THE MAHARAJA SAYAJIRAO UNIVERSITY OF BARODA

Faculty of Science

Fifth-semester mini-project

On

Fingerprint Attendance System

Guided by

Mr. Krishnanand Rastogi

In fulfilment of the degree

Of

Bachelors of Computer Applications

In

Department of Computer Applications

December, 2019

Submitted by:

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Lokhandwala HajiHuseinali – 522035
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The Maharaja Sayajirao University of Baroda
Faculty of Science
Department of Computer Applications.

5TH SEM MINI-PROJECT

Cerberus – Attendance Management System

Date: 18th December 2019

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Invigilator Signature_____

Contents

Acknowledgment

Success cannot be achieved single-handedly. For this reason, we would like to express our deepest gratitude to all those involved in making this project a success. This project would not have been successfully completed without the help of our mentors.

Firstly, we thank **Prof. R.S. Srivastava (H.O.D.)** who gave us this opportunity to work for the project which will add to our experience and for giving us a chance to prove our knowledge skill and abilities.

We would also like to thank **Mr. Krishnanand Rastogi** who provided us guidelines throughout the course of the project.

Not missing to thank our own **C.A. Department**, for giving us this opportunity to gain practical experience and enable us to understand the demand of the experience and professional environment. We have gained valuable experience which has given us confidence and has enhanced our professional skill for our competent career.

We would also like to thank all our teachers and family members and friends for helping, bearing, encouraging and boosting our morale, throughout our studies, especially during the project period. Last but not the least we would like to express our sincere gratitude to those who helped us in completing our project directly or indirectly.

Special Thanks to **Mr. Rajesh Kotwala** for his help and support for making the box-design possible.

Abstract

This project uses a biometric concept to simplify the attendance system in educational institutes. It uses the most reliable way of distinctively identifying students through fingerprint reading. Such type of application is very useful in school as well as in college for daily attendance. Through this application we can keep a systematic track of student's attendance. This project enables the easy way of maintaining class attendance with fewer efforts.
Also, it has been implemented for the teaching staff.

- The project requires a fingerprint reader for finger detection.
- Every student can login to the system through finger detection.
- The fingerprint of the student is compared with the one stored in database and if it matches then attendance is marked for that particular student.
- The system also generates a brief report of attendance from the database according to subject-wise or date-wise as required.
- A defaulter list can be generated through system.
- Admin has the option to take a print of the reports and defaulter list thus generated.

Pros and Cons of Cerberus Biometric Attendance

Advantages:

- Students will be more regular in attending their classes since now no password or no attendance sheet signature is required, so no friend or any other student can make an attendance on behalf of others as fingerprints are unique for every student.
- Teachers do not need to waste their time approximately 15min of 1hour for taking attendance of students.
- No need to maintain attendance sheet as the attendance are electronically stored in database.
- The system helps the faculty to easily find out defaulters.
- User may easily get attendance history of a particular student.
- It saves time, cost, efforts and institute resources.

Disadvantages:

- The only disadvantage is that every class requires a fingerprint reader to access the system.

Business Problem and Solution

What is the problem?
Many institutes still follow traditional attendance marking systems which are known for their inconsistencies, discrepancies and unnecessary work force.

What is the solution/concept?
This Fully Automated Attendance System promises to remove all these problems currently faced and install a user-friendly system in its place.

What is unique/innovative about the Idea/Concept?
The Fully Automated system claims a flexible environment for the administrators to change parameters for the description generating system and personalized report for users involved with it.

What is the target market or who do you think will benefit from the solution?
Educational Institutes, Medium Scale to Large Scale Industries/ Offices will be the most benefited from this system, while this system can be implemented in other environments too where the recording attendance of staff/students/employees is required.

Detailed Description of the Idea/Concept
Contrary to the traditional attendance marking system which requires manual labour and risks depreciating accuracy, this system proposes a failsafe attendance marking system. Integrated with an intelligent report generating features, this system promises an easy and user-friendly environment for the administrators.

How will you develop and execute the solution?
The desired objective is achieved with the use of microprocessor(RaspberryPi) to capture fingerprint data and send them to a web server, securely and spontaneously. The web server stores the data into the database for further report generating purposes. A robust and user-friendly graphic user interface is provided for the stakeholders to interact with the system easily in the form of a website. The website promises to generate reports according to the requirements of the administrators on demand.

Will your idea/solution impact the population and economy?
Installing this system in possible locations can improve work efficiency of the employees and removes discrepancies arising due to manual error. It saves manual labour which helps the employee to perform on other productive work.

Project Charter

Project Definition:

Our project focuses on managing a distributed system of devices that are capable of scanning biometrics for the use of attendance for a large scope of stakeholders automatically on the basis of a timetable. The student will be marked present through biometric (fingerprint) **module** and the attendance data can be accessed on our **website** by the users.

Purpose:

Biometric attendance system has numerous benefits. With the System, maintenance of daily attendance on Excel sheets could be avoided, man labour can be reduced, monthly attendance sheet for employees in Excel can be assembled with a single click, etc.

ERP applications like Cerberus is coded with sophisticated algorithms for attendance management to take-in and track attendance of every individual entering and leaving an organization.

- Biometric systems provide more accurate identification
- Biometric responds rapidly, commonly identifying a candidate in only seconds
- Biometric System is less tedious, easy to use, hard to adulterate.
- Organizations can midway and precisely screen every candidate's attendance to counteract proxy attendance and errors.

Scope:

- Scope: Enroll fingerprints
- Authentication
- Manage Faculty/ Admin (Fingerprint data)
- Manage Student (Fingerprint data)

Background Activities (Sync):

- Attendance to database
- Fetch templates from database
- Fetch timetable from database.
- Fetch PRN

Scope of Web-App (made with Java-Servlets):
For Faculty:

- Login
- Timetable Management
- Subjects Management
- Student Management
- Attendance Management (Manual)
- Admin Management
- Student Progression
- OTP for devices
- Profile Management

For Students:

- Login
- View Attendance
- Select Electives

Team

Ebenezer Isaac **522025**
Haji Huseinali Lokhandwala **522035**
Vraj Kotwala **522033**

Project Plan

Objective:
To develop a fully automated Attendance Management System for a University Dept.

Software Model: Agile.
To iterate the development and testing throughout the software development lifecycle of the project.

Methodology: XP
Extreme programming (XP) is a software development practice which is intended to improve software quality and responsiveness to changing customer requirements.

Work Division (w.r.t team members):

- RaspberryPi: Ebenezer
- Box design: Vraj & Ebenezer.
- Backend: Ebenezer & Vraj
- Front end & GUI: Huseinali
- Database Structure Design & SQL: Vraj
- Documentation: Vraj
- Testing: Vraj, Ebenezer, Huseinali

Work Division (w.r.t time):

May:

- Testing components/ Modules.
- FPS, LCD Libraries
- Custom functions for RaspberryPi (waitForFinger(), lcd.print(), lcd.clrscr())
- Database connection with RaspberryPi
- Launcher functions for RaspberryPi

June:

- Sync fingerprints
- Switching to GitHub for version control.
- Commercializing the project
- Circuit Diagram for Arduino/ RaspberryPi
- Blob/Clob for finger data
- Database Schema

July:

- View Attendance
- View Timetable
- Edit Timetable
- Manage password
- Password encryption (SHA2)
- Edit timings
- Add slot
- Remove slot
- View Student Details
- Student Subject Selection
- Add Student
- Delete Student

August:

- Manage Subjects (Add, View, Delete)
- Faculty Management (Add, View, Delete)
- Final Database Normalization
- Adding logs
- Dividing storage space into classes
- Simultaneous interaction of SPI Devices.
- Ethernet Sleep mode.
- Add light show for standby

September

- Download data to excel (Backup)
- Upload student data from excel file.
- Profile Page
- Activity log
- Session Management
- ReCAPTCHA

October:

- Mailer
- OTP
- Email verification
- Handle SQL Exceptions
- Validations in forms (AJAX)
- Animations using CSS and JS
- Particle.js
- Theme and logo

November:

- Box Design
- Student Progression
- JSON format data
- Testing
- About Us page

December:

- Copy timetable from previous week
- Fix scrollbar
- First login asks for details
- Manual Attendance
- Email and network connectivity check
- Documentation
- Presentation

Hardware Requirements:

- RaspberryPi Microcontroller
- FPS Module
- Ethernet Module
- Buzzer
- Real Time Clock (RTC)
- Screen
- Keypad
- HDD space on server (for database): 12 MB
- HDD space on RaspberryPi: 8 GB memory card

Software Requirements:

- OS: Windows or Linux Server OS
- OS: RaspbianOS on RaspberryPi.
- MySQL
- Tomcat Server

Tools and Technologies used:

On Device (RaspberryPi):

- OS: Raspbian
- Lang: Python
- Tool: Notepad++

On Web-App:

frontend:

- AJAX
- HTML5
- JavaScript
- CSS
- Bootstrap4
- JQuery

backend:

- Java-Servlet
- JSP.

Database:
MySQL with PhpMyAdmin

Server:
Apache Tomcat Server 7 or above

Product Backlogs:

The product backlog is the single authoritative source for things that a team works on.

- Testing components/ Modules.
- FPS, LCD Libraries
- Custom functions for RaspberryPi (waitForFinger(), lcd.print(), lcd.clrscr())
- Database connection with RaspberryPi
- Launcher functions for RaspberryPi

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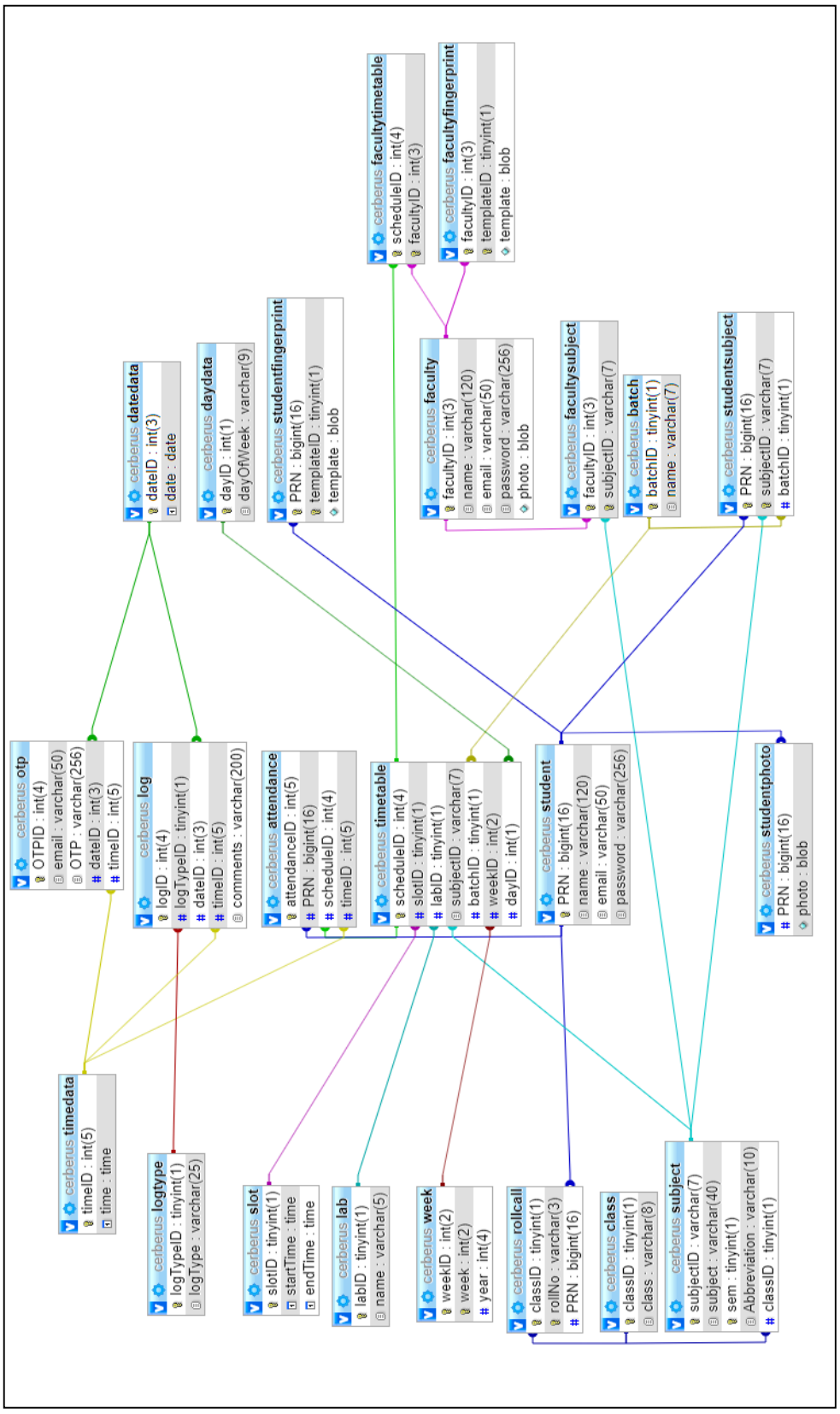
Database Modelling

ER-Diagram



Database-Dictionary:

attendance

Column	Type	Null	Default	Comments
attendanceID *(Primary)*	int(5)	No		
PRN	bigint(16)	No		
scheduleID	int(4)	No		
timeID	int(5)	No		

batch

Column	Type	Null	Default	Comments
batchID *(Primary)*	tinyint(1)	No		
name	varchar(7)	No		

class

Column	Type	Null	Default	Comments
classID *(Primary)*	tinyint(1)	No		
class	varchar(8)	No		

datedata

Column	Type	Null	Default	Comments
dateID *(Primary)*	int(3)	No		
date	date	No		

daydata

Column	Type	Null	Default	Comments
dayID *(Primary)*	int(1)	No		
dayOfWeek	varchar(9)	No		

faculty

Column	Type	Null	Default	Comments
facultyID *(Primary)*	int(3)	No		
name	varchar(120)	No		
email	varchar(50)	No		
password	varchar(256)	No		
photo	blob	No		

facultyfingerprint

Column	Type	Null	Default	Comments
facultyID *(Primary)*	int(3)	No		
templateID *(Primary)*	tinyint(1)	No		
template	blob	Yes	*NULL*	

facultysubject

Column	Type	Null	Default	Comments
facultyID *(Primary)*	int(3)	No		
subjectID *(Primary)*	varchar(7)	No		

facultytimetable

Column	Type	Null	Default	Comments
scheduleID *(Primary)*	int(4)	No		
facultyID *(Primary)*	int(3)	No		

lab

Column	Type	Null	Default	Comments
labID *(Primary)*	tinyint(1)	No		
name	varchar(5)	No		

log

Column	Type	Null	Default	Comments
logID *(Primary)*	int(4)	No		
logTypeID	tinyint(1)	No		
dateID	int(3)	No		
timeID	int(5)	No		
comments	varchar(200)	No		

logtype

Column	Type	Null	Default	Comments
logTypeID *(Primary)*	tinyint(1)	No		
logType	varchar(25)	No		

otp

Column	Type	Null	Default	Comments
OTPID *(Primary)*	int(4)	No		
email	varchar(50)	No		
OTP	varchar(256)	No		
dateID	int(3)	No		
timeID	int(5)	No		

rollcall

Column	Type	Null	Default	Comments
classID *(Primary)*	tinyint(1)	No		
rollNo *(Primary)*	varchar(3)	No		
PRN	bigint(16)	No		

slot

Column	Type	Null	Default	Comments
slotID *(Primary)*	tinyint(1)	No		
startTime	time	No		
endTime	time	No		

student

Column	Type	Null	Default	Comments
PRN *(Primary)*	bigint(16)	No		
name	varchar(120)	No		
email	varchar(50)	No		
password	varchar(256)	No		

studentfingerprint

Column	Type	Null	Default	Comments
PRN *(Primary)*	bigint(16)	No		
templateID *(Primary)*	tinyint(1)	No		
template	blob	Yes	*NULL*	

studentphoto

Column	Type	Null	Default	Comments
PRN	varchar(16)	No		
photo	blob	Yes	*NULL*	

Studentsubject

Column	Type	Null	Default	Comments
PRN *(Primary)*	bigint(16)	No		
subjectID *(Primary)*	varchar(7)	No		
batchID	tinyint(1)	No		

subject

Column	Type	Null	Default	Comments
subjectID *(Primary)*	varchar(7)	No		
subject	varchar(40)	No		
sem *(Primary)*	tinyint(1)	No		
Abbreviation	varchar(10)	No		
classID	tinyint(1)	No		

timedata

Column	Type	Null	Default	Comments
timeID *(Primary)*	int(5)	No		
time	time	No		

timetable

Column	Type	Null	Default	Comments
scheduleID *(Primary)*	int(4)	No		
slotID	tinyint(1)	No		
labID	tinyint(1)	No		
subjectID	varchar(7)	No		
batchID	tinyint(1)	No		
weekID	int(2)	No		
dayID	int(1)	No		

week

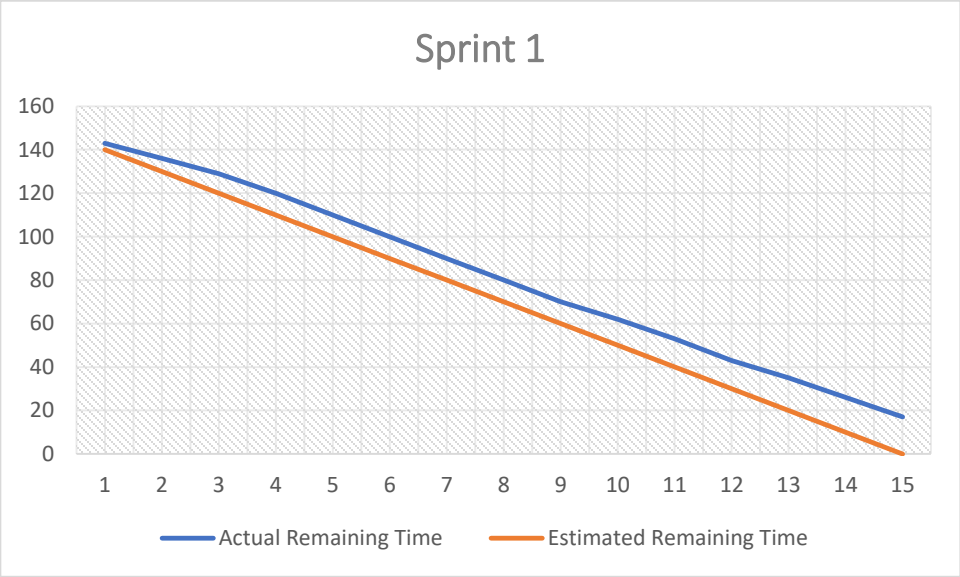
Column	Type	Null	Default	Comments
weekID *(Primary)*	int(2)	No		
week	int(2)	No		
year	int(4)	No		

Sprint Backlogs with Burn-down Charts:

Sprint1 (July1 to July15)

Stories:

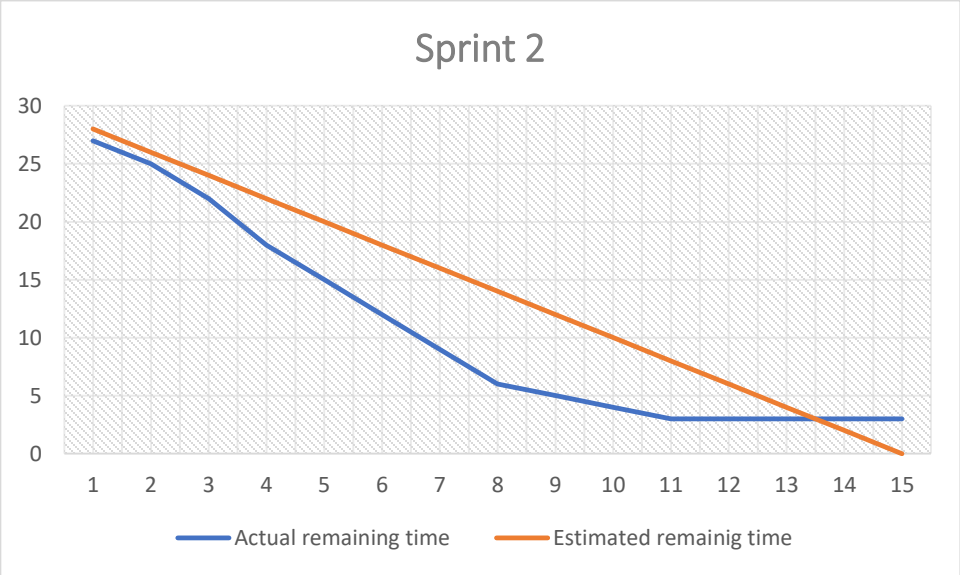
Testing hardware components
FPS,LCD Libraries



Sprint2 (July16 to July30)

Stories:

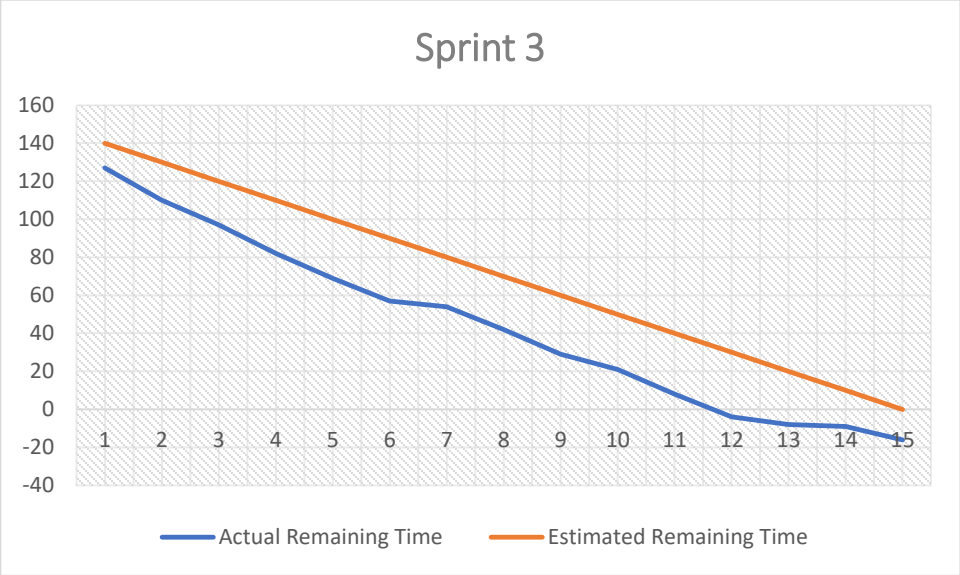
Custom functions for RaspberryPi
Database connect with RaspberryPi
Launcher functions for RaspberryPi



Sprint3 (Aug1 to Aug15)

Stories:

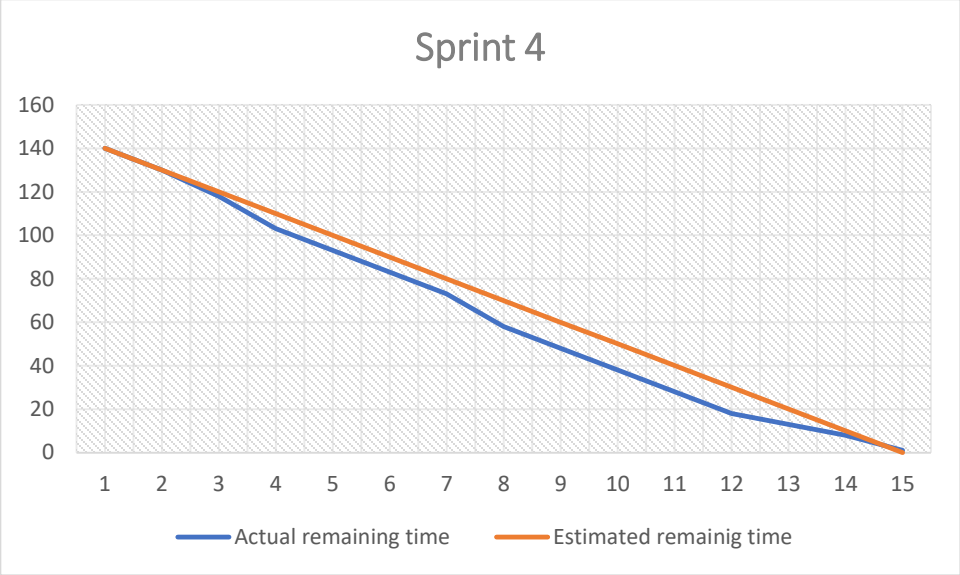
Sync fingerprints
Switching to GitHub for version control.
Commercializing the project
Circuit Diagram for Arduino/ RaspberryPi
Blob/Clob for finger data
Database Schema



Sprint4 (Aug16 to Aug30)

Stories:

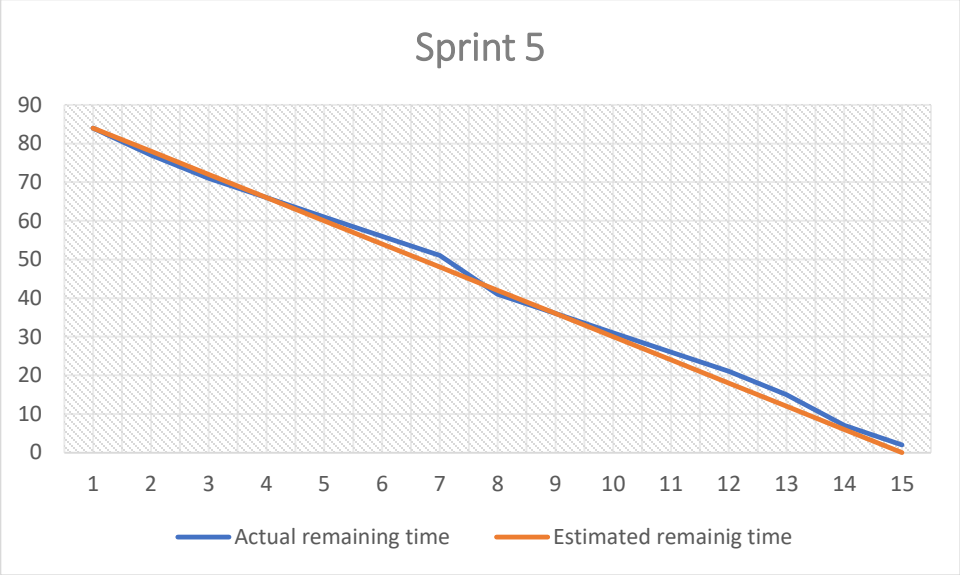
View Attendance
View Timetable
Edit Timetable
Manage password
Password encryption (SHA2)
Edit timings



Sprint5 (Sep1 to Sep15)

Stories:

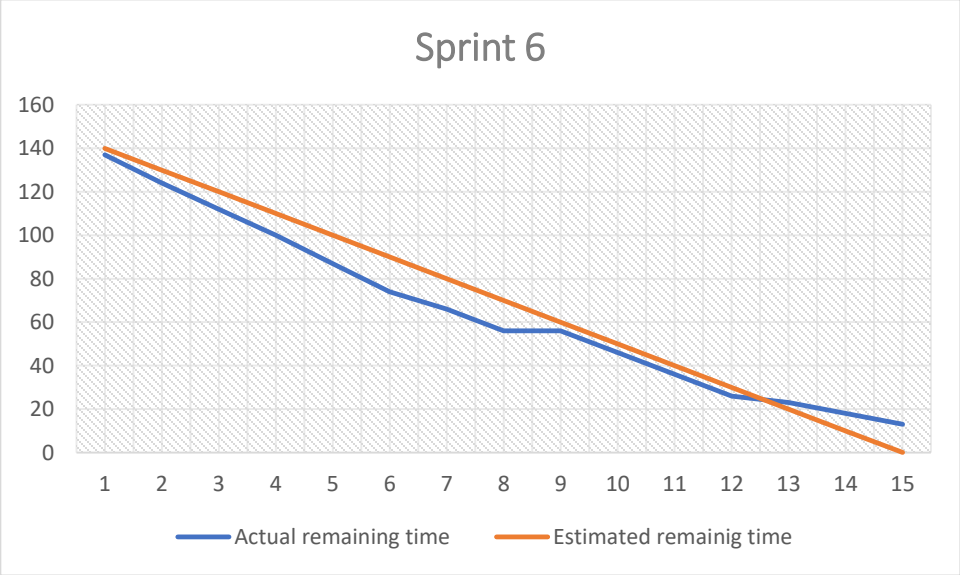
Add slot
Remove slot
View Student Details
Student Subject Selection
Add Student
Delete Student



Sprint6 (Sep16 to Sep30)

Stories:

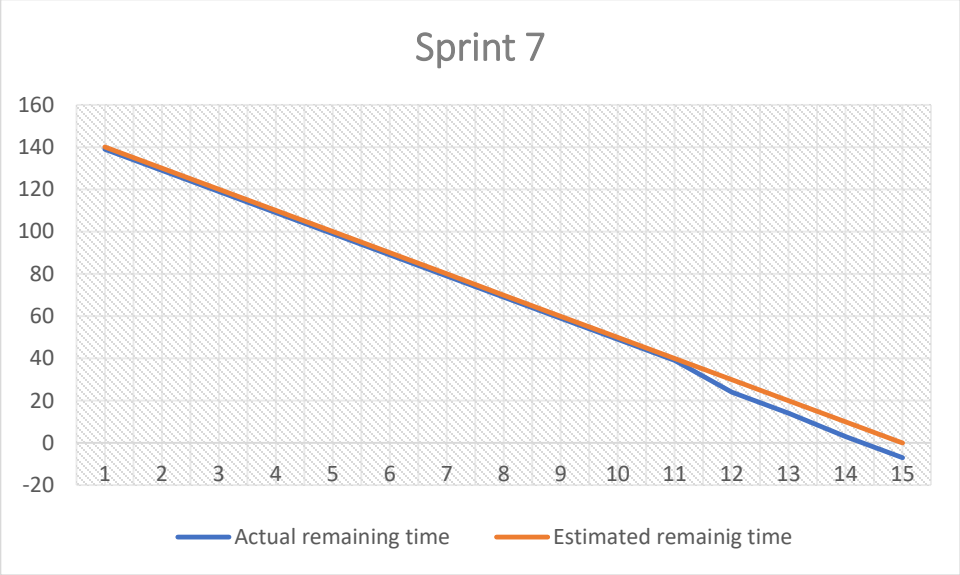
Manage Subjects (Add, View, Delete)
Faculty Management (Add, View, Delete)
Final Database Normalization
Dividing storage space into classes
Simultaneous interaction of SPI Devices.
Ethernet Sleep mode.
Add light show for standby



Sprint7 (Oct1 to Oct15)

Stories:

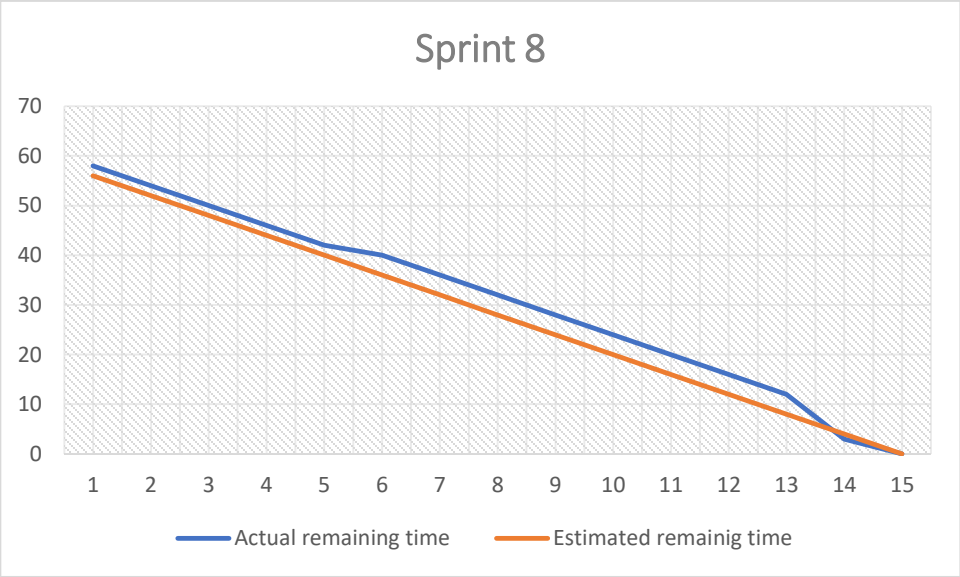
Download data to excel (Backup)
Upload student data from excel file.
Profile Page
Activity log
Session Management
ReCAPTCHA



Sprint8 (Oct16 to Oct30)

Stories:

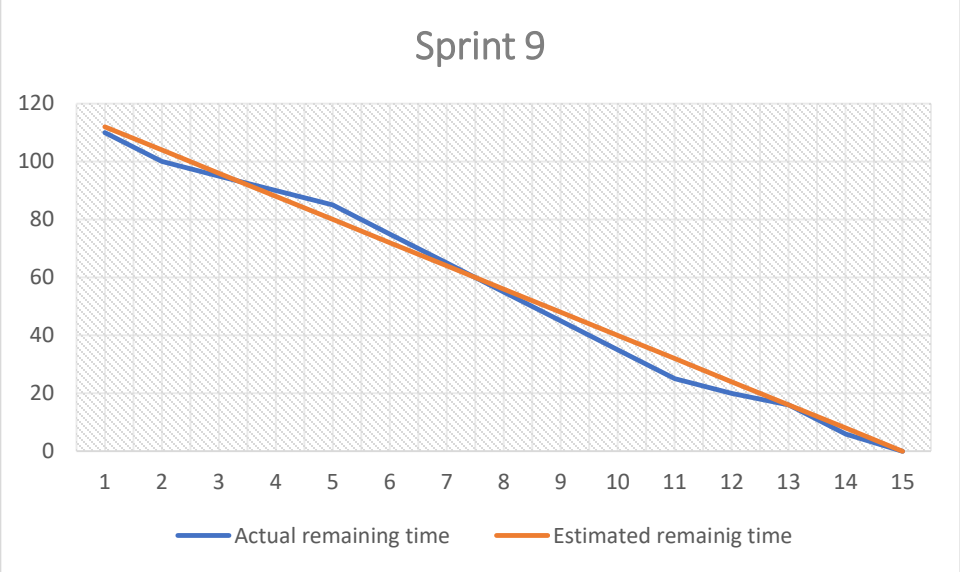
Mailer
OTP
Handle SQL Exceptions
Validations in forms (AJAX)
Animations using CSS and JS
Particle.js
Theme and logo



Sprint9 (Nov1 to Nov15)

Stories:

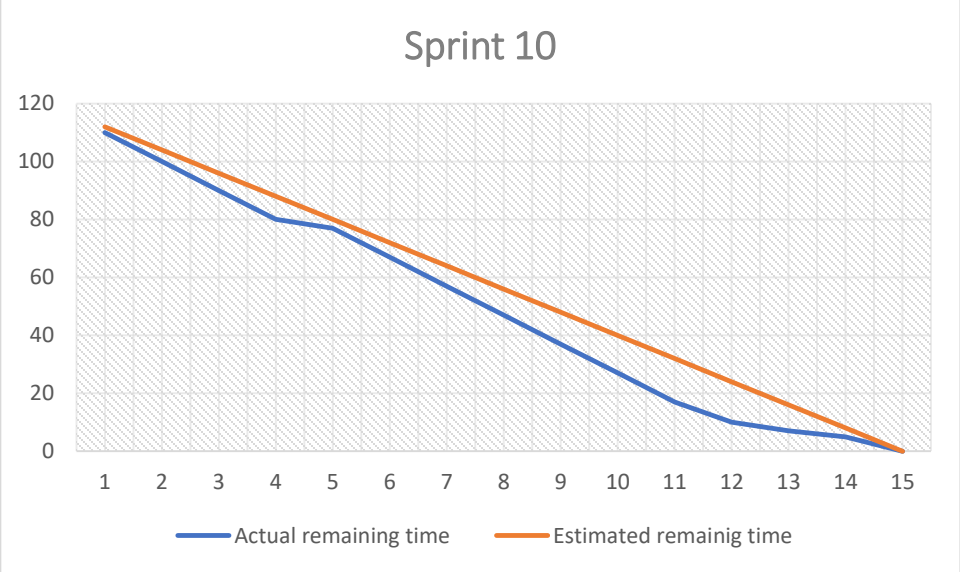
Box Design
JSON format data
Testing
Ajax on website load
About Us page



Sprint10 (Nov16 to Nov30)

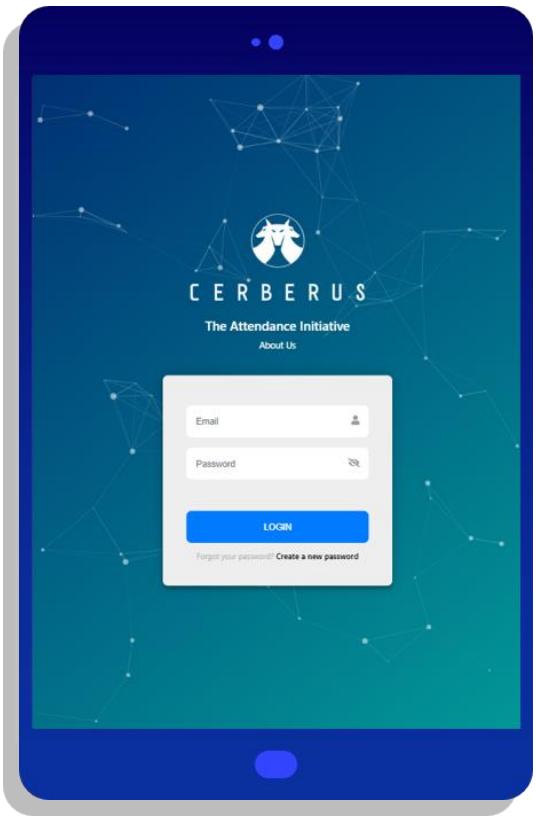
Stories:

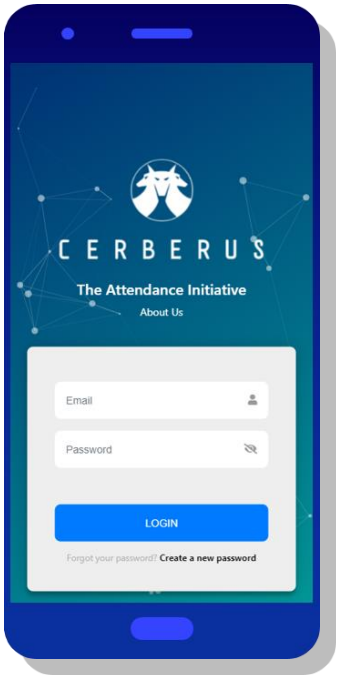
Copy timetable from previous week
Fix scrollbar
First login asks for details
Manual Attendance
Email and network connectivity check

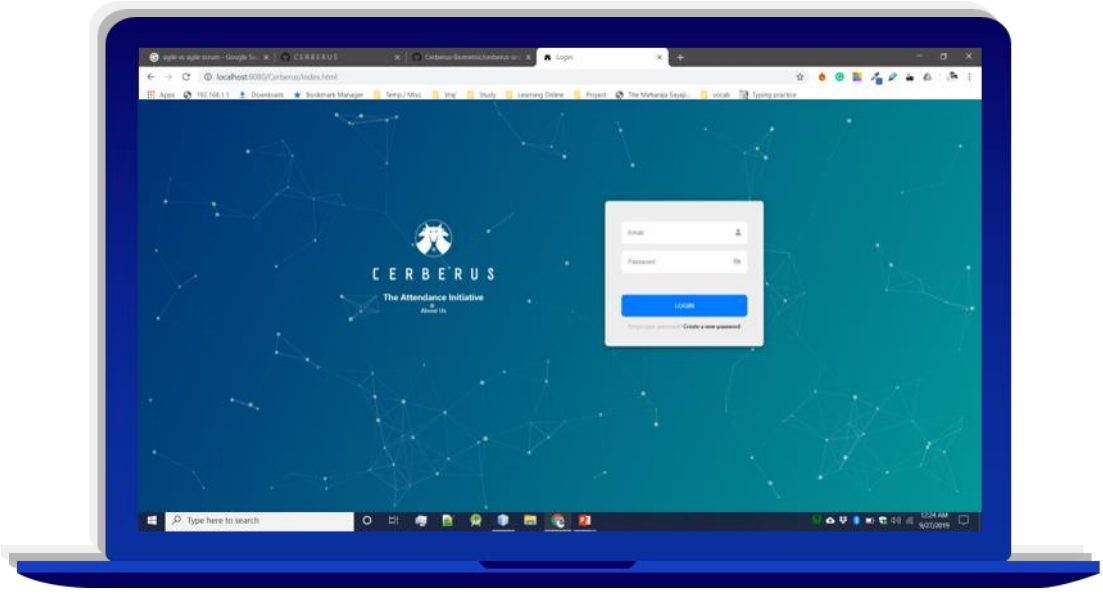


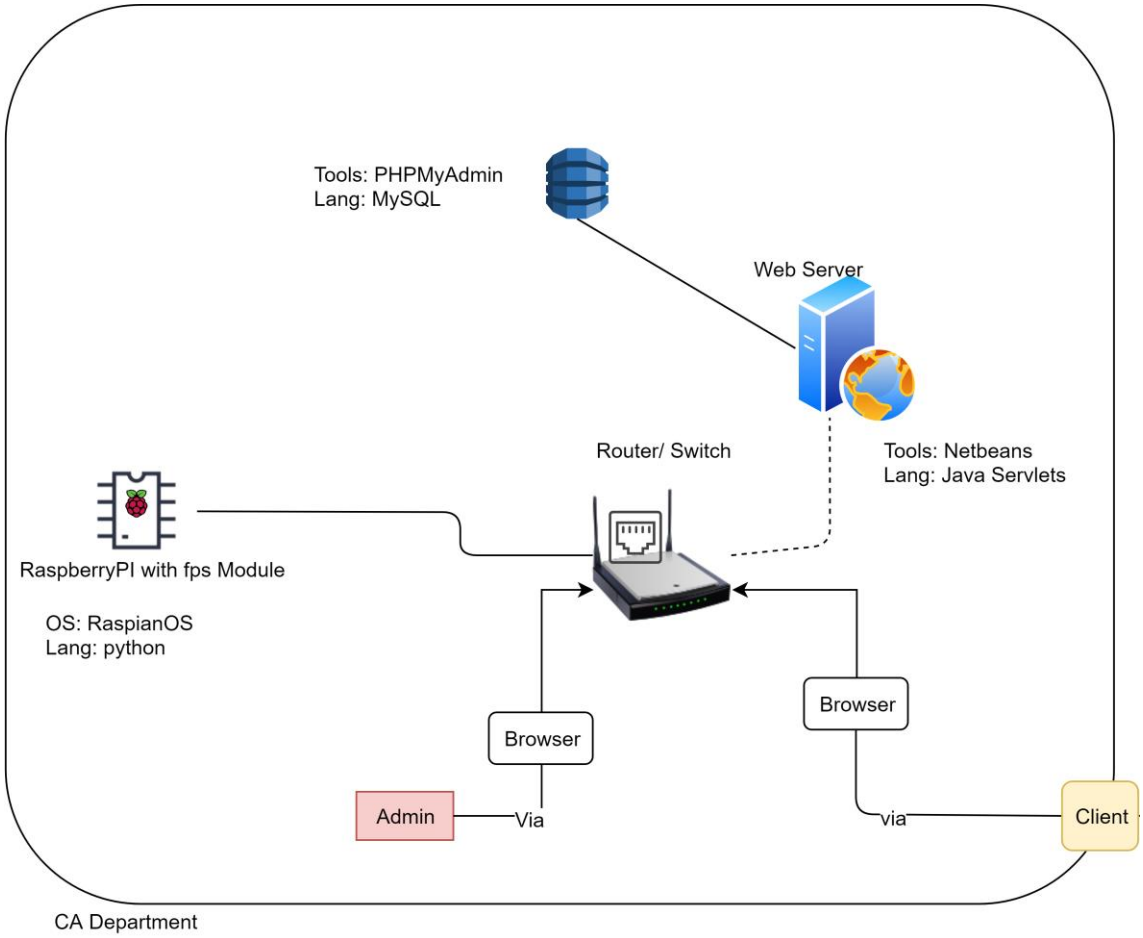
Interface Design (Screenshots and Explanations)

Perks of using Bootstrap:



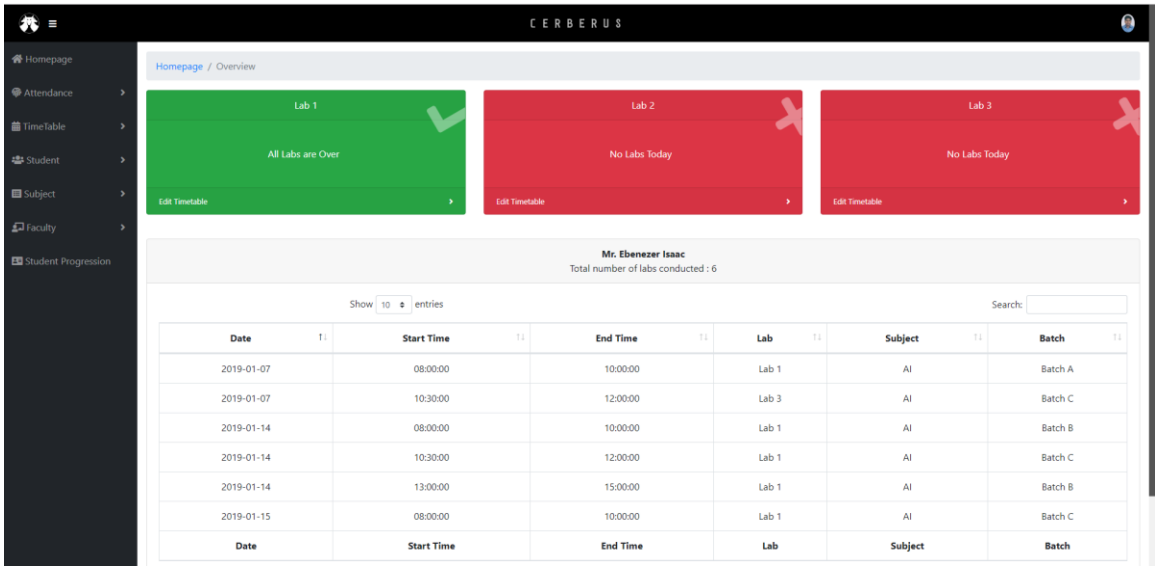




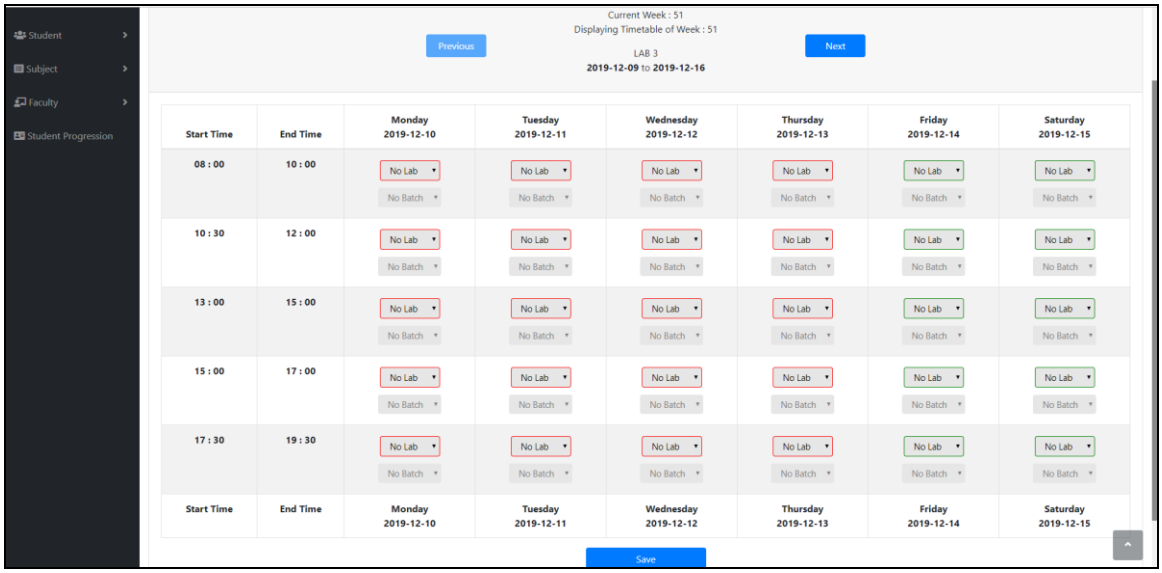


System Architecture:

- The attendance can be marked by the help of RaspberryPi with FPS module.
- The finger templates are then stored in the database (which resides on web server) with the help of router.
- The webserver also helps retrieve the data when accessed by browser.
- The attendance can be manipulated by Admin/Teachers.
- The attendance can be viewed by Students through portal.

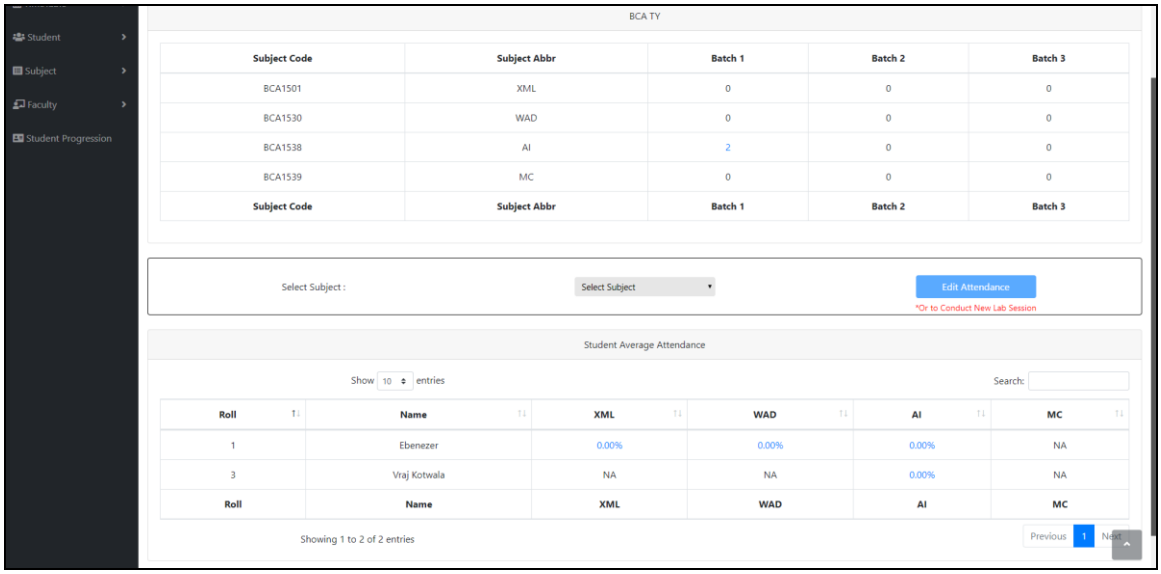


Homepage



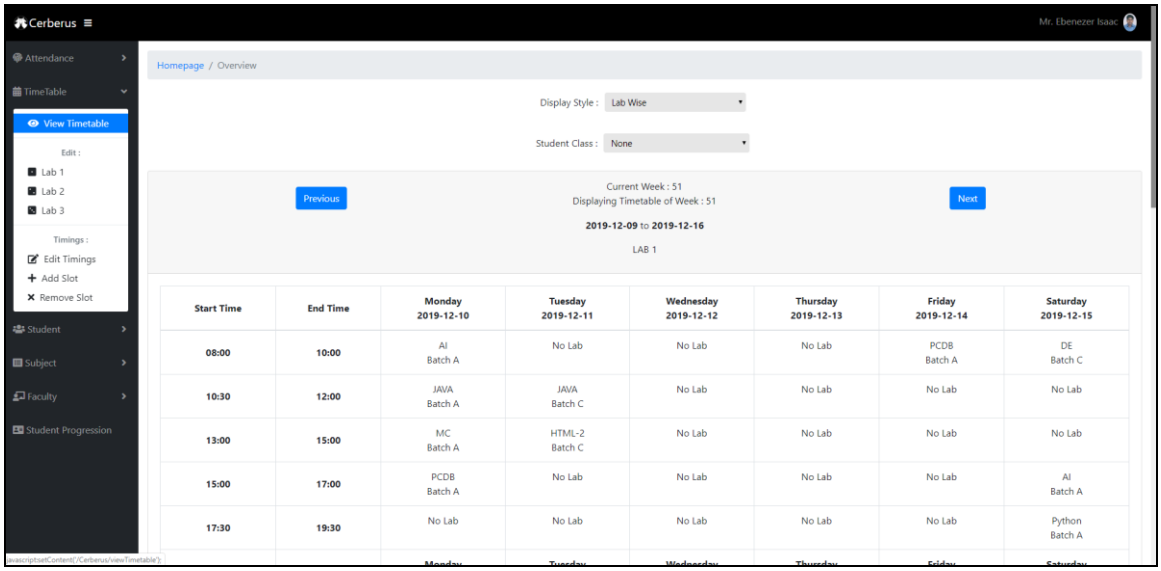
Edit Timetable

- Teacher/Admin can edit the week's timetable and store it into database.
- Smooth GUI for easy understanding and manipulation of data is applied.



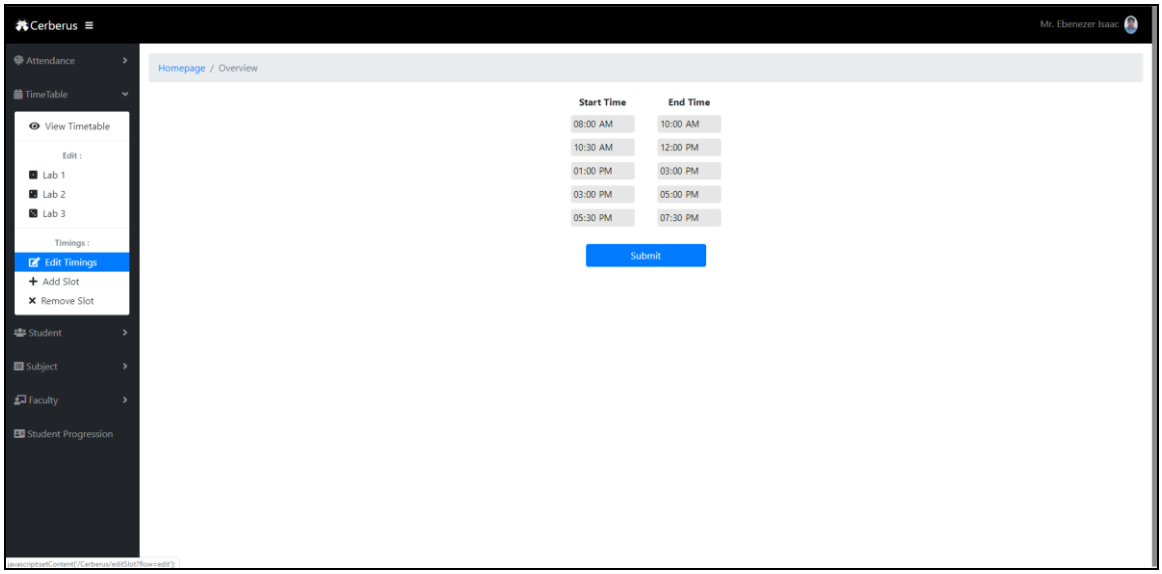
View Attendance

- Total subjects for particular class and their respective lab sessions can be viewed in this page of the portal.
- Manual Attendance can also be done.
- All students' data with respect to class and their selected subject can be viewed.
- Students' percent wise attendance in a particular subject can be viewed too.



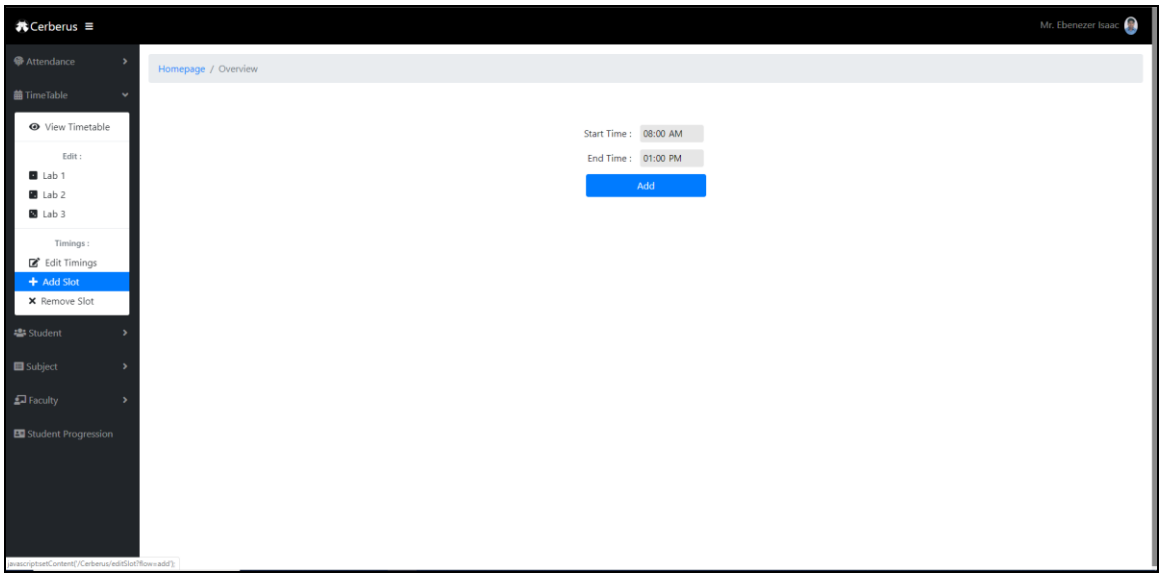
View Timetable

- Timetable can be viewed for current and previous weeks.



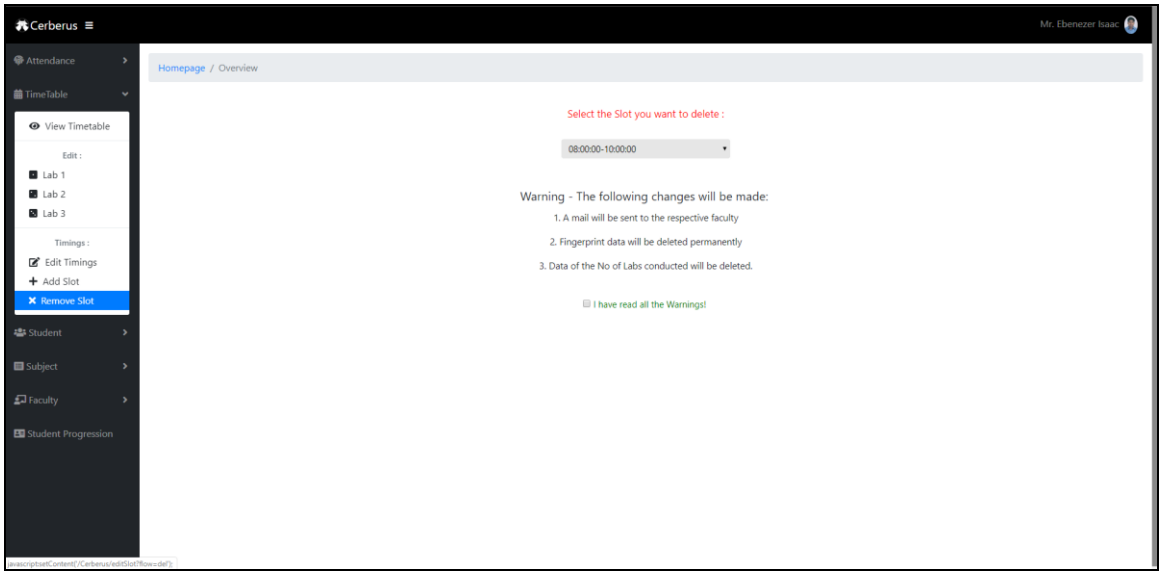
Edit Timings

- Timings can be added and removed for all the lab sessions of the day.



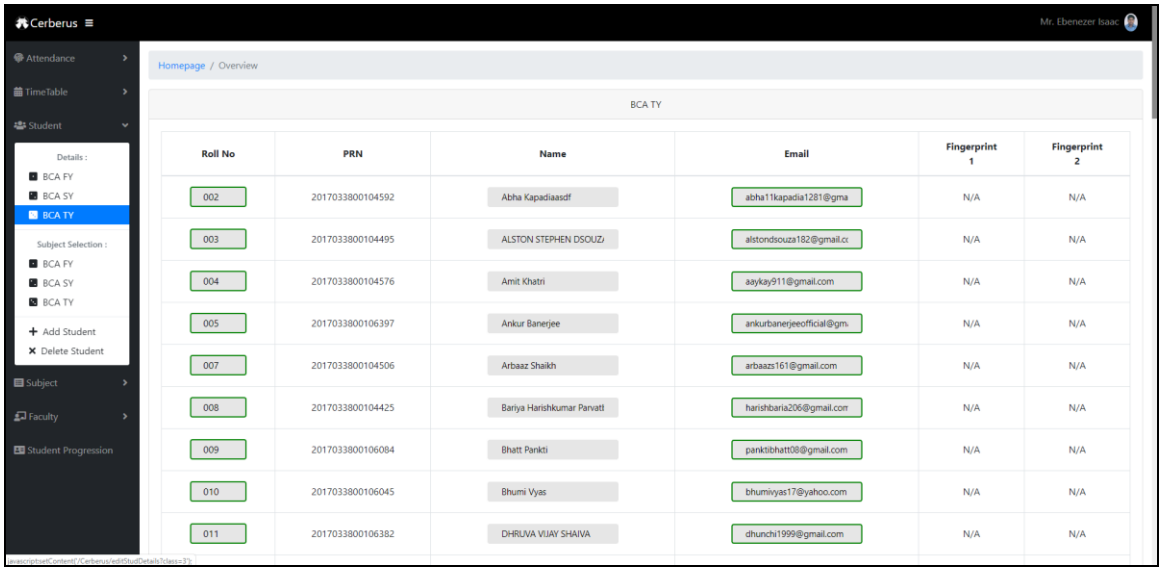
Add Slot

- Multiple time slots can be added.



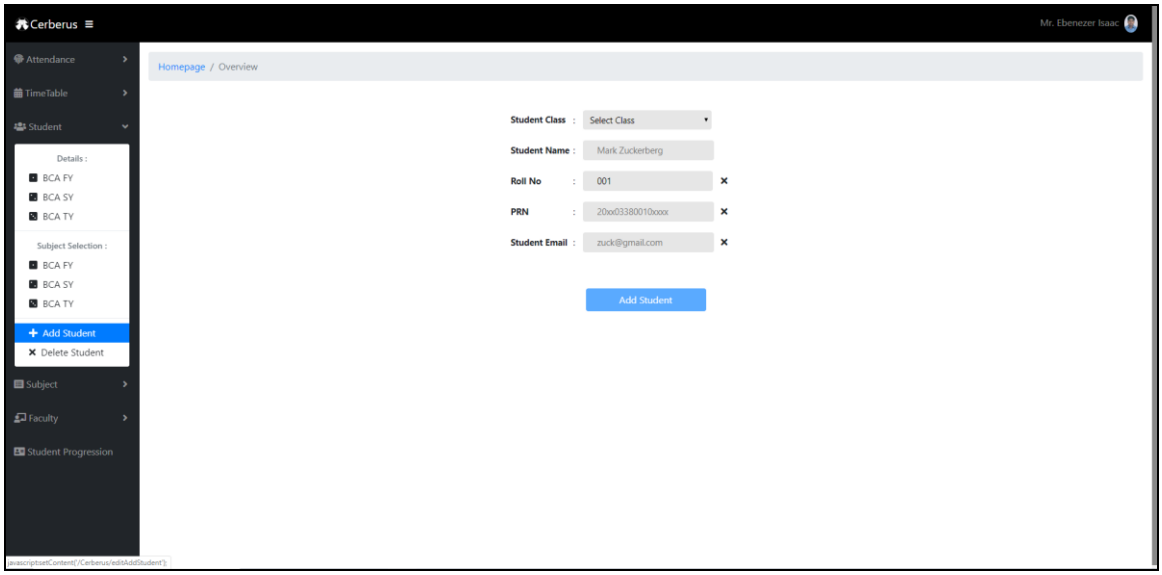
Remove Slot

- A time slot can be removed too.



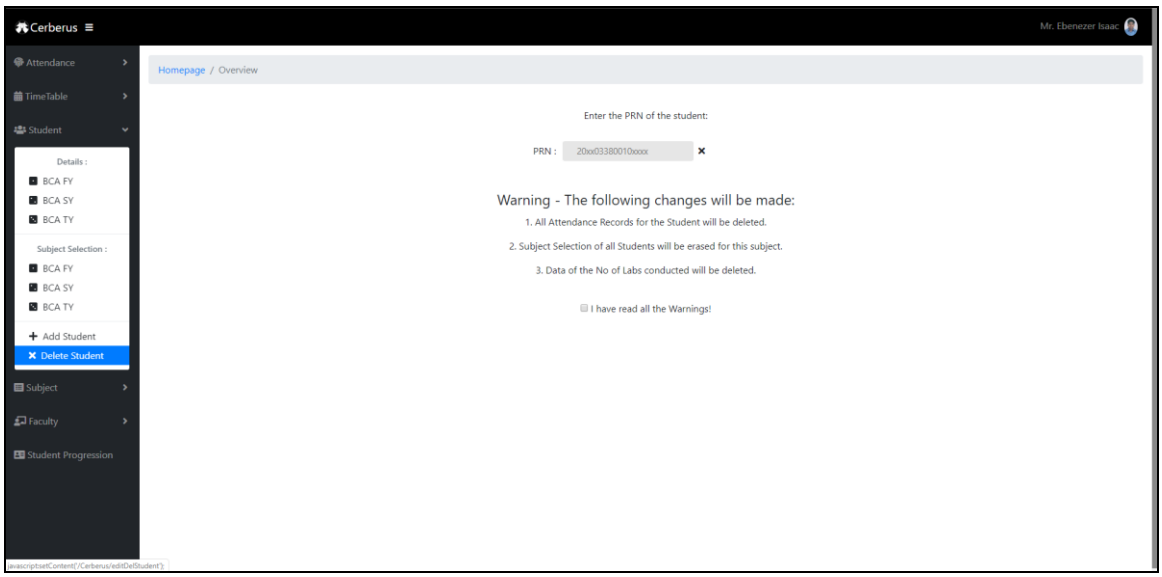
Student Details

- Student details like roll number, PRN, name, email, and finger template data can be viewed from here.
- Student details are divided into classes.
- Student details can also be edited from here.



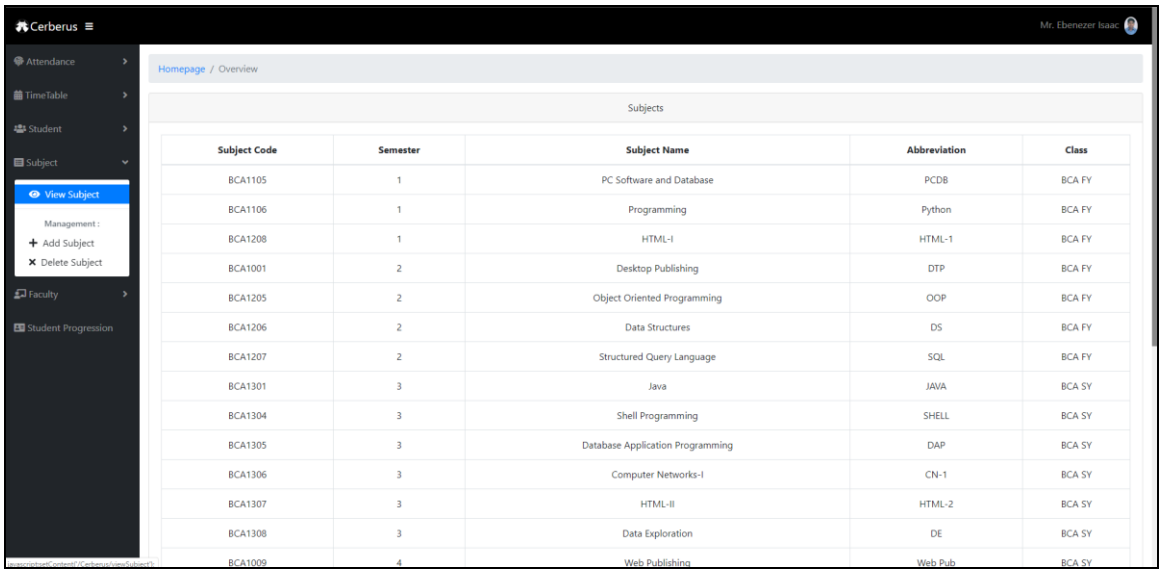
Add Student

- Student can be added from the portal.
- Validations are applied with the help of AJAX.
- A mail is sent to student with OTP for first login when he/she is added from here.



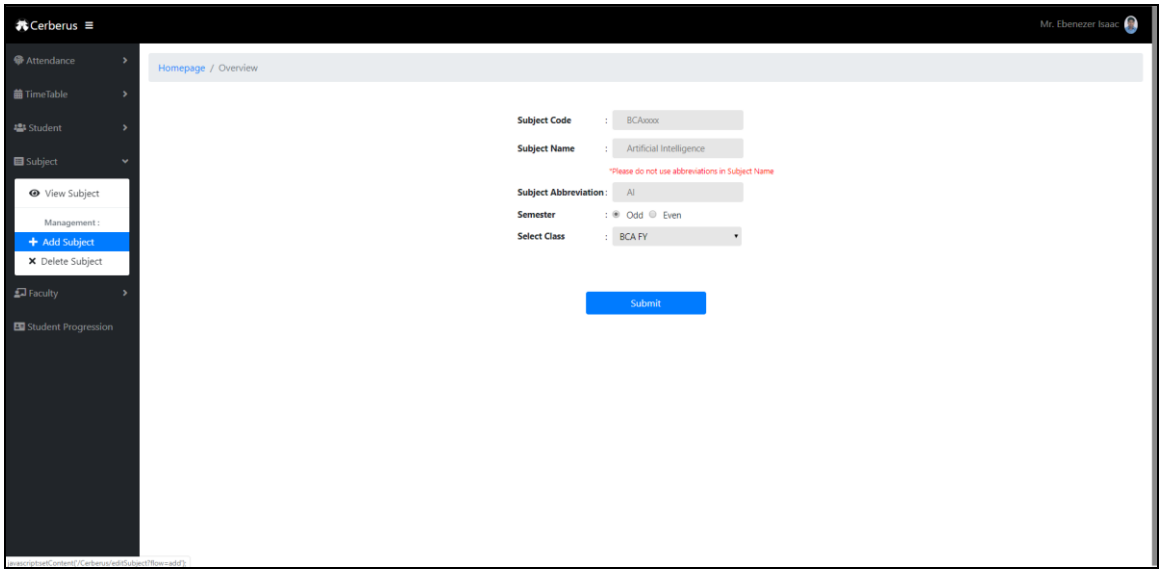
Delete Student

- Student can be removed from the database as well.
- A mail is sent to the student when he/she is removed.



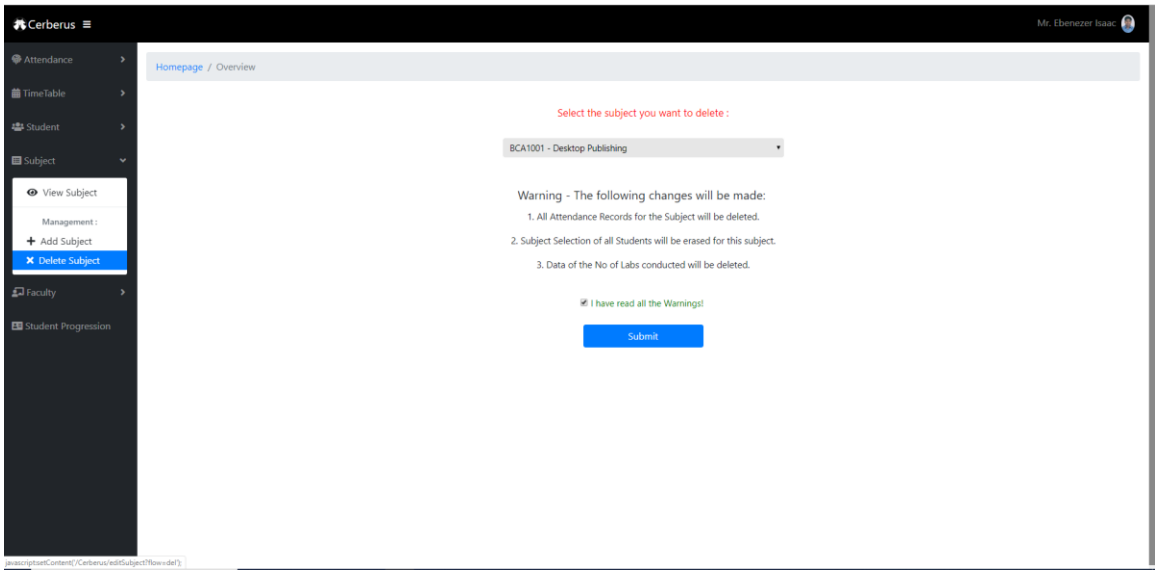
View Subject

- All the subjects of all the semesters including electives are visible here.
- Lab sessions for particular subject can be seen if the subject linked is further clicked.



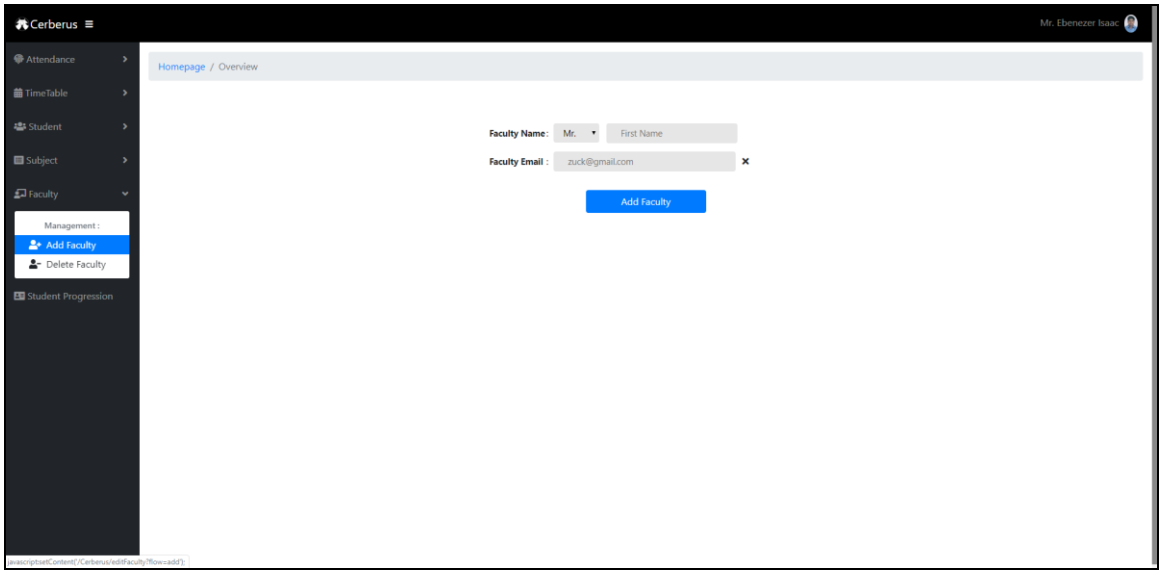
Add Subject

- New subjects if added, then they can be added from here.



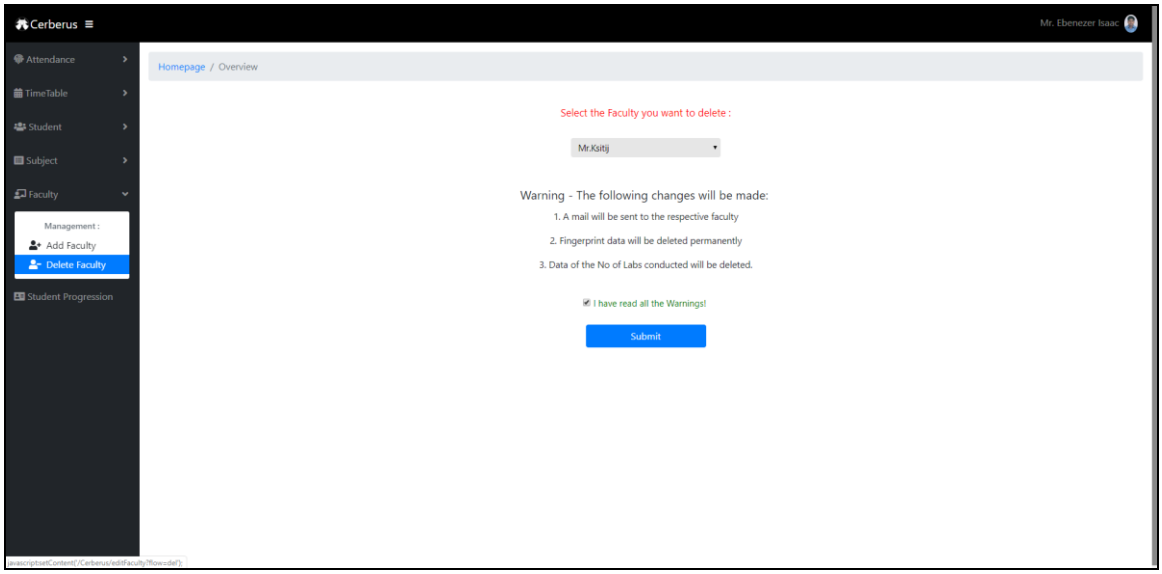
Delete Subject

- Old/Outdated subjects can be removed from the portal from here.



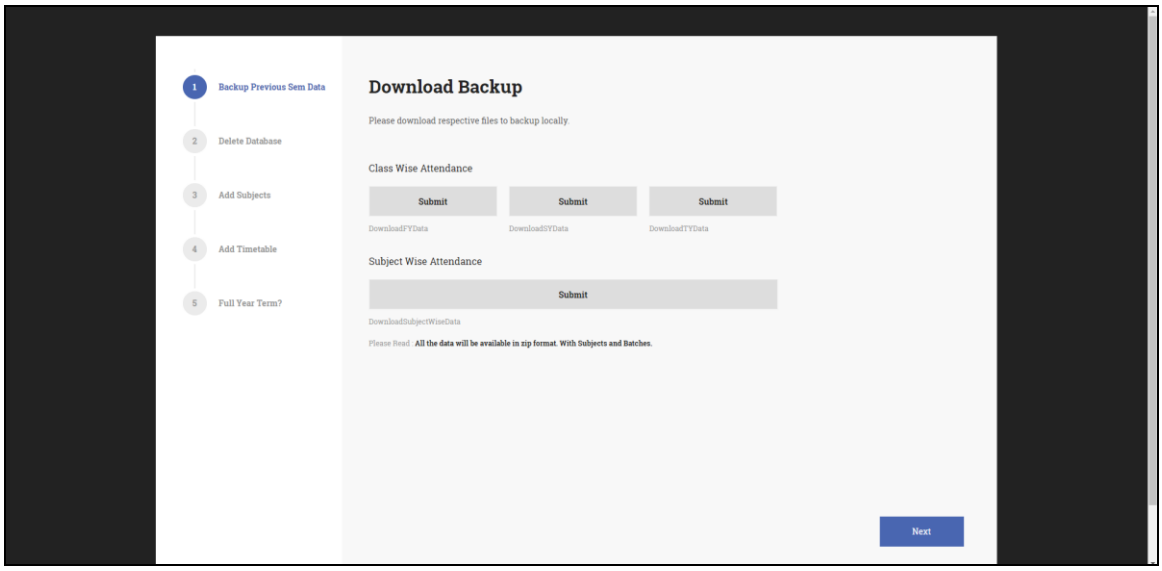
Add faculty

- New joining faculty can be added from here.
- Mail is received to the respective faculty when he/she is added.



Delete Faculty

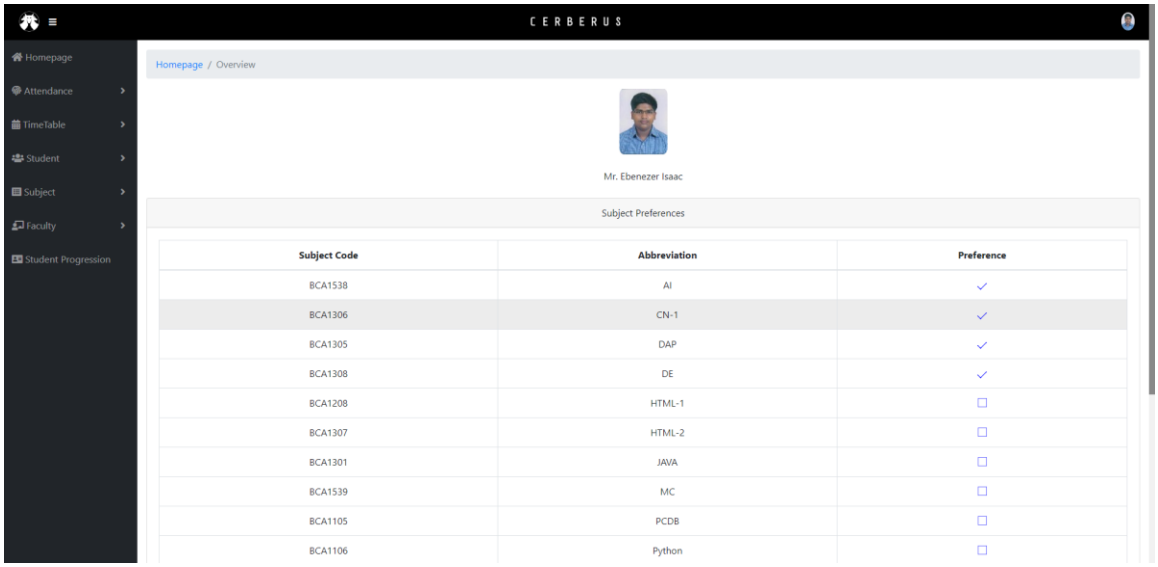
- Faculty can be deleted.
- Mail is received and the respective faculty has no longer access to the portal.



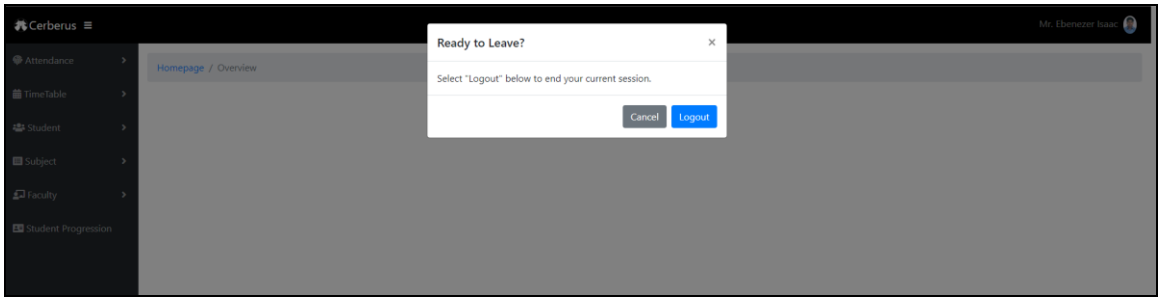
Student Progression

- When Student passes class and is shifted to higher class, its data is transferred too.
- Backup of attendance is being done before shifting to new sem.
- All the tables in the database are updated
- Change in student roll number after he/she passes class can be done here.
- ClassID for particular student can be manipulated.
- New data for FY Students can be uploaded to database with an excel file.
- New Students are then registered automatically to the portal.
- New students receive the mail with OTP for first time login.

- Students are then asked to enroll their respective fingerprints in RaspberryPi.
- Previous pass out student data is removed from the database with backup kept.
- Student new subject is linked with SY and TY students.

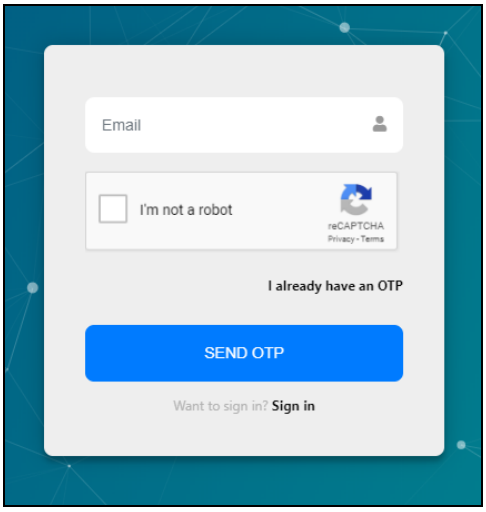


TeacherProfile



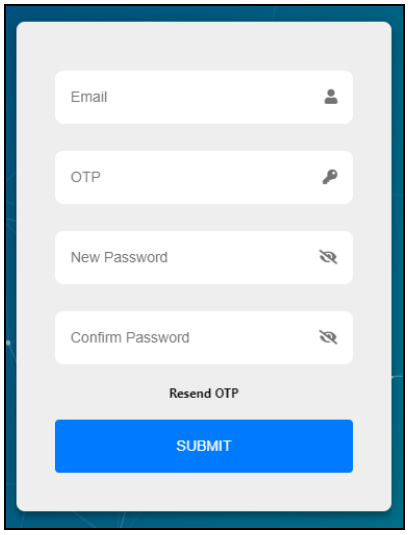
Logout

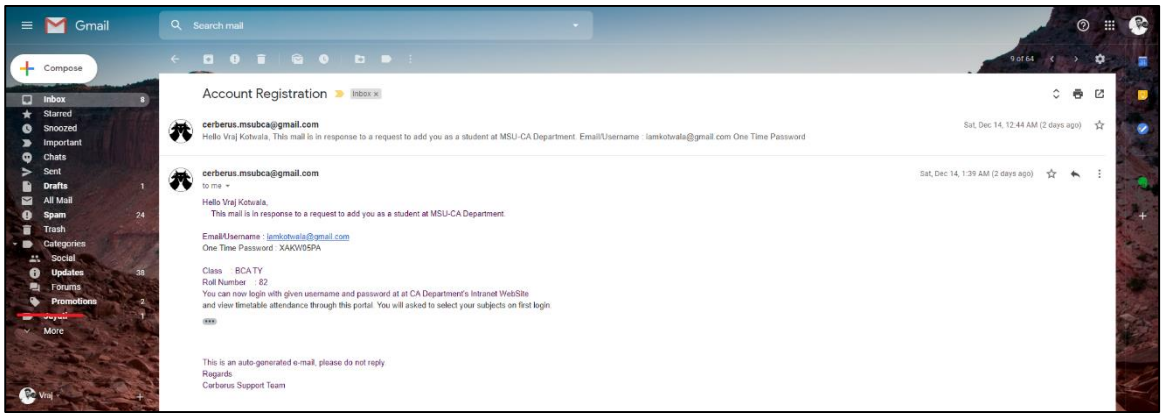
- Verifies before logging out of session.



Forgot Password

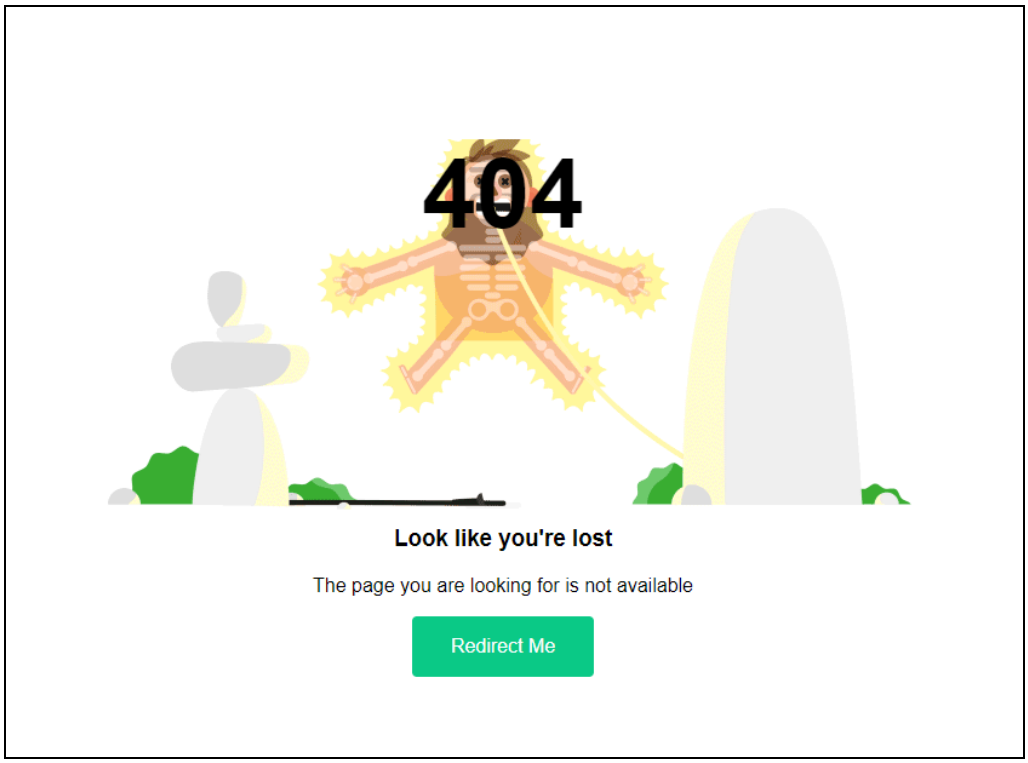
- OTP is sent to mail id of respective student/ Adimn.



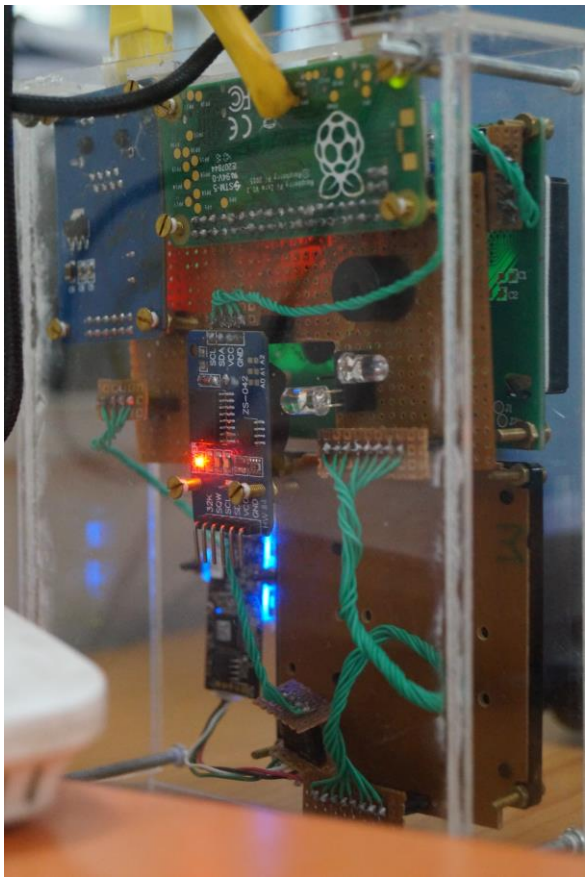


Account Registration mail

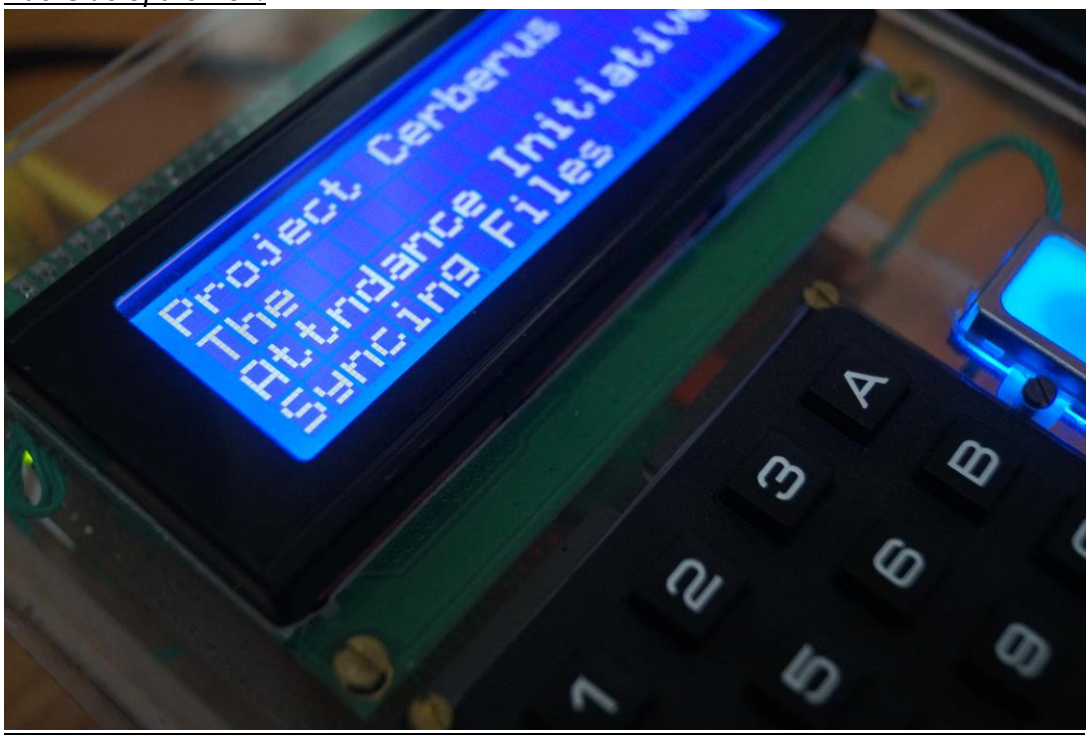
Account Deletion Mail



Error 404 Page when page not found



Backside of the Box.



RaspberryPi booting up and syncing files

Sync is complete and ready for attendance

Testing

Software testing is the process used to identify the correctness, completeness, security and quality of developed computer software. With that in mind, testing can never completely establish the correctness of computer software.

Test Method:

a. Unit Testing
b. Validation Testing
c. Performance Testing
d. System Testing
e. Black box testing

Test Plan:

- *Unit testing (RaspberryPi side)*

Test Scenario	Requirements	Test cases	Test Data	Results
Enroll	3 fingerprint data	dry, wet, dirty fingerprints	templates of students and admins	Enrolment Successful. Unsuccessful only when dirty fingerprints.
Verification	3 fingerprint data	dry, wet, dirty fingerprints	templates of students and admins	Verification Successful. Unsuccessful only when dirty fingerprints.
Download templates	1 finger template	template with limited size	templates of students and admins	templates downloaded successfully
upload templates	1 finger template	template with limited size	templates of students and admins	templates uploaded successfully
get student list	Start lab session	Multiple time slots	Dummy data in database	getting student list successfully
get faculty details	Start lab session	Multiple time slots	Dummy data in database	getting faculty details successfully
get time slots	sync function on power up	3 times	Dummy data in database	Getting time slots successfully
get timetable	sync function on power up	3 times	Dummy data in database	Getting timetable successfully
attendance sync	multiple fingerprint data	fingerprint data on Raspberry's SD cards	fingerprint data on Raspberry's SD cards	Sync data successful.

- *Unit Testing (Web-Application side)*

Test Scenario	Requirements	Test cases	Test Data	Results
Login Module	All correct combinations entered in login/password Field will let user login.	Check response on entering valid email and password	iamkotwala@gmail.com as mail. 'admin123' as password	Login Successful
	All incorrect combinations entered in login/password field	Check response on entering invalid email and password	xyz@gmil.com. "sxasxcw12" as password	Login Failed
	SQL injections on login form	SQL inject string	"""='	No harm to database
	5 times login with incorrect password	5 times login with incorrect password	wrong string of passwords	session blocked
	teacher and student common login	login with teachers and students in same form	Dummy Data stored on different tables	Login Successful
edit Timetable	select subject to edit Timetable	check response on save button	multiple subjects selected	saved timetable successfully
	select subject to edit Timetable from past time	check response on save button	cannot select subjects	saved timetable unsuccessfully
edit slot	Time slot required	check response on save button	slot edited	slot edited successfully
add slot	time slot required	check response on save button	slot added	slot added successfully
remove slot	time slot required	check response on save button	slot deleted	slot deleted successfully
add student	student data required	check response on save button	student added with dummy data	student added successfully
delete student	student data required	check response on save button	student deleted with dummy data	student deleted successfully
add subject	subjects name required	check response on save button	subject added with dummy data	subject added successfully

delete subject	subjects name required	check response on save button	subject deleted with dummy data	subject deleted successfully
add faculty	faculty name required	check response on save button	faculty added with dummy data	faculty added successfully
delete faculty	faculty name required	check response on save button	faculty deleted with dummy data	faculty deleted successfully

b. *Validation Testing*

- Using JavaScript and Ajax validated all the forms.
- Validations working correctly? – Yes

c. *Performance Testing*

- Web application is performing well – Yes
- RaspberryPi is performing well – Yes
- RaspberryPi heating issues – No
- Functions are dependent on each other – Yes

d. *System Testing*

- Signed in user will be directed directly to the dashboard- Yes
- Proper flow of Web-Application – Yes
- Proper flow of RaspberryPi – Yes
- Functionalities and modules are the same – Yes

e. *Black Box Testing*

- Independent testing of the system in the department. – Yes

Bug Fixing/ Test Reports:

During testing phase, we found some bugs in the coding. We had rectified the bugs and re-test the system and it passes the test with different test cases. Some bugs include:

Bugs fixing in Web Application:

- OTP spam blocking
- Reset password page
- Message.jsp background.
- Fix subject list not showing
- Maximum login attempt fix
- Login query fixed
- First login function fixed
- Session exceptions fixed
- Roll number validation with AJAX
- Username in session variable fixed
- Insert logs at appropriate places
- Hover texts on fontawesome icons
- About Page CSS fixes
- Logout on back button (browser)
- Week year fix in database
- Ajax on subjectID field
- Catch session exceptions on login
- Edit Timetable JavaScript fix

Bugs fixing in RaspberryPi:

- Exception handling if file not found.
- GPIO pin out
- Database connectivity
- Auto launch shell script
- Loose connectivity
- RTC library
- Keypad library

Security Features:

- Prepared-Statement to avoid SQL injections.
- Error page to prevent the server information.
- SHA-256 algorithm used for encryption of sensitive data like passwords.
- Use of Re-captcha in forms to avoid attacks like cross site request forgery attack.
- Use of one-time-password (OTP) to authenticate the user
- Prevention of spamming OTP using time based OPT mailer.
- Session Management to prevent unauthorized access to data tables.
- Menu can be only accessed by teachers/admins with their fingerprint.
- Teacher fingerprint is needed to start lab, prevents illegal attendance marking by students.
- Buzzer to alert teacher of unauthorized access, if any, detected on the system.

Coding Standard followed:

- Indentation: Proper and consistent indentation is important in producing easy to read and maintainable programs.
- Inline Comments are used.
- Structured Programming - Structured (or modular) programming techniques are used.
- The names of the classes, subroutines, functions, and methods have verbs in them.
- Variable have meaningful names that convey to a casual observer, the intent of its use. Variables are initialized prior to its first use.
- Proper and consistent scheme for naming (CamelCase and _underscore)
- Principle of DRY. Don't Repeat Yourself, also known as DIE (duplication is evil). Made classes and functions for repeating blocks of code.
- Proper organization of files and folder.
- Open source code readability.
- Refactoring of code.

Limitations and Future Enhancements:

Limitations:

- Costly than traditional way of attendance.
- Needs LAN connectivity
- Supervisor needed for smooth operation
- Needs power supply

Future Enhancements:

- Student Progression – No need to re-register fingerprints when student class is changed.
- Student count in lab – Real-Time.
- In-built fire-safety alarm (Box)

Experience and Learning

Building a whole system from scratch considering all the aspects of software engineering from gathering requirements to planning, designing, proposing the project plan, defining the scope, modeling, analyzing the design, coding, building a database for a whole system, testing was a lifetime experience in itself.

Building an IoT device and a website for a University Dept., working with database, server, interface design, backend coding, assembling everything to get the final output under the guidance of our teachers and the project guide taught us how different is the real world. Working in team made us realize the importance of team spirit, unity and patience.

We faced many difficulties but having a mentor/guide makes everything much easier, every time we were stuck somewhere our guide was there to help us, challenged us to solve the queries on our own and in the end always used to give us the finest solutions.

We learned to solve real problems, learned lot of new techniques and technologies during this period. This project helped us to get out of our comfort zone, learn new technologies and their implementations.

We also learned how to deal with a client, how to elicit requirements from the clients. We learned to design and model the system. For the first time we created test cases for a system made by us and made others test the prototype.

The last 6 months were a roller coaster ride for us consisting of knowledge gain, experience, life lessons, team work, real time dealing. We are grateful to our client and the department for such an amazing experience.

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