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Application of Blockchain to Secure e-FIR

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Abstract: ***Electronic First Information Report (e-FIR) is a document filed to the police stations by a victim or accuser when offense is committed. In traditional e-FIR databases, offense's records can be tampered because of its centralized nature. Also intentional false e-FIR can be registered. Thus, data transparency and integrity is big concern. To overcome this problem e-FIR with decentralized blockchain system can be integrated with e-FIR portal. The main characteristics of the blockchain technology are advanced security and decentralized system. This technology uses the encrypted blocks to make FIR data secured. Proof of Stake (PoS) protocol is used in this system. Users have to submit e-FIR through portal which will be stored in blocks in blockchain. Due to advanced security feature of system, data tampering will be prevented. Integrating such FIR registration system will ensure transparency and enhance data integrity.***
Keywords: Bloockchain, e-FIR, Security, Tamper - proof, Proof of Stake, Smart Contracts.

I. INTRODUCTION

India is the largest democracy with an increasing crime rate which is inevitable. There are several robust rules in the constitution to secure smooth functioning of the system, however, sometimes; the entire process can be slowed down with the need for verification at each step. To avoid the delay in specifically the FIR and case related proceedings, a digitized solution is proposed where in all steps were carried out online reducing the time and was more helpful to both the user (public) and the police department. To overcome this problem E-FIR is a solution for both public and police department. Due to E-FIR, time of entire case related processes will get reduced. Blockchain technology stands out with its unparalleled level of security, setting it apart from conventional network systems. This technology uses the cryptographically engineered block to make the information secured. In this system user have to fill E-FIR by submitting the required essential details.

By implementing blockchain technology for e-FIR data management, the security challenges associated with the current system can be effectively addressed. The traditional approach involves storing e-FIR data in a local police station database, which can be easily manipulated due to its centralized control. However, blockchain provides a decentralized architecture that enhances data security and integrity. Blockchain acts as a distributed ledger, recording all transactions in a transparent and immutable manner. Each transaction, in this case, would represent an e-FIR report. The use of blockchain ensures that once a report is recorded, it cannot be altered or tampered with, providing a reliable and trustworthy source of information. This eliminates concerns related to non-registration, false registration, and data integrity. Furthermore, blockchain's peer-to-peer network structure enhances the efficiency and accessibility of e-FIR data. Instead of relying solely on a central database, authorized personnel from different police stations can securely access and share e-FIR information across the network. This facilitates collaboration and improves coordination among law enforcement agencies. In summary, the adoption of blockchain technology in the management of e-FIR data offers significant advantages for a smart city's law enforcement system. It improves data security, integrity, and accessibility while fostering transparency and accountability among the police force. By leveraging blockchain, smart cities can enhance their crime management capabilities and provide a safer environment for their citizens.

A. Problem Description

To develop an Electronic First Information Report (e-FIR) system that enables victims or their representatives to file FIRs for cognizable offenses directly to police stations. The e-FIR system should ensure data integrity and transparency in recording and managing FIR details. To achieve this, the system needs to be integrated with blockchain technology, providing a secure platform for storing and accessing FIR information.

B. Problem Scope

The project scope for blockchain based E-FIR involves developing a digital platform that utilizes blockchain technology to enhance the efficiency, security, and transparency of FIR processes.

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The system aims to streamline the reporting of crimes and improve collaboration between stakeholders such as law enforcement agencies, victims, and the judiciary. Application enables user to easily report crimes and file FIRs through an intuitive and user-friendly interface. The system should capture all necessary details related to the incident, such as location, time and date, nature of the crime, and any supporting evidence or documents. Integration with blockchain will ensure immutability and tamper resistance.

II. LITERATURE REVIEW

Centralized systems used to store criminal records and offense data suffer from various deficiencies, including the risk of a single point of failure. Storing such data in local databases within police stations introduces additional vulnerabilities. Two key issues are data tampering and false registration. Data tampering can occur when a superior authority within the institution manipulates critical data without oversight. To address this, data should be marked with digital signatures and distributed among different entities to ensure transparency [1].

To fortify system security and guarantee the unassailable integrity of offense data, the implementation of a decentralized consensus-based approach becomes imperative [2]. The widespread adoption of blockchain technology can be attributed to its inherent decentralized nature, revolutionizing traditional systems by eliminating centralized control and engaging multiple entities in the validation of record authenticity. Digital signature confirms the authenticity of uploaded data. Encryption improves the security objective of this system. The randomly generated encryption key ensures maxi-mum security of data [3].

Public and private blockchains are two main types, with public blockchains like Bitcoin and Ethereum using Proof-of-Work (PoW) and private blockchains like Hyperledger Fabric using Proof-of-Stake (PoS). This protocol uses highly secured encryption and hashing techniques.eg. - AES Rijndael, SHA-256[4]. The use of a consortium blockchain in the management of criminal records and offense data offers increased trust, improves privacy, scalability, and regulatory compliance. By leveraging a consortium blockchain, law enforcement agencies can establish a secure and efficient platform for the storage, sharing, and verification of sensitive information, ultimately leading to more effective law enforcement practices [5].

Decentralized blockchain systems have emerged as a solution to the deficiencies of centralized storage for criminal records and offense data. In proposed system FIR records are protected with ethereum based smart contracts. This blockchain based system prevents data tampering and false FIR registrations because of its decentralized nature [6].

Filed FIR will store hash and details in block.If the police refuse to file the FIR due to pressure or claim they did not receive any complaint, the complainant would have substantial evidence against them. This evidence would be in the form of the complaint itself, which includes a timestamp, stored on a blockchain network. By having all the records stored on an immutable database like the blockchain, any possibility of tampering with the NCR (Non-Cognizable Report) would be eliminated. [7].

Blockchain-based systems have been introduced but infrastructure with respect to scalability research is in progress [8]. For example, Dubai Police launched project, which aims to integrate various police services using various technologies like blockchain. As part of this project, they are developing a blockchain-based e-FIR system.Indian Police also planning to use polygon based blockchain network for online FIR application. Integrating chatbot with blockchain will ensure user-friendly,transparent and highly secured E-FIR system[9]. These survey highlights the growing interest and efforts in utilizing blockchain technology to address the challenges associated with traditional e-FIR systems. By leveraging blockchain's decentralized and immutable nature, these initiatives aim to enhance the trust, security, and efficiency of law enforcement processes while ensuring the integrity and reliability of e-FIR data.

III. PROPOSED WORK

The proposed project involves the development of a blockchain-based Electronic First Information Report (E-FIR) system, which consists of three main modules: User, Police Officer, and Admin. The User module allows victims or their representatives to file FIRs for cognizable offenses directly through the system. The Police Officer module enables police personnel to access and manage the received FIRs, update the status of the cases, and communicate with the users if necessary. The Admin module has administrative privileges to oversee the overall system operations, manage user accounts, and handle any system-related issues. To ensure secure transactions and user authentication, the project incorporates Metamask, which serves as a wallet and login mechanism for users. Metamask enables users to securely sign transactions using cryptographic keys stored locally on their devices.

In terms of technology, the project leverages blockchain for storing and validating FIR data. The blockchain technology ensures data integrity, tamper-proof and transparency in recording and managing FIR details. Smart contracts are utilized to process FIR transaction and enforce rules within the system. Blockchain network implement cryptographic algorithms such as SHA-256 for hashing sensitive data, ensuring the integrity and confidentiality of information.

Public-key cryptography algorithms like RSA or Elliptic Curve Cryptography (ECC) can be employed for secure key management and authentication. Overall, the proposed work aims to create a reliable and transparent E-FIR system by integrating blockchain technology, Metamask for secure transactions and authentication, and employing appropriate algorithms to safeguard sensitive data. This system will provide a robust platform for filing and managing FIRs, enhancing efficiency and accountability in the criminal justice system.

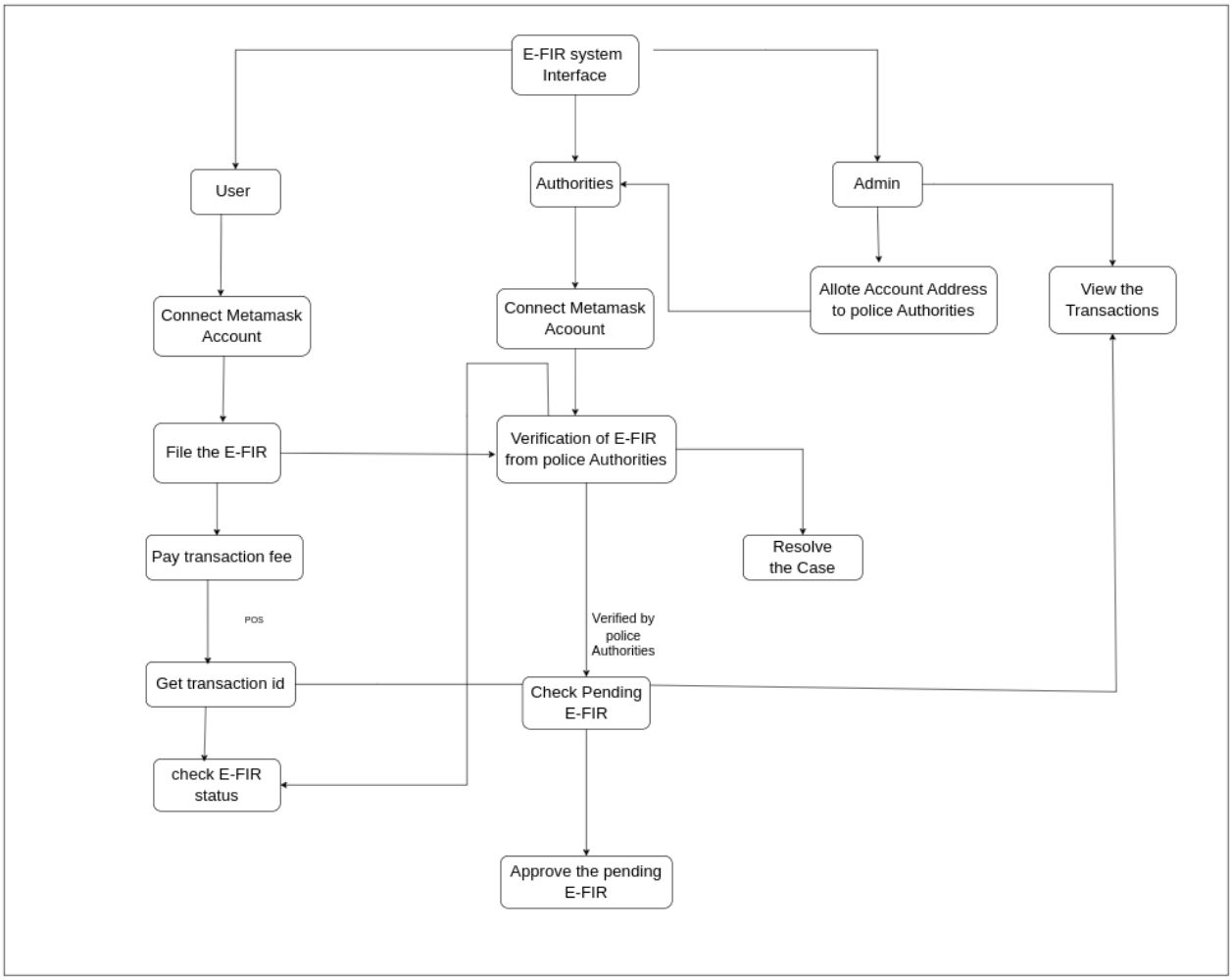


Fig. 1 System Architecture

IV. IMPLEMENTATION

The implementation of a blockchain-based e-FIR (First Information Report) system involves three modules: User, Police Officer, and Admin. System incorporates various technical specifications such as the Thirdweb platform, Matic currency, JavaScript, Next.JS, Express.JS, and smart contracts using Solidity. Users interact with the e-FIR platform through the user module. They submit complaints, providing necessary details and documents. These complaints are stored securely on the blockchain network, utilizing features like decentralization, consensus mechanisms, and cryptographic hashing to ensure immutability and transparency. The Thirdweb platform, built on technologies like Mumbai Matic, facilitates efficient and scalable blockchain operations, enabling high throughput and low-cost transactions. Mumbai-Matic is used for transaction in blockchain. The police officer module grants authorized personnel access to the submitted complaints. They can view the complaints, initiate investigations, and update the status of the FIRs. Smart contracts, written in Solidity, are utilized to define and enforce the business logic of the e-FIR system.

These contracts execute on the blockchain network, enabling secure and trustless interactions while ensuring data integrity through consensus algorithms like Proof of Stake or Proof of Authority. The admin module plays a pivotal role in managing the e-FIR system. They have authority to verify each transaction. JavaScript, Next.JS, and Express.JS are employed in the development of the user interface and backend services. JavaScript, a widely used programming language, allows for dynamic and interactive web applications. Express.JS, a web application framework useful for handling user requests and interacting with the blockchain network. Solidity is essential for deploying smart contract in blockchain. Smart contract processes each transaction of FIR in blockchain network. The chosen technologies, including JavaScript, Next.JS, and Express.JS, enable efficient development and a seamless user experience.

V. RESULTS

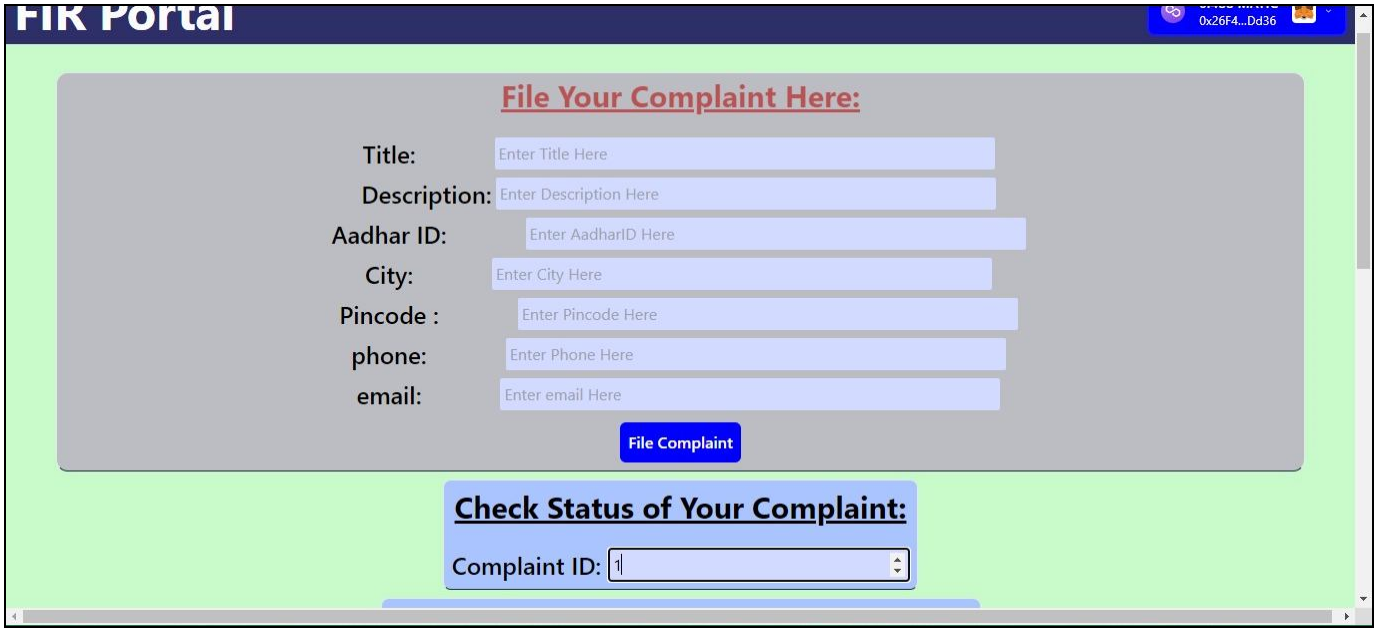


Fig .2 Home Page

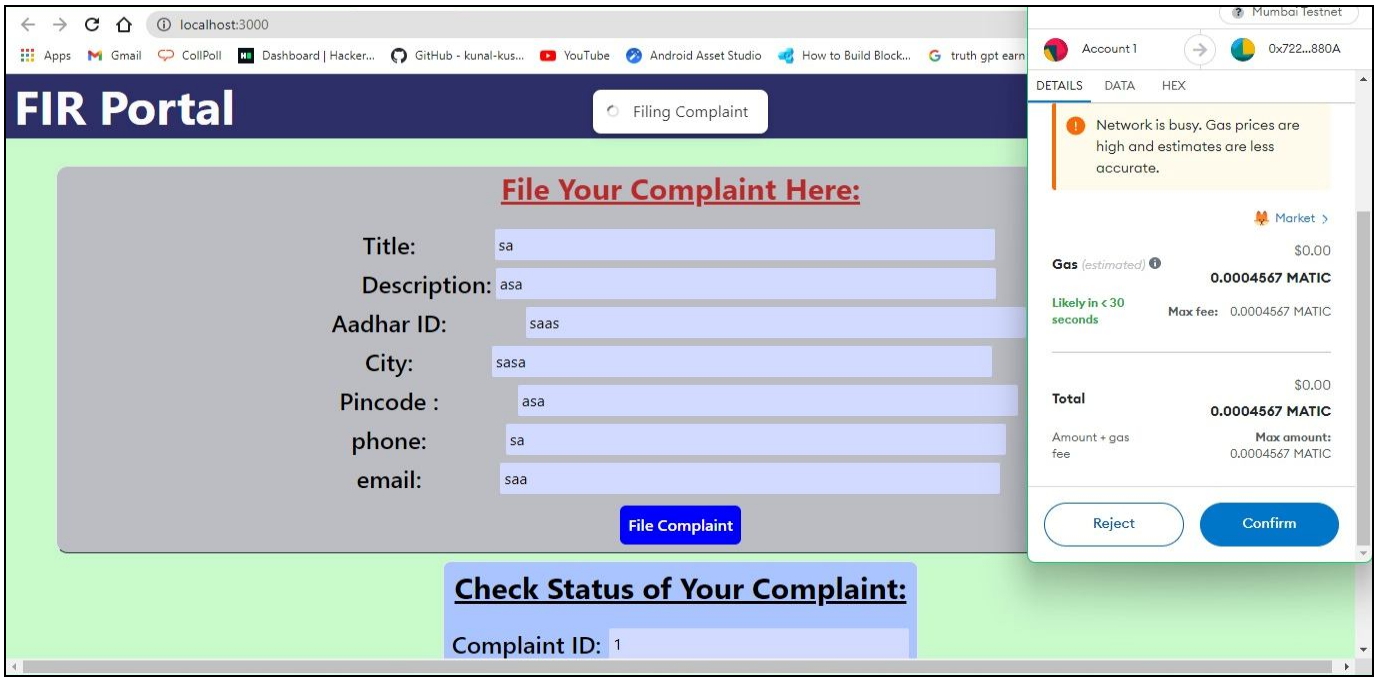


Fig. 3 Metamask Transaction

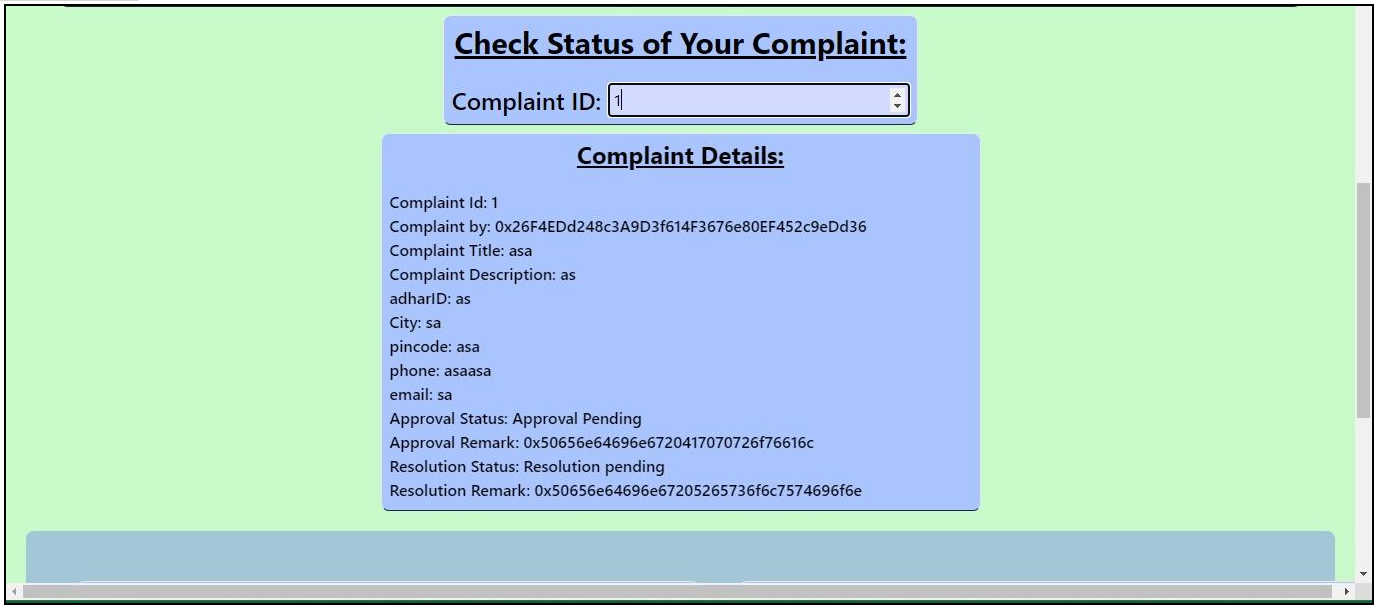


Fig. 4 Complaint Status

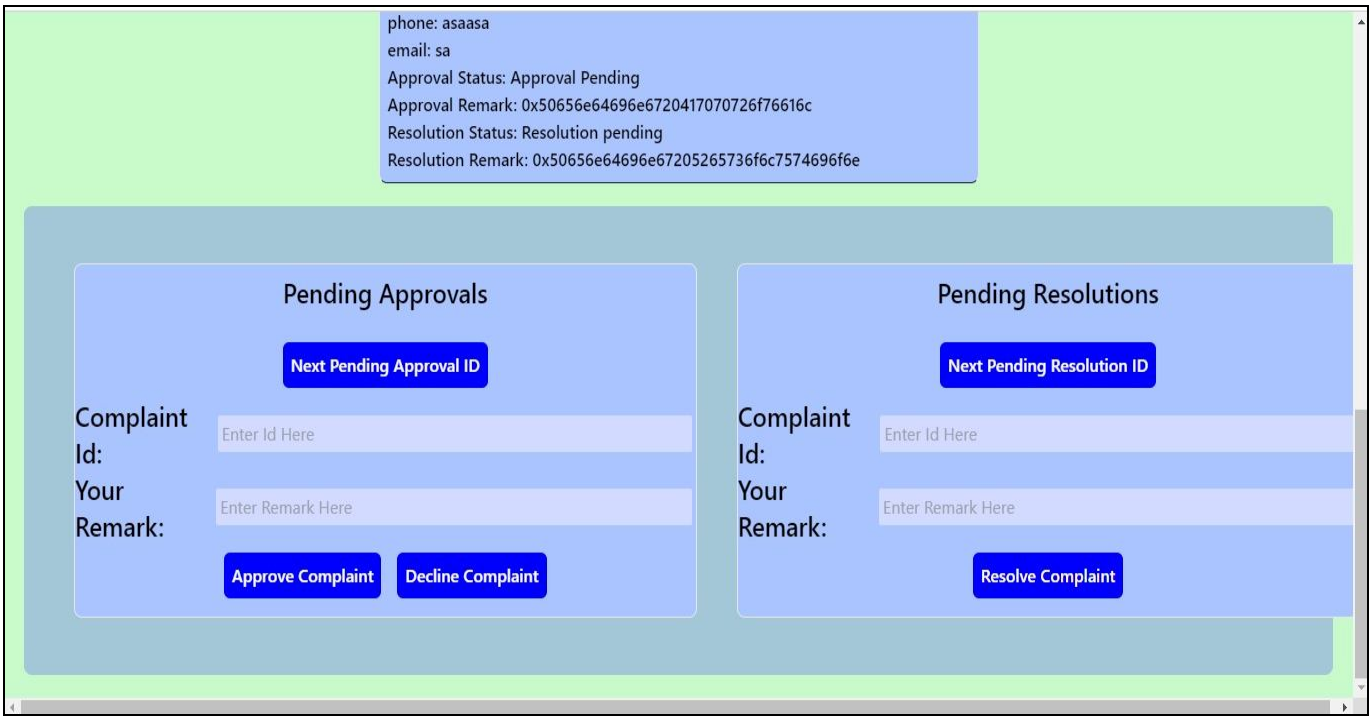


Fig. 5 Pending Status (Approval and Resolution)

VI. CONCLUSION

The project aims to enhance the security, transparency, and efficiency of the e-FIR process. By leveraging blockchain technology, the project provides a secure and accountable system for storing and managing electronic First Information Reports. The outcomes include improved data security, increased transparency, streamlined processes, and enhanced trust within the e-FIR ecosystem .One of the key outcomes of the project is improved data security. By utilizing blockchain's decentralized and immutable nature, the e-FIR system ensures that the stored information is highly resistant to tampering or unauthorized modifications. Each FIR record is securely stored on the blockchain network, making it extremely difficult for malicious actors to alter or manipulate the data without detection.

VII. FUTURE SCOPE

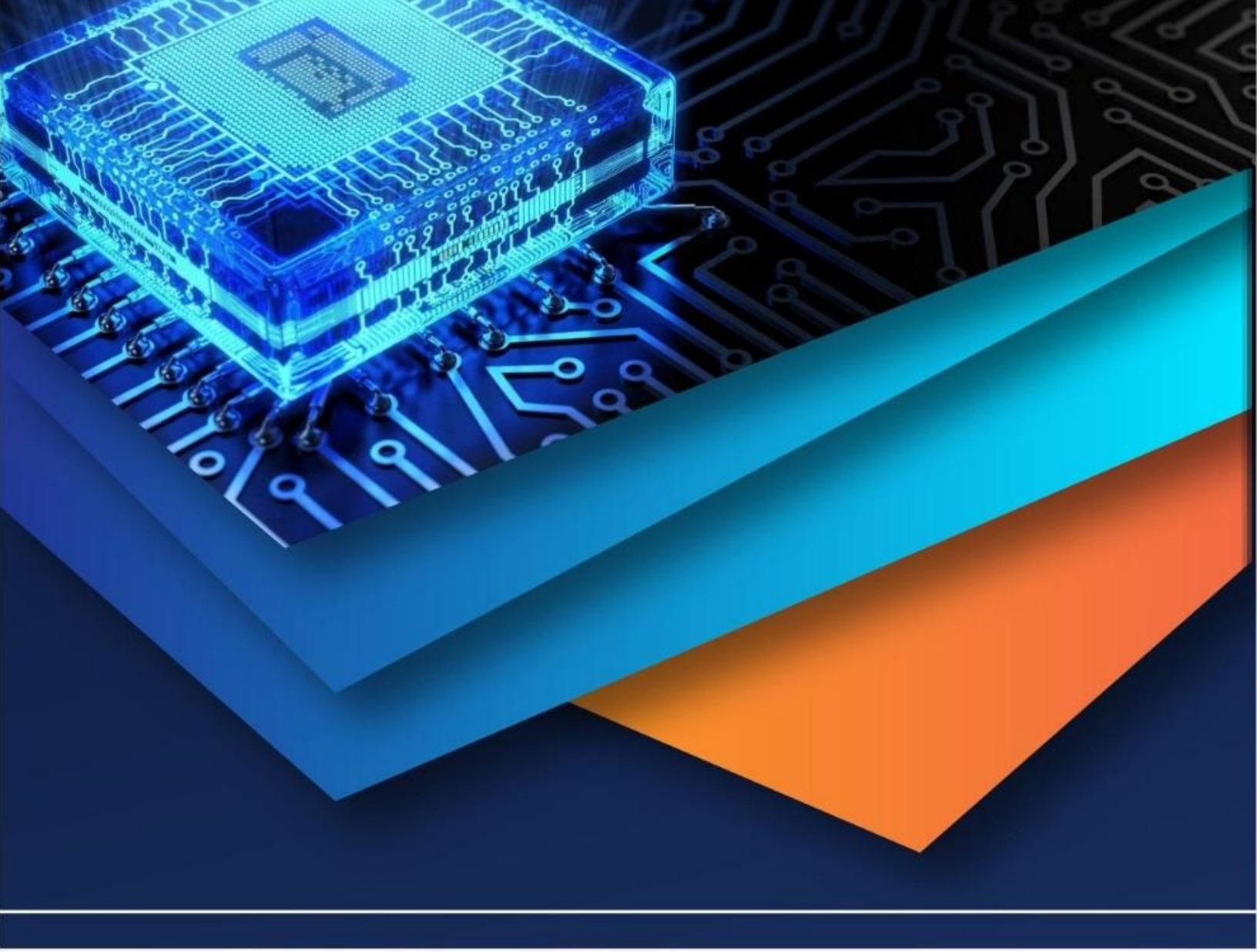
Future work for the project includes optimizing scalability and performance, integrating with existing systems, conducting real-world deployments and gathering feedback, continuous security enhancements, and fostering collaboration and knowledge sharing within the law enforcement domain. As the project expands and handles a larger volume of FIRs, optimizing scalability becomes crucial. Exploring techniques such as sharding, sidechains, or layer 2 solutions can help improve the system's capacity and transaction throughput. Additionally, performance optimization measures should be implemented to ensure fast and responsive interactions between users, police officers, and administrators.

VIII. ACKNOWLEDGMENT

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