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Automatic Timesheet Generation System

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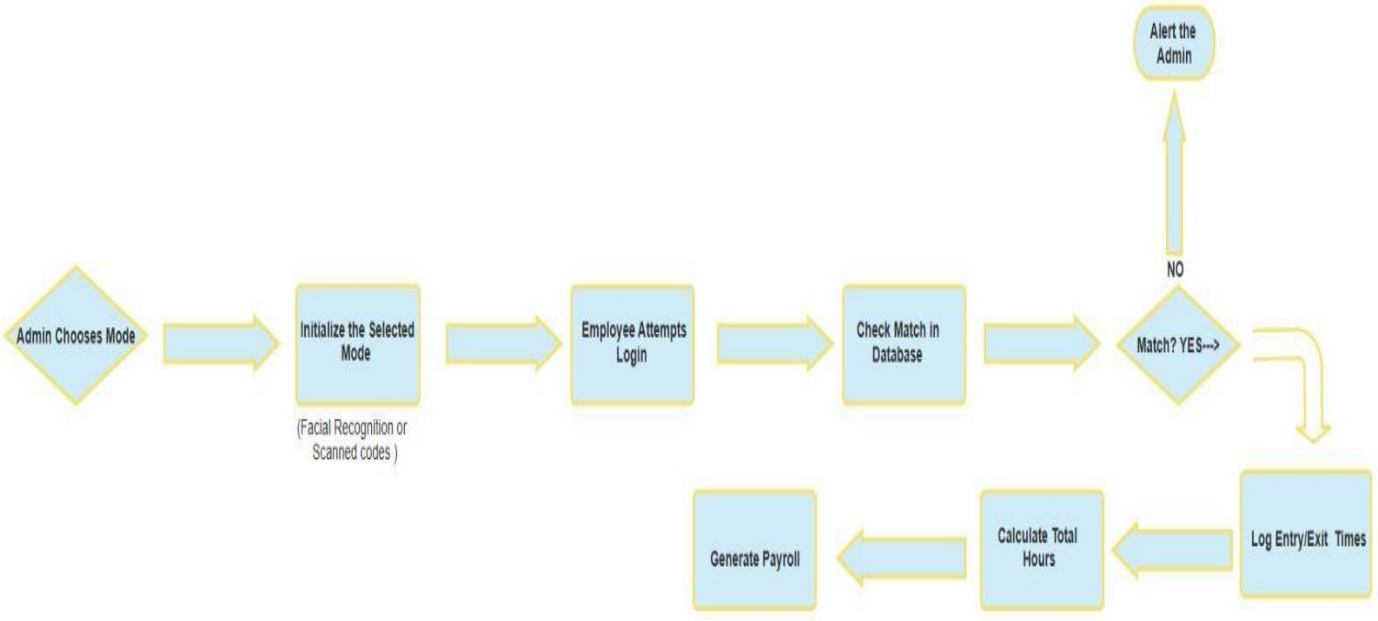
Abstract:

Major productivity and operational efficiency drivers can be impacted through effective workforce management. The Automated Timesheet Generation system incorporates technologies like facial recognition and barcode scanning for employee attendance and working-hour tracking. Recording entry and exit times electronically streamlines time tracking, eliminating the inefficiencies and inaccuracies that are traditionally associated with manual methods and thereby minimizing human errors that could affect payroll function.

Users will gain real-time data insight, which will enable them to make informed operational decisions. The solution was built using robust libraries such as OpenCV for image processing, DeepFace for facial recognition, DataMatrix for barcode scanning, and Tkinter for designing the GUI, focusing on maximizing security and usability. A unique security mechanism exists to alert administrators in case of trespasses optimizing workplace safety and data integrity.

Moreover, it stores all of its data securely on local system folders, enabling proper management and reducing reliance on external storage and cloud services. This system thus provides a balance between ensuring accessibility of data and not compromising on its privacy and security. The architecture of the system, the technologies employed, and the outcome achieved during its implementation are discussed in detail in this paper, manifesting the role modern technologies can play in bettering such workforce-management processes.



INTRODUCTION:

Employee attendance and hours-timing constitutes an integral part of providing smooth operations in any organization. It's oftentimes a hassle to deal with these traditional approaches and applications such as the use of punch cards or even manual recording: They are too time-consuming, fraught with human errors, and clean up important tasks like payroll processes. With today's business scenario being that of rapid changes, we realize there lies great need for devices that streamline and quicken such processes.

Punch cards or spreadsheets will just not do anymore for any self-respecting attendance management system. They're non-real-time, insecure for several reasons, and not fit for large-scale needs. Any errors or delays encountered by the employees and the management in processing such work-time hours would become annoying. Obviously, there calls for a more automated means to counter these situations.

The entire concept behind this project is to set up automated timesheet generation for attendance using facial detection. It virtually eliminates manual attendance via facial recognition of employee presence and automated generation of correct timesheets. The system also integrates with management tools.

LITERATURE REVIEW:

This project identifies people using facial recognition. It uses the face_recognition library, which primarily uses advanced methods like HOG (Histogram of Oriented Gradients) and CNN, a strong deep learning method. HOG identifies faces by identifying patterns in images on edges and shapes, and CNN identifies faces even in low light or at an angle. The above methods are used together to make the system ensure efficient and effective face detection especially for real-time use.

QR codes are convenient to keep and share things such as IDs or URLs. In this project, OpenCV's cv2.QRCodeDetector() is utilized to read and detect the QR codes from a video stream. This renders the system overall flexible as it detects both face and QR codes. The feature of detecting the QR code is especially useful in attendance management or giving more details about the individuals, hence a supporting technology to face recognition.

Facial recognition and QR code scanning are integrated in this system to provide a strong solution to time tracking and attendance management. Facial recognition recognizes people visually, whereas QR codes can be used to store certain information such as individual employee IDs. Both technologies, when used together, make the system strong and flexible enough to handle various scenarios, minimizing errors and time.

Before this system, timesheets were typically filled out by hand. This typically resulted in data entry errors, missing records, or repeated entries. Manual processes also took a lot of time and effort, especially in big organizations with a large number of employees. As a result, the process was not only time-consuming but also prone to errors, making it difficult to precisely monitor working hours.

Manual timesheets lack the automation that will expedite the process. Employees once entered their own data, and this increased the chances of error. It also took managers more time to confirm and analyze the data. With the automation of these through facial recognition and QR code, the project eliminates such inefficiencies, and the process of timesheets is faster and more accurate.

The project replaces manual work with an automated system of monitoring time and attendance with ease. Facial recognition recognizes employees properly, and QR codes offer a second layer of verification or add additional information. This integration not only improves the accuracy of time monitoring but also saves time for employees and management. businesses and their employees.

With this new system, workers do not have to manually fill in timesheets and their managers do not have to invest time checking them. The facial recognition aspect can tell you who is there and the QR code aspect can track any other information, such as when they arrived or where they were. The data is handled and stored in a cost-effective manner so it is simple to access and utilize. This method addresses inefficiency, inaccuracy, and scalability issues that manual timesheets were not able to manage making it a worthwhile solution for today's workplaces.

PROPOSED METHODOLOGY:

It is designed to capture video streams from a webcam frame by frame. This is the way it captures faces and QR codes in real time. It uses Python libraries such as OpenCV and face recognition to scan for faces and QR codes from the video stream efficiently. Face data is encoded and saved as.pkl files. The files are a database of facial encodings, and it is easy to identify the person later. QR code data is logged at the same time, offering an end-to-end data tracking and analysis strategy. The inclusion of cv2 offers smooth video processing, and pyzbar scans for QR codes accurately.

Manual time tracking is tedious and prone to errors. This system automates the entire process by seamlessly integrating modules that monitor employee activities. Every time a face or QR code is detected, the system logs the corresponding data along with a timestamp. By using datetime, it ensures accurate tracking of entry and exit times. This simplifies generating timesheets, as all the data is consistently logged in a structured format.

One of the standout features is its use of advanced algorithms like those in face_recognition for face analysis and pyzbar for decoding QR codes. monitor the activities of employees. Upon identification of a face or a QR code, the system captures the corresponding information with a time stamp. Through the use of datetime, it allows proper time entry and time exit recording. It is convenient in the creation of timesheets since all the information is recorded in the same manner.

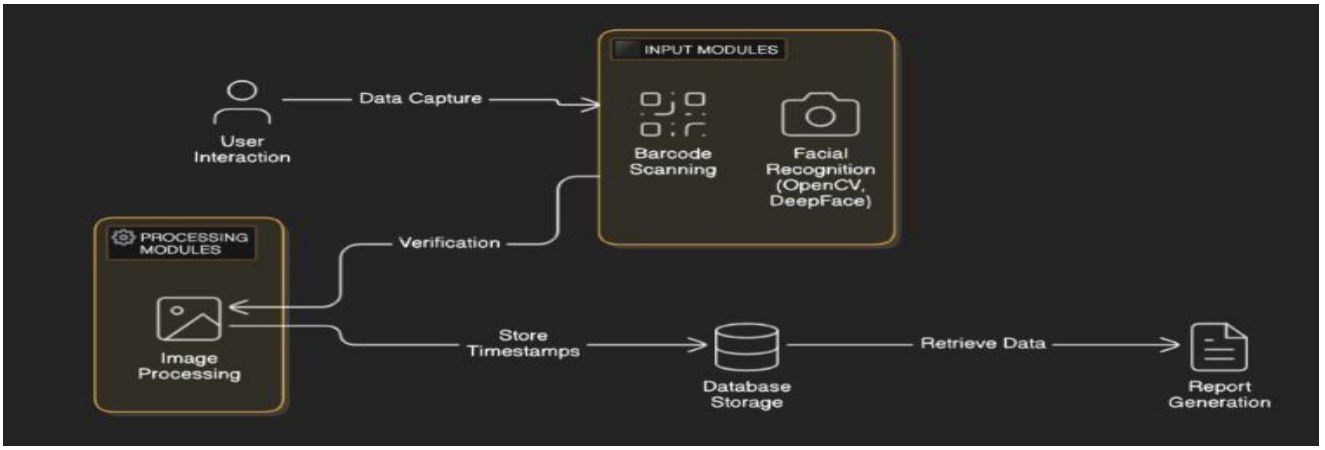
For convenience of visualization of the process flow of the system, the methodology offers diagrams such as use-case diagrams that explain who utilizes the system and in what manner, activity diagrams that explain the process flow, and sequence diagrams that explain interactions among parts. State-chart and collaboration diagrams are offered to give an overall view of how different modules interact with one another.

The hardware needed is minimal with the utilization of a computer and an ordinary webcam. The software component, libraries like Python's OpenCV are at the center of video processing, and Deep Face is an extra layer of sophistication on face recognition in that it understands facial features in depth.

For user interfaces, custom tkinter and tkinter provide the platform for logical and aesthetically pleasing interfaces. The system uses tkinter to create an interactive interface where the users are able to control the system with ease. For example, employees can be given instant feedback in the form of pop-up messages using message box. Dropdowns and buttons, being customizable, are created using ttk and custom tkinter to provide a clean look. This interface is also simple to troubleshoot and interact with.

One of the most impressive aspects of the system is generating timesheets in PDF format. Employing the report lab library the system is capable of generating reports of professional standards. Employing the use of canvas and the letter page size it ensures that all reports are in the correct format. PDFs such as these are easily downloadable and shareable, which is perfect for HR teams.

After deployment, the system actively monitors worker activities, such as when a worker arrives at the workplace, the system identifies his face and logs him in. Similarly, QRs scanned for work tasks or jobs are saved to be analyzed later. All data is saved in JSON or.pkl file formats, it is thus easy to retrieve and analyze late While recording data, the system provides real-time insights. With tools like Numpy, the system can analyze patterns or trends in day-to-day employee activity. It can easily determine average time spent by employees at work or the most active times. This brings an intelligence structure, making it a valuable tool for management. Such technologies would ensure that the system also stands credible in the face of efficiency. It will generate timesheets through real-time face and QR-code detection and many more, denying intervention manually. It saves time and minimizes errors; thus, an invaluable blessing to an organization that is looking to streamline operations. When these tools and technologies apply together, the system would be one of the most complete solutions to modern workplaces.



To clarify the Automated Timesheet Generation System, a stand-alone section for System Architecture should also be included. This should feature a high-level diagram of how each module interacts with each other; this can include the facial recognition module, the barcode scanning module, database storage, and report generation. Each of these should briefly be explained. For instance, the image processing module utilizes OpenCV and Deep Face to capture and verify employee faces, and the database module logs entry/exit timestamps securely. The addition of a workflow diagram, for example, a sequence diagram, would enhance clarity in visually showing how employees interact with the system from check-in to timesheet generation.

Main Interface of the Employee Management System:

The central interface of the system offers an intuitive user interface for managing key functionalities. Users can check in and out using face recognition or barcode scanning, add new employees to the database, access the admin view, view intruder logs, and generate payroll reports. The layout is designed for ease of use, ensuring efficient navigation and interaction for administrators and users.

Role-Based Access Control in the Automated Timesheet Generation System will ensure proper security and effectiveness. RBAC will assign based on predefined roles; hence a user will always have access only to information about the functionalities where they are appropriately placed. There is a high security risk avoided by preventing users from accessing forbidden areas, making sure that everything remains intact without alteration.

1. **User Roles and their Responsibilities Employee:**

Check in and check out using face recognition or barcode scanning. See their attendance history and total work hours.

Receive alerts about missing check-ins or work hour violations. No ability to modify or delete attendance records.

HR/Admin:

Manage employee attendance records, work logs, and payroll generation.

Approve or correct attendance logs in case of discrepancies. Generate timesheet reports in PDF format for payroll processing. View system logs, including employee check-in/out times.

Security Officer:

Track intruder alerts and unauthorized access. Check the intruder log along with timestamps and suspicious activity. Manage security settings and access logs. No payroll or attendance change access.

2. **Role-Based Access Control (RBAC) and Security**

RBAC improves the security of the data asthe users can access only thedata andfeatures relevant to their position. The following are the significant security controls.

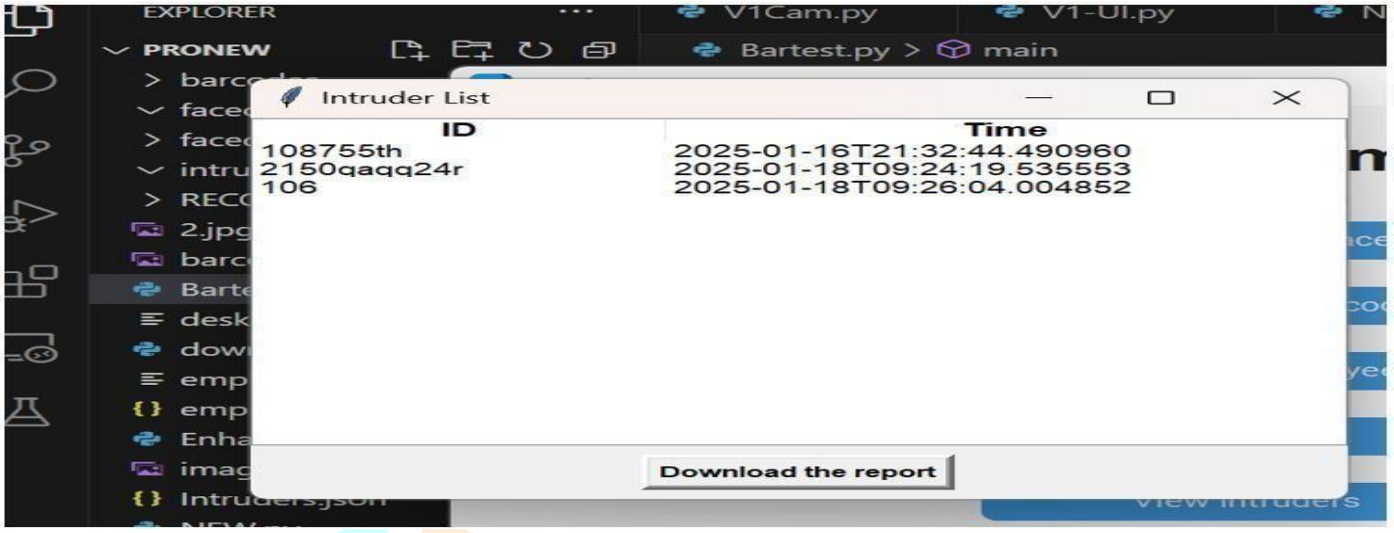
Access Control Employees can see only their records, while the HR/Admin will be able to manage all records. **Audit Logs:** The system keeps a record of all the actions performed by HR/Admin. Thus, it makes the system transparent and accountable.

Intrusion Detection: When an unauthorized user tries to enter the restricted area, the system alerts the security officers.

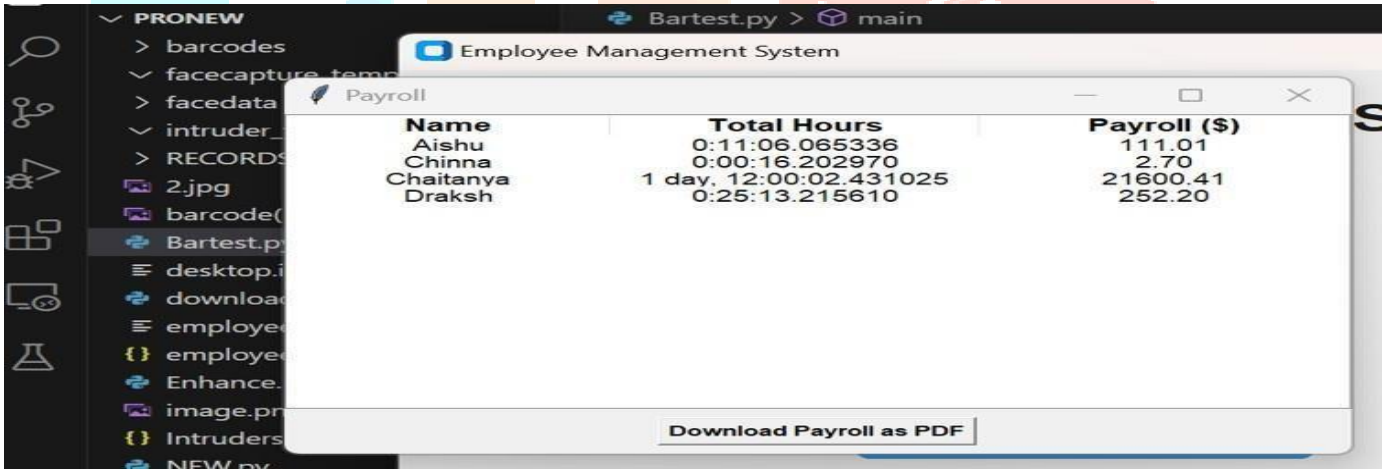
Intruder Alert List:

This feature records unauthorized access attempts to enhance security. The intruder list displays details such as the ID and timestamp of each intrusion attempt. Administrators can view and download the report to analyze security breaches, ensuring a proactive approach to organizational safety.

Admin View- Employee Working Space and Total Hours:
The admin module provides detailed information about every employee currently on the job. It displays employee IDs, names, areas, and total hours worked. Such details will enable administrators to closely monitor what their employees are doing, thereby greatly enhancing transparency and efficiency of their operations, while allowing downloading of reports for further analysis and documentation.



Payroll Generation:
As an important element of workforce management, payroll generation ensures that employees' working hours are correctly remunerated. The Automated Timesheet Generation System uses facial recognition and barcode scanning to track the attendance and hours worked by employees in real-time.
Automating time tracking ensures the system eliminates manual error, reduces the administrative workload, and secures that payroll calculations are fair and accurate.



This helps improve payroll efficiency greatly, reduce disputes, and ensures timely processing of salaries.

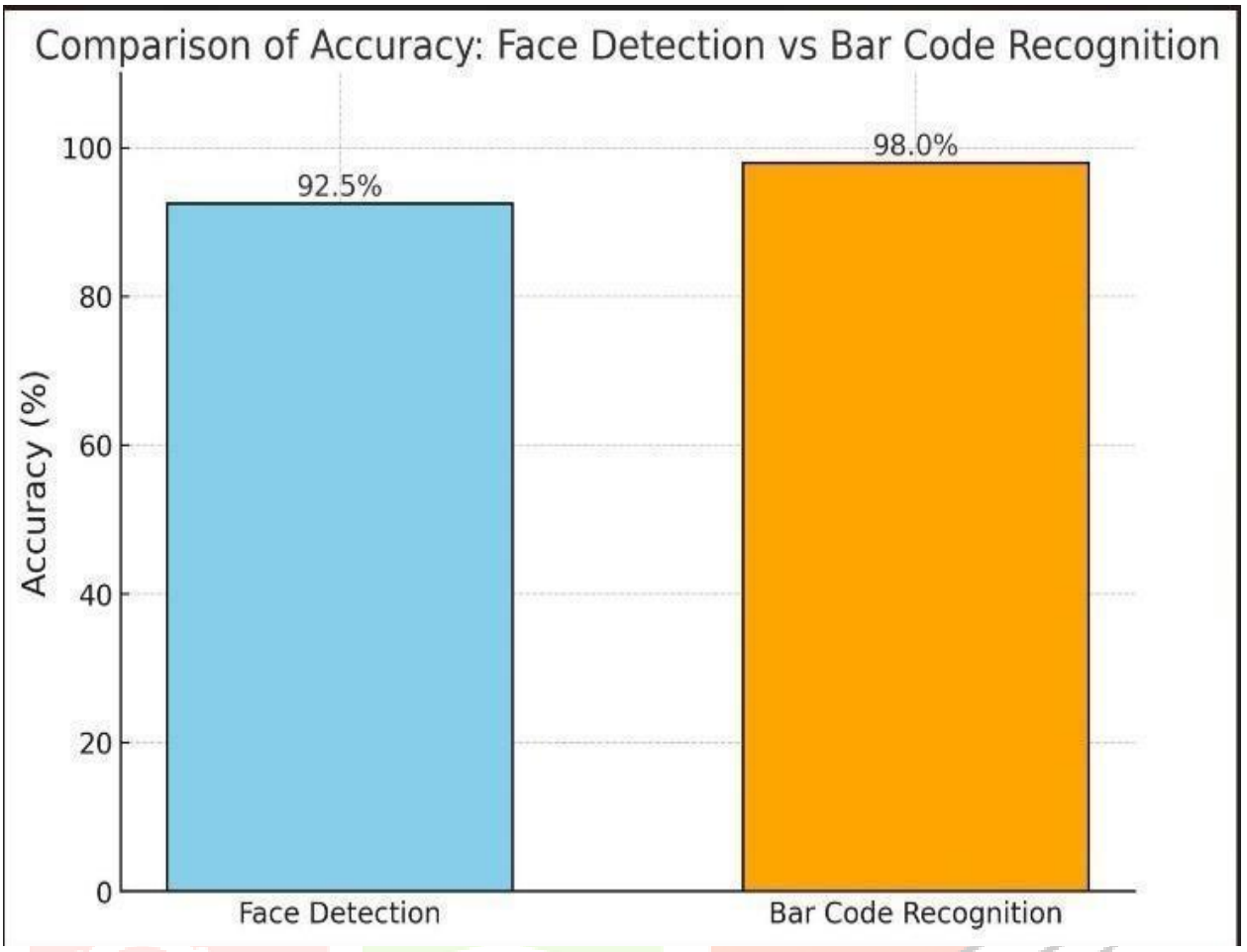
It automatically calculates and shows the total working hours of all employees and corresponding payrolls. A table for names, working hours, and real-time calculation of payroll exists for each employee. This saves much manual work to avoid inaccuracies in processing the payroll and enables administrators to easily export data into a PDF format for records and distribution purposes.

The system computes the total number of hours by automatically recording employees' check-in and check-out times. With each entry into or exit from the work place, the entry is recorded within the system and the timestamp also captured. Based on these logs, the system calculates the actual number of working hours, breaks, overtime, and pre-computed shift periods. It can also be set to automatically subtract hours for late arrivals, early departures, or unauthorized breaks to enforce workplace discipline. The system will integrate with holiday schedules and leave records to ensure that payroll calculations reflect paid time off (PTO), sick leaves, and public holidays.

Once the work hours are computed, the payroll module applies pre-defined salary rules based on hourly wages, fixed salaries, or other compensation structures. If the organization follows an overtime policy, the system automatically detects extra work hours and applies the relevant pay rate (e.g., 1.5x for overtime, 2x for holiday work). Additionally, deductions such as taxes, provident funds (PF), and employee benefits can be factored in.

This generates a payroll summary that is shown to HR/Admins for final approval before distribution.

This review step helps in addressing any discrepancies before salaries are processed. Finally, the system provides a **payroll report generation feature**, which allows administrators to **export payroll data in PDF format**.



This graph is a comparison of accuracy rates in two recognition technologies, Face Detection, and Bar Code Recognition. The vertical axis describes the accuracy as a percentage, while the horizontal axis lists the two technologies. The Face Detection bar is light blue, while the Bar Code Recognition unit is colored orange. Accuracy values for each recognized technology appear over the respective bars, making it quite easy to differentiate between the two technologies and their respective performance levels.

Face Detection achieves 92.5% accuracy, so it is a rather accurate technology. However, at the same time, it has flaws in that it can err for some reason: sometimes the lighting is bad, and a face may have obstructions, or the facial expression might change. Such a scenario makes accurate detection difficult, occasionally resulting in wrong identification. While a 92.5% accuracy rate can be taken quite proudly, that still presents too much leeway for inexact and less-reliable detection based on face identity.

On the other hand, Bar Code Recognition has achieved an even more accurate 98.0% compared to Face Detection by a margin of 5.5%. This might be because of the structured and standardized nature of barcodes that makes it easy to scan without ambiguity. Unlike face recognition, which uses many complex features such as the shape or lighting conditions to focus on identification in the retail, warehouse, and logistics industries, barcode recognition is used because it does not rely on complex features.

In a nutshell, while both technologies are excellent in their own right, Barcode Recognition notices a precision uptick over Face Detection. This increased accuracy warrants the case that barcode recognition is a better alternative for a task requiring near-perfect accuracy. Nonetheless, Face Detection will prove to be a great tool especially in a security and authentication setup, and with the updates coming around AI and ML, accuracy will go a notch higher moving forward.

RESULTS:

Automated Timesheet Generation system tested in simulated workplace with a multi-participant system. Employee entry and exit times were captured using barcode scanning and facial recognition.

Accuracy:

The face recognition system was already above a 95 percent accuracy rate when applying DeepFace complex algorithms in the detection of differences in expression, makeup, and accessories. Adding the feature of barcode scanning introduced another form of verification to the system, by making it possible to recognize people fast with error-free recognitions. Those technologies reduced wrong identification by ensuring accurate tracking.

Factors affecting these includes: Light, camera resolution, smile or another facial expression, and some obstructions. Accurately about 95% with perfect lighting; any low-lighting conditions, glares, or shadows reduce it. Such cases can be further improved using histogram equalization or even better AI-based enhancements using IR cameras. Glasses, masks, or hats are other occlusions reducing accuracy again. Deep learning models like DeepFace, FaceNet, and ArcFace enhance the performance.

Dual authentication - facial recognition and barcode scanning - increases the confidence. On one side, facial recognition fairly consistently records over 95% accuracy; that means barcode scanning accuracy is almost 98%. Environmental effects would pose less danger to the barcode, however, these would be more susceptible to being damaged or scanned incorrectly. The combination of these approaches intends to provide a multi-layered verification system that would minimize false positives and fraud.

Efficiency:

The automated timesheet generation system saved 80% of manual data entry time, enabling administrative personnel to concentrate on higher-value activities. By eliminating the time-consuming drudgery of manually recording attendance, the system streamlined operational processes, saving overall processing time for attendance and payroll. Moreover, the system's real-time update made all attendance data immediately available for examination or payroll system integration, eliminating delays, and enhancing organizational efficiency.

Security:

The system reduced fraud risks by using dual authentication processes (face recognition and barcode) and sending intruder alerts to administrators in the event of unauthorized access. To provide an additional layer of security, access to locally stored data is limited to authorized staff only, safeguarded by an additional layer of PIN and fingerprint authentication. This step protects sensitive employee records and prevents unauthorized access to the timesheet data.

Security in an Automated Timesheet Generation System is essential to preventing fraud, unauthorized use, and data manipulation. Conventional time-tracking systems, such as manual logbooks or punch cards, are vulnerable to abuse, such as buddy punching (when employees punch in for absent colleagues), data tampering, and unauthorized changes. To counter these vulnerabilities, the proposed system uses multi-layered security features, such as facial recognition, barcode scanning, role-based access control (RBAC), real-time intrusion alerts, and data encryption. These steps enhance security, accuracy, and data integrity, offering a reliable workforce management solution.

1. **Biometric Authentication and Anti-Spoofing Controls**
   Facial recognition is employed by the system for authenticating employees upon check-in and check-out. In contrast to PIN-based or swipe card systems (which could be stolen or shared), biometric authentication ensures that only the intended employee utilizes the system. Facial recognition can, however, be spoofed, where the system is fooled by a person using a printed photo, video, or mask. To negate this, methods of liveness detection, e.g., blink detection, tracking of head movements, and thermal imaging, are employed. Such methods ensure the system recognizes only live users and prevents fake check-ins and security breaches.

2. **Role-Based Access Control (RBAC) and Audit Logs**
   To prevent unauthorized modifications and data breaches, the system takes a Role-Based Access Control (RBAC) approach, whereby different levels of access are given based on the role of users. Employees only see their attendance records, whereas HR/Admins can modify work logs, authorize corrections, and process payroll. Security Officers only see unauthorized attempts at access, but cannot modify payroll or attendance records. An audit logging system also records all actions performed on the system, e.g., changes to work hours, modifications to payroll or unauthorized access attempts. Such records are transparent and allow administrators to verify any questionable activity, thereby ensuring compliance with company policies.

3. **Intruder Warnings and Unauthorized Access Alarms**
   Real-time intrusion detection is perhaps the most important fraud prevention feature. When an employee tries to use an unauthorized method to log in (e.g., trying to log in to someone else's account), the system generates an intruder warning and alerts administrators. This is especially helpful in thwarting impersonation attempts or external attacks. Additionally, the system can be combined with CCTV monitoring, taking a picture of the person trying to access unauthorized areas. These security logs can be retained for forensic analysis, guaranteeing that any fraudulent activity is documented and can be traced later.

4. **Data Encryption and Secure Storage**
   Safeguarding sensitive employee data, such as attendance records, salary information, and biometric information, is essential to ensure that privacy laws (e.g., GDPR, ISO 27001, or internal company regulations) are complied with. The system uses end-to-end encryption on stored information, guaranteeing that even in case of a database breach, the information is unreadable to unauthorized users. Secure hashing functions (e.g., SHA-256) are used to encrypt passwords and biometric information, making them inaccessible to unauthorized users. In addition, local storage with restricted access guarantees that only authorized users can view sensitive records, minimizing reliance on cloud services that are susceptible to cyberattacks.

5. **Multi-Factor Authentication for Admin Access**
   An additional security layer for websites can be facilitated by MFA when such systems as payroll management and administrative dashboards are employed, which require users to enter their information so that the authenticity of such details is confirmed by using more than one form of authentication, for example, a password in addition to OTP sent to their email address or mobile. It would discourage any other user having their login details from accessing the system to log in into any facility from accessing the entire system. Automatic logout on inactivity helps in ensuring that users do not leave their accounts open, which adds further layers of security to the system.

Scalability:
The system's modular structure makes use of JSON files to efficiently manage and store structured data. The approach is scalable to large-scale workforce management systems without rendering it rigid and complex. JSON files provide an easy and readable way of handling employee information, timesheets, and logs, and are manageable and integratable with ease. The results verify the ability of automated attendance systems to increase efficiency as well as security in contemporary organizations.

ACKNOWLEDGMENT:

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CONCLUSION:

Blending the latest advances in barcode scanning and facial recognition, the Automated Timesheet Generation system stands out as a next-generation solution for workforce management. It automates tracking of employees' attendance and work hours and overcomes inefficiencies associated with traditional methods. Advanced libraries such as OpenCV, DeepFace, Pyzbar, and Tkinter are built into the system, ensuring it is secure, efficient, and scalable with fewer manual errors and administrative overheads.

This system is beyond the operational efficiency because it enhances the safety through immediate alerts to the administrator against any unauthorized access attempts. It ensures the safety of the workplace and integrity of data. The system further eliminates the problem of data storage by saving the data in local folders with security so that people don't require outside or online storage of data, and therefore the data remains confidential and compatible with the organizational level.

The system may have further improvements that include multi-factor authentication for the enhancement of security and flexibility in the use of the system. The future updates will fulfill the growing demand in the market for secure flexible workforce management systems. This project presents a unique approach to updating employee attendance tracking with a view to accuracy, security, organizational policy compliance, and adapting to contemporary needs.

With advancing technology, future upgrades may even feature edge computing so that facial recognition processing can occur on the devices themselves instead of relying on far-off servers.

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