Ceylon LawMate: Designing an AI -Powered Assistant for Sri Lanka's Justice System

Abstract — **The justice framework is a fundamental aspect of any society. In Sri Lanka, the justice framework faces various impediments that ruin its adequacy, counting a long excess of cases, long court procedures, and constraints on the general public to access legal data. As a result, there's an expanding interest in the utilization of artificial intelligence (AI) to improve the effectiveness and adequacy of the justice framework. The objective of this research paper is to present Ceylon LawMate, an AI-powered framework outlined specifically for Sri Lanka's justice framework. This solution is planned to supply lawful data to the common open, help legal counselors in lawful inquiries, and offer assistance to judges in decision-making. The design and improvement of this research were challenging due to the special aspects of Sri Lanka's legal framework and the constrained accessibility to data. However, there are still noteworthy impediments to overcome, such as issues related to information quality and the lack of accessibility to information. The proposed solution provides to a fundamental step towards progressing the effectiveness and adequacy of Sri Lanka's justice framework.**

Keywords — *Legal Tech, AI for justice, Sri Lanka, Legal Assistant, AI in legal system*

I. INTRODUCTION

A. Background

Sri Lanka's Civil and common law has advanced through centuries of colonial impact and local practices. While it boasts a rich history, the modern justice framework in Sri Lanka faces critical challenges. These challenges include a need for access to legal resources, restricted public understanding of legal processes, and systemic inefficiencies that contribute to an accumulation of cases. Thus, attorneys, judges, and the general public are often burdened by the complexities of the legal framework.

Sri Lanka's legal framework is characterized by a differing set of laws, impacted by Roman-Dutch civil law, English common law, and traditional Sri Lankan customary law. This system also faces issues such as long court procedures, a deficiency of skilled legal experts, and a need for modernization in the form of digital innovation. As a result, the framework battles to supply convenient and equitable access to justice for all citizens, which undermines public trust within the country's legal institutions.

The research aims to address the need for a more effective and accessible legal framework in Sri Lanka by designing an AI-powered collaborator custom-made to the special complexities of the country's justice framework. This AI-driven solution, called Ceylon LawMate, will back legal professionals, judges, and the public in overcoming the challenges they right now confront in the legal framework.

The objectives of the research are as follows:

To analyze the specific challenges confronted by legal counselors, judges, and the general public inside the Sri Lankan legal framework.

To distinguish the fundamental components of an AI-powered legal assistant tailored to the needs of the Sri Lankan justice framework.

To plan and create the solution, consolidating AI and machine learning innovations to help users in exploring the complexities of the legal framework.

To assess the adequacy of the solution in improving access to lawful assets and support services, as well as streamlining the legal process.

The research will make significant contributions to the field of legal technology by planning an AI-powered assistant, particularly for the Sri Lankan legitimate framework. By leveraging cutting-edge AI and machine learning procedures, Ceylon LawMate will encourage simpler access to legitimate resources, give support to legitimate practitioners, and improve public understanding of the law.

Three major factors have been identified as impeding the effective administration of justice in Sri Lanka using data from polls of attorneys, judges, and members of the general public.

1. The struggle by Legal professionals with time-consuming research due to paper-based resources and extensive reference requirements.
2. Time constraints that arise from lengthy case records and numerous superficial cases.
3. Gap in legal knowledge that is experienced by the Sri Lankan citizens.

II. LITRATURE REVIEW

We have identified three key variables in our thorough analysis that prevent the swift and effective administration of justice within the Sri Lankan judicial system. The suggested solutions for each of the variables are listed below.

1. An AI-powered Legal Q&A System
2. An Intelligent Case Summarizing Tool
3. An Intelligent Mobile Solution for Interacting with Citizens.

Recent studies have looked at the potential of Q&A systems in a variety of sectors, using machine learning and natural language processing techniques to improve accuracy and effectiveness. Despite this, little research, especially in Sri Lanka, has focused on their application within the legal sector.

In fields like healthcare, finance, and customer support, Q&A systems have shown promise in enhancing decision-making accuracy, effectiveness, and client satisfaction. Studies that focused on the legal industry, mainly in the US and Europe, have also investigated Q&A systems, showing their potential to speed up legal decision-making and encourage accountability and openness. Despite the need for modernization and reform, study on Q&A systems in the Sri Lankan legal sector is still limited.

Evidence suggests that Q&A systems can increase decision-making accuracy and aid legal professionals in keeping up with the most recent developments and trends,

and this possibility has also been studied in relation to how to better legal systems. Additionally, Q&A systems have been used in legal study to give access to pertinent data and encourage well-informed choices.

Text summarization has grown over time to include sophisticated online tools. These web-based tools make use of cutting-edge technologies, like Scholarcy, which processes uploaded or pasted material using NLP. Another website called Summry allows users to obtain summaries of articles that have been condensed to no more than 16 pages. AI and NLP technologies are also used by Resoomer, an AI-driven summarization tool, and Quillbot AI, which offers customizable summary lengths and plagiarism-free summaries. A novel tool called Chat GPT creates accurate, human-like summaries without plagiarizing by utilizing AI, RNN, DNN, and CNN.

Legal Mind is the only currently accessible online tool created especially for a South Asian Court System, and legal text summarization has become a study focus. This AI-based, paid tool offers case filtering, graphical depictions of case timelines, citations, and views, as well as keyword search capabilities. The platform's Deeplex feature also summarizes and recommends related court cases and legal papers.

A technique for identifying important concepts in judgments was described in a Canadian university study that looked into summarizing legal document. To produce a logical, readable table-style summary, this method examines the document's design and thematic structures. This approach is demonstrated by the LetSum system, which recognizes thematic frameworks and argumentative roles, extracts pertinent sentences, and generates a summary that is within the abstract size limit. LetSum, a Java and Perl program, uses part-of-speech tagging and semantic grammars carried out by a GATE transducer to handle English legal judgments.

A graph-based algorithm was used by a study team from the University of Alberta to create a novel extractive summarization method for court decisions. The process creates directed and disconnected graphs that reflect subject-related sentence clusters. The suggested node/edge-weighting scheme eliminates the need for expensive linguistic features or resources, and the algorithm chooses coherent and representative sentences without setting a preset compression rate. In comparison to earlier clustering- and machine-learning-based methods, such as TF*IDF and centroid-based sentence selection, experimental findings show improved performance.

The following is an evaluation the current applications and technologies that offer similar services. This includes analyzing their features, user interface, content, and accessibility, among other factors. By understanding the strengths and weaknesses of these existing applications, we can draw valuable insights that will guide us in designing a more refined and efficient solution.

a. *Mobile app to provide a reliable legal advisory service for the clients in Sri Lanka*:
   The goal of this study is to create a mobile application that offers Sri Lankan customers trustworthy legal advice. The Android OS, IONIC platform, PHP, TypeScript, and MySQL technologies were used to create the program.

b. *Artificial intelligence and machine learning-based legal application: the state-of-the-art and future research trends:*
   An overview of applications of artificial intelligence and machine learning in the legal field is given in this article. It discusses upcoming study trends and examines the most cutting-edge legal technologies currently available.

c. *A broad view of automation in legal prediction technology:*
   This study provides a thorough analysis of machine learning algorithms in legal prediction technology. The research explores the potential uses of machine learning in legal prediction as well as its potential advantages.

d. *Legal decision support systems in Cuba:*
   This study investigates legal decision-support systems in Cuba with an emphasis on technologies like artificial intelligence, soft computing, big data, and open data. The study looks at how these mechanisms are currently functioning in Cuba and how they might be developed to strengthen the legal system.

e. *Text and data mining techniques in judgment open data analysis for administrative practice control:*
   In this study, text and data mining methods are applied to the analysis of judgment open data for administrative practice control. The study's objective is to find trends and ideas that can help judges make better decisions.

III. METHODOLOGY

This research project is primarily focused on a target audience that encompasses individuals involved in Sri Lanka's justice system, such as legal professionals, law enforcement officers, and policymakers. "Ceylon LawMate" is an AI-powered assistant designed and developed to support the Sri Lankan justice system by providing efficient and accessible legal assistance for a wide range of users.

A. System Overview Diagram

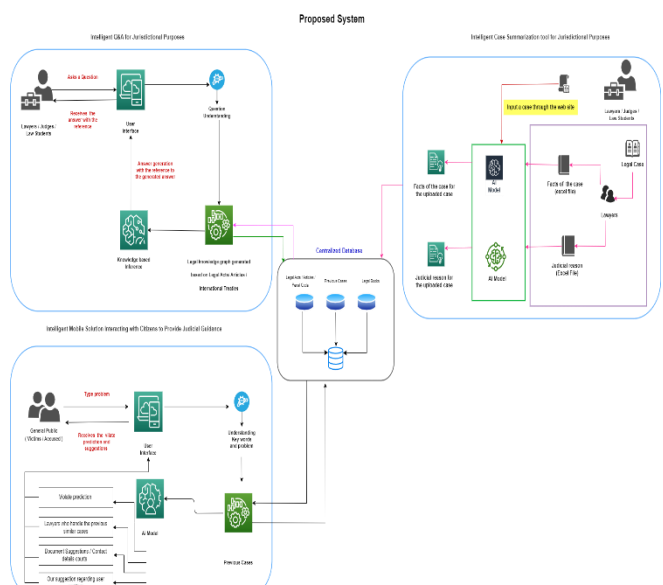The development of the final prototype of "Cyelon LawMate " involves various phases.

Fig. 1. System Overview Diagram

B. Implementation

1. Implementation details of the AI-powered Legal Q and A System.

The legal Q and A system for lawyers and judges has a modular architecture consisting of five main modules, namely, input processing, question understanding, knowledge graph management, inference, and output generation.

a. *Input Processing*: The input processing module is responsible for receiving the legal query in natural language from the user, pre-processing the query, and tokenizing the input text into its constituent elements. This module may use techniques such as Named Entity Recognition (NER) to extract the named entities from the input text.

b. *Question Understanding*: The question understanding module receives the tokens representing the input query and identifies the key information in the question according to the named entities.

c. *Knowledge Graph Management*: The knowledge graph management module is responsible for managing the legal knowledge graph, which is a graph-based representation of legal knowledge extracted from legal documents.

d. *Inference*: The inference module receives the structured representation of the input query and uses an inference method based on weighted path ranking on the knowledge graph to score the related entities according to the key information and intention of a given question.

e. *Output Generation*: The output generation module constructs the answer based on the inferred candidate entities and the references used to create the answer.

2. Implementation details of the Intelligent Legal Case Summarizing Tool.

Case summarization is done in four major steps. The first step is text preprocessing and tokenizing. In this stage, contents of the case are split into smallest units which named as tokens, and the paragraphs of the case are decomposed into sentences and then sentences into words. Most of the words of the cases are generated from one word by adding prefixes or suffixes and it can add redundancy within the data set and also it can give a negative impact for the output. Therefore, it

is a must to convert those words into the root form of them and this process is known as normalization.

The second step of data preprocessing is removing stop words to give a better focus on prime words. Data tokenizing, normalizing, and removing stop words are done by using Python NLTK library.

The third step is identifying topics and the sub parts. It is done by unsupervised topic modeling AI model by identifying the frequencies of the words in case document, and it is done at the document level. To create those two summaries, used two different AI models.

The final step is removing citations and references of the case and extracted the citations by using PyPDF2. And the two summaries are generated according to data that was processed.

3. Implementation details of the Intelligent Mobile Solution for Interacting with Citizens

This public support system identifies their issues, provide a pre guidance before going to a lawyer and identifies the best lawyers for similar cases, and connects with them. This also works as a legal advice system for the public to get help in Fundamental law-related cases. We implement react native mobile application and machine learning algorithms to predict the most relevant answers like whether they are violated or not and if they are violated. What is the law they violated and simplified laws for their issues, and the most suitable lawyers who have handled similar cases earlier to handle the case by analyzing the data that has been provided.

The system will identify the issue by analyzing data that input by the users. Steps of the Public Support System (Mobile Application). people can input their problems into the system., They can use keywords, and sentences to input the problem. After The system will identify the problem from that or if cannot, will ask for more information from the user. and the system will analyze the penal code, earlier cases, and judgments in the database of the system and predict the relevant support. What will be the solution for this issue/Problem? Predict violated or not, Lawyers who have handled similar cases, if a violated document should be brought to court and contact detail of courts.

IV. RESULTS AND DISCUSSIONS

"Ceylon LawMate" serves as a comprehensive aid for individuals seeking legal assistance. Developed through a combination of supervised and unsupervised learning methodologies, this tool's underlying architecture is designed to enhance user experience. Below are some notable outcomes that demonstrate its effectiveness.
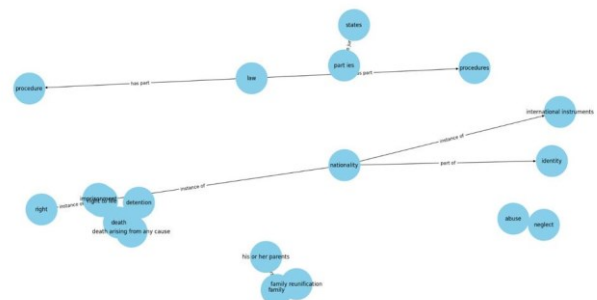
Fig. 2.   NER Diagram of the Q and Q Model

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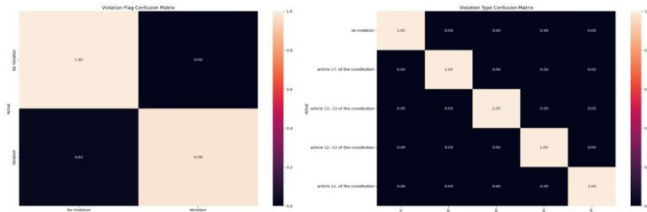
Fig. 3.   Words Dictionary of the Mobile App

Fig. 4.   Confution Matrix of the Summerization Model

Fig. 5. User Interface of the Web Application

V.   CONCLUTION AND FUTURE WORKS

Ceylon LawMate research project has demonstrated the potential of artificial intelligence in revolutionizing Sri Lanka's justice system. By combining advanced AI algorithms with a comprehensive understanding of the local legal landscape, Ceylon LawMate has been designed to enhance efficiency, accessibility, and fairness within the judicial process. The successful deployment of this AI-powered assistant not only holds the potential to expedite case resolution and reduce the burden on legal professionals, but also to empower individuals by providing easier access to legal information and resources.

This system can be improved in various ways, including expanding the range of legal cases, employing new summarization methods, and utilizing advanced language models to create a superior user experience. As individuals are accustomed to traditional techniques, this offers an entirely new approach. By providing a more user-friendly experience, the current solution can be refined to ensure user comfort. Globally, people have begun to recognize the gradual technological shift in legal assistance over the past decade. In summary, "Ceylon LawMate" has met these evolving needs

by offering a comprehensive solution for managing legal cases worldwide.

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