KARADENİZ TECHNICAL UNIVERSITY
THE GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

DEPARTMENT OF COMPUTER ENGINEERING

MODERN ATTENDANCE MONITORING SYSTEM

YÜKSEK LİSANS TEZİ

AMEER ARAFAT

AUGUST 2021
TRABZON

KARADENİZ TECHNICAL UNIVERSITY

THE GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

COMPUTER ENGINEERING

MODERN ATTENDANCE MONITORING SYSTEM

Ameer ARAFAT

This thesis is accepted to give the degree of
"MASTER OF SCIENCE"
By
The Graduate School of Natural and Applied Sciences at
Karadeniz Technical University

The Date of Submission : 14/07/2021
The Date of Examination : 19/08/2021

Supervisor : Assoc. Prof. Hüseyin PEHLİVAN

Trabzon 2021

ACKNOWLEDGMENT

This thesis is written as the completion of the Master of Department of Computer Engineering, Graduate Institute of natural and Applied Sciences, at Karadeniz Technical University. First of all, I would like deeply to thank my respected thesis supervisor Assoc. Prof. Dr. Hüseyin PEHLIVAN. I owe a debt of gratitude to him for his attention and assistance. including valuable discussions and comments, as well as constructive feedback and suggestions throughout the realization of this thesis. Without his guidance and assistance, this thesis would never have come into being. In the thesis, I have benefited from his extensive knowledge and experience, with his interest and support in planning, researching, execution, and formation. My dear professor who shaped my work in the light of scientific foundations with their guidance and information thank him forever. I would like to give my quiet thanks to my family for all the sacrifices they made for me and their endless support. Without forgetting the most two precious persons in my life, I would thank my dear father and mother and my dear brothers that I love them so much, who gave me so much love, support, encouragement, spur, and confidence during my entire studies. Certainly, I want to thank my lovely friends that always helped, stood beside me propped, and supported me during studying. Thank you all from the depth of my heart.

Ameer ARAFAT
Trabzon 2021

THESIS STATEMENT

This note is to declare that the research work in this thesis entitled “Modern Attendance Monitoring System” is a report of reliable research carried out by me, Ameer ARAFAT and under supervision, follow-up, and directions Assoc. Prof. Hüseyin PEHLIVAN. Neither this thesis nor any part of it has been submitted to any other University or Institute for the award of any degree or diploma, except where due reference acceptance has been given in the thesis. 19/08/2021.

Ameer ARAFAT

CONTENTS

Page No

ACKNOWLEDGMENT II
THESIS STATEMENT III
CONTENTS IV
SUMMARY VI
ÖZET VII
FIGURE LIST VIII
TABLE LIST X
1. INTRODUCTION 1
1.1. Thesis Motivation 1
1.2. Thesis Aim 1
2. LITERATURE 2
3. HARDWARE 4
3.1. ARDUINO 4
3.1.1. Why ARDUINO 4
3.1.2. Definition of Arduino 4
3.1.3. Types of Arduino Device 5
3.2. Breadboard 6
3.2.1. What is a Breadboard? 6
3.2.2. Advantages of the Breadboard 7
3.3. Fingerprint Sensor 8
3.3.1. The Functions of the Fingerprint Sensor 9
3.4. Bluetooth Device 10
3.4.1. How Bluetooth Works? 12
3.5. Battery 12
3.6. Jumper Cable 13
3.7. Resistance 13
3.7.1. What is Resistance? 13
3.7.2. Overview of Resistor 14
4. SOFTWARE 15
4.1. IDE Code 15

4.2. Database 16
4.2.1. What is the Database? 16
4.2.2. What is the SQL? 16
4.2.3. Advantages and disadvantages of SQL language 16
4.3. Visual Studio 2019 17
5. SYSTEM DESIGN 19
5.1. To Save Data Into the Fingerprint Sensor 22
5.2. Software Application 24
5.3. Lessons Information 26
5.4. Lesson Program 27
5.5. Student Information 28
5.6. Update Information 31
5.7. The Attendance Record 33
6. THE REPORTS 35
6.1. General Report 36
6.2. Report of Attendance Dates 37
6.3. Report of Students 38
6.4. Report of Lessons 39
6.5. Report of the Eligible Students for the Exam 40
6.6. Report of the Non-Eligible Students for the Exam 41
7. Web Application 43
7.1. Authorization Page 43
7.2. Attendance Page 44
8. CONCLUSION 46
9. FUTURE WORK 48
10. REFERENCES 49
CURRICULUM VITAE

Master Thesis

SUMMARY

MODERN ATTENDANCE MONITORING SYSTEM

Ameer ARAFAT

Karadeniz Technical University
The Graduate School of Natural and Applied Sciences
Computer Engineering Graduate Programs
Supervisor: Assoc. Prof. Hüseyin PEHLIVAN
2021, 48 Pages

For the betterment of e-education quality, monitoring the attendance of students is a very important part of the modern education system. Manual filling of traditional attendance sheets can raise many inconvenient issues. To avoid these issues, we come up with the idea of an attendance system that uses the fingerprints of the students to monitor their attendance. This study aims to make it easier and more accurate for both the teachers and the students to examine. There are two possible methods for an attendance management system. The first method is that the teacher calls all students' names, which takes a lot of lesson time. The other one is to give the attendance sheet to the students in the lecture class, asking them to write their names and place their signatures on it; in this method, some students can sign instead of other students who are not present in the course. Such methods can lead to the problem of inaccurate attendance records. the students can calculate their attendance by entering their student number and password on a website which is created for that. Within the scope of the study, it is possible to prevent the inconveniences of the traditional attendance system in schools, universities, and offices. At the same time, it aims to prevent time-consuming tasks such as organizing the transaction using the polling system and recording it. With the proposed tool, it will be sufficient to monitor the attendance of students in schools and universities and there will be no waste of time in attendance calculation. This system can replace the traditional participation system when it is used in all schools in the future, in which case the arrangement of the attendance can be done very easily and quickly, and reports can be issued easily.

Keywords: Biometrics, Fingerprint, Attendance, Database, Arduino.

Yüksek Lisans Tezi

ÖZET

MODERN DEVAM İZLEME SİSTEMİ

Ameer ARAFAT

Karadeniz Teknik Üniversitesi
Fen Bilimleri Enstitüsü
Bilgisayar Mühendisliği Anabilim Dalı
Danışma: Doç. Dr. Hüseyin PEHLİVAN
2021, 48 Sayfa

Eğitim kalitesinin iyileştirilmesi için öğrencilerin devamsızlığını takip etmek, modern eğitim sisteminin çok önemli bir parçasıdır. Geleneksel yoklama sayfalarının manuel olarak doldurulması pek çok rahatsız edici sorunu ortaya çıkarabilir. Bu sorunlardan kaçınmak için, öğrencilerin devamlarını takip etmede onların parmak izlerini kullanan bir devam sistemi fikriyle yüz yüze geliriz. Bu çalışmanın amacı öğrencilerin derslere devam durumlarının kayıt altına alınmasını daha kolay ve daha doğru hale getirmektir. Bir katılım yönetim sistemi için iki olası yöntem vardır. İlk yöntem, öğretmenin tüm öğrencilerin adını okumasıdır ki bu da ders süresinin bir kısmını alır. Diğeri ders sınıfındaki öğrencilere yoklama kağıdını vermek, kendi isimlerini yazmalarını ve üzerine imza atmalarını istemektir, Bu yöntemde bazı öğrenciler derste bulunmayan diğer öğrenciler yerine imza atabilirler. Ayrıca bu çalışmanın amacı, öğrenciler bunun için oluşturulan web sitesinde öğrenci numaralarını ve şifrelerini girerek katılımlarını hesaplayabilirler. Çalışma kapsamında okullarda, üniversitelerde ve ofislerde geleneksel devam sisteminin aksaklıklarının önüne geçmek mümkündür. Aynı zamanda, sorgulama sistemini kullanarak işlemin organize edilmesi ve kaydedilmesi gibi zaman alıcı görevlerin önüne geçmeyi amaçlamaktadır. Önerilen araç ile öğrencilerin okullara ve üniversitelere devamlarının izlenmesi yeterli olacak ve devamsızlık hesaplamasında zaman kaybetmeye gerek kalmayacaktır. Bu sistem, ileride tüm okullarda kullanıldığında geleneksel katılım sisteminin yerini alabilir ve yoklamanın düzenlenmesi çok kolay ve hızlı bir şekilde yapılabilir ve raporlar kolaylıkla çıkarılabilir.

Anahtar Kelimeler: Biyometri, Parmak İzi, Devam, Veritabanı, Arduino.

FIGURE LIST

Page No

Figure 1. Arduino NANO 5
Figure 2. Breadboard 6
Figure 3. Types of Breadboard 7
Figure 4. Architectural design for the Breadboard 8
Figure 5. Fingerprint sensor 9
Figure 6. System diagram of an optical fingerprint sensor 10
Figure 7. The finger data storage in the fingerprint database 10
Figure 8. Bluetooth device 11
Figure 9. The architectural design of the Bluetooth device 11
Figure 10. Representation of the shape of the tesistors 13
Figure 11. LDE for coding the Arduino 15
Figure 12. Designed database tables and their relations 18
Figure 13. Teacher and student case diagram 20
Figure 14. Flow diagram of system working procedure 21
Figure 15: The Arduino connected with the Fingerprint sensor 22
Figure 16: The connection of the Arduino and the Bluetooth device 23
Figure 17. Arduino LED code for the storage of fingerprint data 23
Figure 18. The controlling process of Arduino LED code 24
Figure 19. Login interface 25
Figure 20. Activity diagram for admin login 26
Figure 21. Lesson information form 27
Figure 22. Lessons program form 28
Figure 23. Adding student information form interface 29
Figure 24. User form used to enter student information 29
Figure 25. Adding another lesson for the student 30
Figure 26. Displaying student information 30
Figure 27. Student information update form 31
Figure 30. The general report of students and their attendance dates 36
Figure 31. Report of lesson attendance dates 37
Figure 32. A list of lessons 38

Figure 33. The report of the lesson attendance.....39
Figure 34. The first step for creating a report for students who is to enter the exam.....40
Figure 35. The second step for creating eligible students for the exam.....41
Figure 36. Specification of the lesson name and the maximum number for missed lessons42
Figure 37. List of non-eligible students for exam.....42
Figure 38. Login page of the web application.....43
Figure 40. Information of student attendance.....44
Figure 41. Password modification interface.....45

TABLE LIST

Page No

Table 1. A description of how to connect a Bluetooth HC-06 12
Table 2. Identification of resistors by color codes 14
Table 3. Cost of devices 34

1.INTRODUCTION

1.1. Thesis Motivation

To ensure quality full lectures in schools and colleges, with respect to an increase in the number of lessons and students, there is a student monitoring scheme [1]. Monitoring a student's attendance gets more difficult and problematic, especially in the case that the number of students in the classroom is large. In general, two popular ways can be followed to record student attendance. First, the teacher reads and records all of the student names on the attendance sheet, which takes a significant amount of time away from the lesson. Second, the teacher gives each student in the class an attendance sheet and asks them to sign it. In this scenario, some students can try to cheat by signing on behalf of classmates who are unable to attend class. In addition, there are some other issues that can arise more rarely. On calculating the attendance rate for each student, the instructor can misplace attendance papers or make errors. To avoid these issues, we take advantage of technological advancements rather than relying on outdated attendance monitoring methods. Particularly, the discovery and production of biometric devices have presented to a better way of restricting access to a variety of sensitive locations, including high-security government buildings and structures. Several biometric devices can serve to monitor students [2], such as the fingerprint device [3], iris recognition [4], and hand recognition [5].

1.2. Thesis Aim

The thesis aims to develop an attendance monitoring system that can be used to monitor the attendance of students based on a specific place and time. There would be no need to waste time or encourage students to manipulate or return the attendance sheets to measure attendance rates if the developed system is used to monitor student attendance in education institutes. Biometric systems focus on some of the features used to recognize only a person's physical or behavioral characteristics that set them apart from others. The fingerprint reader can be used for a variety of purposes, including staff monitoring and access control, among others.

2. LITERATURE

The merits and demerits of some of these designs that inspired us while designing this cost-effective and compact version of the attendance monitoring system are mentioned below.

Nayyar and Puri [6] created a mobile application to monitor student attendance. To keep track of the students' attendance, they used a fingerprint device to save and match their fingerprints. Node MCU was also used to keep track of attendance in its memory, and when the Arduino Nano sends a message, the data is transferred to the MySQL database and displayed on the website (by using PHP code). It's also available in Excel format. They used a screen LCD to monitor the operations of recording attendance and submitting attendance data to the database. Since all of the information for attendees was stored on Amazon Web Services, this system had the downside of requiring a strong internet connection to function (AWS).

Node MCU device is like Arduino device but its memory capacity is more than Arduino. This device can save a long string text. It also has the capability of integrating Wi-Fi.

Zainal, Gunawan et al. [7] developed a portable attendance device that uses a Real-Time Clock (RTC) to determine the time and date of attendance recording. The fingerprint device's memory was used to store fingers and align them with those stored in the fingerprint device's memory. Also, an SD card is used to store attendance data, but before it is saved, it is encrypted. To encrypt/decode data, Bloodshed Dev C ++ program was used. The time, date, and student name are shown on the touch screen shield (TFT) that is mounted on top of the Arduino Mega. They didn't say where the encrypt/decrypt data code was published. The downside of this device is that it will not function if there is even a minor problem with the SD card.

Kumar, Dhanalakshmi et. al. [8] equipped a system to take students' presence by storing and matching their fingerprints, and a keypad to enter student information such as names, addresses, and phone numbers (student number, name, student class, etc.). Via LCD operations, a GSM module is used to upload/download attendances from the server as well as send SMS to the parent form reporting attendance. It also used a 2GB flash drive to save attendance.

Dastidar, Bansod et. al. [9] have come up with a great idea for keeping track of student's attendance and saving classroom attendance data. They have not, however, produced a flawless implementation of their system. There's also no mention of how they'll collect and store data before sending it to the database. Furthermore, there is no clarification as to what would happen to the data collected if there is no Wi-Fi link.

Developed by Peter, Uzoechi et. al. [10], database design, fingerprint enrollment, check-in/out system, and web-based report monitoring system were all very comprehensive. This device also had the capability of testing attendance during regular lectures and exams. Another fantastic aspect of this implementation is the ability to monitor teacher attendance. However, one drawback of the system is its size, as well as the length of time it takes to register students. The authors have proposed the use of a modular fingerprint framework to solve this issue.

Shoewu, Oluwagbemiga et. al. [11] completed a study that takes the attendance in class using fingerprints. In addition, the packaging proposal they gave for ease of use and portability is also impressive. However, nothing was addressed concerning the examination side, such as guaranteeing that the exam was taken by the same person who attended the lectures. Furthermore, there was no mention of the lecturer taking the test.

In the study performed by Abd Wahab, Mohd Helmy et. al. [12], the RFID technology was utilized to create a class attendance system. An active RFID reader was employed in their proposed system to automatically trigger a tag on the student, and the information contained in the tag was then validated against a database of student information. The portability of this technology is an advantage. The pupils, on the other hand, will be compelled to wear tags. This is something they may forget, and as a result, they will be marked absent from the lecture. This is especially bad if the student forgets the tag during an exam.

To avoid issues such as a bad internet connection or a damaged SD card, we designed a device that connects to the computer directly via a Bluetooth device (HC06) connected to an Arduino Nano and a fingerprint scanner (these three devices are mounted on a breadboard and connected by jumper cable) to transfer the finger data into a database table in MSSQL. If all of the data from the fingerprint scanner matches what is stored in the database, the student's attendance will be registered.

3.HARDWARE

3.1. Arduino

The use of open-source controllers is getting more widespread [13]. Technologies have evolved into a critical component of our time, allowing us to better facilitate the processes that support our everyday lives in all facets of our lives [14]. Arduino is one of these new open-source technologies, for which a typical example is an automated irrigation system.

3.1.1. Why Arduino

There are a variety of Micro-Controllers to choose from [15], All of them, including Parallax, Basic Stamp, and Raspberry Pi, are capable of controlling various electronic parts and software programs, although with different preferences, but what sets the Arduino apart from the rest is a set of features, of which the most crucial ones are listed below [16]:

a) Simplicity.
b) The price.
c) Self-assembly.
d) Multi-platform.
e) Easy and simple programming environment.
f) Open Source Software.
g) Open Source Hardware.

3.1.2. Definition of Arduino

Arduino is a free and open-source framework for building electronic projects [17]. It is a small device that can communicate with and monitor the environment better than a desktop or laptop computer. Technically, it's an open-source microcontroller platform designed to be simple to use by anyone with an interest in electronics. You can use Arduino to read signals from different sensors, switch lights on and off, start motors, and perform any electronic application you like. As seen in Figure 1, it consists of a Micro-controller and an IDE [18].

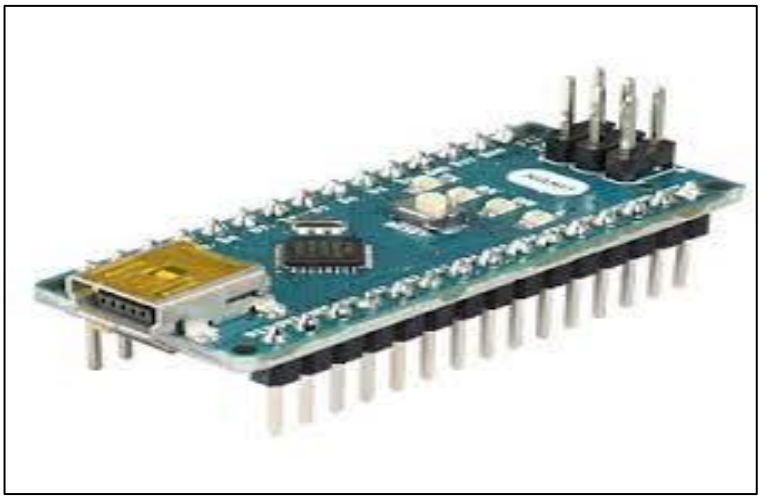


Figure 1. Arduino NANO

3.1.3. Types of Arduino Device

a) Arduino Uno.
b) Arduino Leonardo.
c) Arduino Mega.
d) Arduino Due.
e) Arduino Nano.
f) Arduino Mini.
g) Arduino Lily Pad.
h) Arduino Board.

The Arduino's strength lies in its ability to communicate with other electronic components, such as switches or sensors, and to use them to obtain various types of data, such as temperature or lighting intensity, as well as its ability to regulate motors, LEDs, and a variety of other electronic components. Arduino devices can be controlled by connecting them to a computer and instructing it to run one of the programs on the device, or they can be run independently.

3.2. Breadboard

3.2.1. What is a Breadboard?

The electronic experimental board is the first step in creating electrical circuits that allow you to install a group of electric devices and allow you to add wires and create a variety of electronic circuits without the need for welding or spending time changing or removing any wire or electronic compound from the circuit you're creating. It's quite easy to use it whenever you want. This board's benefit is that it provides an experimental environment for basic educational experiments as well as complex circuits that can be converted into collectibles and home goods [19]. It enables us to test the circuit that we set up quickly. It enables us to test circuits until they are transferred to printed circuit boards or punch cards. We can check the circuit connections and notice any errors this way. We can reuse electronic components already used in other projects since the circuit can be installed as a plug-and-play. It's a flat-shaped plastic sheet with rows and columns of metal attachment points that are used to put together electronic circuits. It is reusable and does not need welding. This makes it simple to use to construct temporary circuit models and experiments. A breadboard is shown in Figure 2.

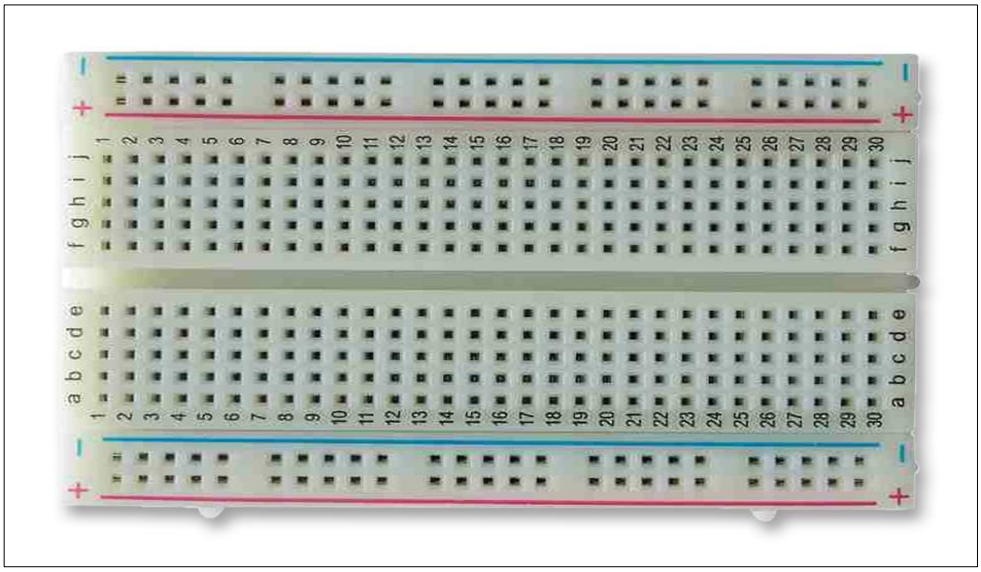


Figure 2. Breadboard

Breadboards are divided into numerous categories based on their size. The amount of electronic components and the number of legs in our project or design will determine which breadboard we employ. Depending on the size of your project, you can select the appropriate breadboard. For sophisticated and multi-component electronic applications, even a big breadboard may not be enough. In these circumstances, a board of the desired size is created by joining multiple breadboards and using the notches on the edges to join them together. Mini-size, medium-size, and large-size breadboards are the three types of breadboards. The price of a breadboard rises in proportion to its size. There are three types of a breadboard, as shown in Figure 3.

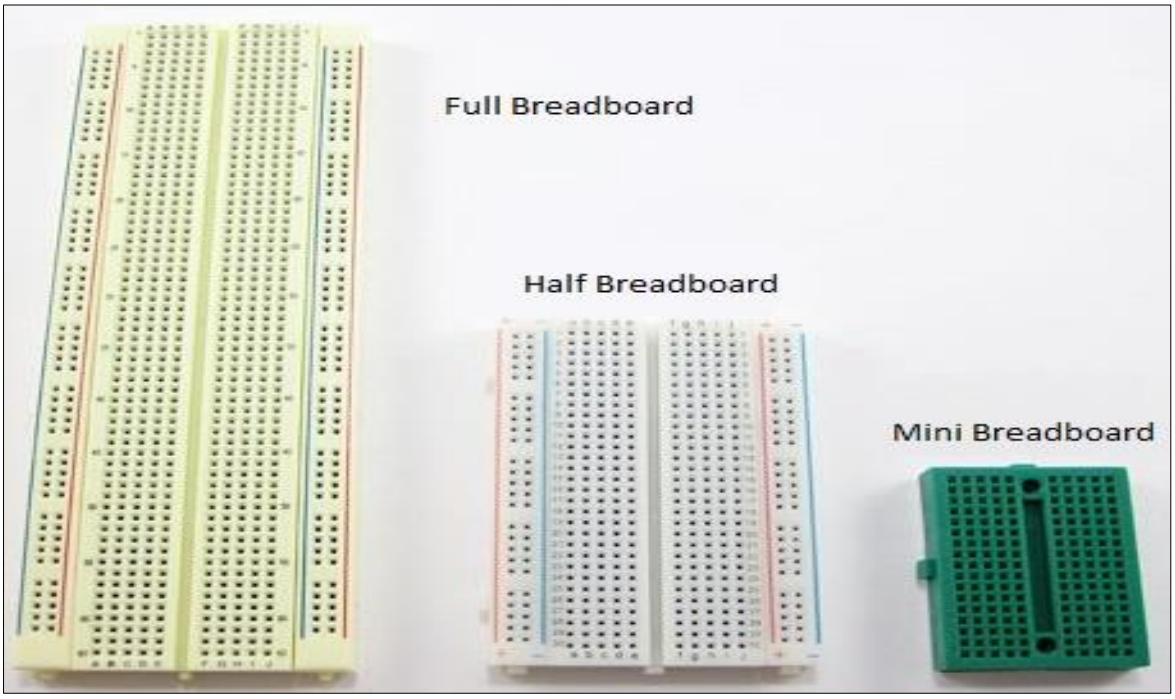


Figure 3. Types of Breadboard

We use a breadboard to attach the devices Fingerprint, Arduino Nano and Bluetooth, and feed the machine with the energy it needed to transmit orders and data.

3.2.2. Advantages of the Breadboard

The breadboard highlights some advantages below.

a) It is easy to disassemble and install electronic parts.

b) It is possible to use electronic parts more than once.

c) It gets multiple electronic forms.

d) It does not require welding to install components.

e) It provides an experimental environment for either simple educational experiments or complex circuits.

f) It can make a group of various electronic circuits.

g) It can replace any wire or electronic component from your circuit whenever you want.

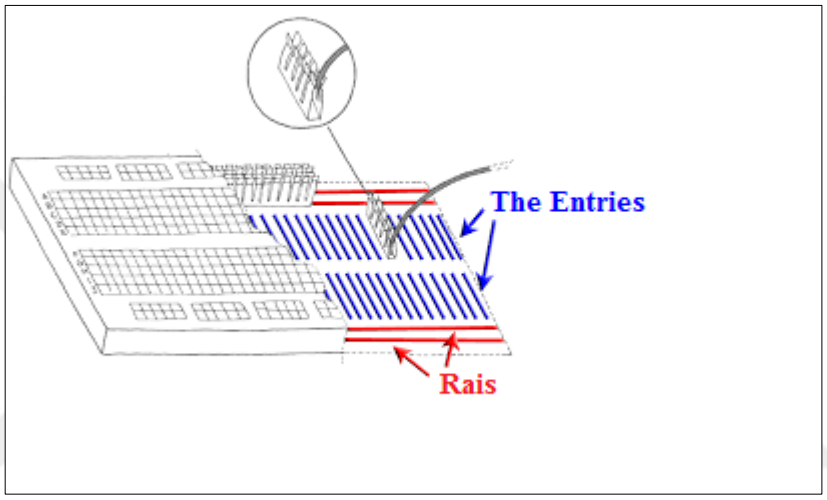


Figure 4. Architectural design for the Breadboard

3.3. Fingerprint Sensor

For decades, fingerprint sensors have been the subject of spy and surveillance films and stories. These scanners were, in reality, a rare piece of technology until recently. However, in recent years, it has begun to show up in several places, including police stations and high-security buildings, as well as on personal computers and smartphones. Nowadays, you can purchase a fingerprint that is exclusive to you. Since it uses people's unique fingerprints, the fingerprint sensor is extremely accurate (Figure 5. Fingerprint Scanner). Since the fingerprint is more secure and difficult to fool, the conventional password or ID card has been replaced with a fingerprint scanner to access security buildings such as police stations and buildings with high-security systems. The device's operation is focused on the fact that when there are no fingers on the device's glass plate, the light inside the device is entirely reflected on the internal sensor, so when the fingers

contact the glass, the camera receives the reflected light from the fingerprint. As a result, the unit generates a representation of it. The finger must not be dirty or damp to enhance the functionality and efficiency of the fingerprint system, as this decreases the performance of Fingerprint realization [20].

Figure 5. Fingerprint sensor

The fingerprint reader serves two purposes: the first is to store the fingerprint entered into the device's database; the second is to match the fingerprints put on the device to the fingerprints already stored in the device's database[21]. The system will submit the finger ID if matching is successful.

3.3.1. The Functions of the Fingerprint Sensor

First, when we put our finger on fingerprint sensor with a pressure of fingers the print is taken by the light coming from the device as a digital image and this digital image is converted into a matrix of zero and one values then these values are saved into the database of the device. Figure 6 illustrates how the fingerprint sensor works and Figure 7 shows how the data produced by the fingerprint sensor is stored.

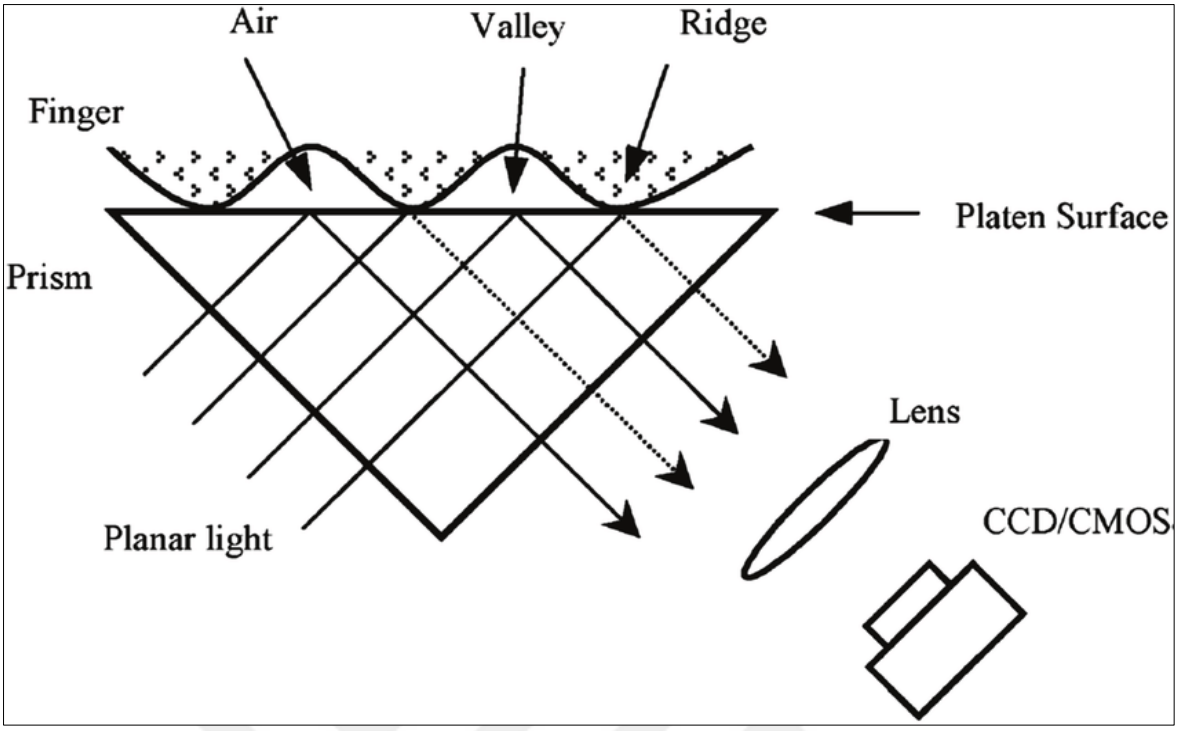


Figure 6. System diagram of an optical fingerprint sensor

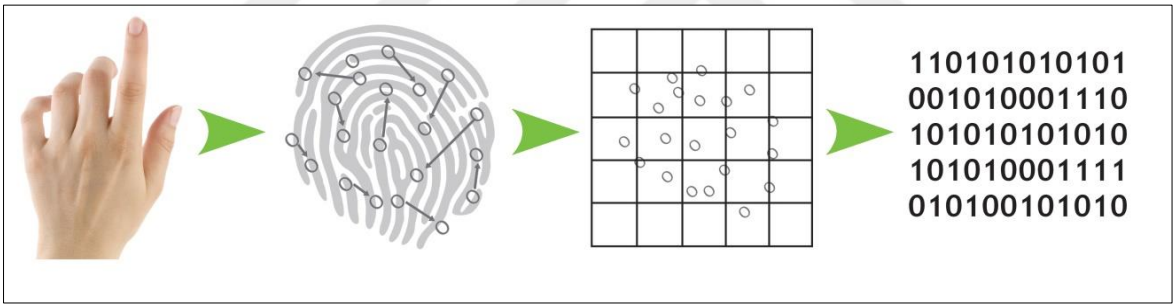


Figure 7. The finger data storage in the fingerprint database

As seen in Figure 7, the matching process ensures that the canyon pattern and the edges on the finger surface in the image match the pattern of one of the images stored inside the database of the device**.**

3.4. Bluetooth Device

Since its activity is focused on the propagation of short-range radio waves, Bluetooth technology is one of the most commonly used wireless communication technologies. Figure 8 shows the Bluetooth device and Figure 9 demonstrates the architectural design of the Bluetooth device.

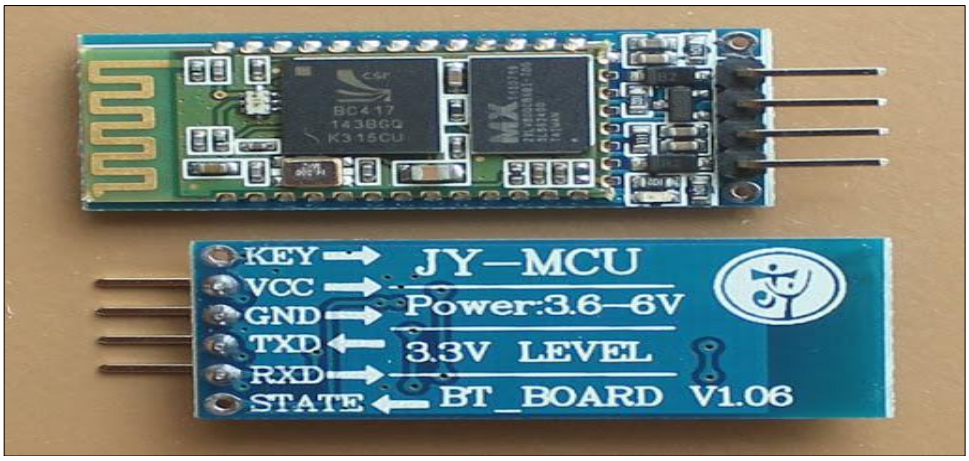


Figure 8. Bluetooth device

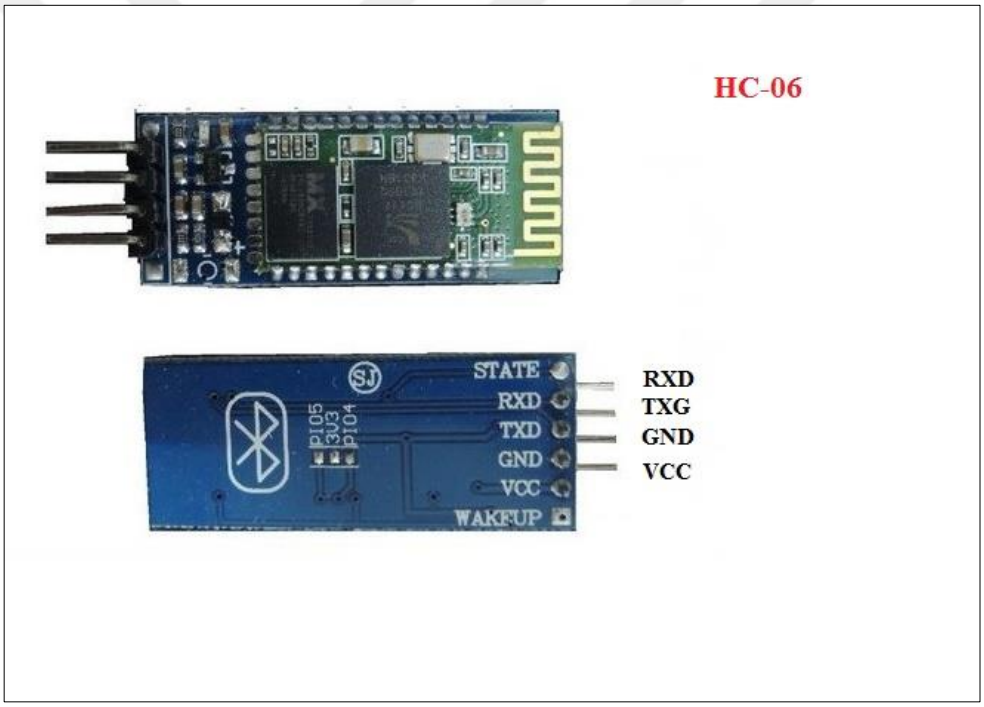


Figure 9. The architectural design of the Bluetooth device

To allow communication, the Bluetooth interface uses low energy depletion. Establishes wireless communication between electronic devices, enabling them to connect and interact without the use of wires [22]. It can be used in a wide range of products, including smartphones, speakers, laptops, and many other smart devices [23]. Since we cannot have a reliable link to Wi-Fi all of the time and anywhere on campus or at school, it is preferable to connect to a network using Bluetooth rather than Wi-Fi.

3.4.1. How Bluetooth Works?

Bluetooth is a wireless technology that has been in use for more than two decades. Multiple devices can link, communicate, and sync using a Bluetooth device without the need for a network. Bluetooth modules can now be used on anything from smartphones to laptops and car stereos. Bluetooth technology is compatible with a wide range of devices. Instead of using a direct wired link, Bluetooth is used to establish a short-range wireless connection. In the tables below, the method for connecting the device to the Arduino board or the breadboard and is noted that four pins must be used for the device to function properly. Table 1 describes the connection process of a Bluetooth HC-06 device.

Table 1. A description of how to connect a Bluetooth HC-06

The pin name	characterization
TXD	Connect this pin to RXD pin on the Microcontroller. It is transmitted Serial data (wireless signals received by the Bluetooth are converted by module and transmitted out serially on this pin)
RXD	Connect this pin to the TXD pin on the Microcontroller. The HC-05 Bluetooth module receives the data from this pin and then transmits it to wireless.
GND	Connect to the common ground of the circuit.
VCC	Used to power the module. Connect it to a 3.3V pin of the microcontroller.

3.5. Battery

BATTERY is a term used to describe devices that convert chemical energy to electrical energy and store it. Primary (single-use or non-chargeable) and Secondary (reusable or charged) batteries are the two types of batteries. They are use in gadgets

including radios, flashlights, toys, mobile phones, and other wireless power instruments like drills, screwdrivers, cameras, cordless phones, and emergency lighting systems. A five-volt rechargeable battery was used to provide the device with the necessary electricity.

3.6. Jumper Cable

This kind of link cable is ideal for circuits that combine a breadboard and a development board, such as an Arduino And a Breadboard. It was used to provide power to computers. In addition, we needed to link devices so that we could move data from and to the microcontroller (Arduino NANO).

3.7. Resistance

3.7.1. What is Resistance?

Resistance in electrical circuits is the strain encountered by an electric current passing through a conductor. It shows properties similar to friction in mechanical systems. The unit of resistance is Ohm (Ω). It is denoted by the letter R in the equations. The symbol of resistance in electronic circuits can be represented in 2 different ways. The representation of the shape of the resistors is shown in Figure 10. Table 2 presents the color codes to identify the values of resistors.

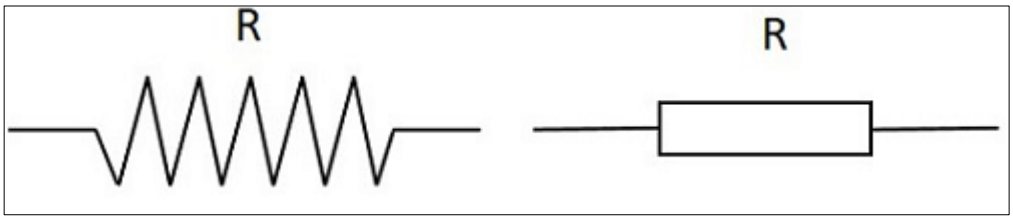


Figure 10. Representation of the shape of the tesistors

Table 2. Identification of resistors by color codes

COLOR	1.strip first digit	2.strip second digit	3.strip third digit	4.strip coefficient	5.strip tolerance	6.strip temperature coefficient
Black	0	0	0	x10^0		
Brown	1	1	1	x10^1	± %1	100
Red	2	2	2	x10^2	± %2	50
Orange	3	3	3	x10^3	± %3	15
Yellow	4	4	4	x10^4	± %4	25
Green	5	5	5	x10^5	± %0.5	
Blue	6	6	6	x10^6	± %0.25	10
Purple	7	7	7	x10^7	± %0.1	5
Gray	8	8	8	x10^8	± %.05	
White	9	9	9	x10^9	± %1	
Gold					± %5	
Silver					± %10	

3.7.2. Overview of Resistor

Instead of printed text, a color code is employed for very small electronic components. The value, rating, and tolerance are all indicated by this color code. For resistance identification, resistors come in a variety of colors. The printed colors provide an accurate depiction of the resistor's value.

Resistors can be printed with three, four, five, or six color bands. The resistor's basic value in ohms is determined by the first three or four bands. Because there is a third significant digit in a 5 band resistor, it is more exact than a 4 band resistor. A 6-band resistor is similar to a 5-band resistor with the addition of a temperature coefficient band.

4. SOFTWARE

4.1. IDE Code.

It's simple to write code and upload it to the board using the open-source Arduino Software (IDE). Any Arduino board will work with this application. It is easy to use and learn (see Figure 11).

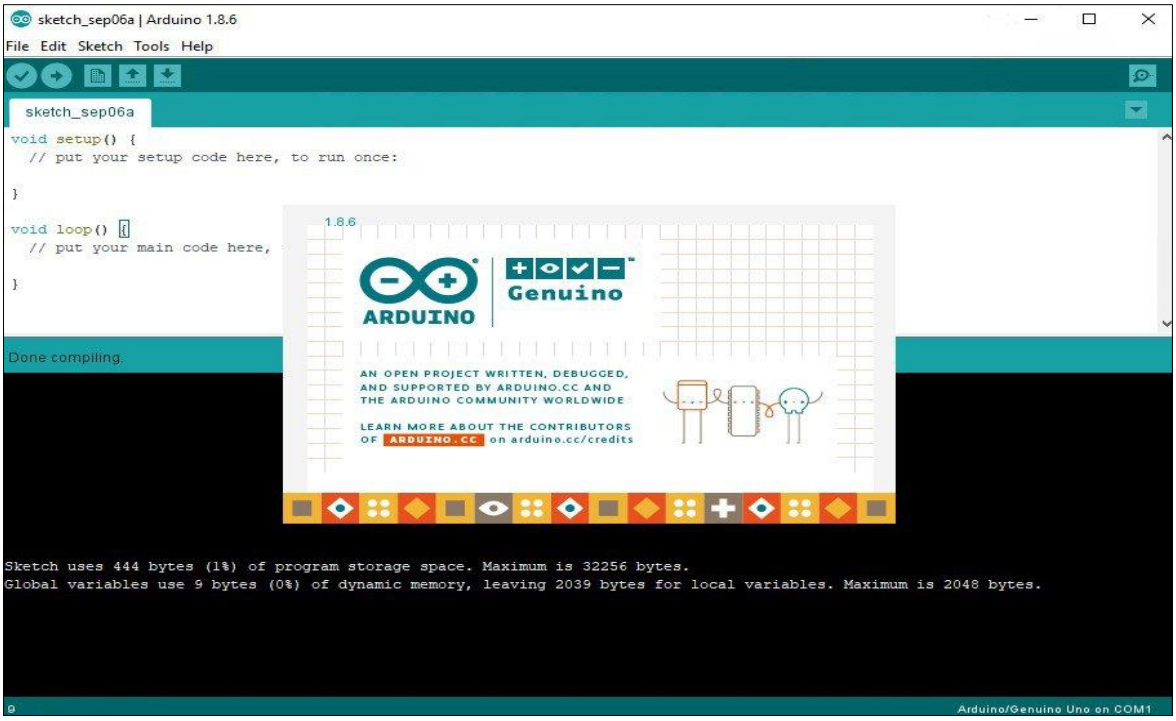


Figure 11. LDE for coding the Arduino

4.2. Database

The most appropriate medium for the data analysis is SQL Server. It offers adequate protection for this data security study because its interface is simple and easy to understand.

4.2.1. What is the Database?

Databases are characterized as a collection of data or information that is specifically structured for computer search and retrieval, as they are organized in a way that allows for the synchronization of data storage, retrieval, modification, and deletion operations.

4.2.2. What is the SQL?

SQL (Structured Query Language) is a query language for retrieving data from databases. SQL is one of the most common database languages, with special versions developed by several major companies such as Microsoft and Oracle, as well as an open-source version called MySQL that has gained a lot of traction. SQL is based on the concept of providing programmers and computer users with a way to help them access the necessary information from a database, as this language has a simple level of a small group of commands. The four basic SQL commands are below.

a) The “Select” command:is used to define data.
b) The “Insert” command:is used to add data to the base.
c) The “Update” command:is used to modify information.
d) The “Delete” command:is used to delete information from the database.

4.2.3. Advantages and disadvantages of SQL language

There is no such thing as a perfect programming language; all languages have advantages and disadvantages, and the use of a language and its desires are determined by the programmer's skill level and ability to learn it.

a) Advantages:

I. It is not necessary to write and compile code; since database systems are simple to handle using standard SQL and don't need any coding.

II. The data can be transferred within the rules that use SQL language easily and conveniently.

III. SQL is an interactive language that is used to communicate with a database to help in the easy retrieval of data related to inquiries in seconds.

b) Disadvantages:

I. Partial control: the programmers do not have complete control over the database because of hidden business rules.

II. Cost: Some SQL versions have high running costs, making them difficult to use for some programmers. User Interface: SQL has a complex interface that makes it difficult for some users to work with.

4.3. Visual Studio 2019

Visual Studio is an interactive development platform that lets you use a variety of programming languages to build apps, programs, and websites. For the Microsoft Windows operating system, Visual Studio is used to create computer apps, websites, desktop applications, web services, and mobile applications. Students' information and attendance were inserted, modified, and processed using Visual Studio 2019 (.NET framework), which was saved in the database (SQL).

The schematic diagram of the SQL server database table we used to save the input data is shown in Figure 12. The Lessons table contains the information for the courses in the class. The Student table contains information about students who took courses for that term. The "Less_program" schedule includes the dates and hours of lessons. It provides an N*N connection between the 'Student' table in the 'Student_Lesson' table and the 'Lessons' table. The "Attendance" table contains information that shows whether students attend the teacher's lectures during the semester.

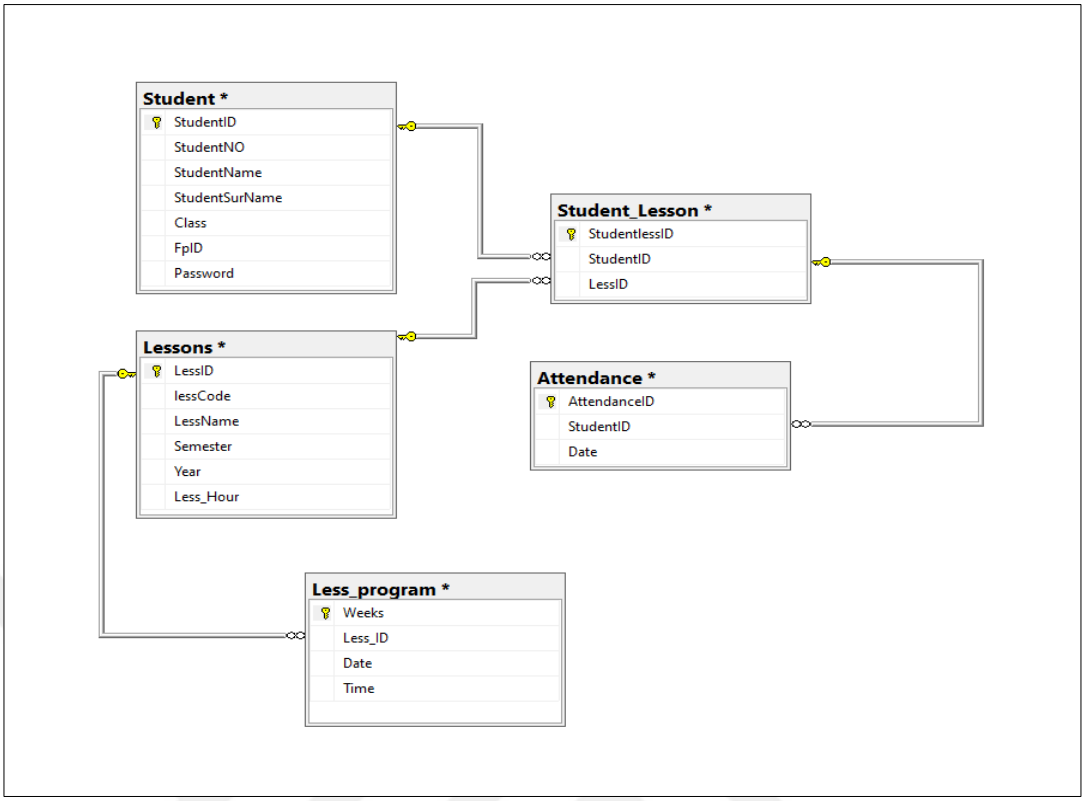


Figure 12. Designed database tables and their relations

5. SYSTEM DESIGN

The function of software modules resembles a schematic diagram to whom is entitled to access the system. We used use case diagram to represent our system's functionalities. Use Case Diagram (UCD) is an approach for describing the functioning of a system in a horizontal manner. Each use case explains how to accomplish a goal or complete a task. A use case is a collection of conceivable sequences of interactions between the system and users in a specific environment, all of which are tied to a specific purpose.

The three basic elements of the diagram are as follows:

1. Actor: This could be a teacher or a student who has an influence on the one or more design tasks.
2. Use Cases are depicted as a horizontal ellipse and describe a set of events that deliver some kind real value to a user.
3. System Boundary Boxes: To represent the scope of the system, a rectangle is drawn around the use cases, referred to as the system boundary box. Anything inside the box is a scope of functionality, and nothing outside the box is a scope of functionality.

There are few other elements which is: An association relationship. A straight-line links an actor with the use case(s) with which it interacts. Figure 13 represents the use case diagram of the system which shows who has the right to access and use the design system.

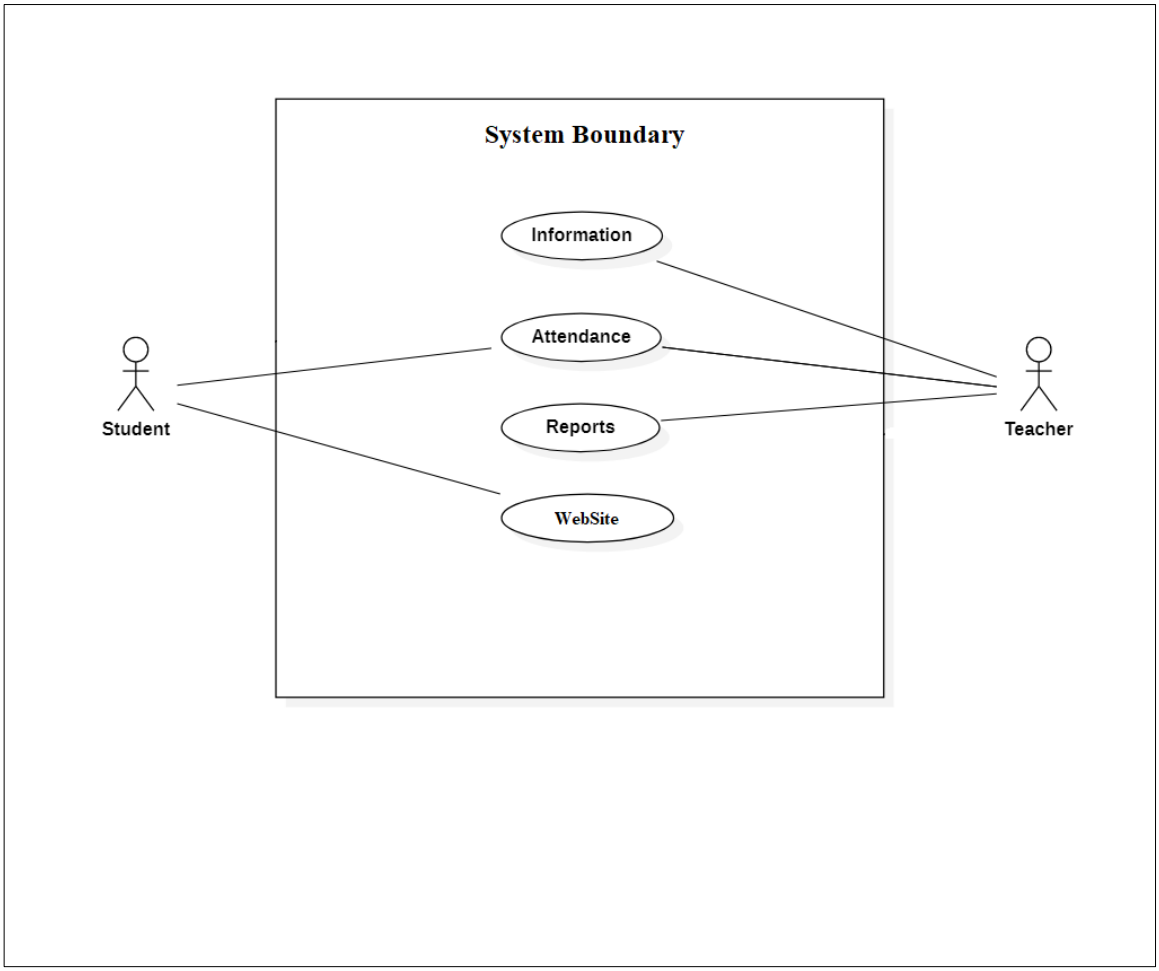


Figure 13. Teacher and student case diagram

The flow charts the steps in the process of keeping track of students' attendance from the beginning. The chart shows the mechanism of the project. Firstly, the teacher selects the lesson name required to take attendance. After that, the fingerprint for students who are in the classroom is taken sequentially. The system will check the fingerprint number that coming from the fingerprint device. Then the system will also look over the lesson that was selected with the fingerprint number and lesson name that was stored in the (Student_Lesson) table in the database. In case of a match, the student's attendance will record in the attendance table in the database. This process is repeated for all students present in the lecture. If the fingerprint number is not identical with any of the recorded fingerprints of the database, then the system will not record the unmatched data. It will show an error message: "No Match Found". In this way, our "Modern Attendance Monitoring System" will continue to monitor student's participation in the corresponding lecture (see Figure 14).

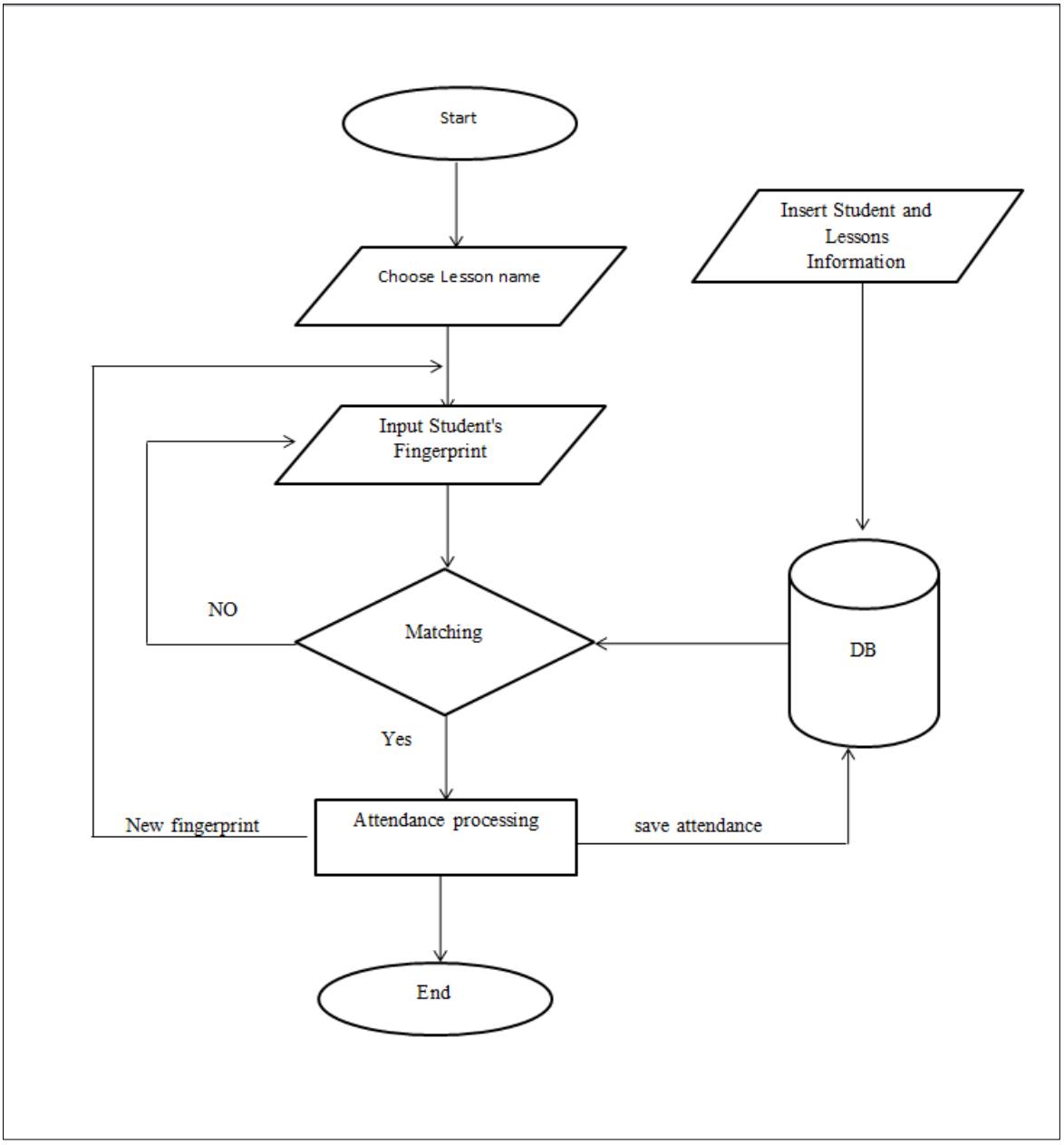


Figure 14. Flow diagram of system working procedure

The following are the components of a modern attendance monitoring system:

In this system, we use a Bluetooth device, a Fingerprint sensor, a Breadboard, and an Arduino NANO. The component in charge of entering, processing, and printing data is coded via the C# language in Visual Basic 2019. The Fingerprint sensor is used to collect and store student's thumbprint. This biometric information is saved in the database of the device with a number which will be identical with the student name in the database management system(DBMS).

5.1. To Save Data Into the Fingerprint Sensor

Initially, the fingerprint sensor is connected to the Arduino by using a sensor cable via the board as seen in Figure 15.

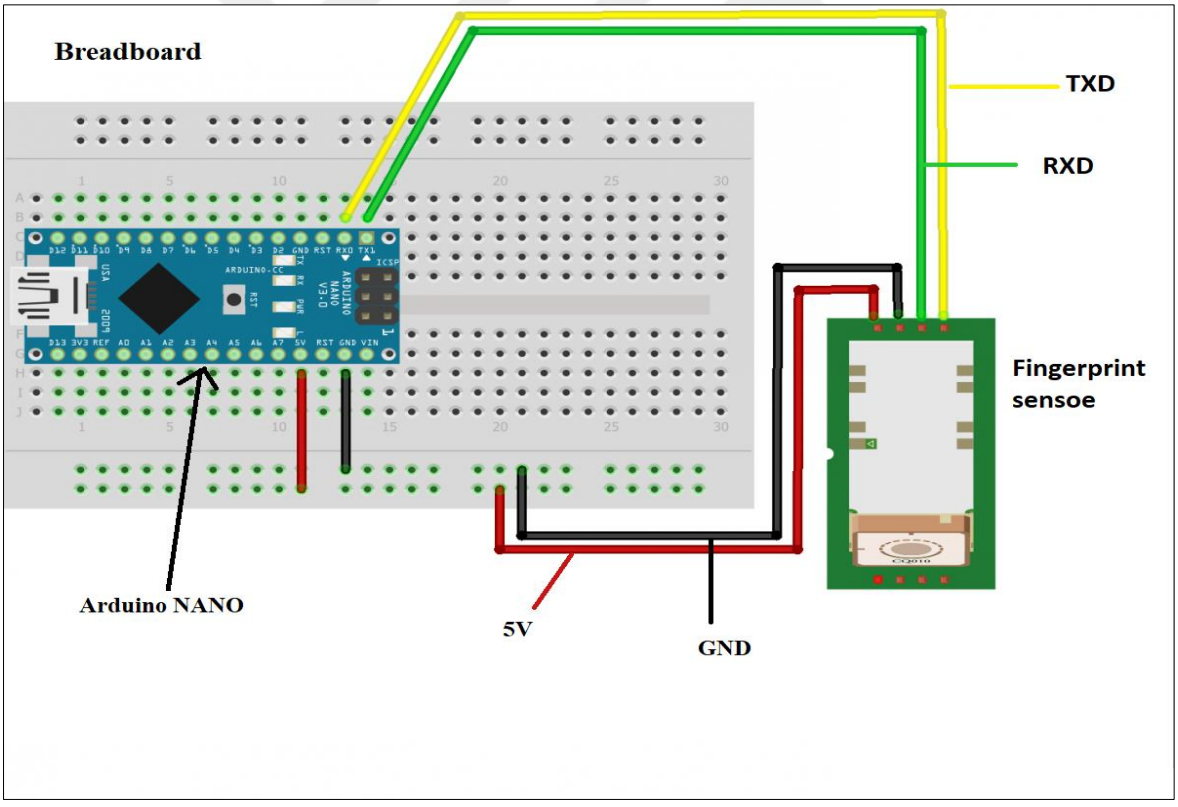


Figure 15: The Arduino connected with the Fingerprint sensor

After that, we connect the Arduino device to the Bluetooth device to send the fingerprint IDs to the system program. Arduino gets these fingerprint ID's from the fingerprint sensor. Figure 16 represents the connection of Arduino with Bluetooth device.

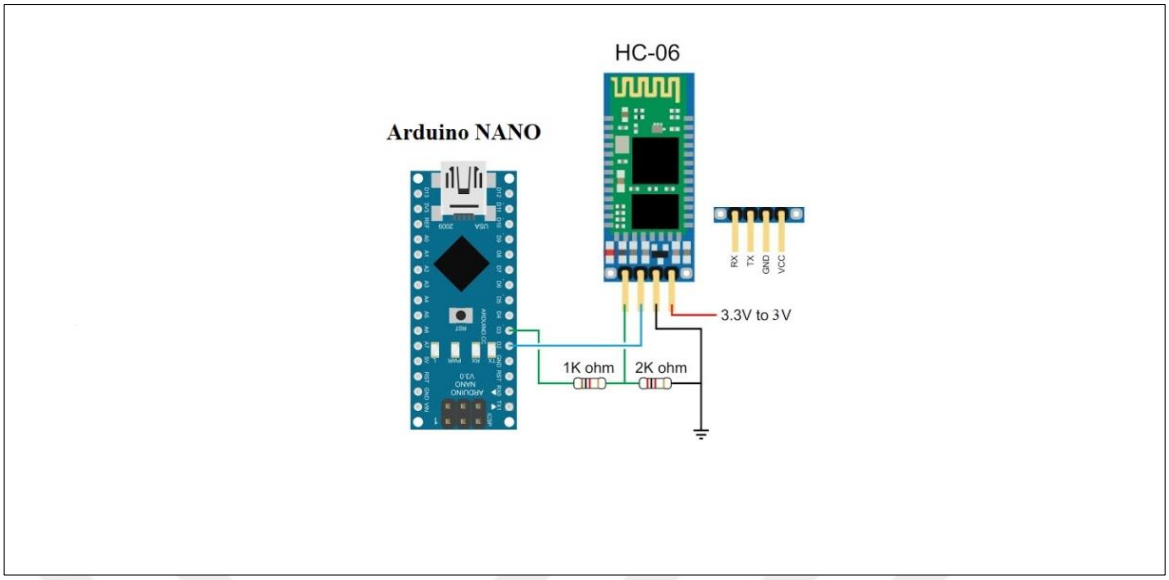


Figure 16: The connection of the Arduino and the Bluetooth device

The IDE program is essential to read and store the students' fingerprint data on the database of fingerprint sensors. Adafruit Fingerprint Sensor library should be install into the IDE program. To read and store the fingerprint by the enroll code, upload it to the Arduino device that is already connected to the computer via USB cable type A/B. Figure 17 shows how to open the enroll code.

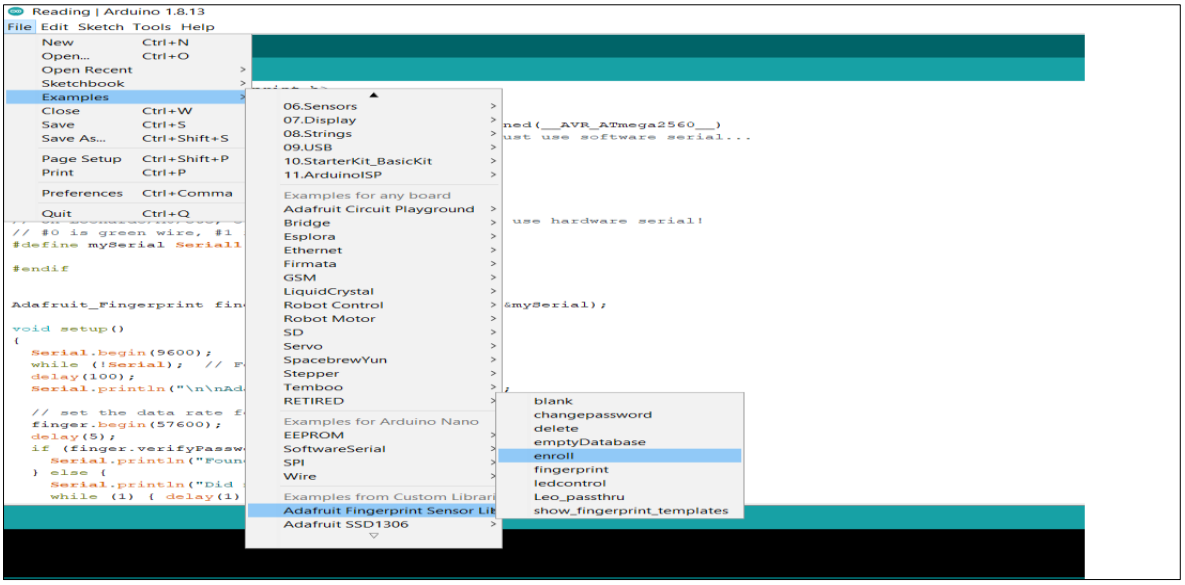


Figure 17. Arduino LED code for the storage of fingerprint data

After the devices have been connected and linked together. Students' fingerprints can be added and stored on the fingerprint sensor database by following steps:

1. Open COM3.
2. Give the number to the finger that you want to save it.
3. Put a finger to the fingerprint sensor twice.

Now the finger ID has been saved into the database of the fingerprint device. After saving all student's fingerprints in it open LED code and download fingerprint code in Arduino device as shown in Figure 18.

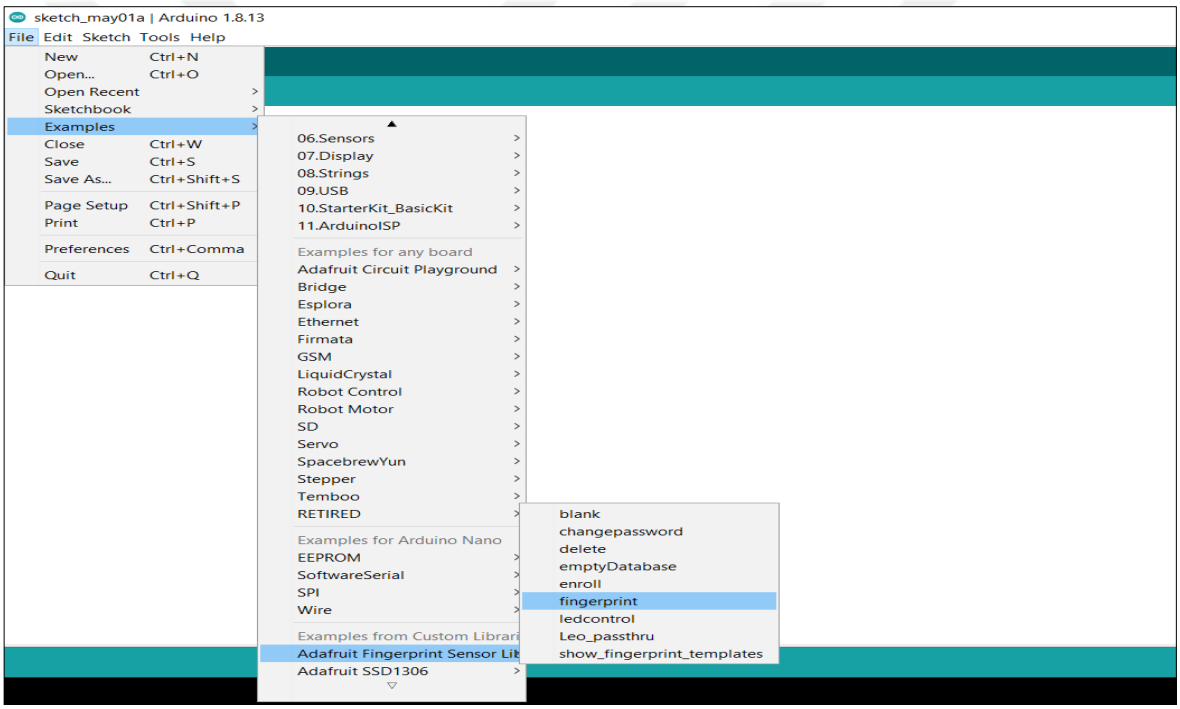


Figure 18. The controlling process of Arduino LED code

Thus, the sensor is ready to read and match students' fingers to record the attendance.

5.2. Software Application

To use this system, the user first needs to login into it, typing the username and password as shown in Figure 19. After the authentication process, the user will get the chance to use the system.

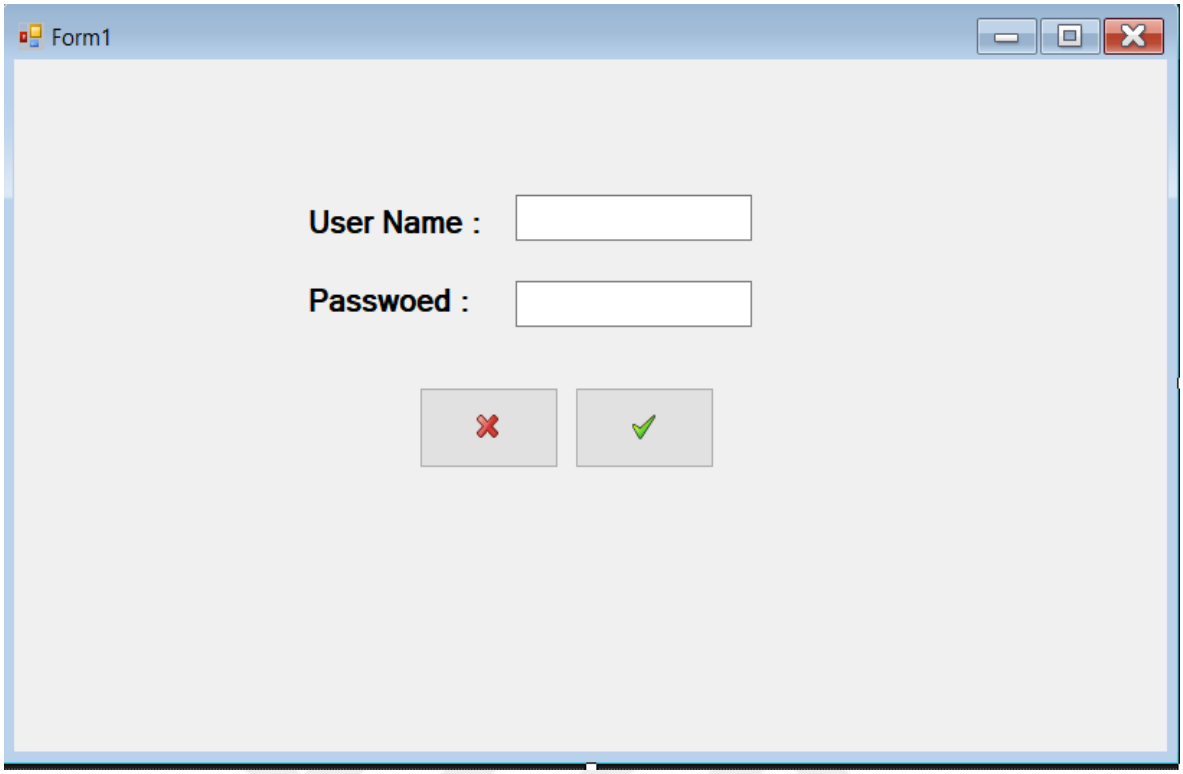


Figure 19. Login interface

Activity diagrams are graphical representations of workflows with choice, iteration, and concurrency that facilitate sequential activities and actions.

Architecture: The following shapes are used to make activity diagrams:

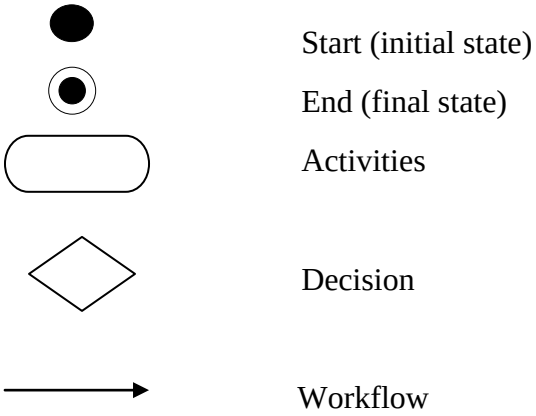


Figure 20 shows the activity diagram related to admin (teacher) login .

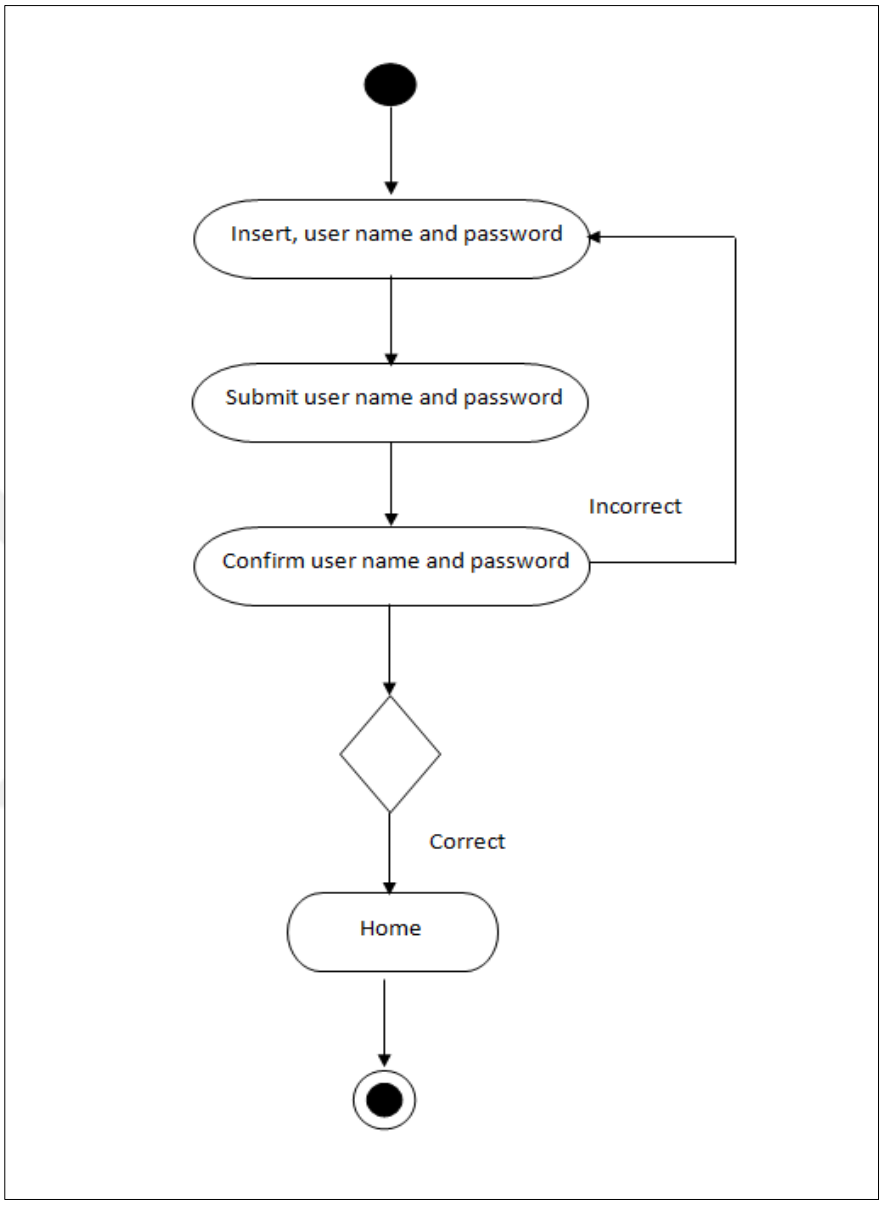


Figure 20. Activity diagram for admin login

5.3. Lessons Information

For entering lesson data (i.e., lesson code, lesson name, semester name, and lesson hours) the following steps are performed.

a) Selection from the menu
b) Lesson Registration
c) Lesson name

This is prepared by using the windows application forms in C#. By using the form interface as shown in Figure 21 the responsible person will be able to insert the lessons information into the system.

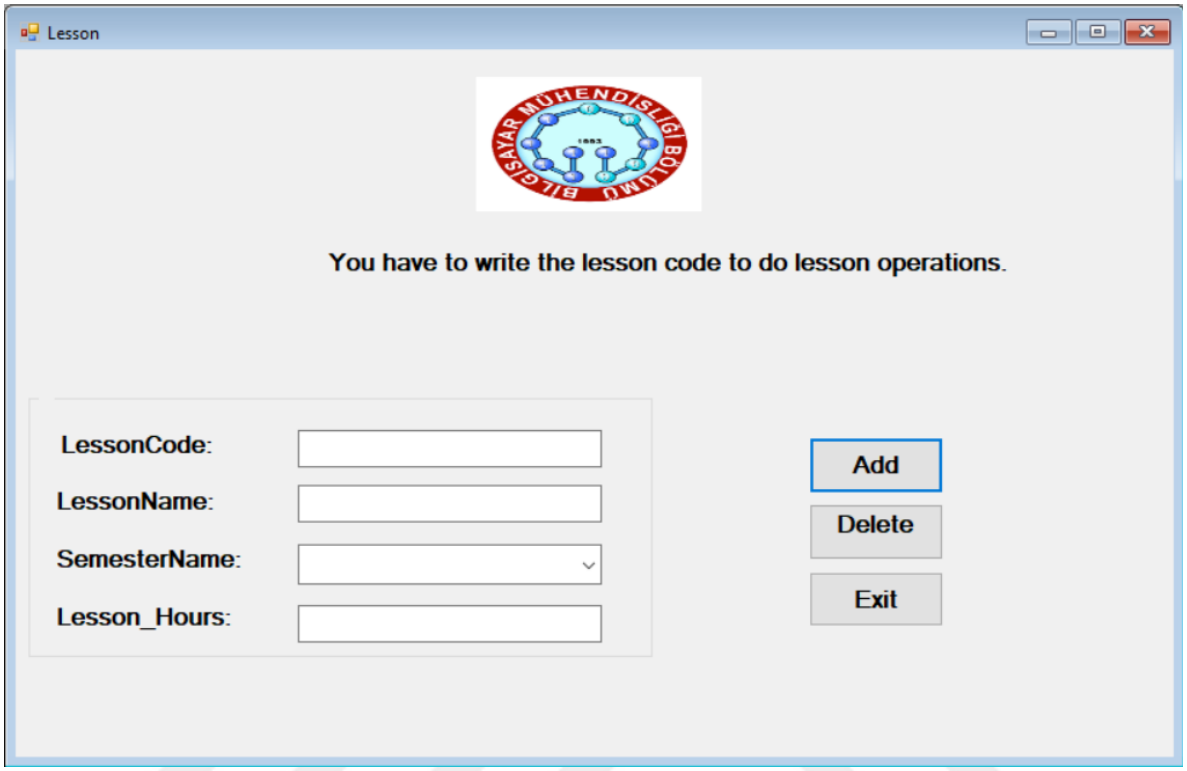


Figure 21. Lesson information form

5.4. Lesson Program

The responsible person who has the authority to enter the course schedule, after getting the access authority, will enter the schedule of the course program. This will include information i.e. the date, time and ID of the course. The information is provided in the following steps.

a) Selection from the menu
b) Lesson Registration
c) Lesson programs

Through the interface form which is represented in Figure 22, the responsible person will insert the course program into the database.

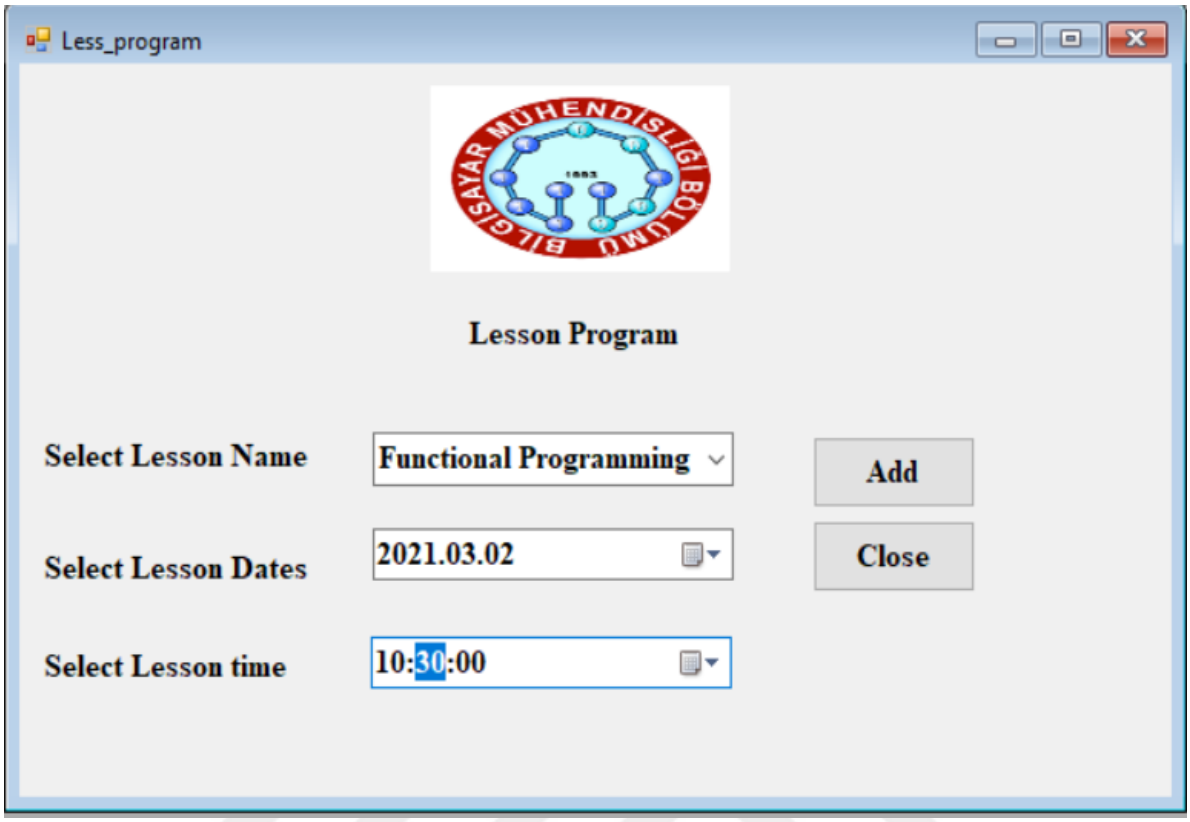


Figure 22. Lessons program form

5.5. Student Information

The software application developed via Visual Studio 2019 is used for entering the student information (student NO, student Name and Surname, class, password, and student finger ID) and course information (i.e., course name, course code, and class). To store this information, a database management system (DBMS) is used. Figure 23 represents student information form and Figure 24 displays all student data typed into the interface form.

The steps of adding new student information are given below.

a) Menu.
b) Student Registration.
c) New student

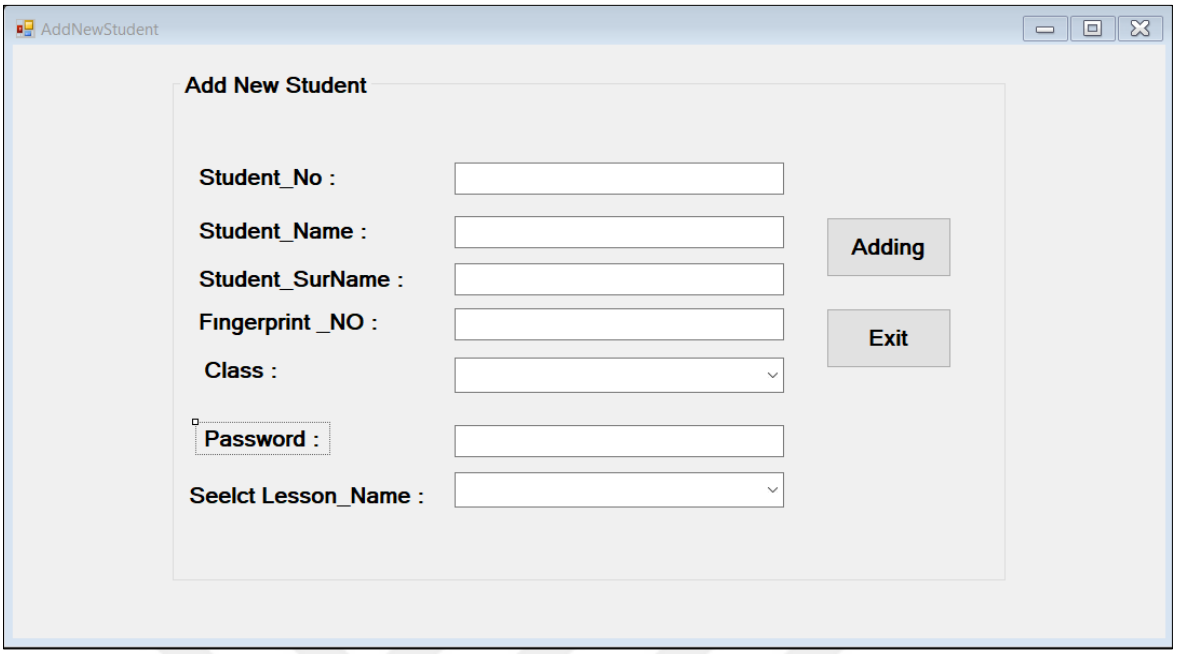


Figure 23. Adding student information form interface

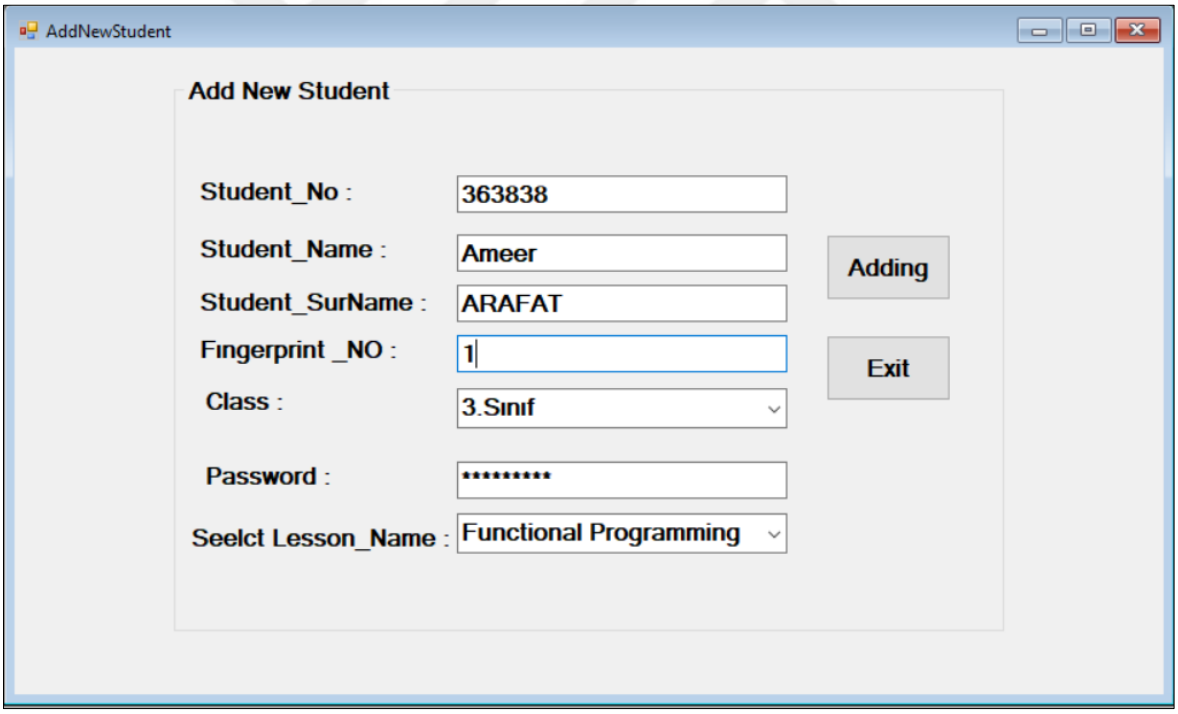


Figure 24**.** User form used to enter student information

After entering all the student information, the “Add” button is pressed. A message will appear telling that the student and the lesson information are successfully added to the student's schedule. If one wants to add another lesson for the same student the system will ask the user as shown in Figure 25.

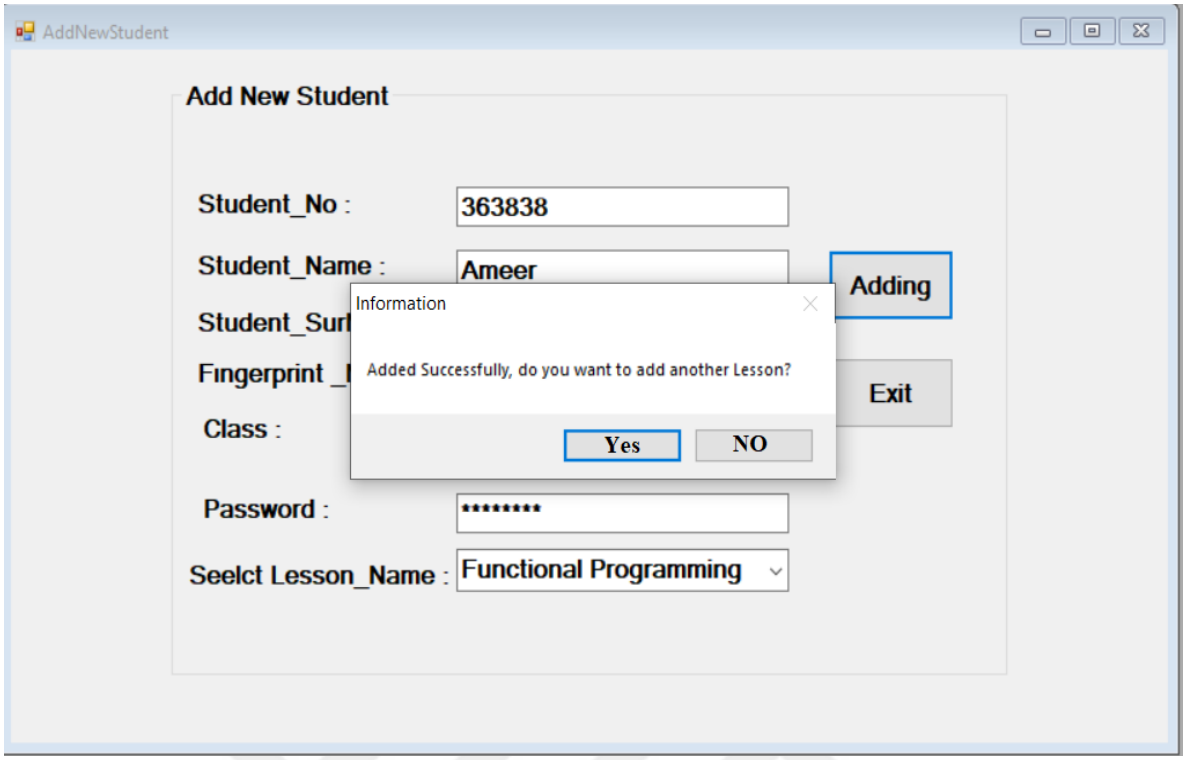


Figure 25**.** Adding another lesson for the student

If recorded student information is entered again then the system will warn the user that the student has already recorded. For every student, the system has a unique ID. When a duplicate number is encountered, system will not accept this data. This scenario is represented in Figure 26.

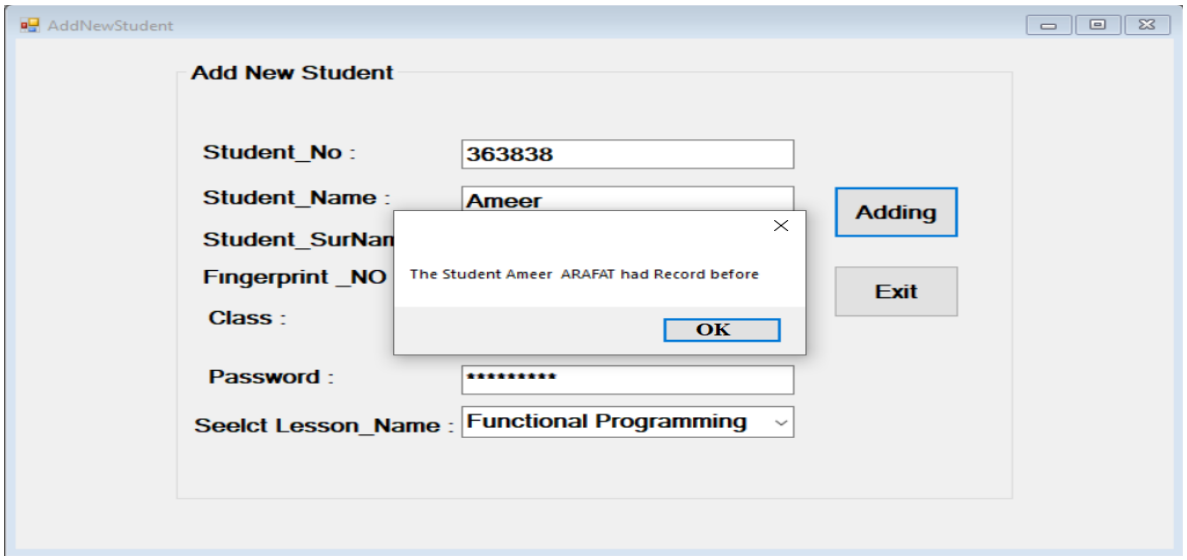


Figure 26**.** Displaying student information

5.6. Update Information

To update the personal information of the students such as student no, name, surname and the like, and to relate the students to lessons, the steps Menu =>Student Registration=>Update are performed, as shown in Figure 27.

After following these steps, the update form will appear in the program screen, which contains some buttons to update and delete the student information from the database tables named Student and Student_lesson. In this form, firstly, the user should write the student No that wants to update or delete his/her information from the database.

The update form also contains another two buttons; the first one associates a lesson with a student, if his/her took the lesson later and the other removes the lesson from he related student. To be able to do these operations, the user must first type the student No and then chose the lesson name from the “Combobox” list to add or remove. The exit button closes the update form and returns to the menu interface form, as shown in Figure 27.

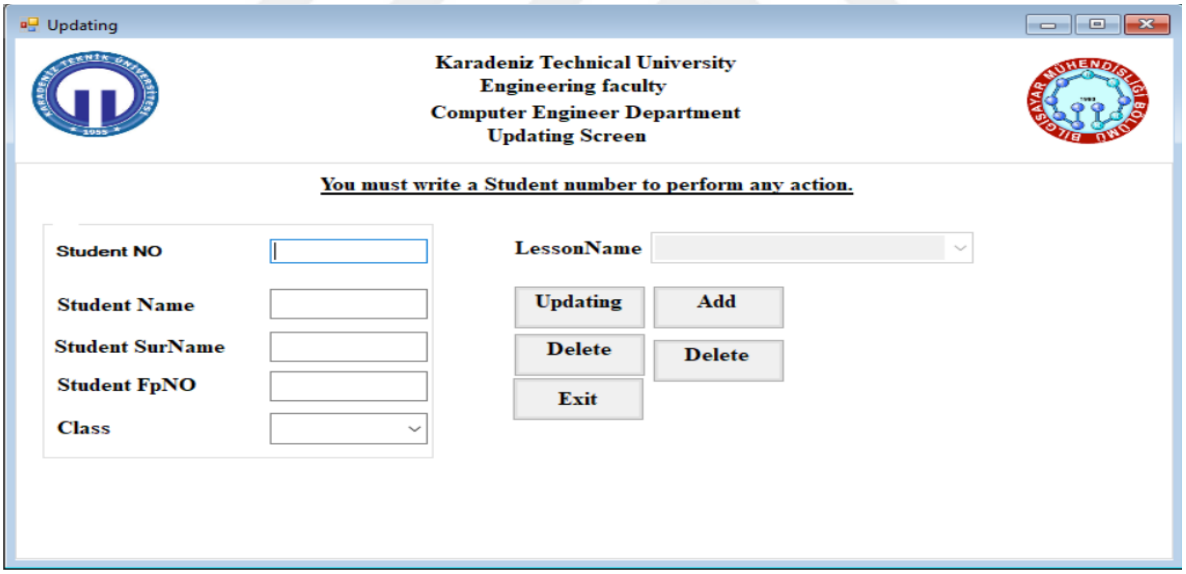


Figure 27. Student information update form

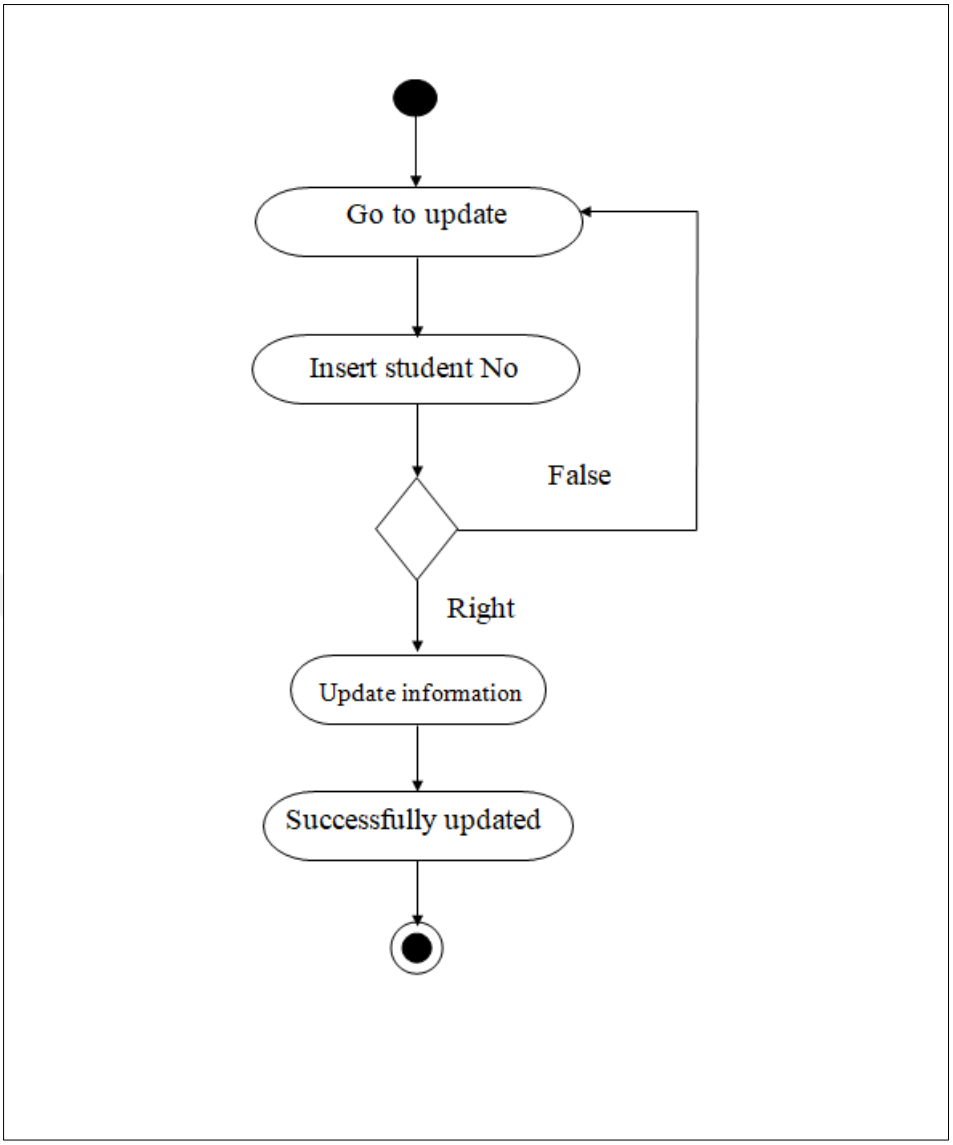


Figure **8.** Activity diagram for updating student information

Figure 28 specifies the steps of updating the student information. After getting all the necessary information and saving it into the database, the software can start to connect the hardware parts. Finally, the system will be ready for taking the attendance of the student.

5.7. The Attendance Record

Figure 29 represents the interface of recording the attendance. To get this form, the user needs to select the attendance record from the menu.

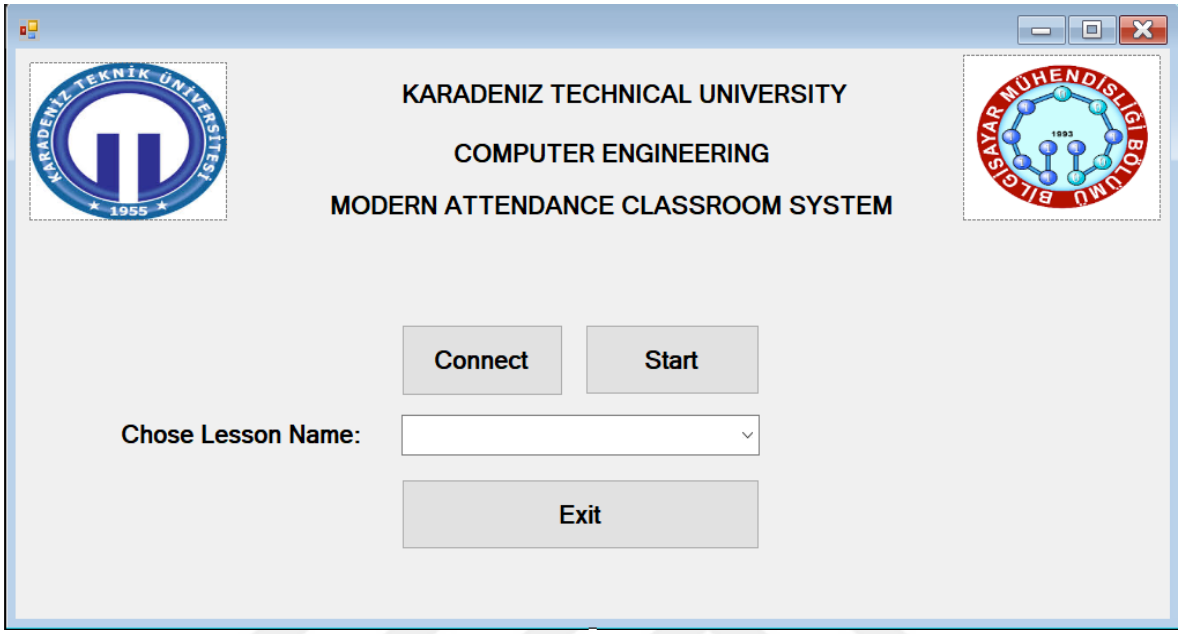


Figure 29**.** The interface form - attendance of the student

This interface form includes the following components.

- The “Connect” button establishes connection the software parts to the hardware parts via Bluetooth.
- The “Start” button makes the system ready to get the fingerprint ID, and record the attendance for the students.
- The “Combobox” list presents the lesson names that we want to record the attendance for it.
- The “Exit” button closes the interface form and goes back to the home interface.

In order to record the attendance for a particular lesson, the user follow the steps; first pressing on the “Connect” button to connect the hardware part with the software part via Bluetooth, then selecting (chose) lesson name from the “Combobox” list that want to record, and finally pressing the “Start” button.

When the “Start” button is pressed, the system is going to record the attendance. It will receive students' fingerprint ID from the fingerprint device. Then it will send the ID to the computer via Bluetooth. After getting the ID, it will compare the ID with the student’s

fingerprint ID stored in the database. When the match is found it will check the name of the lesson that is selected from the attendance interface with the name of the class that the student has chosen. If both of the cases is true, then the student's attendance will be recorded.

Two types of message boxes are displayed in the interface form. The first box informs that the attendance of the student has been recorded together with the name and surname. The second one shows the message "No matched Found" if there is no match between the data that come to the system from the interface with data saved in the database.

Table 3 lists the cost of each device contained in this project.

Table **3.** Cost of devices

Price	**Device**
5,80 $	Arduino (with USE cable)
1,37 $	Breadboard (Full)
0,07 $	Resistance
1,37 $	Jumper cable
4,57 $	Bluetooth
17,12 $	Fingerprint sensor

6. THE REPORTS

The most important section of the study is the reporting section. Through this section, a great effort from the shoulders of the lecturer or the person in charge of the student attendance system will be reduced. The reports are basically concerned with the calculation of the number of times the student attends and misses the lessons. After the evaluation of the attendance, the student is provided with permission to enter the exam of the related lesson unless he/she does not exceed the absence limit.

Through the reporting functionalities, the lecturer or the responsible person for the attendance can calculate the number of times the student attends only by entering the student's number and choosing the name of the lesson. The report includes the student's name, the name of the lesson, the date of the student's attendance or non-attendance, and the number of the student's attendance times. All these types of reports can be saved as a PDF document. This authority is only available for the person who has access to this information.

All reports are created by using the " crysrtalReportViewer " tool, which is supported in the C# language via Visual Studio 2019. To take advantage of this feature we can download the "Microsoft.Report.Viewer" from the Tools menu item "manage NuGet packages" and then install it.

For connecting crystal Report Viewer with crystal report, the following code can be used.

```
CrGeneralReport  cr = new CrGeneralReport();
        DataSet ds = new DataSet();
        SqlDataAdapter da = new SqlDataAdapter(sql, con);
        da.Fill(ds, "Table");
        cr.SetDataSource(ds.Tables["Table"]);
        crystalReportViewer1.ReportSource = cr;
        crystalReportViewer1.Refresh();
        TextObject text =
(TextObject)cr.ReportDefinition.Sections["Section1"].ReportObjects["Text19
text.Text = LessName;
        crystalReportViewer1.ReportSource = cr;
```

There are six types of reports described in the following sections.

6.1. General Report

This report relies on being configured on the course name that chosen for" menuStrip " to generate it. When the lesson name is chosen for " menuStrip " by the responsible person who wants to create a report he needs to press the upload button. The report will be generated into the interface form with assistance " crystalReportViewer" tool.

The report contains the following entries.

- A table that includes the number, name, surname of students and date of their attendances.
- The name of the teacher responsible for the lesson.
- The name of the lesson.

A typical sample of the report is shown in Figure 30.

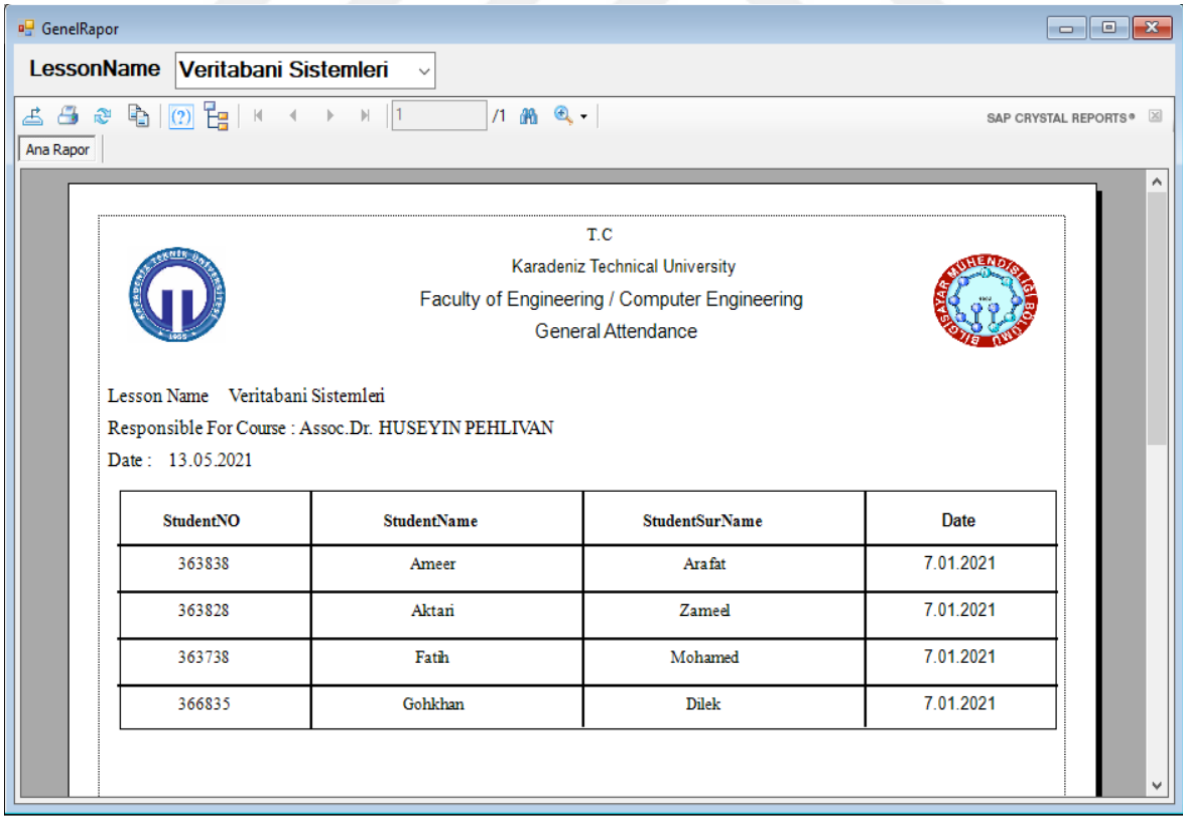


Figure 28. The general report of students and their attendance dates

6.2. Report of Attendance Dates

This report is prepared with respect to the student number and the name of the lesson specified by the user.

Figure 31 shows a list of the student attendance dates.

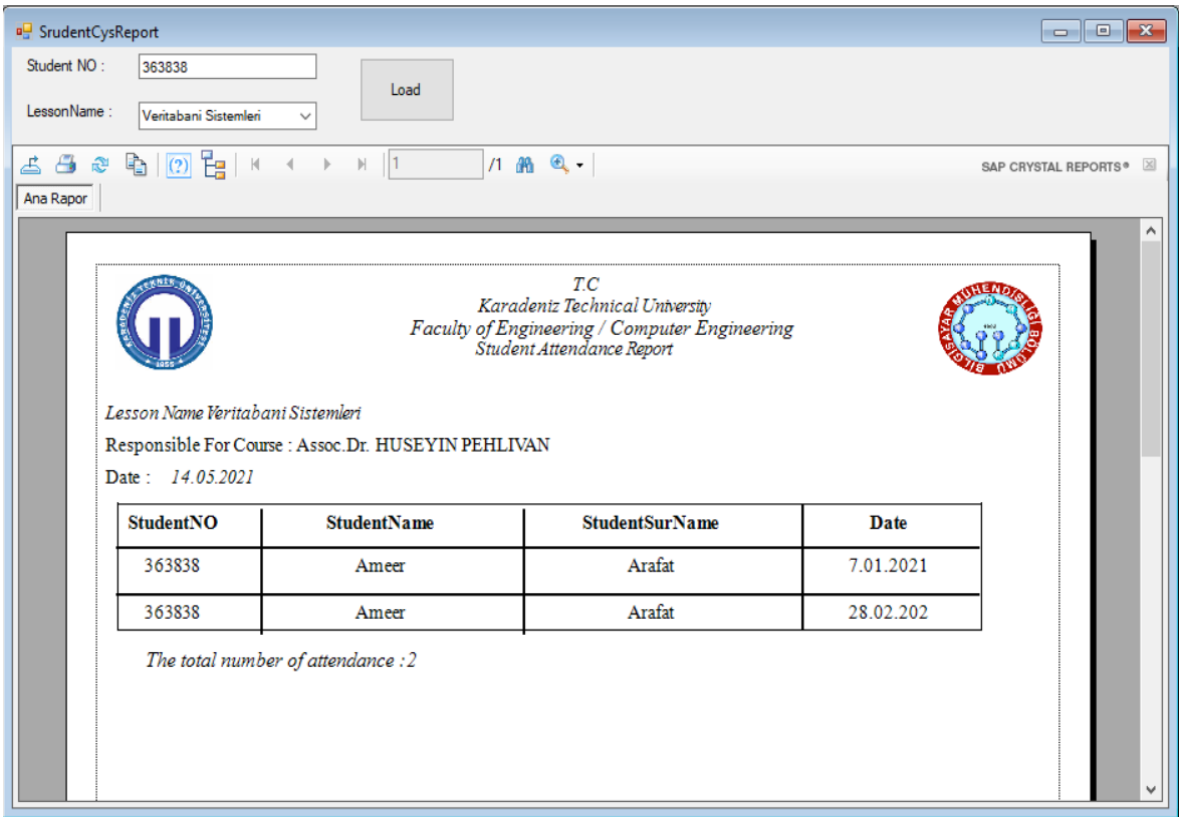


Figure 29. Report of lesson attendance dates

The report contains the following entries.

- Lesson name.
- The name of the teacher responsible for the lesson.
- A table containing the student's surname number and the date of the student's attendance at the lesson.
- The total number of times that the student attends the lesson.
- The date the table is created.

6.3. Report of Students

This report is generated depending on the student number for which the following holds.

The report is shown in Figure 32.

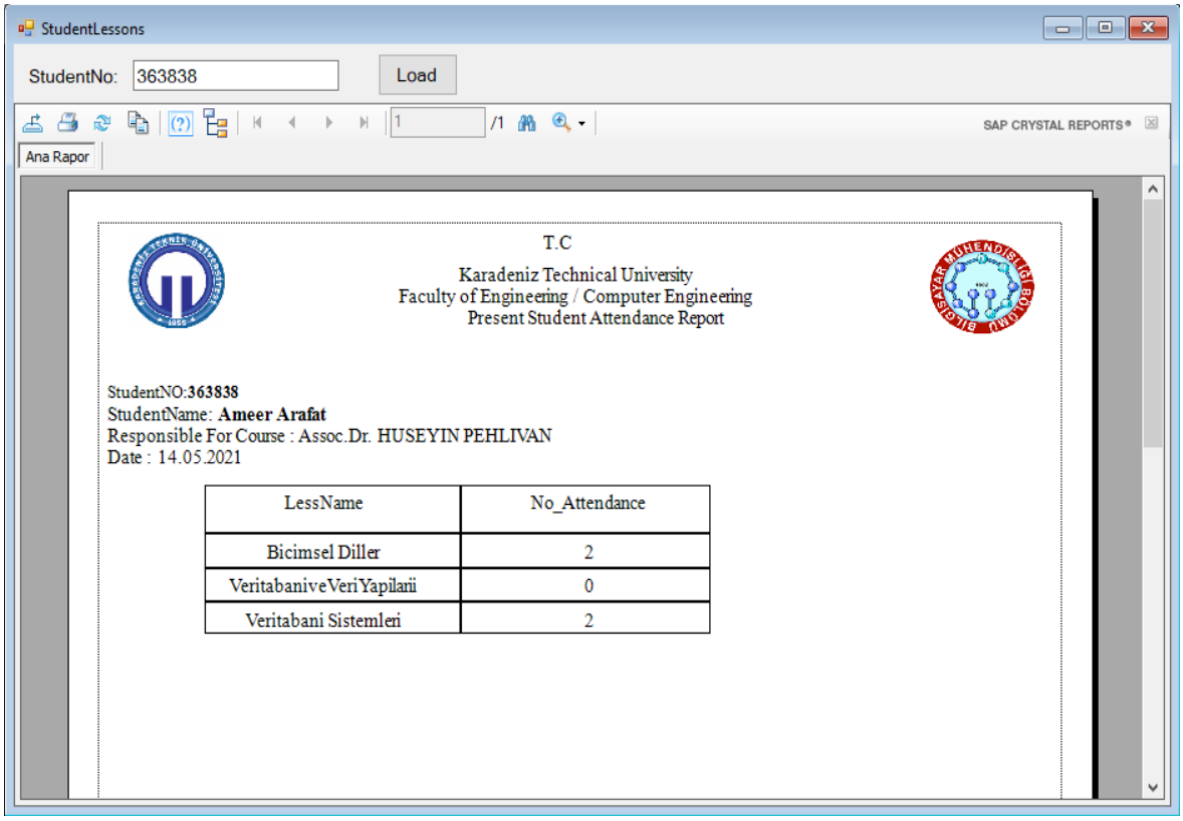


Figure 30. A list of lessons

The report contains the following entries.

- Student number.
- Student name and surname.
- The name of the teacher responsible for the lesson.
- A table containing the name of lessons that a student enters as well as and the number of attendance times.
- The date the table is created.

6.4. Report of Lessons

This type of the report is generated depending on the selection of the lesson name. The report is shown in Figure 33.

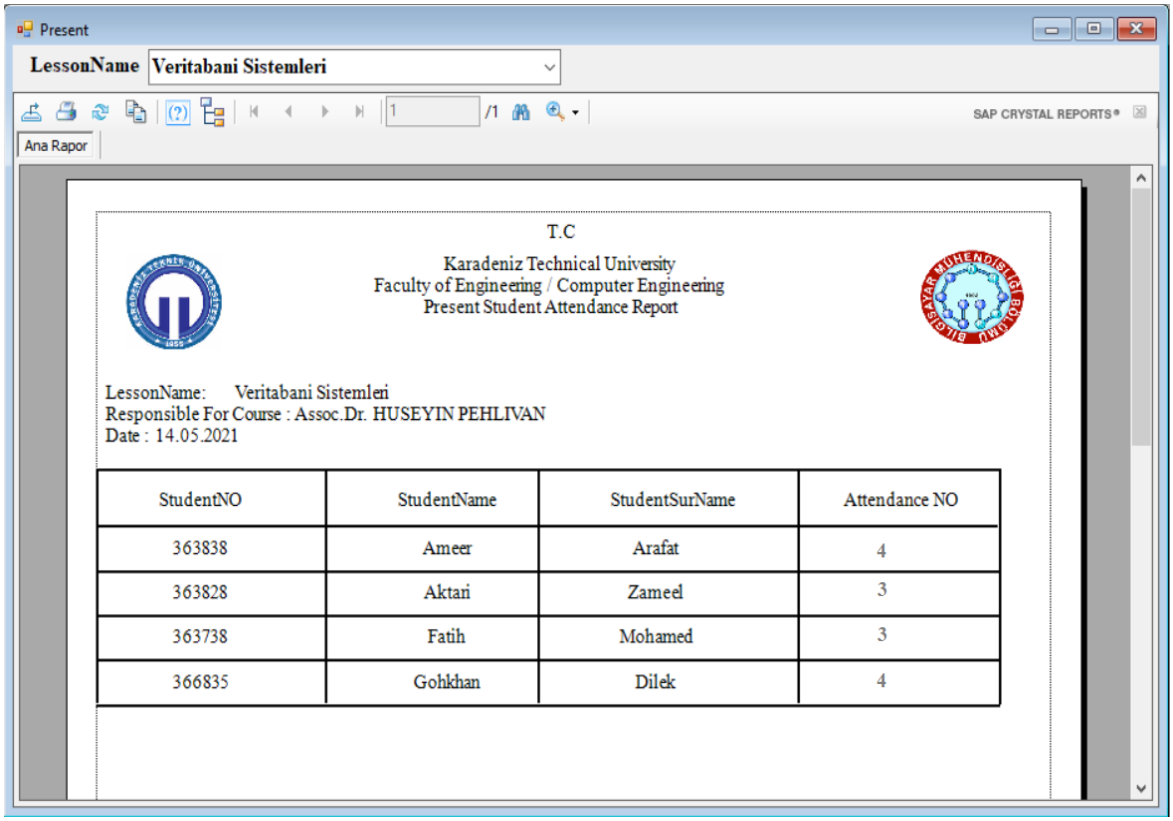


Figure 31. The report of the lesson attendance

The report contains the following entries.

- The lesson name,
- the name of the teacher responsible for the lesson,
- a table containing the number, name and surname of each student who takes the lesson and the total number of the student's attendance,
- The date the report is created.

6.5. Report of the Eligible Students for the Exam

This report shows students who will enter the exam or have the right to take it because they have not exceeded the upper limit for absences for the lesson.

Figure 34 shows the first step of the related

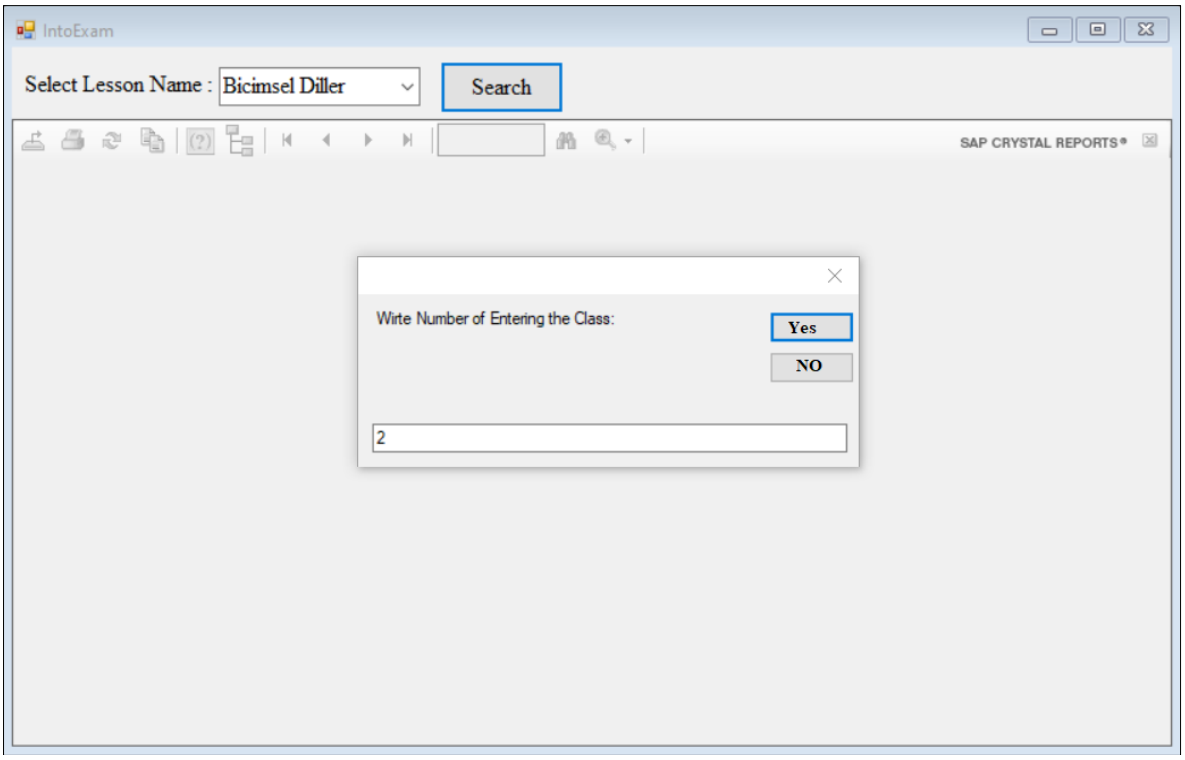


Figure 32**.** The first step for creating a report for students who is to enter the exam

The following entries are included in the report.

- Lesson name.
- The name of the teacher responsible for teaching the lesson.
- A table containing the number, name and surname of each student who takes the lesson and becomes eligible to enter the exam.
- The date the report is created.

Figure 35 shows the report of eligible students for the exam.

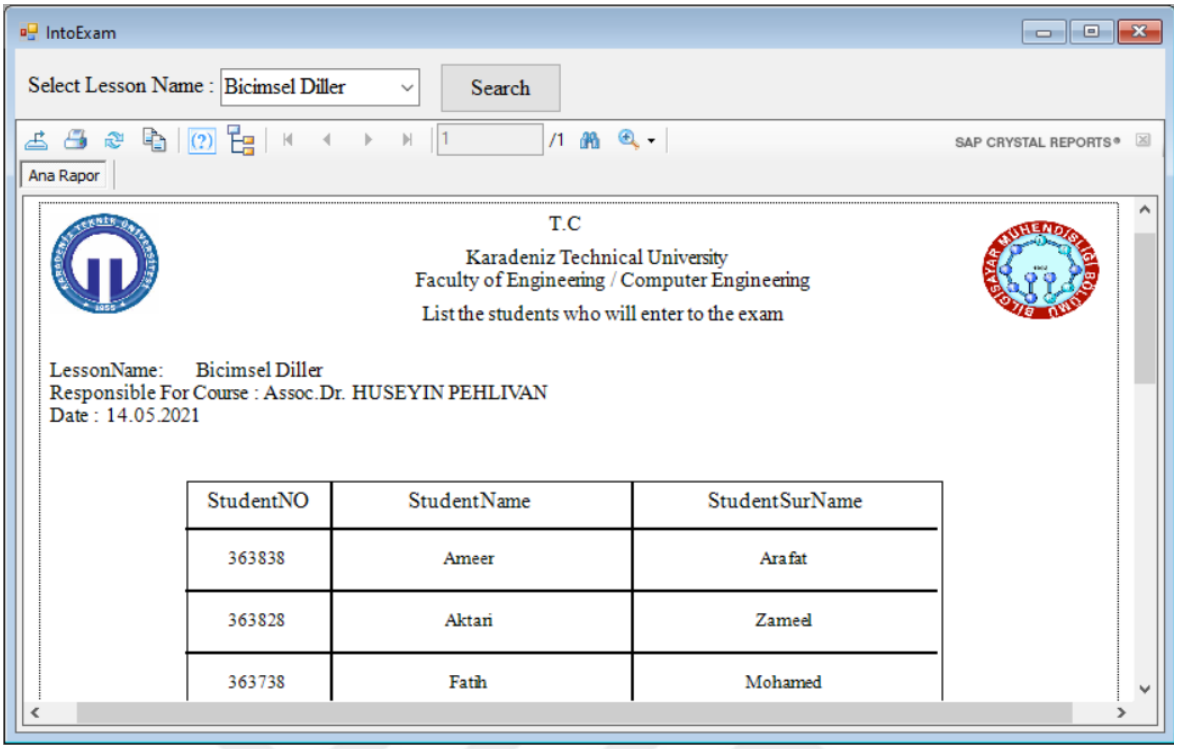


Figure 33**.** The second step for creating eligible students for the exam

The importance of this report is to know the number of students who are expected to take the exam, and to prepare an appropriate class complying with their number as well as a sufficient number of the question papers.

6.6. Report of the Non-Eligible Students for the Exam

This report depends on choosing the name of the lesson and entering the maximum number of times the student may miss the lesson. In this way a message box appears asking to enter the maximum number that the student may not enter the related lesson. After typing the number, a report will be generated by listing the name of the students who is not allowed to take the exam. Figure 36 and 37 shows the steps to create a report for the students that will not be allowed to enter the exam.

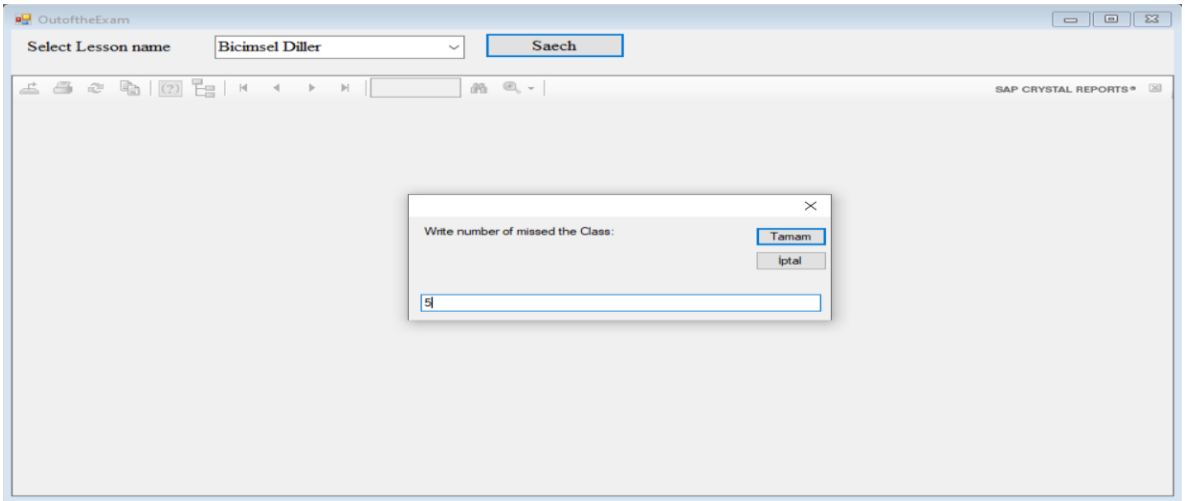


Figure 34**.** Specification of the lesson name and the maximum number for missed lessons

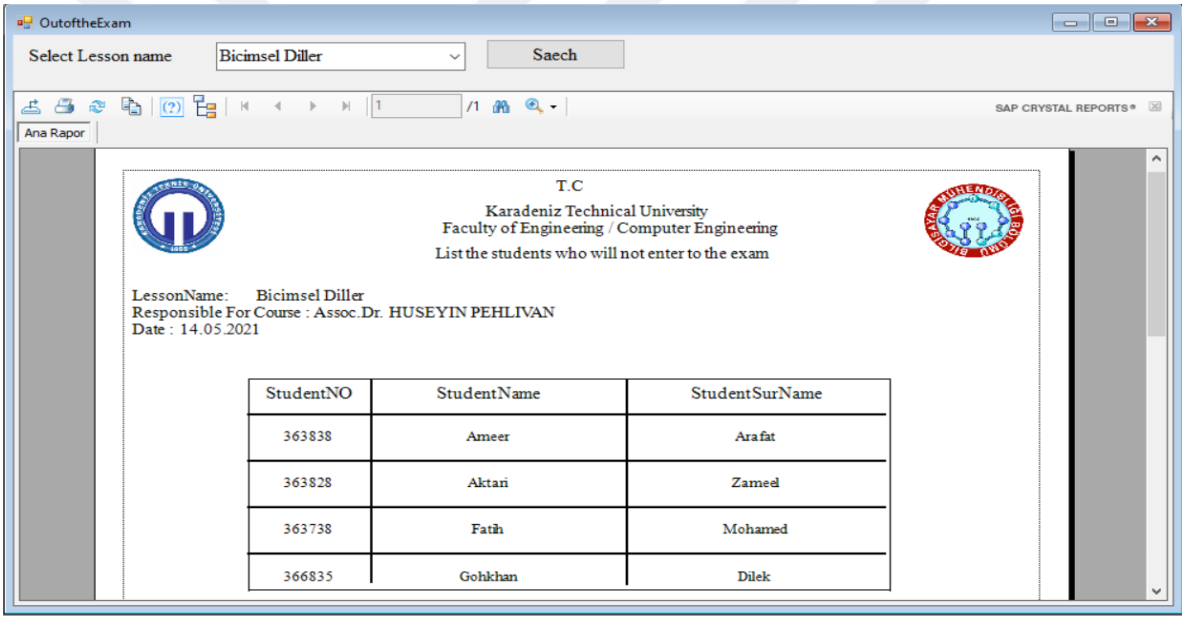


Figure **35.** List of non-eligible students for exam

7. Web Application

A web application is designed to help the student get information about his attendance. Through this website, the student will be able to know the number of absences and attendance to the lessons he/she takes, without the need to ask the lecturer or the person who is responsible for maintaining a record of the attendance.

The website is constructed as using an ASP.NET Web application written in the C# programming language, which consists of two interfaces described below.

7.1. Authorization Page

The first webpage contains two textboxes, where the student enters his/her own student number and password to log in the web application. Then the application connects to the database to verify the information entered. When matching the information entered with the information previously stored in the database, the second page will be loaded as shown in Figure 38.

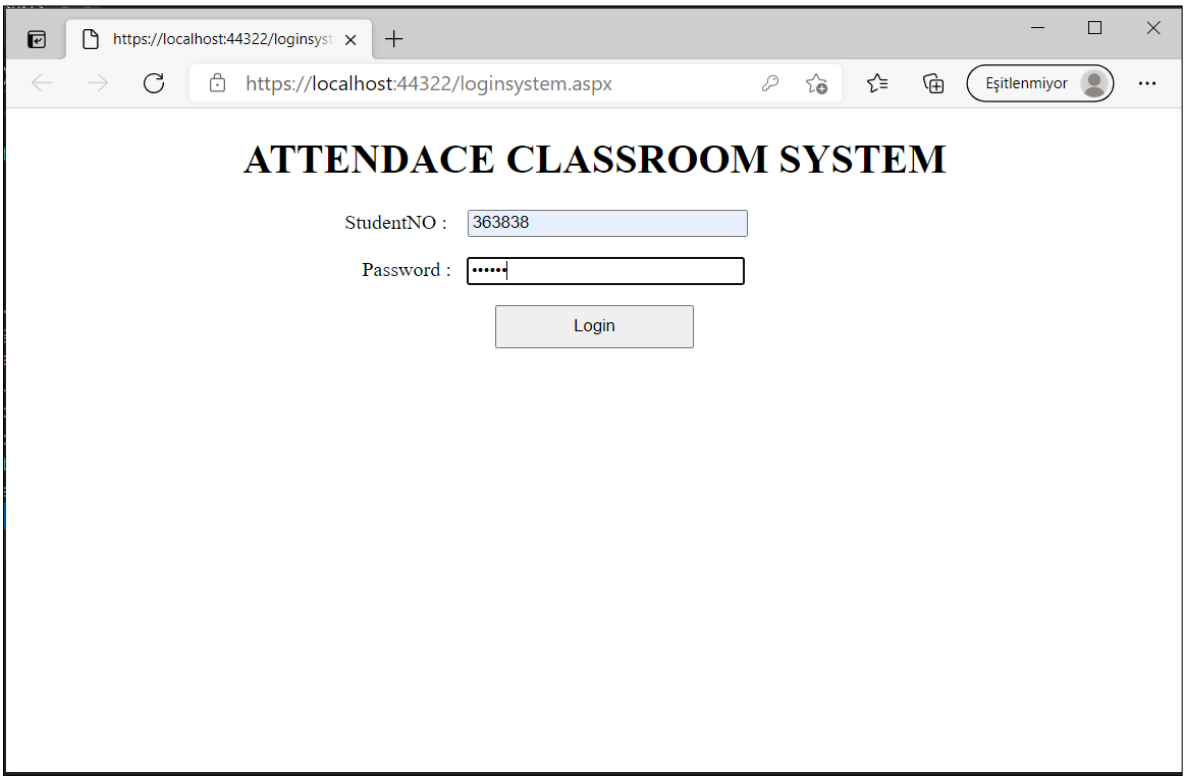


Figure 36. Login page of the web application

7.2. Attendance Page

This page contains two buttons. The first button (named “Attendance”) is used to list the names of the lessons together with attending and missing dates of a particular student in a datagridview component. The second button is to change the student password, as shown in the Figure 39 and 40.

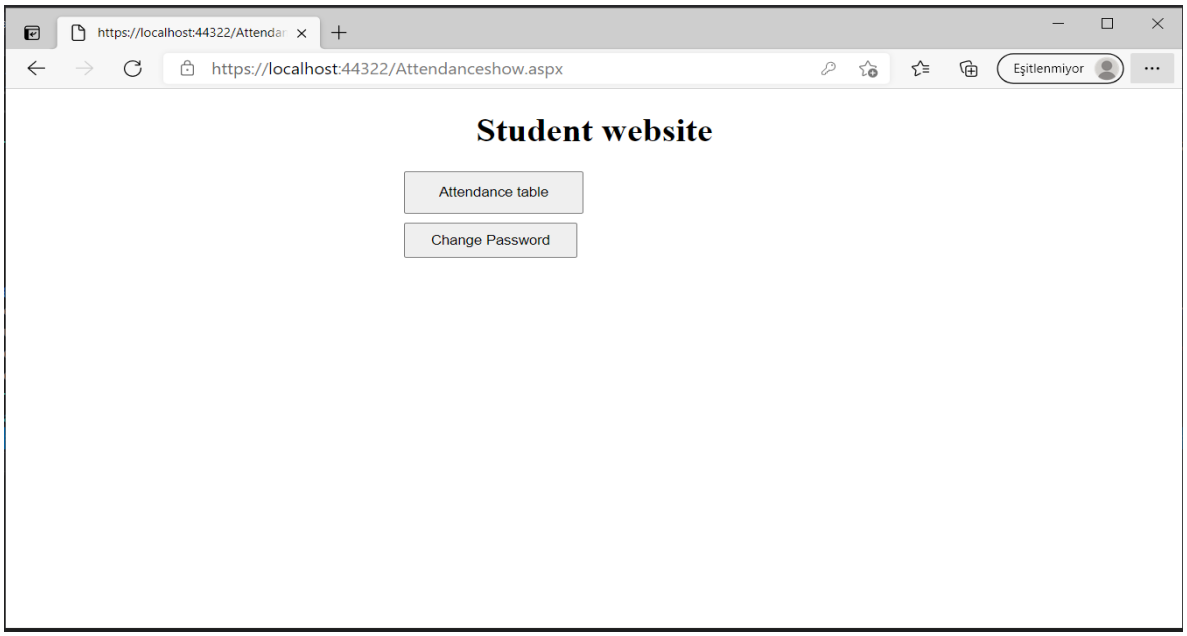
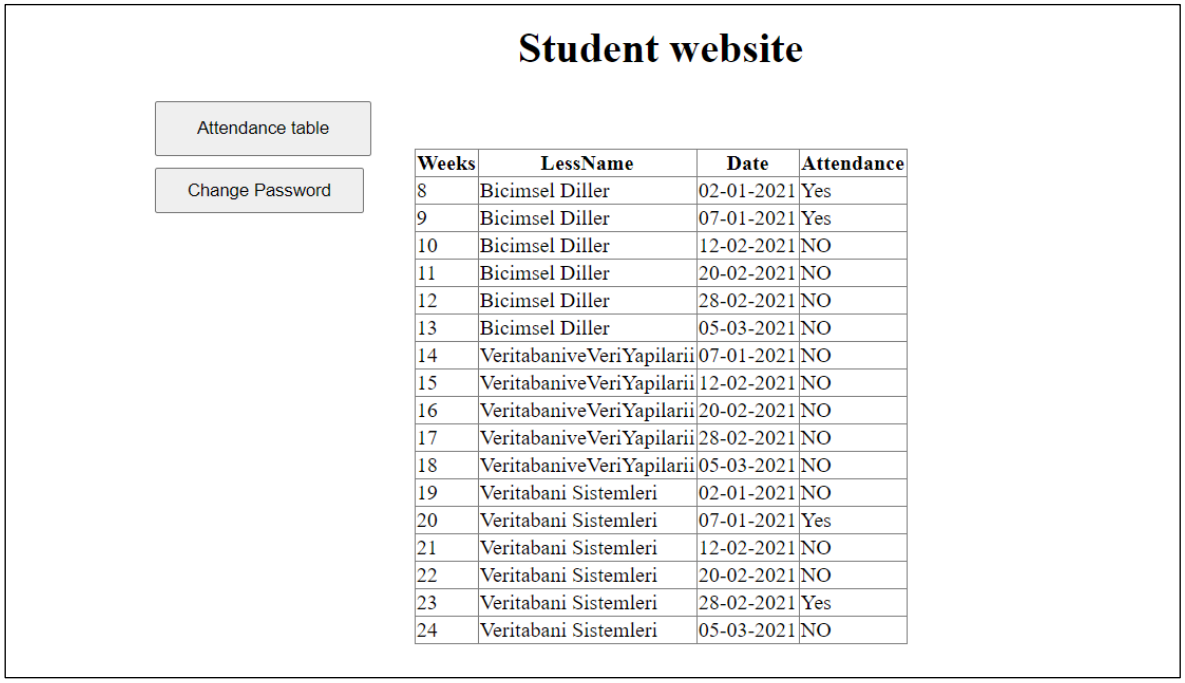


Figure 39. Main page of the web application



Weeks	LessName	Date	Attendance
8	Bicimsel Diller	02-01-2021	Yes
9	Bicimsel Diller	07-01-2021	Yes
10	Bicimsel Diller	12-02-2021	NO
11	Bicimsel Diller	20-02-2021	NO
12	Bicimsel Diller	28-02-2021	NO
13	Bicimsel Diller	05-03-2021	NO
14	VeritabaniveVeriYapilarii	07-01-2021	NO
15	VeritabaniveVeriYapilarii	12-02-2021	NO
16	VeritabaniveVeriYapilarii	20-02-2021	NO
17	VeritabaniveVeriYapilarii	28-02-2021	NO
18	VeritabaniveVeriYapilarii	05-03-2021	NO
19	Veritabani Sistemleri	02-01-2021	NO
20	Veritabani Sistemleri	07-01-2021	Yes
21	Veritabani Sistemleri	12-02-2021	NO
22	Veritabani Sistemleri	20-02-2021	NO
23	Veritabani Sistemleri	28-02-2021	Yes
24	Veritabani Sistemleri	05-03-2021	NO

Figure 37. Information of student attendance

When the student pursues on the button named “Change Password” the datagridview disappears and then another page will appear as shown in Figure 41.

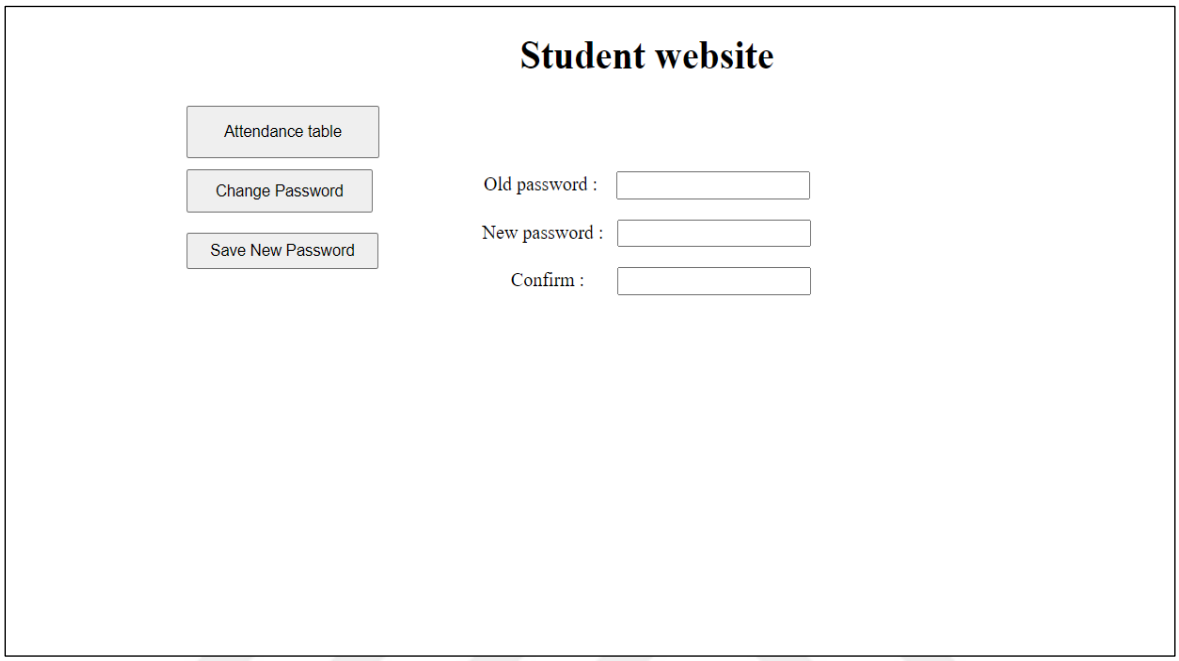


Figure 38. Password modification interface

8. CONCLUSION

The common method of taking student attendance in class has been highly useful, but it is inefficient and ineffective. Traditional pen-and-paper attendance has become obsolete due to technological advancements. The traditional method also entails lecturers taking students' attendance regularly, calculating the student attendance percentage throughout the semester, and compiling their own student attendance report. To fill in the class attendance, students might easily respond or write names on behalf of their friends.

To address the issue, a hardware device is designed to take a student's attendance based on their fingerprint by utilizing a fingerprint sensor. Accordingly, an electronic system is created to monitor student attendance. The system provides a mechanism for taking and assessing student attendance effectively and efficiently.

With the system's user-friendly environment and effective performance, every student will have easier and faster access to their data in the Attendance Report. After the information about students and lessons is saved in the database, it will be used later in the process of taking student attendance. Student attendance is recorded using a finger print reader. We use a device which is able to save 127 fingerprints for students, as a stage of testing. Thus one fingerprint for each student is taken and stored in the device's memory because the memory capacity of the related fingerprint device is rather small. More than one student's fingerprint can be captured and stored in the device's memory if more storage space is available. Visual Studio C# 2019 is used to develop the user interfaces, which is linked to the database to save and retrieve data for taking attendance as well as for printing reports. We have established a wireless connection using Bluetooth technology between the hardware and software components. The Bluetooth connection is more easily accessible. It is more feasible than the Wi-Fi connection as Wi-Fi is not available with good efficiency in all educational institutions and schools.

It is a paperless method that presents a quicker and easier way to keep the attendance information than other traditional methods. Here the attendance is taken using a student's fingerprint rather than a student's signature on the attendance sheet or a call out to all

students whose names are written on the attendance sheet. It enormously reduces load on teachers to maintain attendance registries, because the attendance information will be safe in the computer (database). It will be also protected from damage or loss.

Student attendance can be calculated just by writing student NO. and selecting the lesson name. For that reason, the attendance analysis will be simple and easy without any calculation errors. With the use of the web application that serves online queries, students can see the number of times they attend lessons without asking the responsible teacher or refer to the attendance sheet.

9. FUTURE WORK

Instead of creating a website for the students to check their attendance, we can connect this system with the currently available system of our university. In this application, the information such as the student advisor, term exam, transcript, academic calendar, etc. is available.

This system allows the student to change their password. After that it enables students to select their lessons of the semester, and upload it to the database of the system. İt makes easier the job (i.e. entering the information to the database) of the administrator.

10. REFERENCES

1. Mohamed, B.K. ve Raghu, C., Fingerprint attendance system for classroom needs, 2012 Annual IEEE India Conference (INDICON) 2012, 433-438.

2. Ergen, B. ve Çalışkan, A., Biyometrik Sistemler ve El Tabanlı Biyometrik Tanıma Karakteristikleri, 6th International Advanced Technologies Symposium (IATS'11) 2011, 16-18.

3. Chandramohan, J., Nagarajan, R., Dineshkumar, T., Kannan, G. ve Prakash, R., Attendance monitoring system of students based on biometric and gps tracking system, International Journal of Advanced engineering, Management and Science, 3,3 (2017) 239799.

4. Acar, E. ve Özerdem, M.S., Laws doku enerji ölçümü tabanli k-NN siniflandirici modeli ile iris tanima sistemi.

5. Zhang, Y., Sun, D. ve Qiu, Z., Hand-based feature level fusion for single sample biometrics recognition, 2010 International Workshop on Emerging Techniques and Challenges for Hand-Based Biometrics 2010, 1-4.

6. ALI, A. ve NADIR, B., BEACONDRIOD: AN AUTOMATED STUDENT ATTENDANCE SYSTEM, Journal of Duhok University, 23,2 (2020) 396-401.

7. Zainal, N.I., Sidek, K.A., Gunawan, T.S., Manser, H. ve Kartiwi, M., Design and development of portable classroom attendance system based on Arduino and fingerprint biometric, The 5th International Conference on Information and Communication Technology for The Muslim World (ICT4M) 2014, 1-4.

8. Dhanalakshmi, N., Kumar, S.G. ve Sai, Y.P., Aadhaar based biometric attendance system using wireless fingerprint terminals, 2017 IEEE 7th International Advance Computing Conference (IACC) 2017, 651-655.

9. Dastidar, U.G., Jogi, N., Bansod, M., Madamwar, P. ve Jalan, P., FINGERPRINT SENSOR BASED ATTENDANCE SYSTEM USING ATMEGA 328 AND ESP8266, International Journal of Research In Science & Engineering, 3,2 (2017) 471-475.

10. Peter, U.E., Joe-Uzuegbu, C.A., Uzoechi, L. ve Opara, F., Biometric-based attendance system with remote real-time monitoring for tertiary institutions in developing countries, 2013 IEEE International Conference on Emerging & Sustainable Technologies for Power & ICT in a Developing Society (NIGERCON) 2013, 1-8.

11. Shoewu, O. ve Idowu, O., Development of attendance management system using biometrics, The Pacific Journal of Science and Technology, 13,1 (2012) 300-307.

12. Abd Wahab, M.H., Abdul Kadir, H., Mohd Yusof, M., Sanudin, R. ve Tomari, M.R., Class attendance system using active RFID: a review, Compilation of papers, 2 (2009) 9-21.

13. Nayyar, A. ve Puri, V., A review of Arduino board's, Lilypad's & Arduino shields, 2016 3rd international conference on computing for sustainable global development (INDIACom) 2016, 1485-1492.

14. Kumar, N.K., Vigneswari, D. ve Rogith, C., An Effective Moisture Control based Modern Irrigation System (MIS) with Arduino Nano, 2019 5th International Conference on Advanced Computing & Communication Systems (ICACCS) 2019: 70-72.

15. URL1, http://xash.me/arduino/ ARDEUINO. 15.11 2020.

16. URL2, https://www.matrix219.com/eg/2018/01/09/%D8%A7%D9%84%D8%A7%D8%B1%D8%AF%D9%88%D9%8A%D9%86%D9%88/ WHY ARDUINO. 15.11 2020.

17. URL1, https://www.arduino.cc/en/guide/introduction Arduino.

18. URL3, https://www.matrix219.com/eg/2018/01/09/%D8%A7%D9%84%D8%A7%D8%B1%D8%AF%D9%88%D9%8A%D9%86%D9%88/ WHAT IS ARDUINO. 16.11 2020.

19. URL4, https://www.matrix219.com/eg/2020/07/07/%D9%84%D9%88%D8%AD%D8%A9-%D8%A7%D9%84%D8%AA%D8%AC%D8%A7%D8%B1%D8%A8-%D8%A7%D9%84%D8%A7%D9%84%D9%83%D8%AA%D8%B1%D9%88%D9%86%D9%8A%D8%A9/ BreadBoard. 17.11 2020.

20. Sandip, S.P. ve Zope, P., Selective review of fingerprint enhancement, classification and matching techniques, 2015 IEEE Bombay Section Symposium (IBSS) 2015, 1-6.

21. Kamaraju, M. ve Kumar, P.A., Wireless fingerprint attendance management system, 2015 IEEE International Conference on Electrical, Computer and Communication Technologies (ICECCT) 2015, 1-6.

22. Kajikawa, N., Minami, Y., Kohno, E. ve Kakuda, Y., On availability and energy consumption of the fast connection establishment method by using Bluetooth Classic and Bluetooth Low Energy, 2016 Fourth International Symposium on Computing and Networking (CANDAR) 2016, 286-290.

23. Decuir, J., Bluetooth Smart Support for 6LoBTLE: Applications and connection questions, IEEE Consumer Electronics Magazine, 4,2 (2015) 67-70.

CURRICULUM VITAE

After finishing his secondary eduation from Al Sharqiya for boys in 2009, Ameer enrolled in a Bachelor of Computer Science and Mathematics department enrolled in a Bachelor of Computer Science department of Mosul University, Mosul in 2009 and graduated in 2013. From 2016-2017 he completed Turkish language, and from 2017-2018 he finished English language, preparatory education and started he master's studies in Computer Engineering at Karadeniz Technical University in Trabzon, Turkey. Ameer ARAFAT has successfully published her paper titled "Modern Attendance Classroom System" at 7th International Congress on Applied seciences 2020 . He was been September 2019 to December 2019 Polytechnic Institute of Guarda, Portugal as an ERASMUS student. Ameer speaks Arabic, Englishand and Turkish very good.