

POLINOVA: eFIR System and Forensic Sketch Assistance

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Abstract

Digital governance introduces its most significant effect on law enforcement agencies because it creates the most basic transformation of public administration. The document introduces POLINOVA which serves as an AI-based system to improve First Information Report (FIR) registration and management processes throughout their entire lifecycle. The system consists of four essential parts which include an efficient E-FIR submission and monitoring system, a complete police case management dashboard, an interactive legal assistant chatbot, and an AI-based forensic sketch drawing tool. POLINOVA improves citizen-police relations through its intelligence sharing system and automated operational processes which enable faster investigation work and better data-driven decision-making processes. The platform achieves operational efficiency through its real-time communication system and automated process management system while the two systems work together to provide accountability and transparency. The system enables law enforcement agencies to enhance their digital capabilities while simultaneously improving their public service delivery.

Keywords: AI-based Forensic Sketching, Digital Policing, E-FIR, E-Governance, Legal Chatbot.

1. Introduction

The manual FIR process is too slow, lacks transparency, and often this limits it to a particular language or makes it inaccessible. The victims do not get information about their status in real time while the police spend too much effort in dealing with complaints, suspect sketching, and data. A digital, multilingual, AI-enabled system is needed to ensure that the citizens can file their FIRs faster, more transparently, and more user-friendly. A major challenge is how to integrate citizens' complaint filing with internal police case management on a unified digital platform. As a global trend, the shift to Digital Governance (e-Governance) is aimed at making public service delivery more accessible, transparent and efficient. Law enforcement, as a major public administration, is now evolving from traditionally manual paper-based systems to intelligent digital solutions. A compelling case for developing a unified integrated AI-enabled solution indeed arises from the intrinsic defects of the manual system and the rapidly increasing capabilities of current technology [1,2]. POLINOVA serves for

addressing various gaps like Enhancing Citizen-Centric Service, Improving Operational Efficiency and Unifying Core Functions networks. The organization will create a comprehensive solution which combines administrative tools with legal Chatbot support and advanced forensic Sketch Generator technology to improve complete case processing for developing "smarter" policing methods. The police operational platform provides complete digital capabilities which enable transparent and effective management through its design development and assessment process. POLINOVA functions as an online system which helps with FIR filing through improved communication between victims and police officers. The system enables users to register complaints in multiple languages while providing tools for real-time case monitoring and transparent case status updates and AI-powered forensic sketch creation [3,4]. The manual FIR process is too slow, lacks transparency, and often this limits it to a particular language or makes it inaccessible. The victims do not

get information about their status in real time while the police spend too much effort in dealing with complaints, suspect sketching, and data. A digital, multilingual, AI-enabled system is needed to ensure that the citizens can file their FIRs faster, more transparently, and more user-friendly. A major challenge is how to integrate citizens' complaint filing with internal police case management on a unified digital platform. As a global trend, the shift to Digital Governance (e-Governance) is aimed at making public service delivery more accessible, transparent and efficient. Law enforcement, as a major public administration, is now evolving from traditionally manual paper-based systems to intelligent digital solutions. A compelling case for developing a unified integrated AI-enabled solution indeed arises from the intrinsic defects of the manual system and the rapidly increasing capabilities of current technology. POLINOVA serves for addressing various gaps like Enhancing Citizen-

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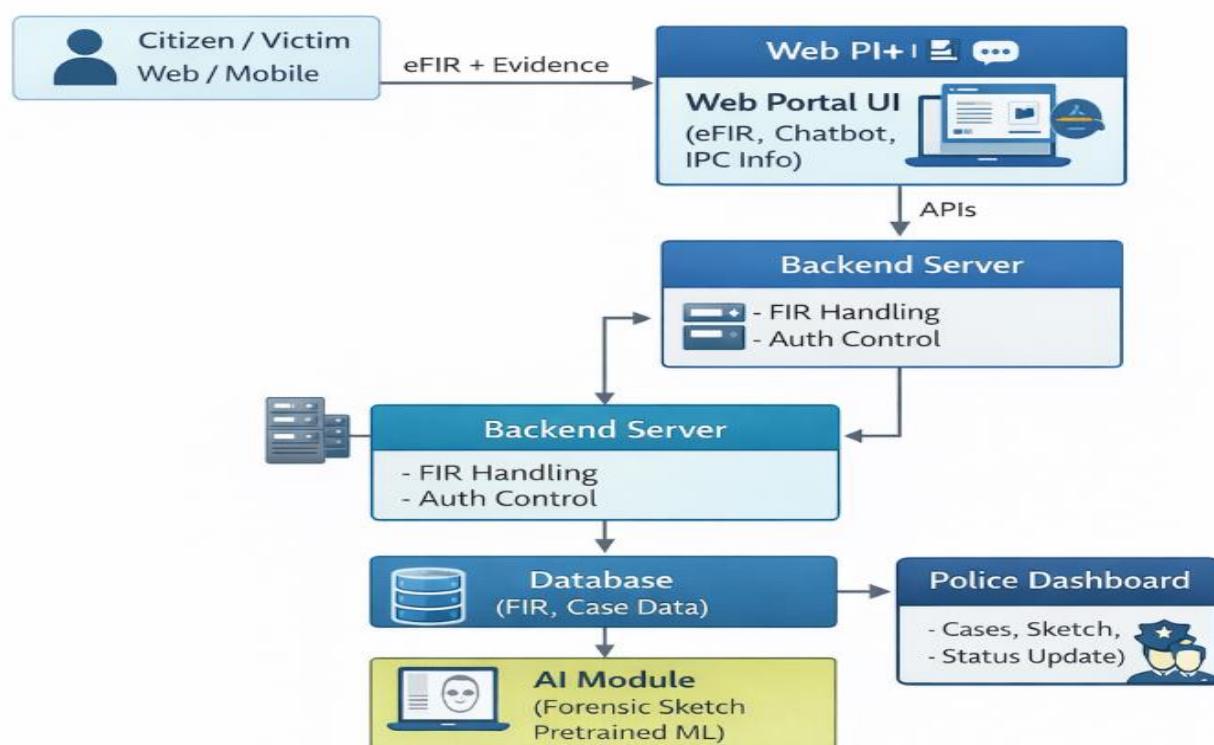


Figure 1 System Architecture

Presentation Layer: The Presentation Layer manages all interactions between end users and the system interface, similar to the user interface tier in

standard three-tier web applications [7,8]. The system develops through front-end development using HTML5 and CSS3 and JavaScript frameworks

which include React.js and Angular. The system offers different user interfaces which serve various user groups:

- Victims can register and file FIRs online, track case progress, and interact with an AI-based chatbot for legal assistance and procedural guidance.
- Police Officers use a protected dashboard system to handle FIRs and confirm report details while they can access the AI forensic sketch creation tool when necessary.
- The system administrators execute all system operations while they verify user access permissions to maintain data security and system performance.

The user interface design enables all users to access the system while they can navigate the system easily and experience responsive design and secure authentication methods which create a unified user experience on various devices [9,10].

The Application Layer business logic layer acts as the system's primary processing unit which controls all system interactions between Presentation and Database layers according to the three-tier application design framework. The system develops through back-end development using Node.js together with Express.js or Python frameworks which include Flask and Django. The system includes these primary functional modules:

- FIR Management Module – Handles creation, validation, tracking, and status updates of FIRs, and coordinates workflow between victims and police officers.
- Chatbot Module – Uses NLP/NLU techniques to provide instant legal guidance, FAQs, and instructions related to FIR filing and basic legal rights.
- Forensic Sketch Module – Integrates deep learning-based image generation (e.g., using DALL·E 2-style APIs) to convert textual suspect descriptions into realistic sketches (Lu et al., 2023).
- The system sends instant notifications to users through email or SMS to inform them about case registration and status updates and critical information.

- The Authentication and Security Module uses role based access control together with token-based authentication which includes JWT and OAuth to provide secure authorized system access.
- The system controls all module functions by following business policies while it maintains secure and consistent user transactions between the user interface and the database.

Database Layer: The Database Layer is responsible for persistent storage, retrieval, and management of application data, corresponding to the data tier in three-tier architectures. The system allows users to select between MySQL and MongoDB as their primary data store based on their deployment needs.

The system includes these primary data elements:

- User_Details – Stores information about victims, police officers, and administrators, including roles and access rights.
- FIR_Records – Maintains details of registered complaints, case status, timestamps, and associated documents or evidence.
- Chat_Logs – Records interactions with the chatbot for future model improvement, auditing, and transparency.
- Forensic_Data – Stores all generated forensic sketches together with their associated metadata which includes time information and case ID details and witness references.

Security at this layer is guaranteed through sensitive data encryption combined with regular database backups and strict database access control policies which follow secure data storage best practices [11,12].

AI and External Integration Layer: PoliNova connects different AI services and cloud-based services to improve system automation capabilities and intelligent decision-making capabilities and system capacity to handle increased workloads which is similar to other AI-augmented web platforms. The system includes these key operational elements:

- AI Chatbot – Utilizes NLU to assist users with common legal queries, procedural steps for filing FIRs, and status-related questions.
- Forensic Sketch Generator – Uses deep learning-based image synthesis models (e.g.,

DALL·E 2-style APIs) to transform textual suspect descriptions into realistic sketches that support investigations (Lu et al., 2023).

- Cloud Services – Platforms such as AWS, Azure, or Firebase can be used for deployment, auto-scaling, secure storage, and real-time notification services (e.g., email/SMS gateways or push services).

1.1. Legal-Bot Module

The Legal Bot functions through its two primary capabilities which include Legal Statute Identification (LSI) that recommends relevant IPC CrPC and IT Act sections and (2) Contextual Legal Guidance which delivers user-friendly legal advice based on statutes (Paul et al., 2022).

Architectural approach: The Graph-aware statute identification system uses LeSICiN architecture to build its LSI system according to Paul et al. The system achieves superior performance through its combination of textual features and legal citation networks which feature both cases and statutes. The method improves Indian legal statute identification through its combined approach which enhances identification capabilities [13,14].

RAG pipeline for answer generation system: The system starts its operations by changing user text into a standard format which it uses for text processing (Veturi et al., 2024). The process begins with language detection before the system breaks the text into tokens and extracts entities from the content.

The system executes semantic retrieval by using a vector store that contains FAISS or Pinecone databases. The database contains statute texts together with cited case annotations and legal commentary. The system delivers retrieved content to the LLM model which uses supervised training or fine-tuning to produce accurate legal responses based on statutory evidence. The generator must include references for all retrieved statutes while mentioning statute numbers and sections to reduce citation mistakes. Model components and pipelines:

- Embedding model: A multilingual sentence-transformer that encodes queries and statute passages.
- The Graph model functions as a heterogeneous graph encoder which shows

how case documents connect to statutes. The system combines node features from text encoders with citation edges to improve LSI ranking.

- The RAG system operates with an LLM which has been either fine-tuned or instruction-tuned to create citizen-friendly responses and section suggestions.

Data provenance and auditing: All chatbot answers include the retrieved statute references and a record of the passages used. The system keeps these records in Chat Logs which can be accessed for future inspections and compliance assessments [15].

1.2. Forensic Sketch Generator Module

PoliNova built the Forensic Sketch Generator by using a pretrained Stable Diffusion checkpoint from the latent diffusion model family and implementing conditional control methods to produce authentic sketches within predefined limits. Pretrained models enable training acceleration because they provide strong visual foundations which support the process.

Modeling approach and architecture: Pretrained backbone: Stable Diffusion (LDM). The model generates forensic outputs through its function as either a frozen image generator or a slightly fine-tuned image generator.

Spatial conditioning (ControlNet-style conditioning): Spatial/structural guidance (simple line sketch, landmarks, or mask) constrains the diffusion process, respecting structures provided by the witness. The system uses ControlNet as its method for conditioning to enable conditional control without reducing the pretrained backbone's performance.

Text-to-attribute mapping: Witness descriptions are transformed into structured attributes (face shape, hair, complexion, age range) and the witness/assistant can create a coarse line mask for mapping purposes; attribute tokens function as either prompt constraints or embedding triggers (Tan et al., 2021).

Third-party ethics and safeguards comprise the following elements:

- Access control: sketches are visible only to authorized police roles.
- Use restrictions and logging: every creation of sketches is logged with what was the

demand, reason and time stamp which clears away points of misuse.

- Quality checks: passing optional human-in-the-loop vetting by a forensic officer before wide

2. Results and Discussion

2.1. Results

The POLINOVA system shows that a digital platform can digitally handle electronic FIR registration together with AI-based investigation assistance. The developed system enables users to file eFIRs through an online platform while their complaint information remains safely stored in the backend database. Registered users can use the eFIR processing module to submit complaints while they monitor their complaint progress. The police dashboard gives authorized personnel access to view all submitted FIRs which they need for conducting essential case status updates. The AI-based forensic sketch module creates initial suspect drawings from organized eyewitness accounts through its preexisting model. The legal chatbot module provides users with answers to their questions about IPC sections and the process of filing FIRs. The testing process for the system used sample inputs to test all data flow and module integration and response generation aspects of the system. The preliminary findings demonstrate that FIR services have become easier to access while the first stage of case registration now requires less manual work.

2.2. Discussion

The POLINOVA system results demonstrate how digital platforms combined with AI support bring benefits to law enforcement operations. The eFIR module enables citizens to submit their complaints through a structured process which eliminates the need for physical FIR registration requirements. The police investigations use the AI-based forensic sketch generation module to create visual evidence from eyewitness accounts. The sketches which forensic artists create serve as essential investigative tools which help police officers during their initial research stages. The legal chatbot improves user experience by delivering instant legal procedure guidance and IPC information. The system provides predefined knowledge responses which do not allow any legal decision-making functions to operate. The system

currently tests its functions but needs additional development work to achieve better accuracy and scalability and to enhance its real-time capabilities.

Conclusion

The research presents POLINOVA as a digital platform that enables police departments to complete electronic FIR filings through its artificial intelligence capability for creating forensic sketches. The system design combines a secure backend system with user-friendly interfaces, an AI module, and a police dashboard. The prototype demonstrates eFIR service operations by displaying how the system functions together with intelligent assistance tools to improve accessibility and efficiency and transparency during FIR registration. The system functions as a prototype because it requires system development to achieve its complete operational capabilities through ongoing AI system enhancements and advanced chatbot user support. The digital and artificial intelligence technologies which POLINOVA has implemented enable law enforcement agencies to modernize their operations through effective application of these technologies.

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