Bilkent University

Department of Computer Engineering

Senior Design Project

Automated Attendance Taking System (AATS)

Project Specifications Report

Alba Mustafaj, Argert Boja, Ndriçim Rrapi, Rubin Daija

Supervisor: Selim Aksoy
Jury Members: Ibrahim Korpeoglu and Hamdi Dibeklioglu

October 14, 2018

This report is submitted to the Department of Computer Engineering of Bilkent University in partial fulfillment of the requirements of the Senior Design Project course CS491/2.

Contents

Project Specifications Report

Automated Attendance Taking System (AATS)

1. **Introduction**

The best way to understand a topic is by being involved in it. This is one of the main reasons why in universities participation in lectures is highly advised and sometimes even mandatory. However, occasionally student tend to skip their lectures but they still want to be counted as present, and for this they use several ways. This fact is widely known even by the professors, nevertheless, it is sometimes impossible to avoid it. Despite the alternative ways that can be used for checking whether all signatures are one-to-one, this can lead to inefficient usage of lecture time.

As we all might have experienced, the traditional way of checking for attendance is by passing a paper which contains all student names so that they can sign for themselves. This method of taking attendance is yet another reason for irregularities in this system. This is because sometimes the professors might forget to bring the attendance paper, or the students might forget to return the attendance paper. Furthermore, some students might come a few minutes late and they forget to sign the attendance.

This project aims to improve the methods of attendance taking, which will lead to less responsibilities for instructors and more accuracy for students. By using face recognition, we will be able to identify all the students present in class. Furthermore, by conducting several checks through the class hour there will be no possibility of cheating. Both students and instructors will be able to check the results on an application that will be build. Even if there is any inaccuracy, the students will be able to still be counted as present by letting their professor know that they were present in the taken picture. In this way, the new data will be collected and the system will be trained again in order to adapt to individuals changing their look.

The following sections of this report, will provide a thorough description of our project. This will be followed by all the constraints that have been identified by this phase. In addition, professional and ethical issues will be discussed in details. Furthermore, in the upcoming section, the functional and non-functional requirements will be listed. It is significant to note that a part of our design is based on the fact that this system would, if deployed, be in connection with the current university system, as such having access to different information within the university's database.

1.1 Description

At the beginning of every course, students here at our university are obligated to sign in order to prove that they have attended the course. This process involves a paper which is circulated in class. Students pass the paper to each other until all students have signed it. The professor giving the lecture is responsible for preparing the paper, handing it to the students and retrieving it at the end of the class. The paper then needs to be assessed by the professor or an assistant who will manually mark the students as present one by one and upload this information on the system. This whole process is strenuous and archaic in that it uses a paper and manual physical work from the university's staff.

Automated Attendance Taking System (AATS) aims to automate the whole process of taking attendance in class. This system will be aided cameras that will be used to take in-class attendance. The cameras will be frequently taking pictures between certain periods to ensure that the students who are attending the class are marked present. These pictures are then analyzed by using image recognition to identify the students that were present during the lecture. This information is then automatically retrieved and sent to the university's database, where the attendance data is instantly updated. The process eliminates all the hassle that the students have to go through while signing the attendance sheet but it also aids professors who might occasionally forget to deliver the attendance paper. It also eliminates the time wasted by professors or their assistants to manually upload the attendance data online.

The students and the professors will be able to get feedback on the process as a whole through a mobile application. This application will notify students when they are counted as present or absent and inform the professor about the current class attendance. The app will also allow professors to manage the attendance should there be any mistake in counting a student as absent by the system. There will be a server that will manage the computations and the data flow as well as a database system that will record the attendances.

1.2 Constraints

1.2.1 Economic Constraints

- The cameras used for the system should be as cheap as possible while allowing for a satisfactory recognition ratio.
- The app will not be published on the Google Playstore.
- Only open source libraries will be used
- For the scope of this project, a free domain and server for the website will be sufficient.

- Cables and adaptors will also be bought in order to get the information from the cameras.

1.2.2 Environmental Constraints

- A high quality camera will be needed in order to take the pictures which will be later analyzed by the program.
- The camera should be positioned in a position where no usual activity will obstruct its view.

1.2.3 Ethical Constraints

- Everything should be implemented such that it is GDPR compliant [1]
- Our application will not distribute any personal data to third parties.
- An authentication system will be required for both students and instructors.
- The cameras will also be provided with an authentication system in order to avoid fraud cameras.
- Data in server will be encrypted.

1.2.4 Sustainability Constraints

- The system should be able to learn when a student's appearance changes and update the information it uses to recognize that student.
- Regular periodic maintenance on the system needs to be operated by the organization that has deployed the system.

1.2.5 Implementation Constraints

- GitHub will be used to manage our source code and collaboration between our team members.
- Modeling languages such as UML will be used throughout the implementation
- The application will use several open-source libraries to utilize their image recognition algorithms

- The application will be implemented for Android phones as a POC (proof of concept)

1.3 Professional and Ethical Issues

Our system will constantly process data pertaining to different individuals in different instances. Therefore, pseudonymisation is required [2]. This will be provided by encryption based communication between our server, database and user application. No one will have access to the training data except the system itself. Whereas only authorized individuals will have access to the attendance data the system has. As a precautionary step, the system will take steps in processing the data such that a higher level of anonymity to the subjects can be provided. The images of classes will only be stored for a short period of time in case of an objection.

The attendance data will only be shared with the university. The students will receive a notification when the picture is being taken as well as when they are counted as present or absent. In addition to the students, the professor will receive a notification on how many students were present, however that data will not be saved locally. All these steps will be taken in order to fulfill the GDPR requirements.

The user (i.e. University) using this system has to put a system in place for students who are under 18 years old such that the guardian of the minor can provide permission for the act of taking pictures during class hours.

All the libraries that are not developed by us and will be used in this project will be open source. Depending on the way image-taking part of the system will be implemented, device authentication will be implemented to prevent hacking.

2. Requirements

2.1 Functional Requirements

- The user should always be informed when the picture is being taken by a notification.
- The user should be able to make an objection in case he was present in the class but the system marked her/him absent.
- In case of an objection, the professor as a higher authority should be able to accept or deny the objection.
- The professor should be able to view attendance statistics for his/her classes.

2.2 Non-functional Requirements

- Performance: The system should be able to process at least a picture from each class in the University within the timeframe of a lecture hour.
- Capacity: The system should be able to take a picture of the whole class.
- Confidentiality: A picture cannot be taken without firstly notifying the user.
- Accessibility: The application will use university credentials for a one time log in and is accessible by all students.
- Availability: The system shall be available to the users at any time of the day.
- Reliability: In case of a server issue and inability to process the data, the images will be stored in the database for later processing.
- Security: The communication within the systems will be encrypted. Only authorized individuals can access will have access to the data.
- Accuracy: The system should be able to identify multiple individuals with a high degree of similarity of their facial features.

3. References

[1] THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION (2016). REGULATION (EU) 2016/679 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation). Official Journal of the European Union, p.48.

[2] THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION (2016). REGULATION (EU) 2016/679 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation). Official Journal of the European Union, pp. 59-60.