IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 1, March 2026
Impact Factor: 8.2

Lost Person Identification using AI based Camera

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Abstract: *Public safety in crowded locations such as railway stations, airports, and shopping malls requires a smart surveillance solution capable of identifying threats instantly. The proposed system introduces an automated, real-time monitoring framework powered primarily by Convolutional Neural Networks (CNNs). Live video feeds collected through IoT-enabled cameras are processed at the edge, where a CNN-based model detects and classifies hazardous objects such as firearms or sharp weapons with high accuracy.*

In addition, the same deep learning architecture is applied to facial analysis, generating feature embeddings that are matched against stored records to identify missing individuals across multiple camera streams in real time.By relying entirely on CNN-driven analysis, the system minimizes human dependency and improves the speed and reliability of decision-making during emergency situations.

The use of edge computing reduces processing delays and ensures immediate alert generation when a threat or missing person is detected. Integrating weapon detection and face recognition within a unified deep learning framework enhances system performance, scalability, and operational efficiency. Overall, this approach contributes to the development of intelligent, secure, and responsive public spaces within modern smart city environments.

Keywords: CNN, Computer Vision, Deep Learning, Object Detection, Face Recognition, IoT Surveillance, Edge Computing, Public Safety, Real-Time Monitoring

I. INTRODUCTION

Public safety has become a major concern in today's rapidly growing urban environments, especially in densely populated areas such as railway stations, airports, shopping malls, and public events. With increasing crowd density and the rising risk of security threats, traditional surveillance systems that rely heavily on manual monitoring are no longer sufficient. Human operators may overlook critical events due to fatigue, distraction, or the overwhelming volume of video data generated by multiple cameras. This creates the need for an intelligent and automated surveillance solution capable of real-time monitoring and rapid response. Advancements in Artificial Intelligence (AI), Computer Vision, and Deep Learning have significantly transformed the field of security and surveillance. Modern AI-based systems can automatically analyze video streams, detect suspicious activities, and identify individuals with high accuracy. Among these technologies, Convolutional Neural Networks (CNNs) have proven highly effective in object detection and image classification tasks, making them suitable for identifying dangerous weapons in live video feeds.At the same time, missing person incidents in crowded areas present another serious challenge. Locating an individual within a large and dynamic crowd using conventional methods is time-consuming and often inefficient. Facial recognition technology, powered by deep learning models, provides a reliable solution by extracting unique facial features and comparing them with stored records. This enables fast and accurate identification of individuals across multiple camera views. The proposed system integrates both weapon detection and missing person identification into a unified, intelligent surveillance framework. IoT-enabled cameras continuously capture live video streams, which are processed in real time using CNN-based models. The system automatically detects hazardous objects such as guns or knives while simultaneously performing facial recognition to identify missing individuals. To ensure fast processing

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and minimal delay, the system leverages edge computing technology. Instead of sending all video data to a central server for analysis, processing occurs closer to the data source. This reduces latency, enhances response time, and ensures that alerts are generated instantly during critical situations.

Whenever a weapon or a missing person is detected, the system triggers immediate notifications to security personnel through multiple channels such as SMS, email, mobile applications, or alarm systems. This rapid alert mechanism enables authorities to take timely action, potentially preventing dangerous incidents and improving overall crowd management. In addition to enhancing security, the proposed framework improves efficiency by reducing dependence on continuous manual monitoring. It offers scalability for deployment across smart cities and large infrastructures. By combining deep learning, computer vision, IoT surveillance, and edge computing, the system represents a modern and intelligent approach to strengthening public safety in urban environments. This project aims to build a reliable, automated, and real-time surveillance solution that addresses both threat detection and human tracking challenges. The integration of advanced AI technologies ensures higher accuracy, faster response, and improved operational effectiveness, contributing to safer and more secure public spaces.

II. LITERATURE SURVEY

1. In the paper titled "A Contour Based Procedure for Face Detection and Tracking from Video," Aniruddha Dey proposed a contour-based approach for detecting and tracking faces in video sequences. The method primarily focuses on identifying facial boundaries using edge detection and contour extraction techniques. By analyzing geometric properties of facial regions, the system tracks faces across consecutive frames. The study demonstrates that contour-based detection can achieve reliable tracking under moderate lighting and motion conditions, although it may face challenges in complex backgrounds and occlusions.

2. In "A Mobile Vision System for Robust Multi-Person Tracking," Andreas Ess and his team developed a mobile camera-based tracking system capable of detecting and tracking multiple individuals simultaneously. The research combines object detection, stereo vision, and motion estimation techniques to improve tracking performance in dynamic environments. Their system is particularly effective in crowded outdoor scenes, emphasizing robustness against occlusion and varying camera movements. The work laid a strong foundation for real-time multi-person tracking in surveillance applications.

3. In their study "An Adaptive Motion Model for Person Tracking with Instantaneous Head-Pose Features," the authors introduced an adaptive tracking model that integrates head-pose estimation with motion prediction. By incorporating instantaneous head orientation features, the system enhances person tracking accuracy, especially in scenarios involving rapid movement or direction changes. The proposed approach improves robustness against tracking loss and demonstrates effectiveness in surveillance environments with frequent pose variations.

4. In "An Algorithm for Fatigue Driving Face Detection and Location," the authors presented a face detection algorithm designed for monitoring driver fatigue. The system detects facial regions and locates key facial features such as eyes to determine drowsiness. The study emphasizes real-time processing and accuracy under different lighting conditions. Although focused on driver monitoring, the techniques contribute valuable insights into face detection reliability in real-time safety systems.

5. In "An Efficient Face Detection and Recognition Method for Surveillance," the researchers proposed a hybrid approach combining face detection and recognition techniques to improve surveillance efficiency. Their method focuses on enhancing recognition speed and reducing computational complexity while maintaining accuracy. The study demonstrates that optimized algorithms can significantly improve real-time surveillance systems used in security applications.

6. In "Detection of Faces from Video Files with Different File Formats," the authors examined the challenges of detecting faces in videos encoded in various formats. Their work highlights the impact of compression, resolution, and frame quality on detection performance. The study proposes preprocessing strategies to standardize video input before applying detection algorithms, thereby improving overall system reliability across multiple file types.

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7. In "Sparse Hashing Tracking," the authors introduced a tracking algorithm based on sparse representation and hashing techniques. The proposed method enhances tracking speed and accuracy by efficiently encoding visual features. It demonstrates robustness against background clutter, illumination changes, and partial occlusion. This approach significantly contributes to real-time object tracking in complex surveillance scenarios.

8. In "Multi-Person Tracking with Sparse Detection and Continuous Segmentation," the authors presented a tracking framework that combines sparse detection results with continuous segmentation methods. The system effectively handles crowded environments by improving detection reliability and reducing identity switching errors. Their work contributes to advancements in multi-person surveillance systems operating in real-world dynamic scenes.

9. In "Robust Online Face Tracking-by-Detection," the researchers proposed an online tracking-by-detection approach for real-time face tracking. The system repeatedly applies detection algorithms to maintain accuracy and avoid tracking drift. The method shows strong performance in unconstrained environments and supports practical deployment in surveillance and monitoring systems.

10. In "Video-Based Face Recognition Using Adaptive Hidden Markov Models," the authors developed a face recognition framework based on adaptive Hidden Markov Models (HMMs). The model captures temporal variations in facial appearance across video frames, improving recognition accuracy over static image-based systems. Their work demonstrates the importance of temporal modeling in video-based identification systems.

11. In "Find Missing Person Using Artificial Intelligence," the authors proposed an AI-driven system that utilizes facial recognition to locate missing individuals. The system compares uploaded images with real-time surveillance feeds to identify potential matches. Their study highlights the social importance of AI in public safety and demonstrates practical implementation strategies for missing person detection.

12. In "Efficient Face Recognition System for Identifying Lost People," the researchers designed a facial recognition system specifically aimed at identifying lost individuals in crowded places. The system uses feature extraction and classification algorithms to match faces with stored records. The study emphasizes improved accuracy and real-time detection capabilities, contributing to humanitarian and security applications.

13. In "A Review on Identification of Missing Persons and Criminals using Image Processing," the authors provided a comprehensive review of image processing and facial recognition techniques used for identifying missing individuals and criminals. The paper analyzes various algorithms, discusses their strengths and limitations, and highlights future research directions in AI-based surveillance systems. This review underscores the growing significance of automated identification technologies in modern security infrastructures.

III. PROBLEM OF STATEMENT

Rapid urbanization and increasing population density in public spaces such as railway stations, airports, shopping malls, and large event venues have significantly heightened security challenges. Traditional surveillance systems rely heavily on human operators to monitor multiple camera feeds simultaneously. This manual monitoring approach is inefficient, prone to human error, and often results in delayed responses due to operator fatigue, distraction, or information overload. Consequently, critical threats such as the presence of weapons or the sighting of missing individuals may go unnoticed, leading to serious safety risks.

In addition, identifying missing persons in crowded environments remains a complex and time-consuming task. Conventional methods depend on manual verification and physical searches, which are often ineffective in dynamic and densely populated settings. The lack of real-time automated detection and identification mechanisms limits the ability of authorities to respond promptly to emergencies.

Furthermore, many existing surveillance systems process video data centrally, causing latency issues and reducing real-time responsiveness. High data transmission requirements and processing delays can hinder immediate threat detection and alert generation, especially during critical incidents.

Therefore, there is a need for an intelligent, automated, and real-time surveillance system that can:

• Detect and classify hazardous objects such as firearms and sharp weapons with high accuracy.

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• Identify and track missing individuals across multiple camera streams.
• Minimize human dependency in monitoring operations.
• Reduce latency through edge-based processing.
• Generate instant alerts to security personnel for rapid intervention.

The problem addressed by this project is the design and implementation of a unified deep learning-based surveillance framework that integrates weapon detection and facial recognition using Convolutional Neural Networks (CNNs), supported by IoT-enabled cameras and edge computing. The system aims to enhance public safety, improve response time, and provide a scalable solution for modern smart city environments.

IV. EXISTING PROBLEM

Existing surveillance systems in crowded public areas primarily rely on continuous human monitoring of CCTV footage, which is inefficient and unreliable. Security personnel are required to observe multiple video streams simultaneously, making it difficult to maintain consistent attention over long periods. This often results in missed detections of critical threats such as weapons or suspicious activities. Additionally, traditional systems lack intelligent automation to instantly analyze video content, causing delays in identifying dangerous situations.

In cases of missing persons, the process typically involves manual searching and verification, which is time-consuming and ineffective in large, dynamic crowds. Furthermore, many current systems depend on centralized data processing, leading to higher latency, network congestion, and slower response times. These limitations highlight the need for an advanced, automated, and real-time surveillance solution capable of improving accuracy, speed, and overall public safety management.

V. PROPOSED SYSTEM

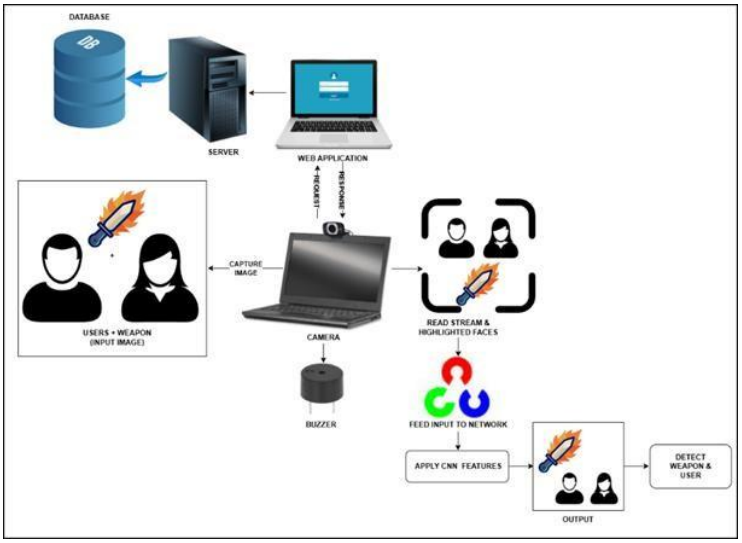

Figure 1: System Architecture

The proposed system presents an intelligent real-time surveillance framework designed to enhance public safety in crowded areas such as railway stations, airports, shopping malls, and public gatherings. The system integrates advanced computer vision and deep learning techniques to automatically detect weapons and identify missing persons from live video streams. Unlike traditional surveillance systems that depend on manual monitoring, this approach provides automated analysis and rapid decision-making in critical situations.

The system utilizes IoT-enabled CCTV cameras to capture continuous video feeds, which are processed using Convolutional Neural Networks (CNN) for weapon detection and facial recognition. The CNN model identifies

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dangerous objects such as guns and knives, while facial recognition techniques analyze and match faces with a stored database of missing individuals. This enables accurate identification and tracking across multiple camera views in real time. Edge computing technology is incorporated to perform data processing near the camera source, reducing latency and ensuring faster response.

When a weapon or missing person is detected, the system automatically generates alerts and sends notifications to security personnel through a control center, mobile devices, or alarm systems. All detected events are recorded and stored in a centralized database for monitoring and analysis. The proposed system improves surveillance efficiency, reduces human dependency, and enhances response time in emergency situations. It is scalable and can be implemented in smart cities, transportation hubs, and large public venues. By combining deep learning, IoT, and real-time monitoring, the system offers a reliable and intelligent solution for modern public safety challenges.

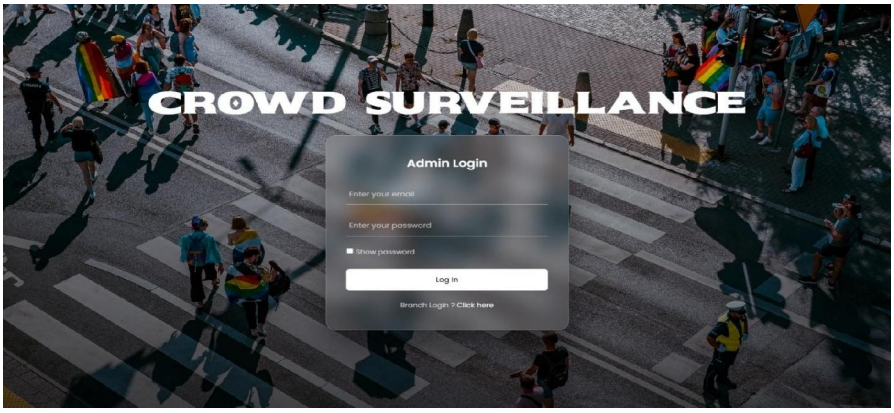
VI. CONCLUSION

In conclusion, the proposed intelligent surveillance system provides an effective solution for enhancing public safety in crowded environments by integrating deep learning, computer vision, and IoT technologies. The system enables real-time detection of weapons and identification of missing persons through automated video analysis, reducing reliance on manual monitoring and improving response time during critical situations. With the use of CNN-based detection, facial recognition, and edge computing, the framework ensures high accuracy, low latency, and efficient performance. This approach not only strengthens security measures in public places such as railway stations, airports, and malls but also supports the development of smart and safe urban infrastructures, making surveillance systems more reliable, scalable, and responsive.

VII. ACKNOWLEDGMENT

The proposed system begins by initializing IoT-enabled cameras, loading the trained CNN model for weapon detection and the FaceNet model for face recognition, and establishing a connection with the central database containing missing person records. The system continuously captures live video streams and converts them into frames for processing. Each frame is preprocessed and passed through the CNN model to detect dangerous objects such as guns or knives. If a weapon is detected, an alert is immediately generated and sent to the control center and security personnel, while the event is logged in the database. Simultaneously, faces detected in the frame are processed using FaceNet to extract facial features, which are then compared with stored embeddings of missing individuals. If a match is found above a predefined threshold, the system identifies the person, triggers instant alerts, and records the detection. This process repeats continuously to ensure real-time monitoring and rapid response in crowded public environments.

VIII. OUTPUT



DOI: 10.48175/IJARSCT-31455

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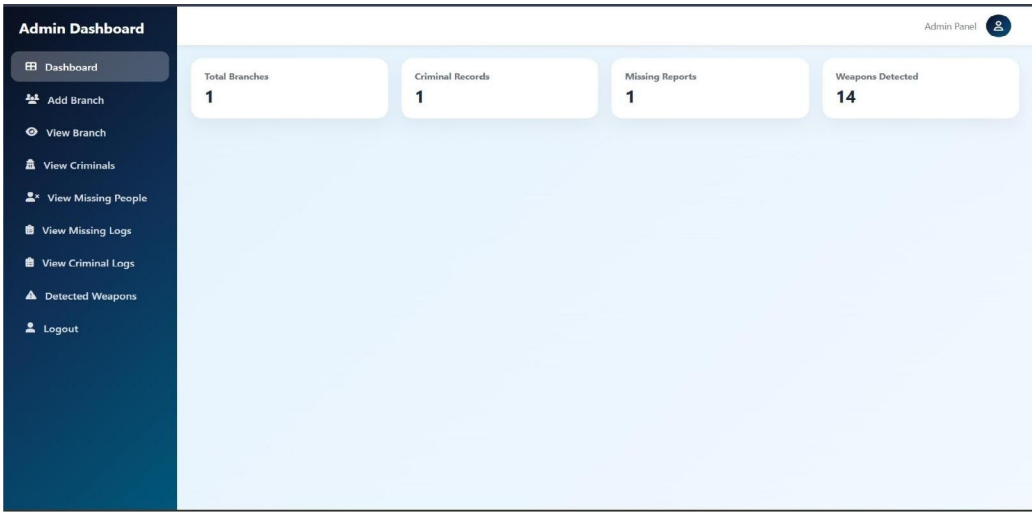

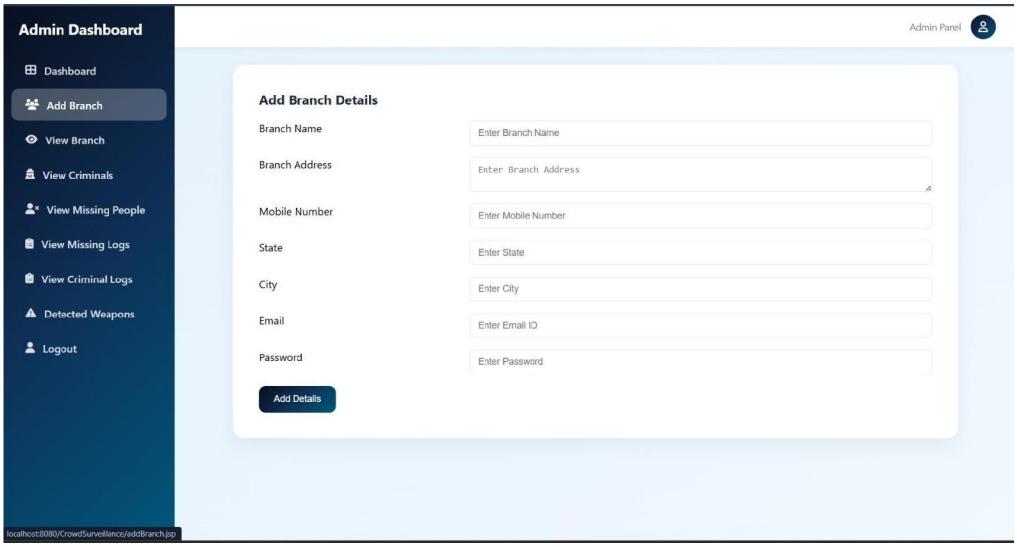

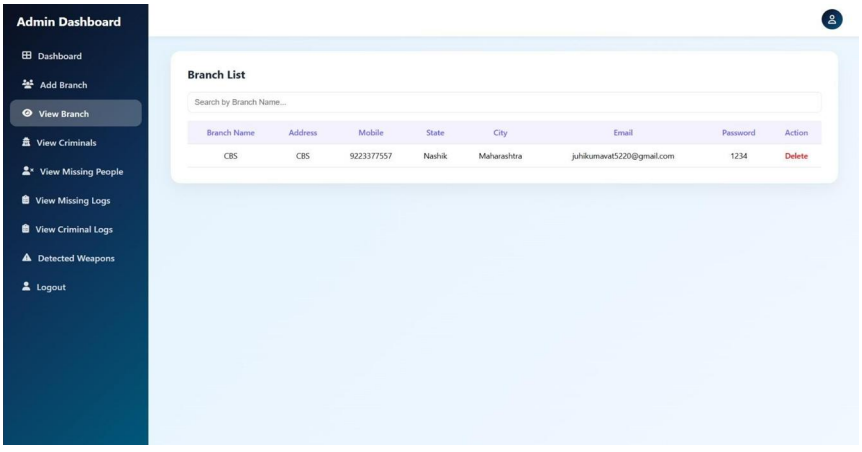

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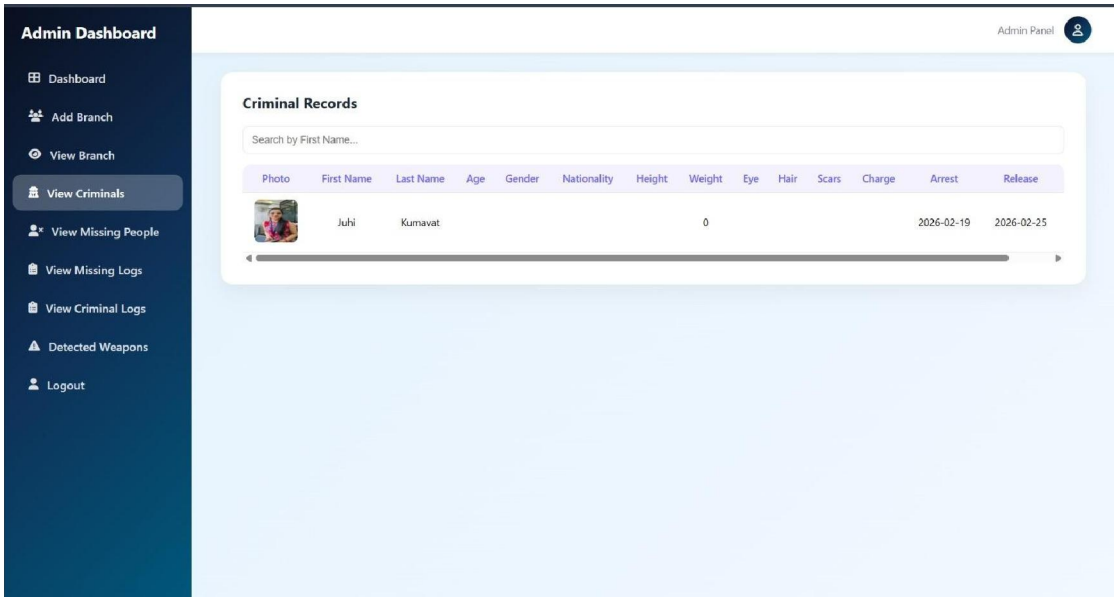

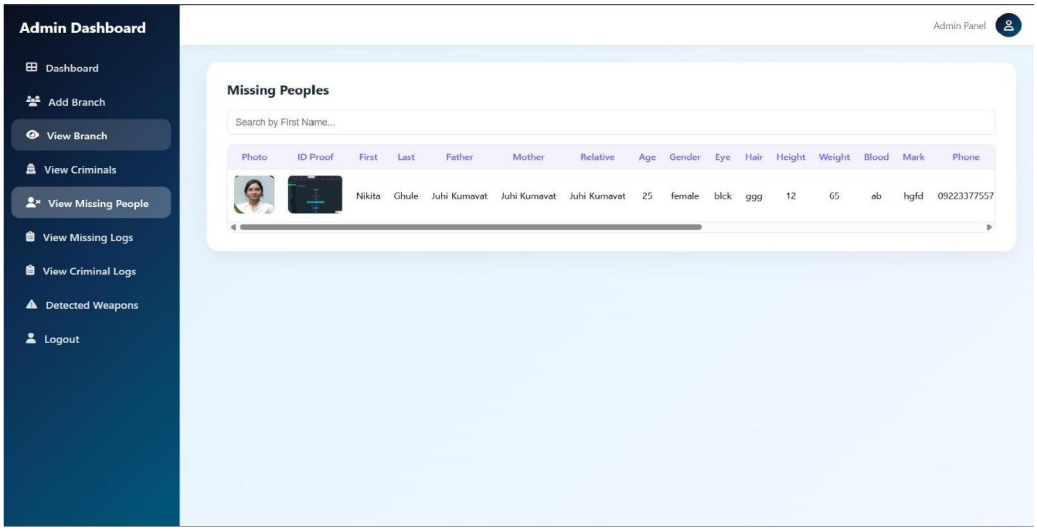

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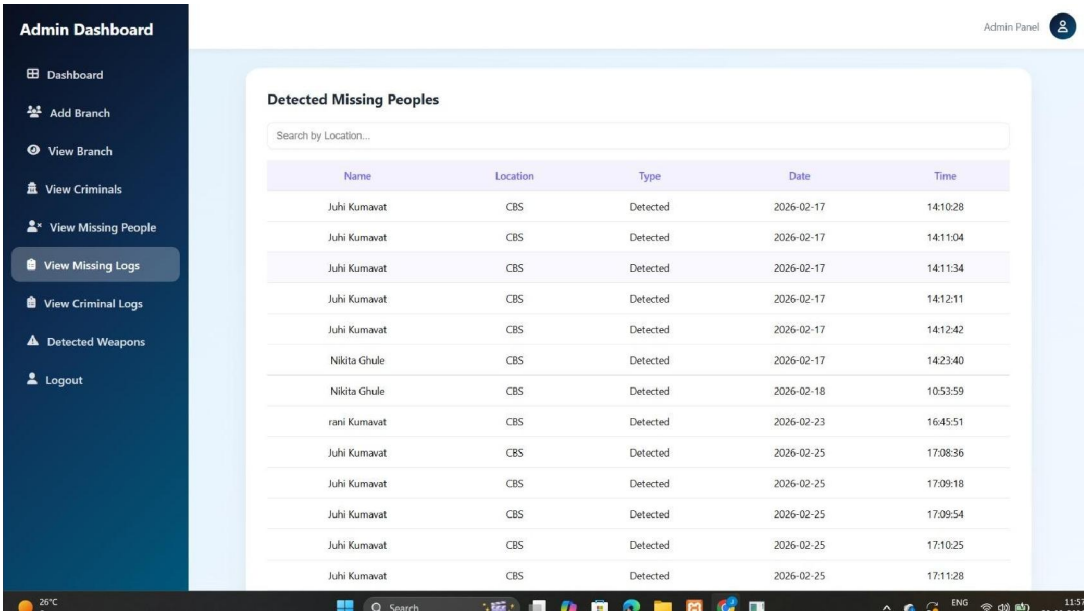

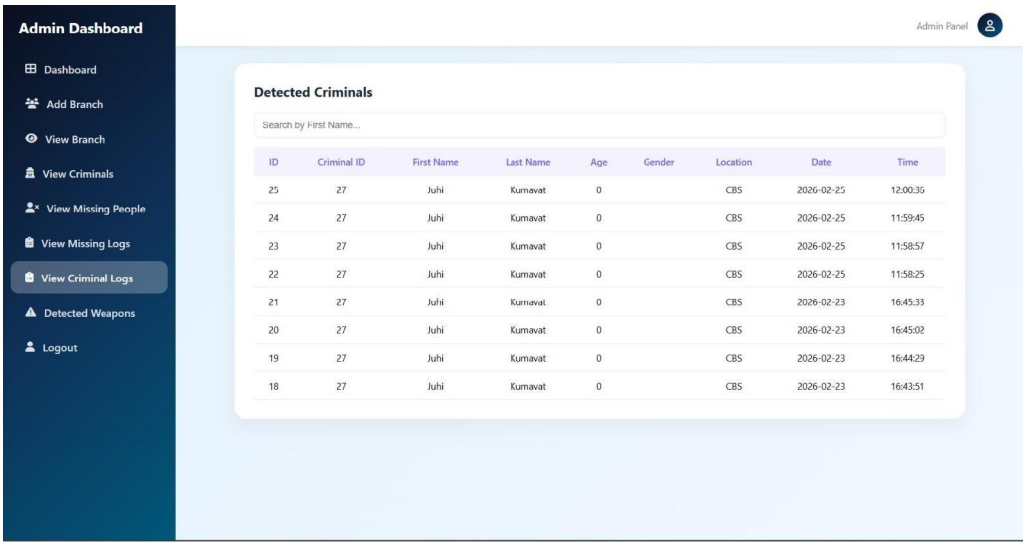

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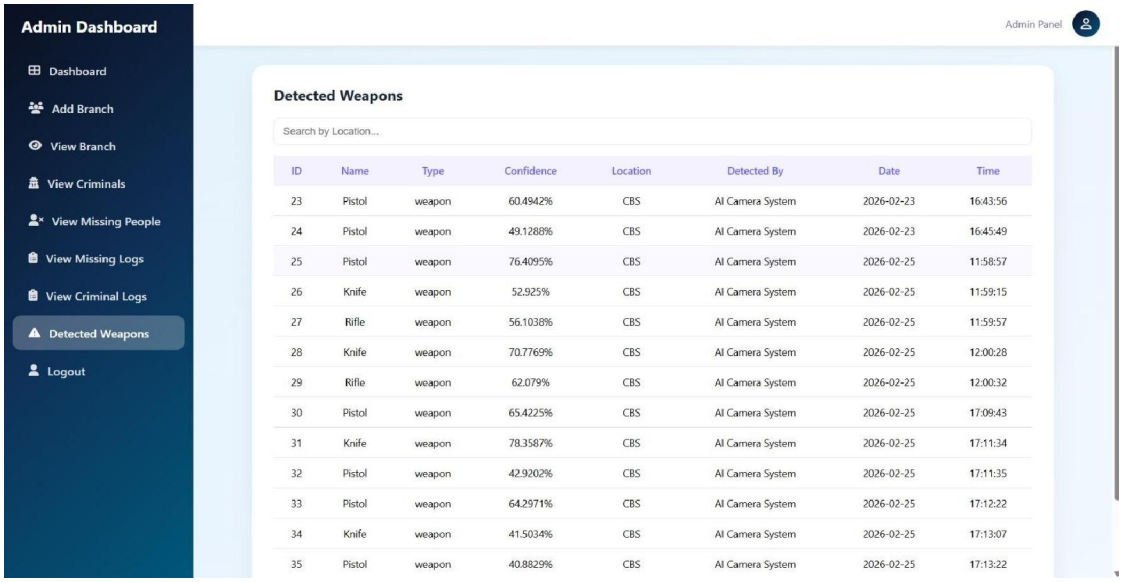

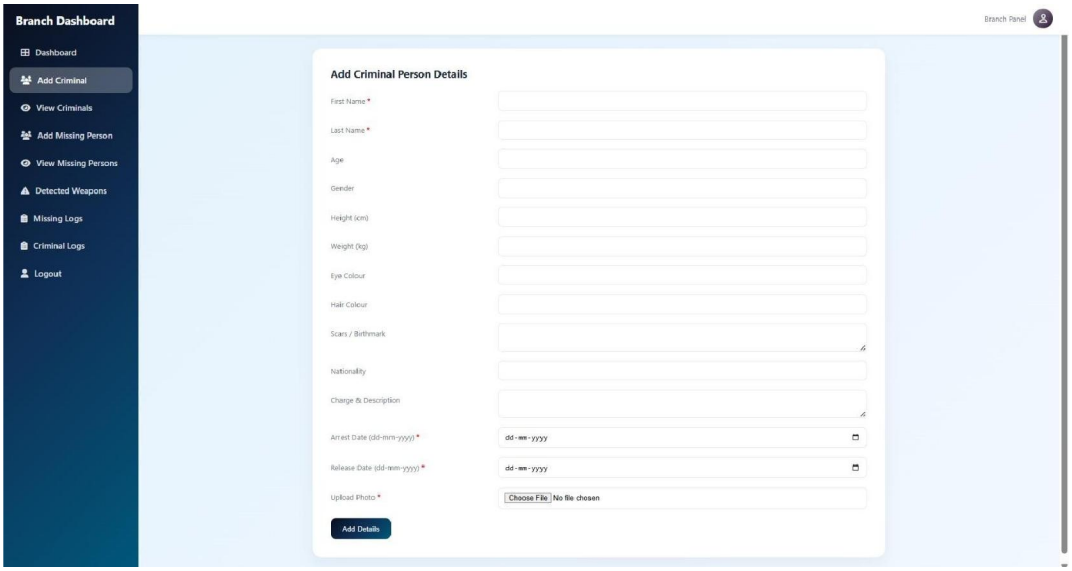

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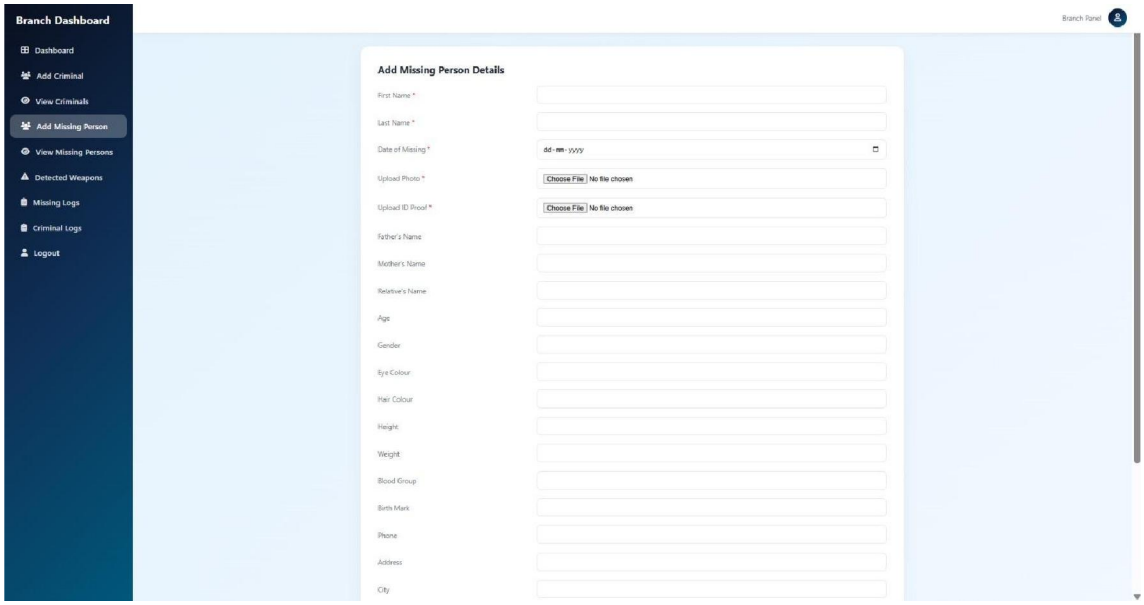

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