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Innovating Legal Aid with AI: A Chatbot Framework for Deep Learning-based IPC Information and Assistance

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ABSTRACT: The lack of assistance and access to legal information for the underprivileged common man is a major problem in India. The complex aspects of the legal system render the marginalized communities of society helpless, obstructing them from justice. This paper proposes using AI chatbots powered by technologies such as NLP and deep learning models like BERT to provide accessible and cost-free legal aid information on the Indian Penal Code to bridge the gap between people's voices and the legal system, and also evaluate the challenges associated with the usage of this AI chatbot in the legal domain. In addition, to providing information on general queries, the chatbot also aims to spread awareness by improving public understanding related to the newly introduced Bhartiya Nyaya Sanghita (which took effect on 1 July 2024). It aims to clarify and resolve any confusion surrounding these recent legislative changes.

KEYWORDS: Legal Aid, Indian Penal Code (IPC), AI chatbot, Natural Language Processing (NLP), Deep Learning

I. INTRODUCTION

Background

The need for more availability of legal aid services is still a persistent challenge in many parts of India. The complexities of the legal system, which are intertwined with the lack of resources, are the root cause of the inadequate legal representation of the middle class and poor societies [1][2]. This issue highlights the need for innovative solution which is universally accessible and is capable of reducing the disparity of limited legal aid services among individuals [3]. Various NGOs, such as Justice Alive Foundation (JAF) and Human Rights Law Network, are actively working to provide free legal assistance. Despite their significant efforts, accessibility and reach remain limited.

Awareness of the Indian Penal Code (IPC)

Awareness about the provisions and fundamental rights offered by the Indian Penal Code is not widespread, especially among middle-class and economically disadvantaged communities [4]. Only a small percentage of India's population is aware of available legal aid services, severely limiting their utilization.

Inefficiencies within the Legal System

The procedural complexities and bureaucratic inefficiencies within the legal system create additional obstacles [5]. The backlog of millions of cases in the judiciary exacerbates these issues, leading to prolonged delays in justice delivery [6]. The COVID-19 pandemic has further strained the legal aid system, with court closures and delays making it even harder for economically disadvantaged groups to access legal aid, highlighting the urgent need for reforms.

Economic Exploitation

This limited access to legal aid and unawareness about IPC can leave Indian citizens vulnerable [8]. Lawyers often indulge in unethical exploitative practices by charging exorbitant fees for their services, exploiting their clients' desperation and lack of alternatives. This financial burden is particularly burdensome for economically disadvantaged groups who already struggle to afford necessities.

II. METHODOLOGY

System Architecture

The legal aid chatbot system is built on a multi-layered architecture framework consisting of many components interlinked together to deliver accurate and reliable responses.

These layers comprise:

1. User Interface Layer

The UI Layer is the hub for interaction between the user and AI. It is responsible for capturing user queries and sending them to the Backend Server Layer. It also helps in displaying the response generated by the chatbot.

Components:

- Chat Interface: It may include: A web-based chat window, a mobile app interface, or an integration with messaging platforms such as WhatsApp or Facebook Messenger.

2. Backend Server Layer

The Backend Server Layer connects the Frontend (UI Layer) and the Backend (NLP and Deep Learning Layer). It is responsible for routing the queries to the NLP layer for detailed analysis.

Components:

- API Gateway: It handles the incoming requests from the UI Layer and subsequently routes them to the appropriate modules.
- Request Processor: It will pre-process the query input for accurate results from the NLP model.

3. NLP and Deep Learning Layer

This layer is the core of the chatbot's intelligence, which is responsible for interpreting and constructing human language according to the query. Once, this layer receives the query inputted, it employs various NLP techniques and deep learning models to understand the query. Thereafter, it fetches relevant information from the Knowledge Base Layer to synthesize an accurate response, which is transmitted back to the Backend Server.

Components:

- Tokenization Module: Breaking down text into smaller discrete units.
- Intent Recognition Module: Its function is to recognize the intent of the user.
- Named Entity Recognition (NER) Module: Classification of key entities in the query.
- Contextual Understanding Module: Models like BERT to understand the context of the query and legal terms present.

4. Knowledge Base Layer

The Knowledge Base Layer stores the information required by the chatbot to answer user queries. This includes the full text of the Indian Penal Code, legal precedents, and other relevant legal documents.

Components:

- Database Management System (DBMS): A structured database to store and manage legal documents like IPC corpus, legal documents

5. Automated Knowledge Refinement Module

The Automated Knowledge Refinement Module (AKRM) is a critical component of the chatbot system, designed to enhance the accuracy and relevance of the information provided to users. It works in coordination with the update engine to ensure that the knowledge base remains up-to-date and reflects the latest information while still being contextually appropriate.

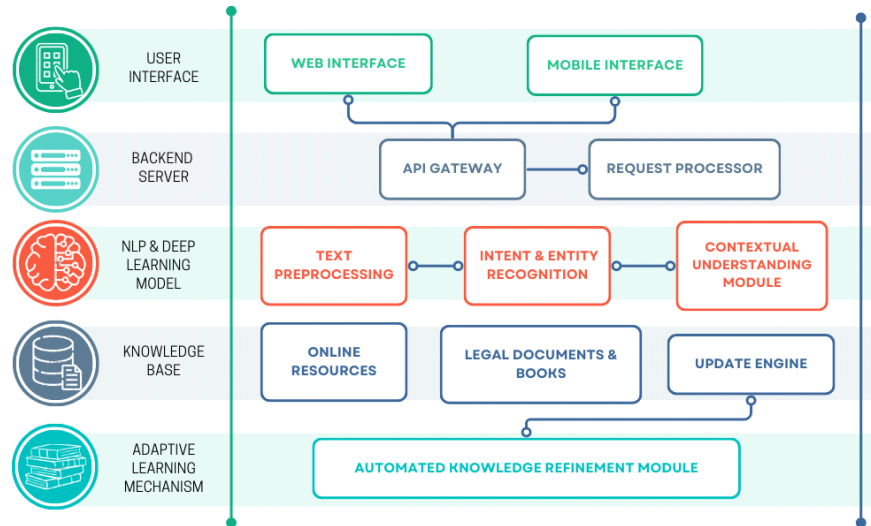


Figure 1: System Architecture Diagram

III. NLP PIPELINE

NLP is an interdisciplinary sub-field of artificial intelligence that allows the computer to interpret and construct human language. NLP enables our legal chatbot to interpret complex legal queries and generate understandable responses accordingly and accurately [7].

The NLP module works by sequentially following a set of steps which include tokenization, intent classification, entity recognition, and response generation.

1) Tokenization:

Tokenization is the process of breaking down the vast textual data of the user query into small manageable chunks called tokens. Tokens may include anything ranging from simple words, phrases, or even characters, depending on the level of specificity desired. The primary purpose of this step is to reduce the data while retaining the context. This helps the chatbots to analyze queries effectively and allows the NLP model to optimize output more accurately. In the context of our legal chatbot, this helps to segregate complex legal terminology and phrases to recognize the user intent accurately.

2) Intent Classification:

Intent classification deals with the process of discerning the intent behind a user's query. This is done by classifying the user query based on predefined categories set by the developer such as seeking general legal advice, getting information on specific IPC sections, and understanding legal procedures [8]. This classification will help the chatbot decide the subsequent actions and the trigger of the information retrieval process.

3) Entity Recognition:

NER is a technique employed to identify and categorize named entities within the textual data into predefined categories such as names of persons, organizations, geographical locations, expressions of times, monetary values, percentages, etc [9]. In the context of legal chatbots, it is essential to identify entities such as IPC sections, legal procedures, terminologies, judicial decisions, and other pertinent entities. This extraction is instrumental in retrieving precise information from the knowledge base.

4) Response Generation:

After all the preprocessing, and interpretation are done, response generation is the final step. This involves synthesizing a response based on the query and the corresponding information from the knowledge base. This will ensure that the response is informative, legally accurate, and understandable to the layman.

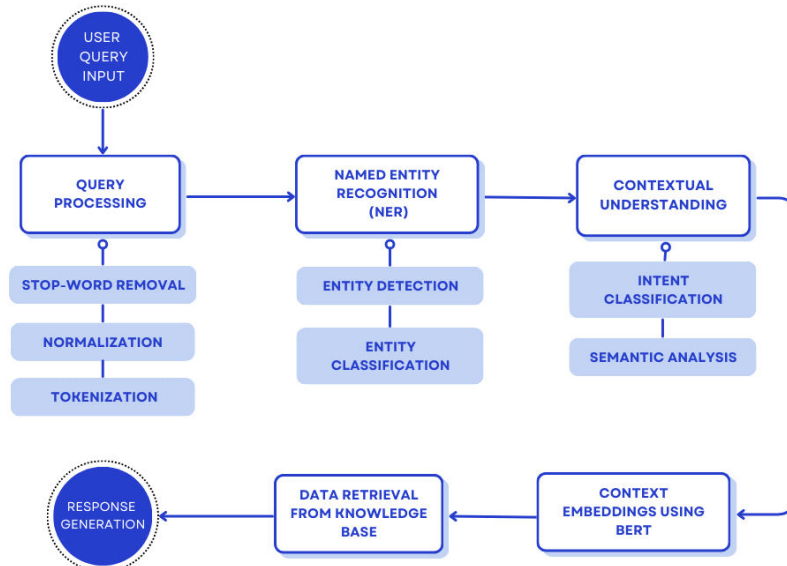


Figure 2: System Architecture Diagram

IV. DEEP LEARNING OVERVIEW

Deep learning models revolutionized the field of NLP. They are critical in expanding the capacity of NLP tasks. These models are remarkably accurate and adept at handling the complexity of spoken language because they are trained on large datasets, which allows them to identify complicated patterns and correlations within the data [10].

BERT (Bidirectional Encoder Representations from Transformers)

BERT is built on transformer architecture that has transformed NLP tasks due to its bidirectional approach toward extracting subtle nuances and semantic meanings in textual data. In contrast to models like recurrent neural networks (RNNs) that process sequential data in a unidirectional manner, the transformer-based design determines the relationships between words in a sentence, considering both left and right contexts simultaneously [11].

For a legal aid chatbot, BERT can be fine-tuned on a corpus of the IPC, to improve its grasp of legal language and its jargon. This fine-tuning enables the model to recognize intents and entities specific to legal queries with greater accuracy.

Training and Fine-Tuning of Deep Learning Chatbot Model

Training and tuning deep learning models like BERT involve several steps:

1) Data Collection: This involves collecting a comprehensive corpus of legal texts related to IPC that are necessary for training and fine-tuning the model [12]. To ensure that our chatbot is equipped with diverse and authentic legal corpora for accurate results, data is collected from a variety of reputable sources. The following list outlines a portion of the data we used to train our chatbot:

Books

1. Ratanlal & Dhirajlal's "The Indian Penal Code"
2. "Introduction to the Constitution of India" by D.D. Basu
3. S.N. Mishra's "Indian Penal Code"
4. "Text Book on the Indian Penal Code" by Dr. Krishna Murari Yadav & Trapti Aggarwal
5. "Law of Torts" by Ratanlal & Dhirajlal

Online Resources and Legal Aid Organizations

1. National Legal Services Authority (NALSA)
2. Legal Aid Clinics and NGOs

2) Preprocessing: The collected data requires preprocessing before it is suitable for training purposes. Primarily to deal with noise inherent in the data that can otherwise hinder the performance of models. It includes steps to remove noise, tokenizing sentences and words, and annotating entities. This enhances the quality of the datasets and the accuracy of the results.

3) Model Training: The model undergoes training on large datasets to recognize general language patterns and broadens its comprehension of the syntax and semantics of the language.

4) Fine-Tuning: The pre-trained model is fine-tuned on the IPC corpus to adapt it to the contextual meanings, and unique linguistic structures prevalent in legal texts. It involves calibrating the model’s inputs based on the legal data to enhance its efficacy in processing and responding to legal queries.

5) Evaluation: The model’s performance is assessed using a suite of metrics such as accuracy, precision, recall, and F1 score. This evaluative process is instrumental in ascertaining the model's proficiency in comprehending and executing legal queries, thereby ensuring its reliability and robustness in a legal context.

V. IMPLEMENTATION & DEMONSTRATION

Chatbot Interaction

The interaction with the legal aid chatbot is pivotal to understanding how users engage with the system to obtain relevant legal information based on the Indian Penal Code (IPC). This section outlines the steps involved in user interaction, from query input to response delivery and feedback mechanism.

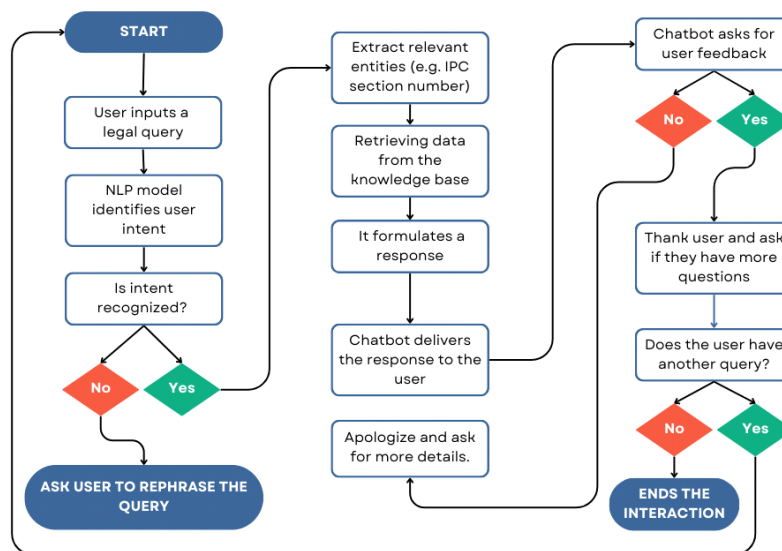


Figure 3: AI chatbot Interaction Flow

Implementation

The chatbot uses a combination of deep learning frameworks such as TensorFlow and chatbot interface Python web frameworks like Flask.

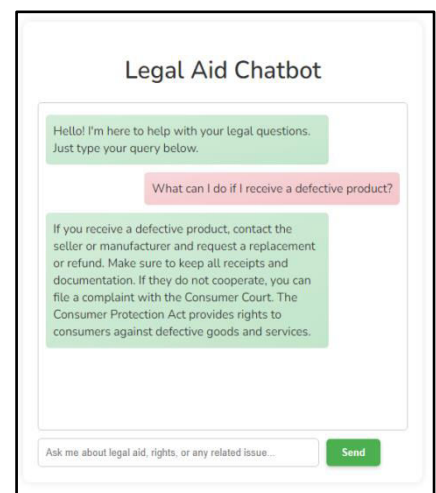
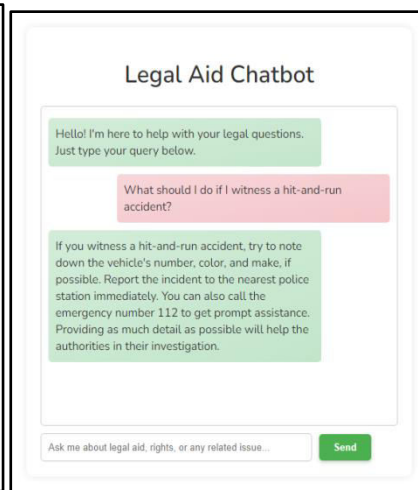
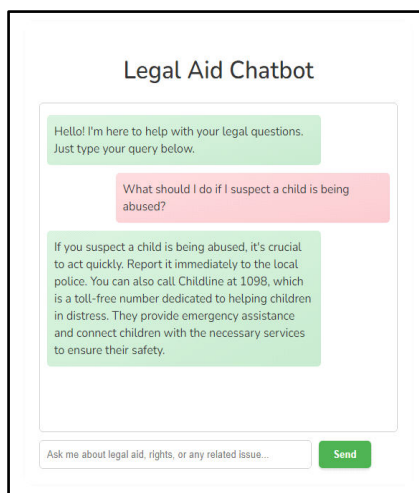
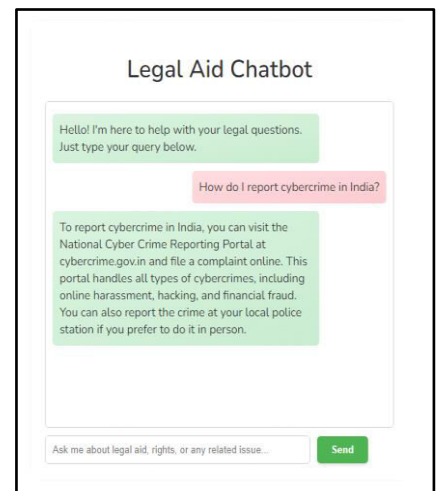
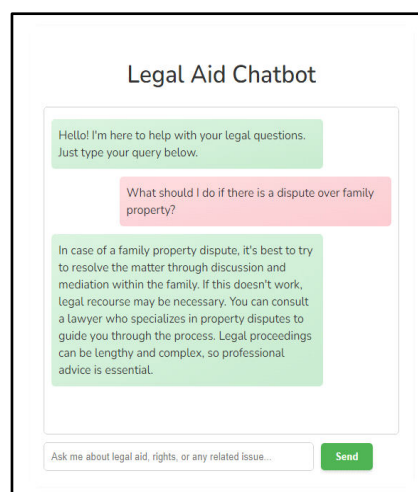
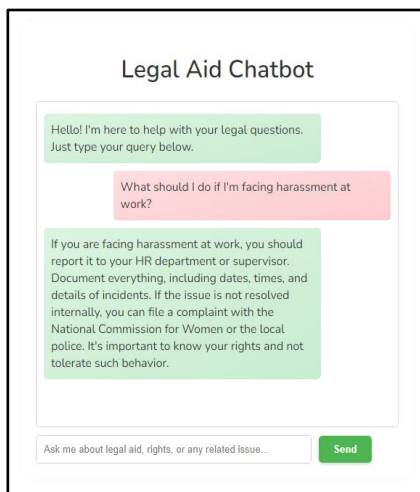
TensorFlow is helpful in the development and training of deep learning models integrated with the aforementioned NLP techniques [13]. Flask is chosen for its simplicity and efficiency in creating web applications, providing an interactive platform for users to engage with the chatbot.

Demonstration

This section presents the outcomes of the developed legal aid chatbot. The following sample interactions illustrate how the chatbot performs in real-world scenarios, demonstrating its effectiveness in delivering accurate and relevant legal information.

Sample Outputs for the Legal Aid Chatbot

- User: What should I do if I'm facing harassment at work?
- User: What should I do if there is a dispute over family property?
- User: How do I report cybercrime in India?
- User: What should I do if I suspect a child is being abused?
- User: What should I do if I witness a hit-and-run accident?
- User: What can I do if I receive a defective product?



VI. RESULTS AND DISCUSSION

The development of this legal aid chatbot can transform the legal aid landscape by using tools like deep learning and natural language processing. This section delves into the broader implications of the chatbot's implementation.

Benefits

1. **Accessibility:** The people of the middle-class community may not have the means to consult a lawyer in person for their legal queries. This chatbot provides instant and accessible information to all which builds a bridge between the middle class and the legal system.
2. **Cost-Effective:** The chatbot provides legal assistance that is more affordable for the middle class than hiring a lawyer for the same.
3. **24/7 Availability:** The chatbot is available around the clock, allowing users to get legal information and advice at any time, which is convenient for those with busy schedules.
4. **Anonymity and Privacy:** Users can ask questions and seek legal advice without revealing their identity, which can be important for sensitive or personal legal issues.
5. **Quick and Accurate Information:** The chatbot can provide immediate responses to legal queries based on a vast database of legal information, ensuring users get timely and accurate information.
6. **Educational Resource:** The chatbot can also play an educational role in inculcating the rights and responsibilities of citizens under Indian law. this can raise awareness and empower them to make informed decisions.
7. **Guidance and Support:** The chatbot can guide users through various legal processes, such as filing complaints or understanding legal procedures, making the legal system more navigable.
8. **Reduces Overload on the Legal System:** By providing preliminary legal advice and information, the chatbot can help reduce the burden on the legal system, allowing lawyers and courts to focus on more complex cases.
9. **Tailored Legal Advice:** The chatbot can offer advice tailored to specific legal issues faced by the middle class, such as property disputes, consumer rights, and cybercrimes.

Challenges

1. **Diverse Linguistic and Cultural Contexts:** The chatbot must accommodate various languages, dialects, and regional legal interpretations, which can complicate the design and negatively impact the accuracy of responses [14]. This spectrum of language poses the risk of misinterpretation or inadequate coverage of legal information for users from different linguistic backgrounds.
2. **Adaptation to Legislative Changes:** The chatbot's knowledge base must be continually updated to provide accurate responses that comply with the current legislative framework, such as the newly introduced Bhartiya Nyaya Sanghita (BNS).
3. **Handling Complex Legal Queries:** Despite advances in NLP and deep learning, handling complex and nuanced legal queries remains a significant challenge. Legal language often includes intricate terminology and specific contextual meanings that can be difficult for the chatbot to interpret and address effectively.

Future Plans

In the future, we aim to enhance our chatbot by incorporating advanced features that improve accessibility and societal impact. This includes integrating cutting-edge cryptocurrency technologies and protocols into our system.

Educational Section on Indian Legal System and IPC

We plan to implement an educational section within the chatbot to raise public awareness about the IPC and the Indian Legal System. This section aims to inform users of their rights and obligations under the law empowering them to make informed decisions. This will also include quizzes and challenges. These activities will be powered by Ocean Protocol which offers an innovative solution to host challenges with offering rewards for participation [15].

Integration with Decentralized Applications (DApps)

We plan to integrate the chatbot with iExec's decentralized platform, offering cryptocurrency rewards for engaging with educational content. This framework provides cryptocurrency-based incentive to the users to learn about legal matters. By leveraging iExec's monetization mechanisms, crypto rewards or NFT'S can be distributed securely and transparently, ultimately driving greater public engagement with legal education [16]. Alternative platforms like Sei can also be used which provide a scalable infrastructure which operates with unparalleled speed and efficiency. Additionally, its commitment to carbon neutrality helps addresses the energy intensive nature of blockchain platforms.

Matching Service for Legal Assistance

We plan also to implement a matching service wherein our system will directly engage and connect economically disadvantaged individuals with pro bono legal assistance from law firms, lawyers, and NGOs. This matching protocol

can be built with TARS AI capabilities which would generate this sophisticated algorithm to connect individuals to people with appropriate expertise [17].

Here are some of the notable NGOs and pro bono services which align with our aim:

1. Justice Alive Foundation (JAF)
2. Global Law Foundation
3. Human Rights Law Network
4. Socio Legal Information Centre (SLIC)
5. ProBono India
6. Nyaya Bandhu

This feature strives to eradicate the problem of accessibility and remove the wall between these communities and the legal system. These pre-bono services and NGOs are already working at grassroots levels to remove the wall between these communities and the legal system. Our system complements their efforts by providing scalable and accessible technology that helps them fulfil their commitments, offering a valuable tool to enhance their capacity to deliver legal assistance more effectively and reach a broader audience.

Continuous Improvement and Expansion

To better equip our chatbot with the changing times, its capabilities should be expanded too. This includes updating educational content, refining matching algorithms, and adding multilingual support to cater to India's diverse population, ensuring broader accessibility and effectiveness.

VII. CONCLUSION

The integration of chatbots with deep learning technologies presents a promising solution to improve access to legal information in India. This chatbot has the potential to revolutionize legal aid by incorporating future features like educational modules and cryptocurrency-based incentives. Future work will focus on improving the chatbot's accuracy and reliability as well as integrating it with the newly introduced Bhartiya Nyaya Sanghita (BNS) and adding multilingual support.

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