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Digital Policing & Crime Reporting System

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Abstract: ***The system proposed offers features such as filing FIRs and complaints online with OTP, based verification, secure handling of documents and multimedia evidence, and live tracking of the case status. A role, based system guarantees that access is appropriately granted to citizens, police officers, and administrators. In contrast to traditional systems, this platform uses GIS, based crime mapping to illustrate the crime distribution and locate the most dangerous areas, thus empowering the police authorities with better situational awareness. Besides, the system features AI, driven conceptual elements for crime categorization and anomaly detection, thus enabling crime analysts to make data, based decisions and conduct predictive analysis of the future.***

The security and safety of the data are guaranteed by encrypted communication, access control with authentication, and digital record management that is well, organized. The system is a scalable and modular architecture that can be easily integrated with national e, governance initiatives and digital policing infrastructures. Through the experimental evaluation and the functional testing, it has been revealed that the users' accessibility has been improved, reporting delays have been lessened, and transparency has been increased compared to traditional crime reporting methods. The proposed system is a step towards intelligent, citizen, centric, and technology, enabled policing that is practical in modern law enforcement environments.

Keywords: Online Crime Reporting System, e-FIR, Digital Complaint Management, Public Safety, Identity Protection, Cloud Computing, Smart Policing, e-Governance, Data Privacy, and Law Enforcement Automation.

I. INTRODUCTION

Crime reporting is of paramount importance in initiating the criminal justice process; on the other hand, the conventional station, centric and paper, based reporting methods usually cause delays, lead to under, reporting and lack of transparency. The factors that hinder citizens from filing formal complaints about crimes include inconvenience, fear of retaliation, jurisdictional barrier, and administrative inefficiencies. These factors have been particularly witnessed in the cases involving minor or sensitive crimes [1], [2]. As such, the law enforcement agencies are confronted with difficulties in carrying out investigations in time and managing crimes effectively.

Different online crime reporting systems that allow citizens to lodge their complaints and FIRs through web, based platforms have been designed to mitigate the above constraints [1], [3]. Although they continue to be limited to mere complaint registration and the provision of status updates, such systems enhance accessibility and reduce manual paperwork. Many of the issues, e.g., protecting the identity of the complainant, ensuring data integrity, and the lack of analytical capabilities, still exist in many solutions [4], [5].

New research emphasizes the need for secure, technologically advanced crime reporting platforms that utilize encryption, role, based access control, and centralized data management in order to build trust and improve transparency [6], [7]. Also, recent legal reforms such as e, FIR and Zero FIR provisions under the Bharatiya Nagarik Suraksha Sanhita (BNSS), 2023, highlight the necessity of citizen, friendly and time, bound digital reporting methods [8].

Nevertheless, up to now, there is hardly any adoption of GIS, based crime visualization and intelligent analytics tools in the real, life applications of the system.

Against this background, the Digital Crime Reporting and Policing System under consideration will span the above challenges by offering the users a secure, scalable platform for online FIR and complaint registration, real, time status tracking, and GIS, based crime mapping, thus enabling transparent and data, driven policing.

II. RELATED WORK

Several research works have dealt with the inadequacies of the traditional crime reporting model and have suggested the use of web, based online crime reporting systems. Initial systems were concerned mainly with giving citizens the tool to file their FIRs and complaints via an online portal, thus, cutting down on paperwork and making it more accessible [1], [2]. However, these solutions, while making complaint submission simpler, were still pretty much limited to basic reporting and information display functionalities.

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Subsequent developments have increased the capability of law enforcement officers to track the progress of complaints and have allowed the police to manage cases more efficiently from their side through evidence uploads and complaint tracking. Acharya [3], Verma et al. [4], and Selvi et al. [5] have put forward web, based practical systems that increased transparency and reduced administrative delay. These platforms, however, did not have the advanced analytical features and real, time situational awareness that law enforcement agencies require. Shih et al. [6] tackled security and privacy issues and came up with a cloud, based crime reporting framework that utilized cryptography as a tool to safeguard the identities of the individuals involved, to ensure data integrity, and to achieve non, repudiation. The result was a system that was able to secure reports effectively; nevertheless, the authors concentrated mostly on the protocol design rather than on operational policing features. Recently, some researchers have used agile and RAD, based methodologies to improve usability and scalability, but they have still kept the main focus on basic reporting workflows [7]. However, up to now, most of these systems have neither a GIS, based crime visualization component nor intelligent analytics integrated in them. Moreover, newly established legal frameworks such as the e, FIR and Zero FIR under BNSS, 2023, put forward the requirement of creating technology, enabled, citizen, centric crime reporting platforms [8]. All these reasons have led to the idea of a fully, fledged digital crime ecosystem with features such as secure reporting, spatial analysis, and data, driven decision support.

Comparison of Existing Crime Reporting Systems and the Proposed System

Ref.	System Type	Key Features	limitations
[1]	Online Crime Reporting System	Web-based FIR/complaint filing, admin control, crime information display	No GIS, no analytics, limited security
[2]	Web-Based Crime Reporting	Online FIR, complaint tracking, centralized database	Basic workflow, lacks intelligence
[3]	Online FIR & SOS System	Evidence upload, SOS alerts, location forwarding	IP-based location, no visualization
[4]	Digital FIR & Complaint System	PDF FIR generation, encrypted document transfer, officer chat	Limited analytical capabilities
[5]	Secure Cloud-Based Reporting	Strong identity protection, cryptographic security	Protocolfocused, no policing analytics

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III. SYSTEM OVERVIEW

The suggested Digital Crime Reporting and Policing System is a secure and scalable platform based on the web. It is aimed to replace and upgrade the old, fashioned police recording of crimes and law, enforcement processes. The main features of the system are the registration of FIR and complaints online, safety and security of the handled data, crime mapping, and automatic intelligent modules to help in decision, making that all work in a single platform.

The application is implemented as three different modules, Citizen, Police, and Administrator thus facilitating a role, based access and ensuring that users are held responsible for their actions [1], [4]. Through OTP authentication, citizens can fill out FIRs and complaints forms, upload evidences, and get notified about the progress of their cases at any given time, thereby enabling them to have easy access and full knowledge about the process [3], [5]. On the other hand, Police officers can authenticate the complaints, continue with the investigation, and also handle the documentation of FIRs duly. The administrators, however, keep track of system functioning and the allocation of user roles [2], [4].

In order to satisfy the data protection issue and build customer confidence, the system uses, among other things, verified access control, encoded communication, and safe electronic record management thus fulfilling the requirements of identity protection and data integrity, which had been raised by past studies [6]. In addition, the platform is equipped with GIS, enabled crime mapping that allows to see crime patterns in the neighborhood, and thus helps in the better planning and efficient deployment of resources [7].

Besides that, the system has concept, level AI components for crime sort and spotting outliers to form the base for data, driven policing and later, on predictive analysis [7], [8]. The present scheme is in line with the progressive digital policing measures namely the online FIR, e, FIR, and Zero FIR under BNSS, 2023, and it has been made compatibly for the future links with national e, governance platforms like

CCTNS [9].anomaly detection, providing a foundation for data-driven policing and future predictive analysis [7], [8]. The proposed solution is aligned with emerging digital policing initiatives such as online FIR, e-FIR, and Zero FIR under BNSS, 2023, and is designed for future integration with national egovernance platforms including CCTNS [9].

IV. SYSTEM ARCHITECTURE AND METHODOLOGY

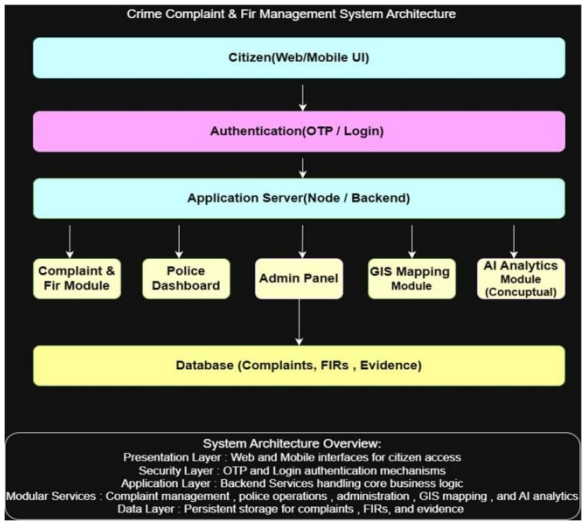


Figure 1: Architecture of Crime complaint & FIR Management

The Digital Crime Reporting and Policing System which has been proposed adopts a modular, web, based architecture that was intended to be scalable, secure, and easy to integrate with different digital policing infrastructures. The system uses a client, server model where user interfaces communicate with centralized backend services through secured channels.

As per the figure 1, three primary layers constitute the architecture: presentation layer, application layer, and data layer. The presentation layer, offers different web interfaces for the citizens, police officers, and administrators. The application layer focuses on core functionalities such as user authentication, role, based access control, complaint, and FIR processing, investigation updates, and administrative monitoring. The data layer stores the complaints, FIR records, user profiles, and digital evidence in a centralized database [1], [4].

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The system workflow starts when citizens file crimes online after being authenticated. Then police officers verify and process the crimes based on their jurisdictions and assigned roles. System administrators, on the other hand, ensure that the procedures followed are in compliance and the whole operation is transparent. Multiple security features such as secure authentication, encrypted communication, and controlled data access are implemented to protect sensitive information and maintain record integrity [5], [6].

Besides that, the system has a GIS, based crime mapping feature to illustrate, geographically, where the crimes occurred to facilitate the identification of hotspots and the preparation of operational plans. Conceptual AI, driven components for crime classification and anomaly detection are also incorporated to allow data, driven policing and later predictive analysis [7].

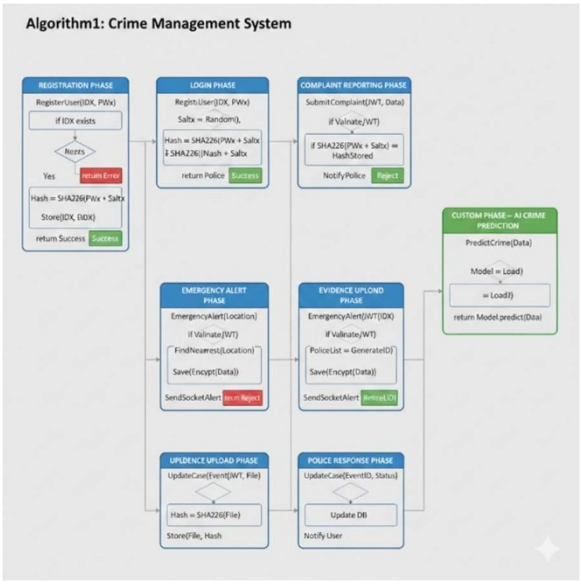


Figure 2: Algorithm Crime Management System

V. SYSTEM IMPLEMENTATION

System Implementation The suggested Digital Crime Reporting and Policing System is realized as a secure web, based application that supports scalable, role, based, and centralized crime management. The architecture unifies citizen, police, and admin modules into a single digital platform, thus overcoming the shortcomings of previous online crime reporting systems [1], [2], [10].

1) Frontend Implementation The frontend is built with React allowing a component, based and responsive user interface. Different dashboards are given to citizens, police, and administrators ensuring role, based access control. Citizens can lodge complaints, attach digital evidence, and get FIR status updates in real time while police officials can authenticate and add information to the cases. This compartmentalized interface further the structured, access and centralized, dashboard concepts from earlier web, based systems [4], [11], [12].

2) Database and Backend Implementation The backend is responsible for request processing, validation, and execution of business logic. MongoDB serves as the main database for storing users, complaints, FIRs, and crime scene GPS data. Its document, oriented architecture allows for a versatile and scalable storage of crime, related information thus going beyond the traditional database, driven implementations [5], [10]. Role, based authentication procedures secure the system from unauthorized access, thus the data integrity and identity protection issues raised in previous research are handled [6], [7].

3) GIS Module To further improve spatial awareness, the system uses the Google Maps API to visually represent crimes. Every complaint is geotagged and represented on a map as a marker, this map is interactive which makes it easy to analyze crime distribution and identify hotspots. This GIS, based feature not only records a complaint but also provides a platform for crime analysis [1], [3] which is in accordance with the recommendations for data, driven policing and spatial crime analysis [7], [14].

4) Security and Data Handling Security is guaranteed through various means such as authenticated access control, secure API communication, and structured data storage. To ensure that digital evidence files are not tampered with, they are securely referenced in the database. These security measures are in line with the secure cloud, based crime reporting frameworks and digital identity protection models proposed in earlier studies [6], [7], and they also comply with the requirements of the latest e, FIR frameworks under BNSS, 2023 [9].

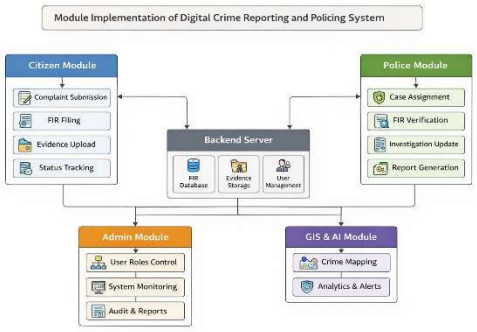


Figure 3: Module Implementation

VI. RESULTS AND DISCUSSION

The Digital Crime Reporting and Policing System developed in this work was put through running tests, checking workflows, and was GIS, visualized with the support of MongoDB schema and backend services implemented. The evaluation is mainly concerned with the aspects of user, friendliness, proper structured data handling, and the system's capability to support the user's decisions rather than the prediction accuracy, which is in line with prototype, oriented digital policing works [6], [10].

A. Functional Results

Validation was performed successfully for the major modules such as registration of complaints, management of FIR status, police verification and handling of notifications. The MongoDB collections (Complaint, User, Notification) were used to guarantee data as structured and persistently stored, thus solving the issue of record loss and inefficiencies that were identified in earlier online crime reporting systems [1], [2], [11].

People could file complaints and check the status digitally, whereas police users could update the investigations via their role, based dashboards. The above hits of the results are a proof of the improved transparency and operational efficiency that the digital methods and especially, online crime

[403091]reporting bring forth in contrast to traditional station, based methods and earlier web, based systems [3], [4], [12].

B. GIS and Analytical Evaluation

Geotagged crime records have been displayed using the Google Maps API, which also facilitates finding the areas where complaints are more stringent and supports the knowledge of hotspots. Thus, this spatial facility goes one step further than the text, based reporting platforms and lays the ground for enhanced situational analysis [5], [6], [13].

AI, based decision support is shown by the analytical dashboard(s) that include(s) crime risk display, and police resource suggestion graphs. Earlier systems were primarily focused on complaint submission [1], [3] whereas here the integrated platform of secure reporting with spatial and analytical insights that are compatible with the data, driven policing recommendations is envisaged [7], [14]. " The structure of the dataset used for functional and analytical evaluation in summarized in Table 2."

Attribute	Description	Source
Complaint ID	Unique identifier for each crime report	Auto-generated by system
Crime Type	Category of crime (e.g., theft, assault, cybercrime)	Complaint schema

Crime Description	Textual description of the incident	Citizen input
Latitude	Geographic latitude of incident	Google Maps API
Longitude	Geographic longitude of incident	Google Maps API
Assigned Police Unit	Police authority handling the case	Police Controller
Risk Score (Derived)	Aggregated crime severity indicator	Analytics module

While previous systems mainly focused on complaint registration or cryptographic security aspects [1], [6], [11], they did not have integrated spatial and analytical features. The proposed system tightly integrates secure data management, role, based access, GIS mapping, and dashboard analytics in one architecture. The results show that the system not only lays down a scalable foundation for the next generation of digital policing but also facilitates the progress of e, governance and digital FIR projects [8], [9].

AI, assisted decision support is clearly shown through police resource suggestion graphs and crime risk visualization on analytical dashboards.

Whereas earlier systems were mainly complaint submission, oriented [1], [3], the proposed platform has security at its core and adds spatial and analytical components in line with data, driven policing recommendations [7], [14].

VII. LIMITATIONS

Such a system, while advanced in terms of providing more accessibility, transparency, and decision, support, also has some limitations. An important limitation is that the evaluation has been done on synthetically generated datasets rather than on large, scale real, world crime data which means that the assessment has been limited to only orderly operations excluding the real chaotic conditions of an operation. The AI, driven components merely act as decision, support tools, They are thus not capable of fully automated or real, time crime prediction.

Moreover, the system is tested under a controlled environment only, and still, it is neither integrated with national platforms such as CCTNS or NCRB, nor evaluated under high user load scenarios. The present version is mainly designed for web, based access and has very limited mobile optimization and no offline reporting capability at all. To take these limitations away a large, scale deployment, a collaboration among institutions, and an integration with the national digital policing infrastructure would be needed.

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VIII. CONCLUSION AND FUTURE WORK

This article described how we designed and implemented an advanced Digital Crime Reporting and Policing System which is secure and scalable and addresses the gaps of traditional as well as online crime reporting mechanisms.

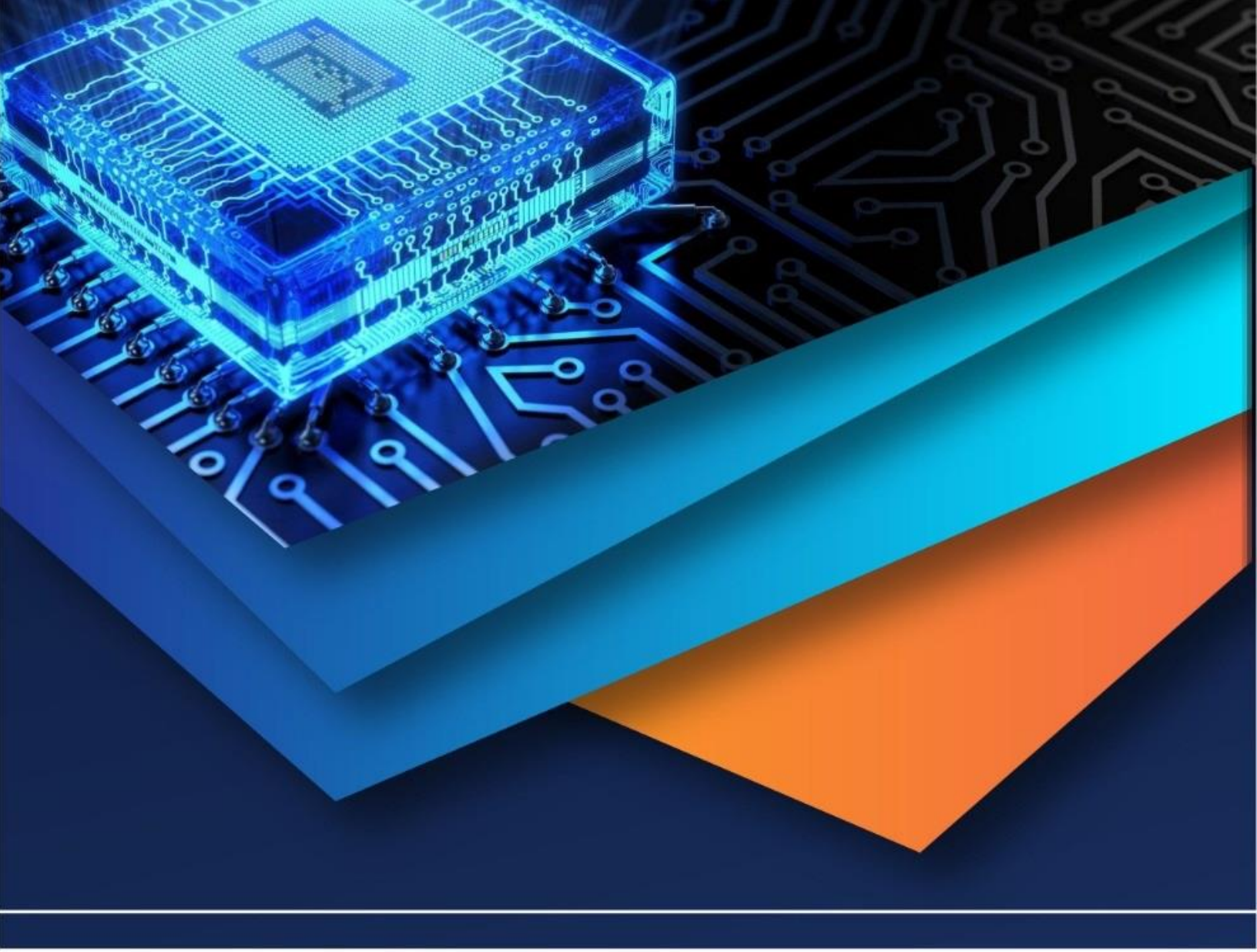
The proposed system through the online FIR and complaint registration, role, based access for citizens, police, and administrators, and secure digital evidence handling features enhances accessibility, transparency, and operational efficiency as compared to manual station, centric processes [1], [3], [4]. The addition of GIS, based crime visualization component also facilitates enhanced situational awareness by enabling law enforcement agencies to locate crime, prone areas and track spatial crime patterns in real time [5], [7]. We conducted experimental evaluation of the system functionalities using synthetically generated datasets that demonstrated the system's capability of handling end, to, end complaint processing, real, time status tracking, and analytical dashboard visualization. Differently from many existing systems that focus only on complaint submission and tracking [1], [2], our proposed platform combines secure reporting workflows with spatial analysis and decision, support functionalities. The combined model complies with the latest studies which stress the importance of data, driven and citizen, centric digital policing solutions [6], [8].

Our system, however, is at present a prototype and was tested in a controlled environment only. The future plan is to employ real crime data and further enhance the system features by the incorporation of advanced machine learning models for analytical purposes.

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