Criterion B: Design

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Design Overview

Language:

The language chosen to develop this software is Java programming language with JavaFX library, and FXML language is used to create GUI.

Data Inputs from the User:

The following data are required to be inputted from the user before making room allocations.

Data Field	Description	Data Type
Username	The name set by the client for login	String
Password	Password set by the client for login	String
Room No./Names	The numbers or names of all rooms and the buildings number or names they belong to	String
Maximum Capacity of all rooms	The maximum number of people who can live in each room	int
Type of all rooms	Whether it's a boy's room or girl's room	String
Students' names	Family names and given names of all students	String
Students' sex	Whether a student is male or female	String
Students' nationalities	Countries which all students are from	String

User Interfaces Design:

The following screen layouts are designed with **Balsamiq Cloud**[1].

Figure 1. Login Window

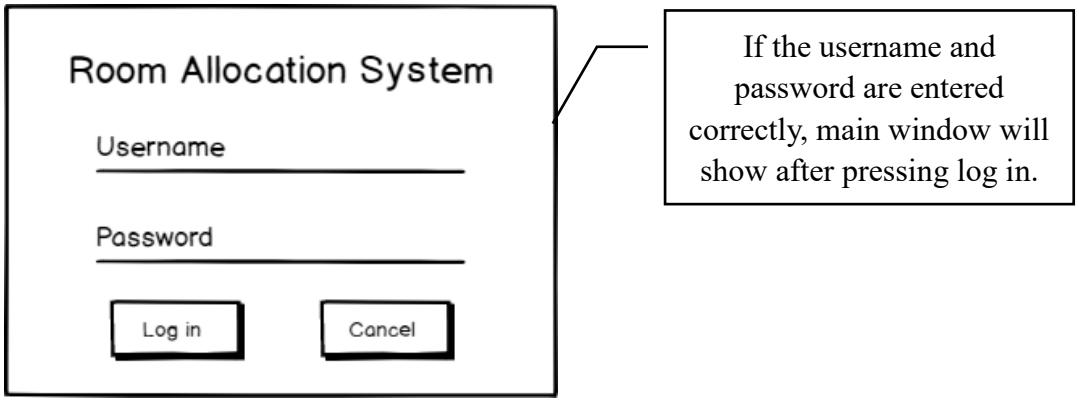
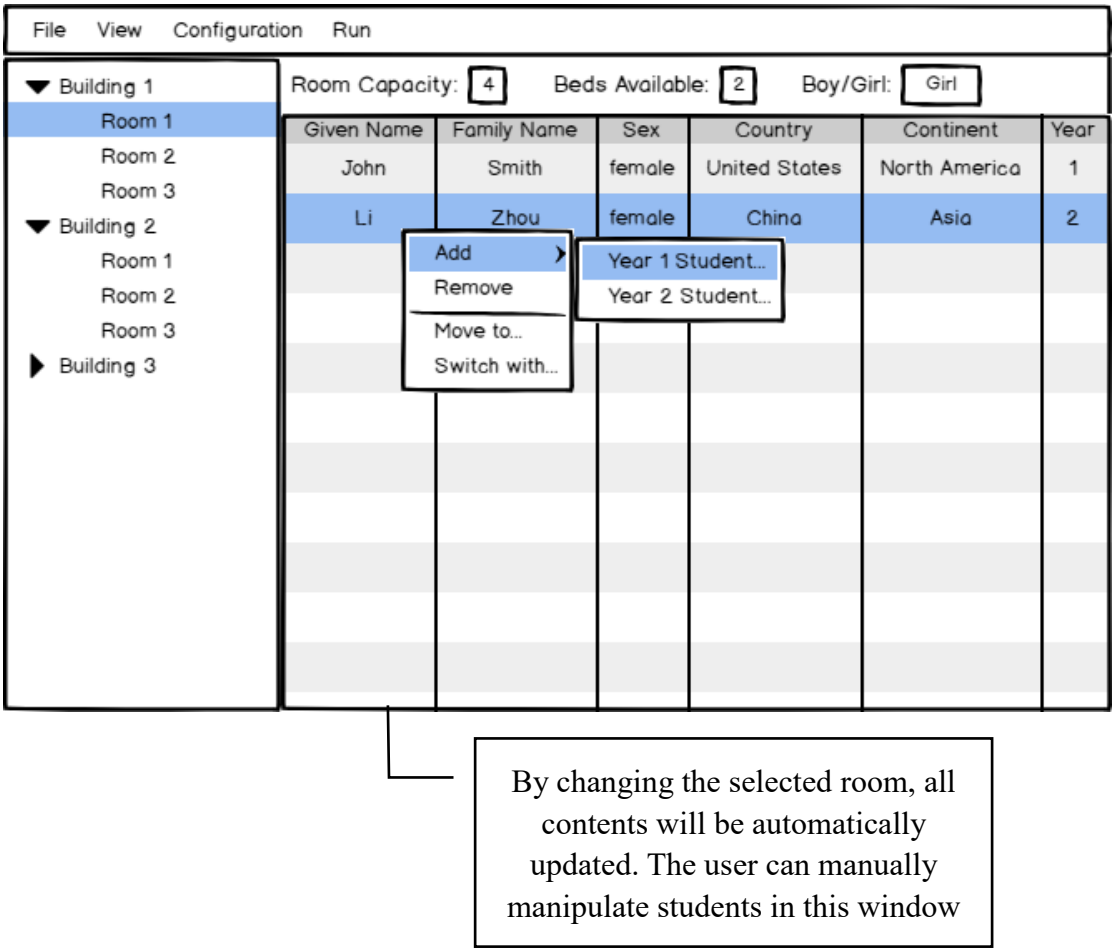


Figure 2. Main Window



[1] https://balsamiq.com/

Figure 3. Room Configuration Window

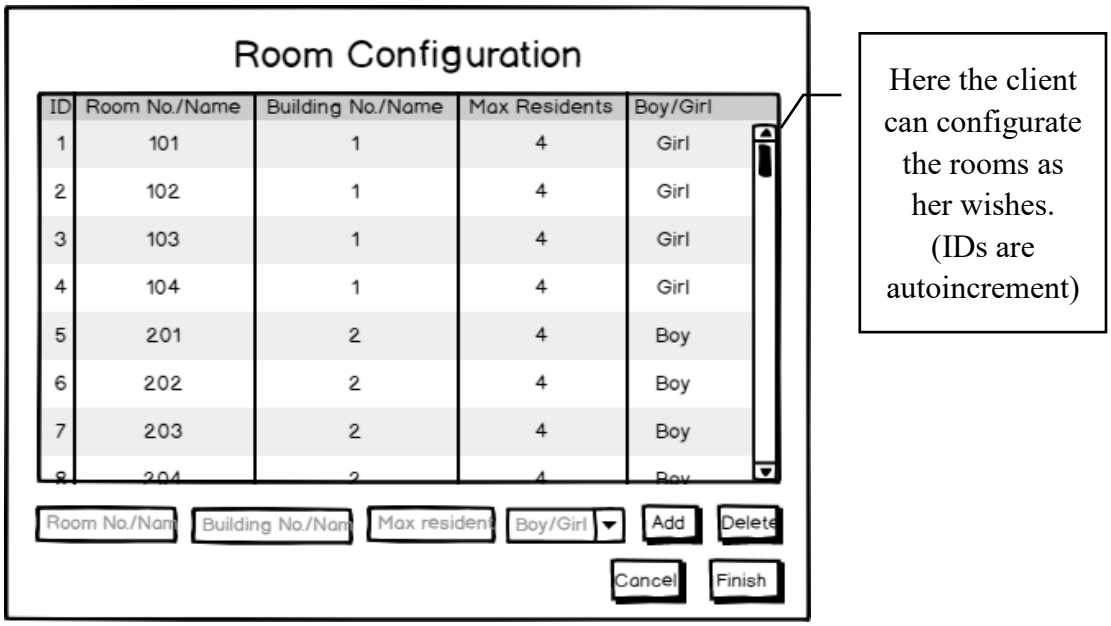


Figure 4. Student Upload Window

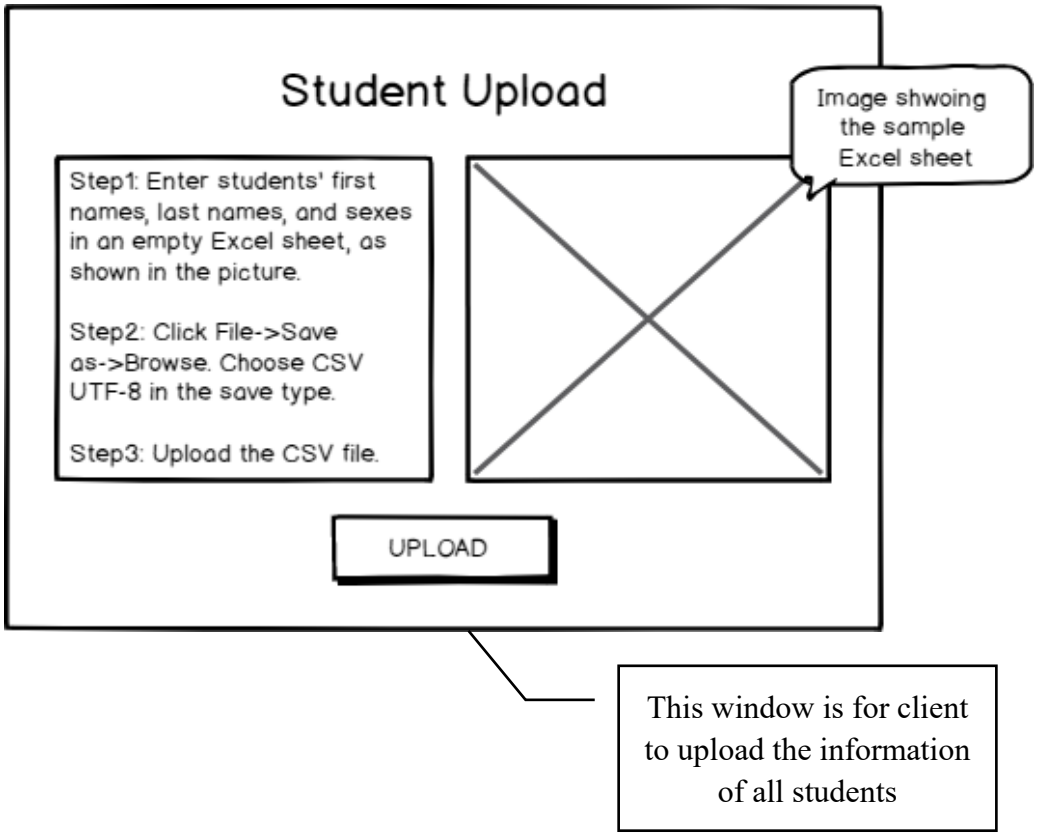
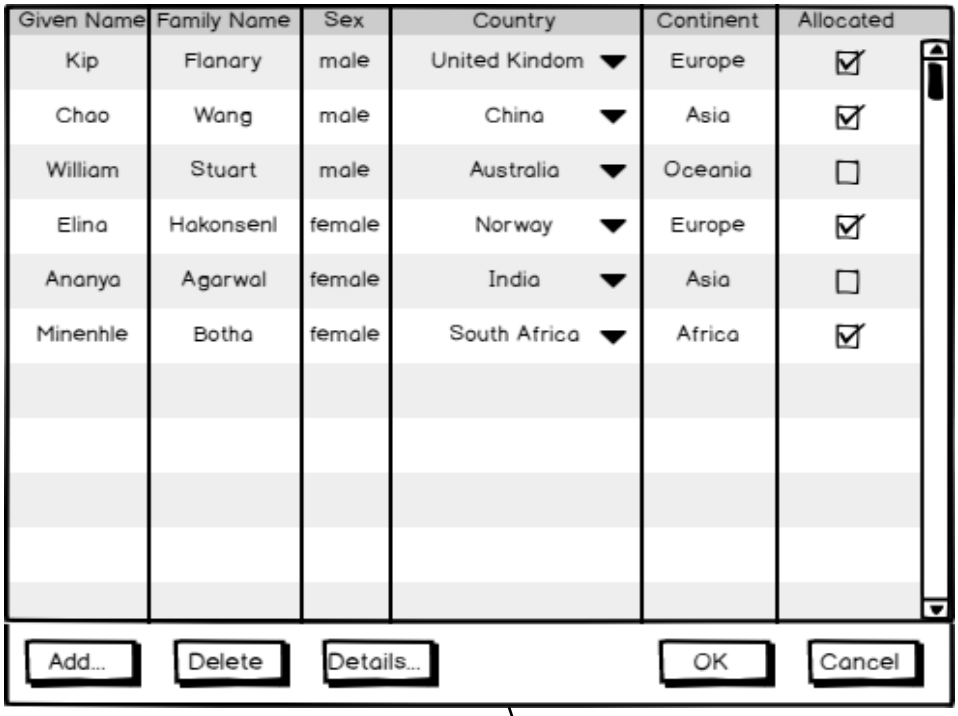
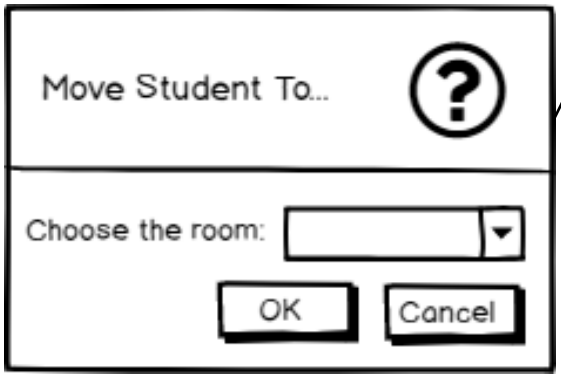


Figure 5. Student Configuration



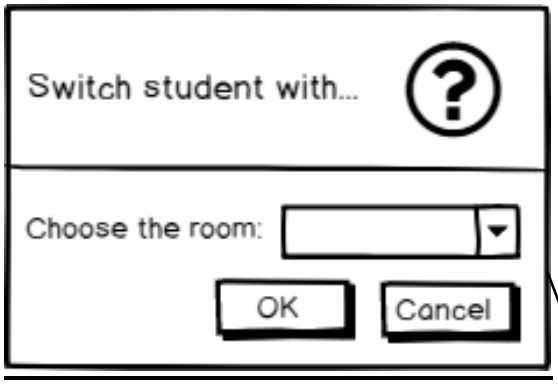
Here the client can modify the student info, and check whether students are allocated, and where is the student allocated.

Figure 6. Move Student Window



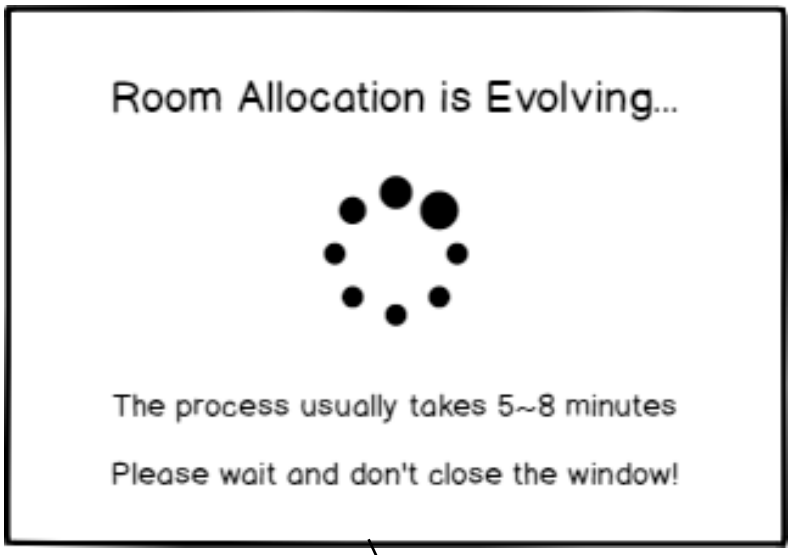
By clicking the "Move To…" in the Main Window, this window will pop up and all room that correspond with the sex of the chosen student will be added into the ComboBox.

Figure 7. Switch Student Window



By clicking the "Switch with…" in the Main Window, this window will pop up and all room that correspond with the sex of the chosen student will be added into the ComboBox.

Figure 8. Running Genetic Algorithm Animation



This window will automatically pop up while genetic algorithm is running in the background thread to allocate room. Once the allocation is done, the spinner will change to a tick, telling the client that the allocation is done.

Classes Design:

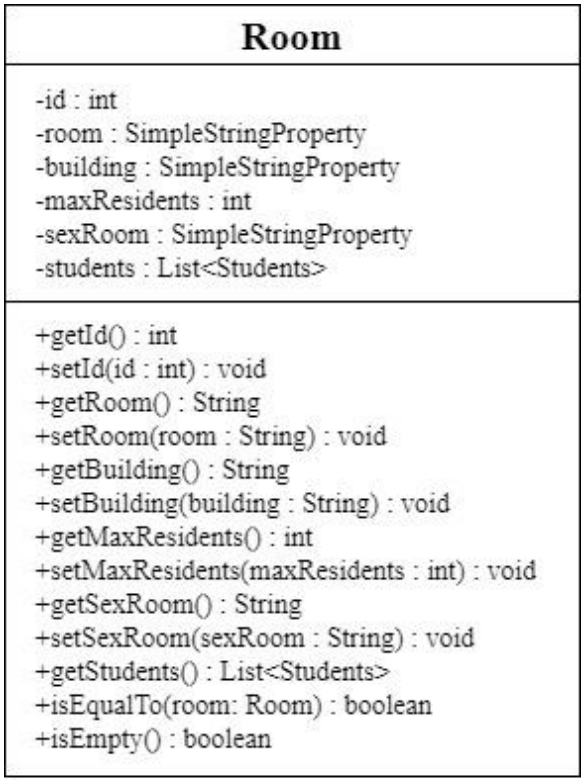
The software is designed with JavaFX. Therefore, there are a lot of different controller classes, each handling the functionality within one Stage (Window), and there are also some functional classes to provide other functionalities.

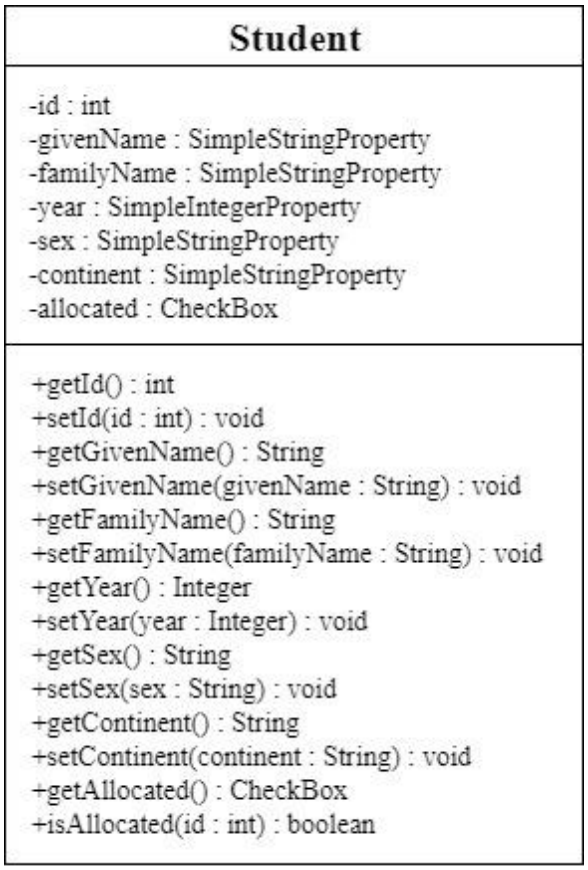
Package Name	Class Name	Functionalities
/	Main	➢ The entry of the program ➢ Connect the software to Database ➢ Read the last opened file
GA	DNA	➢ Represent an allocation (the list of all Rooms that contain students) ➢ Calculate the fitness of this allocation ➢ Mutation (make changes in the current allocation)
GA	Population	➢ Contains 1000 DNAs ➢ Select next generation of 1000 DNAs based on their fitness ➢ Apply mutation with specific mutation rate to each selected DNA ➢ Evaluate whether the evolution should stop and output the result
functional	AutoComplete ComboBox	➢ An imported class, to make selcteCountry ComboBox autocomplete
functional	HandleButton	➢ Handle all the “next”, “cancel” buttons
functional	Room	➢ Container of properties of a room
functional	Student	➢ Container of properties of a student (Country is of ComboBox type for the purpose of TableView)

functional	StudentString	➢ Container of properties of a student (country property is of String type)
controllers.login	LoginController	➢ Show the login screen and check if the username and password are correct. ➢ If correct, show the main window.
controllers.main	MainController	➢ Show the main window ➢ Controls all the actions that happen through it
controllers.main	AddYear1Student Controller	➢ Show the list of unallocated first-year students that matches with the sex of the chosen room. ➢ Add the chosen student into the chosen room
controllers.main	AddYear2Student Controller	➢ Same with above except the students are second-year students.
controllers.main	SwitchStudents Controller	➢ Switch the chosen student in another room with the chosen student in this room.
controllers.main	RunningGA Controller	➢ Show the process indicator while the genetic algorithm is allocating rooms in the background thread.
controllers.main	ShowUnallocated StudentsController	➢ Show the list of unallocated students before starting allocation. ➢ Ask the user for confirmation to start allocation
controllers.newFile	Directory Controller	➢ Show the window for entering new file name and choosing its directory
controllers.newFile	RoomConfig Controller	➢ Show the window for configuring student rooms

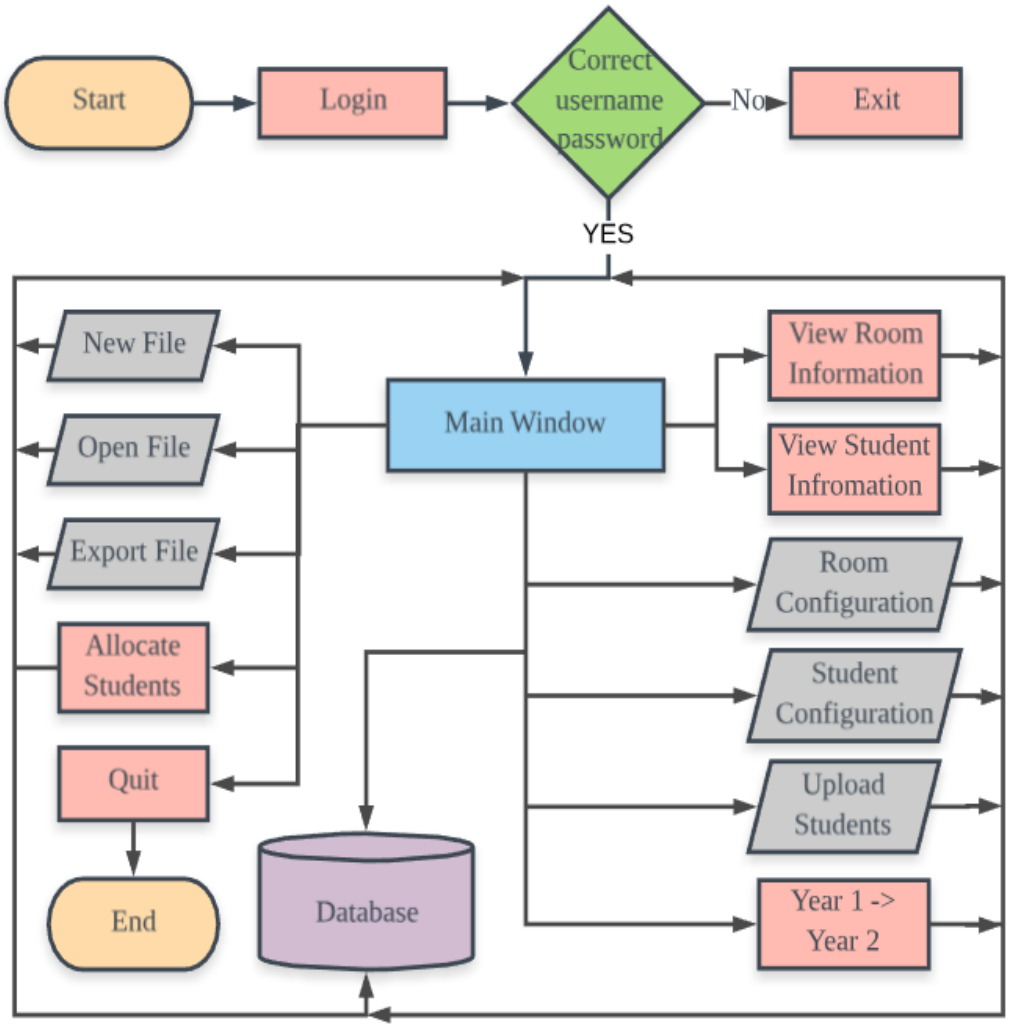
controllers.newFile	StudentConfig Controller	➢ Show the window for uploading student CSV files including their name and sex
controllers.newFile	StudentConfig2 Controller	➢ Show the window for choosing students nationalities in ComboBoxes. ➢ Map the students' nationalities to the continents they are from
controllers.view	RoomController	➢ Show the number of rooms and beds for boys and girls.
controllers.view	StudentController	➢ Show the number of boys and girls and totoal number of students
controllers. configuration	AddOrDelete RoomController	➢ Show the window for adding or deleting student rooms
controllers. configuration	UpdateRoomInfo Controller	➢ Modify room No./Names, building No./Names, Max Residents, and Boy/Girl.
controllers. configuration	Year1Student Controller	➢ Add/Delete Year 1 Students ➢ Modify names, sexes, countries, and continents of Year 1 students.
controllers. configuration	Year1StudentAdd ClickedController	➢ Create a pop-up window for adding new Year 1 student
controllers. configuration	Year2Student Controller	➢ Add/Delete Year 2 Students ➢ Modify names, sexes, countries, and continents of Year 2 students
controllers. configuration	Year2StudentAdd ClickedController	➢ Create a pop-up window for adding new Year 2 student
controllers. configuration	UploadYear1 StudentController	➢ Override the existing Year 1 student by uploading new students file.
controllers. configuration	UploadYear2 StudentController	➢ Override the existing Year 2 student by uploading new students file.

Designed UML Diagram for Room Class and Student Class





System Flowchart



Test Plan

Before releasing the software to the client, the software should go through alpha testing first to detect and identify all possible bugs. Therefore, I have made the following test plan to ensure the functionality of the software.

Test No.	Test Name	Test Purpose	Testing Method	Expect Outcome
1	Login Test	To ensure the login system is working correctly	1. Enter the wrong username and password. 2. Enter the correct username and password.	1. Does not log in 2. Logs in
2	Create New File Test	To ensure the client can create new file	Go through the process of creating a new file.	No error message is displayed; all data are updated in the database
3	Open File Test	To ensure that the client can open another file	Go through the process of opening a file	No error message is displayed; new data are being updated from the new database file
4	Export Test	To ensure that the client can export data to Excel sheet	Click “File” -> “Export to Excel File” in the main window	The created Excel sheet should have the exact same allocation as displayed in the software
5	Room Config Test	To ensure that rooms can be configured at any time	Try complex configurations combination at the same time.	All changes should be updated properly without throwing error messages
6	Student Config Test	To ensure that students can be configured at any time	Try complex configurations combination at the same time.	All changes should be updated properly without throwing error messages

7	Context Menu Test	To ensure that “Add”, “Delete”, “Move to”, and “Switch with” functionalities in the context menu are working properly	Try each function multiple times with students from different rooms.	All changes should be updated properly without throwing error messages
8	Allocation Test	To ensure that the Genetic Algorithm is working to optimize for the diversity in all rooms	Run the allocation for 10 times. After each time, check all the rooms for their diversity.	In most of the rooms all students are from different countries and no more than 2 students are from Asia. In each room no more than 2 students are from the same country.