Possible ideas to authenticate a single user in the app we proposed:

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Abstract

We are trying to design an attendance maintaining system which consists of server (teachers or attendance maintainer) side app and client (students or attendance giver) side app. We are trying to find some authentication system so that teachers or attendance maintainers become sure that the indented student or attendance giver is providing his/her attendance. We discuss some possible mechanisms and their disadvantages in this document.

1 Facial Recognition

This can be implemented in the following three ways in the current context:

1.1 Facial recognition through client's phone

1.1.1 Prerequisite:

A regular smart phone with medium resolution front camera for each student or attendance giver, a regular smart phone for each teacher or attendance maintainer, a protected Wi-Fi whose range is set to the classroom's range or a bluetooth device whose range is set to the classroom's range

1.1.2 Possible Implementation idea:

Now, the authentication must be performed in some server where multiple pictures of each student (attendance giver) need to be uploaded. As an example, if a particular student (attendance giver) wears glasses then some pictures of the students without wearing glasses should also be uploaded. Also, some photos also should be uploaded in different light density. Now, when a student (attendance giver) opens the app, it will ask the student (attendance giver) to take either a snap or a video (say of 5 seconds) using that app (the app will control the camera of student's or attendance giver's phone during that time). There will be no uploading option in the client side app. The whole thing needs to be represented as if the app takes either a snap or a video of the student (attendance giver). Then this video will be sent to the server. Server will recognize the student's face as well as it will perform the "liveliness test" on the sent video and based on the calculated result it will authenticate the student (attendance giver). Now, student or attendance giver's side app must be connected with the teacher or attendance maintainer side's app via bluetooth or a protected Wi-Fi (whose range is set to the classroom's range) so that attendance maintainer side app could check the existence of students or attendance givers device within the range after a certain time interval in a repetitive manner. Additional facilities should be provided to both teachers or attendance

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maintainers and students or attendance givers side app. Like: the attendance maintainer or teachers side app could fix the allowable range of arrival time as well as could manipulate the students database maintained by the server if necessary. Whereas, the attendance giver side app could see the student database maintained by the server.

1.1.3 Possible Disadvantages:

1. This recognition/authentication idea is susceptible to spoof attacks . As an example, suppose a student or an attendance giver carries another student's or attendance giver's phone and has a good resolution photo or video of the other student or attendance giver is his/her phone. Now, when the app is running on the other student or attendance giver's phone asking for that student's/attendance giver's snap or video he/she holds his/her phone displaying the picture or playing the video of the other student or attendance giver and can successfully give the attendance of the other student or attendance giver. Though, there are ways to counter it since huger research is already done on facial recognition

2. Server must be capable of handling huge load

3. High bandwidth of internet is required to support the mechanism

1.2 Facial recognition via an android phone or an android tab provided by the teacher or attendance maintainer

1.2.1 Prerequisite:

A regular smart phone or tab with medium resolution front camera (for each teacher or attendance maintainer). If additionally we want to develop students or attendance givers side app to provide some facilities to them like viewing the student database maintained by the server then each student or attendance giver must also have a regular smart phone

1.3 Possible implementation idea:

The need of developing client side (student or attendance giver) app is optional. The need of protected Wi-Fi or a bluetooth device whose range is to set to classroom's range is also optional. A tab or android phone needs to be circulated among the students or attendance givers who are present in the class. It will ask a student for taking a snap or a video (of say 5 seconds) through this app. Now, this server side app will send those pictures or videos to a centralized server (an instance of

a program running in some other machine which will perform the recognition job) and this centralized server will recognize the users. The server side (teachers or attendance maintainer) app could also set the allowable range of arrival time and check a student's attendance and manipulate the student attendance database if necessary. However, we additionally develop a student or attendance giver side's app to see the student database maintained by the server. Also,facilities like manipulating the students' or attendance givers' database must be provided to the teacher's or attendance maintainer's side app

1.3.1 Possible Disadvantages:

1. This recognition/authentication idea is susceptible to spoof attack like the last way. As an example, suppose a student or an attendance giver has medium resolution videos or pictures of other students or other attendance givers. When the app running in the android phone or tab provided by the teacher or attendance maintainer asking for snap or video he/she could simply hold his/her phone in front of the tab or android phone provided by the teacher or attendance maintainer displaying the picture or running the video of the other attendance giver and thus successfully providing the attendance of other student or attendance giver

2. Server must be capable of handling huge load as well as high bandwidth of internet must be provided to support the mechanism

3. If we want to support more end users with the app, Like: say if we want to support the attendance system of a large office with this idea, then the idea sounds really naïve

4. Even if we fix our end users as students present in some classroom, to ensure that the students are present throughout the class span the device needs to be rotated at least twice and it could really annoy students. However, this could be countered by implementing the response checking idea we mentioned earlier. But, this could only ensure that a particular student or attendance giver is present throughout the class after he/she successfully authenticate himself/herself through the app. There's no way to ensure the arrival time of a student in a particular class.

5. Any attendance giver or student can cause intentional or unintentional damage to the device which will be circulated among the students or attendance givers.

1.4   Facial recognition via a surveillance camera

1.4.1   Prerequisite

A surveillance camera per entrance of a classroom. The need of developing teacher's or attendance maintainer's side app as well as student's or attendance giver's side app is optional. We could develop a server program to do all the stuffs for us.

1.4.2   Possible implementation idea:

The surveillance camera would focus on the only entrance of a classroom (let's say, there is . It will send the live streaming video feeds to the server. Server will perform facial recognition of the attendance giver and note the attendance giver's or student's arrival time and departure time. Additionally we could build an app for the teachers or attendance maintainers to set the allowable range of arrival time and check a particular student's attendance and to manipulate the students attendance database if necessary. We could additionally also develop an app for attendance givers or students to see the students' or attendance givers' database maintained by the server.

1.4.3   Possible Disadvantages:

So far, the only notable disadvantage we can see is that it will put a huge load in the server (maximum among the three ideas so far provided)

1.5   Indoor Positioning System

1.5.1   Prerequisite

Bluetooth beacons that send out signals via Bluetooth placed in every few meters or grid of antennas placed in every few meters

1.5.2   Possible Implementation idea:

This is a technology under development. Many big tech giants Like: Google, Nokia are trying to implement it more accurately. We will discuss the basic principle of Indoor Positioning System Below:

Positioning Principle: Proximity:The proximity principle is mainly used in Radio Frequency based systems. We use a grid of antennas with fixed locations within the building. When a student carrying the mobile station is detected, the closest antenna is the one considered when calculating the object's location. If the mobile is detected by more than one antenna, the antenna that receives the strongest signal is then considered when calculating the object's location. However, we can

implement the same thing with bluetooth beacons that send out signals via Bluetooth placed in every few meters or grid of antennas placed in every few meters.

Technique for determining range:-(TDOA)

First we have to determine the relative location of a targeted transmitter by using the difference in time at which the signal emitted by a target arrives at multiple measuring units. Three fixed receivers give two time difference of arrival and thus provide an intersection point that is the estimated location of the target.

Bluetooth technology is mainly used in small-scale positioning, such as single-room or warehouse. Bluetooth indoor positioning technology of the biggest advantages is the device small and easy to integrate the mobile phones, so it is easy to popularize. However, like we said before, this is a technology under development. Like a new chip (Broadcom Chip) is under development which supports IPS through Wi-Fi, Bluetooth, and even NFC. This chip also ties in with other sensors, such as a phone's gyroscope, magnetometer, accelerometer and altimeter.

1.5.3   Possible Disadvantages:

1. Accuracy and precession could be an issue as different devices provide different results.

2. Students can register attendance from outside of classroom taking the advantage of high range of the antenna.

3. To get accuracy we need to train the system. This needs time.

2   Conclusion:

Only these given ideas could be practically implemented and less vulnerable out of which facial recognition through client's phone and facial recognition through surveillance camera seem more realistic.Also, we do not discuss the mechanism by which we can secure that the students or attendance givers are providing their attendance through the correct version of the app i.e. we do not discuss the mechanism by which we can ensure the integrity of the student or attendance giver's side app. We will discuss it in our next document.