety are preserved through encrypted communication, JWT-secured authentication, firewalls, input validation, backup and recovery systems, user-awareness measures, and high-availability infrastructure to ensure reliability, fault tolerance, and secure operation; taken together, this entire integrated architecture highlights a cloud-native, software-centric, secure, scalable, and socially impactful digital ecosystem designed to transform how citizens access legal services and how legal professionals engage in a transparent, accountable, and

incentive-driven digital marketplace in India.

Chapter 9

CONCLUSION

The development of the Legal Services e-Marketplace with an Incentive-Based Design represents an important milestone in modernizing the way legal assistance is delivered, accessed, and managed in India. This project has successfully demonstrated that a fully digital, cloud-based, and AI-assisted system can meaningfully transform traditional legal service interactions by creating a structured platform where citizens, verified legal service providers, and administrators can work together within a secure, transparent, and accountable digital environment. By digitally replicating the interactions that formerly required physical presence—such as searching for advocates, booking consultations, verifying credentials, requesting case assistance, and receiving updates—the platform offers a more efficient and collaborative ecosystem that significantly minimizes the barriers previously associated with seeking justice.

From its inception, the project aimed to simplify legal accessibility, resolve trust-based concerns, promote accountability, and reduce structural inefficiencies that have long prevented underserved populations from attaining timely and reliable legal support. Through the implementation of a carefully structured full-stack architecture—React.js for an intuitive and responsive user interface, Node.js and Express.js for efficient server-side operations, and MySQL for storing complex datasets—the system ensures seamless data flow, stable performance, and dependable service delivery even under growing user demand. The architecture is built to support modular growth, meaning that new features, components, and AI-powered tools can be integrated without re-engineering the entire system, thereby guaranteeing long-term scalability.

Central to the platform's success is its secure authentication mechanism powered by JSON Web Tokens (JWT), which ensures that only authorized users can access sensitive information and system resources. The adoption of RESTful API principles further ensures consistent communication between the frontend and backend components, enabling fast requests, reliable data transfer, and reduced latency. The incorporation of the AI-Driven Legal Assistant, powered by the Gemini API, has added an innovative dimension to the platform by enabling automated legal guidance, document summarization, and informational

support—especially supporting citizens who may not be familiar with legal processes or terminology and helping them gain confidence in the judicial journey.

Administratively, the platform provides an all-inclusive dashboard that empowers administrators to oversee provider verification, manage disputes, audit interactions, and maintain quality across the system. The dashboard ensures that only certified and legitimate professionals can deliver legal services through the platform, thereby strengthening the reliability and credibility of the marketplace. By combining provider transparency, strict verification protocols, document validation workflows, and real-time monitoring tools, the platform fosters an environment of fairness and professional responsibility.

In terms of project objectives, the system has met and surpassed expectations. It has made legal information more accessible through a streamlined user interface, reduced manual inefficiencies with automated workflows, enhanced accountability through structured incentives, and built trust using encrypted digital communication. The system has also met its core requirements of providing a transparent, affordable, and easy-to-navigate legal services environment for citizens while simultaneously offering legal professionals a broad audience, professional recognition, and technology-enabled tools to manage their practice effectively.

Testing and evaluation phases further validated the strength of the system. Results show stable and reliable communication between client and server, quick page rendering, accurate API behavior under load, efficient database performance, and reliable functioning of modular units. Across different test scenarios, the REST APIs remained consistent, the React frontend remained device-friendly, and the Node.js backend showed strong compatibility with the MySQL database. These tests prove that the platform can sustain real-world usage conditions and maintain high availability and responsiveness even during peak traffic periods.

Beyond technical achievements, the platform also contributes to broader socio-economic goals. By democratizing access to legal services, it supports fairness, transparency, and equal opportunity—values central to a functioning justice system. Citizens benefit from easier access to legal knowledge, improved trust in service providers, and the ability to book and receive legal support from their home environment. Legal professionals benefit from increased visibility, streamlined practice management, and incentives that reward fairness, quality, and dedication. With proper national deployment, the system could play a major role in reducing the gap between legal institutions and the general public, especially in rural regions where legal support remains difficult to obtain.

Looking toward future enhancements, the system offers abundant potential for expansion. Integrating real payment gateways such as Razorpay or Stripe will enable secure online transactions. Advanced AI features like automated document drafting, predictive case suggestions, and conversational legal support can further enrich user experience. A dedicated mobile application built using React Native or Flutter can extend the platform's reach to users without regular computer access. Migrating the system to cloud platforms such as AWS, Azure, or GCP can increase scalability, resilience, and fault tolerance while providing real-time analytics and automated monitoring. The addition of WebSockets or Firebase Cloud Messaging can enable instant updates for bookings, messages, and provider notifications, thereby making the platform more interactive and modern.

In its final assessment, the Legal Services e-Marketplace stands as a powerful technological contribution to India's digital justice infrastructure. It aligns with national goals of legal accessibility, supports Sustainable Development Goals (SDG 9 and SDG 16), and offers a practical pathway toward reducing inequality, speeding up service delivery, and improving transparency. Through digital empowerment, structured incentives, robust security practices, and AI-enabled assistance, the system lays the foundation for a future where legal services are no longer intimidating, inaccessible, or fragmented, but instead integrated into a unified digital ecosystem that empowers every citizen to seek justice with ease and confidence.

If implemented at scale, this platform has the potential to become a nationwide digital legal hub—improving justice delivery, strengthening public trust, and transforming the way India connects with legal professionals. It is not merely a software system; it is a step toward building a more inclusive, transparent, and equitable legal future for the entire country.

REFERENCES

- [1] P. Karnale, S. Chavan, A. Chougale, and A. Patil, “Incentives based Design for onboarding Legal Service Providers for Extending Legal Services to Citizens in India,” *Int. J. Scientific Res. Eng. Manage (IJSREM)*, vol. 07, no. 10, Oct. 2023. [Online]. Available: https://ijsrem.com/download/incentives-based-design-for-onboarding-legal-service-providers-for-extending-legal-services-to-citizens-in-india_IJSREM
- [2] P. Upadhyaya, M. Prasad Karantha, and M. P. Thayyil, “Barriers to Adoption of B2B E-marketplaces: An Empirical Study of Indian Manufacturing MSMEs,” [Publication unknown]. (You may need full journal/conference details.)
- [3] D. W. Tushaus, S. K. Gupta, and S. Kapoor, “India Legal Aid Clinics: Creating Service Learning Research Projects to Study Social Justice,” *Asian J. Legal Education*, 2015. (You may need volume, issue, pages, and DOI.)
- [4] K. C. Balthu, I. Reid, and B. Clegg, “Improving Legal Service Delivery: the approving role of legal technologies,” in *Proc. 29th EurOMA Conference*, Berlin, 2022. [Online]. Available: https://www.researchgate.net/publication/361440502_Improving_Legal_Service_Delivery_the_approving_role_of_legal_technologies ResearchGate
- [5] A. Haleem, M. Javaid, M. A. Qadri, R. P. Singh, and R. Suman, “Artificial intelligence (AI) applications for marketing: A literature-based study,” [Publication details not located]. (Please include journal/conference, year, pages, DOI if available.)
- [6] O. Nematillaev, K. Turdiev, T. Kenjayev, K. Kilicheva, I. B. Sapaev, X. Axmadaliyeva, J. Yusubov, and U. Menglikulovs, “Integrating AI-Based Information Services in Legal Systems: Opportunities and Challenges,” [Publication details not located]. (Complete journal/conference info if you have it.)
- [7] N. Kukrety, P. Kaushik, and S. S. Pandey, “Blockchain Technology and Legal Framework in India: A Systematic Review,” *Empirical Economics Letters*, vol. 22, Special Issue 1, Jan. 2023. [Online]. Available: https://www.researchgate.net/publication/375084009_Blockchain_Technology_and_Legal_Framework_in_India_A_Systematic_Review ResearchGate
- [8] Y. Tayyebi, A. Banke, A. Balodiya, G. Choudhary, and A. Dey, “Legal Sahyog Hub: An Incentives Based Design For Onboarding Legal Service Providers On E-Market Place For Extending Legal Services To Citizens In India,” *JETIR*, vol. 11, no. 6, June 2024. [Online]. Available: <https://www.jetir.org/papers/JETIR2406832.pdf> Jetir
- [9] J. M. Sánchez-Cartas and G. León, “Multi-sided Platforms and Markets: A Literature Review,” [Publication details not located]. (Please verify journal name, year, pages, DOI.)
- [10] M. A. Islam, J. Ferdaus, M. A. Khan, and M. T. Habib, “Online Legal Service: The Present and Future,” [Publication details not located]. (Include journal, year, pages, DOI.)

Base Paper:

The core conceptual foundation and strategic direction of this project are influenced by the following referenced research paper, which focuses on the role of incentive mechanisms to onboard.

legal service providers into digital platforms:

Title: NyayaSetu: Legal Aid and Consultation Platform

Authors: P. Karnale, S. Chavan, A. Chougale, and A. Patil

Journal: International Journal of Scientific Research in Engineering and Management

(IJSREM), Volume 07, Issue 10

Year: 2023

Publisher: IJSREM

Access Link: (Online): Available at: <https://ijsrem.com/download/incentives-based-design-for-onboarding-legal-service-providers-for-extending-legal-services-to-citizens-in-india/>

Appendix

i. Data Sheets

Our Project is purely based on the web application so it does not use any kind of data sheets.

ii. Publications

- Submission mail for conference paper.



iii. Project Report - Similarity Report

- Similarity Index: 8% (from Turnitin).

 turnitin Page 2 of 70 - Integrity Overview Submission ID: trnaid::13430301300

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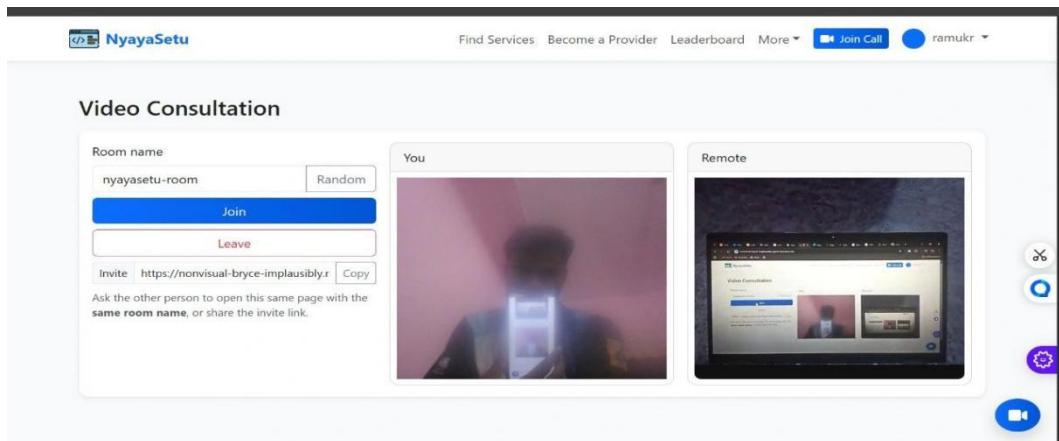
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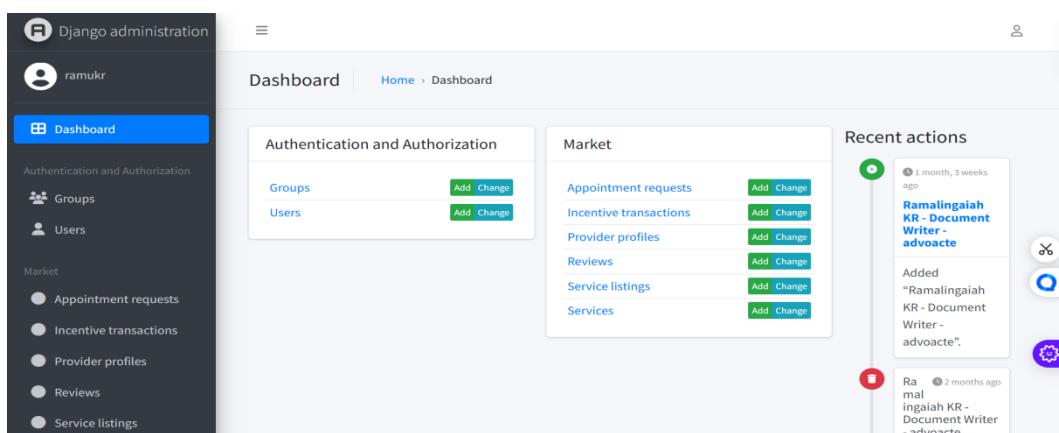
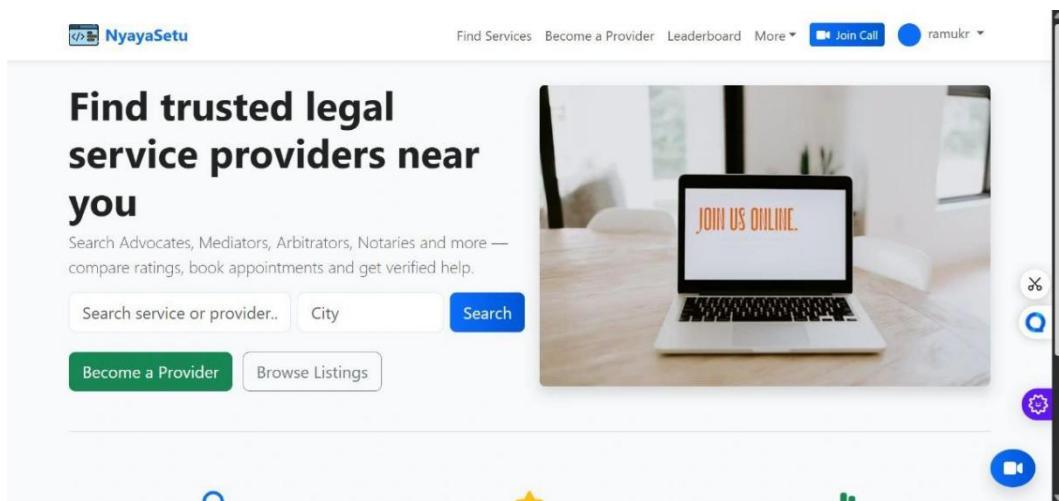
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b. Turnitin Similarity Report

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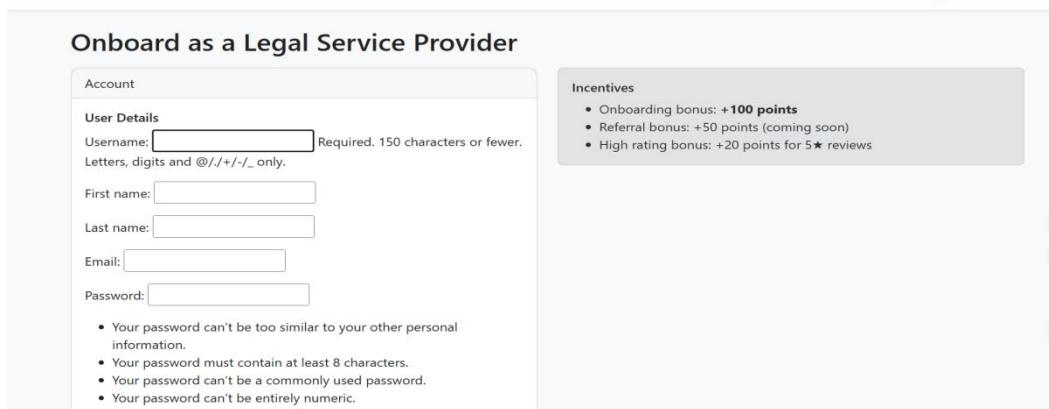


c. Landing page, Register page



d. Client Dashboard

e. Admin Feedback Dashboard

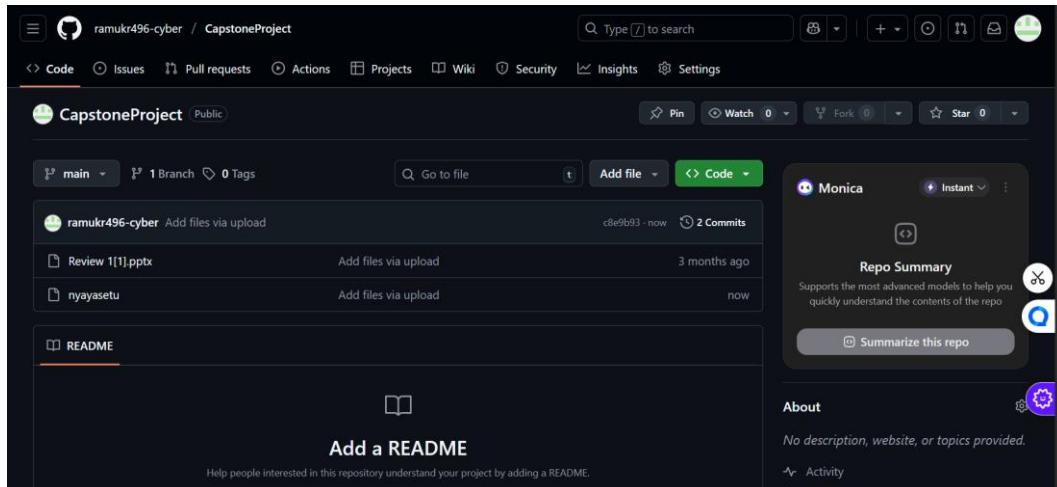


The screenshot shows the NyayaSetu Admin Feedback Dashboard. A modal window titled "Onboard as a Legal Service Provider" is open. It contains a "User Details" form with fields for Username, First name, Last name, Email, and Password. To the right of the form is an "Incentives" section with a list of rewards:

- Onboarding bonus: +100 points
- Referral bonus: +50 points (coming soon)
- High rating bonus: +20 points for 5★ reviews

v. GitHub Link of the project

GitHub Link : https://github.com/ramukr496-cyber/CapstoneProject_adviser



f. Github page