CS 360 - Software Engineering
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Client - Dr. Amal Khalifa

Attendance Tracking System 3.0: Final Documentation

1. Introduction

Application Purpose

The Attendance Tracking System 3.0 is the next major release of the system after the 2.0 version. This Android application helps the user (lecturer) track students' attendance and generate reports containing useful and relevant attendance data. The application will allow the user to create an account on their local device, create semesters, organize courses within each semester, import a prepared class list, generate quick response (QR) codes that identify students, send the created QR codes to students through their (PFW) email address, take attendance using the system's QR code scanner, generate reports that list student attendance, and finally send attendance reports to the user through the user's email.

Project Goals and Objectives

1. **Login/Registration Screen:**
   The user can register an account and log in to the system. Once registered using one's email and password, a user can log in through these credentials. Version 2.0 did not implement this requirement.
2. **Main Screen:**
   Once the user has logged in, the main screen is displayed. This screen will display semesters and courses together. The user can edit semesters and courses as they wish, including deleting them.
3. **Course Screen:**
   Once the user has selected a course, this screen emerges and displays a list of students in the course. Selecting a student shows that student's attendance history and QR code. The screen also presents buttons that correspond to the following functionalities:
   a. **Import Class List:**
      When the import class list button is selected, an application file explorer window appears, prompting the user for a comma-separated values (CSV) file. Once a CSV file is selected, the application populates the course screen with students from the file.

b. **Add Student Functionality:**
When the add student button is selected, a pop-up window prompts the user for the name and email of a new student. This student is then added to the current course.

c. **Send QR Code Batch Functionality:**
When the send QR code batch button is selected, the application sends unique QR codes to each student in the course. This QR code represents each student by their email address for proper attendance tracking. Previously, QR codes were generated to represent student names, but with the possibility that multiple students had the same name, this was changed so each student would be unique.

d. **Report Generation Functionality:**
When this button is pressed, several CSV files containing student attendance information for that course are sent using the email address that the user input when registering. These reports list the following information:
   i. The full attendance report file contains all past meeting dates and the students present and absent on each meeting date.
   ii. The date-specific attendance report file contains the requested meeting date and the students present and absent on the meeting date.
   iii. The last date attended report file contains the last date every student attended the class.

e. **Continuous QR Reading:**
When the scan button is selected, the application accesses the camera on the device and continuously scans QR codes presented by students. Student attendance data is then stored in the database and updated with the date attended.

f. **Analytics Screen:**
When this button is pressed, it brings the user to an analytics screen that displays course attendance information summarized on a graph.

4. **Student Screen**
Students may be selected from the course screen to display their information. This screen will display the selected student's name, email, QR code, and attendance history. Attendance history will be displayed as a list and as a calendar view.

5. **Improved User Interface and User Experience.**
Among functional implementations of the project, the user interface has been improved to have a more finished look that is in accordance with Purdue Fort Wayne's style guide. In addition, certain elements of the application have been improved to assist in the use of the application, including tooltips within the application and easier navigation to improve user experience.

6. **Database Rebuild**

The previous implementation of the database did not allow user registration. The database had to be rebuilt to allow this, and a different database API was selected that allowed for local storage and better implementation.

Project Constraints

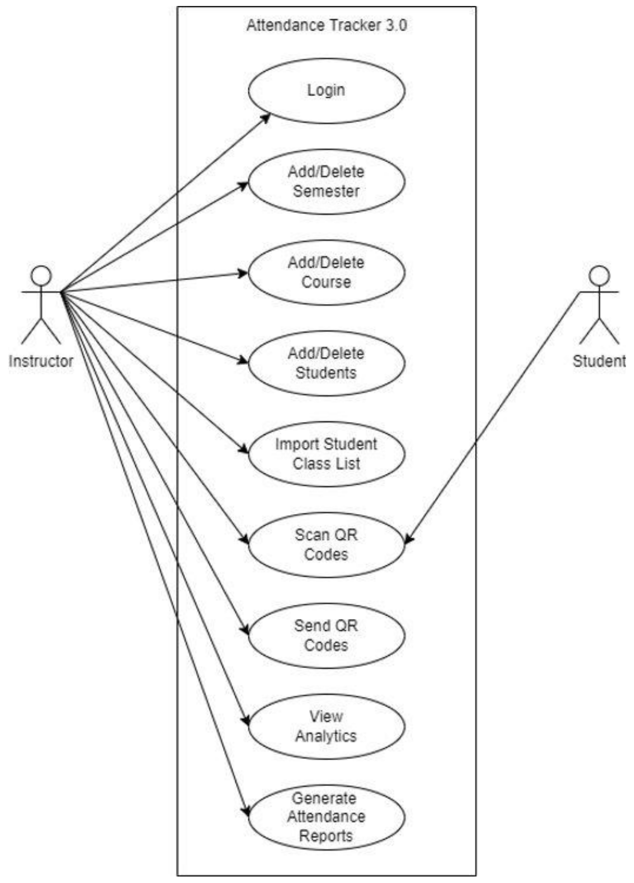
- Time was a significant constraint, as we had one semester to develop the project.
- Integrating PFW's authentication and login system was not possible as it required permission from PFW authorities.
- Lack of experience made some tasks challenging, as the team was not yet trained on certain subjects, such as networking and database implementation, at the start of this project.
- The previous implementation required refactoring and reconstruction, which required more time than previously anticipated. Documentation files and comments within the source code have assisted minimally with learning how the system works.

2. Project Glossary

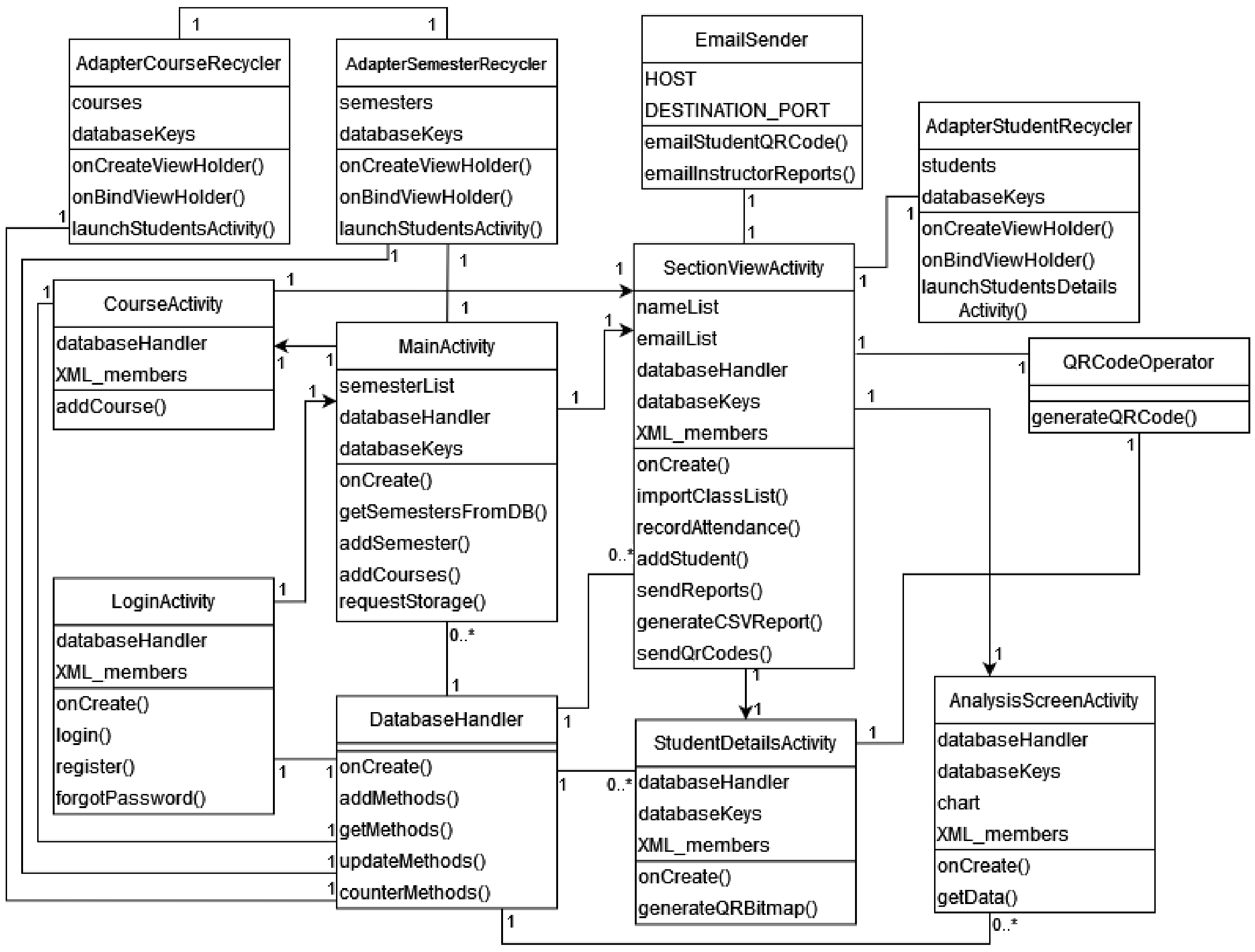
A. **Attendance Tracker:** The main application that records students' attendance using a barcode scanner to scan QR codes generated for each student.
B. **Database:** An organized collection of logically related data.
C. **Barcode Scanner:** An auxiliary application that scans QR codes corresponding to student names and writes the details associated with the scanned QR codes to a file.
D. **Quick Response (QR) Code:** A unique bitmap that stores the encoded information of a string into the black and white areas of an image. QR codes are used to store student attendance information in the database.
E. **Bitmap:** A mapping from some domain (such as an image) to bits.
F. **Comma-Separated Values (CSV) File:** A text file that separates data values by commas. This format is used to easily import and export data in spreadsheets and databases. In the attendance tracker, class list information can be imported from CSV files, and attendance data can be generated as CSV files.

3. Design

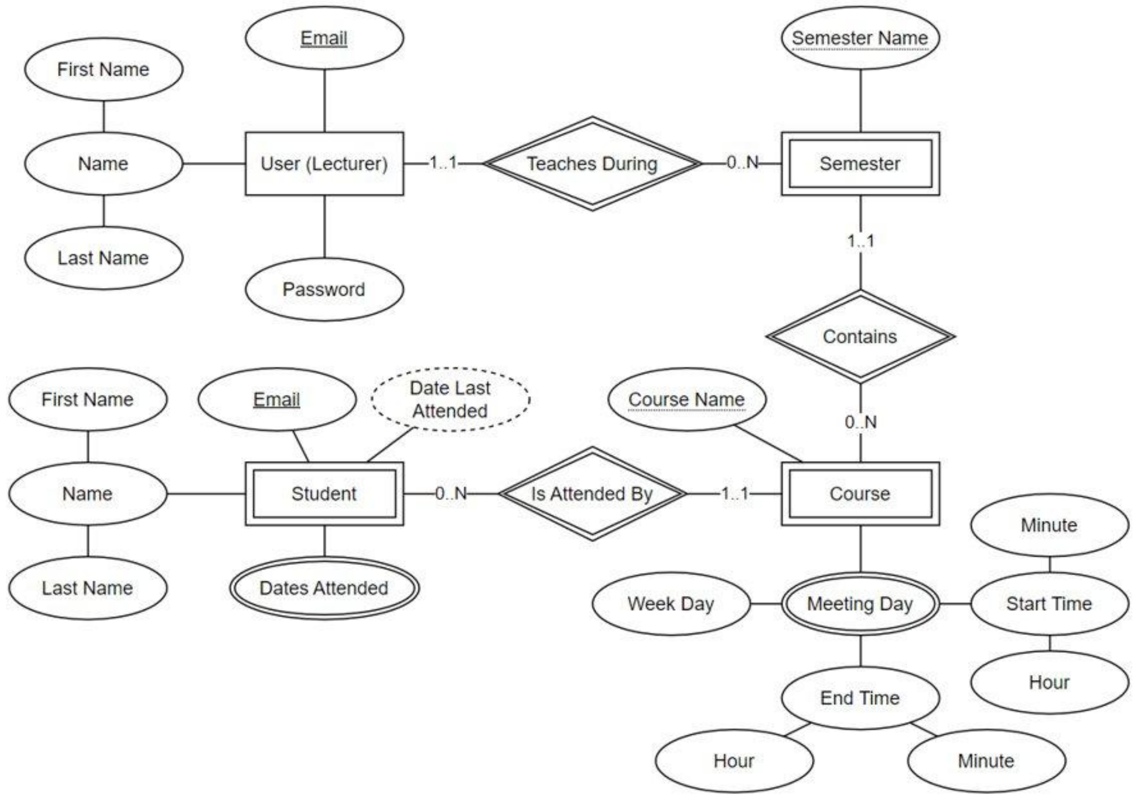
A. Use Case Diagram:



B. Class Diagram:



C. Entity Relationship (ER) Diagram:



4. Important Modules

A. LoginActivity
   a. onCreate()
      i. Parameters: Bundle savedInstanceState
      ii. Functionality: Initializes the activity's attributes and objects such as XML views and widgets, data structures, and drives the activity's functions.
      iii. Postcondition: The user's display will contain all of this class's views and widgets, and it will have all of the functionality listed in the following methods.
      iv. Returns: void
   b. loginClicked()
      i. Parameters: none
      ii. Functionality: Takes user input from email and password EditText objects and checks credentials with the database.
      iii. Postcondition: User will be brought to MainActivity screen if credentials are confirmed. Otherwise, a message will display that the entered credentials are invalid.

        iv. Returns: void
    c. registerClicked()
        i. Parameters: none
        ii. Functionality: Displays a screen overlay that allows the user to input information. The user may press the back button to return to the login screen.
        iii. Postcondition: The registration screen will be displayed to the user.
        iv. Returns: void
    d. registerSubmitClicked()
        i. Parameters: none
        ii. Functionality: Adds a new user to the database if all fields are entered and the email address has not been used before on the current device.
        iii. Postcondition: If the entered email address is unique to the database and all fields are entered, the system will display a message that the new user has been registered. If the email is not unique, a message will display that the user was not added successfully. If all fields are not entered, a message will display and the user will not be added.
        iv. Returns: void

B. MainActivity
    a. onCreate()
        i. Parameters: Bundle savedInstanceState
        ii. Functionality: Initializes the activity's attributes and objects such as XML views and widgets, data structures, and drives the activity's functions.
        iii. Postcondition: The user's display will contain all of this class's views and widgets, and it will have all of the functionality listed in the following methods.
        iv. Returns: void
    b. getSemestersFromDB
        i. Parameters: String email
        ii. Functionality: Retrieves the semester list from the database using the user's email as the primary key.
        iii. Postcondition: An array list of String objects representing semester names will be returned to be used in the recycler view display.
        iv. Returns: ArrayList<String>
    c. addSemester()
        i. Parameters: String email
        ii. Functionality: Displays a popup that allows the user to insert a new semester and up to five courses in that semester.

iii. Postcondition: A semester and any number of courses in that semester will be added to the database. The display will be updated with the semester and courses. Any errors will prompt an error message to the user.
iv. Returns: void

d. addCoursesToDB()
   i. Parameters: ArrayList<String> courses, String semesterName, String userEmail
   ii. Functionality: Works as a part of addSemester() to add courses to the database.
   iii. Postcondition: After a semester is created with courses, those courses will be added to the database.
   iv. Returns: Boolean

e. requestStoragePermissions()
   i. Parameters: none
   ii. Functionality: Requests access to the storage of the user's device.
   iii. Postcondition: System will be able to access storage on the device for input and output of data.
   iv. Returns: void

C. CourseActivity
   a. onCreate()
      i. Parameters: Bundle savedInstanceState
      ii. Functionality: Initializes the activity's attributes and objects such as XML views and widgets, data structures, and drives the activity's functions.
      iii. Postcondition: The user's display will contain all of this class's views and widgets, and it will have all of the functionality listed in the following methods.
      iv. Returns: void
   b. addCourse()
      i. Parameters: String userEmail, String semesterName
      ii. Functionality: Adds a single course to the semester in the database and on the recycler view.
      iii. Postcondition: The semester will display the new course and the database will reflect the addition.
      iv. Returns: void

D. SectionViewActivity
   a. onCreate()
      i. Parameters: Bundle savedInstanceState
      ii. Functionality: Initializes the activity's attributes and objects such as XML views and widgets, data structures, and drives the activity's functions.

   iii. Postcondition: The user’s display will contain all of this class’s views and widgets, and it will have all of the functionality listed in the following methods.
   iv. Returns: void

b. editMeetingTimes()
   i. Parameters: none
   ii. Functionality: On its first use, displays a popup window that allows the user to input the days and times this course meets. Once the user has added days and times to the database, the system will not allow changes. The button that calls this method will display “View Times”. Calling this method again after the database contains meeting times for this course will only have a button to dismiss the popup. Any changes made will not be saved at this point.
   iii. Postcondition: Meeting days and times will be inserted into the database reflecting what the user inputs. Clicking the button again will display what the database holds.
   iv. Returns: void

c. initiateAnalysisScreen()
   i. Parameters: none
   ii. Functionality: Brings the user to the analysis screen.
   iii. Postcondition: The system will have navigated from SectionViewActivity to AnalysisScreenActivity.
   iv. Returns: void

d. importClassList()
   i. Parameters: Uri uri
   ii. Functionality: Allows the user to select a CSV file from external storage. The method will read through the file, getting students from a line's fields and adding students to the database and student list.
   iii. Postcondition: The database and student list are updated with the imported students.
   iv. Returns: void

e. makeScanOptions()
   i. Parameters: String prompt
   ii. Functionality: Constructs the options for the QR code scanner (used when launching the barcodeLauncher).
   iii. Postcondition: Returns ScanOptions that have been configured for the QR code scanner.
   iv. Returns: ScanOptions

f. recordAttendance()
   i. Parameters: String studentEmail

   ii. Functionality: Returns true if 1) a student with the given student email exists in the database and 2) the date present for the student was successfully recorded in the database. This returns false otherwise.
   iii. Postcondition: Records the current date as a date present for the given student in the database (as long as it is valid).
   iv. Returns: boolean

g. generateReports()
   i. Parameters: None
   ii. Functionality: Displays a pop-up window allowing the user to enter a date that will be used in report generation. This allows the user to input the date either through the keyboard or through a date picker. The pop-up disappears if the user selects “cancel” or “accept.” If the user selects “accept,” then attendance reports will be sent to the user’s email.
   iii. Postcondition: The pop-up disappears, and if the user selected “accept” with a valid date, then report generation is started, and reports are sent to the user’s email.

h. writeReports()
   i. Parameters: Date chosenDate
   ii. Functionality: Creates attendance reports based on the date in the database. These files are stored in the device as CSV files. The reports are also mailed to the user via the user's email.
   iii. Postcondition: Attendance reports are stored in the device’s application storage and emailed to the user.
   iv. Returns: void

i. sendReports()
   i. Parameters: File… reportFiles
   ii. Functionality: Constructs an email with the CSV attendance report files and sends it to the user’s email.
   iii. Postcondition: Emails containing attendance report files are sent to the user’s email.
   iv. Returns: void

j. generateQrCodeBatch()
   i. Parameters: None
   ii. Functionality: Generates QR codes based on students in the database and stores them to the device's application data. Then, if the user specified that it wants to send QR codes to students, it sends QR codes to them via their emails.
   iii. Postcondition: QR codes are stored in the device’s application storage, and (if specified) are sent to students via their emails.
   iv. Returns: void

   k. sendQrCodes()
      i. Parameters: String studentName, String studentEmail, File qrCode
      ii. Functionality: Constructs an email with the student's QR code and sends it to the student's email.
      iii. Postcondition: An email is sent to a student with the given QR code.
      iv. Returns: void
   l. addStudent()
      i. Parameters: none
      ii. Functionality: If the fields are entered and the email is not in the database already, then the inputted student information is added to the class list.
      iii. Postcondition: The student will be added to the class list on the screen and in the database.
      iv. Returns: void

E. StudentDetailsActivity
   a. onCreate()
      i. Parameters: Bundle savedInstanceState
      ii. Functionality: Initializes the activity's attributes and objects such as XML views and widgets, data structures, and drives the activity's functions.
      iii. Postcondition: The user's display will contain all of this class's views and widgets.
      iv. Returns: void

F. DBHandler
   a. onCreate()
      i. Parameters: SQLiteDatabase db
      ii. Functionality: Generates the database and all of the tables that will be used within the database using SQL statements. The database is only built if it does not already exist in the applications data.
      iii. Postcondition: The database will be built on the device's storage.
      iv. Returns: void
   b. onUpgrade()
      i. Parameters: SQLiteDatabase db, int oldVersion, int newVersion
      ii. Functionality: Allows the programmer to update tables. This method is called every time a request to the database has been made.
      iii. Postcondition: If the database schema has been upgraded, and version control has been properly maintained, the database will be upgraded to represent the changes made from this method.
      iv. Returns: void
   c. checkEmailExist()
      i. Parameters: String email

   ii. Functionality: Query the database to check if the email exists on the user table.
   iii. Postcondition: True will be returned if the email exists, false will return if the email does not exist.
   iv. Returns: Boolean

d. checkEmailPassword()
   i. Parameters: String email, String password
   ii. Functionality: Authentication method for user credentials when logging in. The system will query the database for a match with the arguments.
   iii. Postcondition: Will return true if there is a match and false if there is not a match.
   iv. Returns: Boolean

e. Add Methods
   i. Parameters: Keys to access desired table
   ii. Functionality: Will add the respective entity to its corresponding table as long as the primary key constraint is not violated.
   iii. Postcondition: The entity will be added to its corresponding table and return a Boolean referring to whether the addition was a success or failure.
   iv. Returns: Boolean

f. Get Methods
   i. Parameters: Keys to access desired table
   ii. Functionality: Retrieves the specified entity/entities in the method name.
   iii. Postcondition: The database will be queried to retrieve all tuples that match the query.
   iv. Returns: String/ ArrayList<String>/ ArrayList<ArrayList<String>>/ ArrayList<String[]>

g. updateSemesterName()
   i. Parameters: String oldSemesterName, String newSemesterName, String userEmail
   ii. Functionality: Updates a semester's oldSemesterName with newSemesterName.
   iii. Postcondition: The semesters table will have an updated tuple where the updated semester name is replaced with the new name.
   iv. Returns: void

h. updateCourseName()
   i. Parameters: String oldCourseName, String newCourseName, String semesterName, String userEmail
   ii. Functionality: Updates oldCourseName with newCourseName.
   iii. Postcondition: The courses table will have an updated tuple where the updated course name is replaced with the new name.

        iv. Returns: void
    i. updateStudentName()
        i. Parameters: newStudentName, String course, String semester, String userEmail, String studentEmail
        ii. Functionality: Updates the name of the student identified with the inputted studentEmail.
        iii. Postcondition: The student's name will be updated with newStudentName.
        iv. Returns: void
    j. updateStudentEmail()
        i. Parameters: String oldEmail, String newEmail, String course, String semester, String userEmail
        ii. Functionality: Changes the email address of a student with newEmail.
        iii. Postcondition: The students table will have an updated tuple where the updated student email is replaced with the new email.
        iv. Returns: void
    k. Delete Methods
        i. Parameters: Keys to access desired table
        ii. Functionality: Deletes the corresponding entity from its table using its primary key.
        iii. Postcondition: The table that the entity was on will no longer contain the tuple corresponding to the deleted entity.
        iv. Returns: void
    l. Count Methods
        i. Parameters: none, or keys corresponding to desired table
        ii. Functionality: Counts the number of occurrences of a particular query. This could be the size of a table or the size of a cursor that queries with a parameter list.
        iii. Postcondition: The size of the query will be returned.
        iv. Returns: long

G. EmailSender
    a. Constructor()
        i. Parameters: none
        ii. Functionality: Sets the session properties required to send an email.
        iii. Postcondition: Email session properties set and credentials authenticated.
    b. emailStudentQRCode()
        i. Parameters: String sectionName, String studentName, String studentEmail, String userName, File qrCode
        ii. Functionality: Constructs a message to the student and sends the specified file (QR code) to the specified student email.

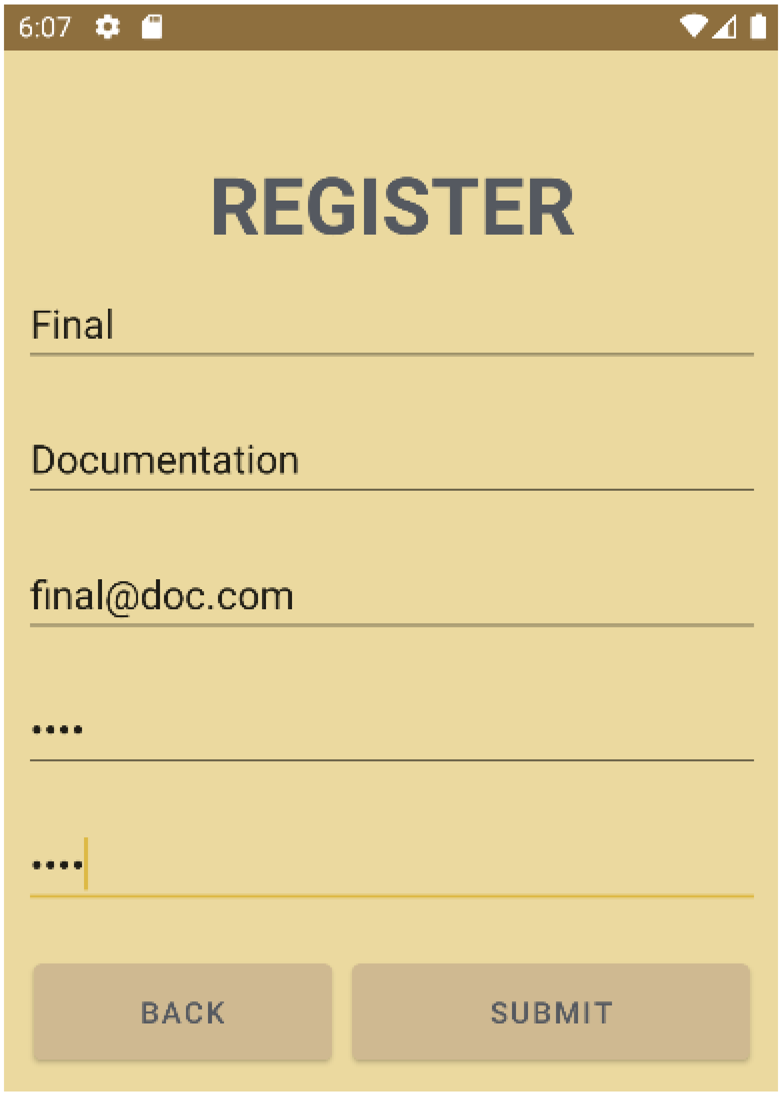
        iii. Postcondition: Email is sent to the student containing the QR code and a simple message.
        iv. Returns: void
    c. emailInstructorReports()
        i. Parameters: String semesterName, String sectionName, String userEmail, String userName, File... reportFiles
        ii. Functionality: Constructs a message to the instructor and sends the specified files (CSV attendance report files) to the specified user email.
        iii. Postcondition: Email is sent to the user containing three attendance report files and a simple message.
        iv. Returns: void

H. QRCodeOperator
    a. generateQRCode()
        i. Parameters: String studentEmail
        ii. Functionality: Encodes the given student's email as a QR code (2D bitmap) and returns the generated QR code.
        iii. Postcondition: QR code that decodes to the given student’s email is generated and returned.
        iv. Returns: Bitmap

5. Demonstration

A. Registration

a. Registering a new account



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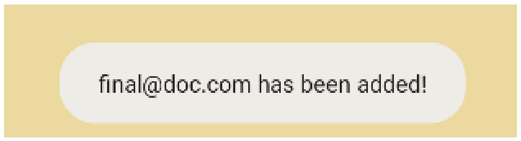
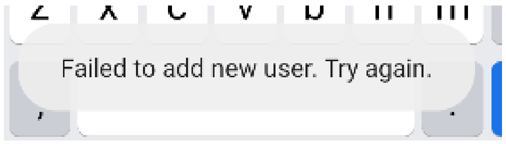
b. Successful registration



final@doc.com has been added!

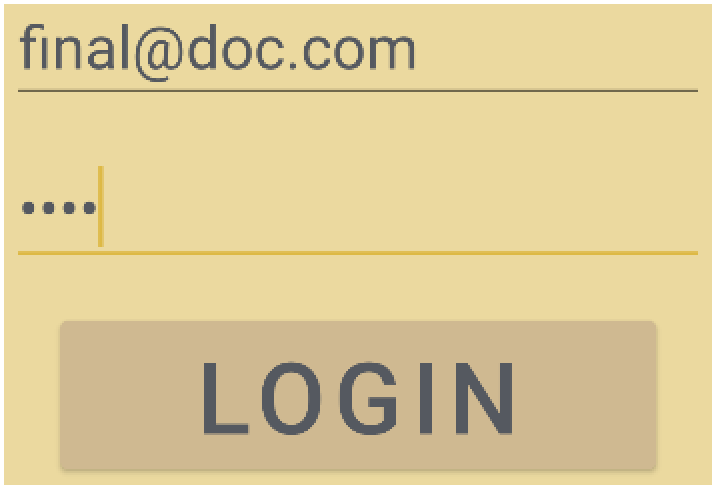
c. Unsuccessful registration



Failed to add new user. Try again.

B. Logging in

a. Entering fields



final@doc.com

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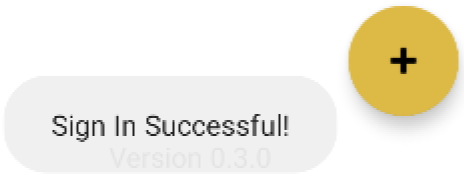
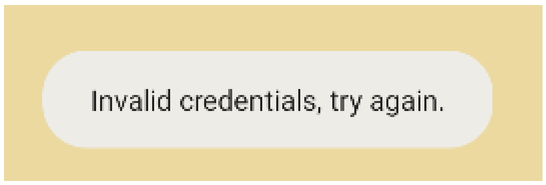
b. Successful login



Sign In Successful!

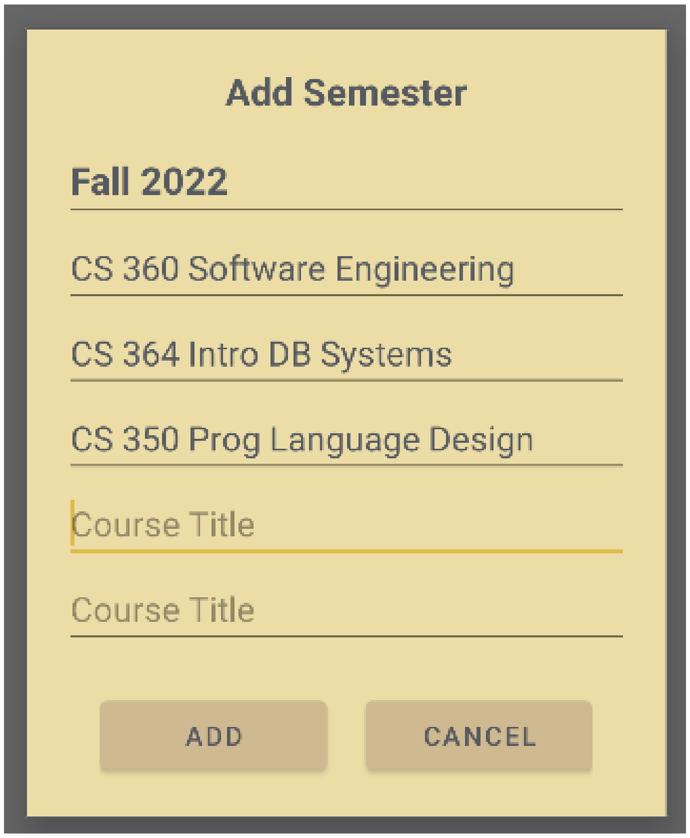
c. Unsuccessful login



Invalid credentials, try again.

C. Adding Semester and Courses

a. Entering fields in new semester window



Add Semester

Fall 2022

CS 360 Software Engineering

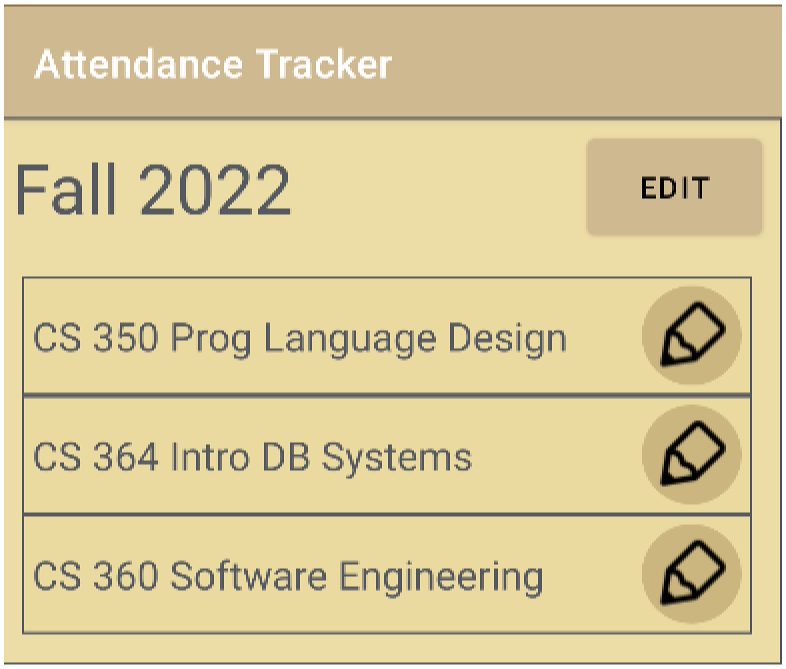
CS 364 Intro DB Systems

CS 350 Prog Language Design

Course Title

Course Title

b. After pressing "Add" button



Attendance Tracker

Fall 2022

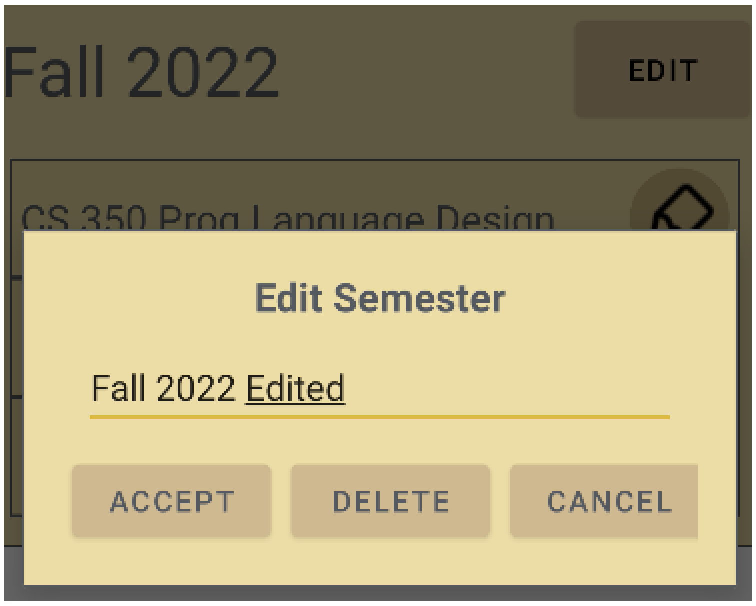
CS 350 Prog Language Design

CS 364 Intro DB Systems

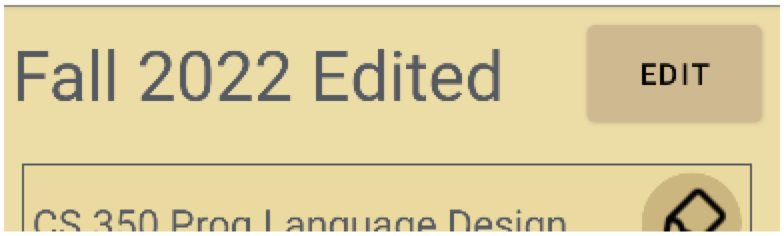
CS 360 Software Engineering

D. Editing Semester and Course

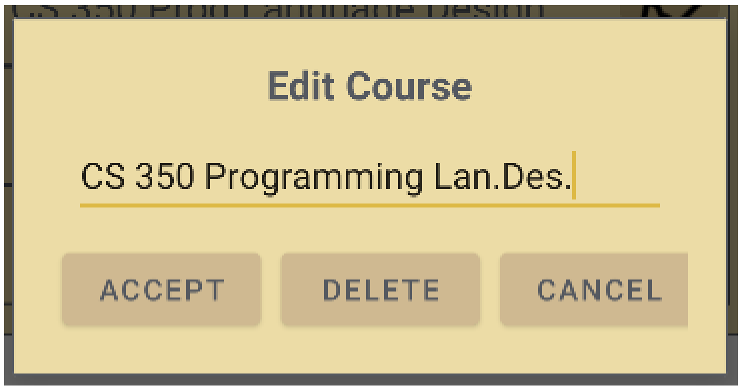
a. Pressing “Edit” button



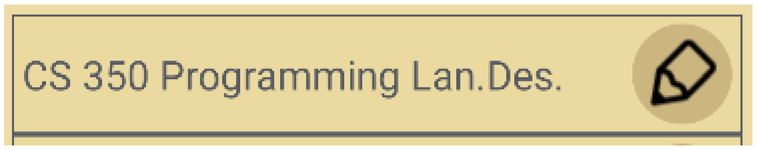
b. After accepting the edit



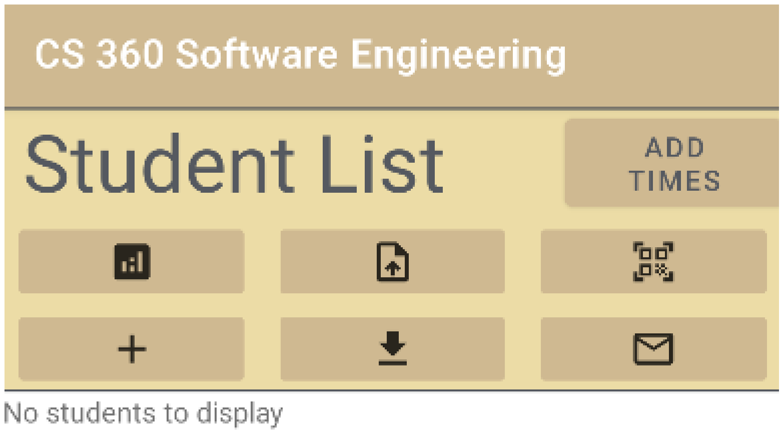
c. Pressing the pencil button to edit a course



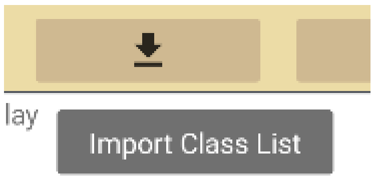
d. After accepting the edit



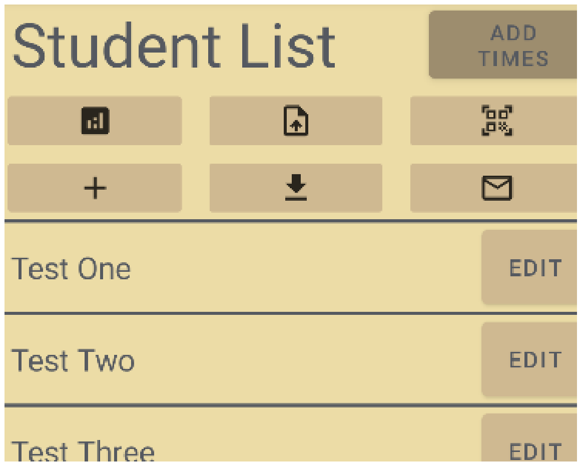
E. After pressing a course

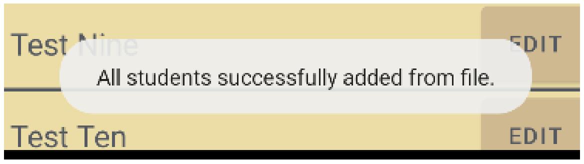


a. Long pressing a button for tooltip



F. Importing a class list (After selecting a CSV file)





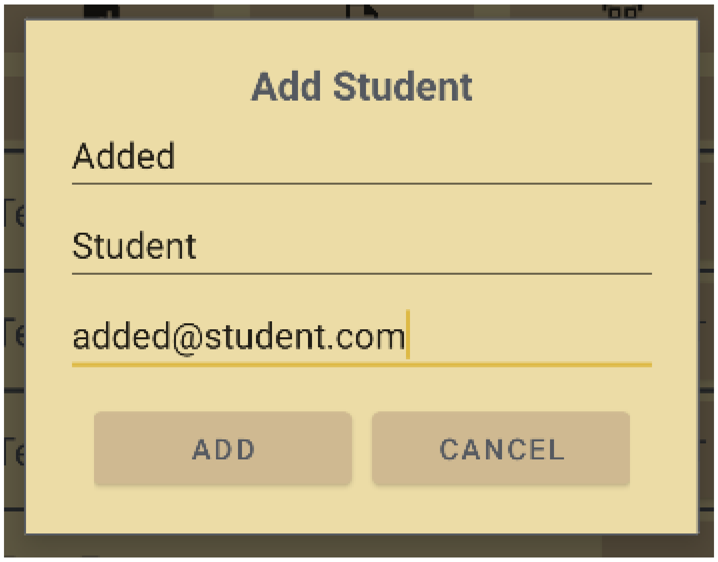
Test Nine EDIT

All students successfully added from file.

Test Ten EDIT

G. Adding an individual student

a. Entering fields



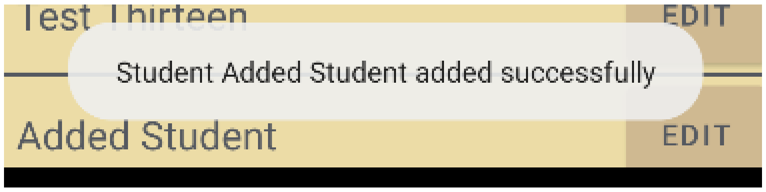
Add Student

Added

Student

added@student.com

b. After pressing "Add"



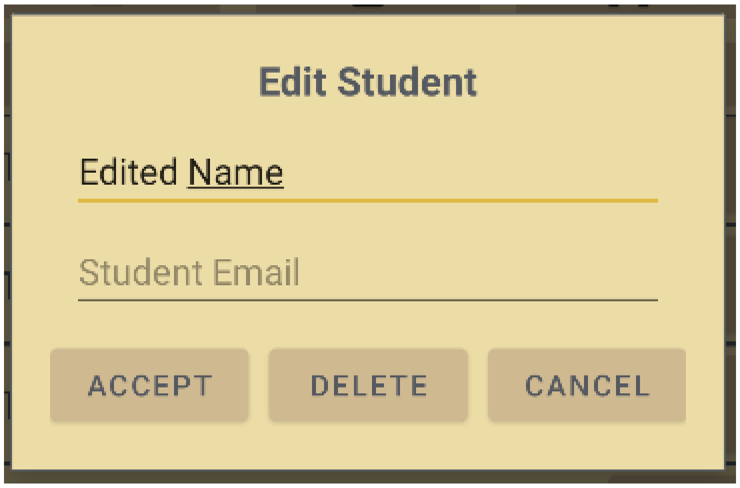
Test Thirteen EDIT

Student Added Student added successfully

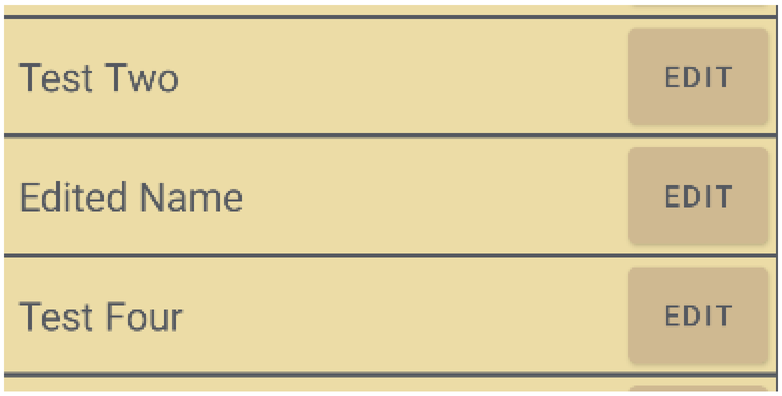
Added Student EDIT

H. Editing and deleting a student

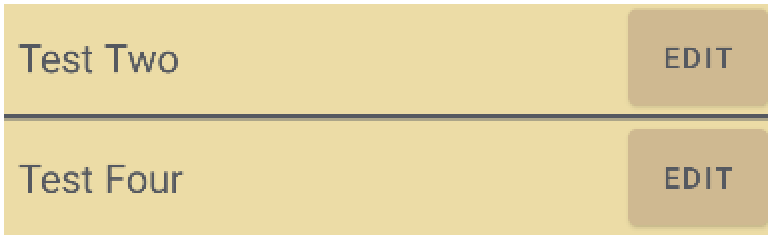
a. Editing a student's name ("Test Three" was selected to be edited)



b. After accepting changes

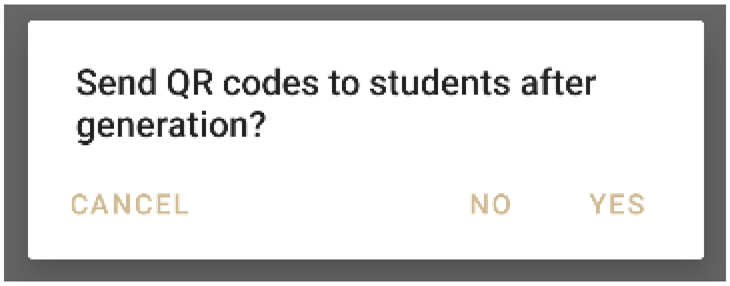


c. After deleting a student



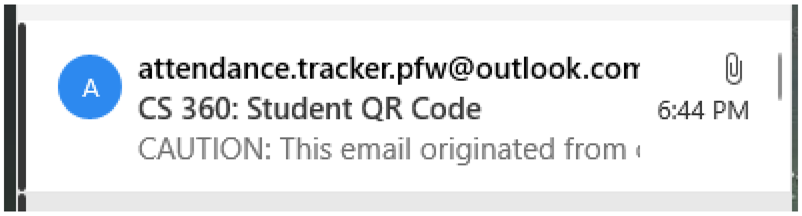
I. Sending QR Codes to students

a. Prompt to send emails



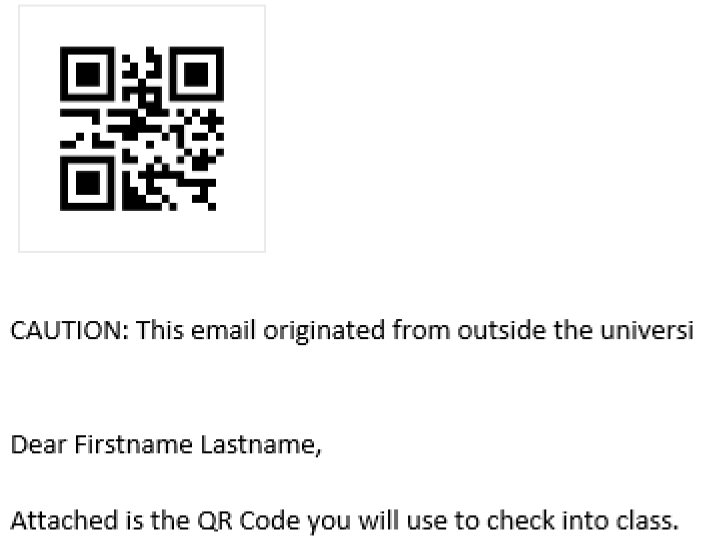
Send QR codes to students after generation?

b. Email in student inbox



attendance.tracker.pfw@outlook.con
CS 360: Student QR Code
6:44 PM
CAUTION: This email originated from

c. Email contents



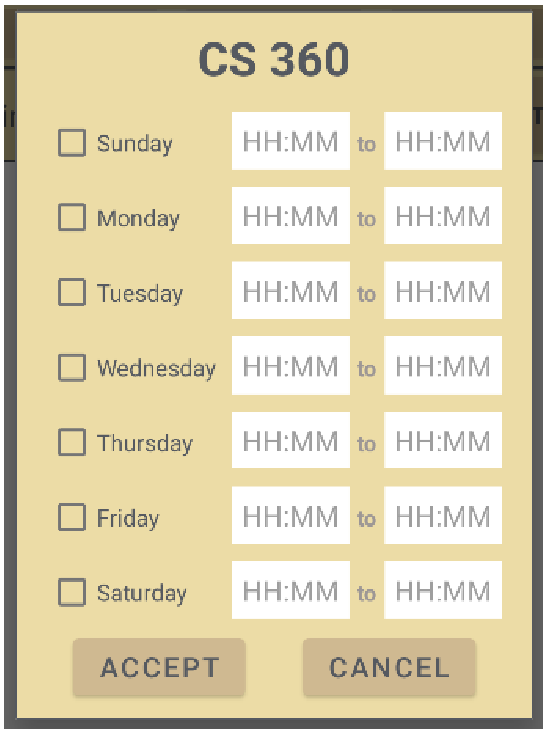
CAUTION: This email originated from outside the universi

Dear Firstname Lastname,

Attached is the QR Code you will use to check into class.

J. Adding class meeting times

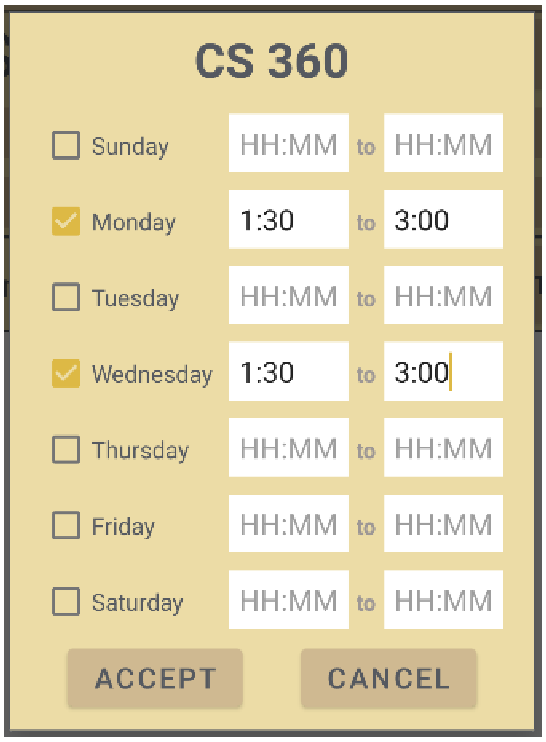
a. Before any data has been submitted



CS 360

☐ Sunday	HH:MM	to	HH:MM
☐ Monday	HH:MM	to	HH:MM
☐ Tuesday	HH:MM	to	HH:MM
☐ Wednesday	HH:MM	to	HH:MM
☐ Thursday	HH:MM	to	HH:MM
☐ Friday	HH:MM	to	HH:MM
☐ Saturday	HH:MM	to	HH:MM

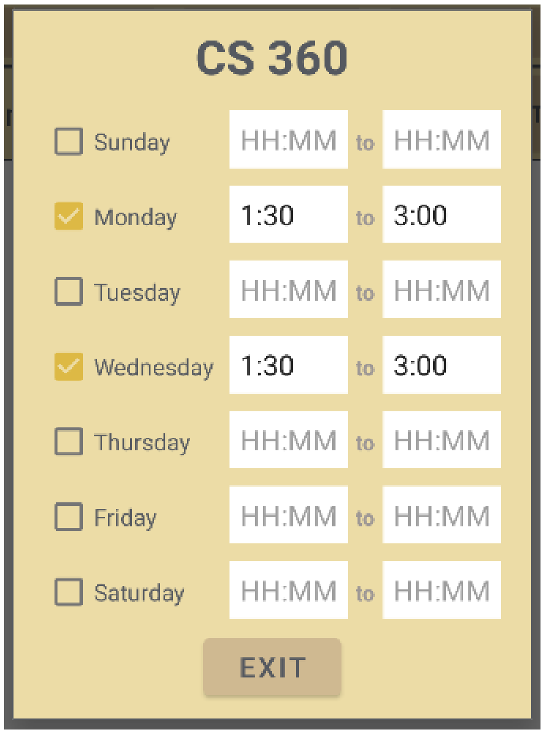
b. Adding data before accepting



CS 360

☐ Sunday	HH:MM	to	HH:MM
✓ Monday	1:30	to	3:00
☐ Tuesday	HH:MM	to	HH:MM
✓ Wednesday	1:30	to	3:00
☐ Thursday	HH:MM	to	HH:MM
☐ Friday	HH:MM	to	HH:MM
☐ Saturday	HH:MM	to	HH:MM

c. Displaying course meeting times after submitting

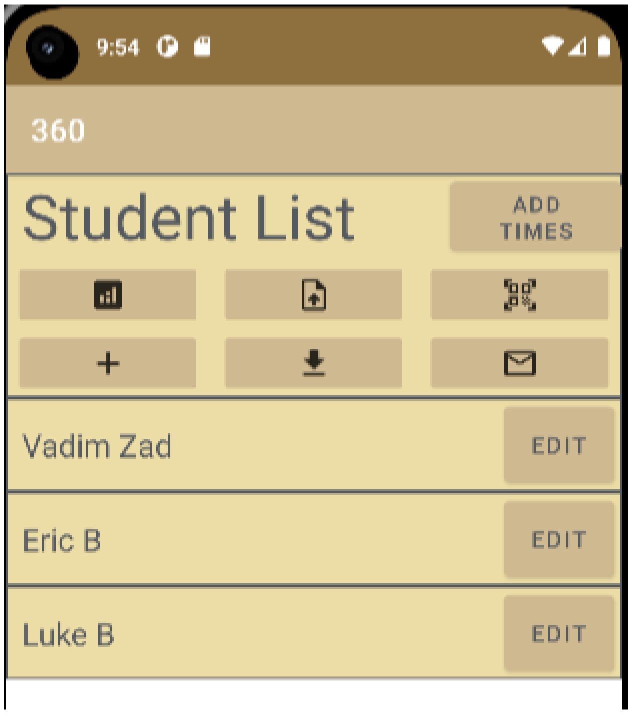


CS 360

☐ Sunday	HH:MM	to	HH:MM
✓ Monday	1:30	to	3:00
☐ Tuesday	HH:MM	to	HH:MM
✓ Wednesday	1:30	to	3:00
☐ Thursday	HH:MM	to	HH:MM
☐ Friday	HH:MM	to	HH:MM
☐ Saturday	HH:MM	to	HH:MM

K. Generating Reports

a. Before report generation button is clicked

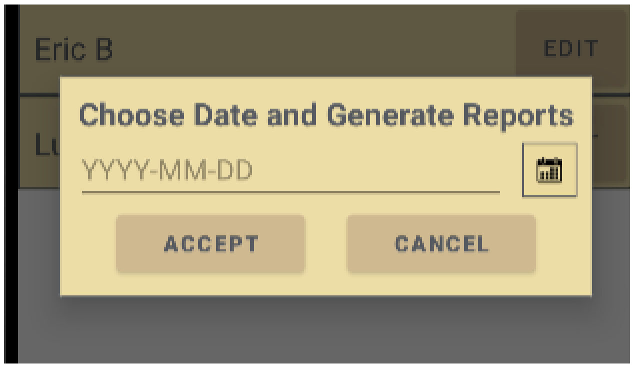


Vadim Zad EDIT

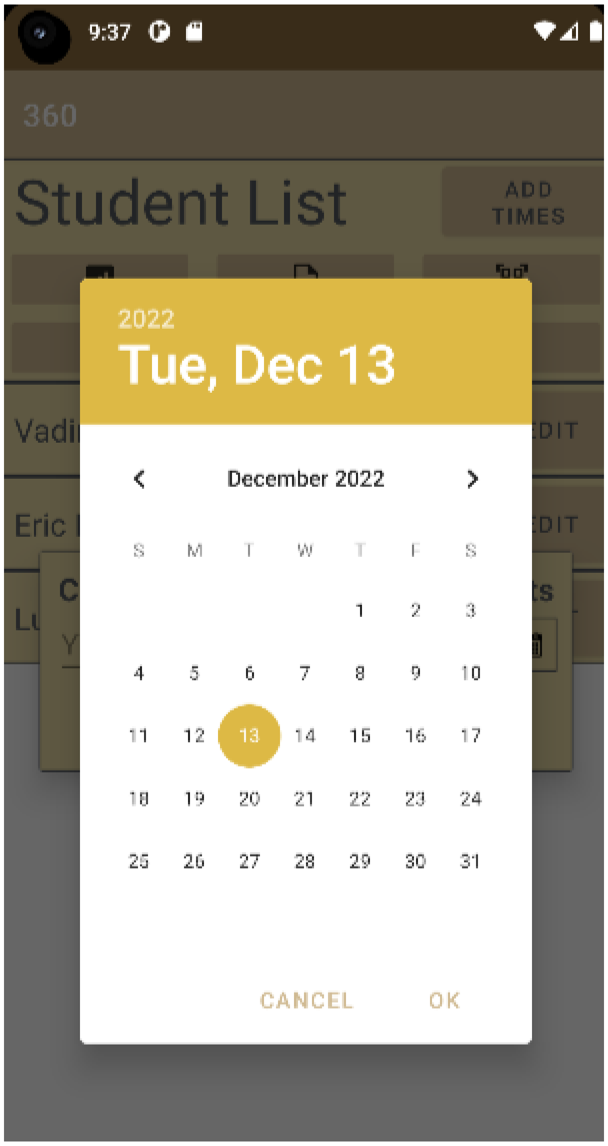
Eric B EDIT

Luke B EDIT

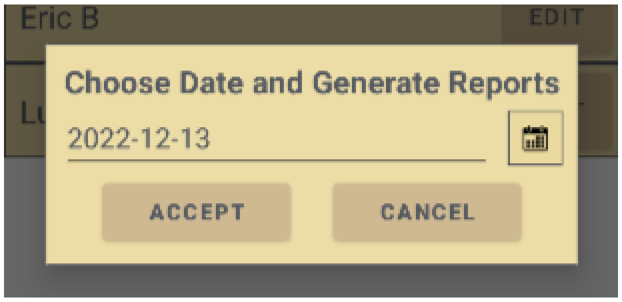
b. After report generation button as been clicked



c. After date button been clicked



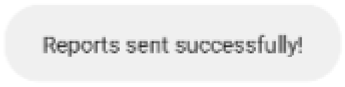
d. After date been selected



Choose Date and Generate Reports

2022-12-13

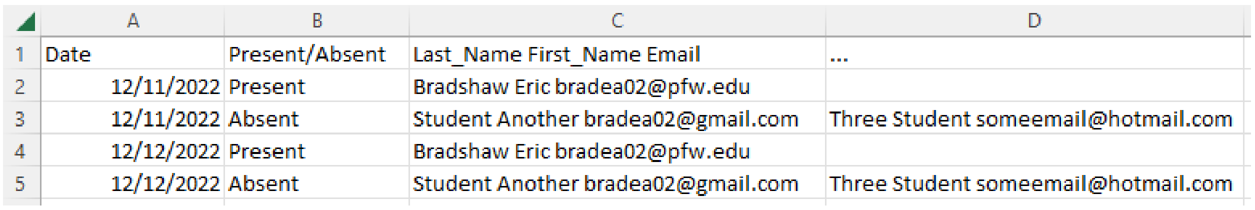
e. After accept button been cliked



Reports sent successfully!

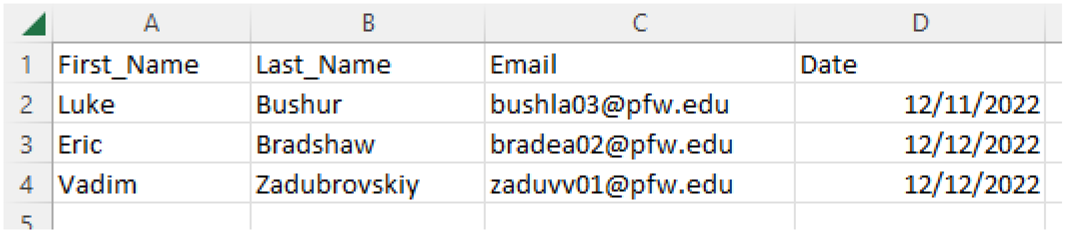
f. CSV Attendence reports files received via email

Per Day Attendance Report.csv example



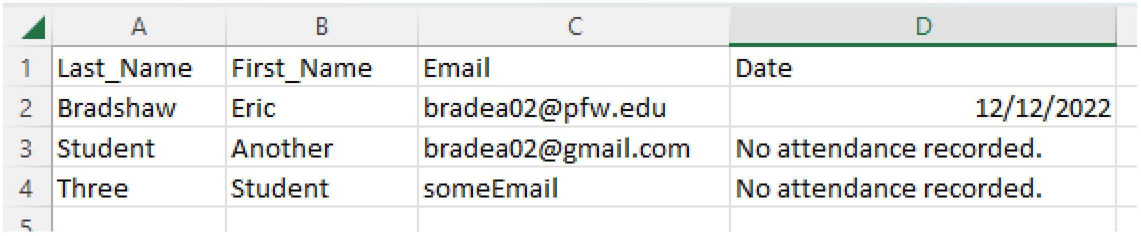
	A	B	C	D
1	Date	Present/Absent	Last_Name First_Name Email	...
2	12/11/2022	Present	Bradshaw Eric bradea02@pfw.edu	
3	12/11/2022	Absent	Student Another bradea02@gmail.com	Three Student someemail@hotmail.com
4	12/12/2022	Present	Bradshaw Eric bradea02@pfw.edu	
5	12/12/2022	Absent	Student Another bradea02@gmail.com	Three Student someemail@hotmail.com

All Attendance Report.csv example



	A	B	C	D
1	First_Name	Last_Name	Email	Date
2	Luke	Bushur	bushla03@pfw.edu	12/11/2022
3	Eric	Bradshaw	bradea02@pfw.edu	12/12/2022
4	Vadim	Zadubrovskiy	zaduvv01@pfw.edu	12/12/2022
5				

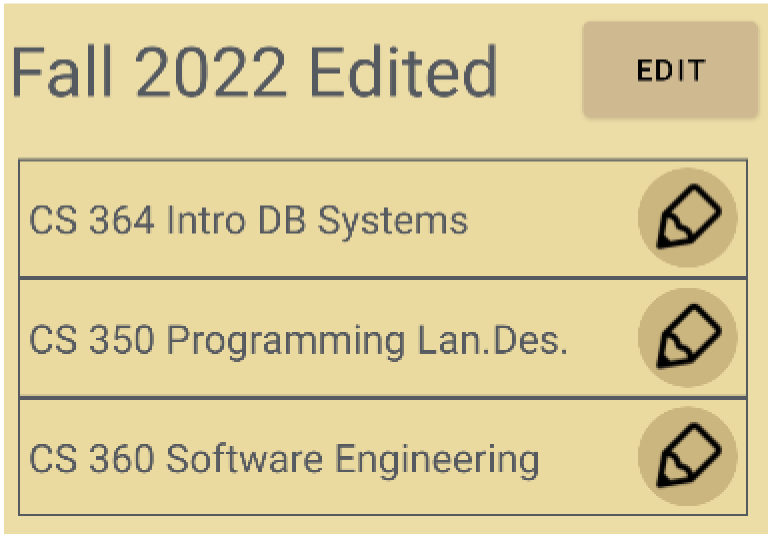
Last Date Attended Report.csv example



	A	B	C	D
1	Last_Name	First_Name	Email	Date
2	Bradshaw	Eric	bradea02@pfw.edu	12/12/2022
3	Student	Another	bradea02@gmail.com	No attendance recorded.
4	Three	Student	someEmail	No attendance recorded.
5				

L. Deleting a course

a. Before deletion

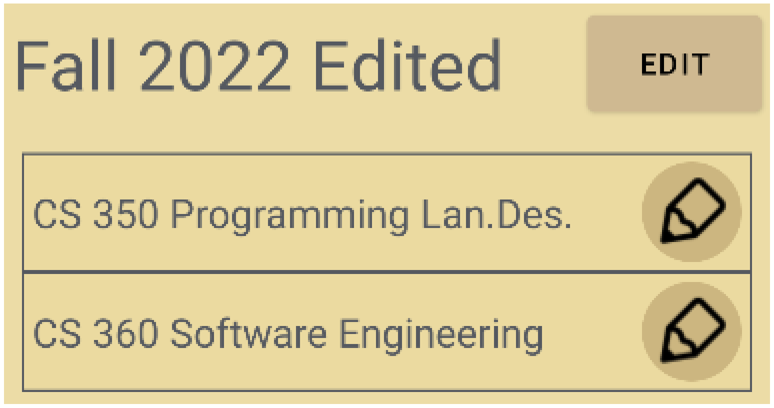

Fall 2022 Edited

CS 364 Intro DB Systems

CS 350 Programming Lan.Des.

CS 360 Software Engineering

b. After deletion

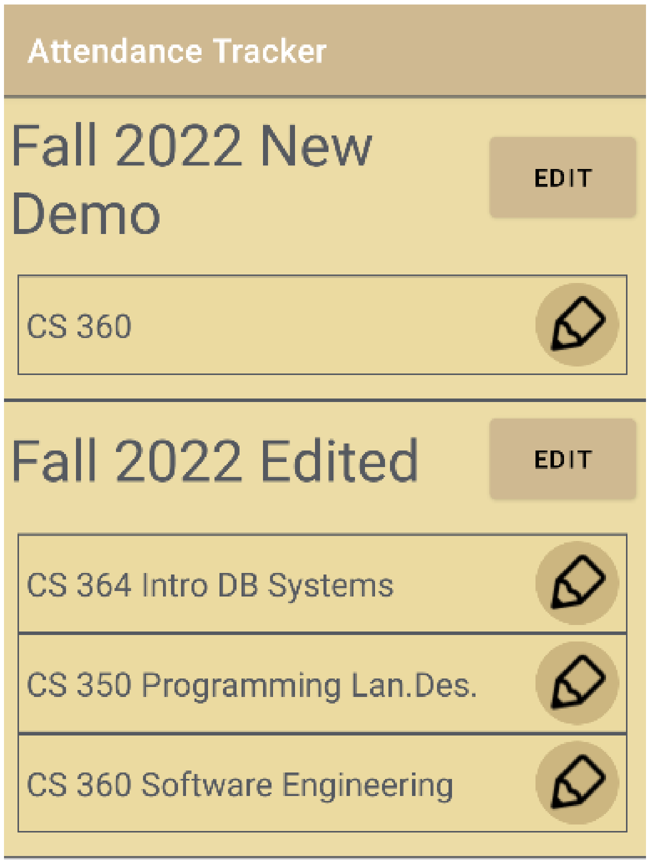

Fall 2022 Edited

CS 350 Programming Lan.Des.

CS 360 Software Engineering

M. Deleting a semester

a. Before deletion


Attendance Tracker

Fall 2022 New Demo

EDIT

CS 360

Fall 2022 Edited

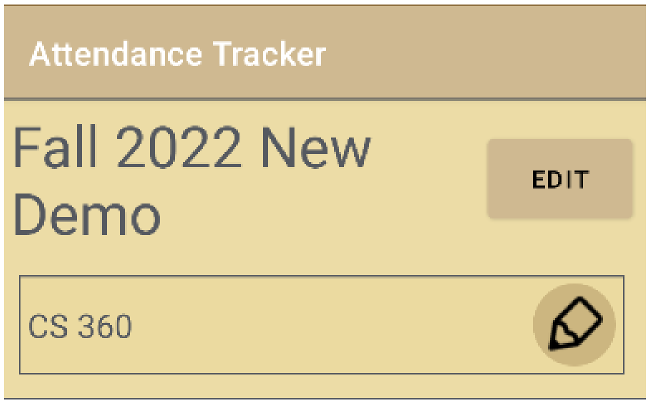
EDIT

CS 364 Intro DB Systems

CS 350 Programming Lan.Des.

CS 360 Software Engineering

b. After deletion


Attendance Tracker

Fall 2022 New Demo

EDIT

CS 360

6. Testing

- A mix of whitebox and blackbox testing was used during this project development cycle.
    - Whitebox testing was done to analyze possible problems in the code during development.
    - Blackbox tests were run at the final stages of the project as regression testing to make sure that no features were broken after the introduction of new modules or unexpected parameters.
- The test coverage report (test cases) starts on the next page.

Test Coverage Report (Test Cases):

Test Case ID	Test Case	Pre-Condition	Test Steps	Test Data	Expected Result	Actual Result	Status Pass/Fail
Login_Test 1.0	Enter valid email and valid password	1) Valid email 2) Valid password 3) Be in login screen	1) Enter email and password 2) Click login button	Valid email name (registered user email), valid password (registered user password)	Sign in successful	Sign in successful	Pass
Login_Test 1.1	Enter valid email and invalid password	1) Valid email 2) Invalid password 3) Be in login screen	1) Enter email and invalid password 2) Click login button	Valid email name (registered user email), invalid password (not registered user password)	Invalid credentials; sign in denied	Invalid credentials; sign in denied	Pass
Login_Test 1.2	Enter invalid email and invalid password	1) Invalid email 2) Invalid password 3) Be in login screen	1) Enter invalid email and invalid password 2) Click login button	Invalid email name (not registered user email), invalid password (not registered user password)	Invalid credentials; sign in denied	Invalid credentials; sign in denied	Pass
Login_Test 1.3	Enter invalid email and valid password	1) Invalid email 2) Valid password 3) Be in login screen	1) Enter invalid email and valid password 2) Click login button	Invalid email name (not registered user email), valid password (registered user password)	Invalid credentials; sign in denied	Invalid credentials; sign in denied	Pass
Login_Test 1.4	Empty log in fields	1) Be in login screen	Click login button	Empty field in email name and password	Fields cannot be empty; sign in denied	Fields cannot be empty; sign in denied	Pass

Test Case ID	Test Case	Pre-Condition	Test Steps	Test Data	Expected Result	Actual Result	Status Pass/Fail
Report_Test 2.0	Generate reports for course with no students added	1) Have no students registered for course selected	1) Click the button with paper and arrow up image 2) Input valid date 3) Select accept to generate reports	2022/12/12	Reports generated with empty list	Reports generated with empty list	Pass
Report_Test 2.1	Generate reports for course with invalid date format	1) Go to course screen of any created crouse	1) Click the button with paper and arrow up image 2) Input invalid date 3) Select accept to generate reports	20221212	Invalid date format	Invalid date format	Pass
Report_Test 2.2	Empty date field	1) Go to course screen of any created crouse	1) Click the button with paper and arrow up image 2) Select accept to generate reports	""	Invalid date format	Invalid date format	Pass
Report_Test 2.3	Generate reports for course with students added	1) Go to course screen of any created crouse with students added	1) Click the button with paper and arrow up image 2) Input valid date 3) Select accept to generate reports	2022-12-12	Reports generated successfully and save to system file	Reports generated successfully and saved to system file	Pass
Report_Test 2.4	Generate reports and send to user	1) Go to course screen of any created course with students added	1) Click the button with paper and arrow up image 2) Input valid date 3) Select accept to generate reports	2022-12-12 and registered user email	Reports generated successfully and email sent	Report generated successfully and email sent	Pass

Test Case ID	Test Case	Pre-Condition	Test Steps	Test Data	Expected Result	Actual Result	Status Pass/Fail
Semester_ Creation_Test 3.0	Enter valid semester name	1) Be in semester screen	1) Click on + button 2) Input valid semester name 3) Leave course fields empty 4) Click add button	Fall 2022	Fall 2022 successfully added	Fall 2022 successfully added	Pass
Semester_ Creation_Test 3.1	Enter duplicate semester name	1) Be in semester screen	1) Click on + button 2) Input duplicate semester name 3) Leave course fields empty 4) Click add button	Fall 2022	Could not add Fall 2022	Could not add Fall 2022	Pass
Semester_ Creation_Test 3.2	Enter empty semester name	1) Be in semester screen	1) Click on + button 2) Click add button	""	Could not add semester	Could not add semester	Pass
Semester_ Creation_Test 3.3	Enter symbols in semester name	1) Be in semester screen	1) Click on + button 2) Input symbols 3) Click add button	!@#$%^&*()_+	!@#$%^&*()_+ successfully added	!@#$%^&*()_+ successfully added	Pass
Semester_ Creation_Test 3.4	Enter valid semester name and course name	1) Be in semester screen	1) Click on + button 2) Input valid semester name 3) Inter valid course name in course field 4) Click add button	Fall 2022 , CS360	Semester and course successfully added	Semester and course successfully added	Pass

Test Case ID	Test Case	Pre-Condition	Test Steps	Test Data	Expected Result	Actual Result	Status Pass/Fail
Course_ Creation_Test 4.0	Enter valid course name	1) Be in course screen	1) Click + button 2) Input valid course name 3) Click accept button	CS360	Course CS360 successfully added	Course CS360 successfully added	Pass
Course_ Creation_Test 4.1	Enter empty course name	1) Be in course screen	1) Click + button 2) Click accept button	""	Course name cannot be empty	Course name cannot be empty	Pass
Course_ Creation_Test 4.2	Enter symbols in course name	1) Be in course screen	1) Click + button 2) Input symbols in course name 3) Click accept button	!@#$%^&*()_+	Course successfully added	Course !@#$%^&*()_+ successfully added	Pass
Course_ Creation_Test 4.3	Enter duplicate course name	1) Be in course screen	1) Click + button 2) Input duplicate course name 3) Click accept button	CS360	Could not add course	Could not add course	Pass
Course_ Creation_Test 4.4	Enter course name with 50 characters	1) Be in course screen	1) Click + button 2) Input course name 3) Click accept button	CS360000000000000 00000000000000000 0000000000000000	Course successfully added	Course successfully added	Pass

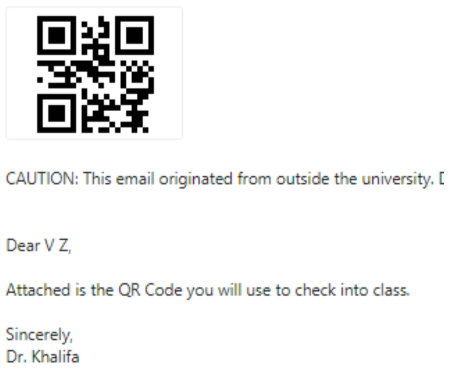
Test Case ID	Test Case	Pre-Condition	Test Steps	Test Data	Expected Result	Actual Result	Status Pass/Fail
Scan_QR_ Code_Test 5.0	Scan blank Image	1) Device with camera 2) Be in course screen	1) Click on button with QR image to activate scanning 2) Point camera at blank image	Blank image	No QR code scanned	No QR code scanned	Pass
Scan_QR_ Code_Test 5.1	Scan an invalid image	1) Device with camera 2) Be in course screen	1) Click on button with QR image to activate scanning 2) Point camera at invalid image	Invalid image (Not a QR code)	No QR code scanned	No QR code scanned	Pass
Scan_QR_ Code_Test 5.2	Scan an invalid QR Code	1) Device with camera 2) Be in course screen	1) Click on button with QR image to activate scanning 2) Point camera at invalid QR code	Invalid QR code	QR code scan unsuccessful	QR code scan unsuccessful	Pass
Scan_QR_ Code_Test 5.3	Scan valid QR code	1) Device with camera 2) Be in course screen	1) Click on button with QR image to activate scanning 2) Point camera at valid QR code	Valid QR code (QR code generated by application)	QR code scanned successfully and data stored	QR code scanned successfully and data stored	Pass
Scan_QR_ Code_Test 5.4	Scan QR code continuousl y	1) Device with camera 2) Be in course screen	1) Click on button with QR image to activate scanning 2) Point camera at valid QR codes sequentially	Valid QR codes (QR codes generated by application)	QR code scanned successfully without existing scanning mode	QR code scanned successfully without existing scanning mode	Pass

Test Case ID	Test Case	Pre-Condition	Test Steps	Test Data	Expected Result	Actual Result	Status Pass/Fail
Generate_ QR_Code_ Test 6.0	Generate bulk QR code	1) Be in course screen 2) Multiple students added in course selected	1) Click on button with mail image to activate QR code generate 2) Select yes in pop up window	Semester, course, and student list	QR codes generated	QR codes generated	Pass
Generate_ QR_Code_ Test 6.1	Write generated QR code to filesystem	1) Be in course screen 2) Students added in course	1) Click on button with mail image to activate QR code generate 2) Select yes in pop up window	Semester, course, and student list	QR codes written to filesystem on device	QR codes written to filesystem on device	Pass
Generate_ QR_Code_ Test 6.2	Send QR codes by email	1) Be in course screen 2) Students added in course with valid credentials	1) Click on button with mail image to activate QR code generate 2) Select yes in pop up window	Semester, course, and student list	QR codes generated and sent by email	QR codes generated and sent by email	Pass
Generate_ QR_Code_ Test 6.3	Error sending QR codes by email	1) Be in course screen 2) Students added with invalid credentials	1) Click on button with mail image to activate QR code generate 2) Select yes in pop up window	Semester, course, student list, invalid credential (student email example.com)	QR codes generated and not sent by email	QR codes generate and not sent by email	Pass
Generate_ QR_Code_ Test 6.4	Write generated QR code to full filesystem	1) QR generated 2) File system full	1) Click on button with mail image to activate QR code generate 2) Select yes in pop up window	Semester, course, and student list	QR codes generated and not stored to files system	QR codes generated and not stored to files system	Pass

Test Case ID	Test Case	Pre-Condition	Test Steps	Test Data	Expected Result	Actual Result	Status Pass/Fail
Import_ Student_ Class_ List_ Test 7.0	Import CSV file with one student	1) CSV file with properly format student data (first, last, email) on local device storage	1) Click on button with arrow down image 2) Select CSV file from local storage	CSV file with student data (first, last, email)	Student successfully added from CSV file	Student successfully added from CSV file	Pass
Import_ Student_ Class_ List_ Test 7.1	Import CSV file with multiple students	1) CSV file with properly format students data (first, last, email) on local device storage	1) Click on button with arrow down image 2) Select CSV file from local storage	CSV file with students data (first, last, email)	Students successfully added from CSV file	Students successfully added from CSV file	Pass
Import_ Student_ Class_ List_ Test 7.2	Import CSV file with no student added	1) CSV file with no students on local device storage	1) Click on button with arrow down image 2) Select CSV file from local storage	CSV file with no student data ("", "", "")	Error reading from file	Error reading from file	Pass
Import_ Student_ Class_ List_ Test 7.3	Import CSV file with invalid format of student data	1) CSV file with invalid format of student data (first, last, email, favorite color) on local device storage	1) Click on button with arrow down image 2) Select CSV file from local storage	CSV file with invalid format student data (first, last, email, favorite color)	Student successfully added from CSV file with the first three fields (first, last, email)	Student successfully added from CSV file with the first three fields (first, last, email)	Pass
Import_ Student_ Class_ List_ Test 7.4	Import CSV file with missing last name	CVS file on device with student data missing last name	1) Click on button with arrow down image 2) Select CSV file from local storage	CSV file with missing data first, email	Student successfully added from CSV file	Student successfully added from CSV file	Pass

7. Tools

- **Java:**
  - High-leve, object-oriented programming language used to write the application in Android Studio.
- **Android Studio:**
  - The official integrated development environment for Google's Android operating system, built on JetBrains' IntelliJ IDEA software and designed specifically for Android development.
- **Android Virtual Device (AVD):**
  - A configuration that defines the characteristics of an Android phone, tablet, Wear OS, Android TV, or Automotive OS device that you want to simulate in the Android Emulator.
- **Device Manager:**
  - An interface you can launch from Android Studio that helps you create and manage AVDs
- **SQLite:**
  - A library that implements a self-contained and serverless SQL database engine. Replaced TinyDB, which was used in the previous version.
  - This is useful for highly personalized apps where the user will not need to share data with another device or person.
- **Outlook API:**
  - The Outlook API is used to send out the QR codes to emails via the attendance.tracker.pfw@outlook.com email address.
  - The credentials for the email address are as follows:
    - **Email:** attendance.tracker.pfw@outlook.com
    - **Password:** PurdueFortWayneAttendanceTracker123
    - **Application Password:** hpoaviagzwckefbz
    - **Country:** United States
    - **Date of Birth:** January 1, 2000
    - **Verification Email:** bradea02@pfw.edu
    - **Verification Phone Number:** (260) 271-9655
  - An example email sent by the application looks like this:


CAUTION: This email originated from outside the university. [

Dear V Z,

Attached is the QR Code you will use to check into class.

Sincerely,
Dr. Khalifa

- **ZXing ("Zebra Crossing") library:**
    - ZXing ("zebra crossing") is an open-source, multi-format 1D/2D barcode image processing library implemented in Java, with ports to other languages.
- **GitHub:**
    - An online software development platform used for storing, tracking, and collaborating on software projects.
    - It enables developers to upload their own code files and to collaborate with fellow developers on open-source projects.
    - It uses Git, a distributed version control system, to keep track of project modifications.
- **Barcode component reader (QR code scanning and history):**
    - The Barcode Scanner is an open-source library from ZXing that allows an Android device with imaging hardware to scan barcodes or 2D barcodes and retrieve the data encoded.

Read Me for Deployment

1. To deploy the Attendance Tracker application, Android Studio must be installed on a computer.
    a. See this link to download Android Studio: https://developer.android.com/studio
2. A USB cable should be used to connect the physical device to the computer that Android Studio runs on.
3. Developer Options will need to be enabled on the Android device in order to put the Attendance Tracker application on it (see device manufacturer's steps for enabling this feature).
    a. See this guide for enabling Developer Options:

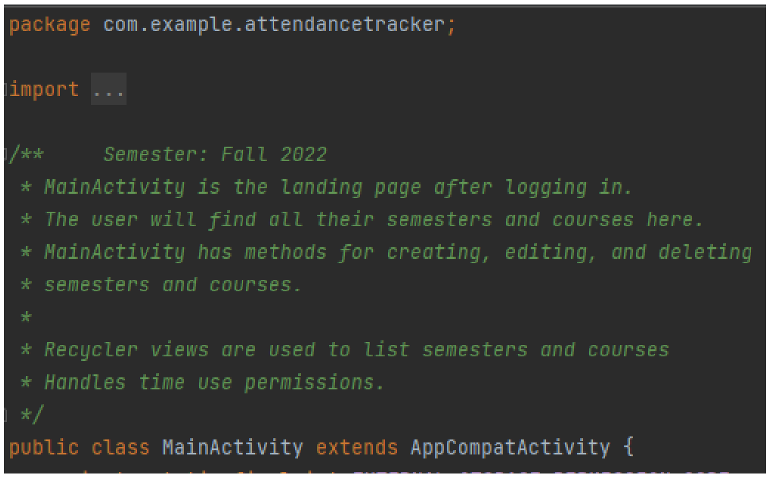
https://developer.android.com/training/basics/firstapp/running-app

4. Once Developer Options has been enabled, enable USB Debugging.
5. Run the Attendance Tracker application on the Android device. It will download the application to the device, where the device can now safely use the app, with or without a connection to Android Studio.
6. When the app is first run, the lecturer may get a pop-up dialog asking for certain permissions (e.g., read and write storage, network activity). These must be enabled in order to use the Attendance Tracker application.

8. Good Programming Practices

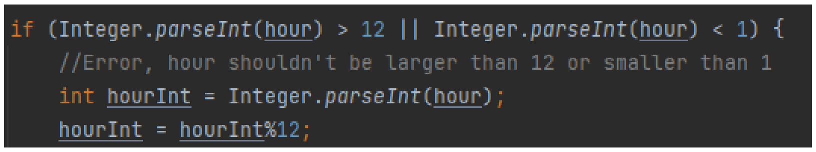
A. Comments

a. Header comment sections were added to the beginning of the main working classes in the project package. These explain the purpose of the class and any important information that is necessary to understand the class further.



```
package com.example.attendancetracker;

import ...

/**     Semester: Fall 2022
 * MainActivity is the landing page after logging in.
 * The user will find all their semesters and courses here.
 * MainActivity has methods for creating, editing, and deleting
 * semesters and courses.
 *
 * Recycler views are used to list semesters and courses
 * Handles time use permissions.
 */
public class MainActivity extends AppCompatActivity {
```

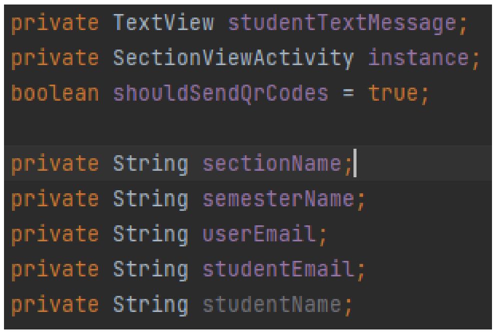
b. The code was written to be self documenting; however, this is not always reasonable for any number of reasons. When this is the case, comments are added to explain the following blocks of code.



```
if (Integer.parseInt(hour) > 12 || Integer.parseInt(hour) < 1) {
    //Error, hour shouldn't be larger than 12 or smaller than 1
    int hourInt = Integer.parseInt(hour);
    hourInt = hourInt%12;
```

B. Variable Declaration

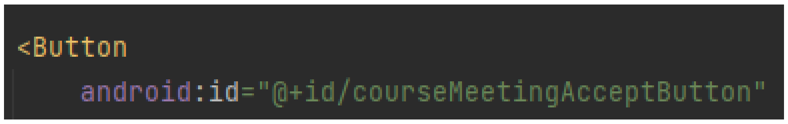
a. Variables were chosen carefully to help identify the purpose it held, and in some cases variables were named to identify their location and relevance in the code.



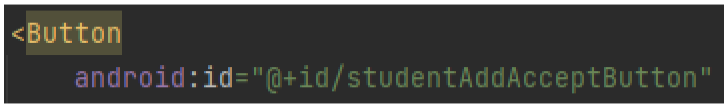
```
private TextView studentTextMessage;
private SectionViewActivity instance;
boolean shouldSendQrCodes = true;

private String sectionName;
private String semesterName;
private String userEmail;
private String studentEmail;
private String studentName;
```

b. XML id attributes were written to specifically identify its purpose and the activity that it is a part of. This was particularly important to distinguish different widgets and views that held the same functionality but were in different locations.

Two "Accept" buttons in two different dialogs



```
<Button
    android:id="@+id/courseMeetingAcceptButton"
```



```
<Button
    android:id="@+id/studentAddAcceptButton"
```

C. Code Reuse

a. Given the nature of the project, much of the code reuse consisted of reusing code from imported libraries. Many methods and other modules had specialized uses that did not allow for general reusability. However, code reusability was always considered when creating these modules.

b. Helper methods were created within classes that could be used outside of its context. For example, the parseTime method in SectionViewActivity takes any String of numeric characters, including the colon ':' symbol, and converts it to an Integer array with two members, hours as [0] and minutes as [1]. This allows input Strings from EditText boxes to be converted so that it can be used with the database. This method is not coupled with the database directly, so this method could be used with any situation requiring the conversion of different String times to a tokenized Integer representation.

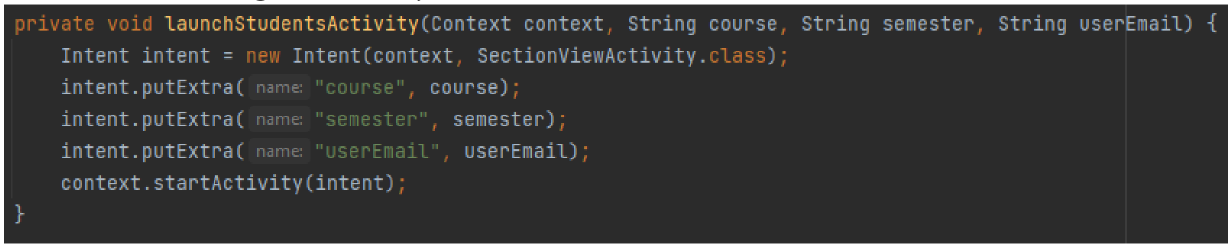
c. QRCodeOperator class is the helper class that creates QR codes. The parameter in the constructor method is a String called studentEmail.

This parameter name represents the intended input, but the class can create a QR code representing any String. This allows the class to be reusable for other purposes, such as a URL.

D. Data Hiding/ Encapsulation

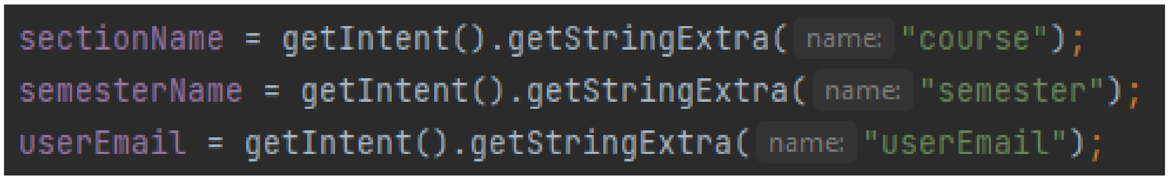
a. Each class has different private attributes within it and methods that act on them within the class. In the context of this project, communication between classes of the application are done through Android intents. Therefore, information between classes in the Attendance Tracking System are shared explicitly and programmatically. Intents use a key-value pair system to access information from the previous activity.

Launching next activity with intent extras



```
private void launchStudentsActivity(Context context, String course, String semester, String userEmail) {
    Intent intent = new Intent(context, SectionViewActivity.class);
    intent.putExtra( name: "course", course);
    intent.putExtra( name: "semester", semester);
    intent.putExtra( name: "userEmail", userEmail);
    context.startActivity(intent);
}
```

Accessing intent extras using their corresponding keys



```
sectionName = getIntent().getStringExtra( name: "course");
semesterName = getIntent().getStringExtra( name: "semester");
userEmail = getIntent().getStringExtra( name: "userEmail");
```

E. Cohesion/Coupling

a. All modules within our project have at least procedural cohesion. Some modules perform a series of actions related by the procedure to be followed by the product.

b. All modules within our project have at least common coupling. Some modules have write access to global variables; however, modules do not have write access simultaneously.

9. Team Member Contribution:

Team Member	Requirements	Design (Diagrams and Modeling)	Presentations and Documents	Implementation	Testing
Eric Bradshaw	x	x	x	x	x
Luke Bushur	x	x	x	x	x
Vadim Zadubrovskiy	x	x	x	x	x