Facial Recognition Attendance System

Implementation Overview

Objective

- Low-cost facial attendance system
- Works on desktop and mobile
- File-based storage (no database)

Technologies (tech stack)

Frontend

- React (PWA will be use to make it work as mobile and desktop app)
- MediaPipe Face Detection
- HTML5 Video + Canvas
- Tailwind CSS, Framer Motion (light animations)

Backend

- Python (FastAPI)
- FaceNet Recognition Model
- Cosine Distance Matching
- NumPy, OpenCV

Storage

- File system: JSON + NumPy files (I will be using numpy files because they are much more memory efficient in storing embeddings of faces)
- Employees: metadata + embeddings
- Attendance: daily JSON files

Features

Attendance

- Live face rectangle feedback (Adding this feature so that we can reduce the server cost and we do not stream the entire video to the server, Instead we will first stabilize the face on front end using lightweight face detector That will run on client side. Once the face is stabilized only one single frame will be send to server for recognition)
- Check-in / check-out
- Success / error feedback

Employee Enrollment *(Extra Feature)*

- Upload image
- Add name and ID
- Generate and save embedding

User Guidance on frontend

- Instructions for lighting, positioning, and stillness based on input image from user

User stories

Front end

- Basic user instructions to adjust the face of the user for Face detection
- Face detector will activate and will stabilize the face
- Once the face is stabilized we will send a single frame to backend

Backend Flow

- Receive captured image
- Generate FaceNet embedding
- Compare with stored embeddings (cosine distance)
- Mark attendance, Maintain records of check in and check out hours

Enrollment Flow

- Receive uploaded image
- Generate embedding
- Save metadata and embedding in files

Extra Features: (this will require additional cost on development)

- Employee enrollment section
- Crash Backup Module (See details below)

If you want to add a databackup feature we can do it also, Because since we are not using database in current case, And if the server crashes all the files off records in facial recognition data will be deleted and you will need to re-enter all the details for employees
2 ways to solve it

- Add cloud based DB (more cost every month)
- I can develop a additional module in it in which I will provide you with a structured zip file and you will just need to upload that zip file and all the data will be created again instantly

NOTE: I am assuming that we are not adding a database in keeping the cost low if we are adding a database the plan will be slightly different

Updated things for implementation as a plug and play module

Technologies (Tech Stack)

Frontend

- **React (web-first)** – runs standalone or inside CMS ✅
- **PWA** – works on desktop & mobile ✅
- MediaPipe Face Detection – client-side stabilization
- HTML5 Video + Canvas
- Tailwind CSS & Framer Motion

Backend

- **Python (FastAPI, standalone service)** – handles only face recognition ✅
- FaceNet – embedding generation
- Cosine distance – identity matching
- NumPy & OpenCV

Storage

- **File-based: JSON + NumPy files** – self-contained, plug-in/out friendly ✅
- Attendance stored in CMS, not in FR module ✅

Plug-and-play highlights ✅:

1. Web-first PWA frontend → works standalone or integrated
2. Backend is standalone → only provides identity API
3. File-based storage → independent & easy to backup/restore
4. Attendance managed by CMS → module can be enabled/disabled easily