DU Estate Office Management Application
SRS Project
SE-406: Software Requirements Specification and Analysis

Submitted by

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Introduction

The Software Requirements Specifications (SRS) document outlines the functional and non-functional requirements of the DU Estate Office Management Application. This application aims to streamline various administrative tasks related to managing estate properties, including user management, allocation of resources, application processing, and financial management. The SRS provides a comprehensive overview of the system's functionality, intended audience, and key features to be developed.

Purpose

The purpose of this SRS is to serve as a blueprint for the development team, guiding them in the design, implementation, and testing phases of the DU Estate Office Management Application. By clearly defining the requirements and expectations of the system, this document ensures that all stakeholders have a common understanding of the project scope and objectives. Additionally, the SRS facilitates communication between stakeholders and developers, enabling effective collaboration throughout the software development lifecycle.

Intended Audience

The intended audience for this SRS includes stakeholders involved in the planning, development, and implementation of the DU Estate Office Management Application. This includes:

Development team: Software engineers, designers, and testers responsible for building and testing the application.
Estate management personnel: Estate managers, officers, and administrators who will use the application to streamline administrative tasks.
University employees: Teachers, staff, and officials who may interact with the system to apply for residency or access relevant information.
Syndicate members and treasurer: Stakeholders responsible for overseeing administrative processes and decision-making.
Vendors: Market vendors who will utilize the application for market tender applications, payments, and contract management.
Security guards: Personnel responsible for security-related tasks within the estate management system.

Renters: Individuals or organizations renting properties within the estate, involved in reservation and payment processes.
Other stakeholders: Any other parties involved in the development or usage of the DU Estate Office Management Application.

Conclusion

In conclusion, the Software Requirements Specifications document serves as a vital document in the development of the DU Estate Office Management Application. By outlining the system's functionality, purpose, and intended audience, this document provides a foundation for successful project execution. With clear requirements and objectives defined, the development team can proceed with confidence, knowing they have a comprehensive understanding of the project scope and goals. Ultimately, the SRS aims to ensure the successful delivery of a robust and user-friendly estate management system that meets the needs of all stakeholders involved.

Inception

Identifying the Stakeholders:

Direct Stakeholders:

Direct stakeholders are individuals or groups who are actively involved in the project, process, or system and directly interact with it. Their roles and responsibilities are clearly defined, and they are impacted by the system's operations, changes, and performance. Following are the direct stakeholders:

1. Estate Manager (Admin)
2. Estate Officer
3. Teachers
4. Staff
5. University Officials
6. Syndicate Members
7. Treasurer
8. Security Guards
9. Vendors (Market)
10. Renters (Senate) - Those responsible for reserving Senate Hall Building.

Indirect Stakeholders:

Indirect stakeholders are individuals or groups who do not interact directly with the system but are affected by its outcomes. They have an interest in the project's success or failure and can be impacted by the decisions and operations of the system. These stakeholders might not have specific roles within the system but their well-being or operations are influenced by its performance.

1. **Secretary (Senate):** Affected by the booking of Senate Hall via the application.
2. **University Students:** Affected by how well the university manages its estate and resources, which can influence campus life and housing availability.
3. **Families of University Employees:** Indirectly impacted by housing decisions and availability, which affects their living conditions.

4. **Prospective University Employees:** Interested in the quality and availability of housing as a factor in their employment decisions.
5. **Community Members:** Engage with university markets and attend events, impacted by the management of university facilities.
6. **Government and Regulatory Bodies:** Oversee compliance with housing standards and contractual obligations, indirectly affected by the system's adherence to regulations.
7. **Technology Providers:** Maintain the online payment gateway and other tech services, affected by system performance and any issues that arise.
8. **Service Providers:** Contractors and service providers affected by changes in contract management and payment processes.
9. **Alumni:** Might interact with university facilities for events or housing, indirectly impacted by system efficiency and management.
10. **External Auditors and Consultants:** Need access to system data for audits and compliance checks, indirectly affected by the system’s data accuracy and transparency.

The Reason It Exists

The development of the DU Estate Office Management Application and its accompanying Software Requirements Specification (SRS) is driven by several key reasons aimed at addressing existing challenges and optimizing the operations of the estate office. Below are the elaborations and explanations of why software automation is crucial for the DU Estate Office:

1. Efficiency and Productivity Improvement

Current Challenges:

Manual Processes: Many tasks are performed manually, leading to inefficiencies and delays.
Resource Allocation: Assigning and managing resources such as staff, security guards, and vendors can be time-consuming without automation.
Benefits of Automation:

Streamlined Operations: Automation of routine tasks such as user management, application processing, and building management significantly reduces the time required to complete these tasks.
Optimized Workflow: Automated assignment and notification systems ensure that tasks are allocated and communicated efficiently, reducing idle time and increasing productivity.

2. Enhanced Accuracy and Data Management

Current Challenges:

Human Error: Manual data entry and processing are prone to errors, which can lead to incorrect allocations and mismanagement of resources.
Data Consistency: Maintaining accurate and consistent records is challenging without a centralized system.
Benefits of Automation:

Error Reduction: Automated data entry and processing minimize human errors, ensuring more accurate records and reliable information.
Centralized Database: A unified system provides a single source of truth for all data, enhancing consistency and reliability across the estate office's operations.

3. Improved User Experience

Current Challenges:

Limited Access: Users face difficulties in accessing information and services in a timely manner.
Cumbersome Processes: Lengthy and complex procedures for applications, reservations, and payments can frustrate users.
Benefits of Automation:

Self-Service Capabilities: Users can access information, submit applications, and make payments online, providing convenience and improving their overall experience.
Real-Time Updates: Automated notifications and updates keep users informed about the status of their requests and applications, enhancing transparency and satisfaction.

4. Enhanced Security and Compliance

Current Challenges:

Unauthorized Access: Manual systems make it difficult to control and monitor access to sensitive information.
Regulatory Compliance: Ensuring compliance with relevant regulations and policies can be complex without automated checks and balances.
Benefits of Automation:

Access Control: Role-based access control (RBAC) systems ensure that only authorized users can access certain information and perform specific actions.
Audit Trails: Automated systems can generate detailed logs and reports, making it easier to demonstrate compliance with regulatory requirements and internal policies.

5. Scalability and Future-Proofing

Current Challenges:

Scalability Issues: Manual systems struggle to cope with increasing volumes of data and growing user demands.
Future Enhancements: Integrating new features and capabilities into existing manual processes is challenging.
Benefits of Automation:

Scalable Infrastructure: An automated system can scale to accommodate more users, data, and functionalities as the needs of the estate office grow.
Flexibility for Future Enhancements: The system can be designed to integrate future technologies and features, such as 3D views, AI chatbots, and machine learning recommendations, ensuring it remains relevant and effective over time.

Quality Function Deployment

Stakeholders:

1. Estate Manager (Admin)
2. Estate Officer
3. Teachers
4. Staff
5. University official
6. Syndicate Members
7. Treasurer
8. Security Guards
9. Vendors(Market)
10. Secretary(Senate)
11. Renter(Senate)

Normal Functionality

- **User Management:** The estate manager can create new user accounts, assign roles and permissions, and manage existing user data. This ensures authorized access and proper user control within the system.
- **Estate Officer Activity:** The estate manager can assign estate officers to specific activities within the system, optimizing workflow and resource allocation.

- **Allocating Security Guards:** Estate office employees can maintain and update the database for allocating security guards, ensuring accurate and up-to-date information.
- **Application Management:** Estate office employees can view pending applications from teachers and staff for vacant residents, manage approval processes, and notify accepted applicants.
- **Building Management:** Estate office employees can manage all details of buildings within the territory, including details and occupancy status.
- **Apartment Assignment:** Following syndicate meeting decisions, estate office employees can assign apartments to accepted applicants for residence.
- **Senate Building Reservations:** Estate office employees can review applications for Senate Building reservations and approve them based on predefined guidelines.
- **Reservation Management:** Estate office employees can manage reservations, including accepting, rescheduling and canceling reservations made by renters.
- **Vendor Management:** Estate office employees can manage all relevant information about vendors and the marketplace, including contracts, payments, and communication.
- **Recruitment Management:** Estate office employees can update and manage information related to new employee recruitment.

Expected Functionality

- **Payment History:** Estate office employees can access and view the payment history of vendors and renters, enabling efficient financial tracking and management.
- **Meeting Management:** Estate office employees can update details and information related to meetings, facilitating clear communication and organization.
- **Tender Management:** Estate office employees can update and manage details related to tenders, ensuring smooth and transparent processes.
- **Account Setup:** Estate office employees can set up their accounts within the system after initial creation by the estate manager.
- **Duty Assignment Notification:** Estate office employees will receive notifications from the estate manager regarding their assigned duties, promoting efficient workflow.
- **Vendor Account Setup & Credentials:** After receiving a tender, vendors will be notified with unique credentials for setting up their accounts within the system.
- **Online Payment:** Vendors and renters can make payments and update their rent conveniently via an online platform.
- **Vendor Contract Management:** Vendors can initiate processes for contract cancellation and renewal within the system.
- **Payment and Contract Irregularity Alerts:** Vendors will be notified promptly concerning any irregularities in payments or contracts, ensuring timely resolution.

Exciting Features (for future consideration)

- **3D Apartment Views:** Teachers and staff can access a 3D view of vacant apartments, providing a more immersive and informative search experience.
- **3D Shop Views:** Vendors can access detailed information and a 3D view of their desired shops, facilitating informed decisions during the tender process.
- **Shop Tender Applications:** Vendors can directly apply for available shop tenders through the system, streamlining the application process.
- **Machine Learning Recommendations:** Based on user profiles, a Machine Learning model can suggest suitable apartments to teachers and staff, personalizing the search experience.
- **AI Chatbot Assistant:** An AI chatbot can provide an overview of recent updates, extract relevant public information, and offer guidance within the app, enhancing user experience and accessibility.

Usage Scenario of DU Estate Office Management Application

User Authentication

All users of the estate office's automated system, including service providers and consumers, are required to have a unique profile that serves as their account and allows them to continue and communicate during any kind of procedure. Syndicate Members/Treasurer, Vendor, Estate Manager (Admin), Estate Office employees, and University Employees are the five categories into which the profile will be divided based on users' viewpoints within this system.

1. Estate Office Employees

Employees of the estate office are mostly in charge of managing the entire estate office management application. They would have a separate user profile where their accounts would previously be created by the administrator (Estate Manager). They can access it with the given credentials provided by the admin or change the password to further enhance their security. The administrator will decide who has access to the software and at what level for each estate employee. The administrator will use their recruitment CV to fill in the required information.

2. University Employees

Additionally, university employees will have exclusive access to the EOMA. To apply for residency, modify or withdraw from their current residence, they must log in with their individual DU website account. A separate interface will be displayed to them.

3. Syndicate Members/Treasurer

They can log in to the system through their DU account. Estate manager marks syndicate members and treasurer into the system so that they can receive necessary notifications.

4. Vendor

The administrator will give the vendor the login information they need to pay the invoice and renew the contract after the deal is finalized. Vendors can request a contract renewal, termination or transfer. If the vendor wants to transfer the contract they should pay a transfer fee after the application has been accepted.

5. Estate Manager(Admin)

As the admin is in charge of the whole system, this account holder (Estate Manager) type is pre-set while the system is built and maintained cohesively and consistently.

Usage Scenario of Estate Office Employees

Employees of the estate office are responsible for maintaining all office operations and the estate office's workload. Each employee has a task allocated to them, which they can view, and the task assigned changes every time.

- **Security**

    I. Maintain the database for all employees related to security tasks.

- **Market**

    I. Validating vendor related information and their applications.
    II. Validating the tender part of the markets.
    III. Validating the process of renewing the contract.

- **Allocation of vacant flats and Senate Building**

    I. Arrange (sort) the applicants according to their points (priority).
    II. Inform the applicants of any available flats based on the sorting.
    III. Assign the applicants' apartments in accordance with the decisions made during the syndicate meeting.
    IV. Gathers the application for the Senate Building reservation.
    V. Handle those applications and inform applicants of their approval or rejection of reserving the Senate Building, along with the reason.
    VI. Manages the payment for the Senate Building reservation.

Usage Scenario of University Employees:

University employees can apply for residency, change their current residence, or leave their current residence.

- **Apply for flat**

University employees can apply to be tenants. There are four classified types of buildings for residence in the DU area - Teachers only, teachers and university officials, university officials only and staff only including technical and non-technical staff. Interested applicants can view the buildings and flats available to them and apply for that particular residency, but they can not apply for flats outside their availability. Their applications will be sorted using a point based sorting system that follows the following steps-

I. Joining date (2 points per year in service)
II. Basic Salary (1 point per hundred taka)
III. Designation (point according to designation)
IV. Previous Government Job (1 point per year in service)
V. Marital Status (3 points if married)

Apart from that, if their spouses are also active service holders in the university, fifty percent of their spouses (junior one) points get added to seniors total points.

There is another general classification of flats, that is standard flats (1000 sq ft or above) and sub-standard flats (below 1000 sq ft). Employee husband-wife can not apply for a sub-standard flat.

University employees can also choose which territory or which buildings they prefer to stay in. If, by the points metric system, they fail to get that desired building, they are not given any allocation in that span. Also, employees can choose the number of rooms they want in the flat and specify the floor number.

Apart from all these, there's still a provost complex and many bungalows that are allocated for university employees. However, to apply for these, no general rule will follow. Only Treasurer and syndicate members have the authority to allocate these residences to their preferences.

They can also view standings in order of points based sorting.

- **Flat View**

University employees can view the details of a flat, including a full 3D view.

- **Notification**

University employees will get individual notifications regarding the allocation of vacant flats if they have applied for those flats.

Usage Scenario of Syndicate Members/Treasurer

- **Arrange Meeting**

Syndicate members/Treasurers will be able to arrange meetings related to the allocation of vacant flats.

- **Notification**

Syndicate members/treasurer will get notifications about the details of their meetings.

Usage Scenario of Vendors

Vendors are able to view information, apply for open markets, and make bill payments.

- **Specifications of the Markets**

Vendors have access to information about market availability as well as specifics like location, size and area, and potential rent. Additionally, they have a 3D view of the markets.

- **Apply to Available Markets**

For a chance to be chosen for a tender, vendors can apply for open markets. Currently, the DU estate office has 15 mobile shops, 372 shops in Katabon Market, and roughly 159 shops in Green Super Market. Vendors must guarantee a cautionary deposit to the estate office upon receiving a contract for a specific shop.

- **Contract management**

Vendors can terminate their contract and their caution money will be refunded back to them. However, there is also an option to transfer vendorship. In that case, a transfer fee of 100k needs to be paid to transfer the vendorship to another vendor. The other vendor's details also need to be validated by the Estate Office Employees.

- **Payment**

Vendors can pay their rent on the system, but they will pay using SSLCommerz gateway to use online banking through card or mobile banking.

- **Notification**

Regarding the contract or auction for the tender they requested, vendors will be notified.

Usage Scenario of the Estate Manager (Admin)

As an Estate Manager and System Administrator,
He/she can create user accounts, assign roles and permissions, and manage user data so that only he/she has control system access and ensure only authorized users can perform specific actions.

- The system should allow the admin to create new user accounts.
- Admin should be able to define user profiles with relevant information such as name, department, and contact details.
- The system should provide a role-based access control system (RBAC).
- Admin should be able to assign specific roles to users, such as Teacher/Staff, vendors, Estate Office Employees etc.
- Each role should have predefined permissions that determine the functionalities a user can access within the system.
- Admin should be able to view and edit existing user information and assigned roles.
- The system should allow the admin to disable or delete user accounts if necessary.
- Estate manager creates a recruitment notice for available posts in the Estate Office that will be posted on the notice board.
- Estate manager can allocate estate office employees to their specific tasks for that particular day.

Usage scenario of Renter

Senate Hall reservations are done by renters. Senate hall consists of three hall rooms, an auditorium with a capacity of 420, a seminar room for 90 people, a conference hall for 30, six guest rooms and a dining room able to accommodate hundred people.

- ### Apply for Reservation of Senate Hall

  Renters can apply for reservations for the Senate Hall according to the available dates for available rooms.

Notice board

Anyone can view a general notice board with announcements and updates from the estate office so that they can stay informed about important information from the estate office.

- The system should display a central notice board accessible to all users.
- Estate office employees or authorized personnel should be able to create and update announcements on the notice board.

- Announcements should be categorized or searchable for easy access to relevant information.
- Users should be able to filter announcements to cater to their specific needs.

Notification

- The system should deliver notifications to users through various channels (e.g., email, in-app pop-up).
- Notifications should be categorized and prioritized based on urgency and user type.
- A Teacher/Staff member might receive notifications about upcoming flat vacancy applications.
- A shop vendor might be notified about maintenance schedules and monthly payment reminders affecting their shop.
- An estate office employee might receive alerts about new applications requiring review.
- Users should be able to view a history of their notifications within the system.
- The system should allow users to manage notification preferences (e.g., opting out of certain categories).

Online Payment

This system will have all the current popular payment options available in Bangladesh, including bKash, Rocket, Nagad etc. Payment with credit card (VISA, Mastercard, etc.) will also be allowed through a payment gateway called SSLCommerz.

Vendors can securely pay the acceptance fee and rent online so that they can conveniently complete the application process without needing to visit the estate office in person.

- The system should display the amount due for the vacancy acceptance fee and/or rent.

- Vendors should be able to choose a preferred online banking payment method.
- The system should securely process the payment and update my application status accordingly.

Use Case Diagram

A Use Case describes the system behavior under various conditions as the system responds to a request from one of its stakeholders. In fact, a use case diagram is a kind of visualization of the system where an end-user has an idea of a specific feature. It simply describes a story using corresponding actors who perform important roles in the story and make the story understandable for the users.

The first step in writing a Use Case is to define the set of “actors” that will be involved in the story. Actors are the different people or systems that use the system or product within the context of the function and behavior that is to be described. Actors represent the roles that people play as system operators. They procedure some information or consume some information. Every user has one or more goals when using the system.

Primary Actor

Primary actors interact directly to achieve the required system function and derive the intended benefit from the system. They work directly with the software. They produce some information and consume some information too.

Secondary Actor

Secondary actors support the system so that primary actors can do their work.

They either produce or consume information.

Here is the use case diagram to observe the non-technical view of the

System.

Actors

- Estate office employees
- University Employees
- Syndicate Members
- Treasurer
- Vendor
- Estate Manager(Admin).
- Renter
- Security guard
- SSLCommerz
- OpenAI

Primary

- Estate Manager(Admin)
- University Employees
- Estate Office employees
- Vendor
- Renter

Secondary

- Treasurer
- Syndicate members
- Online payment gateway
- Security guard
- SSLCommerz
- OpenAI

Level: 0

Name: DU EOMA
Primary Actor: Estate Manager, Estate employee, University employee, Vendor, Renter
Secondary Actor: Treasurer, Syndicate member, Security guard, SSLCOMMERZ, OpenAI, Email

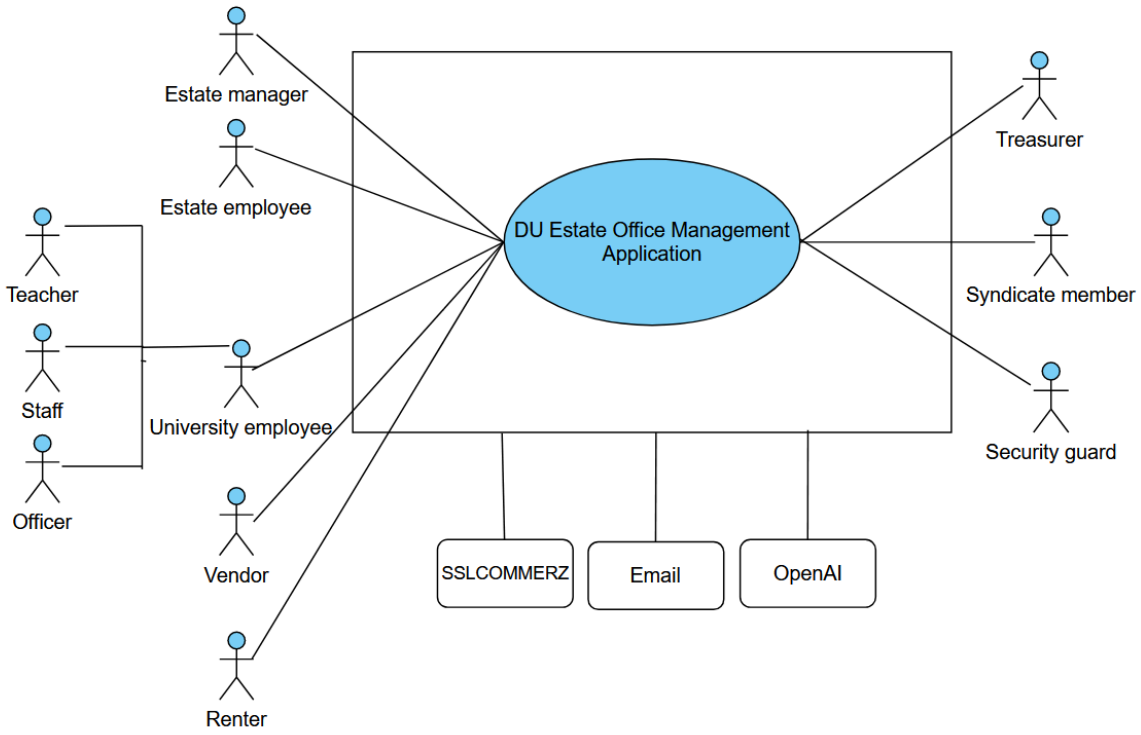


Figure 1: DU Estate Office Management Application use case diagram

Level: 1

Name: DU EOMA (Detailed)
Primary Actor: Estate Manager, Estate employee, Estate employee, Vendor, Senate Renter
Secondary Actor: Treasurer, Syndicate member, Security guard, SSLCOMMERZ, OpenAI

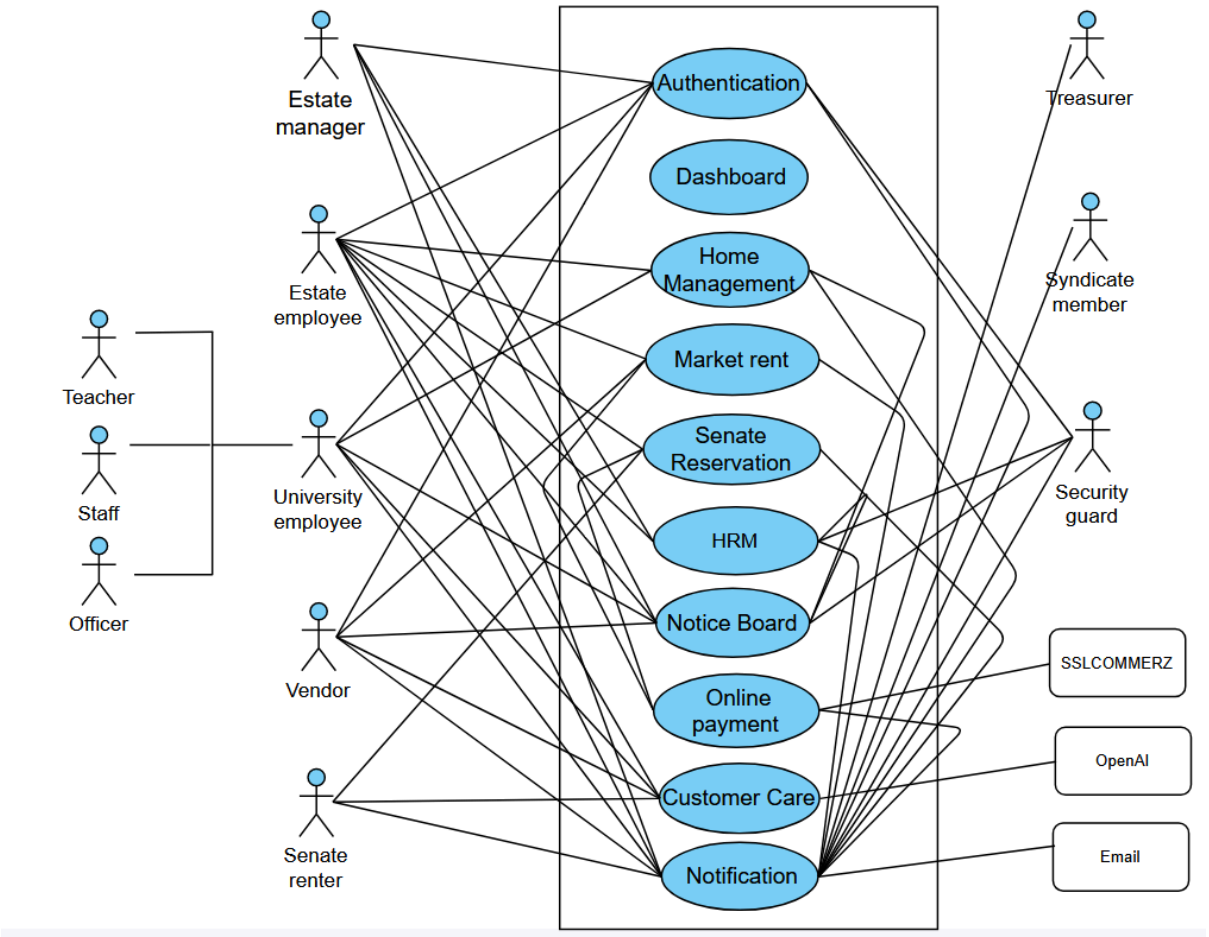


Figure 2: DU Estate Office Management Application (Detailed) use case diagram

Level: 1.1

Name: Authentication
Primary Actor: Estate Manager, Estate employee
Secondary Actor: Treasurer, Syndicate Member, University employee, Vendor, Renter, Security guard

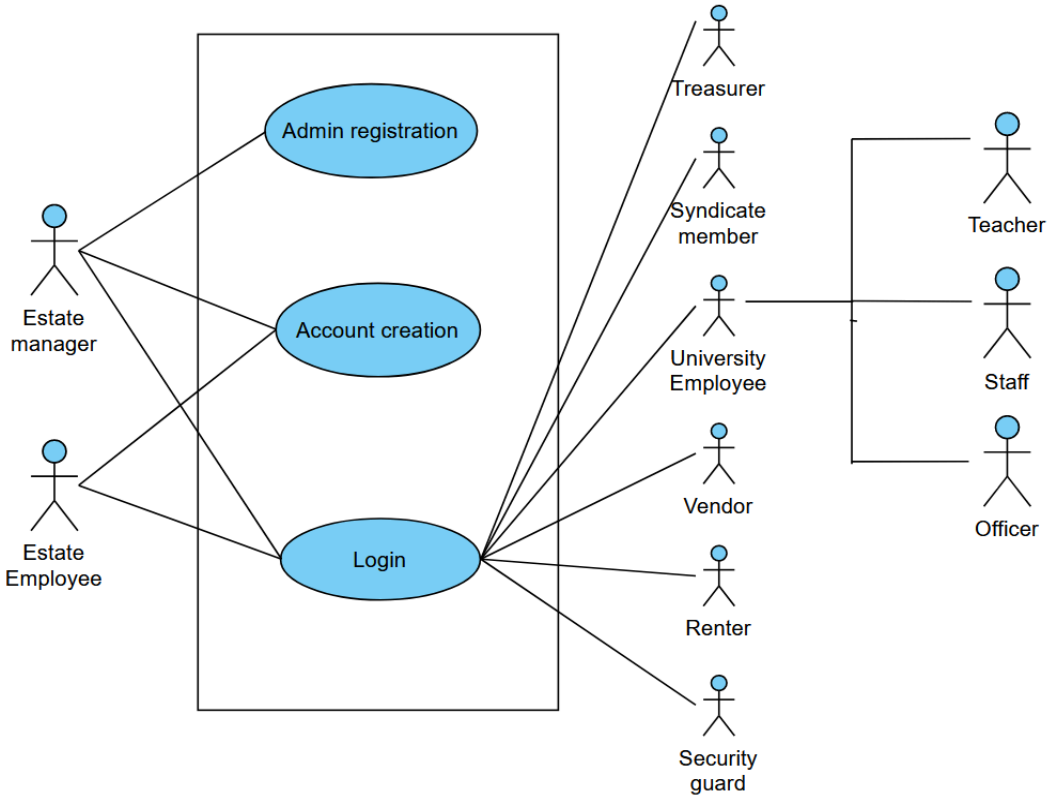


Figure 3: Authentication use case diagram

Action 1: Estate manager enters the system for the first time and registers himself/herself as an admin.

Reply 1: An admin account is created.

Action 2: Admin creates accounts for employees.

Reply 2: Different types of accounts are created.

Action 3: Estate manager/employee initiates a mail with the help of a notification module to send the created credential to the actual owner of the account.

Reply 3: Notification module sends a mail to the user.

Action 4: A user logged in with proper credentials.

Reply 4: The user is redirected to the system.

Action 1: Estate manager creates an employee account.

Reply 1: An employee account is created.

Action 2: Estate manager/ employee created a vendor account.

Reply 2: A vendor account is created.

Action 3: Estate manager/employee creates an account for the security guard.

Reply 3: A security guard account is created.

Level: 1.2

Name: Home rent
Primary Actor: University Employee, Estate employee
Secondary Actor:

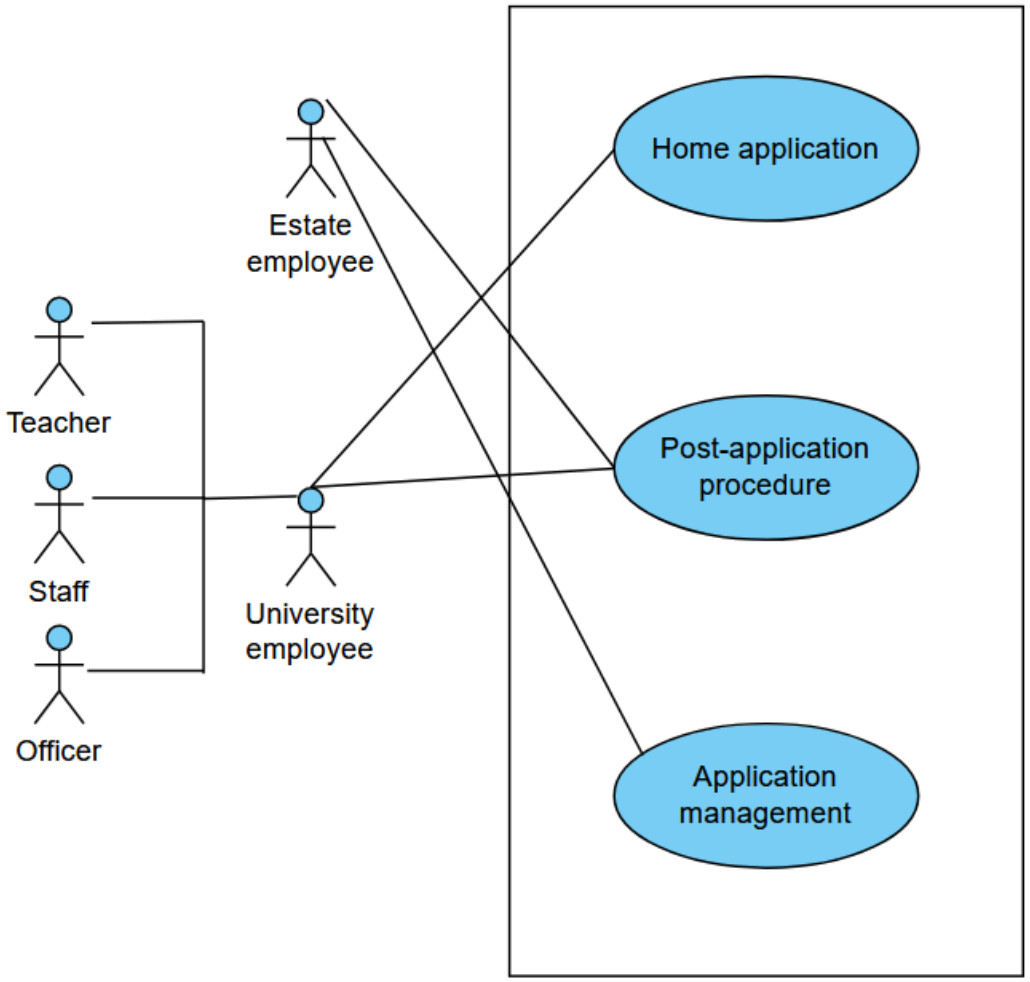


Figure 5: Home rent use case diagram

Action 1: University Employees tends to see 3D view of a flat

Reply 1: EOMA displays a 3D view of the flat.

Action 2: Treasurer wishes to hold a meeting for the allocation of available flats.

Reply 2: All the actors are notified about this.

Alternate Reply: A notice is posted about this meeting.

Action 3: Teachers & staff wish to leave their respective flats.

Reply: Their profile and flat details will be updated.

Action 4 : University Employees wish to see their respective standings on the list.

Reply : System displays their standings.

Action 5: Employee can update the 3D view of the markets.

Level: 1.2.1

Name: Home Application
Primary Actor:
Secondary Actor: University employee

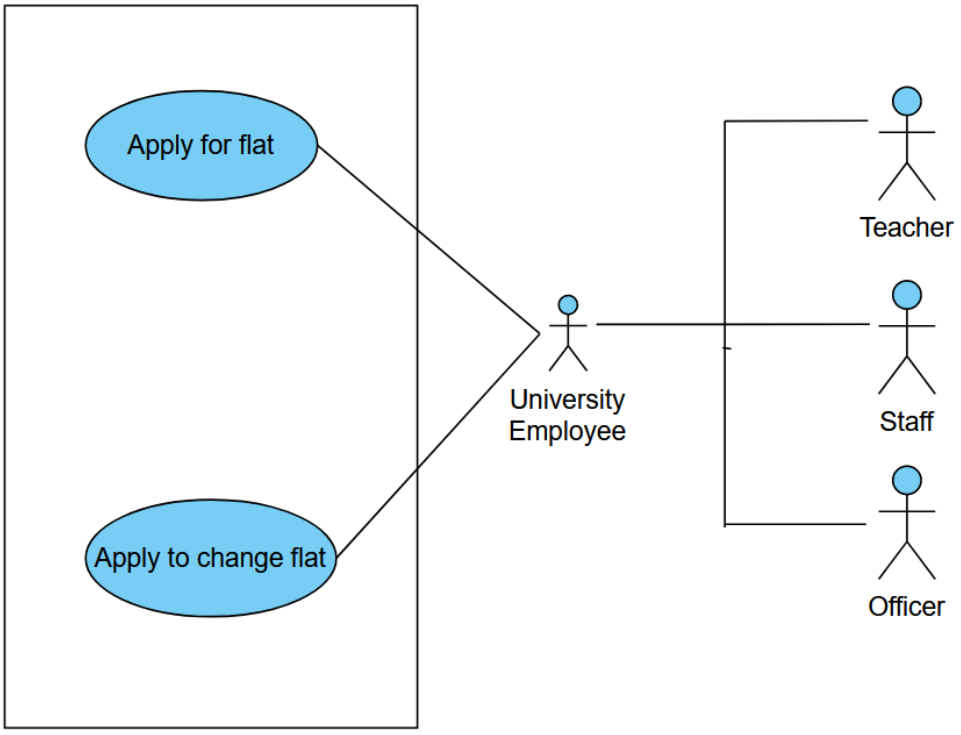


Figure 6: Home Application use case diagram

Action 1: University employees apply for desired flats with proper details.

Reply 1: Their application will be automatically validated and sorted.

Action 2: University employees apply for changing flats.

Reply 2: Their application will be validated and sorted.

Level: 1.2.2

Name: Home rent application management
Primary Actor: Estate employee
Secondary Actor:

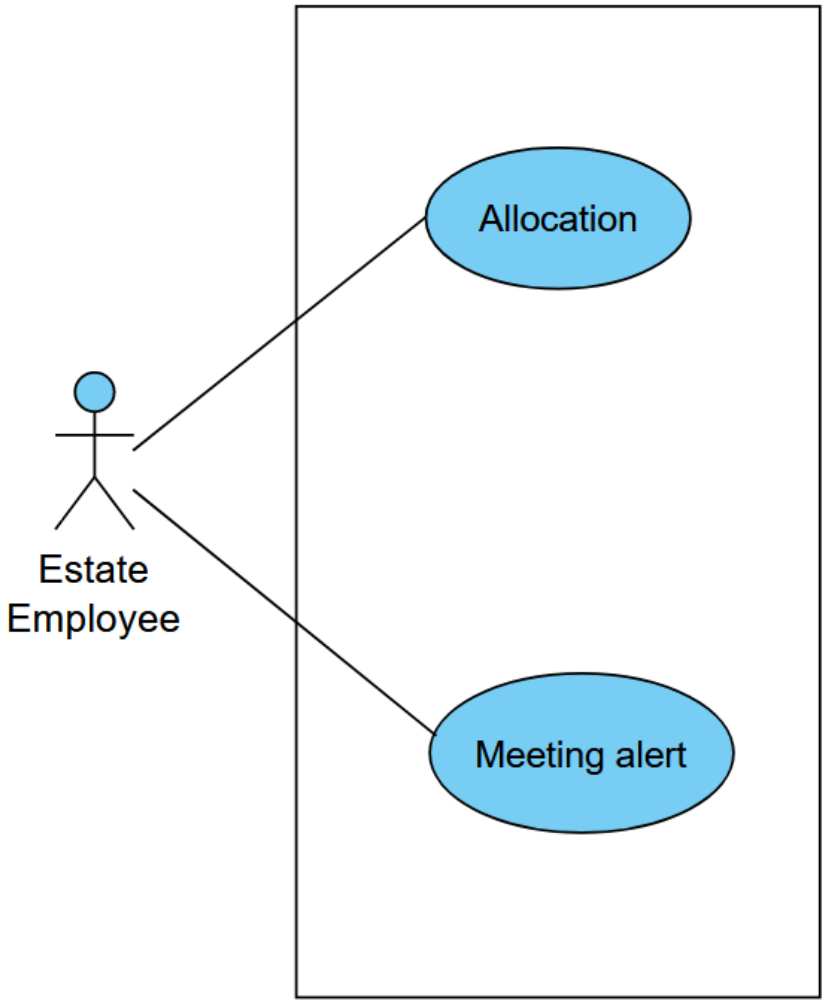


Figure 7: Home rent application management use case diagram

Action 1: Nominated teachers and staff names are put into the system with their respective flat numbers.

Reply 1: The nominated person will get a notification, and flat details will be updated.

Action 2: Employee can allocate and update the home database after a house gets allocated

Action 3: Estate employee can arrange a meeting for vacant flats.

Reply 3: The meeting details will be notified to employees,treasurer and syndicate members.

Level: 1.3

Name: Market rent
Primary Actor: Estate employee, vendor
Secondary Actor:

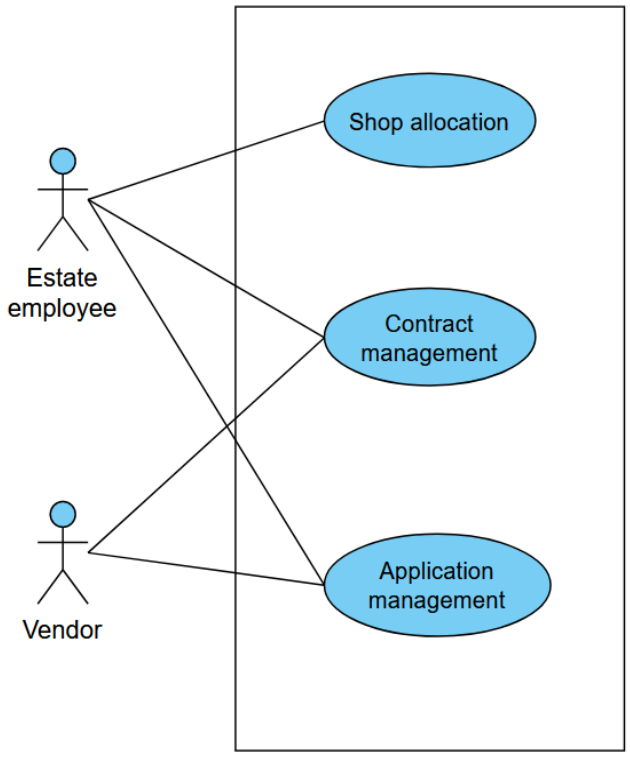


Figure 8: Market rent use case diagram

Action 1: The employee updates tender information accordingly in the EOMA.

Reply 1: System sends a notification request to the notification module to send a notification to the vendor with proper credentials.

Action 2: Employee can update the 3D view of the market.

Action 3: Vendors can access a 3D view and rental details of the market.

Action 4: Vendors can apply for vacant markets.

Reply 4: System promptly records their application.

Action 5: Employee will validate the application based on their predefined guidelines.

Reply 5: A notification is sent to vendors via the notification module.

Level: 1.3.1

Name: Market rent contract management
Primary Actor: Estate employee, vendor
Secondary Actor:

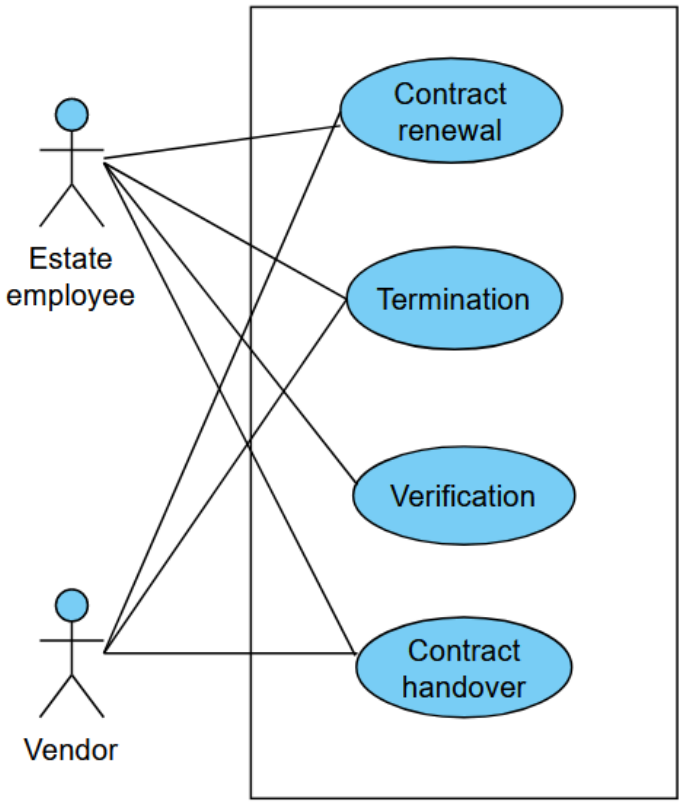


Figure 9: Market rent contract management use case diagram

Action 1: Employee can terminate contract of a vendor.

Action 2: Employee validates a vendor's application and their information.

Reply 2: System sends a request to the notification module to send notifications to the treasurer and syndicate.

Action 3: Vendors can pay their rent via online.

Reply 3: System sends a request to the payment module.

Action 4: Vendor can apply for renewing his/her contract.

Reply 4: System waits for validation by employee.

Action 5 : Vendor can apply for transfer of his contract.

Reply 5 : System sends a notification for the payment of transfer fee.

Action 6 : Vendor pays the transfer fee.

Reply 6 : System updates contract details with new vendor info.

Action 7: Vendor can terminate his/her contract.

Reply 7: System removes their account and restricts their further access.

Level: 1.4

Name: Senate rent
Primary Actor: Estate employee, Renter
Secondary Actor: N/A

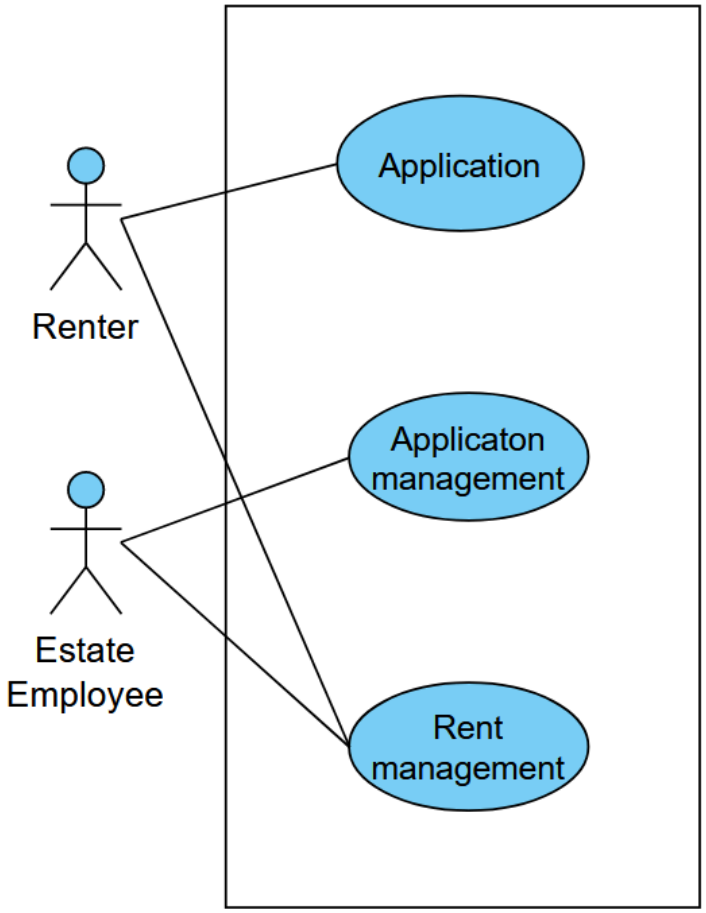


Figure 10: Senate rent use case diagram

Action 1: A renter can apply for the booking of the Senate Hall with proper details.

Reply 1: The application is submitted for review.

Action 2: Renter can pay their due fee via online payment gateway.

Reply 2: System calls the payment module to redirect renters to online payment gateway.

Action 3: Estate Employee can warn renters of their due fee.

Reply 3: System sends a request to the notification module to send a notification to renter.

Level: 1.4.1

Name: Senate rent application management
Primary Actor: Estate employee, Renter
Secondary Actor:

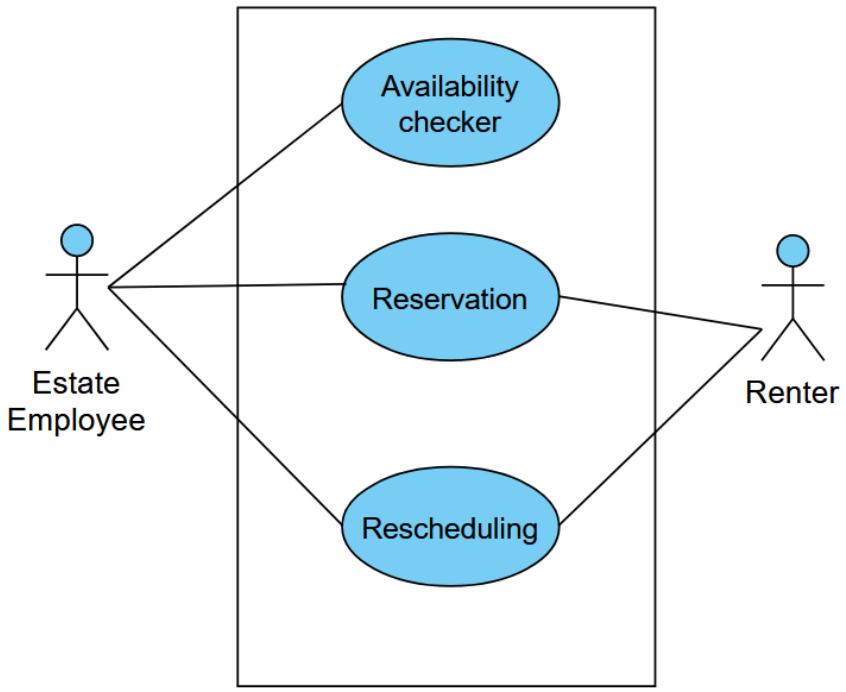


Figure 11: Senate rent application management use case diagram

Action 1: Estate Employee can check the availability for the application date and update it.

Reply 1: Availability of Senate Hall will be updated.

Action 2: Employee will validate the application based on their predefined guidelines.

Reply 2: A mail will be sent to the renter with a validation message with the help of notification module.

Action 3: Employee can reschedule the booking date for senate hall.

Reply 3: Availability of senate hall will be updated and a mail will be sent to the user about the reschedule with the help of Notification module.

Level: 1.5

Name: HRM
Primary Actor: Estate manager, Estate employee
Secondary Actor: Security guard

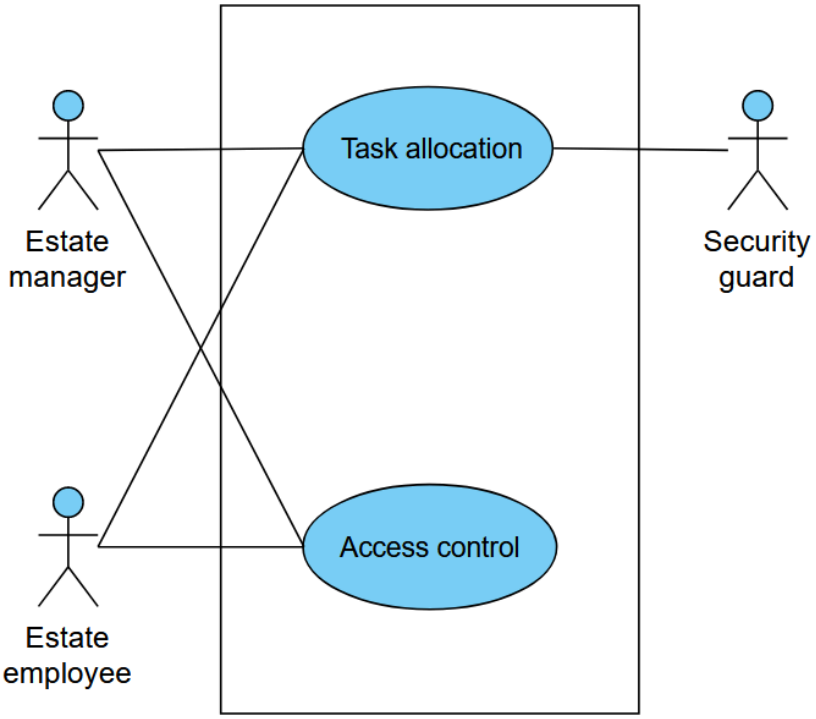


Figure 12: HRM use case diagram

Action 1: Estate Manager assigns estate employees their respective tasks for that particular day.

Reply 1: Estate office employees get a notification on their dashboard for his/her assigned task.

Action 2: Estate office employee allocates security guard in the DU area as per the need.

Reply 2: The database is updated accordingly and sends a request to the notification module to send notifications to the allocated security guard.

Action 3: Estate manager creates a recruitment notice for available posts in Estate office.

Reply 3: A recruitment notice is posted on the notice board.

Action 4: Estate manager can view and edit existing user information and assigned roles.

Reply 4: The system gets promptly updated.

Level: 1.6

Name: Notification
Primary Actor: None
Secondary Actor: Estate Manager(Admin),University Employees, Estate Office employees, Vendor,Renter,Treasurer,Syndicate members,Online payment gateway,Security guard,SSLCommerz,OpenAI

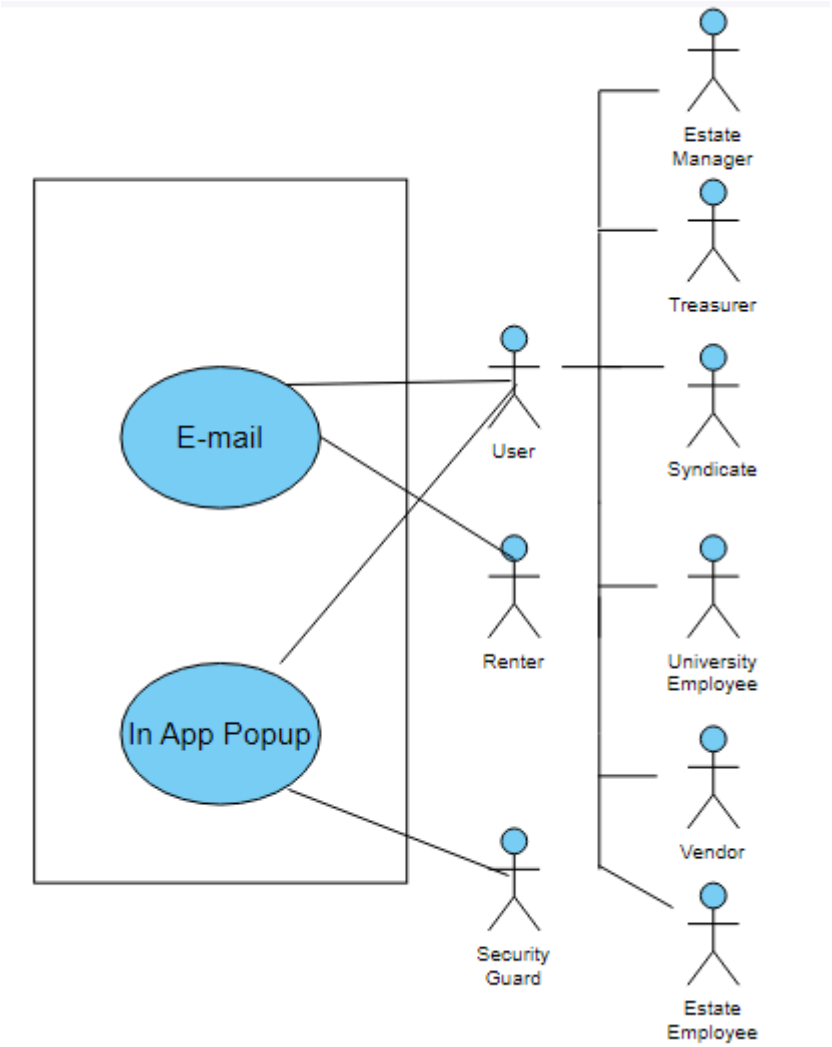


Figure 13: Notification use case diagram

Action 1: User receives notification through E-mail and In-app Pop-Up when a request is sent by a different module by another actor.

Action 2: Security Guard receives notification through In-app Pop Up when a request is sent by a different module by another actor.

Action 3: Renter receives notification through Email when a request is sent by a different module by another actor.

ACTIVITY DIAGRAM

Level: 1

Name: EOMA
Reference: Use case Diagram level 1

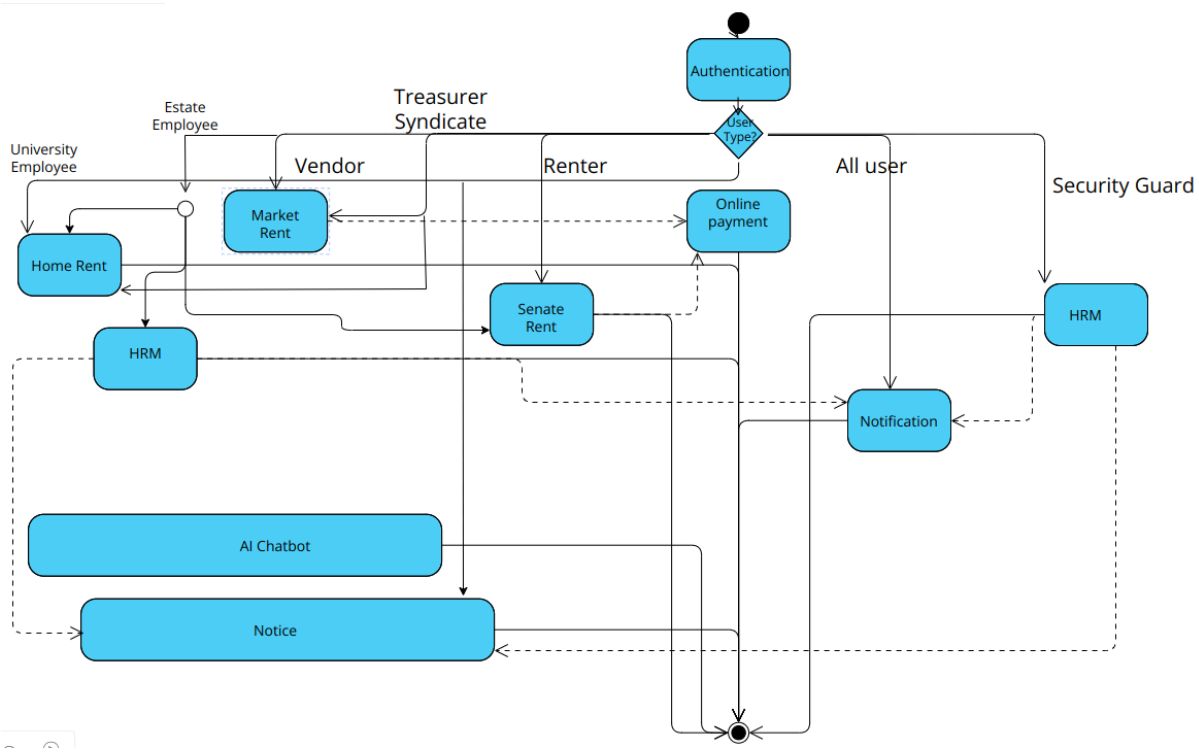


Figure 14: EOMA activity diagram

Level: 1.1

Name: Authentication
Reference: Use case Diagram level 1.1

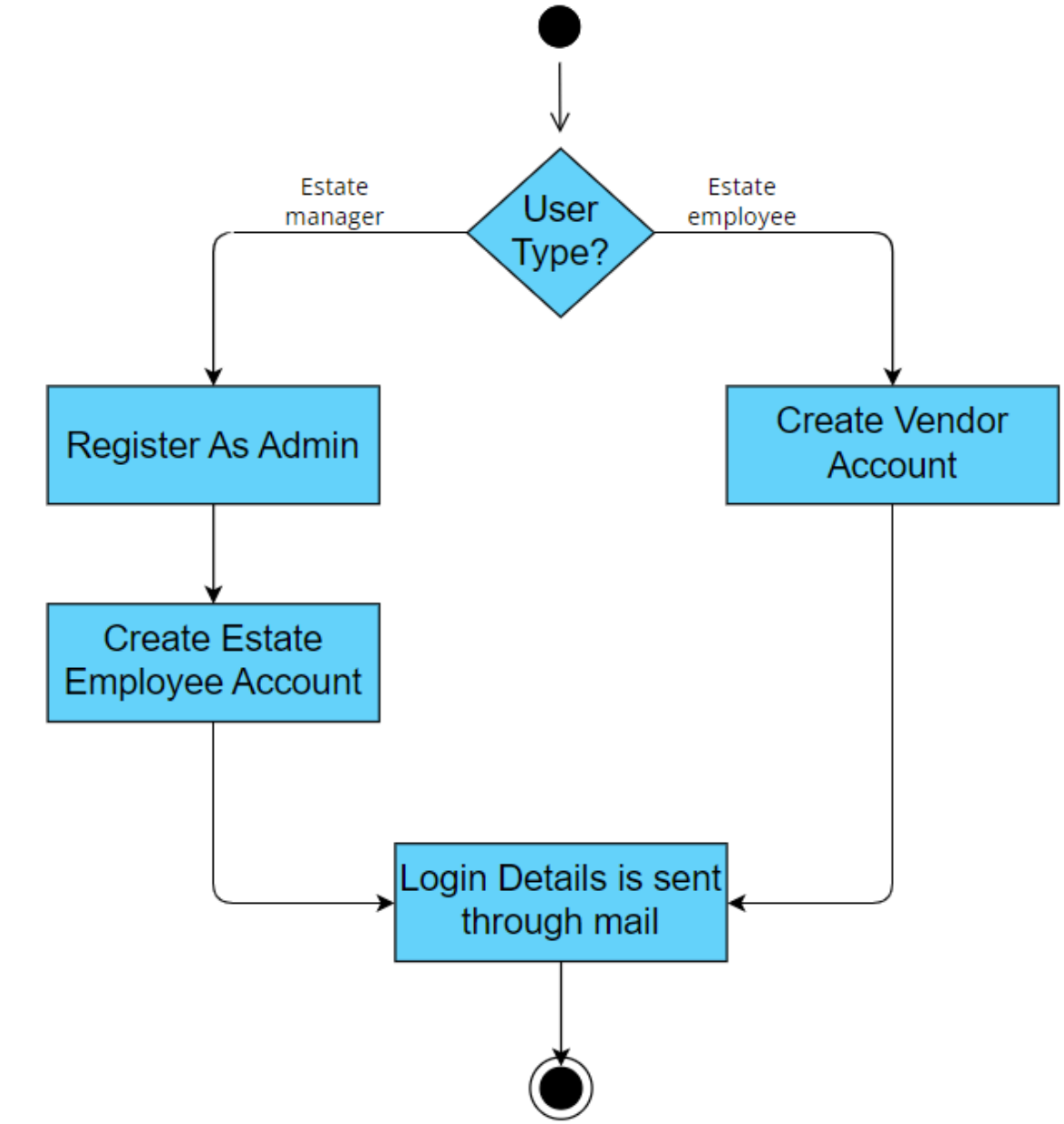


Figure 15: Authentication activity diagram

Level: 1.2

Name: Home rent
Reference: Use case Diagram level 1.2

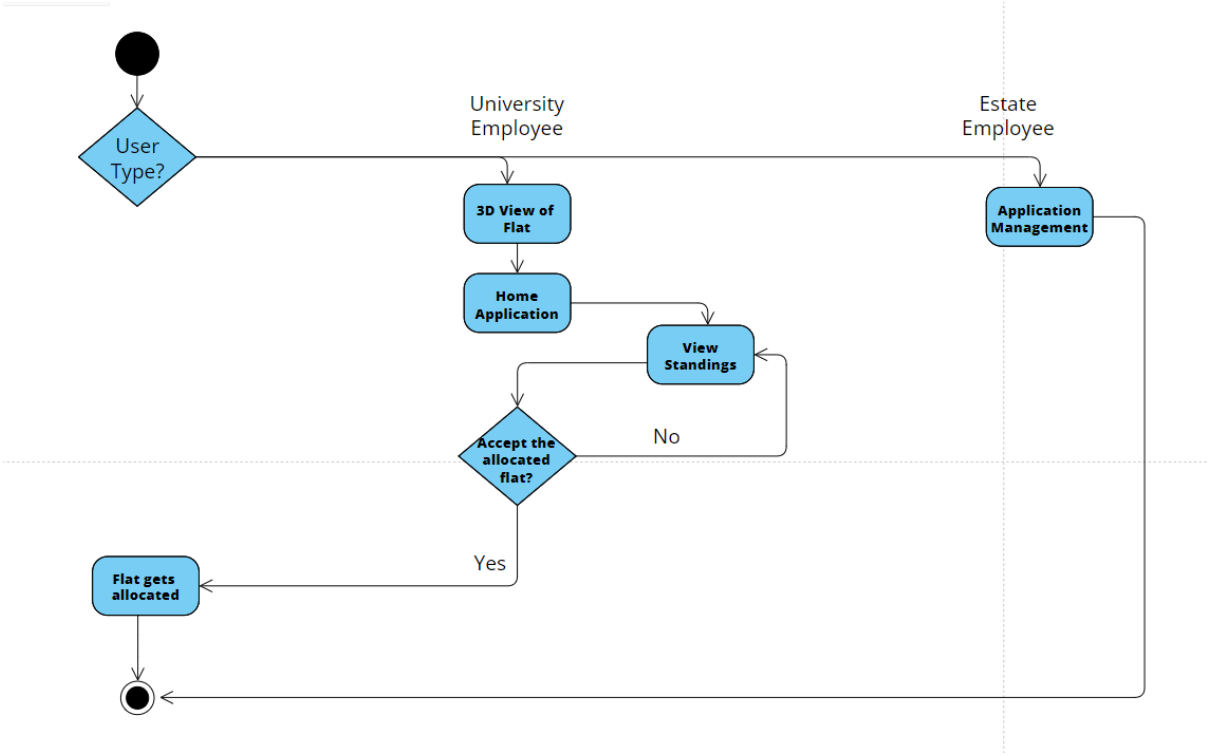


Figure 17: Home rent activity diagram

Level: 1.2.1

Name: Home rent apply
Reference: Use case Diagram level 1.2.1

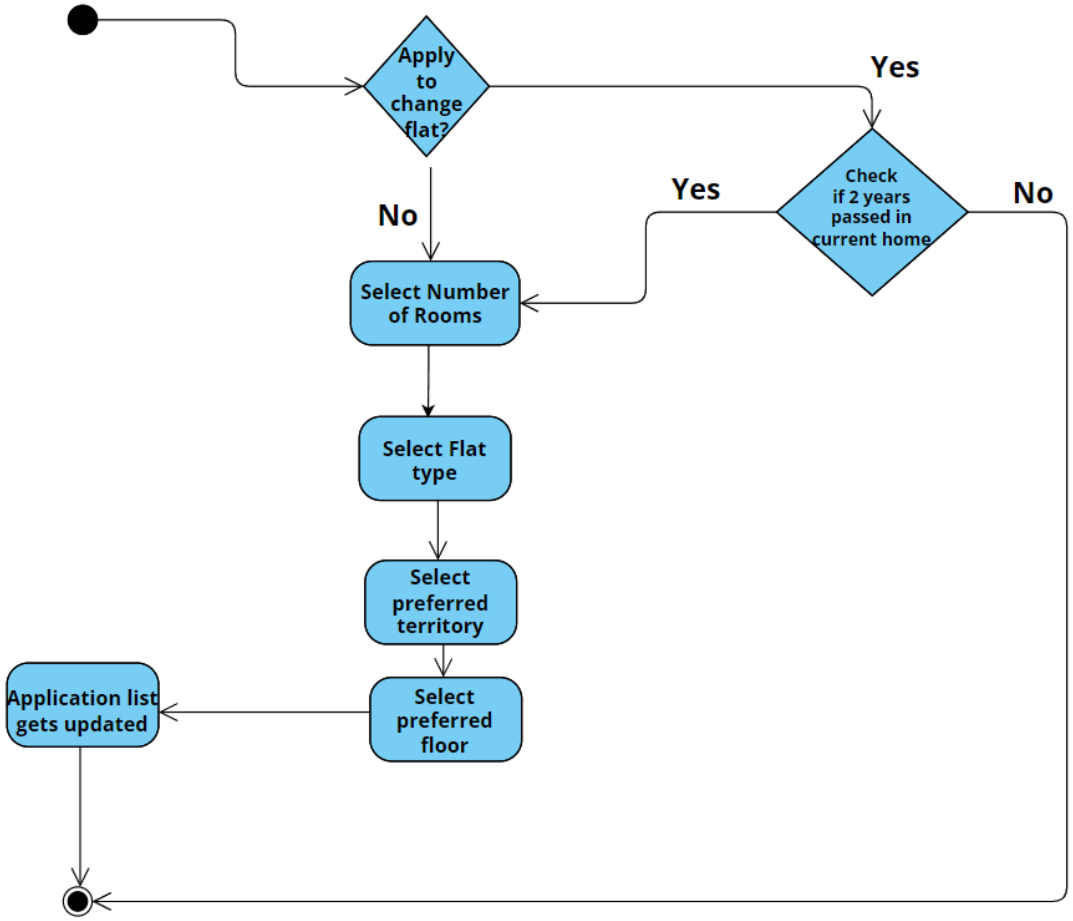


Figure 18: Home rent apply activity diagram

Level: 1.2.2

Name: Home rent application management
Reference: Use case Diagram level 1.2.2

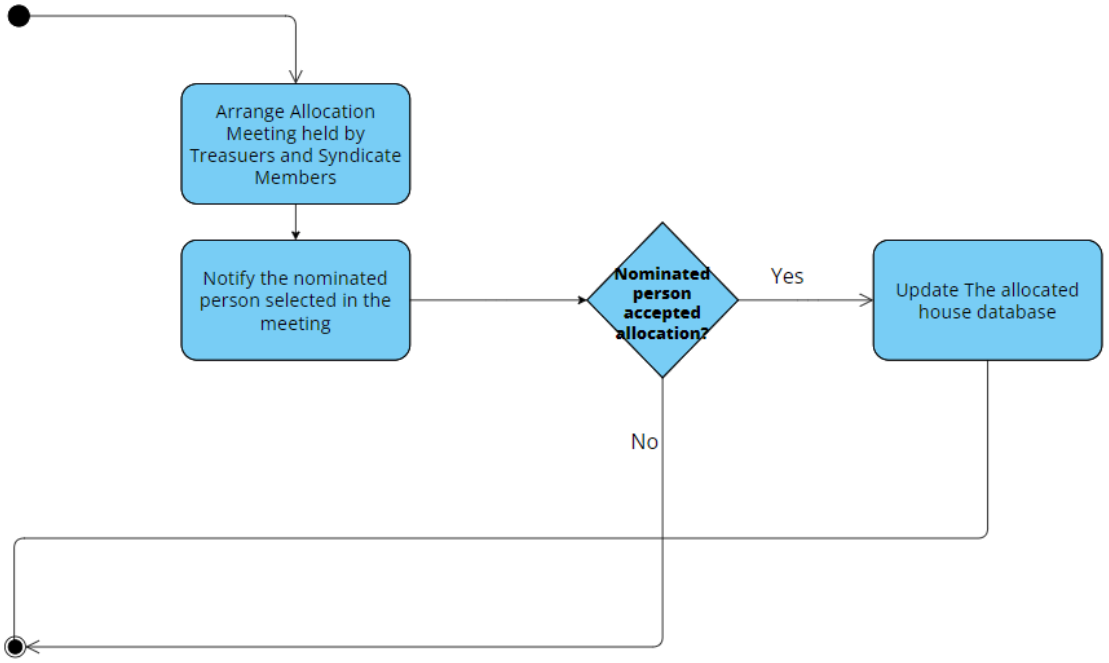


Figure 19: Home rent application management activity diagram

Level: 1.3

Name: Market rent
Reference: Use case Diagram level 1.3

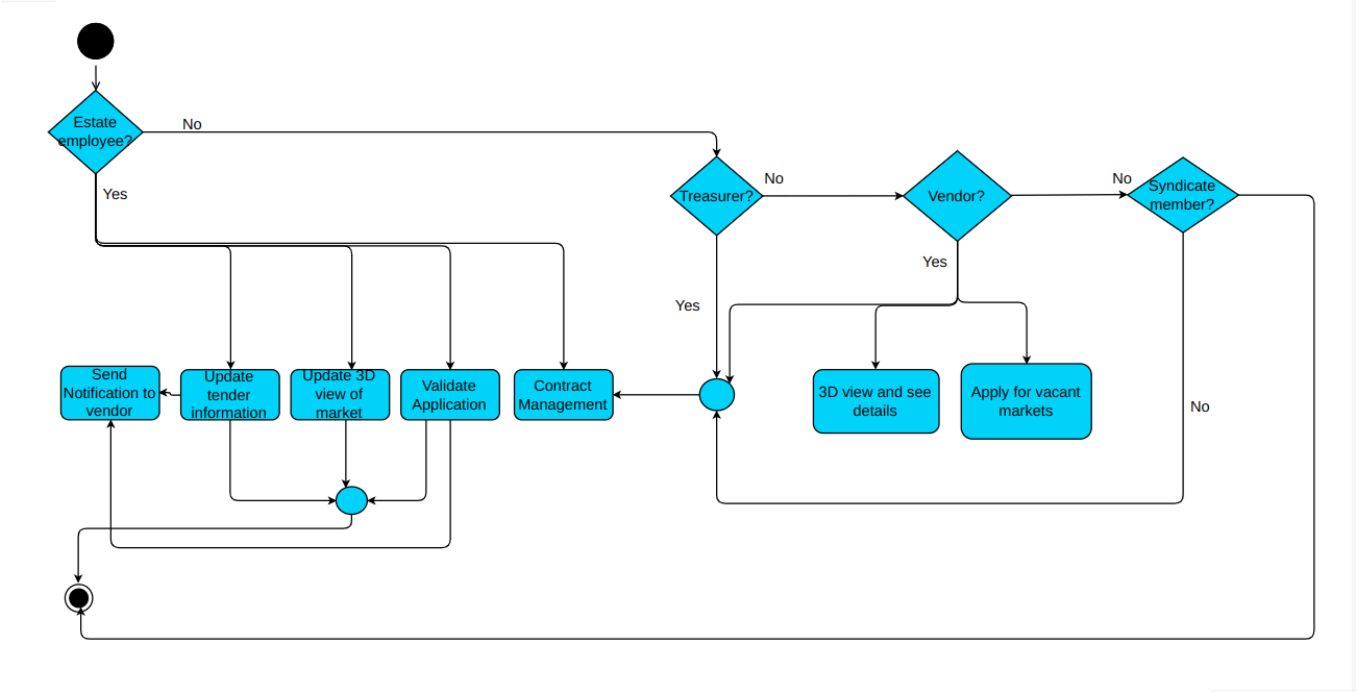


Figure 20: Market rent activity diagram

Level: 1.3.1

Name: Market rent contract management
Reference: Use case Diagram level 1.3.1

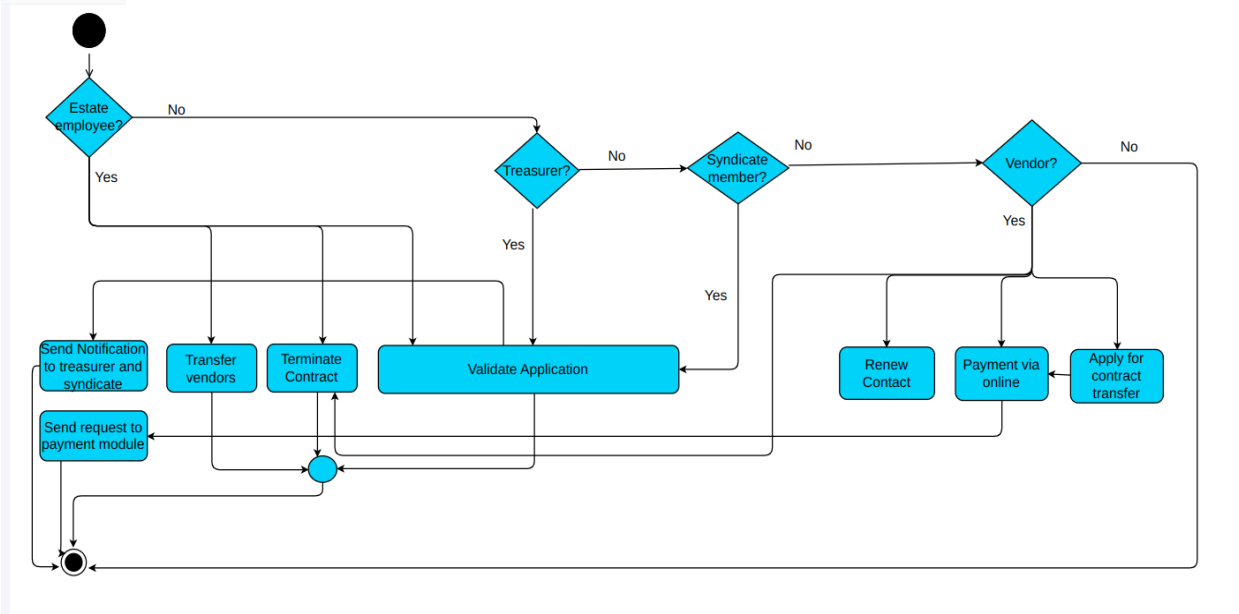


Figure 21: Market rent contract management activity diagram

Level: 1.4

Name: Senate rent
Reference: Use case Diagram level 1.4

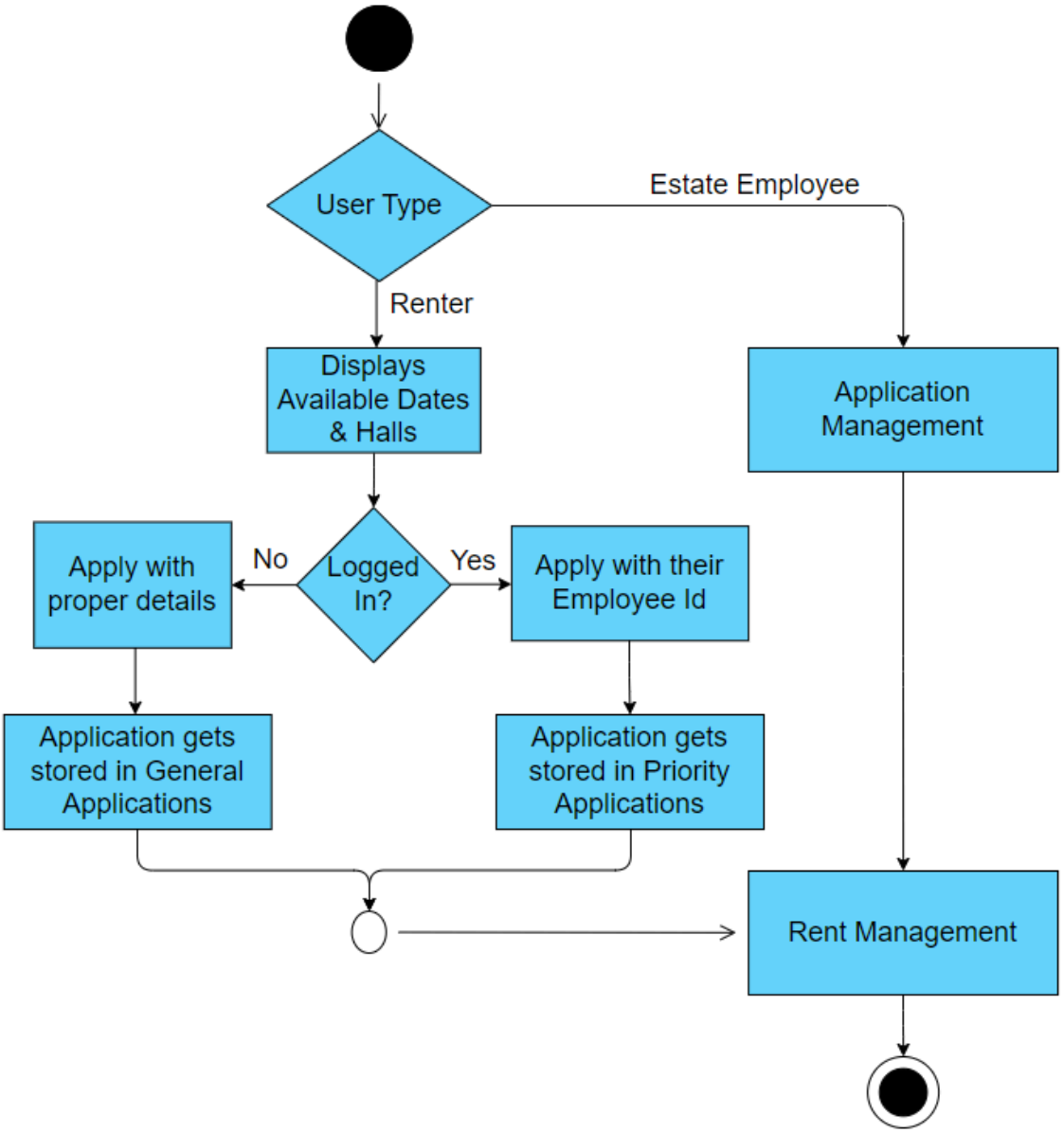


Figure 22: Senate rent activity diagram

Level: 1.4.1

Name: Senate rent application management
Reference: Use case Diagram level 1.4.1

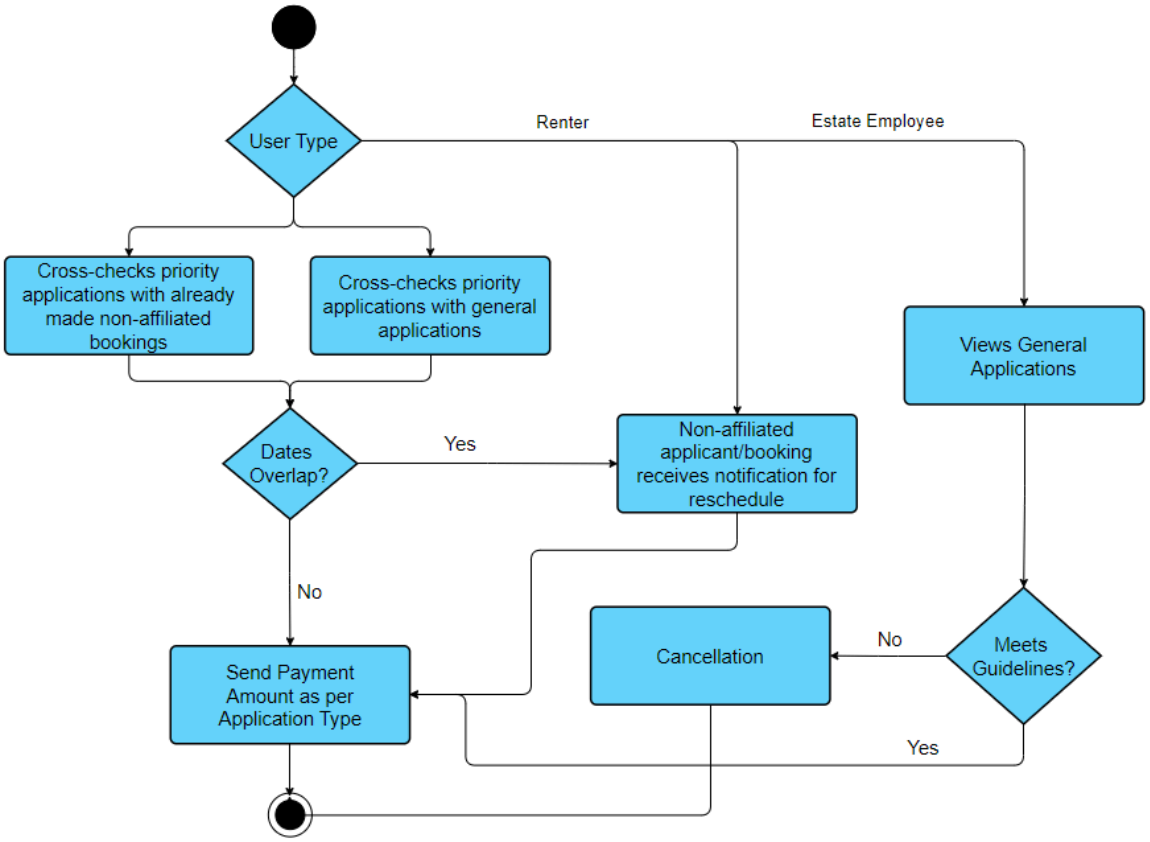


Figure 23: Senate rent application management activity diagram

Level: 1.5

Name: HRM
Reference: Use case Diagram level 1.5

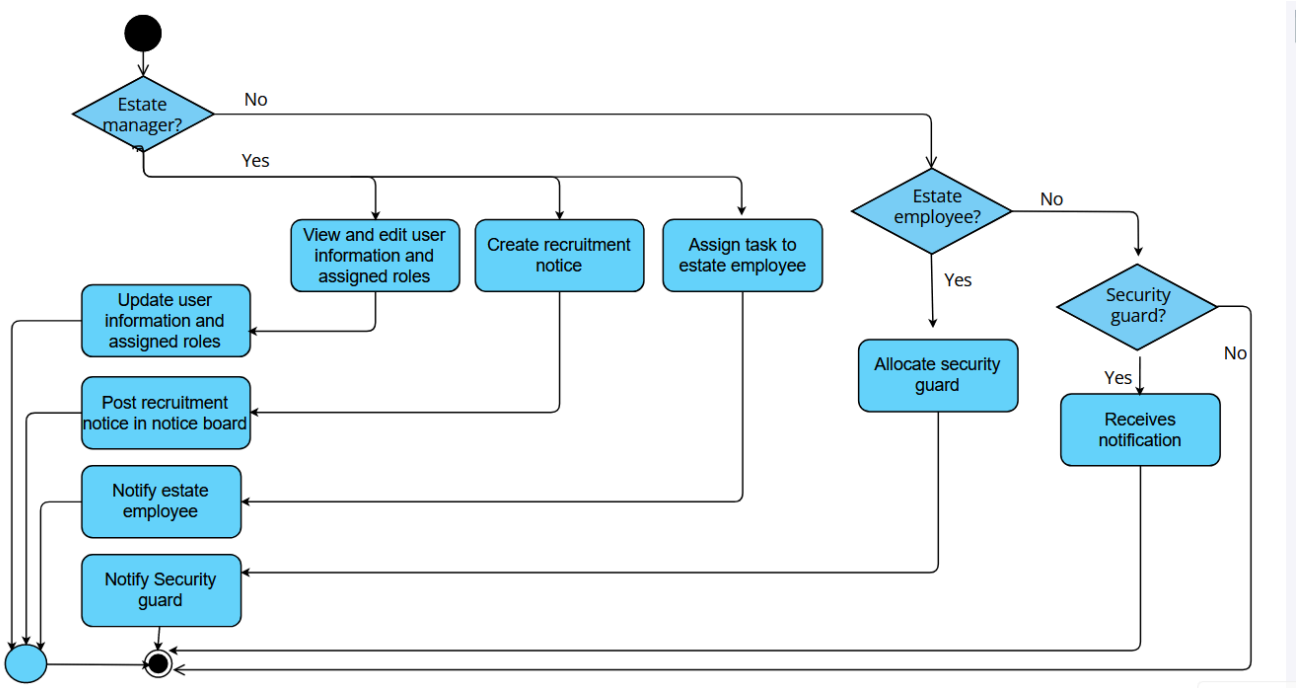


Figure 24: HRM activity diagram

Level: 1.6

Name: Notification
Reference: Use case Diagram level 1.6

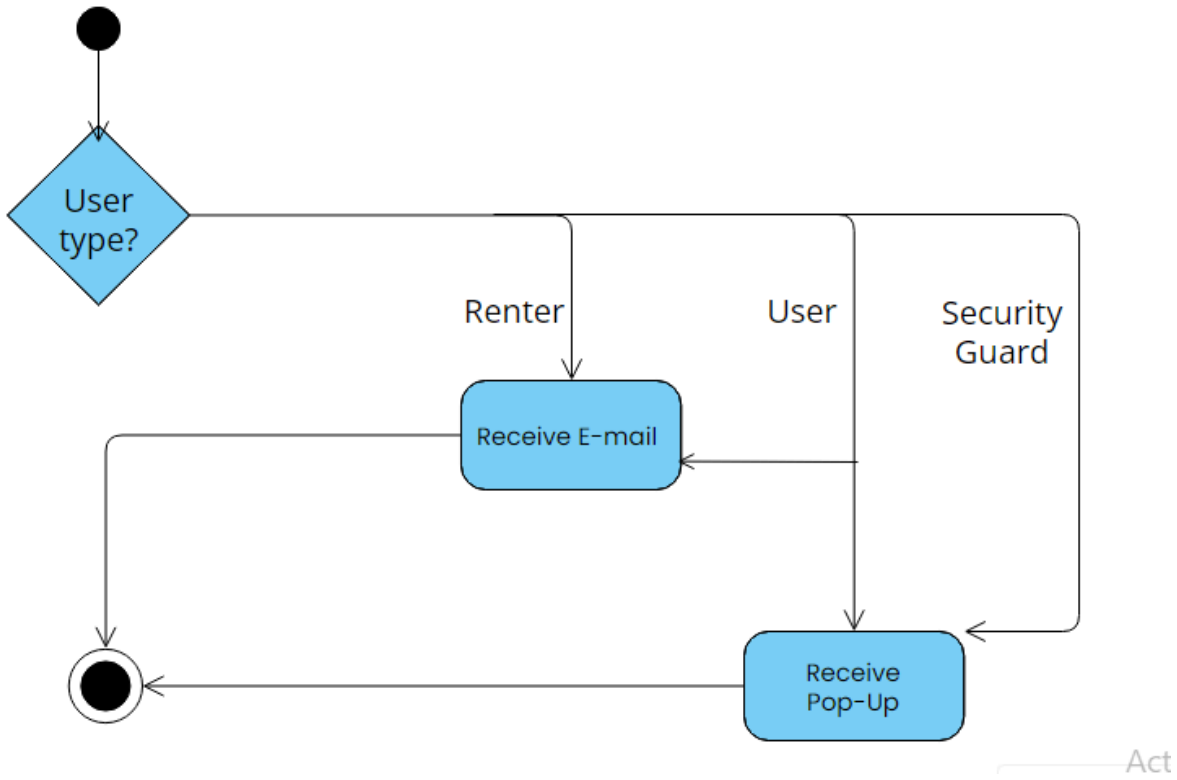


Figure 25: Notification activity diagram

SWIMLANE DIAGRAM

SID (Swimlane ID): 1

Name: DU EOMA (Detailed)
Reference: Use case and activity diagram level 1

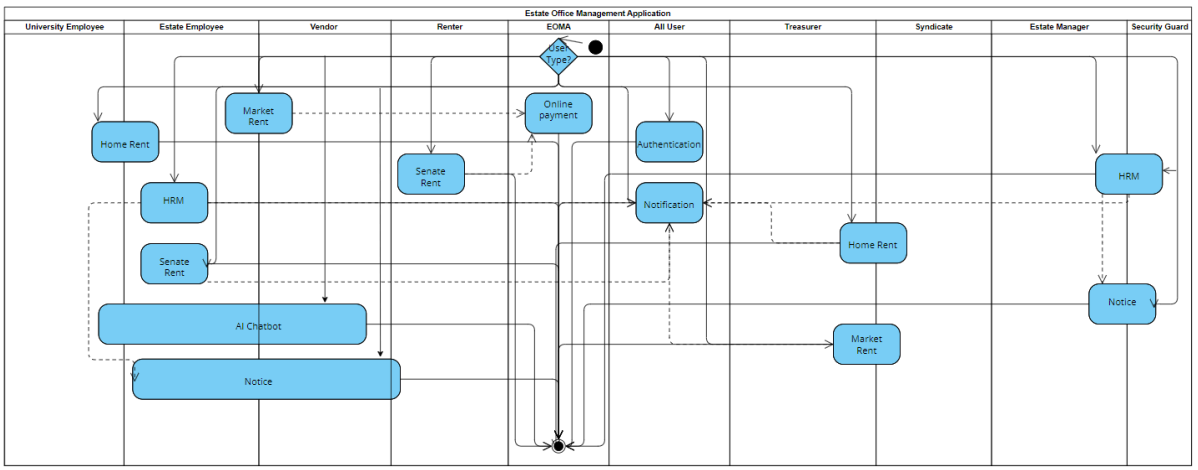


Figure 26: DU EOMA (Detailed) swimlane diagram

SID (Swimlane ID): 1.1

Name: Authentication
Reference: Use case and activity diagram level 1.1

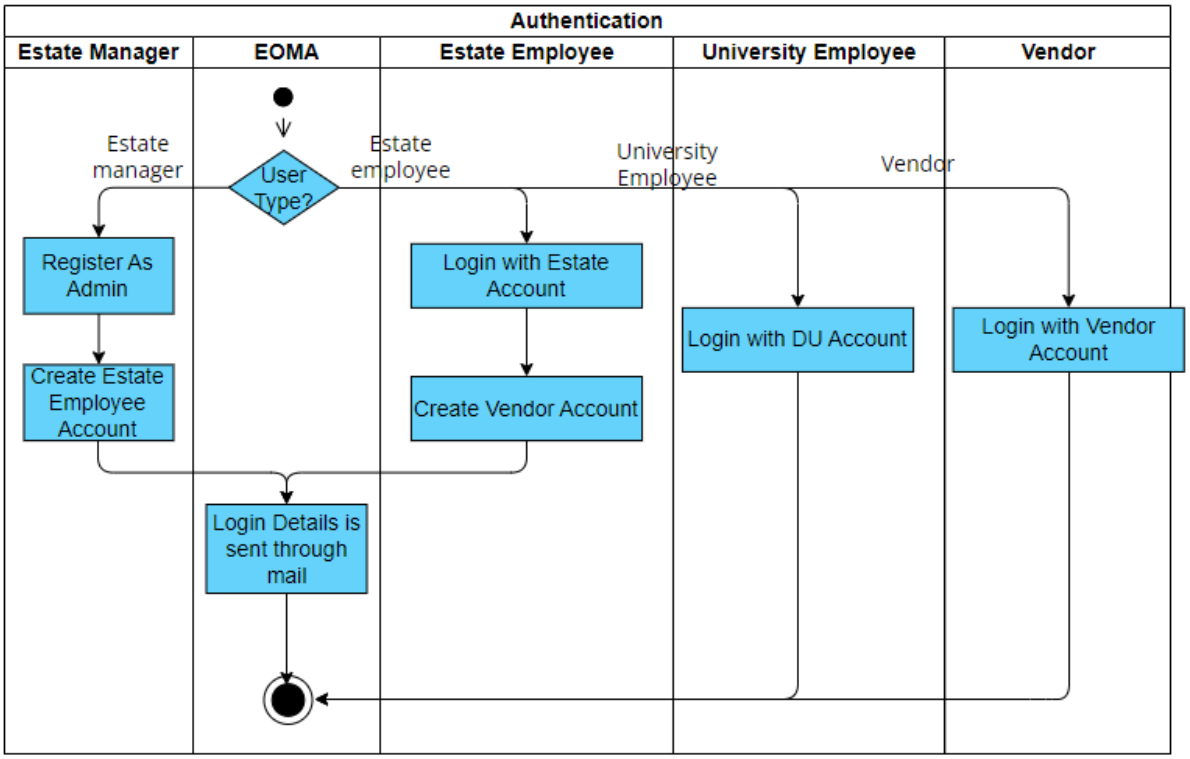


Figure 27: Authentication swimlane diagram

SID (Swimlane ID): 1.2

Name: Home rent
Reference: Use case and activity diagram level 1.2

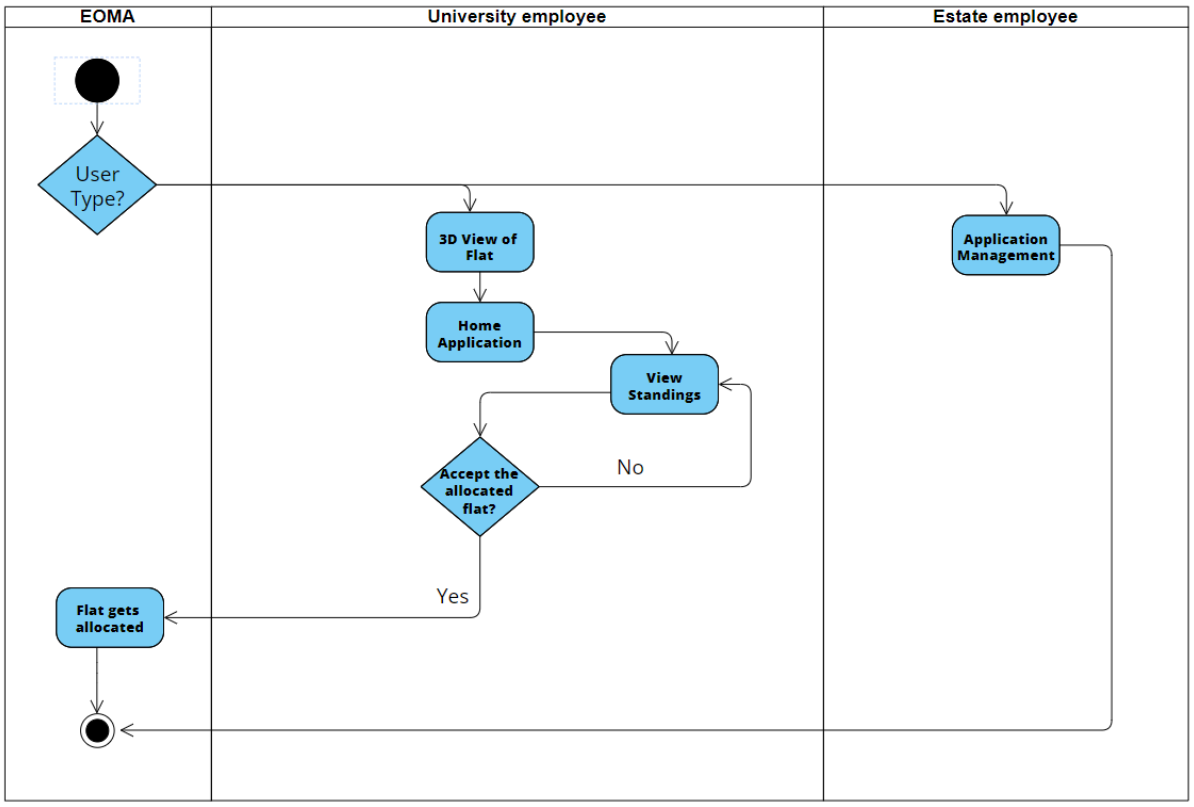


Figure 29: Home rent swimlane diagram

SID (Swimlane ID): 1.2.1

Name: Home rent apply

Reference: Use case and activity diagram level 1.2.1

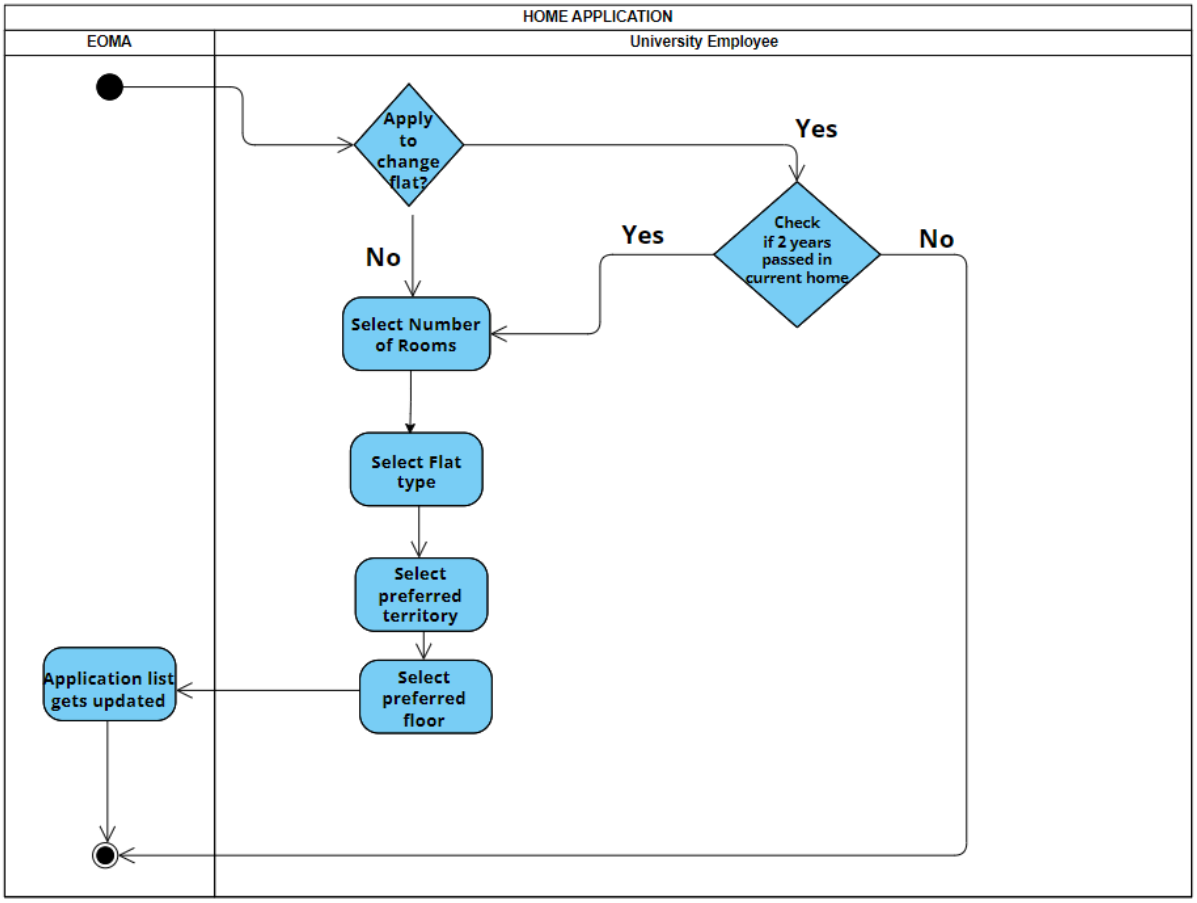


Figure 30: Home rent apply swimlane diagram

SID (Swimlane ID): 1.2.2

Name: Home rent application management
Reference: Use case and activity diagram level 1.2.2

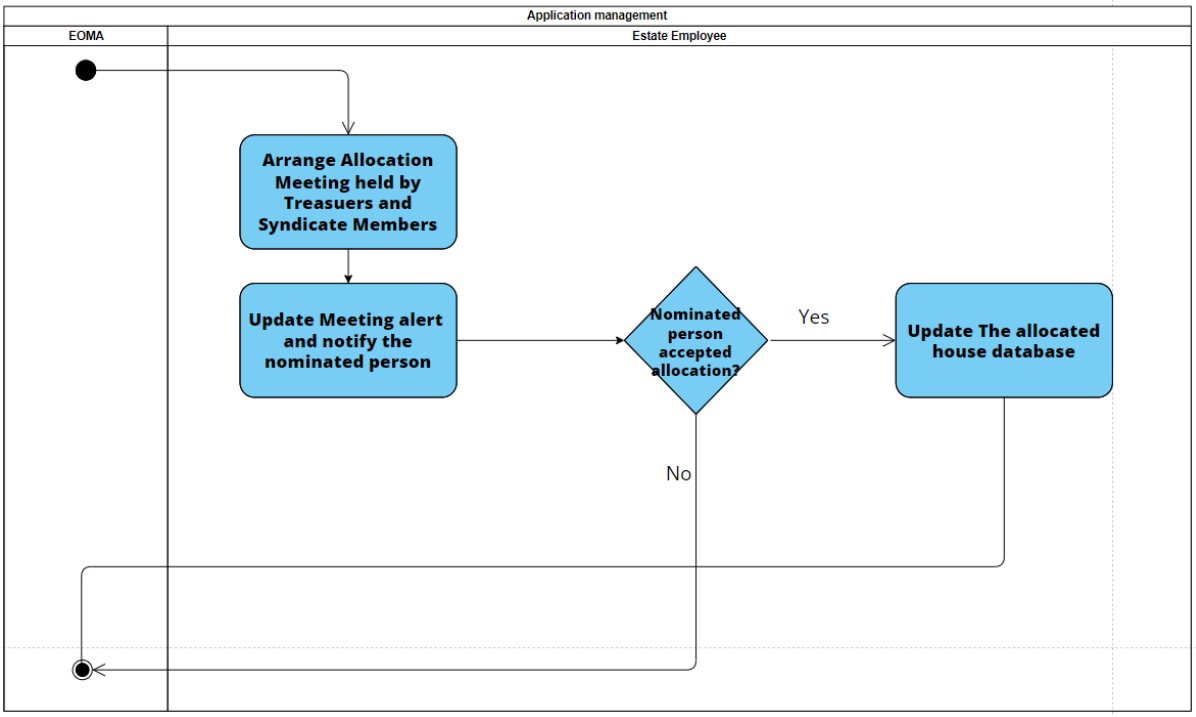


Figure 31: Home rent application management swimlane diagram

SID (Swimlane ID): 1.3

Name: Market rent
Reference: Use case and activity diagram level 1.3

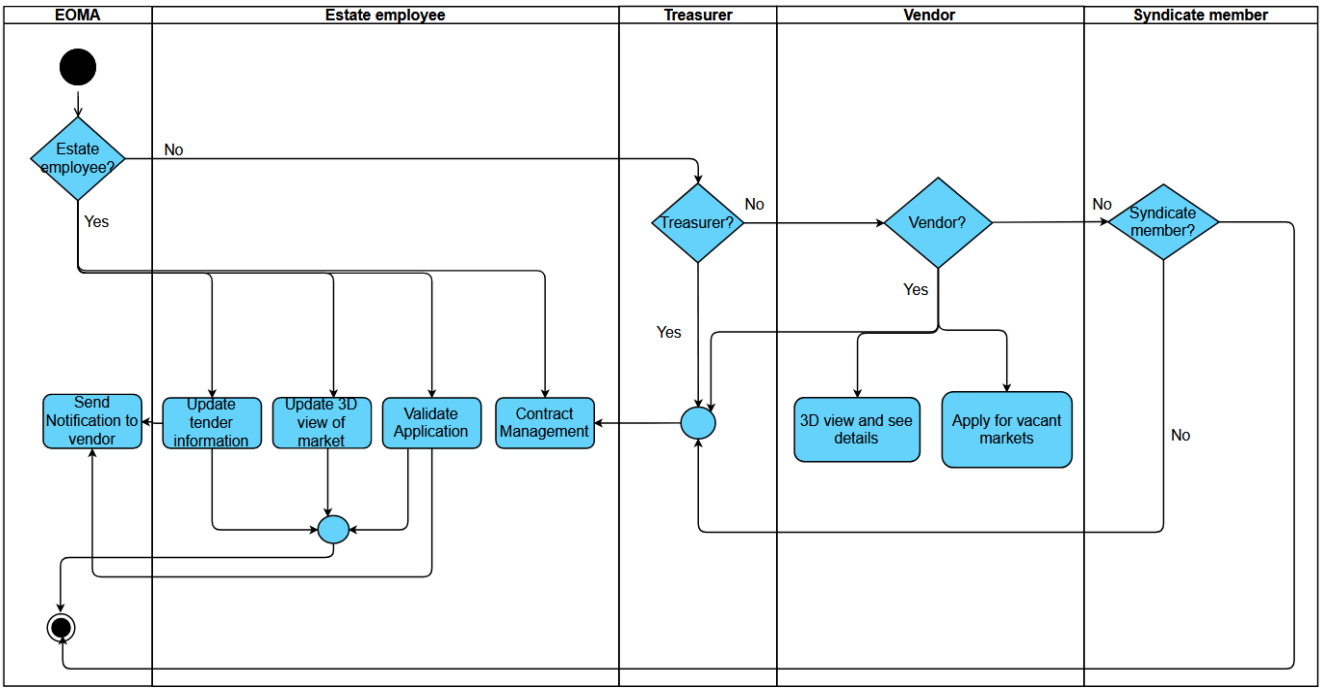


Figure 32: Market rent swimlane diagram

SID (Swimlane ID): 1.3.1

Name: Market rent contract management
Reference: Use case and activity diagram level 1.3.1

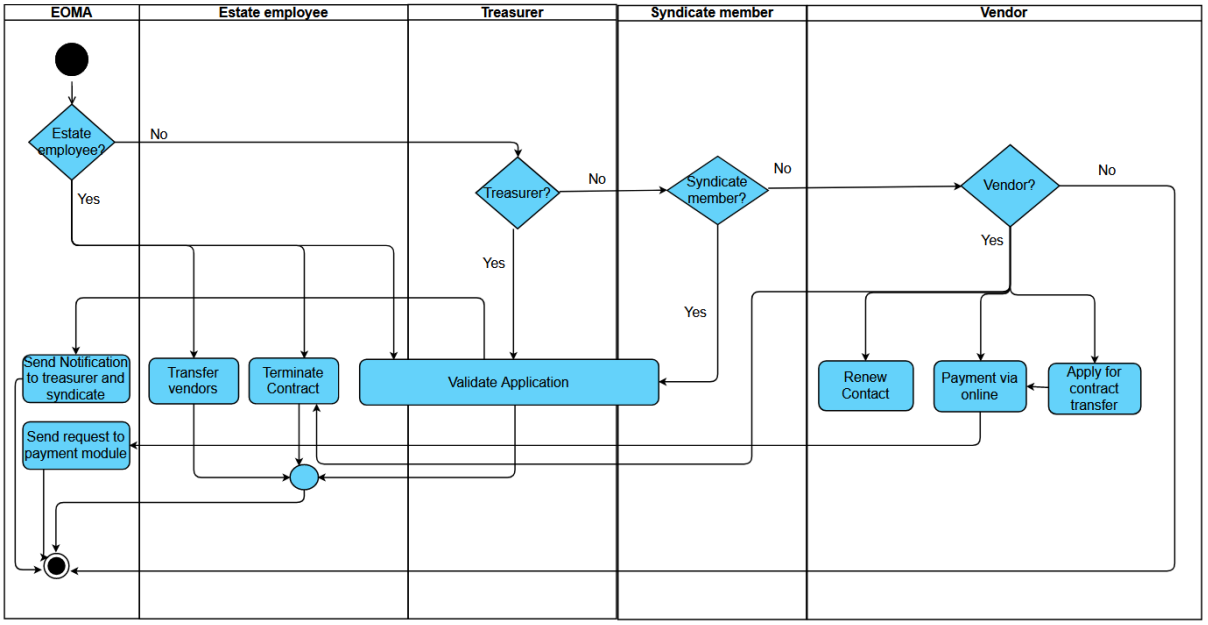


Figure 33: Market rent contract management swimlane diagram

SID (Swimlane ID): 1.4

Name: Senate rent
Reference: Use case and activity diagram level 1.4

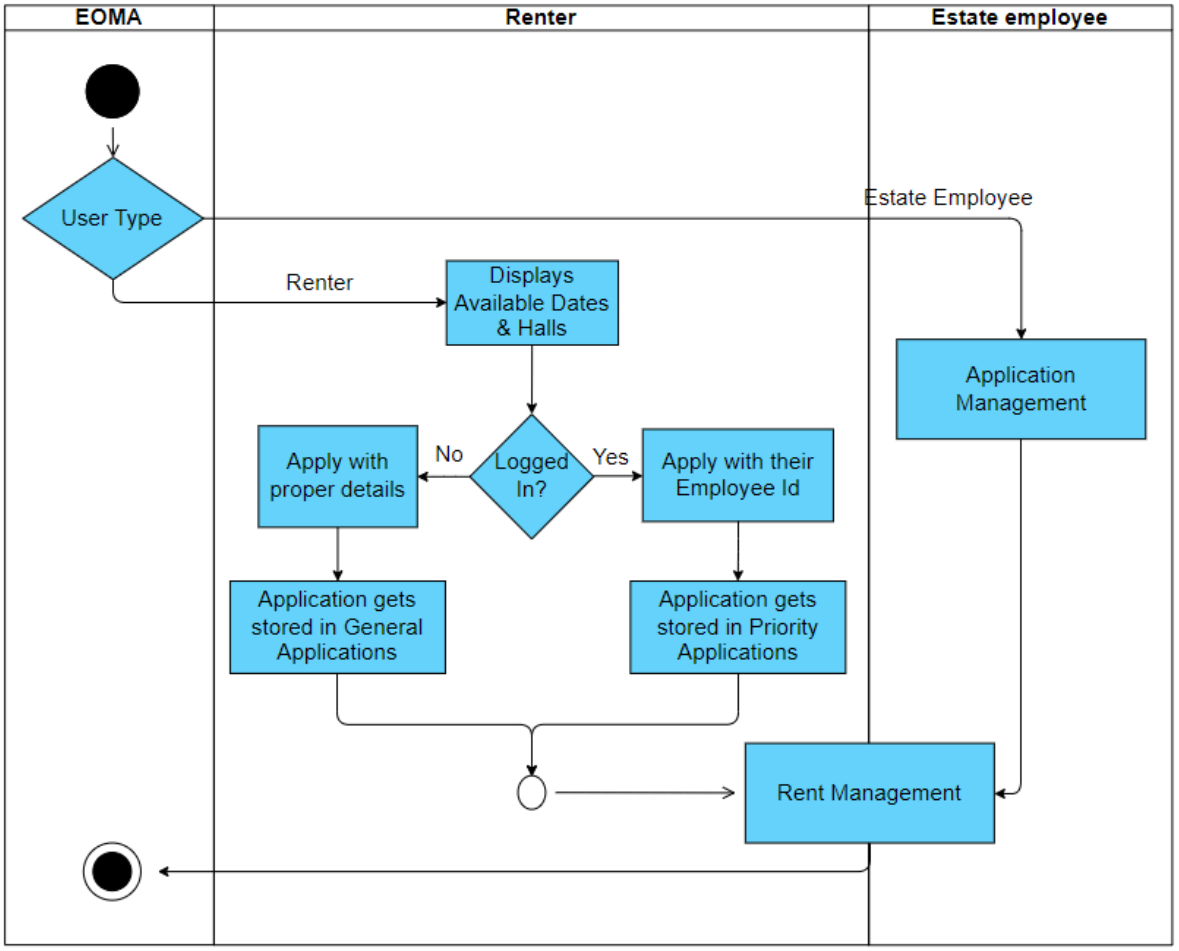


Figure 34: Senate rent swimlane diagram

SID (Swimlane ID): 1.4.1

Name: Senate rent application management
Reference: Use case and activity diagram level 1.4.1

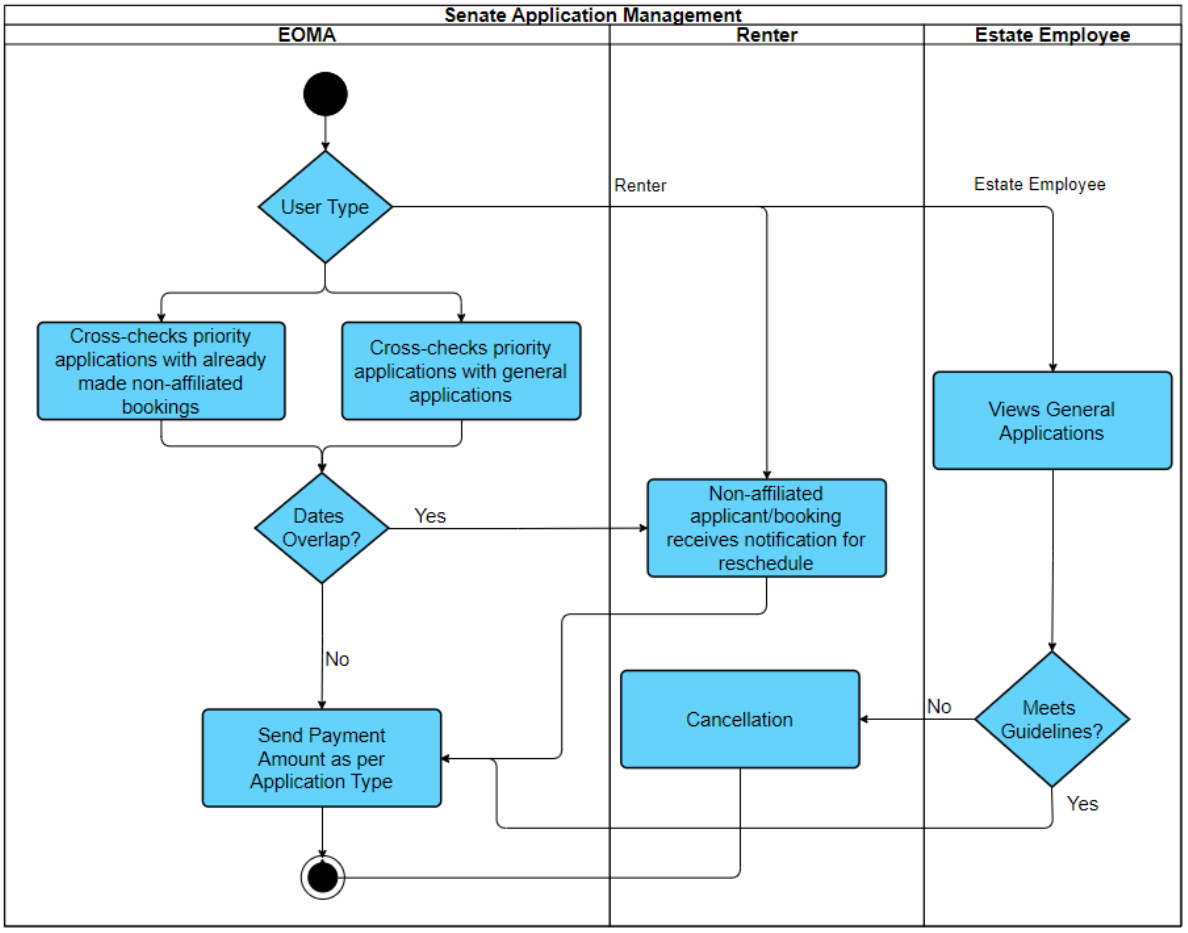


Figure 35: Senate rent application management swimlane diagram

SID (Swimlane ID): 1.5

Name: HRM
Reference: Use case and activity diagram level 1.5

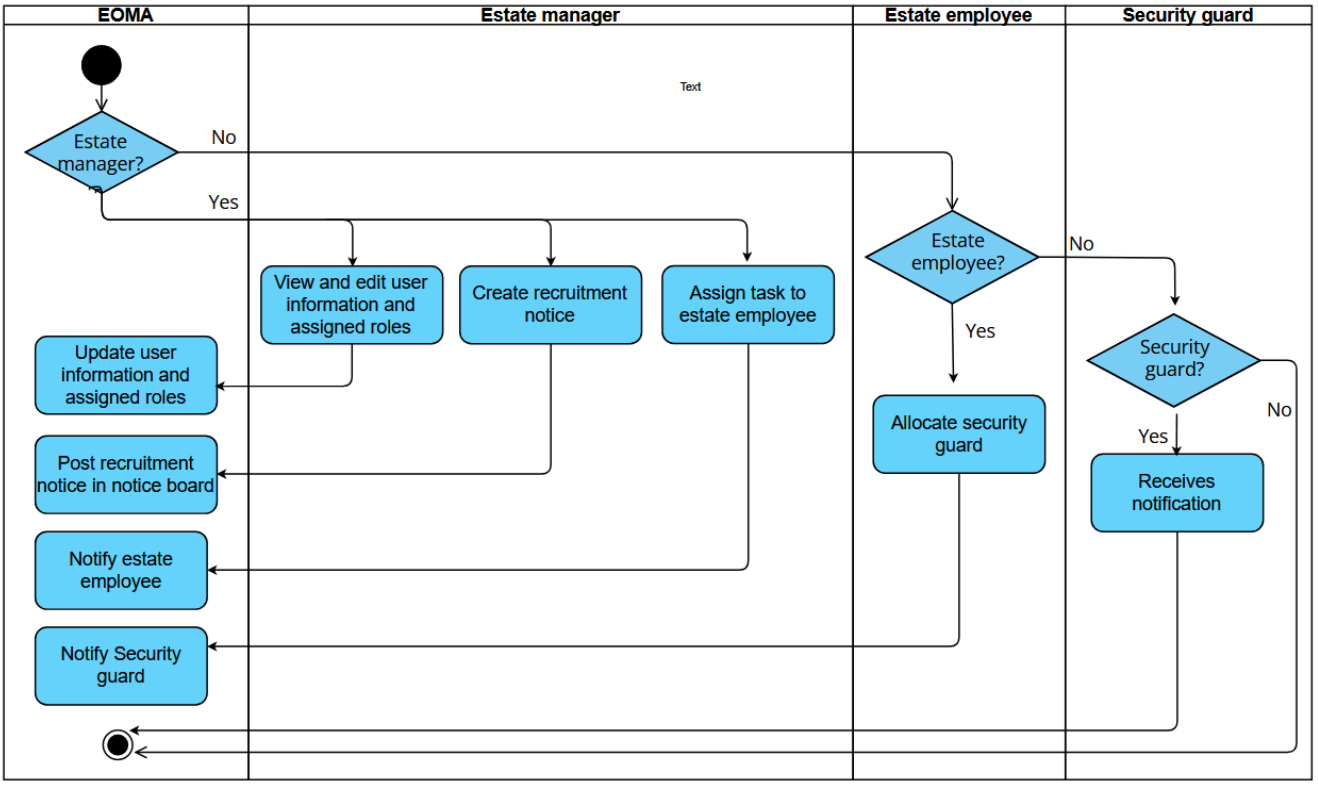


Figure 36: HRM swimlane diagram

SID (Swimlane ID): 1.6

Name: Notification
Reference: Use case and activity diagram level 1.6

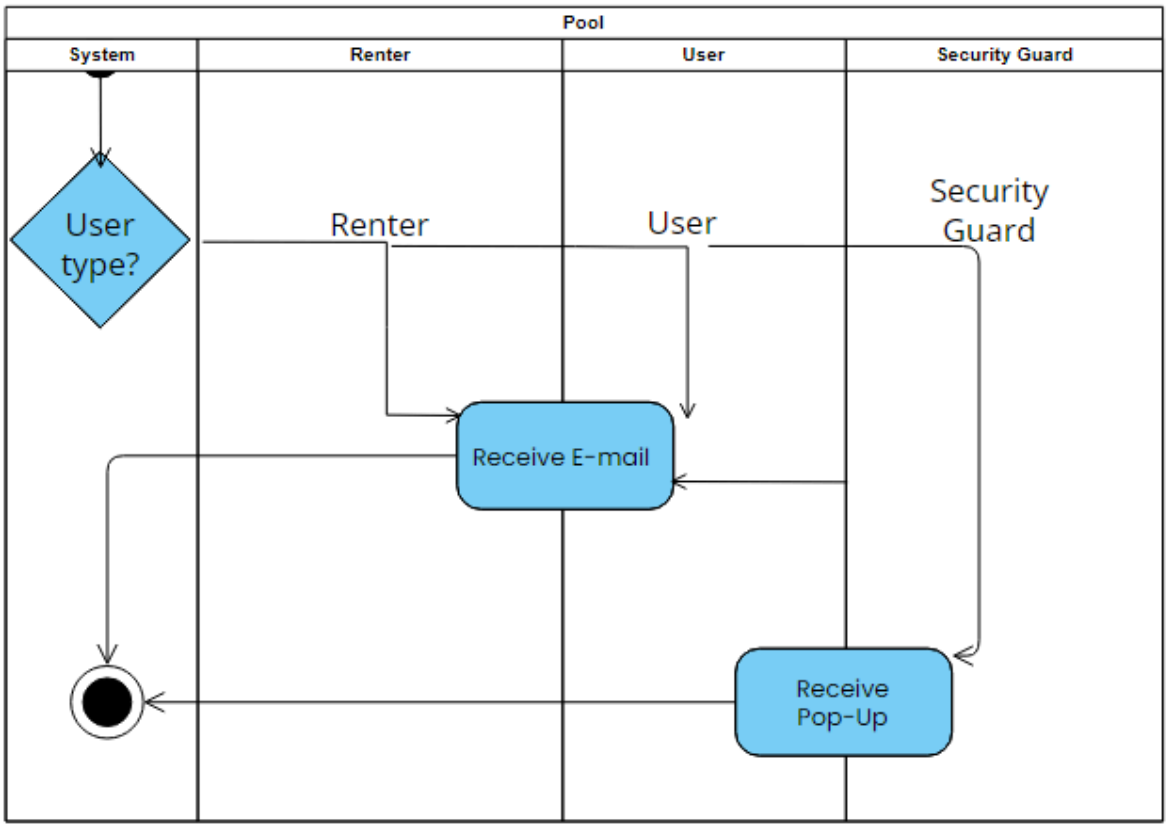


Figure 37: Notification swimlane diagram

DATA BASED MODELING

Data Modeling Concept

A Data Model is an organized view of database concepts and their relationships. The purpose of creating a conceptual data model is to establish entities, their attributes, and relationships. In this data modeling level, there is hardly any detail available on the actual database structure.

The 3 basic elements of Data Modeling are-
- Entity: A real-world thing
- Attribute: Characteristics or properties of an entity
- Relationship: Dependency or association between two entities

The entity relationship diagram (ERD) defines all data objects that are processed within the system, the relationships between the data objects and the information about how the data objects are entered, stored, transformed and produced within the system.

The main goal of a designing data model is to make certain that data objects offered by the functional team are represented accurately. It should be detailed enough to be used for building the physical database.

Data Objects

A data object is a collection of one or more data points that create meaning as a whole. In other words, it's a storage or container to store data values. More specifically, data objects are usable, functional, and meaningful artifacts whose form and function is to encode data. It can be used in type checking operations. A data object can be an external entity, a thing, an occurrence, a role, an organizational unit, a place or a structure.

Data Object Identification

SL No.	Noun	P/S	Attributes
1.	Syndicate Member	S ✅	48,76
2.	Treasurer	S ✅	48,76
3.	Vendor	S ✅	14,16,36,42,43,44, 48
4.	Estate Manager	S ✅	48,76
5.	Admin(Taken)	S ✅	
6.	Estate employee	S ✅	11,48
7.	University Employee	S ✅	48,76
8.	DU account	S ✅	20,21,22,23,24,25, 49,50,63,71
9.	Administrator (Taken)	S ✅	
10.	Contract	S ✅	14,16,69
11.	Task	S ✅	
12.	Security Guard	S ✅	64,19,49
13.	Shop	S ✅	16,37,38,39,40,41, 42
14.	Personal Information	S ✅	
15.	Home Application	S ✅	71,26,28,30,31,69
16.	Tender	S ✅	
17.	flat	S ✅	18,26,27,28,30,31, 39,41,72

18.	Vacancy status	S ✅	
19.	Address	S ✅	
20.	joining date	S ✅	
21.	basic salary	S ✅	
22.	designation	S ✅	
23.	Prev. govt. job	S ✅	
24.	marital status	S ✅	
25.	spouse	S ✅	
26.	Standard flat	S ✅	
27.	3D image	S ✅	
28.	territory	S ✅	
29.	Building	S ✅	72, 32, 33, 55
30.	Room count	S ✅	
31.	floor number	S ✅	
32.	provost complex	S ✅	
33.	bungalow	S ✅	
34.	notification	S ✅	35,11,10,63,61,67, 69,
35.	meeting detail	S ✅	
36.	bill payment	S ✅	45,46,47,66,67,69
37.	market availability	S ✅	
38.	Shop no	S ✅	
39.	size	S ✅	

40.	area	S ✅	
41.	rent	S ✅	
42.	caution money	S ✅	
43.	transfer fee	S ✅	
44.	Payment	S ✅	45,46,47,66,67,69
45.	gateway	S ✅	
46.	Visa card	S ✅	
47.	mobile banking	S ✅	
48.	role	S ✅	
49.	name	S ✅	
50.	department	S ✅	
51.		S ✅	
52.	Teacher	S ✅	48,76
53.	Staff	S ✅	48,76
54.	recruitment notice	S ✅	
55.	Residential Building	S ✅	
56.	notice board	S ✅	54,61,62
57.	renter	S ✅	14,65,70,64,19,63
58.	Senate Hall	S ✅	60,77
59.	Reservation details	S ✅	
60.	available date	S ✅	
61.	announcement	S ✅	
62.	Notice category	S ✅	

63.	email	S ✅	
64.	Phone number	S ✅	
65.	acceptance fee	S ✅	
66.	amount	S ✅	
67.	due	S ✅	
68.	Account	S ✅	63,49,51
69.	date	S ✅	
70.	Rent payment	S ✅	45,46,47,66,67,69
71.	Employee ID	S ✅	
72.	Building ID	S ✅	
73.	Officer	S ✅	48
74.	Residential Building	S ✅	
75.	Points	S ✅	
76.	Standings	S ✅	
77.	Hall type	S ✅	
78.	Senate Application	S ✅	14,19,49,59,63,64, 69,77
79.	Dining room	P	
80.	Conference hall	P	
81.	Auditorium	P	
82.	Service Provider	P	
83.	Consumer	P	
84.	Profile	P	

85.	User type	P	
86.	Procedure	P	
87.	Recruitment CV	P	
88.	transfer vendorship	P	
89.	Software	P	
90.	Estate Office management application	P	
91.	System	P	
92.	EOMA	P	
93.	Credentials	P	
94.	Invoice	P	
95.	Deal	P	
96.	Workload	P	
97.	Database	P	
98.	Contract renewal process	P	
99.	Applicant	P	
100.	User	P	
101.	Available flat	P	
102.	Application sorting system	P	
103.	Point based sorting system	P	
104.	meeting	P	
105.	flat view	P	

106.	3D view	P	
107.	information	P	
108.	open market	P	
109.	mobile shop	P	
110.	Katabon Market	P	
111.	Green Super Market	P	
112.	caution deposit	P	
113.	online banking	P	
114.	auction	P	
115.	user account	P	
116.	permission	P	
117.	control system access	P	
118.	authorized user	P	
119.	user profile	P	
120.	role-based access control system	P	
121.	RBAC	P	
122.	predefined permission	P	
123.	functionality	P	
124.	view	P	
125.	edit	P	
126.	disable	P	
127.	user account	P	
128.	update	P	

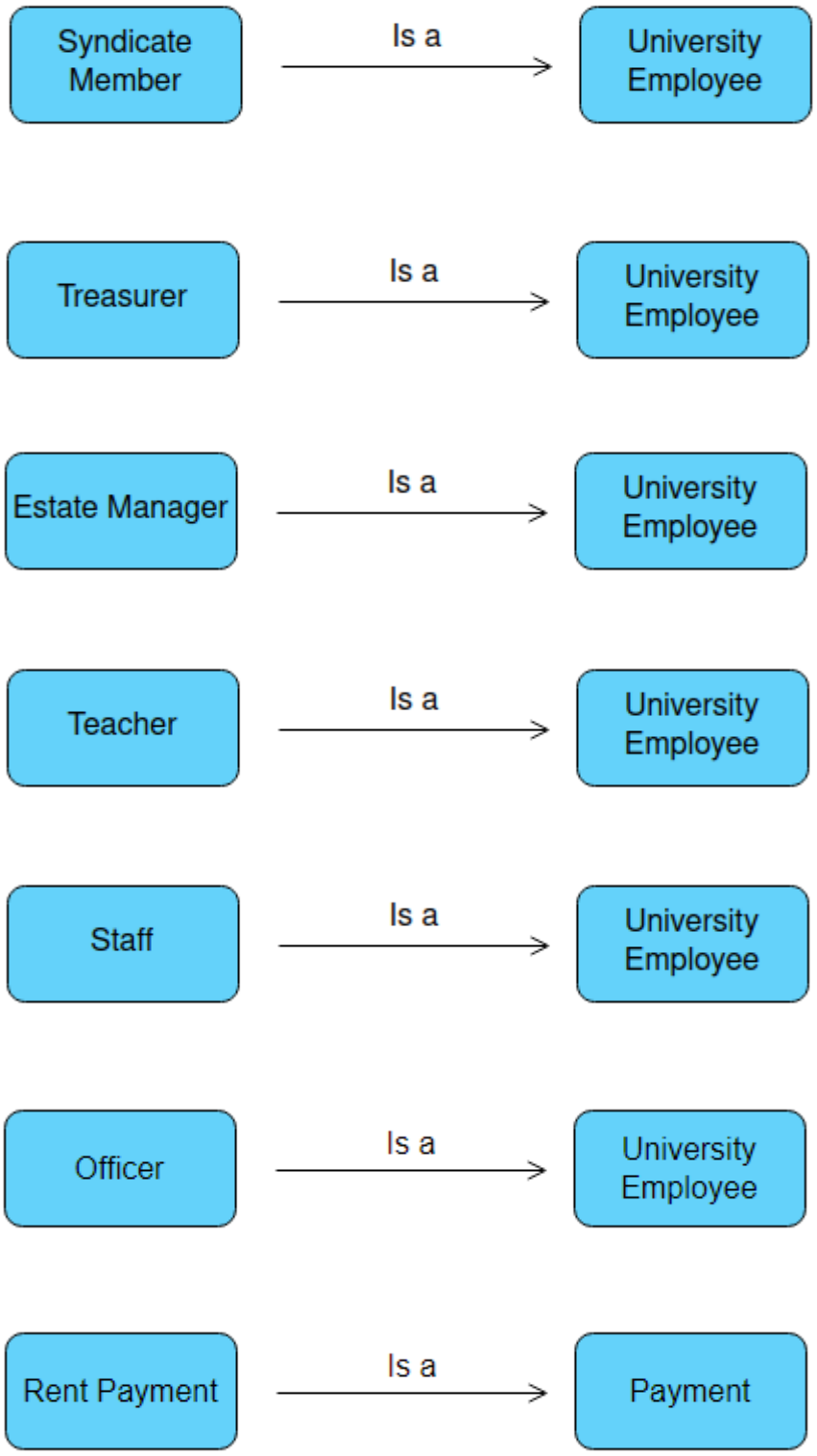
129.	central notice board	P	
130.	authorized personnel	P	
131.	search	P	
132.	relevant information	P	
133.	filter	P	
134.	specific need	P	
135.	channel	P	
136.	in-app pop-up	P	
137.	priority	P	
138.	urgency	P	
139.	maintenance schedule	P	
140.	monthly payment reminder	P	
141.	Senate office vacancy	P	
142.	notification history	P	
143.	notification preference	P	
144.	online banking payment method	P	
145.	application process	P	
146.	Review	P	
147.	eligible		

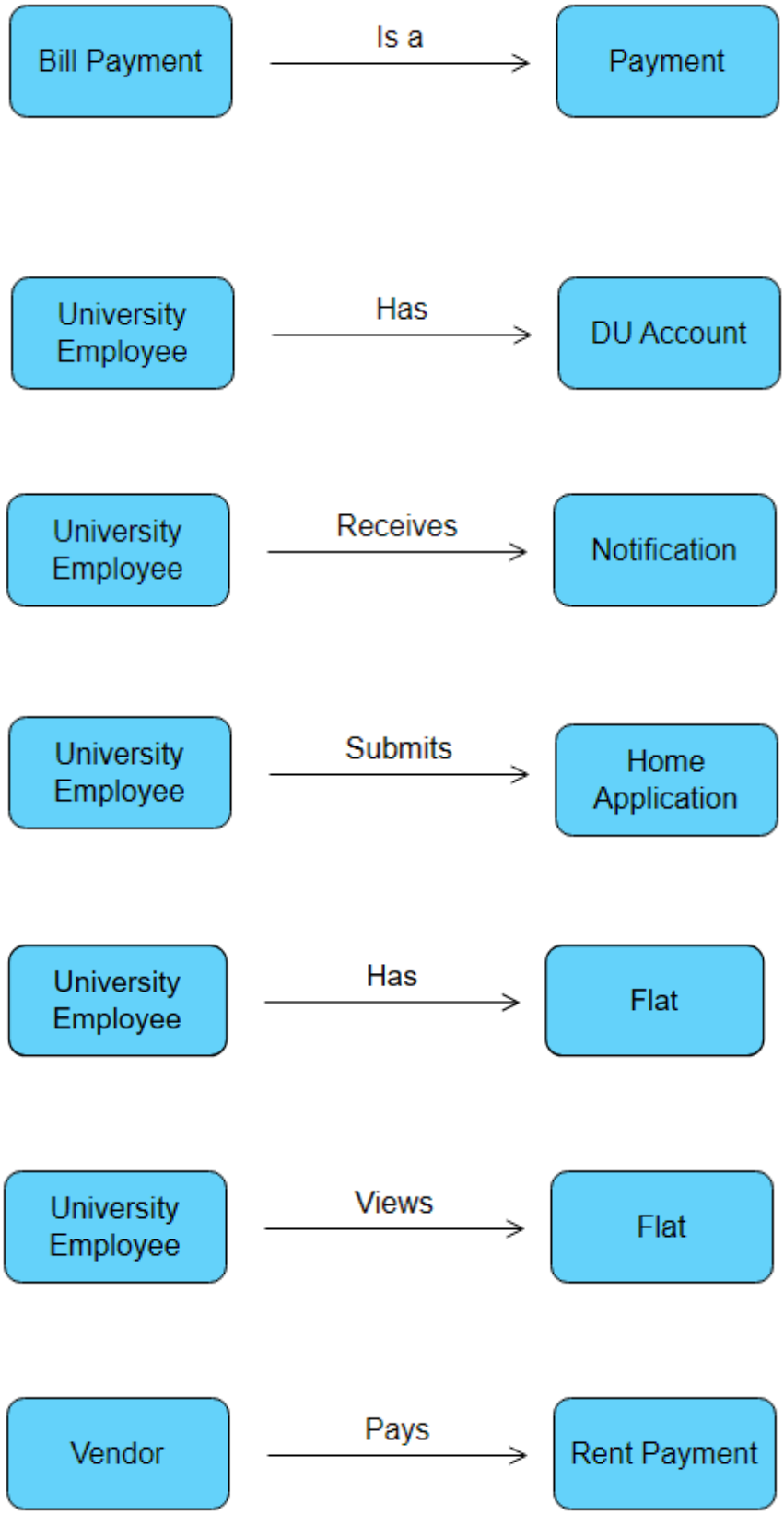
Probable data objects:

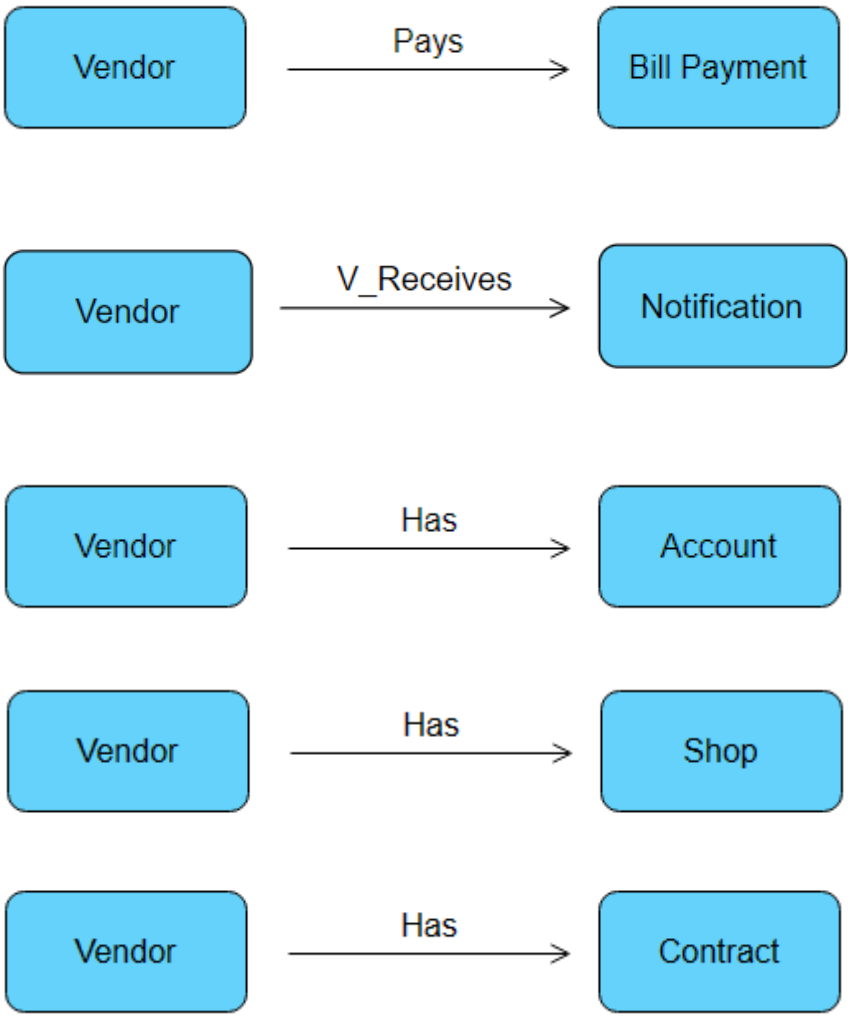
Sl No.	Data Object	Attributes
1.	Syndicate Member	Role
2.	Treasurer	Role
3.	Estate Manager	Role
4.	Teacher	Role
5.	Staff	Role
6.	Officer	Role
7.	Building	Building ID,provost complex, Bungalow, Residential
8.	Estate employee	Task,Role
9.	Vendor	Personal Information,Tender,caution money,Transfer fee,Role
10.	Contract	Personal Information,Tender, date
11.	renter	Personal Information,Acceptance fee,phone, address, email
12.	Shop	Tender, Market availability,Shop no,Size,Area,Rent,caution money
13.	flat	Vacancy Status,Standard flat,Building ID,Room count,Floor number,Size,rent
14.	DU account	Joining date, basic salary, designation, prev. Govt. job, marital status,

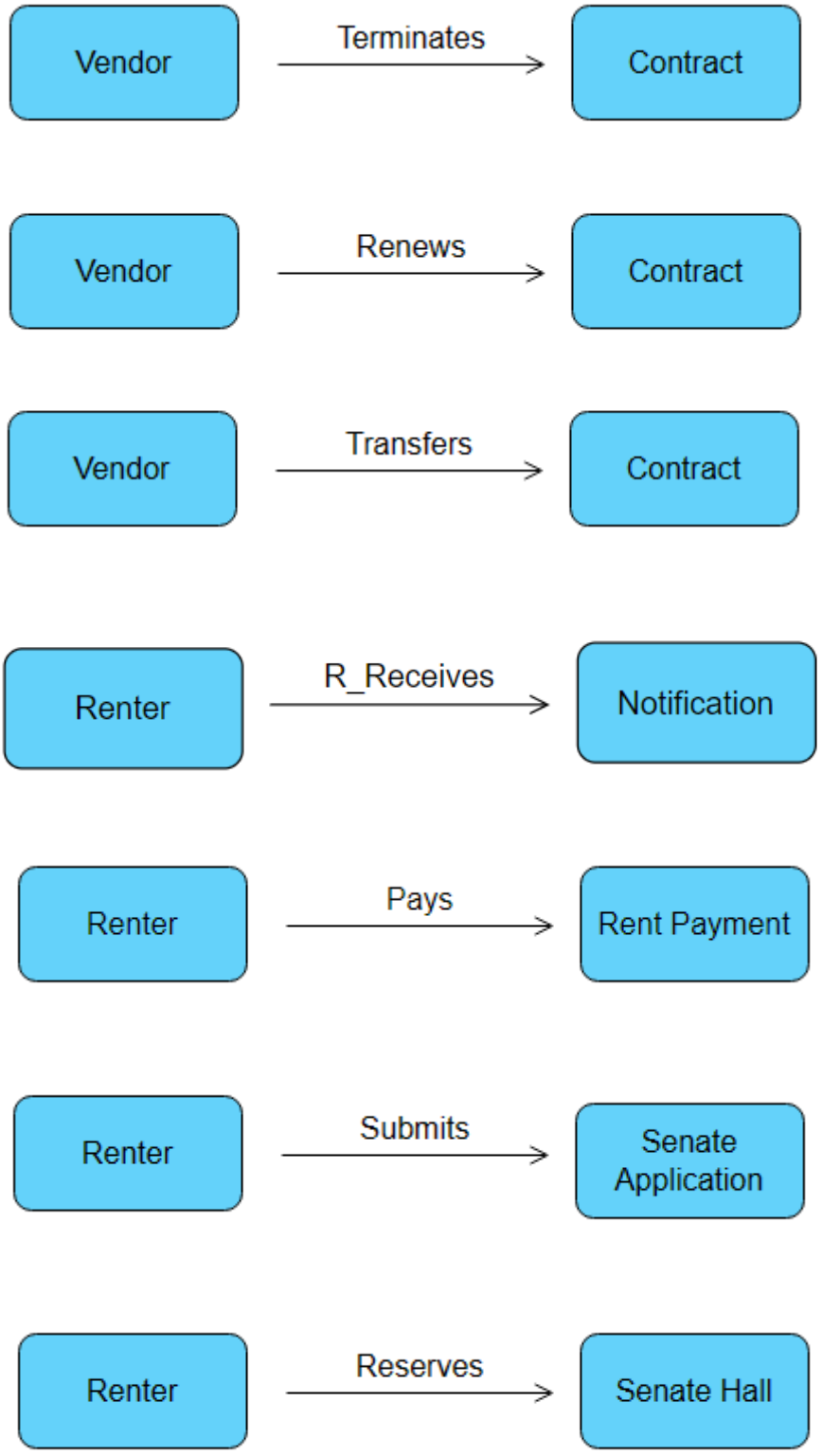
Sl No.	Data Object	Attributes
		spouse,name,department,email, employee id
15.	Notification	Meeting details,Task,Contract,email,Announcement,due,date
16.	Bill payment	gateway,Visa Card,Mobile banking,Amount,Due,date
17.	Payment	gateway,Visa Card,Mobile banking,Amount,Due,date
18.	Rent payment	gateway,Visa Card,Mobile banking,Amount,Due,date
19.	University Employee	Role
20.	Notice board	Recruitment notice,Account,Notice category
21.	Senate Hall	Available Date,Hall type
22.	Account	email,name,phone,address
23.	Home Application	EmployeeID,Standard,Territory,Room Count,Floor Number,date
24.	Security Guard	Name, Address, Phone-Number
25.	Senate Application	Personal Information,Address,Name,Reservation Details,Email,Phone number,date,Hall type

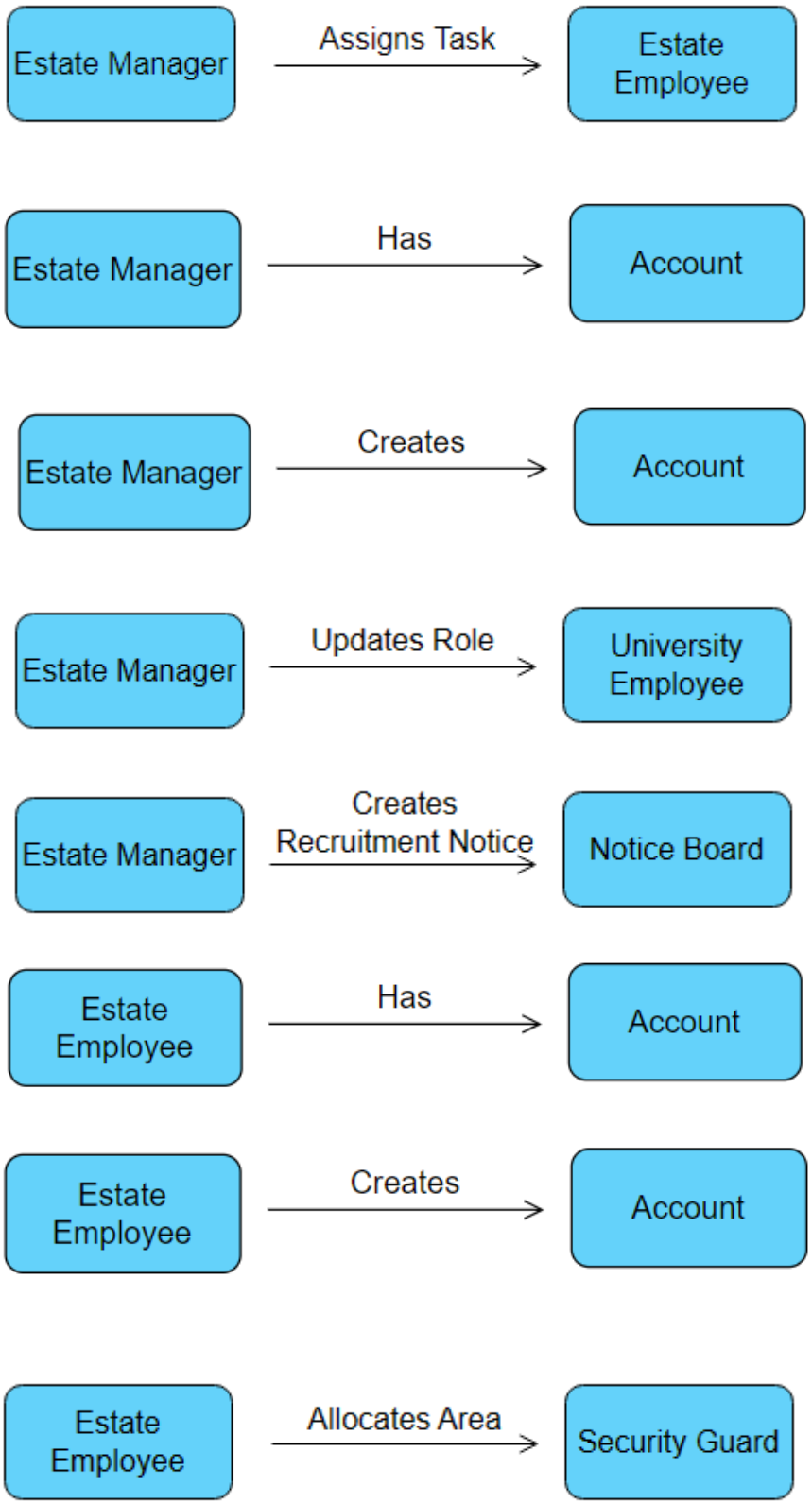
Relationship Between Data Objects

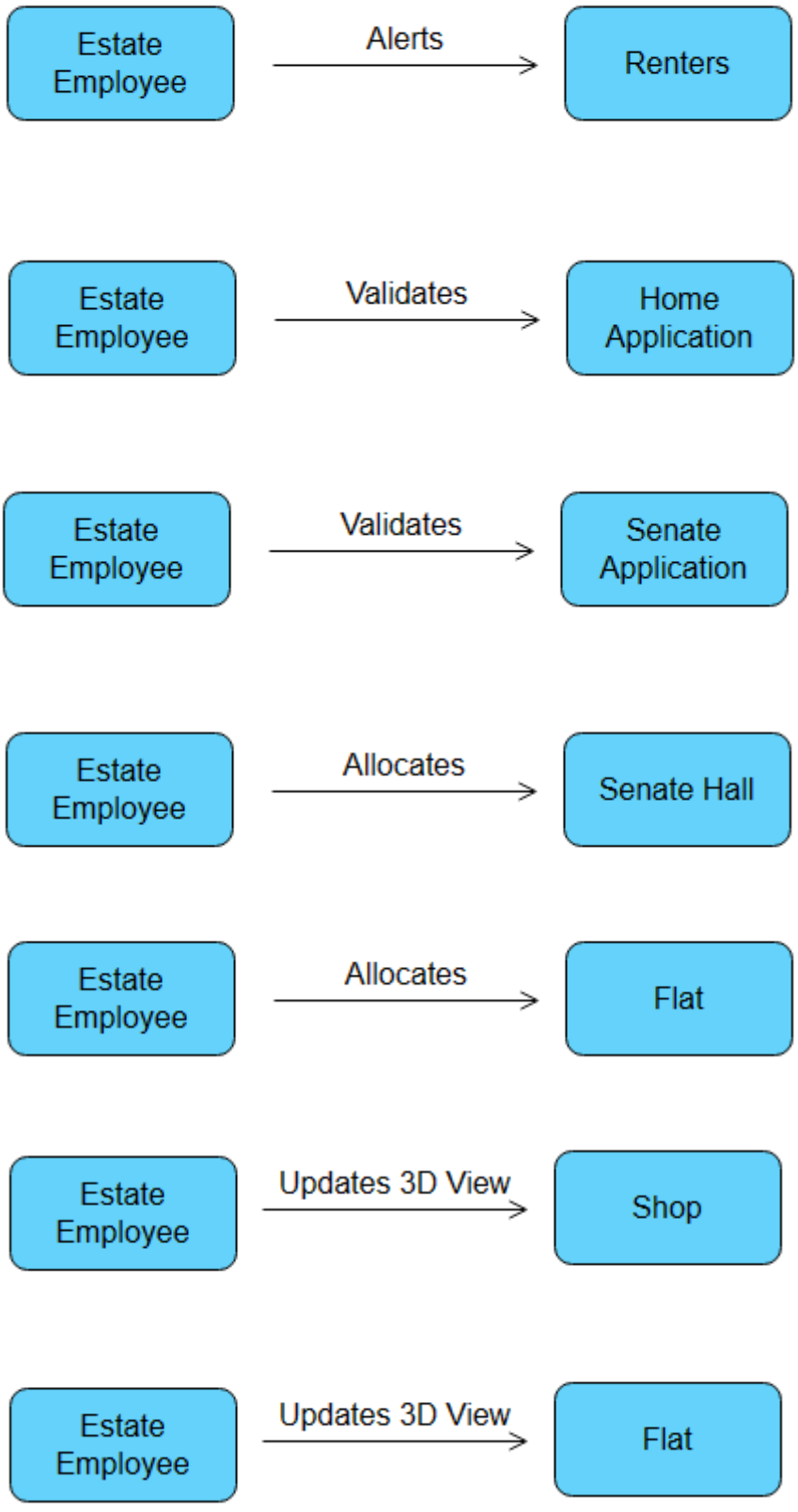


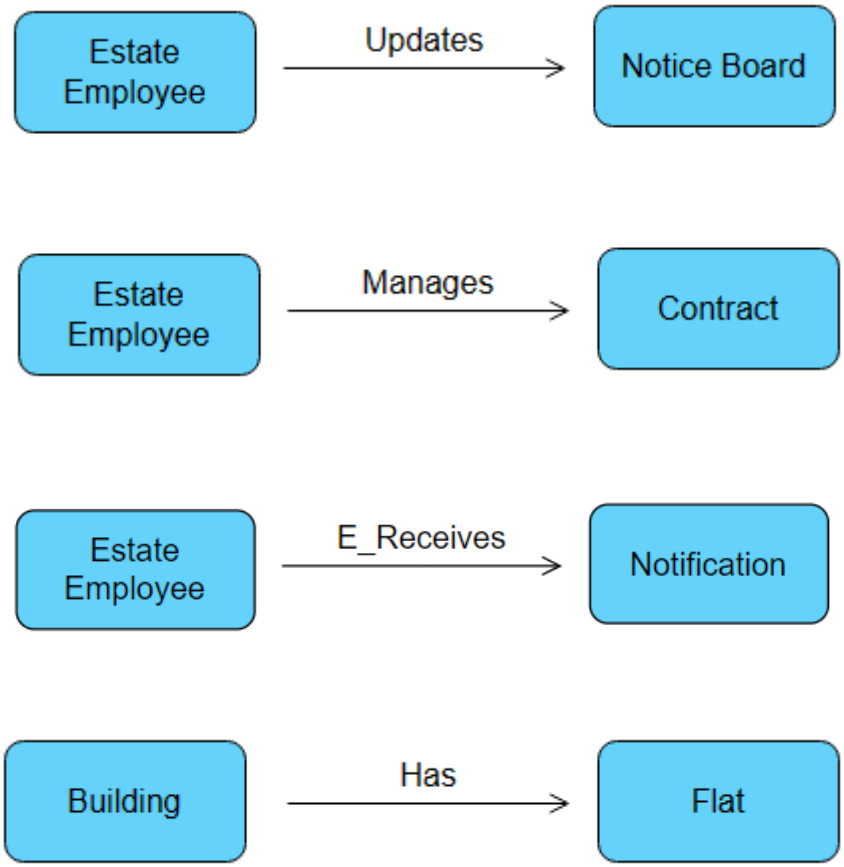

Bill Payment
Is a
Payment
University Employee
Has
DU Account
University Employee
Receives
Notification
University Employee
Submits
Home Application
University Employee
Has
Flat
University Employee
Views
Flat
Vendor
Pays
Rent Payment


Vendor
Pays
Bill Payment
Vendor
V_Receives
Notification
Vendor
Has
Account
Vendor
Has
Shop
Vendor
Has
Contract


Vendor
Terminates
Contract
Vendor
Renews
Contract
Vendor
Transfers
Contract
Renter
R_Receives
Notification
Renter
Pays
Rent Payment
Renter
Submits
Senate Application
Renter
Reserves
Senate Hall


Estate Manager
Assigns Task
Estate Employee
Estate Manager
Has
Account
Estate Manager
Creates
Account
Estate Manager
Updates Role
University Employee
Estate Manager
Creates Recruitment Notice
Notice Board
Estate Employee
Has
Account
Estate Employee
Creates
Account
Estate Employee
Allocates Area
Security Guard


Estate Employee
Alerts
Renters
Estate Employee
Validates
Home Application
Estate Employee
Validates
Senate Application
Estate Employee
Allocates
Senate Hall
Estate Employee
Allocates
Flat
Estate Employee
Updates 3D View
Shop
Estate Employee
Updates 3D View
Flat


Estate Employee
Updates
Notice Board
Estate Employee
Manages
Contract
Estate Employee
E_Receives
Notification
Building
Has
Flat

ER Diagram

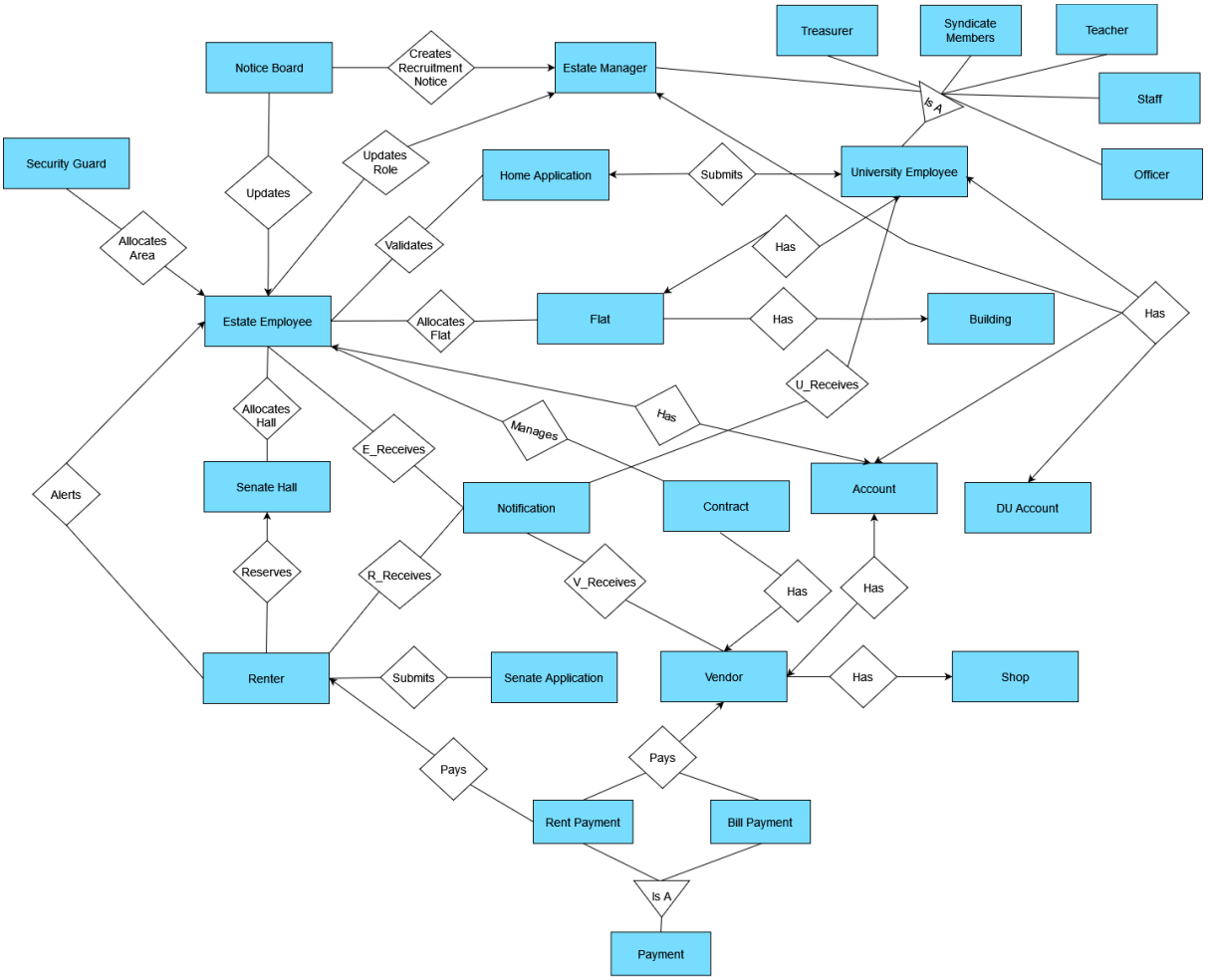


Figure 38: ER Diagram

Schema Diagram

Entity	Attribute	Type	Description
DU Account	EmployeeID	INT	Unique identifier for each employee
	Name	VARCHAR(100)	Name of the employee
	JoiningDate	DATE	Date of joining
	BasicSalary	DECIMAL(10, 2)	Basic salary of the employee
	Designation	VARCHAR(100)	Designation/title of the employee
	PrevGovtJob	VARCHAR(100)	Description of previous government job experience
	IsMarried	BIT	Marital status of the employee
	IsSpouseEmployee	VARCHAR(100)	Whether the employee has another employee as his/her spouse
	Department	VARCHAR(100)	Department where the employee works
Flat	FlatID	INT	Primary key, unique identifier for each flat
	VacancyStatus	BOOLEAN	Indicates if the flat is vacant (TRUE) or occupied

Entity	Attribute	Type	Description
			(FALSE)
	IsStandardFlat	BIT	Indicates if the flat is a standard flat
	BuildingID	INT	Foreign key referencing Building table's Building ID
Flat	RoomCount	INT	Number of rooms in the flat
	FloorNumber	INT	Floor on which the flat is located
	Size	DECIMAL(10, 2)	Size of the flat in square ft.
	Rent	DECIMAL(10, 2)	Rent amount for the flat
	EmployeeId	VARCHAR(100)	Foreign Key(University Employee)
	Tender	VARCHAR(100)	The tender or license type of the shop
	IsMarketAvailable	BIT	Indicates if the shop is available in the market
Shop	ShopNo	INT	The unique number identifying the shop
	Size	DECIMAL(10, 2)	The size of the shop in square units

Entity	Attribute	Type	Description
Shop	Area	VARCHAR(100)	The area or location of the shop
	Rent	DECIMAL(10, 2)	The rental cost of the shop
	CautionMoney	DECIMAL(10, 2)	The caution money or deposit required
	VendorID	VARCHAR(100)	Foreign Key(Vendor)
	EmployeeID	INT	
Vendor	VendorID	INT	PRIMARY KEY, unique identifier for the vendor
	PersonalInformation	VARCHAR(100)	Vendor's contact information
	Tender	VARCHAR(100)	Details about the vendor's tender
	CautionMoney	DECIMAL(10, 2)	Amount of caution money
	TransferFee	DECIMAL(10, 2)	Transfer fee amount
	Role	VARCHAR(100)	Vendor's role
Building	BuildingID	INT	Unique identifier for each building (Primary Key)
	IsProvostComplex	BIT	Indicates if the building is the provost complex
	IsBungalow	BIT	Indicates if the building is a

Entity	Attribute	Type	Description
Building			bungalow
	IsResidential	BIT	Indicates if the building is residential
Contract	ContractID	INT	Unique identifier for the contract
	PersonalInformation	VARCHAR(100)	Information about the vendor
	Tender	VARCHAR(100)	Details of the tender
	Date	DATE	Date of the contract
	VendorID	VARCHAR(100)	Foreign Key(Vendor)
	EmployeeID	INT	
Renter	RenterID	INT	Primary key to uniquely identify a renter
	PersonalInformation	VARCHAR(100)	Information about the renter
	AcceptanceFee	DECIMAL(10, 2)	Fee paid by the renter for acceptance
	ReservationDetails	VARCHAR(100)	Details about the reservation
	Email	VARCHAR(100)	Email address of the renter
	EmployeeID	INT	
	Task	VARCHAR(100)	Describes the task assigned to

Entity	Attribute	Type	Description
Estate Employee			the employee.
	Role	VARCHAR(100)	Represents the role of the estate employee.
	EmployeeId	INT	Foreign Key(University Employee)
Payment	PaymentID	INT	Primary key, unique identifier for payments
	Gateway	VARCHAR(100)	Indicates if SSLCommerz payment method used
	VisaCard	VARCHAR(100)	Indicates if Visa Card payment method used
	IsMobileBanking	BIT	Indicates if Mobile Banking payment method used
	Amount	DECIMAL(10, 2)	Total amount of the bill payment
	Due	DECIMAL(10, 2)	Amount due for the bill payment
	Date	Date	Date of the bill payment
	IsBillPayment	BIT	
	IsRentPayment	BIT	
	VendorID	INT	Foreign Key(Vendor)

Entity	Attribute	Type	Description
	RenterID	INT	Foreign Key(Renter)
Notice board	NoticeID	INT	Primary key identifier for each notice
	RecruitmentNotice	VARCHAR(100)	Details of recruitment notices posted on board
	Account	VARCHAR	Account information related to the notice
	NoticeCategory	VARCHAR(100)	Category classification for the notice
	EmployeeID	INT	Foreign Key(University Employee)
Senate Hall	HallID	INT	Unique identifier for each Senate Hall
	AvailableDate	Date	Date when the Senate Hall is available
	HallType	VARCHAR(100)	Type or category of the Senate Hall (e.g., conference, meeting, event)
	RenterID	INT	Foreign Key(Renter)
	EmployeeID	INT	

Entity	Attribute	Type	Description
Account	email	VARCHAR(100)	Email address of the account holder
	name	VARCHAR(100)	Name of the account holder
	phone	VARCHAR(100)	Phone number of the account holder
	address	VARCHAR(100)	Address of the account holder
	VendorID	VARCHAR(100)	Foreign Key (Vendor)
Home Application	EmployeeID	INT	Unique identifier for the employee
	Standard	VARCHAR(100)	Standard or classification of the home
	Territory	VARCHAR(100)	Territory or location of the home
	RoomCount	INT	Number of rooms in the home
	FloorNumber	INT	Floor number of the home
	Date	Date	Date associated with the home
Security Guard	GuardID	INT	Unique identifier for the guard
	Name	VARCHAR(100)	Name of the security guard
	Address	VARCHAR(100)	Address of the

Entity	Attribute	Type	Description
			security guard
	PhoneNumber	VARCHAR(100)	Phone number of the security guard
Senate Application	ApplicationID	VARCHAR(100)	Unique identifier for each application
	PersonalInformation	VARCHAR(100)	Information about the applicant's personal details
	Address	VARCHAR(100)	Applicant's address details
	Name	VARCHAR(100)	Applicant's full name
	ReservationDetails	VARCHAR(100)	Details about the reservation request
	Email	VARCHAR(100)	Applicant's email address
	PhoneNumber	VARCHAR(100)	Applicant's contact phone number
	Date	Date	Date of the application submission
	HallType	VARCHAR(100)	Type of hall requested for reservation
	RenterID	INT	Foreign Key(Renter)

Entity	Attribute	Type	Description
	EmployeeID	INT	
University Employee	Role	VARCHAR(100)	Specifies the role in the EOMA
	IsTreasurer	BIT	
	IsSyndicate	BIT	
	IsTteacher	BIT	
	IsStaff	BIT	
	IsOfficer	BIT	
	IsEstatemanager	BIT	
	EmployeeID	INT	Foreign key(DU Account)
Notification	NotificationID	INT	Primary key, unique identifier for notification
	MeetingDetails	VARCHAR(100)	Details of the meeting associated with the notification
	Task	VARCHAR(100)	Description of the task associated with the notification
	Email	VARCHAR(100)	Email address of the recipient for the notification
	Announcement	VARCHAR	Description of the announcement
	DueDate	DATE	Due date for the notification

Entity	Attribute	Type	Description
	CreationDate	DATE	Date when the notification was created
Allocates Area	EmployeeID	INT	Composite Primary Key(University Employee)
	GuardID	INT	Composite Primary Key(Security guard)
E_Receives	EmployeeID	INT	Composite Primary Key(Estate Employee)
	NotificationID	INT	Composite Primary Key(Notification)
V_Receives	VendorID	INT	Composite Primary Key(Vendor)
	NotificationID	INT	Composite Primary Key(Notification)
R_Receives	RenterID	INT	Composite Primary Key(Renter)
	NotificationID	INT	Composite Primary Key(Notification)
U_Receives	EmployeeID	INT	Composite Primary Key(University Employee)

Entity	Attribute	Type	Description
	NotificationID	INT	Composite Primary Key(Notification)

Class Based Modeling

Class Based Modeling Concept

Class-based modeling identifies classes, attributes and relationships that the system will use. It represents the object. The system manipulates the operations.

The elements of the class based model consist of classes and object, attributes, operations, class – responsibility - collaborator (CRC) models.

Classes are determined using underlining each noun or noun clause and entering it into the simple table. Attributes are the set of data objects that are defining a complete class within the context of the problem. The operations define the behavior of an object.

Noun List From EOMA

SL No.	Noun	SL No.	Nou
1.	Syndicate Member	2.	Vacancy status
3.	Treasurer	4.	Address
5.	Vendor	6.	joining date
7.	Estate Manager	8.	basic salary
9.	Admin(Taken)	10.	designation

SL No.	Noun	SL No.	Nou
11.	Estate employee	12.	Prev. govt. job
13.	University Employee	14.	marital status
15.	DU account	16.	spouse
17.	Administrator (Taken)	18.	Standard flat
19.	Contract	20.	3D image
21.	Task	22.	territory
23.	Security Guard	24.	Building
25.	Shop	26.	Room count
27.	Personal Information	28.	floor number
29.	Home Application	30.	provost complex
31.	Tender	32.	bungalow
33.	flat	34.	notification
35.	size	36.	Shop No.
37.	area	38.	renter
39.	rent	40.	Senate Hall
41.	caution money	42.	Reservation details
43.	transfer fee	44.	available date
45.	Payment	46.	announcement
47.	gateway	48.	Notice category

SL No.	Noun	SL No.	Nou
49.	Visa card	50.	email
51.	mobile banking	52.	Phone number
53.	role	54.	acceptance fee
55.	name	56.	amount
57.	department	58.	due
59.	Teacher	60.	Account
61.	Staff	62.	date
63.	recruitment notice	64.	Rent payment
65.	Residential Building	66.	Employee ID
67.	notice board	68.	Building ID
69.	meeting detail	70.	Officer
71.	bill payment	72.	Residential Building
73.	market availability	74.	Points
75.	Senate Application	76.	EOMA
77.	Dining room	78.	Credentials
79.	Auditorium	80.	Invoice
81.	Service Provider	82.	Deal
83.	Consumer	84.	Workload
85.	Profile	86.	Database

SL No.	Noun	SL No.	Nou
87.	User type	88.	Contract renewal process
89.	Procedure	90.	Applicant
91.	Recruitment CV	92.	EOMA
93.	Dashboard	94.	Database
95.	transfer vendorship	96.	System
97.	Software	98.	eligible
99.	Estate Office management application	100.	control system access
101.	Conference hall	102.	predefined permission
103.	authorized user	104.	functionality
105.	user profile	106.	disable
107.	RBAC	108.	user account
109.	Review	110.	update
111.	User	112.	central notice board
113.	Available flat	114.	authorized personnel
115.	meeting	116.	search
117.	flat view	118.	relevant information
119.	3D view	120.	filter

SL No.	Noun	SL No.	Nou
121.	information	122.	specific need
123.	open market	124.	channel
125.	mobile shop	126.	priority
127.	Katabon Market	128.	urgency
129.	Green Super Market	130.	maintenance schedule
131.	caution deposit	132.	Senate office vacancy
133.	online banking	134.	notification history
135.	auction	136.	notification preference
137.	user account	138.	online banking payment method
139.	permission	140.	Application Process

General Classification

Candidate classes were then characterized in seven general classes. The seven general characteristics are as follows:

1. External entities
2. Things
3. Events
4. Roles
5. Organizational units
6. Places
7. Structures

Potential nouns to become a class after general classification criteria

SL No.	Noun	General Class
1.	Vendor	Role, external entity, things
2.	Estate Manager	Role, external entity, things
3.	Estate employee	Role, external entity, things
4.	University Employee	Role, organizational units, external entity
5.	Contract	Things, event

SL No.	Noun	General Class
6.	Security Guard	Roles, external entity
7.	Shop	Things,places, structures
8.	Flat	Things, places, structures
9.	Building	Things, places, organizational unit, structures
10.	Provost complex	Things, places, organizational unit, structures
11.	Bungalow	Things, places, organizational unit, structures
12.	Notification	Things, external entity
13.	Bill Payment	Things, external entity, structures
14.	Payment	Things, external entity, structures
15.	Teacher	Role, organizational units, external entity
16.	Staff	Role, organizational units, external entity
17.	Residential Building	Things, places, organizational unit, structures
18.	Notice board	Things, structures, external entity
19.	Renter	External entity, role,

SL No.	Noun	General Class
		organizational units
20.	Senate Hall	Things, place, external entity
21.	Account	Things, external entity, organizational unit, structures
22.	Rent payment	Things, external entity, structures
23.	Officer	Role, organizational units, external entity
24.	Residential Building	Things, places, organizational unit, structures
25.	Senate Application	Things, structure, external entity
26.	Home Application	Things, structure, external entity
27.	Database	Things, structure, external entity
28.	Dashboard	Things,Events,Structure

Selection Criteria

The candidate classes are then selected as classes by six Selection Criteria. A candidate class generally becomes a class when it fulfills around three characteristics.

1. Retain information
2. Needed services
3. Multiple attributes
4. Common attributes
5. Common operations
6. Essential requirements

Potential general classified nouns to become a class after selection criteria

SL No.	Noun	Selection Criteria
1.	Vendor	1-6(Selected)
2. *	Estate Manager	1,2,6
3.	Estate employee	1-6(Selected)
4.	University Employee	1-6(Selected)
5. *	Contract	1,3,4
6. *	Security Guard	3,4
7.	Shop	1,3,4,6 (Selected)
8.	Flat	1,3,4,6 (Selected)
9.	Building	1,3,4,6 (Selected)
10.	Notification	1-6 (Selected)

SL No.	Noun	Selection Criteria
11.	Payment	1,3,4,6(Selected)
12.	Teacher	1-6(Selected)
13.	Staff	1-6(Selected)
14.	Notice board	1-5(Selected)
15.	Renter	1-6(Selected)
16.	Senate Hall	1,3,4,6(Selected)
17. *	Account	1,3,4,6
18.	Officer	1-6(Selected)
19. *	Senate Application	1,3,4,6
20. *	Home Application	1,3,4,6
21. *	Announcement	1,3,4,6
22.	Dashboard	2,3(Selected)
23.	Database	1,6(Selected)
24.	SSLCommerz	6(Selected)
25.	Gmail	6(Selected)

Verbs List:

SL no.	Verb
1.	create
2.	assign
3.	manage
4.	maintain
5.	update
6.	view
7.	notify
8.	inform
9.	approve
10.	handle
11.	accept
12.	cancel
13.	delete
14.	fill
15.	validate
16.	access
17.	change
18.	set up
19.	receive
20.	arrange
21.	apply
22.	search

23.	specify
24.	classify
25.	join
26.	add
27.	provide
28.	pay
29.	initiate
30.	ensure
31.	facilitate
32.	suggest
33.	personalize
34.	extract
35.	guide
36.	require
37.	log in
38.	display
39.	sort
40.	choose
41.	withdraw
42.	reserve
43.	post
44.	disable
45.	deliver
46.	categorize
47.	prioritize

48.	filter
49.	allow
50.	complete
51.	visit
52.	process

Classes:

SL No.	Noun	Attributes	Method
1.	Vendor	-PersonalInformation -Tender -CautionMoney -Transfer fee -Role -Account -contract -shop -notficationDetails	+pay() +view_shop() +renew_contract() +terminate_contract() +transfer_contract()
2.	Estate Manager	-Role -Employee ID -Account -NoticeBoard -EstateEmployee[]	+register_asAdmin() +allocate_task() +create_empAccount() +assign_role() +delete_user() +create_recruitment_notice()
3.	Estate employee	-Role -AssignedTask -Account -SSLCommerz -Vendor[] -NotificationDetails	+change_password() +allocate_flat() +validate_vendor() +validate_tender() +validate_contract()

SL No.	Noun	Attributes	Method
			+confirm_hallReservation() +reschedule_hallReservation() +sort_homeApplication() +create_vendorAcc()
4.	University Employee	-Role -NotificationDetails -	+apply_flat() +view_flat() +change_flat() +leave_flat()
5.	Shop	-Tender -MarketAvailability -ShopNo -Size -Area -Rent -CautionMoney	+update_tender_info() +update_view() +update_vendor()
6.	Flat	-VacancyStatus -StandardFlat -BuildingID -RoomCount -FloorNumber -Size -Rent -Employee	+update_vacancy() +update_home_renter() +update_rent()
7.	Notification	-MeetingDetails -Task -Contract -email -Announcement -due -date	+send_pop-up() +send_email()
8.	SSLCommerz	-gateway -VisaCard -MobileBanking	+redirect_to_SSLCommerz()

SL No.	Noun	Attributes	Method
		-Amount -SSLCommerz -Due -date	+send_transactionID ()
9.	Notice board	-RecruitmentNotice -Account -NoticeCategory	+display_notice() +categorize_notice()
10.	Renter	-PersonalInformation -AcceptanceFee -Phone -Address -Email	+apply() +pay() +reschedule()
11.	Account	-Name -Department -Email -Employee id	+update_info()
12.	Gmail	-gmailID	+redirect_to_g-mail()
13.	Database	-tableName	+create_table() +find() +update_table() +delete_table()

CRC Card:

Class	Responsibility	Collaborator
Vendor	• View Shop Information • Make bill payments • Make rent payments • View 3D image of market • Renew Contract • Terminate Contract • Transfer Contract • Get Notification • View Notice Board	Shop SSL Commerz Shop Notification Notice Board
Estate Manager	• Create user accounts • Assign roles • Assign task • Update user profile/role • Delete/disable user profile • Create recruitment notice	Account Estate Employee Database Notice Board
Estate employee	• Login • Refund caution money • View Task • Maintain Security Database • Validate Vender_Info • Validate Tender • Validate Contract • Sort home applications • Notify approved applicants(Home) • Manage Senate Application • Reschedule Reservation	Account SSLCommerz Database Vendor Notification

	• Cancel Reservation • Confirm Reservation(Payment)	
University Employee	• Login • Apply for flat • Apply for flat change • View Standings • Get Notification	Account Notification
Shop	• Store shop details	Vendor
Flat	• Store flat details • Store flat renter details	University Employee
Notification	• Send Notification • Display Notification History	Dashboard
Notice board	• Display Announcements • Categorize Announcements • Post Announcements • Filter Announcements	Estate Manager Estate Employee
Renter	• Apply for reservation • Get Notification	Notification
Account	• Calculate/Show Points	Database
SSLCommerz	• Make online payment	Vendor, Renter
Gmail	• Send email	
Database	• Stores Security Guard Allocation • Stores	

Class Card:

Vendor	
Responsibility	Collaborator
● View Shop Information ● Make bill payments ● Make rent payments ● View 3D image of market ● Renew Contract ● Terminate Contract ● Transfer Contract ● Get Notification ● View Notice Board	Shop SSLCommerz Shop Notification Notice Board

Estate Employee	
Responsibility	Collaborator
● Login ● Refund caution money ● View Task ● Maintain Security Database ● Validate Vender_Info ● Validate Tender	Account SSLCommerz Database Vendor

• Validate Contract • Sort home applications • Allocating flats • Notify approved applicants(Home) • Manage Senate Application • Reschedule Reservation • Cancel Reservation • Confirm Reservation(Payment)	Notification

Estate Manager	
Responsibility	Collaborator
• Create user accounts • Assign roles • Assign task • Update user profile/role • Delete/disable user profile • Create recruitment notice	Account Estate Employee Database Notice Board

Gmail	
Responsibility	Collaborator
• Send email	Vendor, Renter

Shop	
Responsibility	Collaborator
• Store shop details	Vendor

University Employee	
Responsibility	Collaborator
• Login • Apply for flat • Apply for flat change • View Standings • Get Notification	Account Database Database Notification

Notification	
Responsibility	Collaborator
• Send Notification • Display Notification History	Estate Employee,University employee, Vendor, Renter

Account	
Responsibility	Collaborator
• Calculate/Show Points	Database

Renter	
Responsibility	Collaborator
• Apply for reservation • Get Notification	Notification

Notice board	
Responsibility	Collaborator
• Display Announcements • Categorize Announcements • Post Announcements • Filter Announcements	Estate Manager Estate Employee

Flat	
Responsibility	Collaborator
• Store flat details • Store flat renter details	University Employee

Database	
Responsibility	Collaborator
• Stores security guard database • Stores home allocation list • Stores tender details • Stores reservation details	Estate employee University Employee Vendor Renter

CRC Diagram:

Diagram ID :1

Name : Vendor

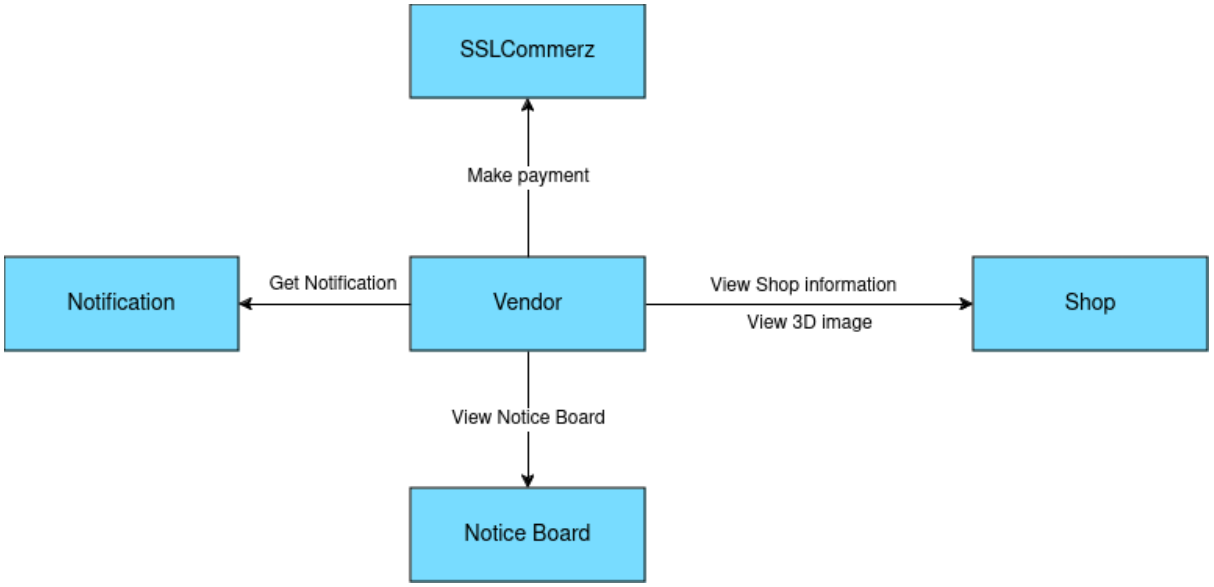


Diagram ID :2

Name : Estate Employee

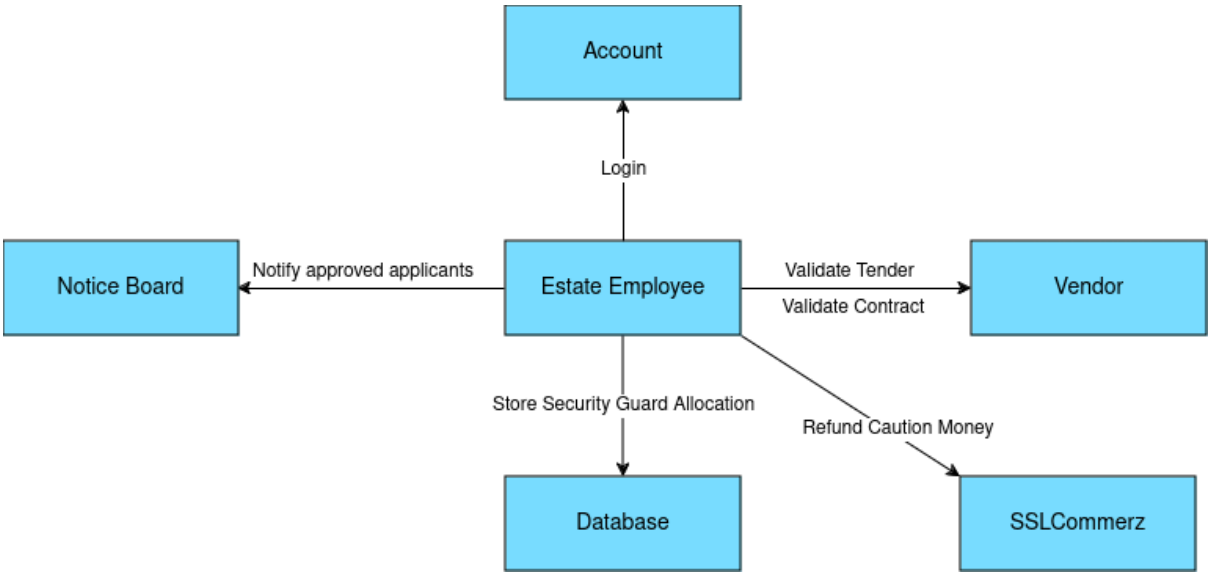


Diagram ID :3

Name : Estate Manager

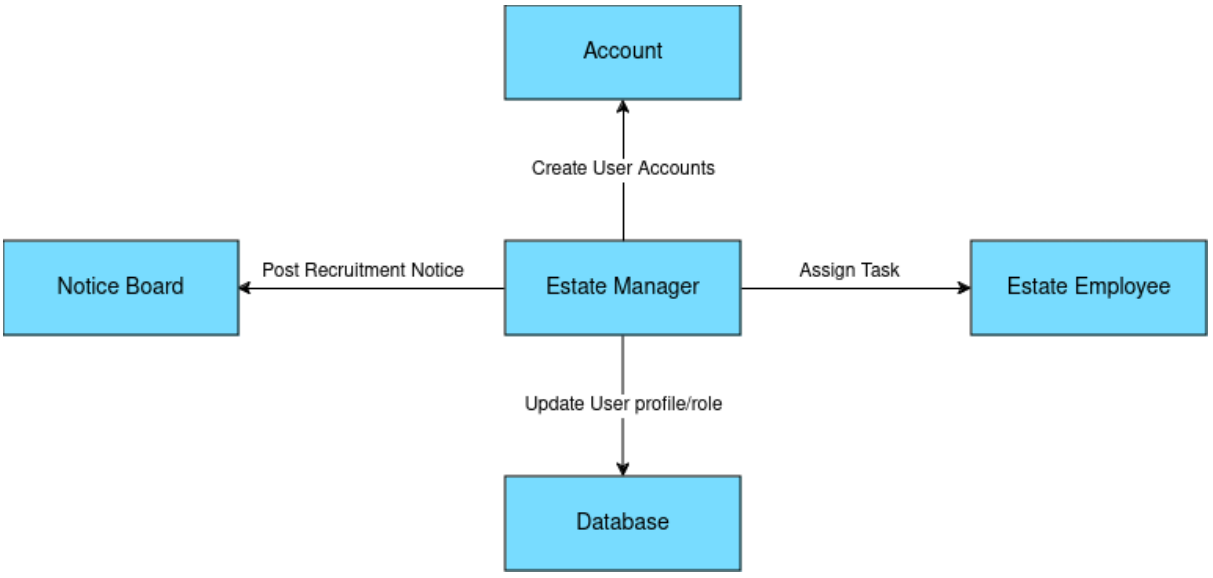


Diagram ID :4

Name : Gmail

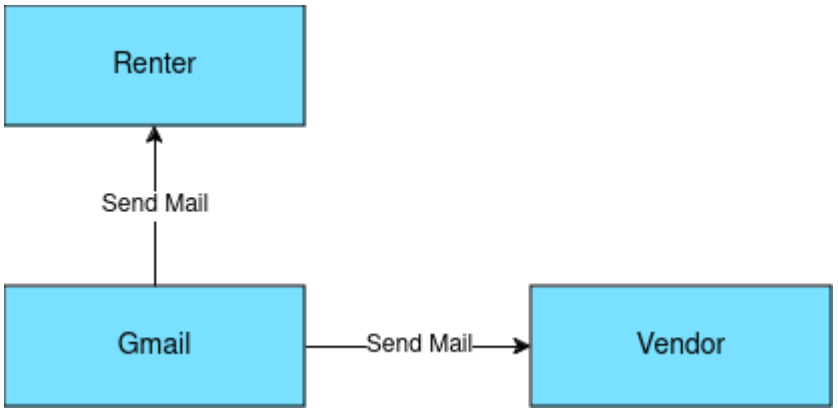


Diagram ID :5

Name : Shop

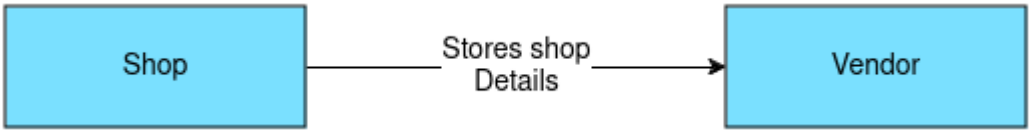


Diagram ID :6

Name : University Employee

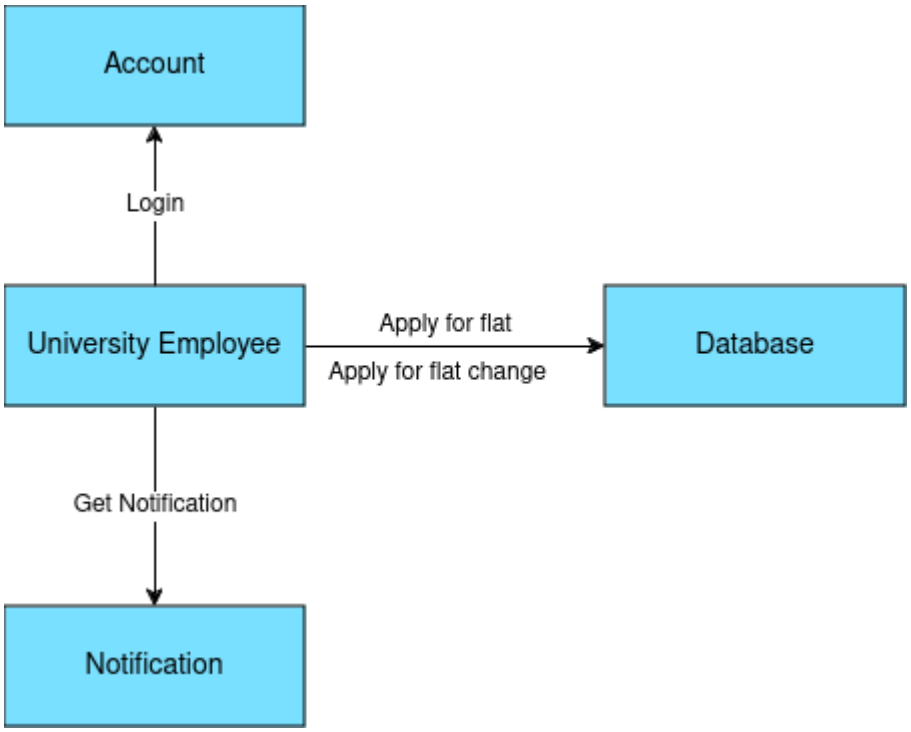


Diagram ID :7

Name : Notification

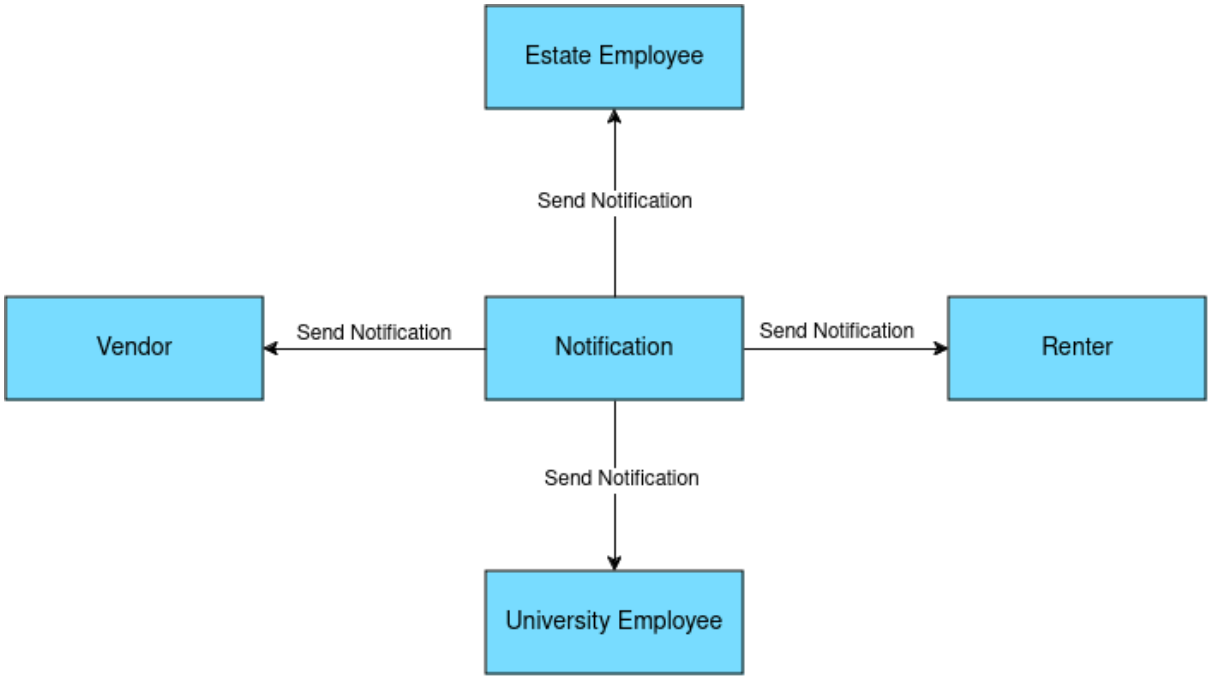


Diagram ID :8

Name : Account

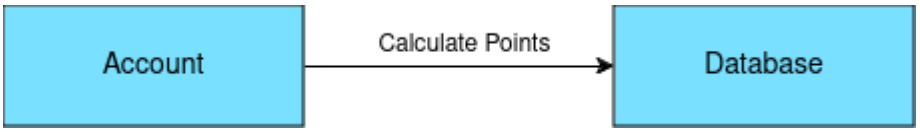


Diagram ID :9

Name : Renter

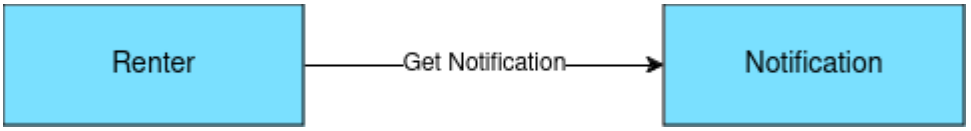


Diagram ID :10

Name : Notice Board

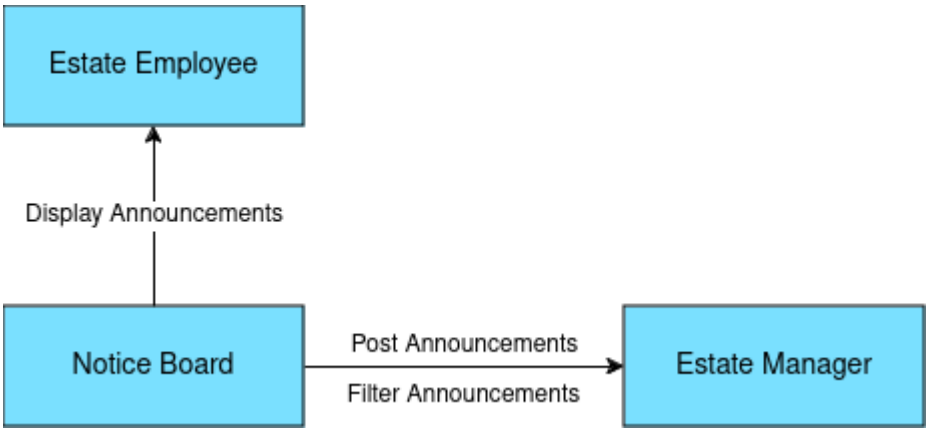


Diagram ID :11

Name : Flat

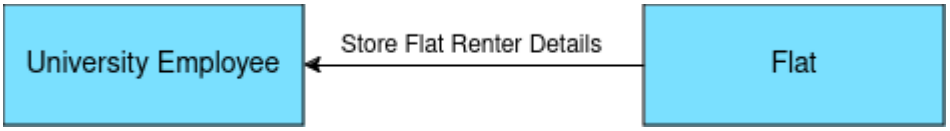


Diagram ID :12

Name : Database