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ATTENDANCE MANAGEMENT SYSTEM USING FACIAL RECOGNITION AND QR CODES

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ABSTRACT:
This paper explores the development and implementation of an Attendance Management System using Facial Recognition and QR Codes to automate and streamline attendance tracking in educational institutions and workplaces. The system utilizes facial recognition technology and QR code scanning to accurately verify and record attendance [1][2][4], eliminating the need for traditional paper-based or manual systems. By combining these technologies, the system ensures efficiency, accuracy, and enhanced security, preventing fraudulent attendance practices such as proxy attendance [3][5]. The system also provides real-time data access [1], reducing administrative burden and offering valuable insights into attendance patterns.

KEYWORDS: Attendance Management System, Real-time Monitoring, Attendance Reports, Data Security

1. INTRODUCTION

1.1 Definition: -

An Attendance Management System using Facial Recognition and QR Codes is a digital solution that automates the process of tracking and managing attendance in institutions or workplaces [1]. It leverages facial recognition technology and QR code scanning to accurately verify user identity and mark attendance, reducing the need for manual intervention.

1.2 Goal:

The primary goal of implementing this system is to streamline and automate attendance tracking with enhanced accuracy, security, and efficiency. The system aims to reduce the possibility of proxy attendance [3], offer real-time data access [2][4], and provide a user-friendly experience. By integrating modern technologies like facial recognition and QR code scanning, the system seeks to replace outdated methods such as paper-based registers [10], thereby improving operational efficiency and data management.

1.3 Scope:

The project scope for developing an Attendance Management System using Facial Recognition and QR Codes involves selecting and integrating facial recognition algorithms and QR code technology to create a comprehensive, secure, and reliable solution. This includes designing a centralized software platform for realtime data capture, processing, and reporting. The scope also covers the creation of intuitive user interfaces for both desktop and mobile devices, integrating the system with existing organizational infrastructures such as HR and payroll systems, and ensuring high-level security measures to protect sensitive data. Compliance with industry standards and regulations is also a key part of the project scope to ensure the system meets privacy and security requirements. Additionally, the scope includes training and support for users to ensure smooth adoption and ongoing system maintenance.

2. OVERALL DESCRIPTION

2.1 Product Perspective:

Viewing the attendance management system as a standalone solution, it integrates with organizational systems, emphasizing user-friendly interfaces, real-time monitoring, and robust security features. Two access modes are available: Administrators manage student details, while users (students) view their profiles and attendance details.

This system has two access modes.

(i) Administrators

Administrators have the access to manage student details and add new students and he has more to do. They have authority to update profile of students.

(ii) User

There are two users:

• Student: Student logs in to view their profile, attendance details, and more.

3. SYSTEM ANALYSIS

The system analysis for implementing an attendance management system using facial recognition and QR code technologies involves assessing existing methods and identifying key requirements. It includes choosing facial recognition for contactless biometric verification [3][6][9] and QR codes for quick scanning and ease of use [2]. The architecture includes modules integrated with a centralized database for seamless data flow [1], real-time sync [8], and platform compatibility [4]. with existing HR or academic

platforms. User interface design is optimized for ease of use across devices such as mobile apps, kiosks, or desktop systems.

4. REQUIREMENT SPECIFICATIONS

4.1 Hardware Requirements:

Memory: 2,4 GB
Hard Disk: 500 GB
Processor: Intel Core i3, i5
Sensor Name: Grow GM65 1D 2D Code Scanner Bar Code Reader Module.

4.2 Software Requirements:

Operating System: Windows 10,11
Front Design: Visual Studio 2021
Frontend Language: Python, HTML, CSS, JavaScript.
Backend Language: MySQL Workbench

4.3 Features Requirements:

Track student attendance, perform operations on student data, and generate customizable attendance lists efficiently

4.4 Reliability

In case of hardware or software failures, the system cannot connect to the central database, ensuring data integrity

4.5 Availability

Available to authorized university users for attendance marking and record management.

4.6 Portability:

The platform-independent software is Windows-based, written in Python and SQL, ensuring flexibility across operating systems.

USE CASE DIAGRAM:

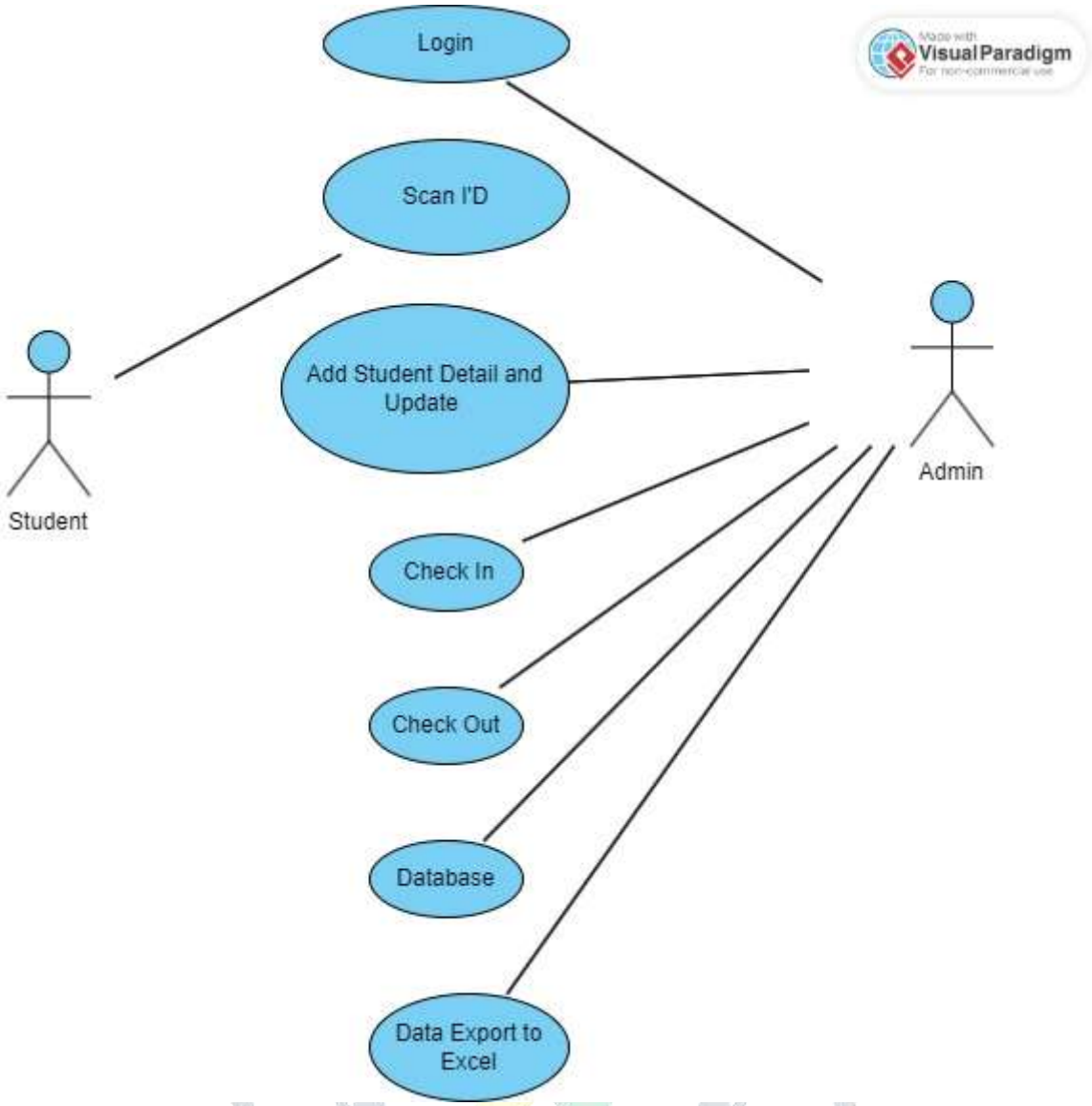

fig.1: user case diagram

5. SOFTWARE DESCRIPTION

5.1 Visual Studio 2021:

Visual Studio 2021 is a comprehensive integrated development environment (IDE) developed by Microsoft, designed to facilitate software development across multiple platforms and languages. It offers a rich set of features and tools that streamline the entire development process, from code writing and debugging to testing and deployment.

5.2 MySQL Workbench:

MySQL Workbench is a unified visual tool developed by Oracle Corporation specifically designed for database architects, developers, and administrators to design, develop, and manage MySQL databases. It offers intuitive visual tools for database design and modeling, including Entity-Relationship (ER) diagrams, alongside a powerful SQL editor with syntax highlighting, auto-completion, and execution capabilities. Additionally, MySQL Workbench provides tools and wizards for data migration, import/export operations, and data transfer between different database systems. It also includes performance monitoring and tuning tools to analyze query performance, optimize SQL queries, and improve database efficiency. The IDE offers comprehensive server administration features for managing server instances, monitoring server health, user management, and security configuration. Moreover, MySQL Workbench supports collaborative database development through version control, shared database models, and collaboration tools. Lastly, it provides capabilities for database backup, recovery, and scheduling, ensuring data protection, disaster recovery, and business continuity.

A lot of clients can easily connect to the server at the same time. The client can use multiple databases at the same time. We can access SQL using various interfaces such as command line clients and web browsers. [4]

6. DATABASE TABLES

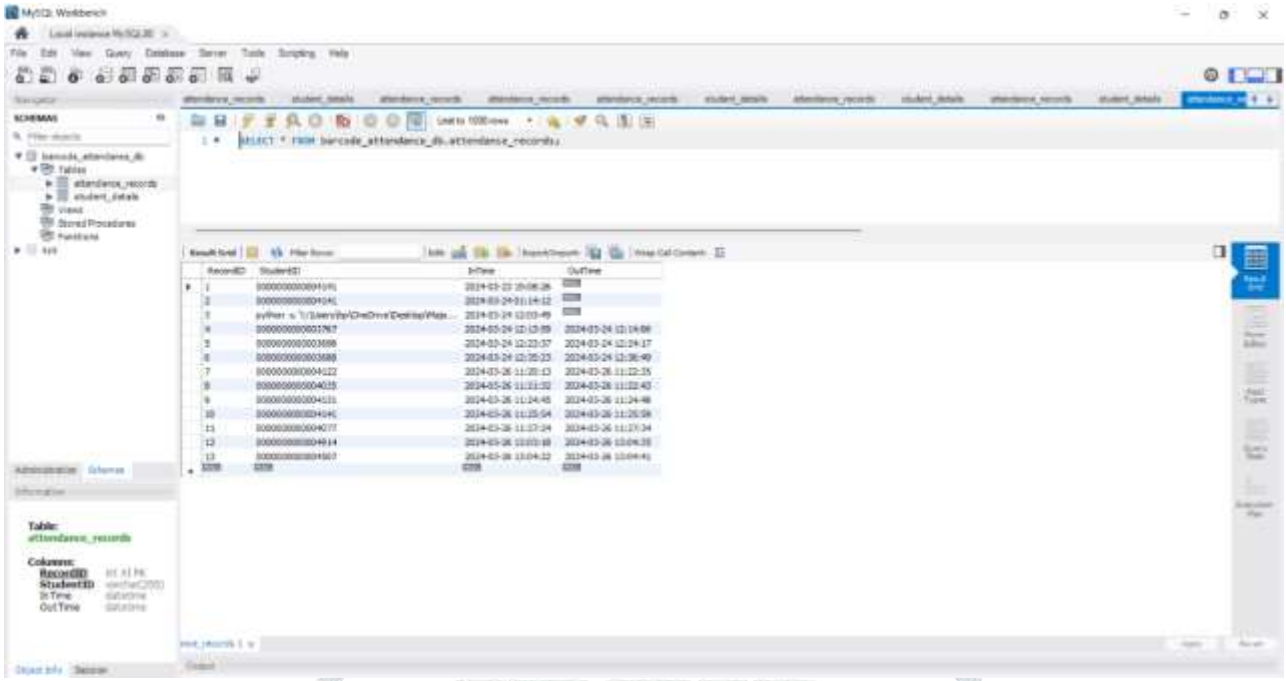

fig.2: Attendance Record

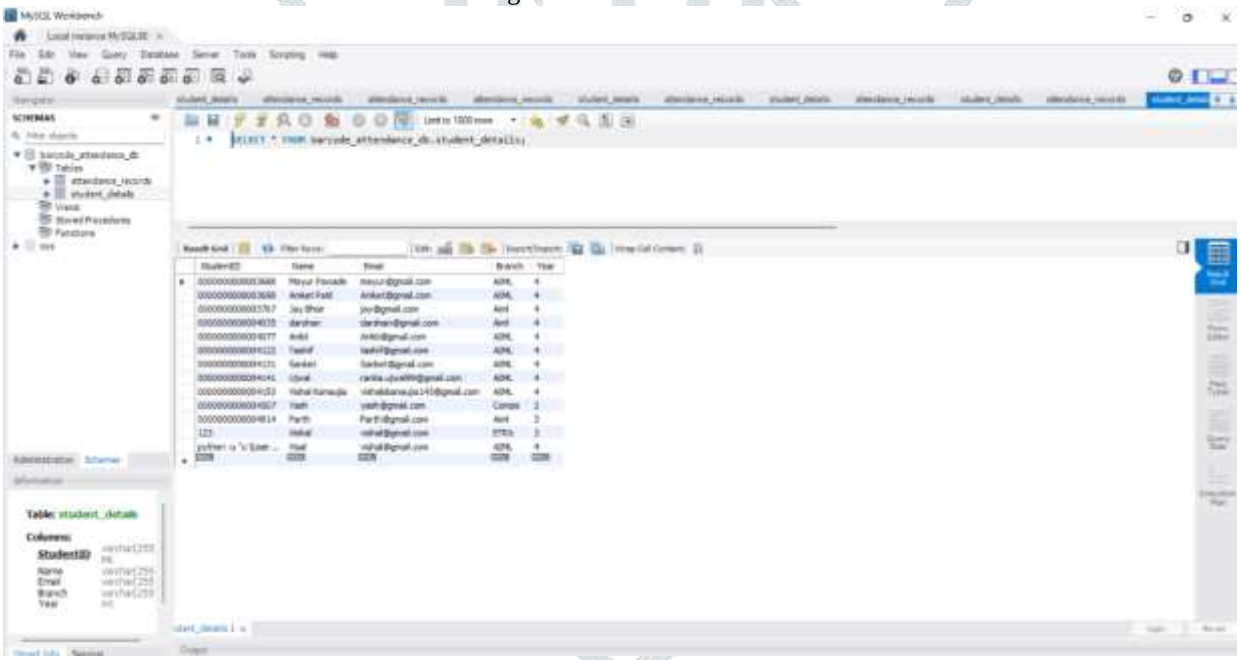

fig.3: Student Detail

7. PROJECT DESCRIPTION

7.1 Problem Definition:

Traditional methods of attendance tracking—manual entry or conventional ID card systems—are time-consuming, error-prone, and susceptible to proxy attendance. These systems also lack long-term data storage and analysis capabilities. To address these issues, the proposed system utilizes facial recognition and QR code scanning for automated attendance tracking. It ensures high accuracy, real-time data capture, and secure, long-term data storage, while enabling quick generation of attendance reports.

7.2 Project Overview:

The Attendance Management System is divided into two major modules:

Management Module:
This module allows administrators and faculty to manage student and staff records, define schedules, track attendance, and generate customized reports. It also manages system settings, such as camera configuration and QR code registration.

User Module:
This module is designed for students or employees. It allows attendance marking via facial recognition or QR code scanning through

a mobile device or terminal. Users can also view their own attendance history and notifications.

8. SYSTEM TESTING

After code generation, systematic testing is performed to identify and rectify errors using white-box and black-box testing techniques, aiming for optimal system functionality, behavior, and performance.

9.SYSTEM MAINTAINANCE

Software Maintenance extends beyond bug identification, encompassing environment changes, system functionality improvements, and failure elimination, ensuring consistent system performance and adaptability.

9. SNAPSHOTS

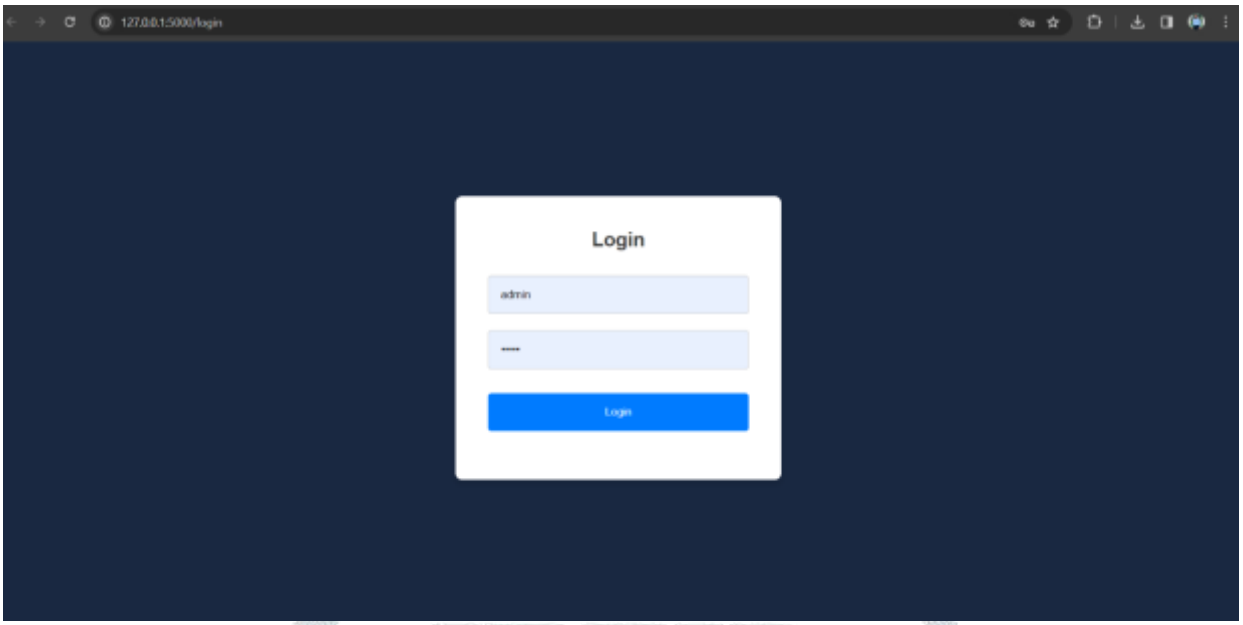

fig.4: login page

fig.5: Home Page

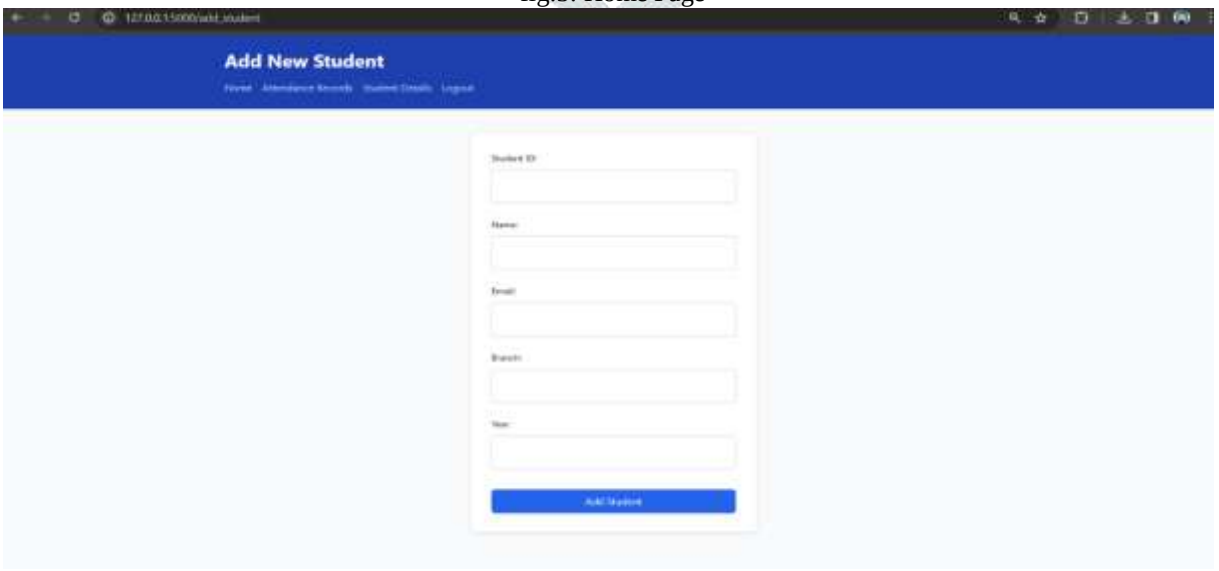

fig.6: Add a Student Page

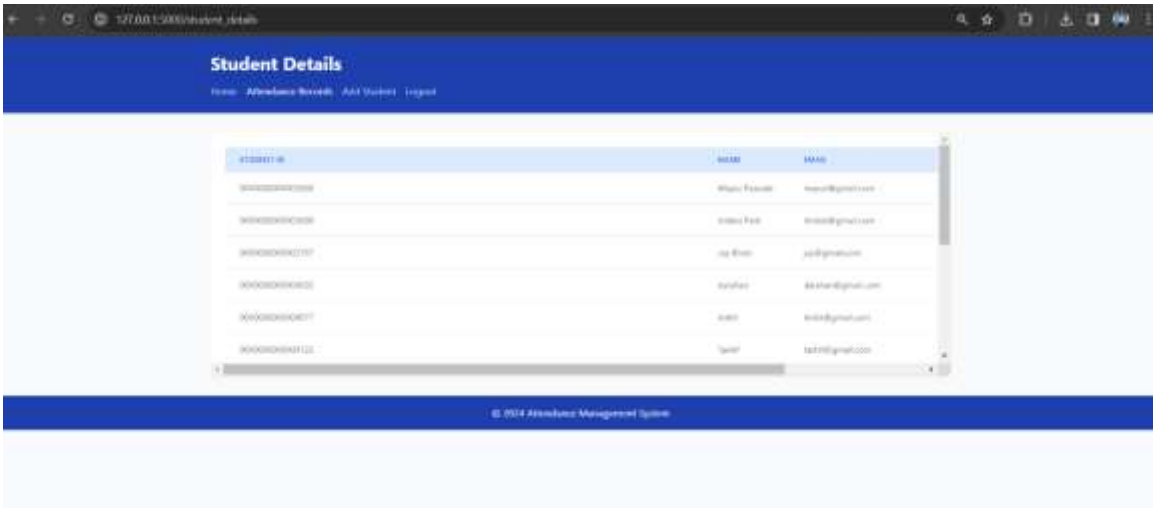

fig.7: Student Detail Page.

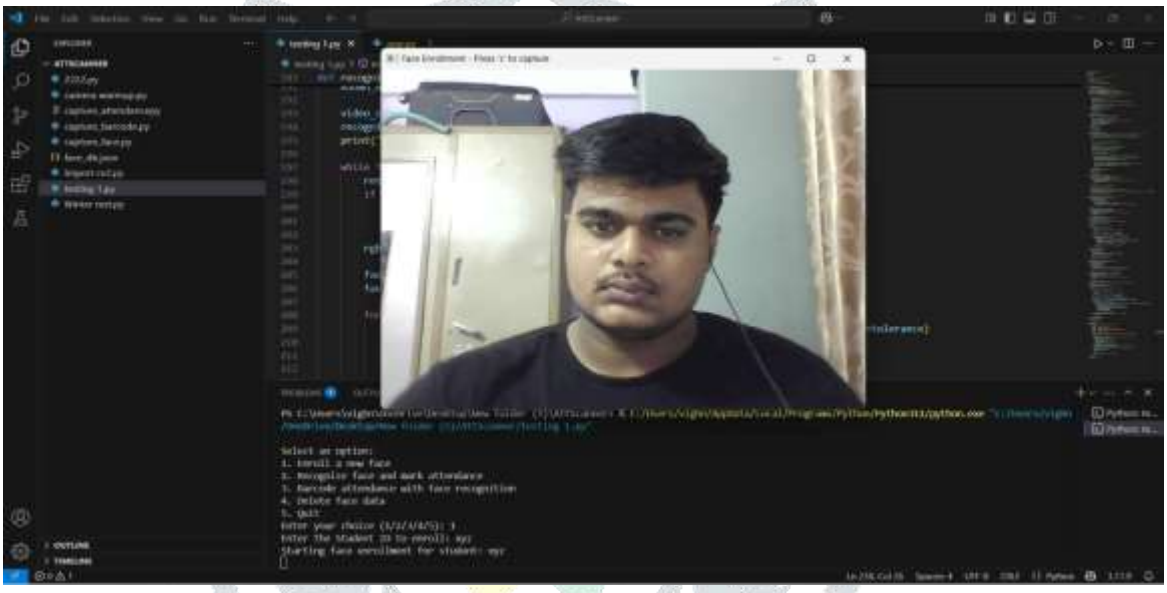

Fig.8 Scanning Process

10. CONCLUSION

10.1 Conclusion:

In conclusion, the **Attendance Management System using Facial Recognition and QR Codes** provides a modern, automated solution for efficient attendance tracking. By replacing traditional manual methods with biometric facial detection and quick QR code scanning, the system minimizes human error, prevents proxy attendance, and significantly reduces administrative workload. Its real-time attendance recording, seamless report generation, and secure data handling ensure operational transparency and reliability. Furthermore, the system aligns with modern data protection standards, maintaining user confidentiality and system integrity.

10.2 Scope of future development:

The system presents several promising avenues for future enhancement. Potential developments include:
Integration with IoT and Smart Devices: Enabling real-time location-based attendance or wearable integration for enhanced monitoring.AI and Machine Learning: Leveraging intelligent algorithms to detect patterns, predict absenteeism trends, and provide actionable insights. Multi-Modal Biometrics: Combining facial recognition with other biometric methods (e.g., fingerprint, iris scan) for enhanced security and redundancy. Cloud Integration: Transitioning to a cloud-based infrastructure for improved data accessibility, storage scalability, and remote system management. Cross-Platform Compatibility: Ensuring seamless operation across various operating systems and devices, including mobile apps and web portals.

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