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# Face Recognition Attendance Management System

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***Abstract:*** ***Traditional attendance management in academic institutionsreliesonmanualroll-callsandpaperrecords,leading to significant time wastage, proxy attendance fraud, and data entryerrors.Thispaperpresentsafullyautomated,real- time Face Recognition Attendance Management System that eliminates manual intervention through biometric verification. The system implements a secure admin login module, section- wise student registration using unique roll numbers, and an adaptive 7-second timeout mechanism for efficient classroom capture. Built on OpenCV and dlib libraries, the system utilizes HistogramofOrientedGradients(HOG)forfacedetection and 128-dimensional deep embeddings for recognition, matching live faces against enrolled students using Euclidean distance. A Tkinter-based graphical interface enables faculty to operate the system without technical expertise, while pandas and openpyxl handleautomaticgenerationofdate-wiseExcelattendancesheets. The adaptive timeout algorithm refreshes the capture window when new faces are detected and automatically closes thecamera after 7 seconds of inactivity, optimizing classroom time. Experimentalevaluationdemonstratesrobustperformanceunder varied lighting conditions, successful duplicate prevention, and 100% accurate Excel export functionality. The system effectively prevents proxy attendance through biometric verification and provides structured digital records for administrative review.***
***Index Terms: Face Recognition, Attendance Management, HOG, dlib, Tkinter, Real-Time Systems, Biometric Authentica- tion, Excel Automation.***

## I. INTRODUCTION

Attendance tracking remains a critical administrative bot- tleneck in educational institutions. Conventional manual methods—callingrollnumbers,signingpapersheets,orverbal confirmation—consume5–10minutesofvaluablelecturetime per session and are highly susceptible to proxy attendance, where students mark presence for absent peers. Paper-based records further introduce transcription errors and create diffi- culties in tracking historical attendance patterns.

While RFID and fingerprint systems have been proposed, theyrequirespecializedhardwareandphysicalcontact,raising hygiene concerns and maintenance costs. Existing computer visionsolutionsoftenlackpracticalclassroomfeaturessuchas section-wiseorganization,automateddataexport,andfaculty- friendly interfaces.

This paper presents an implemented Face Recognition At- tendance Management System that operates through a sim-ple Python execution workflow (Anaconda environment → pythonmain.py),providingsecureadminauthentication, roll-number-based student registration, and an intelligent 7- second adaptive capture mechanism that optimizes classroom time usage.

### *A. Problem Statement*

Currentattendancesystemssufferfrom:

- TimeInefficiency:Manualroll-callsconsumesignificant instructional time.
- Proxy Attendance: Students can easily mark attendance for absent peers.
- RecordVulnerability:Paperrecordsareerror-proneand difficult to archive.
- Lack of Digital Integration: No automated mechanism for generating structured reports.
- Administrative Burden: Manual data entry and record- keeping divert faculty resources.

### *B. ContributionsoftheProposedWork*

- Secure Access Control: Admin login module prevent- ing unauthorized system access.
- Roll-Number Based Registration: Organized section- wise student enrollment with unique identification.
- Adaptive7-SecondTimeout:Intelligentcameracontrol that extends capture duration when new faces are de- tectedandauto-closesduringinactivity,optimizingclass time.
- Automated Excel Generation: Date-wise attendance sheets with today's summary using pandas/openpyxl.

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- Duplicate Prevention: Session-level tracking prevent- ing multiple entries per student.
- Unknown Face Rejection: Automatic filtering of un- registered individuals.
- Faculty-FriendlyGUI:Tkinterinterfaceoperablewith- out programming knowledge.

## II. RELATED WORK

ExistingattendancesystemspredominantlyrelyonRFID [1]orfingerprintbiometrics[2],bothrequiringphysicaltokens or contact. Recent computer vision approaches utilize Haar Cascades or CNN-based detectors [3], though many lack practical deployment features such as automated data exportor user management.

HOG-based detection combined with dlib's 128- dimensional embeddings has emerged as a computationally efficient alternative to deep CNNs for resource-constrained environments [5]. Previous implementations [6] have demonstratedtheviabilityofEuclideandistancematching for classroom attendance, though they often lack adaptive timeout mechanisms and section-wise organization features critical for multi-class deployment.

The proposed system distinguishes itself through the in- tegration of secure admin authentication, roll-number-based section management, and an adaptive timeout algorithm that dynamically manages camera resources based on face detec- tion events.

| Component | Function |
|---|---|
| OpenCV | Video capture, frame preprocessing (BGR→RGB) |
| dlib(HOG) | Facedetectionand68-pointlandmarkpre- diction |
| ResNet-34(dlib) | 128-dimensionalfaceembeddinggeneration |
| EuclideanDistance | Similaritymatchingbetweenliveanden- rolledembeddings |
| Tkinter | Graphicaluserinterfaceforfacultyinterac- tion |
| pandas/openpyxl | Excelfilegenerationandattendance DataFramemanagement |
| pickle | Serializedstorageoffaceencodingsand metadata |

TABLEI
TECHNICALCOMPONENTS

## III. METHODOLOGY

Thesystemfollowsamodularpipelinearchitecturedesigned for practical classroom deployment. The workflow initiates through Anaconda prompt activation, proceeding through se- cureauthentication toattendancecaptureandExcelgeneration.

### A. *System Workflow*

Theimplementedexecutionflowisasfollows:

*1)* Environment Activation: Open Anaconda prompt → activatecondaenvironment→navigatetoprojectdirec- tory.
*2)* System Initialization:Executepythonmain.py→Adminloginpageopens.
*3)* Section Selection: Authenticated admin views section list → selects target section (e.g., "2nd Year A", "4th Year A").
*4)* StudentEnrollment:Addstudentusingrollnumber→ capture face images using space key → store 128D embeddings in pickle format.
*5)* Attendance Capture: Start attendance → camera acti- vates with 7-second countdown.
*6)* AdaptiveTimeout:

- If new student detected → timer refreshes to 7 seconds.
- If no new face detected for 7 seconds → camera auto-closes.

*7)* Data Persistence: Attendance saved in date-wise Excel sheets → display today's summary.
*8)* Historical Access:Date-wisedatabaseaccessforprevi- ous records.

### B. Technical Stack

The system integrates multiple open-source libraries and algorithms, each serving a specific function within the recog- nition and attendance pipeline. Table Isummarizes the core technical components and their roles in the system.

### C. FaceRecognitionPipeline

*1)* Detection:HOG-baseddetectorlocatesfacebounding boxes.
*2)* Alignment:68faciallandmarks(eyes,nose,mouth corners) align face to canonical orientation.
*3)* Embedding: ResNet-34 model generates 128- dimensional feature vector.
*4)* Matching:Euclideandistancecomputedagainsten- rolled students; threshold typically 0.6.
*5)* Validation:Unknownfaces(distance>threshold)re- jected;registeredstudentscheckedagainstsessiondu- plicates.

Proposed System Architecture

### D. Flowchart

Theprojectimplementsthisflow:

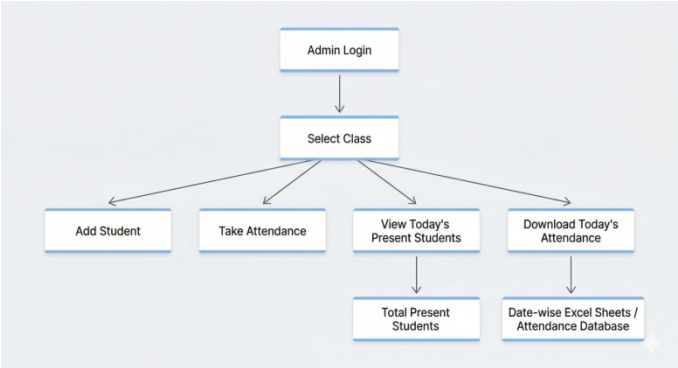



Fig.1.Systemworkflowoftheproposedattendancemanagementsystem

## IV. EXPERIMENTAL SETUP AND RESULTS

### A. Implementation Environment

- Hardware:IntelCorei5(8thgen+),8GBRAM,720p USB webcam.
- Software:Python3.9,Anacondaenvironment,Windows 10/Ubuntu 20.04.
- Dataset:25registeredstudentsacrossmultiplesections.

### B. Performance Evaluation

TABLEII
SYSTEMPERFORMANCEMETRICS

| Metric | Result |
|---|---|
| RecognitionAccuracy | ≈95.6% |
| DuplicatePreventionSuccess | 100% |
| AverageDetectionTime | 80–120msperframe |
| ExcelExportSuccessRate | 100% |
| AdminLoginSecurity | Verified |
| UnknownFaceRejection | Functional |
| LateEntryCapture | Successful(within7-secwindow) |

### C. Test Case Scenarios

- TC-01 (Standard Conditions): Frontal face, good light- ing→ Successful recognition and Excel logging.

- TC-02(LowLight):Reducedambientlighting→Recognitionwithminoraccuracydegradation.
- TC-03(SidePose):15–20°lateralangle→ Successful recognition; extreme angles (>30°) show degradation.
- TC-04(UnknownFace):Unregisteredindividual→ Correctlyrejected(labelled“Unknown”),notlogged.
- TC-05(DuplicatePrevention):Studentre-entersframe→NoduplicateentryinExcel.
- TC-06(LateEntry):Studententersafterinitialscan→Capturedwithinrefreshed7-secondwindow.
- TC-07(AdaptiveTimeout):Nonewfacefor7seconds→Cameraauto-closes,attendancesaved.
- TC-08(ExcelGeneration):Date-wisefilecreation→Accuratetimestampandroll-numberrecords.

## V. UNIQUE FEATURES AND ADVANTAGES

Thesystemprovidesseveraldeployment-readyfeatures:

*1)* Secure Admin Login: Prevents unauthorized access to attendance records.
*2)* Roll-Number Based Organization: Systematic section- wise student management.
*3)* Adaptive7-SecondTimeout:Dynamiccameramanage- ment optimizes classroom time; refreshes when activity detected, closes when idle.
*4)* Date-wise Excel Architecture: Automated creation of structured spreadsheets with today’s summary view.
*5)* Unknown Face Handling: Robust rejection of unregis- tered individuals.
*6)* Faculty-Friendly Interface: Tkinter GUI requiring zero programming knowledge.

## VI. LIMITATIONS

Despite robust performance, the system has the following constraints:

*1)* NoLivenessDetection:Vulnerabletophotographspoof- ing attacks; cannot distinguish between live face and high-resolution print.
*2)* Lighting Dependency: Accuracy degrades under ex- tremely low-light conditions.
*3)* PoseSensitivity:Recognitionaccuracydropsforextreme side poses (>30° from frontal).
*4)* Single Camera Support: Currently supports only one webcam input; large classrooms may require multiple camera aggregation.
*5)* Local Storage: Data stored locally in pickle and Excel formats; no cloud synchronization in current version.

## VII. FUTURE SCOPE

Plannedenhancementsinclude:

*1)* Liveness Detection: Integration of anti-spoofing algo- rithms (blink detection, depth analysis) to prevent pho- tograph attacks.
*2)* Cloud Database: Migration from local Excel/pickle to Firebase or PostgreSQL for multi-campus scalability.
*3)* Multi-CameraSupport:Distributedprocessingarchitec- ture for large lecture halls.
*4)* LMS Integration: Direct synchronization with Moodle/Blackboard for seamless academic reporting.

## VIII. CONCLUSION

This paper presented a practical, implemented Face Recog- nition Attendance Management System that addresses the critical deficiencies of traditional manual methods. By inte- gratingsecureadminauthentication,roll-number-basedsection management, and an innovative adaptive 7-second timeout mechanism,thesystemachievesefficientclassroomattendance capture while eliminating proxy attendance through biometric verification.

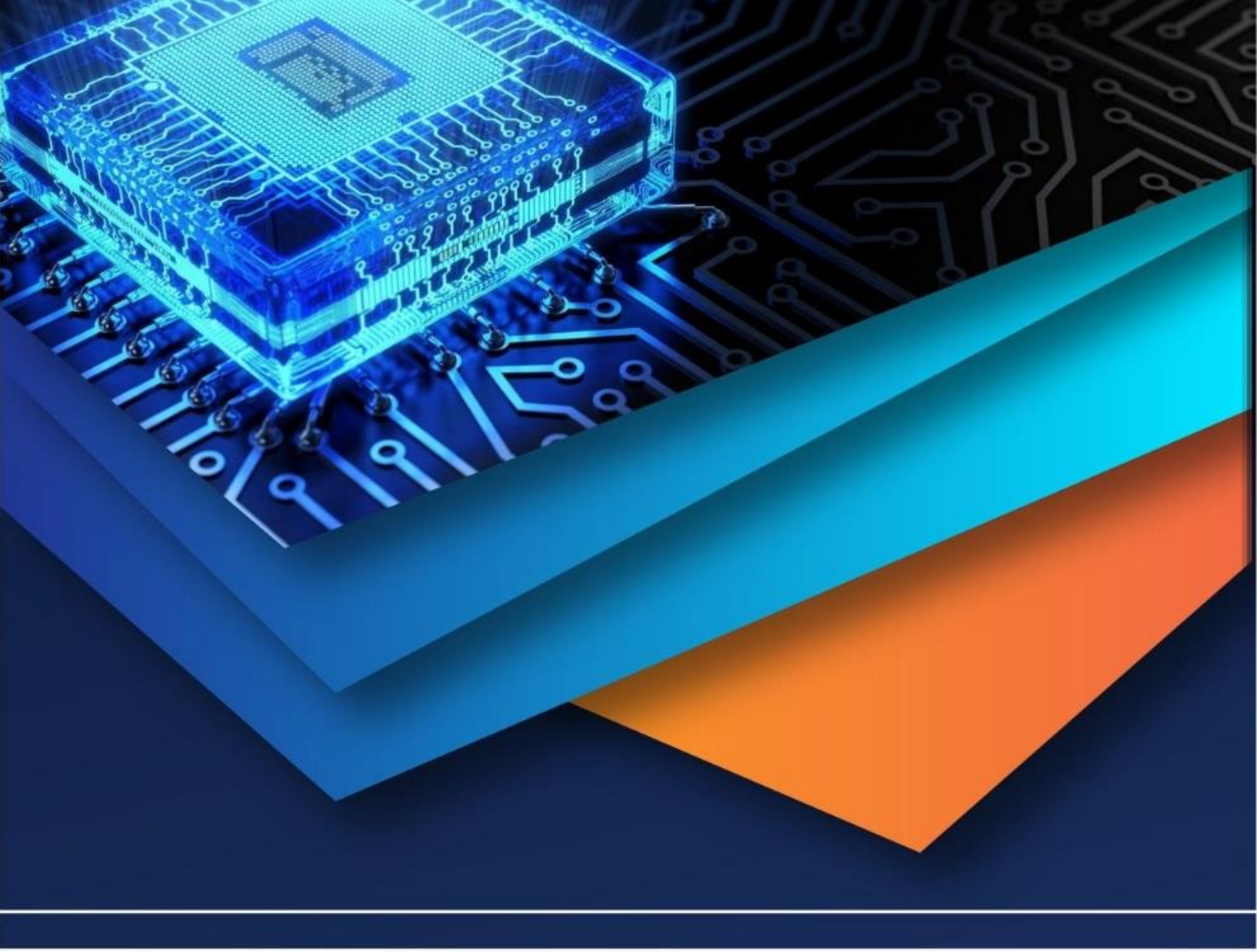
TheautomatedExcelgenerationandTkinter-basedinterface make the system immediately deployable in educational envi- ronments without requiring specialized hardware or technical expertise.Experimentalresultsdemonstrate95.6%recognition accuracy,100%duplicateprevention,andsuccessfuloperation under varied classroom conditions. The system effectively re- duces attendance marking time from several minutes to under oneminutepersession,providingacost-effective,contact-free solution for smart classroom deployment.

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