**ÇANKAYA UNIVERSITY**
**FACULTY OF ENGINEERING**
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**Project Report**
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**Cankaya Mobile App**

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## Abstract

Due to the development of technology day by day and the digitalization of our world, many old-fashioned works done with human power in many fields can now be done faster and more easily by computers. We have chosen the mobile application project that we aim to prepare for our school, taking this matter into consideration.

At our school, attendance is taken by signing the signature paper. After finding the idea that attendance can be taken with QR technology instead, we saw that this is possible because of our literature research. In this way, we think that the attendance process will be faster and more hygienic without causing paper waste. Another issue is about the identity check of the students while the school buses enter the school. This process is done by the security guards entering the services and having each student's identity read to the device with the device in their hands. For shuttles that arrive at school at almost the same time each morning, this process takes too long due to the lack of devices and security guards. To minimize this waste of time, we aim to provide identity control by using QR technology within the services. Finally, we aim to ensure that the course evaluation questionnaires distributed before the final exams are filled through our application. In this way, we want to prevent the waste of paper and the loss of time caused by entering these surveys into the system.

## Özet:

Teknolojinin her geçen gün gelişmesi ve dünyamızın dijitalleşmesi nedeniyle birçok alanda insan gücü ile yapılan eski usul birçok iş artık bilgisayarlar sayesinde daha hızlı ve kolay bir şekilde yapılabilmektedir. Biz de okulumuz için hazırlamayı hedeflediğimiz mobil uygulama projesini bu konuyu dikkate alarak seçtik.

Okulumuzda yoklama imza kâğıdı imzalanarak alınmaktadır. Bunun yerine QR teknolojisi ile yoklama alınabileceği fikrini bulduktan sonra literatür araştırmamız sayesinde bunun mümkün olduğunu gördük. Bu sayede yoklama sürecinin kağıt israfına yol açmadan daha hızlı ve daha hijyenik olacağını düşünüyoruz. Bir diğer konu da okul servislerinin okula girişlerinde öğrencilerin kimlik kontrolü yapmasıyla ilgili. Bu işlem güvenlik görevlilerinin servislere girerek her öğrencinin kimliğini elindeki cihaza okutmasıyla yapılır. Her sabah okula hemen hemen aynı saatte gelen servislerde, cihaz ve güvenlik görevlisi eksikliğinden dolayı bu süreç çok uzun sürüyor. Bu zaman kaybını en aza indirmek için hizmetler içerisinde QR

teknolojisini kullanarak kimlik kontrolü sağlamayı hedefliyoruz. Son olarak final sınavları öncesi dağıtılan ders değerlendirme anketlerinin uygulamamız üzerinden doldurulmasını amaçlıyoruz. Bu sayede kağıt israfının ve bu anketlerin sisteme girilmesinden kaynaklanan zaman kaybının önüne geçmek istiyoruz.

# 1.   Introduction

## 1.1  Problem Statement

- One of the purposes of creating the Cankaya University Mobile Application is to overcome the difficulty of taking attendance in lessons, which we frequently encounter. Sometimes there are people who cannot sign because the signature paper is circulated incorrectly. Sometimes the lecturer forgets to give the signature paper and even though the lecture is over, lecturer and students has to wait in the classroom for a long time to sign it. In addition to such problems, it is a time-consuming process in general, and the paper and common pens that touch everyone's hand can pose a threat in terms of hygiene.
- There may be very long waiting times for the identity checks of the passengers when school buses enter the school. These checks are carried out by the security guards entering the shuttles in order, and by reading the passenger ID cards to the devices in their hands. This process can cause students and lecturers to be late for classes in the morning hours.
- The last problem is the course evaluation surveys used for complaints and suggestions about lessons and school. These questionnaires are distributed by the lecturers to the students just before the final exams. This may cause students who experience exam stress to be distracted, be more stressed and not be able to fill out the questionnaire correctly. In addition, the lecturers' processing of the questionnaires into the system causes a waste of time for them and causes a lot of paper wastage.

## 1.2  Solution Statement

Our application aims to digitize the attendance process, preventing paper waste, reducing the possibility of forgery in documents for QR Attendance; minimizing the queue that occurs during identity checks at school entrances for QR ID Check; minimize the use of paper and the loss of time in the process of entering the questionnaires into the system for Online Course Evaluation Questionnaires.

## 2. Literature Review

## 2.1 Literature of QR Technology

This study aims to summarize the QR technology research literature that relates to mobile app technologies and QR Attendance. We considered research that directly addresses the QR Attendance in the developing world after gaining general information about QR Technology. Our criteria for including a paper require that it touch previous studies related to our project subject and the technologies we aim to use. As technology develops rapidly, we chose to review the recently shared ones while researching articles.

### 2.1.1. Methodology

This study aims to summarize the QR technology research literature that relates to mobile app technologies and QR Attendance. We considered research that directly addresses the QR Attendance in the developing world after gaining general information about QR Technology. Our criteria for including a paper require that it touch previous studies related to our project subject and the technologies we aim to use. As technology develops rapidly, we chose to review the recently shared ones while researching articles.

### 2.1.2. Topic Areas Studied

We searched for the best publications and projects among mobile applications related to attendance, including human-mobile application interaction, mobile computing, and current technologies, where people attendance and people's attendance is tracked.

As expected, many different technologies and software languages have been used in previous or ongoing projects, and there are or are being made many applications offered to the user with different interfaces. We think that the reason for this may be Covid-19 as well as the digitalizing world. Because it may not be very hygienic for a whole class to pass the same paper in their hands. On the other hand, there is no software language, technology, and direct student-teacher oriented application existing similar to what we intend to do.

## 2.2 Main Findings

When searching for studies with a focus on QR attendance, our overall impression is that the existing mobile app is sparse.

When we examine many projects and articles, we see that many technologies (Fingerprint, voice recognition, face recognition, QR reading, etc.) and many software languages and software frameworks (JavaScript, Java, Python, etc.) have been used from the old to the new. However, these remained as a rather incomplete, unsustainable, or useless project. Universiti Teknologi Petronas (UTP) [9] and Multimedia University [10] in Malaysia, used the absentee tracking technology with this QR code. It is not difficult to foresee that over time, most universities will have their own application and that online attendance will be tracked through that application. Over time, not only universities but also businesses will want to use it for the entry-exit tracking of their employees. Let's look at the projects we found in general:

One of the projects developed a project on the Android system, not for iOS [1]. If the user requests it, the program can output the barcode or QR code it reads as an XLS or CSV document after saving it to the database and storing it. The database of choice is SQLite. GPS was added to another project that is similar to this idea but done differently [3]. Some projects employ various databases, including MySQL [4].

An application that runs on iOS and Android was created for a different purpose [2]. The technological stack includes MongoDB with NoSQL, which handles high-performance data logging and adaptable data modeling for the database. With Angular's Single Page Program (SPA), which breaks the application into pieces and makes it reusable, it has a modular structure that makes it simple and quick to construct applications using third-party frameworks. Additionally, it makes use of Node.js, a JavaScript-compatible platform that facilitates upgrades. React Native, a cross-platform language, is used by mobile apps to offer quick testing, a superior user experience, and interoperability with the JavaScript back-end. A Node.js server is used to implement Create, Read, Update, and Delete operations on cloud databases together with MongoDB and Angular for the web interface. The application runs on "localhost" and has Angular, which offers the user interface for participants. A Node.js server supports network operations, attendance tracking, and data transmission. The Node.js server that accepts the incoming attendance requests is contained in the app, which is operated by the local IP address of the attendance network (for instance, 192.168.1.2). An alternative React Native application with facial recognition is also available if the participant's device does not enable biometric recognition.

On the internet, there are just apps created for iOS [5]. The database was MySQL DBMS, while PHP was utilized as the programming language. To gather all the technology employed throughout this Attendance generally:

### 2.2.1  Fingerprint Recognition Based

The majority of studies have shown that fingerprint or hand gesture recognition is an excellent technique for an attendance management system. Automated fingerprint recognition is the process of digitally matching one or more unknown fingerprints to a group of known and unknown fingerprints in the database. Mohamed and Raghu [6] described a specific finger assumption tool that is a part of a unique finger impression attendance architecture. By pressing their fingertips on the sensor of the gadget, the students may assess their essence. However, this approach is unworkable since fingerprint scanners can't always successfully detect things the first time. An attendance system using smartphone GPS and fingerprint technology was described by Soewito et al. [8]. Due to the usage of fingerprint recognition, the process is time-consuming.

### 2.2.2  GPS-based Attendance System

With the use of the Global Positioning System, or GPS, we can locate and navigate to anybody at any time, anywhere on Earth. The ability to locate folks and go to different locations is still something that people Satellites currently make use of the objects in the sky that Bawar Ali Abdalkarim and Devrim Akgün, A Literature Review on Smart Attendance Systems, ICAENS 2022, Konya, Turkey 1570 needed. A unique location-based time and attendance tracking system that was implemented on an Android mobile app was provided by Kumar and Kumar [11] in their work. Utilizing smartphones lessens the requirement for additional biometric scanning apparatus. A particular location is one of the organization's components that may be located using GPS. Each student's position is known by the GPS on their phones, and these locations are essential for some time and attendance tracking.

### 2.2.3  Barcode / QR code Based

A related barcode is a pictorial representation of information that machines can read about the object. Similar to a barcode is a rapid response code, sometimes called a QR code. However, due to its two-dimensionality, it can store information in each of the two perpendicular

directions. A QR code may thus hold several times more data than a barcode. Noor et al. [12] presented the topic of discussing a system for automatically recording student attendance. Each user in this system has an individual ID with a barcode that the mobile app may scan. Each user in this system has a unique ID that can be scanned by the mobile app since it contains a barcode. This method had the disadvantage that a single student might manipulate it by utilizing the IDs of the other participants in the arrangement.

A different strategy relies on obtaining attendance information and updating data in one place. The recommended approach is a smart attendance system that would accelerate the attendance process by making and scanning QR codes, and it is based on research by Sutar et al. [13]. It was developed using QR code technology. The system is based on QR Technology and operates as an application on mobile devices. Sunaryono et al. also recommend "an Android-based course attendance system employing facial recognition" to guarantee student participation in the course. [14]. The course information is displayed from the front of the class via a QR code. Just a selfie of their face and the display of a QR code are needed from the student's phone. In order to manage attendance, the server will then get the photo.

### 2.2.4 Face Recognition Based

Face detection is the concept of identifying human faces in cited images or movies. A face recognition system is a form of technology that can assess the likeness of a person's face in a video or photo against a database of both recognized and unrecognised faces. Smitha created the Face, Recognition-based Attendance Management System to provide a structured classroom attendance system utilizing face recognition techniques [18]. The technology has the ability to track engagement using face ID. It locates faces using a camera, after which it recognizes them. Face detection and facial recognition are the two components of the system. The system will detect student faces in the livestreamed video from the class using the Local Binary Pattern Histogram (LBPH), and if the identified face is located in the database, the system will register the student's attendance.

Varadharajan et alarticle .'s also included face recognition technologies. They used this method to take images by placing a camera inside the classroom. After faces are located and recognized in the database, the attendance is recorded as a present. If a student's attendance is recorded as absent, parents are notified of their child's disappearance [21].

The study by Chandramouli et al. [17], in which they used NVIDIA's Jetson Nano, is one of several that aims to update time management guidelines as well as how attendance is controlled in a particular way. The gadget is placed in the classroom, where it displays the pupils' names and pictures. The photographs are obtained through Open CV. The developer kit for the NVIDIA Jetson Nano would be the CPU board. Once the extraction has been processed, faces are identified using a Haar classifier. The LBPH Algorithm was then used to help them identify. Data from the relevant class instructor is created and updated hourly in an Excel file.

In order to improve the effectiveness of face identification techniques, Ofualagba et al. [25] proposed a system called Automated Student Attendance Management System Using Face Recognition that emphasizes the usage of Cloud Computing (CC) technical ideas. The FACECUBE system, which is proposed here, takes attendance using face recognition. Online features are available to administrators, teachers, and students through the system. But assembling this system requires a number of steps, including buying new gear and software.

A somewhat different kind of study project involving the Android device-based facial recognition of lecturers present in the application system was undertaken by Susanto et al. [15]. In order to obtain information about the presence of lecturers who are instructing, they link with facial recognition detection and then store it to the database. The facial recognition system is evaluated using the local binary pattern histogram (LBPH) classifier technique, which might be employed as a tactic in the attendance system of lecturers to be more effective and efficient.

The Hava et al. [22] study offered an open-source, generic application for evaluating daily attendance using facial recognition and utilizing the Android system. Almost all institutions may easily obtain it for free. Google Sheets are automatically produced and made accessible to the institution using this proposed fix. To identify specific pupils and track their involvement, the system uses face identification and recognition algorithms.

Prangchumpol notes in his study, "Face Recognition for Attendance Management System Using Multiple Sensors," [16] that he is still unable to validate or correct the data when an error happens in class, and that his performance still falls short when it comes to reliably identifying students' faces. He therefore aims to increase the effectiveness of the attendant system based on facial recognition and simplify its concepts for pupils. With the help of the

Android Face Recognition with Deep Learning method, this kind of validation seeks to learn how to recognize faces. Cloud storage is used to connect the database to the web server.

Three important problems were addressed by the methods Alburaiki et al. [19] developed: Initially, utilizing the cameras on mobile phones and automatically identifying and evaluating faces. The second is a facial recognition API that is based on machine learning. Maps API is the last. The results show that face recognition has advanced to great accuracy in recognizing students' faces even in challenging circumstances. By recording a student's attendance after recognizing their face and location, the system provided real-world instances of replies. The lecturer also had the opportunity to view a report of recorded attendance.

Salac's study [23] was motivated by a portable attendance system that could be accessed at any time and from any location. The professor may simply check attendance using an Android smartphone instead than hauling paper and computers. The students may easily check their attendance data thanks to their Android phones. Additionally, SMS technology is used to maintain student security and inform parents of their children's attendance. A valid attendance record may also be created using face recognition technology. Using the Android device's camera, a specific student's face is recognized and noted as being present in the database. Attendance reports might also be created if needed.

### 2.2.5  Android-Based Authorized ID and Password

Android OS was primarily created for touch-screen mobile devices. It is built on top of other open-source software and a significantly modified version of the Linux kernel. Every time you use an Android-based smartphone and access an application or website, you can be asked to sign up or sign in. Usually, you can request a login and password creation. Some users may register their accounts now that this process is so well-liked without paying attention to their password because it has essentially become a routine. Unfortunately, there is a lot of risk if a user chooses subpar credentials. An sophisticated Android-based attendance system was created and implemented by Hameed (20). The system offers a quicker, more convenient, and affordable way to measure online student attendance since it automatically generates attendance data. The admin account, which can log in and alter the database, the instructor account, which may designate students as present, and the reporter account, which can check attendance records and report all responsibilities, are the three features of the attendance system.

According to Islam et al. [24] study, the course teacher will be able to easily collect attendance using phones running the Android OS, which has been built to save attendance both on the device and servers, as well as to verify statistics and print a paper version. With the use of the recorded data, their system can track attendance, flag intruders for entry, compute attendance percentages, and send emails and text messages to parents to keep them updated on their child's enrollment at the institution. The suggested technology would make it possible to access the internet at any time and from any location, which might be quite beneficial for teachers who need to keep track of their students' attendance.

Kumbhar et al. [26] created an attendance management solution to handle problems with Android-based device attendance. To access the system, both students and teachers must install APKs on their smartphones. Additionally, they received a special ID and password. The application must be filled out by students and their parents. After the lecturer starts the software and it is ready to be used for monitoring attendance, the student may log their attendance with only one click. For lecturers, attendance data are accessible both weekly and monthly. Each month, parents receive an SMS with information regarding their child's attendance.

## 2.2.6 Android-Based RFID

RFID is sometimes referred to be a simpler variation of NFC (near field communication), a technology that many Android smartphones use to facilitate digital payments. Souza et al. [27] examine a variety of frameworks proposed for board participation utilizing various modifications. In light of this debate, the board is urged to employ a different method of participation designed expressly for institutions of a lower tier. The suggested approach has elements for RFID and mobile applications. It is advised to use the RFID component to record student interaction in the database at the back end. Information on their attendance will be sent to their family in the application phase. The application component is used as a fallback to track attendance when there is no electricity or not enough resources to send by the RFID component.

## 2.3 Challenge Areas in QR Code Technology

- Open Research Challenges: Since QR codes are not human-readable, users must first decode them in order to determine whether the content may be trusted. Users still struggle to determine how trustworthy a URL is once it has been decoded.
- Security Awareness Challenges: The most popular QR code readers for Android have been examined, and it was discovered that the majority of them do not effectively recognize phishing attempts.

1. Phishing: In a barcode phishing attack, the attacker tries to obtain private information from a user, such as their login information and credit card number, by encoding a malicious Web address inside the barcode that directs them to a fake Web page, typically a login Web page, that strongly resembles the real one.
2. Malware propagation: This is usually accomplished via an exploit kit, which analyzes the device's fingerprints to choose the optimal exploit and malware.
3. Barcode tampering and counterfeiting: Since 2D barcodes are frequently used in advertising and e-commerce to identify specific product information or to carry out the purchasing procedure, an attacker can profit from the company's good name by pasting phony 2D barcodes on the genuine posters.
4. Reader applications attacks: Many 2D barcode scanner programs ask users for full access to their smartphone's location, contact list, and photo gallery during the installation process. An attacker may be able to get sensitive user information if a reader application has a bug that can be used by a specifically created barcode.

In addition to all these mentioned problems, as a security vulnerability a student in the classroom can share the QR code used for attendance with an absent student, causing problems in QR attendance system.

## 2.4 Conclusion

As we mentioned in Section 3, many different projects can be done with many different technologies and many software languages. It is a bit difficult to see a project that has just come into effect, there are not many examples apart from a few examples. There may be more than one reason for this; The financial situation in the project, the opportunities provided, the companies-institutions-people that support the project, etc. But we know that the more

technology is used in this project, the more money, the more time, and the more problems there will be. It has always been a better choice to provide a solution to the user with the simplest and most effective way, such as a QR code.

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# 3. Software Requirements Specification

## 3.1 Introduction

### 3.1.1 Purpose

The purpose of this document is describing the mobile application whis is called Cankaya Mobile App: An application developed for Çankaya University which has several functions such as QR Attendance, QR Id Check for school buses and Online Course Evaluation Questionnaires. This application aims to digitizing the attendance process, preventing paper waste, reducing the possibility of forgery in documents for QR Attendance; minimizing the queue that occurs during identity checks at school entrances for QR ID Check; minimize the use of paper and the loss of time in the process of entering the questionnaires into the system for Online Course Evaluation Questionnaires. The project's requirements are covered in full in this paper. It represents the suggested software functionalities and the recognized restrictions. The SRS document also describes how users interact with the program. This paper outlines the steps taken to address the stakeholders' concerns.

### 3.1.2 Scope of Project

QR code started to play a big role in our daily life. With the Cankaya University Mobile Application, we aim to take advantage of the fast and easy process opportunities provided by the QR code. Quick Response, QR code in short, is a special code encoded with black dots in a white square background. The location and shape of these black dots in the white square background allows encoding of different information.

The main purpose of creating the Cankaya University Mobile application is to overcome the difficulty of taking attendance in lessons, which we frequently encounter, and to eliminate problems such as long shuttle queues at school entrances. When we addressed all these problems, we realized that the solution could be solved with QR codes, which are used frequently today. Another feature of our application is the questionnaires used for complaints and suggestions about lessons and school.

The only thing required to use the ID Check, QR Attendance, which are solved with the QR code, and the Course Evaluation Questionnaire features will be for the users to have a smartphone with a camera.

### 3.1.3   Glossary

**Table 1 Glossary of SRS**

| Term | Definition |
|---|---|
| QR | It is a kind of barcode that a digital device can read quickly and that contains data as a grid of square-shaped pixels. |
| iOS | It is an operating system used for mobile devices manufactured by Apple Inc. |
| Android | It is an open-source mobile operating system based on a modified Linux kernel that is particularly intended for touchscreen mobile devices like smartphones and tablets. |

## 3.2  Overall Description

### 3.2.1   Product Perspective

Cankaya Mobile App is a mobile application which is intended to operate on iOS and Android operating systems, containing QR Attendance, QR Id Check for school buses and Online Course Evaluation Questionnaires.

The application has two different interfaces prepared for lecturers and students. When the lecturers open the application, the courses they are giving that semester will be displayed on the screen, and the course content will have options to create a QR code for taking attendance, view past attendance information and export the attendance. When lecturers want to take attendance; they will have two options: before or during the class, they can choose the course they will take and create a QR code, then print the code and take it to the class, or by clicking on the e-mail option, sending the QR code to their e-mail address and project the code on the projection screen in the classroom, they can take attendance. Leturers can view their attendance history on the screen. They can also export the selected attendance record to a Word file. Another feature that lecturers will display will be QR Id check, which is for identity checks when boarding school buses.The interface of the QR Bus feature will be the same for students and lecturers. When this option is clicked, the camera will open and the QR code at the entrance of the services will be scanned while boarding the service, and the driver will control the screen. If the person is verified to be from the school, a green message will appear on the screen, and if not verified, a red warning will appear. The driver will control it.

The last feature is for the lecturers is to create and activate the course evaluation questionnaires. They can prepare course evaluation questionnaires via app and activate them whenever they want.

When students open the application, they will see QR Attendance and Id Check options for school buses. When the selection is made for both features, the camera will open. The QR Bus interface was explained in the previous paragraph. For QR Attendance, students will scan the QR Code and close the application. Students will be able to see the course evaluation survey only when the instructors activate it. They will not be able to perform any other action on the application without completing these surveys.

### 3.2.2 Development Methodology

We aim to develop our project with the agile project management method. This method is basically based on "iteration" and its main purpose is to increase efficiency in projects. Agile project management models are used in projects whose details are not clear at the initial stage. The desired project is completed by bringing together small and working parts. Each iteration goes through the stages of analysis, design, coding, testing, user feedback and evaluation. In this way, sudden changes can be organized quickly. At the same time, after each completed iteration, the product is given feedback by the customer and the process continues.[1] We thought that this method would be the most suitable for us, since there is a possibility that there will be changes in our project over time, and our project consultant, whom we can see as a customer, evaluates the point we have reached in the meetings we hold every week and gives feedback.

## 3.3 User Characteristic

### 3.3.1 Participants

- Participant must be an active student or employee (janitor etc.) of Cankaya University.
- Participant must have a Smartphone.
- Participant must have an Internet.

### 3.3.2 Admin

- Admin must be a lecturer of Cankaya University.
- Admin must have a Smartphone.
- Admin must have an Internet.

## 3.4  Requirements Specification

### 3.4.1  External Interface Requirements

#### 3.4.1.1  User interfaces

The user interface will be worked on iOS and Android smartphones.

#### 3.4.1.2  Hardware interfaces

For using CankayaMobileApp, requires smartphone which have camera for using QR Technology.

#### 3.4.1.3  Software interfaces

Survey templates will be used for the surveys to be created.

#### 3.4.1.4  Communications interfaces

There are no external communications interface requirements

## 3.5  Functional Requirements

### 3.5.1  Profile Management Use Case

Use Case:

- Sign in as Lecturer
- Sign in as Student

Brief Description:

It is required to sign in with the e-mail addresses used in the Çankaya University system. The application cannot be used without signing in. There are two options for user sign in: Lecturer and Student.

Initial Step-By-Step Description:

1. Users must sign in to start the application.
2. If password or e-mail address is invalid, users should try again.

Diagram:
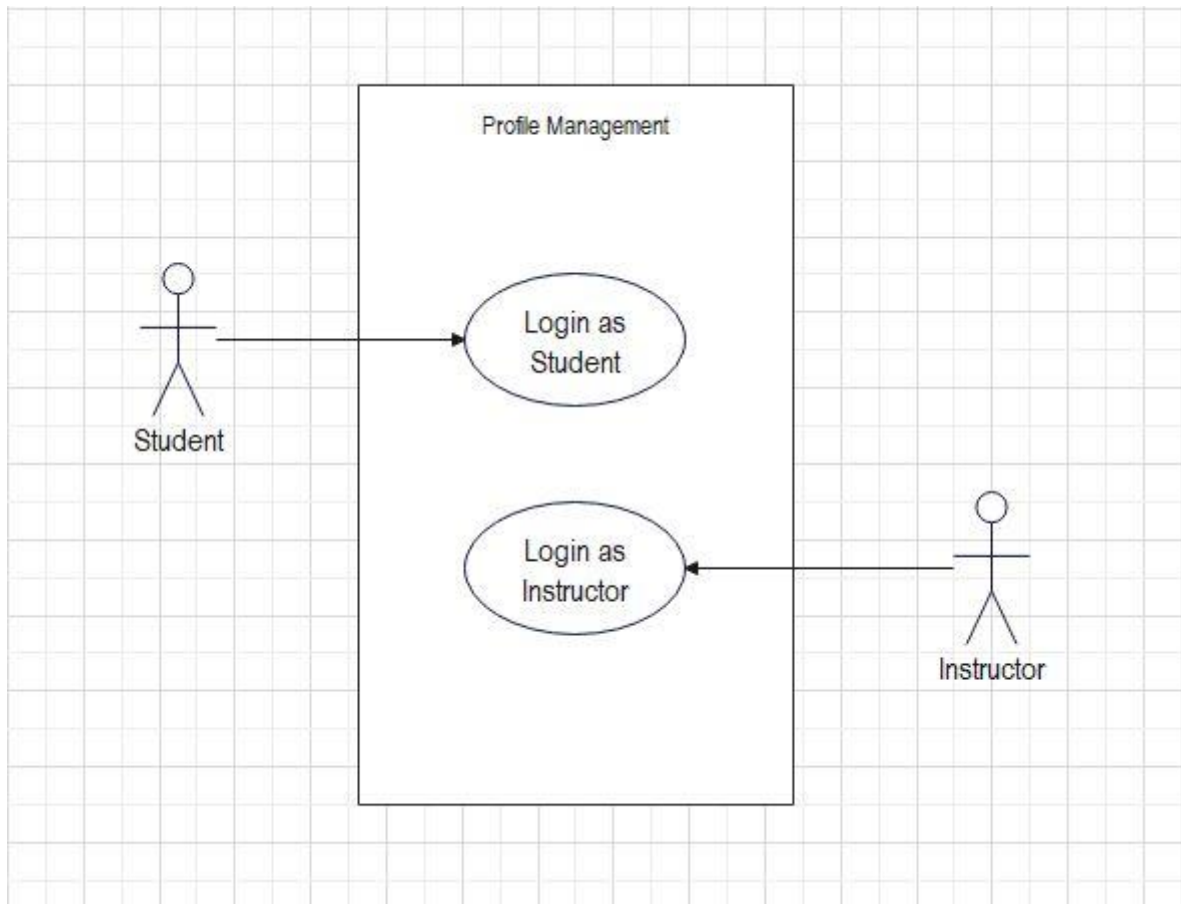
### 3.5.2 Options Menu Use Case

Use Case:

- QR Attendance
- QR ID Check
- Course Evaluation Questionnaire
- Exit

Brief Description:

After successful login to the application user can display the menu and choose one of the functions such as QR Attendance, QR ID Check, Course Evaluation Questionnaire or Exit.

Initial Step-By-Step Description:

1. If user selects QR Attendance button, according to the user type course name and QR code scan button for course attendance is displayed.

2. If user selects QR ID Check button, according to the user type QR code scan button for ID check is displayed.

3. If user selects Course Questionnaire button, course names later on course's questionnaire is displayed.

4. If user selects Exit button, main menu is displayed.

Diagram:
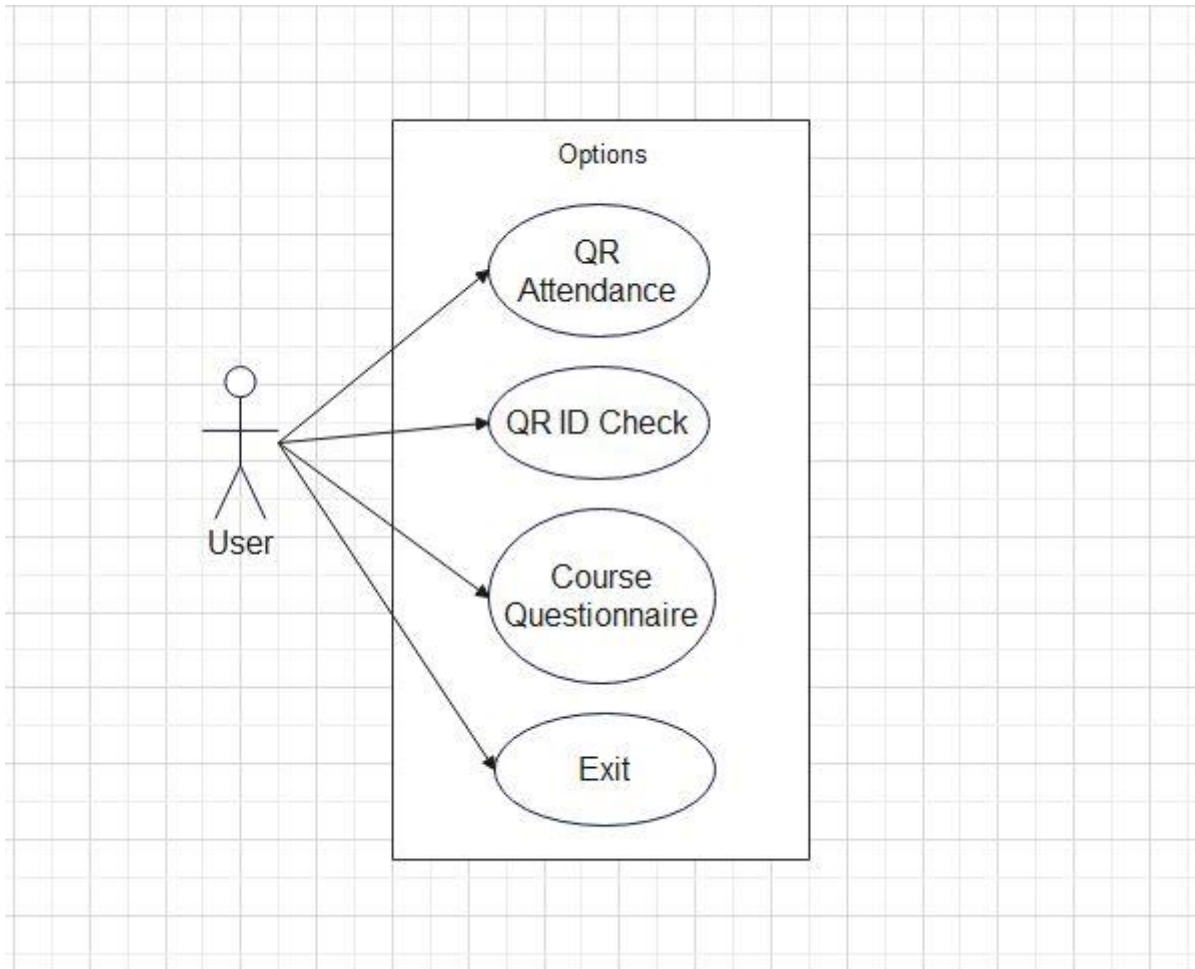


### 3.5.3 QR Attendance Use Case

Use Case:

- Add course to the system
- Login to the course
- Create QR code for course
- Scan QR code for attendance

- Collect attendance data
- Access the attendance data

Brief Description:

In this use case diagram, instructor add course to the system later on system create specific QR code for the course. Student scan this QR code for attendance, system collect student's data and instructor can receive the data via system's commune.

Initial Step-By-Step Description:

1. Instructor adds course to the system for attendance tracking.
2. System creates QR code for course.
3. System uploads this QR code to the course page.
4. Student scans QR code with camera access.
5. System collects every single student data for attendance tracking.
6. Course instructor receives this data and attendance will be taken.

Diagram:
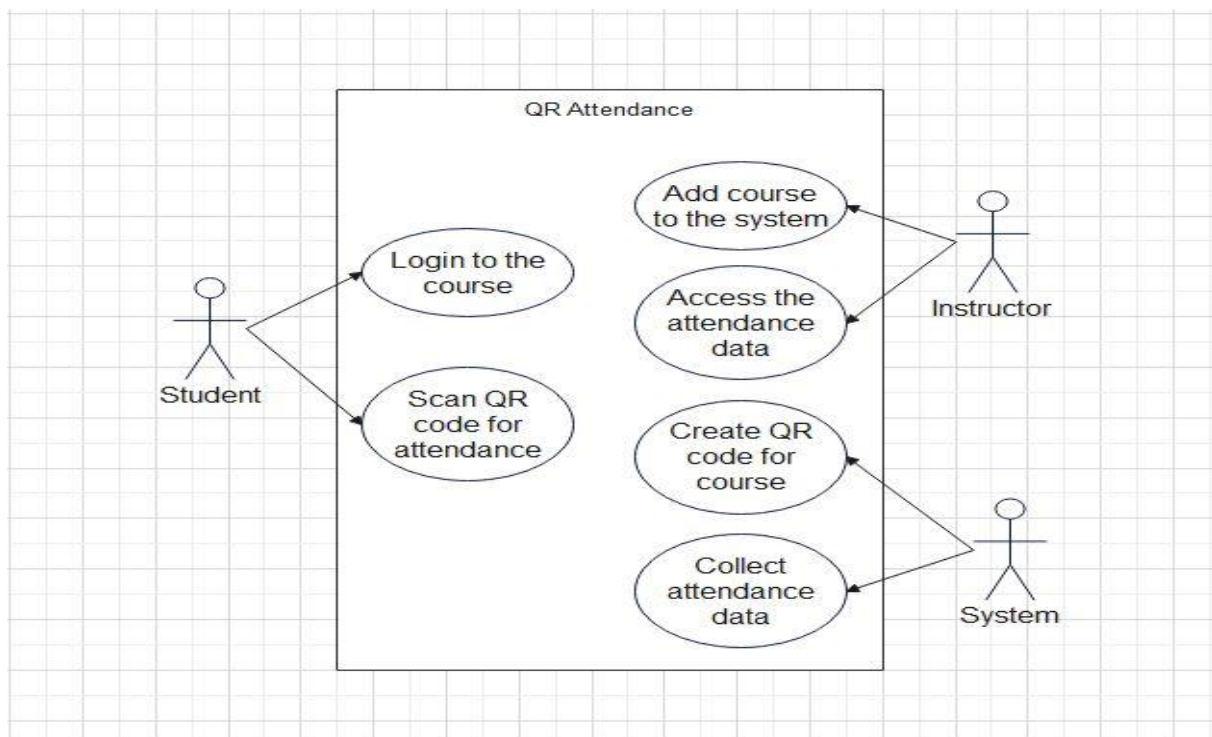
### 3.5.4 QR ID Check Use Case

Use Case:

- Create QR code for ID check
- Scan QR code for ID check
- Access ID data from system
- Collect data of passengers' ID

Brief Description:

In this use case diagram application provides an improvement to prevent the shuttle waiting queue at school entrances. Passengers get into shuttle by scanning the QR code created by system. System collect the data and security will check it on the school entrance.

Initial Step-By-Step Description:

1. System creates QR code for each shuttle.
2. All passengers will scan QR code while get into shuttle.
3. System will store data for ID check.
4. Security will check data.

Diagram:
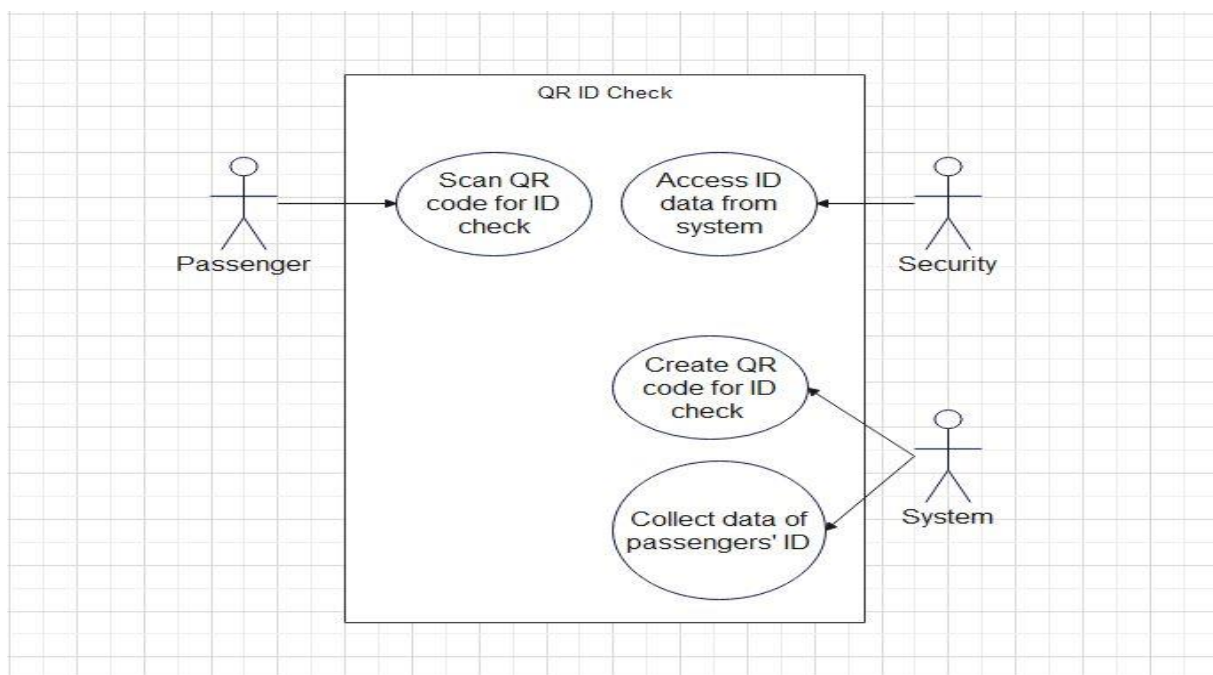
### 3.5.5 Course Evaluation Questionnaire Use Case

Use Case:

- Add questionnaire
- Fill in questionnaire
- Add opinions/suggestions
- Process questionnaire data
- Show evaluation result
- Access the results

Brief Description:

In the survey section, while making the surveys about the courses more accessible through the application, it also allows to receive the suggestions and opinions of the students. Creation of questionnaire and evaluation part is arranged by instructor and the system.

Initial Step-By-Step Description:

1. Course instructor creates questionnaire.
2. Student fills in questionnaire.
3. Student adds opinions/suggestions about the course and Çankaya University.
4. System processes the data.
5. System shows evaluation results to instructors.
6. Instructor of the course accesses the evaluation results and student's opinions/suggestions.

Diagram:
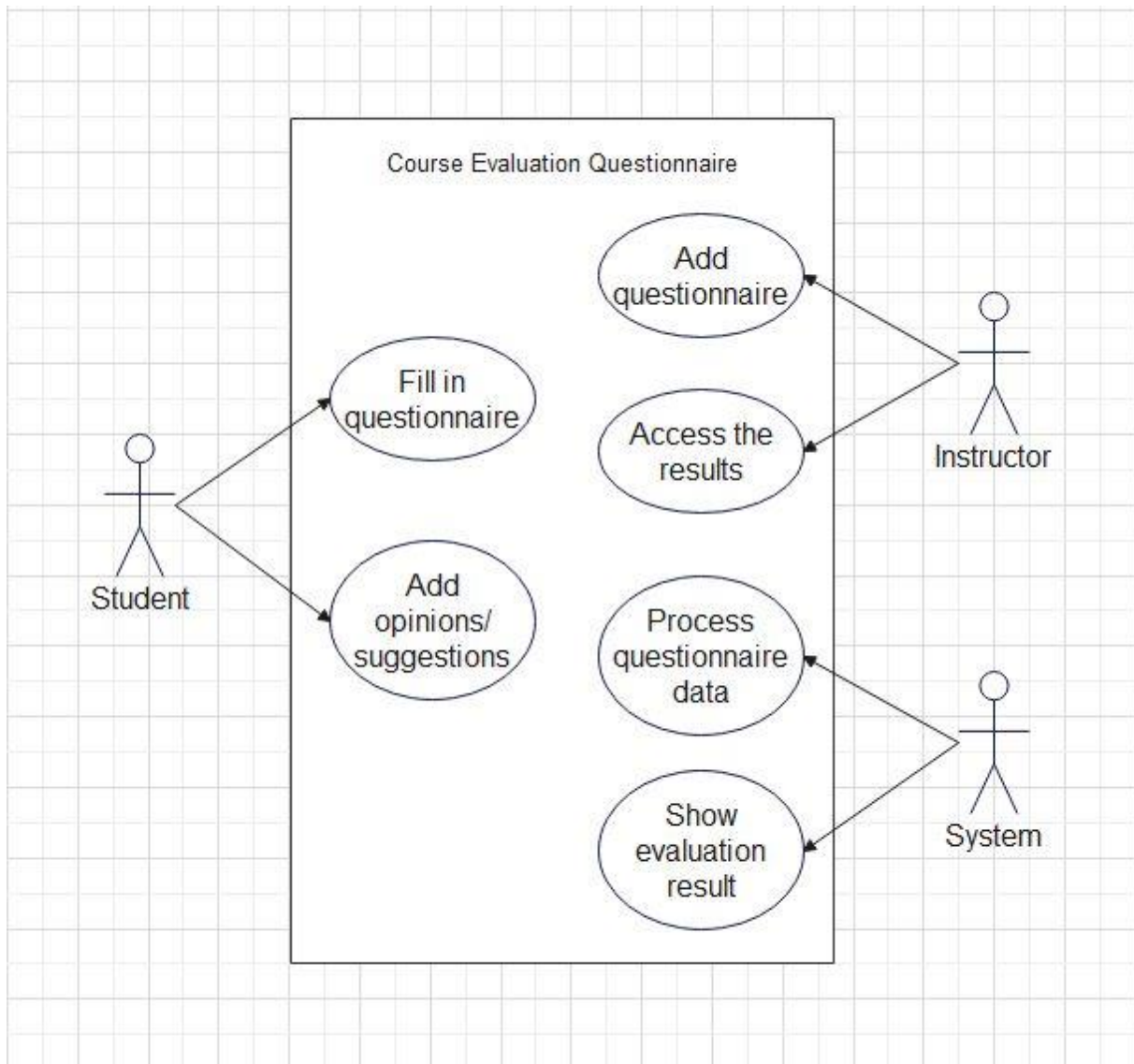


## 3.6 Performance Requirement

App must run smoothly without any latency to keep the level of user experience high. Minimum requirements for running CankayaMobileApp are:

- Operating system: iOS (iOS 11 or higher), Android (Android 9 Pie or higher)

### 3.7  Software System Attributes

### 3.7.1  Portability

The application can be used with all smartphones and can be easily used with the phones we carry in our daily life.

### 3.7.2  Useability

It will be very easy, user-friendly, and familiar to everyone, just like the apps we use almost every day. Utilize certain cryptographical techniques;

### 3.8  Safety Requirement

The application was designed to be used by a student, on a phone only. It is not safe for the user if it is not entered from another phone or if it is entered by two different users from the same phone. The application can be blocked, and you can request a reset request from student affairs.

### 3.9  References

[1] https://medium.com/atdijital/agile-%C3%A7evik-proje-y%C3%B6netimi-nedir-f07eaf0b172c

# 4 Software Design Description

## 4.1 Introduction

### 4.1.1 Purpose

The purpose of this document is describing the mobile application whis is called Cankaya Mobile App: An application developed for Çankaya University which has several functions such as QR Attendance, QR Id Check for school buses and Online Course Evaluation Questionnaires.

The target audience is students at Çankaya University. The mobile application will make it easier for students to track attendance and id check for school buses with QR technology, and will provide an opportunity for teachers to receive feedback by presenting surveys to students. We aim to make the work of students and teachers easier.

This application aims to digitizing the attendance process, preventing paper waste, reducing the possibility of forgery in documents for QR Attendance; minimizing the queue that occurs during identity checks at school entrances for QR ID Check; minimize the use of paper and the loss of time in the process of entering the questionnaires into the system for Online Course Evaluation Questionnaires. The project's requirements are covered in full in this paper. It represents the suggested software functionalities and the recognized restrictions. This SDD incorporates a number of diagrams, including a project's UML diagram, an activity diagram, and a block diagram, to aid in providing a better understanding.

### 4.1.2 Scope

This document contains a complete description of the design of Cankaya Mobile App.

For creating genuine, natively rendered mobile applications for iOS and Android, use the JavaScript framework React Native. Although it is built on React, Facebook's JavaScript toolkit for creating user interfaces, it targets mobile platforms as opposed to browsers. We'll write a large percentage of cross-platform code [1]. There is another similar and selectable framework, that is Flutter. Flutter is an open-source UI software development kit created by Google. It is used to develop cross-platform applications for Android, iOS, Linux, macOS, Windows from a single codebase [2]. We choose React Native, because Since Flutter uses Dart, only used by 6.54% of people, according to Statista[3], which states fewer developers can learn Dart. Moreover, since it is not widely used, it is restricted by several IDEs,

providing no support for the language. Because of these facts, we have chosen React Native as our development environment.

Scripting part of the project is occurred using JavaScripts. A dynamic computer programming language is called JavaScript. Its implementations enable client-side script to interact with users and create dynamic pages, and it is most frequently used as a component of web pages. It is an object-oriented programming language that may be interpreted. Because all of the group members are familiar with JavaScript programming and because JavaScript is required for React Native, JavaScript was chosen as our programming language.

### 4.1.3    Glossary

**Table 2 Glossary of SDD**

| Term | Definition |
| --- | --- |
| React Native | Using the help of the innovative React Native framework, web developers can build solid mobile applications with their existing JavaScript skills. Without compromising the end user's experience or the caliber of the application, it allows quicker mobile development and more effective code sharing between iOS, Android, and the Web. |
| JavaScript | A dynamic computer programming language is called JavaScript. Its implementations enable client-side script to interact with users and create dynamic pages, and it is most frequently used as a component of web pages. It is an object-oriented programming language that may be interpreted. |
| Flutter | A single codebase may be used to create stunning, natively built, cross-platform applications using Google's Flutter open source framework. |

| Dart | Dart is a general-purpose, object-oriented, open-source programming language designed by Google that uses syntax similar to C. |
|------|------|
| QR | It is a type of barcode that can be read easily by a digital device and which stores information as a series of pixels in a square-shaped grid. |
| iOS | It is an operating system used for mobile devices manufactured by Apple Inc. |
| Android | It is an open-source mobile operating system based on a modified Linux kernel that is particularly intended for touchscreen mobile devices like smartphones and tablets. |
| Udemy | Udemy is an online learning and teaching marketplace with over 213000 courses and 57 million students. |

### 4.1.4   Overview of document

Below is a list of the remaining chapters and what they include.

The System Design section of Section 2 outlines the project development process. Additionally, it has a class diagram for the system and a simulation's architecture design that specifies actors, exceptions, fundamental sequences, priorities, and pre- and post-conditions. A schematic illustrating the scenario generator's activities is also included in this section.

Realization of Use Cases is Section 3. This section displays and explains the system's block diagram, which was created using the use cases in the SRS paper.

References are discussed in Section 4.

## 4.2  Motivation

We are a group of senior students in computer engineering department who are interested in mobile app technologies and web development. As a group, we have taken the course of

innovative mobile app for a better understanding in mobile app field. We aimed to digitizing the attendance process, preventing paper waste, reducing the possibility of forgery in documents for QR Attendance; minimizing the queue that occurs during identity checks at school entrances for QR ID Check; minimize the use of paper and the loss of time in the process of entering the questionnaires into the system for Online Course Evaluation Questionnaires in this project. We have chosen the framework React Native which all the members of the group are already familiar to develop our project. So, in order to increase our knowledge in this field, we have take course from Udemy.

## 4.3 System Design

## 4.3.1 Architectural Design

### 4.3.1.1 Problem Description

- One of the purposes of creating the Cankaya University Mobile application is to overcome the difficulty of taking attendance in lessons, which we frequently encounter. Sometimes there are people who cannot sign because the signature paper is circulated incorrectly. Sometimes the lecturer forgets to give the signature paper and even though the lecture is over, lecturer and students must wait in the classroom for a long time to sign it. In addition to such problems, it is a time-consuming process in general, and the paper and common pens that touch everyone's hand can pose a threat in terms of hygiene.

- There may be very long waiting times for the identity checks of the passengers when school buses enter the school. These checks are carried out by the security guards entering the shuttles in order, and by reading the passenger ID cards to the devices in their hands. This process can cause students and lecturers to be late for classes in the morning hours.

- The last problem is the course evaluation surveys used for complaints and suggestions about lessons and school. These questionnaires are distributed by the lecturers to the students just before the final exams. This may cause students who experience exam stress to be distracted, be more stressed and not be able to fill out the questionnaire correctly. In addition, the lecturers' processing of the questionnaires into the system causes a waste of time for them and causes a lot of paper wastage.

### 4.3.1.2 Technologies Used

- Our IDE: Jetbrains Webstorm version 2022.2.3.
- Programming Language: JavaScript
- Framework: React Native (Facebook)
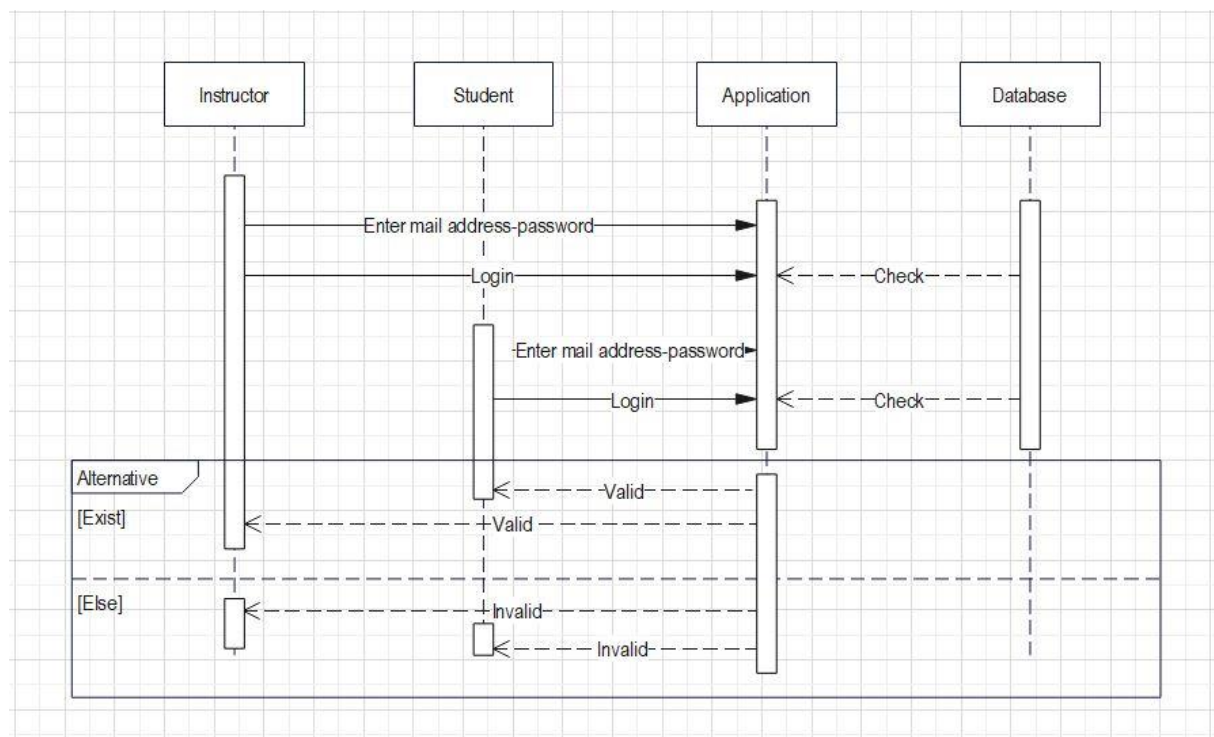- Database: Firebase (Google)
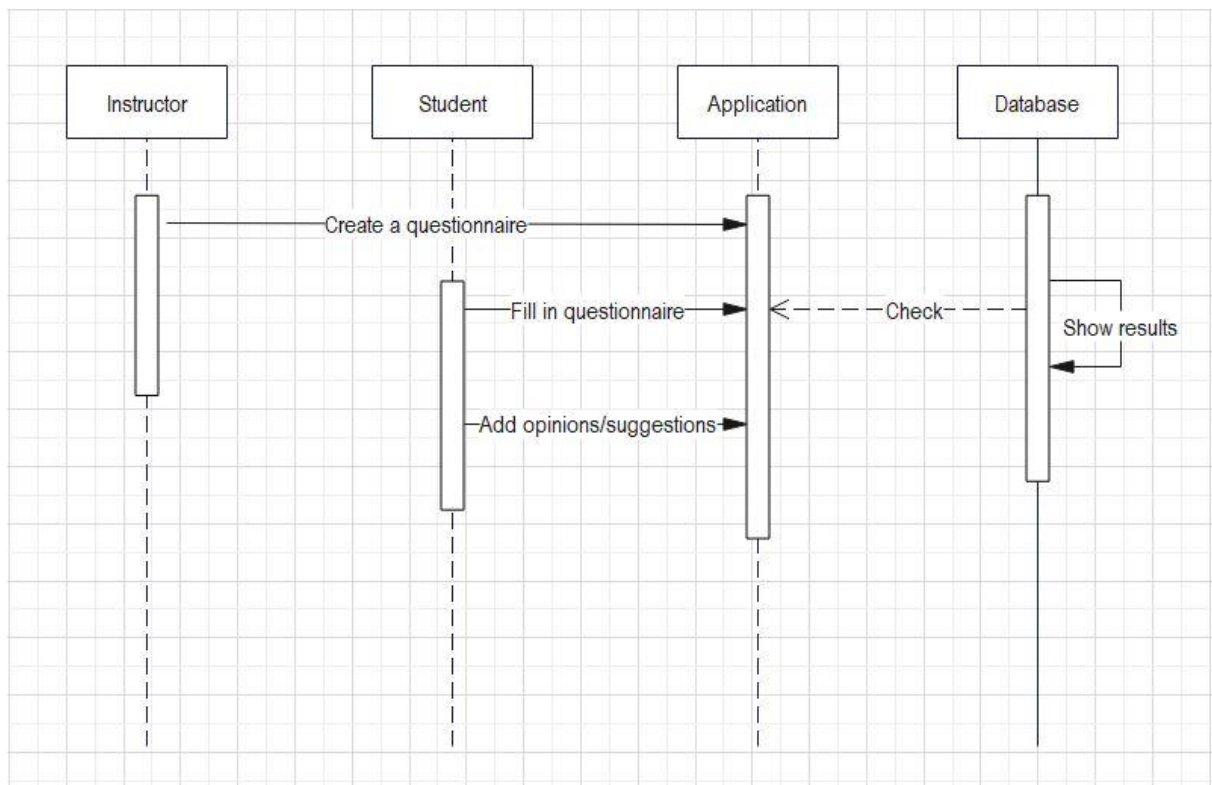
### 4.3.1.3 Activity Diagram
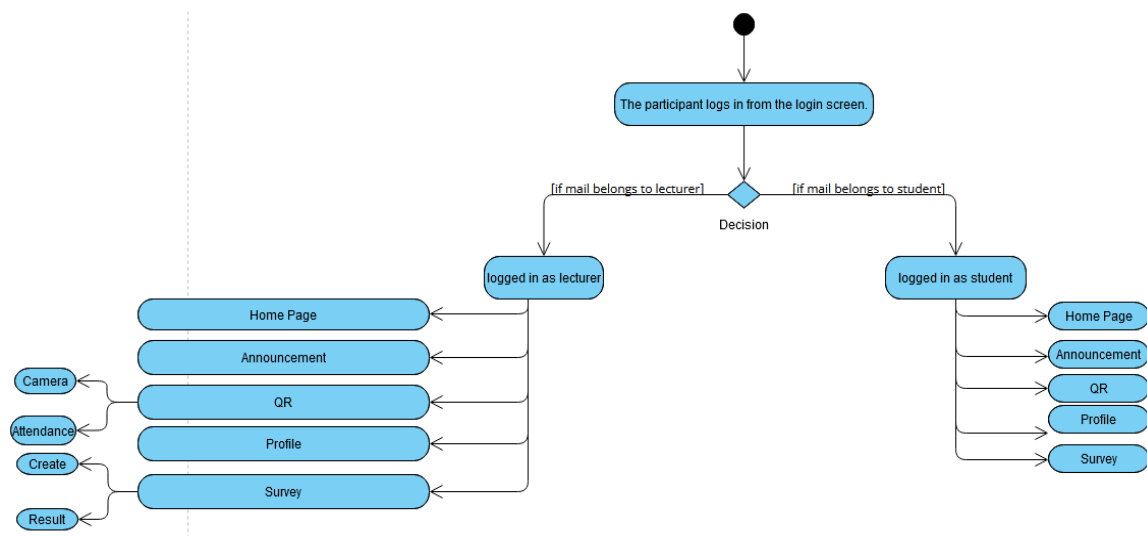
### 4.3.1.4 Class Diagram
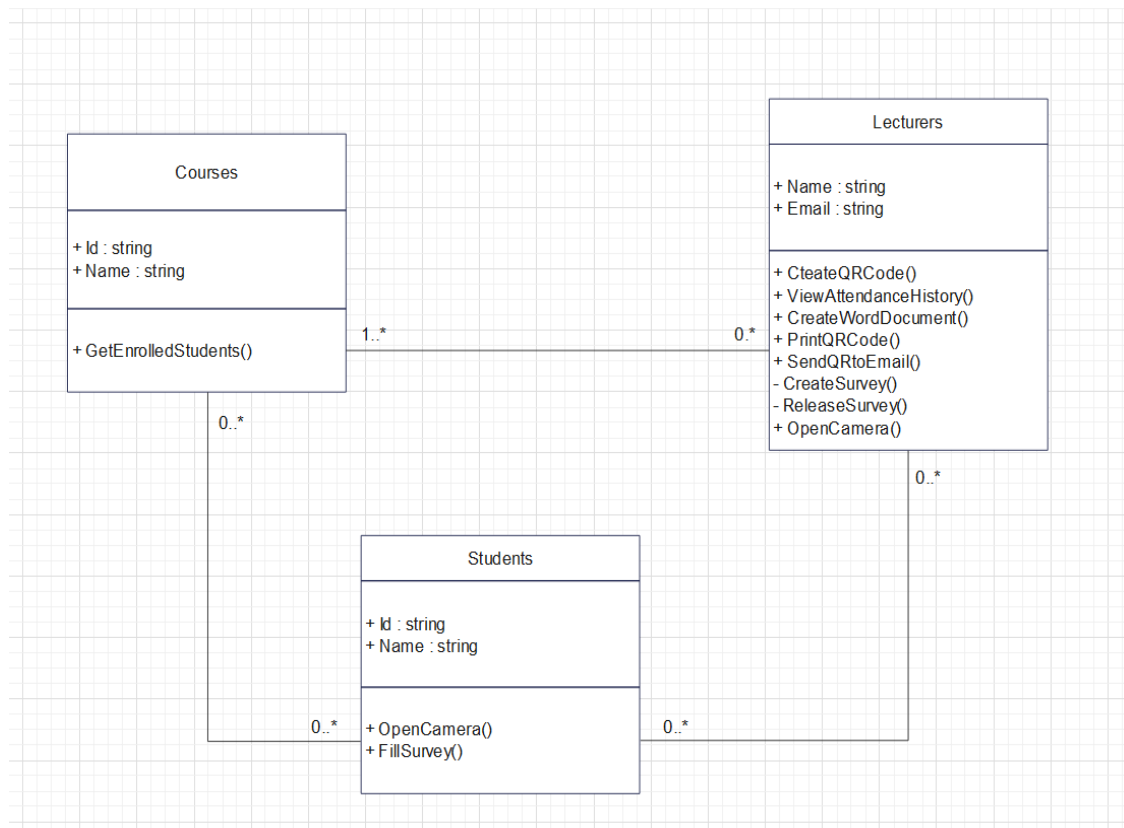

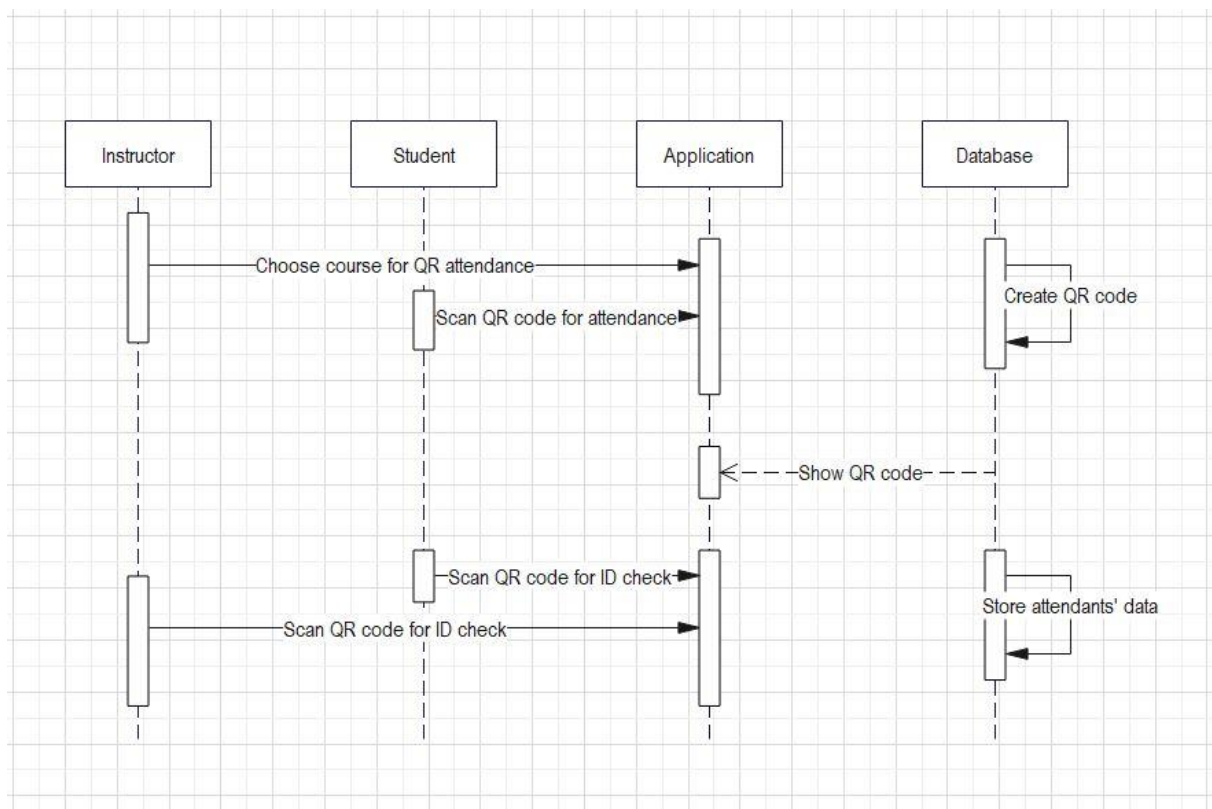
### 4.3.1.5 Sequence Diagram
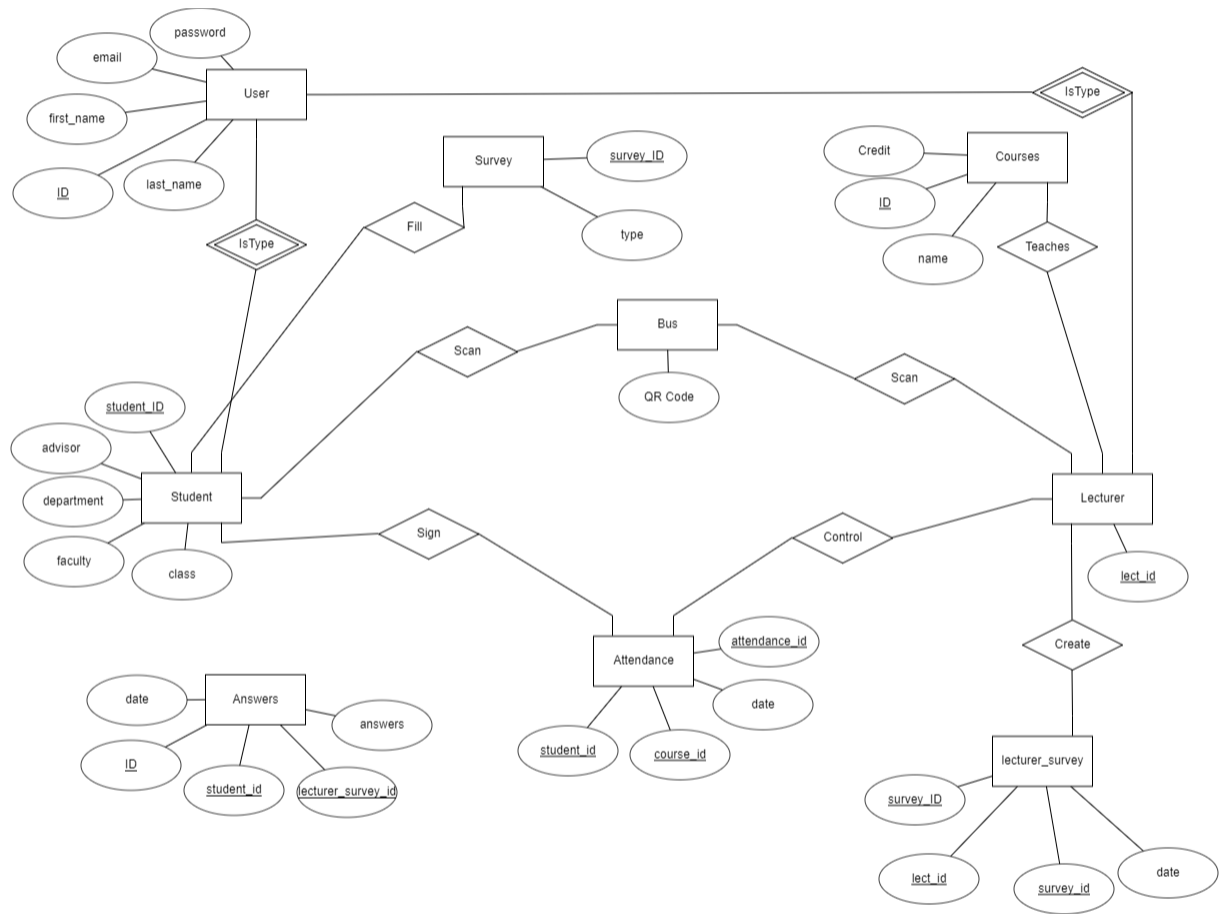
### 4.3.1.5.1 Login Sequence Diagram



### 4.3.1.5.2 Questionnaire Sequence Diagram

### 4.3.1.5.3    QR Attendance and ID Check Sequence Diagram

## 4.3.1.6 Entity-Relationship (ER) Diagram

### 4.3.2 User Interface Design

#### 4.3.2.1 Sign In Page



When the mobile application is opened for the first time, this screen will appear for both the student and the lecturer. When they write their school e-mail accounts, a confirmation code will be sent to this e-mail address. If authentication is provided when they enter this code, the registration process will be completed. This screen will not be encountered again. If an error is detected in the mail address or code, a warning message will be sent.

**4.3.2.2 Home Page**
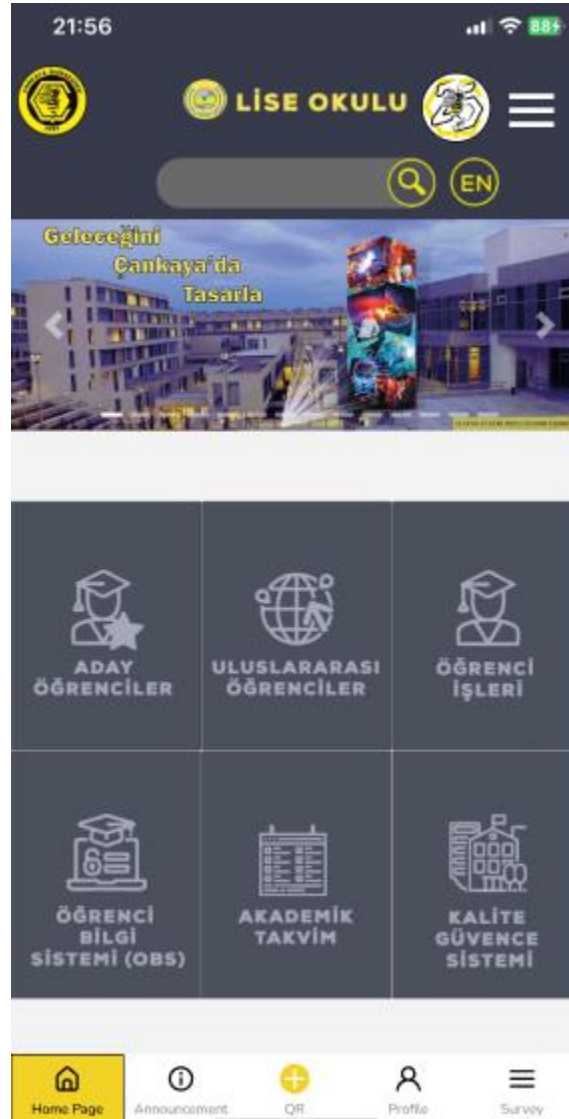


This screen will open to both the student and the lecturer each time the application is opened.

### 4.3.2.3 Announcement Page



On this page, announcements about the school can be viewed. It will be the same for students and lecturers.

### 4.3.2.4 QR Button Page (Available for only lecturer)



When the QR button is pressed, two options will be presented to the lecturer.

**4.3.2.5 QR Scan Page**
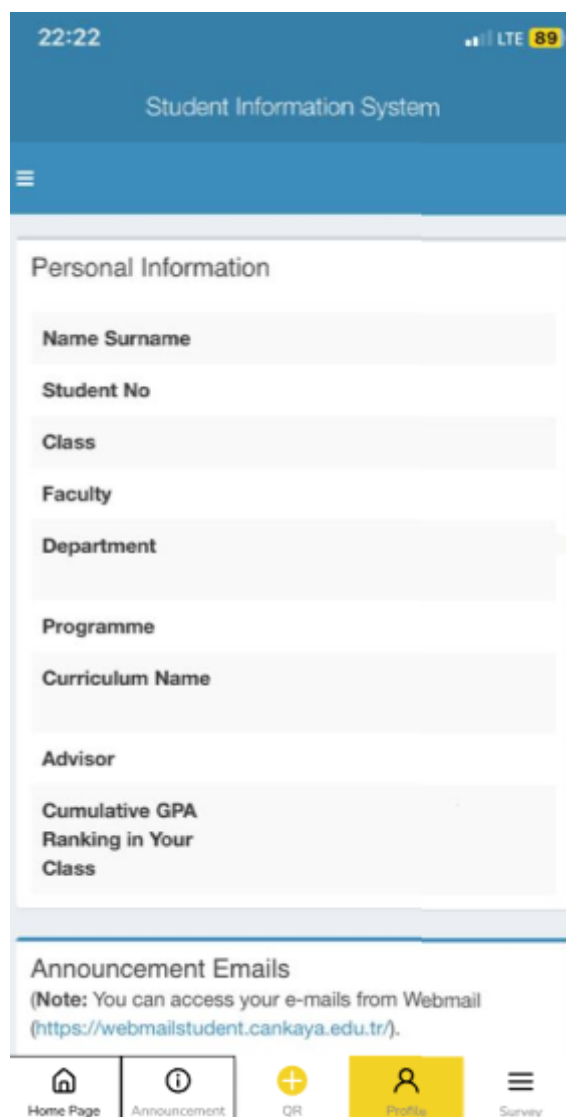


If the lecturer clicks on Camera option, this page will open. If the student clicks on the QR Button, they will be directed to this page directly.

### 4.3.2.6 Attendance Page (Available for only lecturer)



Lecturer will see this page if he chooses "Attendance" from the options that appear when he/she clicks on the QR Button. After selecting the course, he/she wants to take action from the drop-down list, he/she will click on one of the "Create" or "View Attendance" buttons at the bottom. If the Lecturer clicks "Create", the application will generate a QR code, and the lecturer will be presented with sharing options. When the "View Attendance" option is clicked, the attendance history of the selected course will be displayed and sharing options will be presented again.

**4.3.2.7 Profile Page**



This page will contain the user's personal information.

### 4.3.2.8 Survey Page (For students)

Course Evaluation Survey

COURSE

INSTRUCTOR

TERM AND YEAR

TEACHING APPROACHES

| | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| 1. The instructor stimulated my interest in the subject. | ○ | ○ | ○ | ○ | ○ |
| 2. The instructor managed classroom time and pace well. | ○ | ○ | ○ | ○ | ○ |
| 3. The instructor was organized and prepared for every class | ○ | ○ | ○ | ○ | ○ |
| 4. The instructor encouraged discussions and responded to questions. | ○ | ○ | ○ | ○ | ○ |
| 5. The instructor demonstrated in-depth knowledge of the subject. | ○ | ○ | ○ | ○ | ○ |
| 6. The instructor appeared enthusiastic and interested. | ○ | ○ | ○ | ○ | ○ |
| 7. The instructor used a variety of instructional methods to reach the course objectives (e.g. group discussions, student presentations, etc.) | ○ | ○ | ○ | ○ | ○ |
| 8. The instructor challenged students to do their best work. | ○ | ○ | ○ | ○ | ○ |

9. The instructor was accessible outside of class.

○ yes  ○ no

| Home Page | Announcement | QR | Profile | Survey |
|---|---|---|---|---|

The Survey option will only be available for students when the lecturer activates it. When they can view it, they will need to fill out the questionnaires provided.

### 4.3.2.9 Survey Page (Available for only lecturer)



Clicking the Survey option for Lecturer will open two options. If the "Result" option is clicked, the results of the surveys will be displayed and there will be an option to share.

**4.3.2.10        Create Survey Page**
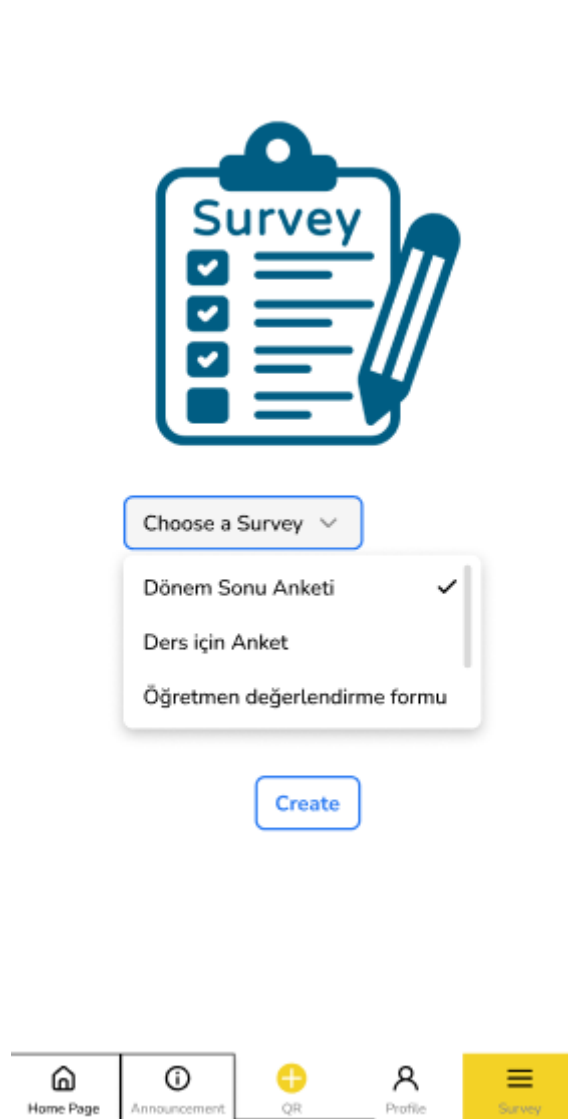


If the "Create" option is clicked from the two options that appear when the Survey button is pressed, this page will open. After the lecturer selects the survey he/she wants to create, prepares the survey on the template that will appear, and clicks on the create button, the survey will be created and shared.

## 4.4 Use case realizations
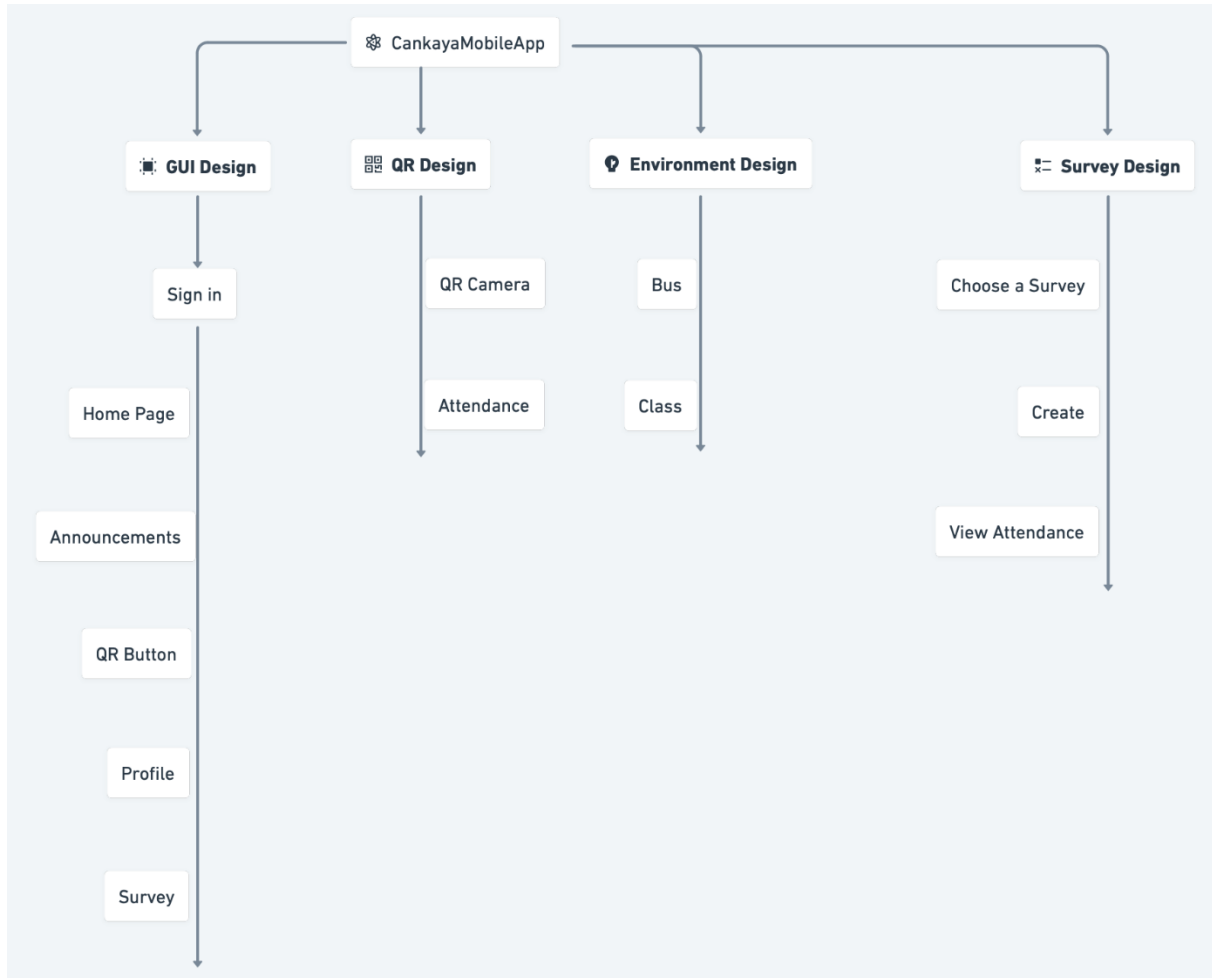


Brief Description:

Components of the CankayaMobileApp Project are shown in the Figure 2. All designed systems of the mobile app are displayed in the block diagram in the figure. There are four main components of the system which have their own sub-systems.

### 4.4.1 GUI Design

GUI design is responsible for interaction between the users and the system. There are five sub-systems in this design which are Home Page, Announcements, QR Button, Profile, and Survey. There is one main-system in this design which is Log in. Log in is a start page, participant should login the system. After logging in, it will be determined that the user is a lecturer or student according to the e-mail extension logged in, and a suitable interface and set of settings will appear.

### 4.4.1.1 Student Interface

There are five tabs in this interface which are Home Page, Announcements, QR Button, Profile, and Survey. Students can enter each tab, read and follow the updated university articles. In the QR tab, student can press the button and read the code directly from the camera and record own attendance.

### 4.4.1.2 Lecturer Interface

It has the same design as the students. There are two differences, the first difference is that when the qr button is clicked, 2 more tabs are opened, one of them is camera and the other one is attendance. The second difference is that when the survey button is clicked, 2 tabs are opened, one is create and the other is result.

### 4.4.2  QR Design

There will be a QR Button in the middle of the bottom of the app. Clicking this button will open the phone's own camera for QR reading.

### 4.4.3  Environment Design

There will be some environments for QR reading, and conditions that must be met in these environments.

### 4.4.3.1 Bus

On buses, there will be a QR sign with the information of the bus, and this QR code will be scanned by the user while getting on the bus.

### 4.4.3.2 Class

In the classrooms, there will be a projector reflecting the code created by the instructor or a QR Code ready for distribution after printing. The student will read this code from our application and record his/her name for attendance tracking.

### 4.4.4  Survey Design

The survey filling part will not appear in the application, instead, when the instructor is asked to fill in any survey, the instructor will create the survey and send it to the required student

community. Students, on the other hand, will receive a notification when survey filling is active and will be required to fill in.

## 4.5 References

[1] https://www.oreilly.com/library/view/learning-react-native/9781491929049/ch01.html

[2] https://en.wikipedia.org/wiki/Flutter_(software)

[3] https://www.statista.com/statistics/793628/worldwide-developer-survey-most-used-languages/