

**T.C.  
BAHÇEŞEHİR UNIVERSITY**

**FACULTY OF ENGINEERING AND NATURAL SCIENCES**

**CAPSTONE PROJECT PROPOSAL**

**RFID Based Attendance System**

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- **they have not received unpermitted aid for the project design, construction, report or presentation;**
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**ABSTRACT**

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## **LIST OF ABBREVIATIONS**

IoT	Internet of Things
RFID	Radio Frequency Identification
LAN	Local Area Network

## **Introduction**

The term RFID is an abbreviation of Radio Frequency IDentification . A wireless communication technology that utilizes radio waves as a medium for information transfer[1], the technology was first discovered in the 1940's however, most of its applications were introduced in the 1970's as the dimensions of its components decreased along with a substantial decrease in its materialization costs. RFID has become a prominent technology in the field of wireless communication, current developments in RFID systems have enabled radio wave based recognition of objects associated with a unique ID that signifies a code carried by the tag possible [2]. much of its uses include the following:

product tracking, shipping, and credit card payments in the banking sector. The project proposed is a modest attempt to enhance the attendance taking procedure in educational institutes by utilizing RFID technology, attendance will be marked whenever a student places the tag on the reader. The ID will be contrasted with a modifiable database and if the student's ID is matched with the database through data authentication, attendance would be marked along with the entrance time otherwise, an error titled "unauthorized attempt of attendance" is delivered. The teacher can remotely monitor any attendance attempt (authenticated or not), number of students (with their entrance time) via a mobile app. The teacher will be capable of acquiring all the students' previous attendance records and has the option to list them in a PDF file . Also, a notification alert will be developed to effectively track the absentees for a predetermined period set by the instructor.

### **1.1. Identification of the need**

It has been well documented that the number of students enrolling into degree granting institutes is increasing rapidly. An attendance report is a measure of students' punctuality, discipline, performance expectation, and appreciation for the material taught.

Attendance is a necessary element in every educational institute. Nowadays, multiple universities in a single metropolitan city with a densely populated urban core include thousands of students . Nonetheless, several universities are still dependent on the classical approach of attendance recording which is unreliable and difficult to moderate on a large scale.

Likewise, the process is renowned to be time-consuming; the teacher must call the names of every student at the start of every lecture which reduces the lecture period by 5 minutes. Cheating in attendance is another element of concern; a colleague of one of the absentees can mark a fake attendance .

Furthermore, this method is subjected to various unintentional human errors; the teacher may forget to take attendance in the first place.

Therefore, the proposed model aims to limit such flaws.

## **1.2. Definition of the problem**

In simple terms, most commonly used attendance methodologies in educational institutes are outdated, inaccurate, and time consuming. It is of utmost importance that an advanced, economical approach is applied to develop an efficient attendance system capable of monitoring students' entrance time on a mobile app.

### **1.2.1. Functional requirements**

The system functional requirements to be achieved once the prototype is ready are given below:

**-System can read the tag successfully:**

The microcontroller circuit must scan the tag and record the tag's ID.

**-System can transmit unlimited number of ID obtained to LAN through Wifi:**

The microcontroller would establish a connection to the database on a LAN and transmit the collected ID information via Wifi in real-time.

**-The teacher can create new student on database:**

A new student registration option would provide a new identity to any unknown id scanned otherwise, the id would be marked as irrelevant.

**-The user can monitor login credentials of registered students :**

Registered students' entrance time can be monitored from a mobile application on weekly bases.

**-Notification:**

A notification will be sent to alert the teacher if a student is absent for more than 6 weeks

### **1.2.2 Performance requirements**

the predicted performance of the system is based on different criterias listed below:

- the app GUI must be user-friendly
- the system has to display all login data in all weeks.
- the system should be fast enough to fetch the ID in Real-time so that students would not have to wait or rescan their cards

### **1.2.3 Constraints**

This project can be considered as a viable long term solution for paper based attendance registration, it provides a fairly undifficult model to be used in educational institutes.

However, There are many constraints related to its real-world implementations, categorised as:

1-Time constraints: the teacher has to make a new user for each student presented to the class for the first time as a consequence of the iterative nature of the course registration process.

2-Ethical constraints: it is a fragile proof of attendance such that the students must not lose their RFID card to get attendance. Otherwise, the presence of one student without a card would mark his/her attendance as absent.

Similarly, the system does not provide any protection against data falsification; a student can use someone else's card to mark for attendance.

Hence, it is applicable to define the project as an RFID “tag” tracking, and not a “student” tracking system.

3-Technical constraints: generally, a teacher is responsible of different sections and different courses throughout the academic year which adds an element of complexity if the system is to be implemented on all sections; multiple ip addresses with Node.js pages would be required, the mobile app programming difficulty increases as well

4-Economical constraints: Although the proposed model is economical and reasonably within our budget, a large scale implementation can be expensive; a copious number of Wifi extenders might be required to widen the system's coverage within the campus, more research is needed before a definitive conclusion can be drawn.

5-Environmental constraints: The model eliminates the permanent consumption of paper and replaces it with RFID cards that are made of PVC, a non-biodegradable plastic polymer that needs a long period of time to breakdown posing a significant hazard on the environment

### **1.3 Literature Review of various attendance systems**

This section discusses the attempts previously performed by other scholars to obtain the proposed model highlighting the main characteristics, results obtained, and techniques used.

These models were assessed by our team members based on 4 major criterias listed below in Table1

1- Can the model manage the students' attendance information ?

2- Can the model alert the instructor by sending a notification ?



3- Can the model keep track of the students' record for a continuous period ?

4- Can the model utilize a database for access ?

scholars	criteria 1	criteria 2	criteria 3	criteria 4	approach
Arbain et al., 2014 [3]	yes	no	no	no	Arduino based model with web server support
Yuru et al., 2013 [4]	yes	no	no	no	used an ARM microcontroller to display data on an embedded screen
Kuriakose & Vermaak, 2015 [5]	yes	yes	yes	no	ST232 microcontroller programmed in java language
Srinidhi et al. , 2015 [6]	yes	yes	yes	yes	biometric input based management system using arduino

**Table 1 previous projects**

A miniature review of different input scanning technologies used in industry as an alternative to RFID is presented in the following section.

### **1.3.1 Barcode Attendance System**

The barcode system is an early proposed primitive system of input aimed to eliminate the use of the classical method of attendance taking and its associated human caused error .Such a technology invented in the early 20th century is widely used until this day. Hence it was one of the early solutions for attendance tracking.Furthermore, the system is inexpensive in the long run considering the amount of paper wasted in many educational institutes.

The system can be implemented by issuing a card that carries a unique barcode to each student . Attendance taking process occurs when the barcode reader scans the card and transmits the data to a time clock which can be presented to the teacher in a printed form after each session, The Universal Product Code (UPC) is a 12-digit character located under the barcode, once the UPC is scanned by the reader a mathematical calculation starts And,the check digit determines the validity of the calculation.Thus, an error occurs if the check digit is different[7], Figure 1 is a “representational” form of a barcode.One of the drawbacks of barcode system is the low security features that can be manipulated easily; any physical or digital picture of a barcode is adequate for replicating the student's data.Hence, this model is deficient in tracking purposes.



**Figure 1 Barcode sample [8]**

### 1.3.2 Biometric identifier Attendance System

is an attendance model based on the measurements of Biological characteristics .The sentence “Biometric identifier” refers to authentication techniques based on measurable physical properties for authorization[9]. Various different forms of biometric based identification techniques include:fingerprint scanning, iris scanning etc. , such physical identifications can be monitored by an AI based algorithm to determine the user. For a system like the ones used in industry the software is linked to a clock where the means of identification are based on biometric characteristics for validation . For example: a student marks his/her attendance by placing their finger on the scanner as shown in Figure 2.

This system can be considered efficient and simple.moreover, the usage of biometrics identification terminates the consistent use of a student card along with its associated financial obligations on both the students and the educational institute which can be subject to loss, or damage Furthermore, this system provides the highest level of identity security in which physical characteristics are impossible to replicate.

Recently, due to the newly emerged Covid-19 pandemic a physical characteristic measurement based solely on the use of contact for identification is undesirable.



**Figure 2 fingerprint sensor based attendance system [9]**

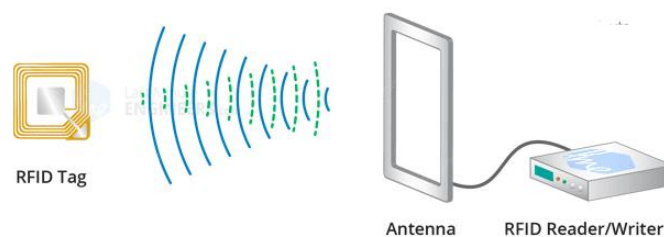
### 1.3.3 RFID technology

RFID utilizes radio waves as a medium of communication between its components, RFID is fully recognized with its wide range of applications in the world of technology [10]. RFID systems have three main components: reader antenna, reader module, and tag, Figure 3 presents the RFID system. The reader antenna is an active component while a tag is passive. Active components have an independent power source to generate electromagnetic waves radiated space while passive components require energy from the electromagnetic field surrounding them to transfer the information[11].

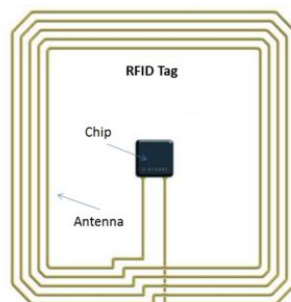
Antennas are categorised in three different frequency ranges. Low frequency (LF) ranging from 30KHz to 300KHz, high frequency (HF) between 3MHz and 30MHz, and ultra-high frequency (UHF) 300MHz to 3 GHz. tags operating on low frequency (LF) have a maximum reading distance of approximately 500 cm. meanwhile, high frequency antennas (HF) can operate within a distance of one meter.

Ultra-high frequency (UHF) antennas reign supreme in terms of coverage, reaching 12 meters.

the RFID tag consists of an antenna and a chip, the antenna transmits waves carrying data stored in the chip, and simultaneously receives radio waves from the reader antenna to supply energy to the chip for the reading operation. The coverage is directly proportional to the antenna's length (turns), Figure 4 shows the RFID tag inner components



**Figure 3 RFID system[12]**



**Figure 4 RFID tag[13]**

## 1.4 Concepts

Three different concepts were researched thoroughly before a decision was made in designing the project. The concepts were put in comparison on the following parameters: cost, performance, features, and complexity. The team concluded that concept 2 due to its modest economical approach while preserving the fundamental functionality of the system under various circumstances.

Table 2 compares different conceptual solutions concerning the four .

Parameters	1-Attendance using RFID with Arduino and ethernet module on local network	2-Attendance using RFID with NodeMCU on local network	3-Attendance with NodeMCU on a web server
Cost	High	Low	Medium
Complexity	Low	Low	Medium
Performance	High	High	Medium
Features	Low	Medium	High

**Table 2 Comparison of three similar conceptual solutions.**

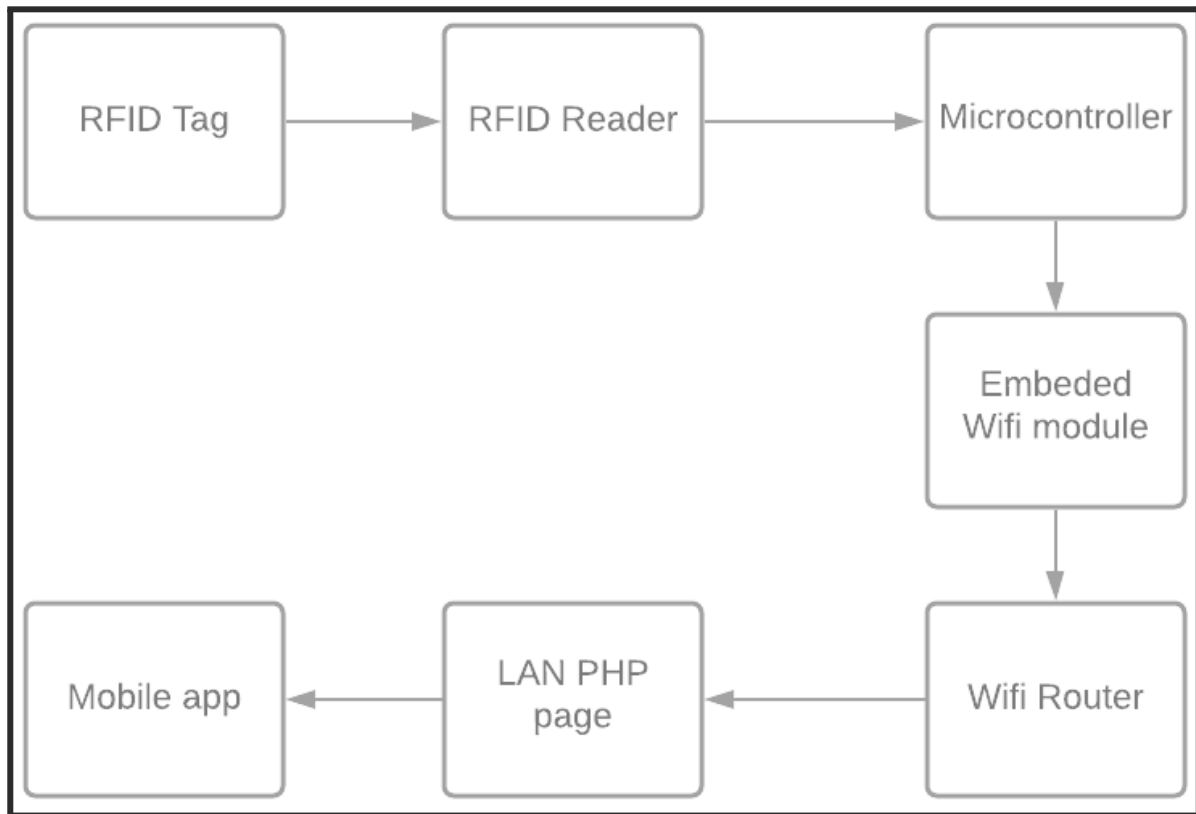
Concept 1: The main drawback from using an Arduino based approach is that the ethernet module requires a wired connection to the router and this defies the purpose of the project. Additionally, the Arduino and ethernet shield are very expensive.

Concept 2: The NodeMCU is equipped with a wifi module that connects to the router providing wireless means of communication for a fairly low price .

Concept 3: Identical to concept 2 in terms of hardware but the main difference lies in its database location (on the internet) which makes the system accessible from any device connected to the internet. However, such an approach is expensive (renting a server).

## 1.5 System architecture

Figure 5 depicts the physical architecture of the system

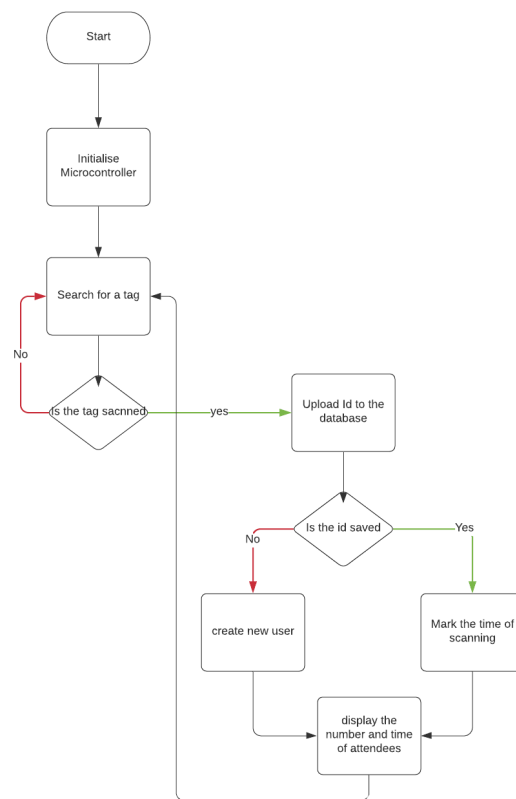


**Figure 5 System Architecture**

## 1.6 Data Flow Diagram

The attendance system data flow is illustrated in Figure 6.

First, the microcontroller is connected to a power source (PC, external battery) and the code is flashed, once the microcontroller is initialized a read loop is started to scan for any available tag within the reader's premises. When a tag is scanned, the ID of the tag is extracted and sent to the database through Wifi for authentication. If the ID is already associated with an attendant, the time of attendance is recorded and sent to the webpage to be viewed from the mobile app otherwise, an error will be displayed stating that there was an unknown ID scanned, the teacher can create a new user linked with the unknown card if deemed necessary.



**Figure 6 Data flow chart**

## 2. WORK PLAN

Work Plan is an important aspect of project management aimed to guide team members by using different strategies to assign tasks and track the main components of the project.

### 2.1. Work Breakdown Structure (WBS)

WBS is used to make the project manageable for the team by breaking the whole system into its individual components outlining the required tasks to be completed under two subsystem: Hardware and Software, a simple representation is shown in Figure 7

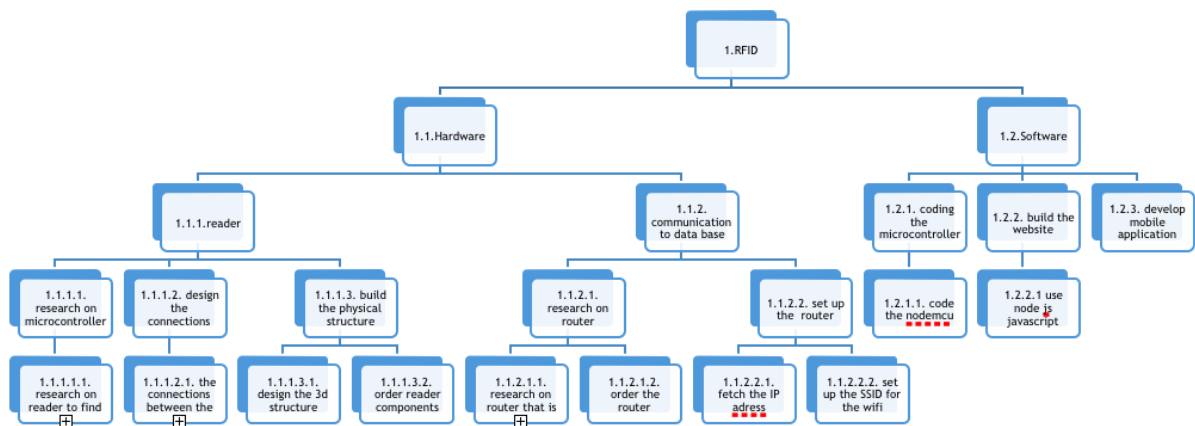


Figure 7 WBS

### 2.2. Responsibility Matrix

The responsibilities of each member shown in Table 3 were negotiated between the team members and the project supervisors according to the university's project standards,

Task	Karim	Nadir	Selim	Tarek
Assembling the circuit	R	S		
Coding the microcontroller		R	S	
Router setup			R	S
Web page design			S	R
Developing the codes for mobile app			R	S
Planning	S	R		
Reporting	R		S	
Integration	S	S	S	R

R= responsible , S= support

Table 3 Responsibility Matrix

## 2.3. Project Network

The project network provides a distributed work hierarchy in a certain sequence of activities to achieve the finalized product, our model is shown below in Figure 8.

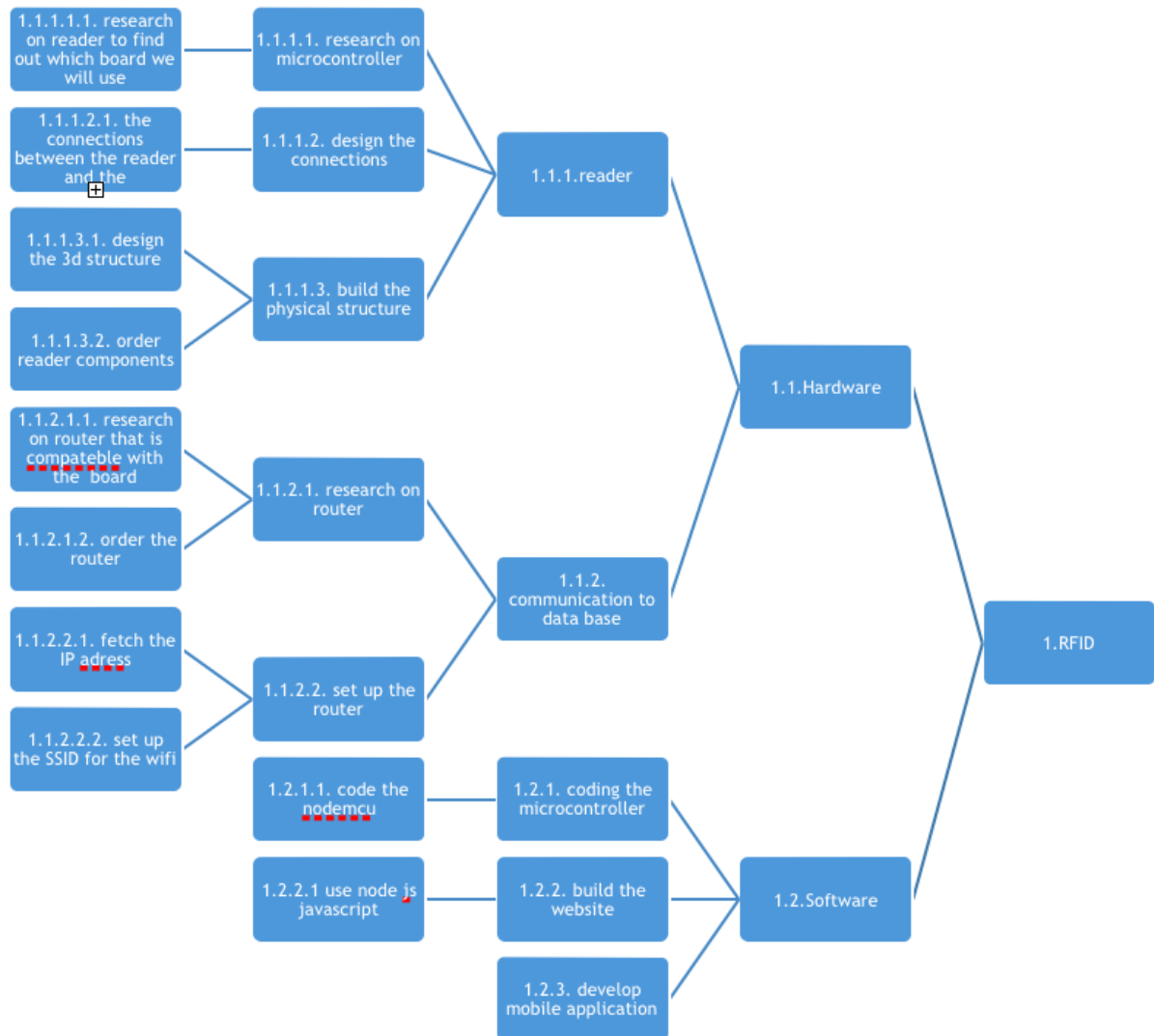


Figure 8 Project Network



## 2.4. Gantt chart

The Gantt chart is based on a 12 week span , our team divided the tasks in this duration as shown in Figure 9.



Legend: Nader + Karim

Selim + Tarik

All the team members

Figure 9 Gantt Chart

## 2.5. Costs

The project costs are all hardware related, and will be calculated based on the prices given by the distributor “Direnc.net”.

Due to the volatility of Turkish lira, the team has expressed its intention to estimate the costs related with the project in US dollars , Table 4 presents a list of hardware to be used and the corresponding price of each component.

Components	
RC522 RFID Reader Module	\$3
NodeMcu v3	\$5.4
3D printed prototype	\$2
Female to Female Jumper Wires	\$1
Wifi Router	\$50
Renting 3D cnc machine	\$10
Total	\$69.4

**Table 4 Cost Analysis**

Thus, the system is considered to be within the budget negotiated with the team members defined to be 100\$

## 2.6. Risk assessment

Multiple potential risks related with the project functionality that can jeopardize the final product were identified and discussed between the team members, these risks were summarized in Table 5

<b>Event</b>	<b>Probability</b>	<b>Severity</b>	<b>Risk level</b>	<b>Plan of Action</b>
<b>Unregulated voltage or Short circuit</b>	<b>Unlikely</b> power will be delivered from a usb port with a stable voltage output of 3.3V	<b>Major</b> hardware components will be fried	<b>Medium</b>	use an external power source with a voltage regulator circuit
<b>microcontroller stuck in an infinite loop</b>	<b>possible</b> it is probable that the system can get stuck in an infinite loop during card reading and data sending process	<b>Major</b> The whole input system fails	<b>High</b>	perform a system reboot , use of a different loop function
<b>Connection interruption between the router and microcontroller</b>	<b>Unlikely</b> Unless the reader is subject to be mobile the connection shouldn't be interrupted as long as the reader is in close proximity to the router	<b>Moderate</b> Data will be saved but will not be uploaded until a successful connection is established	<b>Low</b>	Use of a wifi extender
<b>COVID-19 Lockdown</b>	<b>Likely</b>	<b>Minor</b>	<b>Medium</b>	Concept 3 would be chosen as an alternative approach such that the project can be assessed outside the campus

**Table 5: Risk Assessment**

### **3. SUB-SYSTEMS**

The project in its essence requires the collaboration between the Electrical and Electronics Engineering and Software Engineering division to achieve a functional system.

We have divided our project into two subsystems

#### **3.1. Electrical Engineering**

The Electrical engineering students are responsible for the hardware components and the integration of the microcontroller code to the system as a whole.

##### **3.1.1. Requirements**

Obligations to be fulfilled are listed in order:

1-pre-scanning procedure: to create a circuit that links the RFID card reader with the microcontroller

2-data collection: to develop the microcontroller software to detect and extract the card ID when scanned.

3-data transmission: to send the obtained information to the database on a Local Network through Wifi

##### **3.1.2. Technologies and methods**

This section presents a comprehensive review of the hardware components and the implementation process.

##### **-RC522 RFID reader**

RC522 RFID reader is an 8-pin module that exploits high frequency levels of 13.56MHz to produce an electromagnetic field used for communication with the tags.the module can operate with voltages between 2.5V and 3.3V with a reading range of 5cm making it a suitable component for the purpose of our project.

An image of the module along with its pin configuration is represented in Figure10, Table 6 summarizes the pin within the circuit.

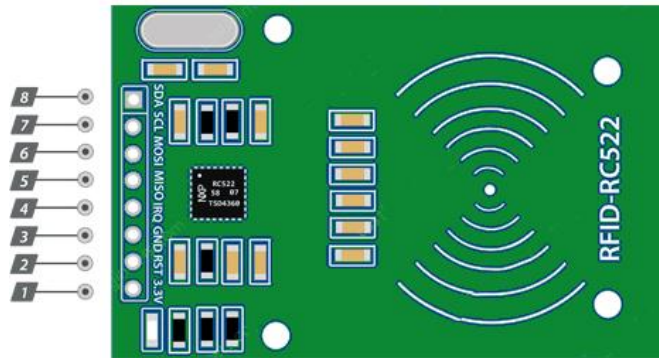


Figure 10 RC522 RFID module

Pin	1	2	3	4	5	6	7	8
Name	3.3V	RST	GND	IRQ	MISO	MOSI	SCL	SDA
Function	supplies power to the module	resets the module	ground pin to microcontroller	interrupt pin to alert the microcontroller when tag is near	output from module	input to module	receives clock signals from microcontroller	signal input

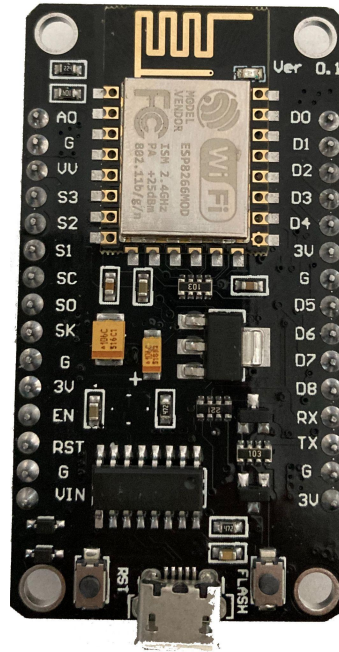
Pin	1	2	3	4	5	6	7	8
Name	3.3V	RST	GND	IRQ	MISO	MOSI	SCL	SDA
Function	supplies power to the module	resets the module	ground pin to microcontroller	interrupt pin to alert the microcontroller when tag is near	output from module	input to module	receives clock signals from microcontroller	signal input

Table 6 RC522 pin configuration

### -Lolin NodeMCU V3 ESP8266

NodeMCU V3 is an open source microcontroller built on (SOC) an acronym for system-on-chip, the chip in concern is the ESP8266. The team members opted to use this specific microcontroller for its networking capabilities (Wifi support), compact design, and reasonable price. Furthermore, the microcontroller is compatible with Arduino IDE and can be programmed with C code, a familiar language to the electrical engineering students. Additionally, the microcontroller has a builtin voltage regulator circuit to retain a constant voltage and a 4MB memory (the microcontroller can be operated with an external battery and stored code). Thus, eliminating the constant use of a computer as a medium for initializing the microcontroller.

Figure 11 presents the NodeMCU V3.



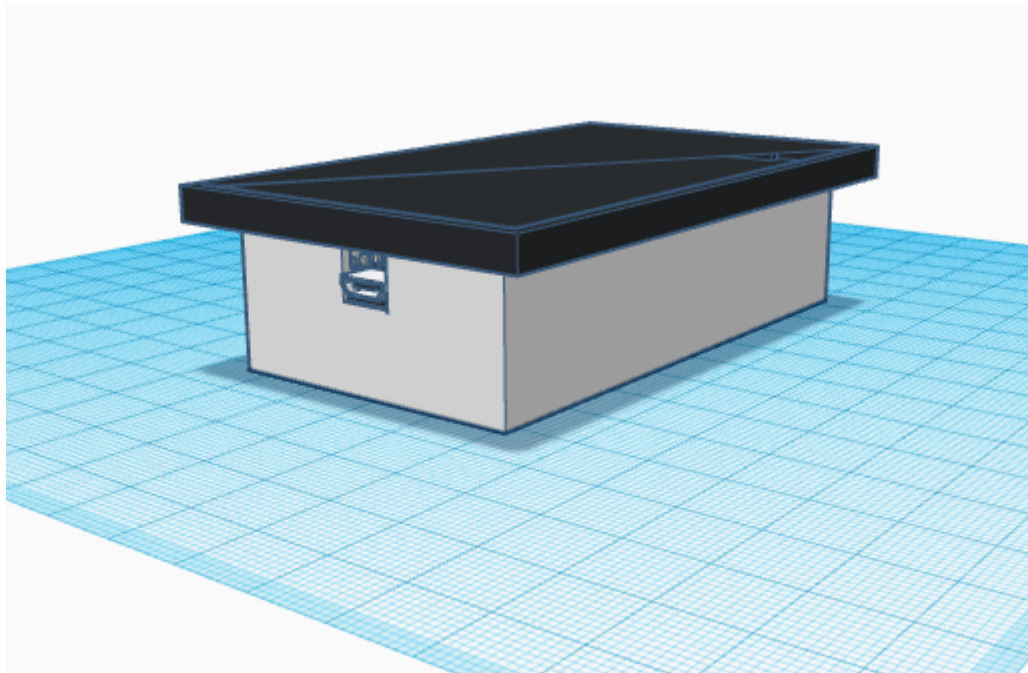
**Figure 11 NodeMCU V3**

#### **-Arduino IDE:**

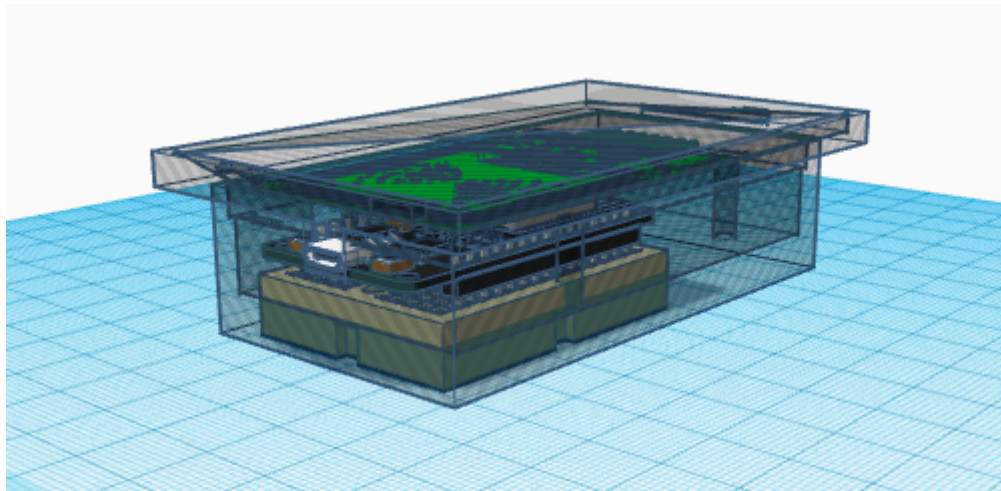
Arduino IDE is a widely known open source software used by hobbyists and professionals to develop the software architecture of various microcontrollers in IoT based projects. The team decided to use Arduino IDE for its vast support of multiple libraries.

### 3.1.3. Conceptualization

Figure 12 and 13 illustrate simple 3d-cad designs of the prototype.



**Figure 12 outer design of the final product**



**Figure 13 internal components in final design**

### 3.1.4. Materialization - Next semester

Begin the first paragraph here.

Begin the second paragraph here.

### 3.1.6. Evaluation - Next semester

Begin the first paragraph here.

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### 3.2. Software Engineering

#### Behaviors of the Software Application

Actor Name	Name of Behavior	Description of Behavior
Teacher	Login Get attendance data	Teacher can access attendance information and has access to the website of the system.
Student	Add attendance	Student scans his/her own card to the system.
Admin	Login Add teacher Add student Add class	Admin has access to everything. Admin can add class, teacher or student to the system.

Table 7 Software Application Behaviour

#### Attributes of the Software Application

Actor Name	Name of Attribute	Description of Attribute
Teacher	_id, name, username, password	_id: "Equals id of the teacher", name: "name of the teacher", username: "username will be used in login actions", password: "password will be used in login actions"
Student	_id, name, studentNumber, grade	_id: "Equals id of the teacher", name: "name of the teacher", studentNumber: "number of student", grade: "grade of student"
Admin	_id, username, password	_id: "Equals id of the teacher", username: "username will be used in login actions", password: "password will be used in login actions"

Table 8 Software Application Attributes



## **Performance Requirements**

If there are performance requirements for the application under various circumstances, state them

## **Safety Requirements**

Specify those requirements that are concerned with possible loss, damage, or harm that could result from the use of the product.

## **Security Requirements**

Specify any requirements regarding security or privacy issues surrounding use of the product or protection of the data used.

## **Business Rules**

List any operating principles about the product, such as which individuals or roles can perform which functions under specific circumstances.

### **3.2.2. Technologies and methods**

**Operating System:** Windows

#### **Backend**

Software Languages: NodeJS

Software Libraries: ExpressJS ( API service ) , Handlebars ( template engine ) , MongoJS ( database library )

Services: Login, Get/Add/Update/Delete Student, Get/Add/Update/Delete Teacher, Get/Add/Update/Delete Class, Export Attendance as PDF

#### **Frontend**

Software Languages: HTML, CSS, Javascript

Software Libraries: AngularJS, Bootstrap ( grid system and mobile responsibility )

Services: Login, Get/Add/Update/Delete Student, Get/Add/Update/Delete Teacher, Get/Add/Update/Delete Class, Export Attendance as PDF

Communication between Frontend and Backend are provided by HTTP - AJAX requests

#### **Database Management System**

Database Name: MongoDB

Vendor: MongoDB Inc.

Version: 5.0 - Latest Stable Version

MongoDB is a NoSQL database. Most of the big companies like Foursquare, Uber, The Guardian etc. are using MongoDB. It has a large community and library support. For all sizes of projects it's quite suitable. Especially for small projects it's a very lightweight and fast solution when it's used with the MongoJS library.

We're using the MongoJS library ( available on node package manager ) in order to connect to MongoDB database engine and run simplified MongoDB queries on NodeJS.

We're using Mongo 3T Studio as GUI in order to connect and check current database structures, view & manage documents, tables etc.

## Database Schema

### **students table:**

\_id ( primary key ), name, studentNumber, grade

### **admins table:**

\_id ( primary key ), username, password

### **classes:**

\_id ( primary key ), name, \_teacher ( secondary key, ref to "teachers" ), code

### **studentEnrollments:**

\_id ( primary key ), \_student ( secondary key, ref to "students" ), \_class ( secondary key, ref to "classes" )

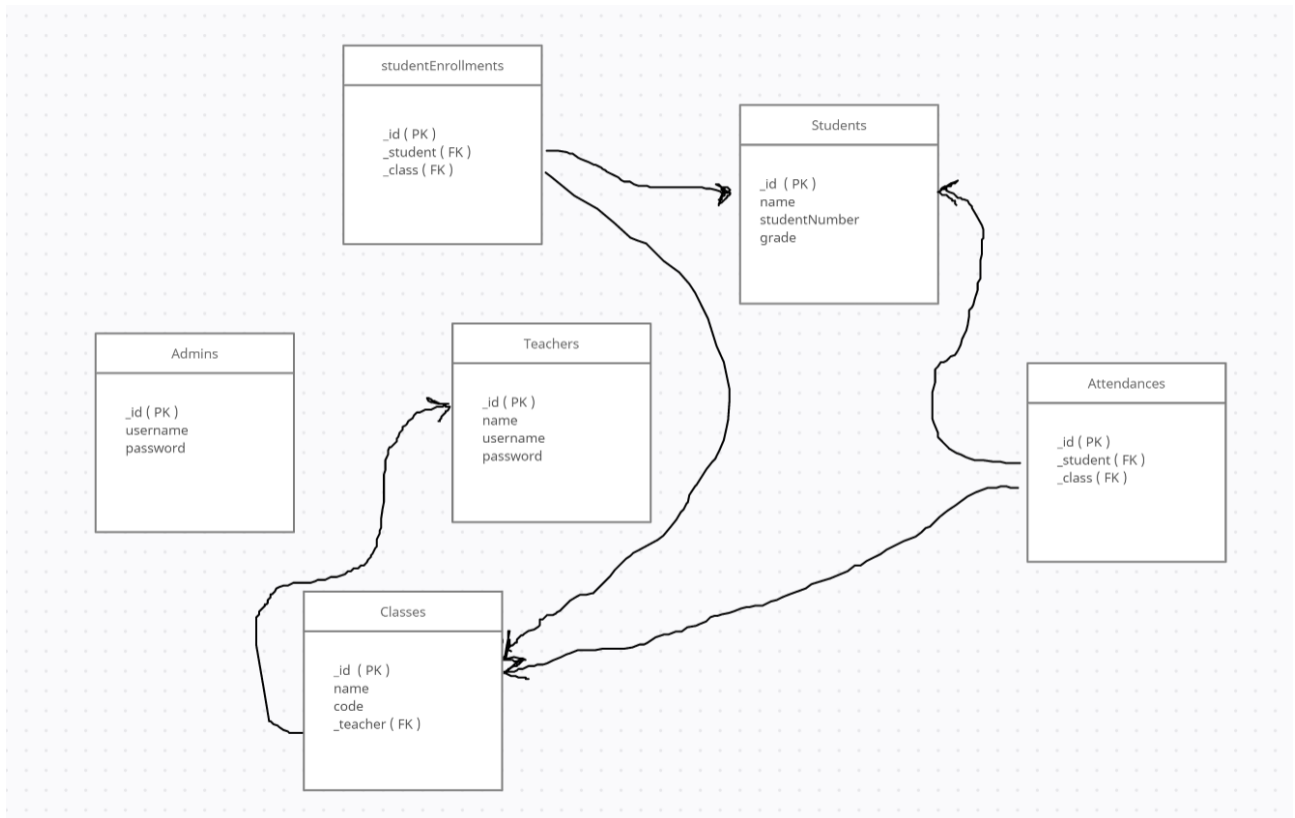
### **attendances:**

\_id ( primary key ), \_student ( secondary key, ref to "students" ), \_class ( secondary key, ref to "classes" )

### **teachers:**

\_id ( primary key ), name, username, password

## Database Physical Model



**Figure 14 Database Physical Model**

### 3.2.3. Conceptualization

#### Actor Glossary

Actor	Synonym	Description
Student	-	Student is an actor who has a card for attending the class. Every student must scan their card to attend the class.
Teacher	-	Teacher is an actor who has several classes and has access to the website. Teacher can see who attended the class at a specific week and can download the attendance data.
Admin	Administrator	Admin is an actor who has a permission to everything. Admin can adjust class, teacher or student data.

**Table 9 Actor Glossary**

#### Use-case Glossary

All functional requirements can be expressed as use-cases. Try to define at least 5 use-cases.

Use-case Name	Description	Participating Actors
Login ( Teacher/Admin )	Teacher/Admin logs in to his/her account	Teacher Admin
Add/Update/Delete teacher	Add/Update account of the teacher with the related information, Delete teacher's account	Admin
Add/Update/Delete student	Add/Update account of the student with the related information, Delete student's account	Admin
Add attendance	Add attendance of student to the related class	Student
Add/Update/Delete class and assign to teacher	Add/Update the class with the related information, Delete class, Assign class to teacher of it.	Admin
Get attendance data	System shows for each class assigned to teacher, shows by date - week, adds general statistics like how many students are attended in class	Teacher
Export attendance datas as PDF	System converts attendance data to PDF format and shows to teacher by each week according to the class	Teacher

**Table 10 User Glossary**

## **Use-case Scenarios**

<b>Use-case Name</b>	<i>Login</i>
<b>Use-case Description</b>	<i>Teacher/Admin enters the username and password information and logs in to his/her account</i>
<b>Actors</b>	<i>Admin, Teacher</i>
<b>Pre-Condition</b>	<i>Admin/Teacher has to have an account</i>
<b>Post-Condition</b>	<i>Admin/Teacher have session</i>
<b>Normal Flow</b>	<ol style="list-style-type: none"> <li>1. Student/teacher enters the account's username and password</li> <li>2. Authentication service validates student/teacher's username and password</li> </ol>
<b>Alternate Flow</b>	Alt-2. Incorrect username or password. Gives error
<b>Business Rules</b>	<i>After successful login admin/teacher will have session token</i>

**Table 11 Case 1**

<b>Use-case Name</b>	Add/Update/Delete teacher
<b>Use-case Description</b>	<i>Add/Update account of the teacher with the related information, Delete teacher's account</i>
<b>Actors</b>	<i>Admin</i>
<b>Pre-Condition</b>	<i>Account must be an admin account.</i>
<b>Post-Condition</b>	<i>Teacher account created and teacher information appended to the database.</i>
<b>Normal Flow</b>	<ol style="list-style-type: none"> <li>1. Admin enters data of teacher</li> <li>2. Teacher is created in system</li> </ol>
<b>Alternate Flow</b>	Alt-2. Username already exist. Gives error
<b>Business Rules</b>	

**Table 12 Case 2**

<b>Use-case Name</b>	Add/Update/Delete student
<b>Use-case Description</b>	<i>Add/Update account of the student with the related information, Delete student's account</i>
<b>Actors</b>	<i>Admin</i>
<b>Pre-Condition</b>	<i>Account must be an admin account.</i>
<b>Post-Condition</b>	<i>Student data will be sent to the database.</i>
<b>Normal Flow</b>	<ol style="list-style-type: none"> <li>1. Admin enters data of student</li> <li>2. Student is created in system</li> </ol>
<b>Alternate Flow</b>	
<b>Business Rules</b>	

**Table 13 Case 3**

<b>Use-case Name</b>	<i>Add attendance</i>
<b>Use-case Description</b>	<i>Add attendance of student to the related class</i>
<b>Actors</b>	<i>Student</i>
<b>Pre-Condition</b>	<i>Student must have a card.</i>
<b>Post-Condition</b>	<i>After scanning the card, the system gets the scan data..</i>
<b>Normal Flow</b>	<ol style="list-style-type: none"> <li>1. Student scans the card.</li> <li>2. The data of the scan will be sent to the system.</li> </ol>
<b>Alternate Flow</b>	<i>Alt-2. Card is not working.</i>
<b>Business Rules</b>	<i>Students cannot share their cards.</i>

**Table 14 Case 4**

<b>Use-case Name</b>	Add/Update/Delete class and assign to teacher
<b>Use-case Description</b>	<i>Add/Update the class with the related information, Delete class, Assign class to teacher of it.</i>
<b>Actors</b>	<i>Admin</i>
<b>Pre-Condition</b>	<i>Account must be an admin account. Class must exist in university.</i>
<b>Post-Condition</b>	<i>Class data will be sent to the database.</i>
<b>Normal Flow</b>	<ol style="list-style-type: none"> <li>1. Admin enters data of class</li> <li>2. Class is created in system</li> <li>3. Assign class to teacher</li> </ol>
<b>Alternate Flow</b>	Alt-3. Teacher has the class already
<b>Business Rules</b>	

**Table 15 Case 5**

<b>Use-case Name</b>	<i>Get attendance data</i>
<b>Use-case Description</b>	<i>System shows for each class assigned to teacher, shows by date - week, adds general statistics like how many students are attended in class</i>
<b>Actors</b>	<i>Teacher</i>
<b>Pre-Condition</b>	<i>There must be attendance data (emptyCheck).</i>
<b>Post-Condition</b>	<i>Detailed data of the attendance information will be shown and enriched with graphics.</i>
<b>Normal Flow</b>	<ol style="list-style-type: none"> <li>1. Teacher chooses class</li> <li>2. Teacher selects specific week of the class</li> <li>3. System shows the data to teacher</li> </ol>
<b>Alternate Flow</b>	Alt-3. There is no data yet
<b>Business Rules</b>	<i>Data should remain private.</i>

**Table 16 Case 6**

<b>Use-case Name</b>	Export attendance data as PDF
<b>Use-case Description</b>	<i>System converts attendance data to PDF format and shows to teacher by each week according to the class</i>
<b>Actors</b>	<i>Teacher</i>
<b>Pre-Condition</b>	<i>There must be attendance data (emptyCheck).</i>
<b>Post-Condition</b>	<i>Converted attendance data will be downloaded as PDF format.</i>
<b>Normal Flow</b>	<ol style="list-style-type: none"> <li>1. Teacher presses the 'Export' button.</li> <li>2. System converts attendance data in accordance with the PDF format.</li> <li>3. Teacher downloads the PDF.</li> </ol>
<b>Alternate Flow</b>	Alt-3. There is no data yet
<b>Business Rules</b>	<i>Data should remain private.</i>

**Table 17 Case 7**

## Use-case Diagrams



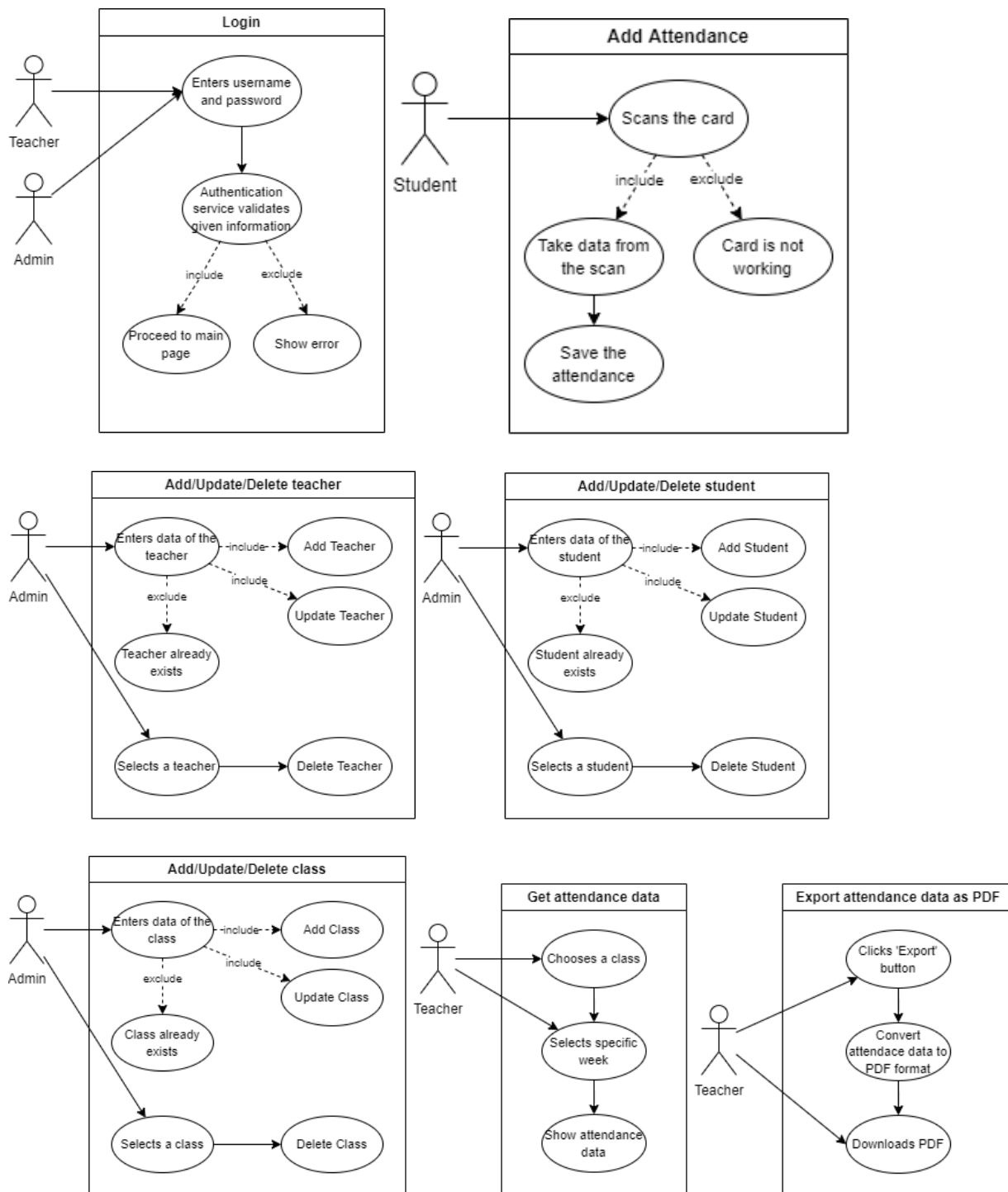


Figure 15 User Case Diagrams

## Interface Designs

# Attendances

## WEEK 1 - STUDENTS ATTENDED

SALIH SELIM BELEK - 1804506  
TARIK CAN - 1803030  
AHMET PETEK - 1708558  
MICHAEL JORDAN - 1704499  
EMRE AYDIN - 1609977











## Students

## WEEK 2 - STUDENTS ATTENDED

SALIH SELIM BELEK - 1804506  
MICHAEL JORDAN - 1704499  
EMRE AYDIN - 1609977




## WEEK 3 - STUDENTS ATTENDED











TARIK CAN - 1803030  
AHMET PETEK - 1708558

NAME	STUDENT NO	ACTIONS
SALIH SELIM BELEK	1804506	 
TARIK CAN	1803030	 
AHMET PETEK	1708558	 
MICHAEL JORDAN	1704499	 
EMRE AYDIN	1609977	 

## Teachers

## Classes

NAME	USERNAME	ACTIONS
NAZAN BELEK	NAZANI1	 
DILEK CAN	DILEK123	 
JANE DAN	JANEFF4	 
MARIA BROWN	MARIA123	 
DAN BROWN	DAN3434	 

NAME	CODE	ACTIONS
Data Science	DT1001	 
French	FR1001	 
Math	MT1001	 
Network Systems	NT1001	 
Physics	PY1001	 

## Login

Sign in to continue. For teacher and admin

EMAIL

hello@rfidattendance.com

PASSWORD

\*\*\*\*\*

log in

## Update/Add Teacher

NAME

Jiara Martins

USERNAME

jiara.martins@rfidattendance.com

PASSWORD

\*\*\*\*\*

save

## Update/Add Student

NAME

Jiara Martins

STUDENT NUMBER

1804506

GRADE

4

save

## Update/Add Class

NAME

Capstone Project

CODE

CPI234

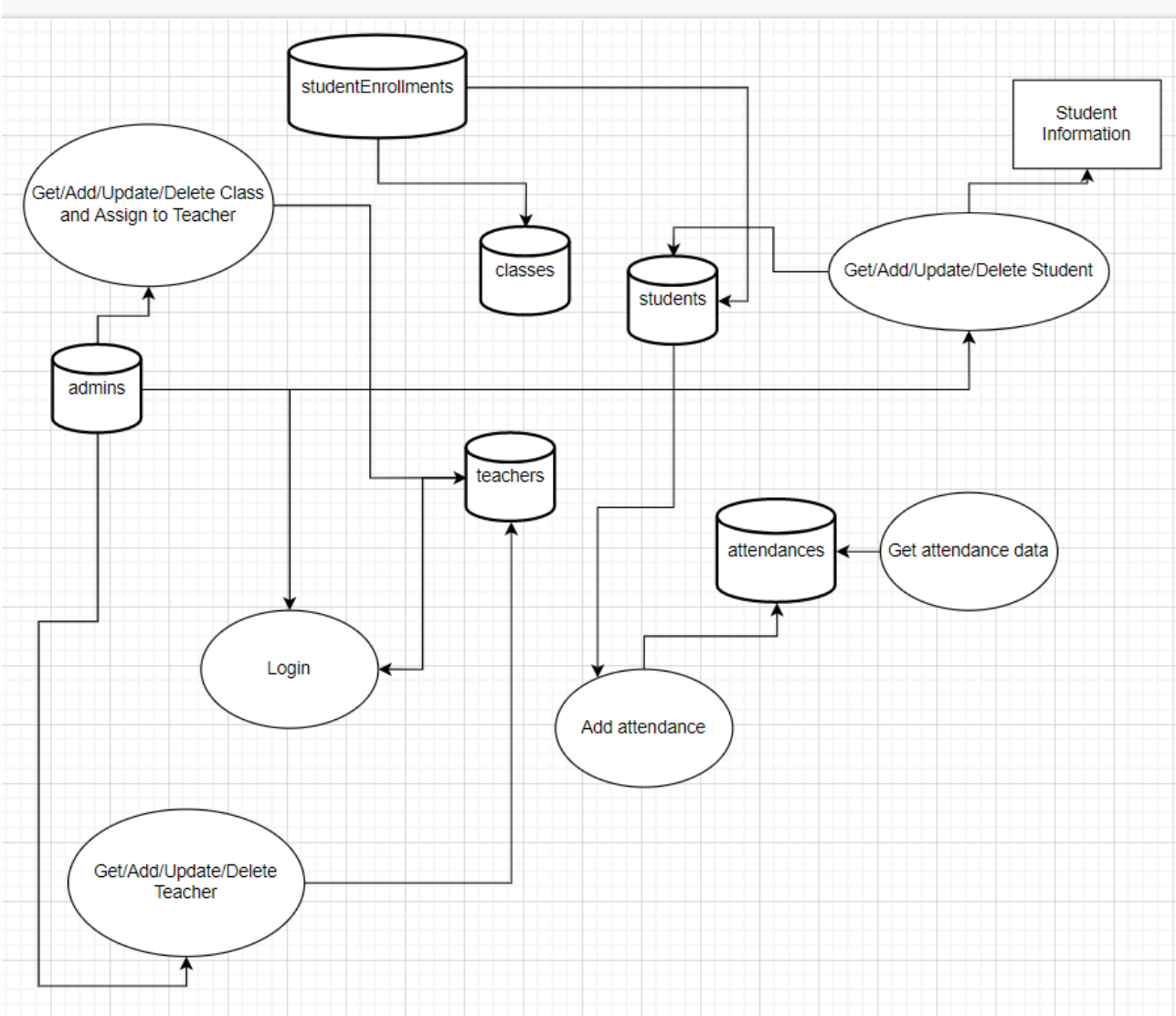
TEACHER

Please select teacher...

save

Figure 16 Interface Designs

**Data Flow Diagram(s)**



**Figure 17 Data Flow Diagram**

**Sequence Diagram(s)**

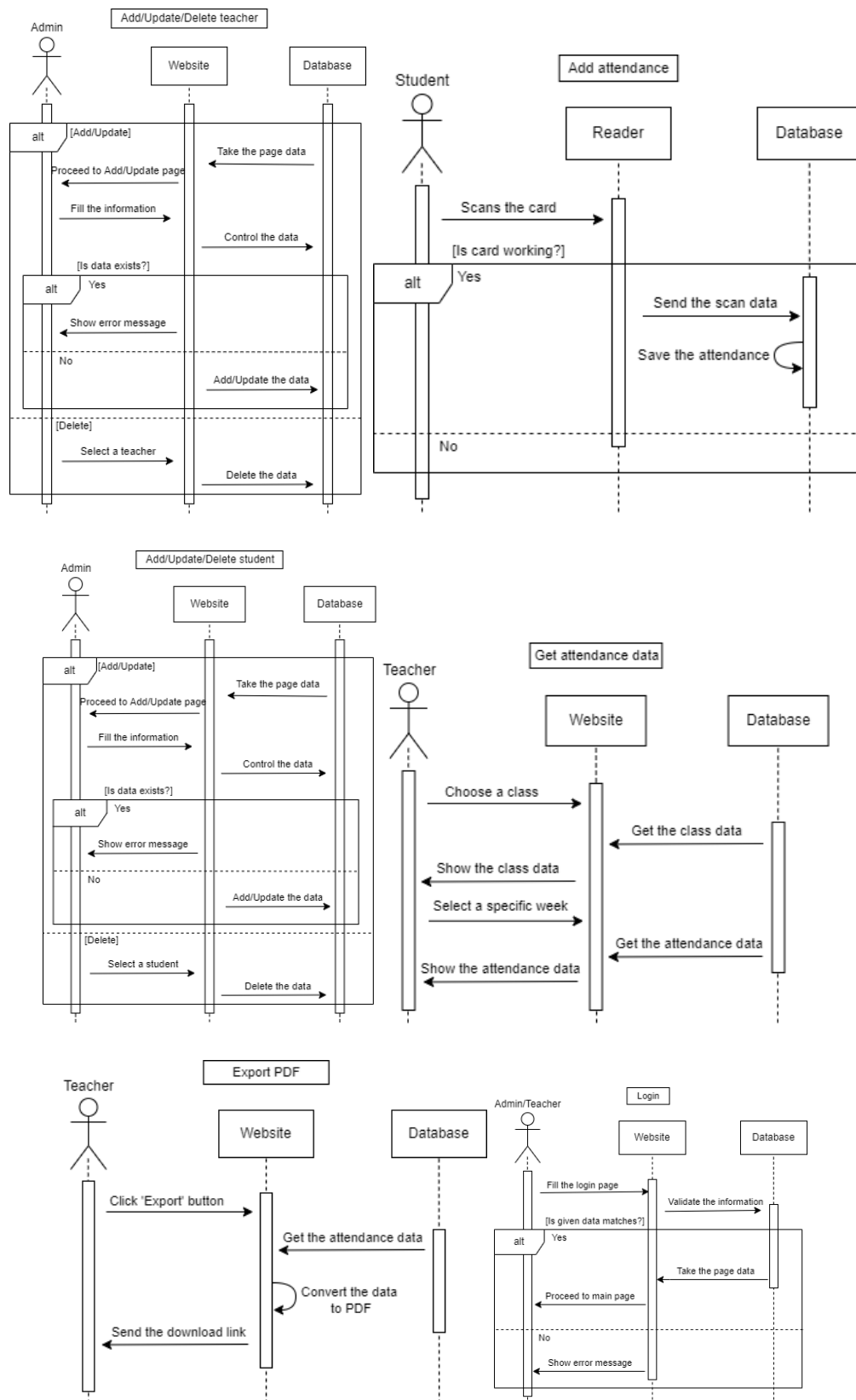


Figure 18 Sequence Diagrams

## Activity Diagram(s).

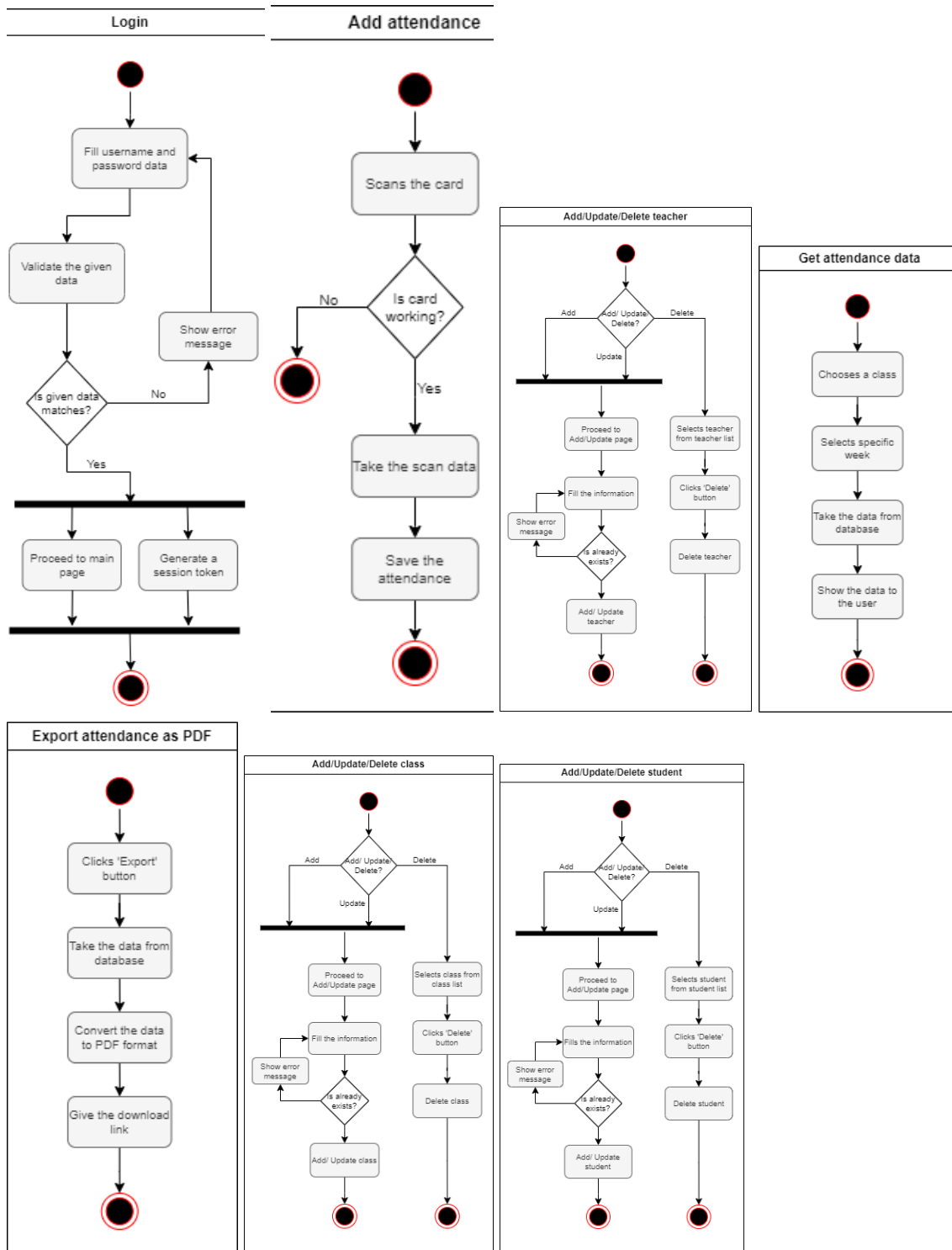


Figure 19 Activity Diagrams

#### **3.2.4. Physical architecture -**

Begin the first paragraph here.

Begin the second paragraph here.

#### **3.2.5. Materialization - Next semester**

Begin the first paragraph here.

Begin the second paragraph here.

#### **3.2.6. Evaluation - Next semester**

Begin the first paragraph here.

Begin the second paragraph here.

## **4. SUMMARY AND CONCLUSION**

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