Critical Review of Police FIR and Case Record Management and Proposed Blockchain-Based Systems

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ABSTRACT

India is the largest democracy with an increasing population where a growing crime rate is almost inevitable. There are several robust rules in the constitution to ensure smooth functioning of the system, however, sometimes, the entire process is slowed down with the need for verification at each step. To avoid the delay in specifically the First Information Report (FIR) and case-related proceedings, a digitized solution is proposed wherein all the steps were carried out online reducing the time and was more convenient to both the public and the police department. Yet the need for a more secure, unalterable, traceable, and chronological sequence of records was still lacking. Hence, to fill in the void, blockchain-based systems have been proposed but an end-to-end system covering the entire span of police judicial proceedings is new and is currently being developed. In our paper, we take this opportunity to study and analyze the existing police case-related proceedings, the blockchain technology, and the proposed systems and also suggest an integrated police record management system using blockchain, Machine Learning (ML), and the Internet of Things (IoT).

Keywords - FIR, Blockchain, Machine Learning, IoT, Police case-recording system.

I. INTRODUCTION

Our Indian judicial system is one of the most important institutions for the smooth functioning of the world's largest democracy. For record-keeping in the police force, it is essential to maintain an unaltered chronological sequence of events and documents so that police can analyze criminal activity to avoid discrepancies or interference in the records and documents.

More than 50 lakh criminal cases were registered in India in the year 2019 [4] To solve such a high number of cases in an effective and timebound manner, the Indian police force is in dire need to upgrade its infrastructure and case management systems with modern technology [10]. This is required to improve efficiency, prevent malpractices and increase public confidence in the police force. Maintaining all the case-records in an unalterable manner is important for the fair, accurate, partial, and speedy resolution of any case. Traditional and current case-record keeping systems have been digitalized but they still lack security and are not tamper-proof [8]. Since police records are sensitive information, they need to be stored in a

chronological sequence, ensure traceability, and must be unalterable once recorded. A blockchain-based system can provide safe and secure record-keeping while maintaining an unalterable, traceable, chronological sequence of records and documents providing total transparency in record handling as required. The blockchain-based system can further be enhanced by integrating it with IoT and Machine Learning.

II. LITERATURE SURVEY

The literature survey intends to study the current FIR process, current research on delays in the FIR process, and other systemic problems which directly or indirectly hamper the case process and can be addressed via technology improvements.

A. Police FIR and case-record management systems

First Information Report (FIR) is an initial step of registering a cognizable offense based on the victim's statement upon verification by the police [1]. The further process states that the police officer starts investigating the crime scene, other facts and collects the required pieces of evidence regarding the case. Post investigation, the police officer sends the complete case report to the magistrate. Now if the offense is proved in the report, then the charge sheet is filed before the magistrate, however, if no offense is made out, then the case closure report is filed before the magistrate [1]. Following this, the court proceedings are started, if then the police fail to complete the further investigation process within sixty or ninety days depending upon the nature of the offense, the accused then will be released on bail.

Along this process, if any officer-in-charge wants to cancel the FIR before the completion of an investigation, there is no provision in the Criminal Procedure Code (CrPC) to do so [2]. Only after the completion of the investigation, the magistrate,

according to 173(2) CRPC, if feels that the case is not strong enough, can drop the proceedings and the FIR is thus canceled.
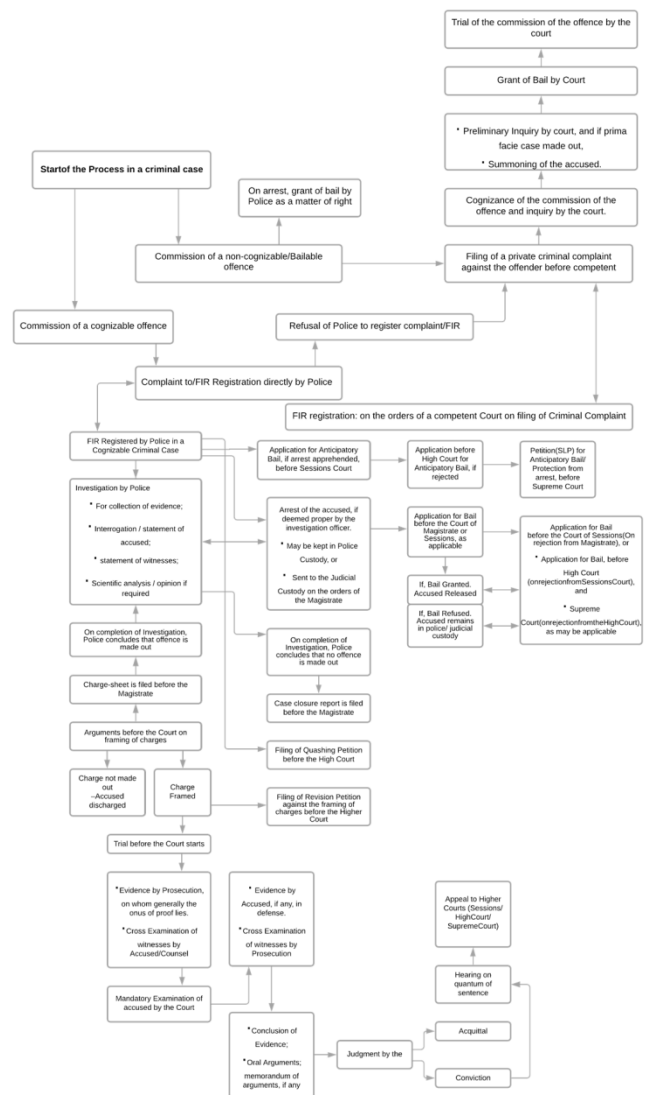

FIG 1. Criminal Case Trial Process (India) [3].

The ever-growing crime rate in India has resulted in a total of 51,56,172 cognizable crimes consisting of 32,25,701 Indian Penal Code (IPC) crimes and 19,30,471 Special & Local Laws (SLL) crimes in 2019. This was an increase of 1.6% over 2018 (50,74,635 cases). The crime rate registered per lakh population has also marginally increased from 383.5 in 2018 to 385.5 in 2019 according to the 2019 NCRB report [4]. A worrying trend indicates that when the crime rates

are controlled in some states, new centers of crime emerge [12].

According to research conducted by Banerjee et al. [5] along with Rajasthan police, it was found that the police staff who often work long hours, display decreased efficiency and reduced job satisfaction which results in delay in the FIR process and other case-related proceedings. Another report [6] showcased that to keep the crime figures low, the officer refuses to file certain FIRs which results in misleading data, and also justice does not prevail. A national survey [7] conducted expresses confidence of citizens in their respective country's police departments did not feature India among the countries with high confidence levels.

Research conducted in 2016 by Marmat and More [8] noted that usually many crimes go unreported or are ignored by the citizens or witnesses due to fear of the police department or lack of time and ignorance, also many of the cases are dropped due to lack of evidence and proof collected and lack of collaboration of the citizens and police. Witnesses to the crime often apprehensive about approaching the police due to fear of crime and sometimes even non-cooperation by the police [9]. Due to the issue of corruption in registration and non-registration of FIRs, a new dual system [10] had been introduced, which allows preliminary verification before FIR registration which also avoids fake FIRs and delays in proceedings.

In "Police Structure: A comparative study of policing models", John Varghese [11], upon studying the Indian police structure and workflow, argued for a consent-based, transparent and accountable framework based on the British model which would help in increasing public confidence.

The Crime Criminal Information System (CCIS) and Common Integrated Police Application (CIPA) were developed and implemented by the Government of India at a national level to make use of information technology in the police department and workflow automation [13].

Research conducted in 2017 titled: "Research on the Impact of Technology on Policing Strategy in the 21st Century, Final Report" for the US Office of Justice Programs by Kevin Storm [14] found out the positive impacts of technology on law enforcement agencies which resulted in an increase in efficiency, communication, enhancing information sharing practices by digitizing the workflow. Digitalization and e-police will help reduce paperwork, duplication and build citizen confidence and transparency [15].

Bhosle et al. in 2019 proposed a Computerized Real-time crime record Management System (CRMS) [16] for the police station where all the case related information could be stored at a centralized location which would result in ease of accessibility, reduced time consumption, cost reduction, and increased operational efficiency and flexibility. A similar study conducted by Iyer et al. [17] proposed an android application for FIR registration and tracking where the complainant would be filing the FIR form, upload shreds of evidence and records, and would later be able to track the progress and get real-time updates on his cellphone. A recent approach towards passenger security is proposed by Pednekar et al. [18] which will help the passengers file an FIR in real-time during their train travel, using cellphone whenever any incident occurs, which would also help them to directly communicate with the Government Railway Police.

Various online systems proposed to date, where the user can lodge their FIRs and track them in real-time, have certain drawbacks. The citizen can file a complaint on the online application but for filing an FIR, [19] according to 154 CrPC, the user must

upload their signature every time after the one-step authentication which could result in delay and inconvenience. Another issue is that the e-FIR verification takes 48 hours to just confirm whether the FIR is valid or not and only then can the user download the copy of the FIR. Even if the FIR is rejected, the reason for the same is not communicated in 51% of the cases [20]. With several e-FIR applications have already been initiated by the government such as Sindhu Police App by the Maharashtra State Police department, there is still a lack of awareness among the citizens with less than 1000 downloads for the aforementioned app [21] even though the technological expenditure on State Police Forces has been increased, the results haven't yet been encouraging.

B. Blockchain-based systems

After studying the traditional and digital FIR and record-keeping methods used by the police department and their pros and cons, a more resilient and secure system can be developed by employing blockchain technology.

The cryptocurrency bitcoin and technology underlying it i.e. blockchain finds its origin in a 2008 paper written by a person or a group of people using the pseudonym Satoshi Nakamoto titled Bitcoin: A Peer-to-Peer Electronic Cash System [22]. The proposed system combined encryption and the distributed storage technology to create a secure, unalterable distributed ledger system. The advantage of the system came from its internal mechanisms to verify the transactions without any mediating third party. While the Bitcoin cryptocurrency is highly volatile and subject to various regulations across the world, its underlying blockchain technology has found growing acceptance as the basis for decentralized, tamper-proof, transparent, and distributed ledger via a peer-to-peer network.

Blockchain is finding an increasing relevance as a means of introducing credibility and trust to the transactions [23].

In a permissioned Blockchain-based system, data can be reviewed or added by any of the peers within the system, however, modifying /adding the data is not possible without a majority of the peers agreeing to it. This makes it computationally infeasible to tamper with the data thus making the system immutable [24].

The benefits of such a system have led to it being researched for application in a wide range of fields such as supply chain management [25], copyright protection [26], healthcare [27]. Further advancements in the underlying blockchain introduced the need for the creation of decentralized applications. In the Ethereum whitepaper by V. Buterin in 2013 [28], smart contracts were introduced to Blockchain. A smart contract is an executable code for the execution of terms of an agreement between untrusted parties upon meeting pre-determined rules.

There are two types of blockchain - public blockchain and private blockchain [29]. In a public blockchain, any anonymous user can join the network, read the content of the blockchain, send a new transaction or verify the correctness of the blocks. Examples of public blockchains are Cryptocurrencies such as Bitcoin and Ethereum. In a private blockchain, only users with permissions can join the network, write or send transactions to the blockchain. Private blockchains will be typically used by organizations and agencies for their specific internal use cases.

Blockchains are chronological in nature. Every transaction, block, data storage in the blockchain network is timestamped and stored in a chronological manner. This provides the system with transparency

and traceability [32]. The key components of a Blockchain network are Cryptography, Transactions, Consensus Mechanism, and the Distributed Ledger.

Information exchange within the blockchain network happens on a peer-to-peer basis between the nodes. This happens through the transfer of files containing information from one node to another. After each transaction, the state of the Blockchain changes [30]. All the system transactions are stored with the distributed ledger. Distributed Ledger is like a replicated, synchronized database that is distributed to all the member nodes of the system [31].

Blockchain has been researched for application in smart cities, specifically for security applications [34]. The reliable nature of Blockchain makes it suitable for creating a security framework for various governmental and other organizations which need storing and processing sensitive information.

A smart Blockchain-based solution for the e-FIR filling was proposed by Nasir et al. in their paper 'Smart FIR: Securing e-FIR Data through Blockchain within Smart Cities' [33]. Ethereum blockchain was explored as a potential solution for adding integrity, transparency to the FIR records while preventing the filling of false FIR's. It was suggested that the use of Blockchain will prevent data tampering and reduce false registrations.

Hassija et al. [35] developed a system for 'Police FIR Registration and Tracking Using Consortium Blockchain'. This system envisaged a way for enabling the people to file their complaints directly if so, required in certain cases where the police officers might be reluctant to do so.

The systems seen so far have not considered the entire police - judicial case proceedings in their system proposals. An end-to-end system encompassing the entire case sequence named "PoliceChain: Blockchain-Based Smart Policing System for Smart Cities" [36] was proposed. Different stakeholders in the system were considered and appropriate access was provided.

III. CRITICAL ANALYSIS

A system proposed in a paper in 2020 titled "Smart FIR: Securing e-FIR Data through Blockchain within Smart Cities" [33] embraced blockchain in e-FIR to secure the current system and make it tamper-proof. In the proposed system, when a user files a complaint, the admin immediately initiates verification. The e-FIR is only registered in the blockchain network if found to be a valid and verified complaint. Since the initial complaint by the user is not entered into the blockchain network, it exposes a potential loophole to be abused by the admin. If any such malpractice is carried out by the admin it would not be traceable since it won't be recorded in the network itself. The designation or the enrollment criteria for the admin is not specified in the paper, combined with the admin being the sole authority in the network creates the possibility of a false FIR filed by the admin himself. Although there is a provision for the Superintendent of Police (SP) to verify the transactions made by the admin, this is inconvenient for the SP and may also introduce a delay in the system. Such an issue would have been better solved if the system architecture would have been taken into account. The system performance was evaluated on a local database, the description of which was not provided. Also, the response time and other parameters of the locally tested system aren't mentioned. Since the system is dependent on the smart city program, the cost analysis should have been provided for the same.

Some of the above-stated issues are addressed in "Police FIR Registration and Tracking Using Consortium Blockchain" [35]. The proposed system

was primarily focused on enabling people to file cases directly. This was to tackle the issue as expressed in some papers of people being hesitant to file reports due to police insensitivity, reluctance, and fear of backlash. The use of blockchain ensures that the system offers all the usual benefits associated with the technology. The system model has 4 roles, namely: commissioner, miner, miner candidate, and client. The commissioner has the highest authority and selects miners, usually officers with high reputations, based on records and can also award points and make deductions based on current performance. Miners are the nodes that work on forming blocks from floating transactions and the blocks are added to the network upon verifying that no malicious activity was detected. -. These are given special roles such as investigations of FIR transactions by the commissioner. The network also employs smart contracts to keep track of actions taken on the FIR and raises alarms if too much time is passed without any significant work. For certifying block authenticity, the proof of voting algorithm [35] is used for the consensus mechanism. The proposers of the system have done a comparative analysis between their system and the traditional systems using 400 cases for time comparison and 200 cases for incentive comparison. The system showed a significant advantage in both cases. Admittedly, the transparency and accountability introduced by blockchain have shown immense improvements.

The aforementioned systems have only considered the police department as a sole stakeholder in the case related proceedings, the most complete and recent research titled "PoliceChain: Blockchain-Based Smart Policing System for Smart Cities" [36] has also considered all the crucial stakeholders such as Citizens, Law Enforcement Agency, Forensics, Court, and Identity Provider and also has provided respective services to the citizens. It also helps in overcoming the limitations of a centralized system by involving multiple stakeholders and agencies that are included in the further judicial proceedings for maintaining the law and order of the nation. It has also addressed the response time issue for multiple requests at different time instances. The blockchain network was created using the Hyperledger Fabric which consists of six chaincodes, namely Citizen Profile chaincode, First Information Report chaincode, Evidence chaincode, Investigation chaincode, Charge-Sheet chaincode, Judgement chaincode, which implements all the functionalities of the system including information access control where Attribute-Based Access Control (ABAC) has been implemented which minimizes the complexity of the network. The entire system takes the idea a step closer to achieving transparency, trust, and accountability in the current system using a blockchain-backed solution.

IV. POSSIBLE ADVANCES TO CURRENTLY PROPOSED SYSTEMS

The need for a modern, technology-based, transparent, credible, traceable, tamper-proof police-judicial record-keeping system is acutely felt. Blockchain has shown promise to be the ideal solution for this problem and systems have been proposed with that intention in mind. Different authors have taken varying approaches to implement the solution, yet, the need and space exist to evolve the system to better, more involved, intelligent systems that function robustly and also help make intelligent decisions. The purpose of these systems should be to help police officers take better and faster decisions.

A majority of the systems, if not all, are static in nature, i.e., they simply perform the tasks as they were programmed to do so, they are unable to make decisions intelligently, depending on the nature of data and events. A smart blockchain-based system

can take the secure distributed ledger and combine it with other upcoming technologies like Machine Learning (ML), Internet of Things (IoT), and Artificial Intelligence (AI). This combinational approach can give the system an added edge.

ML is a field where computers learn through data to find hidden patterns of significance and other information that might not be apparent to humans due to the size of the data. The goal of ML is to get better at a task with respect to some measure as it gains more experience. ML can be used to help assist the human decision-makers, improve the workflow, optimize time efficiencies. An example application can be as follows: Whenever a user files a complaint against any offense on the application, the system can assist the police officer by suggesting the likelihood of it being a genuine case and whether it is a cognizable offense. Similarly, cases can be prioritized, distributed amongst the officials with the best track record in solving that particular type of case. Most of these decisions are currently taken manually and they can be expedited, optimized through the use of ML. This will also help take the pressure off the police officers and they can focus on solving the crime.
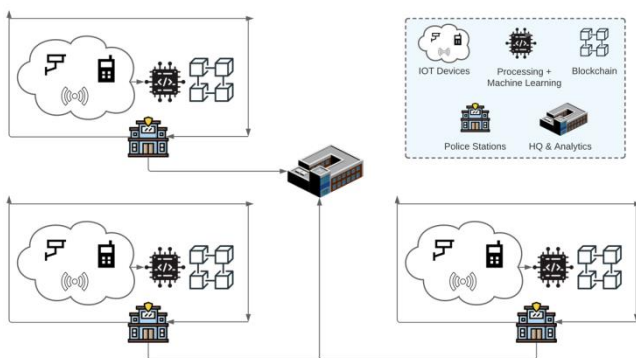

FIG 2. Proposed Integrated Police Case Record Management System

In addition to this, the scope of the blockchain framework may be extended by using additional chaincodes to enforce secure logistics management including but not limited to the transport of evidence, relocation of criminals, etc.

A blockchain-based ecosystem for the management of police stations and jails may be created to assist in additional tracking such as jail-visitors tracking, tracking behavioral progress of jailed criminals, etc. A smart contract that automatically logs any complaint initiated by any citizen (albeit in an ad-hoc state), will ensure that no FIR goes un-logged, which is a major problem as cited by [10].

ML can also be used to improve accessibility through features such as text-to-speech for FIR and update read-outs to the visually impaired and speech-to-text for record-keeping.

IoT employs sensors and devices for capturing information. Through the blockchain-based secure storage system, we are storing the evidence and information related to the case on the system. Smart devices can be of immense help to the police officer. Wearable devices, location tracking, auto evidence collection, crime detection are all applications that can aid the police officer in crime-solving and bring a speedy resolution to the case. The data from these devices can be verified, stored, and used through the blockchain system, Further, ML can be used to analyze this data and gain insights from it.

V. CONCLUSION

In this paper, we studied the Indian police case record management systems, the case flow including the various stakeholders involved in the case proceedings, we saw the traditional methods of FIR registration and case record management, its flaws, and the need for an online system to be introduced. We also studied the subsequent online systems that were introduced and different optimizations suggested by researchers. Having seen these existing systems in use, it was apparent that a modern,

unalterable, transparent, accountable, traceable, chronological system to be introduced to improve efficiency and reduce malpractices. We saw how blockchain technology with its inherent mechanism, architecture, and its different components was a perfect match to this particular application. Along these lines, we analyzed and reviewed various blockchain-based systems that have been recently proposed for solving these particular problems, we also understood the various advantages and drawbacks associated with these systems. While these systems are largely improving their efficiencies and workflows, however, our country being a developing nation, the required infrastructure for a blockchain-based online system such as storage, reach, online facilities, and skilled and trustworthy human resource is still being developed. The challenges associated with these problems are yet to be solved. The blended police record management system solutions that we propose provide a powerful alternative to an efficient, tamperproof case management system.

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