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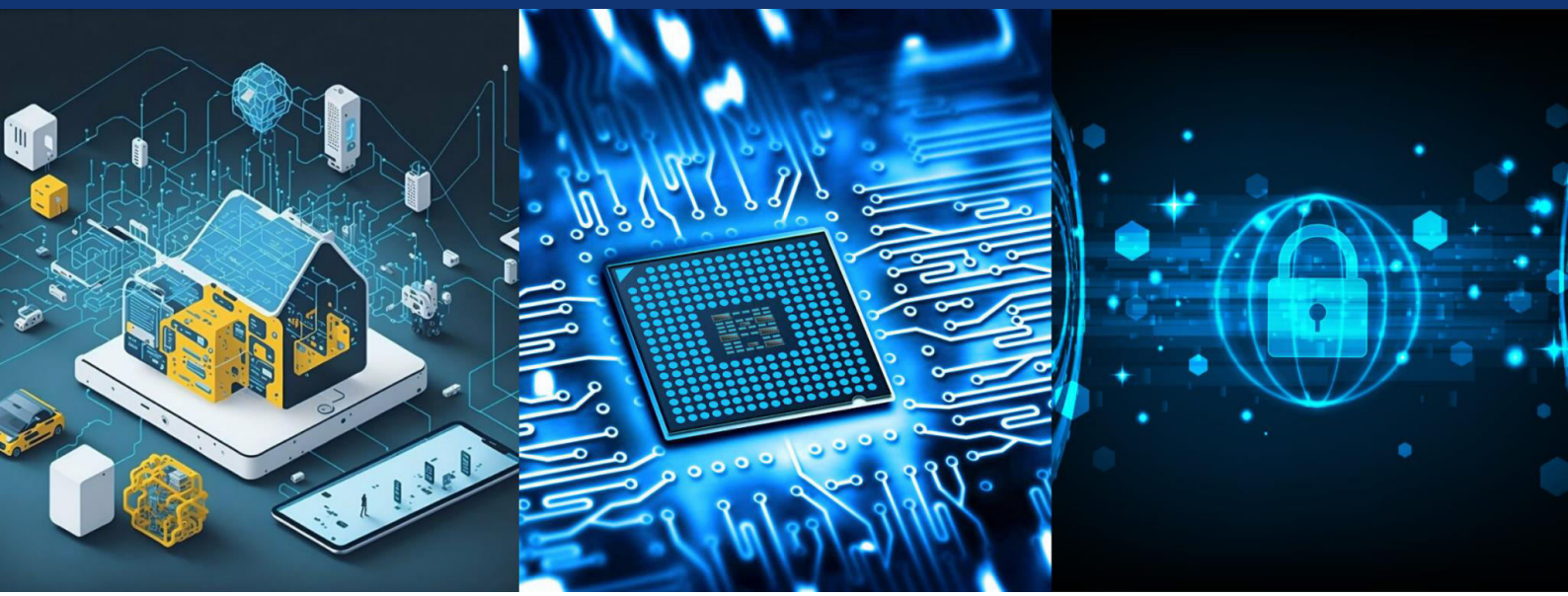

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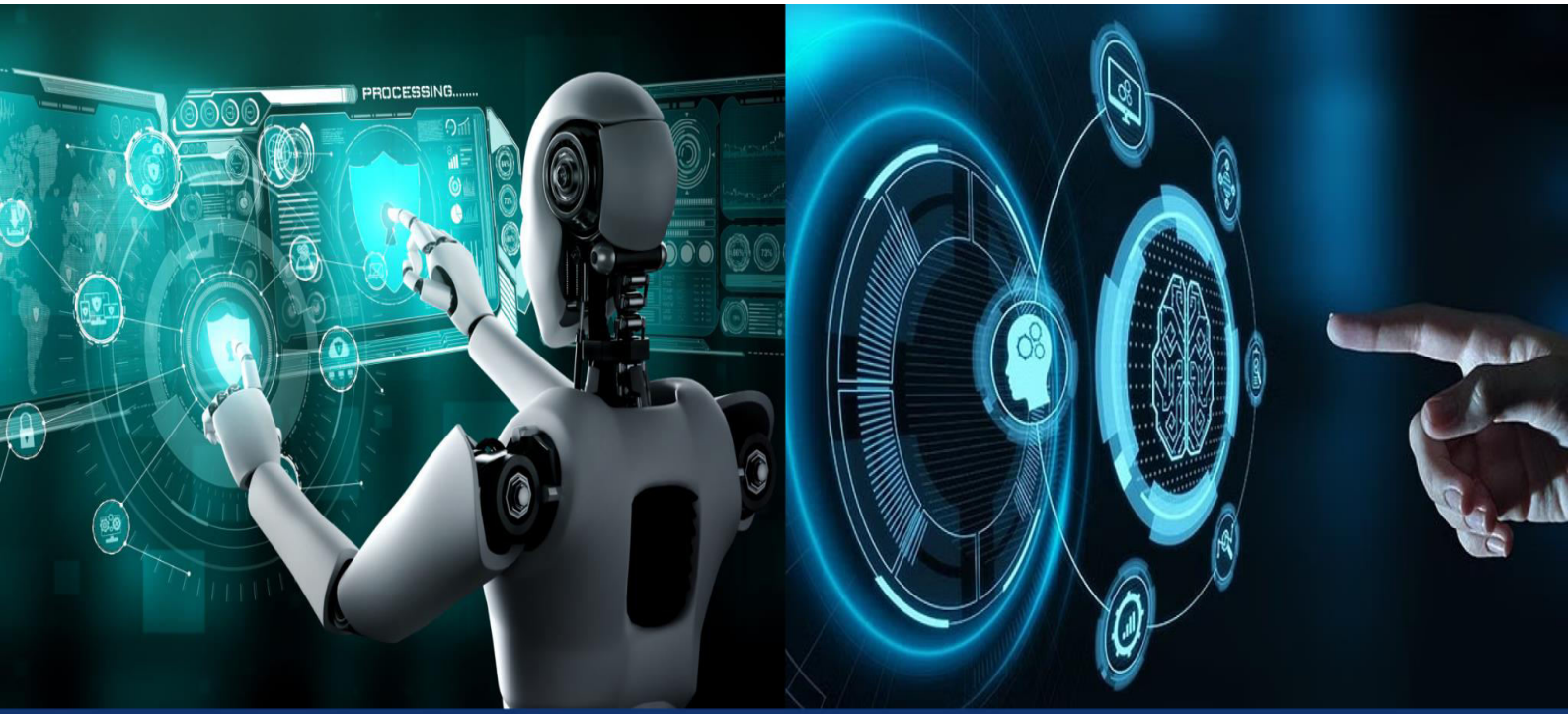

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SnapRoll: Real-Time Multi-Face Recognition for Automated Attendance

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ABSTRACT: SnapRoll is a real-time, multi-face recognition sys- tem designed to automate attendance tracking efficiently. In educational and corporate environments, manual attendance is time-consuming and prone to errors. SnapRoll addresses these challenges by leveraging deep-learning models to automate and accelerate the process. It employs the Multi-task Cascaded Convolutional Network (MTCNN) for accurate face detection and FaceNet for extracting facial embeddings. This combination ensures precise face recognition even in dynamic, multi-person scenarios. The system captures live video streams, identifies multiple individuals concurrently, and logs attendance into a MySQL database. A Flask-based web interface allows real-time monitoring and data retrieval. Through optimized algorithms, SnapRoll achieves 98.7% accuracy and processes up to 15 faces per frame, making it suitable for large-scale environments. This paper provides an in-depth exploration of the system's architec- ture, methodology, and performance evaluation, demonstrating its real-world applicability and efficiency.

KEYWORDS: Face Recognition, Automated Attendance, Real-Time Detection, Multi-Face Recognition, AI Attendance System, Facial Identification

I. INTRODUCTION

Traditional methods of attendance tracking, such as manual roll calls or RFID systems, are inefficient in environments with large populations. Manual methods are time-consuming and susceptible to errors, while RFID systems can be misused or lost. Automated face recognition provides a contactless, efficient alternative for attendance management. SnapRoll is designed to address these inefficiencies by leveraging state-of- the-art deep learning models to automate attendance tracking in real-time. The system ensures high accuracy and scalability, making it ideal for educational institutions and corporate en- vironments. This paper outlines the motivation for the project, identifies existing challenges, and presents how SnapRoll addresses these issues.

II. RELATED WORK

Previous research on automated attendance systems has largely focused on RFID-based tracking or single-face recognition. These methods often lack the ability to process multiple individuals simultaneously, limiting their scalability. Recent advances in deep learning, particularly in convolutional neural networks (CNNs), have enhanced the capabilities of face recognition systems. MTCNN provides an efficient approach for multi-face detection, while FaceNet offers a robust method for extracting unique facial features. SnapRoll builds upon these advancements to deliver a multi-person face recognition solution that balances accuracy and speed. Studies such as Schroff et al.'s work on FaceNet citeref3 and Zhang et al.'s survey on real-time face recognition citeref1 underscore the effectiveness of these approaches.

III. PROPOSED SYSTEM

SnapRoll integrates advanced face recognition techniques with a real-time, automated attendance management system. The core components include:

- **Face Detection**: Utilizes MTCNN for accurate detection of multiple faces in live video streams.
- **Feature Extraction**: Employs FaceNet to generate 128- dimensional facial embeddings unique to each person.

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- **Attendance Logging**: Matches detected faces with a MySQL database and logs attendance in real-time.
- **User Interface**: Provides a Flask-based web interface for monitoring attendance and managing records.
- **Performance Optimization**: Processes up to 15 faces per frame with 98.7% accuracy, ensuring reliable operation in dynamic environments.

IV. METHODOLOGY

The SnapRoll system follows a structured, multi-stage pipeline:

1) **Data Acquisition**: The system captures live video streams from external cameras.
2) **Face Detection**: MTCNN is used to identify and extract face regions from each frame.
3) **Feature Extraction**: Detected faces are processed through FaceNet to generate facial embeddings.
4) **Face Recognition and Logging**: The embeddings are compared against stored data in the MySQL database to identify individuals and log attendance.
5) **Web Interface**: Real-time attendance records and sys- tem status are accessible through a Flask-based dash- board.

The pipeline is optimized to handle real-time workloads while maintaining high accuracy and minimal latency.

V. SYSTEM ARCHITECTURE

The SnapRoll architecture consists of interconnected mod- ules working together to deliver automated attendance track- ing:

- **Input Module**: Captures video streams from multiple sources.
- **Processing Module**: Performs face detection, feature extraction, and recognition using MTCNN and FaceNet.
- **Database Module**: Stores attendance logs and facial embeddings in a MySQL database.
- **Interface Module**: Provides real-time access through a Flask-based web interface.

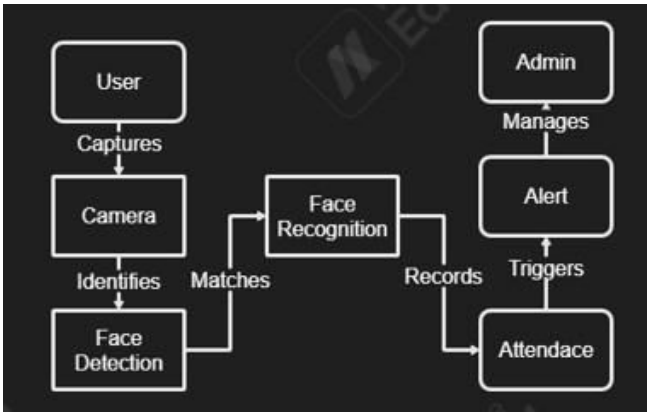

Fig. 1.SnapRoll System Architecture

The modular design enhances system maintainability and scalability, facilitating future improvements.

VI. RESULTS AND DISCUSSION

Extensive testing in real-world environments validated SnapRoll's performance. The system achieved an average accuracy of 98.7% and processed up to 15 faces per frame without performance degradation. Compared to traditional methods, SnapRoll offers faster attendance tracking, improved accuracy, and better scalability. Performance analysis also showed that the system maintains reliability under various lighting conditions and crowd densities.

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Fig. 2. SnapRoll System Output Demonstration

VII. CONCLUSION

SnapRoll presents a robust and scalable solution for real- time, automated attendance tracking. By leveraging advanced deep-learning models and integrating a real-time processing pipeline, the system delivers high accuracy and efficient per- formance. Future improvements include extending support for additional camera sources and improving recognition under challenging lighting conditions. SnapRoll represents a signif- icant step forward in automating attendance management for large-scale applications.

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