Attendance Management System using Face Recognition

A Project Report

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by

Vallabhaneni Datta Jyothi Raditya

vallabhaneniradityadj@gmail.com

Under the Guidance of

Aditya Prashant Ardak

Master trainer, Edunet Foundation

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ABSTRACT

Face recognition in the Attendance Management System targets the inefficiencies of earlier methods, like manual attendance registers and card-based methods of attendance. They are not that error-free, time consuming, and also involve a process with fraudulent practices such as proxy attendance. This project thus aims to develop a solution that is contactless and an efficient, reliable solution built on face recognition technology.

The system would try to take attendance with accuracy and not be prone to human influence, thus bringing robustness to data recorded.

This method considers computer vision methods and uses algorithms that rely on machine learning for the solution. The facial image databases are created at the time of registration, and unique facial features are stored using models like CNN based on deep learning. It captures live video or images input during attendance, detects faces, and matches the database using pre-trained models. OpenCV and TensorFlow libraries are used for face detection and recognition. It also supports a web interface for displaying attendance records and managing user profiles.

The key results depict a high accuracy rate of detection of faces at any angle and under various light conditions with low false positives. It can work effectively for both attendance and group attendance, hence saving considerable time compared to manual methods.

In conclusion, the Attendance Management System using Face Recognition is scalable and efficient compared to traditional attendance methods. It is processing and automation-friendly for educational institutions, workplaces, or events. Future enhancement could be in the form of multi-factor authentications or integration with more comprehensive management systems for seamless running.

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CHAPTER 1

Introduction

1.1Problem Statement:

Earlier attendance tracking methods, such as manual registers and card-based systems, are plagued by inefficiencies that hinder the accuracy and reliability of records. These approaches are prone to human mistakes, slow to process, and often disrupt workflows in large organizations or events. Additionally, they facilitate fraudulent activities like proxy attendance, which compromises the system's integrity. Over time, this leads to greater administrative burden and reduced accountability, making it clear that a more efficient and secure solution is necessary.

1.2Motivation:

As a scholar in better education, I understand the vital position that attendance performs in instructional success. However, outside elements on occasion cause discrepancies in attendance records, whether or not because of manipulation or easy mistakes made via way of means of the accountable person. To cope with this issue, I actually have selected this undertaking, which guarantees to be each time-green and accurate.

Additionally, it lets in college students to screen their attendance regularly. In a international this is swiftly advancing, it is critical that we include new technology and strategies to enhance our lives. The want for structures which are greater green and specific is clear. The capacity makes use of this undertaking are vast. It may be applied in schools, universities, and numerous instructional establishments to manipulate scholar attendance. It also can be carried out in company environments to song worker attendance.

Moreover, this device is beneficial in workshops and seminars in which decreasing guide paintings and making sure specific outcomes is vital. The era may be prolonged to safety structures, presenting managed get admission to legal employees only. This undertaking has a profound effect on each day operations inside each instructional and company sectors. It considerably complements the performance of attendance monitoring and guarantees the accuracy of the facts. By casting off problems like proxy attendance, it improves safety in touchy settings. The device streamlines the method for users, requiring much less guide attempt for facts renovation and analysis.

Furthermore, it reduces expenses related to the conventional approach of recording attendance via registers, which needs greater manpower for each recording and analysis. These programs and blessings underscore the transformative capacity of face popularity era in cutting-edge attendance management.

1.3 Objective:

1.3.1: Automated Attendance System

Developing an automatic attendance control device that information attendance the usage of face recognition, doing away with the want for guide strategies which include registers and attendance sheets.

1.3.2: Strengthening Security Measures

Preventing fraudulent moves like proxy attendance through the usage of particular facial functions to document attendance, consequently safeguarding in opposition to facts manipulation in registers.

1.3.3: Offer a contactless solution

In environments which include company workplaces or business sites, personnel regularly percentage pens or different objects to mark their attendance.

Given the post-pandemic cognizance on hygiene, this contactless device guarantees each cleanliness and consumer convenience, specially in healthcare centers and hospitals.

1.3.4: Save time and resources

A number one intention of this undertaking is to keep the time spent on manually recording attendance, mainly while managing massive groups. Traditional techniques make it tough to correctly song and preserve correct attendance information for massive numbers of attendees.

1.4 Scope of the Project:

Here is a rephrased model of your text: The Face Recognition-Based Attendance Management System automates the whole attendance process, changing conventional strategies like guide logs or card-primarily based totally systems. It offers real-time attendance tracking, making sure short and correct statistics capture. This gadget may be carried out throughout diverse sectors, which include academic institutions, company environments, healthcare facilities, and occasion management. Its scalability guarantees it is able to assist agencies of all sizes and take care of a couple of customers at once.

Additionally, the gadget operates contactless, improving hygiene and person convenience, especially in a post-pandemic context. It shops facial profiles and attendance statistics securely, streamlining statistics management. The gadget can combine seamlessly with current infrastructures, together with payroll or get right of entry to manage systems, optimizing workflows.

Furthermore, it gives complete analytics and insights, assisting agencies make statistics-pushed choices that enhance universal efficiency.

1.5: Limitation of the project

- Performance can be affected by poor lighting conditions and environmental changes.
- The system requires a high-resolution camera, which can result in significant initial setup costs.
- Identifying individuals can be challenging if they are wearing masks, sunglasses, or have substantial changes in their appearance, which may distort facial features.
- The initial setup costs and hardware requirements can be prohibitively expensive, especially for small-scale organizations.
- Privacy and security concerns arise since biometric data is stored, necessitating compliance with data protection laws and regulations.
- For large databases of users, recognition speed and accuracy may degrade unless the system is properly optimized.
- There is a risk of occasional misidentification, including false positives or false negatives.
- System reliability is contingent upon consistent hardware and software performance, and there may be interruptions in service if failures occur.

CHAPTER 2

Literature Survey

2.1 Existing Projects

Student Attendance System:

Arun Katara et al. (2017) mentioned disadvantages of RFID (Radio Frequency Identification) card system, fingerprint system and iris recognition system. RFID card system is implemented due to its simplicity. However, the user tends to help their friends to check in as long as they have their friend's ID card. The fingerprint system is indeed effective but not efficient because it takes time for the verification process so the user has to line up and perform the verification one by one. However for face recognition, the human face is always exposed and contain less information compared to iris. Iris recognition system which contains more detail might invade the privacy of the user. Voice recognition is available, but it is less accurate compared to other methods. Hence, face recognition system is suggested to be implemented in the student attendance system.

System Type	Advantage	Disadvantages
RFID card system	Simple	Fraudulent usage
Fingerprint system	Accurate	Time-consuming
Voice recognition system		Less accurate compared to Others
Iris recognition system	Accurate	Privacy Invasion

Table 1: Advantages and Disadvantages of different biometric System

Employee Attendance Management System

Overview:

The Employee Attendance and Time Tracking System is a modern solution that automates the process of clock-in and clock-out through facial recognition technology. It replaces the old methods like manual timesheets, RFID cards, or fingerprint-based systems with a seamless, contactless, and efficient process. The system also integrates with payroll systems, which track attendance and accurately calculate work

hours to ensure precise payroll management. This system is quite helpful in organizations where time tracking plays a pivotal role in assessment of productivity and compliance.

Features

Face Recognition-Based Attendance:

It marks the attendance of employees based on their facial identification by using real-time camera feeds. This automatically removes all chances of buddy punching, or proxy attendance.

Automatic Time Tracking:

Records accurate clock-in and clock-out times for the employees to accurately calculate work hours.

Payroll System Integration:

Work hours and attendance data are automatically linked to payroll software for the computation of salaries, which is automated according to attendance and overtime.

Monitoring Dashboard:

It provides an administrator-friendly interface for monitoring attendance records, reports, and employee productivity.

Alerts/Notifications:

Automatically sends alerts and notifications to employees and administrators on late entries, absenteeism, or overtime approvals.

Data Storage and Security

Centralized storage of data pertaining to attendance with proper encryption.

Face Recognition Technology:

Algorithms such as OpenCV's Haar Cascades, Dlib's facial landmark detection, or deep learning-based models like FaceNet or DeepFace are utilized to detect and recognize the face. The system is trained on multiple angles and different lightings conditions to ensure high accuracy for the recognition of employees.

Backend Development:

The backend will be developed using Flask or Django, which gives it robust APIs and ensures seamless integration with other systems such as payroll software.Databases including MySQL, PostgreSQL, or MongoDB store employee details, attendance logs, and work hours.

Front-end Development:

A responsive web-based dashboard is developed by using HTML, CSS, JavaScript, and frameworks such as React.js or Bootstrap, which allows administrators and employees to access attendance records easily.

Integration with Payroll Systems

APIs connect attendance data with payroll software like QuickBooks, ADP, or Zoho Payroll, allowing real-time updates and salary calculations.

Cloud and Hosting Services:

The system can be hosted on cloud platforms such as AWS, Azure, or Google Cloud for scalability and remote accessibility.

2.2 How Our Project Is Unique

Our project, Face Recognition-based Attendance Management System is different from the above-mentioned Employee Attendance and Time Tracking System in several key ways. Since our system uses face recognition, it is more attuned to educational and general use cases with flexible usage for various domains.

Code Design and Implementation

Our venture functions a sturdy graphical person interface (GUI) created with Tkinter, providing an intuitive platform for each directors and users. It helps diverse functions, which includes registering new students, manually marking attendance, and dynamically dealing

with attendance records. The 'main_Run.py' report carries SQLite for green database management, allowing modular and localized garage of attendance data.

Educational Focus:

In assessment to worker attendance structures designed for company settings, our device is adapted specially for educational use. The GUI permits instructors to without delay enter attendance, even for unique cases. The device generates separate tables and CSV documents for every subject, presenting particular attendance monitoring on the lecture room level. Features for viewing and coping with registered pupil facts are seamlessly incorporated into the device.

Technological Enhancements:

Our device employs a two-step method for education and face popularity:

Image Dataset Management: Images for education are captured thru the GUI and saved regionally to educate the models. The face popularity method used is LBPH (Local Binary Patterns Histograms). Attendance is recorded dynamically in real-time the usage of the skilled face popularity models, and the records is stored each in CSV documents and SQLite databases.

Versatile Data Retrieval Due to CSV and SQLite In Use Cases

Our system supports automatic marking attendance through face recognition, in addition to manual updates where necessary. This provides versatility in adapting to schools, colleges, seminars, or public events.

File and Data Management:

The system creates files on the fly and handles their management:

Attendance records are stored in structured directories and have timestamped filenames, making them easily retrieved for further analysis. SQLite database tables are auto-generated for every new session or subject, so they are always consistent and scalable.

More Features:

Training Models:

A particular characteristic of the device is its cap potential to teach fashions the usage of captured images, making sure that the popularity method remains correct and up-to-date.

Error Handling:

The GUI consists of notifications that offer customers with real-time feedback, supporting to manual them if invalid inputs or device mistakes occur.

Cross-Platform Compatibility:

By using Python, the device may be deployed throughout numerous working structures with minimum want for modifications.

Our task is designed to serve a far broader audience, combining superior technological capabilities with a focal point on ease of use, scalability, and seamless integration into current educational workflows. This makes it a modular, customizable, and user-pleasant answer that stands aside from employee-precise structures, supplying vast applicability throughout numerous fields.

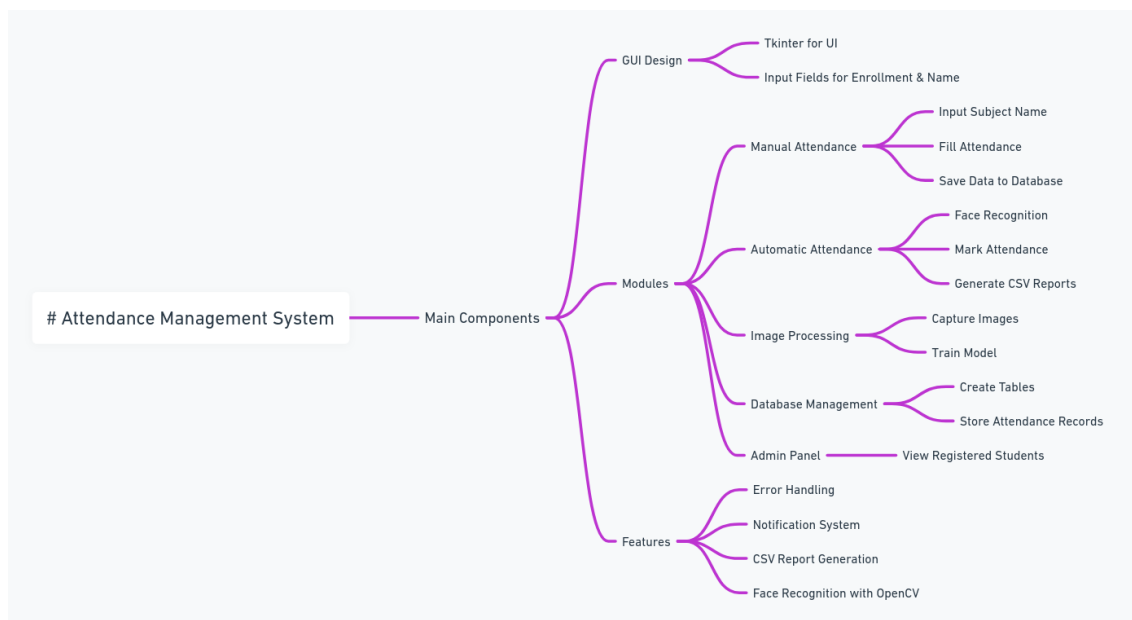# CHAPTER 3
Proposed Methodology

3.1   System Design

Fig 1 Structure of Project

The system design depicted in the above image explains the main components of the project based on the modular approach.

3.1.1: Main Components

The system is divided into three major components: GUI Design, Modules, and Features.

3.1.2: GUI Design

This component is the user interface, built with Tkinter, which is a Python library for GUI development. Input Fields for Enrollment & Name are used for the input of the user's details, such as enrollment number and name, during the registration process. Input Subject Name allows the choosing or naming of the subject or session whose attendance will be taken.

3.1.3: Modules

The gadget organizes its middle functionalities into 4 key modules:

a. **Manual Attendance:**

This module lets in attendance to be entered manually while automation isn't possible. The recorded attendance records is stored in a database for destiny reference and record-keeping.

b. **Automatic Attendance:**

Registered faces are routinely detected and marked for attendance. The identified face is matched with the registered consumer's name, and their attendance is up to date accordingly.Attendance facts may be exported as CSV documents for smooth reporting and sharing.

c. **Image Processing**:

Take Images: Capture stay pictures for face enrollment or reputation.
Train Model: Process and educate the facial reputation version to differentiate among man or woman faces.

d. **Database Management:**

Create Tables: Generate essential database tables to keep consumer and attendance information.
Store Attendance Records: Securely keep attendance records, permitting smooth get right of entry to for destiny analysis.

3.1.4: Features

The extra functions decorate the machine's usability and robustness:

- **Admin Panel:** Provides directors with the cap potential to view and control registered scholar details, making sure green machine oversight.

- **Error Handling:** Facilitates clean operation via way of means of detecting and addressing machine mistakes right away and gracefully.

- **Notification System:** Delivers notifications, consisting of attendance confirmations or indicators for incomplete records, to maintain customers informed.

- **CSV Report Generation:** Enables the export of targeted attendance reviews in CSV layout for evaluation or outside use.

- **Face Recognition with OpenCV:** Utilizes OpenCV, a loose and open-supply pc imaginative and prescient library, to enforce face popularity functionality.

3.2 Requirement Specification

Mention the tools and technologies required to implement the solution.

3.2.1 Hardware Requirements:

To implement the Attendance Management System using Face Recognition, the following hardware components are needed:

1. **Camera:**
   - A high-resolution webcam or surveillance camera for capturing images and videos for face recognition.

2. **Computer System:**
   - A computer with at least the following specifications:
     - Processor: Intel Core i5 or equivalent (or higher).
     - RAM: Minimum 8GB (recommended 16GB for better performance).
     - Storage: 500GB HDD or SSD for storing data and models.

3. **Power Backup:**
   - UPS or any power backup to ensure uninterrupted system operation.

3.2.2 Software Requirements:

The solution requires the following software tools and technologies:

Operating System:
   - Windows 10/11, Linux (Ubuntu preferred), or macOS.

Programming Language:
   - Python 3.x for developing the system.

Libraries and Frameworks:
   - OpenCV: For image processing and face recognition.
   - TensorFlow: For training and deploying deep learning models.
   - dlib: For facial feature extraction and face alignment.
   - NumPy: For numerical computations.
   - Pandas: For handling data and generating reports.
   - Tkinter: For building the graphical user interface (GUI).

Database:
   - SQLite or MySQL for storing user data and attendance records.

Development Environment:

- o PyCharm, VS Code, or Jupyter Notebook for coding and testing.

- o Other Tools: CSV Tools: For exporting attendance records

Hardware Requirements

Component	Specification
Camera	High-resolution webcam with at least 720p resolution
Computer System	Intel Core i5 or equivalent (or higher), 8GB RAM (recommended 16GB)
Power Backup	UPS or any power backup
Internet Connectivity	Stable internet connection for downloading models and updates

Table 2 Hardware Requirement

Software Requirements

Component	Specification
Operating System	Windows 10/11, Linux (Ubuntu preferred), or macOS
Programming Language	Python 3.x for developing the system
Libraries & Frameworks	OpenCV, TensorFlow, dlib, NumPy, Pandas, Tkinter
Database	SQLite or MySQL for storing user data and attendance records
Development Environment	PyCharm, VS Code, or Jupyter Notebook for coding and testing
Other Tools	CSV Tools for exporting attendance records

Table 3 Software Requirement

CHAPTER 4

Implementation and Result

4.1 Snap Shots of Result:

After running the main_Run.py, we will see the main window of our project Attendance Management System is displayed. At first you need to register the student or the user by giving him/her a unique ID number and name. After that we take the photo of the user , the photo is processed through steps like Convert Image to Black and White and Negative ,Face Detection and Identifying Facial Features to save the facial features of the user. After this particular step, Model is trained using this information which is provided to the model. Now, click "Automatic attendance" button ,a new window pops up where we have to enter the name of the subject and now click "Fill the attendance".

Another window pops up and the camera activates and scans the face of the user to mark the attendance in the particular subject.
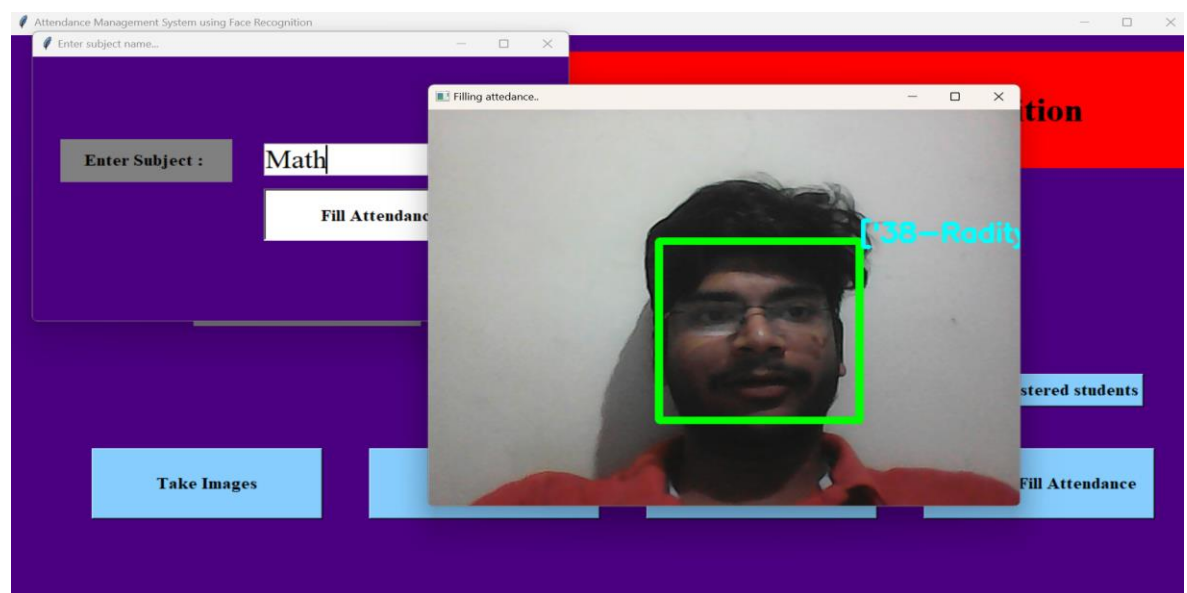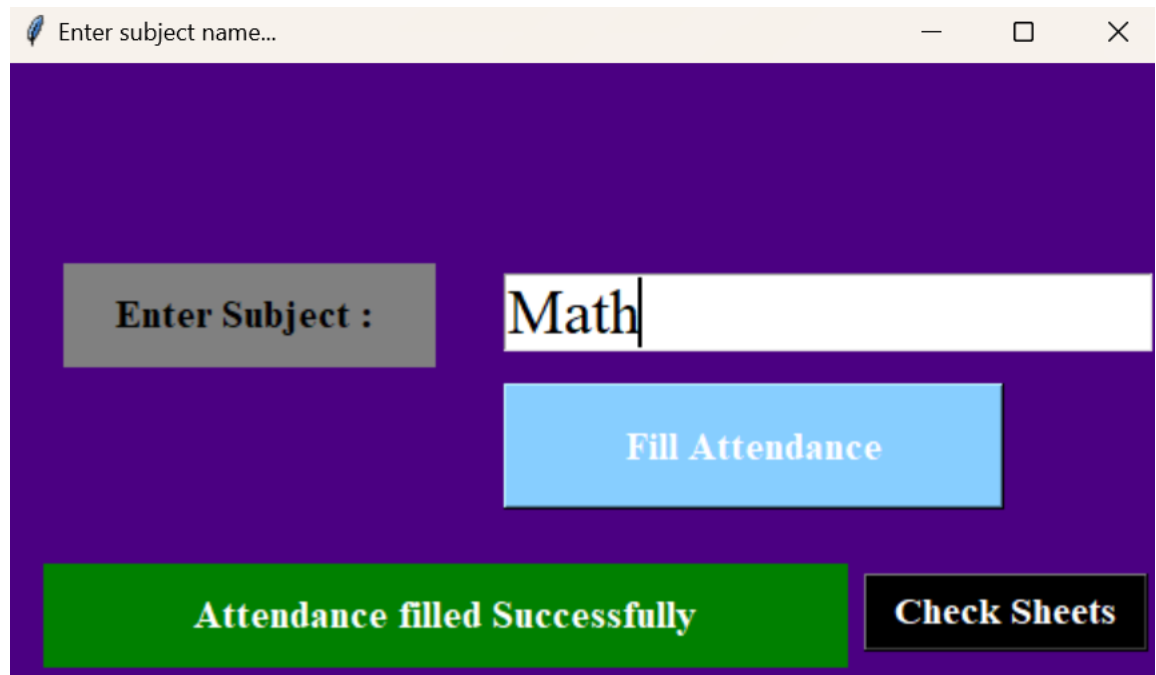

Fig 2: Marking the Attendance for the particular subject

After verifying the image with the database , Attendance is marked successfully and stored in the database.

Fig 3: Attendance marked successfully

We can observe the final working process from the above snapshots of the results and we can also access to the source code from the link provided below.

4.2 GitHub Link for Code:

https://github.com/Raditya-2004/Raditya-2004-Attendance_Management_System

CHAPTER 5

Discussion and Conclusion

5.1   Future Work:

AI-Powered Recognition Models:

As improvements in AI and device mastering progress, face popularity algorithms have become an increasing number of correct and reliable. Future attendance control structures could be capable of manage tough situations consisting of terrible lighting, crowded environments, and non-frontal face angles with minimum errors. With the enhancement of algorithms thru deep mastering architectures like CNNs and transformers, their overall performance in real-global situations will improve, similarly improving their reliability.

Cloud-Based Systems:

Attendance control structures are an increasing number of shifting in the direction of cloud-primarily based totally platforms. Cloud integration permits businesses to centralize attendance records, supplying real-time get right of entry to throughout numerous locations. This is specifically useful for massive establishments with geographically dispersed workforces or instructional establishments with more than one campus. Real-time records synchronization, analytics, and reporting will provide businesses precious insights to enhance operational efficiency. Cloud structures additionally offer scalability and records backup, lowering the hazard of records loss.

Mobile Attendance Management:

The large use of effective cell gadgets has created new opportunities for attendance structures. Mobile programs included with face popularity generation will allow customers to mark attendance immediately from their smartphones. This removes the want for constant hardware like attendance kiosks and gives extra flexibility for faraway personnel and students. Additionally, those programs can also additionally contain geolocation tagging to confirm person location, making sure stable and authenticated attendance marking.

5.2 Conclusion:

The destiny of attendance control structures is promising, as cloud integration and AI-powered information analytics are set to convert how groups song and manipulate attendance. Centralized information get admission to thru cloud structures will allow real-time tracking and easy coordination throughout a couple of locations, making this selection mainly treasured for faraway paintings setups and dispensed teams.

AI-pushed analytics will simplify decision-making with the aid of using figuring out styles and developments, optimizing group of workers control, and predicting attendance-associated issues. These improvements will make sure that attendance structures come to be greater green and insightful than ever before. The subsequent technology of attendance structures could be powered with the aid of using deep learning, multimodal biometrics, and predictive analytics.

By combining facial reputation with different biometric methods, which include voice or fingerprint reputation, those structures will attain new heights of accuracy and reliability. Predictive analytics will permit groups to assume group of workers developments and take proactive measures. It may even beautify safety features, which include encryption and compliance with information safety regulations, making sure the secure and personal garage of touchy information.

As those technology come to be greater less costly and accessible, attendance control structures will extend throughout industries. The boundaries of price and complexity that formerly averted smaller corporations and academic establishments from adopting such answers will diminish.

With scalable and user-pleasant structures turning into the standard, superior attendance control could be democratized, permitting groups of all sizes to gain from those improvements. This evolution guarantees a destiny wherein generation makes operations easier, greater secure, and greater productive.

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