IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940



International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.471 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 15, Issue 11, November 2026

DOI: 10.17148/IJARCCE.2026.1511238

AI Powered Security Camera For Motion Detection And Face Recognition With Real-Time Alerts

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Abstract: The demand for intelligent surveillance systems has increased accelerating the adoption of **Artificial Intelligence (AI)** in modern security applications. Conventional CCTV-based surveillance systems require continuous human monitoring, which consumes more time and prone to human error making them inefficient. AI-powered security cameras overcome such limitations by integrating computer vision and edge computing technologies to perform automated face recognition, detect motion and analyse real-time threats. This review paper presents a detailed survey of recent advancements in AI-based security camera systems designed for face recognition and motion detection with real-time alert mechanisms. This review also discusses widely used face recognition techniques, including convolutional neural networks (CNNs), YOLO-based object detection, MTCNN for face detection, and FaceNet-based feature extraction, along with motion detection methods using computer vision and PIR sensors. Furthermore, it explores the integration of embedded system platforms such as Raspberry Pi with camera modules to enable real-time monitoring, energy-efficient, low-cost. This paper also highlights the communication technologies for instant real-time alert generation through e-mail, messages, mobile notifications or cloud-based services. A comparative analysis of recent research is presented to evaluate system performance based on detection accuracy, computational efficiency, response time, and implementation cost. Finally, the review identifies the current challenges, which include varying lighting conditions, poor illumination and pose variations and privacy concerns. It also identifies the computational limitations- while discussing future research directions involving edge AI and secure IoT-enabled surveillance. This review serves as a valuable reference for researchers and developers working on intelligent, cost-effective, and real-time security-monitoring systems.

Keywords: Artificial Intelligence (AI), Face Recognition, Motion Detection, Real-Time Alerts, Intelligent Surveillance, Computer Vision, Deep Learning, Raspberry Pi, Edge Computing, Internet of Things (IoT).

1. INTRODUCTION

The increasing demand for intelligent surveillance systems has accelerated the adoption of Artificial Intelligence (AI) in modern security applications. Traditional Closed-Circuit Television (CCTV) systems primarily record video footage and depend on continuous human monitoring, making them inefficient for identifying suspicious activities in real time. The integration of AI with computer vision has transformed conventional surveillance into intelligent systems capable of automatically detecting, recognizing, and responding to security events with minimal human intervention.

Among the most significant applications of AI in surveillance are face recognition and motion detection. Face recognition enables the identification and verification of individuals by analyzing unique facial features, while motion detection identifies changes within a scene to detect unauthorized movement or suspicious activities. The combination of these technologies enhances security by providing accurate identification, reducing false alarms, and enabling real-time decision-making. Recent advancements in deep learning algorithms, including Convolutional Neural Networks (CNNs), YOLO (You Only Look Once), FaceNet, MTCNN, and OpenCV-based computer vision techniques, have significantly improved the accuracy, speed, and robustness of intelligent surveillance systems.

Edge computing platforms such as the Raspberry Pi have further expanded the deployment of AI-powered surveillance by providing an affordable, compact, and energy-efficient solution for processing video data locally. Performing AI inference at the edge reduces communication latency, minimizes dependence on cloud infrastructure, improves data privacy, and enables immediate response to security threats. These characteristics make AI-based surveillance systems suitable for smart homes, educational institutions, offices, industries, healthcare facilities, transportation systems, and smart city applications.

Despite remarkable progress, AI-powered surveillance systems continue to face several challenges, including variations

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in illumination, facial occlusion, pose changes, computational constraints of embedded devices, cybersecurity risks, and privacy concerns. Ongoing research focuses on developing lightweight deep learning models, improving detection accuracy under complex environmental conditions, and enhancing the efficiency of real-time edge AI systems.

To address these limitations, the proposed system combines mmWave-based motion detection with AI-driven facial recognition to improve surveillance performance. The mmWave sensor identifies movement in the monitored area and triggers the camera module to capture images. The captured images are processed using OpenCV, while MTCNN is employed for face detection and alignment. FaceNet extracts distinctive facial features and compares them with the stored database to verify individual identities. The Raspberry Pi 3B+ serves as the central processing unit, handling image analysis and system operations. Furthermore, Telegram integration enables instant notification when an unauthorized individual is detected.

2. PROPOSED METHODOLOGY

2.1 FLOW CHART

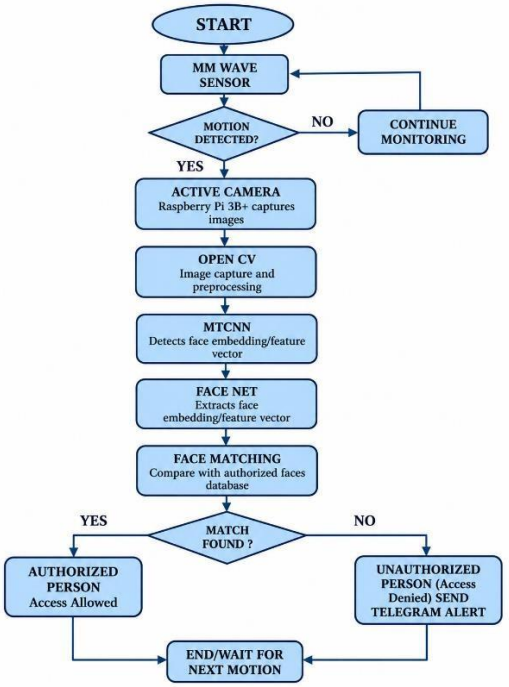


Fig2.1: Flow Chart of AI-Powered Security Camera for Motion Detection and Face Recognition

1. **Motion Detection Using mmWave Sensor:** Initially, the mmWave sensor continuously observes the surrounding area. It identifies the presence or movement of objects using millimetre-wave signals. If no motion is detected, the system keeps monitoring the area. Once the motion is detected, the camera module is activated.

2. **Image Capturing Using Raspberry Pi 3B+:** When motion is detected, the Raspberry Pi 3B+ switches on the camera module to capture images of the person present in the monitored area. The captured images are used for further face recognition and identification.

3. **Image Processing Using OpenCV:**
The captured images are analysed using OpenCV, an open-source computer vision library. Image preprocessing helps to prepare the captured frames for face detection and recognition by carrying out the necessary image-processing operations.

4. **Face Detection Using MTCNN:**
The processed images are passed to the Multi-task Cascaded Convolutional Networks (MTCNN) algorithm. It identifies faces in the captured images and locates the facial region. It also carries out face alignment to enhance the accuracy of the next recognition stage.
It further analyses the facial details to ensure that the detected face is properly positioned and suitable for comparison. This process helps the system achieve more reliable results during individual identification.

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5. Feature Extraction Using FaceNet: After detecting the face, the FaceNet model identifies unique facial features and converts them into a numerical format know as a face embedding or feature vector. This representation enables the system to differentiate between individuals.

6. Face Matching and Verification:
The extracted face embedding is checked against the stored database of authorized faces. The system determines whether the captured face corresponds to any registered individual by comparing the similarity of their feature vectors.

7. Authorized and Unauthorized Person Detection:
Authorized Person: If a matching face is detectednin the database, the indvidual is recognized as an authorized person, and access is premitted.
Unauthorized Person: If no matching face is identified, the individual is classified unauthorized, access is denied, and an alert message is delivered through Telegram

8. System Reset and Continuous Monitoring: After the identification process is completed, the system enteres the end/wait state and remains ready for the next motion detection event. The operation repeats continuously, enabling the system to monitor the surroundings and detect further new movements.

2.2 BLOCK DIAGRAM

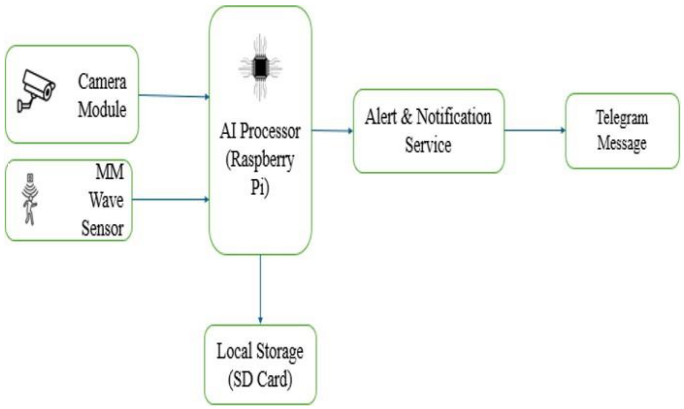


Fig2.2: Block diagram of AI-Power Security Camera for Motion Detection and Face Recognition

The block diagram illustrates the overall structure of the proposed AI-powered security camera system. It includes camera module,
Mm Wave sensor, AI processor (Raspberry Pi), alert and notification unit, Telegram messaging application, and local storage. All these
components function together to achieve intelligent surveillance, image analysis, and security alert generation.

1. Camera Module:
The camera module is responsible for capturing images of the monitored surroundings whenever movement is detected. The recorded visual information is sent to the Raspberry Pi for further processing and facial recognition.

2. mmWave Sensor:
The mmWave sensor continuously monitors the surrounding area to identify movement or human presence. When any motion is identified, it sends the required signal to initiate the camera-based monitoring operations.

3. AI Processor (Raspberry Pi):
The Raspberry Pi acts as the main processing unit of the proposed system. It receives input from the camera module and mmWave sensor, processes the captured images, and performs face detection and recognition using AI-based techniques. It also manages the communication between the different system components.

4. Alert and Notification Service:
This module handles the generation of notifications based on the face recognition results. When an unauthorized person

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is identified, the system generates an alert and forwards it to the notification service.

5. Telegram Message:

Telegram is integrated into the system to deliver security notifications to the registered user. When an unauthorized person is detected, an alert message is sent through Telegram, allowing the user to receive information about the security event remotely.

6. Local Storage (SD Card):

The SD card is used as local storage for saving the required system data, captured images, and other relevant information. It provides storage support for the Raspberry Pi and helps maintain the necessary data for system operation.

Overall Working

The proposed system combines motion detection, camera-based image acquisition, AI-based face recognition, and remote notification facilities. The mmWave sensor detects movement, while the camera module captures the required images. The Raspberry Pi processes the input data and determines the identity of the detected person. Based on the recognition result, the alert and notification service manages the notification process and sends Telegram messages when an unauthorized person is identified. The SD card provides local storage for the system data.

3. HARDWARE AND SOFTWARE COMPONENTS

The proposed AI-powered security camera system consists of various hardware and software components that work together to perform motion detection, image acquisition, face recognition, and real-time alert generation. The hardware components provide the physical interface for sensing and image capturing, while the software components perform image processing, facial analysis, identification, and communication.

3.1. HARDWARE COMPONENTS

Hardware components are the physical devices used to construct the proposed security monitoring system. Each component performs a specific function in the overall operation.

3.1.1 Raspberry Pi 3B+



Fig3.1.1: Raspberry Pi 3 B+

The Raspberry Pi 3B+ is a compact single-board computer that acts as the central processing unit of the proposed security system. It is responsible for controlling the connected hardware devices and executing the software required for image processing and face recognition.

It receives input from the mmWave sensor and camera module and processes the captured visual information using AI-based algorithms. The Raspberry Pi supports Python programming and various computer vision libraries, making it suitable for implementing intelligent surveillance applications.

Main features:

- Broadcom BCM2837B0 64-bit processor.
- Quad-core ARM Cortex-A53 CPU.
- 1 GB LPDDR2 RAM.
- Built-in Wi-Fi and Bluetooth connectivity.
- GPIO pins for connecting external electronic devices.
- Supports camera interfacing and image-processing applications.

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Role in the proposed system: It manages motion detection input, camera operation, facial recognition, database comparison, and Telegram notification generation.

3.1.2 mmWave Sensor

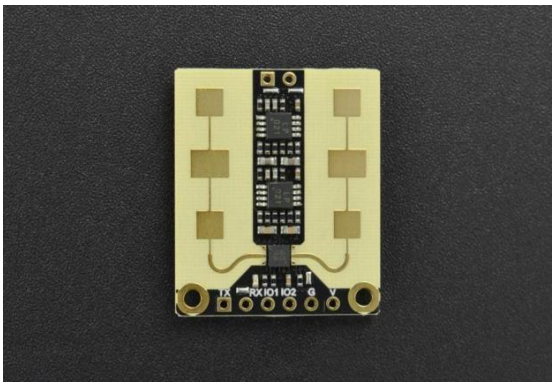


Fig3.1.2:MM Wave Sensor

The millimetre-wave (mmWave) sensor is an electronic sensing device used to detect human movement and presence in the monitored environment. It operates by transmitting high-frequency electromagnetic waves and analysing the reflected signals received from nearby objects. When a person moves within the monitored region, the reflected signals change, allowing the sensor to identify motion or presence. The detected activity is used to initiate the camera-based monitoring process.

Main features:

- Detects movement and human presence.
- Uses millimetre-wave radar technology.
- Can detect movement without requiring visible light.
- Supports continuous environmental monitoring.
- Provides sensor output for controlling other electronic devices.

Role in the proposed system: The mmWave sensor acts as the initial detection unit. It identifies movement and triggers the camera operation, reducing unnecessary image capturing.

3.1.3 CAMERA



Fig3.1.3: Camera

The camera module is an important hardware component used to capture images of individuals present in themonitored area. It provides the visual input required for the face detection and recognition process.

When the mmWave sensor identifies movement, the camera module is activated through the Raspberry Pi. The captured images are transferred to the image-processing stage, where facial regions are identified and analysed.

Main features:

- Captures digital images of the monitored area.

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- Provides visual input for facial analysis.
- Supports integration with Raspberry Pi.
- Can be used for image acquisition and surveillance.
- Supplies image data to computer vision algorithms.

Role in the proposed system: It captures images of the person detected by the mmWave sensor and supplies them to the Raspberry Pi for further processing.

3.2. SOFTWARE COMPONENTS

Software components are used to control the hardware devices and perform intelligent operations such as image preprocessing, face detection, feature extraction, identity verification, and notification delivery.

3.2.1 Python Programming Language



Fig3.2.1: Python

Python is a high-level, interpreted programming language widely used in artificial intelligence, machine learning, and computer vision applications. It provides a simple programming structure and supports several libraries required for developing AI-based systems.

In the proposed security camera system, Python is used to develop the main application and coordinate the interaction between the mmWave sensor, camera module, and Raspberry Pi processor.

Main features:

- Simple and readable programming syntax.
- Supports artificial intelligence and machine learning applications.
- Provides libraries for image processing and face recognition.
- Supports hardware interfacing with Raspberry Pi.
- Enables integration with external communication services.

Role in the proposed system: Python controls the complete program execution, processes sensor inputs, manages image acquisition, and coordinates the face recognition and alert-generation operations.

3.2.2 OpenCV (Open Source Computer Vision Library)



Fig3.2.2: OpenCV

In the proposed system, OpenCV is used to handle the images captured by the camera module. It performs the necessary image-processing operations before the images are supplied to the MTCNN algorithm for face detection.

Main features:

- Image and video processing.

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- Image resizing and colour conversion.
- Frame acquisition from camera devices.
- Image enhancement and preprocessing.
- Supports integration with Python.

Role in the proposed system: OpenCV manages image acquisition and preprocessing, preparing the captured images for the subsequent facial detection and recognition stages.

3.2.3 MTCNN (Multi-task Cascaded Convolutional Networks)



Fig3.2.3: MTCNN

MTCNN is a deep learning-based algorithm used for detecting human faces and identifying faciallandmarks in digital images. It is designed to locate faces accurately, even when there are variations in facial position, orientation, and image conditions.The algorithm identifies the facial region and performs face alignment using important facial landmarks.This helps provide properly positioned facial images for the next stage of the recognition process.

Main features:

- Detects multiple faces in an image.
- Locates facial regions using bounding boxes.
- Identifies important facial landmarks.
- Performs face alignment.
- Supports face detection under different image conditions.

Role in the proposed system: MTCNN identifies and aligns faces from the images processed by OpenCV. The detected facial regions are then provided to FaceNet for further feature extraction.

3.2.4 FaceNet



Fig3.2.4:Face Net

FaceNet is a deep learning-based face recognition model that converts facial images into numerical representations known as face embeddings. These embeddings contain important facial characteristics that help distinguish one individual from another.

The model generates feature vectors for the detected faces. These vectors are compared with the previously stored authorized face data to determine whether the individual is known or unknown.

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Main features**:**

- Extracts distinctive facial characteristics.
- Converts facial information into numerical embeddings.
- Supports face verification and identification.
- Compares facial representations using similarity measurements.
- Helps distinguish between different individuals.

Role in the proposed system: FaceNet extracts facial embeddings from the aligned images and compares them with the authorized face database to verify the identity of the detected individual.

3.2.5 Telegram Application



Fig3.2.5:Telegram

Telegram is a cloud-based messaging application that supports instant communication and automated message delivery. It provides an interface through which the proposed security system can send notifications to the registered user.
The Raspberry Pi communicates with Telegram through a bot integration. Whenever an unauthorized person is identified, the system generates an alert message and sends it to the user's Telegram account.

Main features:

- Instant message delivery.
- Supports automated bot communication.
- Provides remote notification facilities.
- Allows communication through an internet connection.
- Supports text and media messages.

Role in the proposed system: Telegram is used to deliver security alerts whenever an unauthorized individual is detected, allowing the user to receive notifications remotely.

4. RESULTS

4.1 HARDWARE IMPLEMENTATION AND SYSTEM OUTPUT

The AI-Powered Security Camera System with Motion Detection and Face Recognition was successfully implemented using a Raspberry Pi. The system was designed to detect a person, capture their face, and identify whether they are registered or unknown.

The hardware prototype consists of a Raspberry Pi, USB webcam, wave sensor, LCD display, motor driver circuit, power supply and door-lock mechanism. All the components were connected and integrated to perform the required operations. When a person approaches the system within the sensor's detection range of approximately 50 cm, the sensor detects the movement and activates the camera. The camera captures the person's face, and the Raspberry Pi processes the captured image using the face recognition algorithm.
The LCD display is used to show the system information and status. The motor driver controls the door-lock mechanism based on the recognition result.

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The hardware implementation was completed successfully, and the individual components were tested to verify their proper operation.

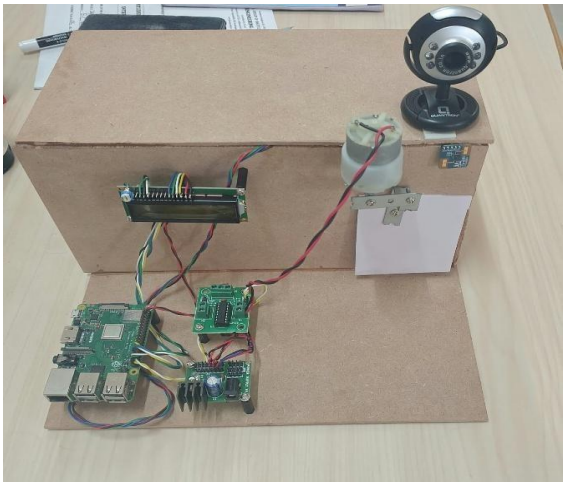


Fig:4.1Hardwareimplementation of the AI-powered security system showing Raspberry Pi, camera, LCD, sensor, and door-lock mechanism

4.2 FACE RECOGNTION RESULTS

The face recognition module was tested using both registered and unregistered faces. The camera continuously captures the person's face, and the Raspberry Pi compares it with the stored face database.When a registered person is detected, the system successfully identifies the person and displays their registered name with a green bounding box around the face. This indicates successful face recognition.When an unknown person is detected, the system displays the message "Unknown" with a red bounding box. This indicates that the person's face does not match any registered face in the database.The system was tested with different individuals to verify its recognition capability. The results show that the system can distinguish between registered and unknown persons.

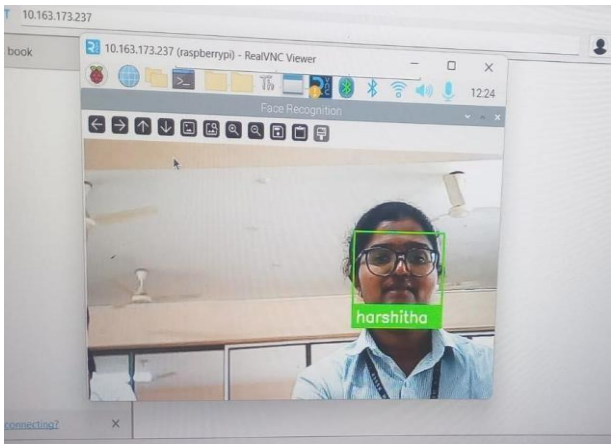


Fig 4.2.1: Successful recognition of a registered person with a green bounding box and name Display.

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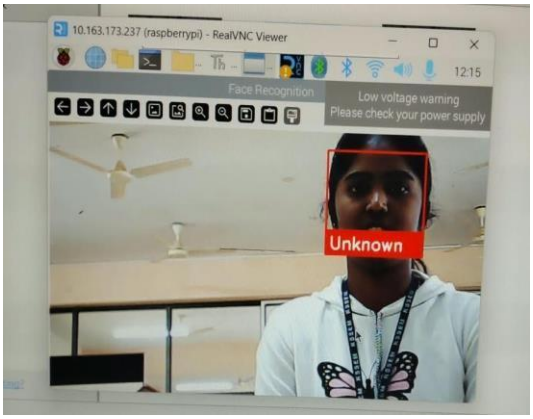


Fig 4.2.2: Detection of an unknown person with a red bounding box and Unknown message

These results demonstrate that the face recognition module performs the main identification function of the proposed security system. The captured images processed by the Raspberry Pi using the face recognition algorithm. The system compares the detected face with the previously stored images in the database to identify the person. If a matching face is found, the person's registered name is displayed on the screen with a green bounding box, indicating successful identification. If the detected face does not match any stored image, the system displays the message "Unknown" with a red bounding box, indicating an unauthorized person. This process helps the system differentiate between authorized and unauthorized individuals. The face recognition process was tested with multiple individuals to check the identification capability of the system. The camera captures the face in real time, and the software analyses the facial features to find a match. The system also displays the recognition output through the RealVNC Viewer, allowing the user to monitor the results remotely from another computer. The results show that the system can recognize registered individuals and identify unknown persons. This improves security by reducing manual identification and providing automatic monitoring. The recognition output is also used as an input for the access control mechanism, which determines whether the door should be unlocked or remain locked.

4.3 ACCESS CONTROL RESULTS AND OVERALL PERFORMANCE

The access control mechanism was tested based on the output of the face recognition system. After identifying the person, the Raspberry Pi sends the corresponding control signal to the motor driver circuit.

When a registered person is recognized, the motor mechanism operates to unlock the door, providing access to the authorized person. When an unknown person is detected, the door remains locked, preventing unauthorized access.

The system was also tested under different lighting conditions and with different faces to observe its performance. The camera was able to capture faces, and the recognition module displayed the corresponding identification results.

Testing Results

- **Registered Person:** The system successfully identifies the registered person and displays their name in green.
- **Unknown Person:** The system displays “Unknown” in red and prevents unauthorized access
- **Motion Detection:** The wave sensor detects a person approaching within the specified detection range.
- **Camera Operation:** The webcam captures images for face recognition.
- **Door Control:** The motor and driver circuit control the locking and unlocking mechanism according to the recognition result.
- **Display Operation:** The LCD provides system status information.

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4.3.1 Overall Result

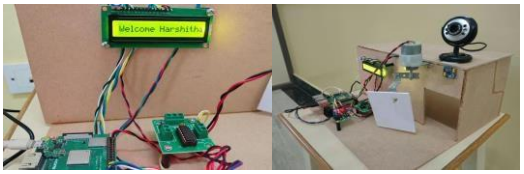


Fig4.3.1:Over All Result

The project was successfully implemented and demonstrated the integration of motion detection, face recognition and automatic access control using Raspberry Pi. The system reduces the need for manual security monitoring and provides an additional level of protection against unauthorized entry.
The experimental results demonstrate that the proposed system can identify registered users, detect unknown persons and control the door mechanism based on recognition results. Thus, the project achieves its main objective of developing an intelligent and automated security system.



Fig4.3.2:Final demonstration of the implemented face recognition and access control system

LITERATURE REVIEW

[1] Title: A Smart Security System Using IoT
Authors: P. Kumar, A. Sharma, R. Singh (2025)
Description: This IoT-based security system integrates sensors, cloud computing, and intelligent monitoring. It detects threats and sends notifications through mobile applications. The architecture supports secure and scalable remote surveillance.

[2] Title: AI Smart Security Camera for Person Detection, Face Recognition, Tracking and Logging
Authors: V. G. Almeida, J.C.Filipe,H. Oliveira(2024)
Description:
The authors proposed an AI-based surveillance system that performs person detection, face recognition, tracking, and activity logging. It improves monitoring accuracy and automatically records important events with timestamps. The system enhances security but requires high computational resources.

[3] Title: Facial Recognition Robots for Enhanced Safety and Smart Security
Authors: P. Jongsuk, W. Yodsukdee, K. Patcharatanakul(2024)
Description:
The authors developed an autonomous robot with facial recognition for intelligent surveillance. It patrols designated areas, identifies individuals, and monitors suspicious activities. The system improves security coverage while reducing human workload.

[4] Title: Real-Time Criminal Identification Using MTCNN for Security Surveillance
Authors: R. Kumar, S. Patel, A. Singh (2024)
Description:
The proposed system identifies criminals in real time using MTCNN and deep learning techniques. It compares detected faces with a criminal database and sends instant alerts. The method improves public safety and reduces manual identification.

[5] Title: Deep Learning-Powered Face Detection and Recognition for Challenging Environments
Authors: A. O. Adeyemi, F. Nzeh, O. Abiodun (2024)
Description:
The study applies deep learning models for face recognition under poor lighting and varying poses. Image preprocessing



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improves recognition accuracy in challenging environments. However, the system requires powerful hardware and large datasets.

[6] Title: Smart Surveillance Camera Using AI Authors: M. Hassan, A. Raza, U. Farooq (2024)
Description:
This AI-powered surveillance camera detects motion, recognizes faces, and analyzes suspicious activities. It records only significant events and sends instant notifications. The approach reduces storage usage and improves monitoring efficiency.

[7] Title: Implementation of a Multitudinous Face Recognition Using YOLOv3
Authors: V. Suresh, M. Harini, P. Janardhan (2022)
Description:
The proposed system uses YOLOv3 to detect and recognize multiple faces simultaneously. It provides fast and accurate real-time performance in crowded environments. GPU hardware is required for optimal operation.

[8] Title: Automated Face Recognition by Smart Security System Using AI & ML Algorithms
Authors: S. Ramya, K. Priya, G. Karthick (2021)
Description:
The authors developed an AI and machine learning-based face recognition system for automated surveillance. It accurately identifies individuals while minimizing human intervention. The system is suitable for homes, offices, and educational institutions.

[9] Title: Video-Based Real-Time Intrusion Detection System Using Deep Learning for Smart City Applications
Authors: S. S. Patil, S. Phulari, C. Patil (2020) Description:
The proposed system detects unauthorized intrusions using deep learning-based video analysis. It continuously monitors surveillance footage and generates real-time alerts. The method achieves higher accuracy than conventional motion detection.

[10] Title: Face Recognition Based Surveillance System Using FaceNet and MTCNN on Jetson TX2
Authors: J. Binu, B. Kareem (2019) Description:
This system uses FaceNet and MTCNN for accurate real-time face recognition on the Jetson TX2 platform. It provides high recognition accuracy with low processing delay. The approach demonstrates efficient embedded AI surveillance.

[11] Title: IoT-Based Facial Recognition Security System
Authors: C. Ngo, T. Tran, H. Nguyen (2018)
Description:
The system combines facial recognition with IoT and cloud technology for remote monitoring. Users can access surveillance data through smartphones and computers. The approach enhances accessibility but introduces cybersecurity concerns.

[12] Title: Face Recognition in Multi-Camera Surveillance Videos
Authors: O. Arandjelovic et al. (2013) Description:
The system combines multiple camera views to improve face recognition and tracking accuracy. It minimizes blind spots and recognizes faces from different angles. However, it increases hardware cost and implementation complexity.

[13] Title: Real-Time Video Surveillance System Using Motion Detection
Authors: B. K. Saho, M. Fujii (2012) Description:
The system records video only when motion is detected using background subtraction techniques. This reduces storage requirements and processing time. However, it cannot identify individuals and may produce false alarms.

CONCLUSION

The AI-Powered Security Camera for Face Recognition and Motion Detection with Real-Time Alerts is an advanced surveillance system designed to provide intelligent, automated, and reliable security. Unlike traditional CCTV cameras that only record video, this system uses Artificial Intelligence (AI) to analyze live video streams, recognize authorized and unauthorized faces, detect motion, and instantly notify users whenever suspicious activity is detected. This reduces the need for continuous human monitoring while improving the speed and accuracy of threat detection.

The integration of face recognition technology allows the system to identify registered individuals and distinguish them from unknown persons. This feature is particularly useful in homes, offices, schools, banks, hospitals, and industries where access control and identity verification are important. At the same time, the motion detection module continuously monitors the surroundings and records only when movement is detected, which helps save storage space and makes it



International Journal of Advanced Research in Computer and Communication Engineering
Impact Factor 8.471 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 15, Issue 11, November 2026
DOI: 10.17148/IJARCCE.2026.1511238

easier to review important events.

One of the major advantages of this system is its real-time alert mechanism. Whenever an unknown person is detected or unusual motion occurs, the system immediately sends notifications to the user's mobile phone or computer along with images or video clips. This enables users to take quick action, even when they are away from the location. The combination of AI algorithms and real-time communication significantly improves security and reduces the chances of theft, unauthorized access, or other criminal activities. The proposed system is cost-effective, scalable, and easy to deploy, making it suitable for both small-scale and large-scale applications. It minimizes manual surveillance, increases operational efficiency, and provides continuous monitoring with higher accuracy than conventional security systems. The project also demonstrates the practical application of AI, computer vision, and machine learning in solving real-world security challenges. In the future, this system can be further enhanced by integrating cloud storage for secure data backup, IoT devices for smart home automation, multiple camera support, license plate recognition, emotion detection, object tracking, voice-based alerts, and predictive analytics. These improvements will make the surveillance system even more intelligent, efficient, and adaptable to modern security requirements.

In conclusion, the AI-Powered Security Camera for Face Recognition and Motion Detection with Real-Time Alerts is an effective, intelligent, and future-ready security solution. It combines AI, computer vision, and real-time communication technologies to provide accurate face recognition, instant threat detection, continuous monitoring, and immediate alerts. This project not only enhances safety and security but also demonstrates the growing importance of Artificial Intelligence in developing smart surveillance systems for homes, businesses, educational institutions, and public spaces.

REFERENCES

[1] P. Kumar, A. Sharma, and R. Singh, "A smart security system using IoT," in Proc. IEEE Int. Conf. Smart Syst. Innov. Res. (ICSSIR), 2025.
[2] V. G. Almeida, J. C. Filipe, and H. Oliveira, "AI smart security camera for person detection, face recognition, tracking and logging," in Proc. IEEE 7th Int. Conf. Image Signal Process. Appl. (ISPA), 2024.
[3] P. Jongsuk, W. Yodsukdee, and K. Patcharatanakul, "Facial recognition robots for enhanced safety and smart security," in Proc. IEEE Int. Conf. Electron. Inf. Commun. Technol. (ICEICT), 2024.
[4] R. Kumar, S. Patel, and A. Singh, "Real-time criminal identification using MTCNN for security surveillance," in Proc. IEEE Int. Conf. Intell. Syst. Signal Process. (ISSP), 2024.
[5] A. O. Adeyemi, F. Nzeh, and O. Abiodun, "Deep learning-powered face detection and recognition for challenging environments," in Proc. IEEE Int. Conf. Comput. Intell. Appl. (ICCIA), 2024.
[6] M. Hassan, A. Raza, and U. Farooq, "Smart surveillance camera using AI," in Proc. IEEE Int. Conf. Emerg. Technol. (ICET), 2024.
[7] V. Suresh, M. Harini, and P. Janardhan, "Implementation of a multitudinous face recognition using YOLO.V3," in Proc. IEEE Int. Conf. Comput. Commun. Informatics (ICCCI), 2022.
[8] S. Ramya, K. Priya, and G. Karthick, "Automated face recognition by smart security system using AI & ML algorithms," in Proc. IEEE Int. Conf. Commun. Signal Process. (ICCSP), 2021.
[9] S. S. Patil, S. Phulari, and C. Patil, "Video-based real-time intrusion detection system using deep learning for smart city applications," in Proc. IEEE Int. Conf. Commun. Signal Process. (ICCSP), 2020.
[10] J. Binu and B. Kareem, "Face recognition-based surveillance system using FaceNet and MTCNN on Jetson TX2," in Proc. IEEE Int. Conf. Adv. Comput. Commun. Inform. (ICACCI), 2019.
[11] C. Ngo, T. Tran, and H. Nguyen, "IoT-based facial recognition security system," in Proc. IEEE Int. Conf. Electron. Inf. Commun. Technol. (ICEICT), 2018.
[12] O. Arandjelovic et al., "Face recognition in multi-camera surveillance videos," in Proc. IEEE Conf. Comput. Vis. Pattern Recognit. (CVPR), 2013.
[13] B. K. Saho and M. Fujii, "Real time video surveillance system using motion detection," in Proc. IEEE Workshop Signal Process. Appl. (WOSPA), 2012.

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