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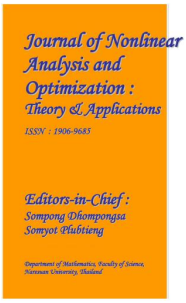

BLOCK CHAIN BASED POLICE COMPLAINT MANAGEMENT SYSTEM

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ABSTRACT

The criminal activities in India are increasing at a rapid rate. Many of these activities go unreported. Even after having an online portal for the police for storing FIRs and NCRs, most of the FIRs are handwritten as a traditional practice. In most of the cases, the complainant has to be present in the police station to file a cognizable offense. An effective system for e-governance was started in 2009 named Crime and Criminal Tracking Network and Systems (CCTNS) for the entire country. However, it is a centralized system for a particular state. Thus there is a need for a completely decentralized system for assuring that there is no central point of failure in the system and complaints are managed securely protected from unauthorized access. Our aim is to propose a blockchain-based solution to manage complaints against both cognizable and non-cognizable offenses. The FIR filed by the police will be encrypted, stored in the IPFS and hash is added to the blockchain network. If the police decide not to file the FIR under pressure or deny receiving any complaint, then the complainant will have strong proof against him/her as the complaint

along with its timestamp was stored on the blockchain network. Having all the records stored in an immutable database would remove any chances of the FIR/NCR being tampered and going unnoticed.

1.
2. INTRODUCTION

In India, complaints regarding offenses have to be registered under the law. There are two types of offenses i.e. cognizable and non-cognizable offenses. Cognizable offenses include serious types of crimes like murder, theft, kidnapping, and rape, etc. As defined in Section 2 (c) of the Criminal Procedure Code 1973, in case of a cognizable offense, police can arrest the suspect without any warrant [6]. The assigned inspector can start the investigation process without any orders from the court. In the commission of any cognizable offense, the First information report aka FIR. is registered at the police station. Any individual can file an FIR. if he/she is a victim or has seen the offense being committed. FIR[1] details include the complainant's name and address, date and time of location and facts of the incident, etc. Once the FIR is registered, chargesheet report is filed by the police officer. The complainant can apply for acquiring the chargesheet by submitting a letter under the Right to Information Act (RTI)[2]-[7] and by paying a certain amount of fees to the court.

Non-cognizable offenses include criminal activities like cheating or forgery etc. N.C. complaint aka non-cognizable complaint can be registered at the police station. It has a structure similar to FIR. As defined in Section 2(l) of Criminal Procedure court 1973, in case of non-cognizable offense, a police officer has no authority to arrest/investigate without a warrant [6]. The police officer has to obtain permission from the court/magistrate in order to start the investigation process. The crime rate i.e. crime per lakh is increasing at a rapid rate. More than 50 lakh cognizable crimes were registered in the year 2018 [1]. Due to increased criminal activities as well as the presence of corrupt police officials, they tend to refuse, avoid or detain the registration of FIR/NCR/Complaints which are the obstacles for the complainants to seek justice at the very beginning. According to a survey [2], 24% of people were unable to register their complaints and 9% of people said that the non-registration was because they were demanded to pay a bribe. Among the people who were able to register their complaints, 30% of the

complainants didn't receive an FIR copy. There is a need for a transparent system to eradicate corruption from the public systems.

We aim to propose an online police complaint management system using blockchain technology for managing FIR's and NCR's in a decentralized manner in order to cater to problems involving denial of police officers to file complaints. Blockchain technology is based on a peer to peer network topology i.e. it is a distributed as well as a decentralized data structure that contains all the legal transactions in links of blocks. The first application of blockchain technology is bitcoin [5], which was proposed by Satoshi Nakamoto. The prime functionality of blockchain is to make sure that only valid blocks are entered into the chain i.e. the block should acquire minimum votes/consensus. The validation of a block is done with the help of consensus mechanisms like Proof of Work, Proof of State and Proof of Capacity, etc. Once a block of transactions is added to the network, it is computably infeasible to tamper a block. The Interplanetary file system(IPFS) is an algorithm which involves peer to peer network for storing as well as sharing files in a distributed manner. The mechanism uses content based addressing i.e. every file is hashed (based on content) and stored in a decentralized network. IPFS can be incorporated with blockchain to provide features like immutability, high reliability and throughput. Relevant to this context, we tend to provide a decentralized application which keeps a track of all the activities related to police complaints right from filing a complaint to submission of charge-sheet to the court. The use of blockchain technology [9],[10] ensures trust between the complainants and the police department. The system is not only secure from loss of data but also from brute force hacking or other types of malicious attacks

3. LITERATURE SURVEY

In recent times, various forms of crime have been happening worldwide. The law-and-order department of any country officially records a crime in electronic forms or on paper when the crime is reported by a victim or someone on behalf of the victim. The document that is prepared to file any perceptible committed crimes including dowry, kidnap, murder, rape, theft, and others is called First Information Report(FIR). Nowadays, online FIR[11] also known as e-FIR has been used worldwide. Every day a number of e-FIR are filed, and they are maintained in a centralized database with the aid of third-party trust. Consequently, malicious entities including

insiders and outsiders' dishonest personnel, and third-party authorities may tamper with e-FIR that questions the transparency and integrity of FIR reports. To address this exposure, in this paper, we propose a blockchain based FIR system[12] to store all kinds of offense-related records to assure security, fidelity and privacy of FIR records. In this proposed system, the blockchain technology that refers to a decentralized and distributed ledger across peer-to-peer networks continually updates the shared ledger and strictly maintains synchronization among all network nodes. Though blockchain technology guarantees tamper-proof of the data, it cannot store a large amount of data due to the replication of ledger among all network nodes. To solve this issue, we adopt the Inter-Planetary File system (IPFS) [13] protocol to store data in the blockchain. IPFS is a distributed file-sharing system that can be leveraged to store and share large files. The blockchain based FIR system has been tested on an Ethereum environment using blockchain and IPFS technology.

The huge success of internet and information technology have a remarkable effect on both public and private sectors within a country[14]. The internet services and applications have drastically increased. That's why people find it more convenient to use internet applications to give an online complain regarding any suspicious activity rather than visiting a police station. This method is reasonably secure since it is possible to hide the identity of the person who reported the complain about the crime. Many cases are not registered in police station since the person complained wants to hide the identity due to the possible risk or danger. It is also feared that there are many pending investigations[15] due to lack of proper evidences from the reporting people. An online application can bridge this communication gap between police and the individuals to send reports or other required information. This paper proposes an application that can be used by the individuals in Riyadh to report and manage their complains effectively. Further the system can be used by the people to register the complaints and is helpful to the police department in identifying the criminals. The main purpose of the application is to improve the effectiveness and efficiency of interaction procedures between the police officials and common people. It would be an outstanding tool to monitor and track the criminals around the country and also have a complete online record of crime related information.

We can see that technology has touched many spheres of our lives in India. There is technology in business, in education, in socializing and maintaining human relations, in purchasing, in

agriculture, in banking, communication, and almost every part of our lives. This intrusion of technology has aided the work in all these sections, and has proved beneficial, and time and effort saving. The only major part of our society that still remains majorly devoid of this luxury is the Indian Police Department. The Indian Police [16],[17] Department has ever since remained manually driven for most of its routine chores. The officials have been adopting the basic fundamental methods of carrying out the proceedings with the traditional "pen and paper" method being highly prevalent. These traditional practices were comfortable in earlier days, when population was far less, and the crime rates were also comparably minimal. But in today's India, when the evil elements of the society are in a boom and so many cases being registered every day, it has become a very tedious task to manage the case and all its related documents, manually. Digitization in Police department is the need of the hour. The traditional method of visiting a police station for registering a police complaint and getting updates needs to be replaced with an online process. Hence an E-police system[18] is being developed which will collect complainant's data through a mobile application, sends the information over to the Police department on their web portal, and in this way the entire interaction occurs online, with information exchanges over the application and the web portal.

This paper is on the project 'Online FIR registration and SOS system'. The system Online FIR registration and SOS project is the first of its kind .It is designed to bridge the gap between the police and the common people. There are plenty of applications nowadays for shopping, travel and even for gaming purposes. However there is no application for the purpose of registering FIR or for helping the people while facing emergency situations. We intend to create a system where the users could register an FIR under various IPC [19] sections and inform the police whenever in an emergency situation. We believe this will be a widely used system in the future and will help to bridge the gap between the police department and the people.

Policing system in Nigeria, a country of about 160 million people is in a state of degradation, criminal offences such as theft, bribery, armed robbery, assassinations and corruption are highly enormous. At the centre of this transformation is the electronic policing (E-policing) [20] system, which is an emerging Internet technology. E-policing practiced by many law enforcement organizations around the globe to improve law enforcement services provided to the community. The use of Internet technology and electronic-based systems seeks an infrastructure with initial

costs that are high and fast application development. This paper is focused on designing and developing an E-policing system to track and control crime rate in Nigeria, and also presents a framework based on technology towards alleviating barriers of manual policing and provisions of how cloud computing principles and Internet technology could be adapted to Nigeria Police Force (NPF) present and future expectations.

E-government is the ICT based system of government service delivery for achieving good governance which is necessity for good and corruption free nation. E-police system is an e-government related service and it makes the communication process a possibility [21], a great success for modern era which increases the professional efficiency for the government police administration, so we can apply this system in Bangladesh. The aim of this paper is to upgrade the country's police administration to the world standard. The home ministry would be connected with the several police units of the city in a fiber-optic based metropolitan area network and a database will be setup for warrant notices, examining the finger prints using the latest electronic device etc. There have to be set up a 'Third Eye' [23] software in the special branches of the police department so that it helps the police supervisors to monitor crime and criminal records. There have to be set up an electronic database and an interactive website which will contain daily press releases, supplement, list of top terrorists and criminals, lists of people under police custody and people injured in road or other accidents etc. In this paper we focus on the infrastructure of an e-police system as well as its steps, challenges of implementation and its necessity. For implementing the software we can use JAVA, PHP (especially AppServer) and MySQL.

Customers are the essential factor in the organization. The business has to support the customers' preferences and demands for creating the customer loyalty, which make the customer still purchases with the particular company. The customer may feel dissatisfied with the service when he or she receives the delay of services and they do not know the channel for filing the complaint, and also the current complaint handling in the organizations still has the problems. Therefore, we, developers of this project implemented the Smart Complaint Management System (SCMS) consisting of the mobile application, chatbot and web application, for solving the customer's dissatisfaction issue. Furthermore, the SCMS [22] has the service for classifying the complaint, then automatically direct to the responsible department, and the service for finding the similar

complaint to avoid submitting the duplicate complaint. The test result shows that this system is able to reduce the time and procedures for complaint handling, increase the channel for filing the complaint, and increase the channel for progress reporting and tracking the status of the complaint.

E-government, necessity for good and corruption free nation, means by using information and communication technologies, especially internet, to achieve better government by delivering public services and processing internal works in government in a much more suitable, customer leaning and cost effective. Like other e-government related services e-police system is also an e-government related service which makes the communication process a possibility, a great success for modern era with increasing the professional efficiency for the government's police administrations. Although E-police system is not a new and original idea in context to global scenario especially in developed countries but it is new for developing countries. Our work will definitely help the police system in making the police work more efficient through equipping the police with modern ICT solutions i.e. it aims to ensure solutions and means for the police officers that support their main activity and it will be interesting for audience in the context of law and order situation in developing countries. In our paper we present all about of an e-police system as well as its steps, challenges during implementation, its necessity etc for developing countries and the ultimate goal of this paper is to upgrade the developing countries' police administration to world standard.

The present world is technology driven as it is employed by many fields in the performance of their operation. In the case of law enforcement agencies, this is evident in the use of automated crime record management systems (CRMS) [21] worldwide to keep record of crime and criminals involved. Crime being an act against the law of a society is a threat to the well-being of the populace and so, requires efficient and effective monitoring. For this reason, CRMS have been developed to achieve this purpose. However, in Nigeria, the CRMS employed is majorly manual, which is, the use of pen and paper. This records are therefore susceptible to destruction from pests and uncensored manipulation by both authorized and unauthorized personnel. This crude method has resulted in problems in the areas of authenticity, security, retrieval, storage, and exchange of information within the NPF. This research aims to design and implement a computerized real time (CRMS) for the (NPF). In developing this CRMS, the waterfall model of

system development was adopted through the stages of requirement elicitation from stakeholders of the CRMS to the systems design and analysis using tools such as entity relationship diagrams for the database and use case diagrams which describe user requirements. The system was implemented using Hypertext Mark-up Language (HTML) for a highly interactive graphical user interface, PHP and MySQL for a robust database. The CRMS enhances efficiency in correcting the problems earlier stated and it is an effective tool for easy analysis of data which will improve the NPF's law enforcement operations, it also allows for criminal records check by Background Check Companies (BCC). The application of the CRMS will result in lower threat level to the Nigerian citizens, thus, improving national buoyancy.

Blockchain is an innovative technology that allows a untrusted node network to share transactional data consistently while removing the need of a centralized authority. In this paper we propose a system to store citizen criminal records in a decentralized way by using a permissioned blockchain, taking advantage of some of its characteristics to ensure privacy, security, immutability, and disponibility of stored sensitive data. This system would overcome the current one since it can cryptographically guarantee that data, once stored, had not been modified but by a competent authority. It also improves the delivery of the records to its destination which can be geographically spread throughout the territory.

4. EXISTING SYSTEM

In the existing scenario, portals provided by Mumbai Police, Crime and Criminal Tracking Network Systems (CCTNS) etc. are being used to register complaints online. While Mumbai Police registers complaints against only Non-Cognizable Offences,[14] CCTNS is providing a centralized system for each state, whilst being decentralized at the national level, taking into consideration both types of offences. Many governments have leveraged blockchain technology to provide cybersecurity, integrate hyper connected service and provide trust and accountability. This ensures the operational and technical feasibility of our proposed system.

LIMITATIONS

Centralization:

The CCTNS is described as a centralized system for a particular state. Centralized systems can have a single point of failure and may be more vulnerable to security breaches or data loss.

Limited Decentralization:

While the CCTNS is a step toward digitization, it might not provide the level of decentralization and security offered by a blockchain-based system. A fully decentralized system can enhance data integrity and reduce the risk of unauthorized access.

5. PROPOSED SYSTEM

Decentralization:

The proposed system suggests moving away from a centralized model to a fully decentralized one. This helps eliminate a single point of failure, making the system more robust and resistant to unauthorized access.

Blockchain Integration:

Utilizing blockchain technology for storing FIRs ensures immutability, transparency, and security. Each FIR is encrypted and stored on the InterPlanetary File System (IPFS), and its hash is added to the blockchain, providing a secure and verifiable link.

Tamper-Proof Records:

By leveraging the blockchain's immutability, the proposed system aims to eliminate the possibility of tampering with FIRs or NCRs, ensuring that the records remain unchanged and verifiable.

Proof for Complainants:

The system aims to provide complainants with strong proof in case of police refusal or denial by storing the complaint along with its timestamp on the blockchain. This enhances the accountability of law enforcement.

Secure File Storage with IPFS:

Storing encrypted FIRs and NCRs on IPFS ensures secure and distributed file storage. This not only enhances data security but also facilitates efficient retrieval and sharing of complaint records.

Smart Contracts:

The proposed system may utilize smart contracts for automating certain processes, such as verifying the legitimacy of a complaint and ensuring that required information is provided before recording it on the blockchain.

Encryption and Secure Communication:

Implementing end-to-end encryption ensures secure communication between complainants, police officers, and the blockchain network, protecting sensitive information from unauthorized access.

Timestamping:

The system incorporates a reliable timestamping mechanism on the blockchain for each complaint. This ensures an indisputable record of when a complaint was filed, adding to the system's transparency and accountability.

User-Friendly Interfaces:

Developing user-friendly interfaces for both complainants and police officers enhances the usability of the system, making it more accessible and efficient.

Integration with Existing Systems:

While not explicitly mentioned in the abstract, the proposed system could consider integration with existing systems like the Crime and Criminal Tracking Network and Systems (CCTNS) for improved interoperability.

4.1 ADVANTAGES

Enhanced Security:

Blockchain technology ensures a high level of security through cryptographic algorithms and decentralization. The use of encryption for FIRs, storage on the IPFS, and inclusion of hashed records on the blockchain provides a secure and tamper-resistant environment. This helps maintain the integrity of complaint records and protects sensitive information from unauthorized access.

Transparency and Accountability:

The decentralized and transparent nature of blockchain technology contributes to increased accountability within the system. Every action, including the filing of complaints and updates to records, is timestamped and recorded on the blockchain. This transparency reduces the likelihood of manipulation, providing a clear audit trail that can be independently verified.

Immutable Records:

The immutability of blockchain ensures that once a record, such as an FIR, is added to the blockchain, it cannot be altered or deleted. This feature prevents any unauthorized tampering or manipulation of complaint records. Immutability enhances the reliability of the system, providing a trustworthy source of information for law enforcement and complainants.

Decentralization and Redundancy:

The shift towards a decentralized system eliminates the risk associated with a single point of failure. By distributing data across a network of nodes, the system becomes more resilient to technical failures or cyberattacks. This redundancy contributes to the system's reliability, ensuring that complaint records are consistently available and accessible.

Proof of Complaint for Complainants:

Blockchain's timestamping and immutability features provide complainants with strong evidence of when a complaint was filed. In case of disputes or denial by law enforcement, the blockchain record serves as irrefutable proof of the complainant's actions. This empowers individuals and increases trust in the complaint management process.

6. IMPLEMENTATIONS

User Registration and Authentication:

This module handles the registration of users, including complainants and police officers. It incorporates secure authentication mechanisms to ensure that only authorized individuals have access to the system. User roles and permissions are defined to control the level of access granted to each user.

Complaint Filing and Verification:

In this module, complainants can file new complaints through a user-friendly interface. The system verifies the legitimacy of the complaint, ensuring that all required information is provided. Smart contracts may be employed to automate the verification process, checking for completeness and authenticity before recording the complaint on the blockchain.

Blockchain Integration and Record Management:

This central module focuses on integrating with the blockchain network. It handles the encryption of FIRs, storage on the IPFS, and the addition of hashed records to the blockchain. Smart contracts could be employed to manage the creation, updating, and retrieval of complaint records. This module ensures the security, transparency, and immutability of complaint data.

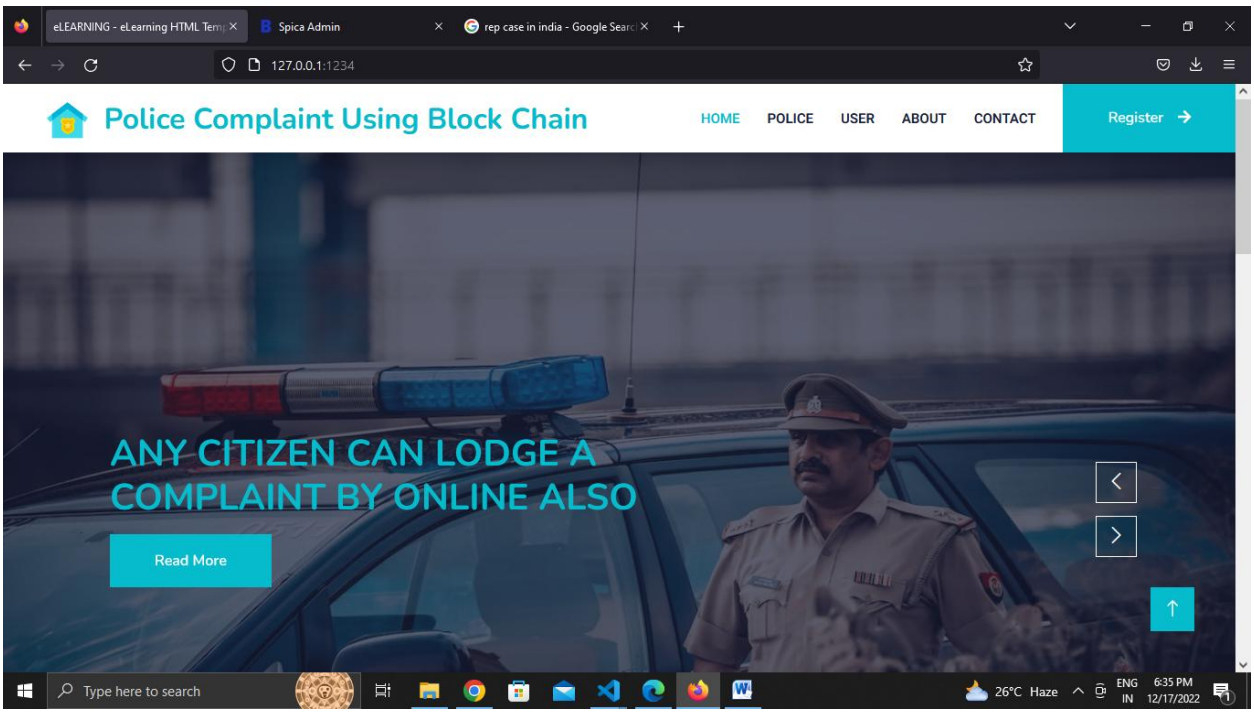
Access Control and Authorization:

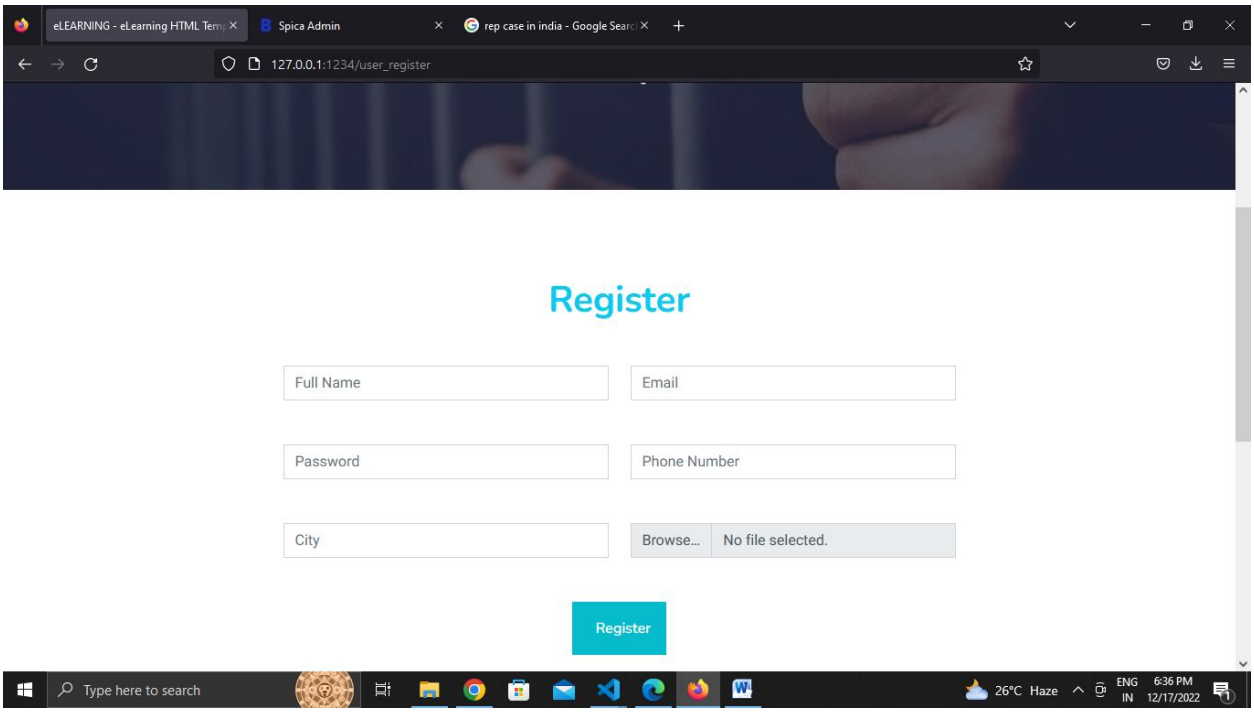
The Access Control and Authorization module manages user permissions and defines who can access, modify, or view specific records. It ensures that only authorized personnel, such as police officers, have the rights to update complaint statuses, while complainants can access and view their own filed complaints. This module contributes to the overall security and integrity of the system.

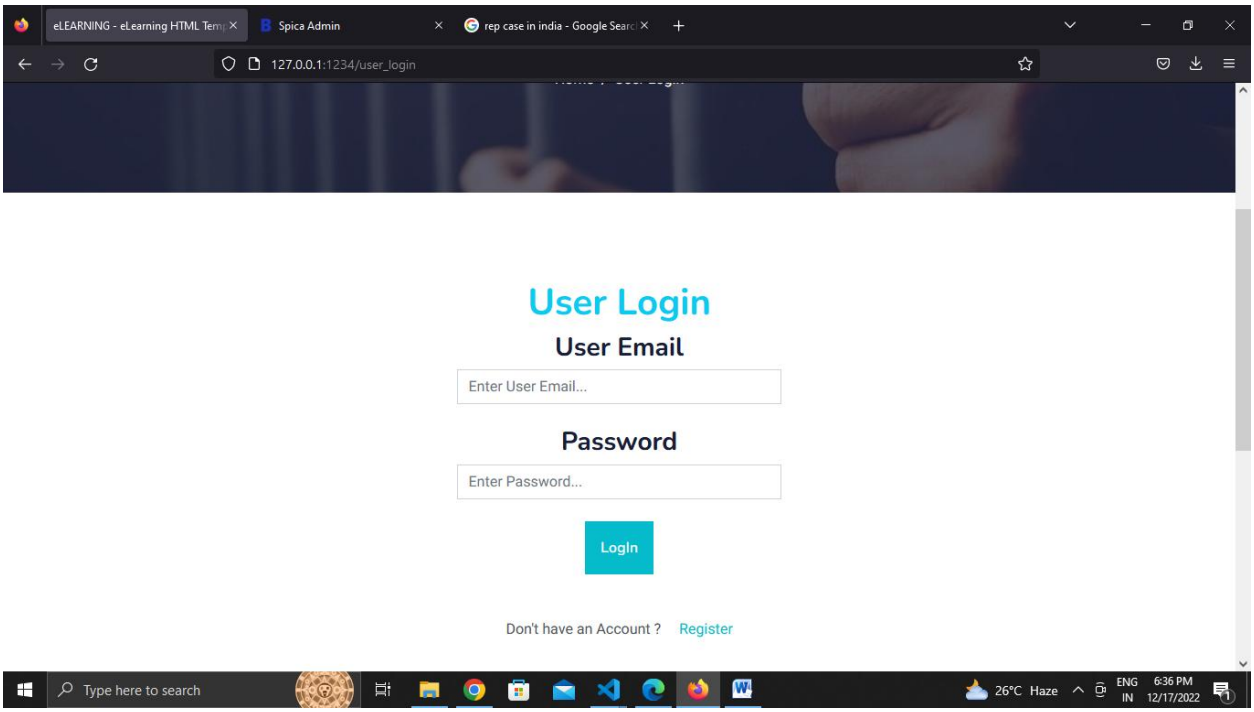
Monitoring and Reporting:

This module provides real-time monitoring of the complaint management process. It allows authorized personnel to track the status of complaints, view updates, and generate reports. Monitoring tools could be integrated to offer insights into system performance and user activities. This module enhances the system's efficiency and facilitates informed decision-making.

7. OUTPUT RESULTS



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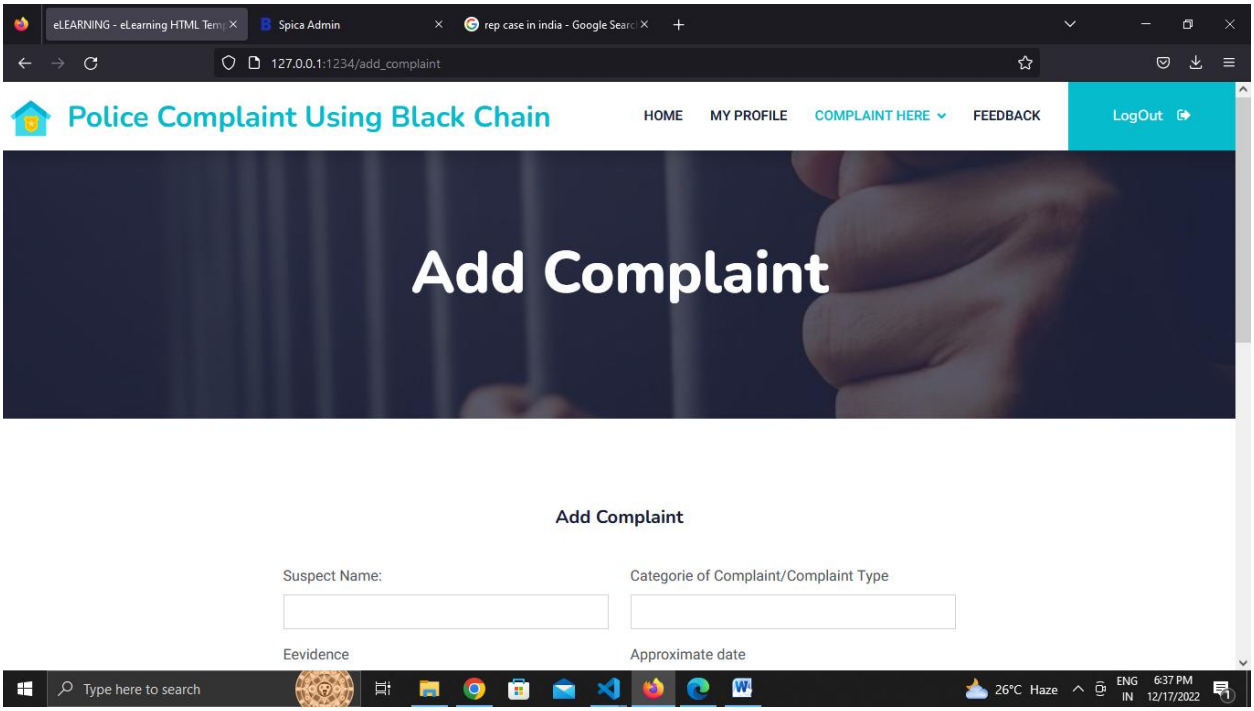
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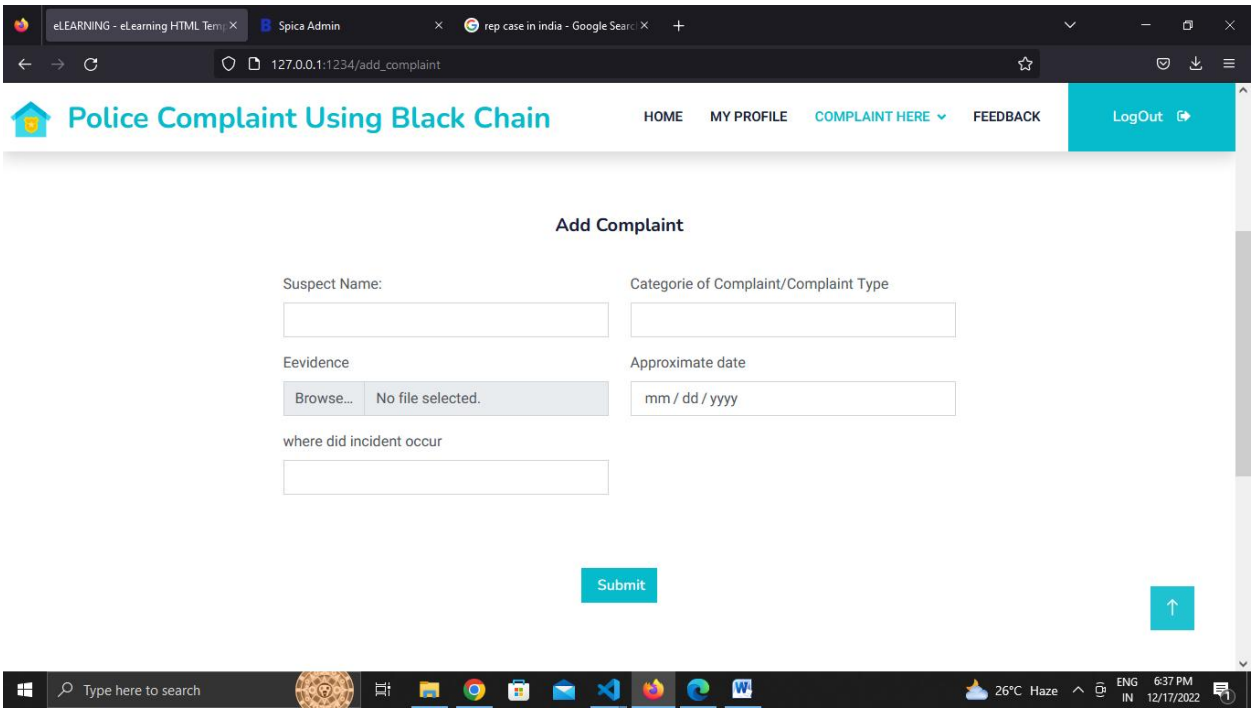
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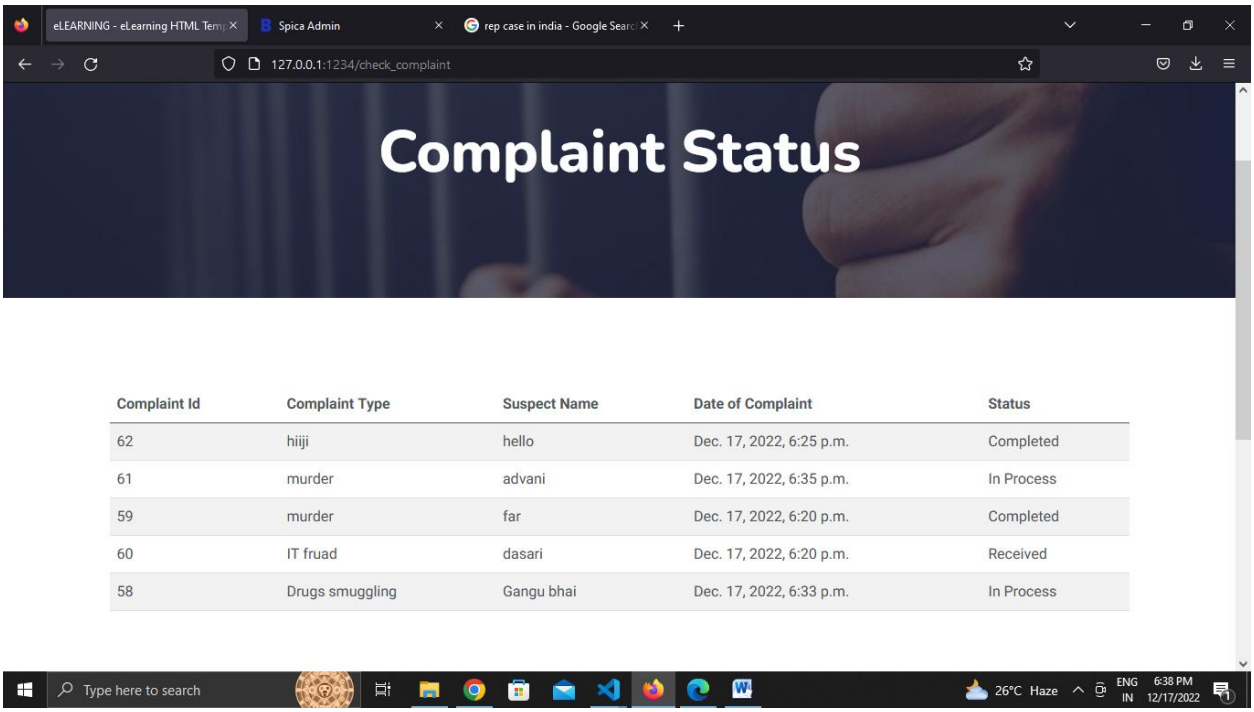
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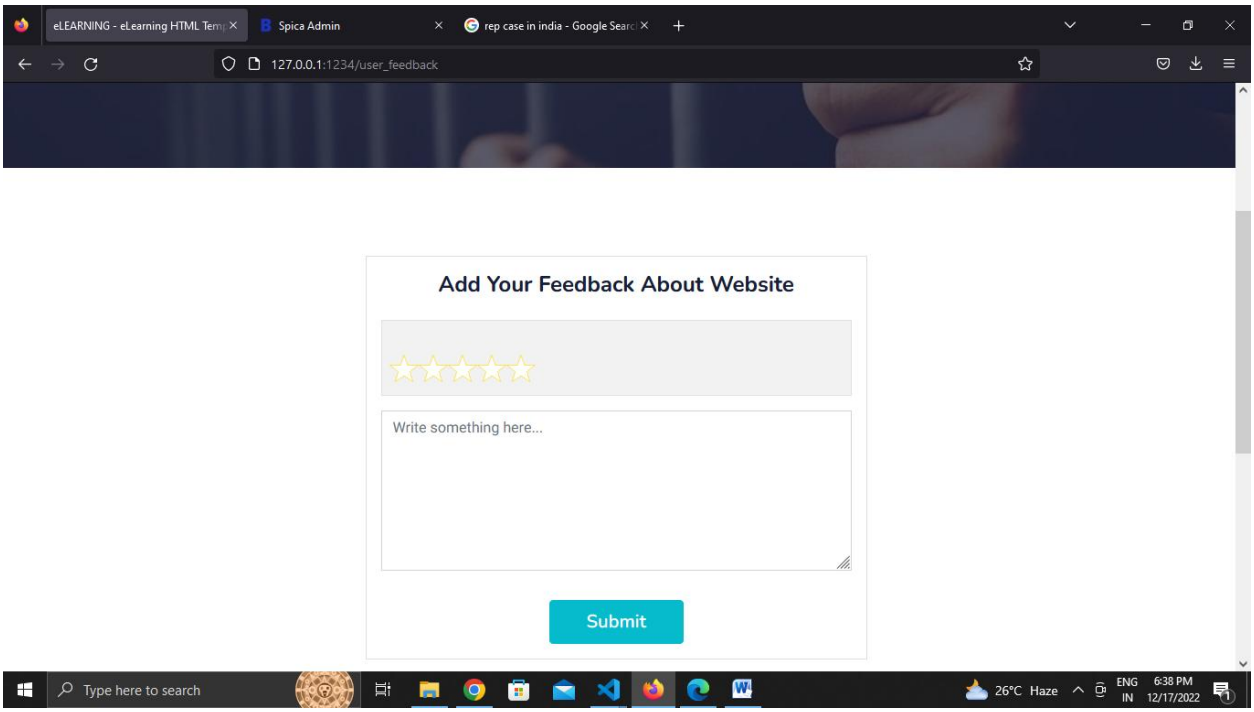
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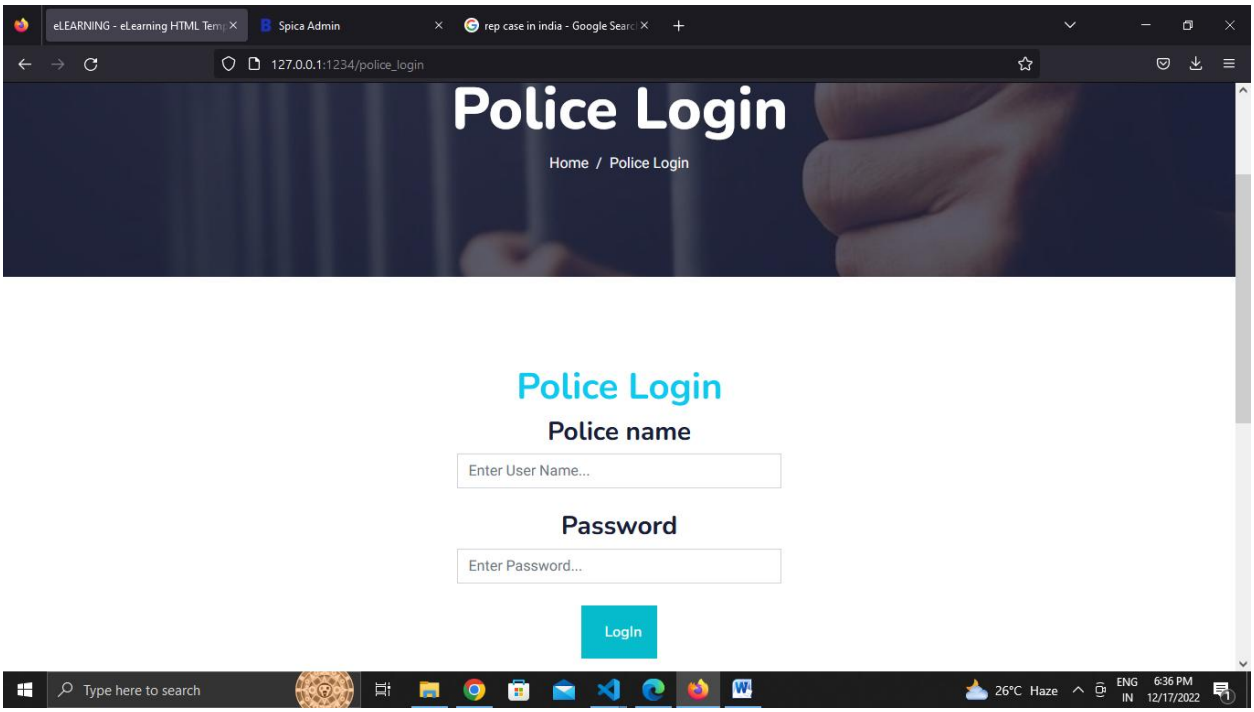
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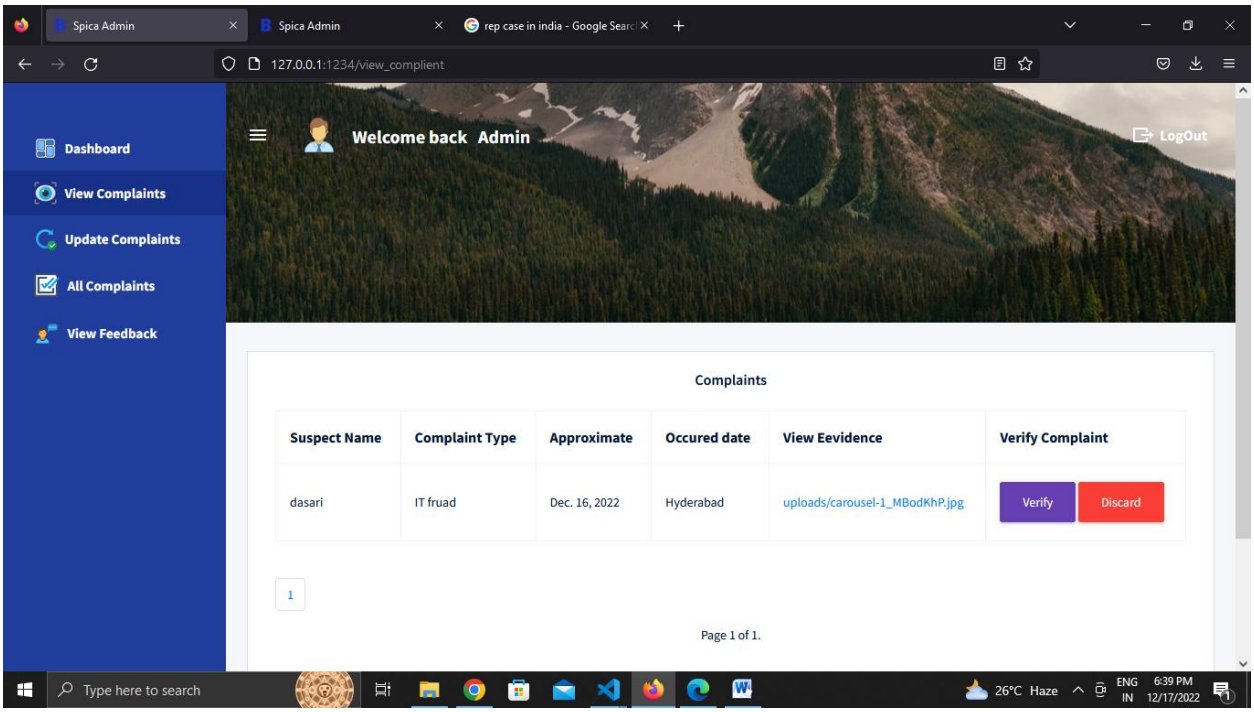
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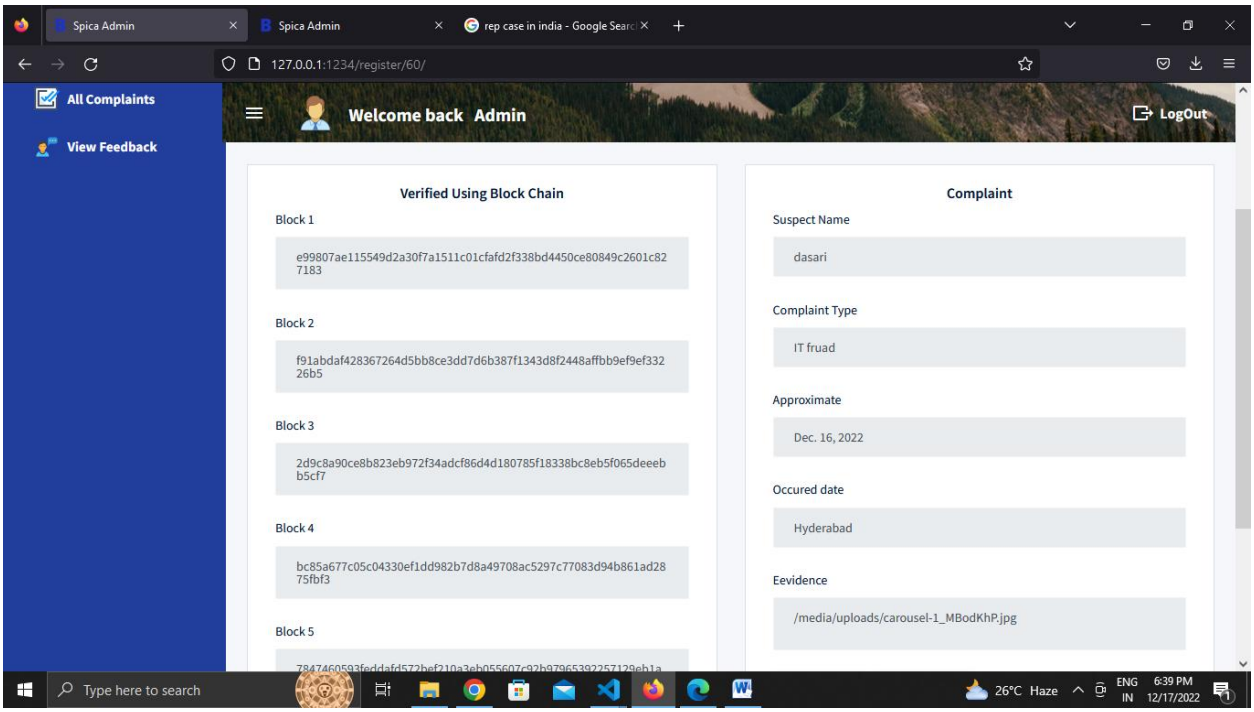
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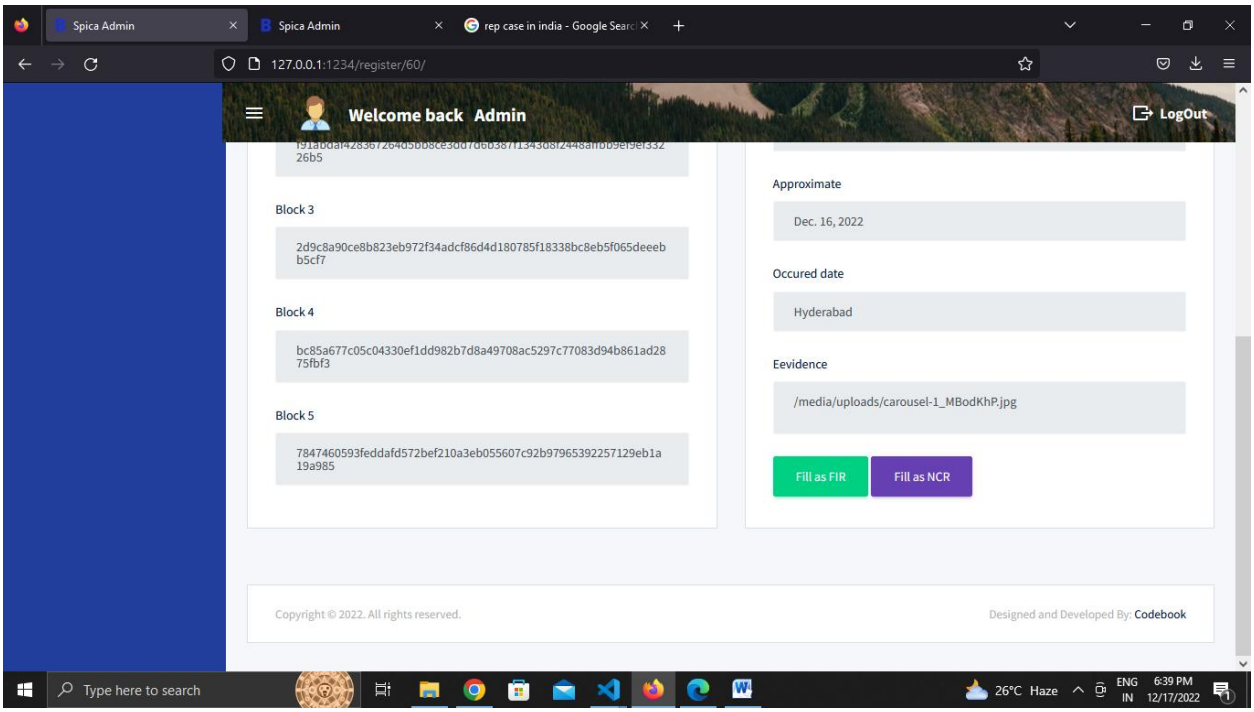
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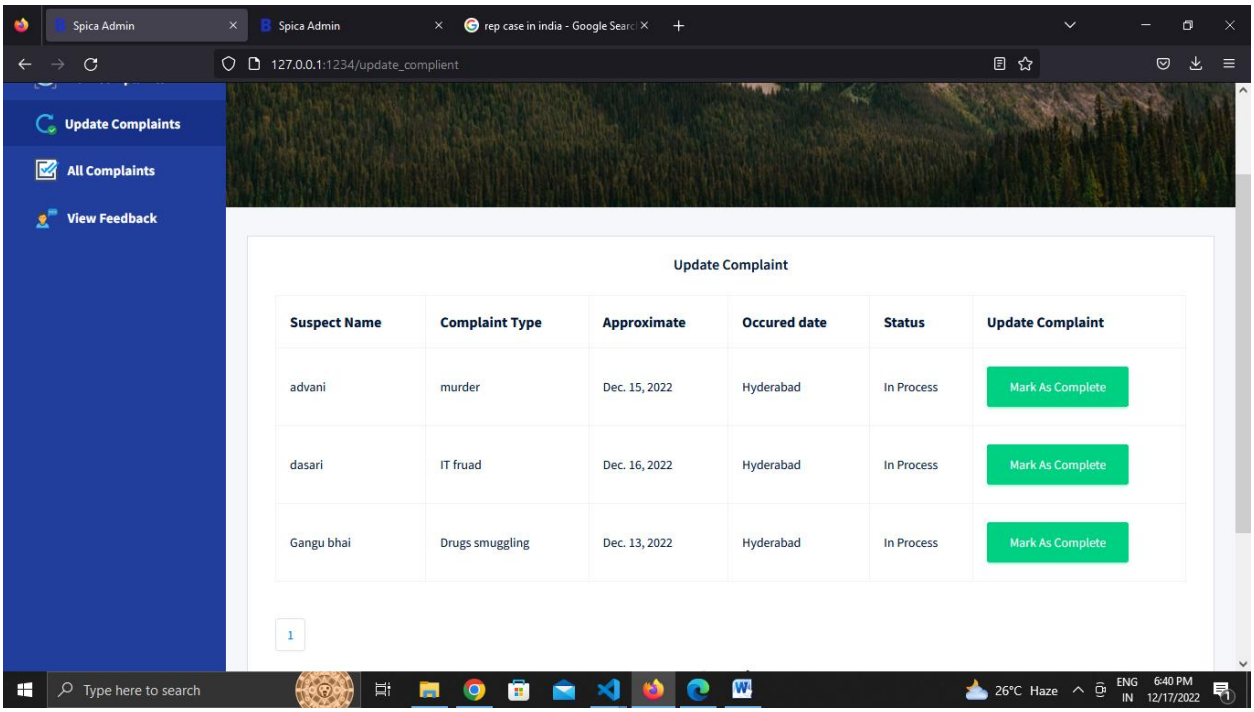
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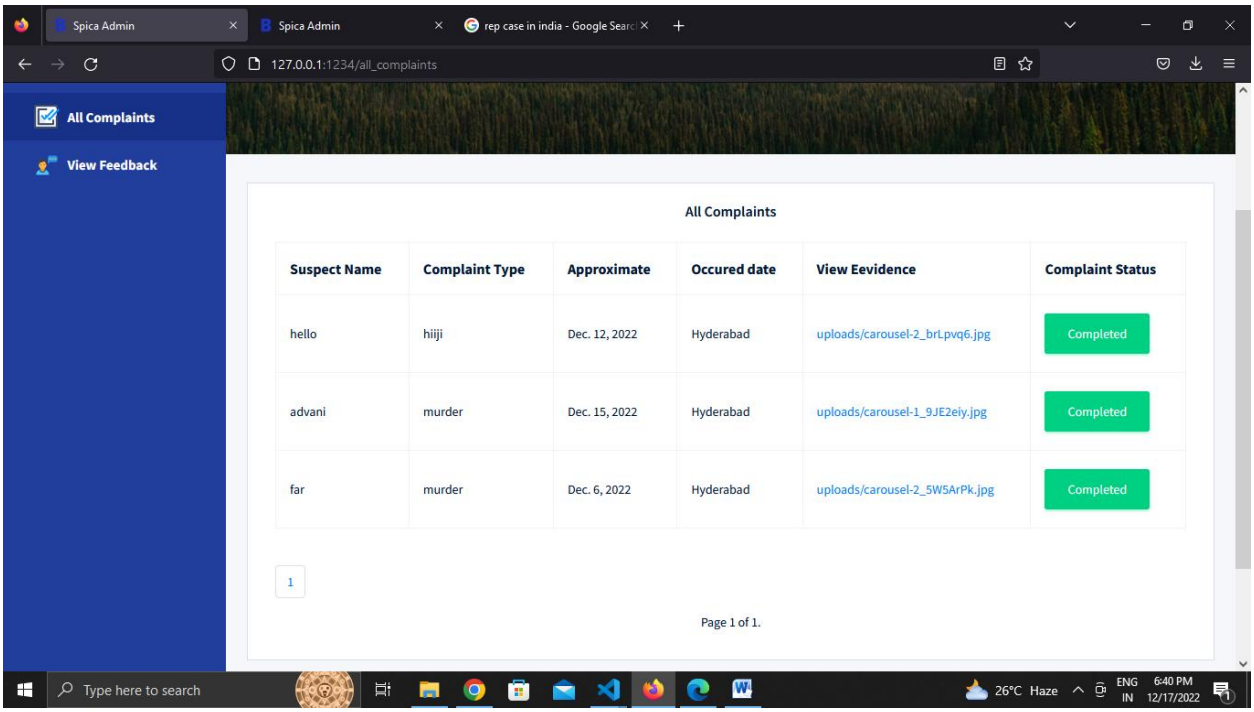

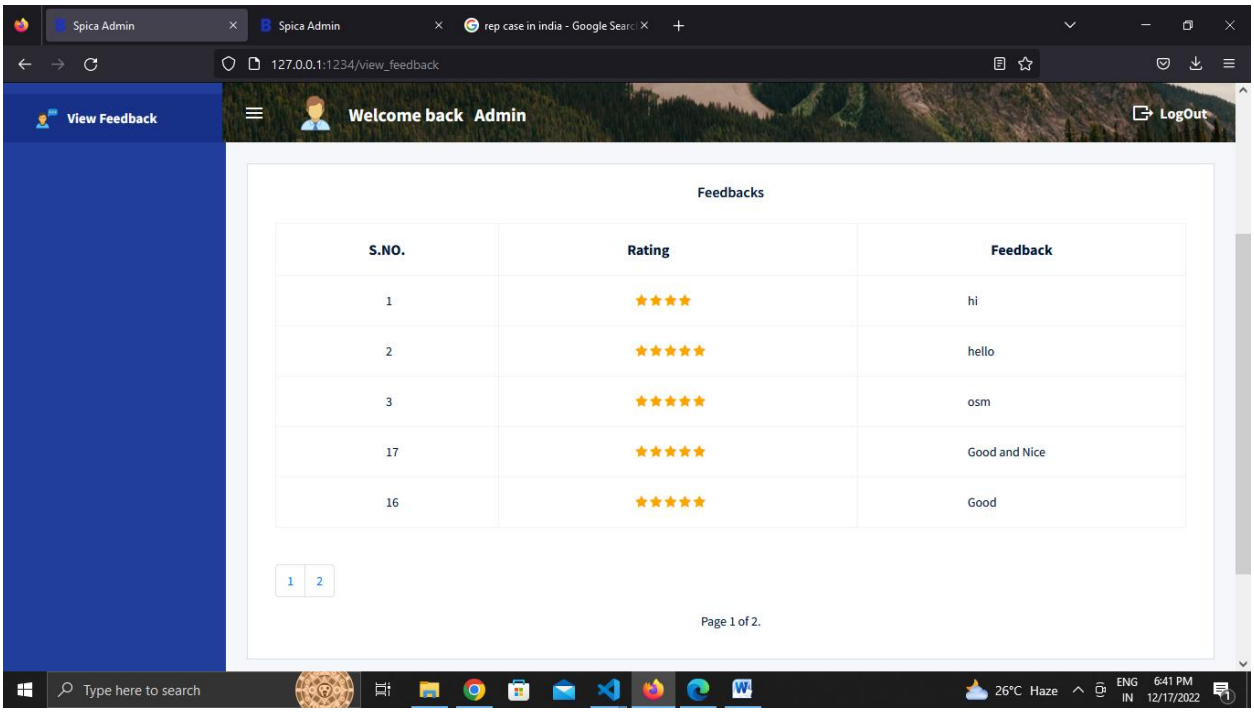

6. CONCLUSION

Indian Police Services are a crucial part of our country. On a yearly basis, more than 50 lakh complaints against cognizable crimes are filed. Even after having systems to manage complaints

online, there is still a burden on the police officers for filing handwritten reports and fear of filing a complaint in the mind of society. Managing Police Complaints in an efficient and secure way is very crucial because it contains sensitive data. The proposed system will provide transparency while also ensuring the confidentiality of the data stored. It will also motivate people to come forward and file their complaints knowing that it cannot be ignored by the police. It will also benefit the police officers by simplifying the tedious work of filing reports such as FIRs. The decentralized network does not rely on the trust factor of the stakeholders. We proposed a system that will protect against corrupt police activities and provide justice at the very beginning.

FUTURE SCOPE :

Here are some potential future directions for a police complaint management system based on blockchain technology:

Improved Trust and Transparency: Blockchain ensures that once data is recorded, it cannot be changed, enhancing trust in the complaint handling process by making it transparent and accountable.

Efficient Collaboration: Blockchain can facilitate seamless sharing of complaint data among different law enforcement agencies, making collaboration smoother and more effective.

Automated Processes: Smart contracts, which are self-executing contracts with predefined rules, could automate various aspects of complaint management, such as notifications and status tracking.

Enhanced Security and Privacy: Blockchain's cryptographic features can bolster the security and privacy of complaint data, ensuring sensitive information is protected while still allowing for necessary sharing.

Integration with Emerging Tech: Integration with technologies like AI and IoT devices could further enhance the system's capabilities, enabling advanced analytics and predictive policing.

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