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AI Driven ATM Premises using Raspberry Pi Technology

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Abstract: *The project focuses on developing a smart ATM that leverages biometric security features like retina scanning, fingerprint recognition, and facial recognition to authenticate users instead of relying on traditional PINs. These advanced technologies aim to enhance transaction security, minimize fraud, and ensure that only the rightful account holder can access their funds. By integrating these features, the system intends to make banking safer, more efficient, and highly convenient for users. It emphasizes improving the reliability and ease of cash withdrawals while reducing the risk of unauthorized access. The innovative use of biometrics represents a shift towards modern, secure banking solutions. Overall, the project aspires to redefine the way individuals interact with ATMs, prioritizing safety and user friendliness.*

Keywords: ATM Premises, AI&ML, Raspberry pi 4b, IP CCTV Camera, Wi-Fi Router, POE switch, Audio speaker, Python3.1.1, yoloV8

I. INTRODUCTION

The ATM Examining System is a comprehensive solution designed to enhance the efficiency and reliability of automated teller machines (ATMs). It leverages advanced technologies to monitor and manage ATMs in real time, ensuring smooth operations, timely maintenance, and strong security measures. By integrating various devices, connectivity, and data analytics, the system aims to reduce downtime and detect fraudulent activities. This proactive approach helps financial institutions maintain seamless banking services for their customers while ensuring the security of transactions. One of the key challenges faced by ATM systems is the increasing incidents of fraud, where individuals use masks and helmets to avoid identification. Such activities make it difficult for security systems to track and prevent suspicious Behavior effectively. To address these concerns, the system implements robust security measures, such as facial recognition, AI-powered surveillance, and anomaly detection techniques. These features help in identifying suspicious activities and preventing potential fraud attempts. In conclusion, the ATM Examining System plays a crucial role in modern banking by improving ATM functionality, minimizing fraud risks, and ensuring a safer banking environment for both financial institutions and customers

II. PROPOSED WORK

The proposed ATM Examining System is designed to enhance the functionality, security, and maintenance efficiency of automated teller machines (ATMs) by incorporating real-time monitoring and artificial intelligence. This system will utilize IoT-based sensors and surveillance cameras to continuously monitor the operational status of ATM components, such as the cash dispenser, card reader, and power supply. In case of any malfunction or irregularity, instant alerts will be sent to maintenance teams to ensure timely intervention and minimize downtime.

To address the growing concern of ATM fraud involving the use of masks and helmets for identity concealment, the system will integrate AI-powered facial recognition and object detection models. These models will identify individuals who attempt to access ATMs while wearing face coverings or helmets, and will trigger alerts to security personnel if such unauthorized activity is detected. Additionally, the system will implement behavior analysis techniques to detect

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unusual or suspicious actions, such as loitering near ATMs, repeated failed transactions, or attempts to tamper with the machine.

The surveillance module will automatically log events like entry and exit, facial mismatches, and the presence of concealed identities, storing the data either on a local server or cloud platform for later review. An integrated alert system will notify bank officials through SMS, email, or app notifications about any security or hardware-related issues. Furthermore, a centralized dashboard will provide bank administrators with a real-time overview of multiple ATMs, enabling efficient monitoring and decision-making.

The system will also feature a reporting and analytics module to generate periodic reports on machine performance, security incidents, and maintenance history. Edge computing devices like Raspberry Pi or Jetson Nano may be used for processing data locally, reducing latency and ensuring swift detection and response. Overall, the proposed work aims to provide a robust, AI-driven solution that enhances ATM security, improves maintenance workflows, and ensures uninterrupted banking services

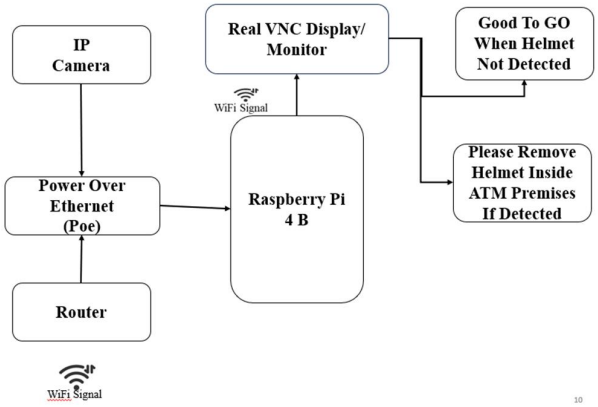

Fig.1. Block Diagram for AI driven ATM Premises

Fig(1) shows the block diagram illustrates a system designed for monitoring activity in an ATM environment through the use of an IP camera. The IP camera connects directly to the RaspberryPi 4 B, facilitating data transmission and image processing. This camera is powered using Power Over Ethernet (PoE), which allows both power and data to travel through the same cable, enhancing efficiency. The Raspberry Pi acts as the central processing unit, receiving video input from the camera and analyzing it for specific conditions, such as detecting whether a helmet is being worn. The processed information is then sent to a Real VNC Display/Monitor for Realtime viewing. If the helmet is not detected, a "Good To Go" message is generated, indicating that entry into the ATM premises is permitted. Conversely, if a helmet is detected, the system prompts the user to "Please Remove Helmet Inside ATM Premises If Detected," ensuring safety and compliance with regulations. Additionally, the router provides WiFi signal connectivity, allowing for remote monitoring and control of the system. This integrated setup enhances security measures around ATMs while simultaneously ensuring user safety by monitoring compliance with specific entry guidelines. The entire system operates seamlessly, ensuring effective surveillance and user feedback in real time.

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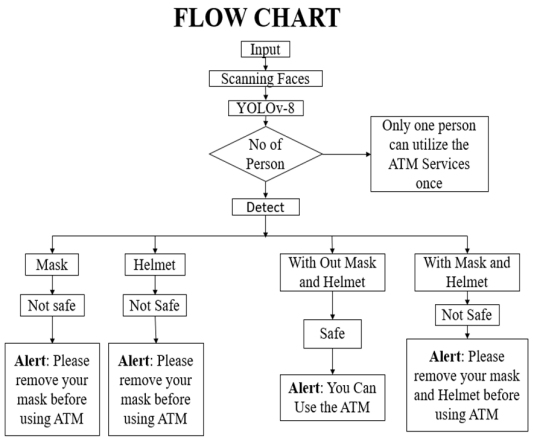

Fig.2.Flow chart for AI driven ATM Premises

Fig (2) shows the flow chart for AI driven ATM premises, represents a system designed for ensuring safety in ATM usage during specific conditions. Initially, the system receives input through scanning faces using theYOLOv8 model. This advanced detection system first checks the number of individuals attempting to access the ATM. Importantly, it specifies that only one person can utilize the ATM at any given time. Following the face detection, the system categorizes users based on their safety gear. If a user is detected wearing a mask or a helmet, the system evaluates whether either is present. It identifies scenarios where users may be without a mask or helmet, subsequently classifying the situation based on safety criteria. If both mask and helmet are missing, users receive an alert indicating that ATM usage is not safe. Conversely, if the user is wearing both required items, they still receive a warning to remove them before utilizing the ATM. Each alert is crafted to enhance public safety and ensure compliance with health regulations. The process is systematic, highlighting the importance of protective gear while navigating public services in the current environment. This structured approach promotes safety while also allowing necessary functionalities for users. Overall, the block diagram efficiently integrates safety protocols with the user experience at ATMs.

III. EXPERIMENTAL RESULT

Fig. 3. Detected a person wearing helmet inside the ATM premises.

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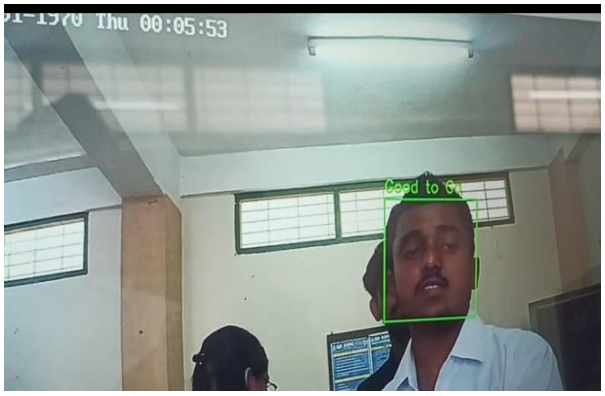
Fig. 4. Detected person good to go inside the ATM premises



When a helmet is detected inside an ATM premise using a Raspberry Pi-based surveillance system, it becomes an effective and low-cost security enhancement. The Raspberry Pi, integrated with a camera module and a trained AI model such as YOLO or a Convolutional Neural Network (CNN),
can perform real-time object detection to identify whether a person is wearing a helmet. Since helmets can obscure a person's face, their

Fig. 5. Mask detection

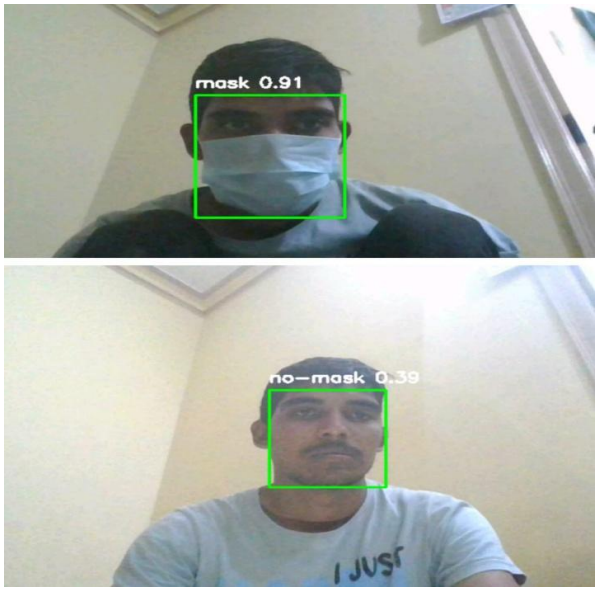


Fig. 6. People count detection

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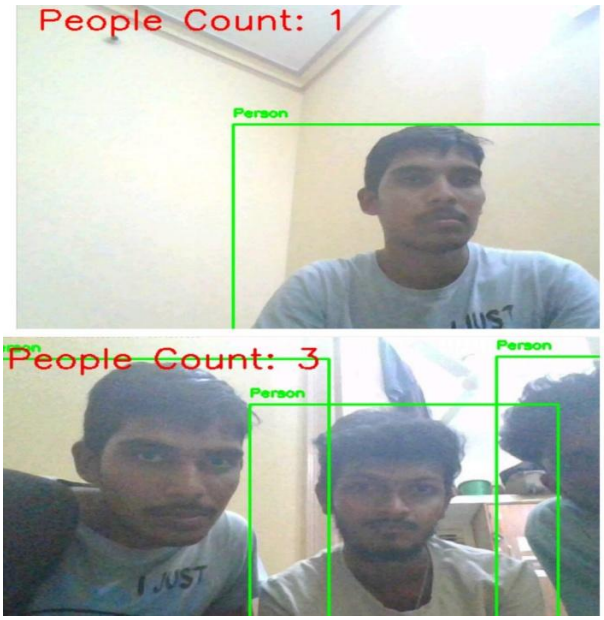

Presence in an ATM violates standard security protocols and may signal suspicious activity. The system can be programmed to automatically trigger alerts or log the event when a helmet is detected, capturing the image and timestamp for later review.

Despite its compact size and low power consumption, the Raspberry Pi is capable of running lightweight AI models optimized for edge devices, making it ideal for continuous monitoring in ATMs where full-scale surveillance systems might not be feasible. This implementation supports intelligent video analytics, enhancing ATM security by ensuring that face visibility policies are enforced and potential threats are identified early.

When no helmet is detected inside an ATM premise using a Raspberry Pi-based surveillance system, it typically indicates compliance with ATM security protocols, which require individuals to keep their faces visible for identification purposes. The Raspberry Pi, equipped with a camera module and a lightweight object detection model like YOLO or a CNN, continuously monitors the video feed to detect helmets. If no helmet is found, the system can log this as a normal or safe activity, ensuring that the person inside the ATM can be clearly identified through facial recognition or CCTV footage. This confirmation helps maintain a secure environment while reducing false alarms. Additionally, the absence of a helmet may prevent the triggering of unnecessary alerts, allowing the system to focus only on actual threats or policy violations. Such real-time processing on the Raspberry Pi makes it a cost-effective and efficient solution for intelligent surveillance in ATM premises.

The proposed system significantly enhances ATM security by integrating facial recognition and helmet detection technologies to ensure only authorized individuals can access the machine. A Raspberry Pi 4B connected to an IP camera continuously monitors the ATM environment in real-time, detecting faces and helmets using the YOLOv8 algorithm. If a person is detected wearing a helmet or mask, the system prompts them via a VNC display to remove it, ensuring proper identification and compliance with ATM safety protocols. This proactive approach prevents identity concealment, reduces fraudulent activities, and restricts multiple users from accessing the ATM simultaneously. Real-time video feeds are analyzed using machine learning to detect anomalies, while motion detection further enhances surveillance by identifying unusual behavior around the ATM. Alerts are sent to security personnel through GSM or internet-based notifications, ensuring immediate response to potential threats. The system's use of Power over Ethernet (PoE) streamlines both power and data transmission, reducing cable clutter and ensuring efficient, uninterrupted operation, even in low-power areas. The Raspberry Pi 4B serves as the core processor, handling real-time image processing and alert generation.

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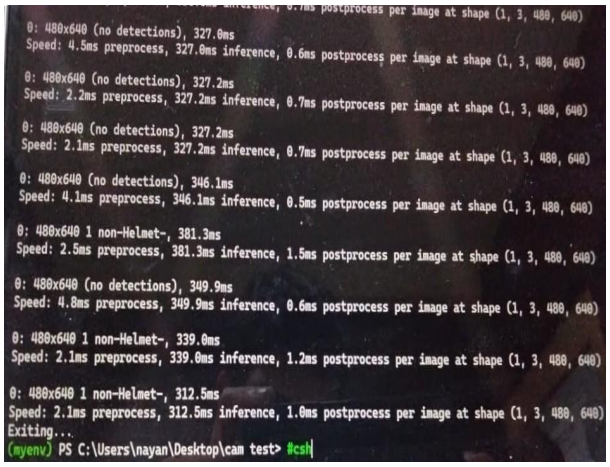
Users receive live feedback via a VNC monitor, improving user interaction and security compliance. The system delivers an AI-driven, reliable, and intelligent solution for monitoring ATM premises, making it ideal for modern banking environments that demand high-security measures

Fig. 7. Output shown in terminal



III. CONCLUSION

AI-driven ATM premises powered by Raspberry Pi offer numerous practical benefits beyond traditional surveillance systems. With the integration of computer vision and machine learning, the system can be trained to detect specific events such as loitering, vandalism, or even the absence of required safety gear like helmets or masks—ensuring compliance with safety protocols in certain environments. Additionally, features like facial recognition and motion tracking can be implemented to enhance identity verification and track customer interactions securely. The Raspberry Pi, despite its compact form factor, proves to be a highly capable platform for running lightweight AI models and interfacing with various sensors and cameras, making it a robust and versatile solution. This innovation not only supports cost-effective deployment but also encourages the adoption of smart technologies in sectors where high-end computing infrastructure may not be feasible. As digital banking continues to evolve, AI-based ATM premises using Raspberry Pi stand as a scalable and intelligent solution for modernizing ATM infrastructure while significantly improving safety, surveillance, and customer experience.

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