



# Hacettepe University

Computer Engineering Department

## BBM479 Project Proposal Report

### Project Details

<b>Title</b>	Class Attendance With Face Recognition	
<b>Short Description</b> (max. 200 words)	This project aims to take the attendance of the students in the classroom more quick, convenient, reliable, complete way without distraction in the classroom by using artificial intelligence, machine learning, computer vision, face recognition and image processing methods and technologies.	
<b>Supervisor</b>	Nazlı İkizler Cinbiş	
<b>Technical and Scientific Difficulty</b>	( ) Easy    ( + ) Mediocre    ( ) Challenging	
<b>External Support</b>	( ) Yes    ( + ) No	
<b>If yes,</b>	<b>Type</b>	<b>Details</b>
	( ) Company Funding / Support	Company name: Amount:
	( ) TÜBİTAK Project Fund	Type: Amount:
	( ) Other Fund	Source : Amount:

### Group Members

	Full Name	Student ID
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3	Abdulkadir Alaca	21927019

### Project Summary ( / 20 Points)

Explain the project in summary, including your motivation to do the project, your solution plan in short and your expected outcome and impact. You have to summarize your project between 200-500 words

The project that we are planning to do is taking attendance with an AI application. We are going to use artificial intelligence, machine learning, face recognition and image processing methods and technologies for this project. First, our system is going to detect the faces of the people in the classroom from the snapshots taken inside the classroom. Then, our system will recognize the owner of each face by passing the detected faces through the neural network trained with the faces of the students who took the course. Each student whose face was detected will be marked in the attendance list of the class. Each class's attendance list and traigned neural network will be kept in a database. And also, instructors can access the attendance list of class with a web interface. Instructors can view updated attendance lists and labeled snapshots with people's faces tagged.

With this project, we are aiming to take attendance in a convenient way. Taking attendance distracts the class and takes away their focus from the lecture. It also takes a lot of time. Sometimes the attendance sheet can be lost or damaged. Moreover, there may be some fraudulent situations, such as some students signing the attendance paper for other students. We wanted to develop an application that avoids these problems. With a simple camera, lecturers can take attendance easily and correctly.

For the deep learning, computer vision and training part of the project, we will be using the Python programming language since it is the best option for this project. For the model training part of our project, we would be using our own dataset.

Our goal is developing a web application that lecturers can take attendance by taking a snapshot from a camera and taking attendance without spending time, interrupting the lecture and cheating.

### **Problem Definition and Literature Review ( / 20 Points)**

Define your problem as clearly as possible. Explain your inputs, your context, your outputs and your limitations. Try to use a scientific language as much as possible. Where necessary use citations to existing literature to create context and clarify the problem. Equations, flow charts, etc. are welcome.

Many things in our life are refreshed and updated according to developing technology but attendance checks have not changed for years. We are still using a paper with class list on it and signing it one by one. That paper travels the whole class and each movement of paper destroys the focus of the whole students in class and also lecturer's. Travel of the attendance paper takes almost 15 minutes. It is too long if we know the duration of a lecture is 50 minutes. We are computer engineering students and most of the time half of us do not carry a pen. They need to request a pen from the person that is sitting in the next chair. It disrupts the focus one more time. Since it is very difficult to follow the attendance list at the same time while following the lesson, some students may miss their turn to sign the attendance list. Some students use mock signs for their friends who do not attend the lesson. Absence of evidence documented by snapshots taken from the classroom in case of any confusion or objection regarding the attendance list. According to these problems, we decided to create a system that checks the attendance of class automatically with a camera and artificial intelligence.

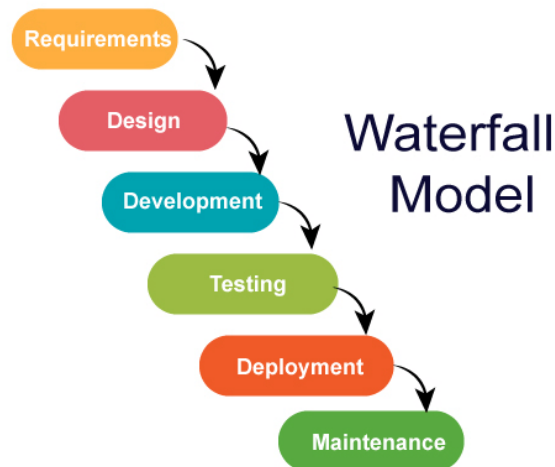
There are two different inputs for our system. The first of these consists of photographs taken from at least five different angles of students who take the course and we use them in order to train our artificial neural network model. Other inputs are snapshots taken from the classrooms during the lesson and the faces detected from these snapshots. Output of the system is an updated attendance list and labeled snapshots with people's faces tagged.

In terms of limitations, although taking attendance with snapshots taken every 5 minutes during the lesson will be more guaranteed in terms of the accuracy of the system, we cannot do this due to laws such as KVKK. In addition, the size of the dataset is limited by the number of our friends who intend to help us during the project and give us their photographs taken from different angles.

## Solution Plan ( / 20 Points)

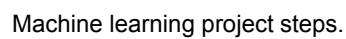
Explain the potential paths to solution. You should propose at least one solid plan to attack the problem. Dissect your plan into steps and clearly identify the inputs and outputs of each step. You are not expected to provide the technical details of each step. Provide a weekly timeline/Gantt chart displaying the relevant weeks for each step.

We are planning to solve the problems with the waterfall approach. In "The Waterfall" approach, the whole process of software development is divided into separate phases. In this Waterfall model, typically, the outcome of one phase acts as the input for the next phase sequentially.

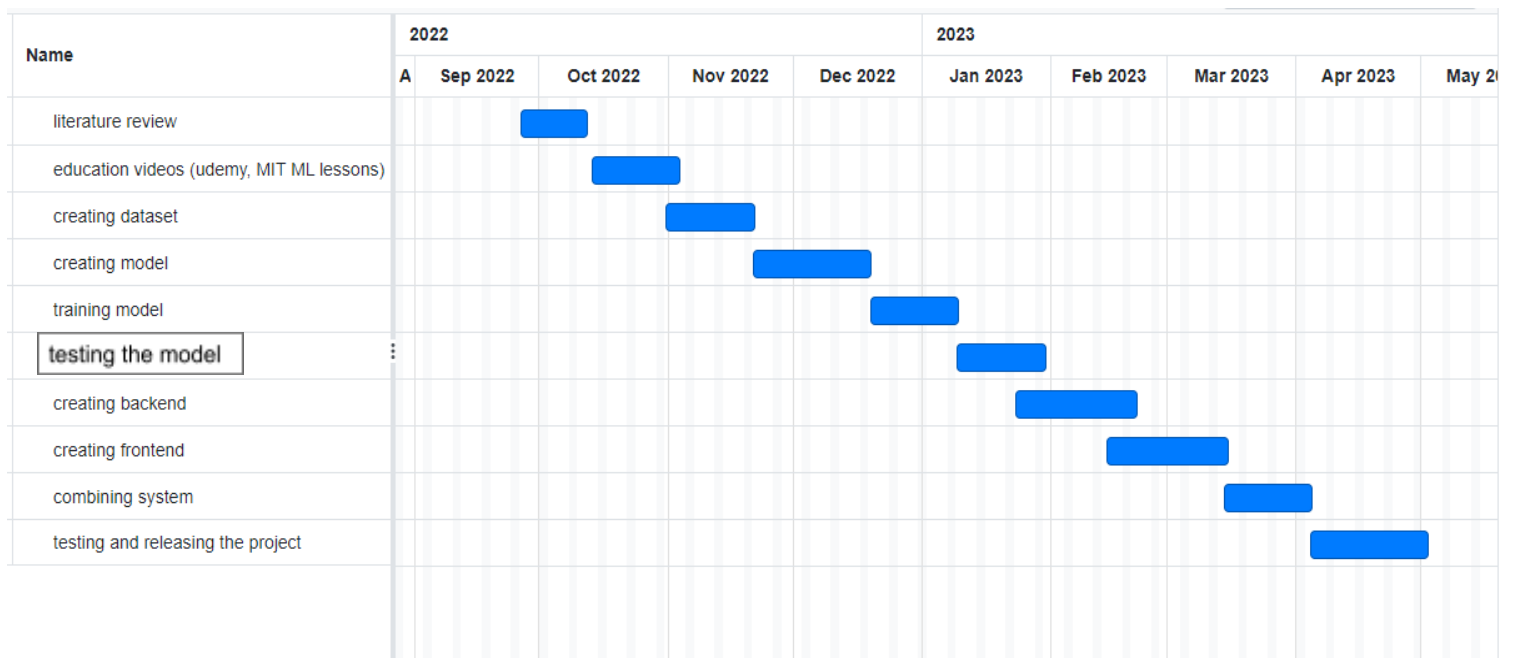


First of all, we are planning to work on the "Machine Learning" part of the project. We will try to gather as many datasets as we can. We are going to request our friends to be a part of our dataset for model training. We will get permission from our friends to take their pictures from at least five different angles. Then these pictures will be used to train our model.

We are planning to use the Python programming language and libraries of the Python language such as OpenCV, Numpy, Matplotlib and Pandas. We are planning to use "Colab" as editor because we can run code snippets separately, work comfortably on the same project as a team, and provide us with useful GPU access. On the back-end side, we are going to use Java language to make wifi communication and database connection with Spring Framework. For the front-end, React.js will be used.



Weekly timeline of the project (Gantt Chart):



## Methodology ( / 20 Points)

Explain the methodology you will use in each of the steps you have described under your solution plan. Here, you are expected to give more technical details about each solution step. Also explain how each member of the project will contribute by assigning members to steps. If you are assigning more than one member to a step, explain their specific role and how the work will be divided among them.

Working steps of the final system:

Step1 : A few snapshots will be taken from the classroom with a request from the interface by the instructor.

Step 2 : Trying to recognize and extract faces from these snapshots.

Step 3 : These faces will be passed forward into the model in database in order to guess the owners of faces.

Step 4 : According to predictions of our model, attendance situations of the owner's faces will be updated in the database attendance list.

Step 5 : Our system will label a snapshot with names of students next to each student's face.

Step 6 : Instructor can check labeled snapshots and attendance list of class.

In the section called "Solution Plan", we mention our solution plan, the technologies we plan to use, and our weekly plans. In this section, we will explain them, and clarify how to distribute the tasks among us.

Steps on the way to a solution of the attendance taking problem:

Step 1) Literature Review : We used "ResearchGate" and "Google Scholar" to search related topics. We read some articles about the works of other people who worked on the same topic with. -Pelin Fildiş, Abdulkadir Alaca, Enes Taha Elmaci

Step 2) Education Videos : We are following an Udemy machine learning course and Stanford computer vision lessons. -Pelin Fildiş, Abdulkadir Alaca, Enes Taha Elmaci

Step 3) Creating Dataset : We will get permission from at least ten of our friends to take their pictures from at least five different angles. Then we will request all of them to sit in the classroom as if they are in the real lesson and we will take photographs of the classroom. Finally, we will ask them to change the sitting configuration and position of their faces, then we will take photographs again. Photos of people will be used to train our model which will be used to predict people. -Pelin Fildiş, Abdulkadir Alaca, Enes Taha Elmaci

Step 4) Creating Model : We will create an artificial neural network. It will contain convolutional and normalization layers with a fully connected layer. It will have activation functions. We may utilize some well-known neural network architectures such as ResNet or VGG. -Pelin Fildiş, Abdulkadir Alaca

Step 5) Training Model : We are planning to pass forward our friend's pictures to our model in order to train the model. After some number of epochs the error rate will start to decrease. For

testing the face recognition part and the model accuracy, we will use the classroom pictures. We will give the pictures to the system and it will give us names of our friends that exist in the classroom picture. -Enes Taha Elmaci

Step 6) Testing The Model : We will take as many snapshots as we can with our friends in the classroom. For example different configurations of people sitting in the classroom with different sitting plans or we may ask them to change their hair styles (we can ask someone with long hair to comb their hair) for each snapshot. And then, we will use these snapshots to test the model. -Abdulkadir Alaca, Enes Taha Elmaci

Step 7) Creating Backend : We will store snapshots and the model in the database. Storage location of the model can be changed according to hardware we would use. To connect the database, we will have a backend service. We are planning to use the Java language and Spring Framework for the backend of the project. -Abdulkadir Alaca

Step 8) Creating Frontend : We will create a web interface so instructors can control the system. Instructors can check the attendance list, see the labeled snapshot, update attendance list manually and much more features. -Pelin Fildiş, Enes Taha Elmaci

Step 9) Combining The System : We will combine all parts of the project such as model, backend and frontend. -Pelin Fildiş

Step 10) Testing and Releasing The Project : We will test the combined project. Before this step each unit would be tested by unit test. After combining we will test them about how they work together. -Pelin Fildiş, Abdulkadir Alaca, Enes Taha Elmaci

In addition, all three of us contribute equally to write the documents, documentation and reports that we need to write during the design project.

## Outcome and Impact ( / 20 Points)

Explain the expected outcome of your project. If it is a software product, try to include example screen designs, if it is a hardware product, try to provide detailed technical specifications, if it is research output try to explain the outcome's contribution to the field. Also, explain the potential impacts of your results. These may be how the result will be used in real life, how it will change an existing process, or where it will be published, etc.

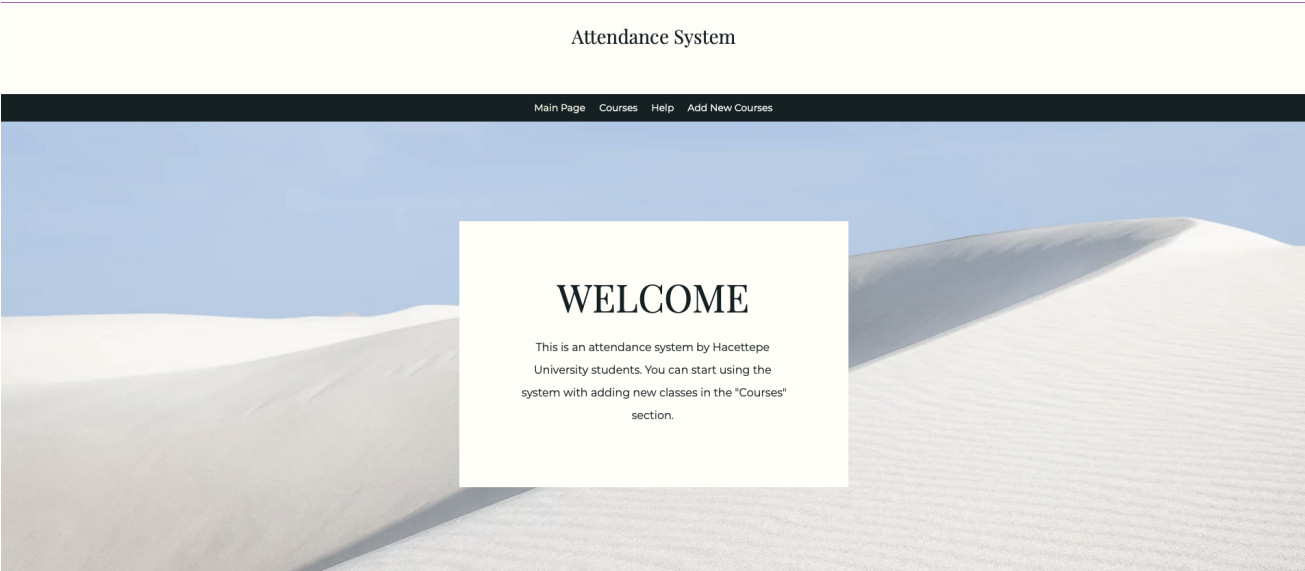
For the web frontend, we are planning to do an interface with React.js that users can see the snapshots that belong to each lesson with labeled names on it. Users can trigger the camera to take a few snapshots of the classroom and the system starts the taking attendance by sending these snapshots to the our model that is stored in the database. There are several features in this web application. There would be a button that opens a pop up screen that lists the students and their attendance list of the classes. The classes can be edited. Students can be added and can be removed. In addition, there would be snapshots that are taken weekly and users can reach them. Users that have instructor authorization can add new classes or delete the closed courses.

The project can also be expanded with adding new gestures, features and interfaces throughout the time period of the project itself. Moreover, the error rate can be decreased with more dataset that we would claim. We will be using volunteers that give us permission to use their photos in the project.

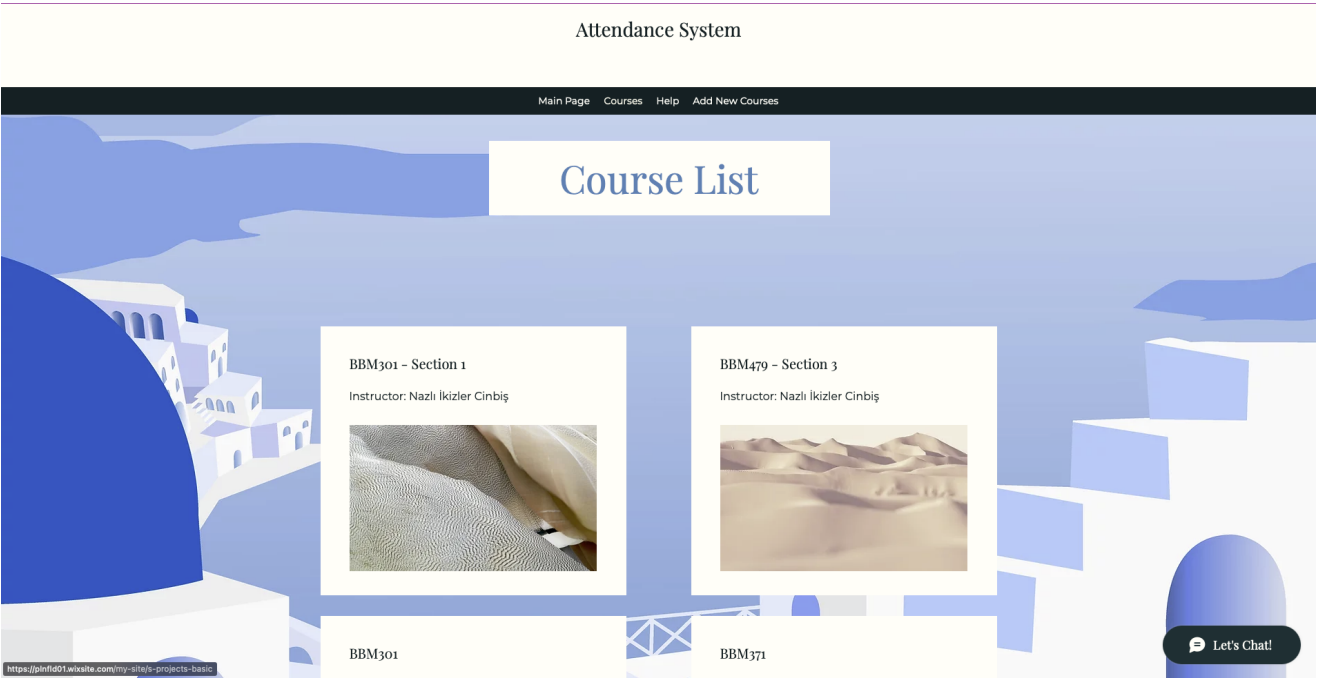
In real-life, we aim to see our application to be used by the schools. With the help of this application instructors and students keep focused on the lecture. So many instructors have difficulties while taking attendance. For example, They complain about fake signatures signed by another person. We believe that our application solves those problems and makes the lectures more efficient.

Following screenshots are not final designs. we put the here to improve your imagination about project.





Sample Main Page



Sample Course List Page

## Attendance System

[Main Page](#) [Courses](#) [Help](#) [Add New Courses](#)

### Bize Ulaşın

Hacettepe University

attendanceSystem123@gmail.com

123-456-7890

Name \*

E-Mail \*

Phone Number

Subject

Detailed Explanation

Send

## Sample Help Page