AUTOMATED ATTENDANCE SYSTEM USING DEEP LEARNING-BASED FACIAL RECOGNITION AND SENTIMENT ANALYSIS

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Abstract: *Attendance management systems are essential in a number of settings, such as events, businesses, and educational institutions. Conventional approaches frequently entail manual procedures that are prone to mistakes, inefficiencies, and time limits. This study suggests a novel way to automate attendance tracking by utilizing face recognition technology in order to overcome these issues. Modern facial recognition algorithms are used by the system to reliably identify people in a database, doing away with the requirement for human input or confirmation. Organizations may increase security, expedite the attendance recording process, and boost overall productivity by incorporating smart attendance with face recognition. The suggested system's main attributes include multi-platform compatibility, real-time monitoring, and strong data encryption to guarantee security and privacy compliance. Additionally, the system can be scaled to meet the needs and sizes of different organizations.*

The efficacy and dependability of the suggested smart attendance system are illustrated through case studies and empirical evaluation. When compared to conventional approaches, the results show notable gains in accuracy, time savings, and user satisfaction.

Keywords: **Smart Attendance, Face Recognition, Attendance Management, Automation, Efficiency, Security.**

1. INTRODUCTION

In today's fast-paced world, traditional methods of attendance tracking are becoming increasingly out dated and inefficient. Paper-based systems are prone to errors, while manual recording consumes valuable time and resources. However, with the rapid advancements in technology, innovative solutions are emerging to streamline this process. One such solution is incorporating facial recognition technology into attendance systems, commonly known as "Smart Attendance using Face Recognition."

Additionally, Face recognition for intelligent attendance enhances security measures within workplaces and educational establishments.

By accurately logging attendance data tied to specific individuals, it creates a transparent and accountable system, discouraging fraudulent behavior and ensuring compliance with attendance policies.

.In summary, "Smart Automated Attendance with Facial Recognition" offers unmatched security, ease, and accuracy, marking a substantial improvement in attendance monitoring systems. Although there are obstacles to its adoption, its advantages in terms of productivity and efficiency make it an appealing alternative for both contemporary companies and educational institutions.

2. LITERATURE SURVEY

1. **Machine Learning Applied to Student Attentiveness Detection: Using Emotional and Non-Emotional Measures**

Authors: Mohamed Elbawab, Roberto Henriques

Publication: Educational Information Technology (Springer, Open Access, May 2023)

Methodology (Summary):

This study developed a forecasting model built with machine learning techniques to estimate students' attentiveness during online learning using only webcam video data. The

process extracted physical features like eye aspect ratio, head pose, drowsiness, and yawning, as well as emotional features such as seven emotion scores from facial expressions. Researchers gathered and processed these features through computer vision and a VGGNet-based emotion detector. They collected videos of students attending online lectures, processed frames to extract features, manually annotated compiled attentiveness data and utilized various machine learning models namely Support Vector Machine, Random Forest, and Decision Tree algorithms and XGBoost. The performance assessment of these models used accuracy and AUROC metrics, and oversampling with SMOTE helped address class imbalance.

Algorithm (XGBoost Focus):

XGBoost is an ensemble gradient boosting approach that generates decision trees sequentially. Each tree attempts to correct the mistakes made by the previous one. This algorithm optimizes a specific objective to prevent overfitting. Inputs include captured emotional and behavioral scores, while hyperparameters, such as tree depth and learning rate, were adjusted using random search. The final model achieved 80.52% accuracy and 92.12% AUROC for predicting attentiveness and outperformed the other models tested.

Limitations:

- The dataset was small and included videos from only seven students
- The ground truth depended on subjective human annotation
- Recordings might not accurately reflect typical student comfort; generalizability is limited, and there is a requirement for broader and more varied samples for stronger conclusions.

2. Student Satisfaction Index in Synchronous e-Learning: A Case Study Approach

Authors: Prabha Sunil Kasliwal, Dr. Reena Gunjan, Dr. Virendra Shete
Publication: CEUR Workshop Proceedings (ICEL 2023)
Methodology:

The authors employed mixed methods, combining qualitative interviews and quantitative surveys in an online engineering design-thinking course. Activities included mind mapping, empathy mapping, journey mapping, and collaborative brainstorming. They calculated the Student Satisfaction Index (SSI) by collecting responses across various indicators related to learner engagement and emotions. Real-time surveys captured how teaching strategies and course design affected students' emotions and overall satisfaction.

Algorithm:

There was no direct usage of a machine learning classifier.Instead, statistical analyses including correlation, means, and text mining for word clouds were applied to evaluate and interpret the SSI based on emotion-linked survey responses.

Limitations:

- The study was limited to a single semester, specific course, and sample
- SSI relies on self-reported data and lacks direct ML emotion prediction
- Results might not apply to other academic contexts or broader situations.

3. A Transfer Learning Framework with Multiple Frames for Facial Emotion Recognition in Online Learning

Authors: J. Pordoy et al.
Publication: IEEE (2024)
Methodology:

This study proposed a multi-frame transfer learning (MFTL) framework to improve emotion classification from students' facial micro-expressions during online classes. The

system pre-implemented approaches grounded in deep learning that have been trained using large facial datasets and adapted these features to recognize student emotions in e-learning video frames. It focused on maintaining temporal consistency with frames in sequence to address subtle expressions common in online settings.

Algorithm:

- Utilizes multi-frame CNNs and LSTM layers to capture spatial and temporal cues
- Employs transfer learning by adapting weights from large-scale emotion recognition datasets and fine-tuning them with smaller e-learning datasets
- Multi-class classifiers identify different emotions, including boredom, engagement, and frustration.

Limitations:

- Requires labeled video data with frame-by-frame emotion annotations
- Computationally intensive and may face challenges in real time on low-resource devices.

4. SYSTEM ARCHITECTURE

4.1 System Architecture

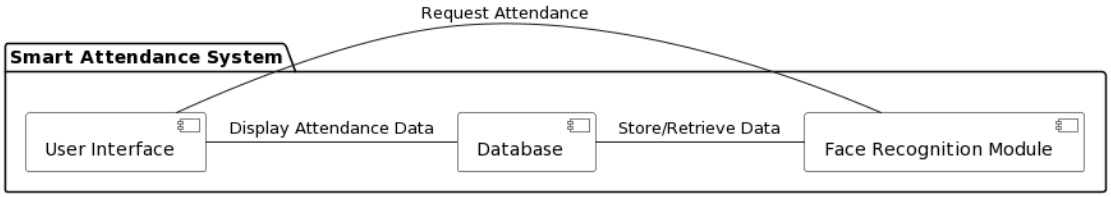

Fig 4.1.1: System Architecture

1. **Input Layer**: Capture live video feed or images from cameras installed in the attendance area.

2. **Pre-processing Module**: Perform image pre-processing techniques such as normalization, resizing, and noise reduction.

3. **Face Detection Module**: Recognize face within pre-processed images through algorithms like Haar cascades or machine learning methods using deep architectures.

4. **Feature Extraction Module**: Convolutional Neural Networks (CNNs) and additional deep learning techniques involve to extract facial data elements retrieved from faces that were discovered.

5. **Face Recognition Module**: Compare extracted features with the pre-registered features in the database to recognize individuals.

6. **Attendance Database**: Store recognized identities along with timestamps to maintain attendance records.

7. **User Interface**: Provide a user interface for managing admins the system, view attendance reports, and register new users if needed.

5. RESULTS

The above file is the excel sheet used to store the details of the student for the attendance marking.

The Figure 5.1 shows the student detail storing file.

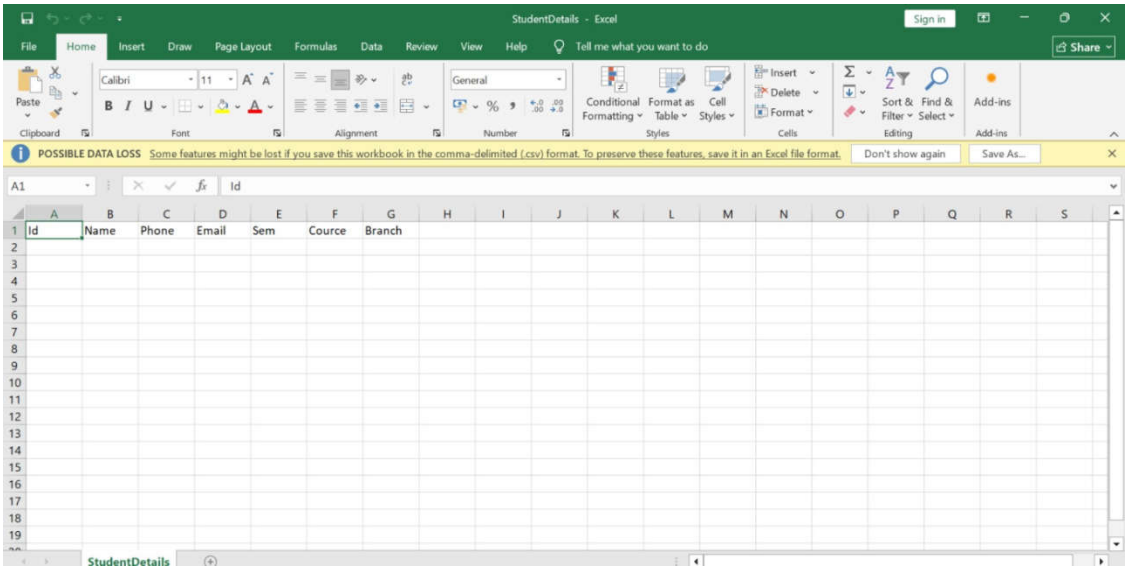

Figure 5.1 Student details Excel Sheet

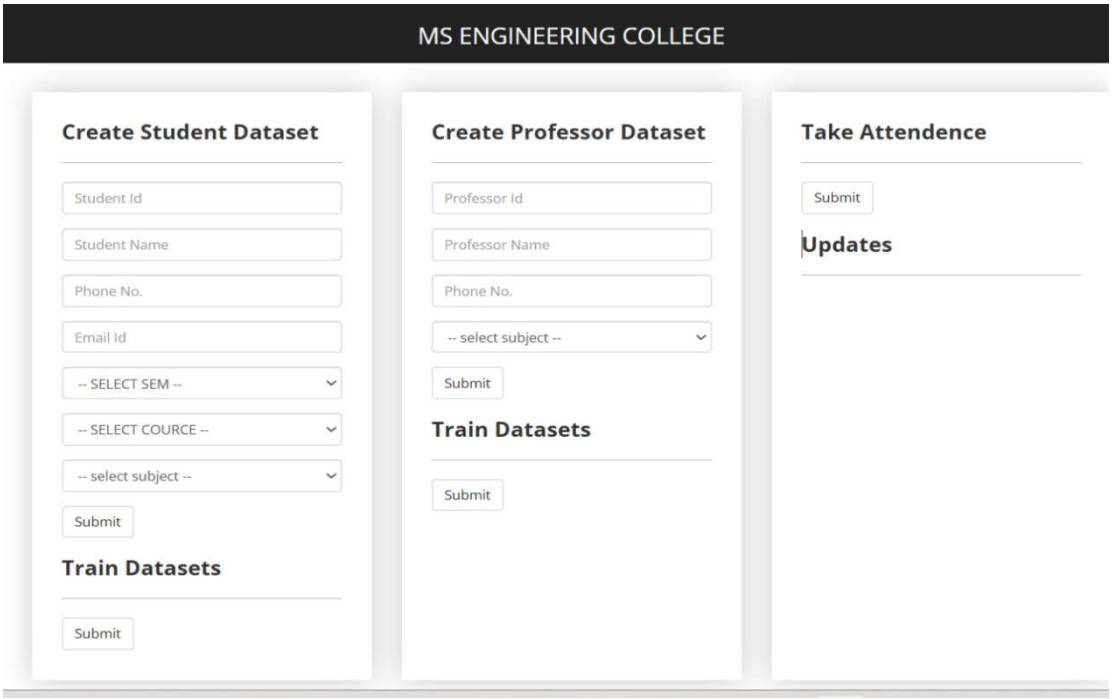

Fig 5.2: First view of Application and entering the data.

After Entering the details of the student, click on the submit button. On clicking the external camera connected to the system or the inbuilt webcam of the laptop gets started and collects the Student Image and stores in database along with ID, Name, Phone number.

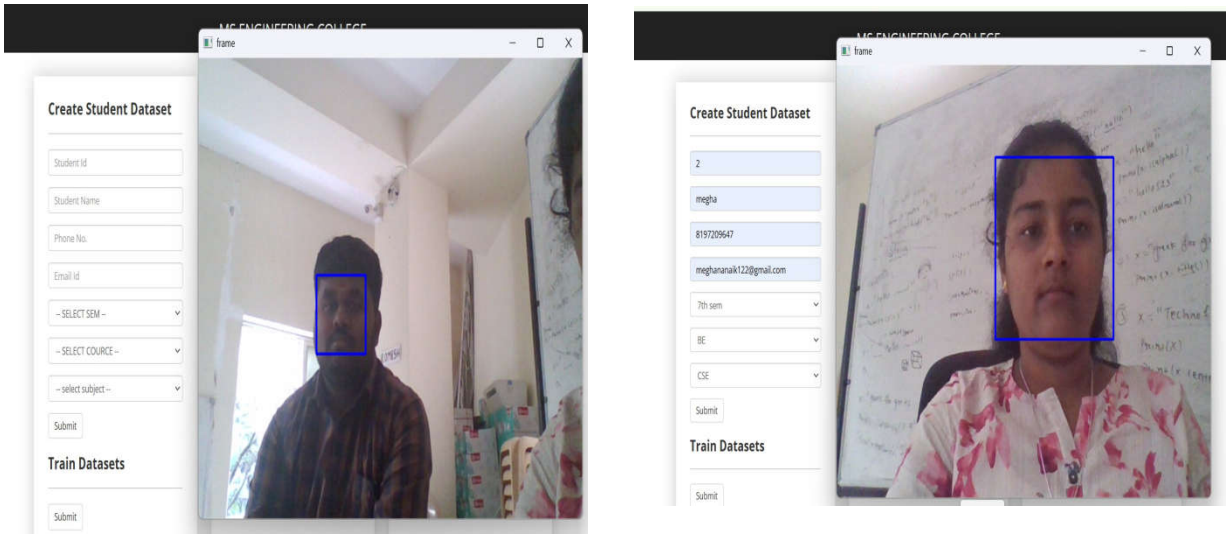

Fig 5.3: Image Capturing and Storing Student details.

Next step is to train the collected dataset to do so we have click on Training Button. On clicking Training Button Image will be trained and it will update as image trained.

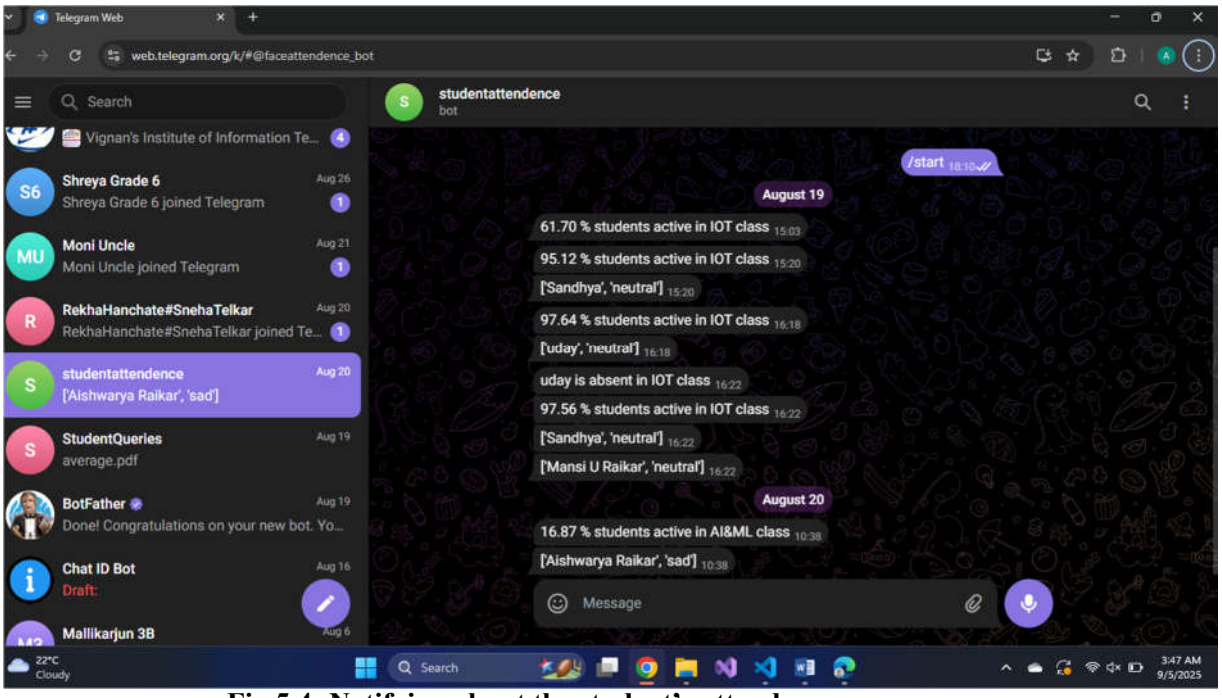

Fig 5.4: Notifying about the student's attendance

The Final step is to recognize the student with their emotions to do so we have click on Recognition button. On clicking the recognition button, a external camera connected to the system or the inbuilt webcam of the laptop gets started to recognize the student emotion's and store the attendance.

6. CONCLUSION

The AI-Driven Classroom Monitoring System demonstrates the potential of leveraging artificial intelligence to enhance educational environments, improving classroom management and teaching efficiency. By integrating automated attendance through facial recognition, sentiment-based analysis of student feedback, and evaluation of student engagement, the system offers a holistic solution for reducing administrative workload and acquiring important insights about student's behavior and learning outcomes.

The facial recognition module minimized manual effort and reduced errors associated with traditional attendance methods. Analysis of student feedback provided instructors with immediate, actionable insights into their teaching practices and classroom dynamics. The engagement assessment component, which relies on visual and behavioral indicators, enabled real-time monitoring of attention levels and identification of disengaged students, allowing educators to intervene proactively.

Overall, the system enhanced both efficiency and accuracy in tracking classroom activities and offered a data-driven framework to support the improvement of teaching effectiveness and student learning outcomes.

7. REFERENCES

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