Virtual Courtroom

Project Presentation

Project Guide
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Contents

Problem Definition

The current legal system faces several challenges, including case posting,lack of automation causing procedural delays,document review delays.

Purpose and need

The purpose of this project is to create a virtual courtroom platform to automate various aspects of the legal process, improving efficiency and the overall quality of court proceedings.

Key Needs Addressed by the Virtual Courtroom:

1. Faster Legal Proceedings
2. Efficient Cross-Examination
3. Reducing Human Error
4. Cost and Resource Efficiency

Objective

The objective of this project is to create a Virtual Courtroom Platform that automates and streamlines legal proceedings using AI and machine learning. The main goals are:

1. Automate Document Processing: Use NLP to analyze petitions.
2. Speech-to-Text: Convert statements to text using pre-trained models.
3. Automate Cross-Examination: Facilitate structured argument presentation
4. Generate Draft Verdicts: Automate decision-making based on speech to text.

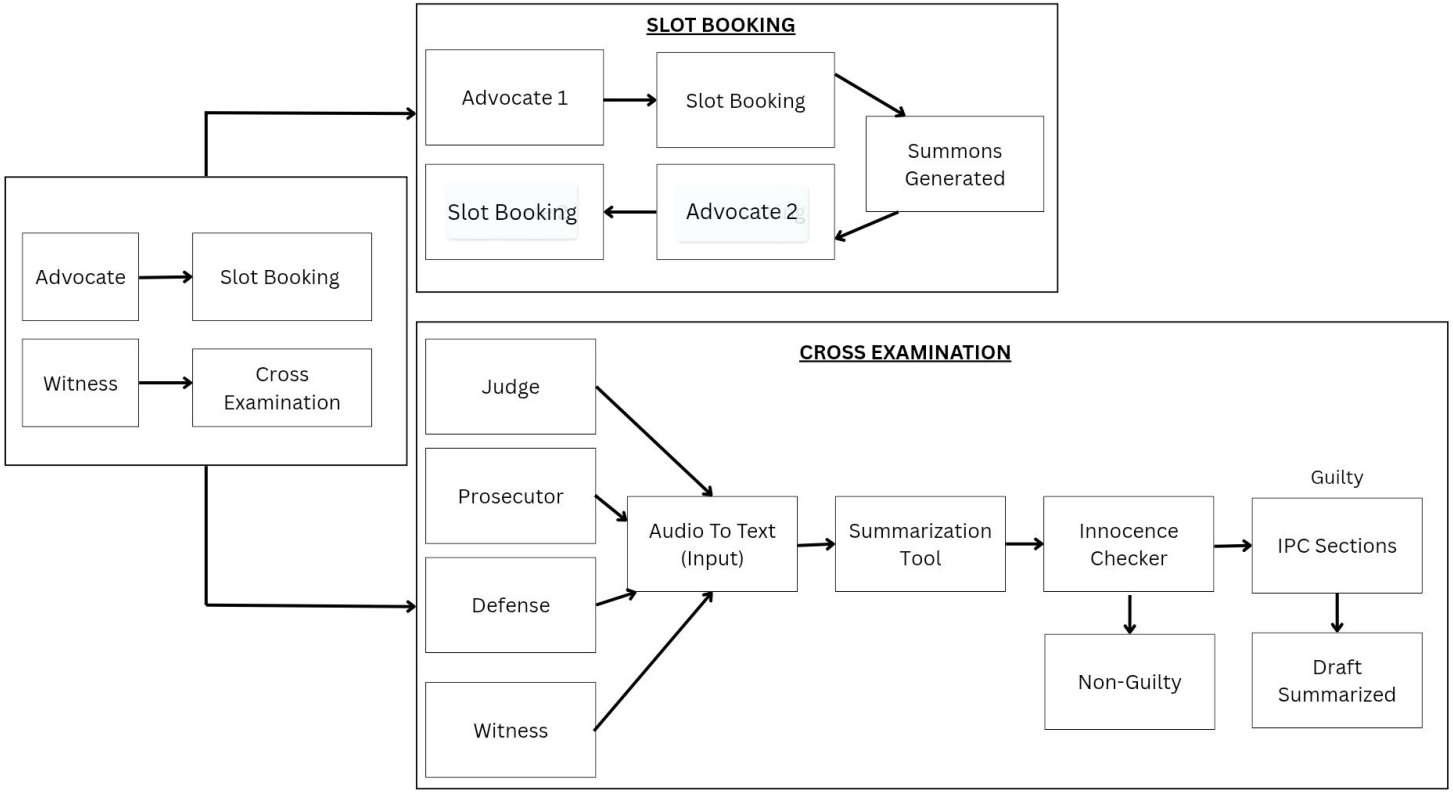
Literature Survey

Paper	Advantage	Disadvantage	Usage
S. Li, H. Zhang, L. Ye, X. Guo and B. Fang, "MANN: A Multichannel Attentive Neural Network for Legal Judgment Prediction",2019	Has multiple input channels.	Cannot handle cases where there is more than one defendant	Verdict Generation
C. He, T. -P. Tan, X. Zhang and S. Xue, "Knowledge-Enriched Multi-Cross Attention Network for Legal Judgment Prediction",2023	Incorporates charge knowledge and fact sheet to as input.	Relies heavily on quality and quantity of legal data to construct legal charge knowledge.	Verdict Generation

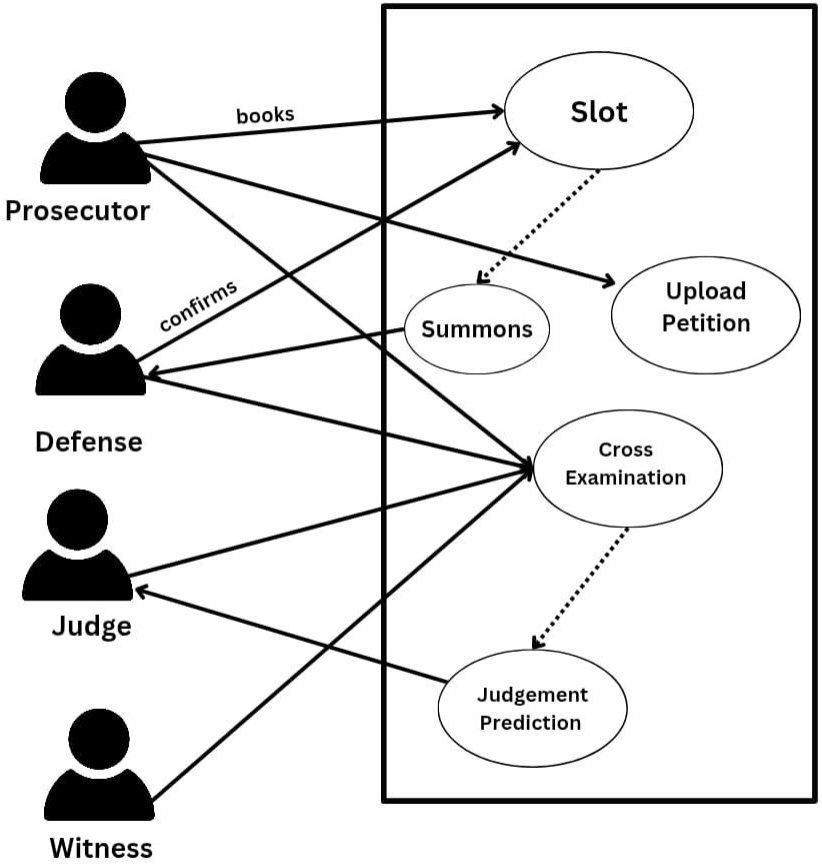
Literature Survey

Paper	Advantage	Disadvantage	Usage
É. Labbé, T. Pellegrini and J. Pinquier, "CoNeTTE: An Efficient Audio Captioning System Leveraging Multiple Datasets With Task Embedding",2023	Improves the cross-dataset performance	Requires careful balancing of the training data.	Audio to Text phase

Architecture Diagram



Use Case Diagram



Methodology

1. Slot Booking Phase

- **Database Management**:
  - Use PostgreSQL to store information regarding available slots, user credentials, and case details.
- **Backend Development**:
  - Implement a Flask backend that handles API requests related to slot bookings.
  - The prosecution will book a slot, which is then stored in the SQL database.
  - Notify the advocate through the defendant with a unique reference ID and passkey for login.

Methodology

2. Initial Input Phase

- **Document Scanning**:
  - Utilize **PaddleOCR** to scan and extract text from court petition.

3. Cross-Examination Phase

- **Audio Transcription**:
  - Employ **Whisper along with PyAnnote for speaker diarization** for conversion of spoken testimony into text.
  - The output will be accurate transcriptions of the proceedings, which will be stored for analysis.

Methodology

- **Text Analysis**:
  - Implement a T5 model to summarize the transcript.
  - The summary is then passed on for further analysis.

4. Judgment Drafting Phase

- **Innocence Checker**:
  - The summary is passed on to classify the accused as guilty or not guilty.
  - If proven guilty, the IPC (Indian Penal Code) sections related to the crime is shown.
  - A verdict is drafted based on the basis of innocence.

Methodology

5. Final Verdict Generation Phase

- **Output Presentation**:
  - The drafted verdict will be formatted and presented to the judge through the Flutter frontend.
  - This phase ensures that the final decision is accessible for review and approval, maintaining transparency and clarity in the legal process.

Modules

1.Slot Booking

2.Petition

3.Cross Examination

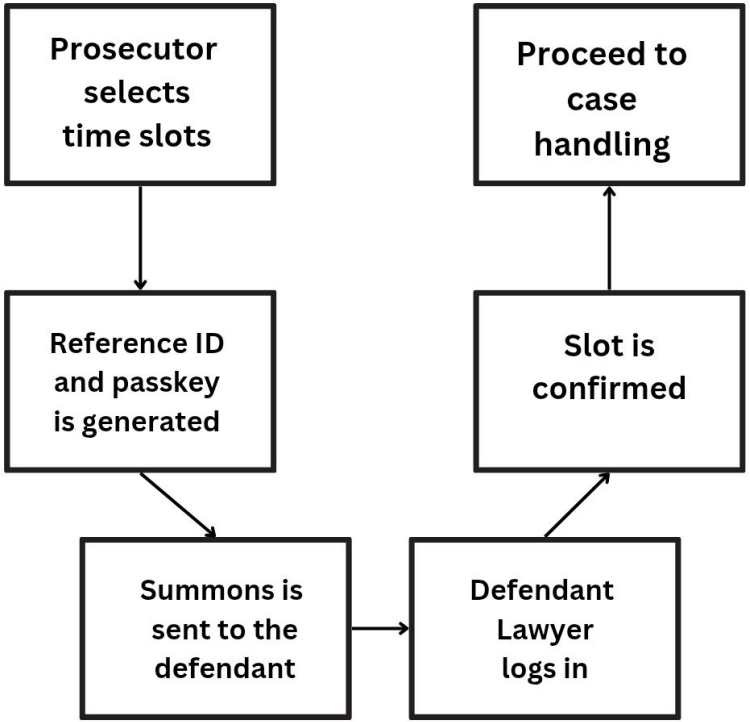
4.Legal Judgement Prediction

Slot Booking

The Slot Booking Module is a crucial part of the virtual courtroom platform, allowing advocates to schedule case proceedings efficiently.The steps involved are:

1. The prosecutor logs in to the platform and enters the case details and the defendant’s mail ID.
2. A reference ID and password is generated.
3. The prosecutor selects multiple time slots for a day.
4. An email is containing the credentials are sent to the defendant.
5. The defendant logs into the platform using the credentials and selects a slot.
6. A confirmation mail with the slot for case hearing is sent to the prosecutor.

Slot Booking-Block Diagram

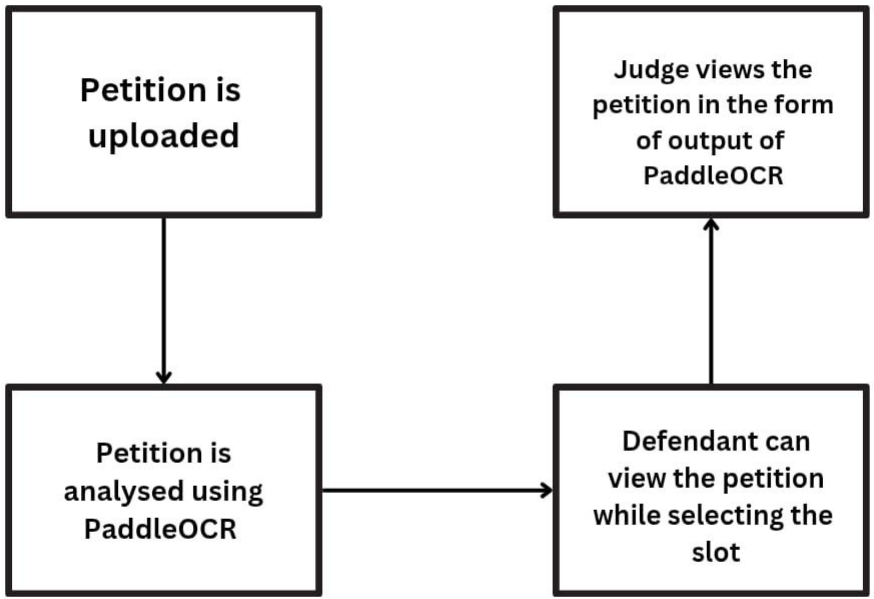


Petition

Petition acts as the first input. The steps involved in the petition module are:

1. The petition is uploaded by the prosecutor while booking the slot.
2. The petition is analysed using PaddleOCR.
3. The defendant gets to view the petition when they select a slot.
4. The judge gets to view the petition in the form of a text file (output of PaddleOCR) as they log in.

Petition-Block Diagram

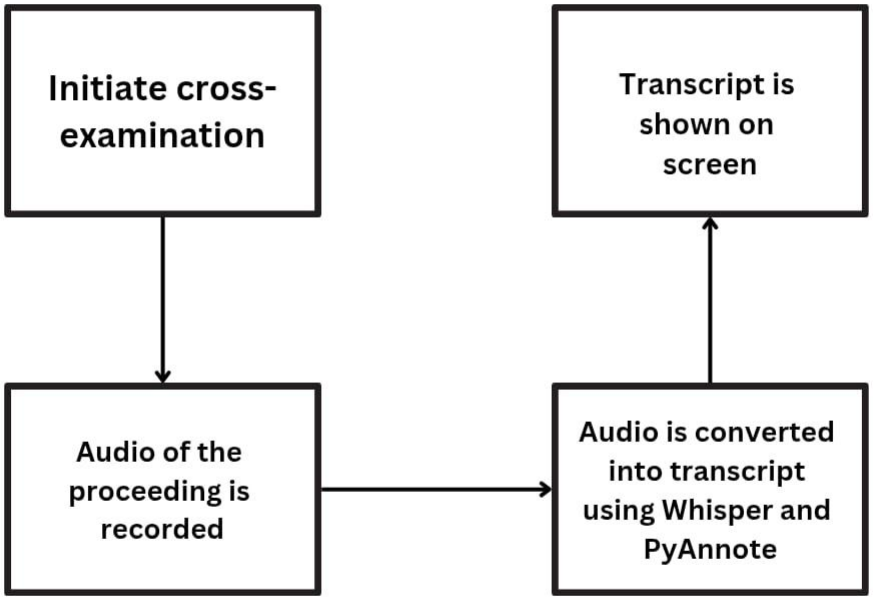


Cross Examination

Cross examination module is the equivalent of court hearing.The steps involved are as follows:

1. The judge logs in to the platform. Cross examination takes place in his account.
2. They are redirected to a page where they start the cross examination. They start speaking and the audio is recorded.
3. The recorded audio is analysed using Whisper and PyAnnote to identify the voices and create the transcript accordingly.
4. The transcript is shown on the screen.

Cross Examination-Block Diagram

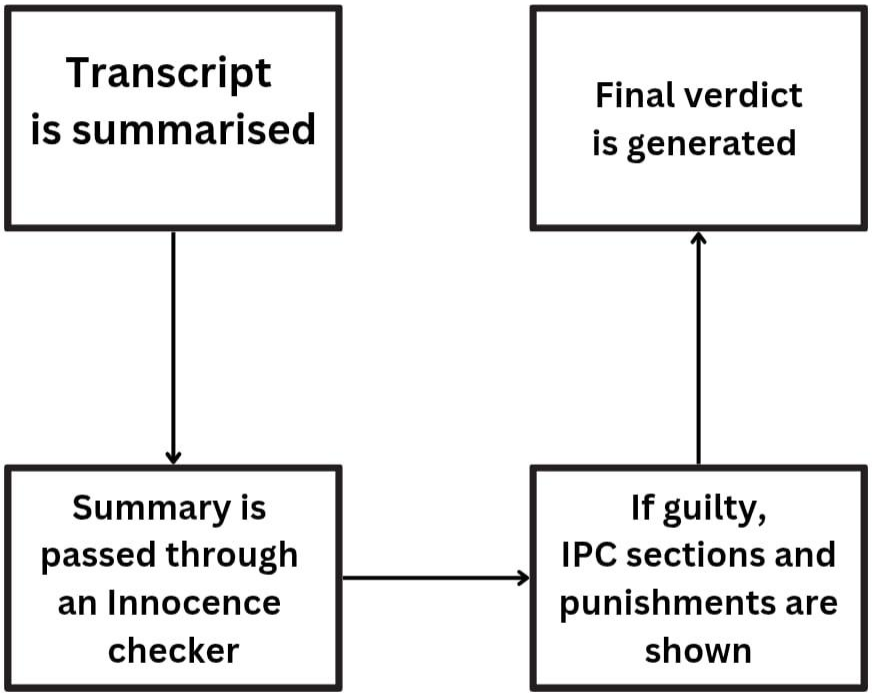


Legal Judgement Prediction

This is the final module of the project which handles the verdict generation. The steps in this module are as follows:

1. The transcript is summarised using a T5 model.
2. The summary is passed onto a binary classification model to check whether the accused is guilty or not.
3. If proven guilty, the IPC sections, punishments and case details are shown.
4. A final verdict is generated regardless of the innocence checker output (binary classification model).

Legal Judgement Prediction - Block Diagram



Assumptions

- The system will have distinct user roles: defendant's lawyer, prosecutor and witnesses, each with different permissions and access rights.
- The uploaded documents will be in standard formats such as PDF or DOCX.
- Cross examination will take place in audio mode will be interpreted precisely given a noiseless environment.
- Model only understands English language.
- All participants are present in the same location.
- The ML model will predict legal charges and law articles based on the provided document and cross examination. It assumes the data input is comprehensive and relevant.
- Judge is available at the booked slots.

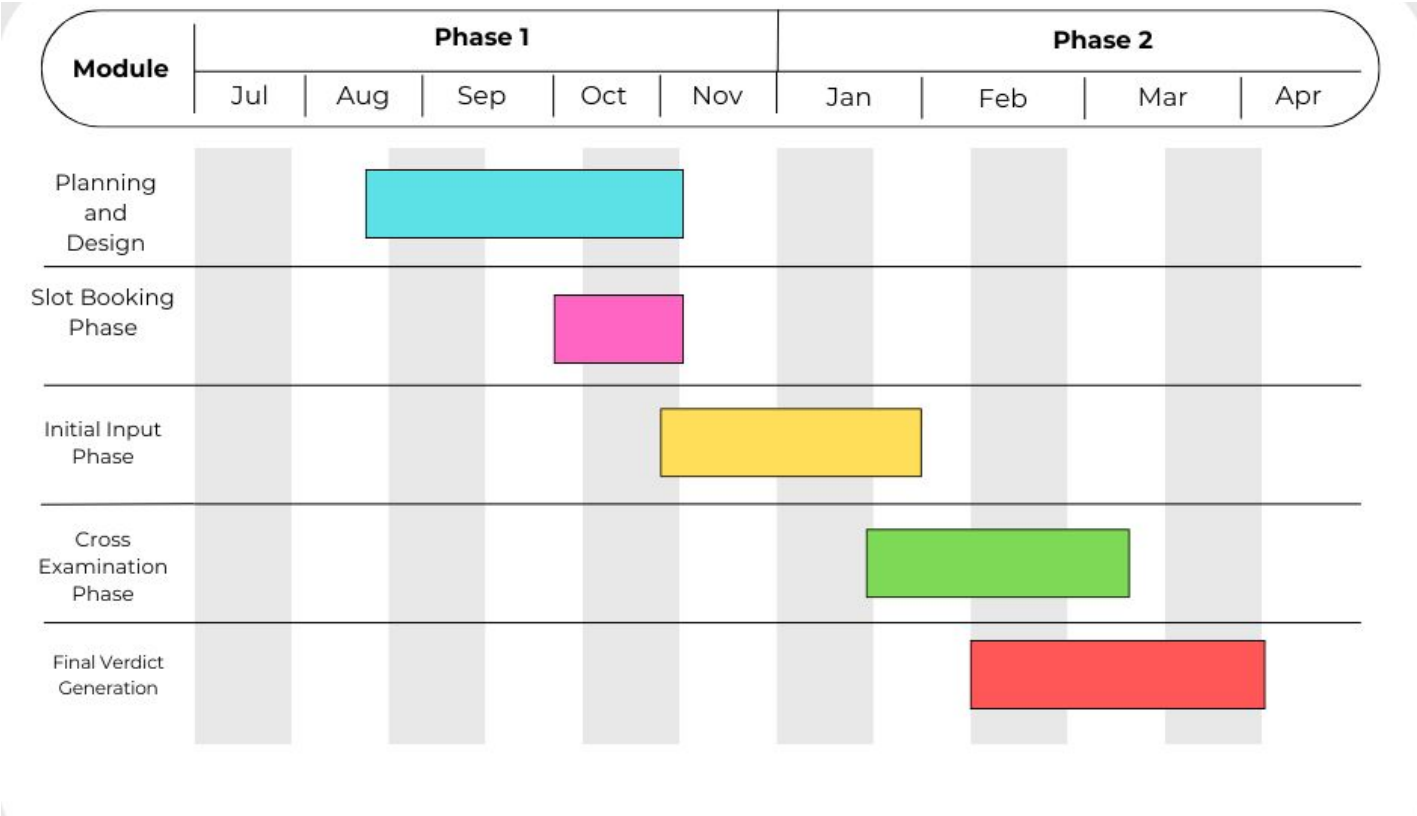
Work Breakdown and Responsibilities

1. Nanditha Jinesh Slot Booking/Petition Module/Judgement Prediction	***2. Riya Salim*** Slot Booking/Cross Examination/Judgement Prediction
3. Nayan A Menon Slot booking/Petition Module/Judgement Prediction	***4. Rohan Chandy Mathews*** Slot Booking/Cross Examination /Petition Module

Requirements

Software	Hardware
FrontEnd: Flutter **Backend:**Flask **Database**: PostgreSQL **NLP Models**:PaddleOCR, SBERT,T5,Whisper **Developing Environment** : VSC, Google Colab	● 16GB RAM minimum ● GPU - NVIDIA GTX 1660 or higher ● Windows 11

Gantt Chart


Module
Phase 1
Phase 2
Jul
Aug
Sep
Oct
Nov
Jan
Feb
Mar
Apr
Planning and Design
Slot Booking Phase
Initial Input Phase
Cross Examination Phase
Final Verdict Generation

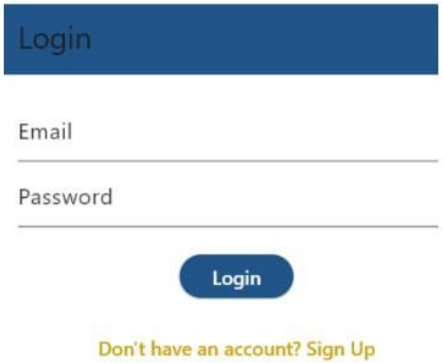
Risk and Challenges

Risks

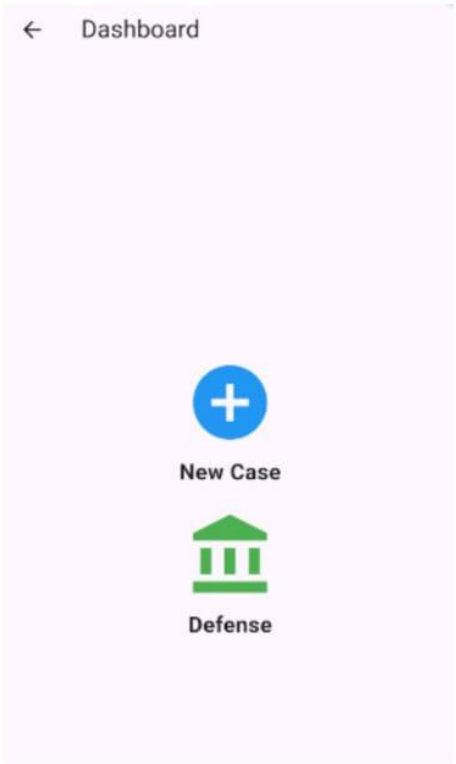
- Misjudgment by AI can be caused due to limitation in training data or complex cases.
- Poor audio quality during cross-examination can lead to errors in speech recognition.

- **Challenges**
- Network connectivity issues can lead to inefficient processing.

Results



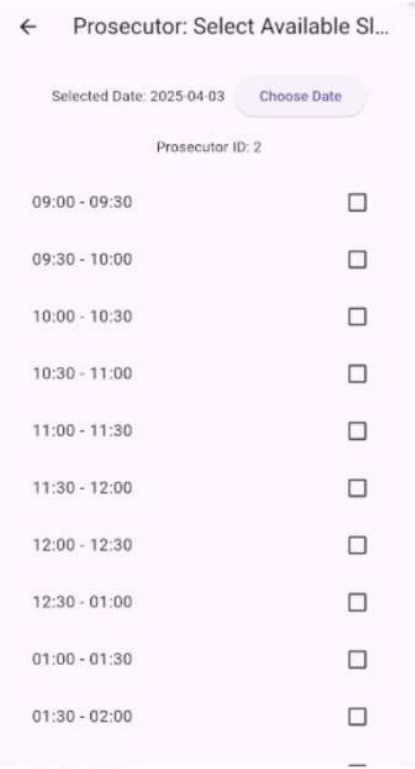
1. Login Page



2.Prosecution/ Defense

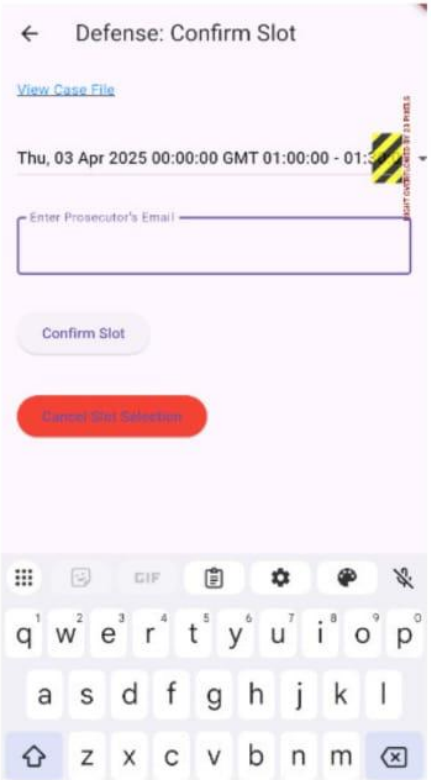
3.Creating New Case

Results



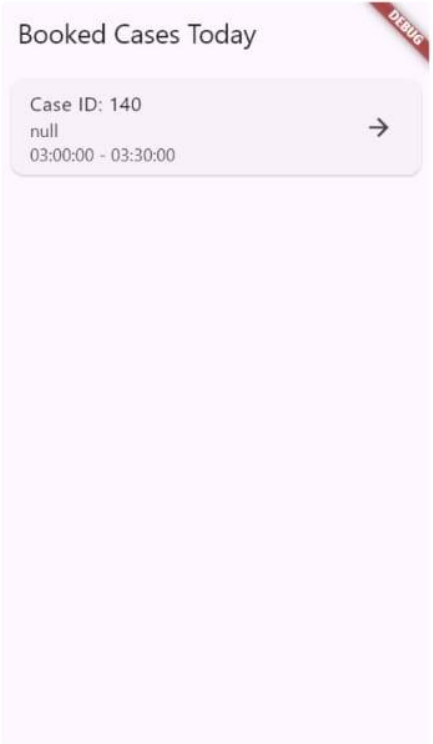
4.Prosecution Slot Booking

5.Defense UI

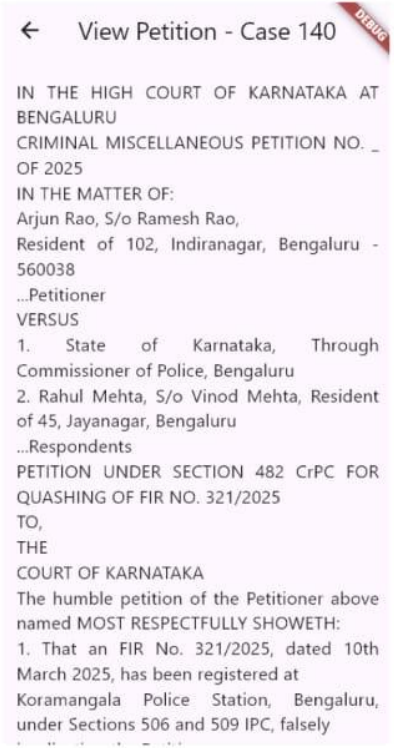


6.Defense views petition and confirms slot

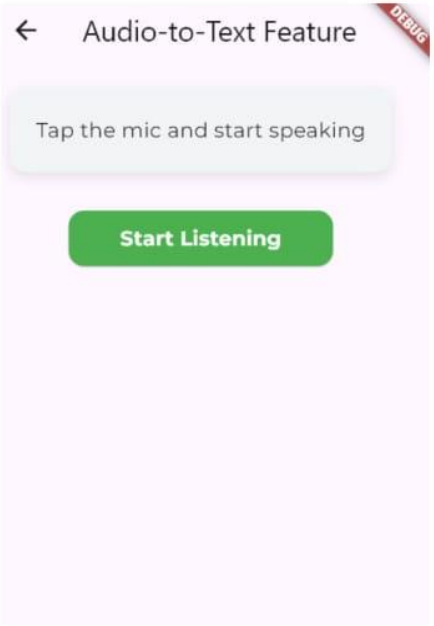
Results



7.Judge views cases for the day

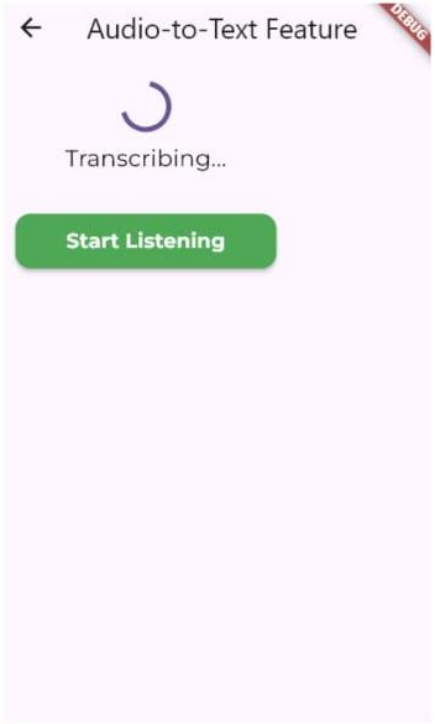


8.Judge views petition

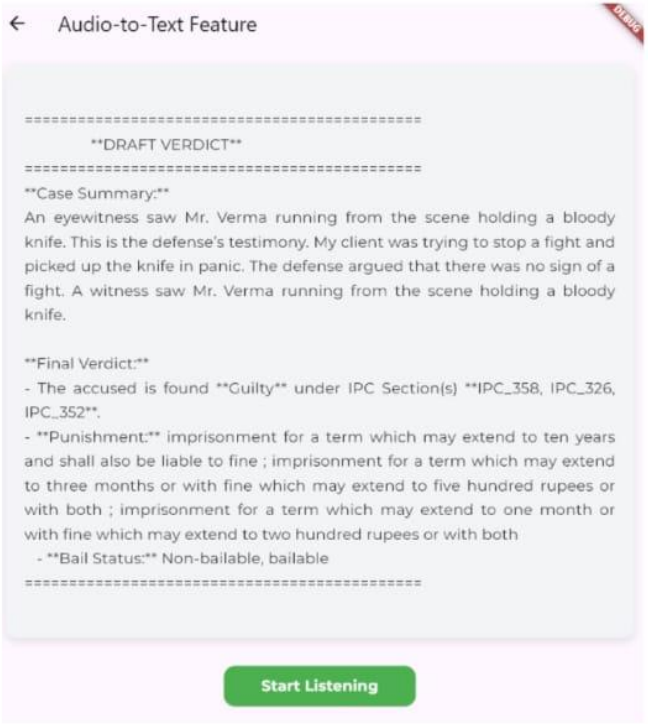


9.Cross Examination starts

Results



10. Generating Transcript



11. Draft Verdict Generated

Future Scope

- **Ensure credibility of inputs**:Since the platform relies on the inputs without checking their authenticity, it can cause lead to inability to predict fair justice.
- **Expanding to other classifications of cases:** Focusing solely on criminal cases restricts the system's versatility, as it won't be applicable to other types of legal disputes, reducing its broader impact on the judicial system.

Conclusion

The Virtual Courtroom Project aims to automate legal proceedings by leveraging advanced technologies to enhance efficiency. By integrating machine learning models and a user-friendly interface, the system facilitates streamlined interactions among advocates, defendants, and witnesses, ultimately contributing to a more effective and transparent justice system.

Reference

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Thank You