RaEng & MPSTME TECH CHALLENGE

Team Name: **Spartans**	College: **K. J. Somaiya College of Engineering**
Topic: **Face Recognition Attendance Management System**	

PROBLEM STATEMENT:

To design and develop an efficient automated attendance monitoring and management system using feature tracking based on facial recognition.

NEED FOR PROJECT:

The traditional system for attendance tracking and monitoring involves the faculty in classroom to manually speak out roll numbers and mark students absent or present based on response. This approach, however robust, is plagued by multiple fallacies that call for a revision in the system. Some of them are:

- **Inefficient & time consuming** - The current approach takes away anything between 5-10 minutes considering a batch size of 60 students which accounts for more than 12% of the lecture duration.

- **Proxy signatures** - In a huge classroom consisting of more than 60 students, if roll calls aren't possible, attendance is usually flawed due to proxy signatures by friends of absent students. Unless the teacher verifies the attendance by checking for each student or taking roll calls, these signatures go unnoticed.

- **Lack of seriousness** - Due to above and other fallacies in manual attendance monitoring, students tend to take important lectures for granted which indirectly affects grades.

Above mentioned problems have been a part of the classroom system for long and thus, warrants a better attendance monitoring system which is efficient and time saving.

APPROACH:

The proposed solution intends to enable the professor to instantiate and complete the process of attendance monitoring with one click of a button, within a matter of seconds. It will make use of a highly efficient face recognition interface using feature tracking to uniquely identify each student. Each student will be tagged with an identifier to maintain individual records, generate reports and update records without continuous availability of Internet.

Some of the features of proposed system are:

- **Robust Facial Recognition** - It is crucial for the system to have accurate and robust facial recognition interface to avoid mismatches. The proposed solution makes use of Deep Learning based image recognition, which is highly scalable apart from boasting appreciable confidence levels on test images.

- **Completely Automated** - The proposed solution requires the professor to simply provide their login credentials and a click of a button to initiate the process. An independent camera interfaced with a computation board such as RPi instantly captures an image and uploads it to the recognition backend service. The results of classification are then updated on the cloud hosting the database of individual students.

- **Fault Tolerance** - The system is designed keeping in mind any no-match-found cases during classification. The API handles unidentified faces, if any, by generating a separate ID and asking the professor for manual validation. This ensures the attendance monitoring remains fault tolerant with little room for error.

- **No reliability on Internet** - The system's design ensures it acts appropriately in case of unavailability of Internet. The image taken by the separate camera system is sent to the

application over smartphone/laptop which is responsible for uploading the image as and when internet is available to the device running the application.

- **Effective report generation** - The end to end solution also provides for daily report generation of individual students, who are notified of their attendance in lectures at the end of day via SMS/Email. If in case a student has any grievances, he/she can inform the admin who can verify the report by checking student's presence from captured images and identifiers.

- **Backup to hardware failure** - In case of non-compliance by hardware camera, the professor can manually click a picture from his/her smartphone for processing. This ensures the system stays up and running until hardware issues are resolved.

OBJECTIVES

The following are the objectives of proposed solution:

- To develop a robust facial recognition service for attendance monitoring
- To implement fault tolerance mechanisms in case of failures
- To implement a comprehensive report generation and notification backend system
- To automate the system flow with least human interference

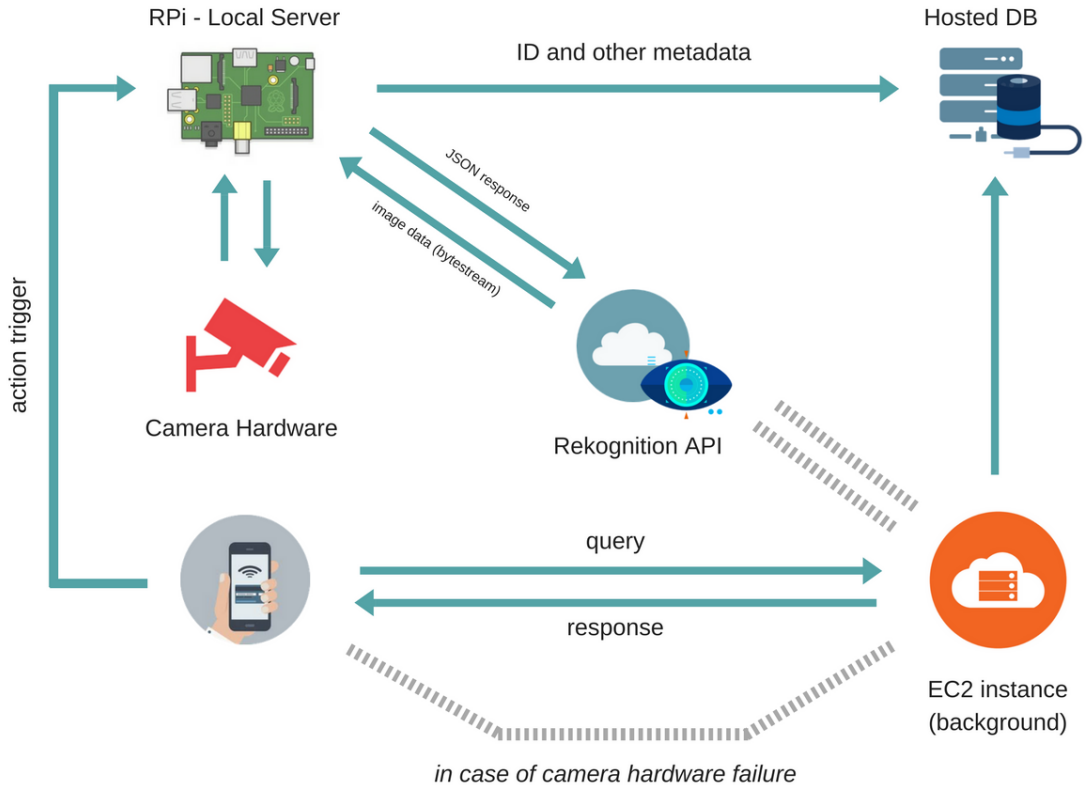
STATUS OF PRESENT SOLUTIONS (IF ANY):

As per preliminary literature survey, the solutions currently available for attendance monitoring don't employ facial recognition, and simply digitise traditional roll call process via native apps. There are some solutions that make use of facial recognition but not currently used in education centers due to various factors - cost hurdles, inefficient implementations, lack of awareness among others.

TECHNOLOGY STACK (PROPOSED):

OpenCV, C++	- Feature detection
Python	- Server (EC2) + RPi + automation scripts
Android SDK / Java	- Native app
HTML/JS/PHP	- Notification backend

ARCHITECTURE DIAGRAM AND OTHER SCHEMATICS:



DATA FLOW (Working):

1. The professor accesses the mobile app and triggers an image capture while connected to the local server (RPi) hotspot. The professor needs to be signed in (will be provided with unique credentials) before triggering the capture.

2. The trigger action is captured by the local server which instructs the camera hardware to take a photograph of entire classroom. The students must be attentive during this span of 3-4 seconds which is ensured by the professor.

3. If internet connection is available to the local server, the image is sent over to the recognition backend service for feature detection and classification. A response from this

service is captured as a JSON object by the local server.

4. The JSON response containing unique identifiers and other metadata is sent over to a hosted DB that stores all the records of attendance and provides data on request via a live EC2 instance running in the background.

5. In case internet access is not immediately available, the image is instead stored locally on the phone and sent over for classification as and when connection becomes available.

6. A notification system will also be handled by the EC2 instance that will generate daily weekly and monthly reports. Daily reports will be sent to each student notifying him of his attendance in that day's lecture. If a student was marked absent due to ill detection), this verification will allow the students to ask for a redressal to the professor who will check the image himself and verify the student's presence. He/she can be marked present from the app itself in this scenario.