Project Report: AI-Powered Attendance System Using Face Recognition (21k-4585)

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1. Objective

The primary objective of this project is to design and implement a mobile-based attendance system that leverages computer vision to automate the process of identifying students and recording attendance. The system aims to minimize manual effort, prevent proxy attendance, and improve efficiency in educational institutions.

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2. Problem Statement

Manual attendance tracking is time-consuming, prone to errors, and susceptible to fraudulent practices such as proxy attendance. Conventional biometric systems are often expensive or lack real-time integration with mobile apps and databases. There is a need for an accessible, accurate, and automated solution that uses modern AI tools and integrates seamlessly with mobile platforms and cloud services.

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3. Methodology

- **Dataset**:
  The project uses a publicly available face recognition dataset from Kaggle:
  Face Recognition Dataset – Kaggle.
  The dataset contains labeled images of various individuals, organized in a folder structure suitable for training.

- **Model Training**:
  A pre-trained **ResNet-50** model was selected due to its proven performance in image classification tasks.

    - The model was fine-tuned on the dataset to adapt it for face recognition across the labeled individuals.

    - Training was conducted on Google Colab using GPU acceleration for efficient computation.

    - Model performance was validated and saved in `.pth` format for deployment.

- **Model Deployment**:
    - The trained model was converted into an API using **FastAPI**.
    - The API was hosted on **Hugging Face Spaces**, enabling easy public access and scalability.
- **Mobile Application**:
    - A mobile app was developed using **Flutter**.
    - Teachers can create and manage lectures from within the app.
    - Students use the app to capture their image via the camera.
    - The image is sent to the backend API hosted on Hugging Face for face recognition.
    - Upon successful identification, attendance is marked and stored in **Firebase Firestore**.
- **Technologies Used**:
    - Python, PyTorch, FastAPI
    - Flutter (Dart)
    - Firebase Firestore (for real-time database)
    - Hugging Face Spaces (for hosting the model API)
    - Google Colab (for training the model)

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4. Results

- The model successfully recognizes faces with high accuracy during real-world tests in the app.

- Attendance is recorded automatically in Firebase within seconds of capturing the image.
- The system significantly reduces the time and human effort needed for attendance tracking.
- Integration with Firebase enables secure and real-time data updates accessible from anywhere.

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5. References

- Kaggle Dataset: https://www.kaggle.com/datasets/vasukipatel/face-recognition-dataset/data
- ResNet-50 Paper: *Deep Residual Learning for Image Recognition* – He et al., 2015
- PyTorch Documentation: https://pytorch.org
- FastAPI Documentation: https://fastapi.tiangolo.com
- Hugging Face Spaces: https://huggingface.co/spaces
- Firebase Documentation: https://firebase.google.com/docs