Build a mobile application for the Hostel Allotment problem:
1. Problem overview
2. User stories (for the student app)
3. Mindmap
4. UI design (wire frames showing the sequence of steps)
5. Suggests for implementation

PROBLEM OVERVIEW

The Hostel Allotment Project is an attempt to streamline and automate the process of room assignment for college students. Hostel Allotment is an event that takes place every year and involves a very large number of students. It is an important part of the students' college stay since it decides the group of people that they will be interacting with on an almost daily basis. As such, this project aims to help the students to ensure that they are satisfied with their choice of wing, wingmates and room and will be comfortable spending their next few years there.

As a mobile application, the project will enable students to interact with it at any place and at any time, thus adding an additional level of comfort.

The Hostel Allotment Process

The hostel allotment process is divided into three rounds and each round is divided into three segments.

Definitions

Group Representative: A group representative is the leader of the group. He/she has powers/responsibilities that the group member does not have.

Group Member: A group member is simply a part of a group.

Group Size Requirement: The size of a wing is the number of students that the wing can accommodate. To be a valid group so as to be considered for allotment, the size of a group must match one of the available wing sizes. This is the group size requirement.

Freezing a group: Once a group is frozen no new members can join the group and no current member can leave the group.

Hostel Layout

Throughout the hostel allotment process, all the students are able to see layouts of all the hostels that are available to them. The layout of every hostel is divided into floors. Each floor has several wings. The availability and size of each wing (the number of students that it can accommodate) is visible.

Prerequisites

1. All students must register on the mobile application.

Round 1

Segment 1: Group Formation
1. Each student has the freedom to be either a group member or a group representative. This choice can be changed until the end of the first segment.
2. Group representatives can send membership requests to students who have chosen to be group members, but are not yet part of any group. The student joins the group as soon as the request is accepted.
3. Students who have chosen to be group members, but are not yet part of any group, can send membership requests to group representatives to be a member of their group. They become members of that group as soon as the request is accepted.
4. If the group size requirement is met, then the group representative can initiate a request to freeze the group. The group is frozen if all members accept the group representative's request. All the groups that satisfy the group size requirement, but are not yet frozen, will be automatically frozen at the end of segment 1.
5. Before a group is frozen, a group member can leave the group by sending a request to the group representative. If the request is accepted, the student is no longer a member of the group.

After the end of segment 1, those groups that do not satisfy the group size requirement (and hence, are not frozen) are not considered for subsequent segments of the current round. The members of these groups must participate in group formation in the second round.

Segment 2: Wing Preferences
1. Each group representative whose group has been frozen can submit up to 3 different wings that their group would like to occupy in order of preference. The size of every wing that is given as a preference must be equal to the size of the group.
2. After the deadline for segment 2, the following algorithm (Wing and Room Allotment) is executed.

Wing and Room Allotment Algorithm:
1. A random permutation of all the groups that have submitted a valid wing preference is created. For example, let the groups that have submitted a valid wing preference be - $g_1, g_2, g_3, ..., g_{20}$. Then a random permutation could be - $g_{16}, g_4, g_8, ..., g_{13}$.
2. Sequentially, the groups in the random permutation are assigned their highest available preference. If none of their preferences are available, then they are randomly assigned a wing of the correct size. If there is no unoccupied wing whose size matches the size of their group, they are not assigned a wing. Members of such groups must try again in round 2.
3. Now, the groups that have not submitted a valid wing preference are considered. A similar random permutation is created and they are randomly assigned a wing of the correct size. If there is no unoccupied wing whose size matches the size of their group, they are not assigned a wing. Members of such groups must try again in round 2.

4. The members of the groups that have been assigned a wing are randomly assigned a room within the wing.

Segment 3: Room and Wing Swap
1. All members (group members and group representatives) of a group which has been assigned a wing after segment 2 can submit requests to other students in the same wing to exchange rooms with them. If the request is accepted, their rooms are swapped.
2. A group representative can submit wing swap requests to other group representatives who have been assigned a wing in this round if they both have the same wing sizes. If the request is accepted, the wings are swapped.
3. A group cannot now make a request to swap their current wing with a wing that is unoccupied, regardless of whether the wing sizes are the same or not. This is because the group could easily have obtained that wing by giving it as their highest preference.

All the groups that have been assigned wings will not be considered for the second and third rounds.

Round 2:
All the students who have not been assigned a room in round 1 can participate in round 2. Participating students can choose whether they want to be group members or group representatives, irrespective of their choice in round 1.

All the steps of round 1 are repeated again.

Round 3:
All the students who have not been assigned a room in round 2 can participate in round 3. Participating students can choose whether they want to be group members or group representatives, irrespective of their choice in round 2and round 1.

Group Formation (segment 1) and wing preferences (segment 2) of round 3 are the same as that of round 1.

Wing and Room Allotment Algorithm for round 3:
1. After the random permutation and wing allotment, some groups might still not have been assigned a wing. These students, along with those who have not yet been assigned a room (for any reason), are considered here.
2. All these students will now be randomly assigned wings and rooms out of those that are still unoccupied. After this, all students have been assigned rooms and wings.
3. Each wing assigned in this manner is considered a new group and a randomly selected student is assigned as the group representative while the rest are group members. After this step, every student is part of some group and every group has a group representative.

Segment 3: Wing and Room Swapping
1. In this segment, in addition to being able to swap rooms within the same wing (like in rounds 1 and 2), the group representative can send a request to swap wings to representatives of all other groups, regardless of the round in which they were assigned the wing.
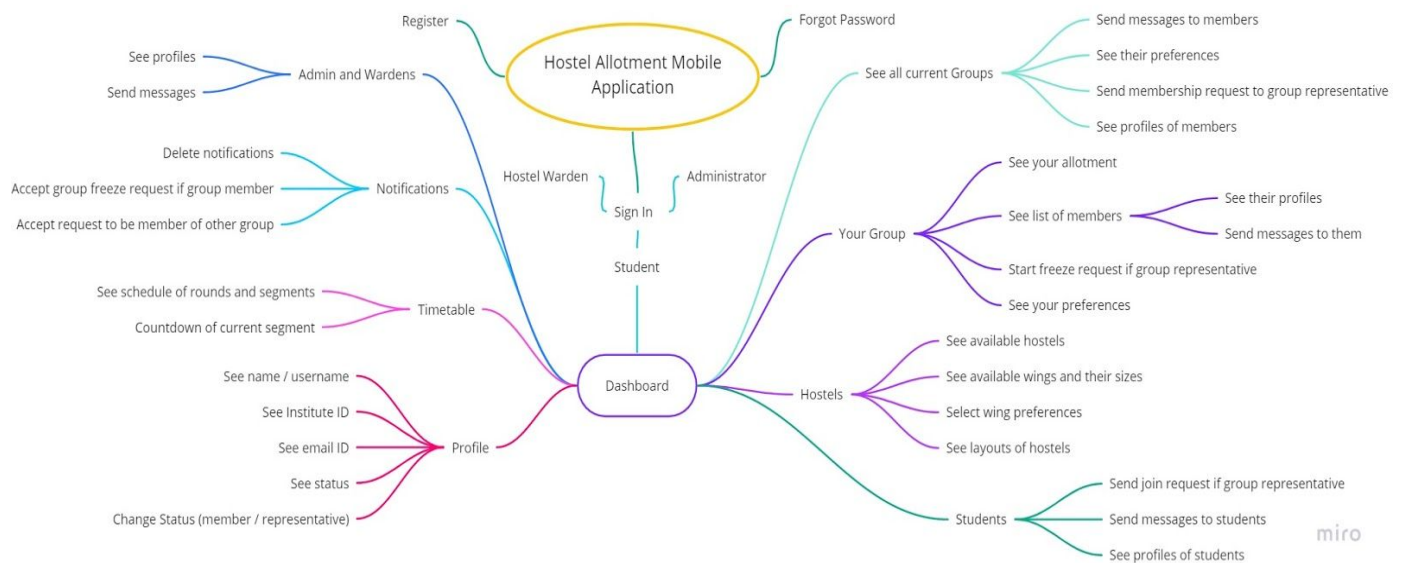
Apart from the students, the Hostel Wardens and the members of the administration also have access to the hostel allotment process.

Hostel Wardens: After each round the Hostel Warden can see which students have been assigned which rooms. They can send requests to the administration to reserve certain rooms/wings for various purposes.

Administrators: They can see the current state of the rounds (the groups that have been formed, the preferences of various groups, the rooms and wings that are occupied and empty) and also have the power to restrict certain rooms/wings from being available. This means that the selected room or wing will appear as unavailable to the students. In case there were already students occupying the wing/room, the assignment will be cancelled and they will once again be eligible for the next round. (In case this happens in the third round the students will randomly be assigned available rooms).

UI DESIGN (WIREFRAMES)

MIND MAP

Mind map: Hostel Allotment Mobile Application

- Register
- Forgot Password
- Admin and Wardens
  - See profiles
  - Send messages
- Hostel Warden
- Administrator
- Sign In
- Student
- See all current Groups
  - Send messages to members
  - See their preferences
  - Send membership request to group representative
  - See profiles of members
- Notifications
  - Delete notifications
  - Accept group freeze request if group member
  - Accept request to be member of other group
- Your Group
  - See your allotment
  - See list of members
    - See their profiles
    - Send messages to them
  - Start freeze request if group representative
  - See your preferences
- Timetable
  - See schedule of rounds and segments
  - Countdown of current segment
- Dashboard
- Hostels
  - See available hostels
  - See available wings and their sizes
  - Select wing preferences
  - See layouts of hostels
- Profile
  - See name / username
  - See Institute ID
  - See email ID
  - See status
  - Change Status (member / representative)
- Students
  - Send join request if group representative
  - Send messages to students
  - See profiles of students

USER STORIES

1. As a student I want to be able to login to my account so that I can be allotted a room. (acceptance criteria includes registration, forgot password, sign-in)
2. As a student I want to be able to see which groups have which members so that I can decide which group I want to be in.
3. As a student I want to be able to send messages to Admins and Wardens so that I can clarify any doubts.
4. As a student I want to be able to see the schedule of rounds and segments so that I do not miss any deadlines.
5. As a student I want to be able to see the layouts of the hostels and wings so that I can decide the wing preferences.
6. As a group member I want to be able to send membership requests to group representatives so that I can become part of their groups.
7. As a group representative I want to be able to send membership requests to students so that they can become part of my group.
8. As a group representative I want to be able to send a request to freeze my group so that I can restrict people from joining and leaving.
9. As a student I want to be able to see the number of students that each wing can accommodate so that I know what the size of my group should be.
10. As a student I want to be able to send messages to other students so that I can collaborate with them.
11. As a student I want to be able to change my status from group member to group representative and vice versa so that I can adapt to the changing requirements of the group formation process.
12. As a hostel warden I want to be able to see the progress of the rounds so that I can collaborate with the administration to quickly resolve any problems.

13. As a hostel warden I want to be able to send messages to students so that I can clarify their doubts.
14. As a hostel warden I want to be able to send messages to the administration so that I can collaborate with them.
15. As an administrator I want to be able to restrict certain rooms or wings from being part of the hostel allotment process so that I can reserve them for other purposes like for guests and parents or for storage.
16. As an administrator I want to be able to see the progress of the rounds so that I can collaborate with the wardens to quickly resolve any problems.