



Leave Management System

SE 2206L: Software Requirement And Specification Analysis

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Leave Management System of University of Dhaka

Introduction

The Leave Management System (LMS) is a digital platform designed to streamline the process of applying, approving, and tracking leaves for faculty members at the University of Dhaka. Traditionally, leave applications have been managed manually, involving physical forms, signatures, and multiple levels of administrative approval. This manual process is often time-consuming, prone to errors, and lacks transparency for both applicants and administrators. The LMS addresses these challenges by providing a centralized, secure, and user-friendly system that automates leave tracking, approval workflows, and reporting. The system also incorporates advanced features such as AI-powered document parsing, OCR-based input support, automated notifications, and digital signatures, ensuring efficiency, accuracy, and compliance with institutional policies. By implementing LMS, the university aims to improve operational efficiency, enhance user experience, and maintain accurate records of faculty leave data.

Purpose

The purpose of the Leave Management System is to provide a comprehensive solution for managing all types of faculty leave, including academic, casual, maternity, earned, recreational, training, and extraordinary leaves. The system ensures that leave applications are submitted, reviewed, and approved following defined institutional rules while providing transparency and accountability at every stage. It also aims to reduce manual paperwork, prevent errors in leave calculation, and enable quick access to leave history and balances. Additionally, the LMS supports automated processing of scanned handwritten applications using OCR and AI, making it adaptable to both manual and digital workflows. Overall, the system is intended to streamline

administrative processes, facilitate timely decision-making, and support faculty in planning their leaves effectively.

Intended Audience

The primary audience for this system includes faculty members who apply for leave and need to track their leave balances and application statuses. Secondary users include administrative roles such as Department Admin Officers, Heads of Departments, Registrars, Admin-1 Officers, Section Officers, and higher authorities like the Vice Chancellor and Pro-Vice Chancellor, who are involved in reviewing and approving leave applications. Technical stakeholders, including System Administrators and the ICT Cell, also interact with the system to manage user accounts, credentials, and system maintenance. Furthermore, external services such as Google Vision OCR and OpenAI API are integrated to support automated processing of applications. This diverse audience ensures that the LMS must be designed to meet both user-friendly requirements for faculty and robust administrative and technical requirements for supporting staff.

Conclusion

In conclusion, the Leave Management System is designed to transform the leave management process from a manual, time-consuming workflow into a streamlined, automated, and transparent system. By addressing the needs of both faculty and administrative staff, the LMS enhances efficiency, accuracy, and accountability while incorporating modern technologies to support document automation and data analysis. The system ensures compliance with university policies, provides real-time access to leave information, and facilitates effective decision-making, ultimately improving overall operational management and faculty satisfaction. Through the LMS, the University of Dhaka can achieve a modern, reliable, and scalable solution for faculty leave management.

Prime Stakeholders

Primary Stakeholders

1. Applicants (Faculty Members): apply for leave, track status, check balances.
2. Department Admin Officers: first-level reviewers, validate documents, forward or reject applications.
3. Heads of Department / Institutional Directors : approve applications, call CND meetings, forward to the Registrar.
4. Registrar : central approver, forwards to Admin-1, manages urgent and foreign travel cases.
5. Admin-1 Officer : manages Section Officers, performs bulk approvals, forwards applications.
6. Section Officers : validate leave balances, documents, prepare memos, forward dossiers.
7. Vice Chancellor (VC) : approves long or foreign travel leaves, requests Government Orders (GO).
8. Pro-Vice Chancellor (Pro-VC) : handles short leave approvals (15 days or less).

9. Academic Body / Syndicate : approve academic leaves such as PhD, Postdoc, Sabbatical.
10. System Admin : manages user registration, credentials, and password reset.
11. ICT Cell : provides institutional user credentials.

Secondary Stakeholders

12. Google Vision OCR – extracts text from handwritten or scanned applications.
13. OpenAI API – parses extracted text to fill structured leave application fields.
14. Immigration Department – receives a Government Order for foreign travel leaves.
15. University Administration / HR – enforces policy and leave rules.

Elicitation Techniques

1. Interviews with faculty, HoDs, Registrar, Admin Officers, and ICT Cell staff.
2. Observation or Job Shadowing observe the current manual leave application process.
3. We have analyzed documents, studied existing university leave policies, HR manuals, and application forms.
4. Surveys distributed among faculty to capture requirements and preferences.

5. Brainstorming Sessions : with IT and admin staff for AI features such as OCR and auto-suggestions.
6. Use Case and Scenario Walkthroughs : simulate a full leave application journey across all roles.

Quality Function Deployment (QFD) is a structured method used to translate customer needs and expectations into specific technical requirements and design features. By systematically prioritizing and linking customer demands with design solutions, QFD helps ensure that the final product or system not only meets but also aligns closely with user expectations, reducing the risk of gaps between what is delivered and what stakeholders actually need. Below we present the list of requirements into normal, expected and exciting categories.

Normal Requirements

1. User registration via credentials from ICT Cell.
2. User login with institutional email and password.
3. Password reset mechanism (Forgot Password).
4. Leave application submission: leave type, dates, reason, destination, documents, and digital signature.
5. Leave balance management: yearly allocation per leave type and balance deduction upon approval.
6. Leave approval workflow: Department Admin Officer → Head/Director → Registrar → Admin-1 → Section Officer → Registrar → HoD.
7. Digital signatures at all approval stages.
8. Leave validation: document verification, balance check, and type-based routing.

9. Supported leave types: Academic (PhD, Masters, Postdoc), Sabbatical, duty, Maternity, Casual, Earned, Recreational, Training, Extraordinary.
10. Automatic leave balance update after leave completion (excluding earned leave).
11. Resume submission and processing for earned leave return.
12. Application rejection with reason and in-app notification.
13. Role-based dashboards for applicant, Department Admin, Head/Director, Registrar, Admin-1, and Section Officer.
14. Government Order (GO) request and delivery.
15. Audit trail logging for all actions (signatures, approvals, rejections).
16. Export reports (PDF, Excel) of leave history.
17. Urgency tagging for prioritized processing.

Expected Requirements

1. Filtering and sorting leave history by type, date, or status.
2. Real-time application tracking with current status and office.
3. Email notifications for password reset, approvals, and end-of-leave reminders.
4. Bulk approval or selection by Registrar or Admin-1.
5. Support for multiple document formats: PDF, PNG, JPG.
6. Data pre-filling from OCR and OpenAI analysis.
7. Leave summary memos written by Section Officers.
8. Intermediate routing and decision-making for long or foreign travel leaves (VC, Syndicate).
9. Viewing historical leave records with metadata.
10. Mobile-compatible file uploads.
11. Deadline reminders for return from leave.
12. Validation of special conditions like foreign travel or academic commitments.

Exciting Requirements

1. OCR-based input support for handwritten applications (jpg, heic/heif).
2. AI-powered document parsing using Google Vision and OpenAI.
3. Auto-suggestions for leave type based on uploaded document content.
4. One-click application generation from scanned handwritten letters.
5. Visual calendar or timeline for leave planning.
6. System-generated leave certificate or summary after final approval.

7. Smart alerts like “Unused leave expiring soon.”
8. Integrated immigration notification for foreign travel.
9. Voice-based leave form filling in future versions.

User Story

In the Leave Management System (LMS), the registration process begins when the System Admin of the Registrar Building registers himself as admin. After confirming the registration, system admin requests user credentials from the ICT Cell. The ICT Cell, which already maintains the institutional email and user information for all relevant personnel—including Applicants, Department Admin Officers, Heads of Departments or Institutions, Academic Bodies, Registrars, Admin-1, Section Officers, Vice Chancellors (VC), and Pro-Vice Chancellors (Pro-VC)—forwards the necessary details to the System Admin. Using this information, the System Admin creates user accounts within the LMS and generates an automated temporary password for each user. Once the accounts are set up, the System Admin sends an email to every user's institutional email address with the subject line “Password of the Leave Management System (LMS).” This email contains the user's login credentials, including the system-generated password. After receiving their credentials, users can access the LMS by logging in with their institutional email and the temporary password provided. Upon first login, the system prompts users to change their password to ensure security. From then on, users access the LMS using their institutional email and newly set password. The System Admin also periodically collects information on newly appointed faculty members and

registers them in the system to ensure ongoing access provisioning. Users including Applicants, Department Admin Officers, Heads of Departments or Institutions, Academic Bodies, Registrars, Admin-1, Section Officers, Vice Chancellors (VC), and Pro-Vice Chancellors (Pro-VC) of LMS log in using institutional mail and password. If a user forgets their password, they can click the “Forgot Password” option in the Leave Management System. Upon doing so, a notification is automatically sent to the System Admin. The System Admin then generates and assigns a new password for the user and sends it to the user’s registered institutional email address.

Every applicant is granted a leave balance either at the beginning of the year or from the date of their appointment, depending on the type of leave. In cases of higher education, an employee may be granted up to five years of paid leave for pursuing Ph.D. or Master’s degrees. Additionally, up to two years of paid leave may be granted for pursuing post-doctoral studies. In exceptional circumstances, an employee may also be eligible for one year of unpaid leave. These types of academic leaves are typically allocated from the start of the employee’s appointment. They are entitled to nine months of paid leave for training purposes, which may be availed in parts, as per the training schedule. Every employee holding the position of Associate Professor or higher is eligible for one year of paid sabbatical leave, which must be utilized for academic research or book writing purposes. Every female employee is entitled to six months of maternity leave, which may be availed up to two times during her tenure. Every employee is entitled to 20 days of casual leave and 33 days of earned leave annually. In addition, they may avail 15 days of recreational leave for every three years of service; however, if granted, the leave is deducted from the employee’s earned leave balance. An applicant may apply for extraordinary leave when no other leave balance is available, provided the leave is essential—such as in cases of medical emergencies or other justified circumstances. In such cases, the approved leave is adjusted by deducting from the employee’s earned leave balance in the following year.

The applicant accesses the application dashboard and submits a leave request by specifying the leave type, start and end dates, reason for leave, any applicable supporting documents (in PDF, PNG, JPG, or image formats), and, if relevant, the travel destination (domestic or international). The applicant provides a digital signature to authenticate the application before forwarding it to the Department Admin Officer. If the application is deemed unqualified, the applicant receives an in-app notification from the Department Admin Officer with the reasons for rejection. Throughout the process, the applicant can track the current status of the application, including which office is handling it. Upon approval, the applicant receives a notification from the Department Admin Officer and, if applicable, can download the attached Government Order (GO). Additionally, the system sends an email reminder to the applicant on the last day of their

approved leave. After resuming his duty, he sends a resume letter to the Department admin officer.

The applicant uses the manual application system. the user uploads a handwritten application in any of jpg(android), heic/heif(apple) format. The image is sent to google vision OCR. The document returned from Google vision OCR is uploaded to OpenAI. Necessary Information such as, start and end date of the application, leave type, reason of the leave is extracted from the document using the OpenAI api and filled in. He can send the resume letter the same as the process above.

Applicants can view their current leave balances across all leave types and review a detailed history of their past leave applications, including types, dates, reasons, and statuses. The dashboard supports filtering and sorting of leave records by date, type, and status, and provides options to download or export leave history reports in PDF or Excel formats. Additionally, it displays relevant notifications such as upcoming leave reminders and alerts about expiring leave balances, offering users a comprehensive and user-friendly interface to manage and track their leaves.

The applicant can view their currently available leave balance across all leave categories, along with a detailed history of previously used leaves, including leave type, duration, approval status, and any associated documents.

The department admin officer visits the received application dashboard which contains applications in a first come first served policy. He selects one application to process it. He sees attached documents to verify if the user has provided enough documents. If he deems it appropriate, he sends the application to the Department head/Institutional director, Otherwise he sends the application back to its applicant along with a message explaining the inadequacy of the application. He also visits the approved application dashboard. The user sends back all approved applications to its respective applicants. He receives the resume letter from the applicant, and sends the letter to the Head of the department/Director of Institution.

The Head of Department/Institution visits the reviewed application dashboard. He receives all the reviewed applications from the department admin officer. When the leave duration exceeds 15 days, he initiates CND meeting with the academic body members to process the application. Leaves such as Academic leave(Phd, masters, post doc), maternity leave, recreational leave incur academic CND meeting. He notifies the CND members to review and approve the application. HOD gives a digital signature to approve the application. He acknowledges that the absence of the applicant will not affect the organizational activities when the leave duration exceeds 15 days by adding another digital signature. After that, HoD sends the approved application to the

Registrar. HoD receives the approved application from the registrar. He sends the approved application to the department admin officer. He receives the resume letter of the applicant from the Department Admin officer. Then he sends it to the Registrar.

The Registrar receives approved applications from Heads of Departments or Institutions. He selects applications one by one or all the applications at once for further processing. He gives his digital signature to all of the selected applications to give approval for further processing. He then forwards all selected applications to the Admin-1 Officer for further processing. He also receives the resume letter of all applicants. He sends the resume letters to the Admin-1. After receiving applications back from Admin-1, the Registrar processes them in a first-come, first-served manner, giving higher priority to applications marked as urgent. He sends each application to its intended recipient, based on the nature of the leave request.

Leave applications with a duration not exceeding 15 days are forwarded to the Pro-Vice Chancellor (Pro-VC) for further action.

Leave applications with a duration exceeding 15 days, or those that involve foreign travel, are forwarded to the Vice Chancellor (VC). The VC requests for the Government Order (GO) for applications which includes foreign travel.

In the case of applications involving foreign travel, once the VC receives the GO, the Registrar ensures that the GO is sent to the Immigration Department and Registrar as part of the required processing.

Leave applications with a duration of more than 3 months are forwarded to the Syndicate body for approval. Upon receiving an approval notification from the Syndicate, the Registrar applies his digital signature to the application and returns it to the concerned Head of Department or Institution. If the application involves foreign travel, the GO issued by the VC is also attached and delivered accordingly.

Admin-1 manages the list of active Section Officers, with the ability to add or remove officers. Furthermore, he can update the department or institution assignments of Section Officers by modifying their mappings. A section officer can manage multiple departments but a department cannot be managed by more than one section officer at a time. Admin-1 receives forwarded applications from the Registrar for initial review. He can either select individual applications or apply actions to all pending applications in bulk. After reviewing, Admin-1 provides a digital signature to approve the selected applications for further processing. Approved applications are then forwarded to the appropriate Section Officer, based on the relevant department or institution. If necessary, Admin-1 can mark specific applications as "urgent" to ensure they are prioritized. He receives all of the resume letters from the office of Registrar, forwards the

letters to its respective section officer. Section officers receive applications from Admin-1 in the sorted way. Upon opening an application, the Section Officer reviews the applicant's cover letter to extract key details, including the type of leave requested, the exact start and end dates, reason for leave and any special considerations—such as foreign travel that may influence the decision. Simultaneously, the officer examines each uploaded attachment to ensure it is legible, complete, and appropriate for the leave type. For example, a medical certificate must include an official stamp and signature, while a research proposal is relevant only to a Study Leave application. Once the documents have been validated, the Section Officer initiates a call to the Leave Management System's Leave-Balance Service. The system promptly retrieves and displays the applicant's remaining entitlement for the requested leave category. If the balance is sufficient—for example, if the applicant has 12 days remaining and is requesting 10—the officer proceeds to approve this stage of the workflow. They apply their digital signature to mark the application as "Section Officer Approved," and prepare a brief summary memo (e.g., "Checked balance: 12 days remaining; documents verified and complete"). He can also use earned leave of the applicant. If necessary he can use future earned leave also, if the applicant requested the leave under extraordinary leave. Regardless of the outcome, every action taken like a digital signature, balance verification, or return notice—is recorded in the Leave Management System's audit trail. This memo, along with the original application and supporting documents, is compiled into a single sealed dossier and forwarded to the Registrar through Admin-1. All relevant metadata is logged automatically for tracking and audit purposes.

Finally, once the Registrar has applied the final approval signature, the Section Officer prepares the cover letter addressed to the Head of Department. This letter provides a comprehensive summary of the application's progression—including initial submission, document validation, leave balance verification, and Registrar approval—and attaches the complete, signed application package. With their own digital signature affixed, the Section Officer forwards the finalized dossier to Admin-1. Admin-1 then sends the dossier to its respective Head of Department's LMS inbox, which triggers a notification. At this stage, the Head of Department reviews the application to issue the ultimate decision and notify the faculty member, thereby completing the process. After getting the resume letter from Admin-1, the section officer updates the status of the applicant. It is logged in.

Use case diagram

A use case diagram is a visual representation of a system's functional requirements, showing how users (actors) interact with the system to achieve specific goals (use cases). Primary actors are the main users or entities who directly initiate interactions with the system to accomplish their objectives, such as applicants submitting leave requests in a Leave Management System. Secondary actors, on the other hand, support the system indirectly by providing services or information needed for the primary actors' tasks, such as the ICT Cell providing user credentials or external APIs like Google Vision OCR assisting in document processing. This distinction helps clarify roles and responsibilities within the system.

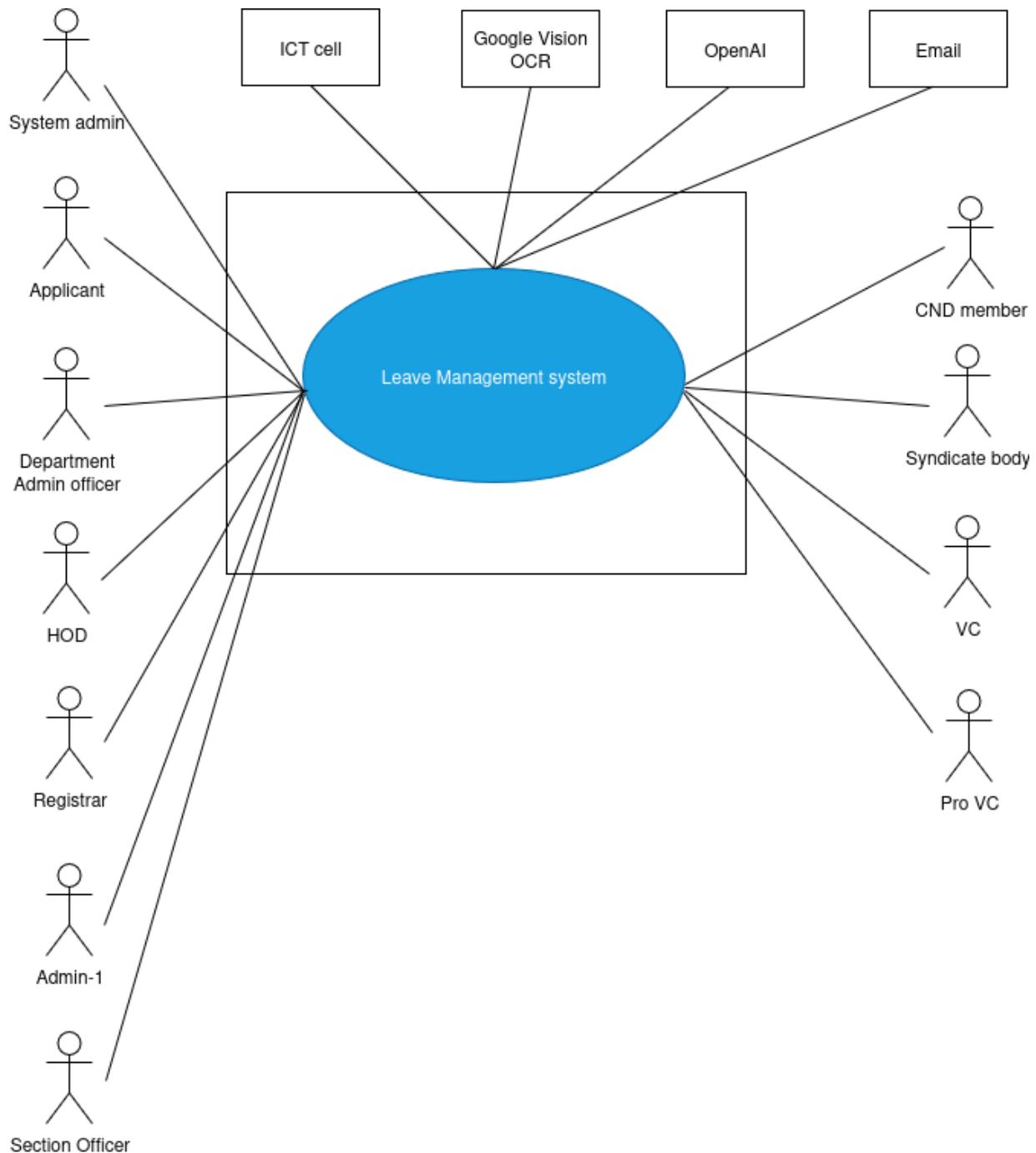
Level: 0

Name: LMS

Primary Actor: System admin, Applicant, Department Admin officer, HOD(Head of Department), Registrar, Admin-1, section officer.

Secondary Actor: CND member, Syndicate body, VC, Pro-VC

External system: ICT cell, Google Vision OCR, OpenAI, Email.



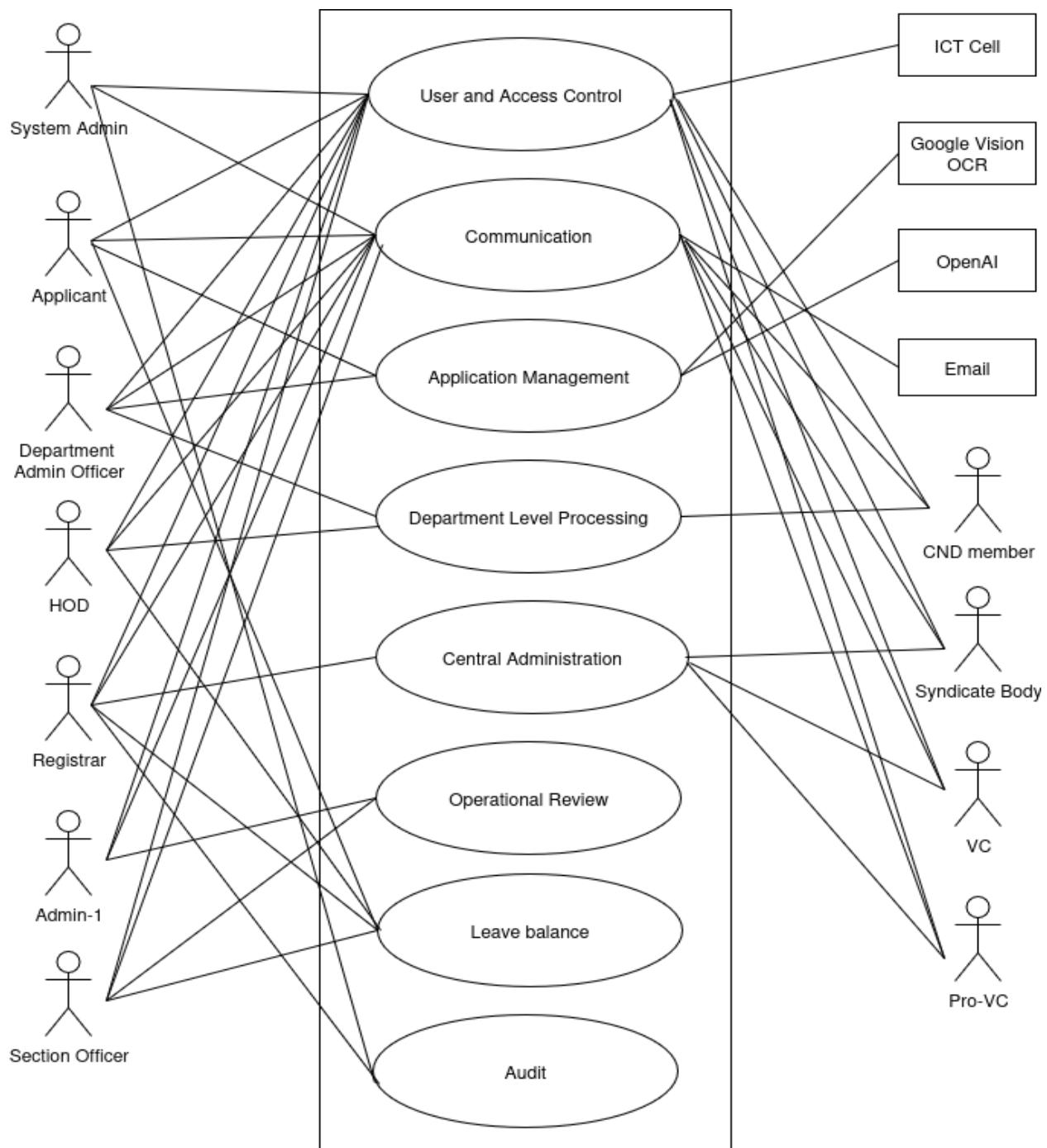
Leave Management System use case diagram

Level: 1

Name: LMS(detailed)

Primary Actor: System admin, Applicant, Department Admin officer, HOD, Registrar, Admin-1, section officer.

Secondary Actor: CND member, Syndicate body, VC, Pro-VC, ICT cell, Google Vision OCR, OpenAI, Email.



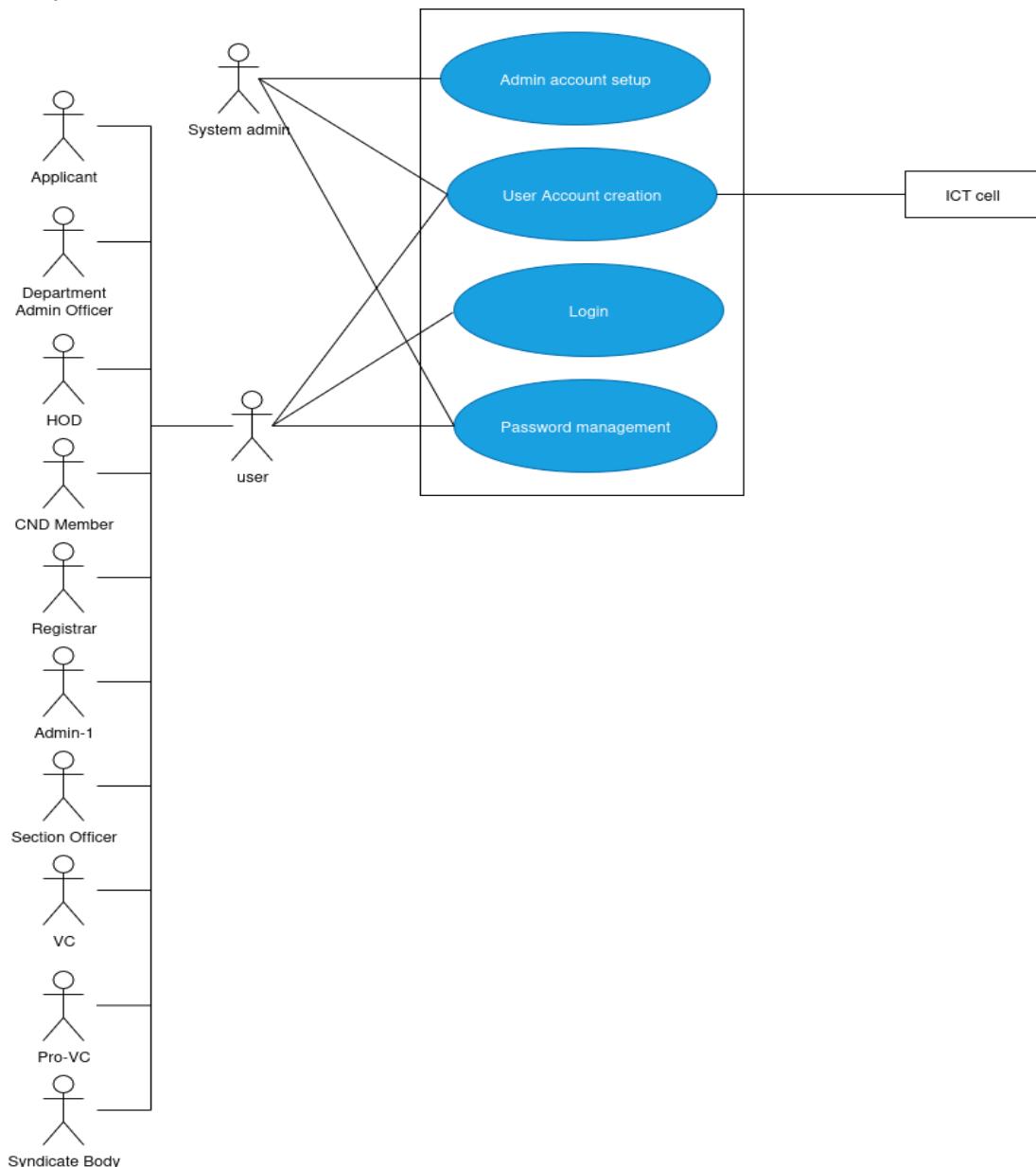
Leave Management System(detailed) use case diagram

Level: 1.1

Name: User Access Control

Primary Actor: System admin, Applicant, Department Admin officer, HOD, Registrar, Admin-1, section officer, CND member, Syndicate body, VC, Pro-VC.

Secondary Actor: ICT cell, Communication



User and Access Control use case diagram

Action: System Admin check his account

Reply: LMS confirm account has been created then login

Action: System Admin registers himself in LMS.

Reply: LMS confirms successful self-registration then login

Action: System Admin requests user credentials from ICT Cell.

Reply: ICT Cell sends institutional email and user details of all relevant personnel to System Admin.

Action: System Admin creates LMS accounts for all personnel using ICT Cell data.

Reply: LMS confirms accounts are successfully created.

Action: System Admin generates system-created temporary passwords for each account.

Reply: LMS confirms passwords have been generated.

Action: System Admin sends login credentials (email + password) to each user's institutional email.

Reply: Email system confirms successful delivery of credentials.

Action: User logs in with institutional email and temporary password.

Reply: LMS prompts user to change password on first login.

Action: User changes password to a secure, personal password.

Reply: LMS confirms password change and grants full access.

Action: System Admin periodically collects details of newly appointed faculty.

Reply: LMS adds new faculty accounts and confirms access provisioning.

Action: User clicks "Forgot Password" link in LMS.

Reply: LMS sends automated password reset request to System Admin.

Action: System Admin generates a new password for the user.

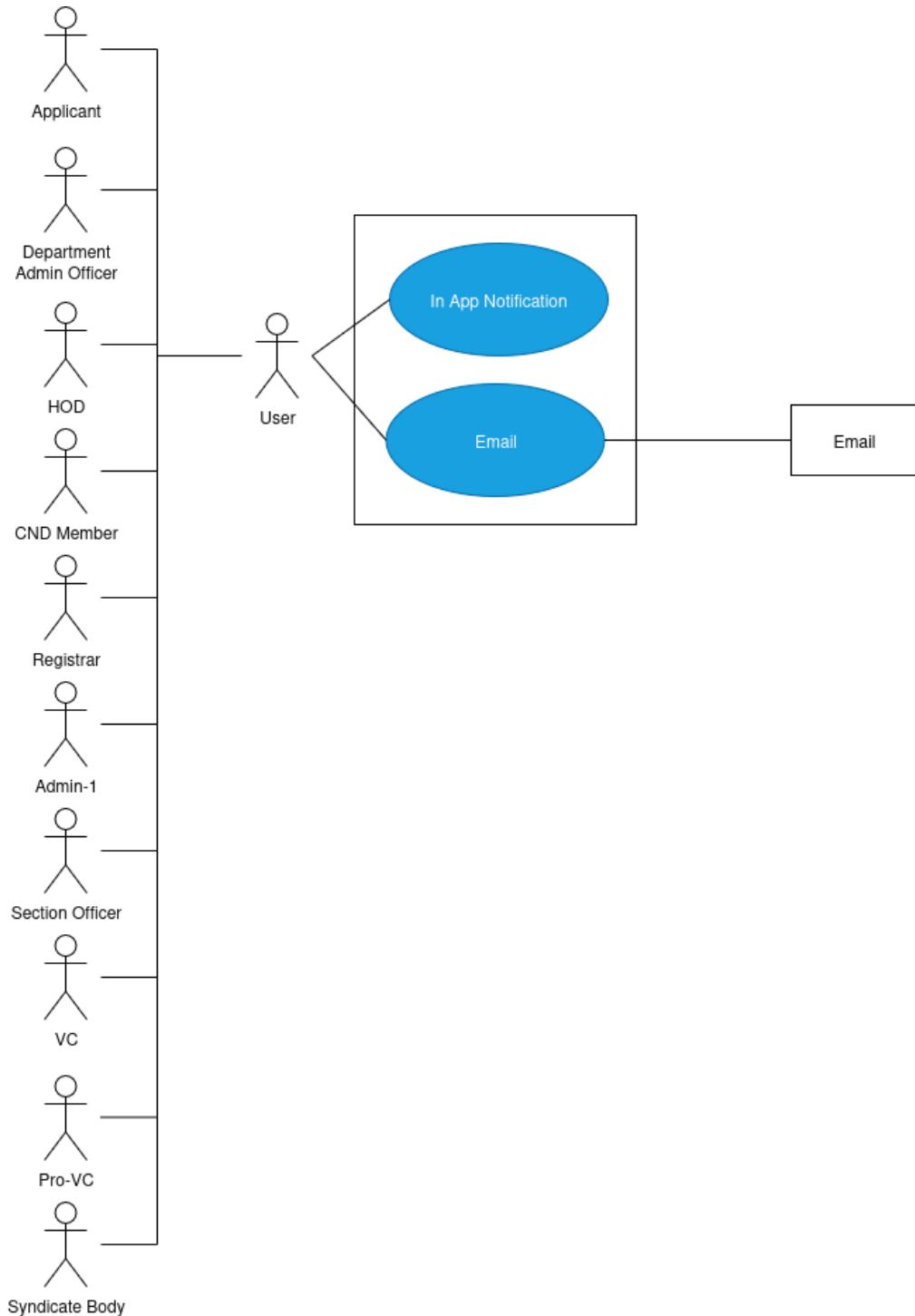
Reply: LMS confirms password update and sends new credentials to user's institutional email.

Level: 1.2

Name: Communication

Primary Actor: System admin, Applicant, Department Admin officer, HOD, Registrar, Admin-1, section officer, CND member, Syndicate body, VC, Pro-VC.

Secondary Actor: Email



communication

Action: User initiates an action

Reply: System sends an in app pop up notification to the necessary recipient

Action: Users sends an email

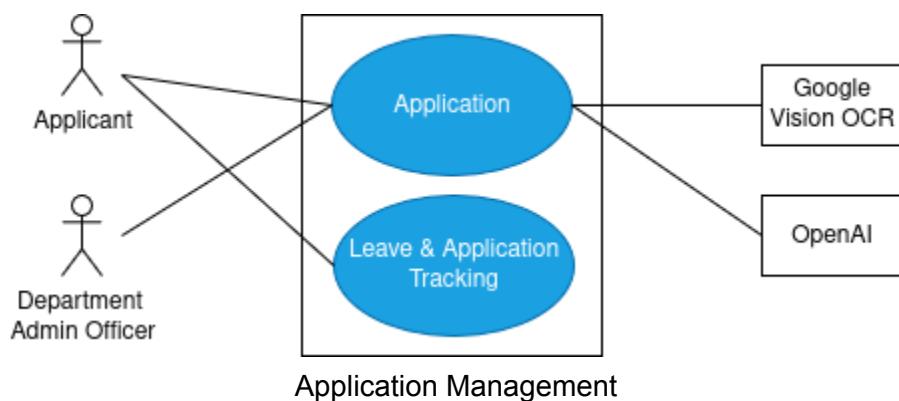
Reply: System sends the email to its desired recipient

Level: 1.3

Name: Application Management

Primary Actor: Applicant, Department Admin officer

Secondary Actor: Google Vision OCR, OpenAI



Action: Applicant requests their leave balance

Reply: System provides the leave balance

Action: Applicant apply for a leave by providing necessary information

Reply: Application is sent to Department Admin Officer for reviewing

Action: Applicant requests for current status of the application

Reply: System provides the current status of the application

Action: Upon resuming duty after leave, the applicant submits a letter to the HOD along with supporting documents that verify the reasons stated in the leave application.

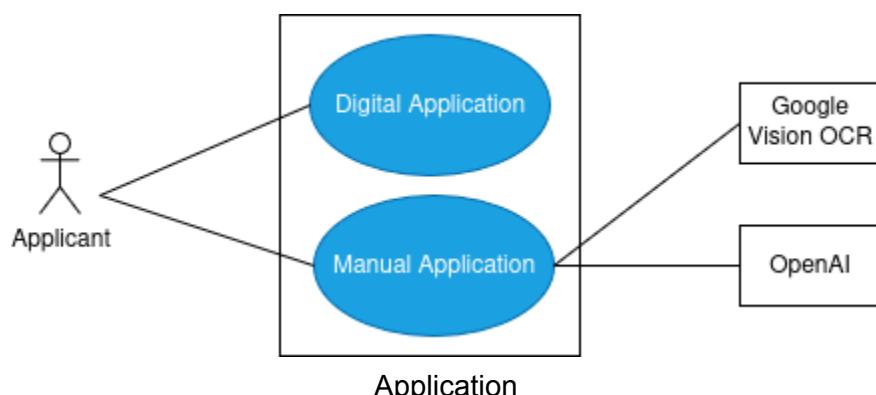
Reply: letter is sent to department admin officer

Level: 1.3.1

Name: Application

Primary Actor: Applicant

Secondary Actor: Google Vision OCR, OpenAI



Action: Applicant chooses to apply digitally.

Reply: system allows to apply digitally

Action: Applicant chooses whether to apply for a leave or to send resume letter

Action: when applying for leave, Applicant Provides Necessary information such as leave type, starting and ending of the leave, travel destination if necessary (domestic or international), necessary documents according to the leave type such as medical report for maternity leave, official enrollment document for study leave

Reply: System accepts the application.

Action: Applicant provides necessary documents along with a digital resume letter after joining duties.

Reply: System accepts the resume letter

Action: Applicant chooses to apply manually

Reply: System allows manual application

Action: Applicant uploads a photo of handwritten leave application in LMS and necessary documents according to the leave type such as medical report for maternity leave, official enrollment document for study leave.

Reply: System accepts the application

Action: System sends the photo to Google vision OCR for character recognition

Reply: System receives the text from Google vision OCR

Action: System sends the application text to OpenAI for extracting information such as leave type, starting and ending date of leave, leave destination(domestic and international).

Reply: System receives the required information.

Action: Applicant uploads a photo of handwritten resume letter in LMS and necessary documents after joining duties.

Reply: System accepts the resume letter

Action: System sends the photo to Google vision OCR for character recognition

Reply: System receives the text from Google vision OCR

Action: System sends the application text to OpenAI for extracting information such as leave type, starting and ending date of leave, leave destination(domestic and international).

Reply: System receives the required information.

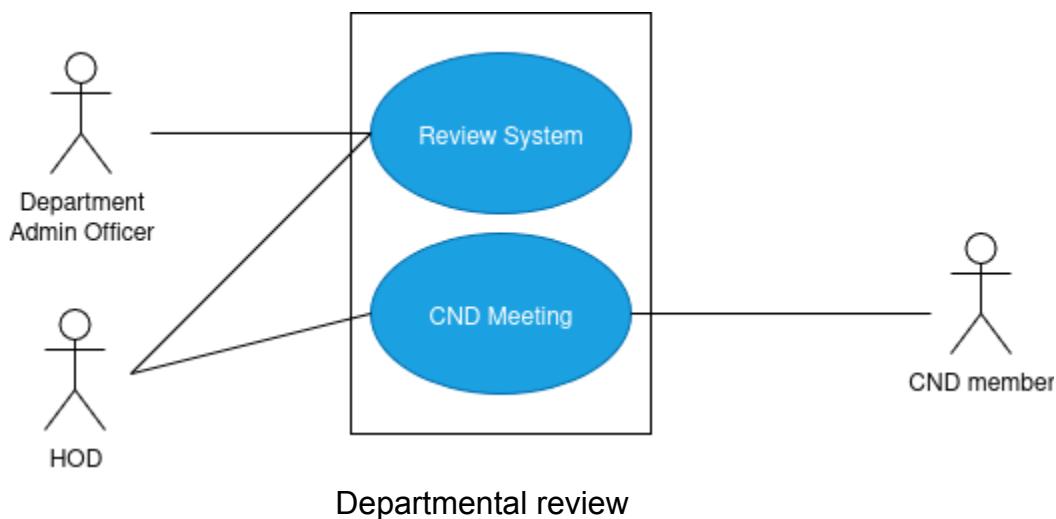
Action: System forwards the application or resume letter to Department Admin officer.

Level: 1.4

Name: Departmental review

Primary Actor: Department admin officer, HOD

Secondary Actor: CND member



Action: Department Admin Officer receives application/resume letter.

Action: Department Admin officer requests to review an application

Reply: System sends the application

Action: Department admin officer sends the application back to the applicant with a review message.

Reply: system sends the application to its respective applicant

Action: Department admin officer sends the reviewed application to HOD

Reply: System sends the application to HOD

Action: Department admin officer sends the resume letter to HOD

Reply: System sends the resume letter to HOD

Action: HOD initiates the CND meeting if the leave duration exceeds 15 days

Reply: System notifies the CND members

Action: HOD approves the application after CND meeting approval.

Reply: HOD is notified about the approval.

Action: HOD receives Approved application from Registrar

Action: HOD sends Approved application to department admin officer

Action: Department admin officer sends approved application to its respective applicant.

Action: HOD provides digital signature after approving the application

Reply: system updates the status of the application

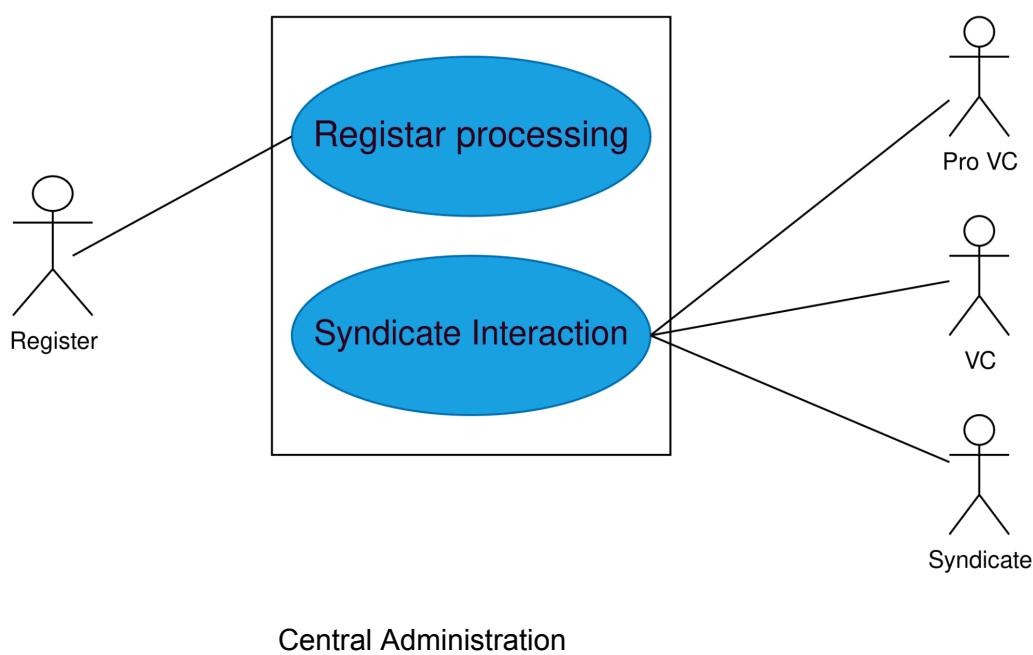
Action: HOD acknowledges in the absence of the applicant will not hamper the academic proceeding if the leave duration exceeds 15 days.

Level: 1.5

Name: Central Administration

Primary Actor: Registrar

Secondary Actor: Pro VC, VC, Syndicate



Action: Registrar selects applications, gives digital signature and forwards them to admin 1 for further processing.

Reply: Add digital signature.

Action: Registrar selects resume letter, gives digital signature and forwards them to admin-1.

Reply: Add digital signature.

Action: Registrar forwards reviewed applications from Admin-1 to Pro VC if the leave duration is less than 15 days, if the leave duration is less than 3 months but longer than 15 days, it is sent to VC. If the duration exceeds 3 months it is sent to the Syndicate body.

Reply: Sent to the appropriate destination.

Action: Registrar forwards reviewed applications from Admin-1 to VC if the leave includes foreign travel

Action: VC requests for Government Order(GO).

Action: VC receives GO.

Action: VC adds digital signature and sends the application back to registrar

Reply: System adds digital signature

Action: Pro VC adds digital signature and sends the application back to registrar.

Action: VC sends the GO to immigration office and Registrar,

Reply: System sends the GO.

Action:

Action: Syndicate body receives the application.

Action: Syndicate body accepts the application and sends it back to VC.

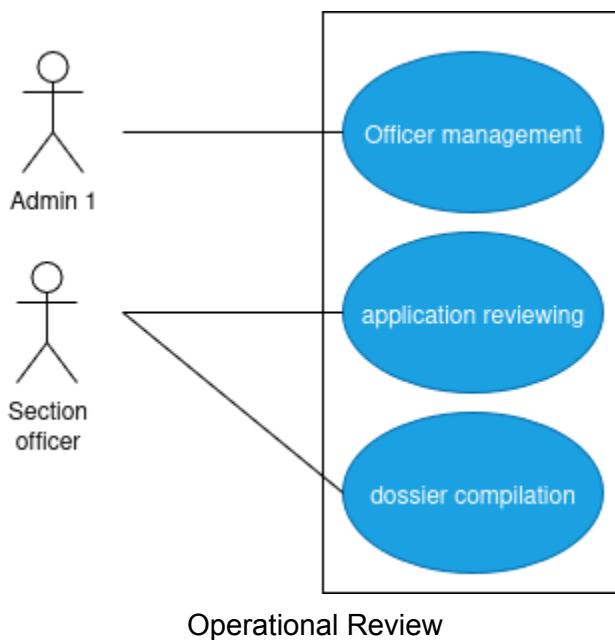
Action: After reviewing the application centrally, Registrar sends the application to Admin-1 again for compilation.

Level: 1.6

Name: Operational Review

Primary Actor: Admin 1, Section officer

Secondary Actor: None



Action: Admin-1 adds, removes or reassign section officer

Reply: System updates officer list and department mappings;

Action: Admin-1 accesses list of applications

Reply: System provides the list

Action: Admin-1 selects and give digital signature on applications

Reply: system adds digital signature on applications and forwards them to the mapped section officer's inbox

Action: Section Officer opens application, reads cover letter, checks type/dates/reason, validates supporting documents.

Reply: System Displays attachments for validation; records “document verification step complete” in audit log.

Action: Section Officer Compiles memo + documents into sealed dossier; forward to Registrar via Admin-1.

Reply: System Generates dossier metadata; audit log updated; forwards dossier.

Action: Section Office prepares cover letter to HOD; attach full signed package; forward to Admin-1.

Reply: System forwards dossier to Admin-1 in HOD inbox; HOD receives notification.

Action: Section Officer Updates applicant's status upon receiving resume letter from Admin-1.

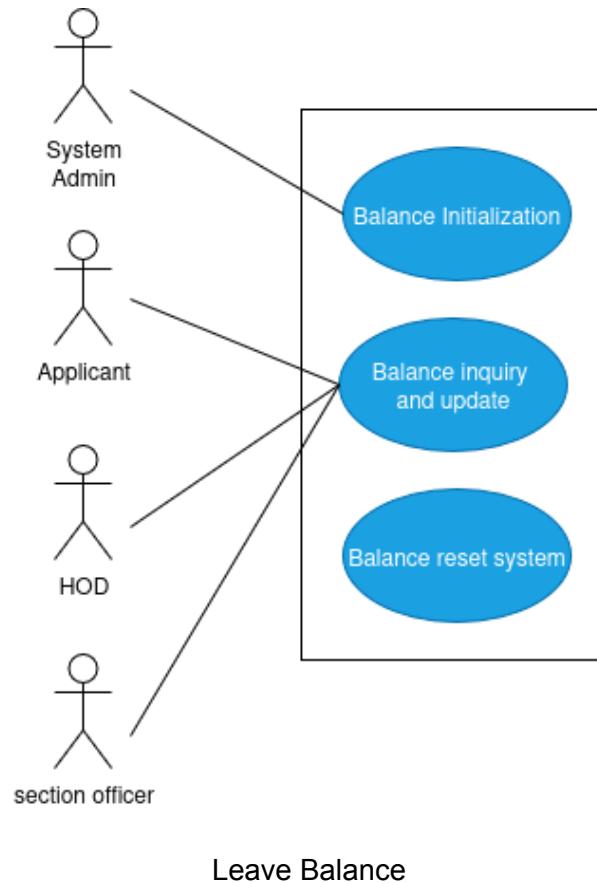
Reply: System updates status; recorded in audit trail; applicant notified.

Level: 1.7

Name: Leave Balance

Primary Actor: System admin, Applicant, HOD, Section officer

Secondary Actor: None



Leave Balance

Action: System admin initializes leave balance at the end of the year or at the start of the appointment of every faculty member.

Reply: System initiates the leave balance accordingly

Action: Applicant inquiries for leave balance for his requested type of leaves

Reply: system provides the balance

Action: Section officer inquiries for leave balance requested by the applicant

Reply: system provides the balance

Action: After the final approval from the registrar office, Section officer updates the balance.

Reply: System updates the balance

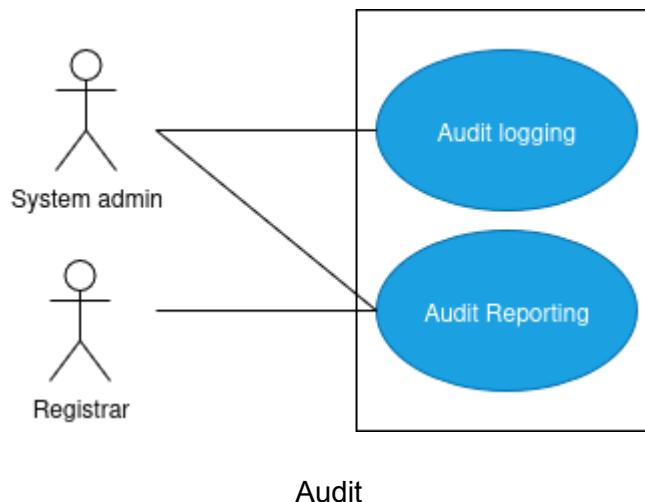
Action: system resets the balance of every faculty member at the end of every year, if future leave balance was used, it is balanced out during the reset.

Level: 1.8

Name: Audit

Primary Actor: System admin, Registrar

Secondary Actor: None



Action: System logs every important action taken by every actor into audit log

Reply: actions are recorded in log

Action: system admin or Registrar requests for audit report

Reply: System provides the audit report.

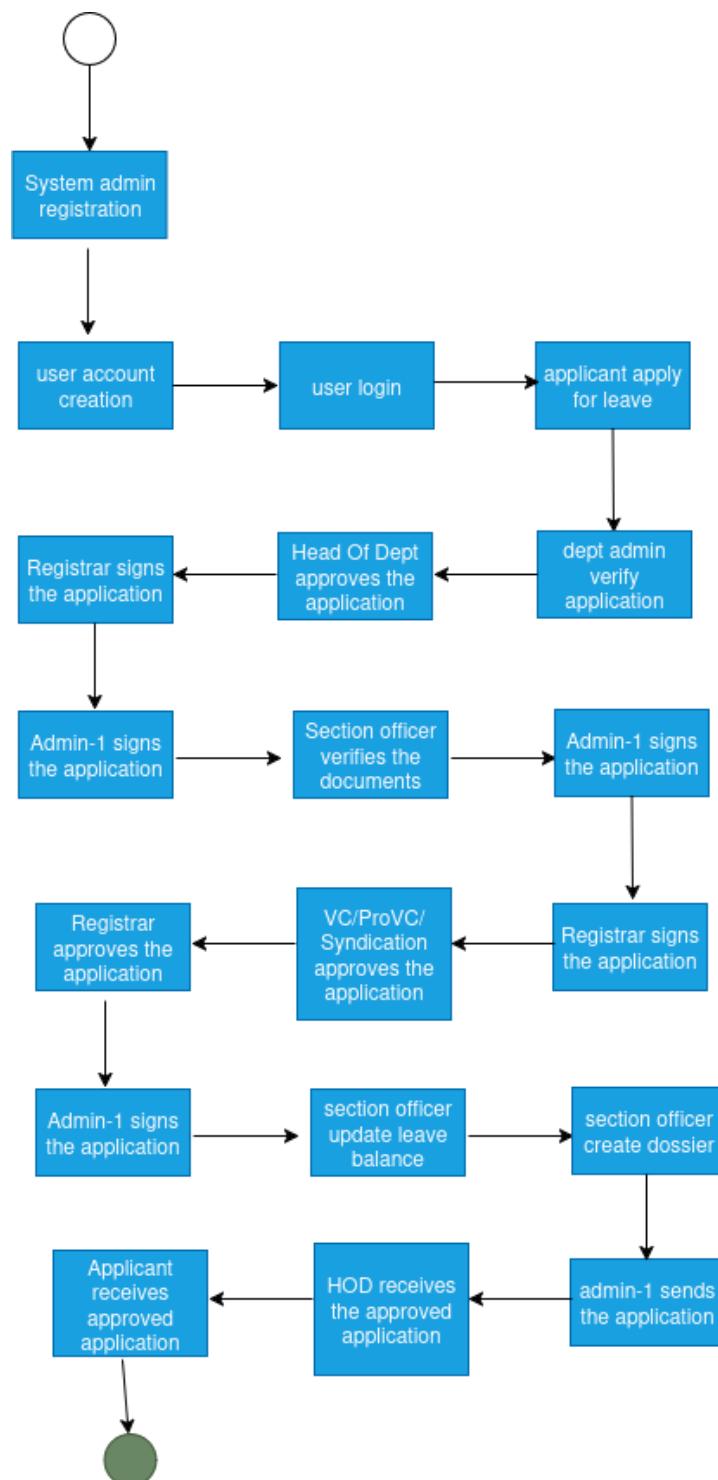
Activity Diagram

An activity diagram is a visual representation used in system modeling to illustrate the flow of activities or actions within a process. It shows the sequence of steps, decision points, parallel processes, and the overall workflow from start to finish. Activity diagrams help in understanding how a system or process operates, identifying bottlenecks, and ensuring that all possible paths, conditions, and interactions are captured. They are particularly useful for modeling business processes, complex workflows, and scenarios where multiple roles or actions are involved.

AID (Activity ID): 1

Name: LMS Details

Reference: Use case level-1

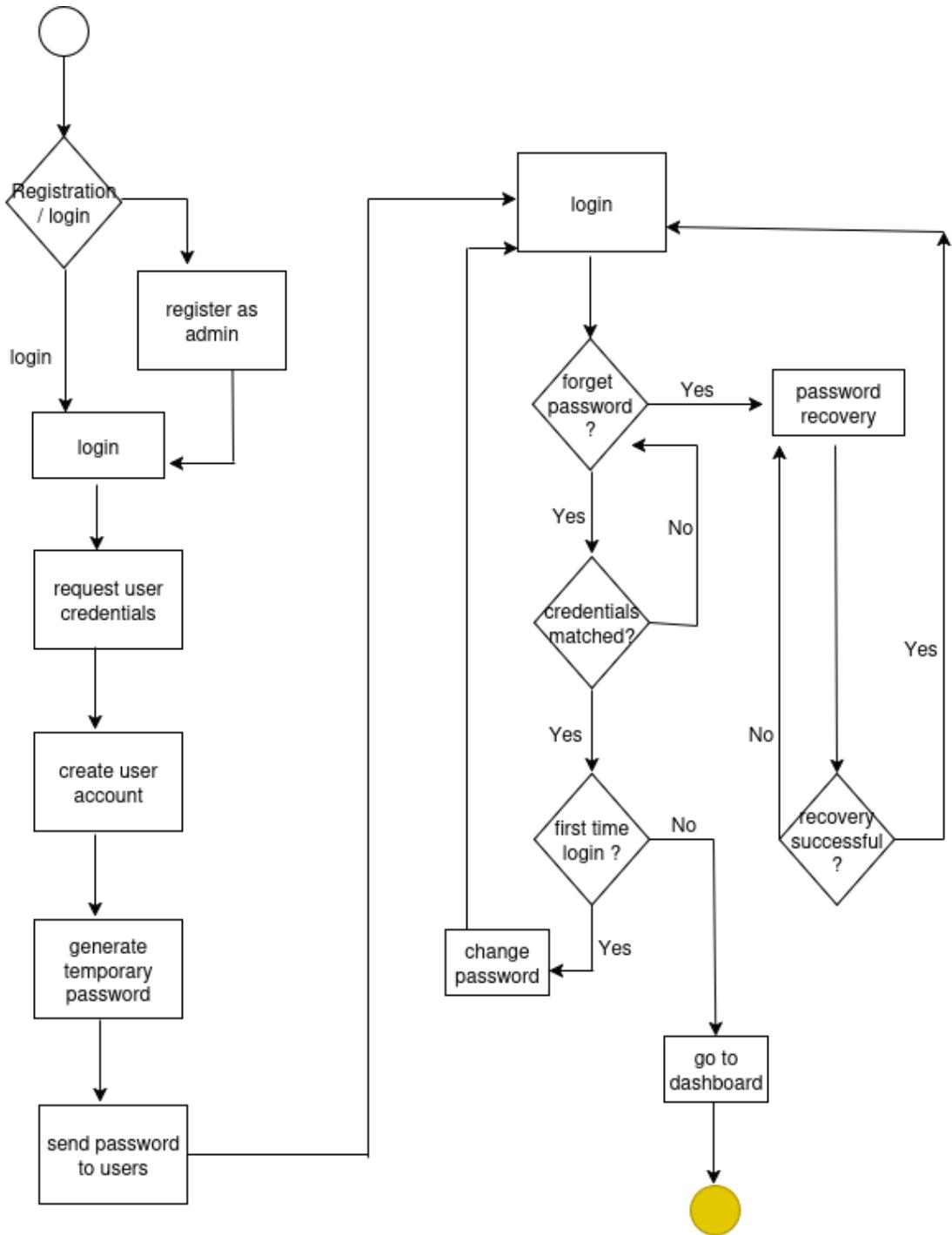


Leave Management System

AID (Activity ID): 1.1

Name: User Access Control

Reference: Use case level-1.1

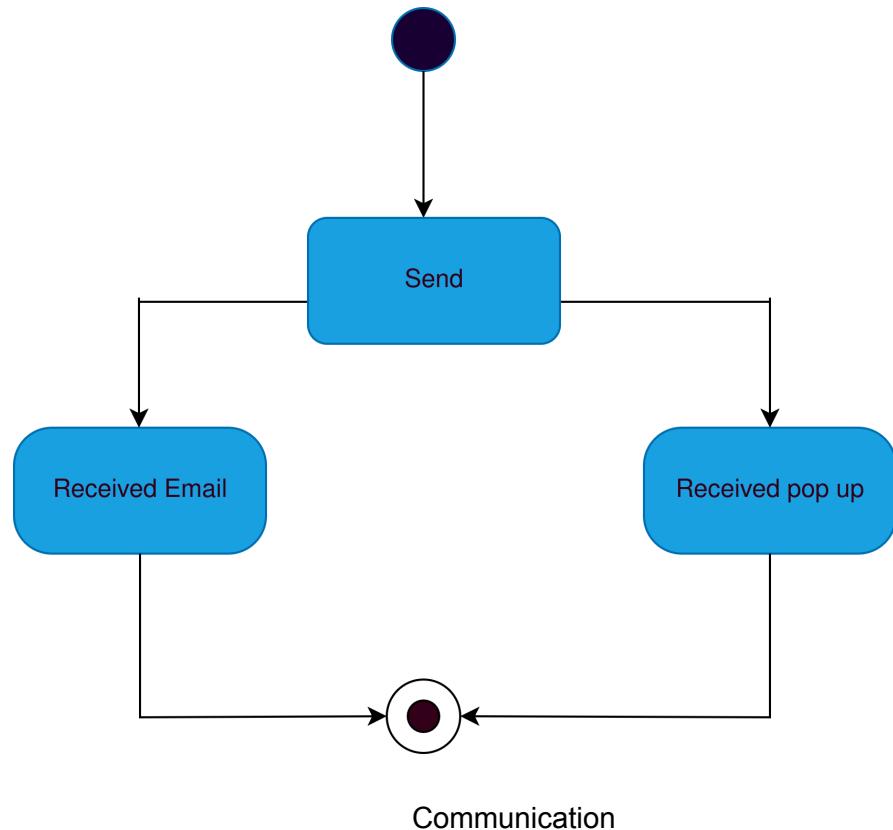


User Access Control

AID (Activity ID): 1.2

Name: Communication

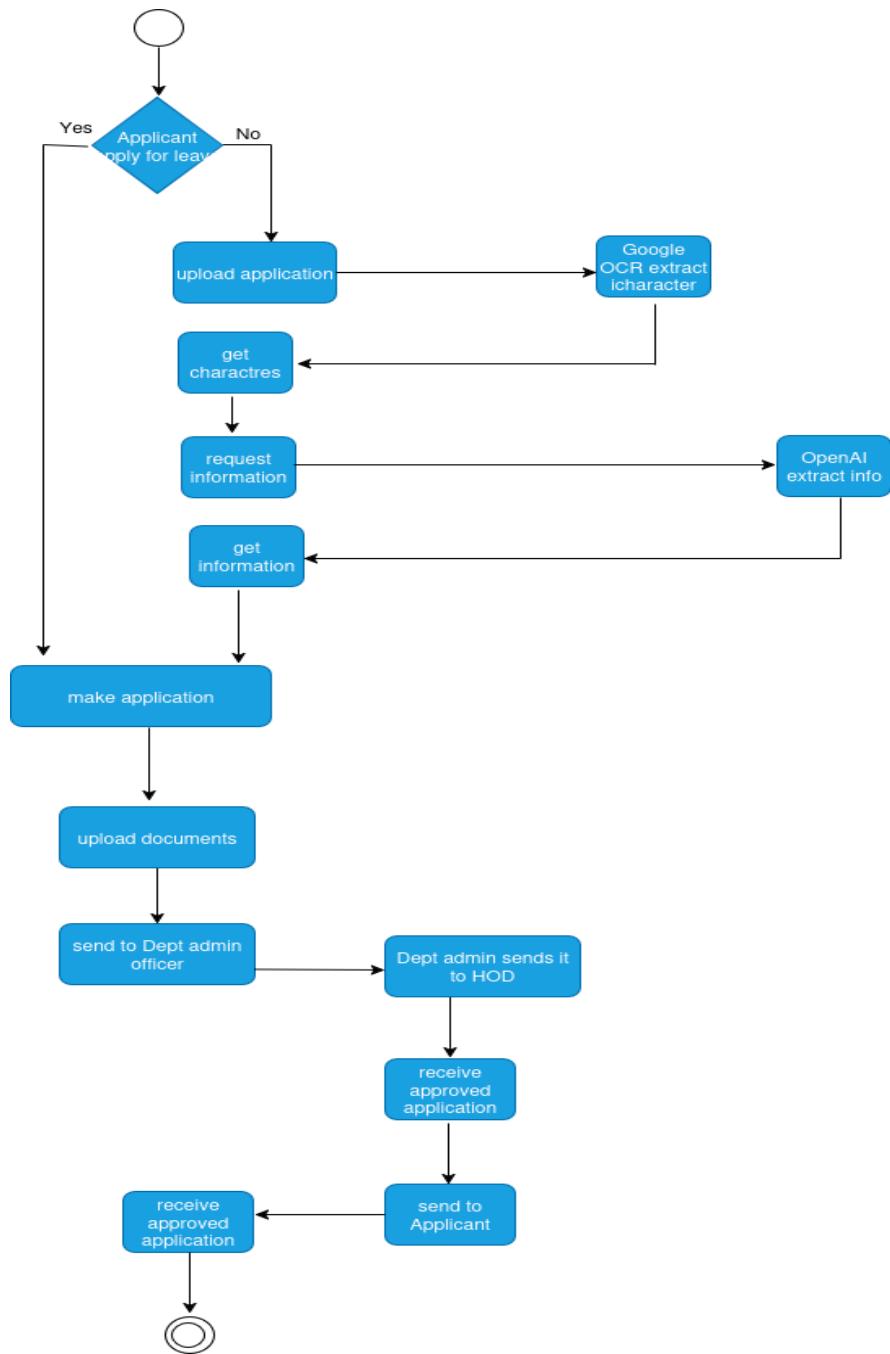
Reference: Use case level-1.2



AID (Activity ID): 1.3

Name: Application Management

Reference: Use case level-1.3

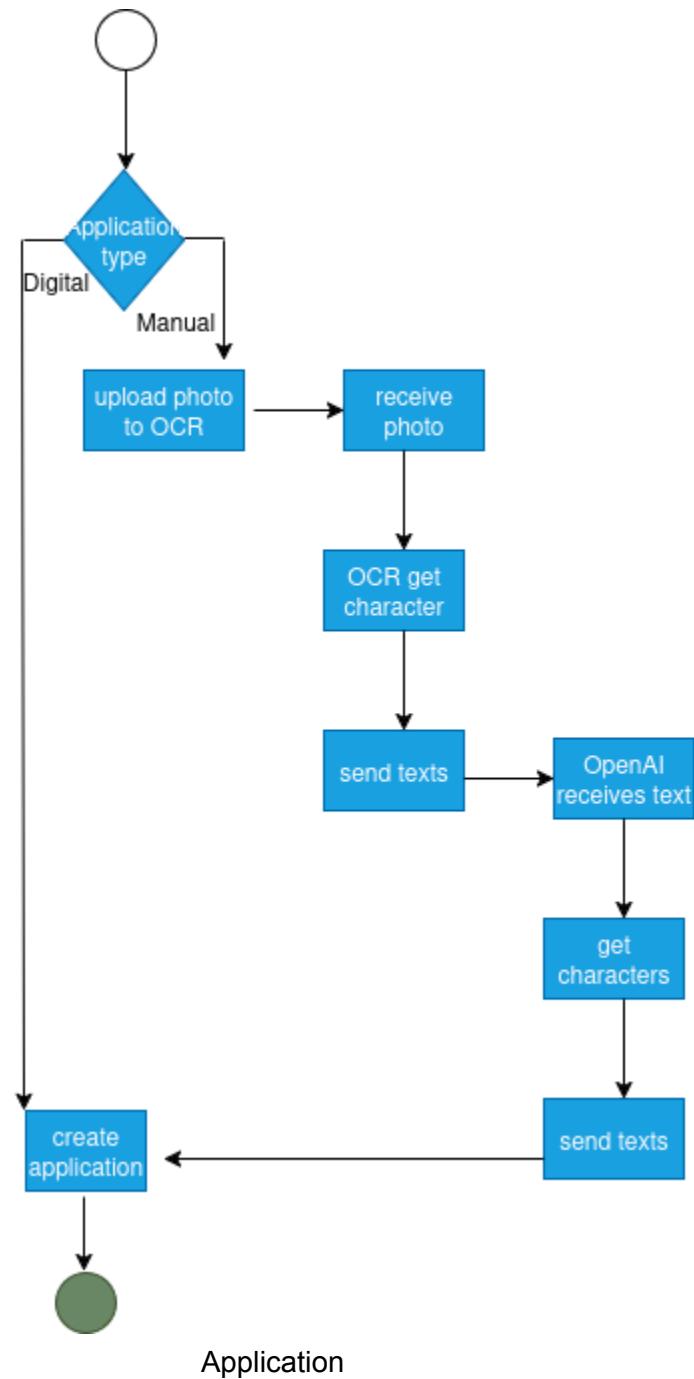


Application Management

AID (Activity ID): 1.3.1

Name: Application

Reference: Use case level-1.3.1



AID (Activity ID): 1.4

Name: Departmental Review

Reference: Use case level-1.4

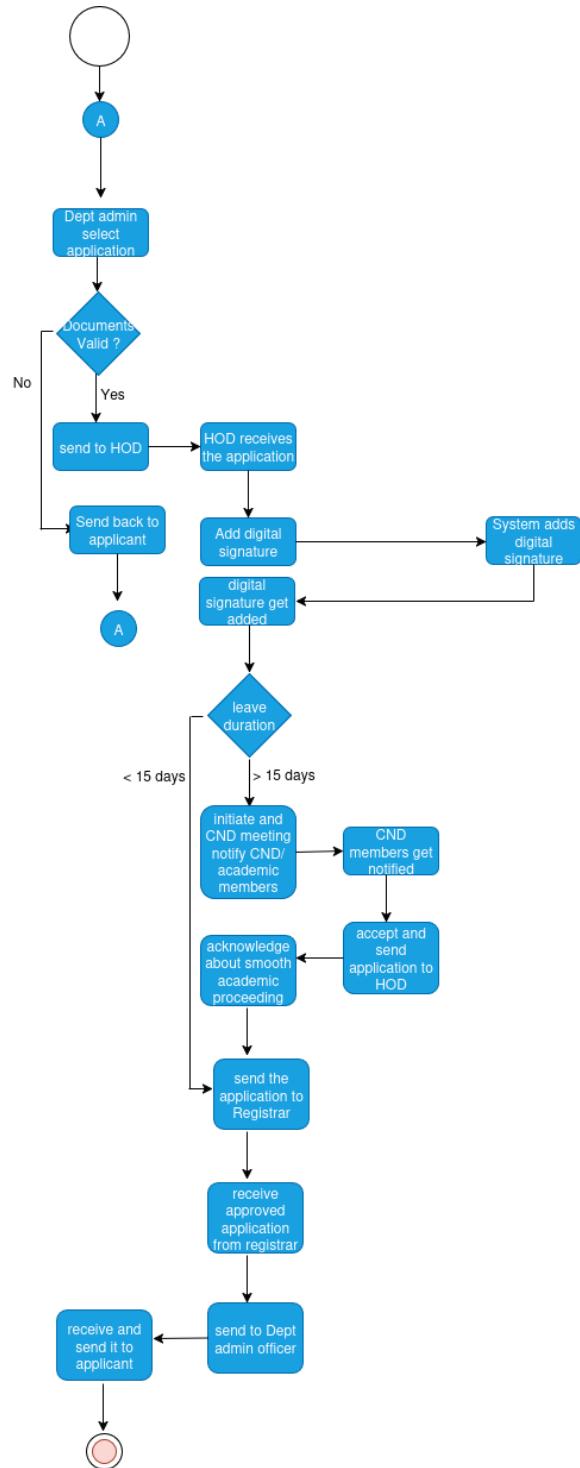
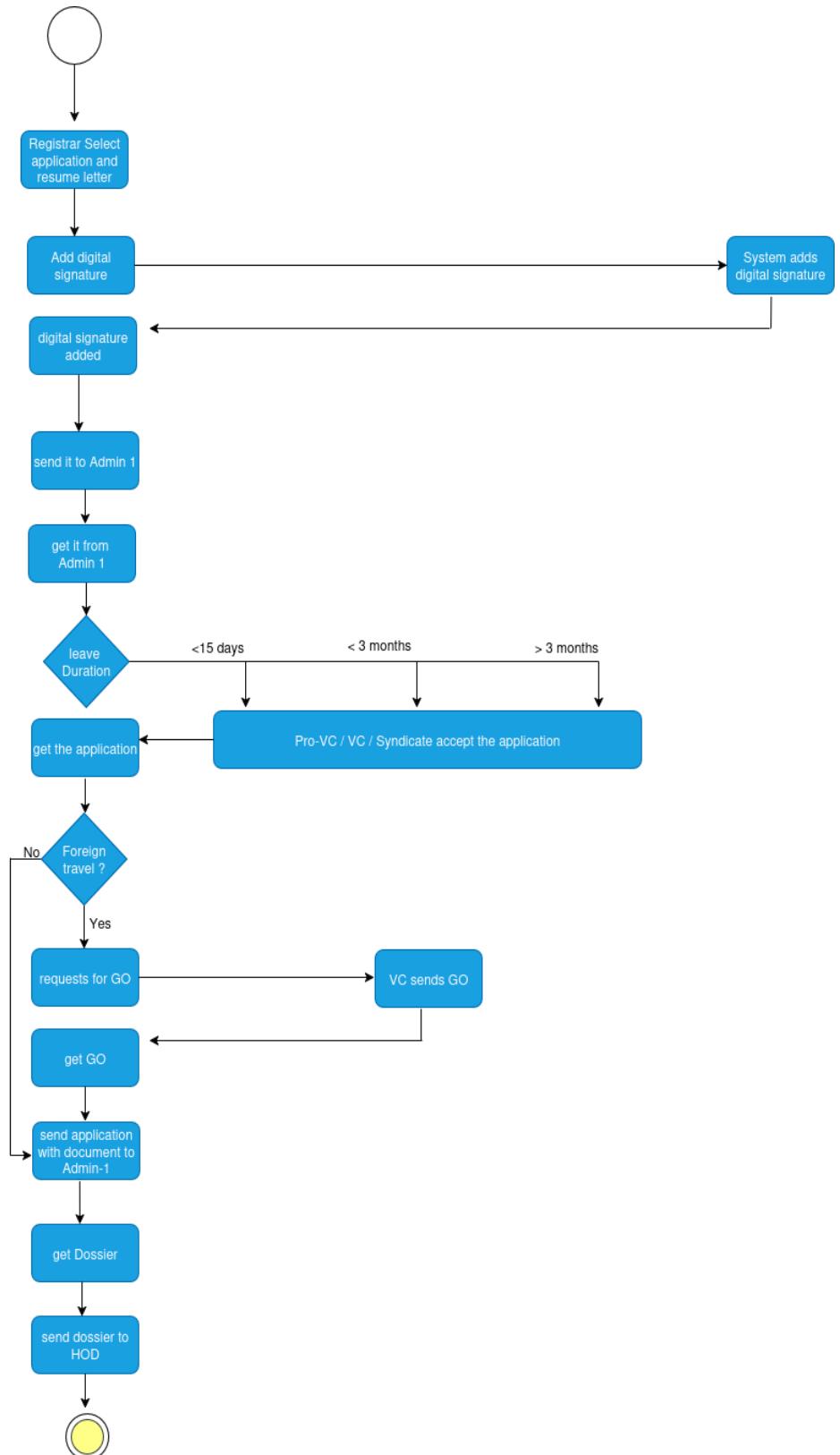


Fig: 1.4

AID (Activity ID): 1.5

Name: Central
Administration

Reference: Use case
level-1.5



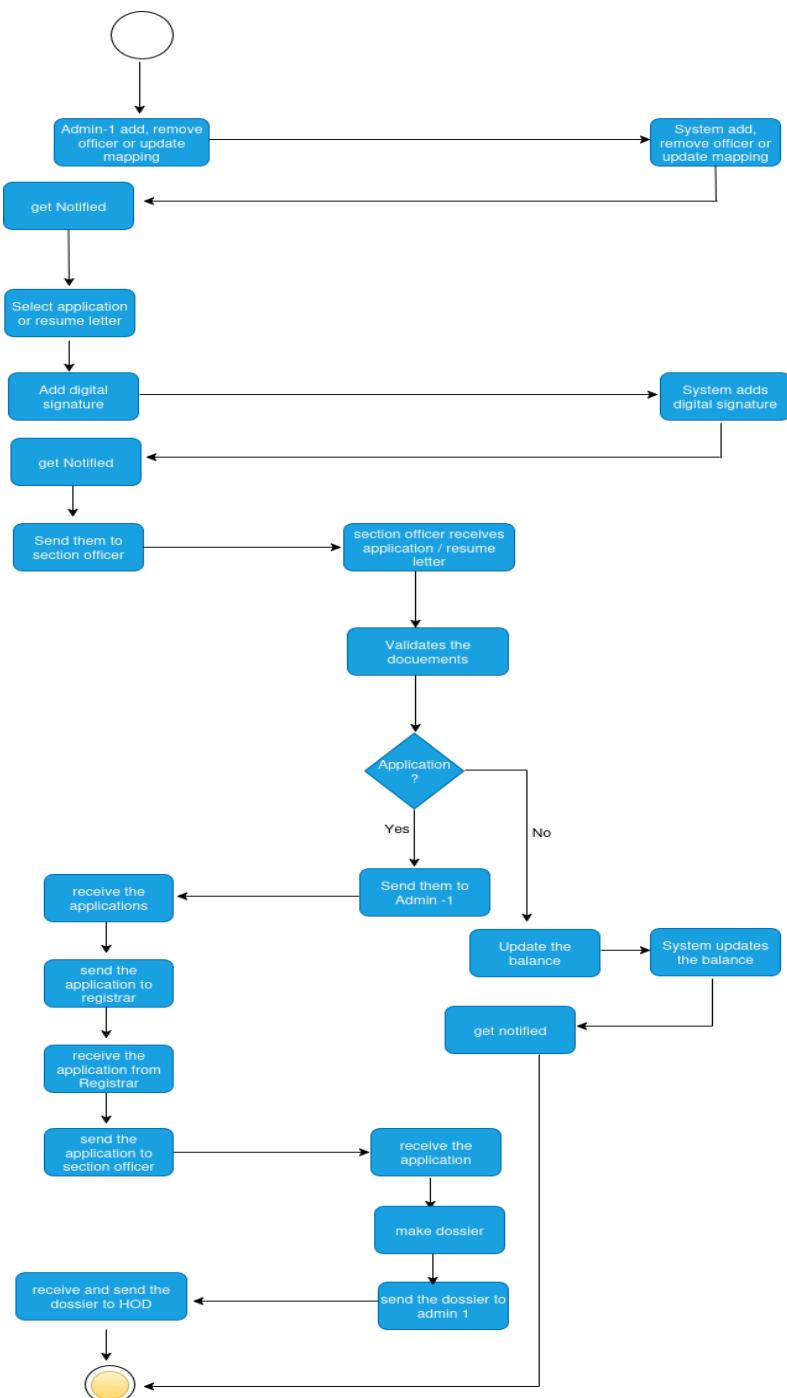
Activity Diagram

ID: 1.6

Name: Operational

Review

Reference: Use case
level 1.6



Operational Review

AID (Swimlane ID): 1.6.1

Name: Officer Management

Reference: Use case level-1.6.1

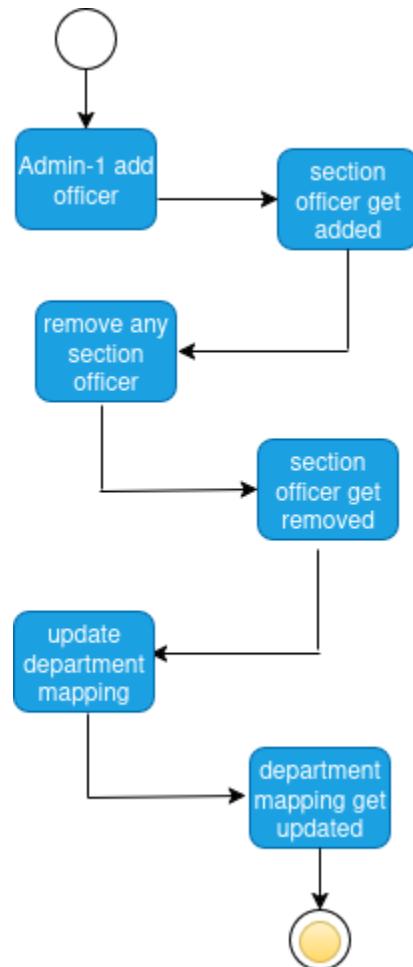
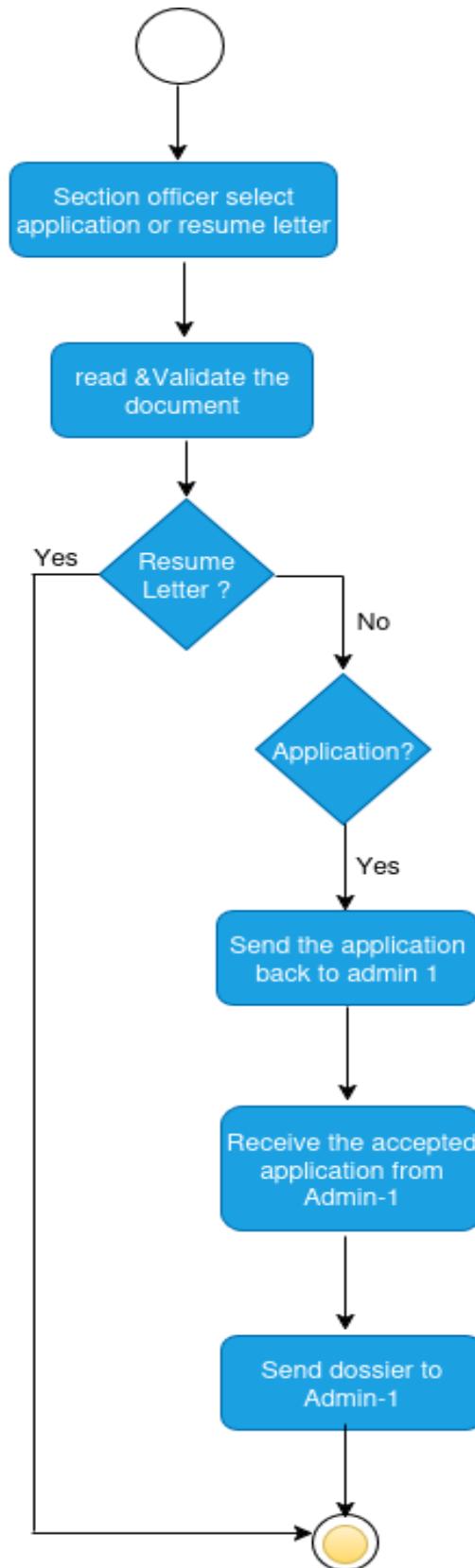


Fig: 1.6.1

AID (Activity ID): 1.6.2

Name: application reviewing

Reference: Use case level-1.6.2



AID (Activity ID): 1.7

Name: Leave Balance

Reference: Use case level-1.7

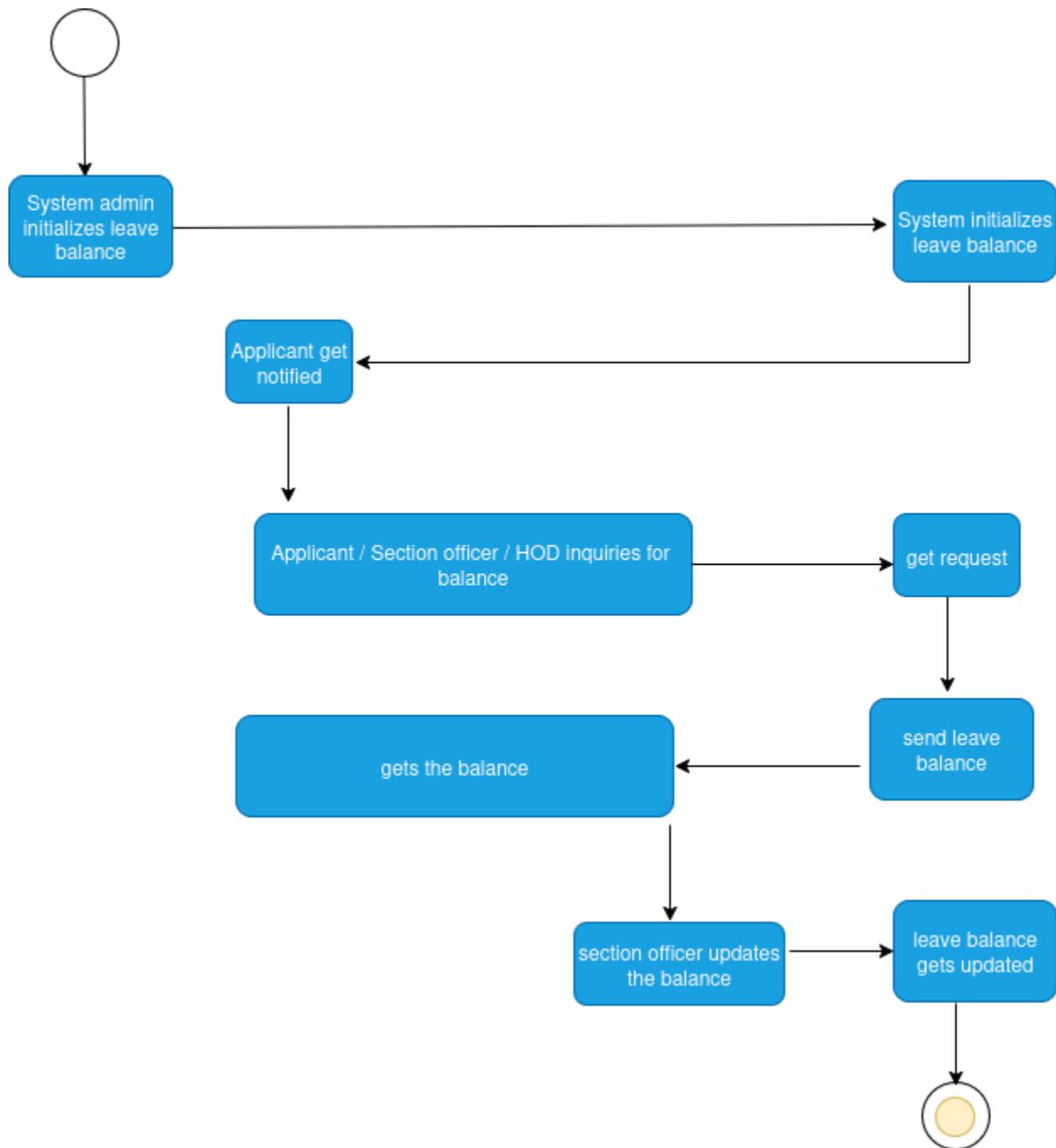


Fig: 1.7

AID (Activity ID): 1.7.1

Name: Balance Initialization

Reference: Use case level-1.7.1

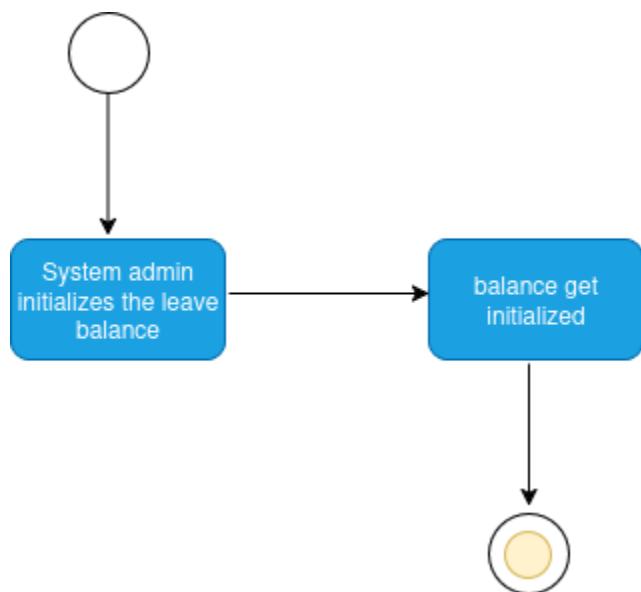


Fig: 1.7.1

AID (Activity ID): 1.7.2

Name: Balance Inquiry and Update

Reference: Use case level-1.7.2

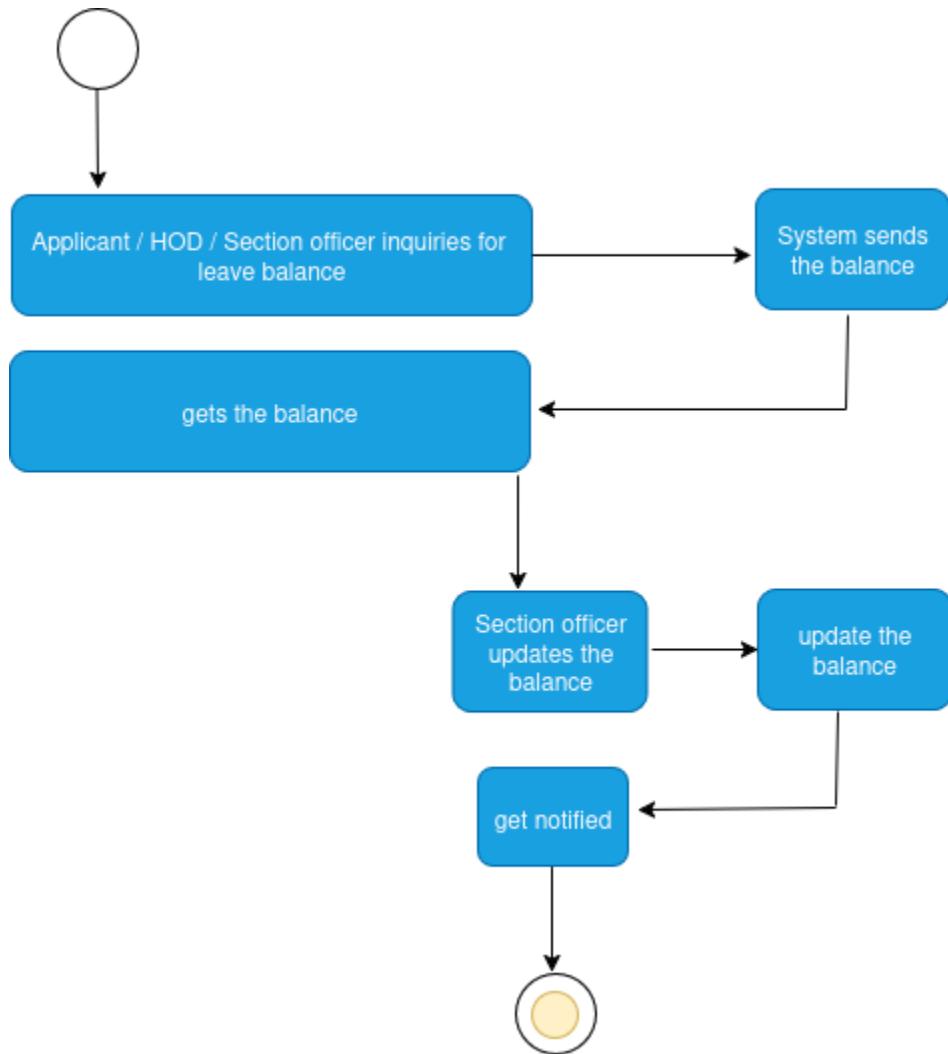


Fig: 1.7.2

AID(Activity ID): 1.8

Name: Audit

Reference: Use case level-1.1

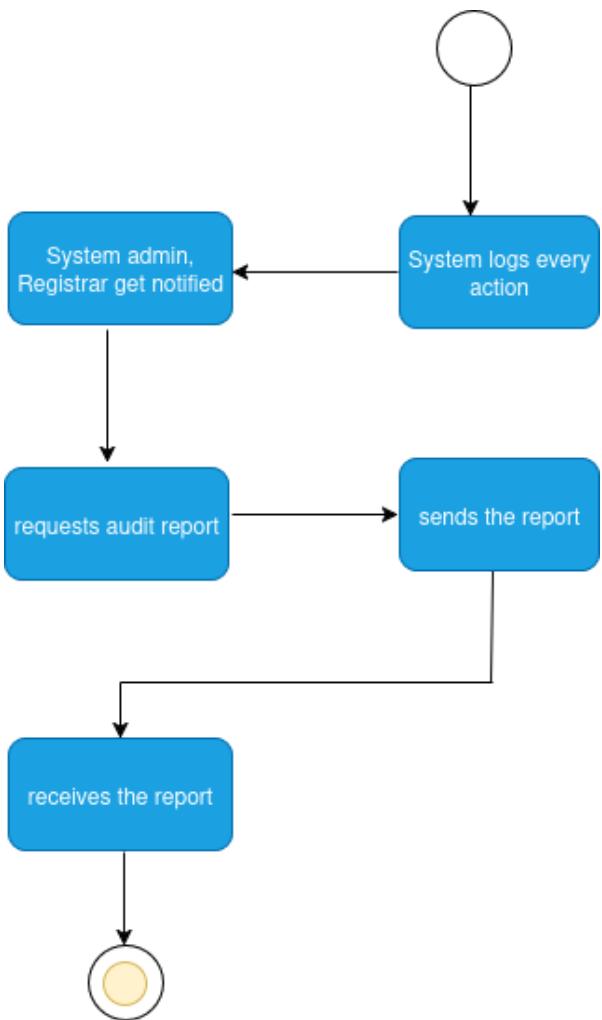


Fig: 1.8

AID (Activity ID): 1.8.1

Name: Audit logging

Reference: Use case diagram level-1.1

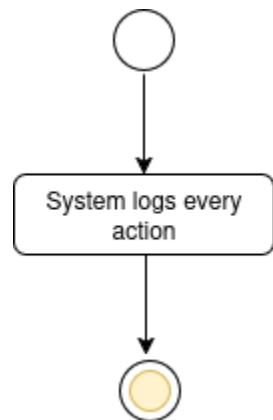


Fig: 1.8.1

AID (Activity ID): 1.8.2

Name: Audit reporting

Reference: Use case diagram level-1.8.2

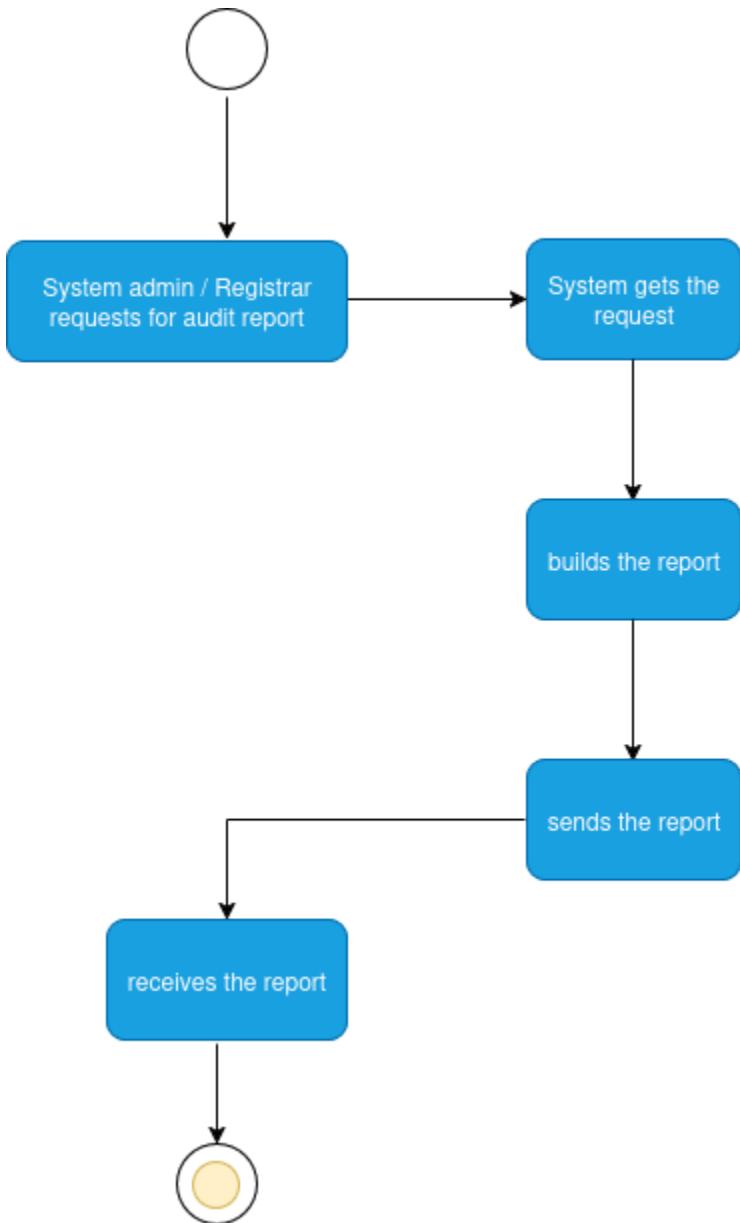


Fig: 1.8.2

Swimlane Diagram

A swimlane diagram is a type of activity diagram that organizes actions into separate “lanes” to show which actor, department, or system is responsible for each step in a process. Each lane represents a specific role, and the flow of activities is mapped across these lanes to illustrate interactions and handoffs clearly. Swimlane diagrams help identify responsibilities, reduce process confusion, and highlight inefficiencies or delays in workflows, making them particularly useful for modeling complex, multi-actor processes.

SID (Swimlane ID): 1.1

Name: User Access Control

Reference: Use case and Activity diagram level-1.1

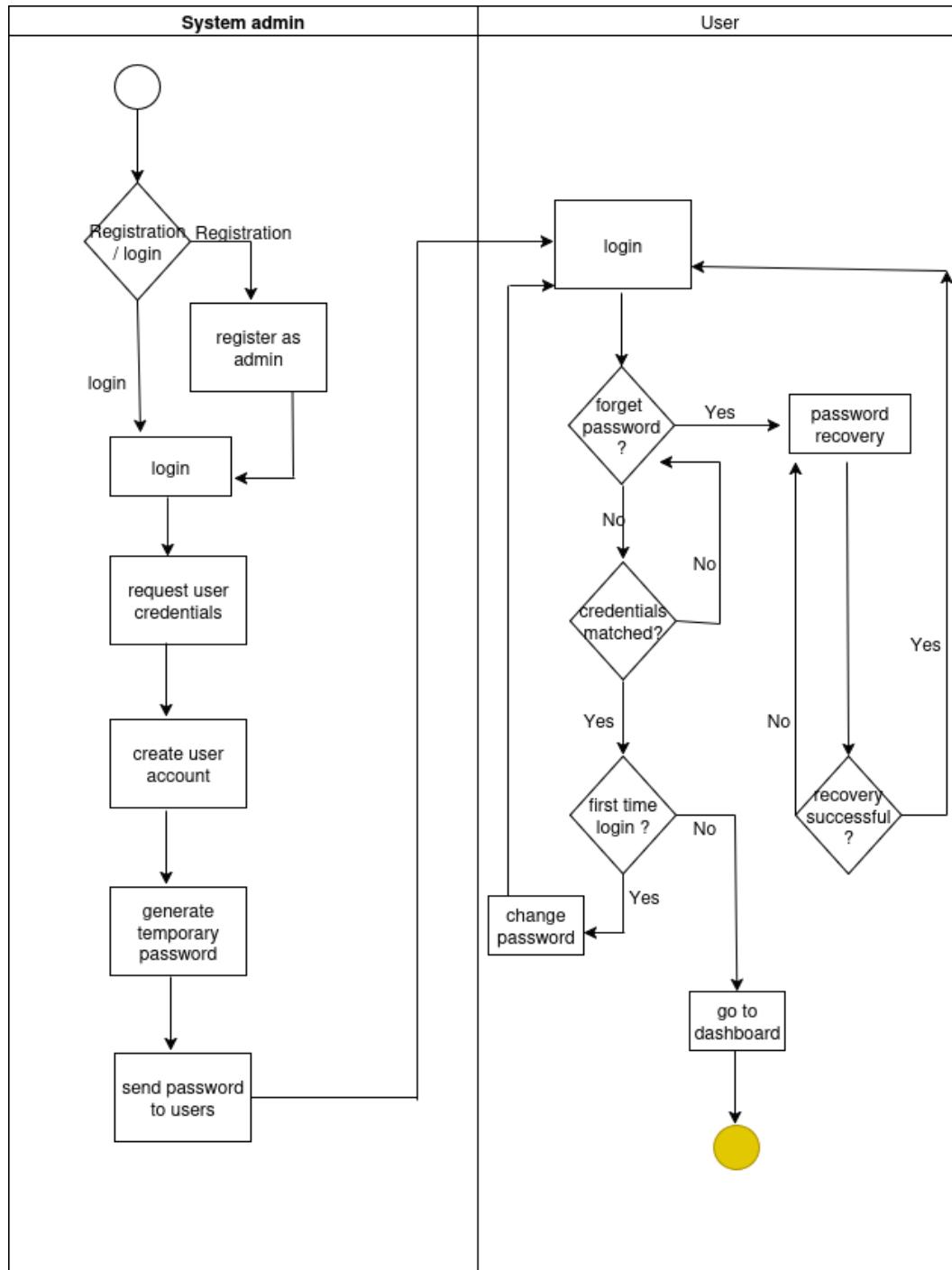
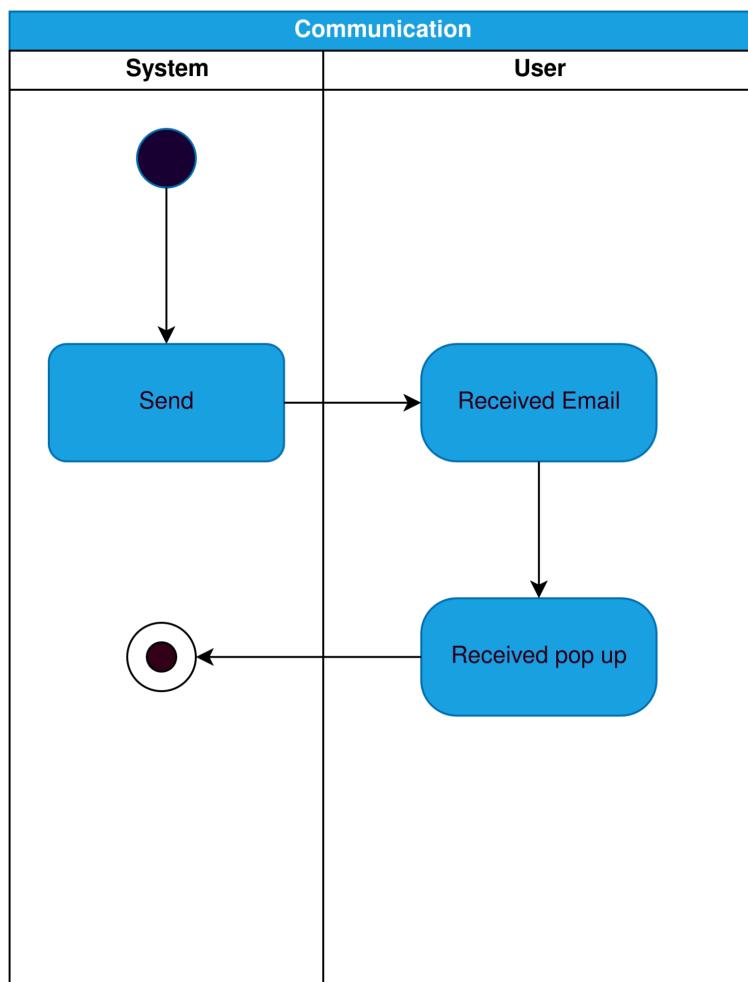


Fig:

SID (Swimlane ID): 1.2

Name: Communication

Reference: Use case and Activity diagram level-1.2



SID (Swimlane ID): 1.3

Name: Application Management

Reference: Use case and Activity diagram level-1.3

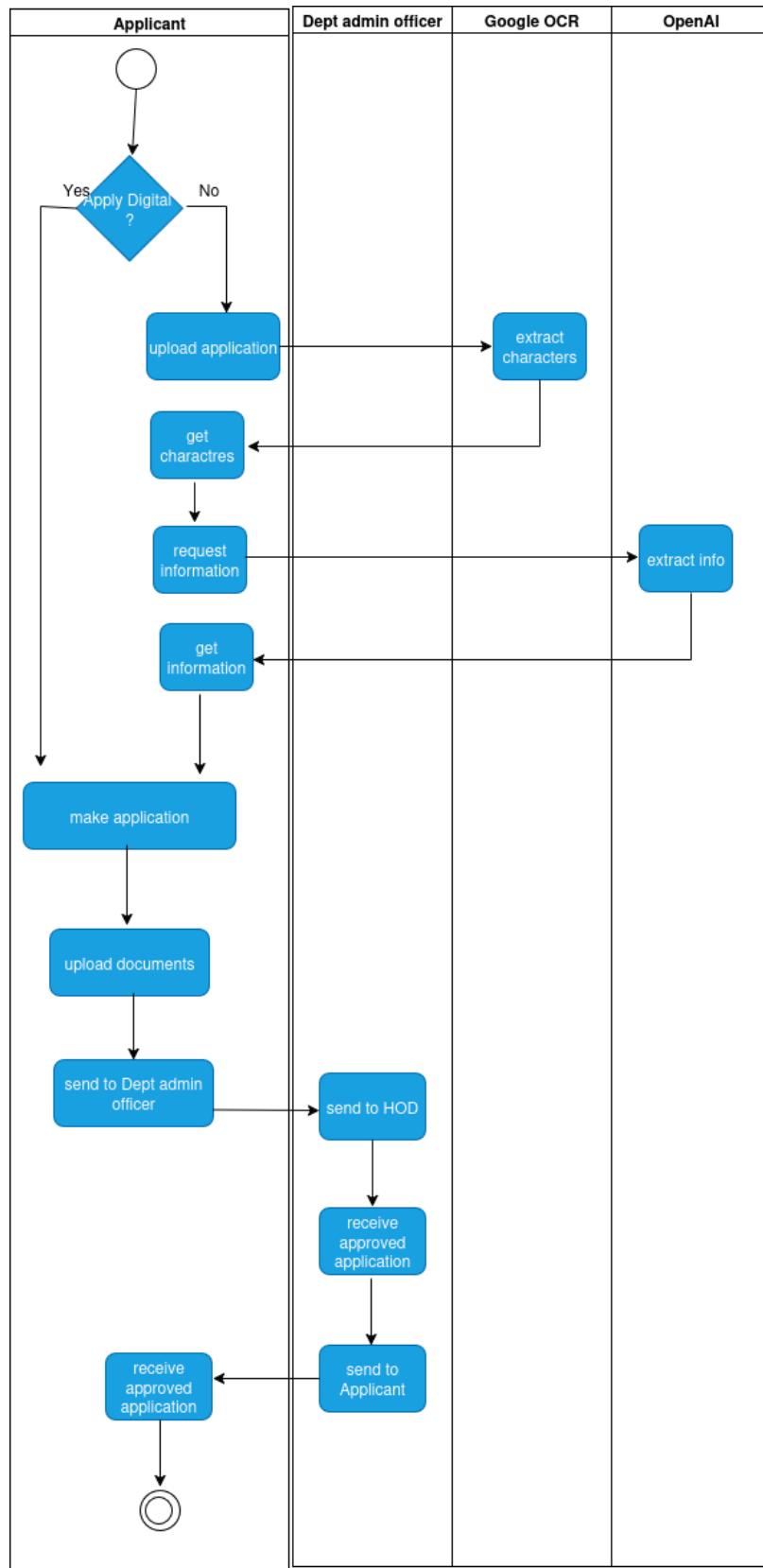


Fig: 1.3

SID (Swimlane ID): 1.3.1

Name: Application

Reference: Use case and Activity diagram level-1.3.1

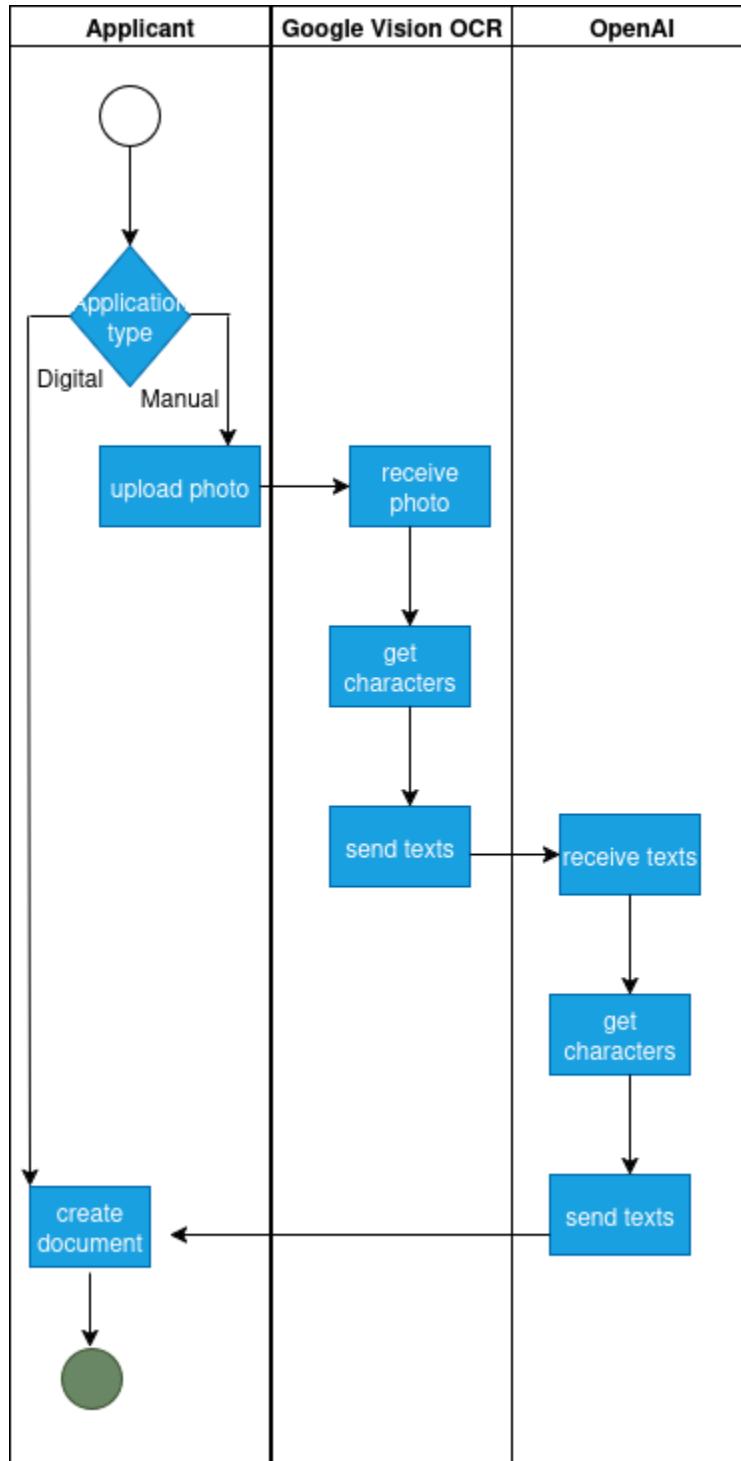


Fig: 1.3.1

SID (Swimlane ID): 1.4

Name: Departmental Review

Reference: Use case and Activity diagram level-1.4

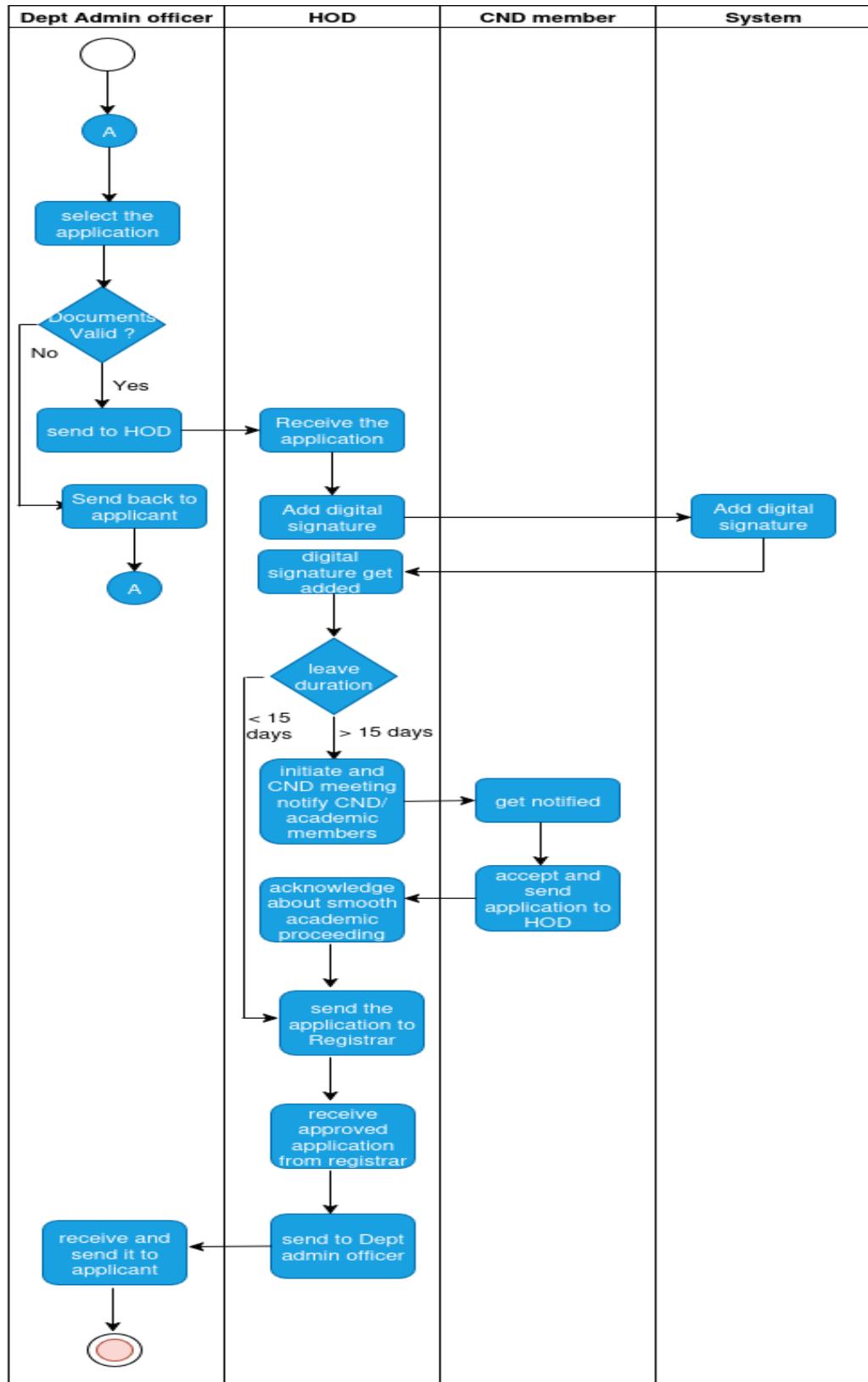
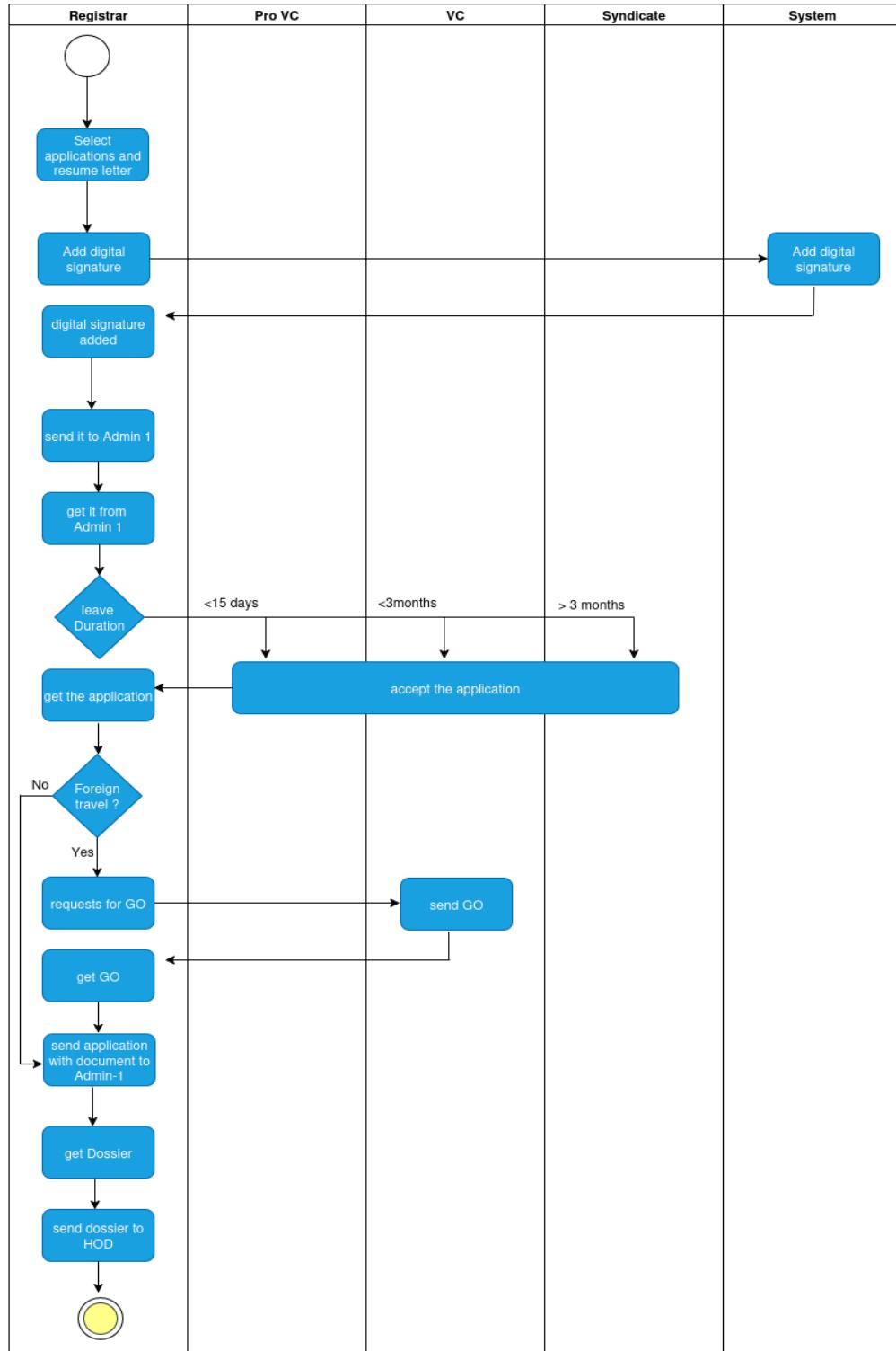


Fig: 1.4

SID (Swimlane ID): 1.5

Name: Central Administration

Reference: Use case and Activity diagram level-1.5



SID (Swimlane ID): 1.6

Name: Operational Review

Reference: Use case and Activity diagram level-1.6

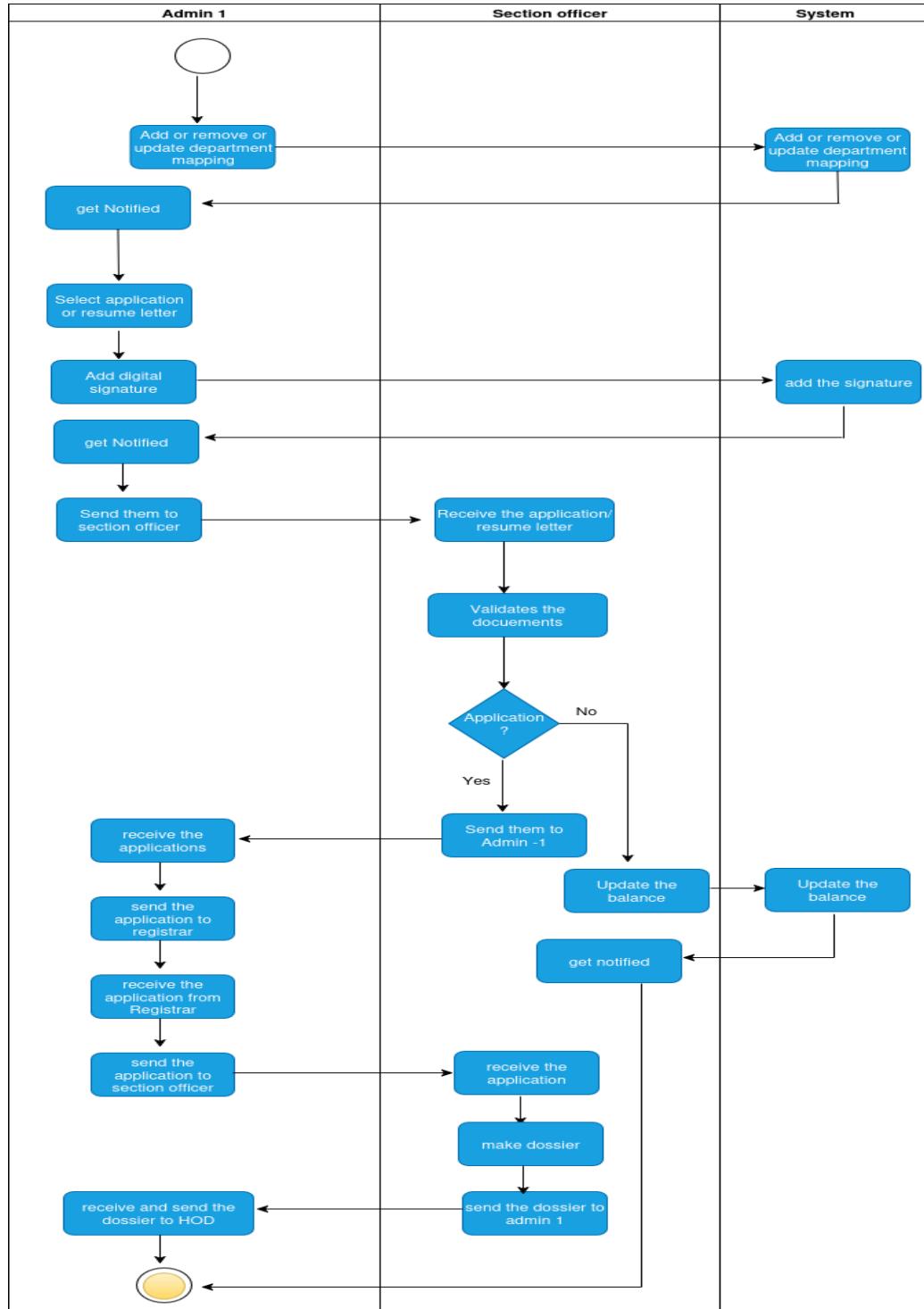


Fig: 1.6

SID (Swimlane ID): 1.6.1

Name: Office Management

Reference: Use case and Activity diagram level-1.6.1

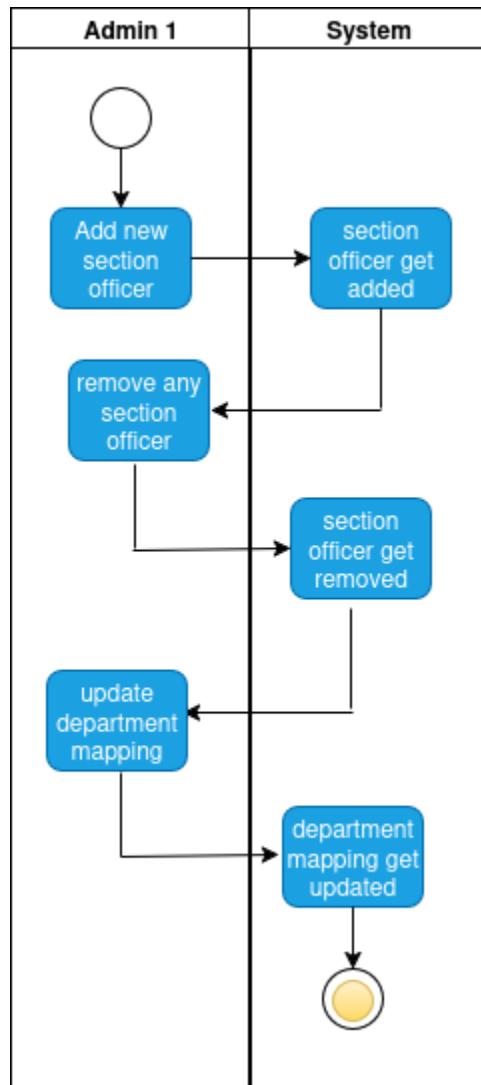
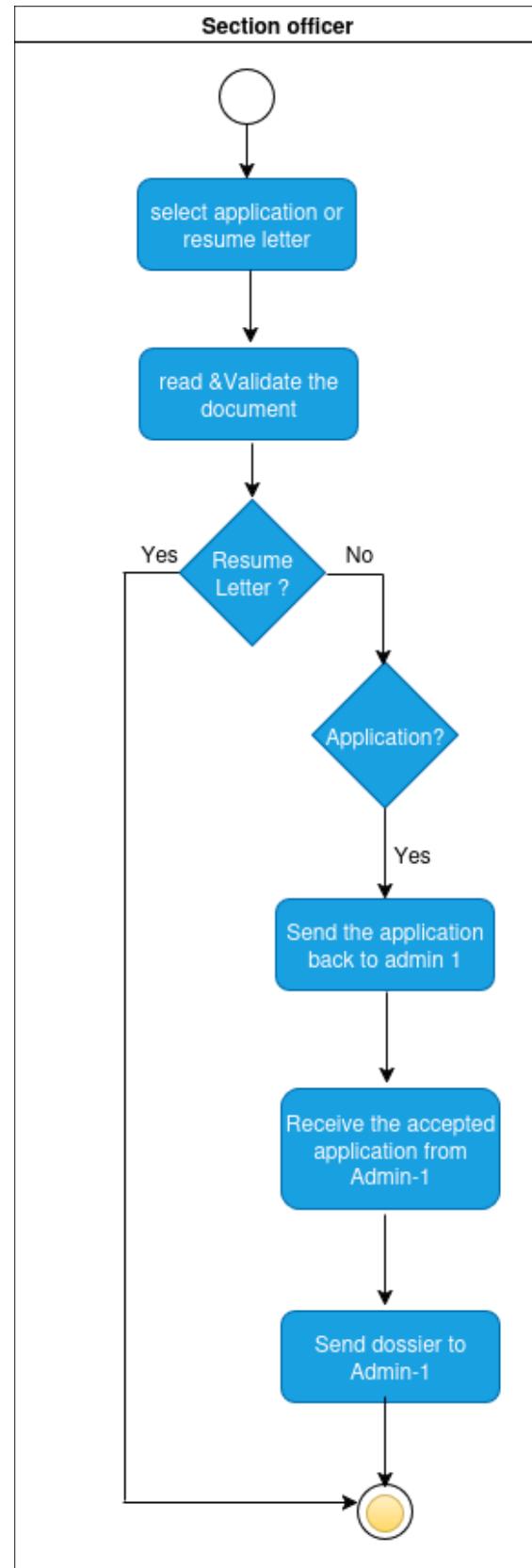


Fig: 1.6.1

SID (Swimlane ID): 1.6.2

Name: Application Review

Reference: Use case and Activity diagram level-1.6.2



SID (Swimlane ID): 1.7

Name: Leave Balance

Reference: Use case and Activity diagram level-1.7

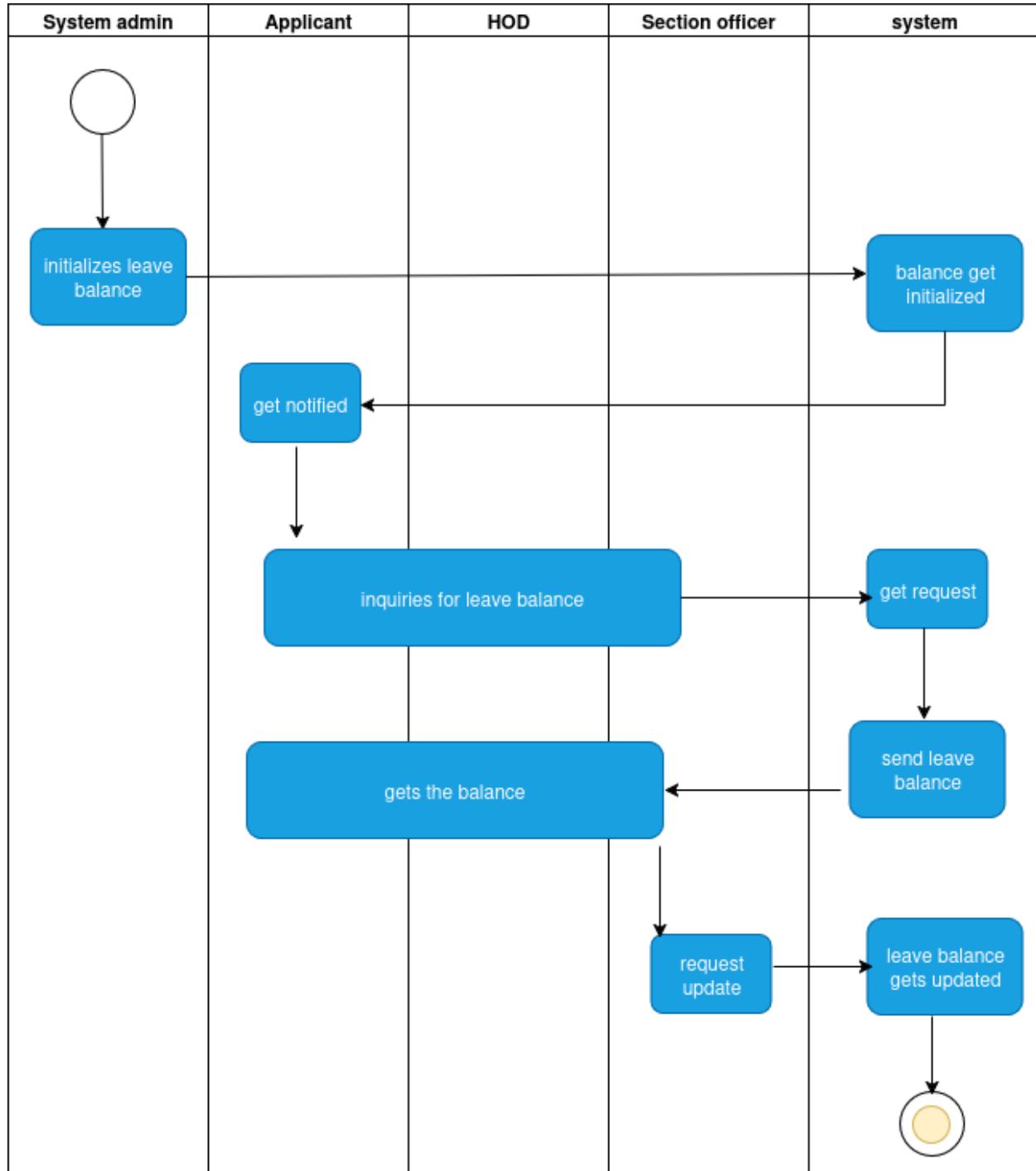


Fig: 1.7

SID (Swimlane ID): 1.7.1

Name: Balance Initialization

Reference: Use case and Activity diagram level-1.7.1

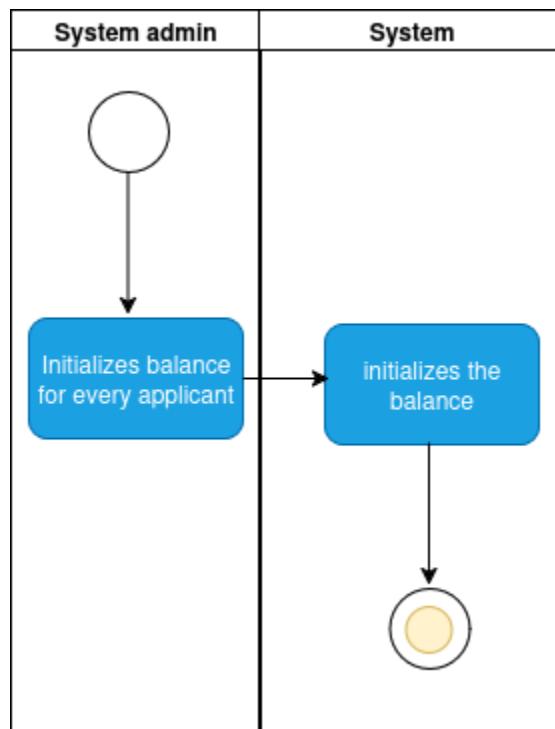


Fig: 1.7.1

SID (Swimlane ID): 1.7.2

Name: Balance Inquiry

Reference: Use case and Activity diagram level-1.7.2

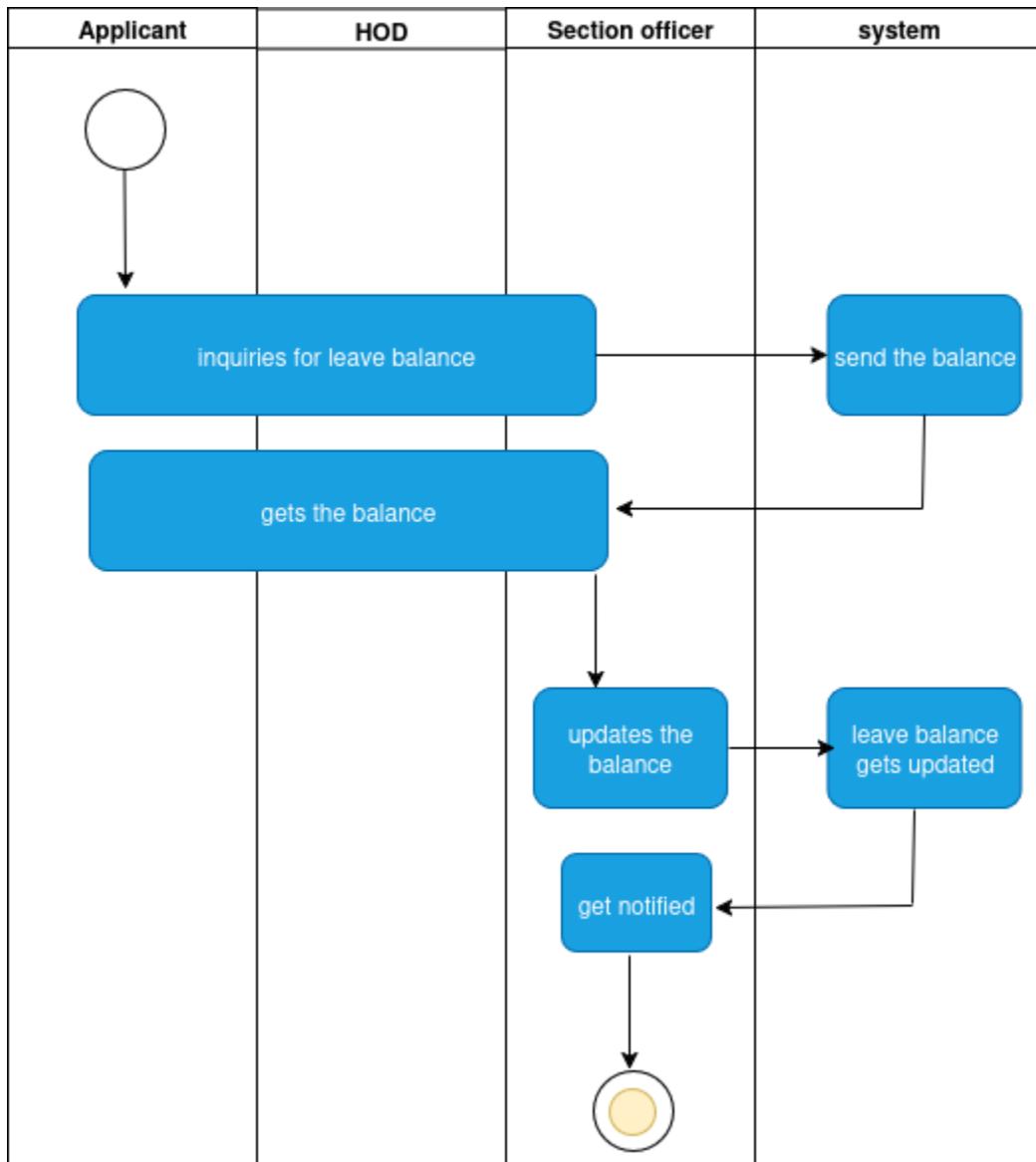


Fig: 1.7.2

SID (Swimlane ID): 1.8

Name: Audit

Reference: Use case and Activity diagram level-1.8

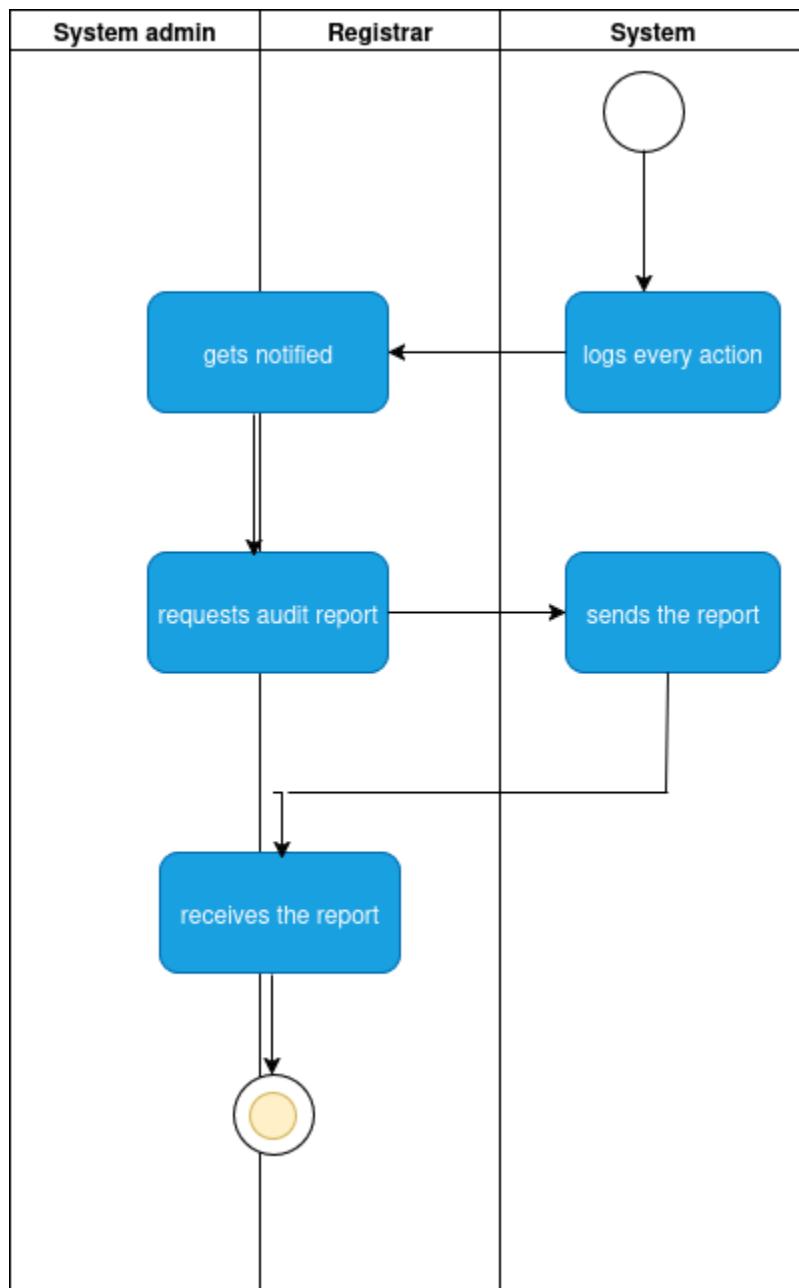


Fig: 1.8

SID (Swimlane ID): 1.8.1

Name: Audit Logging

Reference: Use case and Activity diagram level-1.8.1

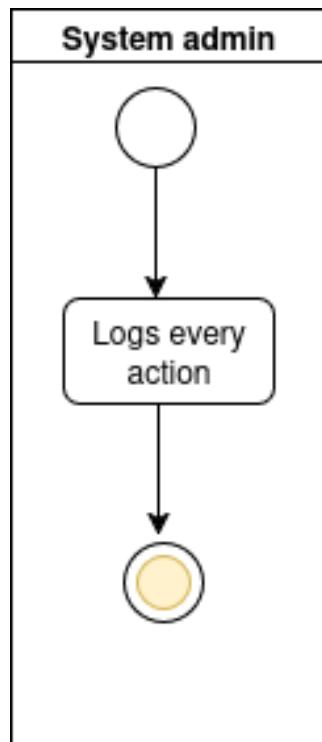


Fig:1.8.1

SID (Swimlane ID): 1.8.2

Name: Audit reporting

Reference: Use case and Activity diagram level-1.8.2

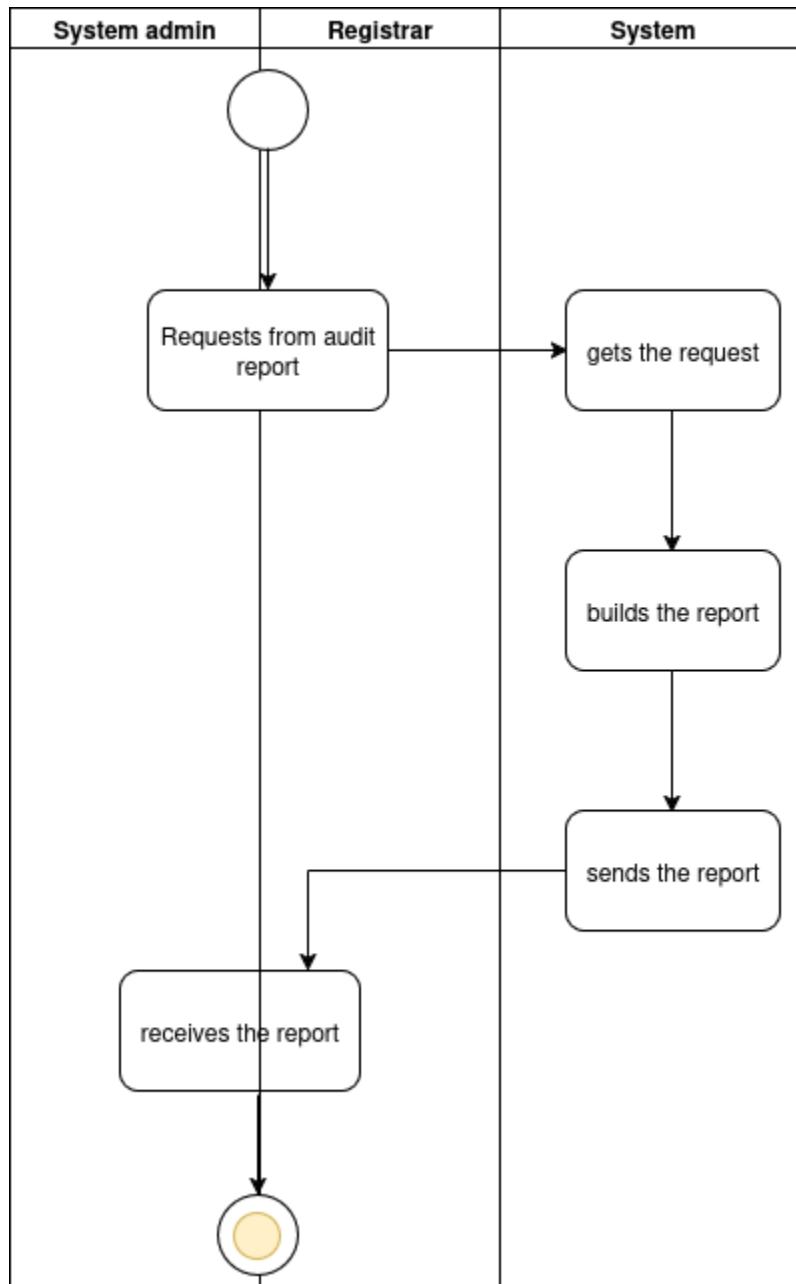


Fig: 1.8.2

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.	Nouns	P/S	Attribute
1.	User	S <input checked="" type="checkbox"/>	19, 21, 22, 23, 33, 34, 35, 36, 37, 38, 39, 40, 43, 46, 58, 60
2.	Role	S	
3.	Department	S <input checked="" type="checkbox"/>	25, 126, 26, 127
4.	Institution	S	

5.	LeaveType	S 	44, 45, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 59, 61, 62, 63, 65, 134
6.	LeaveApplication	S 	68, 69, 70, 71, 72, 78, 79, 80, 82, 83, 84, 85, 87, 97, 118
7.	LeaveBalance	S 	41, 42, 64, 94, 95, 99, 102, 104, 135, 136
8.	Document	S 	73, 74, 75, 76, 77, 89, 90, 91, 92, 93, 96, 98, 109, 129, 131, 132, 133
9.	ApprovalWorkflow	S 	83, 85, 118, 119, 120, 121, 122, 123, 137, 138, 114, 115, 116, 117, 122, 125, 128
10.	Notification	S 	81, 86, 100, 101, 110, 123
11.	EventLog	S 	96, 98, 105, 106, 140, 142
12.	CNDMeeting	S	
13.	MeetingMembers	S	
14.	Leave Management System (LMS)	S	
15.	Faculty members	P	
16.	University of Dhaka	P	
17.	System Admin	S	
18.	Registrar Building	S	
19.	User credentials	S	

20.	ICT Cell	S	
21.	Institutional email	S	
22.	User information	S	
23.	Applicants	S 	
24.	Department Admin Officers	S	
25.	Heads of Departments	S	
26.	Institutions	S	
27.	Academic Bodies	S	
28.	Registrars	S	
29.	Admin-1	S	
30.	Section Officers	S	
31.	Vice Chancellors (VC)	S	
32.	Pro-Vice Chancellors (Pro-VC)	S	
33.	User accounts	S	
34.	Password	S	
35.	Email	S	
36.	Login credentials	S	
37.	Temporary password	S	
38.	Institutional email address	S	
39.	Subject line	S	
40.	Security	S	
41.	Leave balance	S	
42.	Year	P	

43.	Date of appointment	P	
44.	Leave type	P	
45.	Higher education	P	
46.	Employee	P	
47.	Ph.D.	P	
48.	Master's degrees	P	
49.	Paid leave	P	
50.	Post-doctoral studies	P	
51.	Unpaid leave	P	
52.	Training purposes	P	
53.	Training schedule	P	
54.	Associate Professor	P	
55.	Sabbatical leave	P	
56.	Academic research	P	
57.	Book writing	P	
58.	Female employee	P	
59.	Maternity leave	P	
60.	Tenure	P	
61.	Casual leave	P	
62.	Earned leave	P	
63.	Recreational leave	P	
64.	Service	P	
65.	Extraordinary leave	P	
66.	Medical emergencies	P	
67.	Circumstances	P	
68.	Application dashboard	S	
69.	Leave request	S	

70.	Start date	S	
71.	End date	S	
72.	Reason for leave	P	
73.	Supporting documents	S	
74.	PDF	S	
75.	PNG	S	
76.	JPG	S	
77.	Image formats	S	
78.	Travel destination	P	
79.	Digital signature	S	
80.	Application	S	
81.	In-app notification	S	
82.	Reasons for rejection	P	
83.	Status	S	
84.	Office	S	
85.	Government Order (GO)	S	
86.	Email reminder	S	
87.	Resume letter	S	
88.	Manual application system	S	
89.	Handwritten application	S	
90.	Google Vision OCR	S	
91.	Document	S	
92.	OpenAI	S	
93.	OpenAI API	S	
94.	Leave balances	S	

95.	Leave categories	S	
96.	History	S	
97.	Leave applications	S	
98.	Dates	S	
99.	Approval status	S	
100.	Notifications	S	
101.	Leave reminders	S	
102.	Expiring leave balances	P	
103.	Interface	S	
104.	Leave records	S	
105.	Reports	S	
106.	Excel formats	S	
107.	Received application dashboard	S	
108.	First-come, first-served policy	S	
109.	Attached documents	S	
110.	Message	S	
111.	Inadequacy	P	
112.	Approved application dashboard	S	
113.	Reviewed application dashboard	S	

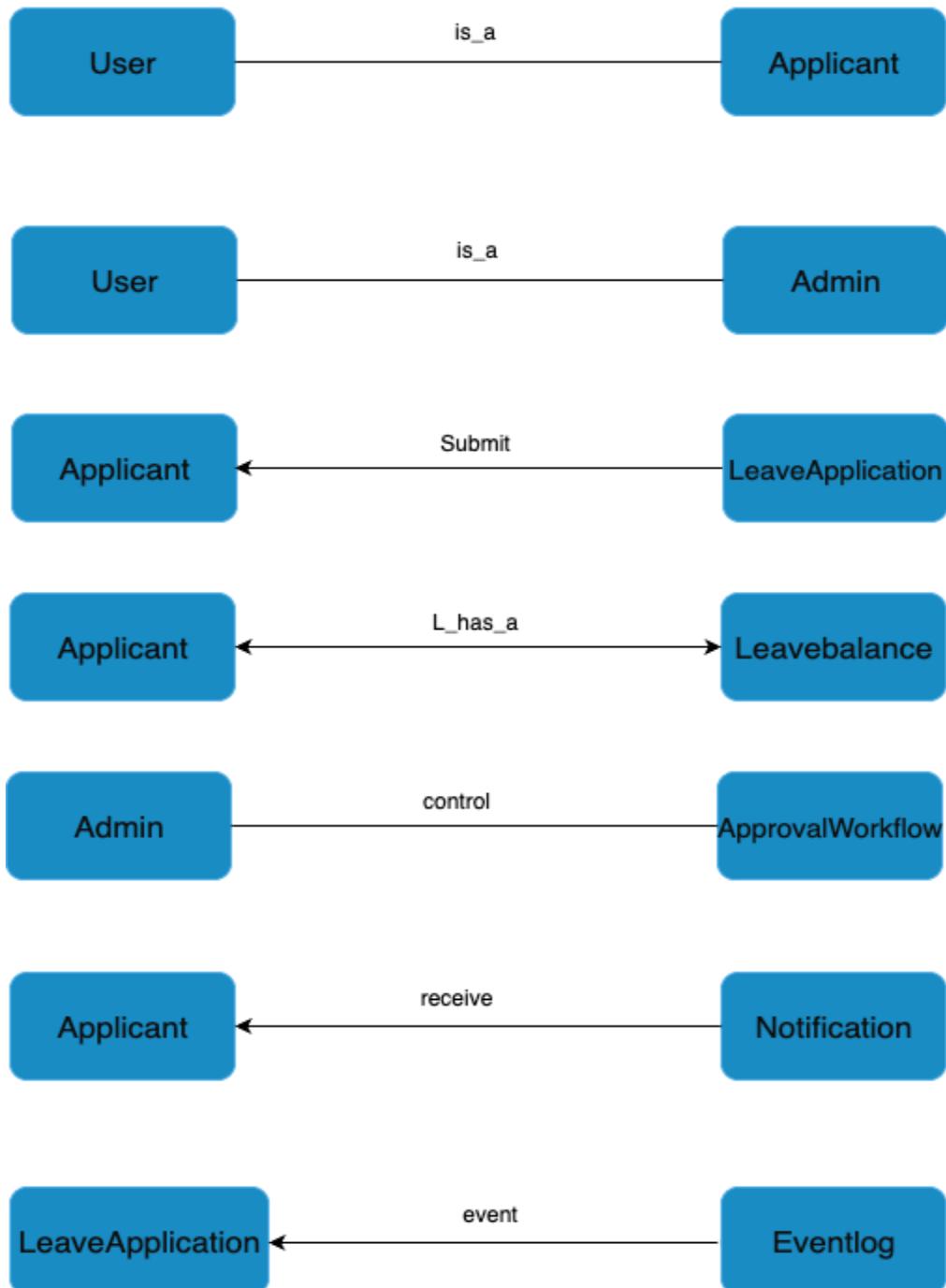
114.	CND meeting	S	
115.	Academic body members	S	
116.	Absence	P	
117.	Organizational activities	P	
118.	Processing	S	
119.	Urgent applications	S	
120.	Foreign travel	P	
121.	Immigration Department	P	
122.	Syndicate body	S	
123.	Approval notification	S	
124.	List	S	
125.	Active Section Officers	S	
126.	Department assignments	S	
127.	Institution assignments	S	
128.	Mappings	S	
129.	Cover letter	S	
130.	Special considerations	P	
131.	Medical certificate	P	
132.	Official stamp	P	
133.	Research proposal	P	
134.	Study Leave application	P	

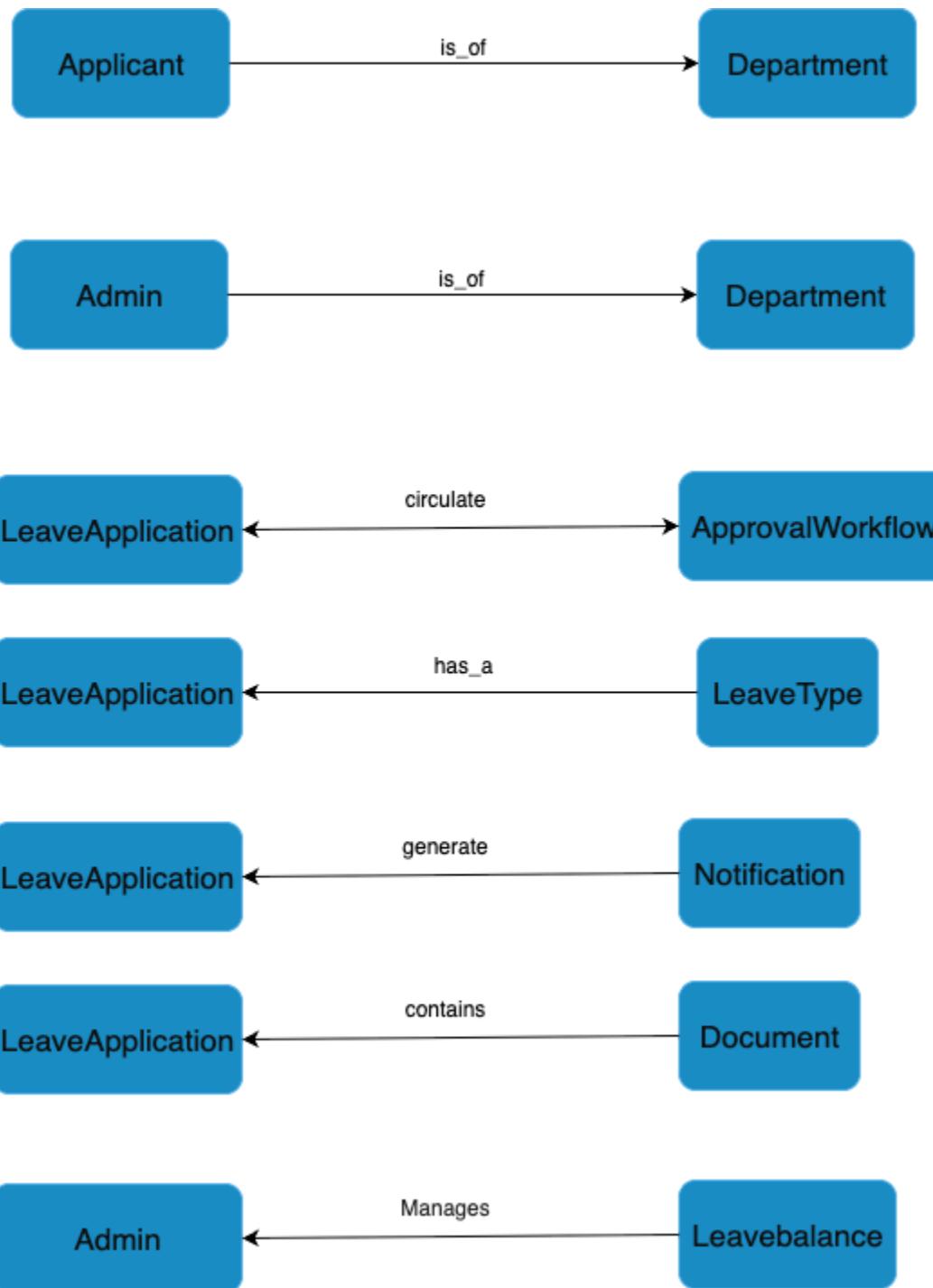
135.	Leave-Balance Service	S	
136.	Entitlement	P	
137.	Stage	S	
138.	Workflow	S	
139.	Summary memo	S	
140.	Audit trail	S	
141.	Dossier	S	
142.	Metadata	S	
143.	Joining letter	S	

Probable data objects

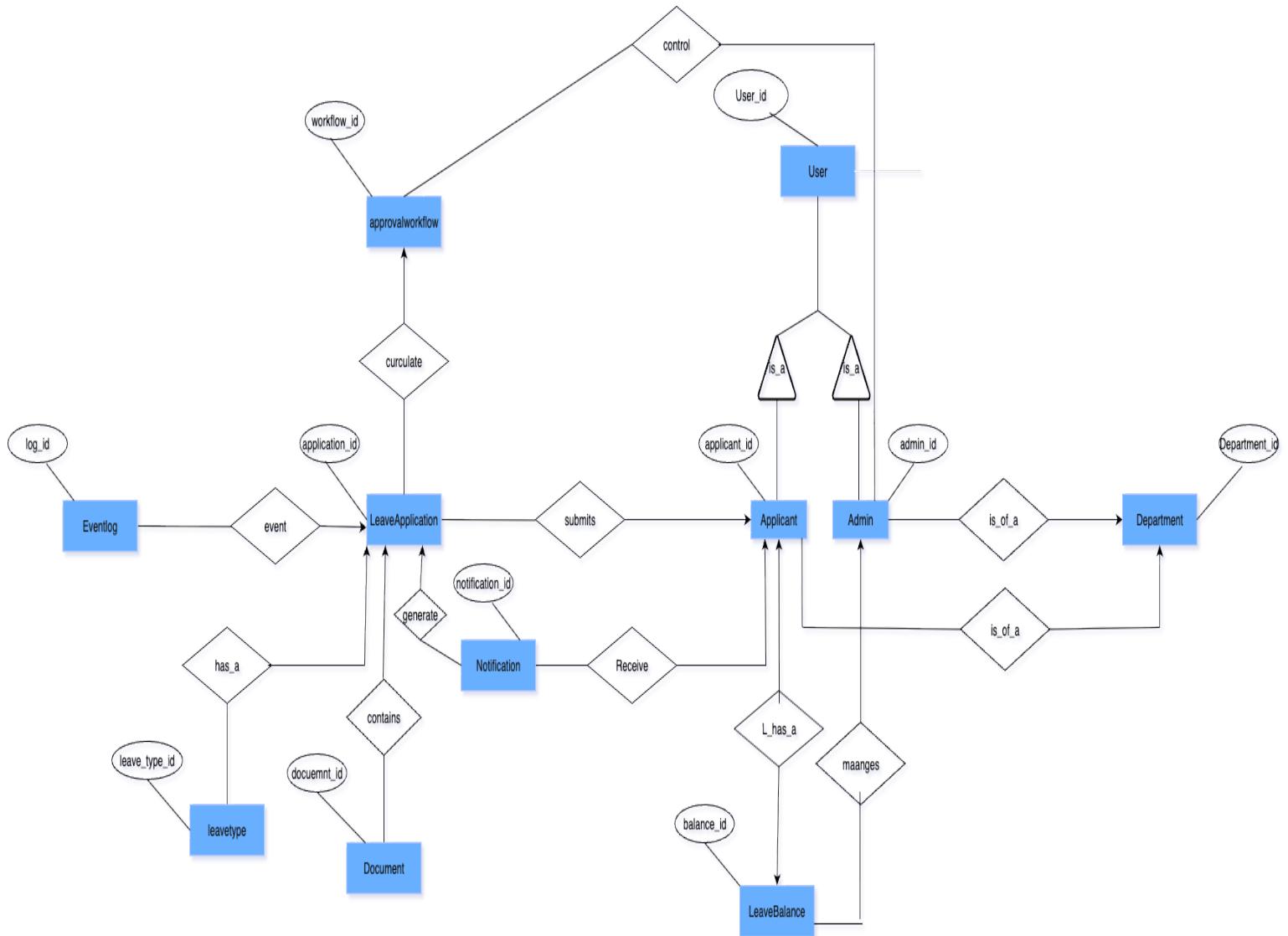
Sl No.	Data Objects	Attributes
1.	User	user_id , name, email, password_hash
2.	Applicant	Applicant_id,designation ,department_id
3.	Admin	Admin_id,designation, department_id
4.	Department	department_id,department_name
5.	LeaveType	leave_type_id ,leave_type_name,application_id
6.	LeaveApplication	application_id ,applicant_id , start_date, end_date, status,submission_date
7.	LeaveBalance	balance_id,applicant_id,year,Days_entitled ,admin_id,days_used,days_remaining
8.	Document	document_id , application_id,file_path, upload_date
9.	ApprovalWorkflow	workflow_id , admin_id , stage, decision, decision_date
10.	Notification	notification_id , applicant_id,application_id
11.	Eventlog	event_id , application_id (FK), action_type, timestamp

Relation between data objects





ER Diagram



Schema Diagram:

Entity	Attribute	Type	Description
User	user_id (PK)	INT	Unique identifier
	name	VARCHAR(100)	Name of the user
	email	VARCHAR(150)	Email id of the user
	password_hash	VARCHAR(255)	Hashed password of the user
Applicant	Applicant_id(PK)	INT	Unique identifier
	designation	VARCHAR(50)	Designation of the applicant
	department_id(FK)	INT	Reference to the department table
Admin	Admin_id(PK)	INT	Unique identifier
	designation	VARCHAR(50)	Designation of the admin
	department_id(FK)	INT	Reference to the department table
Department	department_id(PK)	INT	Unique identifier
	department_name	VARCHAR(50)	Name of the department
LeaveType	leave_type_id(PK)	INT	Unique identifier
	leave_type_name	VARCHAR(50)	Name of the leave
	application_id(FK)	INT	Reference to the LeaveApplication

			table
LeaveApplication	application_id (PK)	INT	Unique identifier
	applicant_id (FK)	INT	Reference to the applicant table
	leave_start_date	DATE	Leave start date
	leave_end_date	DATE	Last day of leave
	status	VARCHAR(20)	Status of application
	submission_date	DATE	Application submission date
	workflow_id(FK)	INT	Reference to the workflow table
LeaveBalance	balance_id(PK)	INT	Unique identifier
	year	INT	Leave year
	Days_entitled	INT	Total days entitled for that leave type
	admin_id(fk)	INT	Reference to the admin table
	days_used	INT	Number of days already taken
	days_remaining	INT	Remaining days of a leave
Document	document_id(PK)	INT	Unique identifier
	application_id(FK)	INT	Reference to the LeaveApplication table
	file_path	VARCHAR(255)	Path of the file where it is stored
	upload_date	DATE	Date when document was attached

ApprovalWorkflow	workflow_id (PK)	INT	Unique identifier
	admin_id (FK)	INT	Reference to the admin table
	decision	ENUM	Decision status
	decision_date	DATE	Decision date
Notification	Notification_id(PK)	INT	Unique identifier
	application_id(FK)	INT	Reference to the application table
	Applicant_id(FK)	INT	Reference to the applicant table
Eventlog	event_id(PK)	INT	Unique identifier
	application_id(FK)	INT	Reference to the application table
	action_type	VARCHAR(250)	Action performed
	timestamp	DATETIME	Time of action

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.

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

SL No.	Nouns	General classification
1.	User	1,2,4
2.	Role	2,4,5
3.	Department	2,5
4.	Institution	2,5
5.	LeaveType	2,4,5
6.	LeaveApplication	2,3,5
7.	LeaveBalance	2,3,4
8.	Document	2,3,5
9.	ApprovalWorkflow	2,3,4
10.	Notification	2,3,4
11.	EventLog	2,3,4
12.	CNDMeeting	3,5
13.	MeetingMembers	4,5
14.	Leave Management System (LMS)	2,5

15.	Admin	1,4,5
16.	Registrar Building	5,6
17.	User credentials	2,3
18.	ICT Cell	1,5,6
19.	Institutional email	2,3
20.	User information	2,3
21.	Applicant	1,4,5
22.	Department Admin Officers	4,5
23.	Heads of Departments	4,5
24.	Institutions	2,5
25.	Academic Bodies	4,5
26.	Registrars	4,5
27.	Admin-1	4,5
28.	Section Officers	4,5
29.	Vice Chancellors (VC)	4,5
30.	Pro-Vice Chancellors (Pro-VC)	4,5
31.	User accounts	2,3
32.	Password	2,3
33.	Email	2,3
34.	Login credentials	2,3

35.	Temporary password	2,3
36.	Subject line	2,4
37.	Security	3,4
38.	Application dashboard	2,4
39.	Leave request	2,3
40.	Start date	2,3
41.	End date	2,3
42.	Supporting documents	2,3
43.	PDF	2
44.	PNG	2
45.	JPG	2
46.	Image formats	2
47.	Digital signature	2
48.	Status	2
49.	Office	2
50.	Government Order (GO)	2,3
51.	Email reminder	2,3
52.	Resume letter	2
53.	Manual application system	2,3,5
54.	Handwritten application	2,3,5

55.	Google Vision OCR	1,2,3
56.	OpenAI	1,2,3
57.	History	2
58.	Dates	2
59.	Approval status	2,3
60.	Leave reminders	2,3
61.	Interface	2
62.	Leave records	2,3
63.	Reports	2
64.	Excel formats	2
65.	Attached documents	2
66.	Message	2
67.	Approved application dashboard	2,3
68.	Processing	2
69.	Urgent	2
70.	Syndicate body	2,4,5
71.	Mappings	2,3
72.	Cover letter	2
73.	Google ocr	1,2,3
74.	Audit trail	2,5

75.	Dossier	2,3
76.	Metadata	2
77.	Joining letter	2,3

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	User	1,2,3,4
2	Role	2,3,4
3	LeaveType	1,3,5
4	LeaveApplication	(1-6) (Selected)
5	LeaveBalance	1, 2, 3, 4, 6(Selected)
6	Document	1,2,3
7	ApprovalWorkflow	1-6(Selected)
8	Notification	2,3,4,6(Selected)

9	EventLog	1,2,3,6(Selected)
10	Admin	1-6(Selected)
11	ICT Cell	1,2,4,6(Selected)
12	Applicant	1-6(Selected)
13	Manual Application System	1,2,3,4
14	HandWritten Application	1,2,3,4
15	Google Vision OCR	2,4,6(Selected)
16	Open AI	2,4,6(Selected)
17	Syndicate Body	2,4

Class Analysis

1.LeaveApplication

LeaveApplication is central to the system as it captures and manages all faculty leave requests. It fulfills every SC criterion: it stores essential information, provides needed services such as submission and tracking, has multiple attributes, and supports key operations like edit or cancel. It also absorbs the role of manual or handwritten applications, since these are simply alternative input formats that feed into LeaveApplication via OCR.

2.LeaveBalance

LeaveBalance is essential because it tracks entitlements, used leave, and remaining balances for each faculty member. It meets multiple SC criteria by retaining information, supporting calculations, and providing critical services for fairness and compliance. It naturally covers the responsibilities of leave categories and history, and eliminates the need for a separate LeaveType class by linking leave balances directly with leave types.

3.ApprovalWorkflow

ApprovalWorkflow ensures every leave application passes through the correct sequence of decisions. It records each stage, approver, and outcome, thereby satisfying all SC checks. By embedding committees, syndicate bodies, and academic boards as workflow participants, it avoids the need for separate classes while still modeling the complexity of the approval process.

4.Notification

Notification provides alerts and reminders across the system, keeping users informed at every stage. It meets SC requirements by storing recipient and message details, offering vital services, and supporting common operations such as sending and logging notices. In doing so, it covers related concepts like email reminders and in-app messages without needing separate classes.

5.EventLog

EventLog (AuditTrail) records every action in the system, ensuring accountability and integrity. It satisfies SC by retaining information, providing critical tracking services, and supporting system-wide operations. This class makes separate recordkeeping concepts, like processing history or audit documents, unnecessary.

6.Admin

Admin (Approver) represents the decision-making authorities in the system. It fulfills all SC categories by being an external role, providing services like approval and review, and holding multiple attributes such as ID and designation. It absorbs specialized roles like Registrar, Section Officer, or VC by modeling them as role instances rather than separate classes.

7.ICT Cell

ICT Cell covers system administration, user management, and credential handling. It satisfies SC by being an organizational unit, retaining user information, and providing services like support and account recovery. This eliminates the need for separate credential or email classes, as these are functions embedded within ICT Cell responsibilities.

8.Applicant

Applicant represents faculty who apply for leave and is thus an external entity as well as an essential system role. It meets all SC requirements through its attributes, operations like apply or withdraw, and its central role in initiating workflows.

9.Google OCR

Google OCR supports the system by converting scanned or handwritten applications into machine-readable text. It fits SC as a service provider, ensuring integration of manual inputs into digital workflows. This class takes over the functions of “Handwritten Application” and “Manual Application System,” making them redundant.

10.OpenAI

OpenAI assists in text extraction, classification, and possibly chatbot-based query support. It qualifies under SC as a service entity, providing automation, language understanding, and digital support. It subsumes concepts like chatbot or AI assistant, ensuring external API use is captured without introducing fragmented classes.

Verbs list:

SI No.	Verb Name
1	begin
2	register
3	confirm
4	request
5	maintain
6	forward
7	create
8	generate
9	send
10	contain
11	access
12	log in
13	prompt
14	change
15	ensure

16	collect
17	appoint
18	grant
19	pursue
20	avail
21	utilize
22	allocate
23	deduct
24	apply
25	specify
26	provide
27	authenticate
28	forward
29	deem
30	receive
31	track
32	handle
33	download
34	remind
35	resume
36	upload
37	return
38	extract

39	fill in
40	visit
41	contain
42	process
43	select
44	verify
45	attach
46	send back
47	explain
48	review
49	initiate
50	notify
51	approve
52	acknowledge
53	affect
54	sign
55	receive
56	give
57	process
58	prioritize
59	mark
60	request
61	issue

62	deliver
63	manage
64	add
65	remove
66	update
67	assign
68	modify
69	review
70	apply
71	mark
72	sort
73	open
74	examine
75	include
76	validate
77	initiate
78	retrieve
79	display
80	remain
81	proceed
82	approve
83	prepare
84	check

85	record
86	compile
87	log
88	affix
89	trigger
90	update
91	complete

CRC Card:

1.Applicant

Attribute	method
-name	+register()
-faculty_id	+login()
-department	+applyForLeave()
-designation	+attachDocument()
-contact_info	+trackApplication() +updateApplication() +resumeJob()
Responsibility	collaborator
Submit new leave application	LeaveApplication
Attach supporting documents	LeaveApplication
Track leave application status	LeaveApplication
Maintain leave history	LeaveBalance

2.Admin

Attribute	method
-name -role (Registrar, VC, Section Officer, etc.) -designation -office_location	+reviewApplication() +checkLeavebalance() +approveApplication() +rejectApplication() +signDecision() +addpriority() +issueOfficialLetter() +triggernotification()
Responsibility	collaborator
Check leave balance	LeaveBalance
Add priority to the application	LeaveApplication
Forward application	LeaveApplication
Notify applicant	Notification
Approve or reject request	ApprovalWorkflow

3.ICT Cell

Attribute	method
	+createUserAccount() +authenticateUser()

	+resetPassword() +manageUserRoles() +maintainSystemSecurity() +supportUser() +integrateServices()
Responsibility	collaborator
Provide system maintenance	EventLog
Manage user/system access rights	
Resolve technical issues in workflow	ApprovalWorkflow
Ensure integrations (OCR, AI) run smoothly	Google OCR, OpenAI

4.LeaveApplication

Attribute	method
-application_number	+createApplication()

-leave_type	+specifyDates()
-start_date	+addSupportingDocs()
-end_date	+validateApplication()
-status	+updateStatus()
-submission_timestamp	+processApplication()
	+getHistory()
Responsibility	collaborator
Application creation	
Attach supporting docs	Applicant
Provide audit trail of actions	Eventlog

5.LeaveBalance

Attribute	method
-faculty_name (link to Applicant in OOP sense) -year -entitled_days -used_days -remaining_days	+allocateLeave() +deductLeave() +updateBalance() +trackBalance() +carryForwardLeave() +retrieveHistory() +generateBalanceReport()
Responsibility	collaborator

Manage Leave balance	
Deduct leave when application is approved	LeaveApplication
Provide leave balance reports	Applicant,Approver

6.ApprovalWorkflow

Attribute	method
-workflow_id -application_number (association to LeaveApplication) -current_stage -approver_history -decision_status	+initiateWorkflow() +addStage() +assignApprover() +forwardApplication() +assignApplication() +getCurrentStage()
Responsibility	
Define Sequence of approvers	Approver
Track current approval stage	Approver
Record decision history	EventLog
Ensure correct routing	Approver

7.Notification

Attribute	method
-recipient_name	+sendNotification()

-message_content	+sendReminder()
-notification_type (Email, SMS, In-app)	+sendEmail()
-delivery_status	+notifyStatusChange()
-created_time	+triggerReminder()
	+trackDelivery()
Responsibility	collaborator
Generate alert for status change	ApprovalWorkflow
Deliver messages	Applicant,Approver
Track delivery	EventLog

8.Eventlog

Attribute	method
-actor (Applicant/Admin/System)	+logAction()
-action_performed	+recordChange()
-action_timestamp	+trackEvents()
-description	+compileAuditTrail()
-location/ip	+generateReport() +verifyIntegrity()
Responsibility	collaborator
Record system activities	LeaveApplication
Record system activities	ApprovalWorkflow
Provide traceability for actions	approver,applicant

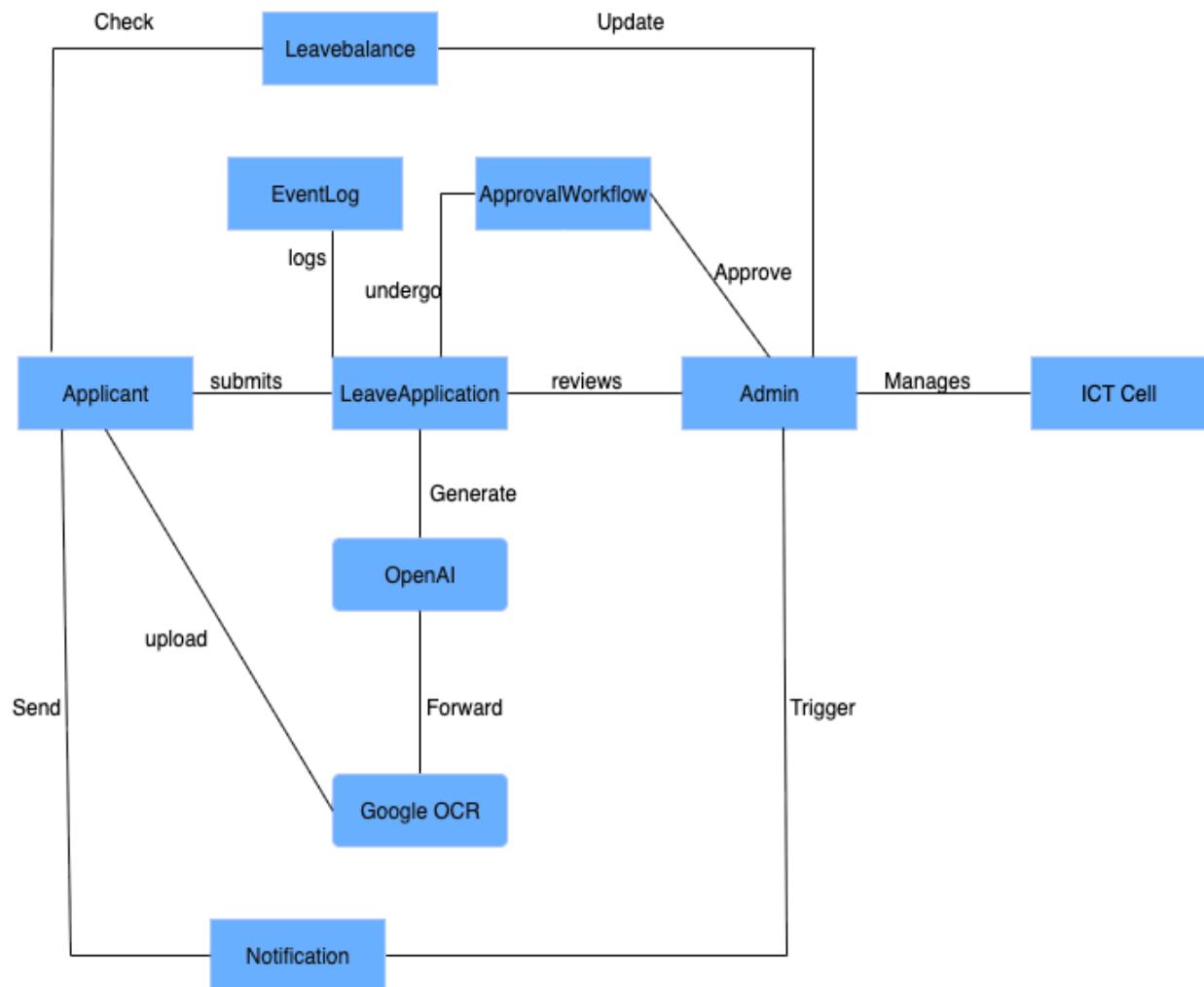
9.GoogleOcr

Attribute	method
-raw_document	+extractText()
-extracted_text	+validateExtraction()
-accuracy_score	+processDocument()
-processing_time	+sendBackResult() +improveAccuracy()
Responsibility	collaborator
Scan uploaded handwritten application	Applicant
Extract text from scanned documents	Applicant
Provide data to system	LeaveApplication

10.openAI

Attribute	method
-input_text -generated_response -confidence_level -processing_time -use_case (chatbot, summarization, reasoning)	+analyzeText() +summarizeApplication() +assistApplicant() +validateReasoning() +generateResponse() +supportDecisionMaking()
Responsibility	collaborator
Provide chatbot support	
Summarize or classify leave applications	LeaveApplication
Answer user queries	Admin/Approver

CRC Diagram:



Behavioural Modeling

State Transition Diagram

A state diagram is a visual representation of the various states an object or system can occupy and how it transitions from one state to another based on events or conditions. It is useful for modeling the dynamic behavior of a system, showing how an entity responds to inputs, triggers, or actions over time, and capturing states such as “pending,” “approved,” or “rejected” in processes like leave management.

Event table

SL No	Event Name	Initiator	Collaborator
1	Register System Admin	Admin	EventLog
2	Request User Credentials	Admin	ICT Cell
3	Forward User Details	ICT Cell	Admin
4	Create User Accounts	Admin	EventLog
5	Generate Temporary Password	Admin	EventLog
6	Send Login Credentials Email	Admin	Notification
7	User Login	Applicant	EventLog
8	Change Password on First Login	Applicant	EventLog
9	Collect New Faculty Information	Admin	ICT Cell
10	Register New Faculty	Admin	EventLog
11	Forgot Password Request	Applicant	Notification
12	Generate New Password	Admin	EventLog
13	Send New Password Email	Admin	Notification
14	Grant Leave Balance	Admin	LeaveBalance
15	Submit Leave Application	Applicant	LeaveApplication
16	Upload Supporting Documents	Applicant	LeaveApplication
17	Apply Digital Signature	Applicant	LeaveApplication

18	Forward to Department Admin	LeaveApplication	ApprovalWorkflow
19	Upload Handwritten Application	Applicant	Google OCR
20	Process OCR Document	Google OCR	OpenAI
21	Extract Application Information	OpenAI	LeaveApplication
22	View Leave Balance	Applicant	LeaveBalance
23	View Leave History	Applicant	LeaveApplication
24	Export Leave Report	Applicant	LeaveApplication
25	Display Leave Reminders	Notification	Applicant
26	Review Application (Dept Admin)	ApprovalWorkflow	LeaveApplication
27	Verify Documents (Dept Admin)	ApprovalWorkflow	LeaveApplication
28	Forward to HOD	ApprovalWorkflow	LeaveApplication
29	Reject Application	ApprovalWorkflow	Notification
30	Send Rejection Notification	Notification	Applicant
31	Send Approved Applications Back	ApprovalWorkflow	Notification
32	Submit Resume Letter	Applicant	LeaveApplication
33	Forward Resume to HOD	ApprovalWorkflow	LeaveApplication
34	Review Application (HOD)	ApprovalWorkflow	LeaveApplication
35	Initiate CND Meeting	ApprovalWorkflow	Notification
36	Notify CND Members	Notification	ApprovalWorkflow

37	Apply HOD Digital Signature	ApprovalWorkflow	LeaveApplication
38	Acknowledge No Impact	ApprovalWorkflow	LeaveApplication
39	Forward to Registrar	ApprovalWorkflow	LeaveApplication
40	Forward Resume to Registrar	ApprovalWorkflow	LeaveApplication
41	Review Application (Registrar)	ApprovalWorkflow	LeaveApplication
42	Apply Registrar Signature	ApprovalWorkflow	LeaveApplication
43	Forward to Admin-1	ApprovalWorkflow	LeaveApplication
44	Forward Resume to Admin-1	ApprovalWorkflow	LeaveApplication
45	Forward to Pro-VC	ApprovalWorkflow	LeaveApplication
46	Forward to VC	ApprovalWorkflow	LeaveApplication
47	Request GO	ApprovalWorkflow	LeaveApplication
48	Forward to Syndicate	ApprovalWorkflow	LeaveApplication
49	Send GO to Immigration	ApprovalWorkflow	Notification
50	Manage Section Officers	Admin	EventLog
51	Update Department Mapping	Admin	EventLog
52	Review Application (Admin-1)	ApprovalWorkflow	LeaveApplication
53	Apply Admin-1 Signature	ApprovalWorkflow	LeaveApplication
54	Mark Application Urgent	ApprovalWorkflow	LeaveApplication
55	Forward to Section Officer	ApprovalWorkflow	LeaveApplication
56	Forward Resume to Section Officer	ApprovalWorkflow	LeaveApplication
57	Review Application (Section Officer)	ApprovalWorkflow	LeaveApplication

58	Validate Documents	ApprovalWorkflow	LeaveApplication
59	Check Leave Balance	ApprovalWorkflow	LeaveBalance
60	Apply Section Officer Signature	ApprovalWorkflow	LeaveApplication
61	Prepare Summary Memo	ApprovalWorkflow	LeaveApplication
62	Use Earned Leave	ApprovalWorkflow	LeaveBalance
63	Use Future Earned Leave	ApprovalWorkflow	LeaveBalance
64	Record Audit Trail	ApprovalWorkflow	EventLog
65	Prepare Cover Letter	ApprovalWorkflow	LeaveApplication
66	Forward Final Dossier	ApprovalWorkflow	LeaveApplication
67	Send to HOD Inbox	ApprovalWorkflow	Notification
68	Update Applicant Status	ApprovalWorkflow	LeaveApplication
69	Send Leave Reminder Email	Notification	Applicant
70	Download GO	Applicant	LeaveApplication
71	Track Application Status	Applicant	ApprovalWorkflow
72	Send Approval Notification	Notification	Applicant

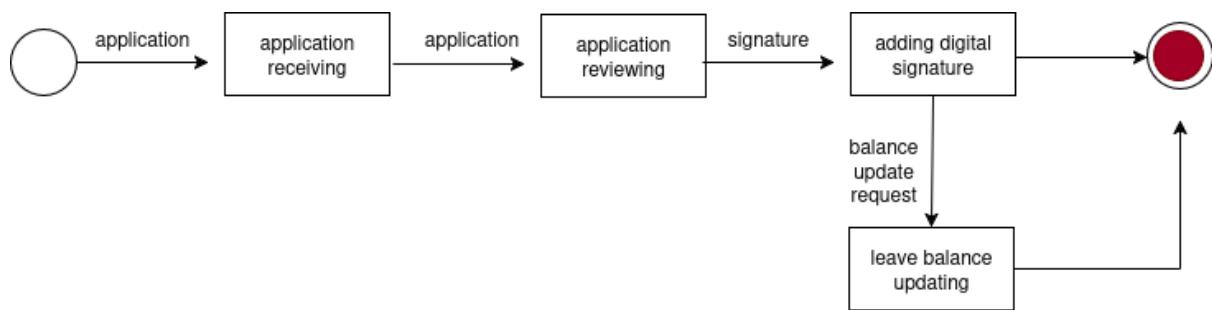
Sequence Diagram

A sequence diagram illustrates how objects or components in a system interact with one another over time to complete a specific process or use case. It shows the order of messages exchanged between actors and system elements, highlighting the flow of information and operations in a step-by-step manner. Sequence diagrams are particularly helpful for

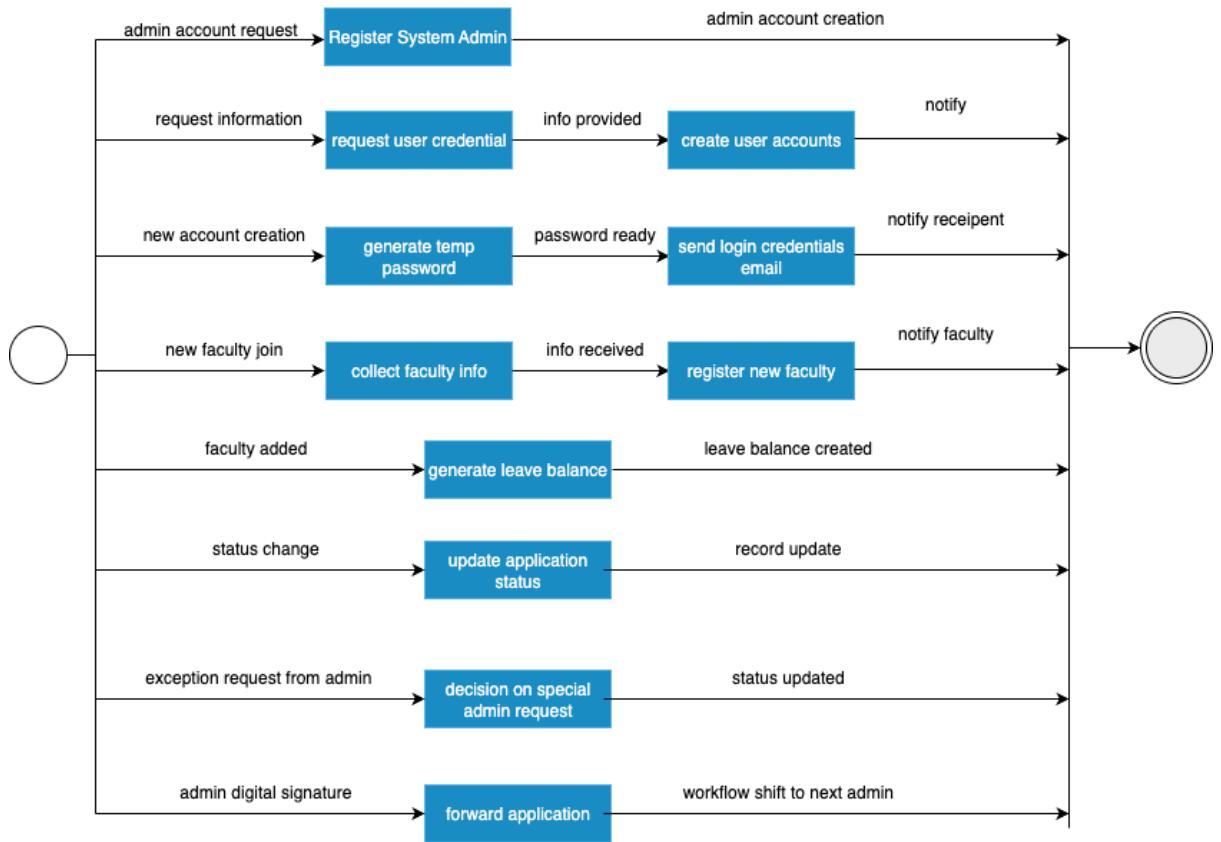
understanding interactions in workflows, such as the leave application approval process, and ensuring that system behavior is correctly implemented

State transition diagram:1

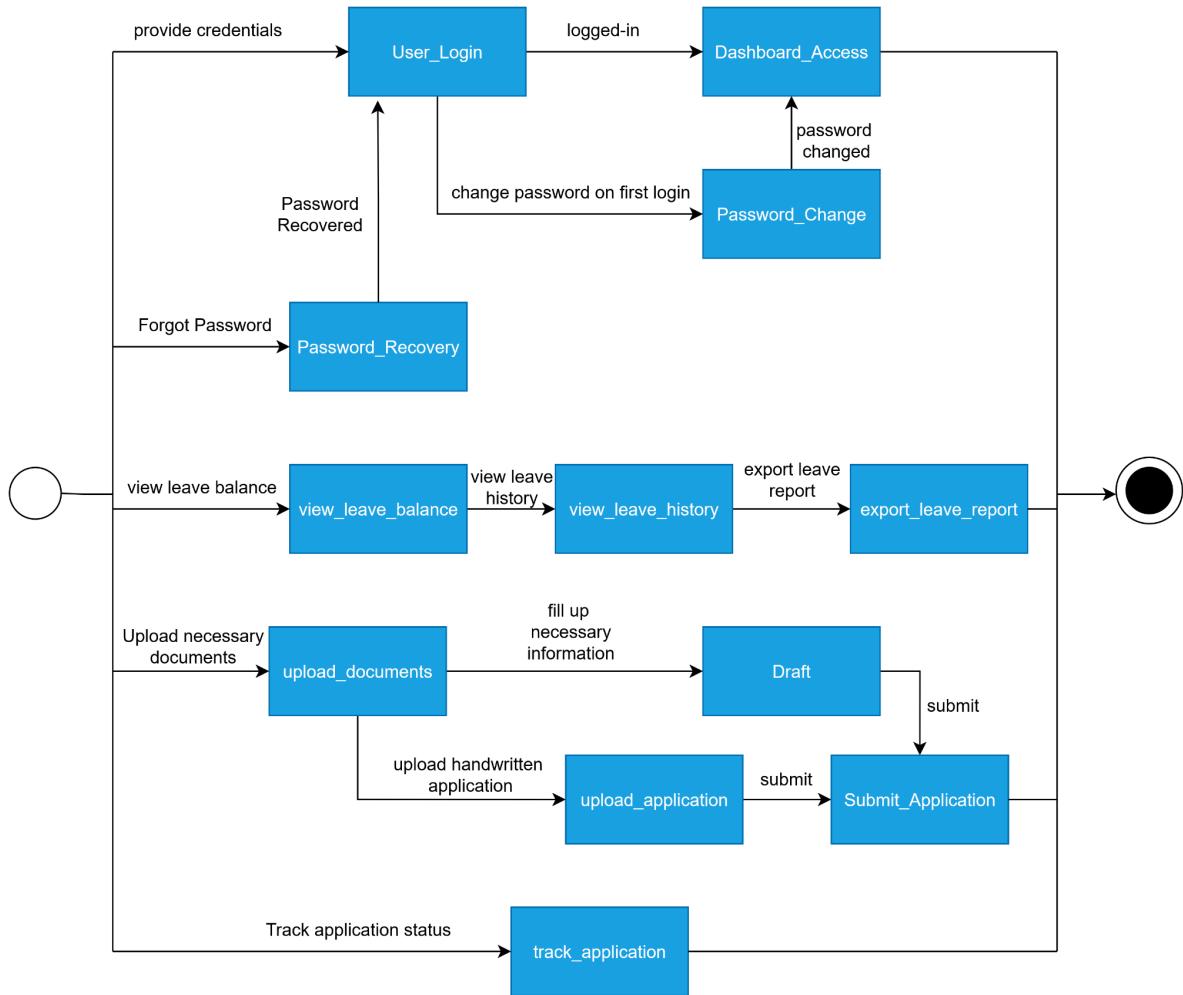
Admin



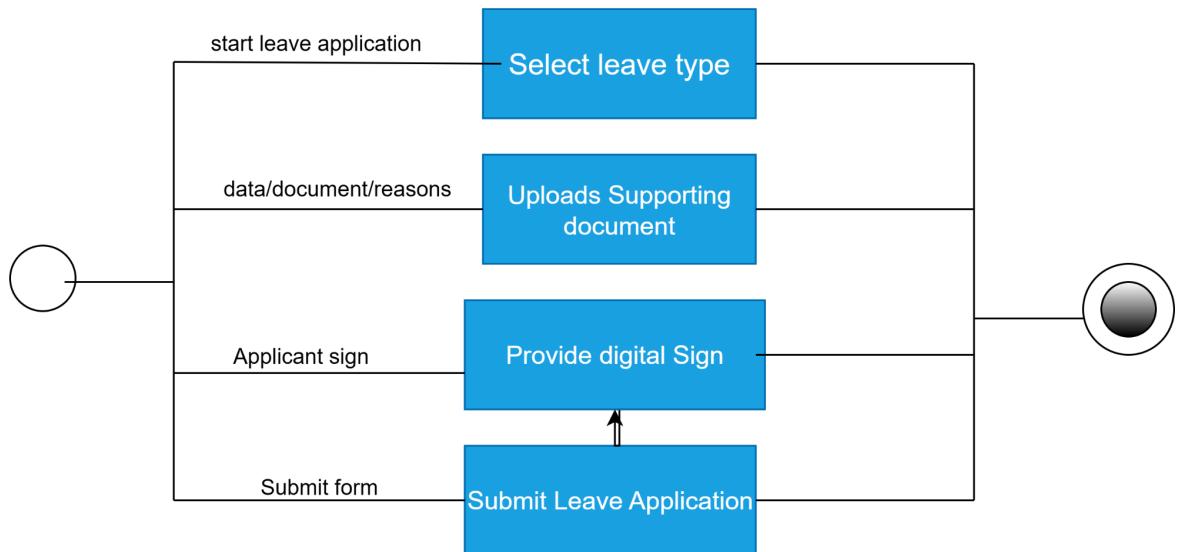
State transition diagram:2 approvalworkflow



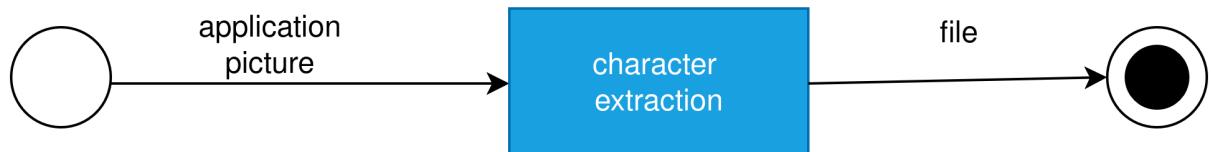
State transition diagram:3 Applicant



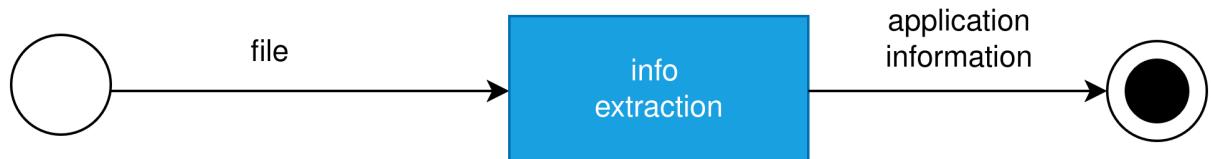
State transition diagram:4 LeaveApplication



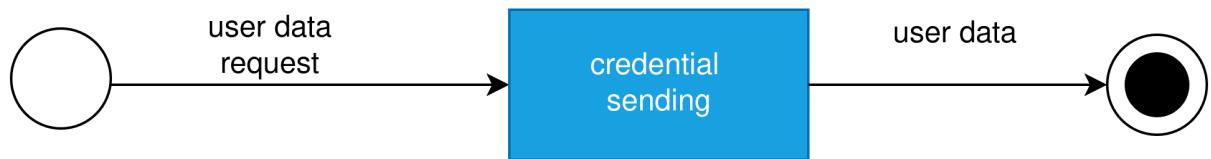
State transition diagram:5
Google OCR



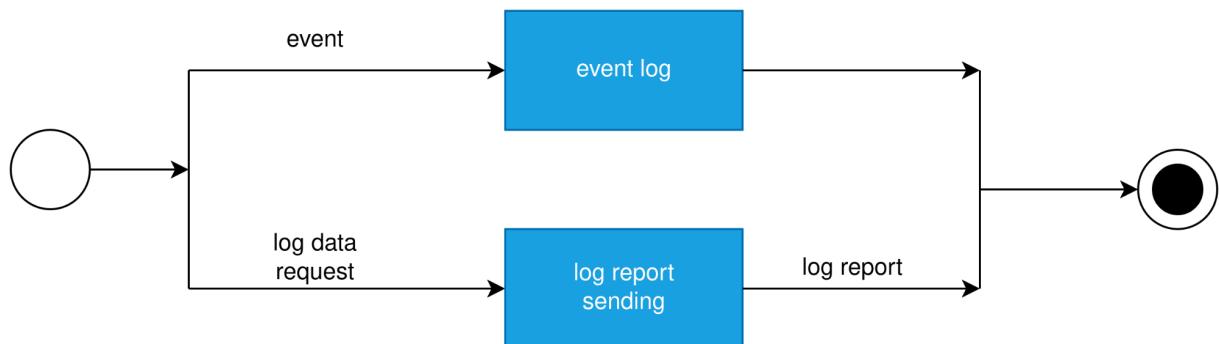
State transition diagram:6
OpenAI



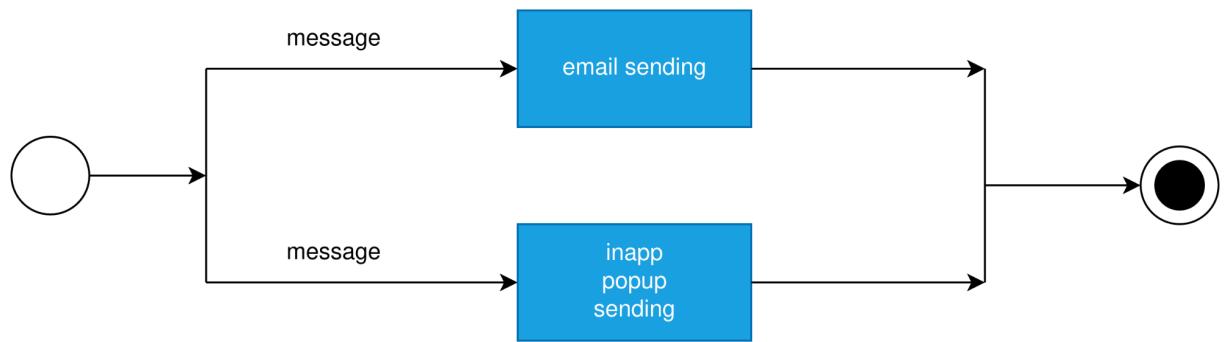
State transition diagram:7
ICT cell



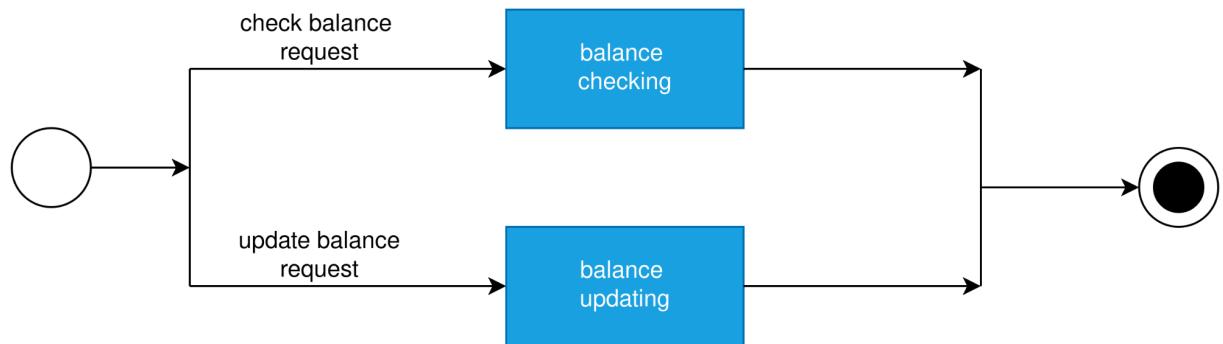
State transition diagram:8
Eventlog



State transition diagram:9
Notification

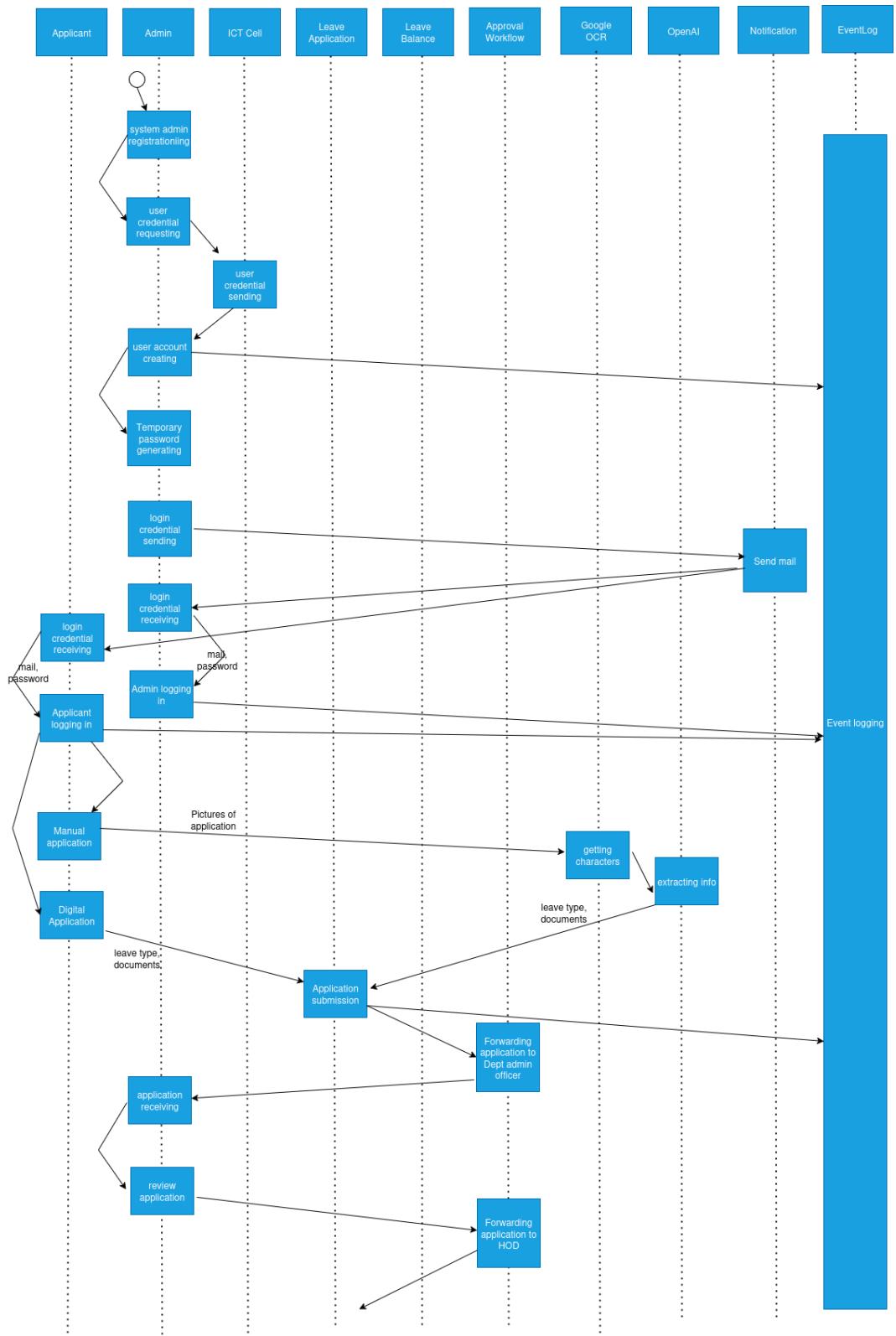


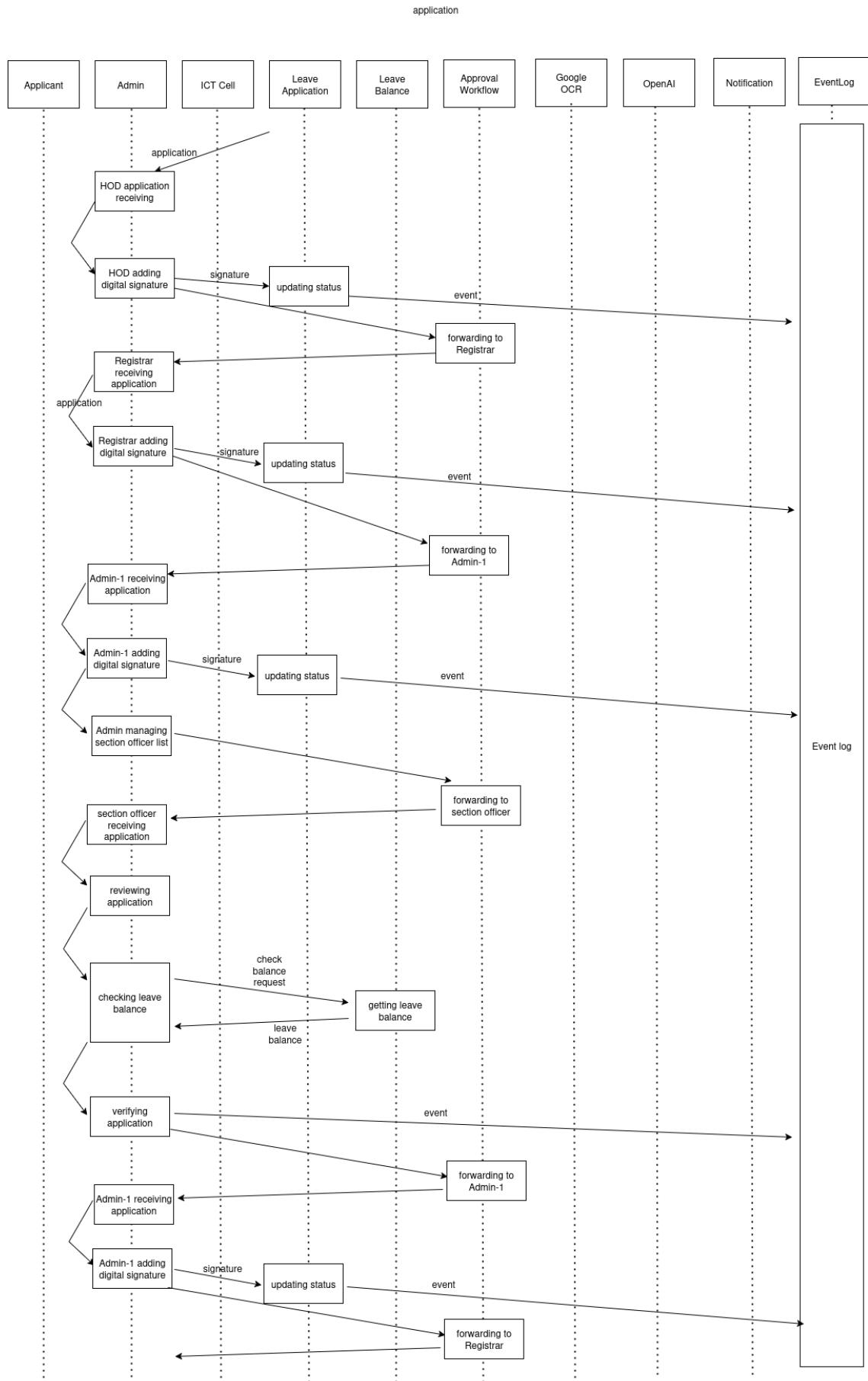
State transition diagram:10
Leave balance

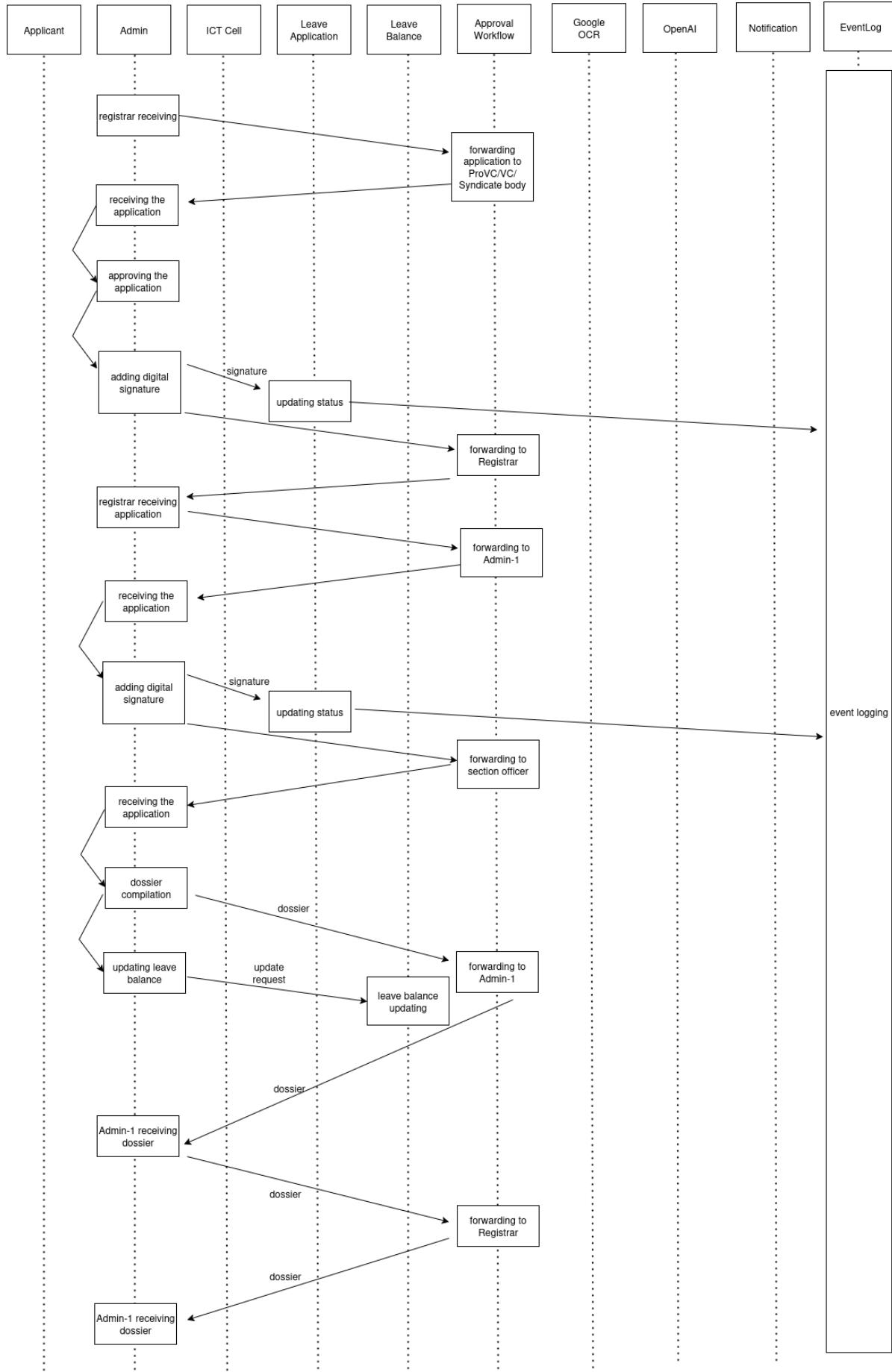


Sequence Diagram

A sequence diagram illustrates how objects or components in a system interact with one another over time to complete a specific process or use case. It shows the order of messages exchanged between actors and system elements, highlighting the flow of information and operations in a step-by-step manner. Sequence diagrams are particularly helpful for understanding interactions in workflows, such as the leave application approval process, and ensuring that system behavior is correctly implemented.







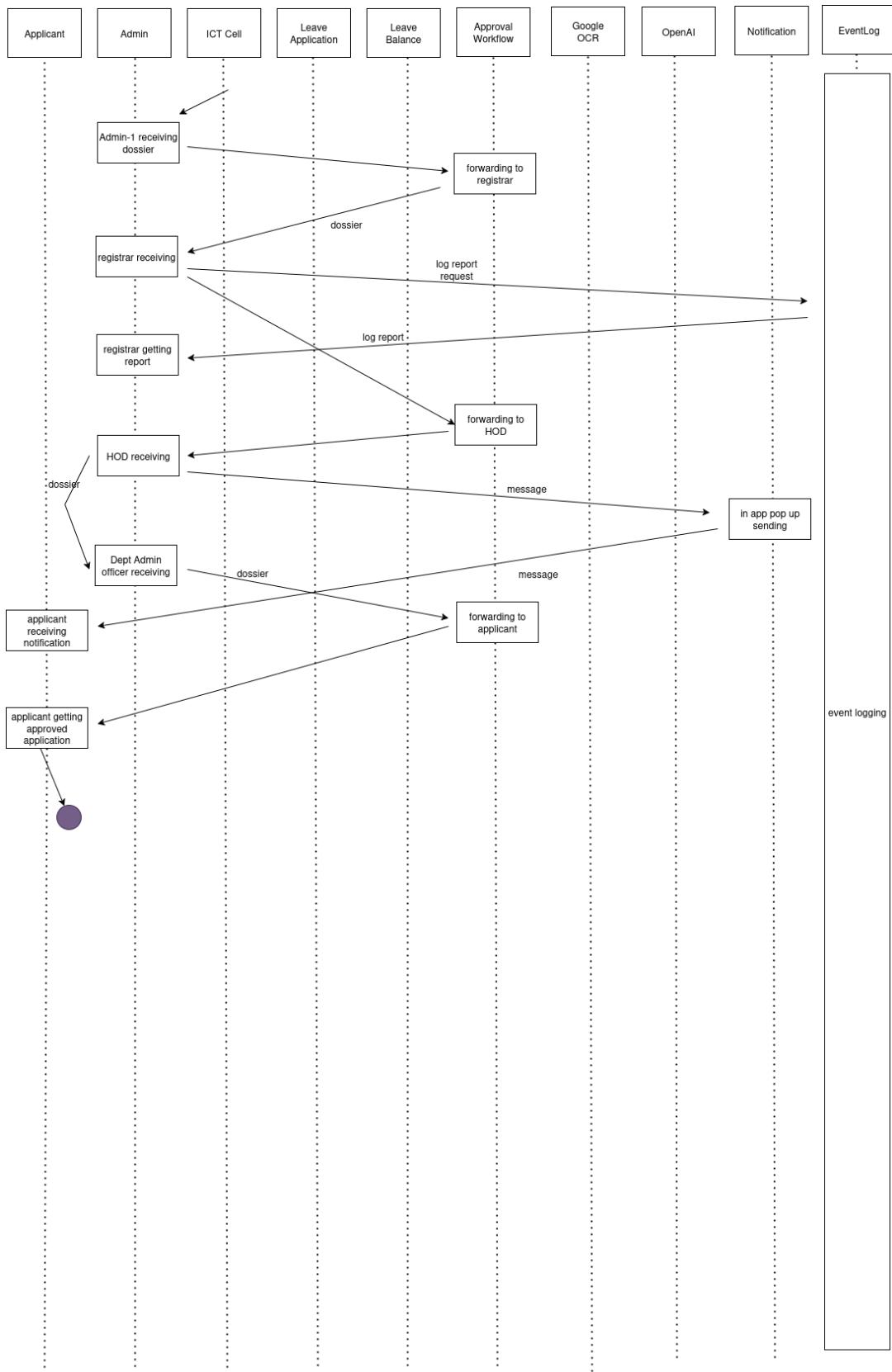


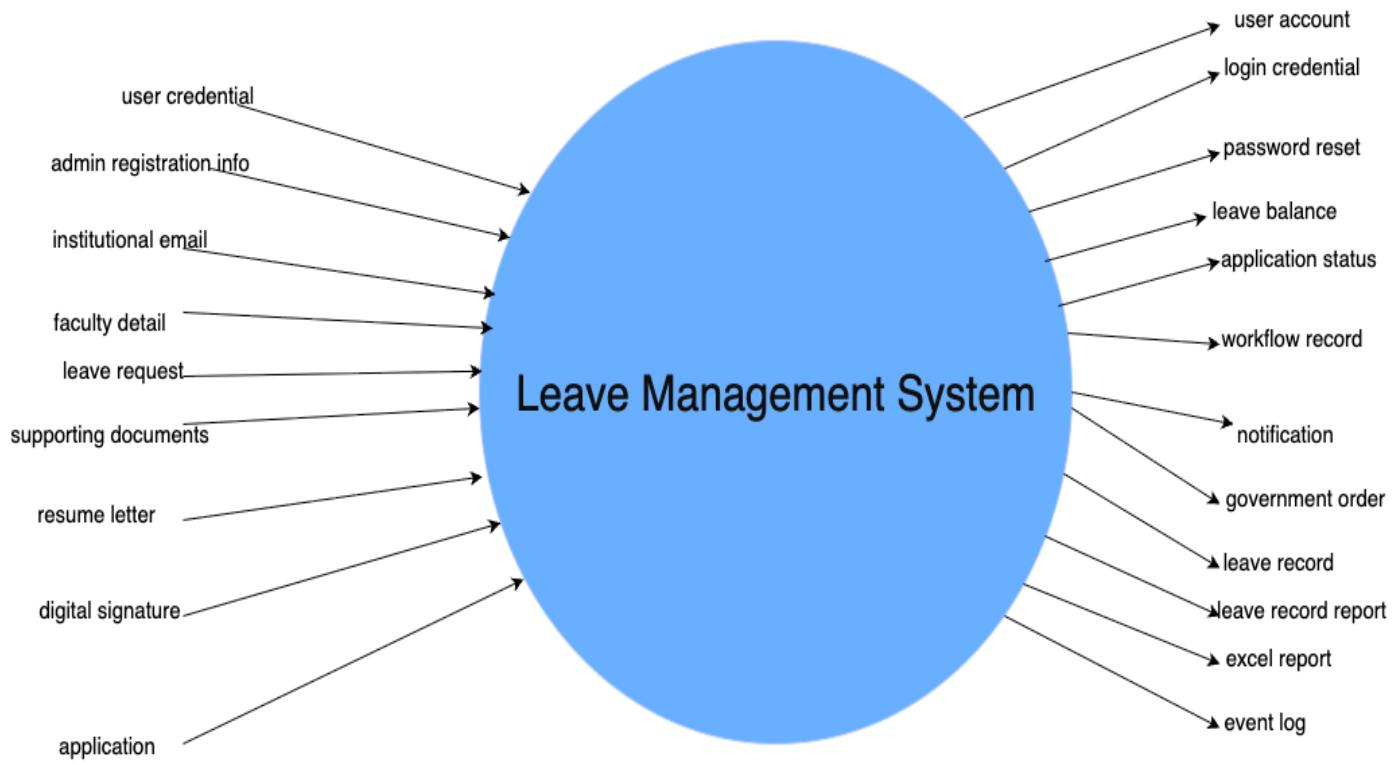
Fig: Sequence diagram

Data flow diagram

A data flow diagram (DFD) is a visual representation of how data moves through a system, showing the flow between processes, data stores, and external entities. It helps to understand the system's functionality by illustrating how inputs are transformed into outputs, where data is stored, and how different components interact. DFDs are particularly useful for analyzing system requirements, identifying inefficiencies, and ensuring that all necessary data flows are accounted for in the design.

A context diagram is a high-level version of a data flow diagram that depicts the entire system as a single process and shows its interaction with external entities such as users, departments, or external services. It provides an overview of the system boundaries and the sources and destinations of data entering or leaving the system. Context diagrams are valuable in the initial stages of system analysis, as they help stakeholders quickly understand the scope, inputs, and outputs without delving into detailed processes.

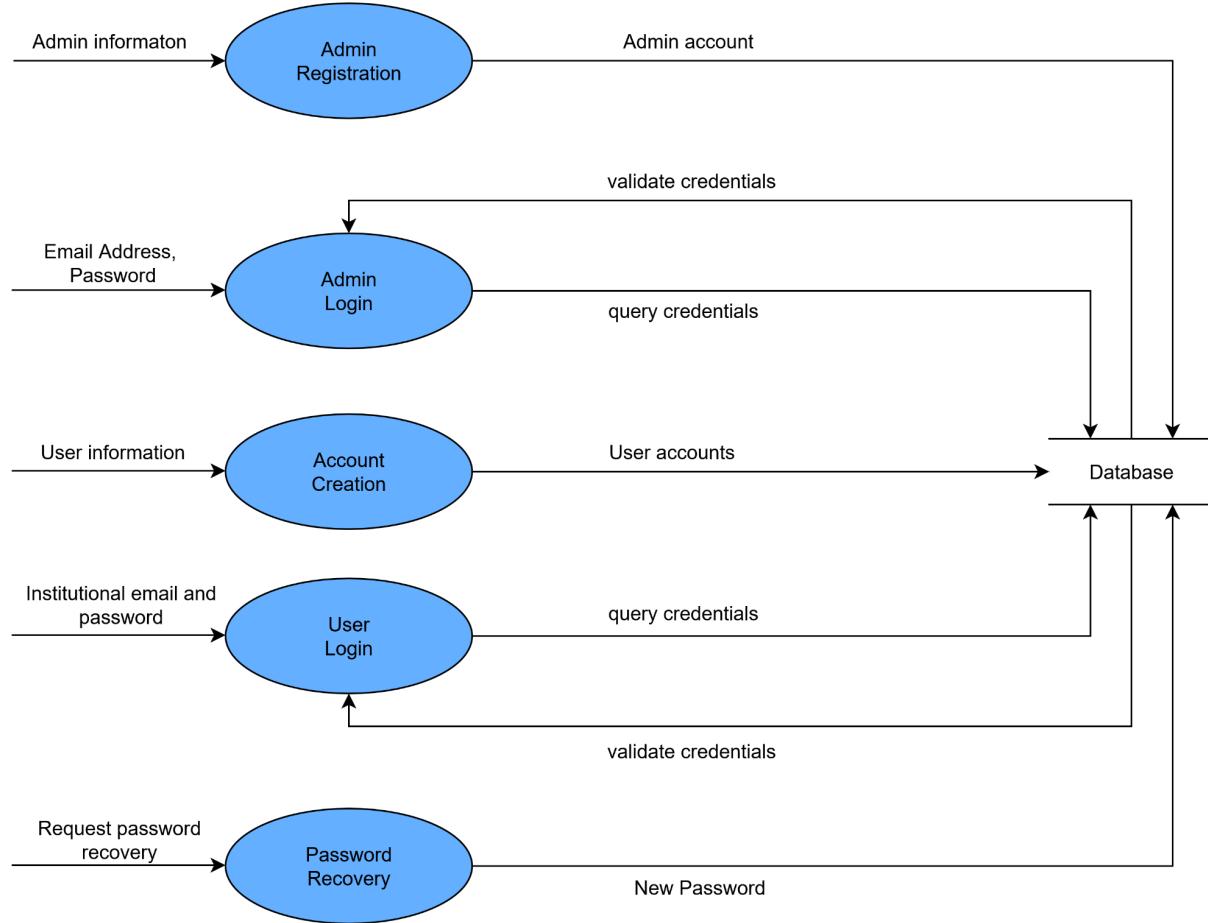
Level 0:



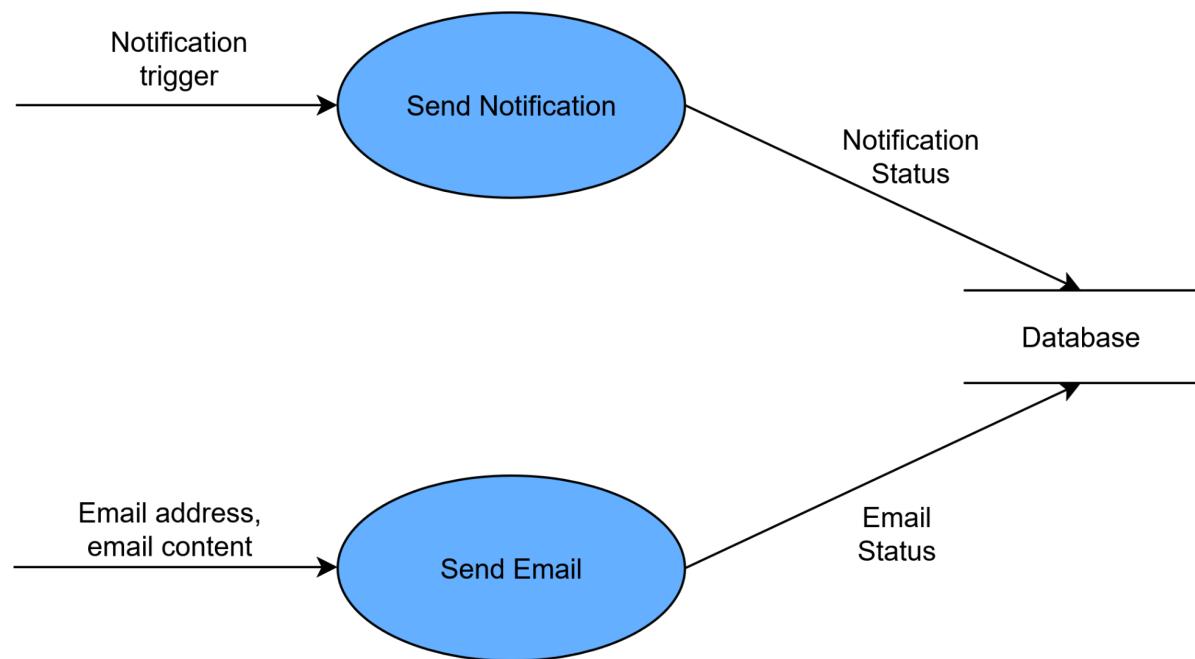
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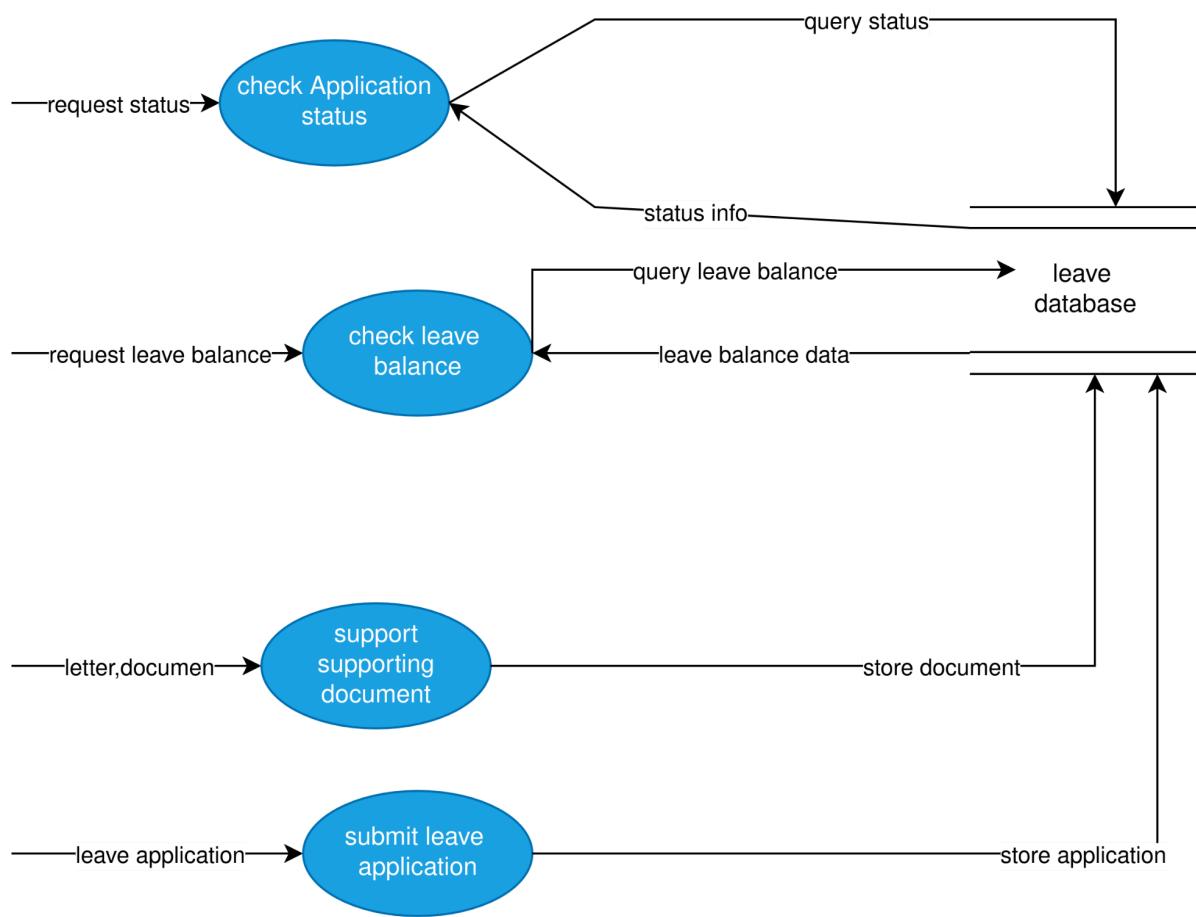
User access control



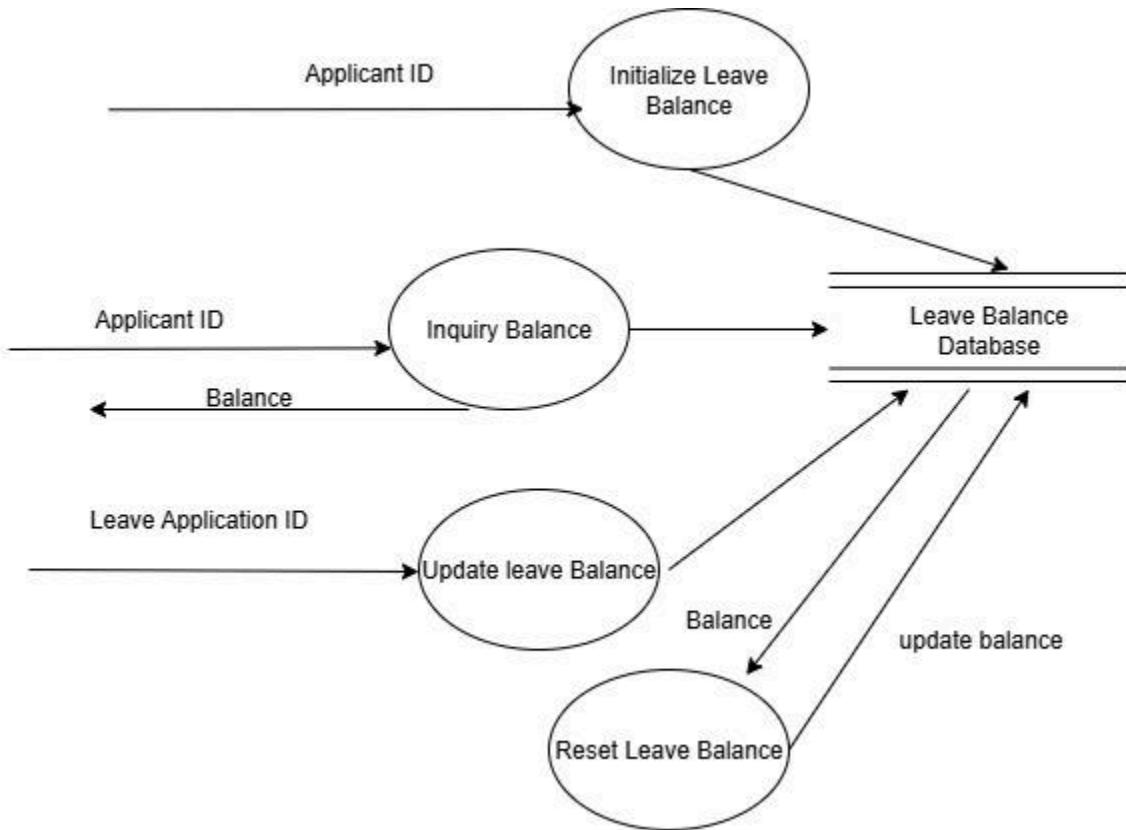
Communication



Application Management



Leave Application



Audit

