

Intelligent FIR Filing System: AI-Powered Automation

ANIKET CHAUDHARI¹, OM DESHMUKH², ASHWINI BHIDE³, BHAVESH AMBORKAR⁴,
ASMITA KAMBLE⁵

^{1, 2, 3, 4, 5} *Sinhgad Institute of Technology and Science, Narhe, Pune, Savitribai Phule Pune University, Pune*

Abstract- In today's rapidly changing legal landscape, there is a critical need to modernize law enforcement processes, especially in the context of filing First Information Reports (FIRs). Traditional FIR filing methods often struggle to cope with the complexities of modern criminal investigations, requiring law enforcement agencies to navigate intricate legal frameworks and manage extensive documentation. To overcome these challenges, there has been a significant shift towards adopting advanced technological solutions to streamline FIR filing processes. This shift recognizes technology's potential to enhance law enforcement capabilities, improve operational efficiency, and facilitate more effective administration of justice. Technologies such as Natural Language Processing (NLP), Automatic Speech Recognition (ASR), Machine Learning (ML), Deep Learning (DL), and Convolutional Neural Networks (CNN) are being utilized to transform audio recordings into actionable FIR documents.

I. INTRODUCTION

The process of filing First Information Reports (FIRs) in India is often inconvenient and time-consuming, leading to delays in justice. To address this issue, we propose an innovative AI-based FIR filing system. Our system allows users to submit audio recordings of incidents, which are then converted into text using advanced speech recognition technology. The text is then analyzed and matched with relevant sections of the Indian Penal Code (IPC) using natural language processing (NLP) techniques. This process not only simplifies the filing process but also ensures accuracy and efficiency in identifying the appropriate legal provisions.

Furthermore, our system aims to enhance accessibility by supporting audio inputs in various Indian

languages. By leveraging machine learning models, we can extract relevant legal clauses from the text, enabling users to quickly identify the sections under which their complaints fall. Additionally, the system generates a comprehensive report for FIR filing, streamlining the entire process and reducing the burden on law enforcement agencies. Through this system, we seek to revolutionize FIR filing, making it more accessible, efficient, and user-friendly.

II. LITERATURE SURVEY

In recent years, researchers have made significant strides in various domains by leveraging advancements in natural language processing (NLP), data visualization, and machine learning. Here, we delve into key studies that highlight innovative approaches and their potential implications.

One groundbreaking development is Chat2VIS [3], a system that harnesses the power of large language models (LLMs) such as ChatGPT and GPT-3 to directly translate natural language queries into data visualizations. By employing well-engineered prompts, Chat2VIS not only

simplifies the NL2VIS process but also automates chart-type selection, all while prioritizing data privacy. However, while Chat2VIS offers streamlined NL2VIS and data privacy benefits, its effectiveness may be limited by the performance and biases of underlying language models, and it may require users to have some understanding of natural language processing concepts.

Transformer-based Neural Architecture Search (NAS) [6] methods have emerged as a promising avenue for automating the design process of neural networks, particularly with models like BERT and Vision Transformers. These techniques aim to yield efficient architectures surpassing manual designs, driving

progress in various NLP tasks. However, challenges persist, such as significant computational costs and complexities in implementation and understanding.

The introduction of a novel Transformer-based framework for Scene Text Recognition (STR) [7] represents a significant advancement in NLP. This framework demonstrates superior performance in recognizing scene text of varying complexities, addressing challenges associated with regular and irregular text formats. However, while this framework shows promise, its effectiveness may be limited by resource-intensive computational requirements and complexities in integrating with existing systems.

Researchers have also demonstrated the potential of social media data and pre-trained BERT models from Hugging Face [1] in predicting mental disorder symptoms with remarkable accuracy. By leveraging even small amounts of data like user bios, this approach opens avenues for early mental health screening and intervention. Yet, despite its potential benefits, this approach raises concerns regarding data privacy and ethical implications surrounding the use of personal data for mental health screening.

Government service consultations present a unique challenge in utilizing large language models effectively. To address this, researchers propose a domain-specific language model (GCALLM) [2] fine-tuned with knowledge from government websites, enhancing response accuracy and improving digital government consulting services. However, while GCALLM improves response accuracy, challenges may arise in terms of model generalization to diverse user queries and potential biases introduced during fine-tuning.

Preserving digital information over time is another significant challenge, tackled by a proposed solution involving a simple abstract machine, technology-neutral descriptions, and a C compiler, ensuring interpretation and retrieval of complex digital formats even after prolonged periods [9]. However, while this solution promises long-term preservation of digital information, challenges may arise in terms of adaptability to evolving technologies and formats, as well as resource-intensive implementation requirements.

The evolution of text representation in NLP [4], from rule-based to context-sensitive learned representations, showcases significant progress. While recent advancements have led to breakthroughs in downstream NLP tasks, challenges such as bias, interpretability, and privacy issues underscore the need for continued research.

Addressing location metonymy resolution in NLP [8], researchers propose innovative feature selection approaches achieving remarkable results without complex models or extensive resources, paving the way for more accurate and efficient text processing systems. However, while these approaches show promise, challenges may arise in terms of model scalability and generalization to diverse datasets and linguistic contexts.

In the realm of fairness in Automatic Speech Recognition (ASR) systems, a counterfactual fairness approach is introduced [10] to mitigate bias and ensure equitable outcomes across demographic groups, aiming for fairer and more reliable ASR systems. Yet, despite its potential benefits, challenges may arise in terms of defining appropriate fairness metrics and ensuring their consistent application across diverse ASR applications and user groups.

Finally, the introduction of a multi-teacher knowledge distillation (MT-KD) network for Tacotron2 Text-to-Speech (TTS) [5] models represent a significant advancement in addressing exposure bias, achieving improved naturalness, robustness, and expressiveness in TTS systems. However, while MT-KD shows promise in mitigating exposure bias, challenges may arise in terms of model scalability and generalization to diverse linguistic contexts and speaking styles.

These studies collectively underscore the interdisciplinary nature of NLP research and its profound impact across various domains. While promising more accessible, reliable, and equitable technologies in the future, addressing the associated challenges remains crucial for realizing their full potential.

III. PROPOSED SYSTEM

The online FIR filing system provides a convenient

platform for Special Police Officers (SPOs) to submit FIRs under relevant sections. Users can easily upload photo evidence to support their complaints. This system also includes a criminal database accessible to the police, ensuring quick access to records. To maintain confidentiality, only user complaints are forwarded to the nearest police station, with SPO information kept private. Utilizing concepts like cookies and IP addressing ensures accurate identification of location and authentication of the user. Furthermore, the system allows users to submit photo evidence, strengthening their case. Overall, this system is designed to be user-friendly and efficient for law enforcement.

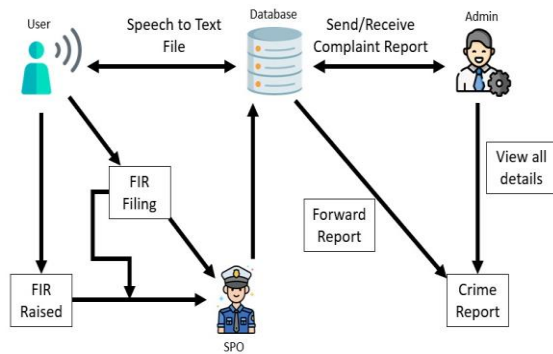


Fig. 3.1 System Architecture

Listed below are few modules which are implemented in system:

1. Authentication Module:

The authentication module plays a critical role in the system by ensuring secure access to the FIR filing system through user identity verification. Its contribution lies in safeguarding sensitive data and upholding system integrity. By granting access only to authorized users, it effectively prevents unauthorized access and potential misuse, thereby maintaining the confidentiality and security of the system.

2. Audio Module:

The audio module facilitates the recording and processing of audio inputs, enabling users to provide verbal descriptions or details of incidents. Its contribution lies in enhancing accessibility and convenience by allowing users to report incidents using spoken language. Additionally, the module ensures accurate transcription of audio inputs, serving

as a crucial input for subsequent processing by other modules in the system.

3. ML Model (Machine Learning Model):

The ML model, often based on models like BERT or GPT-3.5-turbo, serves as the backbone of the system by performing tasks such as language understanding, clause assignment, and text generation. Its role encompasses analyzing transcribed text, extracting pertinent information, assigning criminal law clauses, and generating FIR reports. This model significantly contributes to the core functionality of the system by enabling intelligent decision-making and automating various aspects of the FIR filing process.

The system is incorporated with two crucial models: the Language Understanding Model and the Text Generation Model. Here's how these models are utilized and contribute to their respective roles in the system:

I] Language Understanding Model:

BERT, specifically the bert-base-uncased variant, is instrumental in comprehending and analyzing transcribed text derived from audio inputs. Leveraging its contextual understanding capabilities, BERT accurately interprets nuances within reported incidents, extracting key details such as the nature of the crime, event descriptions, and relevant factors essential for FIR filing. Through fine-tuning, BERT further enhances its functionality by classifying and assigning appropriate criminal law clauses to the given case, drawing insights from annotated examples of FIRs and associated legal statutes.

II] Text Generation Model:

GPT-3.5-turbo serves as the cornerstone for generating coherent textual output, particularly for crafting FIR reports based on assigned criminal law clauses and pertinent details extracted from the transcribed text. Its advanced language generation capabilities ensure that FIR reports are structured, grammatically correct, and effectively communicate essential case details. Moreover, GPT-3.5-turbo adeptly handles varying lengths and complexities of input data, adapting its output generation to encapsulate the intricacies of reported incidents. Together, BERT and GPT-3.5-turbo synergistically drive the efficiency and accuracy of the FIR filing

system, facilitating streamlined processing of incidents and the creation of informative FIR reports.

4. Storage Module:

The storage module manages the storage and retrieval of various data types, such as transcribed audio inputs, processed text data, generated reports, and other pertinent information. Its primary responsibility lies in ensuring the efficient and reliable storage of data, which enables seamless access to historical records and facilitates scalability as the volume of data increases over time. Additionally, the module contributes significantly to maintaining data integrity and implementing backup mechanisms, thereby safeguarding against potential data loss scenarios. Overall, the storage module serves as a foundational component of our system, ensuring the accessibility, reliability, and integrity of essential data crucial for effective incident management and reporting.

5. Form Generation:

The form generation module creates structured forms or templates for collecting additional details related to reported incidents, as necessary. Its primary responsibility is to enhance the completeness and accuracy of incident reports by standardizing the collection of supplementary information. By providing users with structured forms to fill out, the module facilitates the capture of additional context or details that may not have been captured in the audio inputs alone, thereby aiding in the thorough documentation of incidents. Overall, the form generation module contributes significantly to ensuring comprehensive incident reporting and supports the system's goal of facilitating efficient and accurate documentation of reported incidents.

6. Database Module:

The database module serves as the backbone of our FIR filing system, managing the organization, retrieval, and manipulation of structured data encompassing FIR filings, user profiles, historical records, and system configurations. Its primary role is to provide efficient data storage, retrieval, and querying capabilities, ensuring seamless operation across different modules. By facilitating data integration and supporting various functionalities, the module contributes significantly to the system's overall efficiency and effectiveness. Overall, the

database module plays a pivotal role in enabling the smooth functioning of our FIR filing system by ensuring the accessibility, reliability, and integrity of essential data components crucial for incident management and reporting.

7. PDF Module:

The PDF module generates standardized and printable FIR reports based on processed data, including transcribed text, assigned law clauses, incident details, and any additional information. It plays a crucial role in the system by producing professional-looking documents suitable for distribution to relevant stakeholders, such as law enforcement agencies, legal authorities, and court proceedings. By ensuring the creation of official and professional reports, the PDF module contributes significantly to the system's effectiveness and facilitates seamless communication of critical information to pertinent parties.

8. History Module:

History maintains a comprehensive log of all FIR filings, revisions, and interactions within the system. Its primary role is to enable auditing and tracking of system activities, enhancing transparency, accountability, and traceability. By recording user actions, timestamps, and modifications to FIR reports, the module ensures compliance with regulatory requirements and assists in investigations or audits related to FIR filings. Overall, the history module contributes significantly to the system's effectiveness by providing a reliable mechanism for monitoring and documenting system activities, thereby fostering trust and confidence in the FIR filing process.

IV. ALGORITHMS

Our implementation paper focuses on two powerful machine learning algorithms for FIR Filing:

I] Language Understanding Model:

BERT, specifically the Bert-base-uncased variant, is instrumental in comprehending and analysing transcribed text derived from audio inputs. Leveraging its contextual understanding capabilities, BERT accurately interprets nuances within reported incidents, extracting key details such as the nature of the crime, event descriptions, and relevant factors essential for FIR filing. Through fine-tuning, BERT

further enhances its functionality by classifying and assigning appropriate criminal law clauses to the given case, drawing insights from annotated examples of FIRs and associated legal statutes.

II] Text Generation Model:

GPT-3.5-turbo serves as the cornerstone for generating coherent textual output, particularly for crafting FIR reports based on assigned criminal law clauses and pertinent details extracted from the transcribed text. Its advanced language generation capabilities ensure that FIR reports are structured, grammatically correct, and effectively communicate essential case details. Moreover, GPT-3.5-turbo adeptly handles varying lengths and complexities of input data, adapting its output generation to encapsulate the intricacies of reported incidents. Together, BERT and GPT-3.5-turbo synergistically drive the efficiency and accuracy of the FIR filing system, facilitating streamlined processing of incidents and the creation of informative FIR reports.

V. RESULTS

In the system, we ensured data accuracy through rigorous validation processes. Proper controls by higher authorities were implemented to maintain data integrity. By minimizing manual data entry, we achieved greater efficiency in our operations. The system's user-friendliness and interactive features enhanced overall service quality. Additionally, our system significantly reduced the time required for various processing tasks, contributing to its efficiency and effectiveness.

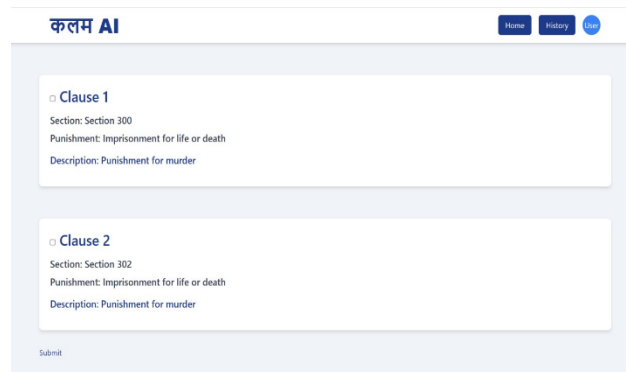


Fig.1 Clause generated for a case

CONCLUSION

Traditional methods of FIR Filing often lack efficiency and precision, leading to delayed interventions and suboptimal outcomes. We address these issues by introducing functionalities such as audio input compatible with all Indian languages, a machine learning model to extract the most appropriate legal clauses, and PDF generation. These enhancements aim to streamline the FIR filing process, ensuring faster and more accurate outcomes. Furthermore, our system integrates secure storage capabilities, safeguarding sensitive information while providing accessibility to authorized personnel. By leveraging cutting-edge technology, we empower law enforcement agencies with a comprehensive solution for swift and reliable FIR filing, ultimately enhancing public safety and justice.

FUTURE WORK

Promising extensions of the present study FIR documents can be made more secure using digital signatures. Evidence management can be improved by using images, and statistical analysis can help understand crime trends. Making it easier to store audio and images as evidence can also help improve case documentation. These changes aim to make law enforcement work better and faster.

REFERENCES

- [1] Alireza Pourkeyvan, Ramin Safa, and Ali Sorourkhah “*Harnessing the Power of Hugging Face Transformers for Predicting Mental Health Disorders in Social Networks*” 16 February 2024
- [2] Jiawei Han, Jiankang Lu, Ying Xu, Jin You, And Bingxin Wu “*Intelligent Practices of Large Language Models in Digital Government Services*” 4 January 2024
- [3] Paula Maddigan and Teo Susnjak “*Chat2VIS: Generating Data Visualizations via Natural Language Using ChatGPT, Codex and GPT-3 Large Language Models*” 8 May 2023.
- [4] Rajvardhan Patil, Sorio Boit, Venkat Gudivada, And Jagadeesh Nandigam “*A Survey of Text Representation and Embedding Techniques in NLP*” 11 April 2023

- [5] Rui Liu, Berrak Sisman, Guanglai Gao, and Haizhou Li “*Decoding Knowledge Transfer for Neural Text-to-Speech Training*” published in 2022
- [6] Krishna Teja Chitty-Venkata, Murali Emani, Venkatram Vishwanath and Arun K. Somani “*Neural Architecture Search for Transformers: A Survey*” 6 October 2022
- [7] Prabu Selvam¹, Joseph Abraham Sundar Koilraj¹, Carlos Andrés Tavera Romero, Meshal Alharbi, Abolfazl Mehbodniya, Julian L. Webber and Sudhakar Sengan “*A Transformer-Based Framework for Scene Text Recognition*” 16 September 2022
- [8] Muhammad Elyas Meguellati, Rohana Binti Mahmud, Sameem Binti Abdul Kareem, Assaad Oussama Zeghina, and Younes Saadi “*Feature Selection for Location Metonymy Using Augmented Bag-of-Words*” 1 August 2022
- [9] Ivar Rummelhoff, Eladio Gutiérrez, Thor Kristoffersen, Ole Liabø, Bjarte M. Østvold, Oscar Plata, and Sergio Romero “*An Abstract Machine Approach to Preserving Digital Information*” 16 November 2021
- [10] Leda Sar, Mark Hasegawa-Johnson and Chang D. Yoo “*Counterfactually Fair Automatic Speech Recognition*” published in 2021