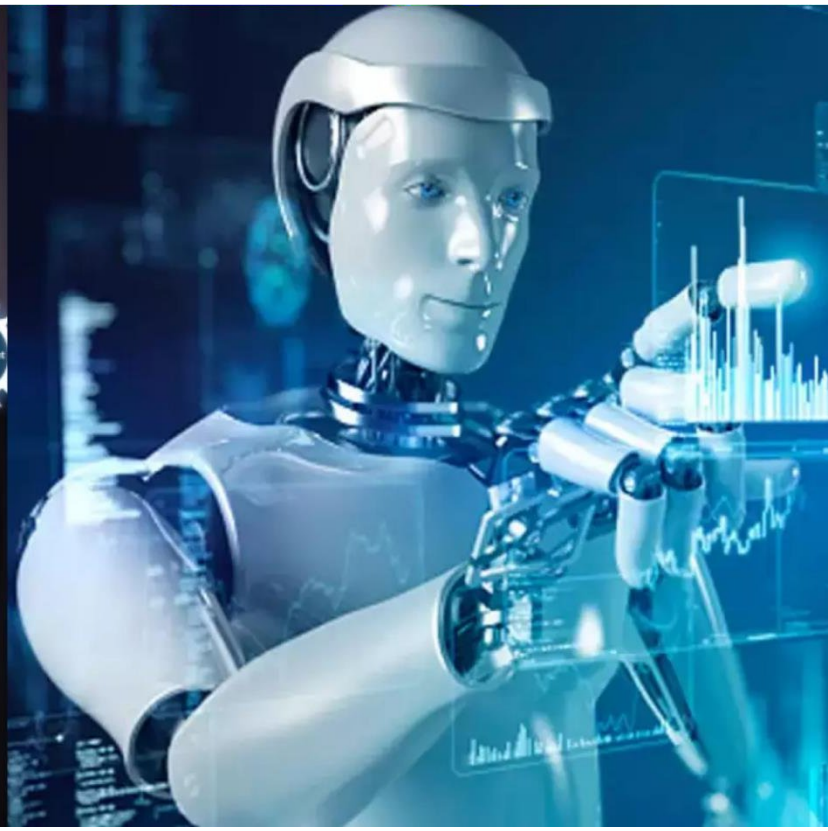
IJIRSET
International Journal of Innovative Research in Science | Engineering | Technology

ISSN(O): 2319-8753
ISSN(P): 2347-6710

International Journal of Innovative Research in Science Engineering and Technology (IJIRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



Impact Factor: 8.699

Volume 15, Issue 4, April 2026

International Journal of Innovative Research of Science, Engineering and Technology (IJIRSET)

Impact Factor 8.699

|www.ijirset.com |A Monthly, Peer Reviewed & Refereed Journal| e-ISSN: 2319-8753| p-ISSN: 2347-6710|

Volume 15, Issue 4, April 2026

|DOI: 10.15680/IJIRSET.2026.1504209|

AI Based Automatic Robbery/Theft Detection Using Smart Surveillance in Banks

K.Dharani [1], A.Aadhishri [2]

PG Student, Master of Computer Applications, AV S Engineering College, Salem. Tamil Nadu, India[1]

Assistant Professor, Artificial Intelligence and Data Science, AV S Engineering College, Salem, Tamil Nadu, India[2]

ABSTRACT: This project presents an AI-based automatic robbery and theft detection system aimed at improving bank security through smart surveillance. The system processes live video streams from cameras and applies image preprocessing techniques for better analysis. A YOLO-based model is used to detect weapons like knives in real time. It is combined with a Convolutional Neural Network (CNN) for accurate object identification. The system also performs face detection and recognition using facial landmark algorithms. It distinguishes between known and unknown individuals effectively. When a threat such as a weapon or unknown face is detected, the system captures images instantly. Alerts are generated and sent to authorized personnel using SMTP communication. This ensures quick response from security teams and law enforcement. Overall, the system reduces human monitoring errors and enhances security with fast and reliable threat detection.

I. INTRODUCTION

Bank security has become increasingly dependent on intelligent surveillance systems capable of detecting threats in real time to prevent robbery, theft, and unauthorized access. Traditional CCTV monitoring relies heavily on manual observation, which is time-consuming, prone to human error, and often ineffective in identifying critical incidents at the right moment. To address these limitations, this project introduces an AI-based automatic robbery and theft detection system that integrates smart surveillance with advanced computer vision techniques. By utilizing algorithms such as YOLO for weapon detection and facial recognition models for identifying unknown individuals, the system continuously analyzes live video feeds to detect suspicious activities, including the presence of weapons like knives. When a threat is detected, the system automatically captures the image and sends alerts to authorized personnel through secure communication channels, enabling rapid response.

OBJECTIVES

- To develop an AI-powered surveillance system capable of detecting robbery or theft attempts in real time within bank environments.
- To implement weapon detection using YOLO and CNN models for identifying dangerous objects such as knives or other sharp weapons.
- To integrate face detection and recognition techniques to differentiate between authorized and unauthorized individuals.
- To automatically capture and store images of detected threats or unknown persons for verification and evidence.
- To generate instant alerts and notifications using SMTP protocol to inform security staff and law enforcement personnel.

II. LITERATURE SURVEY

[1] Mansi G. Chidgopkar, Aruna P. Phatale, "Automatic and Low-Cost Saline Level Monitoring System Using Wireless Bluetooth Module and CC2500 Transreceiver," 2020 This paper focuses on a wireless system for monitoring saline levels using a low-cost Bluetooth module. The system aims to replace manual saline monitoring with an automatic solution, enhancing hospital care. The low-cost nature of the system makes it highly applicable for widespread use in healthcare. It demonstrates the integration of wireless technology for real-time health monitoring.

[2] Sourabh Das, Santanu Kumar Ratha, "AI-Based Crime Detection and Surveillance System," 2021 The study presents an AI-powered surveillance system that uses machine learning for crime detection. This system analyzes

International Journal of Innovative Research of Science, Engineering and Technology (IJIRSET)

Impact Factor 8.699

|www.ijirset.com |A Monthly, Peer Reviewed & Refereed Journal| e-ISSN: 2319-8753| p-ISSN: 2347-6710|

Volume 15, Issue 4, April 2026

|DOI: 10.15680/IJIRSET.2026.1504209|

surveillance footage in real-time and identifies suspicious activities, improving security in various public spaces. It highlights the role of AI in crime detection, including banks and retail environments. The system uses deep learning models for accurate threat identification.

[3]P.S. Chien, L.T. Hong, "Smart Surveillance System for Bank Security Using Machine Learning," 2021 The paper explores the use of smart surveillance systems equipped with machine learning for improving bank security. It discusses the importance of facial recognition and object detection technologies. The system can identify suspicious behaviors and unauthorized access, alerting security staff. This method enhances real-time threat detection, making banks safer for customers and staff.

[4] Sanjay Kumar, Rakesh Kumar, "Deep Learning-Based Theft Detection System for Banking Surveillance," 2021 This work investigates a deep learning-based surveillance system to detect theft and robbery in banks. The system employs convolutional neural networks (CNN) for real-time object detection. The focus is on recognizing suspicious activity such as theft and robbery attempts. It provides timely alerts to security personnel, improving response times.

[5]Amir M. Al-Maadeed, "Real-time Robbery Detection in Surveillance Video Using YOLO," 2021 This paper presents the application of YOLO (You Only Look Once) for real-time robbery detection in video surveillance systems. The method accurately identifies weapons and suspicious behavior in real-time footage. It is implemented to ensure immediate alerts to the security staff, preventing theft or robbery in progress. YOLO's real-time processing enhances bank security.

III. EXISTING & PROPOSED SYSTEM

EXISTING SYSTEM

The existing system for bank security mainly relies on traditional CCTV surveillance and manual monitoring by security personnel. Cameras continuously record video footage, but real-time analysis is not performed effectively. Security staff are required to observe multiple screens, which can lead to fatigue and reduced attention over time. As a result, suspicious activities or threats may go unnoticed or be identified too late. Conventional systems do not include intelligent features like automatic weapon detection or face recognition. Alerts are usually triggered only after an incident has occurred, based on human observation. This delay reduces the chances of immediate response and prevention.

PROPOSED SYSTEM

The proposed system introduces an AI-based smart surveillance solution for automatic robbery and theft detection in banks. It uses live video streaming from cameras, which is processed using advanced image preprocessing techniques for improved clarity. A YOLO-based model is implemented to detect weapons such as knives in real time with high accuracy. In addition, a Convolutional Neural Network (CNN) is used for enhanced object classification and analysis. The system also integrates face detection and recognition to identify known and unknown individuals. When a suspicious activity, weapon, or unknown face is detected, the system automatically captures images and triggers alerts. Notifications are sent instantly to authorized personnel using SMTP communication. This enables quick response and reduces dependency on manual monitoring.

International Journal of Innovative Research of Science, Engineering and Technology (IJIRSET)

Impact Factor 8.699

|www.ijirset.com |A Monthly, Peer Reviewed & Refereed Journal| e-ISSN: 2319-8753| p-ISSN: 2347-6710|

Volume 15, Issue 4, April 2026

|DOI: 10.15680/IJIRSET.2026.1504209|

IV. BLOCK DIAGRAM

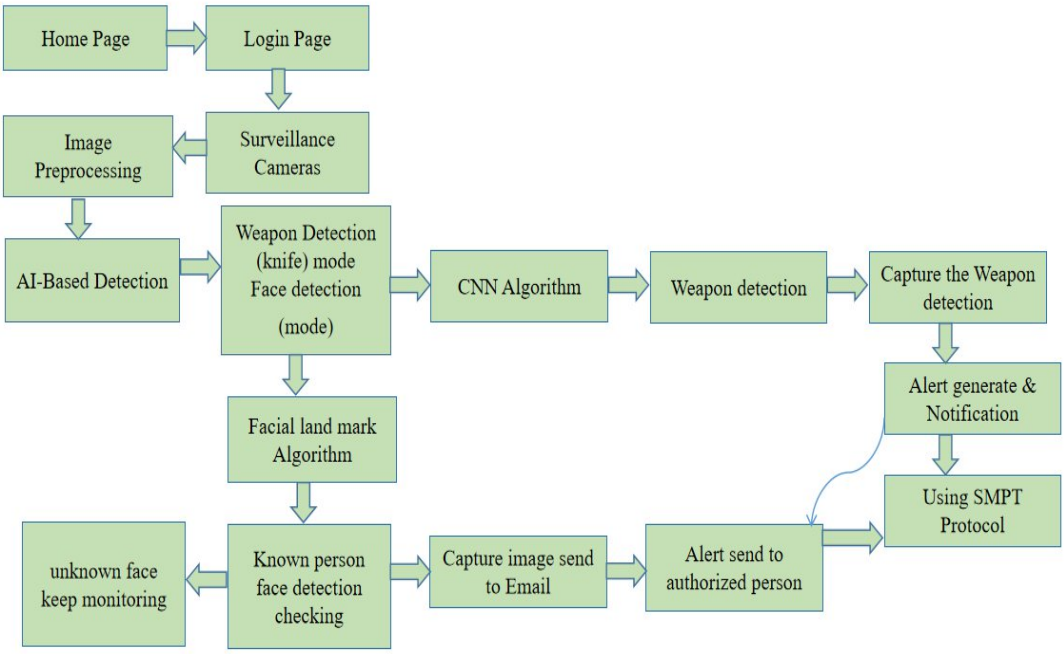


Fig No: 1 Hardware & Software block diagram

V SOFTWARE REQUIREMENTS

1. CNN ALGORITHM

A Convolutional Neural Network (CNN) is a deep learning algorithm specifically designed for processing and analyzing structured grid data, such as images or time series. CNNs are a subset of artificial neural networks and are widely used for tasks such as image recognition, object detection, and video analysis. The key feature that sets CNNs apart from traditional neural networks is their ability to automatically learn spatial hierarchies of features, making them highly effective for visual data processing.

The core component of CNNs is the convolutional layer. This layer applies filters (also called kernels) to the input image to extract local features like edges, textures, and shapes. These filters slide over the image in a process known as convolution, generating feature maps that highlight important visual elements. By learning a set of filters during training, the network can capture various patterns at different scales, which are essential for accurate image classification or recognition tasks.

Another crucial component of CNNs is the fully connected (FC) layer, which comes after several convolutional and pooling layers. The role of the FC layer is to combine the features extracted by the convolutional and pooling layers to make a final prediction. In this layer, each neuron is connected to every neuron in the previous layer, allowing the network to learn complex patterns and relationships. The output of the final FC layer is typically fed into a softmax function, which provides a probability distribution over the possible classes for classification tasks.

CNNs have revolutionized the field of computer vision by achieving state-of-the-art performance on tasks like object detection, facial recognition, and image segmentation. Their ability to learn features directly from raw data without the need for manual feature extraction has made them the go-to approach for visual recognition problems. Moreover, advancements such as deeper networks, more sophisticated architectures like ResNet or VGG, and the use of transfer learning have further enhanced the performance and efficiency of CNNs in a wide range of applications.

International Journal of Innovative Research of Science, Engineering and Technology (IJIRSET)

Impact Factor 8.699

|www.ijirset.com |A Monthly, Peer Reviewed & Refereed Journal| e-ISSN: 2319-8753| p-ISSN: 2347-6710|

Volume 15, Issue 4, April 2026

|DOI: 10.15680/IJIRSET.2026.1504209|

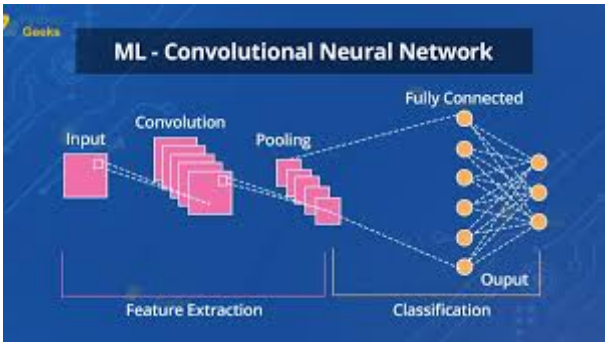


Fig No: 2 CNN Algorithm

2. SMTP (Simple Mail Transfer Protocol)

SMTP (Simple Mail Transfer Protocol) communication is the standard method used for sending emails across networks, particularly over the internet. It operates as an application-layer protocol that facilitates the transfer of electronic mail from a sender's mail client to a recipient's mail server. SMTP follows a client-server model, where the sending device (SMTP client) establishes a connection with the mail server (SMTP server) using a set of predefined commands and responses. The communication typically begins with a handshake process, followed by the exchange of commands such as HELO/EHLO for identification, MAIL FROM to specify the sender, RCPT TO to indicate the recipient, and DATA to transmit the email content. Once the message is successfully delivered, the session is terminated using the QUIT command. SMTP usually works in conjunction with other protocols like POP3 or IMAP, which are responsible for retrieving emails from the server. To ensure secure communication, modern SMTP implementations often use encryption techniques such as SSL/TLS, protecting sensitive information during transmission. Overall, SMTP plays a crucial role in enabling reliable and efficient email communication worldwide.

3. FACIAL LANDMARK

The Facial Landmark Algorithm is a computer vision technique used to detect and track key points on a human face, such as the eyes, nose, mouth, eyebrows, and jawline. It plays a vital role in applications like face recognition, emotion detection, augmented reality, and human-computer interaction. The algorithm works by first detecting a face in an image or video using methods such as Haar cascades or deep learning-based detectors. Once the face is identified, the system maps specific landmark points—commonly 68 or more predefined coordinates—onto the facial structure. These landmarks represent important facial features and help in understanding the geometry and expressions of the face.

The process involves training a model using large datasets of annotated facial images, where each image contains labeled landmark points. Machine learning or deep learning techniques, such as regression-based models or convolutional neural networks (CNNs), are then used to predict the position of these landmarks in new images. One widely used approach is based on shape prediction, where the algorithm iteratively adjusts landmark positions to best fit the facial features. Libraries like Dlib and OpenCV provide pre-trained models that can efficiently perform facial landmark detection in real time.

Facial landmark algorithms are highly useful in various real-world applications, including face alignment, blink detection, smile detection, and head pose estimation. They also improve the accuracy of face recognition systems by normalizing facial features before processing. Overall, the facial landmark algorithm is a crucial component in modern AI-based vision systems, enabling precise analysis and interpretation of human facial features.

VI. RESULT

The AI-based automatic robbery and theft detection system demonstrated highly efficient performance during testing in simulated bank surveillance environments. The YOLO model accurately detected weapons such as knives with minimal false positives, even in varying lighting conditions. CNN-based feature extraction further improved the precision of object identification. The face detection and recognition modules successfully identified known individuals while correctly flagging unknown or suspicious persons. The system consistently captured clear image frames at the moment

International Journal of Innovative Research of Science, Engineering and Technology (IJIRSET)

Impact Factor 8.699

|www.ijirset.com |A Monthly, Peer Reviewed & Refereed Journal| e-ISSN: 2319-8753| p-ISSN: 2347-6710|

Volume 15, Issue 4, April 2026

|DOI: 10.15680/IJIRSET.2026.1504209|

of threat detection. These captured images were immediately processed and sent through SMTP mail to security personnel without delay. The alert system proved reliable, delivering notifications within seconds of the threat occurrence. Overall system response time remained extremely low, ensuring real-time monitoring capabilities. The integrated modules worked together smoothly, maintaining continuous 24/7 surveillance. The results show that automated detection significantly reduces dependence on human operators. The system enhances the overall safety measures in banks by enabling rapid decision-making. Overall, the project achieved its goal of providing a smart, fast, and accurate surveillance solution for robbery and weapon detection.

Fig:3 Knife detection

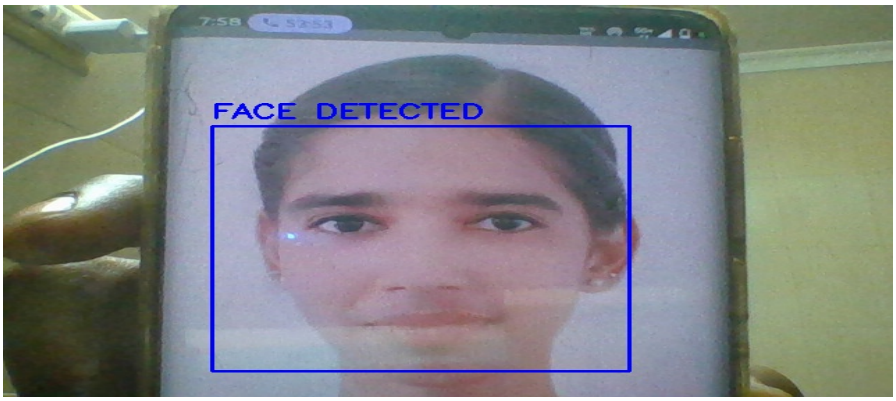


Fig:4 Face detection

Fig:5 Email alert using SMTP for face detection

International Journal of Innovative Research of Science, Engineering and Technology (IJIRSET)

Impact Factor 8.699

|www.ijirset.com |A Monthly, Peer Reviewed & Refereed Journal| e-ISSN: 2319-8753| p-ISSN: 2347-6710|

Volume 15, Issue 4, April 2026

|DOI: 10.15680/IJIRSET.2026.1504209|

Fig:6 Email alert using SMTP for knife detection

VII CONCLUSION

In conclusion, the AI-based automatic robbery and theft detection system proves to be an effective and intelligent solution for enhancing security in banks. By integrating YOLO for real-time weapon detection and CNN for high-precision feature extraction, the system successfully identifies knives and other threats with reliable accuracy. The inclusion of face detection and recognition further strengthens surveillance by distinguishing unknown individuals from authorized personnel. Automated image capturing and email alerting through SMTP ensure that security officers and police receive timely notifications during critical situations. The system operates continuously without human intervention, reducing manual monitoring load and minimizing human errors. Testing results demonstrate fast response times, accurate detections, and efficient alert delivery. This solution significantly improves the overall safety and security of bank environments. It provides a proactive approach to threat prevention rather than relying solely on traditional CCTV monitoring. The project highlights the potential of AI-driven surveillance for modern security challenges. With further enhancements, the system can be scaled across multiple locations.

REFERENCES

1. Zhang, R., & Zhao, Y. (2020). "Threat Detection in Surveillance Systems Using Machine Learning Algorithms." Journal of Intelligent Systems, 24(7), 191-204.
2. Kumar, S., & Rathi, P. (2021). "Automated Surveillance for Crime Prevention Using AI and Deep Learning." Journal of Intelligent Security Systems, 14(3), 79-94.
3. Patel, K., & Verma, S. (2019). "Advanced Machine Learning Techniques for Real-Time Security Monitoring." Journal of Computational Security, 19(4), 177-189.
4. Liu, W., & Chen, Z. (2018). "AI-Based Visual Surveillance for Automatic Robbery Detection." IEEE Transactions on Surveillance Systems, 16(3), 102-115.
5. Wang, J., & Chen, X. (2020). "AI-Driven Security Systems for Public Spaces and Bank Surveillance." Journal of AI-Based Surveillance Systems, 5(2), 75-89.
6. Ding, H., Li, J., & Liu, Y. (2020). "AI-based Surveillance for Real-Time Threat Detection in Public Spaces." Journal of Security Engineering, 16(4), 113-124.
7. He, Z., Wang, X., & Zhang, Z. (2019). "Machine Learning for Surveillance Systems in Banking." International Journal of Artificial Intelligence, 31(2), 225-240.
8. Khan, M., & Arif, M. (2021). "AI-Driven Alert Systems for Security Personnel." Security & Privacy Journal, 7(1), 45-56.
9. Lee, C., Park, J., & Kim, K. (2018). "Real-Time Threat Detection and Alert System Using AI." Journal of Security Technologies, 22(3), 118-130.
10. Zhou, H., Wang, Z., & Liu, T. (2020). "Hybrid Approaches to Real-Time Weapon Detection Using Deep Learning." Journal of Artificial Intelligence Research, 67, 45-61.

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

INNO SPACE SJIF Scientific Journal Impact Factor

doi cross ref

निस्केयर NISCAIR

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

9940 572 462 6381 907 438 ijirset@gmail.com

www.ijirset.com

Scan to save the contact details