ÇANKAYA UNIVERSITY
FACULTY OF ENGINEERING
COMPUTER ENGINEERING DEPARTMENT

Project Report
Version 1

CENG 407

Innovative System Design and Development I

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Adroit System for Online Time Table and Announcement

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Abstract

The interaction between teachers and students is very significant in academic life. This interaction can become difficult. Especially, when the teachers are out of office. In these circumstances, teachers leave notes on their doors. These paper notes may get lost or get damaged and do not attract attention. With this project, these problems will be solved. Students will be able to check the teachers' time tables, check the published announcements and send messages via using a touchscreen. On the other hand, teachers will be able to add a new announcement and edit their time tables using a mobile application or a website. Finally, admins will verify the new registered devices and add the teachers to the database. The purpose of this project is to ease the communication and interaction between teachers and students in all circumstances, prevent paper waste and design a usable and practical real-time communication system using Raspberry Pi with a touchscreen and a motion sensor, a DBMS and a web server.

Key words:

Time Table, Announcement, Raspberry Pi, Touchscreen, Motion Sensor, DBMS, Web Server.

Özet:

Öğretmenler ve öğrenciler arasındaki etkileşim akademik hayatta çok önemlidir. Bu etkileşim zaman zaman zorlaşabilir. Özellikle, öğretmenler ofislerinde olmadıklarında. Bu şartlar altında, öğretmenler kapılarının üzerine not bırakırlar. Bu kâğıt notlar kaybolabilir veya zarar görebilir ve dikkat çekmezler. Bu proje ile bu sorunlar çözülecek. Öğrenciler, öğretmenlerin zaman çizelgelerine göz atabilir, yayınlanan duyuruları kontrol edebilir ve dokunmatik ekran kullanarak mesajlar gönderebilir. Öte yandan öğretmenler, bir mobil uygulama veya bir web sitesi kullanarak yeni bir duyuru ekleyebilir ve zaman tablolarını düzenleyebilir. Son olarak, yöneticiler yeni kayıtlı cihazları doğrulayacak ve öğretmenleri veri tabanına ekleyecektir. Bu projenin amacı, her koşulda öğretmenler ve öğrenciler arasındaki iletişimi ve etkileşimi kolaylaştırmak, kâğıt atıklarını önlemek ve bir dokunmatik ekranlı ve bir hareket sensörlü Raspberry Pi, veri tabanı ve web sunucusu kullanan kullanışlı ve pratik bir gerçek zamanlı iletişim sistemi tasarlamaktır.

Anahtar Kelimeler:

Zaman Çizelgesi, Duyuru, Raspberry Pi, Dokunmatik Ekran, Hareket Sensörü, Veri Tabanı, Web Sunucusu.

1. Introduction

1.1 Problem Statement

Students may find it difficult to interact and communicate with teachers because teachers are not always present at the school or the papers hung on the doors of the teachers can get damaged or lost. This can lead to critical announcements or updates not reaching to the students. Adroit System for Online Time Table and Announcement project will play a big role to avoid these problems.

Raspberry Pi is a very popular microcomputer. It is more powerful than the other microcontrollers and microprocessors. It is also compatible with so many different devices such as sensors, touchscreens and computers. Therefore, it is robust, easy to use and interactive. These properties of the Raspberry Pi are not enough to save energy, reduce the carbon footprint, keeping track of the data and the real-time communication.

1.2 Solution Statement

Touchscreens are very popular amongst people and companies. The usage of touchscreens increases the usability and visuality. They are also compatible with Raspberry Pi which we will use as our microcomputer. Another thing which is compatible with Raspberry Pi is the motion sensor. Motion sensor will be used for energy saving and reducing carbon footprint.

Many of the embedded systems use database. Usage of database will allow us to keep track of the data of students, teachers and admins. In this way, the data can be read or written when necessary.

With the usage of all the mentioned components this system will help both teachers and students while communicating and will solve the mentioned problems.

1.3 Motivation

We are a group of students in computer engineering department who are interested in microcomputers, embedded systems, software design and implementation. We all have taken the course of microprocessors, software engineering, database management system, object oriented programming and web development. We aim to ease the communication between teachers and students when teachers out of office, provide a better, faster and more reliable source for announcements and grades. We have chosen Raspberry Pi as our microcontroller. With the intention of increasing our knowledge on embedded systems, we will learn how to connect to web and database servers. For the visualization of our project we will use a touchscreen which will be connected to Raspberry Pi.

2. Literature Search

2.1 Using an Embedded System

An embedded system is a computer system that is designed for control functions in big systems. Embedded systems form the part of a device which includes hardware and software in it. Efficiency is one of the most important things for the embedded systems. Criteria like power consumption, size of the code and execute time must be optimized for cost purposes. These systems are used to help the device that they have been embedded in to control, monitor and operate. Demands of keeping track of and controlling embedded systems has largely increased in the last ten years. To match those demands, embedded systems are connected to the internet which allows reaching to those embedded systems from browsers and applications. The best way to do it is to embed a web server inside an embedded system. [1] Considering the needs of our project like connecting to a server and a database and the characteristics of embedded systems, we will use an embedded system and embedded web server in our project to enable necessary connections. When approaching embedded systems architecture design from a software engineering point of view, several models can be applied to describe the cycle of embedded system design. Most of these models are based upon one or some combination of the following development models. [2]

• The big-bang model

• The code-and-fix model

• The waterfall model

• The spiral model

Microprocessors or microcontrollers which are programmed for processing several tasks form the core of the embedded systems. We are going to use Raspberry Pi for these purposes.

2.2 Raspberry Pi

The Raspberry Pi is a small sized computer that can be used in electronics projects, and for many of the things that your desktop PC does, like spreadsheets, word processing, browsing the internet, and playing games. It also includes a HDMI inlet so, it can play high definition videos. It is created to see everyone who are interested in coding and computing use it. [3] With input and output pins that Raspberry Pi have, sending and reading data from electronic systems can be done directly. Also, using infrared, wireless and Bluetooth technologies, it can communicate with other devices easily. Raspberry Pi enables LCD touchscreen connections and C# and Phyton programming languages. Considering our project which includes database connection, GUI and touchscreen interaction, with the usage of Raspberry Pi, implementing those will be easier. Also, to be able to connect sensors to Raspberry Pi via pins will be possible. There are many projects that are completed using Raspberry Pi. These projects include Making a Raspberry Pi supported computer, home automation using Raspberry Pi, operating the Raspberry Pi system using sunlight, etc.

2.3 Designing a User Interface (GUI)

For an interface to be reliable, efficient, easy to use and understandable, the user must be able to interact with it quickly and easily. At the early stages of computer screens, papers were a better way of reading and representing information than electronic screens due to the technological limitations. [4] With today's technology, those limitations are no longer active so; electronic screens with user interfaces are the best way to display information. With these developments, paper waste is prevented. Our user interfaces on the touchscreen, mobile application and web page will be implemented considering the qualities of an efficient interface.

2.4 Using a Touchscreen

It is so common for a technological device such as cameras, mobile phones, remote controls, display screens etc. to have a touchscreen nowadays. Touch screens are popular because they enable a dynamic interaction by combining display and input functions and therefore eliminating buttons and switches. Touchscreens allows users to act more directly with the screen by touching, pushing, dragging. This direct interaction results into easier use, better user experience and acceptance and a faster input implementation. [5] To provide our users a better, easier interaction and usage, a touchscreen with a user interface will be implemented and connected to Raspberry Pi. This will allow users to adapt and use that system more easily and in a better and efficient way.

2.5 Motion Sensor

All live beings spread energy to the environment they are present at that moment with infrared waves. Those waves cannot be seen by human eye, but it can be detected by the usage of a sensor. PIR (Passive infrared) sensor can be used to detect these energy spreads. When a human or an animal spreading an energy with infrared waves passes through the field of view of the sensor, the sensor detects the change in temperature and therefore can be used to detect motion. [6] Motion sensors are easy to use, small, hard to wear out and cheap. Because of all these reasons, those sensors are very popular and common. They can be referred differently as PIR, "Passive Infrared", "Pyroelectric", or "IR motion" sensors. [7] To preserve the battery power of our components and to reduce the carbon footprint, a motion sensor which will be connected to Raspberry Pi will be used. The circuit is very simple for this and does not even need to connect to a breadboard. [8] The details of the sensor can be seen in Figure 1 and Figure 2.
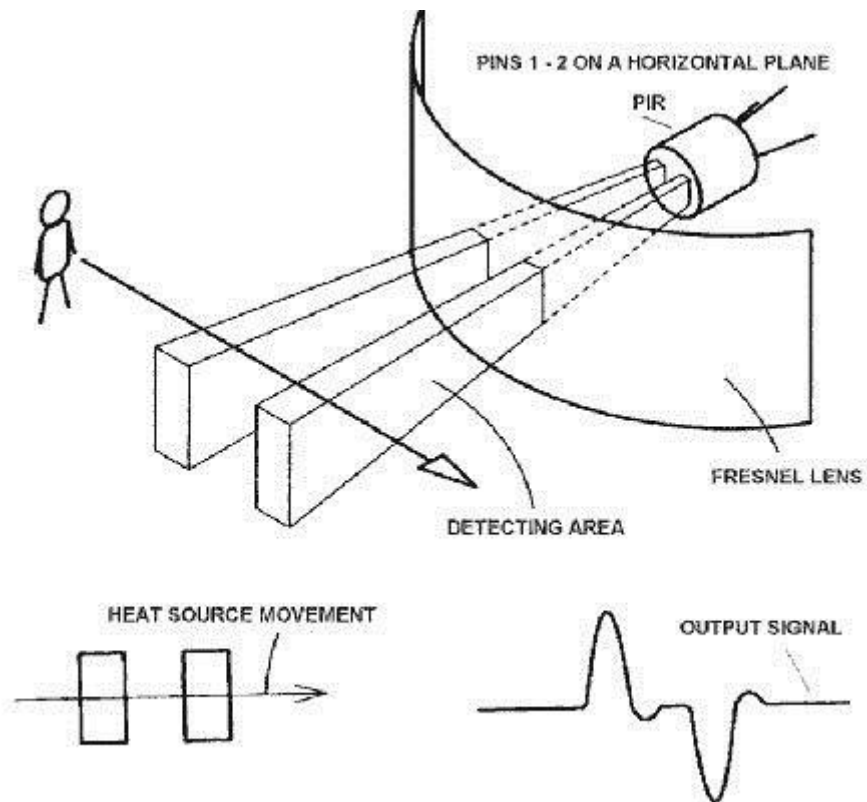
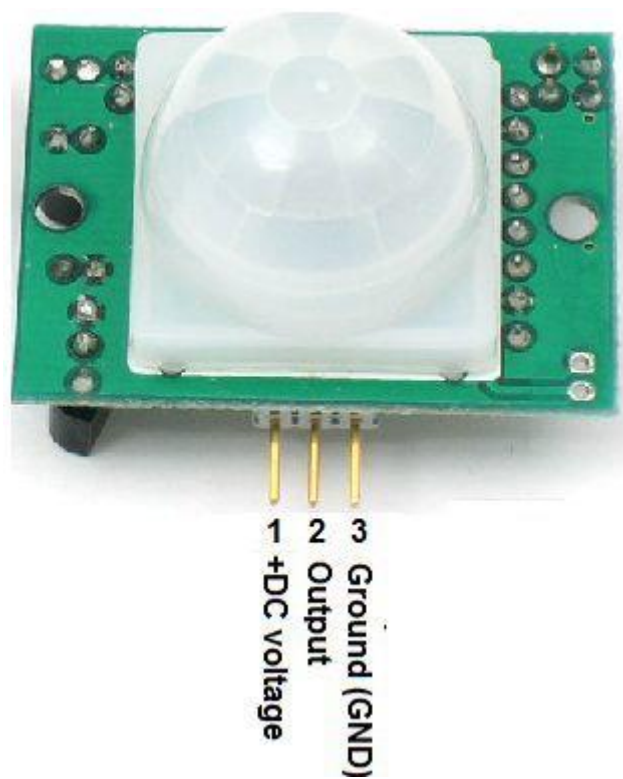*Figure 1: Motion Sensor Working Schema*

Figure 2: Motion Sensor

2.6　Using Timetable

In our project, we are going to use timetable for announcement part. In this way, announcements and schedules of instructors will be displayed on the screen. Each instructor will be able to connect to their screen and add their lectures, messages and announcements via a mobile application. A database system will be developed to store those kinds of information.

2.7　Designing and Implementing a Database

With the growth use of computers, usage of database systems increased dramatically. Nowadays, databases are used in nearly every computational system as a critical element. To keep track of instructors, their lectures, office hours, announcements and messages, a database will be implemented in our project. To enable real time data storage and communication, this database will be connected to a server. To establish that real time connection, the user interface programs and application programs that run on the client side requires an access to the DBMS (Database Management System). The program establishes a connection to the DBMS (which is on the server side); once the connection is created, our user interface program will be ready to communicate with the DBMS. [9]

2.8　Information Pull and Push

Increased number of sales of wireless devices and with the ability to track and record user information, how the information will be pushed and pulled became a major concern. Users may be given so much information that they didn't want to receive or see. To prevent this, an information distribution method can be used. The method used is "PUSH" or "PULL". To define these terms:

• PULL: Information flow that is expected by the user;
• PUSH: Information flow that will be displayed and sent to the user. [10]

With the usage of a wireless network and a database in our project, it is important to send and get data to and from the database. With the help of this method, information can be get from and sent to the user in a flowing and non-disturbing way.

3. Summary

3.1 Technology Used

Raspberry pi is used to visualize the project and it will be the microcomputer of the project. Procedures of designing a GUI, displaying the interfaces to the users, connecting to the database and web servers will be done on Raspberry Pi. Raspberry Pi is a microcomputer that is capable of doing what a desktop PC does, and it enables connections with other devices. There are many programming languages and applications that can be used within or with Raspberry Pi. These properties of Raspberry Pi make it practical, robust and easy to use and implement. Because of all these reasons, Raspberry Pi is the most suitable technology for our project.

For the displaying of the interfaces to the users, there will be three different technologies used: Touchscreen, mobile application, website and motion sensor.

Touchscreens are popular technological devices for displaying and dynamic interaction. This dynamic interaction will provide the users a better user experience and a faster input implementation.

The mobile application will be developed for Android platform and it will be in use for teachers.

The website will be developed using ASP.NET which is the most popular web development technology. The website will be implemented for the use of teachers and admins. Every electronical device has a carbon footprint. To reduce our devices' carbon footprints, a motion sensor will be implemented. Motion sensors are easy to use, small, hard to wear out and cheap. Because of all these reasons, those sensors are very popular and common. Also, Raspberry Pi allows the implementations of motion sensors. Using this feature of Raspberry Pi will allow us to easily implement the motion sensor to the project.

4. Software Requirements Specification

4.1 Introduction

4.1.1 Purpose

The purpose of this document is describing the project which is called Adroit System for Online Time Table and Announcement. This project aims to update the schedule actively and display sudden announcements without losing time, eliminate the difficulty of updating the currently-used schedule tables, eliminate the risk of papers hung on the door getting damaged, prevent paper waste and ease the communication and interaction between teachers and students.

This document includes detailed information about requirements of the project. It reflects the identified constraints and proposed software functionalities. Moreover, the SRS document explains how teachers and students interact with the project. This document explains how concerns of the stakeholders are met.

4.1.2   Scope of Project

Most of the students have difficulty in reaching teachers outside of the lectures and announcements and time tables of teachers hung on their doors can easily be damaged and they are hard to update. Because of these reasons, the interaction between teachers and students may become difficult. In addition to this, at any time, a sudden update on a teacher's time table or condition may appear and it may not reach to the students in time. This project can solve these problems with real time interaction between the teacher and the touchscreen via a website or mobile application.

The purpose of Adroit System for Online Time Table and Announcement Project is to design a system with a touchscreen and a mobile application which will include a GUI that will enable the tracing of schedules and announcement. To increase the level of usability and practicability, Raspberry Pi and a Touchscreen will be used. These two components can be connected easily to each other and because of the Raspberry Pi's functionality which allows users to use different kind of programming languages, a GUI can be implemented and displayed on the touchscreen for the use of students.

For the use of teachers, a mobile application and a website will be implemented to allow teachers to perform specific actions.

For the use of admins, a website will be implemented to allow admins to perform specific actions.

4.2   Overall Description

4.2.1   Product Perspective

Adroit System for Online Time Table and Announcement is a real-time communication and an informative project that aims to replace the current paper-based announcement and time table methods. Another objective is to ease the communication between the teachers and students by using real-time communication. There will be different interfaces for students and teachers.

On students' side, they will only be able to interact with the touchscreen. They will be able to send messages to the teacher by using already determined message templates to avoid objectionable content, see the teacher's time table, announcements and if published, exam grades.

On teachers' side, by using the Wi-Fi connection between Raspberry Pi and their PC or mobile application, they will be able to make changes to their time table such as adding meetings, office hours, rendezvous for meeting students, publishing new announcements or exam grades. To be able to do all these actions, teachers must login to their pre-determined accounts. These accounts will be created to prevent students using those abilities.

4.2.2 User Classes and Characteristics

4.2.2.1 Student

4.2.2.1.1 Students must be studying in Çankaya University.

4.2.2.1.2 Student must be able to read and understand the English language since the touchscreen will be in English language.

4.2.2.1.3 Student must have the knowledge for how to use a touchscreen.

4.2.2.2 Teacher

4.2.2.2.1 Teacher must be a teacher in Cankaya University.

4.2.2.2.2 Teacher must be able to read and understand the English language since the interface for teachers will be in English language.

4.2.2.2.3 Teacher must know how to use a computer.

4.2.2.2.4 Teacher must know how to use a mobile application

4.2.2.3 Admin

4.2.2.3.1 Admin must be an employee in Çankaya University.

4.2.2.3.2 Admin must know how to use a database.

4.2.2.3.3 Admin must know how to use a computer

4.2.3 Operating Environment

This project will run on Raspberry Pi and a touchscreen which will be connected to each other. C# programming language will be used to design and implement a user interface. On the database side, MSSQL will be used to design and implement the necessary entities, tables and relations. The touchscreen will be hung on the teacher's door. Apart from that, the mobile application will run on Android Platform.

4.3 External Interface Requirements

4.3.1 User Interfaces

The interface of the touchscreen will include teacher's time table, buttons and menu transitions which the student will be able to navigate through. There will be buttons such as "Send a Message", "View Exam Notes".

4.3.2 Hardware Interfaces

The project requires a Raspberry Pi and touchscreen. It also requires necessary cable connections between Raspberry Pi and touchscreen to enable visualization.

4.3.3 Software Interfaces

A database connection is required to read/write data about teachers, their time tables, announcements and messages.

4.4 System Features

4.4.1 Functional Requirements

4.4.1.1 Website Use Case

- Login as Teacher
- Login as Admin
- Edit Time Table
- Publish an Announcement
- Check Emails
- Add a Teacher to the Database
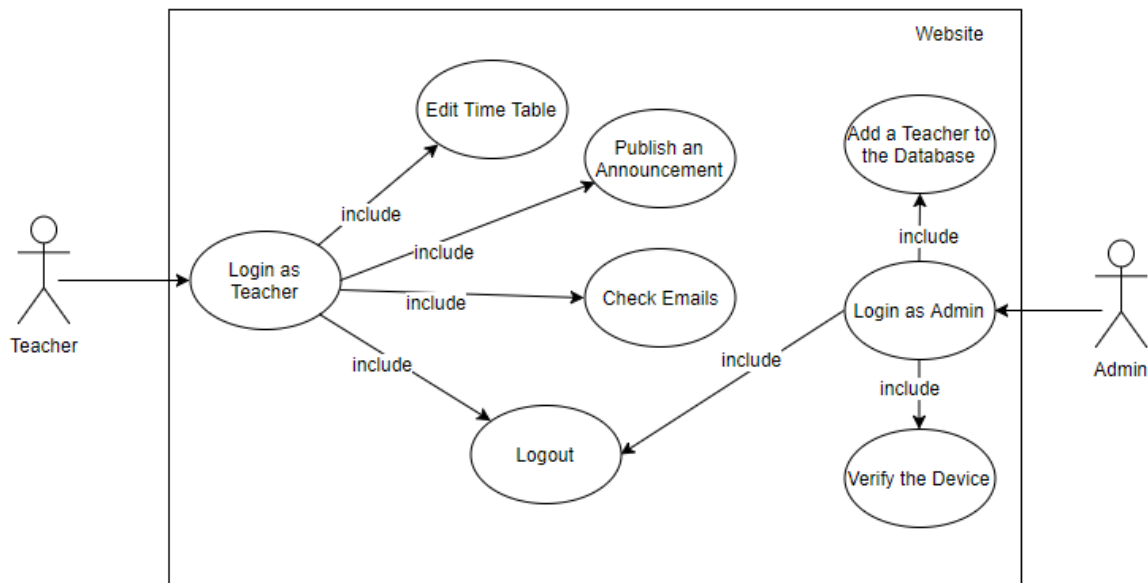- Verify the Device
- Logout

4.4.1.1.1 Diagram

Figure 3: Website Use Case

4.4.1.1.2. Brief Description

- **Login as Teacher:** Teacher should login to his/her account before performing any actions.
- **Edit Time Table:** After the login, the teacher can modify his/her time table.
- **Publish an Announcement:** After the login, the teacher can publish a new announcement.
- **Login as Admin:** Admin should login to his/her account before performing any actions.
- **Verify the Device:** After the login, the admin can verify a newly registered device.
- **Add a Teacher to the Database:** After the login, the admin can add a teacher to the database.
- **Check Emails:** After the login, the teacher can check the received emails.
- **Logout:** Teacher or Admin can logout any time after login.

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4.4.1.1.3. Initial Step by Step Description:

1. Login as Teacher

    1.1. Teacher shall login to the system using e-mail address and password.

        1.1.1.   If the password is invalid for the e-mail address, error message is displayed under the login button for 5 seconds.

        1.1.2.   If the login is successful, teacher is redirected to the actions menu in a second.

2. Edit Time Table

    2.1. Teacher shall modify his/her time table.

        2.1.1.   The teacher shall add a new meeting or an additional course to his/her time table which is displayed in the middle of the screen.

        2.1.2.   The teacher shall remove an existing course or meeting from his/her time table which is displayed in the middle of the screen.

3. Check Emails

    3.1. The teacher shall check emails sent by the students.

4. Publish an Announcement

    4.1. The teacher shall publish a new announcement which will be on display for one week.

5. Login as Admin

    5.1. Admin shall login to the system using e-mail address and password.

        5.1.1.   If the password is invalid for the e-mail address, error message is displayed under the login button for 5 seconds.

        5.1.2.   If the login is successful, admin is redirected to the actions menu in a second.

6. Verify the Device

   6.1. The admin shall verify a newly registered device which will be verify for a
        term.

7. Add a Teacher to the Database

   7.1. The admin shall add a teacher to the database who will be active for one term.

8. Logout

   8.1. Admin and Teacher shall exit from the system.

      8.1.1. A message will be displayed for 3 seconds to show the logout is
              successful.

4.4.1.2   Mobile Application Use Case

- Login

- Edit Time Table

- Publish an Announcement

- Check Emails

- Logout
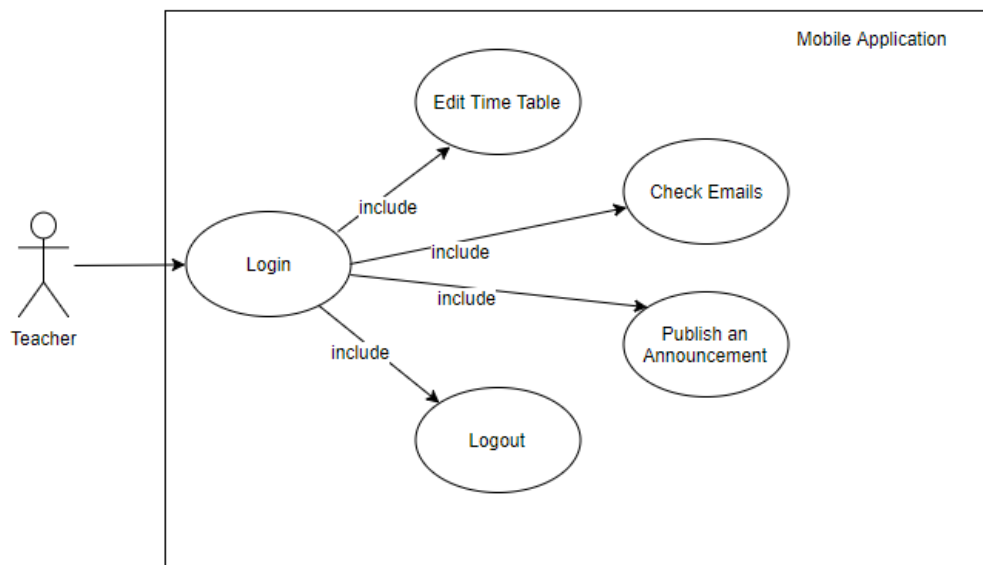
4.4.1.2.1   Diagram

Figure 4: Mobile Application Use Case

4.4.1.2.2   Brief Description

- **Login:** Teacher should login to his/her account before performing any actions.
- **Edit Time Table:** After the login, the teacher can modify his/her time table.
- **Publish an Announcement:** After the login, the teacher can publish a new announcement.
- **Check Emails:** After the login, the teacher can check the received emails from students.
- **Logout:** Teacher or Admin can logout any time after login.

4.4.1.2.3   Initial Step by Step Description

1. Login

    1.1. Teacher shall login to the system using e-mail address and password.

    1.1.1.   If the password is invalid for the e-mail address, error message is displayed under the login button for 5 seconds.

    1.1.2.   If the login is successful, teacher is redirected to the actions menu in a second.

2. Edit Time Table

    2.1. Teacher shall modify his/her time table.

    2.1.1.   The teacher shall add a new meeting or an additional course to his/her time table which is displayed in the middle of the screen.

    2.1.2.   The teacher shall remove an existing course or meeting from his/her time table which is displayed in the middle of the screen.

3. Publish an Announcement

    3.1. The teacher shall publish a new announcement which will be on display for one week.

4. Check Emails

    4.1. The Teacher shall check the received emails which will be refreshed every 10 seconds.

5. Logout

    5.1. Teacher shall exit from the system.

    5.1.1. A message will be displayed for 3 seconds to show the logout is successful.

4.4.1.3   Touchscreen Use Case

- Check Announcements

- Send an Email

- Fill the Email Address

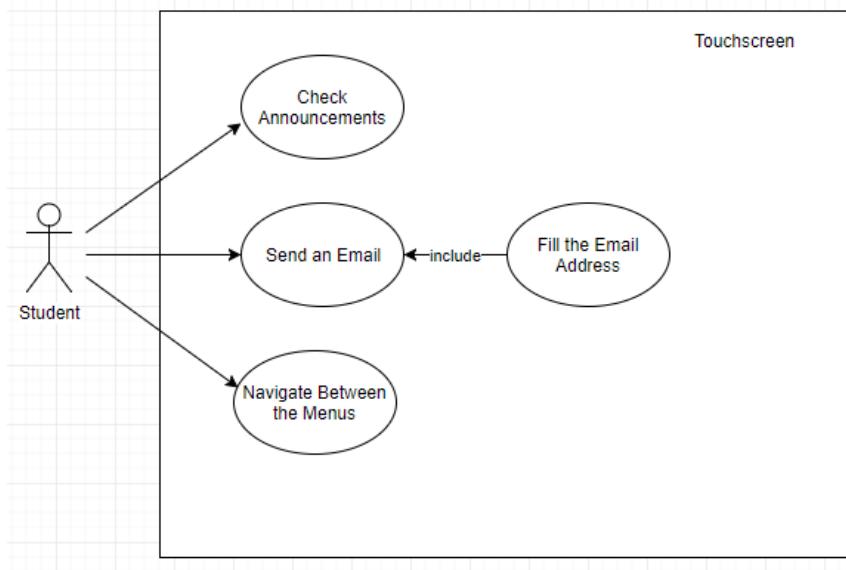- Navigate Between the Menus

4.4.1.3.1   Diagram

Figure 5: Touchscreen Use Case

4.4.1.3.2   Brief Description

- **Check Announcements:** Students can check published announcements by the teacher.

- **Fill the Email Address:** To be able to send a message, the student must enter his/her e-mail address.

- **Send an Email:** Students can send messages to teachers using already determined message templates.

- **Navigate Between the Menus:** The student can navigate between different menus to perform different actions.

4.4.1.3.3 Initial Step by Step Description

1. Check Announcements

    1.1. Student shall check the announcements published by the teacher.

    1.1.1. If there are no announcements, a message will be displayed in the middle of the screen.

2. Fill the Email Address

    2.1. Student shall fill the textbox placed in the top-left corner of the screen with his/her email address.

3. Send an Email

    3.1. Student shall send a message to the teacher.

    3.1.1. If the filled email address is invalid, an error message will be displayed under the textbox for 5 seconds.

    3.1.2. The student shall choose one of the already determined message templates to send it to the teacher.

4. Navigate Between the Menus

    4.1. Student shall change the pages by using the right and left arrows placed on the right and left-hand sides of the screen.

4.4.2 Performance Requirement

The touchscreen's response time must be immediate to increase usability. Also, the connections between Raspberry Pi, touchscreen, database server, webpage and web servers must be smooth without any latency to prevent the loss of data and keep the flow of usage going.

4.4.3 Security Requirements

The messages which will be sent to the teacher will only include templates determined by the admin to prevent inappropriate messages. To be able to send a message to the teacher, the student must enter his/her e-mail and password before sending an e-mail.

4.4.4 Software Quality Attributes

4.4.4.1 Adaptability

Since there will be three different roles for this project, the system will adapt itself for the use of those different roles by asking for approvals.

4.4.4.2 Portability

- Adroit System for Online Time Table and Announcement is implemented using Raspberry Pi.
- The project can mainly be used with Raspberry Pi but other microcomputers or microprocessors like Arduino can also be used for implementing this project.

4.4.4.3 Usability

- There are 3 different user roles that can use this system.
- Teachers have 3 different actions to perform which requires a login operation.
    - o Publish announcements.
    - o Publish grades.
    - o Check received messages.
- Students have 3 different actions to perform.
    - o Send a message to the teacher which requires an authentication with e-mail and password.
    - o Check announcements.
    - o Navigate between the menus using the touchscreen.
- Admins have 2 different actions to perform which requires a login operation.
    - o Add a teacher to the database.
    - o Verify a newly registered device.

5. Software Design Description

5.1 Introduction

5.1.1 Purpose

The purpose of this Software Design Document is providing the details of project Adroit System for Online Time Table and Announcement how and when it can be used, information about their components and how they operate, used techniques and why they were used are discussed and specified.

The expected audience is teachers of Computer Engineering Department of Çankaya University and all the students in Çankaya University. We aim to provide a real-time communication environment which enables an easier communication between teachers and students.

The purpose of this project is to update the schedule actively and display sudden announcements without losing time, eliminate the difficulty of updating the currently-used schedule tables, eliminate the risk of papers hung on the door getting damaged, prevent paper waste and ease the communication and interaction between teachers and students.

In order to provide a better comprehension, this SDD includes various diagrams such as UML diagram of the project, activity diagram and block diagram.

5.1.2 Scope

This document contains a complete description of the design of Adroit System for Online Time Table and Announcement.

In the architecture, a touchscreen will be connected to a touchscreen to design a GUI using C#. C# is an object-oriented programming language that allows developers to design an easy to use and modern GUI with its functions [1].

A website will be implemented for the use of teachers and admins which will be designed using ASP.NET. ASP.NET is a server side web development language. With ASP.NET language apart from static pages, dynamic web pages can also be implemented. In the ASP.NET, there is not always request to the server so, it is more secure and fast.

The database connection will be enabled using MSSQL. Moreover, a mobile application will be developed for Android platform.

Raspberry Pi will be used which is used by many developers because of its functionality, usability and robustness. There are various programming languages that can be used within Raspberry Pi. It is also a great source for designing a user interface and connection with a touchscreen. Furthermore, it can be programmed in Linux, Windows and Mac OS.

For the tracking of the data MSSQL will be used as DBMS. A DBMS is a software that defines, creates, uses and changes the databases. MSSQL is the most popular database management system in the world. With MSSQL, data can be managed in different ways and complicated results can be returned using stored procedures. So, desired data can be obtained.

5.1.3 Glossary

Table 1: Glossary of SDD

Term	Definition
BLOCK DIAGRAM	The type of schema which the components in the system are displayed in blocks.
TOUCHSCREEN	It is a display and an input device. Its screen is sensitive to the pressure so; inputs are taken by touching the buttons on the screen.
RASPBERRY PI	It is a credit-card sized computer which includes audio, video, LAN, USB and HDMI ports and it can be connected to multiple hardware devices such as touchscreens. [2]
STAKEHOLDERS	Any person who has contribution in the project.
SDD	Software Design Document.
UML DIAGRAM	It is a modelling language which is used in Software Engineering.

5.1.4 References

[1]. Hejlsberg, P. Golde and S. Wiltamuth, C♯ language specification, 1st ed. Reading, Mass.: Addison-Wesley, 2003.
[2]. Watkiss, S. (2016). Learn electronics with Raspberry Pi. 7th ed. United Kingdom: Apress, p.92.

5.1.5 Overview of document

The remaining chapters and their contents are listed below.

Section 5.2 is the Architectural Design which describes the project development phase. Also, it contains class diagram of the system and architecture design of the project which describes users' functions and variables. Additionally, this section includes activity diagram of Touchscreen Usage.

Section 5.3 is Use Case Realization. In this section, a block diagram of the system, which is designed according to use cases in SRS document, is displayed and explained.

Section 5.4 is Human Interface Design. In this section, we have shown user interfaces of the components of the project.

5.2 Architecture Design

5.2.1 Simulation Design Approach
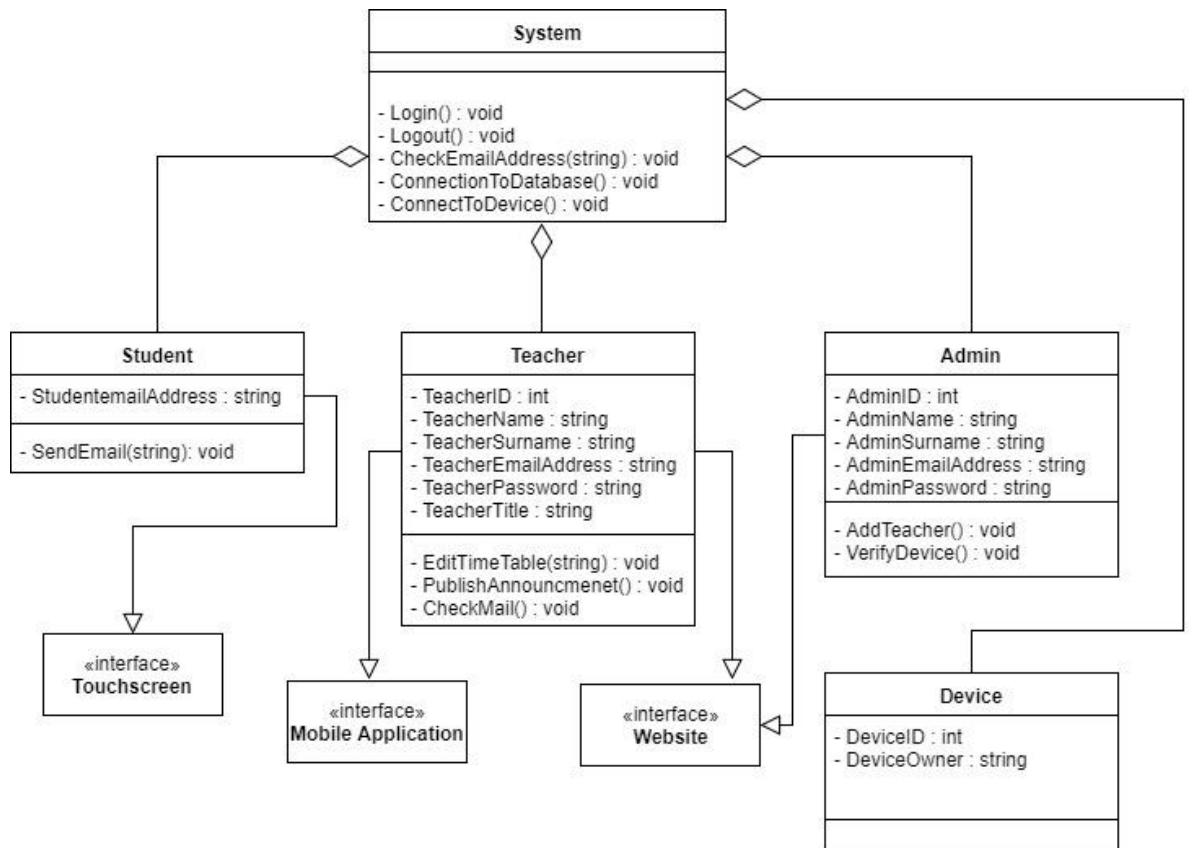
5.2.1.1 Class Diagram

Figure 6: Class Diagram of the Project

Figure 6 displays information about connections between the systems within the project. System Class is the main system function which contains other systems. It is responsible for connections between other systems such as Admin, Teacher, Student and Device. Admin class represents the admins who use the system. Teacher class is for the registered teachers that use the Mobile Application and Website interfaces of the system. Student class is for the Çankaya University students that use Touchscreen interface of the system. Device class is for the registered devices in the Computer Engineering Department.

5.2.2   Architecture Design of Project

5.2.2.1   Profile Management

Summary: This system is used by teacher, student and admin. Teachers can login to their accounts using the system. In addition to this, admin can add a new teacher or a course and verify a newly registered device.

Actor: Teacher, admin
Precondition: User must run the website or the mobile applications.

Basic Sequence:

1. User and the device must be verified if s/he doesn't have an account.
2. User shall login to the system by entering his/her username and password.
3. Admin can add a teacher to the database by selecting add a teacher button from admin menu.
4. Admin can verify a device which is registered recently by selecting verify a device button from admin menu.
5. Teacher can edit his/her timetable by adding or removing lectures.
6. Teacher can publish homework or exam grades by selecting publish grades button from the teacher menu.
7. Teacher can publish an announcement by selecting the publish announcement button from teacher menu.
8. User can log out from the system by selecting log out button.

Exception: Database connection can be failed.

Post Conditions: Changes made by the admin will be saved to the related tables. Published grades and announcements will appear on the related screens on the touchscreen.

Priority: High

5.2.2.2 Touchscreen Display

Summary: Student can see the teacher's timetable, check the announcements and grades, and send a message to the teacher.

Actor: Student

Precondition: Student must enter his/her e-mail address to send message. Other actions do not require any preconditions.

Basic Sequence:

1. Student can check the teacher's timetable which is placed on the main page of the touchscreen.
2. Student can check the published grades by clicking the right arrow button.
3. Student can check the published announcements by clicking the left arrow button.
4. Student can send an e-mail to the teacher by selecting a template from the screen.

Exception: None

Post Conditions: The touchscreen automatically returns to the main page if the screen remains untouched for 10 seconds.

Priority: Medium
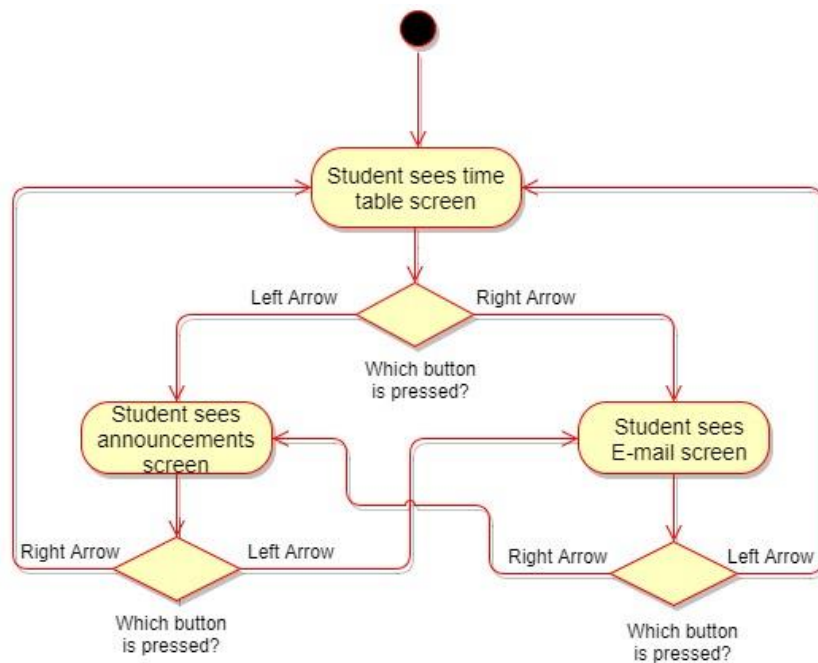
5.2.3 Activity Diagram

Figure 7: Activity Diagram of Touchscreen Usage

Figure 7 shows how the interaction between the touchscreen and students occurs as an activity diagram. The student shall click on right or left arrow button on the screen or none of them. If he/she chooses not to click anything, the timetable stays on the screen. If the student presses the right arrow button, e-mail page appears on the screen. If he/she presses the right arrow button while on the e-mail page, the touchscreen returns to the main page. If the left arrow is pressed, the page goes to the announcements screen.

5.3 Use Case Realizations

Adroit System for Online Time Table and Announcement Project
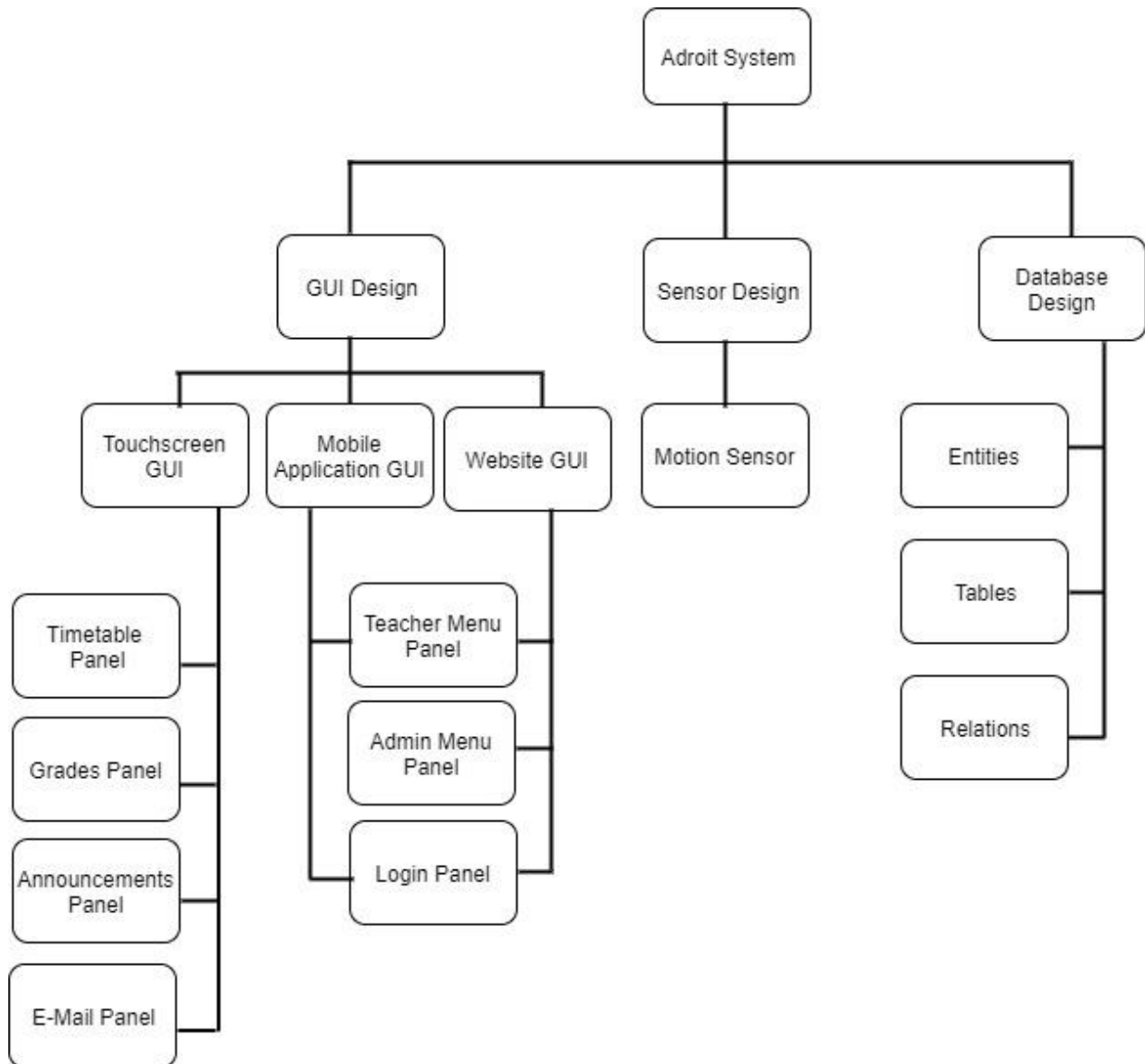

Figure 8: Project Components

5.3.1 Brief Description of Figure 8

Components of the Adroit System for Online Timetable and Announcements Project are shown in the *Figure 8*. All designed systems of the project are displayed in the block diagram in this figure. There are three main components of the system which have their own sub-systems.

5.3.1.1 GUI Design

GUI design is responsible for interaction between the students, teachers, admins and the system. There are three sub-systems in this design which are Touchscreen GUI, Mobile Application GUI and Website GUI. These three sub-systems are divided into other sub-systems. Touchscreen GUI consists of Timetable Panel, Grades Panel, Announcements Panel, E-Mail Panel and Login Panel. Website GUI consists of two panels: Teacher and Admin. On the Mobile Application GUI, there is only a teacher panel. To be able to navigate between various pages, there are arrow buttons which user can press to go from one page to another. On the top of the screen, the teacher's title, name and surname are shown.

5.3.1.2 Sensor Design

Sensor Design is responsible for the management of the power of the components and reducing the carbon footprint of the components. When a student comes in front of the screen, the sensor will sense the motion and activate the touchscreen. With the help of this motion sensor, energy saving will be provided.
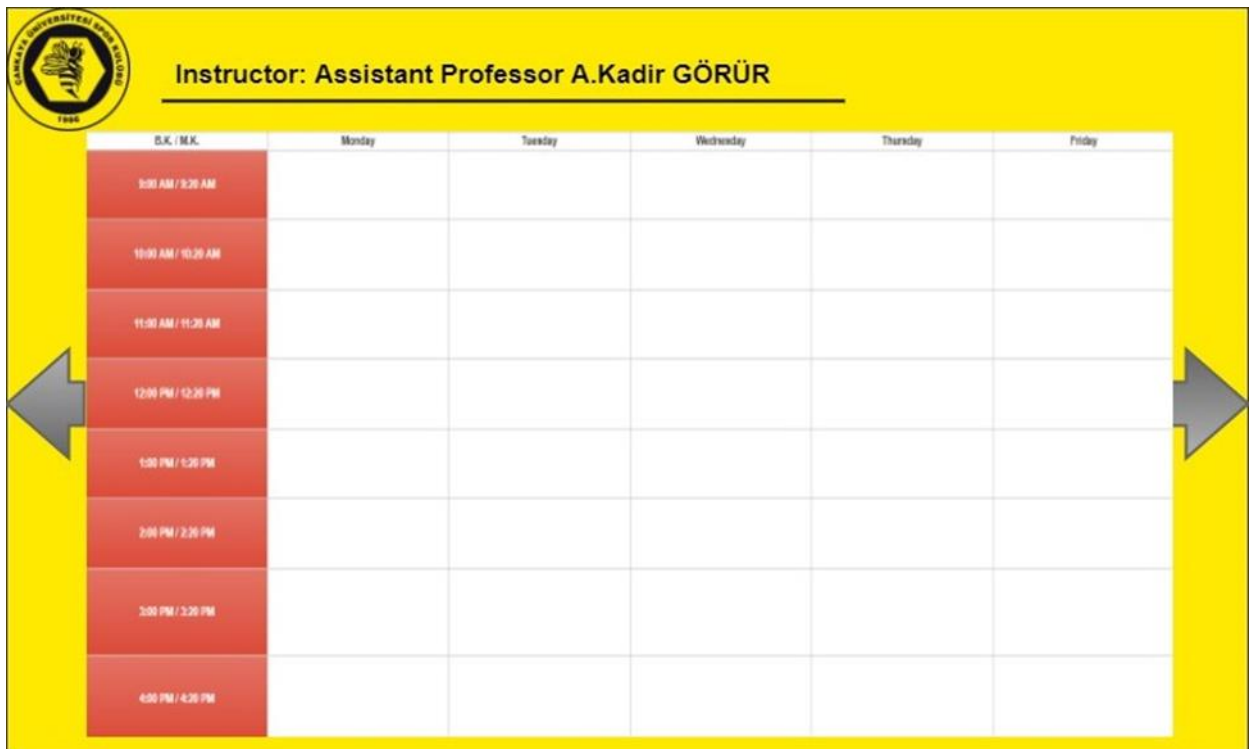
5.3.1.3 Database Design

Database design is responsible for the data that will be read, written and kept track of. The information about teachers, admins, students and components will be stored in the database. This design includes entities, tables and relations.

5.4 Human Interface Design

5.4.1 Overview of User Interface

For an effective interaction between the users and the system, a user interface is crucial. Our project consists of three different user interface designs. Touchscreen, Website and Mobile Application. These three divides into sub-parts in themselves. Timetable Panel is placed on the main page which show the students the teacher's timetable and schedule (Figure 9).

Figure 9: Main Page with Timetable Panel

When the right arrow button is pressed, e-mail page is opened and e-mail panel appears on the screen (Figure 10). Student can select a message template and send it to the teacher after entering his/her e-mail address.

If the right arrow is pressed again in this page, announcement page is opened and both announcements and grades panels appear on the screen (Figure 11). Student can check published grades or announcements. Moreover, if the left arrow button is pressed while the system is on the main page, announcements page is opened. If again the left arrow is pressed on the announcements page, e-mail page is opened.

Figure 11: Announcements Screen and Panel

Teacher Panel includes specific design for teachers to login, publish announcements and grades, check the received e-mails, edit his/her timetable and logout. Admin Panel includes specific design for admins to login, add a teacher to the database and verify a newly registered device.

6. Conclusion

This document includes wide information about our project titled as "Adroit System for Online Time Table and Announcement". In this project, we have aimed to ease the communication and interact, on between teachers and students, and the project will also prevent paper waste. We plan to use latest Technologies such as Raspberry Pi, touchscreen and motion sensor. The purposes of selecting these products are increasing the level of usability, visuality and easy access. Moreover, with its high level of compatibility with other devices, Raspberry Pi provides a wide area to work on compared to other microprocessors and microcontrollers.

To develop this project, we have researched about Raspberry Pi, its usage area and similar projects. We have analyzed the similar projects, and tried to understand how the Raspberry Pi can be used effectively. We have gained a lot of information about Raspberry Pi, the products that can be used with it and how to use them with Raspberry Pi. After doing research for Raspberry Pi, we have researched about database usage and web servers.

Our Project requires data tracking and real-time communication; because of that gaining knowledge and experience about databases and web servers were crucial. After the research was complete, we have prepared SRS and SDD documents. These documents contain requirements and the design principles of the project.

According to our research, there were nearly no projects that was similar to ours. One of the main advantages of our Project is preventing the paper waste. By eliminating the paper usage of the teachers on their doors, there will be less papers wasted and the risk of them getting damaged or lost will be avoided. Another big advantage is allowing the students to communicate and interact with the teachers regardless of the teachers' location at that moment. This real-time interaction is very important for an effective communication and interaction. Although there are advantages of this Project, there are some disadvantages, too. The complete product is costly and there can be malfunctions in the Raspberry Pi, touchscreen, motion sensors or the connections to the servers. If there is a failure on one of these, it can also be costly to fix, and the system cannot be used before the fix.

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