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Justice with Blockchain and Machine Learning

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Abstract: ***This project, is a web-based program used to modernize and secure judicial process. It uses the Blockchain to guarantee the integrity and immutability of case records, and Machine Learning offers the judges the second opinion on the basis of historical case data. The system enables the judges to obtain detailed information about the cases, evidence management, and secure sharing of data with the stenographers. Cases and evidence can be generated in police stations and uploaded on the Blockchain which is securely stored. The access provided to stenographers to manipulate case updates and add new evidence only with the permission of the judiciary creates transparency and accountability throughout the process. The platform also includes a public view feature, allowing citizens to access case information online, promoting openness in the judicial system. This system will ensure a more reliable, transparent, and efficient judicial process to all stakeholders by integrating the security of Blockchain with analytical power of Machine Learning.***
Keywords: Blockchain in Judiciary, Machine Learning for Case Prediction, Secure Case Management, Judicial Transparency.

I. INTRODUCTION

The judicial system is an essential aspect of the society that provides fair and efficient delivery of justice. Nonetheless, historical court proceedings are known to encounter challenges like slow processing of cases, paperwork in record keeping, lack of transparency, and challenges in processing big data. These problems may increase the rate of justice delivery and in some cases, decrease the trust the people have in the system. These issues can be significantly solved with the assistance of modern technology.The Project is going to modernize the judicial process with the help of new technologies. Blockchain is employed to keep the records of caand evidence in a secure way. Case information can be accessed and updated securely by the judges, police and stenographers and fraud or loss of information is minimized. The system enhances transparency, as citizens can access information on cases in the public on line. All stakeholders remain informed on the dates and updates of the cases through automated notification, enhancing communication and eliminating the chances of missing crucial information. This platform offers a safe, efficient and transparent system of justice by using a combination of Blockchain and Machine Learning. It saves time on paperwork, enhances decision-making and creates public trust, and makes the entire process quicker, safer, and more trustworthy to all parties involved.

II. LITERATURE SURVEY

1) Blockchain in Legal Evidence Management: Dr. J Rajeshwar et al. (2025): This article is a holistic method of Blockchain in managing legal evidence. The authors suggest a scheme based on SHA-256 hashing, Merkle Trees, and a Proof of Authority (PoA) consensus mechanism, which would make sure that all the evidence stored on the blockchain is unalterable and highly secure. [1]

2) CourtSafe: Legal Records storage management with blockchain-Rohit Kumar et al. (2024): The CourtSafe is a project that aims at modernizing the legal record management using blockchain. This system will be set to manage high quantities of legal documents whilst upholding security, transparency, and efficiency.

3) Liu & Zheng (2024) Blockchain is used to store judicial evidence securely.It makes the data tamper-proof and cannot be changed. This improves transparency and trust in the system.However, it does not include machine learning for data analysis ntegrity and reliability of all judicial document.

4) Kayikci & Khoshgoftaar (2024)Combines blockchain for secure data storage and machine learning for analysis and decision-making, but it is only a survey without real implementation.

5) Liu and Lapata (2019) Proposed a BERT-based extractive summarization model that selects important sentences from text.It achieved high accuracy and good ROUGE scores.However, it cannot perform abstractive summarization (no paraphrasing).The model is complex and requires high computational resources.

6) Malaheksa et al. (2025)Blockchain improves data security and ensures authenticity of digital evidence in criminal justice.It helps maintain transparency and prevents tampering of legal records.The study highlights challenges like legal regulations and acceptance of digital evidence.It also faces difficulties in real-world implementation and integration with existing systems.

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III. METHODOLOGY

The proposed system follows a simple and structured methodology to assist judges using machine learning. First, authorized users log in and upload case documents along with evidence images. The system then processes this data and applies ML models to analyze patterns and extract important information. Based on this analysis, it generates a second opinion or suggestions, and finally displays the results clearly on the dashboard for decision-making.

1) User Registration and Login: Judges or authorized users securely log into the system.
2) Upload Case Data: Users upload case documents (text) and evidence images.
3) Data Processing: The system cleans and prepares text data, and processes images for analysis.
4) Machine Learning Analysis: ML models analyze text and images to find patterns, keywords, and important information.
5) Generate Second Opinion: The system provides insights or suggestions to assist judges in decision-making.
6) Result Display: Final results and suggestions are shown on the dashboard.

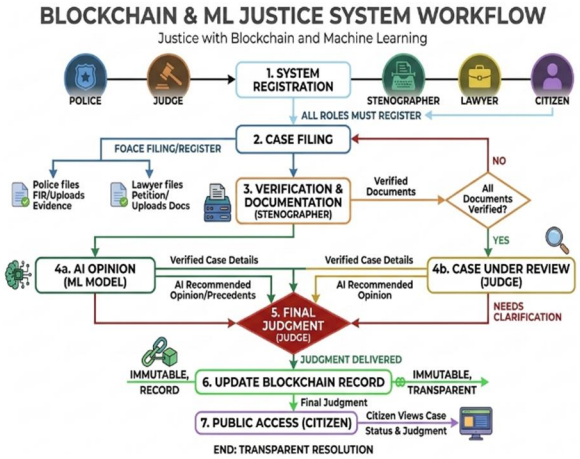


Fig 1. Methodlogy

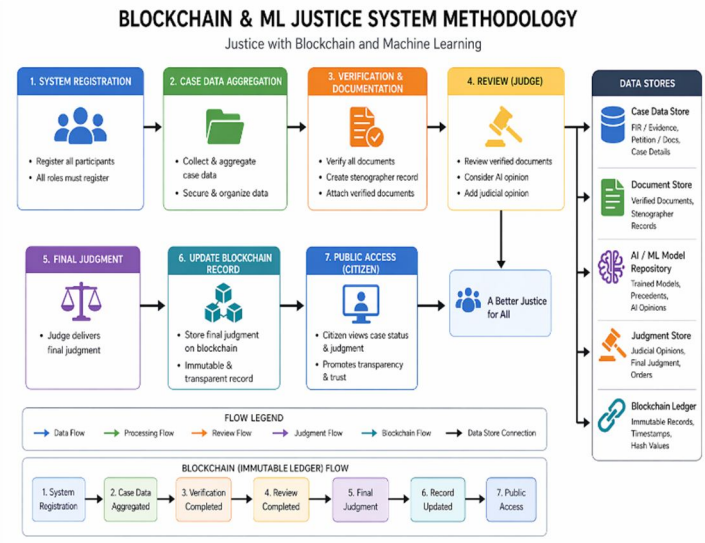


Fig 2.Methodology

IV. OBJECTIVE

1) To securely store case records and evidence using Blockchain, ensuring data cannot be altered or lost.
2) To assist judges in decision-making by providing insights and predictions based on historical case data using Machine Learning
3) To improve transparency by allowing authorized officials and the public to access relevant case information safely.
4) To enhance communication and efficiency by sending automated notifications about case up dates, dates, and important events.

V. PROBLEM DEFINATIONS

The judicial system faces several critical challenges, including delays in case processing, loss or mismanagement of records, lack of transparency, and the burden of handling a large volume of cases. Traditional paper-based systems and even centralized digital platforms are prone to human errors, data manipulation, and security breaches, which can reduce public trust and affect the efficiency of justice delivery. These limitations highlight the need for a more secure, transparent, and efficient system for managing legal data and supporting judicial decisions.

To address these issues, this project proposes the integration of Blockchain and Machine Learning technologies. Blockchain ensures that all case records and evidence are stored in a secure, tamper-proof, and transparent manner, making them immutable and easily traceable. At the same time, Machine Learning analyzes case data to identify patterns, extract meaningful insights, and provide intelligent recommendations to assist judges in decision-making. Together, these technologies improve data security, enhance transparency, reduce errors, and speed up case handling, ultimately increasing the reliability and effectiveness of the judicial system

VI. SYSTEM ARCHITECTURE

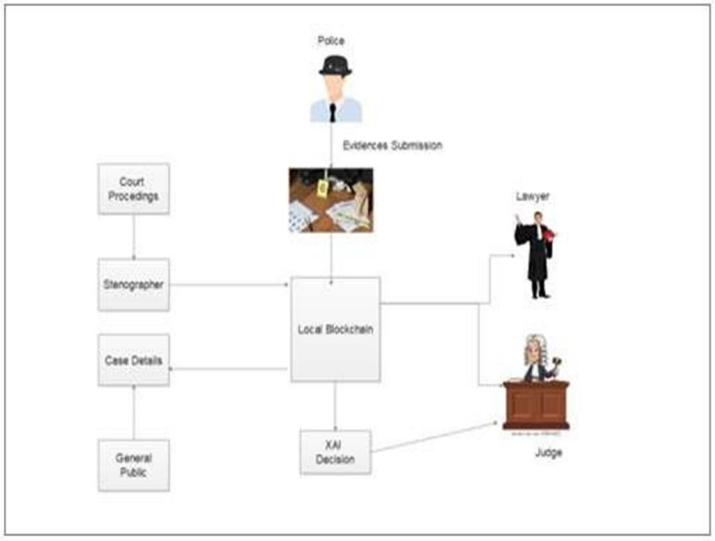


Fig 1: System Architecture

It is a web based system developed with the role based access control and is used to allow interactions between the police, judges, stenographers and citizens in a secure and efficient way. Evidence, updates, and case records are stored in a blockchain, which is immutable, encrypted, and audited. It uses Machine Learning to analyze past case information, uncover patterns, and offer decision-support analytics to judges, enhancing the effectiveness and accuracy of the judgments. The system provides an easy-to-use interface where users can create cases and add evidence, judges can review cases and work with evidence, stenographers can update records after approval, and citizens can access information about the public cases to be transparent. Notifications are automated to ensure that all stakeholders are informed about updates of the cases and the schedule of the hearings. Multi-factor authentication and stringent security are also embedded in the system to ensure that sensitive information is not stolen. Functional, performance and security testing is done to provide reliability, scalability and confidentiality during the judicial process.

VII. FUCTIONAL REQUIREMENTS

Functional user requirements could be high-level statements of what the system must do but functional system requirements must also provide statements on what the system services are in detail.

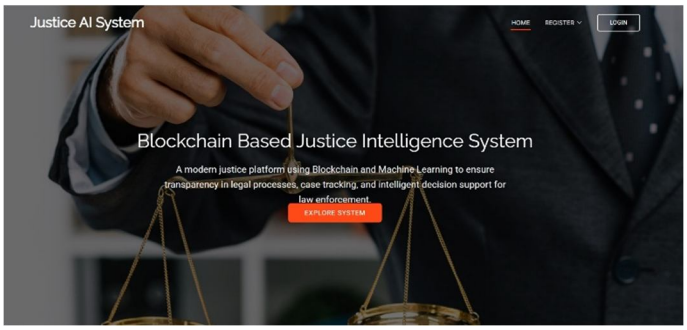
1) User Authentication: The system should permit the secure access of the judges, police, stenographers, and citizens.
2) Case Management: Police are able to create new cases, add evidence and update cases.
3) Evidence Handling: Judges and stenographer scan add, verify, or handle evidence with blockchain secured security.

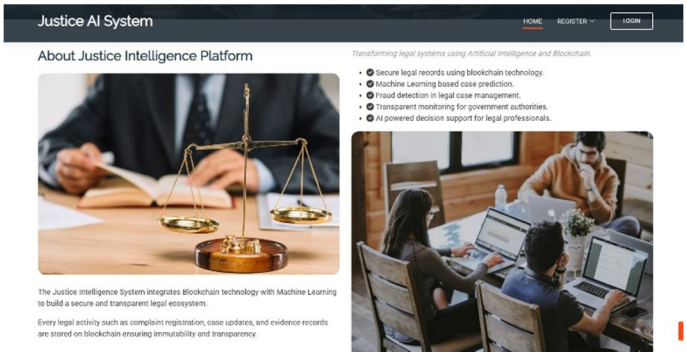
4) Machine Learning Support The system offers predictive information or suggestions to judges on the basis of past case information.
5) Public Access: Citizens have the ability to access public case information in a controlled way.
6) Blockchain Record Storage: The system securely stores all case records, evidence, and judgments on a blockchain to ensure data integrity.
7) System Should Maintan Complete History of data.

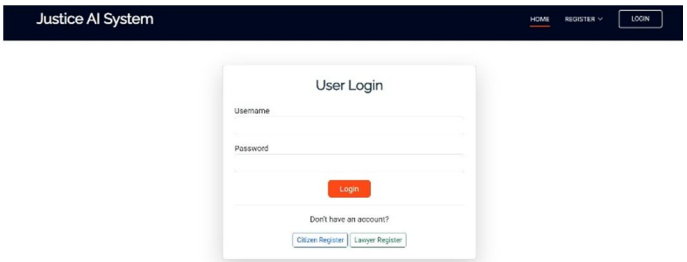
VIII. NON FUCTIONAL REQUIREMENTS

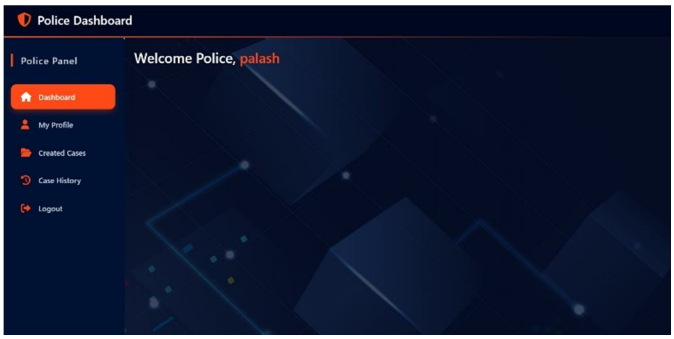
1) Security: Data should be stored safely in the blockchain so that it can not be tampered with and accessed by unauthorized persons.
2) Performance: The system must be able to support multiple users at a time and huge amounts of data.
3. Scalability: Should be able to handle an increase in the number of cases, users and data without a drop in the performance.
3) Reliability: System must be highly available and robust so that there is minimum downtime.
4) Usability: The interface must be easy to use, intuitive and multi-platform friendly.

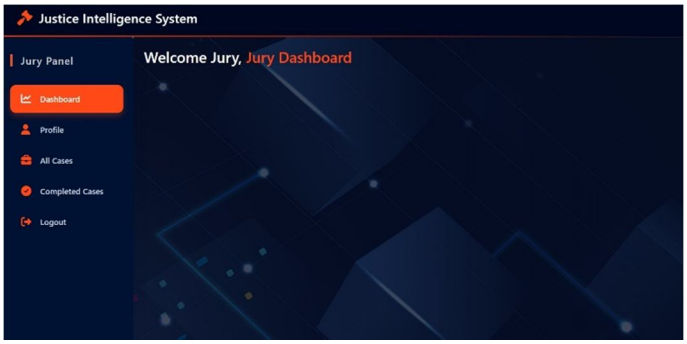
IX. IMPLEMENTATION

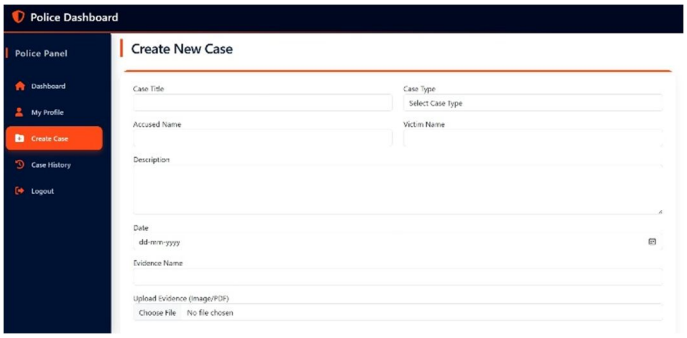






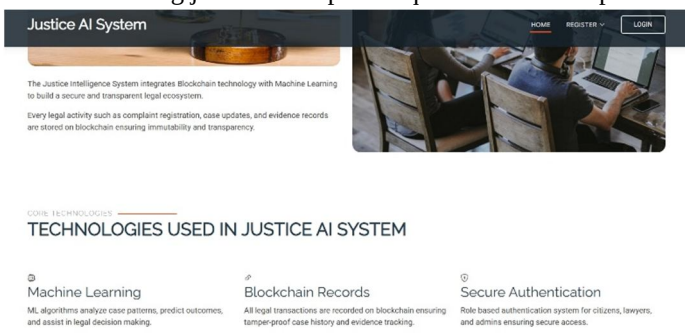






X. CONCLUSION

Finally, project offers a contemporary answer to enhance a judicial system through securing it, making it more transparent and efficient. With the help of Blockchain, all the records and evidence of cases are kept securely and cannot be corrupted, and the judges are assisted by Machine Learning in making more effective decisions, relying on the past information. The system also facilitates easy cooperation between police, judges and stenographers, issues automatic notifications, and permits access to some information in a case, which enhances transparency. On the whole, the platform will minimize delays, provide confidence in the judicial system, and make the process of delivering justice to all parties quicker and more predictable.



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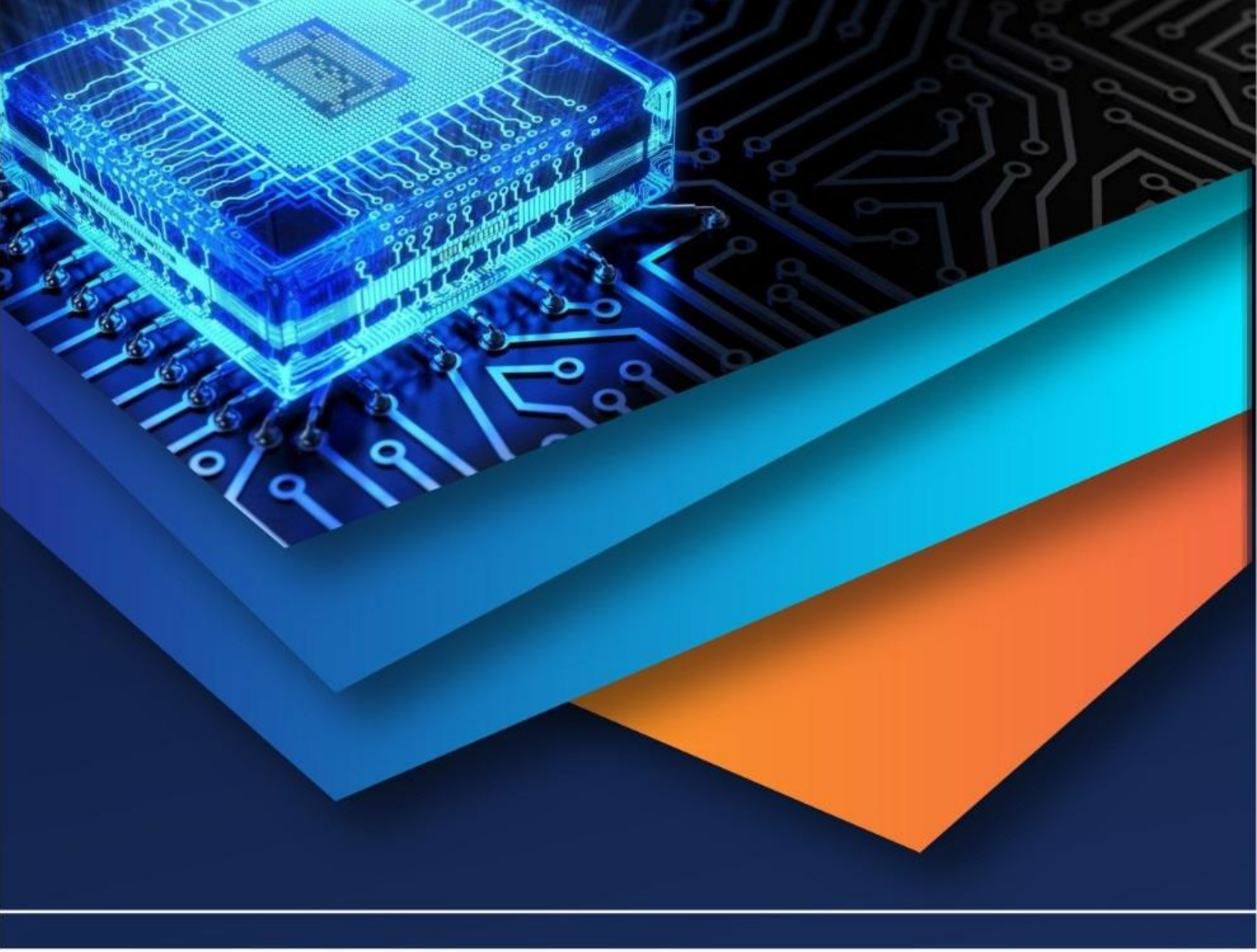

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