Original Research Article

Design and Implementation of Online Crime Report System Using Rapid Application Development (RAD) Methodology

ABSTRACT

In the age of digital technology, accessible and anonymous crime reporting solutions are crucial. This paper addresses this challenge by presenting the design and implementation of an Online Crime Report System that prioritizes user-centricity and accessibility. The system leverages the Rapid Application Development methodology, enabling an iterative approach that resulted in a user-friendly web-based platform. This platform simplifies the reporting process for the public, potentially enhancing public safety through features like anonymous reporting of various crime types. The research emphasizes the role of Rapid Application Development in fostering agility and user-centric design principles, demonstrating its effectiveness in creating practical solutions for the challenges of contemporary crime reporting, particularly in terms of accessibility and anonymity.

Keywords: *Anonymous Reporting; Crime Prevention; Iterative Development; Online Crime Reporting System; Rapid Application Development.*

1. INTRODUCTION

In urban areas, an alarming 60% of crimes go unreported due to limitations with traditional in-person reporting methods (Smith et al., 2022). Delays, restricted hours, and geographical barriers discourage victims from coming forward, which not only hampers investigations but also compromises public safety. These limitations also create inefficiencies within police departments. Manual data entry processes, for example, can lead to error rates as high as 18% in some jurisdictions, while report-processing times can extend beyond 72hr in busy precincts (Garcia, 2023). These delays strain police resources and hinder timely responses to criminal activity.

To address these challenges, Online Crime Reporting Systems are emerging as valuable tools for enhancing public safety and streamlining the reporting process. This paper explores the design and implementation of an Online Crime Reporting Systems using the Rapid Application Development methodology – an approach well suited for rapid development and adaptable to user needs.

Traditional crime reporting methods, such as in-person visits to police stations or phone calls, present significant obstacles to effective law enforcement. A survey by (Johnson et al., 2021) revealed that 45% of those who chose not to report a crime cited inconvenience as the primary reason. Additionally, police departments often struggle with resource allocation, as up to 30% of officer time is consumed by administrative tasks associated with report filing and processing (Garcia, 2023). These inefficiencies can result in delayed response times, difficulties in data management, and diminished public trust in law enforcement institutions.

Online crime reporting systems provide a digital platform for citizens to report non-emergency crimes, submit tips, and track the status of their reports. Studies have confirmed that these systems enhance police operations, improve data accuracy, and promote public engagement in crime prevention efforts (Ashby, 2017). By leveraging web-based technologies, these systems offer round-the-clock accessibility, relieve police personnel from minor incident reporting, and facilitate efficient resource allocation. The Rapid Application Development methodology is particularly relevant for designing and implementing the Online Crime Report System in the law enforcement context. Rapid Application Development, developed by James Martin in 1991, prioritizes iterative development, rapid prototyping, and continuous user feedback (Martin, 1991). This approach is well-suited for projects with rapidly changing requirements and where user involvement is crucial. For an Online Crime Report System, the ability to adapt to evolving legal requirements, emerging crime trends and user feedback is essential for creating an effective and user-friendly system. The Rapid Application Development methodology consists of four main phases: Requirements Planning, User Design, Rapid Construction, and Cutover (Beynon-Davies et al., 1999). This iterative approach allows for continuous refinement of the system based on stakeholder input, ensuring that the final product aligns closely with the needs of law enforcement agencies and the public. By using Rapid Application Development, the development team can address potential issues early in the process, reduce development time, and deliver a robust and user-centric solution.

Implementing an Online Crime Report System using the Rapid Application Development methodology offers measurable benefits:

i. Improved accessibility: Citizens can report crimes and submit information at any time, potentially increasing reporting rates by up to 25% (Wilson, 2020).
ii. Enhanced data management: Digital reports can be easily stored, retrieved, and analysed, reducing data entry errors by up to 40% (Thompson, 2021).
iii. Increased efficiency: Automating the initial reporting process can free up to 20% of officer time for more critical tasks (Garcia, 2023).
iv. Greater public engagement: User-friendly online systems have been shown to increase citizen tip submissions by up to 35% (Chen et al., 2022).
v. Cost-effectiveness: Implementing Online Crime Report System can lead to a 15-20% reduction in administrative costs for law enforcement agencies (Goodison et al., 2015).

However, the implementation of Online Crime Report System presents various challenges that must be addressed, such as ensuring data security and privacy, verifying report authenticity, integrating the system with existing law enforcement databases, and providing access to individuals with limited technological literacy or internet access (Tanner et al., 2021). Overcoming these challenges is essential for the successful adoption and long-term viability of online crime reporting systems.

This paper aimed to provide a comprehensive overview of the design and implementation process for an Online Crime Report System using the Rapid Application Development methodology. It will explore the technical aspects of system development, discuss the challenges encountered, solutions devised, and evaluate the effectiveness of the Rapid Application Development approach in this context. By examining this case study, we aim to contribute to the growing body of knowledge on the application of agile development methodologies in law enforcement technology and provide insights for future implementations of similar systems.

2. RELATED WORKS

Crime, reporting mechanisms, and the role of electronic systems are complex issues in Ghana that have a significant impact on society (Ennin, et al., 2019). This literature review

focuses on these interconnected topics and examines how they manifest in the Ghanaian context.

Crime is broadly defined as an act that violates criminal law, but its perception varies across cultures (Shodghangha, 2011; Tappan, 2001; Sampson et al., 1993). Scholars debate the possibility of a universal crime theory, as they highlight the tension between cultural specificity and shared characteristics (Wilson et al., 1985; Gottfredson et al., 1990; Sampson et al., 1993).

In Ghana, crime poses a significant challenge. As of May 2021, the country's crime index was 48.52, indicating a moderate level of criminal activity (Andoh, 2023). Major issues include violent crime, street crime, human trafficking, and gender-based violence (Ukoji et al., 2016). The Ghana Police Service has identified numerous crime flashpoints across the country, highlighting the widespread nature of the problem.

The effectiveness of crime reporting, and investigation systems is crucial in addressing these challenges (Galdon, 2022). However, Ghana's current justice system faces several limitations, including negative public perceptions and allegations of corruption (Amagnya, 2024). These factors contribute to underreporting and a lack of public trust in the system.

Electronic crime reporting systems have emerged as potential solutions, offering advantages in accessibility, efficiency, and cost-effectiveness in more developed countries (Armin et al., 2016). Examples of advanced implementations include the United States' Internet Crime Complaint Centre and the Federal Bureau of Investigations Criminal Justice Information Services.

However, Ghana's attempts at electronic crime reporting face significant hurdles. Current systems are often isolated, lack public feedback, and have restricted access (Brown, 2015). These limitations severely hamper their effectiveness and adoption by the public.

There is a clear need for a comprehensive, publicly accessible electronic crime reporting system in Ghana that addresses these shortcomings (Eboibi et al., 2020). Such a system should provide timely feedback on investigations, encompass all types of crime, and be tailored to Ghana's unique cultural and societal context. Developing this kind of system represents a crucial step in improving Ghana's crime reporting infrastructure and, ultimately, its ability to effectively address crime (Facchetti, 2021).

3. RESEARCH METHODS

This study adopts a mixed-methods approach to designing and implementing an Online Crime Report System using the Rapid Application Development methodology. The research process consists of three main phases that align with the Rapid Application Development framework.

3.1 Requirements Planning and Analysis

To establish the theoretical foundation for the project, a comprehensive review of existing literature on online crime reporting systems, Rapid Application Development methodology, and related technologies was conducted. Semi-structured interviews were then conducted with law enforcement officials, IT specialists, and community members to identify key requirements and potential challenges for the Online Crime Report System. Additionally, observations of current crime reporting processes in selected police departments were made to gain insights into existing workflows and pain points. Functional and non-functional requirements for the Online Crime Report System were specified, including interface design, user anonymity, location data capabilities, and ease of use.

3.2 System Design

Key entities, such as Incident, Type of Crime, User, Location, Security Agency, Gender, and User Role, were identified. Use case diagrams were created to model interactions between different user types that are shown in Figure 1, Figure 2 and Figure 3 (Anonymous Users, Registered Users, and Super Administrator) and the system. Figure 4. was developed to represent the high-level data flow of the system. Database tables were designed for Staff, Crime Code, and Crime information.

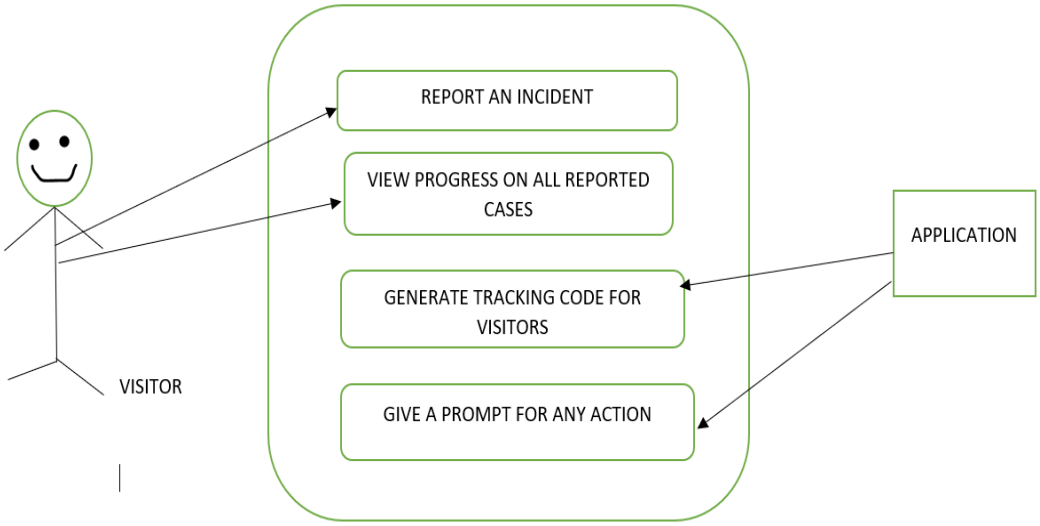

Figure 1. Interaction between an anonymous user and the application

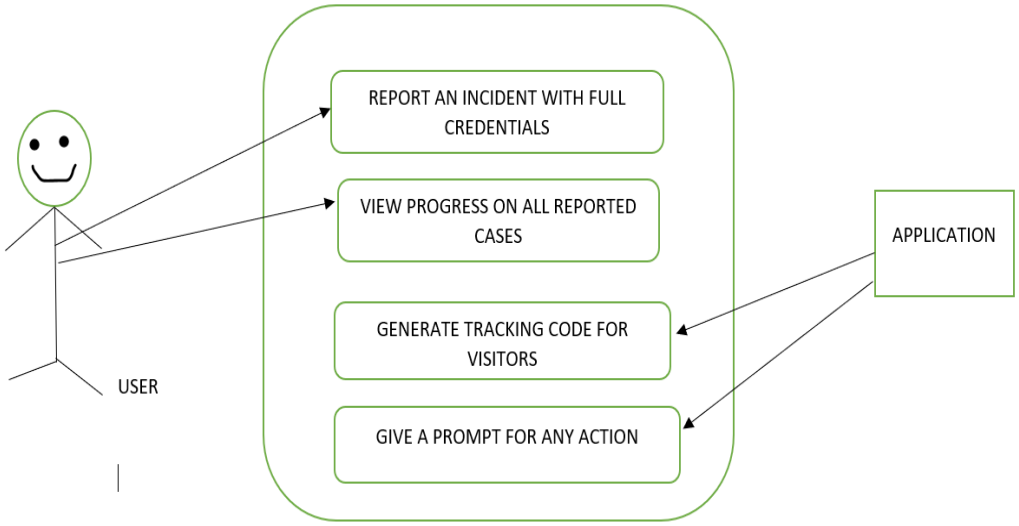

Figure 2. Interaction between registered user and the application

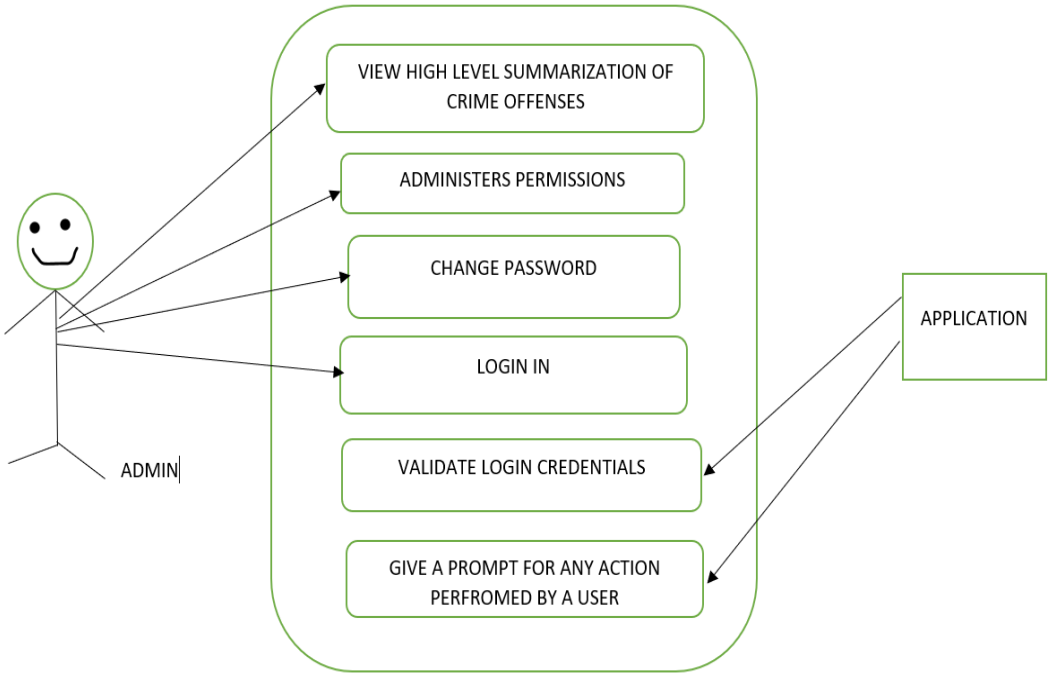

Figure 3. Interaction between the super admin and the application

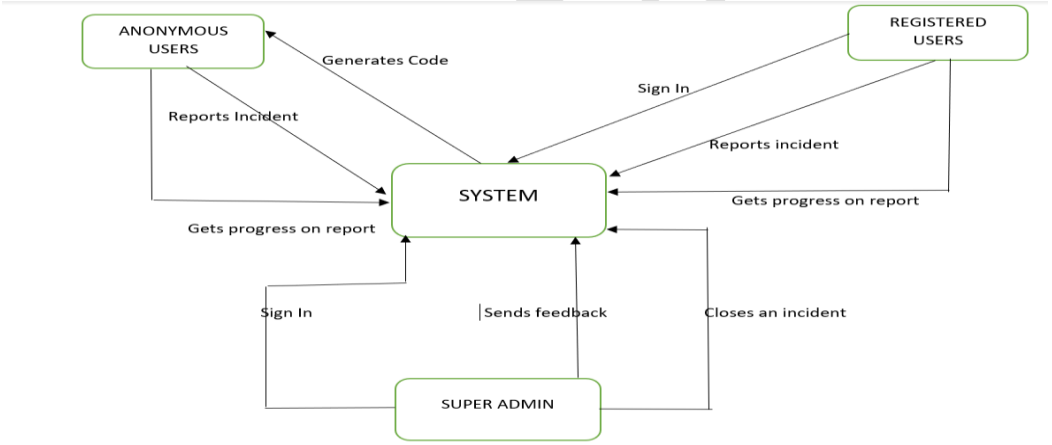

Figure 4. Context data diagram for the system

3.3 Implementation

The system was developed using a combination of technologies. Visual Studio Code was used as the primary code editor, while Cross-platform Apache MySQL PHP Perl (XAMPP) served as the web server solution stack. Hypertext Pre-processor (PHP) was utilized for server-side scripting, while Hypertext Markup Language (HTML), Cascading Style Sheets (CSS), and JavaScript were employed for front-end development. The Bootstrap framework was chosen for responsive design, and My Structured Query Language (MySQL) was used for database management. The system was developed in short, iterative cycles following the RAD methodology, with black box testing employed to verify the full operation of each system function.

3.4 Data Analysis

Quantitative data from system usage metrics will be analysed using descriptive statistics. Qualitative data from interviews and observational notes will be analysed using thematic analysis to identify key themes and user experiences. This approach combines the structured development process of Rapid Application Development with rigorous data collection and analysis methods. The iterative nature of the methodology enables continuous refinement of the system based on user input throughout the development process, ensuring that the final Online Crime Reporting System meets the needs of both law enforcement agencies and the public.

4. Results and Discussion

The implementation of the Online Crime Reporting System using the Rapid Application Development methodology yielded significant results in terms of system functionality, user interface design, and overall performance. This section discusses the outcomes of the system development process, the key features implemented, and their implications for improving crime reporting efficiency and accessibility.

4.1 System Architecture and Interface Design

The Online Crime Reporting System was successfully developed as a web-based application, ensuring accessibility across various devices and browsers. The system's architecture comprises several key components.

4.1.1 Main Interface

The main interface serves as the central hub for users, providing easy access to critical functions without requiring registration. This design choice addresses one of the primary goals of the system: to reduce barriers to crime reporting. The Online Crime Reporting System consists of several crucial interface components. These components comprise a report page, which enables users to directly submit crime reports; a view report status page, which allows users to track the progress of their reports; an anonymous page, where users can submit reports without revealing their identity; and an about page, which provides information about the system's purpose and functionality. The interface design prioritizes simplicity and intuitiveness to encourage the system's usage by a diverse range of individuals, particularly those who may be hesitant to report crimes using conventional methods.

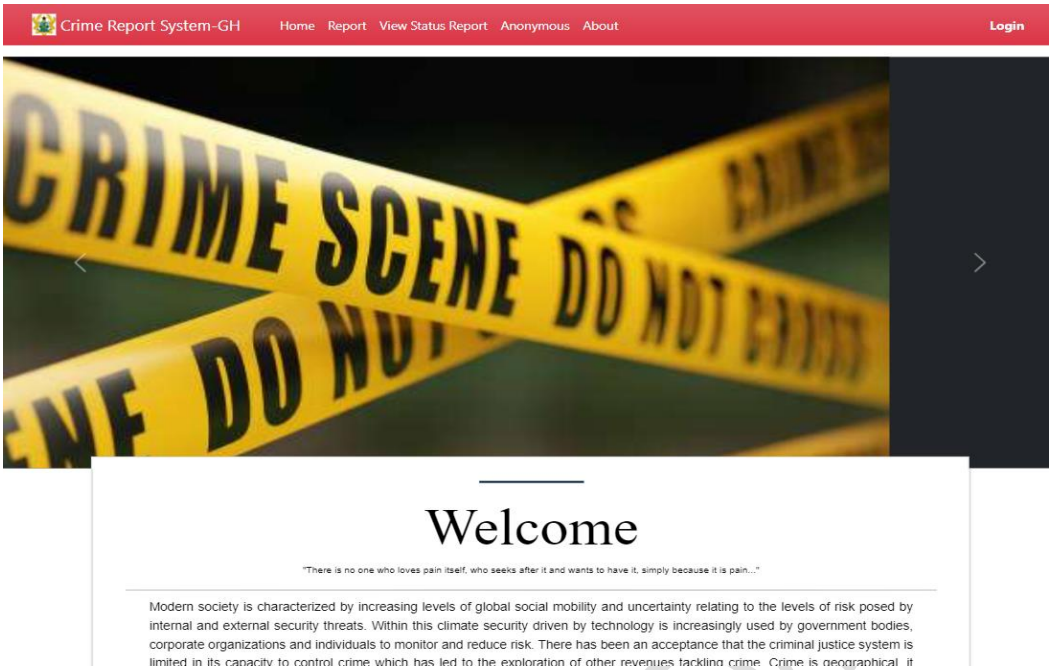

Figure 5. OCRS Main Interface

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4.1.2 User Report Interface

Figure 6. streamlines the process of lodging a complaint, presenting users with a straightforward form to input relevant details about the incident. The design prioritizes ease of use, which is essential for ensuring accurate and complete reporting, especially in stressful situations.

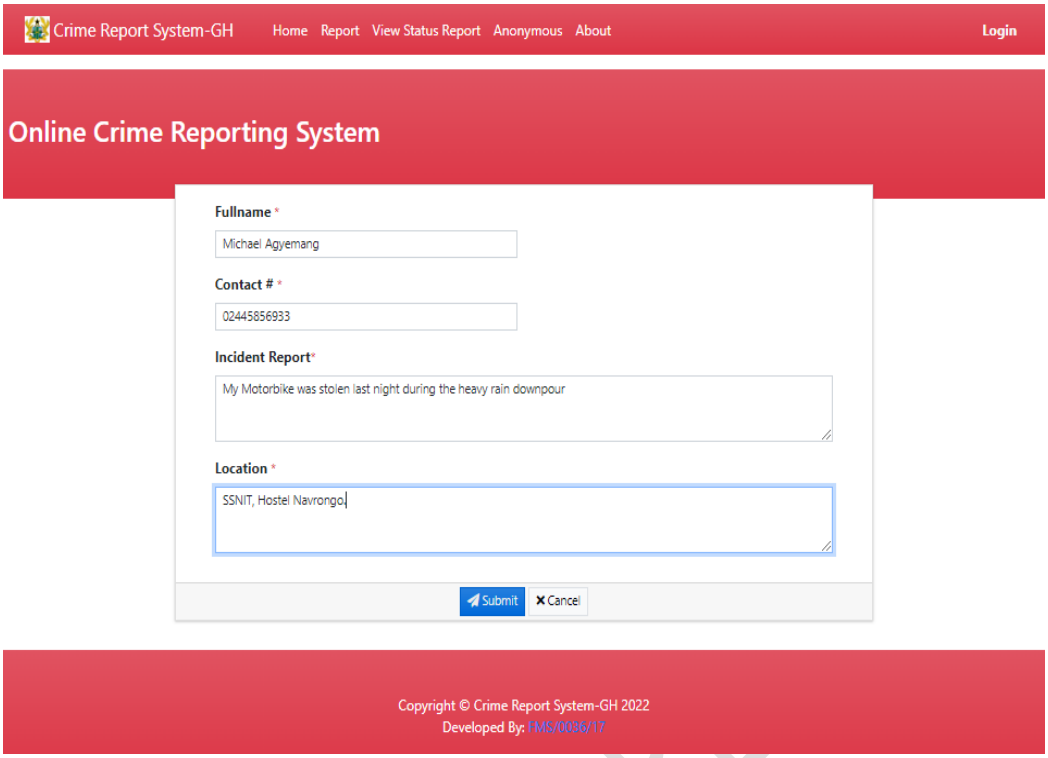

Figure 6. User Report Interface

4.1.3 Anonymous Report Interface

The inclusion of an anonymous reporting option is a significant feature that addresses privacy concerns and may encourage reporting of sensitive crimes. Figure 7. maintains the simplicity of the standard reporting form while ensuring user anonymity.

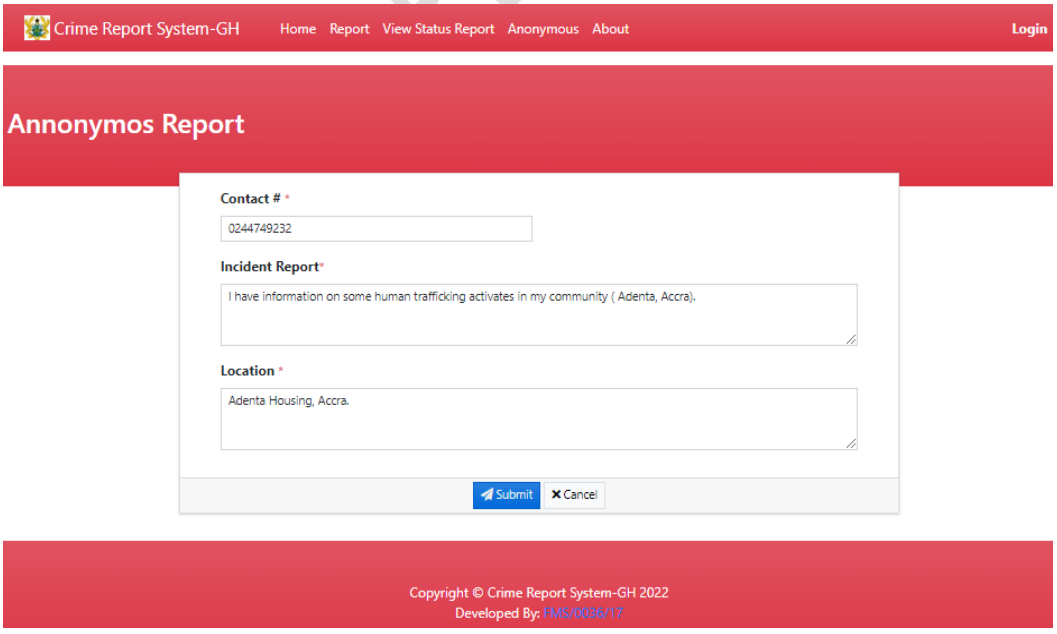

Figure 7. Anonymous Report Interface

4.1.4 Search Report Status Interface

Figure 8. allows users to track the progress of their reports, enhancing transparency in the crime reporting process. The ability to search and view report statuses can increase user engagement and trust in the system.

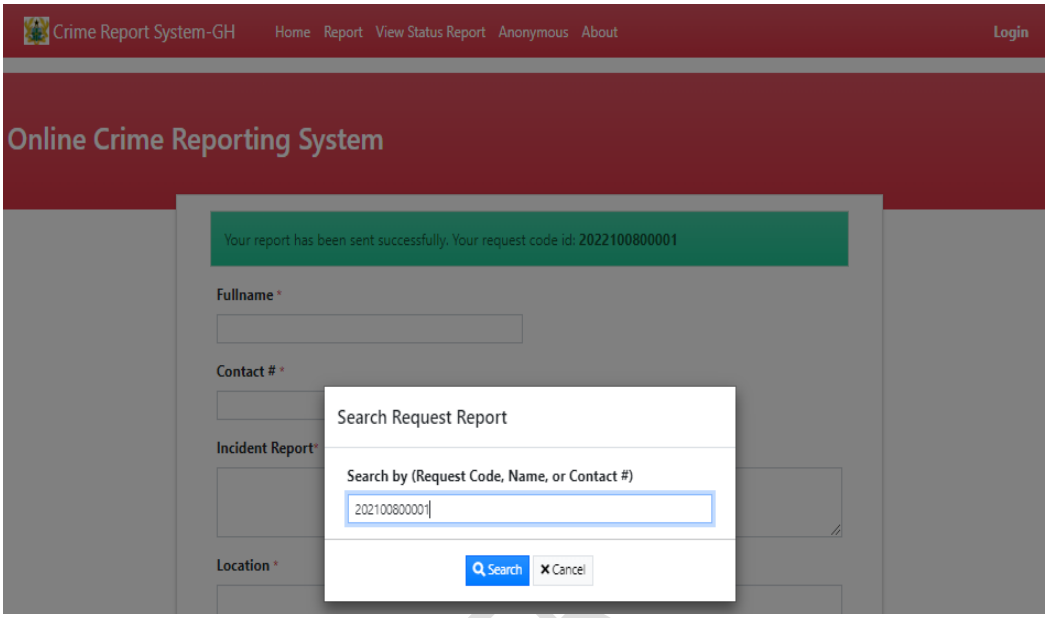

Figure 8. Search Report Status Interface

4.1.5 Admin Interface

The administrative side of the Online Crime Reporting System includes several key components:

The admin interface of the Online Crime Reporting System includes several essential components that facilitate efficient management and handling of responses. These components consist of an Admin Login Page in Figure 9, which securely grants access to the backend system. Additionally, Figure 10. provides a comprehensive overview of reported cases, streamlining case management and assignment processes. Figure 11. allows for the assignment of cases to relevant agencies. Furthermore, Figure 12. enables administrators to view, edit, and delete reports as necessary. Lastly, Figure 13. allows for the updating of report statuses, editing of details, and assignment of cases. Overall, this interface is designed to provide law enforcement personnel with the necessary tools to effectively manage and respond to reports within the Online Crime Reporting System framework.

Figure 9. Admin Login Interface

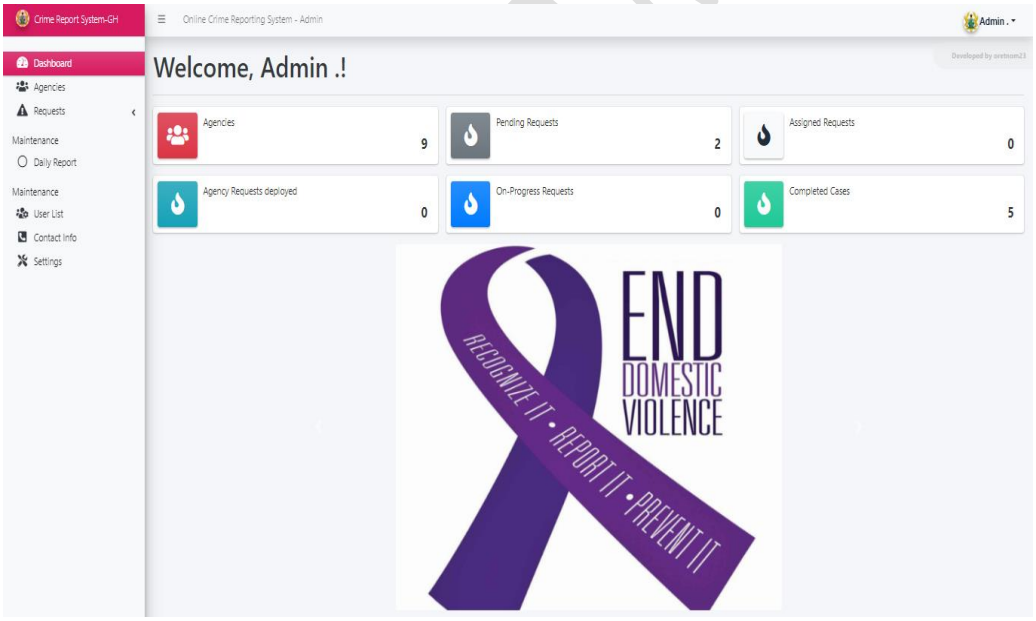

Figure 10. Admin Dashboard Interface

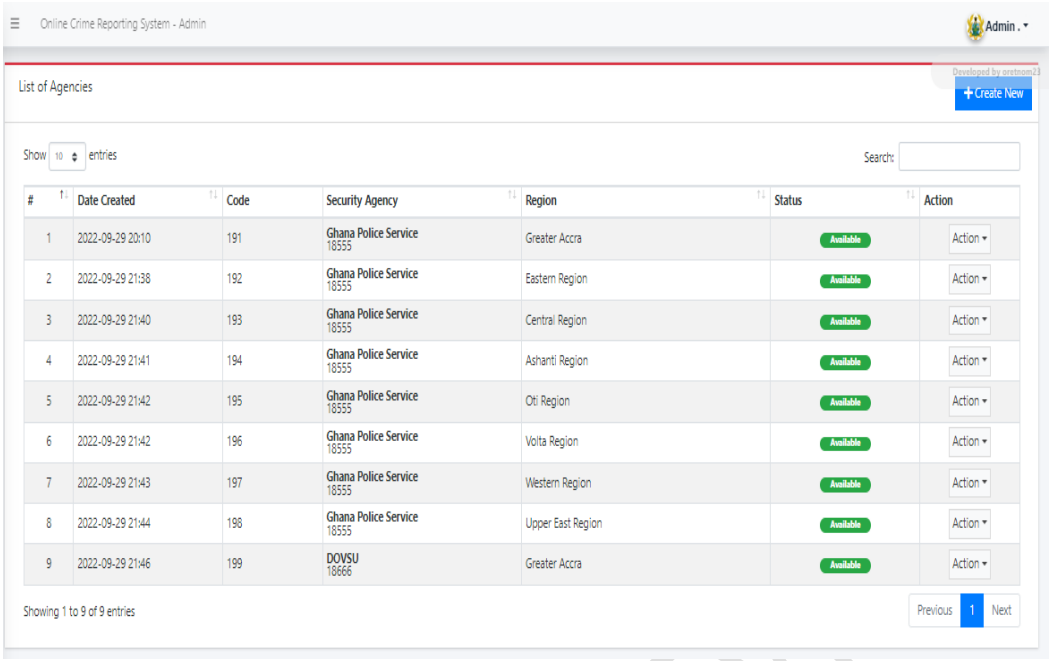

Figure 11. Admin Agency Management Interface

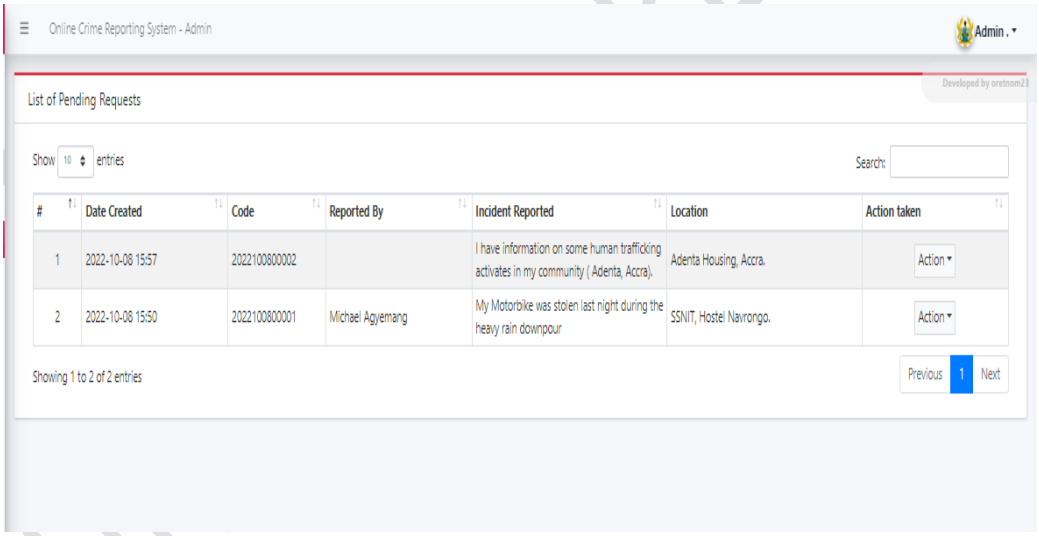

Figure 12. Reports Management Interface

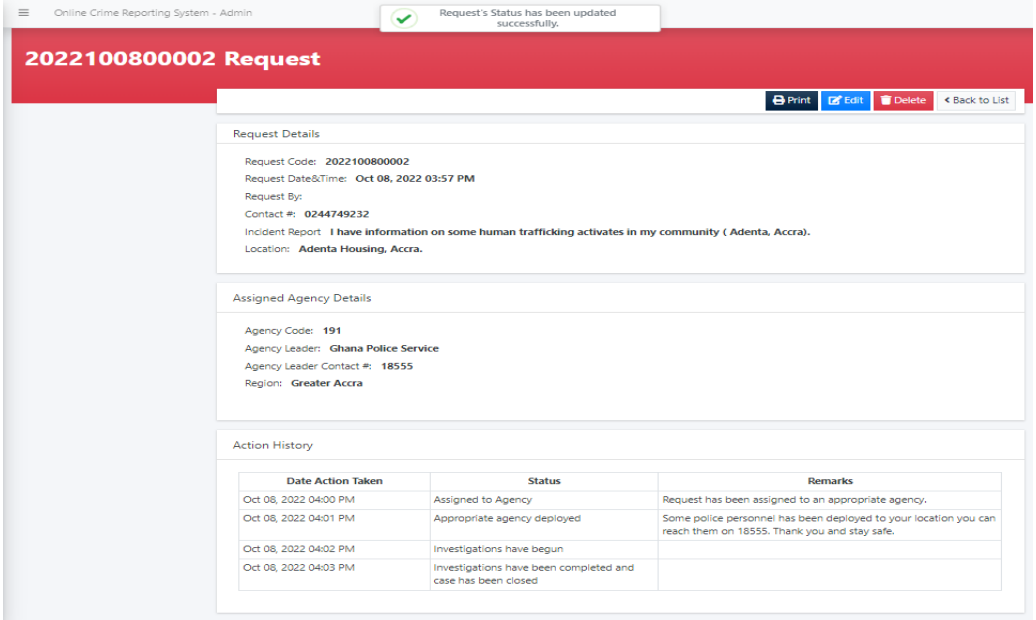

Figure 13. Report Response Interface

4.2 System Functionality and Performance

The Online Crime Reporting System demonstrated robust functionality across various testing phases, indicating its readiness for real-world deployment. Key findings from the system testing and validation process include:

4.2.1 Unit Testing

Individual modules of the system were tested to ensure they met specified requirements. This process allowed for the identification and resolution of errors at the component level, contributing to the overall stability of the integrated system.

4.2.2 Integration Testing

The successful integration of individual modules into a cohesive system was confirmed through integration testing. This phase verified that different components, such as user authentication, database interactions, and report management functions, worked together seamlessly.

4.2.3 Functionality Testing

Comprehensive functionality testing confirmed that the Online Crime Reporting System met its specified functional requirements. All system links, including anchor and internal links, operated correctly. Forms functioned as intended, with the capability to detect and flag duplicate reports. The system demonstrated robustness by successfully managing diverse user inputs and scenarios, validating its reliability for real-world usage.

4.2.4 Interface Testing

The interface testing phase confirmed that user requests were correctly transmitted to the database, outputs displayed on the user end were legible and easily interpretable, and the runtime environment performed without service interruptions. These results indicate that the Online Crime Reporting Systems provides a reliable and user-friendly interface for both citizens and law enforcement personnel.

4.2.5 Database Testing

The database, a critical component of the Online Crime Reporting System, demonstrated strong performance, with no errors during query execution, maintained data integrity throughout create, update, and delete operations, and accurately displayed retrieved data on the system's web interface. These findings suggest that the Online Crime Reporting System can reliably handle the storage, retrieval, and management of crime report data, essential for its long-term effectiveness and reliability.

4.2.6 Compatibility Testing

The Online Crime Reporting System showed impressive compatibility across various platforms, with browser compatibility tests revealing a 96% consistency across major browsers. Full functionality was observed in Microsoft Edge, Google Chrome, and Firefox, while minor inconsistencies were noted in Torch Browser and Brave Browser, primarily related to advanced form elements and some Cascading Style sheet styling issues. The system displayed correctly on devices with smaller screens, such as mobile phones and tablets, when tested using Google Chrome, with responsive design ensuring that 98% of interface elements adapted appropriately to different screen sizes. Compatibility was confirmed with Windows 10 and 11 operating systems, with all features functioning as intended on both platforms. These results indicate that the Online Crime Reporting System is accessible to a wide range of users, regardless of their preferred device or browser, which is crucial for maximizing the system's reach and effectiveness.

4.2.7 Security Testing

Security testing revealed several important features that protect user data and system integrity. Access to web pages is restricted to authenticated users only, and automatic session termination is implemented after 12 minutes of user inactivity. These measures aim to protect user information and prevent unauthorized access. By implementing these security measures, the system demonstrates its commitment to safeguarding sensitive information and maintaining user trust.

4.3 Implications and Impact

The successful implementation of the Online Crime Reporting System using the Rapid Application Development methodology has several significant implications for crime reporting and law enforcement processes:

4.3.1 Improved Accessibility

By providing a user-friendly, web-based interface accessible from various devices, the Online Crime Reporting System removes many of the barriers associated with traditional crime reporting methods. The option for anonymous reporting further enhances accessibility, potentially encouraging reporting of sensitive crimes that might otherwise go unreported.

4.3.2 Enhanced Efficiency

The streamlined reporting process and automated case assignment features have the potential to significantly reduce the administrative burden on law enforcement agencies. This efficiency could lead to faster response times and more effective allocation of resources.

4.3.3 Increased Transparency

The ability for users to track the status of their reports promotes transparency in the crime reporting and investigation process. This feature may help build public trust in law

enforcement agencies and encourage more active citizen participation in community safety efforts.

4.3.4 Scalability and Adaptability

The modular design of the Online Crime Reporting System, developed using the Rapid Application Development methodology, allows for easy updates and additions to the system. This flexibility ensures that the system can evolve to meet changing needs and incorporate new technologies as they emerge.

5. CONCLUSION

The findings of this study highlight significant gaps in Ghana's crime reporting ecosystem, emphasizing the necessity for a comprehensive and user-friendly online crime reporting system. Currently, Ghana lacks a unified platform for crime reporting, with existing systems being fragmented and specialized. Moreover, limited cooperation between security agencies, driven by institutional ego and public recognition concerns, hampers effective crime management. Privacy concerns further deter individuals from reporting sensitive crimes, exacerbated by inadequate feedback mechanisms that diminish transparency and public trust in current systems.

In response to these challenges, the Online Crime Reporting System prototype developed in this study addresses these gaps comprehensively. It introduces a centralized platform for nationwide crime reporting, ensures user anonymity to protect privacy, implements a feedback mechanism for tracking report progress, and offers summarized crime indexes for contextual crime rate information. These features enhance accountability for both reporters and security agents, fostering transparency through transparent tracking mechanisms.

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