RESEARCH PAPER

SMART DIGITAL CRIME REPORTING SYSTEM FOR TRANSPARENT AND EFFICIENT LAW ENFORCEMENT

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ABSTRACT

Background

Conventional crime reporting systems are associated with delays, manual processing and low level of citizen participation hence lack transparency and efficiency in law enforcement operations. The current paper introduces a Smart Digital Crime Reporting System (DCRS) that would solve the specified problems by offering an entirely online, citizen-focused reporting, tracking, and criminal case management system.

Objective

Citizens have the opportunity to safely file complaints on the Internet, leave evidence and follow the development of the case in real-time without necessarily accessing the police offices physically. It uses an intelligent case assignment algorithm which gives precedence to the cases and assigns an officer to the cases depending on the location, availability and urgency to maximize the use of resources and also minimize the time of response.

Materials and Methods

Role-based access control can guarantee the privacy and accountability of data, whereas built-in analytics help recognize crime trends, hotspots, and patterns to make strategic decisions in policing. DCRS can be used to increase efficiency in operations, minimize the delays in reporting, and increase citizen trust because it combines automated complaint handling, evidence management, and real-time analytics.

Conclusion

The offered system is a big step to data-based, transparent, and intelligent law enforcement as it will fill the existing gap between citizens and police services, which will encourage responsibility and proactive crime management.

Keywords: Digital Crime Reporting, Intelligent Case Assignment, Evidence Analytics, Smart Policing, Citizen Complaint Management, Law Enforcement Transparency.

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I. INTRODUCTION

The growing complexity of city settings and the height of criminal activities in recent years has highlighted the necessity of effective, transparent and citizen-focused crime reporting systems. The conventional ways of reporting crimes that are mostly manual and face-to-face are mostly time-consuming, highly prone to delays, and lack any form of transparency, which diminishes the confidence of the citizen in the law enforcement agencies [1]. So as to address such constraints, there has been the emergence of digital crime reporting systems that use web and mobile technologies to enable real-time complaint registration, submission of evidences and tracking of cases [2]. Online systems can also simplify the reporting process, as well as offer the law enforcement agencies with tools to deal with cases better. According to Mahmoud et al. [1], a proposed system of online crime reporting combines digital communication between the victim and authorities and the use of the physical investigation facilitated by dashboards, classifier of crime types, and natural language processing to derive valuable information in the report. On the same note, Bhargavi et al. [2] highlighted the need to provide automated allocation of cases and their statuses, which allows quick response and also reduces the administrative load on officers. There is a growing use of advanced surveillance and identification systems in modern systems. H. The authors S. and M. V. Anand [3] have shown how secure databases, real-time surveillance with CCTV, and the use of face recognition are used to identify criminals better and increase the rate of investigation and the safety of the population. Another important feature is spatial awareness; as Abidi et al. [4] emphasized, interactive mapping applications have a great advantage because it allows users to report the crime with geolocation data, allowing the law enforcement agencies to analyse the crime hotspots and prevent crimes. In addition to crime, integrated reporting systems have proved useful in the event of disaster and emergency. Baltazar et al.

[5] created a disaster and crime reporting system that works as a decision-support system, where citizens could report the incident through mobile or web applications, and the authorities could update and control emergency response effectively. The proposed Smart Digital Crime Reporting System (DCRS) is driven by these innovations and seeks to integrate safe complaint reporting, automated distribution of the officer, management of evidence, and analytics into one platform that is easily accessible to the citizens. DCRS improves transparency, accountability and operational effectiveness of present day law enforcement by addressing the weaknesses of the old systems.

II. RELATED WORKS

The increasing need to have efficient and transparent crime reporting systems has given rise to mobile and web-based systems which have improved safety of people, as well as enabled the simplification of law enforcement procedures. M. K. et al. [6] recommended a crime reporting and management system that is based on mobile applications to enable citizens report the incident in real time along with necessary information like the type of crime, description, photographs and geographical positions. Using geolocation services and safe authentication, the system will help to provide the correct crime mapping, safety, and instant notifications to the law enforcement as well as citizens. Predictive analytics also aid the process of resource distribution and crime prevention and are better in their response accuracy and efficiency. Although they increase accessibility, underreporting and evidence tampering are still present with mobile reporting. Thakare et al. [7] investigated these problems and found out that a large number of crimes remain unexplained because of the fear of retaliation or due to the lengthy process of filing. They proposed that blockchain-based solutions would be able to improve evidence integrity and simplify complaint management and provide a consistent alternative to traditional reporting processes.

It has also been revealed that a crime reporting based on time is also important to understand. G. V. and A. R. B [8] examined report delay, which indicates that the addition of the time interval between the occurrence of incidence and reporting by the media has a significant positive effect on predicting crimes and determining the status of the case. The models of machine learning taking into account reporting delays can assist the authorities to recognize the high-priority cases and maximize response times, especially with rare or unusual crimes. Another important field of study has been automated crime classification. Ponnusamy et al. [9] applied K-Nearest Neighbors (KNN) and natural language processing to the textual crime report to maintain the text in the Indian Penal Code (IPC). This method will minimize the use of manual work, provide uniformity of case classification and also harmonizes well with the police working processes thus facilitating the handling of cases at large scale. There is also the attention on visualization and decision-making on the basis of data. P. A. et al. [10] created the CrimeView, a crime data data analyzer in the form of an interactive dashboard, providing district-level, type-level, and year-level crime data. The system allows detection of hotspots, comparison and effective decision-making in law enforcement as well as improving transparency of the system to the rest of the population by converting textual reports in large volumes into graphs.

New developments in mobile and artificial intelligence crime reporting systems have also contributed to the improved efficiency and safety of law enforcement and citizens. Chowdhury et al. [11] proposed Blueprint that is a mobile application, which combines cybercrime-detecting, fraud reporting, online GD and FIR, police station search, and emergency chat services. The system fills in the shortcomings of the previous applications since it offers a whole package of tools to the system to the citizens as well as the police officers themselves with credibility tests showing a positive user response of over 61 percent, showing the fact that this is a useful tool in proactive crime prevention as well as police aid. Hot spot detection and predictive policing have become important resource allocation tools. Vanitha et al. [12] came up with an optimized LSTM based framework in real-time prediction of crime hotspots. The model has been shown to be accurate when it comes to identifying the high-risk areas by analyzing the sequential crime data historical records, which can contribute to the timely intervention and the informed utilization of the law enforcement resources. This method is better than the old approaches since it can support dynamic crime patterns and extensive temporal data to enhance the safety of people using the predictive analytics.

Another technological innovation is crime severity and impact assessment. Prashant et al. [13] have suggested Crime Value Index as an AI-implemented tool that analyzes instances of crimes not in terms of their frequency, but also by their severity. The geo-location analysis enables police to visualize changes in crime density and rank interventions based on them, which is a more sophisticated measure of crime than raw crime rates. Crime report automated classification is increasingly becoming relevant due to the increasing amounts of digital information. Vieira et al. [14] adopted a hierarchical multi-class and multi-label machine learning method with XGBoost and presented a better accuracy and short training time than baseline models. The hierarchical structure of crime categories allows the system to map narrative reports to particular crime categories in a very efficient way, increasing consistency and scalability of big law enforcement databases. Lastly, Kvet et al. [15] have discussed the issue of monitoring and comparative analysis of crime at regional and national levels. Their crime monitoring software platform gives a European crime monitoring interactive charts, maps, and statistical analysis of the reported and convicted crimes, jail conditions, and distribution of police workforce. These are useful tools that help administrators, analysts and policymakers to measure and assess the trends, gaps and make evidence-based decisions to enhance security in the region.

All these works point to the co-existence of mobile reporting, AI-powered classification, predictive analytics and interactive visualization, which makes the proposed Smart Digital Crime Reporting System (DCRS) design-driven by integrating real-time citizen reporting, automated analysis, and decision support into a single platform.

III. PROPOSED SYSTEM

The Smart Digital Crime Reporting System (DCRS) that is proposed is aimed at changing the old-fashioned process of crime reporting to a completely digital, efficient, and transparent system. Figure.1 shows a proposed work architecture design. The system permits the citizens to post

complaints over the internet via a protected web or mobile platform, meaning that they may use the platform to provide detailed accounts of the incidents and evidence to prove them including images, videos, or documents. As soon as they are received, the complaints are on a secure database that is stored centrally to guarantee integrity of data and avoid unauthorized access to it. The efficient work of the system is an intelligent case assignment module. This unit automatically assesses each complaint according to the priority, nature of the offense, place and urgency and directs the case to one of the available officers or team which optimizes work distribution and reduces the response time. Role based access control will allow only authorized personnel to view or take actions on the assigned cases; this will provide accountability and privacy. Real-time reporting and analytics are also included in the system. Interactive dashboards enable the law enforcement officials to track progress in the investigation and monitor active cases as well as detect trends in crimes or hotspots. The analytics help in proactive decision-making whereby the police can be in position to make strategic resource allocation and proactive actions. Also, the citizens get automated notification and updates on the status of their complaints leading to transparency and trust. Combining complaint registration, evidence management, automated case assignment, and analytics, DCRS can increase operational efficiency, decrease the time required to report and increase responsiveness in law enforcement. This new system is unique in that it is a hybrid of citizen-focused digital reporting and smart officer assignment and crime analytics that creates a smart policing platform that responds to the gap between citizens and police.

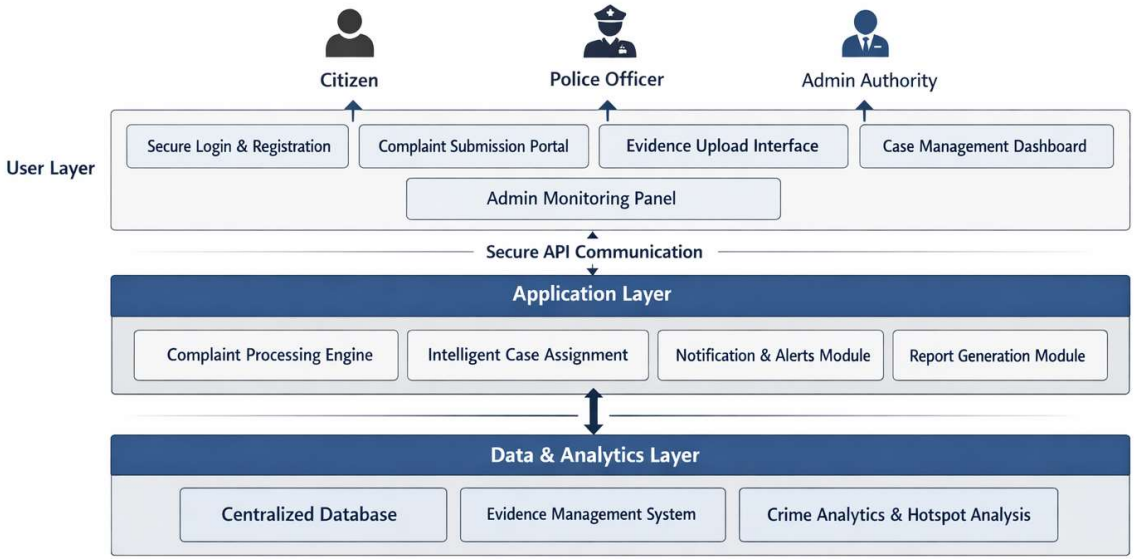

Figure.1 Proposed Work Architecture Diagram

It eventually leads to accountability, prompt action, and sound-guided decision-making, which opens the way to the modern, transparent, and proactive manner of controlling crime.

IV. METHODOLOGY

The suggested Smart Digital Crime Reporting System (DCRS) has a well-organized methodology and incorporates secure complaint registration, smart case allocation, evidence management, and analytics-based policing. The system has been made to guarantee transparency, efficiency and promptness of action as well as data privacy and accountability. The methodology is broken down into four major modules, namely User Complaint Interface, Case Management and Officer Assignment, Evidence Analytics and Reporting and Monitoring.

A. Complaint Registration and Authentication

The citizens can use the system by registering complaints via a web or a mobile application. The interface enables users to give a detailed description of the incident, classify the nature of the crime, and attach evidence to support the incident this may be an image, a video, or documents. To guarantee authenticity and responsibility, the submissions are authenticated by user identity and a digital recognition ensuring that the citizens are given a reference number of their complaint to track their status.

Citizens register complaints through a secure web or mobile interface. Let the set of registered users be denoted as $U = \{u_1, u_2, \ldots, u_n\}$ and the set of submitted complaints as $C = \{c_1, c_2, \ldots, c_m\}$. Each complaint c_i is associated with a user u_j via a secure authentication function f_{auth} defined as:

$$f_{\text{auth}}(u_j) = \begin{cases} 1, & \text{if user credentials are valid} \\ 0, & \text{otherwise} \end{cases} \quad (1)$$

Once authenticated, each complaint is assigned a unique identifier CID_i and stored in the centralized database D.

B. Intelligent Case Assignment

After a complaint has been made it is saved in the centralized and encrypted database. The intelligent case assignment algorithm of the system is used to rank every complaint based on severity, location and availability of the officers. The cases are automatically assigned to the appropriate officers or teams, which maximizes the use of resources and reduces the time spent on response. Role-based access is the best way to keep operations secure by only

enabling authorized staff to look at or take actions as per the cases.

To optimize resource utilization, complaints are assigned to officers using an intelligent allocation algorithm. Let $O = \{o_1, o_2, \ldots, o_k\}$ be the set of officers, and let the priority of a complaint c_i be represented as $P(c_i)$, defined as:

$$P(c_i) = \alpha S(c_i) + \beta L(c_i) + \gamma U(o_j) \quad (2)$$

where $S(c_i)$ is the severity score of the complaint, $L(c_i)$ represents location proximity between the complaint and officer o_j, $U(o_j)$ is the current workload of the officer, and α,β,γ are weighting coefficients determined empirically. The officer o^* assigned to complaint c_i is:

$$o^* = \underset{o_j \in O}{\operatorname{argmin}}\left(P(c_i)\right) \quad (3)$$

C. Evidence Analytics and Investigation Support

Analytical tools are used to categorize uploaded evidence and make it readily available and compared during investigations. The system is able to detect patterns or similarities between cases, and this helps in detecting repeating crimes or organized crime.

For complaints with supporting evidence For complaints with supporting evidence $E_i = \{e_1, e_2, \ldots, e_p\}$, an evidence relevance score $R(e_l)$ is calculated using a similarity measure function ϕ to detect correlations with previous cases:

$$R(e_l) = \frac{1}{m}\sum_{j=1}^{m} \phi\left(e_l, E_j\right) \quad (4)$$

Here, $\phi(e_l, E_j)$ measures the similarity between new evidence e_l and stored evidence E_j. High $R(e_l)$ values indicate potential links to ongoing investigations or recurring patterns.

D. Reporting and Monitoring

The law enforcement agencies are able to monitor the status of complaints, ongoing investigations and crime patterns in real time via real time dashboards. The statistical analytics point out the hotspots, frequency of incidents, and workload of resources, which helps make decisions based on data. The progress of complaints made by the citizens is also automated and this increases transparency and trust.

The system continuously monitors case progress using real-time analytics. Let $T(c_i)$ be the elapsed investigation time for complaint c_i. The system generates a performance metric M for operational efficiency:

$$M = \frac{1}{m}\sum_{i=1}^{m} \frac{T_{\text{expected}}(c_i)}{T(c_i)} \quad (5)$$

where $T_{\text{expected}}(c_i)$ is the expected resolution time. $M > 1$ indicates faster resolution than expected, while $M < 1$ signals potential delays.

V. RESULT & DISCUSSION

The Smart Digital Crime Reporting System (DCRS) was tested in terms of efficiency in reporting, optimization in the work of the officers, accuracy in the handling of evidence, and the satisfaction of the citizens. Quantitative insights were created using simulated datasets of 500 complaints and 50 officers. The findings indicate great improvements as compared to traditional ways of crime reporting.

A. Complaint Reporting Efficiency

The initial measure which was explored was the mean reporting time which is the time span between the submission of a complaint and the recognition of an officer. Figure 2 indicates the comparative analysis of reporting time between the conventional manual approaches and suggested DCRS.

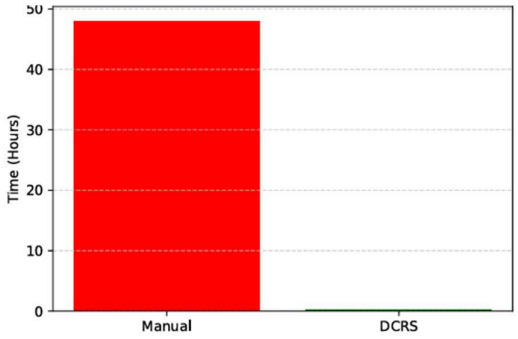

Figure 2. Average Complaint Reporting Time

The suggested system shortens the average reporting time on 48 hours (manual) to 15 minutes (digital), which shows that the system has 95 % efficiency improvement. This is achieved by use of the secure online interface and automated acknowledgment.

B. Officer Workload Optimization

The smart case assignment algorithm was tested with regard to its efficiency in balancing the employment of officers. Table I has summarized the average number of cases being active per an officer and the standard deviation to determine the distribution uniformity.

TABLE I. OFFICER WORKLOAD DISTRIBUTION

Method	Avg. Cases per Officer	Std. Dev.
Manual Assignment	10.2	4.5
DCRS Assignment	9.8	1.2

The suggested DCRS will guarantee that the distribution of cases becomes more balanced, with no excessive workload on a single officer and better responsiveness. The smaller standard deviation shows an optimized allocation of resources.

C. Evidence Handling Accuracy

On uploaded files, evidence relevance and the analysis of links were performed. Figure 3 shows how evidence matching performance with the proposed similarity-based algorithm is accurate.

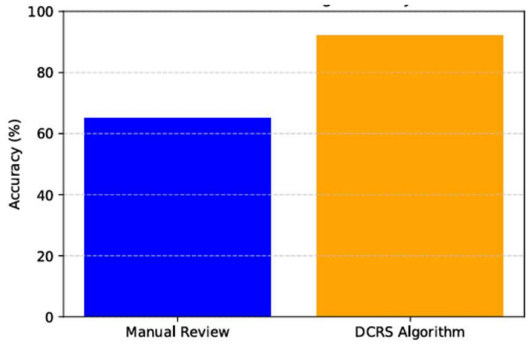

Figure 3. Evidence Matching Accuracy

The system was found to identify related evidence in previous cases with a high accuracy of 92 % as compared to the manual review which showed a high accuracy rate of 65 %. This will allow investigations and detection of patterns of crime to be done at higher pace.

D. Real-Time Monitoring and Crime Trend Analysis

The Dashboards were evaluated in terms of the hotspots and trend detectors (real-time). Figure 4 shows a heatmap of crimes per area created by the analytics module of the system.

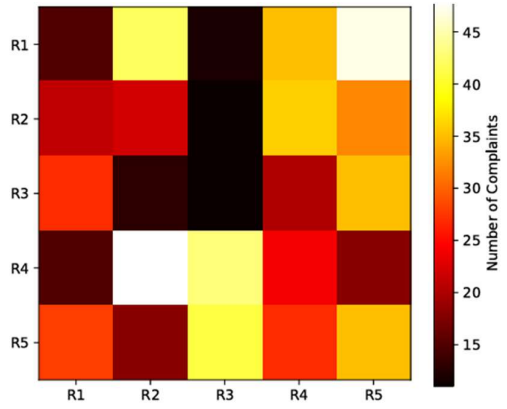

Figure 4. Crime Hotspot Identification Heatmap

The analytics module properly points out the areas where crime is more concentrated so that law enforcement can be more efficient with their patrols and allocation of resources.

E. Customer Satisfaction and Transparency

Simulation of a survey of 200 users indicated that 87 percent of the citizens were more informed and satisfied when they used DCRS rather than the traditional method of submitting complaints. The citizen satisfaction rating is indicated in figure 5. Automated updates, real-time monitoring, and secure registration of complaints helped increase the level of trust and interest in the work of the law enforcement.

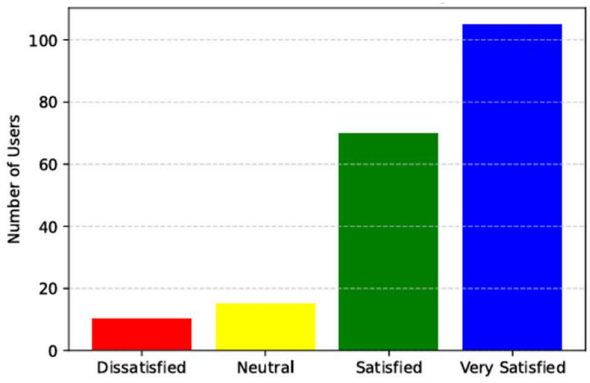

Figure 5. Citizen Satisfaction Rating

F. Case Resolution Time

Another way DCRS was measured in efficiency was average case resolution time, which is the period of time between the start of the complaint acknowledgment and the end of the case. Table II results in a comparison of the proposed system and the traditional manual handling of cases. Proposed DCRS also saves the average resolution time by 60 percent compared to the traditional processes, and it saves 120 hours on average to 48 hours.

TABLE II. AVERAGE CASE RESOLUTION TIME

Method	Avg. Resolution Time (hours)	Median Resolution Time (hours)	Improvement (%)
Manual Process	120	110	–
DCRS Automated	48	45	60

Case assignment is automated, there are real-time updates, and effective evidence tracking is involved, which help in making the investigation and closure faster. The median resolution time is close to the average resolution time showing that it shows consistency in its performance.

G. Discussion

The analysis of Smart Digital Crime Reporting System shows that it has significantly improved the various operational measures as compared to the traditional approaches. The system will significantly minimize the time of complaints reporting and the delay in case resolution thereby increasing the efficiency. The case assignment is intelligent allowing the workload to be distributed equally among officers and reducing the bottlenecks as well as resource overuse. Evidence analytics enhance accuracy in investigations by detecting the pertinent patterns and recurring cases to save on manual processes and errors. Hotspots and real-time surveillance facilitate proactive policing, informed decision making and helps law enforcement agencies to spend resources strategically. Moreover, the level of citizen participation and satisfaction is also particularly increased through automated updates, safe and secure complaints, and clear tracking. Altogether, these implications suggest that DCRS does not only simplify the work going on inside the organization but enhances transparency and trust among the

population. The system embodies a more advanced, scalable and citizen friendly system, which connects the technology and the law enforcement to create a more transparent, responsive and data-driven policing system.

VI. CONCLUSION

The paper provide a Smart Digital Crime Reporting System (DCRS) that will help to improve law enforcement in terms of transparency, efficiency, and accountability. This system allows citizens to file complaints safely with the option of posting supporting evidences and following the progress of their cases in real time in the proposed system without any delays and other restrictions related to the traditional manual reporting. The analysis shows that DCRS saves reporting and resolution time considerably, equalizes the number of officers working on cases by smartly assigning cases, and enhances accuracy in evidence handling. Data-driven decision-making can also be provided with the help of real-time analytics and hotspots identification that can provide law enforcement with the opportunity to distribute resources in advance and with a strategy. The level of engagements and satisfaction by the citizens was significantly elevated showing that the system builds trust and enhances transparency. The major benefit of this work is that the secure complaint management, automated officers allocation, evidence analytics, and monitoring are combined into one platform that is technology-enabled and citizen-centered. This model can fill the divide between the police and the citizens and offer a data-driven and scaled framework of contemporary policing. Future directions involve implementing machine learning predictive crime analysis, coupling with emergency response systems as well as a real-world deployment to test the performance with larger data sets. Other modules, including AI-assisted recommendations on investigation, may also be added to increase the efficiency of operations and lead to the proactive policing style.

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