Employee Performance Evaluation System

Software Requirement & Specification Analysis

SE-505 - Software Project Lab II

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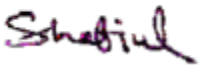
Supervisor's Signature:  07-02-2013

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1. Introduction

Employee Performance Evaluation System(EPES) is an employee monitoring and management system that uses performance metrics to improve the employee workrate and efficiency of an industry. The performance metrics data will be generated using a novel activity recognition mechanism which will use real time data to identify idling workers.

For example, an apparel industry has different tasks assigned to different workers. They perform various tasks like sewing, knitting etc. An employee may sit idle reducing efficiency and workflow of the company. In a huge industry like garments, it is very difficult for any supervisor to monitor each worker individually.

So, we want to design a system to automatically monitor and evaluate employee performance using the techniques of activity recognition. Using this information, the cause of inefficiency can be identified and handled properly leading to increased profit.

1.1 Purpose

This system aims to streamline the assignment of employees to workstations in workplaces, improve workflow and eliminate supervisors' biased ways of employee evaluation.

1.2 Intended Audience

Our system is primarily targeted to solve problems as determined by questioning officials at the Versatile Garments Factory located in Ashkona, Dhaka. However this system is designed keeping the big picture of satisfying the entire garment industry of Bangladesh's needs.

1.3 Conclusion

The analysis helped us figure out the stakeholders and requirements systematically. Moreover, it helped us to focus on the users who will be using our analysis. The document will be helpful to each and every stakeholder of the software to understand, relate and ensure convenient usage of the software. Developers and testers will have some clear ideas of what to do and development will be smoother. More and more communication between the stakeholders and developers will help evolve the software and enhance it further.

2. Inception

2.1 Understanding the problem

Versatile Garments Limited is a garments company located in Ashkona, Dhaka. Their current system of employee monitoring depends on a strict chain of command with manual monitoring.

1. **Target Assignment and Evaluation**

The garments depend on multiple line chiefs and supervisors to monitor each worker. They write the production reports of each worker manually and the impression of the worker totally depends on the mood of these supervisors.

Target Assignment

During the start of each production cycle, a target is set for each worker. The production manager sets the target. Here, the target mainly specifies how many bundles a worker has completed and passed. Every morning, there is a pre-production meeting attended by directors and production managers. They set daily production targets and set line layout in this meeting. The production manager then assigns workers based on this layout. A worker must fulfill their daily target before leaving the factory. If the target is not met, they need to do overtime. Line optimization is also done on an hourly basis if line target is not being met.

Reports and Evaluation

During each hour, supervisors go to each worker and hear the production report from them. It is then written on paper which is then collected and aggregated by line in charge. It is then shown to production managers who judge productivity and perform reassignment if necessary.

As the report is initially given by the worker, it is often misleading. The supervisors are also not free of biases as it is natural they will favor some employees over others. The production reports are just used for monitoring daily production and hence the factory has no long time record of worker performance. The report contains:

- Per hour employee production report
- Done/Target
- Machine problem
- Cutting problem

The only employee evaluation currently the industry has is production report. There is also no evaluation system for the supervisors and managers. Hence, it is only natural that they lack any reward system and training programs.

The evaluation is also not communicated properly to the workers and hence workers never properly know the cause of reassignment or termination of contract.

2. **Worker Specialization**

In garments there are workers with different specializations. These are:

- Plane machine
- Helper
- Ironman

- Overlook machine
- Button
- Button sewing
- JS machines
- Inkjet Plotter Operator

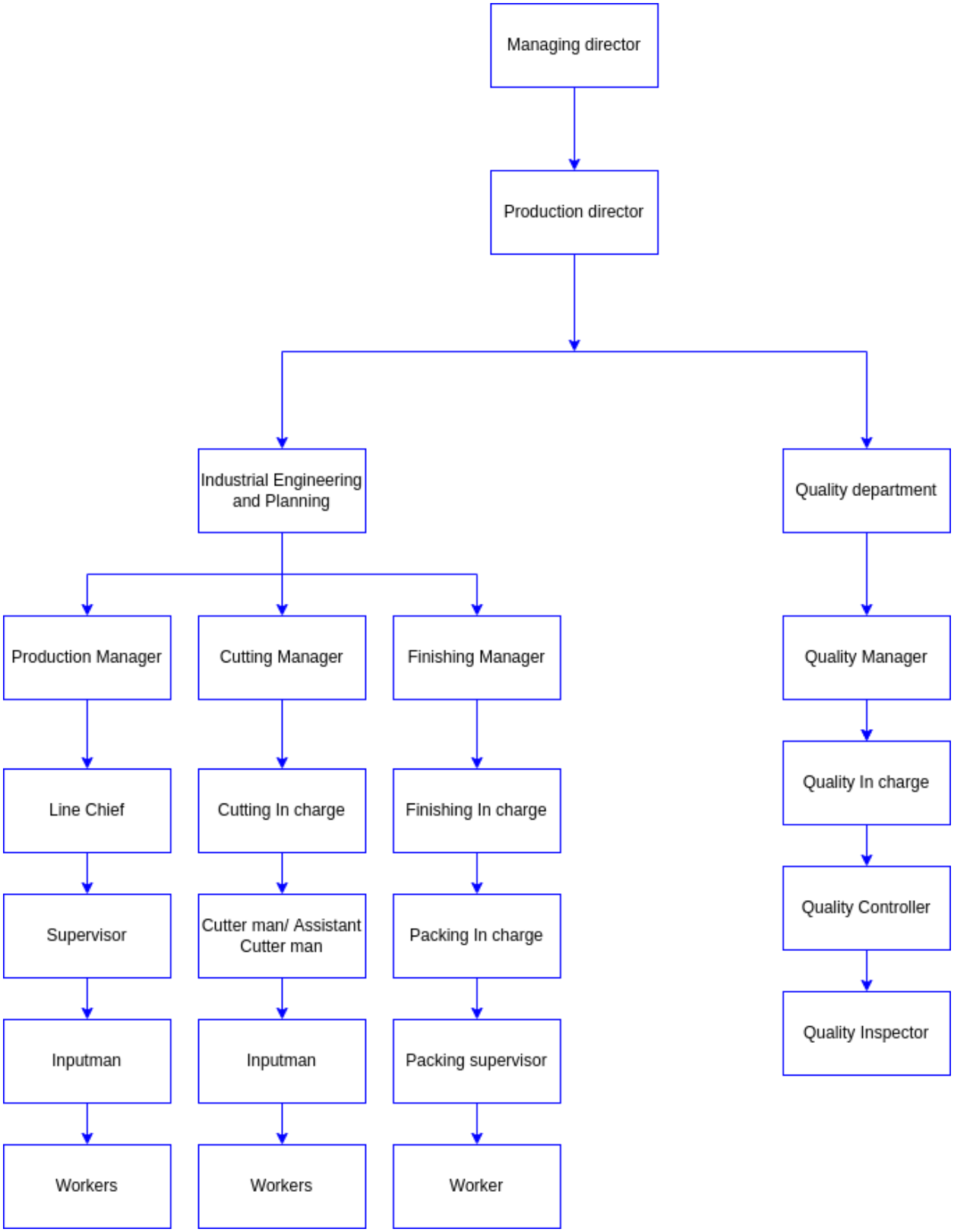
Total work can be divided into four phases during a production phase:

1. Training
2. Sewing
3. Designing
4. Tagging

There are workers who are specialized in multiple fields. They are known as Master Operators. Production managers need to remember the specialties of each worker to remember how well they perform in certain work. But there are no records of this specialization. They have a HR system called “Automation” which stores: payment, next of kin, phone number, address.

3. Chain of Command

The company needs to maintain a strict chain of command for communication down the chain and worker evaluation.


Managing director
Production director
Industrial Engineering and Planning
Quality department
Production Manager
Cutting Manager
Finishing Manager
Quality Manager
Line Chief
Cutting In charge
Finishing In charge
Quality In charge
Supervisor
Cutter man/ Assistant Cutter man
Packing In charge
Quality Controller
Inputman
Inputman
Packing supervisor
Quality Inspector
Workers
Workers
Worker

Line in charge is the head of the line. He collects reports and gives them to the Production Manager. There are two supervisors on the line- front part supervisor and back part supervisor. There are 50 workers, 17 helpers and 6 quality assurance workers on each of the four floors of garments.
The supervisors monitor the workers and write reports. The managers need to give a report to the upper management. Currently, only the workers have an evaluation system. The management has no method of appraisal.

4. Worker Assignment

The assignment of workers to different places is based upon the line layout. The product manager needs to know how many workers he needs and what specialization he needs. He then assigns the workers based on specialization. The line layout is defined based on the order type, the target production rate and the specialities of each worker.
Worker assignment has to be done at the beginning of the production of a new order. It also has to be done each morning as there can be daily absentees. Worker reassignment has to be also carried out as there can be workers who idle dragging down production.
Worker assignment is done by the production manager. At morning the following reports are taken before meeting:

- Manpower report
    - ➢ Per line manpower
    - ➢ Absentees

Based on the report, the Production manager performs worker assignment.

2.2 Icebreaking

Icebreaking refers to breaking the communication barrier between two people. It is a crucial part because it denotes the acceptance of our proposal. We started this phase by talking to the stakeholders in context free languages. Their behavior in response to our questions impacted the whole system.

2.3 Identifying the Stakeholders:

Stakeholder refers to any person or group who will be affected directly or indirectly by the system. Stakeholders include end-users who interact with the system and everyone else in an organization who may be affected by its installation.
The following stakeholders were identified for the system:

1. Directors
2. Managers
    a. Production Manager
    b. Cutting Manager
    c. Finishing Manager
3. Line In Charge

4. Supervisors
    a. Front part
    b. Back part
5. Workers
    a. Master Operators
    b. Special Operators

Direct Stakeholders: Managers, Workers, Supervisors
Indirect Stakeholders: Line In Charge, Directors

2.4 Stakeholder viewpoints

Managing Director
The main stakeholder of the Employee Performance Evaluation System is the managing director of the garments factory named "Versatile Garments Ltd.". The garment factory currently relies upon a large workforce and an extended chain of command to monitor its workforce. However, it is still very difficult to monitor each worker all the time. The monitoring and evaluation of individual workers depends on the supervisors.
Supervisors have a large number of workers under them making it difficult to carefully monitor each worker. They are also prone to biases.
Hence, the director wants to design a "watchdog" to monitor all the workers using a system which will eliminate the need for human supervision. The watchdog will have a credit system which will be used to rate each worker. Based on the credit scores, directors can assign rewards for well performing workers and training programs for workers.
The current system can only evaluate employees based on their “production” meaning how many bundles they have completed and passed daily. The manual system doesn’t have any way of judging how fast or slow a worker is working. The system cannot also find out how much a worker is idling, hence dragging down the production of each line. So, the managing director wants to have a watchdog which can rigorously monitor each worker judging them based on:

1. How fast or slow they can work.
2. How much they spend idling.
3. How much is their individual productivity.

They also want a system to evaluate people in the chain of command as well, along with workers.

Managers
The managers of the factory have the responsibility of setting targets for employees, assigning employees to the workplace and at the end of the day, reviewing whether the targets are being met. It is necessary for the manager to remember the speciality of each worker under their

control as they do not have any automated system to keep track of the speciality of workers and their ability in the field of speciality. He also needs to be given manpower reports regularly so that he can properly define his line layout and perform worker balancing.
So, the manager wants to have a automated system to show him:

1. Daily manpower report
    a. Per line manpower availability
    b. Absentees
2. Speciality of available manpower.
3. Ability of available manpower in their field of specialization.
4. Suggestions on dynamic assignment of manpower based on reports.
5. Target assignment for workers and monitoring daily and monthly target achievement.
6. Leaderboard of best workers.

Everyday workers are reassigned to workplaces based on target achievement. To monitor each worker and their speed, the cycle time of each action has to be detected.

Line In Charge

The line in charge works under managers and has the responsibility to collect production and worker reports from supervisors and give the information to the managers. The line in charge has two supervisors and around 50 workers under him. The line in charge has to manually collect and monitor performance reports. If he finds any discrepancies in those reports, he has to show it to the supervisor. If a line is falling behind on its production, the line in charge asks the production manager to redefine line layout and assign workers. The line in charge is overworked and has a lot of workers under their control, making it difficult to carefully inspect reports of each worker.
The line in charge wants to have a system to automatically monitor performance and production without the need for supervisors to manually inspect each worker.

Supervisors

There are two supervisors on each production line. One is responsible for the front part, i.e the beginning phase of production and the second is responsible for the back part, i.e the ending phase of production. The supervisors are responsible for manually writing evaluation reports for each worker, which are paper records attached to the desk of each worker. The report contains:

1. Per hour employee production report.
2. Completed/Target work.
3. Machine problem.
4. Cutting problem.

Currently, the supervisor has to go to each workbench and ask for a report from the workers directly. The workers often give misleading reports and the supervisor has to sort it out manually.
So, an automatic system for monitoring workers will ease the work of the supervisor and instead of being on the watch for worker performance, they can focus on production more. Instead of manually inspecting workers, they want a system to inspect workers from a distance and evaluate them using it.

Workers

Workers are an indirect stakeholder of the system. Currently, workers need to pause their work and give reports to supervisors each hour. This slows down the line and increases idle time. If an automated system is introduced, workers can focus on their work without the need for keeping count of their own production.

There is also a lack of motivation as there is no reward system for better workers. A leaderboard system can greatly increase motivation in the industry. The workers can also know about which work they excel in and which work they lack behind.

2.5 Working towards Collaboration

Every stakeholder has their own requirements. There are some common and conflicting requirements of our stakeholders. That's why we followed the following steps to merge these requirements-

- Find the common and conflicting requirements.
- Categorize them.
- List the requirements based on stakeholder's priority points.
- Make final decisions about requirements.

Conflicts

1. There are part time workers in the company whom the Director wants to monitor.
2. Director wants a system to evaluate each and every employee in the company. Production managers and supervisors want a system which will only evaluate workers.

Negotiations

1. As the part time workers do not work everyday and also do not have fixed jobs, they cannot be used to generate KPI records and they will not be a part of any reward or training programs.
2. Target assignment is not possible without a unit of production count which is out of scope.
3. The company is in need of a digitalized evaluation system which is relevant to modern appraisal methods. So, the evaluation system has to be designed for everyone, not just only workers. Each employee will be evaluated by their corresponding supervisor.

2.6 Elicitation of EPES

The main task of the elicitation phase is to combine the elements of problem solving, elaboration, negotiation and specification. The collaborative working approach of the stakeholders is required to elicit the requirements. The following tasks have been finished for eliciting requirements of EPES

- Collaborative requirements gathering
- Quality function deployment

- Usage Scenarios

Collaborative requirements gathering

We have met with the stakeholders in the inception phase such as the managers and supervisors. These meetings created an indecisive phase for us to elicit the requirements. To solve this problem we met with the stakeholders who hold a vital role in the entire process, multiple times to elicit the requirements.

3. Quality function deployment

Quality function deployment is a technique that translates the needs of the customer into technical needs for the software. Ultimately the goal for QFD is to translate subjective quality criteria into objective ones that can be quantified and measured, and can then be used to design and manufacture the product. It is a methodology that concentrates on maximizing customer satisfaction from the software engineering process. So we have followed this methodology to identify the requirements for the project. The requirements which are given below are identified successfully by the QFD.

3.1 Normal Requirements

1. Use the system to assign workers to workplaces.
2. Assigned work of workers can be changed anytime.
3. Evaluate employees using the system.
4. The system will generate reports on manpower and evaluation.
5. Assignment of rewards and training through the system to employees.
6. System must be able to distinguish workers who excel in multiple activities.
7. Have rating forms to rate employees.
8. Generate KPI ratings specific to different activities.
9. Keep track of employee attendance using the system.
10. Each employee will have a profile in the system.
11. Each employee will receive notifications about assigned work.
12. Notification about report generation will be sent through the system.
13. Monitoring employees by using the camera.
14. Workers can see their evaluation records through the system.

3.2 Expected Requirements

1. Notification system to notify about any new reports or messages from the manager

2. Keep records about worker specialization.
3. Communicate evaluation reports to employees using the system.
4. Employees, managers, supervisors and admin staff will be able to login to their own respective profiles.
5. Use critical incident logs to monitor employees.
6. Coupon system to reward employees.
7. Users must be logged in before performing any operation.
8. All users must login to the system using username and password.
9. Interoperability across different devices.
10. The system must have an administrator account.

3.3 Exciting Requirements

1. Generation of KPI using activity recognition.
2. A gamified system where employees will be rewarded based on their performance ratings taken from leaderboard systems generated using KPIs.

4. Usage Scenario of EPES

Employee performance evaluation system is an application designed to provide Versatile Garments Ltd. with the means to evaluate employee performance based on activity recognition.

Account Management

The stakeholders of the system hold accounts which they can use to various functions based on their authorization level. The following accounts are found in the system:

1. Manager Accounts
2. Supervisor Accounts
3. Worker Accounts
4. Admin Accounts

Manager Account

Manager accounts will be created by the admin. The following information are needed while creating the account:

1. Manager’s Name
2. Manager’s Employee Id
3. Department
4. Assigned Floor

Manager’s can login to the system using their employee id and admin given password. They can change the password later.

Supervisor Account
Supervisor accounts will also be created by the admin. It requires the following information:

1. Supervisor name
2. Supervisor Employee Id
3. Department
4. Assigned Floor
5. Assigned team/line

They can login and change passwords similarly.

Worker Account
Worker account is to be opened immediately after recruitment under supervision of an admin. During creation the following information are required:

1. Worker Name
2. Worker Employee Id
3. Previous work experience
4. Field of specialization

A picture of the worker will be added to the account. Workers can login using their employee ID to view their profile.

Admin Account
An administrator will act as the background worker to maintain the whole system. The managing director is also an admin. Admin can change the password of any account and edit information.

Key Performance Indicator Generation

The system will use cameras to monitor employees. The KPI of employees will be generated automatically based on activity recognition. If the activity of employees falls under a certain criteria then it will be recognized as a job, and the rest will be recognized as idling. Recording of employee performance will occur during the work hours and will be paused during break. The KPI of an employee will be measured by dividing the total work time by idle time. It will be done on a monthly basis.

Evaluation System

The evaluation of workers will be done by using Key Performance Indicators and appraisal ratings of supervisors.
The complete evaluation of workers will be done by assigning proper weights to KPI and appraisal rating of supervisors, hence achieving a fair evaluation metric.
The system will have a critical incident logging system to evaluate employees. Each employee has a critical incident log. It has sections for poor and excellent performance. The following steps are followed to use the critical incident log:

1. Select the critical incident log of a particular employee.

2. Add a new log under the excellent or poor performance record.
3. Save the log.

This critical incident log can be viewed by the evaluator at any time. It will be used to fill up the rating form of employees. The rating form can be accessed once in a month. The rating form contains the current job field and a skill rating which can be set between 1 and 5.

Dashboards

The system will contain dashboards for workers, supervisors and managers.

Worker Profile

The workers after logging in will be taken to their respective profile. The worker profile will contain the profile picture of worker, worker name, worker id, fields of expertise, current assigned task and overall KPI. A detailed KPI view can be shown by clicking the show more button underneath the overall KPI. At the top of the worker profile, the specialization of the worker will be mentioned. The specializations can be:

- Plane machine
- Helper
- Ironman
- Overlook machine
- Button
- Button sewing
- JS
- BK

Workers who excel in more than 2 fields are known as Special Operators. Workers who excel in more than 3 fields are known as master operators.
The workers can see whether they have been assigned to any training or reward program. They can also view the various leaderboards through their profile. The workers receive notification about new KPI reports in their profile. They also will be notified about assigned jobs through the system, although supervisors will also notify them manually.

Manager Dashboard

The manager after logging in to the system will get access to the dashboard. The navigation bar of the dashboard will contain the section to access manager's profile. Manager's profile will have:

1. Manager's name
2. Manager's id
3. Department.

The dashboard will have the following menu options:

1. Employee

From the employee option, managers can access the list of workers and view their profiles. After accessing the profile, the manager can access all functionalities of the worker profile.

2. Worker Assignment

Managers can assign workers to perform various jobs from the worker assignment option.
The manager will receive a notification about the available manpower and the current demand of workers. The current demand of workers will provide information about how many workers are needed for each specialization. The managers then can use the worker list to assign work to workers. The worker list contains the following information:

1. Worker Name
2. Worker Specialization
3. Worker KPI
4. Leaderboard Position

The list can be sorted based on the information. The list will show whether any worker is currently absent. Worker assignment will occur in the following steps:

1. Managers receive a manpower report.
2. Managers click worker assignment from the employee tab.
3. The worker assignment tab shows the worker list and the manpower needed for each specific task.
4. Manager places employees to their assigned task.
5. Absent employees cannot be assigned and are blurred out.

Supervisors and managers can change the assigned work of a worker at any time. The system will keep track of assigned work of each employee and will distribute the workplace accordingly.
The manager dashboard will have a reward and training panel. Managers can add employees to be rewarded or trained using that panel.

3. Leaderboards

The leaderboard option will contain the gamified leaderboard for each field of specialization. Leaderboards are generated using evaluation metrics of workers. Additionally, there will be an overall leaderboard for workers. From there, the top employee will be selected as the employee of the month.
Using the leaderboard, the manager can also assign workers to reward and training programs.

4. Evaluation

The manager will have two options inside the evaluation tab: critical incident log and rating form. The critical incident log and rating form can be filled in the way mentioned above.

5. Reports

The report tab will contain:

1. Evaluation reports
2. Manpower Reports

Evaluation report will contain the detailed KPI reports of each employee.
Manpower reports are updated regularly and they contain:

1. Manpower needed.
2. Absent Workers

6. Notification

Managers will receive notification about the generation of evaluation reports and manpower reports from the notification tab. If the manager needs to convey any emergency information, it can be done so through the notification tab.

Supervisor Dashboard

The supervisor dashboard will contain the options to generate manpower reports, evaluate workers and receive notifications. Supervisor will also have a profile which can be accessed through the dashboard. Supervisor's profile will have:

1. Supervisor name
2. Supervisor id
3. Department.
4. Assigned team

1. Manpower report

The manpower report contains options to specify manpower needed and fill the absent report.
The supervisor identifies the number of workers needed for a certain layout and inputs it in the manpower report.
Then the supervisor completes the absentees report, which is done by putting a tick or cross against a particular worker from the worker list.

2. Worker Assignment

The supervisor will receive a notification about the assignment of workers and the place they have been assigned to. They will ensure that the employees are stationed at their specified location. After confirming stations, the supervisor will click the worker assignment complete button.

3. Evaluation

The supervisors can evaluate employees. The evaluation method is similar to the manager.

4. **Leaderboards**

Supervisors can view leaderboards and see workers who have been assigned to rewards and training.

5. **Notification**

The supervisor will receive notification about the generation of KPI reports. The supervisor will also be notified if the manager changes the assigned work of any worker.

Notification system

Each dashboard will have tabs to send them notifications about the generation of reports, worker assignment and rewards and training assignment. Emergency notifications can also be sent by the manager using the notification system.

Rewards and training

The manager can use the leaderboard to assign employees to reward or training programs. There is a certain threshold of KPI above which employees cannot be sent to training programs and below which employees can't be sent to reward programs.
The reward system provides employees with special coupons. The coupons can be redeemed by the employees from their profile. They can use the coupons to:

1. Get bonus
2. Get extra off hours
3. Get free food from the cafeteria.

5. Scenario Based Modeling

5.1 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 makes the story understandable for the users.
The first step in writing a Use Case is to define that 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 given the use case diagram to observe the non-technical view of the system.

Level 0:

Name : Employee Performance Evaluation System
Primary Actor: Manager, Supervisor
Secondary Actor: Admin, Worker, Camera

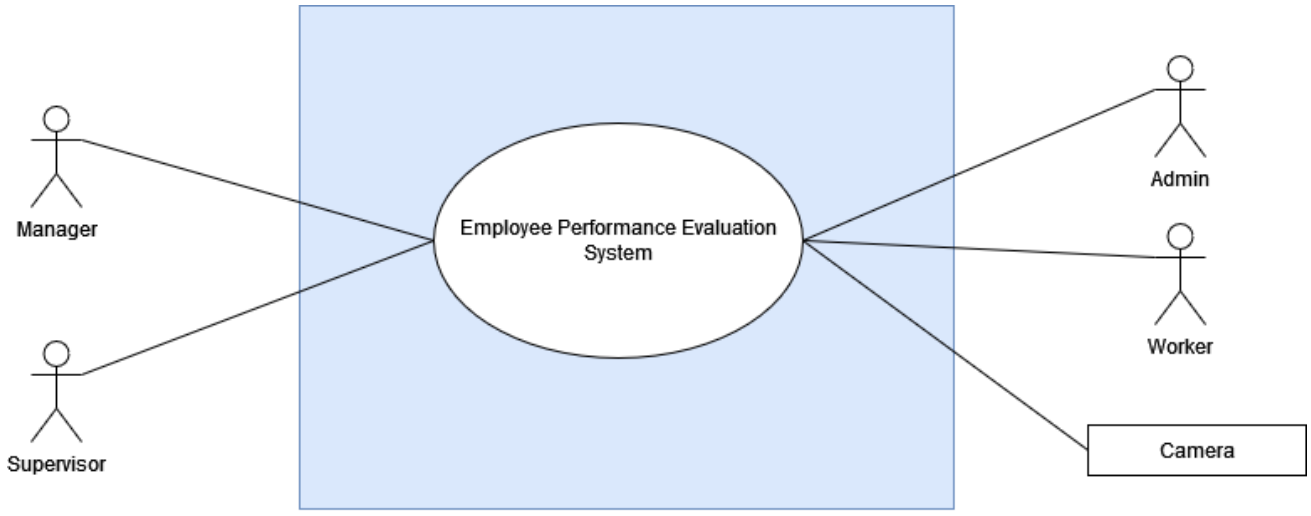


Figure: Use Case Diagram Level 0

Level 1:

Name : Employee Performance Evaluation System(Detailed)
Primary Actor: Manager, Supervisor

Secondary Actor: Admin, Worker, Camera

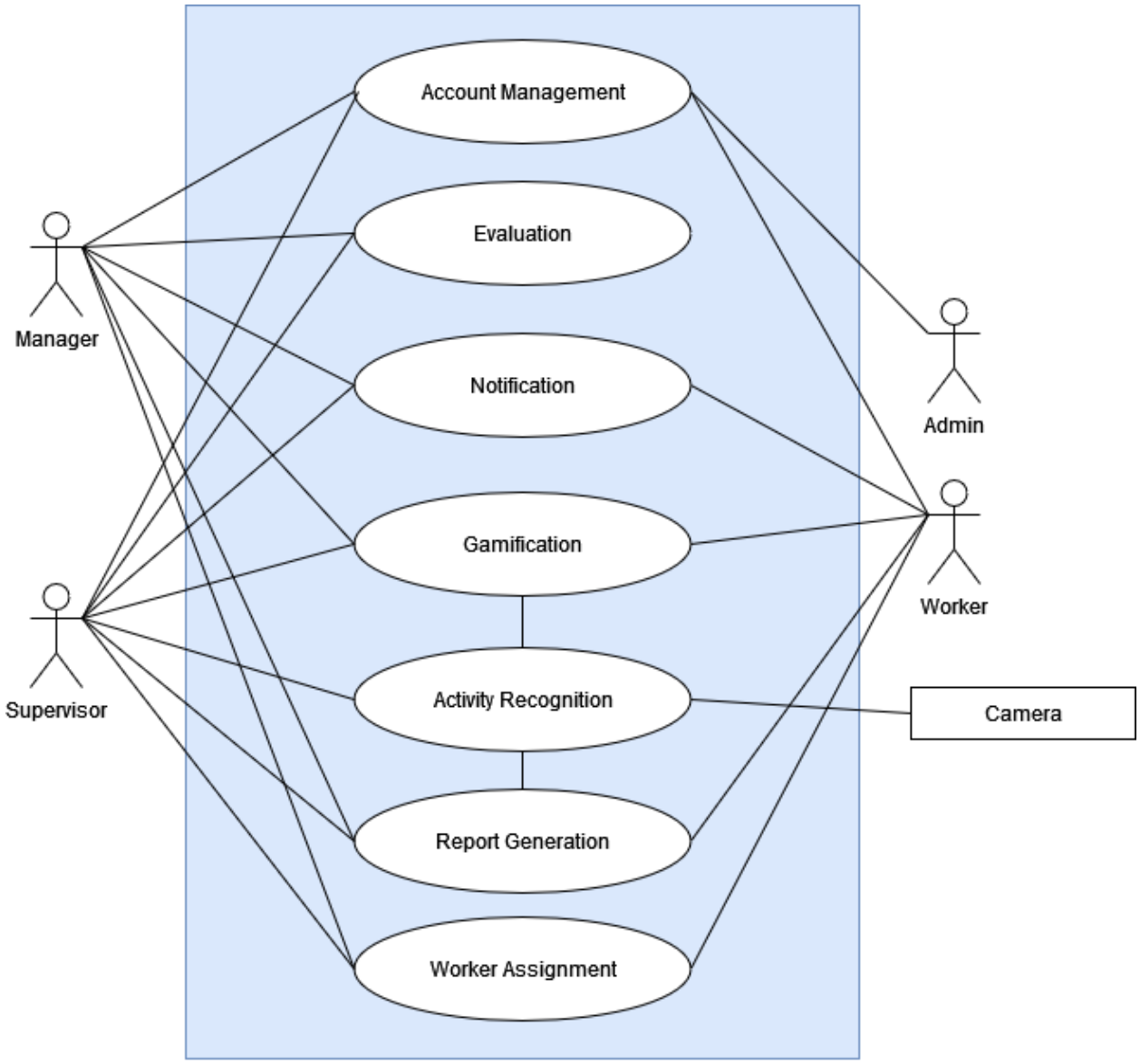


Figure: Use Case Diagram Level 1

Description:

1. **Account Management:** Admin will create accounts of the Employee Performance Evaluation System during inception of the system. Supervisors, workers and managers can login using their employee ID and password. Admin can edit the accounts when necessary.

2. **Evaluation:** The evaluation of workers will be done by using Key Performance Indicators and appraisal ratings of supervisors. Appraisal will be done using critical incident and rating form
3. **Notification:** Employees will be notified about the generation of reports, work assignments and about rewards and training.
4. **Gamification:** The system has gamified leaderboards of workers where employees will be sorted based on evaluation. Based on the leaderboards, managers can assign training and rewards to employees.
5. **Activity Recognition:** The system will generate KPI scores for each worker by using activity recognition on camera feed. Using activity recognition, work and idle job will be separated and their duration will be calculated. Work time and idle time will be divided by total duration to generate KPI score.
6. **Report Generation:** The system generates two kinds of reports: Manpower report and evaluation report. Manpower reports contain manpower needed and an absent worker list which is updated by the supervisor. Evaluation report is based on Key Performance Indicator and Appraisal ratings.
7. **Worker Assignment:** Based on the manpower report, the manager will assign workers to various tasks using the worker list. Supervisor will confirm the assignment

Level 1.1:

Name : Account Management
Primary Actor: Manager, Supervisor, Admin

Secondary Actor: Worker

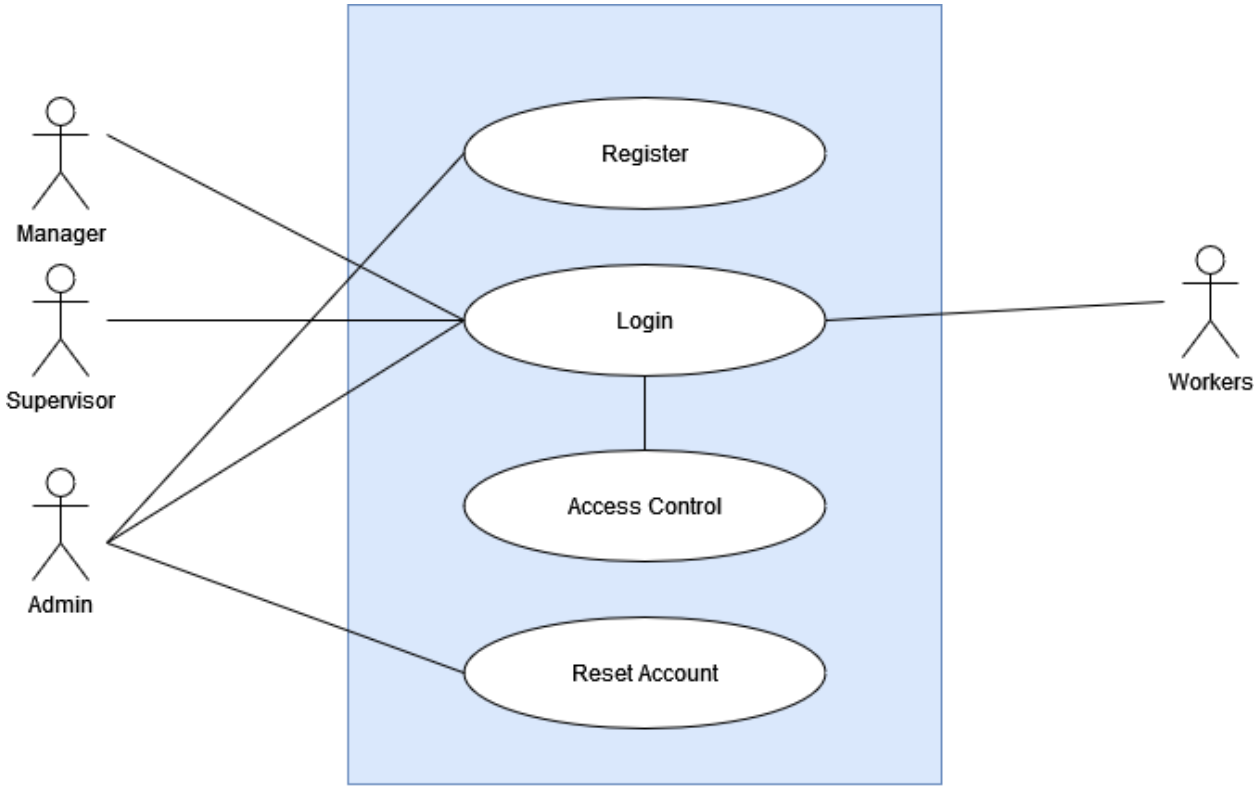


Figure: Use Case Diagram Level 1.1

Description:

1. **Register:** The admin will create various employee accounts.
2. **Login:** Employees can login to the system using employee ID and password.
3. **Access Control:** Access control manages permissions of different accounts.
4. **Reset Account:** Admin can change the information and password of accounts.

Level 1.2:

Name : Evaluation
Primary Actor: Manager, Supervisor
Secondary Actor:

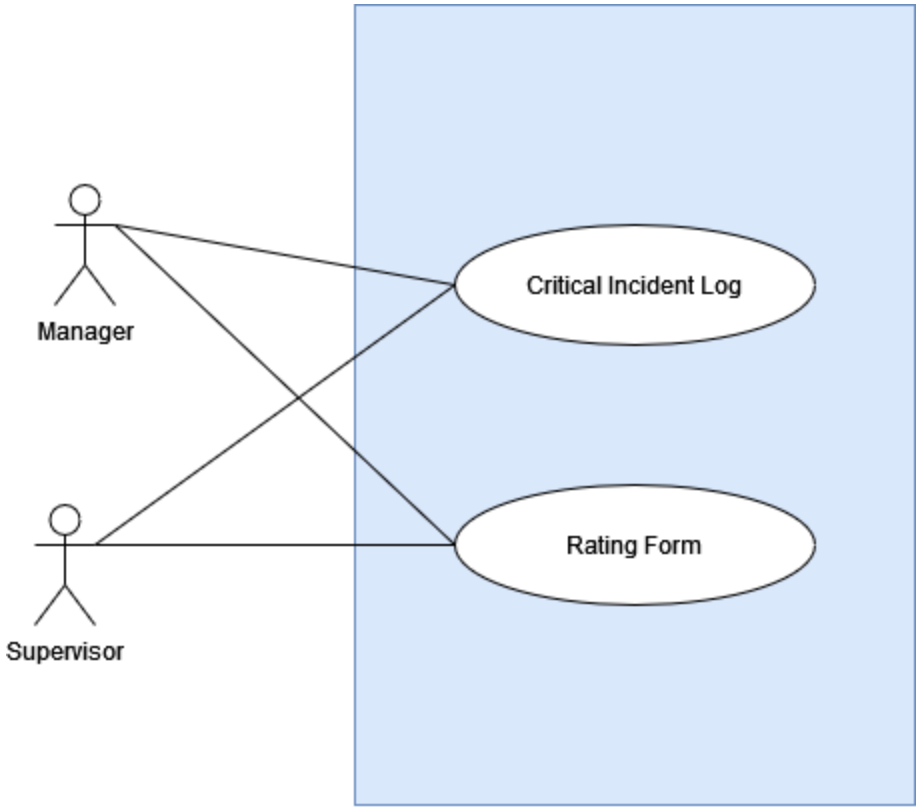


Figure: Use Case Diagram Level 1.2

Description:

1. **Critical Incident Log:** The system will have a critical incident logging system to evaluate employees. Each employee has a critical incident log. It has sections for poor and excellent performance.
2. **Rating Form:** The rating form can be accessed once in a month. The rating form contains the current job field and a skill rating which can be set between 1 and 5.

Level 1.4:

Name : Gamification
Primary Actor: Manager
Secondary Actor: Worker, Supervisor

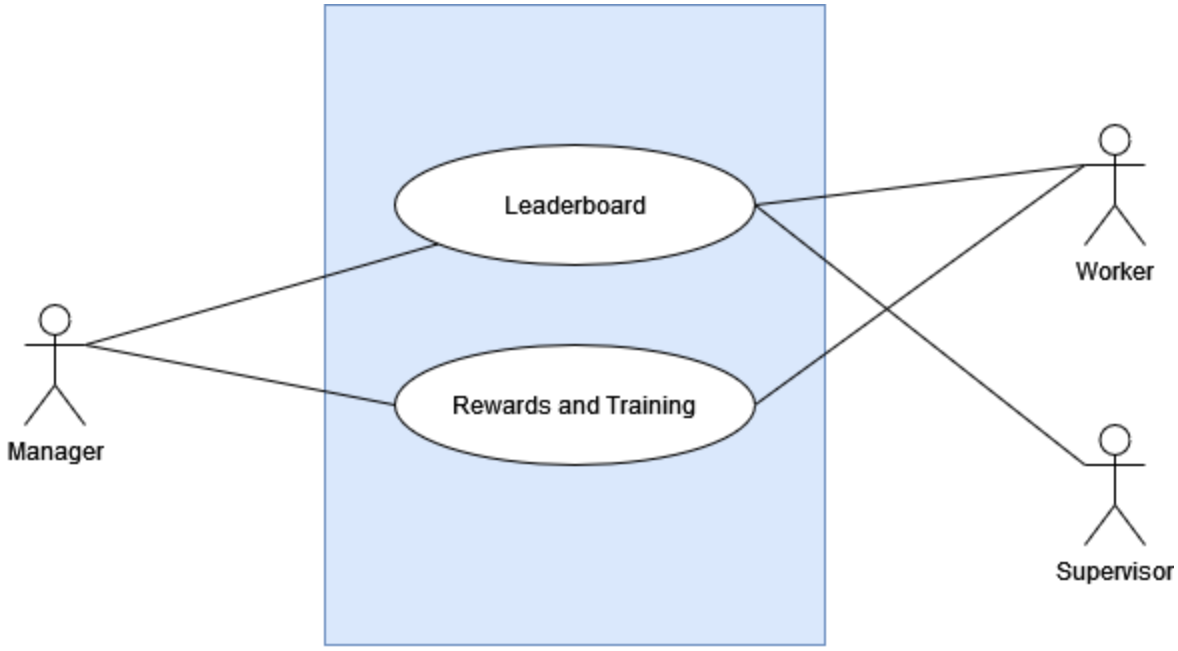


Figure: Use Case Diagram Level 1.4

Description:

1. **Leaderboard:** The leaderboard option will contain the gamified leaderboard for each field of specialization. Leaderboards are generated using evaluation metrics of workers. Additionally, there will be an overall leaderboard for workers
2. **Rewards and Training:** The manager can use the leaderboard to assign employees to reward or training programs. The reward system provides employees with special coupons. The coupons can be redeemed by the employees from their profile.

Level 1.6:

Name : Report Generation
Primary Actor: Manager, Supervisor
Secondary Actor: Worker

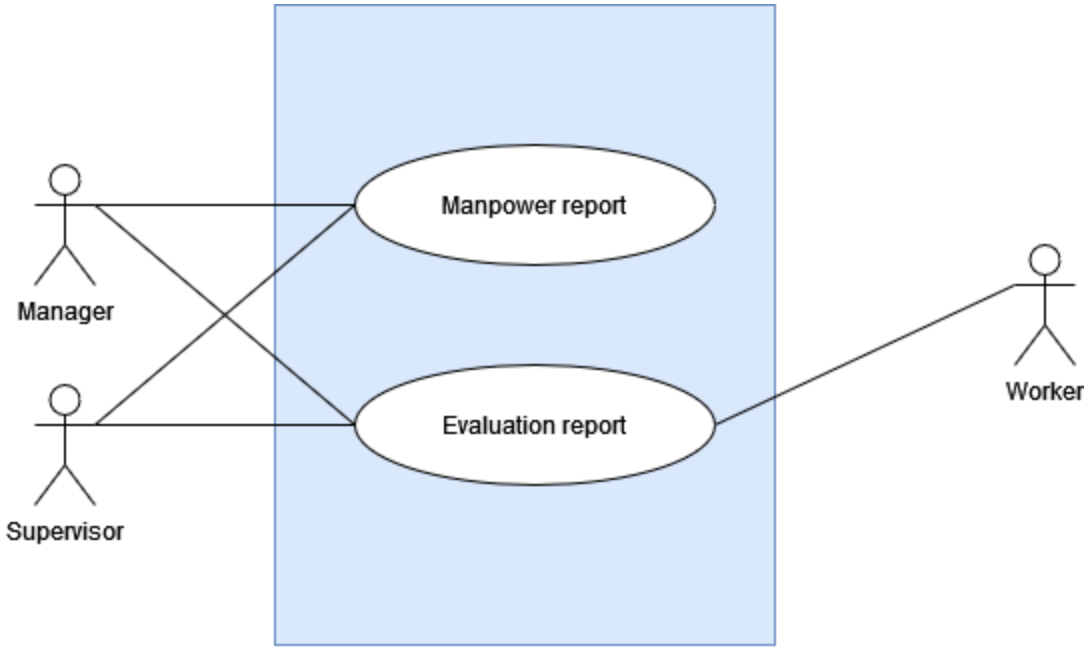


Figure: Use Case Diagram Level 1.6

Description:

1. **Manpower Report:** The manpower report contains options to specify manpower needed and fill the absent report. The manpower report contains options to specify manpower needed and fill the absent report which is done by the supervisor.
2. **Evaluation Report:** Evaluation report will contain the detailed KPI reports of each employee. Managers can assign weights to employee KPI and appraisal rating.

5.2 Activity Diagrams

Level 1:

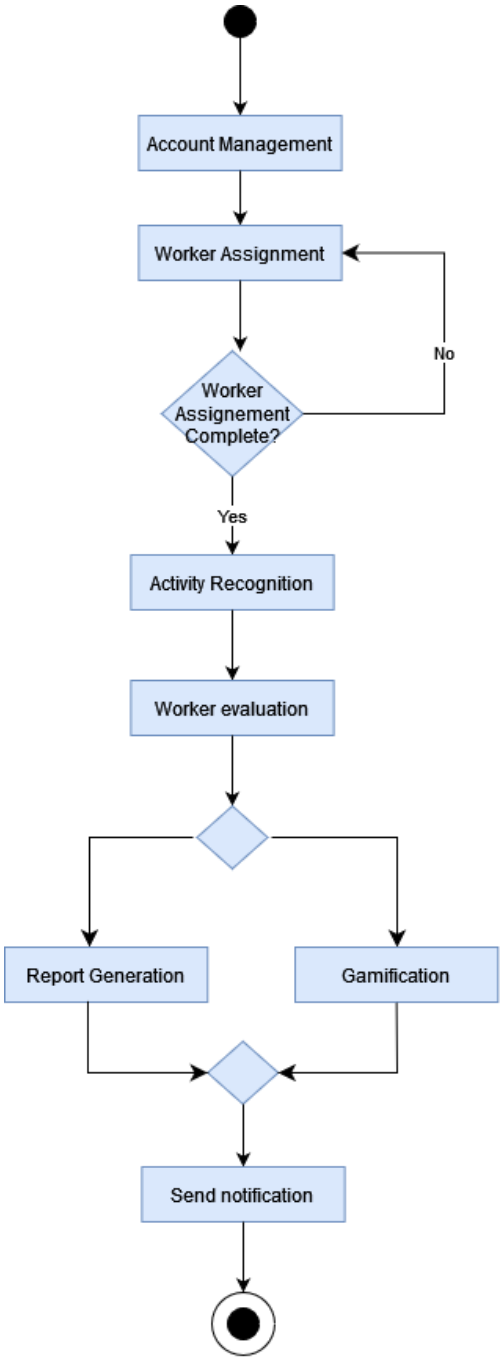


Figure: Activity Diagram Level 1

Name: Employee Performance Evaluation System(Detailed)
Reference: Use Case Diagram Level-1
Activity List:

1. Account management: At the inception of the system, manager, supervisor and worker accounts are created by the admin. The employees can then login using their username and password. It can be changed by the admin.
2. Worker assignment: Manager can use the worker list to assign workers.
3. Activity recognition: After the completion of worker assignment, the system will use activity recognition to automatically calculate KPI of each worker.
4. Worker evaluation: Workers will be evaluated based on appraisal ratings and KPI scores.
5. Report generation and Gamification: Based on the evaluation, the system will generate reports and Leaderboards.
6. Notification will be sent after the generation of reports

Level 1.1:

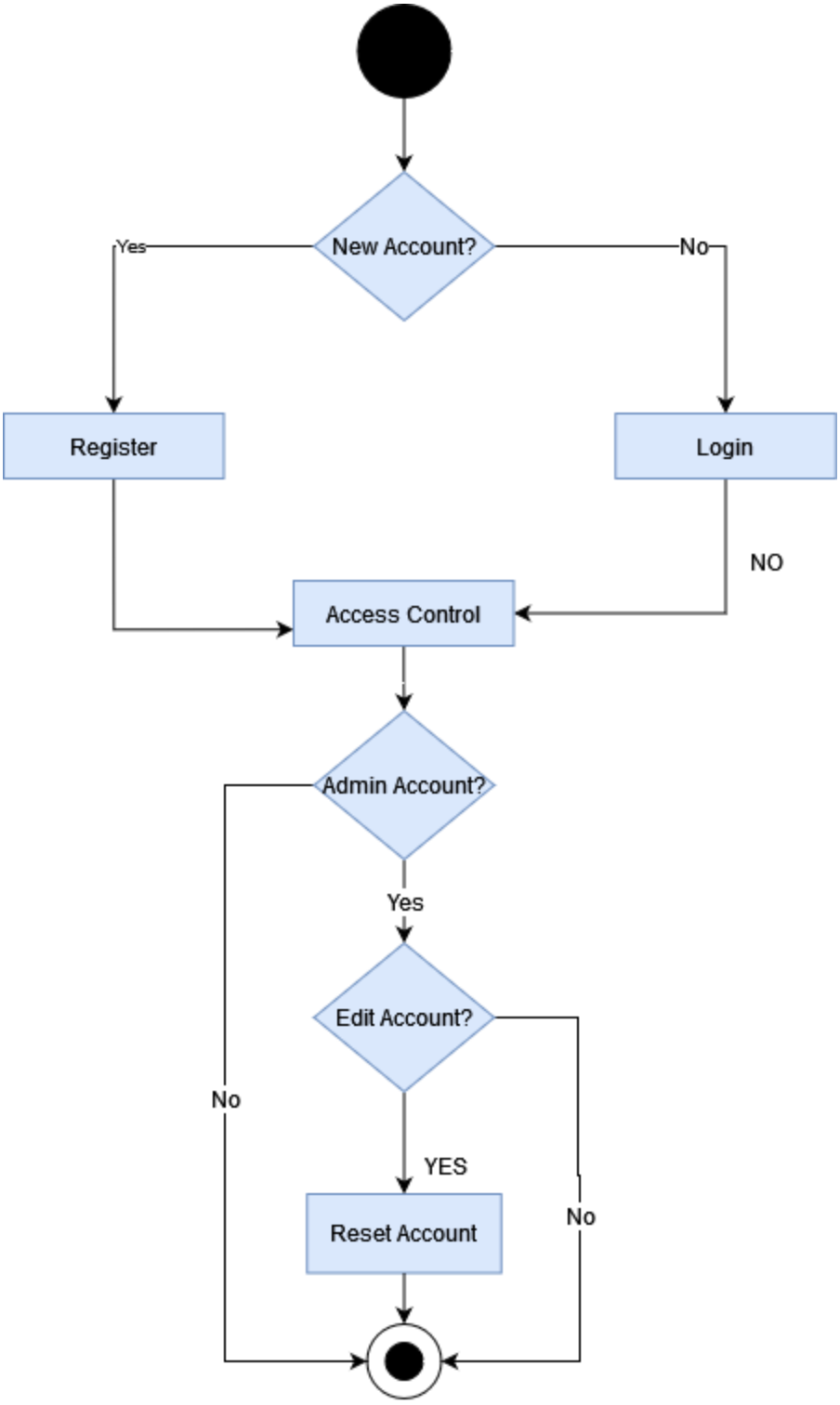


Figure: Activity Diagram Level 1.1

Name: Account Management
Reference: Use Case Diagram Level-1.1
Activity List:

1. Register: New accounts need to be created by the admin.
2. Login: Employees can login using their username and password.
3. Access control: System determines the authorization level of the employee based on access control.
4. Reset account: If the user is admin, accounts can be edited by them.

Level 1.1.1:

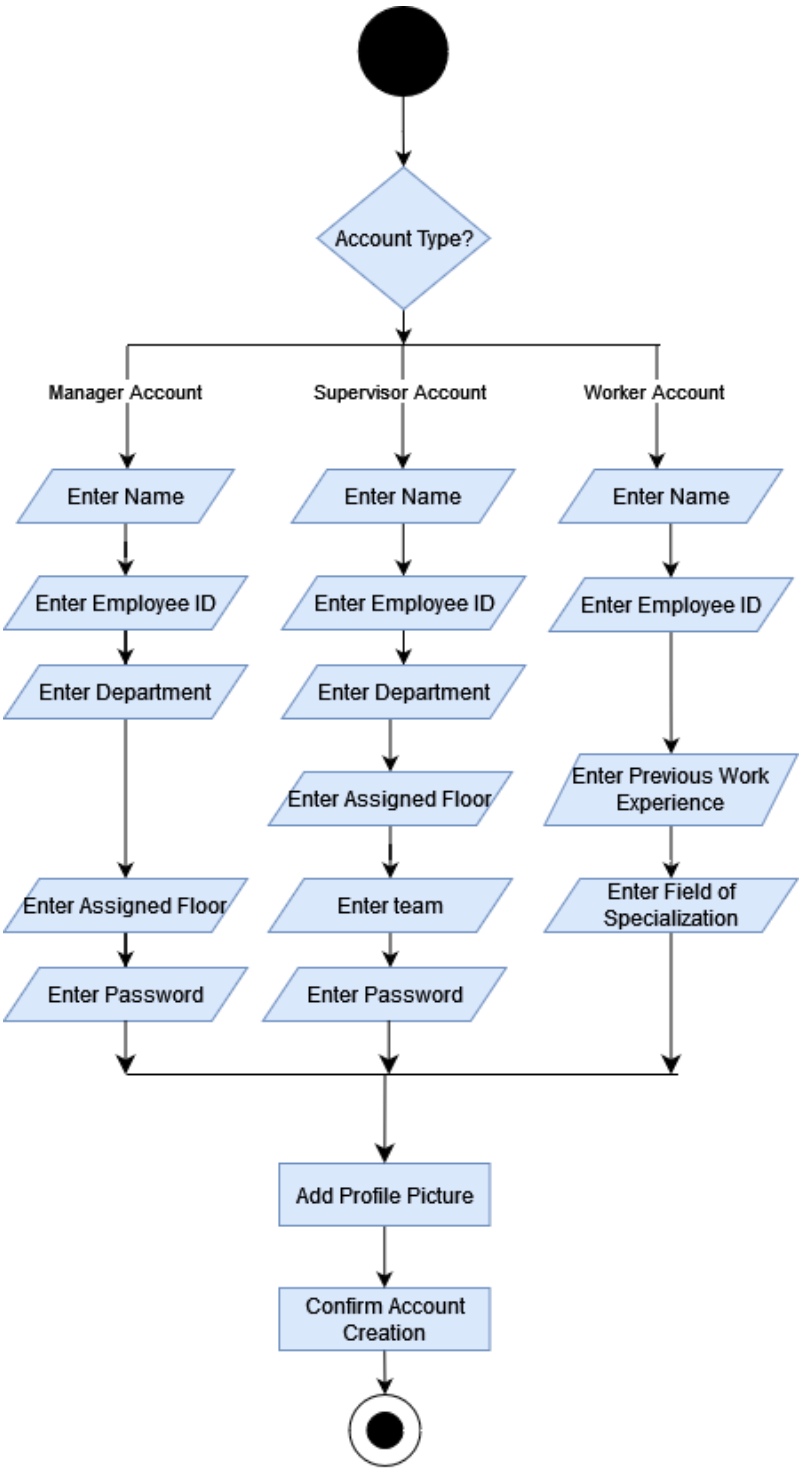


Figure: Activity Diagram Level1.1.1

Name: Register
Reference: Use Case Diagram Level-1.1.1
Activity List:

1. For creating manager account admin needs to enter:
    a. Name
    b. Employee ID
    c. Department
    d. Assigned Floor
    e. Password
2. For creating supervisor account admin needs to enter:
    a. Name
    b. Employee ID
    c. Department
    d. Assigned Floor
    e. Assigned team
    f. Password
3. For creating worker account admin needs to enter:
    a. Name
    b. Employee ID
    c. Previous work experience.
    d. Field of specialization.
4. A profile picture will be added.
5. Account creation will be confirmed by the admin.

Level 1.1.2:

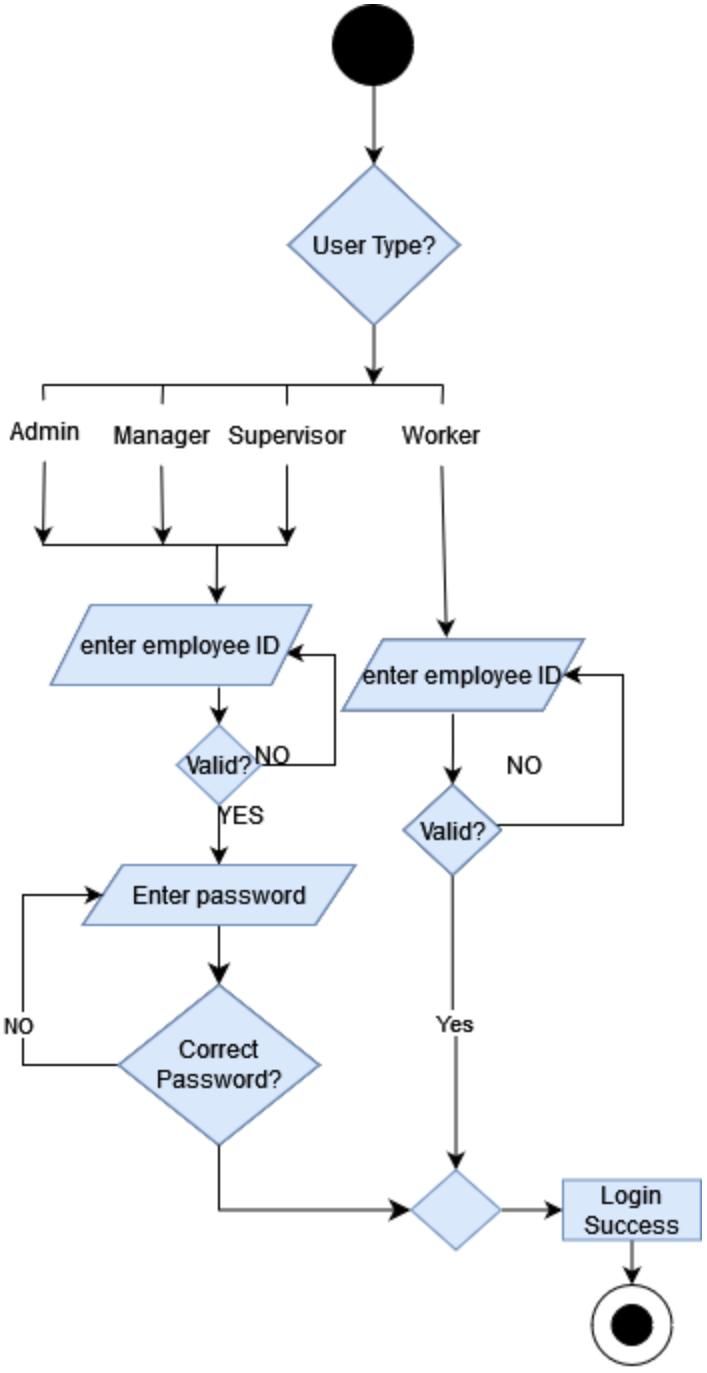


Figure: Activity Diagram level 1.1.2

Name: Login
Reference: Use Case Diagram Level-1.1.2
Activity List:

1. All employees need to enter their employee ID to login.
2. Admin, manager and supervisors need to enter their password.
3. If all information is correct, login is successful.

Level 1.1.3:

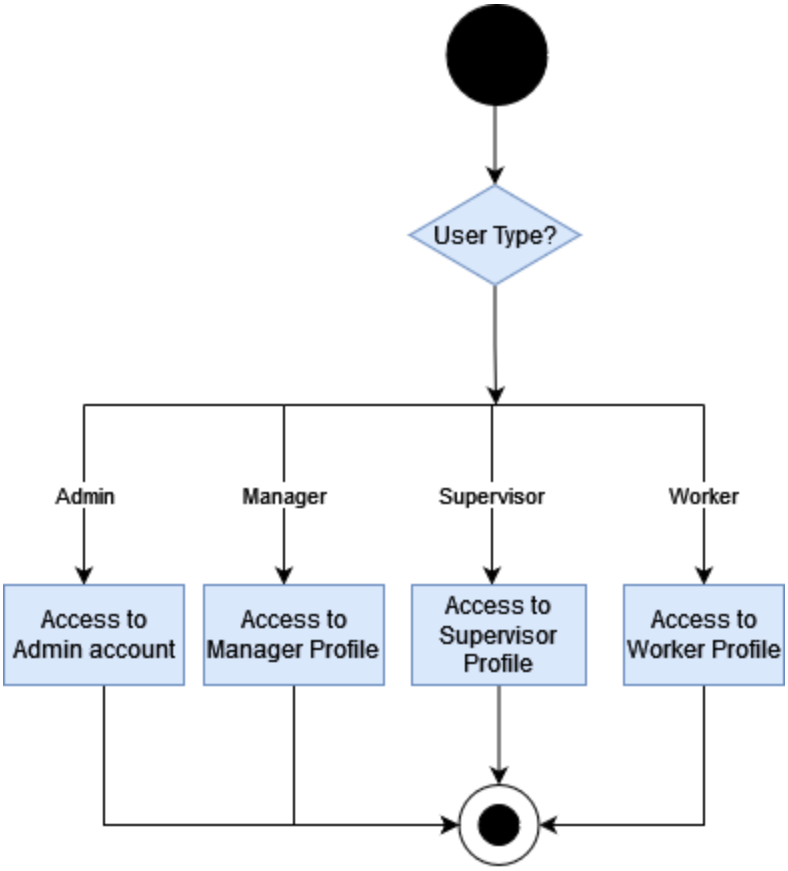


Figure: Activity Diagram Level 1.1.3

Name: Access Control
Reference: Use Case Diagram Level-1.1.3
Activity List:

1. Access control determines the level of access of each employee.

Level 1.1.4:

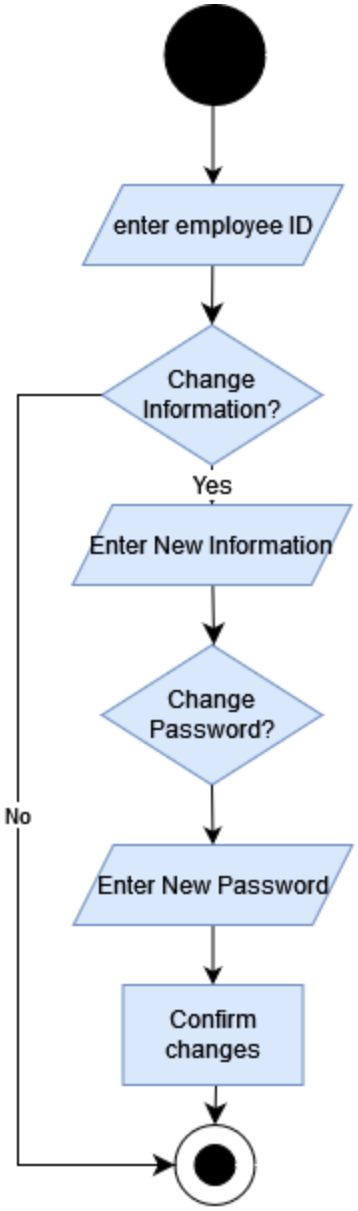


Figure: Activity Diagram Level 1.1.4

Name: Reset Account
Reference: Use Case Diagram Level-1.1.4
Activity List:

1. To edit an account, the admin needs to first enter the employee ID.
2. Admin can change employee information.

3. Admin can change the password
4. Admin needs to confirm the changes to save.

Level 1.2:

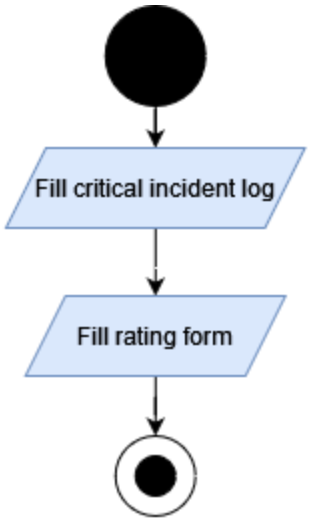


Figure: Activity Diagram Level 1.2

Name: Evaluation
Reference: Use Case Diagram Level-1.2
Activity List:

1. Fill critical incident log: Managers and supervisors can fill critical incident logs.
2. Fill Rating form: Seeing the critical incident logs, managers and supervisors can rate employees once in a month.

Level 1.2.1:

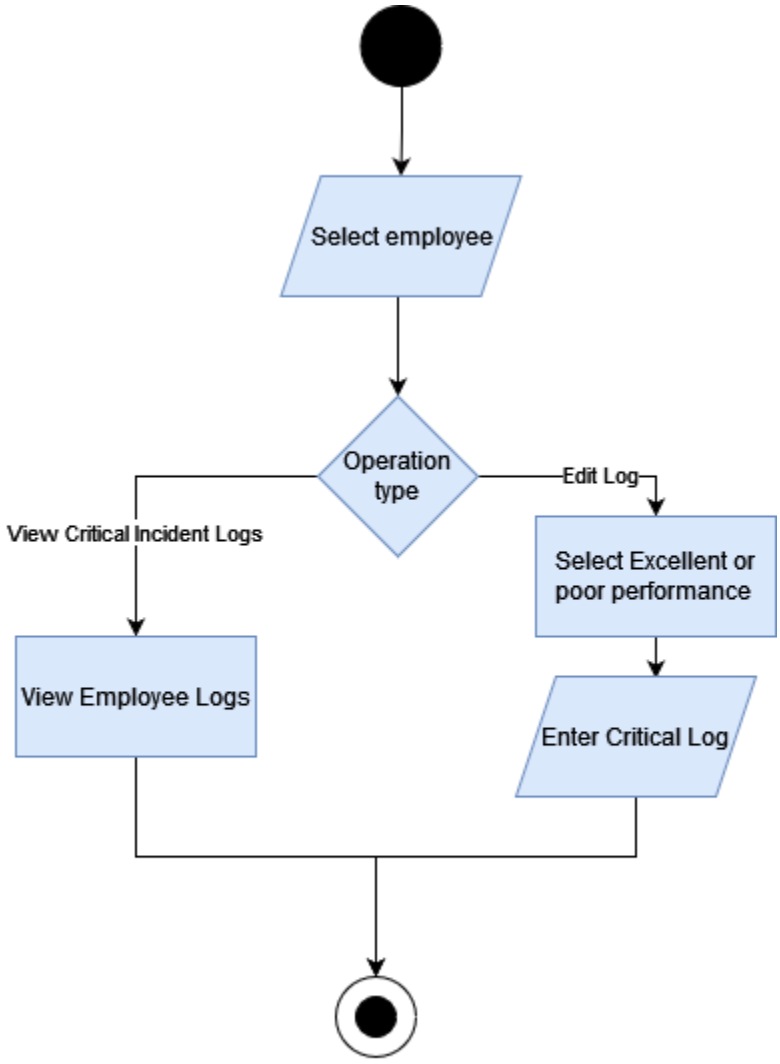


Figure: Activity Diagram Level 1.2.1

Name: Critical Incident Log
Reference: Use Case Diagram Level-1.2.1
Activity List:

1. Select the critical incident log of a particular employee.
2. Add a new log under the excellent or poor performance record.
3. Enter and save the log.
4. The logs can be viewed at any time.

Level 1.2.2:

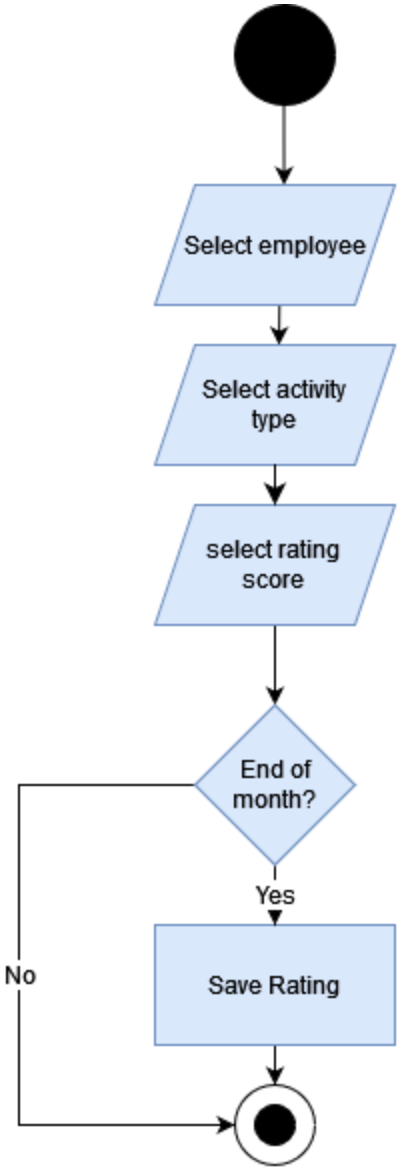
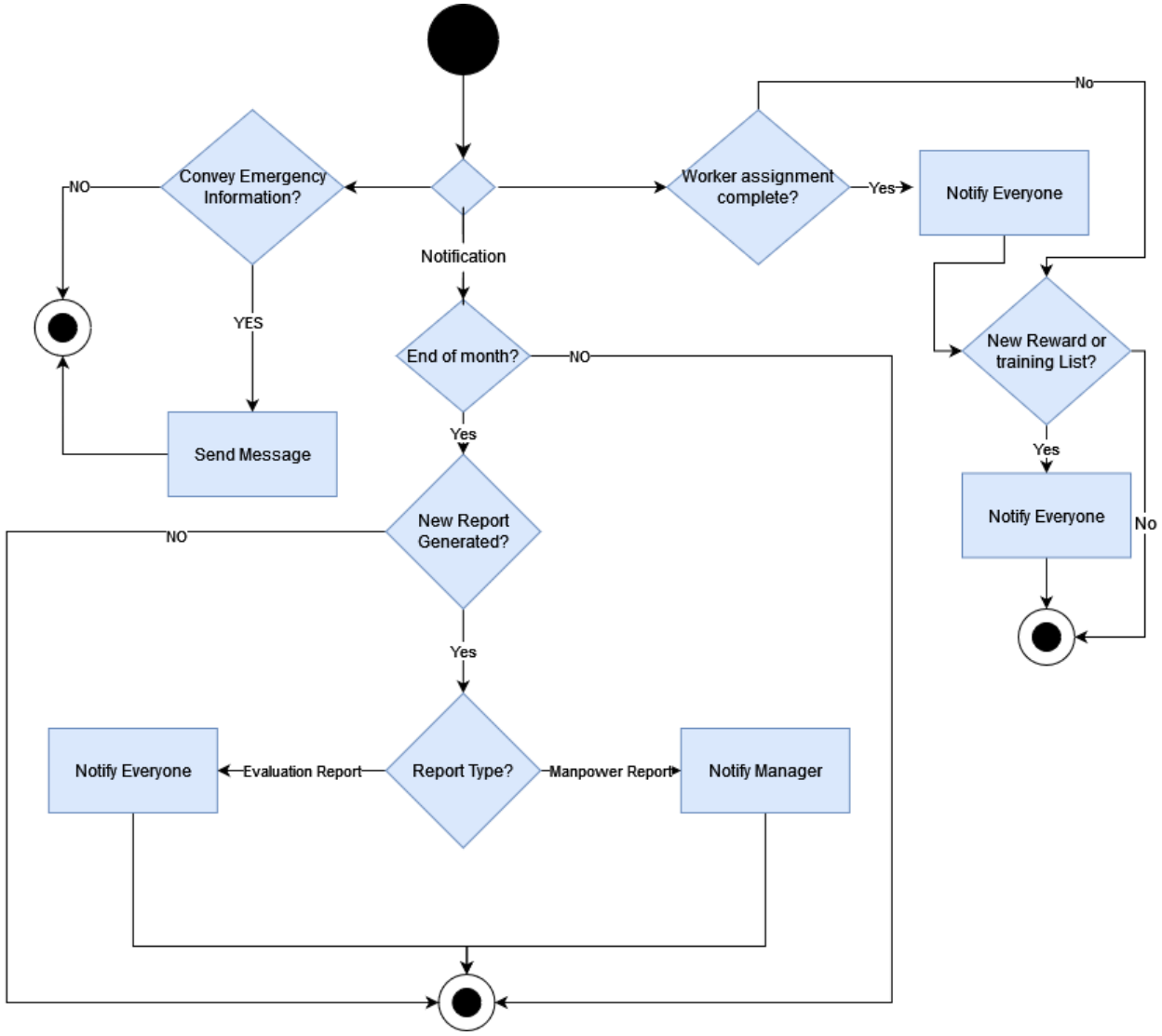


Figure: Activity Diagram Level 1.2.2

Name: Rating Form
Reference: Use Case Diagram Level-1.2.2
Activity List:

1. Select the employee to be rated
2. Select the activity type
3. Select a score between 1-5
4. Save the rating if it's the end of month.

Level 1.3:



Name: Notification
Reference: Use Case Diagram Level-1.3
Activity List:

1. Notify manager: Notify the manager about the generation of manpower reports
2. Send message: Manager can send emergency information to everyone using the notification tab.
3. Notify everyone: Everyone will receive notification about worker assignment, reports and rewards and training.

Level 1.4:

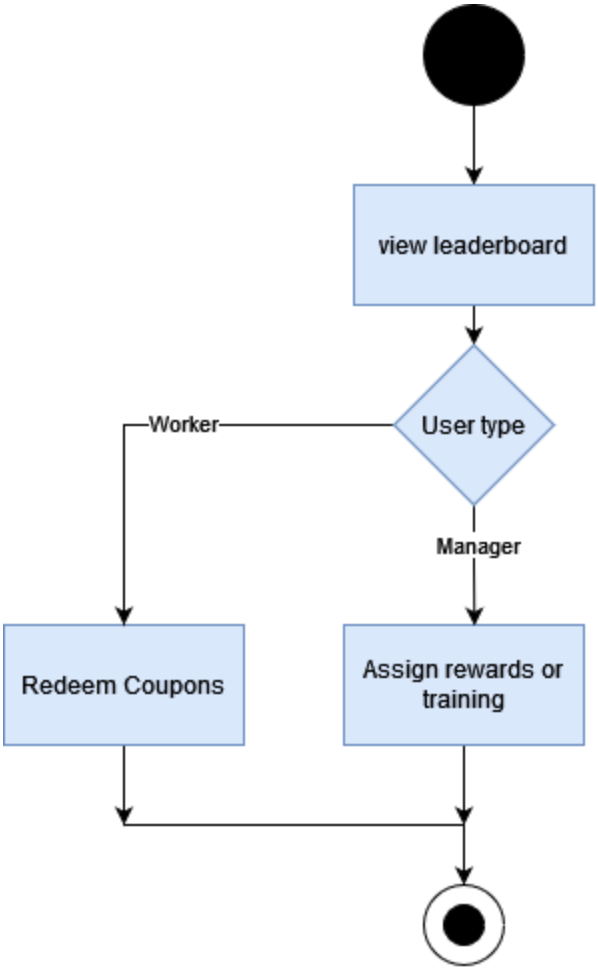


Figure: Activity Diagram Level 1.4

Name: Gamification
Reference: Use Case Diagram Level-1.4
Activity List:

1. View leaderboard: All users can view leaderboard
2. Redeem coupons: Workers can redeem coupons.
3. Assign rewards or training: Managers can assign rewards and training to workers.

Level 1.4.1:

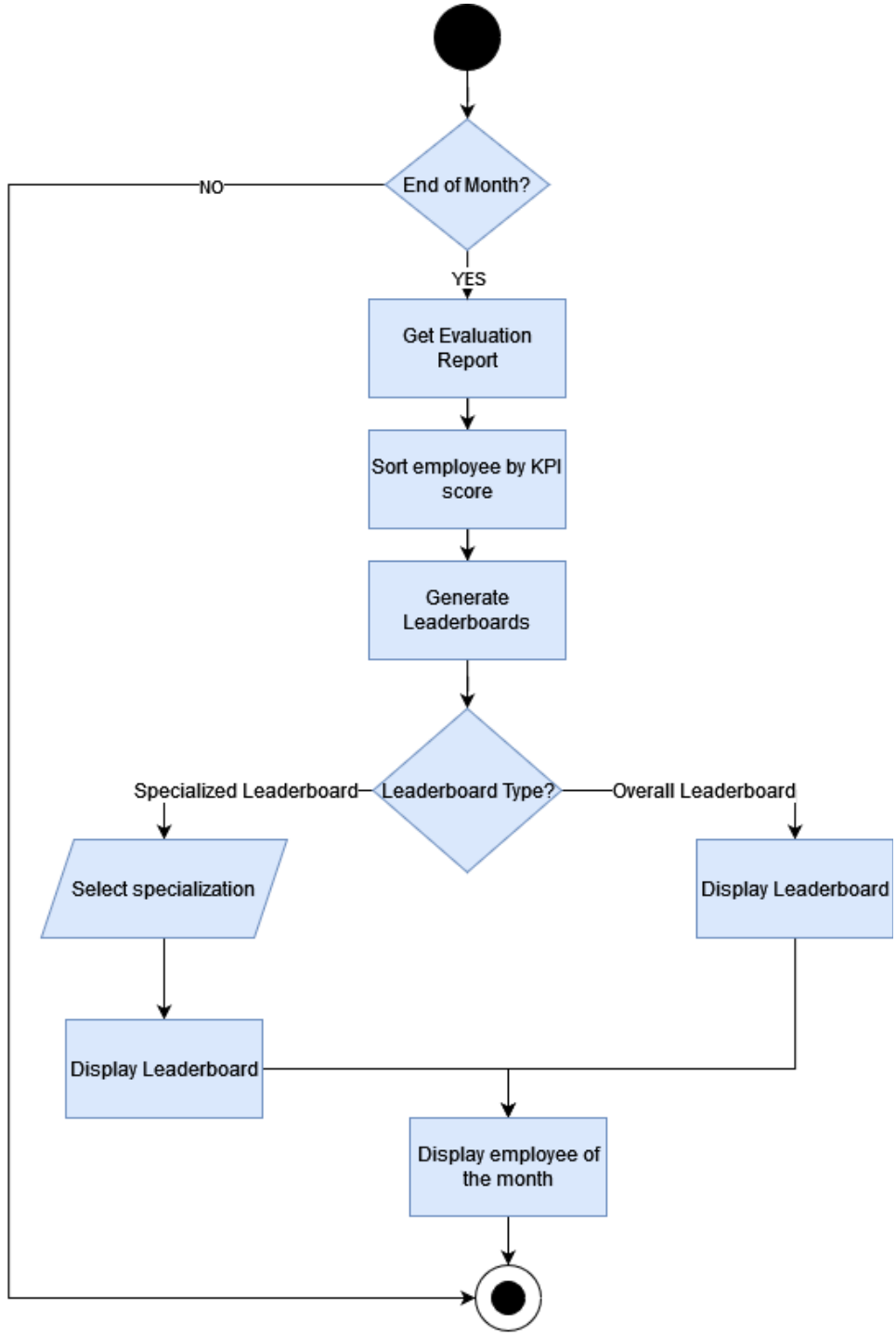


Figure: Activity DiagramLevel 1.4.1

Name: Leaderboard
Reference: Use Case Diagram Level-1.4.1
Activity List:

1. Get evaluation report: If it's the end of month, the system gathers the evaluation reports.
2. Sort employees by KPI score using the evaluation report
3. Generate specialized and overall leaderboards based on score.
4. Employees can see specialized or overall leaderboards.
5. The top employee in the overall leaderboard is displayed as employee of the month.

Level 1.4.2:

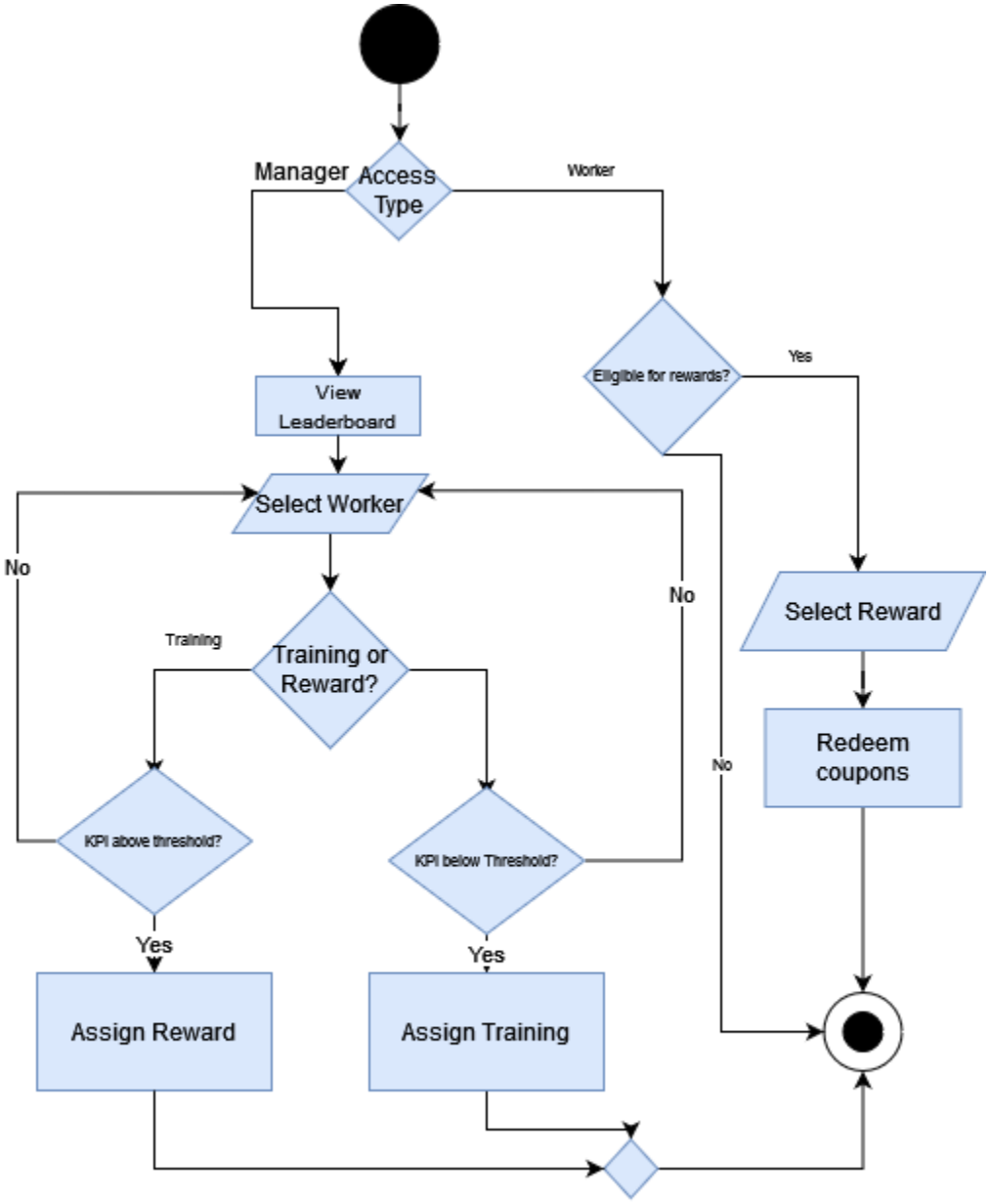


Figure: Activity Diagram Level 1.4.2

Name: Rewards and Training
Reference: Use Case Diagram Level-1.4.2
Activity List:

1. Managers can assign rewards and training by selecting workers from the leaderboard.
2. After checking the KPI threshold, rewards and training will be assigned.
3. Workers can redeem coupons.

Level 1.5:

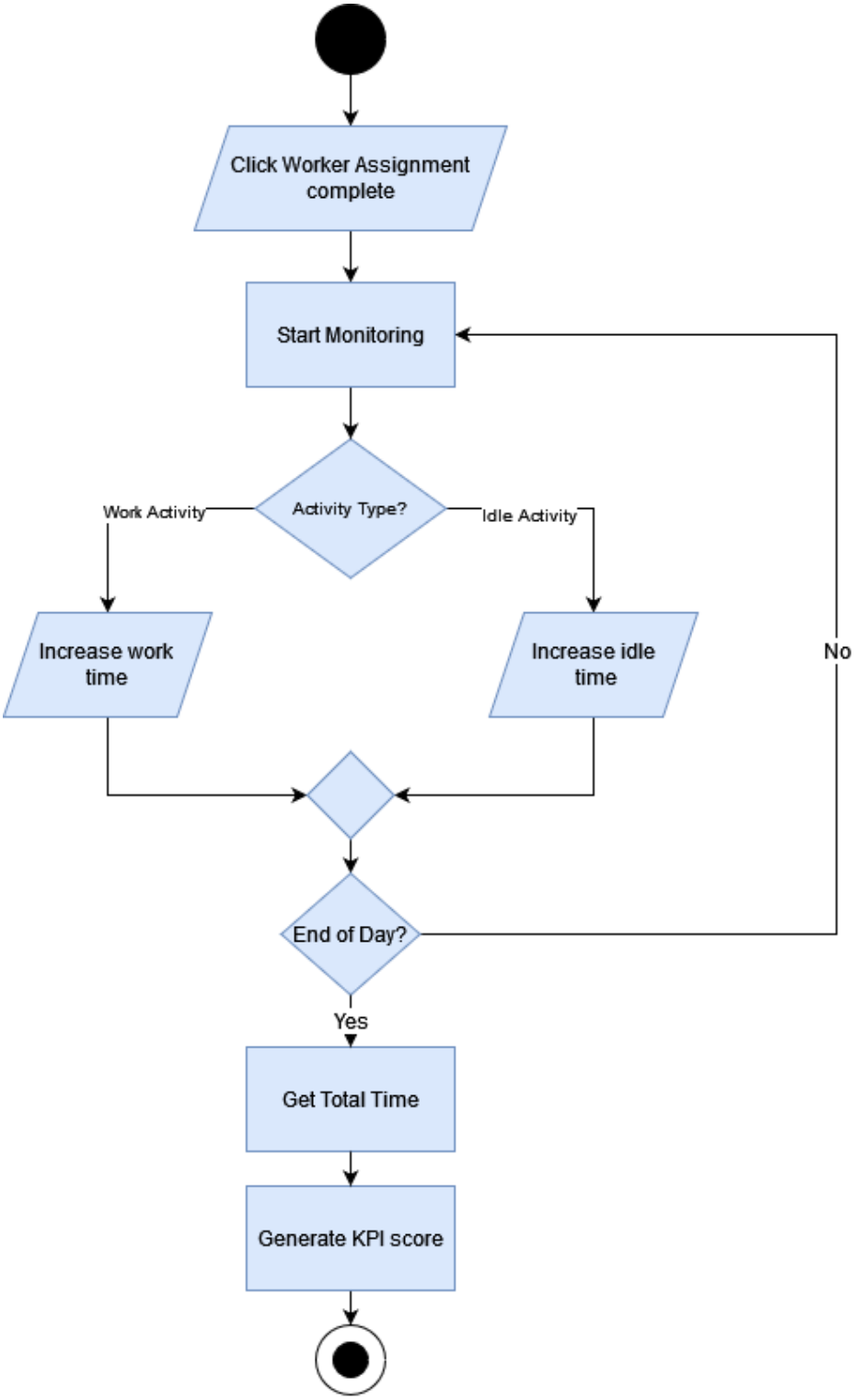


Figure: Activity Diagram Level 1.5

Name: Activity Recognition
Reference: Use Case Diagram Level-1.5
Activity List:

1. The supervisor clicks the assignment complete button.
2. After workers have been assigned to their respective workstations, monitoring starts.
3. The total KPI is recorded for each day

Level 1.6:

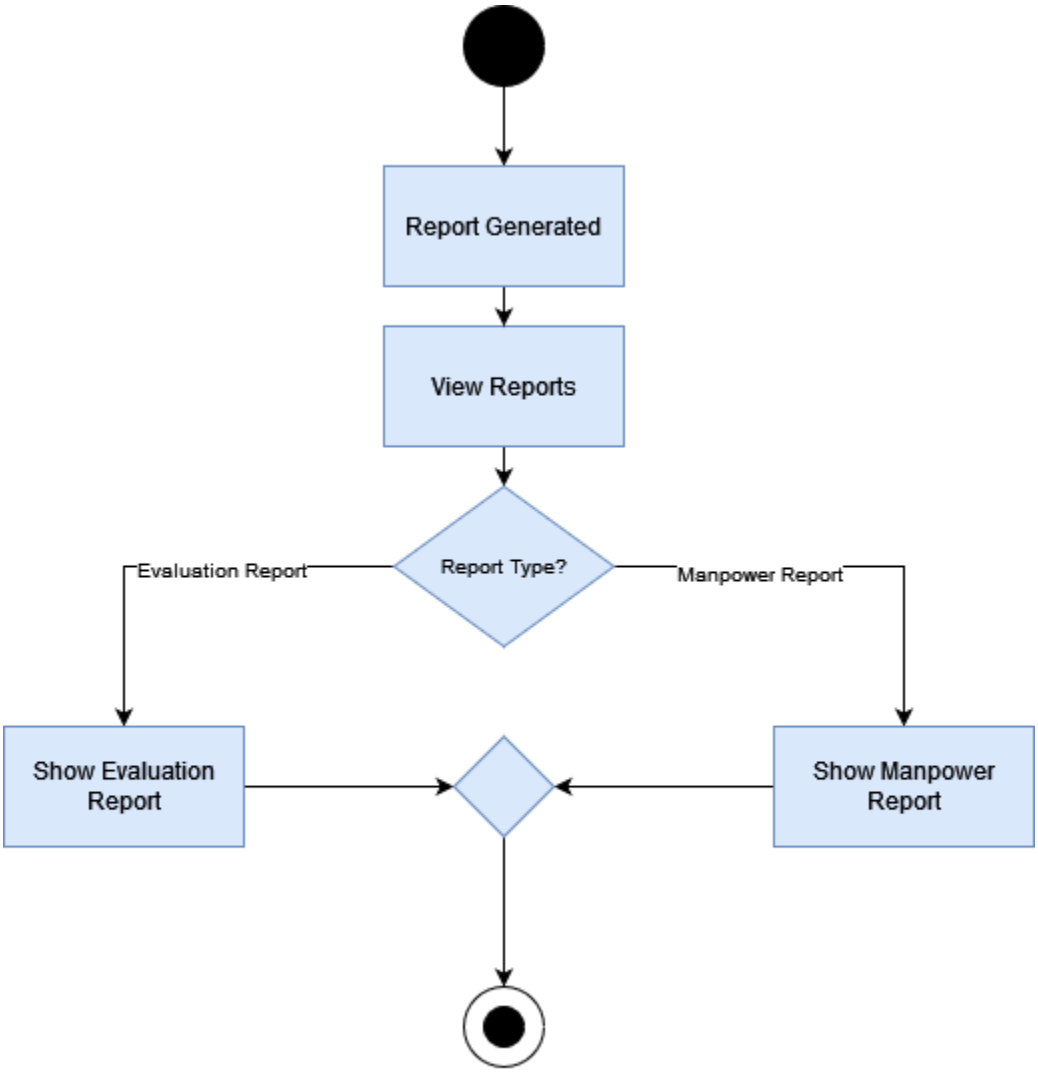


Figure: Activity Diagram Level 1.6

Name: Report Generation
Reference: Use Case Diagram Level-1.6
Activity List:

1. After gathering information from manpower reports and evaluation reports, an overall worker report is generated.
2. The manager, supervisor and workers can view evaluation reports.
3. Manager can view manpower reports

Level 1.6.1:

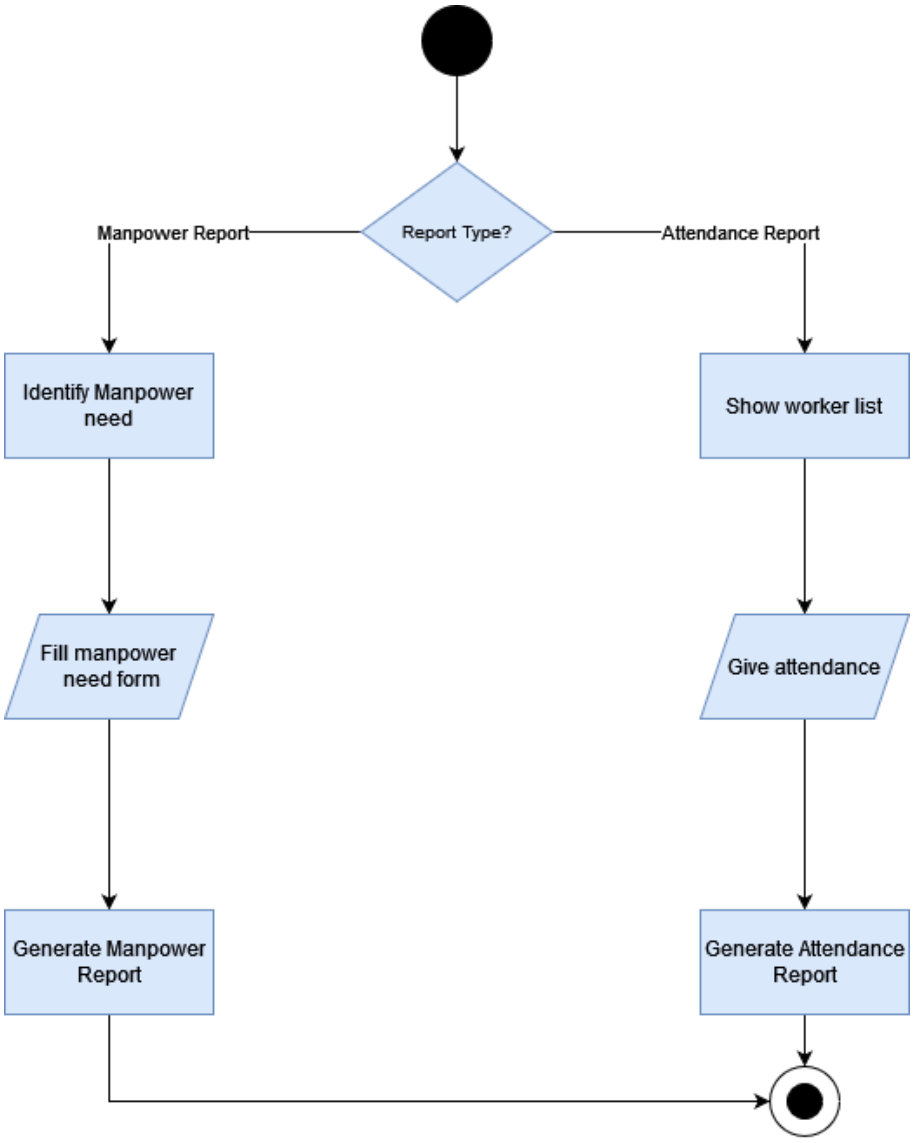


Figure: Activity Diagram Level 1.6.1

Name: Manpower Report
Reference: Use Case Diagram Level-1.6.1
Activity List:

1. Firstly, the supervisor chooses what report to fill between manpower and attendance.
2. The supervisor fills manpower needs form manually.
3. The supervisor generates the manpower needed form.
4. The supervisor views the list of all workers and gives attendance.
5. Generate attendance report: Based on attendance of workers, an attendance report is generated on a daily basis.

Level 1.6.2:

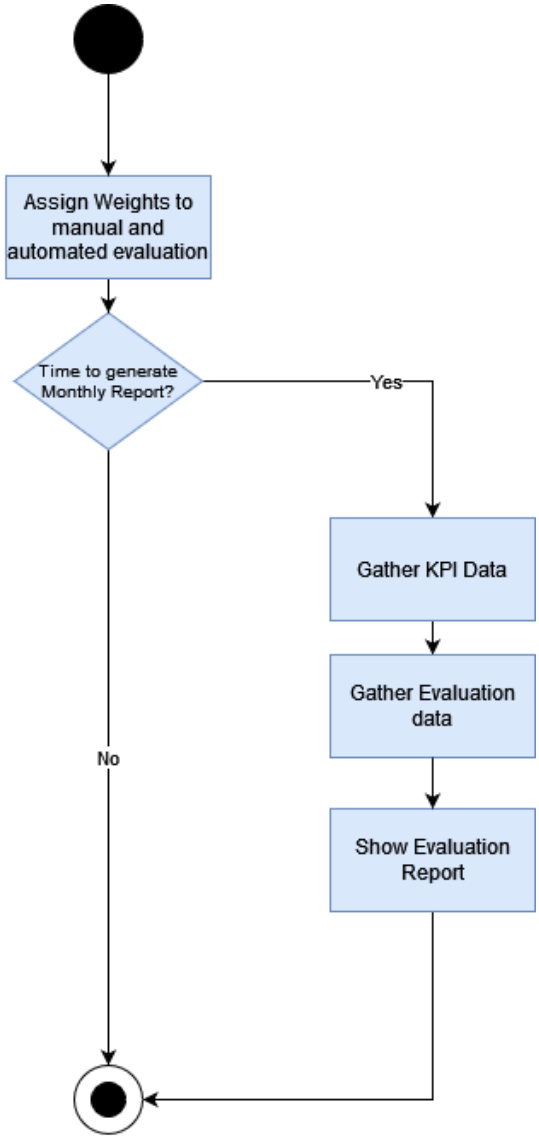


Figure: Activity Diagram Level 1.6.2

Name: Evaluation Report
Reference: Use Case Diagram Level-1.6.2
Activity List:

1. The KPI generation process calculates the total score.
2. Each score is assigned a weight as to how much it impacts the final score.
3. The KPI data of individual workers from different tasks is collected.
4. The evaluation of workers by managers and supervisors is gathered.
5. The report is generated using KPI and evaluation data.

Level 1.7:

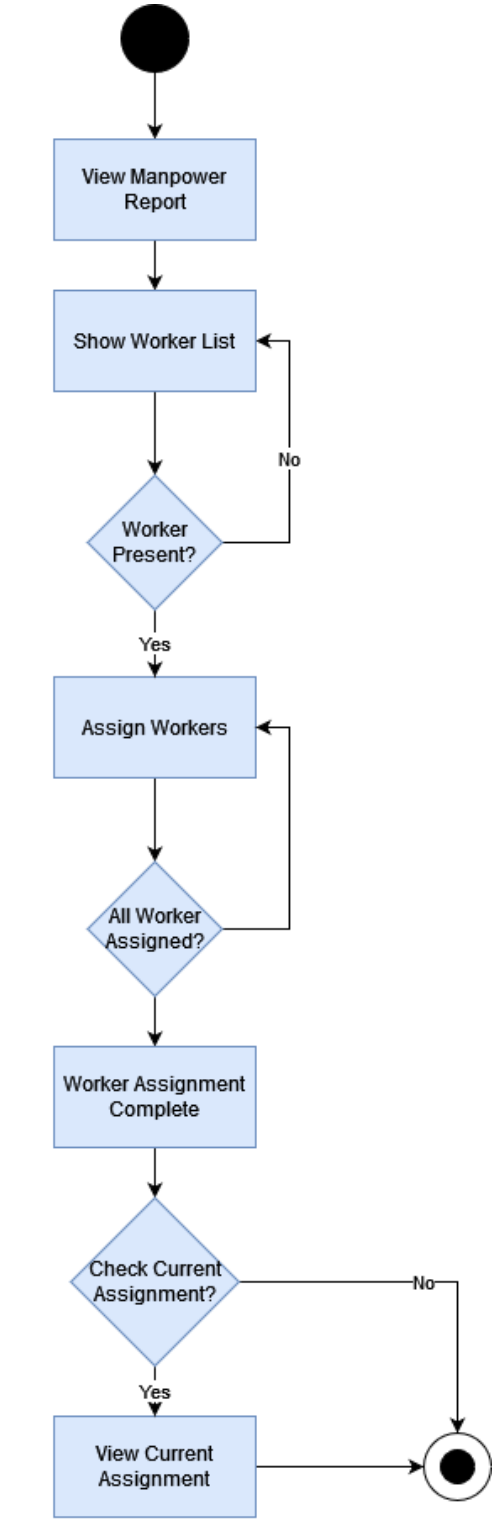


Figure: Activity Diagram Level 1.7

Name: Worker Assignment
Reference: Use Case Diagram Level-1.7
Activity List:

1. The Manpower Report specifies the number of workers present and what tasks require assignment of more workers.
2. The worker list contains workers' details like name, specialization, position etc.
3. The workers are assigned to workplaces according to requirements specified in reports.
4. The manager or supervisor confirms completion of worker assignment by pressing a button.
5. The worker can view their assignments at any given time from their respective profiles.

5.3 Swimlane Diagrams

Level 1:

Reference: Activity Diagram Level-1

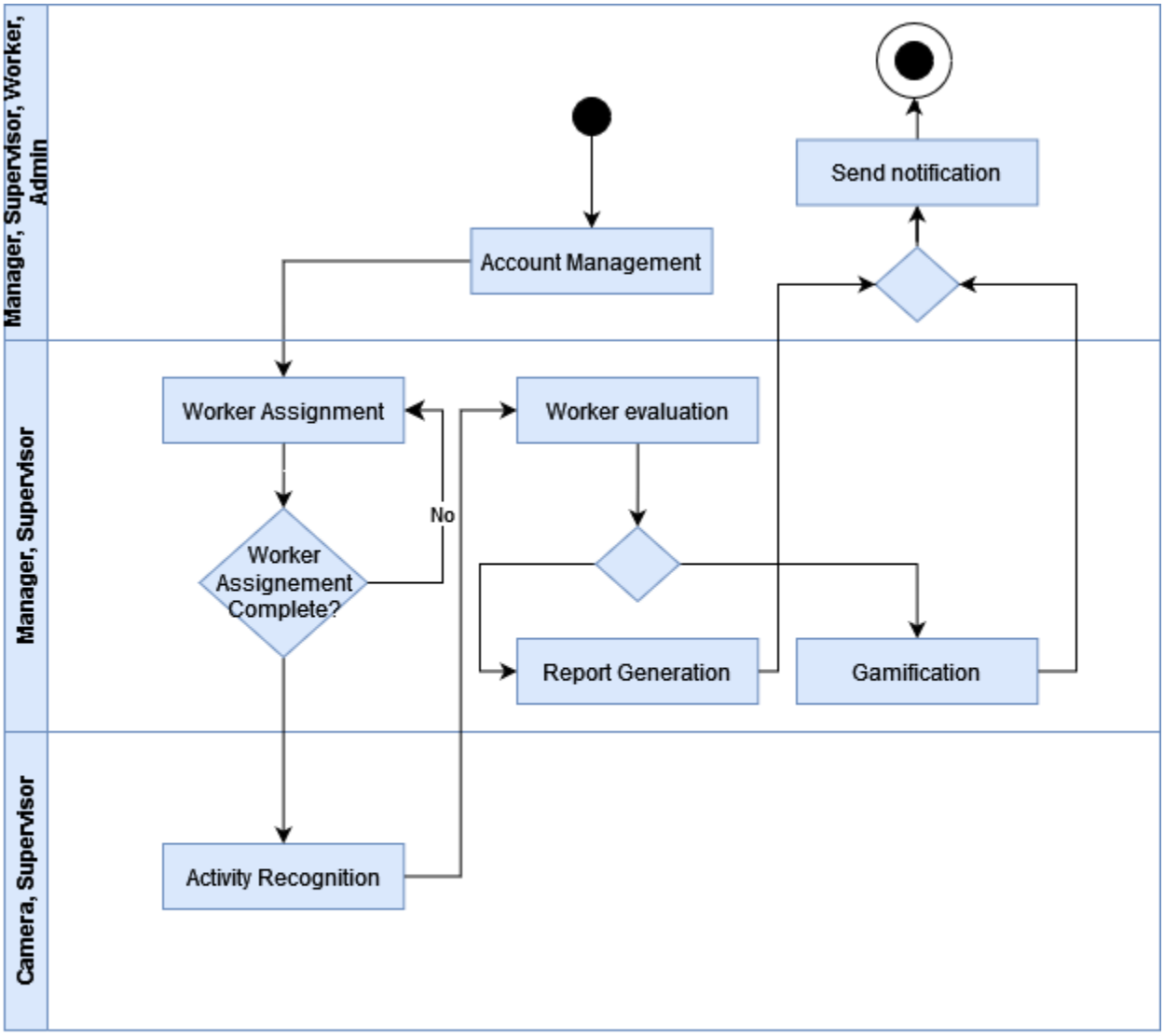


Figure: Swimlane Level 1

Level 1.1:

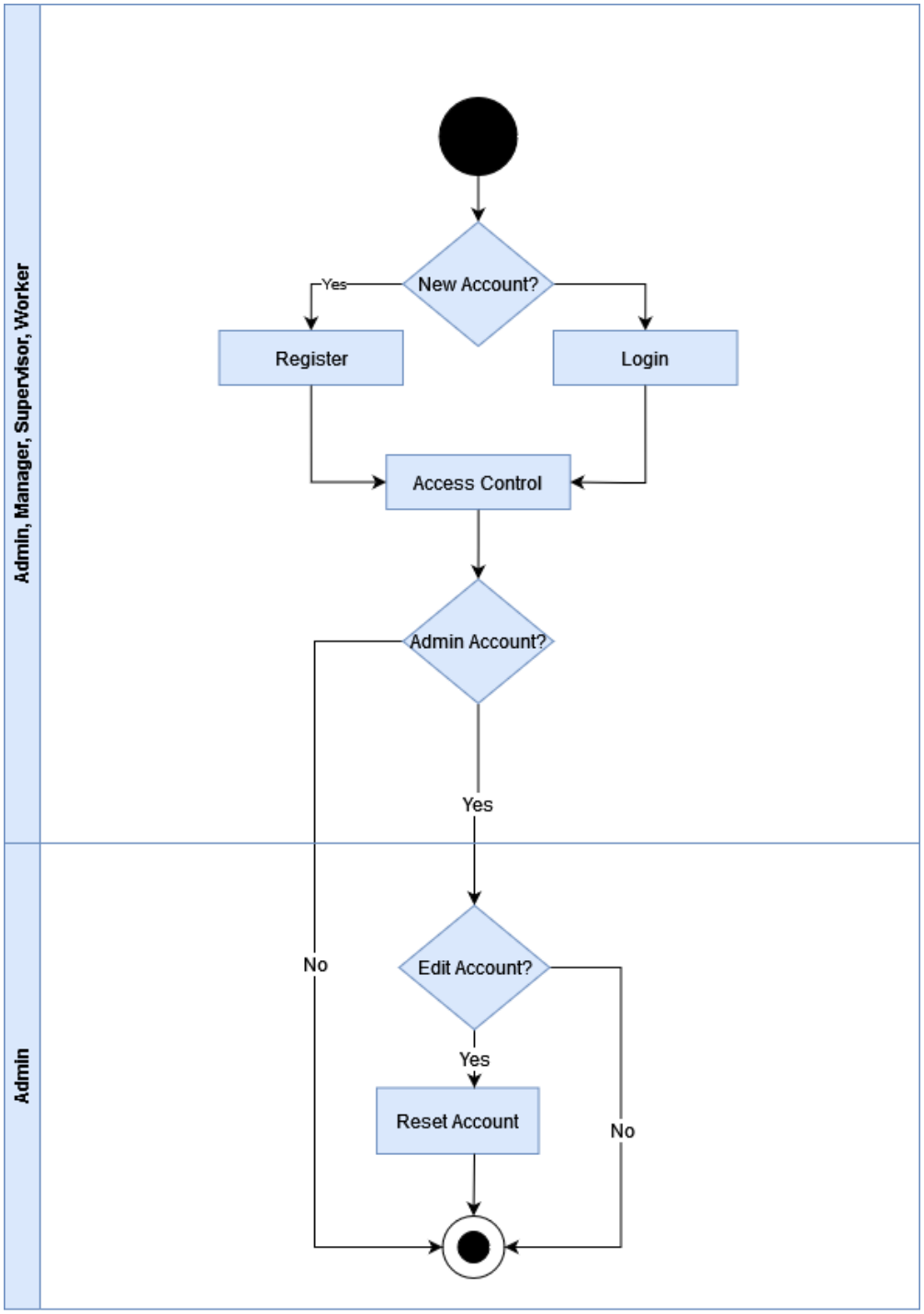


Figure: Swimlane Level 1.1

Reference: Activity Diagram Level-1.1

Level 1.1.1:

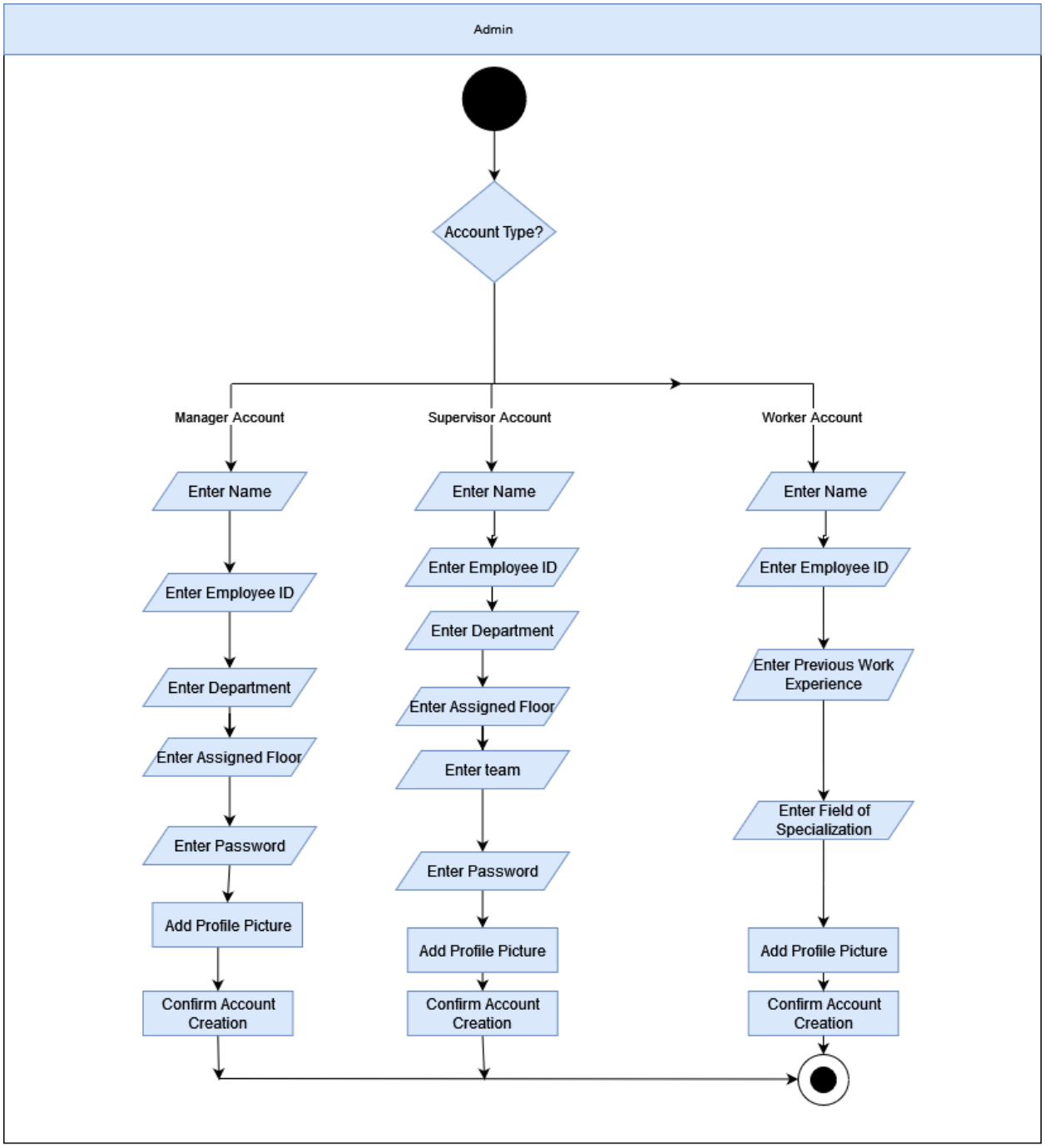


Figure: Swimlane Level 1.1.1

Reference: Activity Diagram Level-1.1.1

Level 1.1.2:

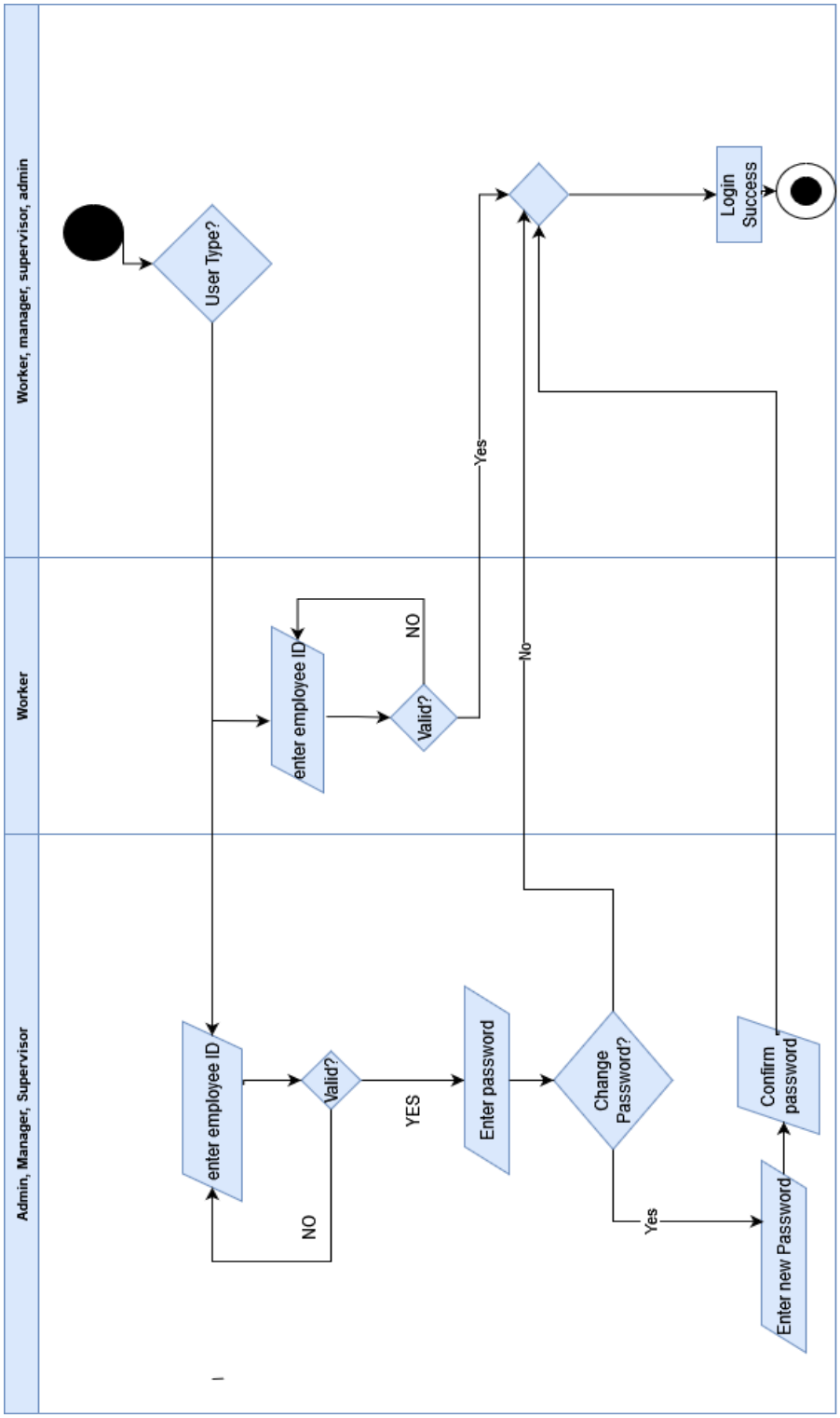


Figure: Swimlane Level 1.1.2

Reference: Activity Diagram Level-1.1.2

Level 1.1.3:

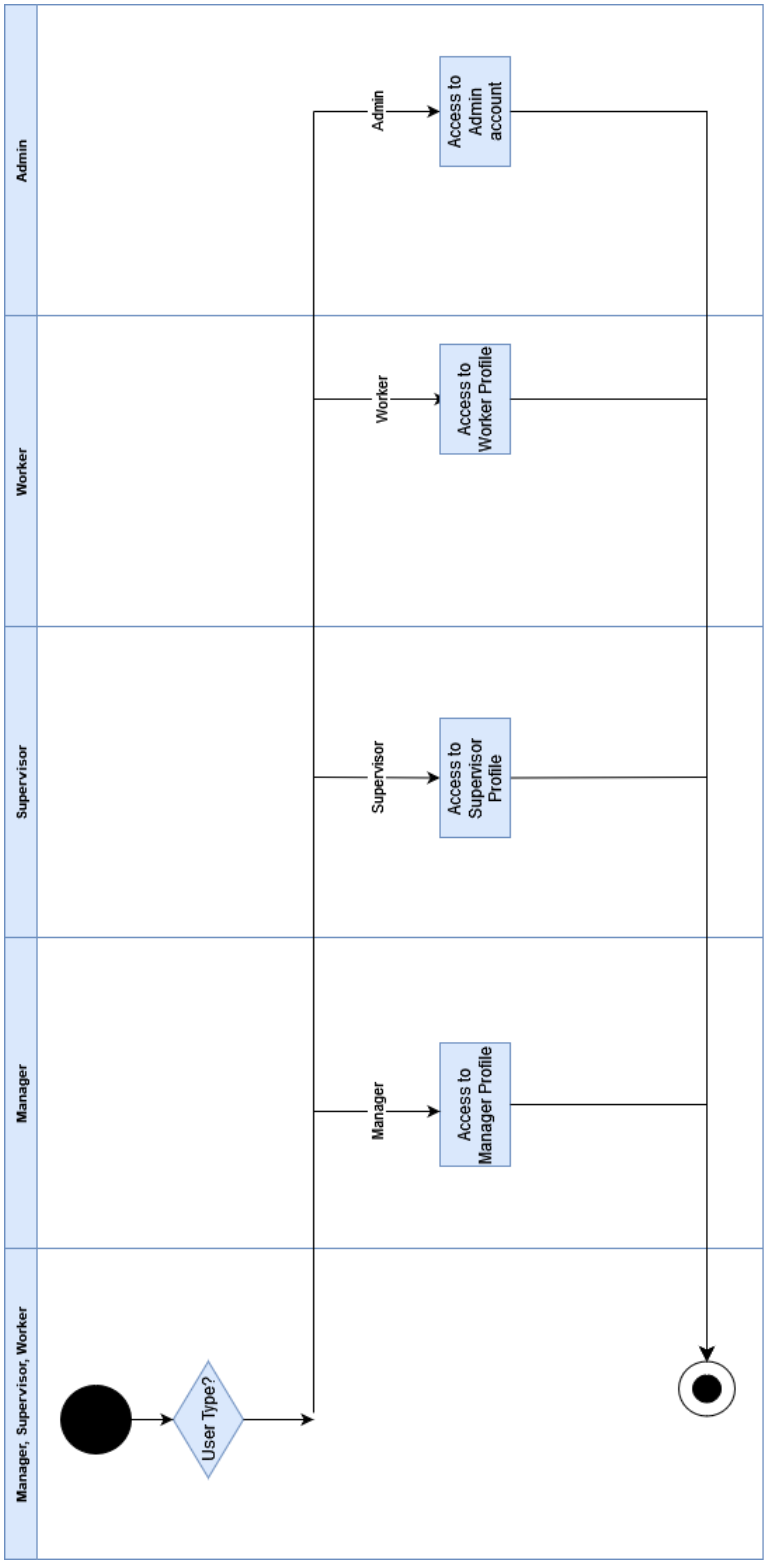


Figure: Swimlane Level 1.1.3

Reference: Activity Diagram Level-1.1.3

Level 1.1.4:

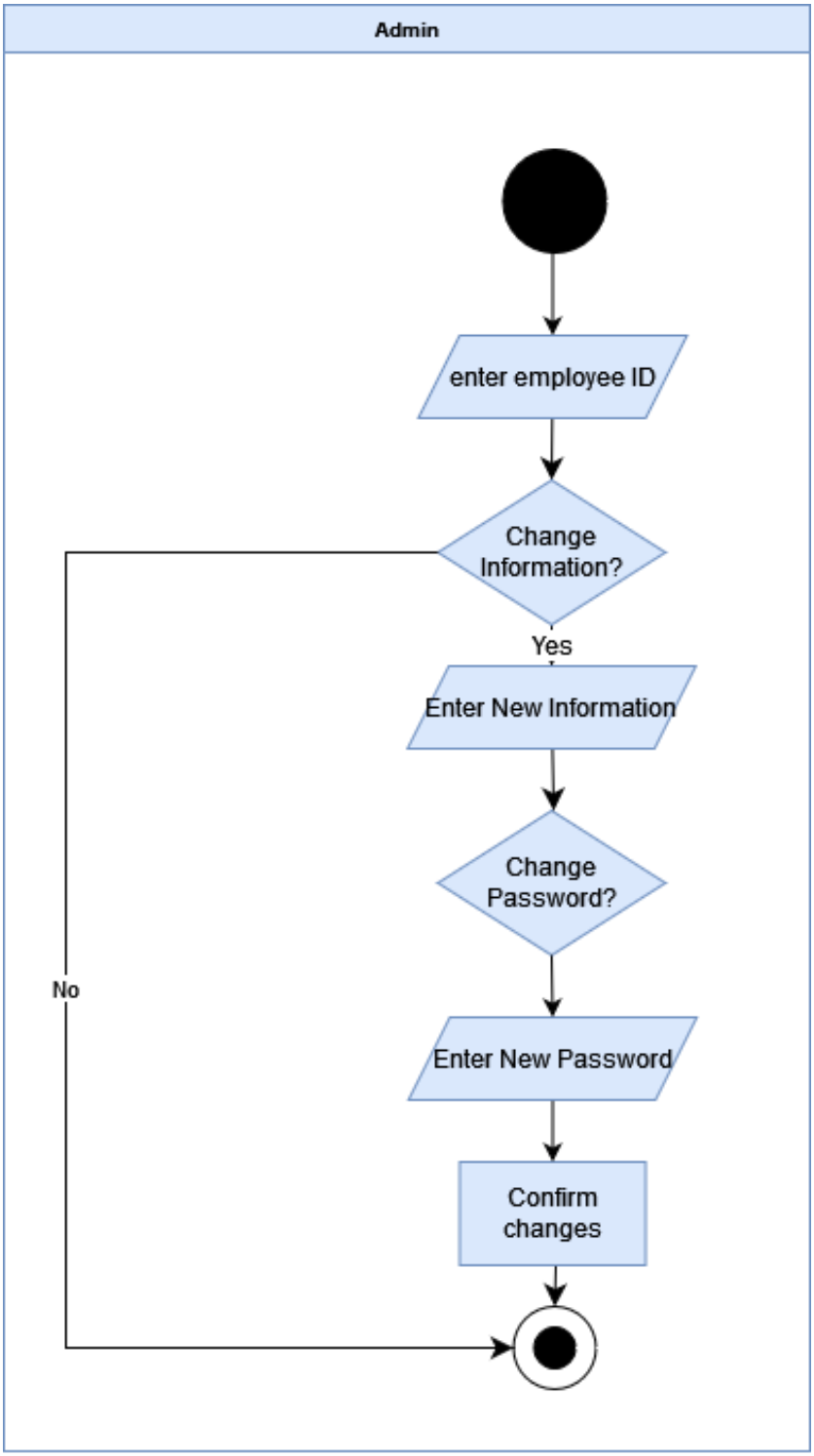


Figure: Swimlane Level 1.1.4

Reference: Activity Diagram Level-1.1.4

Level 1.2:

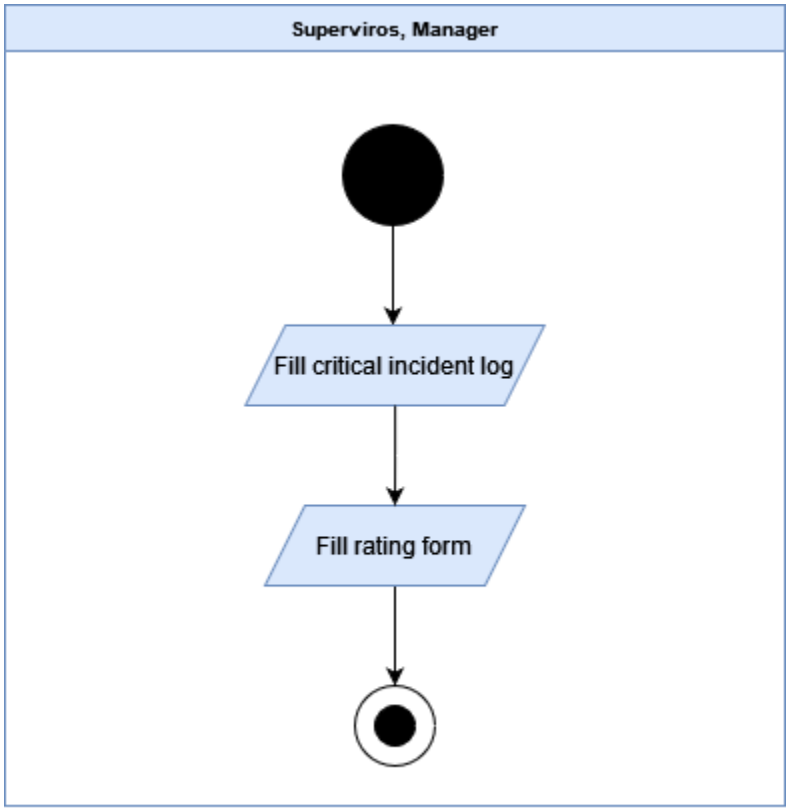


Figure: Swimlane Level 1.2

Reference: Activity Diagram Level-1.2

Level 1.2.1:

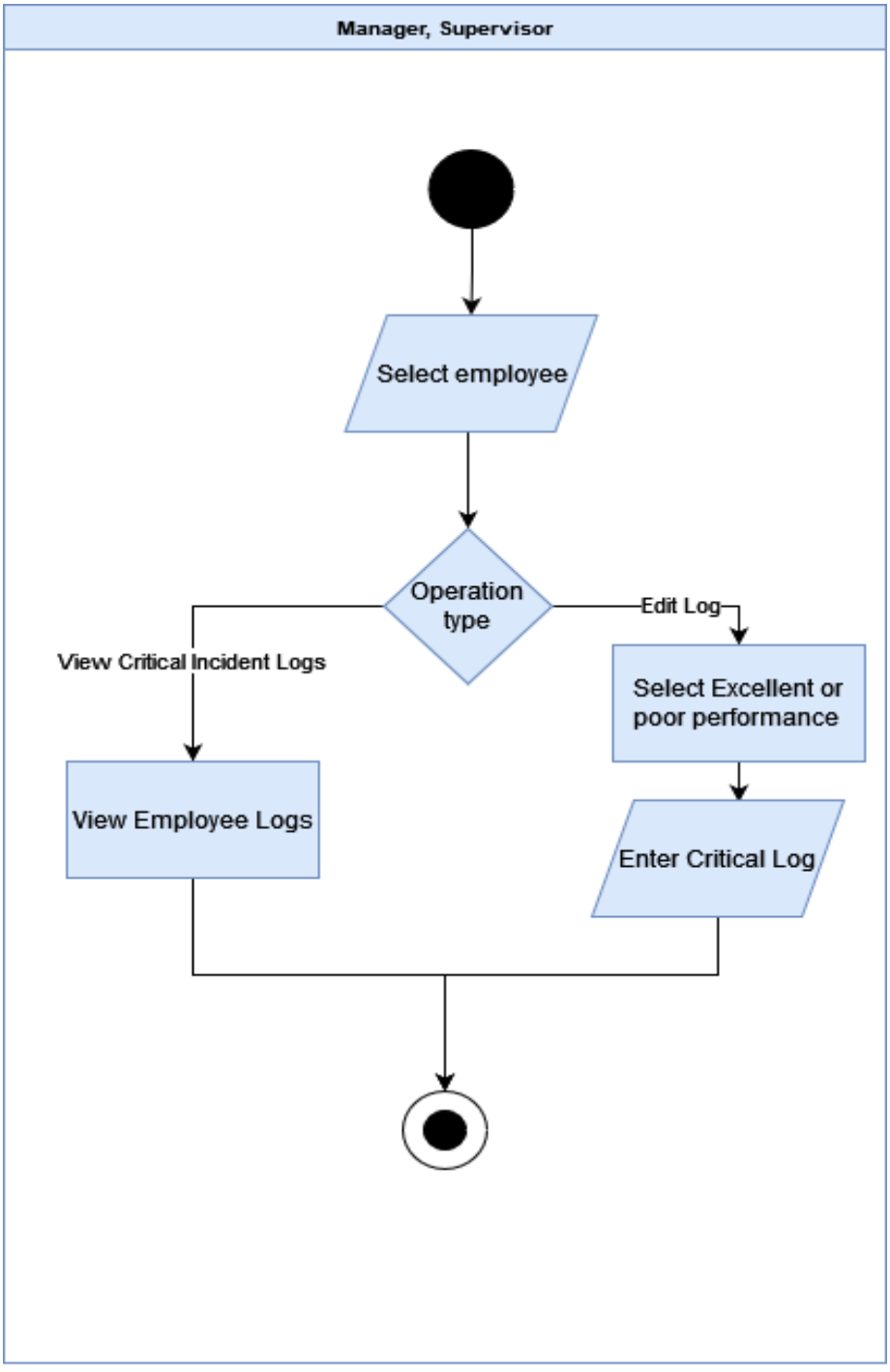


Figure: Swimlane Level 1.2.1

Reference: Activity Diagram Level-1.2.1

Level 1.2.2:

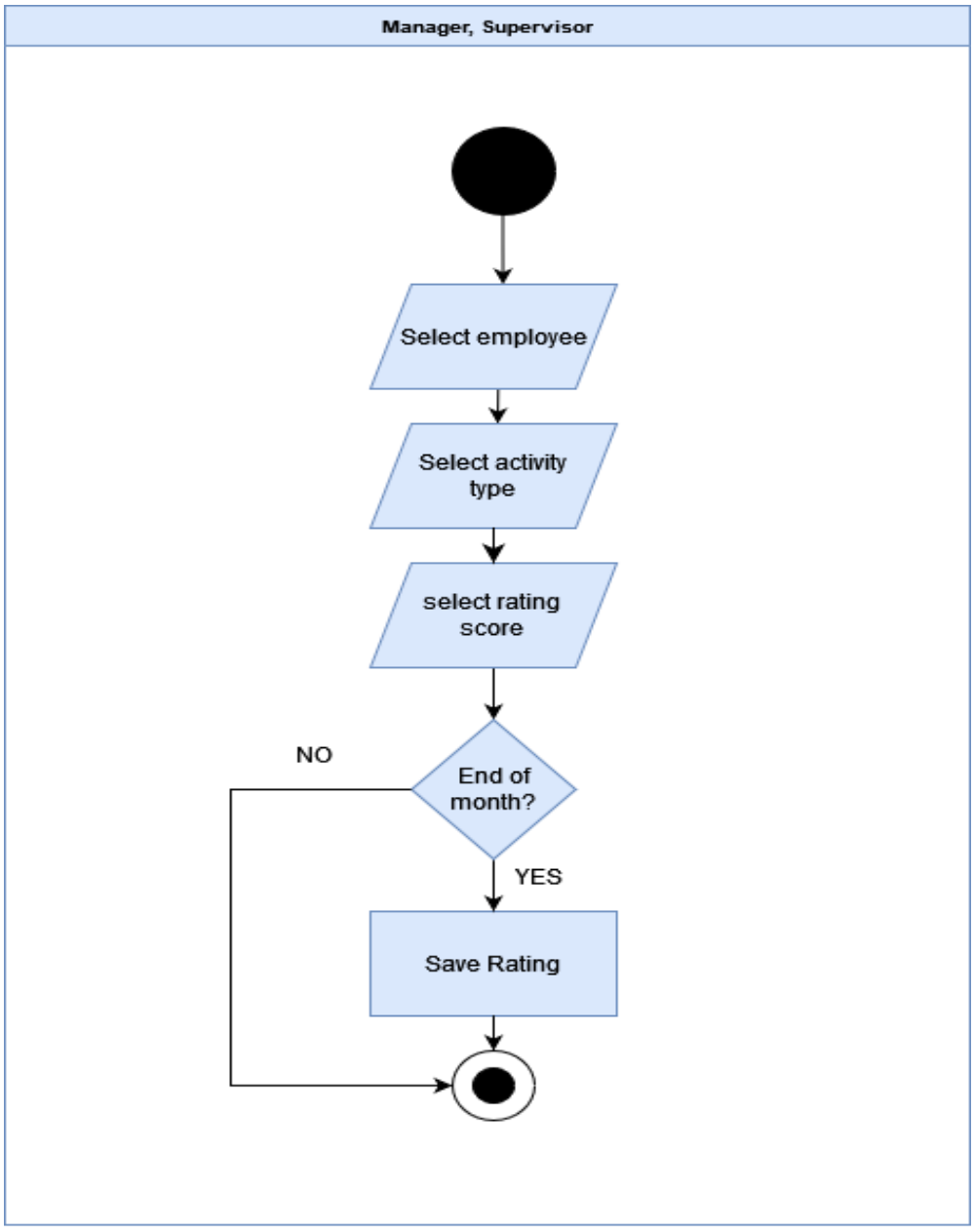


Figure: Swimlane Level 1.2.2

Reference: Activity Diagram Level-1.2.2

Level 1.3:

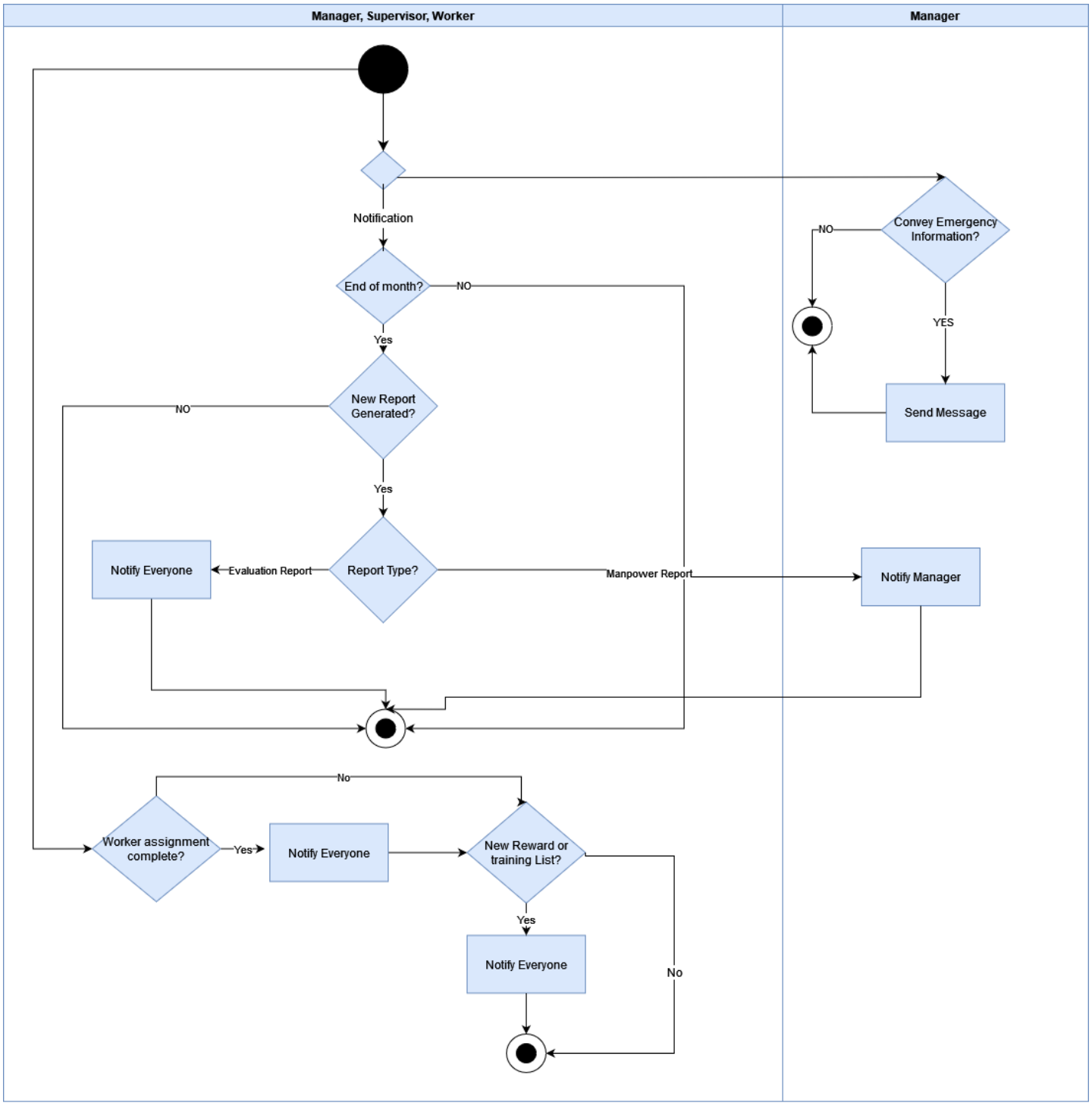


Figure: Swimlane Level 1.3

Reference: Activity Diagram Level-1.3

Level 1.4:

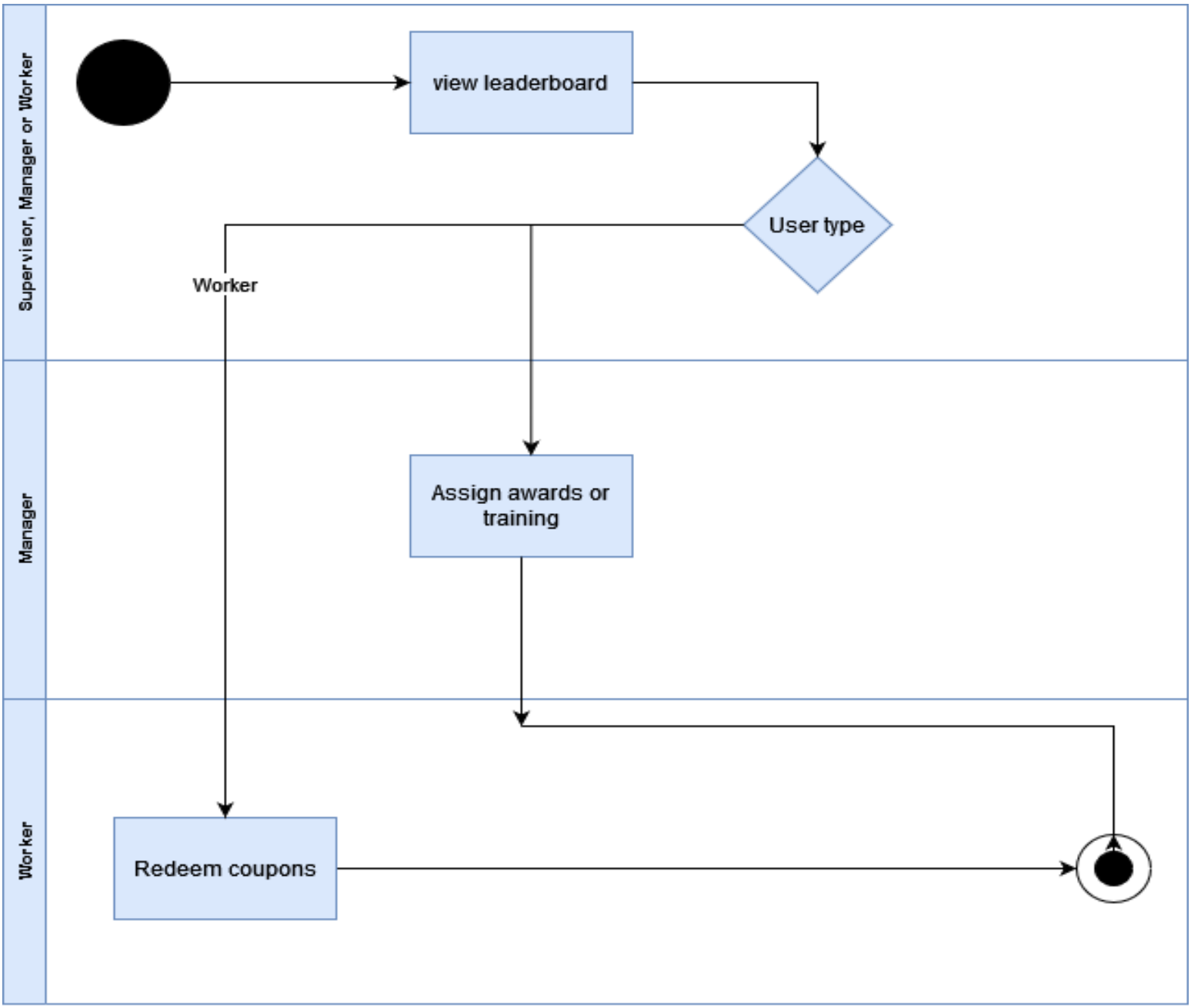


Figure: Swimlane diagram Level 1.4

Reference: Activity Diagram Level-1.4

Level 1.4.1:

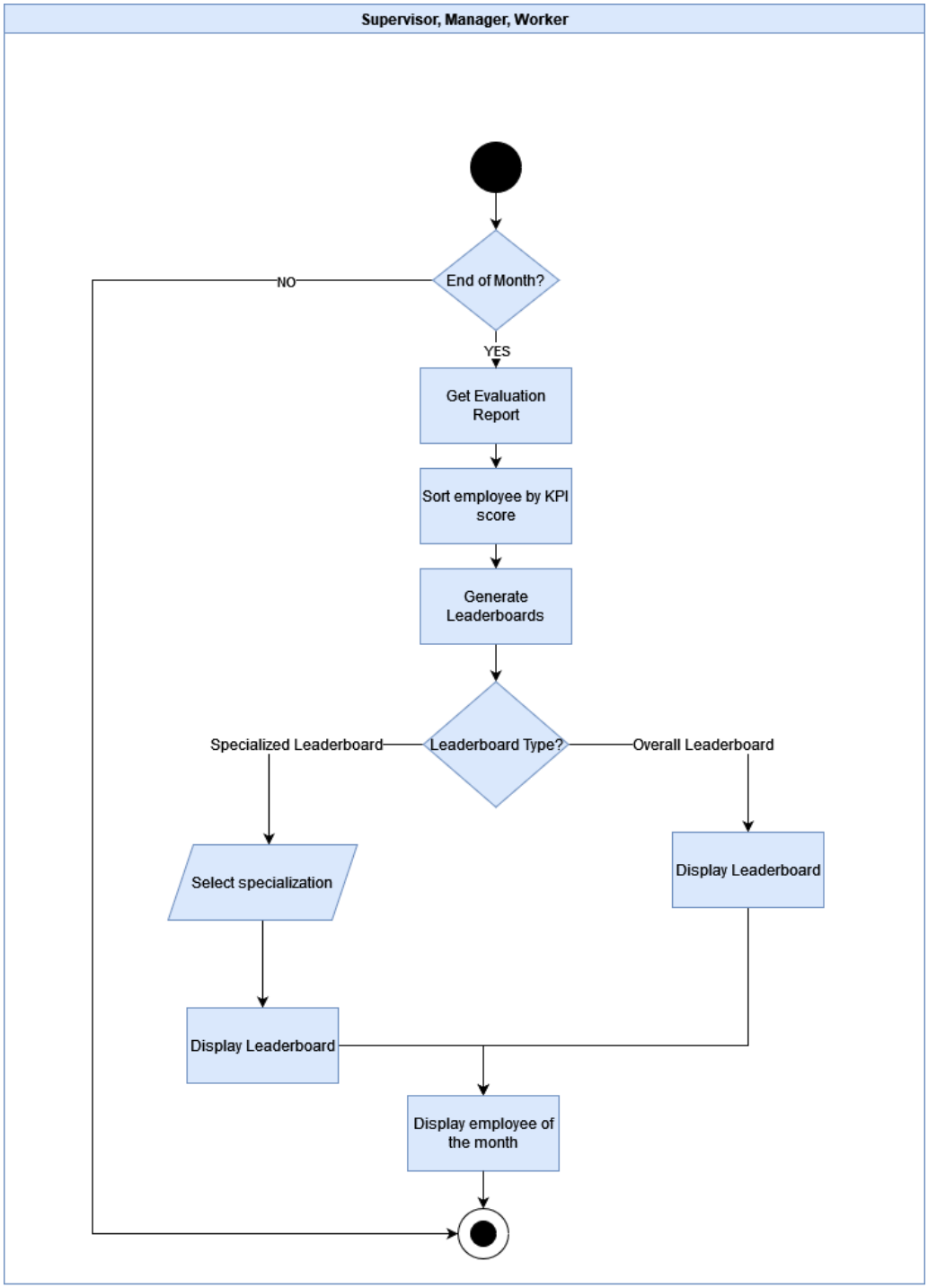
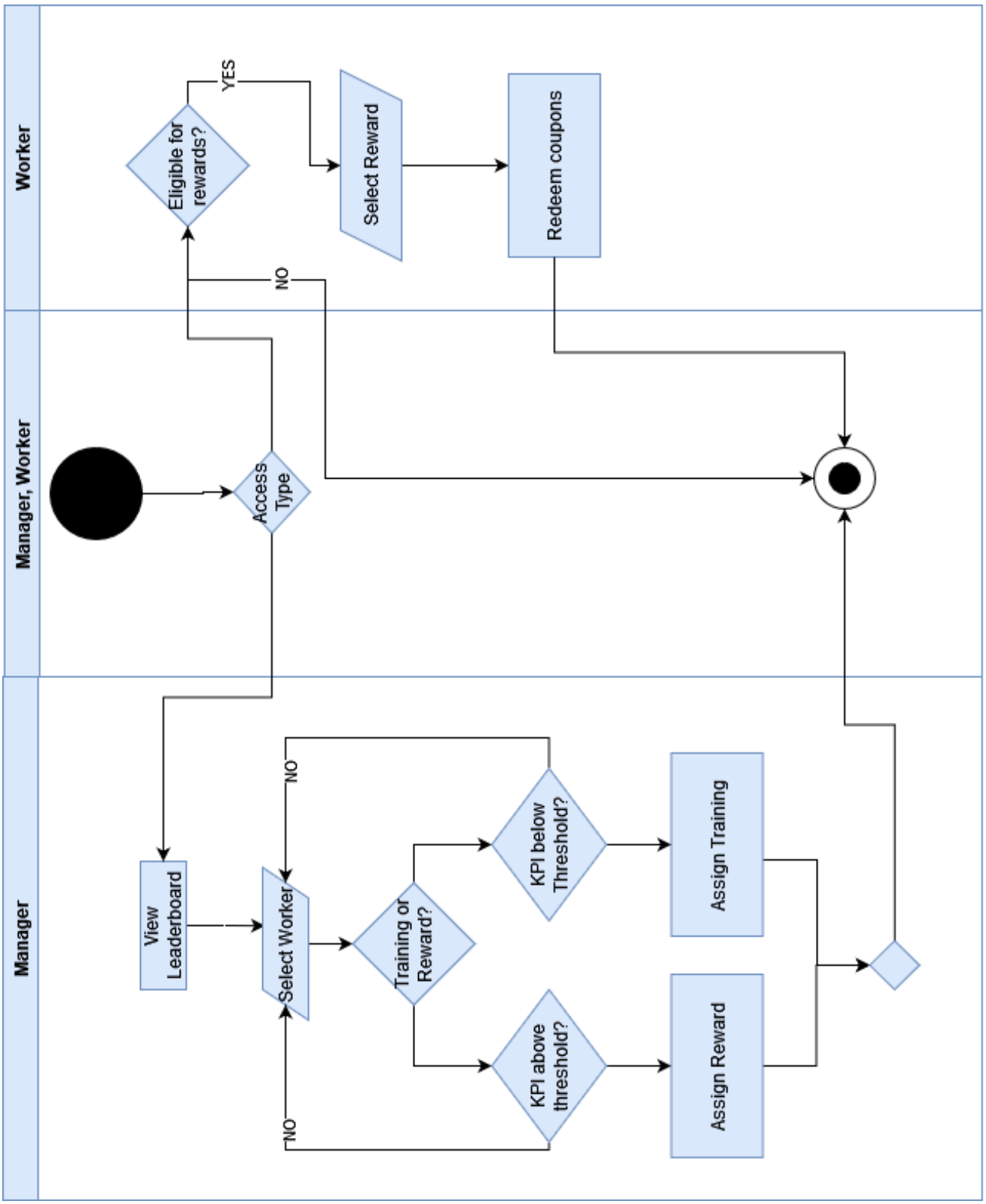


Figure: Swimlane Diagram Level 1.4.1

Reference: Activity Diagram Level-1.4.1

Level 1.4.2:

Reference: Activity Diagram Level-1.4.2



Figure; Swimlane Diagram Level 1.4.2

Level 1.5:

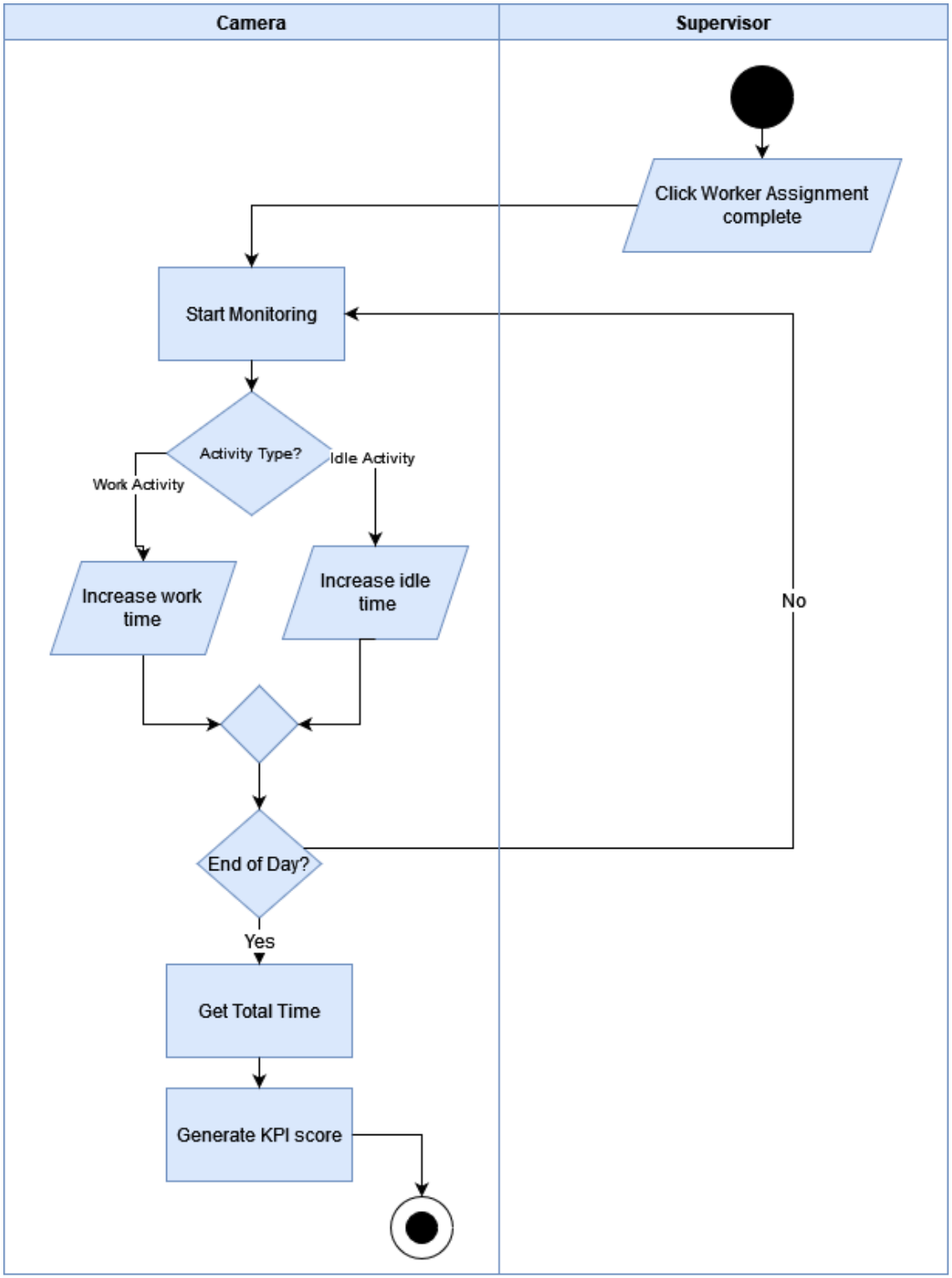


Figure: Swimlane Diagram Level 1.5

Reference: Activity Diagram Level-1.5

Level 1.6:

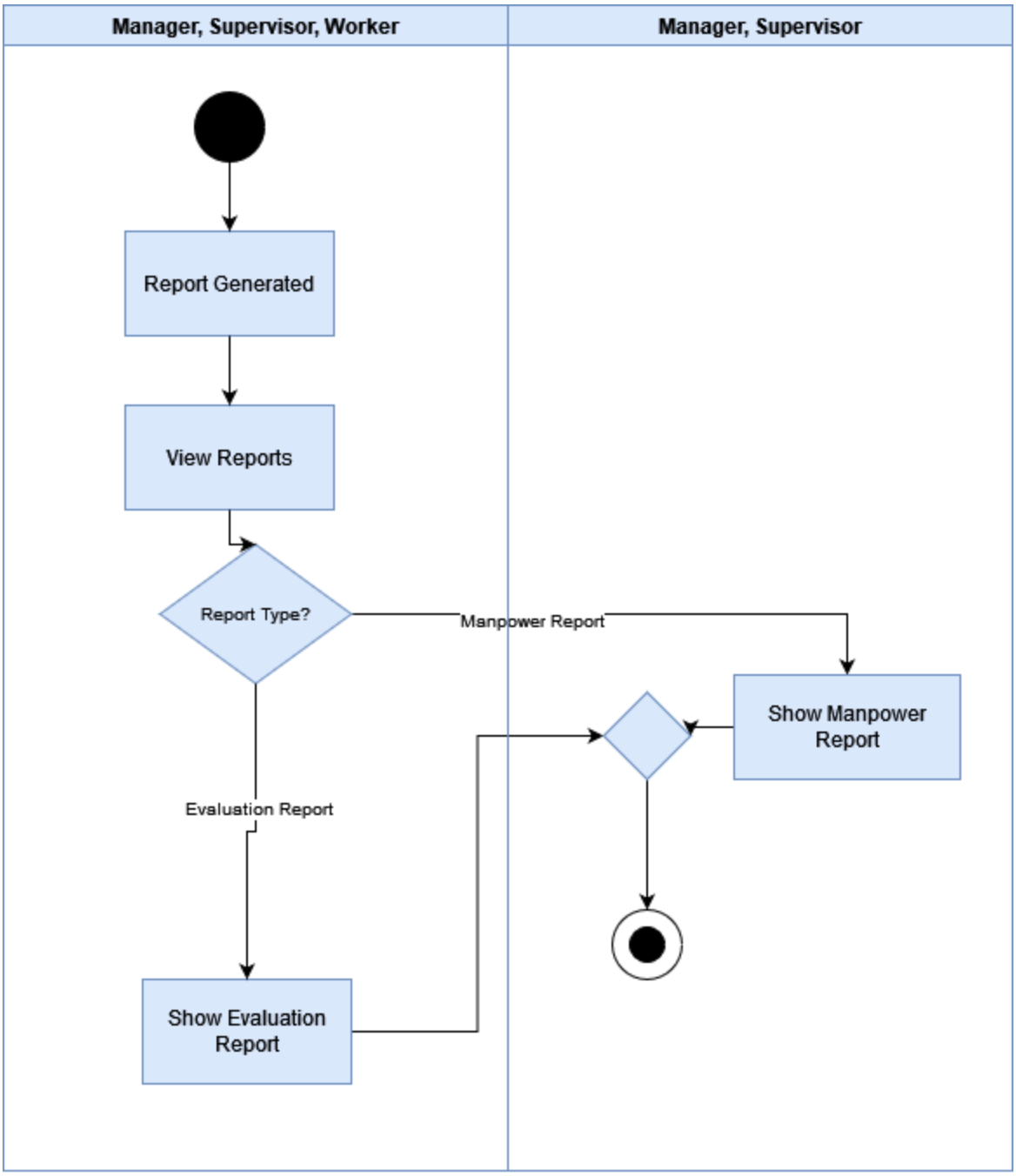


Figure: Swimlane Diagram Level 1.6

Reference: Activity Diagram Level-1.6

Level 1.6.1:

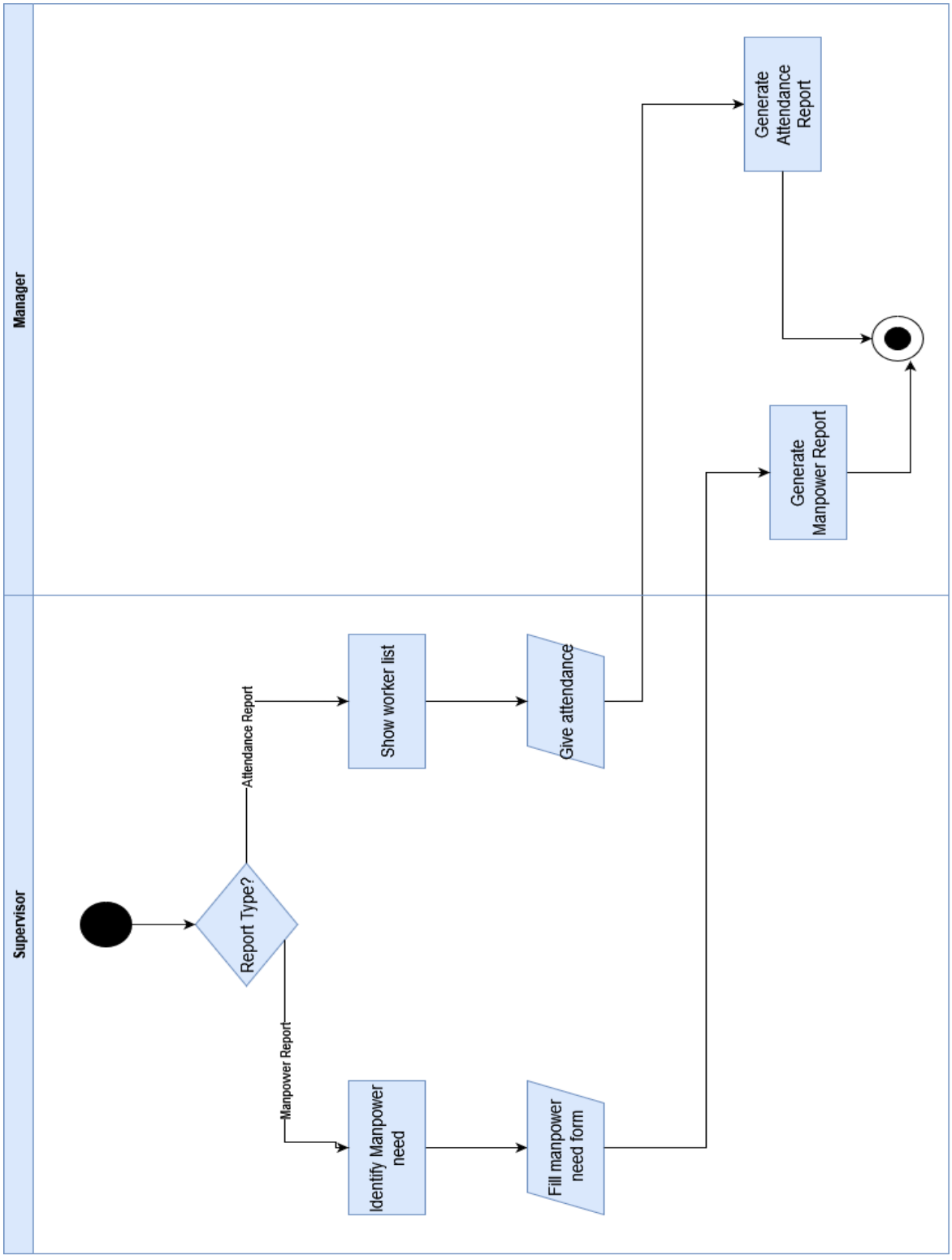


Figure: Swimlane Diagram Level 1.6.1

Reference: Activity Diagram Level-1.6.1

Level 1.6.2:

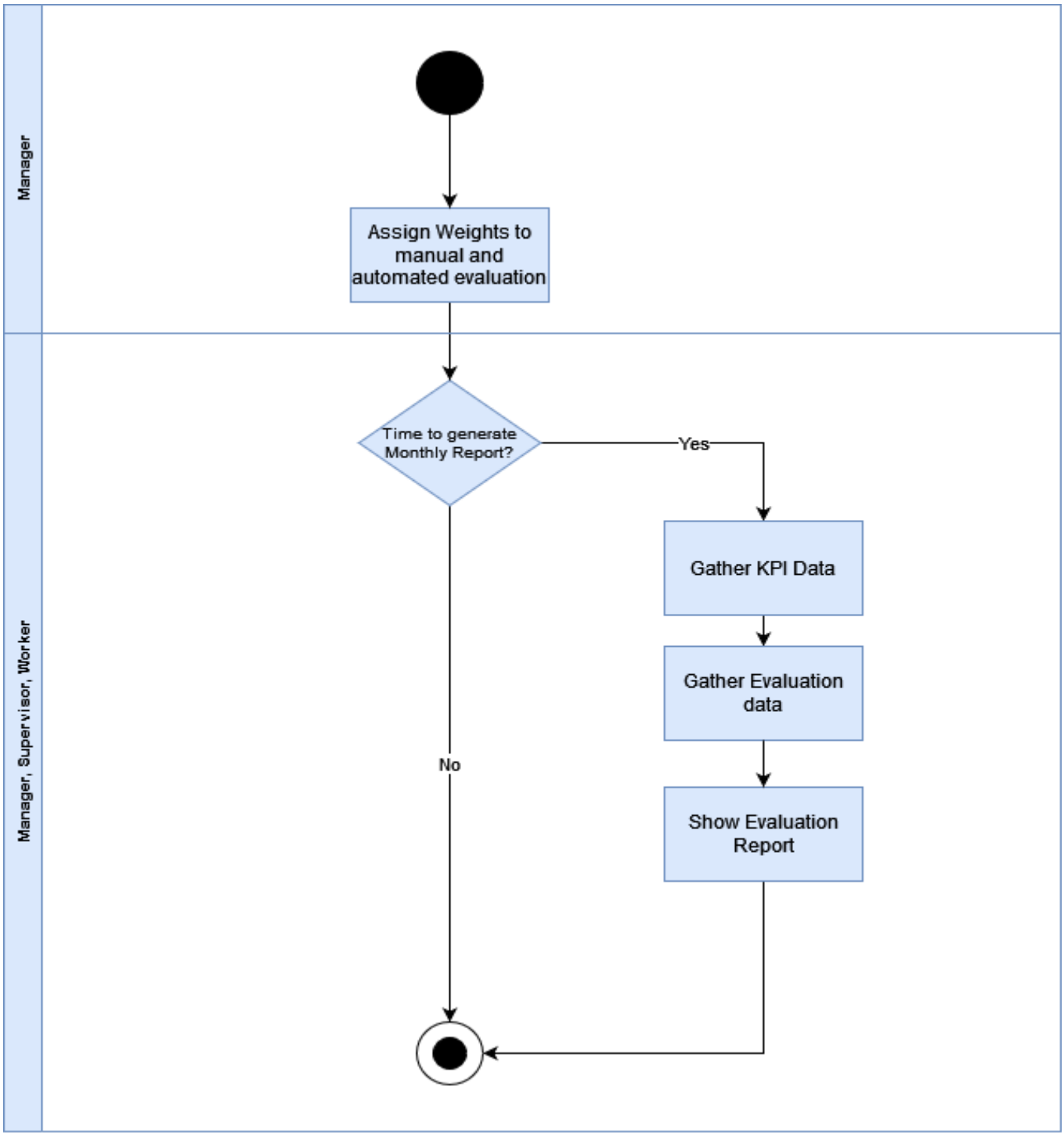


Figure: Swimlane Level 1.6.2

Reference: Activity Diagram Level-1.6.2

Level 1.7:

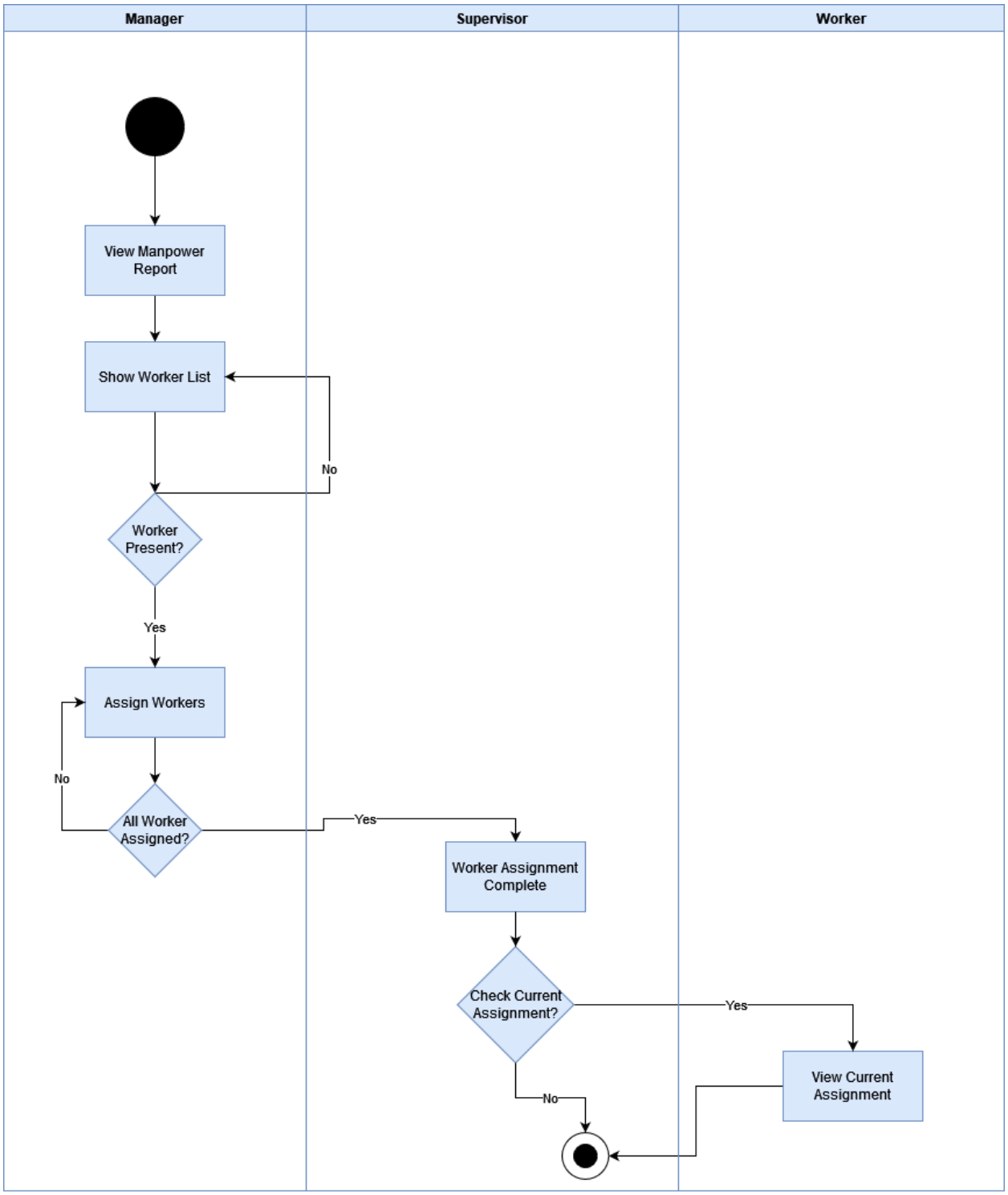


Figure: Swimlane level 1.7

Reference: Activity Diagram Level-1.7

6. Class Based Modeling

Class-based modeling represents the objects that the system will manipulate, the operations (also called methods or services) that will be applied to the objects to effect the manipulation, relationships (some hierarchical) between the objects, and the collaborations that occur between the classes that are defined. The elements of a class-based model include classes and objects, attributes, operations, class responsibility-collaborator (CRC)models, collaboration diagrams, and packages.

6.1 List of nouns:

Noun	**Solution Space**
1. Employee performance evaluation system	
2. application	
3. Versatile Garments Ltd.	
4. employee performance	Yes
5. activity recognition	Yes
6. Account Management	Yes
7. stakeholders	
8. Accounts	Yes
9. Functions	
10. Authorization level	
11. Accounts	Yes
12. Manager Accounts	Yes
13. Supervisor Accounts	Yes
14. Worker Accounts	Yes
15. Admin Accounts	Yes
16. Admin	Yes
18. Information	
19. Manager’s name	Yes

20. Manager’s Employee Id	Yes
21. Department	Yes
22. Assigned Floor	Yes
23. Manager	Yes
24. Employee id	Yes
25. password	Yes
26. Supervisor	Yes
27. Supervisor name	Yes
28. Supervisor Employee Id	Yes
29. Assigned Team	Yes
30. Recruitment	
31. Supervision	
32. Creation	
33. Information	
34. Worker	Yes
35. Worker name	Yes
36. Worker Employee Id	Yes
37. Work Experience	Yes
38. Field of specialization	Yes
39. Picture of worker	Yes
40. Profile	
41. Administrator	
42. Background worker	
43. Director	
44. Cameras	Yes
45. Employees	Yes
46. Key Performance Indicator(KPI)	Yes

47. activity	Yes
48. Criteria	
49. Job	Yes
50. Recording	Yes
51. Employee performance	Yes
52. Work hours	Yes
53. Break	Yes
54. Work Time	Yes
55. Monthly basis	Yes
56. Evaluation system	Yes
57. Appraisal Ratings	Yes
58. weights	Yes
59. Critical incident log	Yes
60. Sections	
61. Poor performance	Yes
62. Excellent performance	Yes
63. Evaluator	
64. Rating form	Yes
65. Month	Yes
66. Current job field	Yes
67. Skill rating	Yes
68. Dashboard	
69. Profile picture	Yes
70. Assigned task	Yes
71. Button	Yes
72. Plane machine	Yes
73. Helper	Yes

74. Iron man	Yes
75. Overlook machine	Yes
76. Button	Yes
77. Button Sewing	Yes
78. JS	Yes
79. BK	Yes
80. Reward panel	Yes
81. Training panel	Yes
82. Leaderboards	Yes
83. Notification	Yes
84. KPI report	Yes
85. Navigation bar	
86. List of workers	Yes
87. Employee option	
88. Worker assignment	Yes
89. Teams	Yes
90. Manpower	Yes
91. Demand of workers	Yes
92. Leaderboard Position	Yes
93. Employee tab	
94. Track	
95. Workplace	Yes
96. Overall leaderboard	Yes
97. Reports	Yes
98. Evaluation Reports	Yes
99. Manpower Reports	Yes
100. Manpower needed	Yes

101. Absent Workers	Yes
102. Emergency information	Yes
103. Tick	
104. Cross	
105. Worker list	Yes
106. Location	Yes
107. Station	
108. Assignment complete	Yes
109. KPI threshold	Yes
110. Reward system	Yes
111. Coupons	Yes
112. Redeem	Yes
113. Bonus	Yes
114. Off hours	Yes
115. Free food	Yes
116. Cafeteria	Yes
117. Special Operator	Yes
118. Master Operator	Yes

6.2 General Classification

Candidate classes are categorized based on the seven general classification. The analysis classes manifest themselves in one of the following ways:

1. External entities (e.g., other systems, devices, people) that produce or consume information to be used by a computer-based system.
2. Things (e.g., reports, displays, letters, signals) that are part of the information domain for the problem.
3. Occurrences or events (e.g., a property transfer or the completion of a series of robot movements) that occur within the context of system operation.
4. Roles (e.g., manager, engineer, salesperson) played by people who interact

with the system.

5. Organizational units (e.g., division, group, team) that are relevant to an application.

6. Places (e.g., manufacturing floor or loading dock) that establish the context of the problem and the overall function of the system.

7. Structures (e.g., sensors, four-wheeled vehicles, or computers) that define a class of objects or related classes of objects.

A candidate class is selected for special classification if it fulfills three or more Characteristics.

Selected Nouns	**General Classification**
employee performance	2
activity recognition	3
Account Management	3, 7
Accounts	3, 6, 7 (selected)
Manager Accounts	3, 6, 7 (selected)
Supervisor Accounts	3, 6, 7(selected)
Worker Accounts	3, 6, 7(selected)
Admin Accounts	3, 6, 7(selected)
Admin	4, 5, 7 (selected)
Manager's name	2
Manager's Employee Id	2
Department	2
Assigned Floor	2
Manager	4, 5, 7 (selected)
Employee id	2
password	2
Supervisor	4, 5, 7 (selected)
Supervisor name	2
Supervisor Employee Id	2

Assigned Team	2
Worker	4, 5, 7 (Selected)
Worker name	2
Worker Employee Id	2
Work Experience	2
Field of specialization	2
Picture of worker	2
Cameras	1 (Selected)
Employees	2
Key Performance Indicator(KPI)	2, 3
activity	2
Job	2
Recording	2
Employee performance	2
Work hours	2
Break	2
Work Time	2
Monthly basis	2
Evaluation system	3, 6, 7 (Selected)
Appraisal Ratings	2
weights	2
Critical incident log	3, 6, 7(selected)
Poor performance	2
Excellent performance	2
Rating form	3, 6, 7(selected)
Month	2
Current job field	2

Skill rating	2
Profile picture	2
Assigned task	2
Button	4, 5
Plane machine	4, 5
Helper	4, 5
Iron man	4, 5
Overlook machine	4, 5
Button	4, 5
Button Sewing	4, 5
JS	4, 5
BK	4, 5
Reward panel	2, 3, 6 (Selected)
Training panel	2, 3, 6 (Selected)
Leaderboards	2, 6, 7 (Selected)
Notification	2, 3, 6 (Selected)
KPI report	2
List of workers	2
Worker assignment	2
Teams	2
Manpower	2
Demand of workers	2
Leaderboard Position	2
Workplace	2
Overall leaderboard	2
Reports	2, 3, 7(Selected)
Evaluation Reports	2, 3, 7(Selected)

Manpower Reports	2, 3, 7(Selected)
Manpower needed	2
Absent Workers	2
Emergency information	2
Worker list	2
Location	2,6
Assignment complete	2
KPI threshold	2
Reward system	3, 6, 7 (Selected)
Coupons	2
Redeem	2
Bonus	2
Off hours	2
Free food	2
Cafeteria	2,6
Special Operator	4, 5
Master Operator	4, 5

6.3 Selection Criteria

Candidate classes are categorized based on the seven general classification. The analysis classes manifest themselves in one of the following ways:

1. Retained information. The potential class will be useful during analysis only if information about it must be remembered so that the system can function.
2. Needed services. The potential class must have a set of identifiable operations that can change the value of its attributes in some way
3. Multiple attributes. During requirement analysis, the focus should be on “major” information; a class with a single attribute may, in fact, be useful during design, but is probably better represented as an attribute of another class during the analysis activity.

4. Common attributes. A set of attributes can be defined for the potential class and these attributes apply to all instances of the class.
5. Common operations. A set of operations can be defined for the potential class and these operations apply to all instances of the class.
6. Essential requirements. External entities that appear in the problem space and produce or consume information essential to the operation of any solution for the system will almost always be defined as classes in the requirements model.

A final class list is made after reviewing the list and merging multiple candidate classes if needed.

Selected Classes	**Selection Criteria**
Accounts	1, 2, 3, 4, 5, 6 (Selected)
Manager Accounts	1, 2, 3, 4, 5 (Selected)
Supervisor Accounts	1, 2, 3, 4, 5 (Selected)
Worker Accounts	1, 2, 3, 4, 5 (Selected)
Admin Accounts	1, 2, 3, 4, 5 (Selected)
Admin	1, 2, 3, 4, 5 (Selected)
Manager	1, 2, 3, 4, 5 (Selected)
Supervisor	1, 2, 3, 4, 5 (Selected)
Worker	1, 2, 3, 4, 5 (Selected)
Cameras	2, 6 (Selected)
Evaluation system	1, 2, 3, 4, 5 (Selected)
Critical incident log	1, 3
Rating form	1, 3
Reward panel	1, 2
Training panel	1, 2
Leaderboards	1, 2, 3, 4, 5 (Selected)
Notification	2, 4, 5
Reports	1, 2, 3, 4, 5 (Selected)

Evaluation Reports	1, 2, 3, 4, 5 (Selected)
Manpower Reports	1, 2, 3, 4, 5 (Selected)
Reward system	1, 2, 3, 4, 5 (Selected)

6.4 List of verbs

1. Will be created
2. Following
3. Needed
4. Creating
5. Login
6. Assigned
7. Change
8. Authorization
9. Will be added
10. Maintain
11. Will use
12. Monitor
13. Idling
14. Evaluated
15. Will be rated
16. Logging
17. Evaluate
18. Select
19. Add
20. Save
21. Fill
22. Can be accessed
23. Excel
24. View
25. Receive
26. Will be notified
27. Will notify
28. Can access
29. Perform
30. Will provide
31. Are needed
32. Contain
33. Can be sorted
34. Receive

35. Shows
36. Needed
37. Be rewarded
38. Using
39. Will contain
40. Gamified
41. Will monitor
42. Will influence
43. Will have
44. Mentioned
45. Will contain
46. Monitor
47. Needed
48. Completes
49. Will ensure
50. Are stationed
51. Specified
52. Confirming
53. Will click
54. Changes
55. Send
56. Be sent
57. Using
58. Reward
59. Training
60. Can be redeemed

6.5 Selected classes

1. Accounts
2. Manager Accounts
3. Supervisor Accounts
4. Worker accounts
5. Admin Accounts
6. Admin
7. Manager
8. Supervisor
9. Worker
10. Cameras
11. Evaluation system
12. Leaderboards
13. Notification
14. Reports

15. Evaluation reports
16. Manpower Reports
17. Reward System

6.6 List of Objects

1. Accounts:
    a. Attributes: employeeID, password
    b. Methods: +login(), +createAccount(), accessControl(), changePassword()
2. Manager Accounts:
    a. Attributes: employeeID, password
    b. Methods: +login(), accessControl(), changePassword()
3. Supervisor Accounts:
    a. Attributes: employeeID, password
    b. Methods: +login(), accessControl(), changePassword()
4. Worker Accounts:
    a. Attributes: employeeID, password
    b. Methods: +login(), accessControl(), changePassword()
5. Admin Accounts:
    a. Attributes: employeeID, password
    b. Methods: +login(), +createAccount(), accessControl(), changePassword()
6. Admin:
    a. Attributes: adminName, adminID
    b. Methods: accessAccountControls()
7. Manager:
    a. Attributes: managerName, managerID, department, assignedFloor
    b. Methods: accessProfile(), useWorkerList(), assignWorkers(), changeAssignment(), accessLeaderboards(), accessRewardsandTraining(), ,accessCriticalIncidentLog(), accessRatingForm(), viewReports()
    , receiveNotification(), conveyEmergencyInformation()
8. Supervisor:
    a. Attributes: supervisorName, supervisorID, department, assignedFloor, assignedTeam
    b. Methods: generateManpowerReport(), specifyManpowerNeeder(), fillAbsentReport(), workerAssignmentComplete(), accessCriticalIncidentLog(), accessRatingForm(), viewLeaderboards(), viewRewardsandTraining(), viewReports(), receiveNotification()
9. Workers:
    a. Attributes: workerName, workerEmployeeID, profilePicture, previousWorkExperience, fieldOfSpecialization, currentAssignedTask, overAllKPI, planeMachineKPI, helperKPI, ironmanKPI, overlookMachineKPI, buttonKPI, buttonSewingKPI, jsKPI, bkKPI, masterOperatorField, specialOperatorField, coupons

   b. Methods: mentionSpecialization(), checkKPI(), showDetailedKPI(), viewLeaderboards(), viewRewardsandTraining(), seeAssignedJobs(), receiveNotification()
10. Camera:
   a. Attribute: workplace, employeeID
   b. Methods: monitorEmployees(), activityRecognition(), calculateKPI()
11. Evaluation system:
   a. Attribute: worker, KPI, criticalLogs, ratings
   b. Methods: assignWeights(), calculateTotakKPI(), selectCriticalLogs(), addLogs(), accessRatingForm(), setRating()
12. Leaderboard:
   a. Attribute: leaderboardType, leaderboardPosition
   b. Methods: showSpecializedLeaderboard(), showOverallLeaderboard(), useEvaluationScore(), generateLeaderboard()
13. Notification:
   a. Attribute: information, notice
   b. Methods: sendNotification(), sendEmergencyInformation()
14. Reports:
   a. Attribute: detailedKPIReport, manpowerReport, evaluationReport
   b. Methods: gatherData(), generateReport()
15. Evaluation reports:
   a. Attribute: weightOfApprisal, weightOfKPI, report
   b. Methods: gatherRating(), gatherKPIScores(), generateReport()
16. Manpower Reports:
   a. Attribute: manpowerNeeded, absentWorkers, report
   b. Methods: fillManpowerNeededForm(), fillAbsenteesReport(), gatherData(), generateReport()
17. Reward System:
   a. Attribute: coupons, bonus, freeFood, offHours, rewardList, trainingList
   b. Methods: assignTraining(), assignRewards(), redeemCoupon(), showRewardList(), showTrainingList()

Analysis:

1. Admin Accounts, Manager accounts, supervisor accounts and worker accounts classes are unnecessary if the Account class is present as it holds the attributes and methods of the remaining classes.
2. As admin, supervisor, manager and workers all have some common attributes and methods, we make a superclass Employee and place these classes as subclasses under that class.
3. Camera class is renamed as Activity recognition for better readability.
4. Leaderboard class is renamed as Gamification for better readability.
5. Evaluation system is renamed as evaluation.
6. Reward system is renamed as Rewards.

6.7 Final Class List

1. **Accounts:**
    a. Attributes: employeeID, password
    b. Methods: +login(), +createAccount(), accessControl(), changePassword()
2. **Admin:**
    a. Attributes: adminName, adminID
    b. Methods: accessAccountControls()

3. **Employees:**
    a. Attributes: employeeName, employeeID
    b. Methods:viewReports(),accessLeaderboards(), viewRewardsandTrainingPanel(), receiveNotification()

    a. Manager:
        i. Attributes: managerName, managerID, department, assignedFloor
        ii. Methods:+accessWorkerProfile(), +useWorkerList(), +assignWorkers(), +changeAssignment(), +accessRewardsandTraining(), +accessCriticalIncidentLog(), +accessRatingForm(), +conveyEmergencyInformation()
    b. Supervisor:
        i. Attributes: supervisorName, supervisorID, department, assignedFloor, assignedTeam
        ii. Methods: generateManpowerReport(), specifyManpowerNeeder(), fillAbsentReport(), workerAssignmentComplete(), accessCriticalIncidentLog(), accessRatingForm()
    c. Workers:
        i. Attributes: workerName, workerEmployeeID, profilePicture, previousWorkExperience, fieldOfSpecialization, currentAssignedTask, overAllKPI, planeMachineKPI, helperKPI, ironmanKPI, overlookMachineKPI, buttonKPI, buttonSewingKPI, jsKPI, bkKPI, masterOperatorField, specialOperatorField, coupons
        ii. Methods: mentionSpecialization(), checkKPI(), showDetailedKPI(), viewLeaderboards(), viewRewardsandTraining(), seeAssignedJobs(), receiveNotification()

4. Activity Recognition:
    d. Attribute: workplace, employeeID
    e. Methods: monitorEmployees(), activityRecognition(), calculateKPI()

5. Evaluation:
    f. Attribute: worker, KPI, criticalLogs, ratings
    g. Methods: assignWeights(), calculateTotakKPI(), selectCriticalLogs(), addLogs(), accessRatingForm(), setRating()

6. Gamification:

h. Attribute: leaderboardType, leaderboardPosition, workerList
i. Methods: showSpecializedLeaderboard(), showOverallLeaderboard(), useEvaluationScore(), generateLeaderboard()

7. Notification:

j. Attribute: information, notice
k. Methods: sendNotification(), sendEmergencyInformation()

8. Reports:

l. Attribute: detailedKPIReport, manpowerReport, evaluationReport, weightOfApprisal, weightOfKPI,absentWorkers, report
m. Methods: gatherData(),gatherRating(), gatherKPIScores(), fillManpowerNeededForm(), fillAbsenteesReport(), generateReport()

9. Rewards:

n. Attribute: coupons, bonus, freeFood, offHours, rewardList, trainingList
o. Methods: assignTraining(), assignRewards(), checkThreshold(), redeemCoupon(), showRewardList(), showTrainingList()

CRC card of Accounts:

Class: Accounts	
Attributes	Methods
-employeeID, -password	+login(), +createAccount(), +accessControl(), +changePassword(), +editInformation()
Responsibility	Collaborators
1. The system has to be user friendly.	Employees(Admin, Supervisor, Manager, Workers)
1. All users must login to the system using username and password	
2. Users must be logged in before performing any operation	Employees(Admin, Supervisor, Manager, Workers)
3. The system must have an administrator account.	Admin
4. The connection must be safe and secure	Admin

CRC Card for Employee Class

Class: Employee	
Attributes	Methods
-employeeName, -employeeID	+viewReports(), +accessLeaderboards(), +showRewardsandTrainingList(), +receiveNotification()
Responsibility	Collaborators
1. Each employee will have a profile in the system.	
2. Employees, managers, supervisors and admin staff will be able to login to their own respective profiles	Accounts
3. Each employee will receive notifications about assigned work.	Notification
4. Monitoring employees by using the camera.	Activity Recognition
5. A gamified system where employees will be rewarded based on their performance ratings taken from leaderboard systems generated using KPIs.	Gamification
6. Communicate evaluation reports to employees using the system.	Notification, Reports
7. Workers can see their evaluation records through the system.	Gamification, Reports

CRC Card of Admin Class

Class: Admin	
Attributes	Methods

-adminName, -adminID	+accessAccountControls()
Responsibility	Collaborators
1. The system must have an administrator account.	Accounts

CRC Card of Manager

Class: Manager	
Attributes	Methods
-managerName, -managerID, -department, -assignedFloor	+accessWorkerProfile(), +useWorkerList(), +assignWorkers(), +changeAssignment(), +accessRewardsandTraining(), +accessCriticalIncidentLog(), +accessRatingForm(), +accessWeights(), +conveyEmergencyInformation(),
Responsibility	Collaborators
1. Use the system to assign workers to workplaces.	Workers, Supervisors
2. Assigned work of workers can be changed anytime.	Worker
3. A gamified system where employees will be rewarded based on their performance ratings taken from leaderboard systems generated using KPIs.	Gamification
4. Communicate evaluation reports to employees using the system.	Notification, Reports
8. Workers can see their evaluation records through the system.	Gamification, Reports
9. Have rating forms to rate employees.	Evaluation

10. Use critical incident logs to monitor employees.	Evaluation
11. Assignment of rewards and training through the system to employees.	Rewards
12. Notification system to notify about any new reports or messages from the manager.	Notification

CRC Card of Worker

Class: Worker	
Attributes	Methods
-workerName, -workerEmployeeID, -profilePicture, -previousWorkExperience, -fieldOfSpecialization, -currentJobField, -overAllKPI, -planeMachineKPI, -helperKPI, -ironmanKPI, -overlookMachineKPI, -buttonKPI, -buttonSewingKPI, -jsKPI, -bkKPI, -masterOperatorField, -specialOperatorField, -coupons	+mentionSpecialization(), +checkKPI(), +showDetailedKPI(), +seeAssignedJobs(), +setAssignedTask(), +redeemCoupon()
Responsibility	Collaborators
1. Employees, managers, supervisors and admin staff will be able to login to their own respective profiles	Accounts
2. Coupon system to reward employees.	Rewards
3. A gamified system where employees will be rewarded based on their performance ratings taken from leaderboard systems generated using KPIs.	Gamification
4. Assignment of rewards and training through the system to employees.	Rewards

5. Communicate evaluation reports to employees using the system.	Reports
6. Keep records of employee specialization.	Evaluation
5. Communicate evaluation reports to employees using the system.	Notification, Reports
6. Each employee will receive notifications about assigned work.	Manager, Notification

CRC Card of Supervisor

Class: Supervisor	
Attributes	Methods
-supervisorName, -supervisorID, -department, -assignedFloor, -assignedTeam	+specifyManpowerNeeded(), +fillAbsentReport(), +workerAssignmentComplete(), +accessCriticalIncidentLog(), +accessRatingForm()
Responsibility	Collaborators
1. The system will generate reports on manpower and evaluation.	Reports
2. Workers can see their evaluation records through the system.	Gamification
3. Employees, managers, supervisors and admin staff will be able to login to their own respective profiles.	Accounts
4. Communicate evaluation reports to employees using the system.	Reports, Notification
5. A gamified system where employees will be rewarded based on their performance ratings taken from	Gamification

leaderboard systems generated using KPIs.	
6. Keep records of employee specialization.	Worker, Evaluation
7. Assignment of rewards and training through the system to employees.	Rewards
8. Each employee will receive notifications about assigned work.	Notification

CRC card for Activity Recognition Class

Class: Activity Recognition	
Attributes	Methods
workplace, employeeID	+monitorEmployees(), +activityRecognition(), +calculateKPI()
Responsibility	Collaborators
1. The system will monitor employees using the camera	Evaluation
2. Generate KPI ratings specific to different activities	Evaluation

CRC card for Evaluation class

Class: Evaluation	
Attributes	Methods
worker, KPI, criticalLogs, ratings	+assignWeights(), +calculateTotalKPI(), +selectCriticalLogs(), +addLogs(), +accessRatingForm(), +setRating(), +getAttendance(), +seeDetailedKPI(), +seeSpecialization()
Responsibility	Collaborators
1. Generate KPI ratings to different activities	Activity Recognition
2. Using critical incident logs to monitor employees	Manager
3. Have rating forms to rate employees	Reports
4. Communicate evaluation reports to employees using the system.	Reports
5. Evaluate employees using the system.	
6. Keep track of employee attendance using the system.	Reports

CRC card for Gamification Class

Class: Gamification	
Attributes	Methods
-leaderboardType, -leaderboardPosition	+showSpecializedLeaderboard(), +showOverallLeaderboard(), +useEvaluationScore(), +generateLeaderboard()

Responsibility	Collaborators
1. Keeping records of employee specialization	Evaluation
2. The system must be able to distinguish workers who excel in multiple activities	Reports
3. Workers can see their evaluation records through the system	Notification, Employees
4. Storing performance ratings of employees based on KPI generation	Activity Recognition, Reports

CRC card for Notification Class

Class: Notification	
Attributes	Methods
Information, notice	+sendNotification(), +sendEmergencyInformation()
Responsibility	Collaborators
1. Notification about report generation will be sent through the system.	Employees
2. Notification system to notify about any new reports or messages from the manager	Employees

CRC Card for Reports Class

Class: Reports	
Attributes	Methods
detailedKPIReport, manpowerReport, evaluationReport, weightOfApprisal, weightOfKPI,absentWorkers, report	+gatherData(), +gatherRating(), +gatherKPIScores(), +generateReport(), +showManpowerReport(), +showEvaluationReport()
Responsibility	Collaborators
1. Generate KPI ratings specific to different activities.	Evaluation
2. Generate reports on Manpower and Evaluation	Supervisor, Evaluation
3. Keep track of employee attendance using the system.	Evaluation
4. Keep track of employee attendance using the system.	Supervisor
5. Keep records about worker specialization.	Evaluation, Supervisor

CRC Card for Rewards Class

Class: Rewards	
Attributes	Methods
-coupons, -bonus, -freeFood, -offHours, -rewardList, -trainingList	+useLeaderboards(), +assignTraining(), +assignRewards(), +checkThreshold(), +showRewardList(), +showTrainingList()
Responsibility	Collaborators
1. A gamified system where employees will be rewarded based on their performance ratings taken from	Gamification

leaderboard systems generated using KPIs.	
2. Coupon system to reward employees.	Worker, Manager
3. Assignment of rewards and training through the system to employees.	Worker, Manager

6.8 Class Responsibility Collaboration Diagram

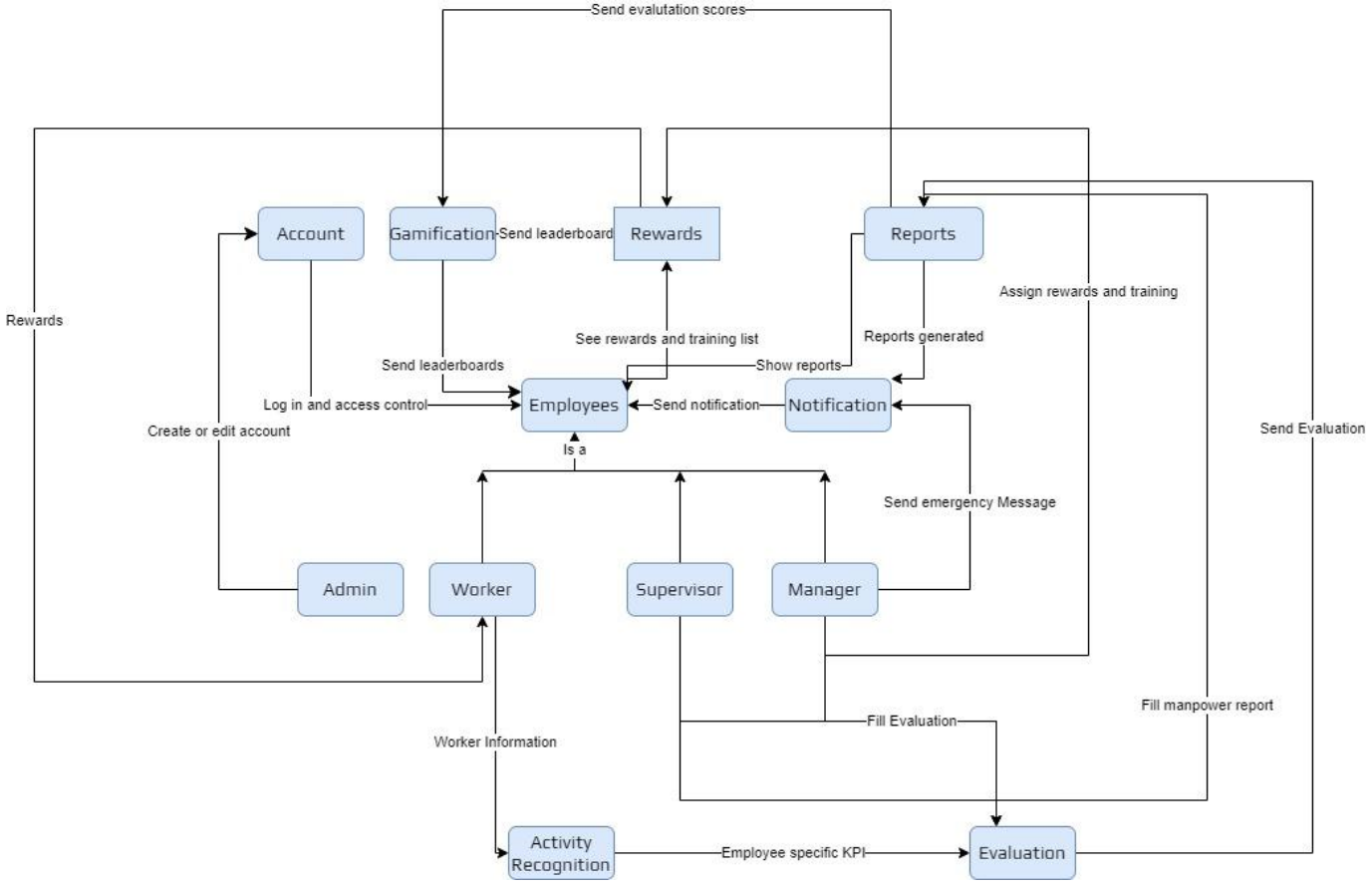


Fig crc.1

Ref: Table 1
Name: Accounts

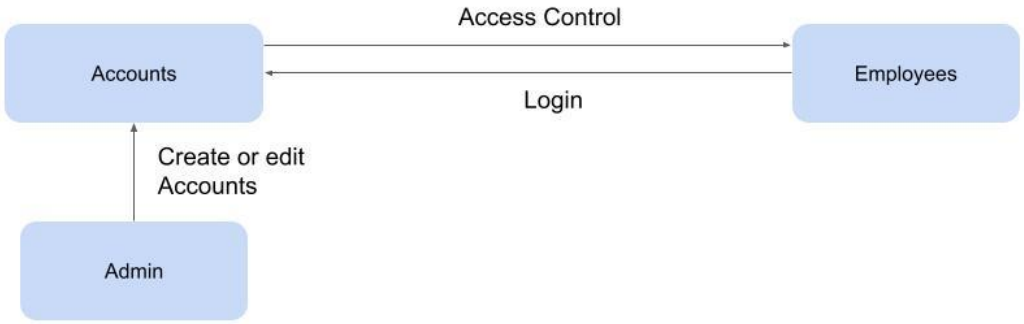


Fig crc.2
Ref: Table 2
Name: Employees

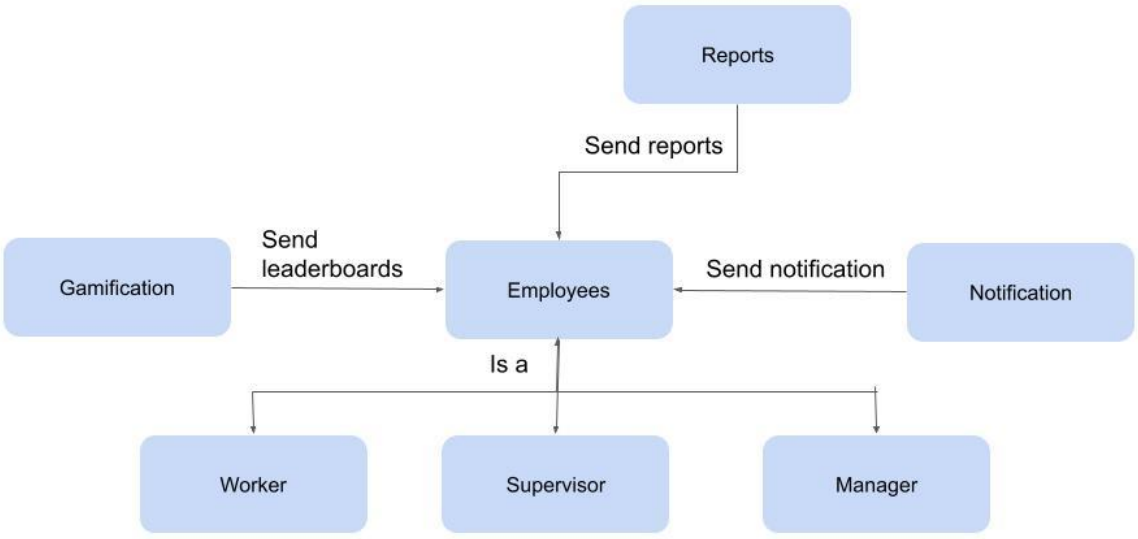


Fig crc.3

Ref: Table 4
Name: Manager

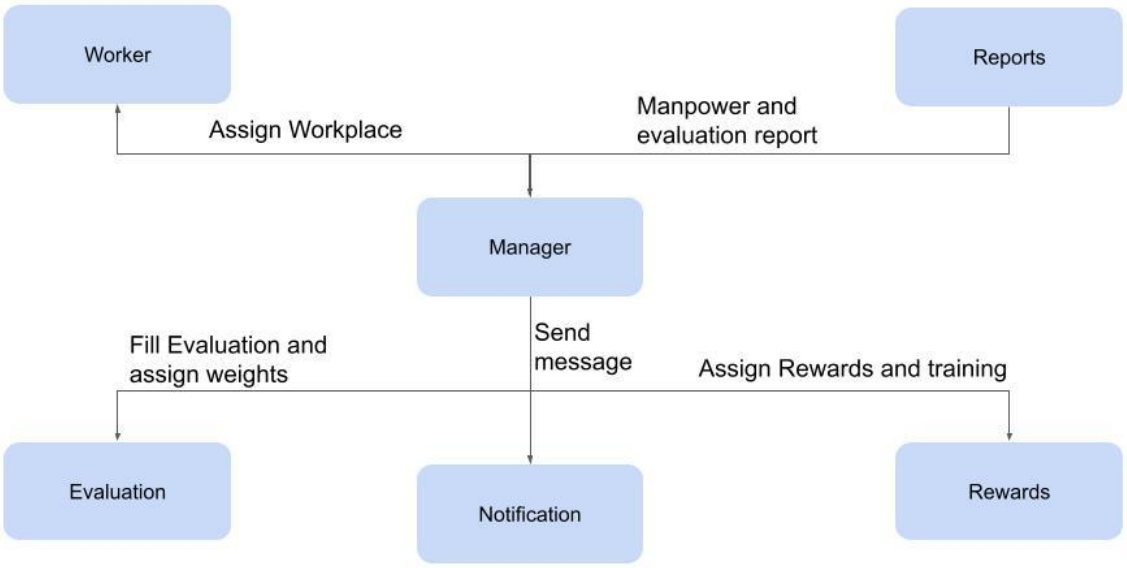


Fig crc.4
Ref: Table 5
Name: Worker

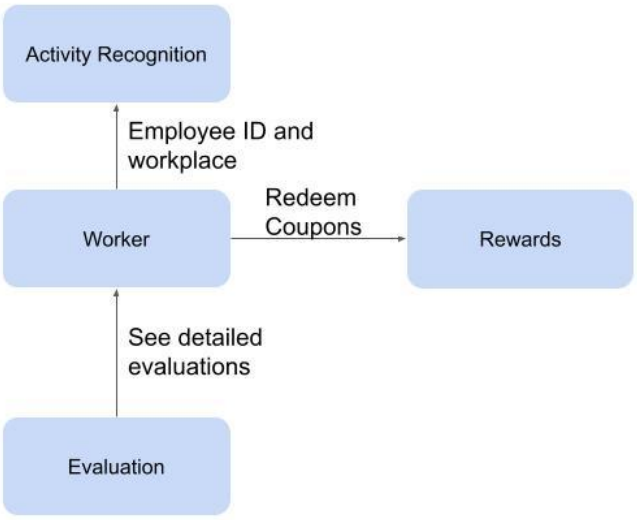


Fig crc.5

Ref: Table 6
Name: Supervisor

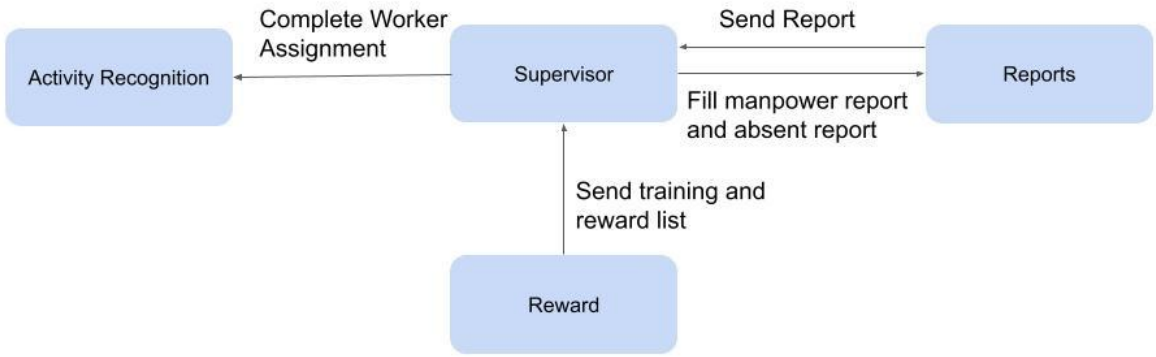


Fig crc.6
Ref: Table 7
Name: Activity Recognition

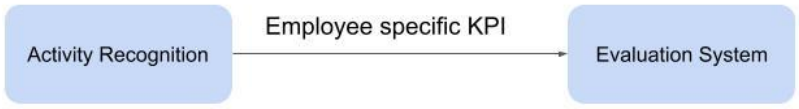


Fig crc.7

Ref: Table 8
Name: Evaluation

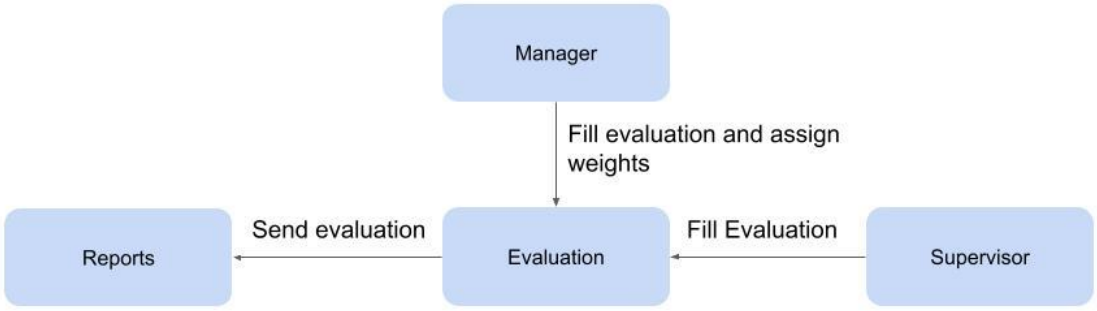


Fig crc.8
Ref: Table 9
Name: Gamification

Fig crc.9

Ref: Table 10
Name: Notification

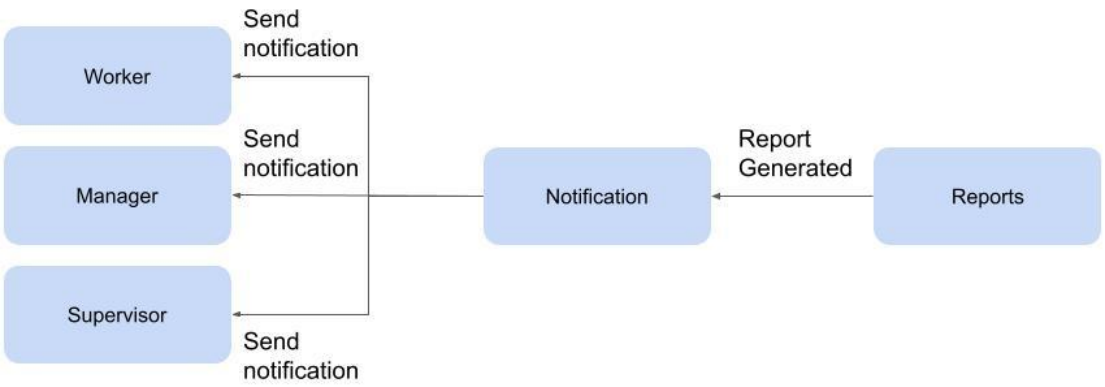


Fig crc.10
Ref: Table 11
Name: Reports

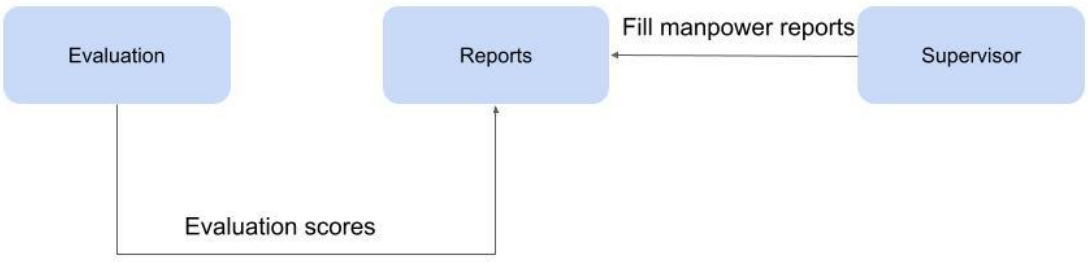


Fig crc.11

Ref: Table 12
Name: Rewards

Fig crc.12

7. Behavioral Modeling

The behavioral model indicates how software will respond to external events or stimuli. In the context of behavioral modeling, two different characterizations of states must be considered: (1) the state of each class as the system performs its function and (2) the state of the system as observed from the outside as the system performs its function.

7.1 Event Identification

In the event identification table, events are mentioned in the leftmost column. The initiator class of the event and collaborator classes are mentioned in the following two columns and special cases for each event are mentioned in the rightmost column, if there are any such special cases.

Serial	Event	Initiator Class	Collaborator Class
1	**Account Controls**	Admin	Account

2	**Edit Account**	Account	Admin
3	**Login**	Account	Admin, Manager, Supervisor, Worker
4	**KPI Generation**	Activity Recognition	Supervisor, Evaluation
5	**Complete Evaluation**	Evaluation	Gamification, Reports
6	**Weights Assignment**	Evaluation	Manager
7	**Critical Incident Logging**	Evaluation	Manager, Supervisor
8	**Rating**	Evaluation	Manager, Supervisor
9	**Show Specialization KPI**	Evaluation	Worker
10	**Access Rewards and Training**	Manager	Worker
11	**Send Notification**	Notification	Manager, Worker, Supervisor
12	**Convey emergency information**	Manager	Notification
13	**Worker assignment**	Manager	Supervisor, Worker
14	**Access Worker Profile**	Manager	Worker
15	**Edit Account**	Account	Admin
16	**Access Dashboard**	Employees	Gamification
17	**Fill Manpower Report Form**	Supervisor	Reports
18	**Complete Worker Assignment**	Supervisor	Activity Recognition
19	**Assign Rewards**	Rewards	Manager
20	**Assign Training**	Rewards	Manager
21	**Redeem Coupons**	Worker	Rewards
22	**Access Evaluation**	Manager, Supervisor	Evaluation
23	**Show Leaderboards**	Gamification	Worker, Supervisor, Manager
24	**Get Evaluation Scores**	Gamification	Evaluation

25	**Generate Leaderboards**	Gamification	-
26	**Gather Information**	Reports	Evaluation, Supervisor
27	**Generate Reports**	Reports	Notification
28	**View Reports**	Reports	Worker, Supervisor, Manager
29	**Add Account**	Account	Admin
30	**Show Profile Details**	Worker	Manager, Supervisor
31	**Show reward and training list**	Rewards	Employees

7.2 State Transition Diagrams

Admin Class:

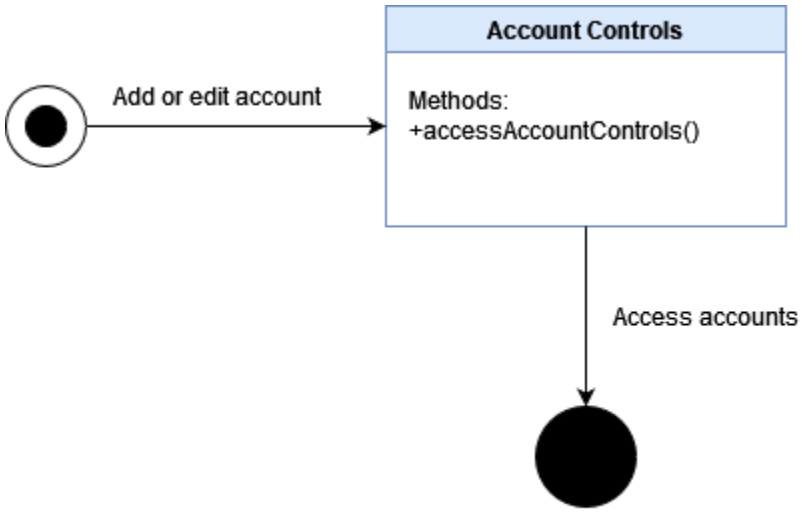


Figure: State Transition Diagram for Admin Class

Accounts Class:

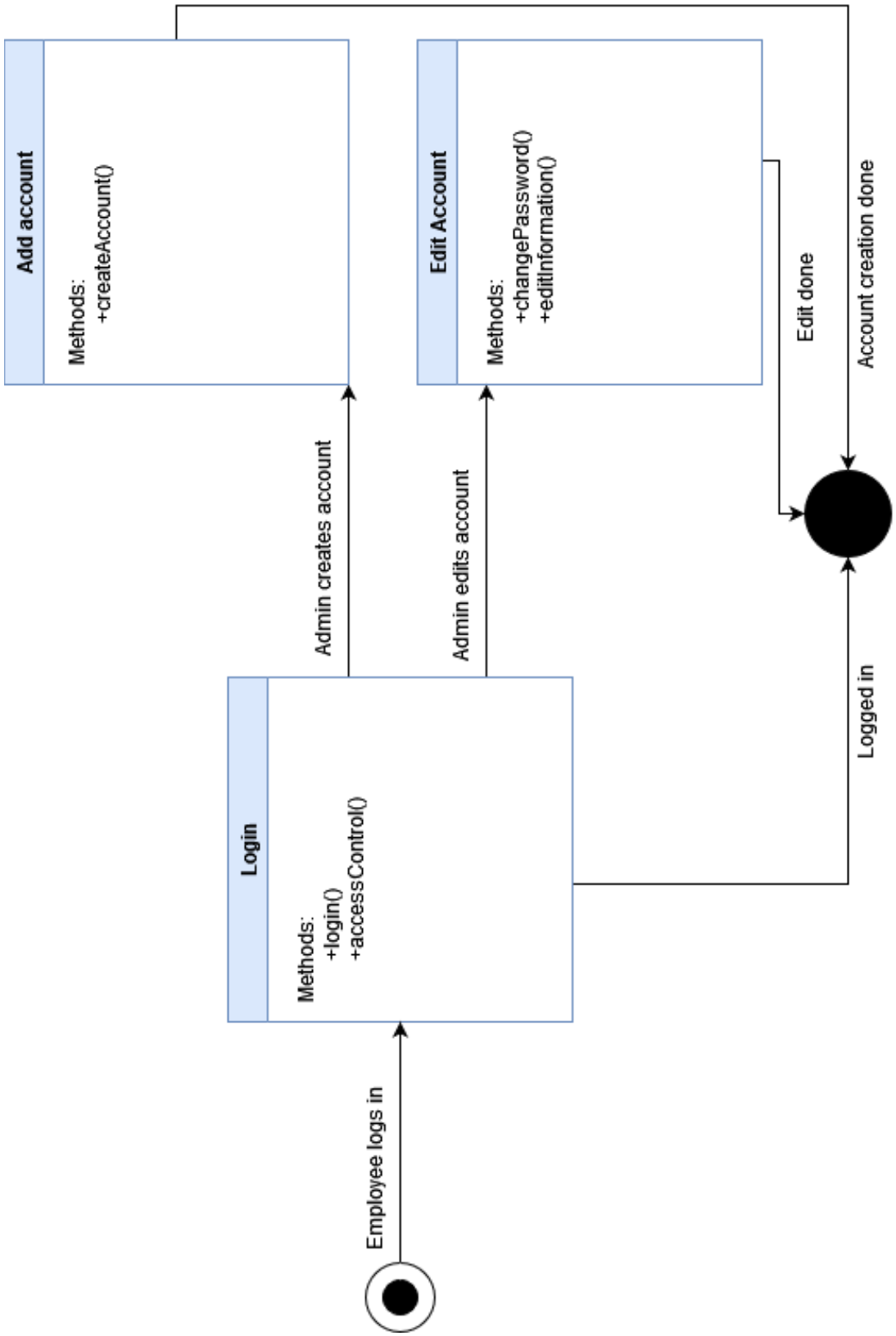


Figure: State Transition Diagram for Accounts Class

Evaluation Class:

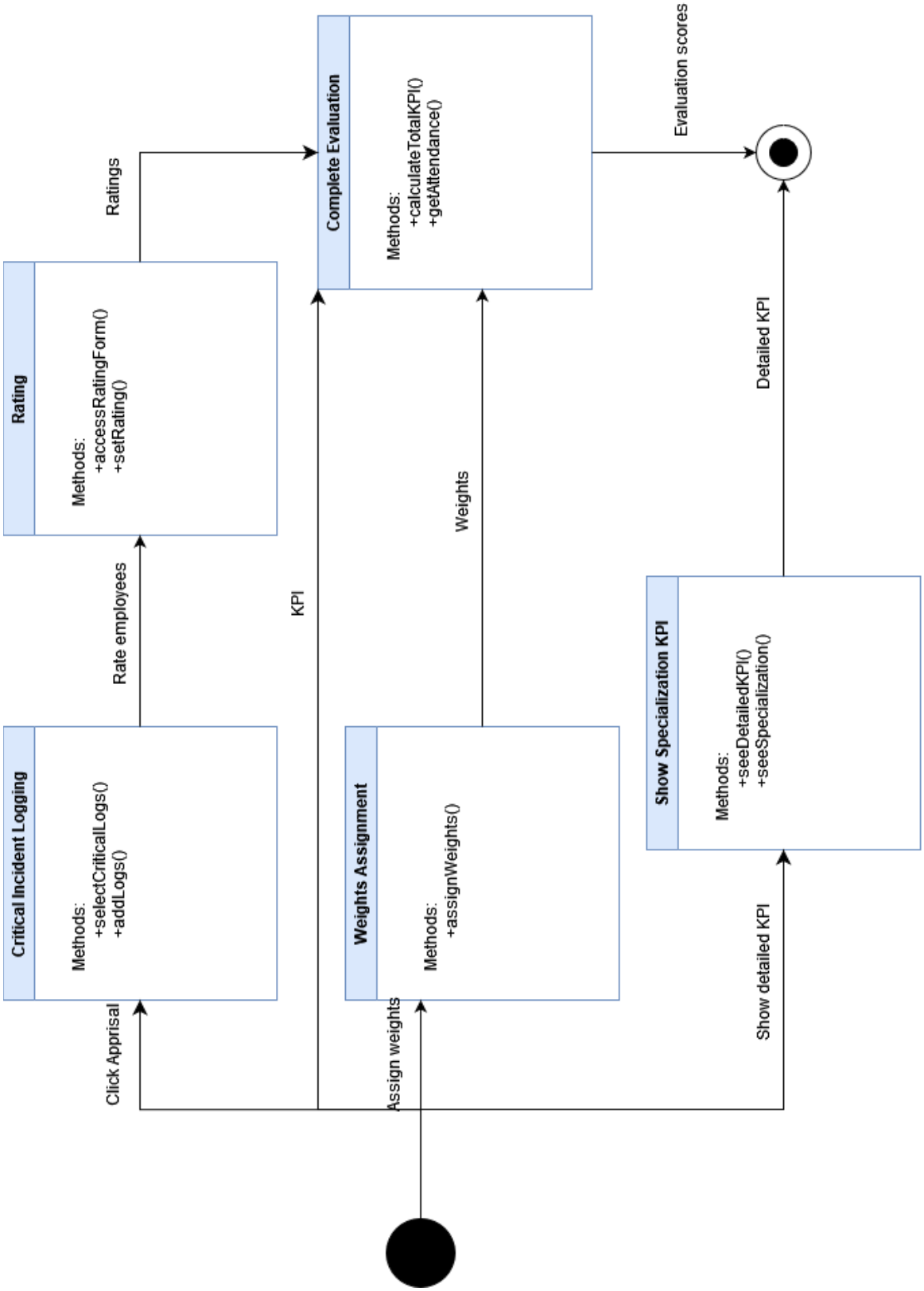


Figure: State Transition Diagram for Evaluation Class

Gamification Class:

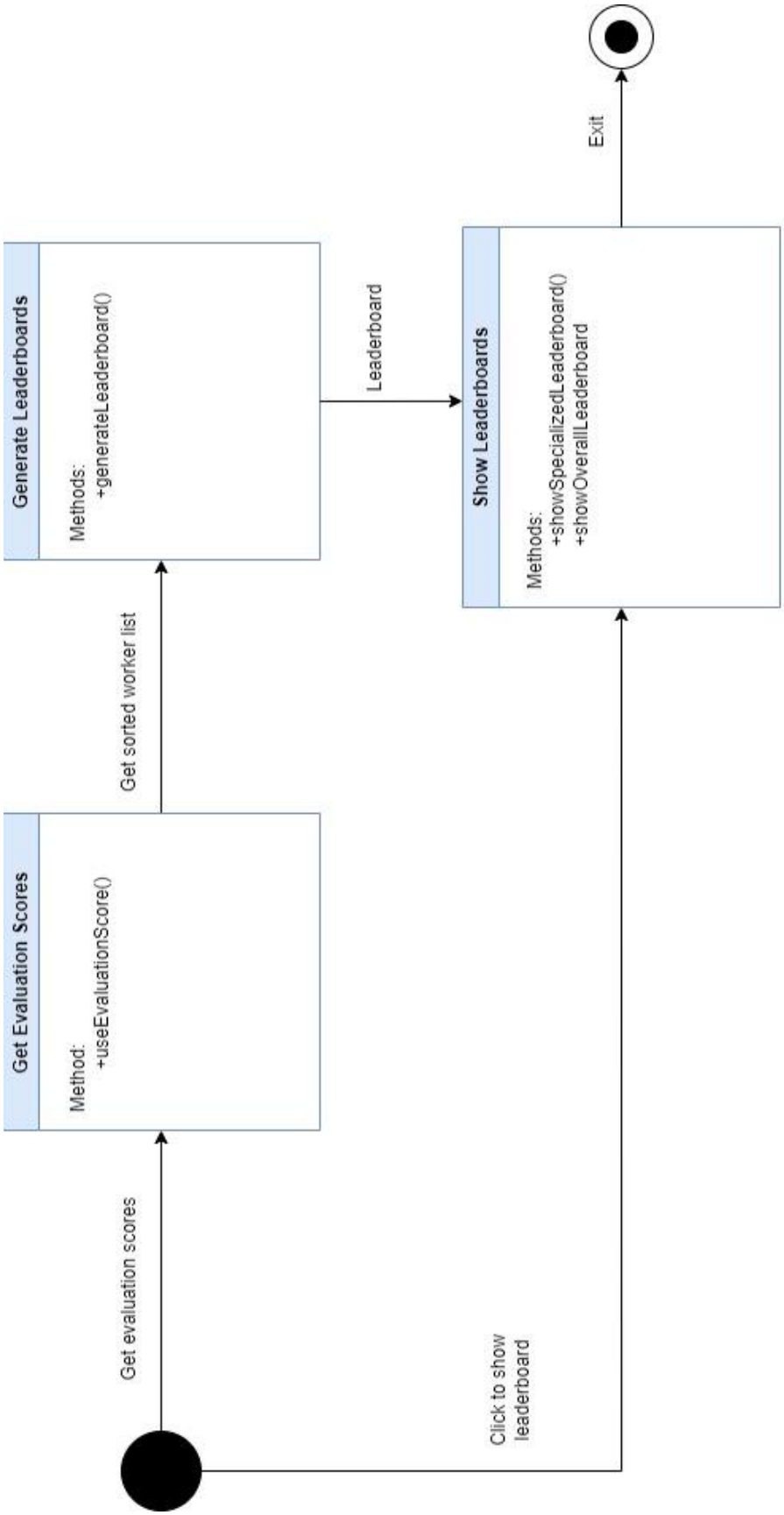


Figure: State Transition Diagram for Gamification Class

Notification Class:

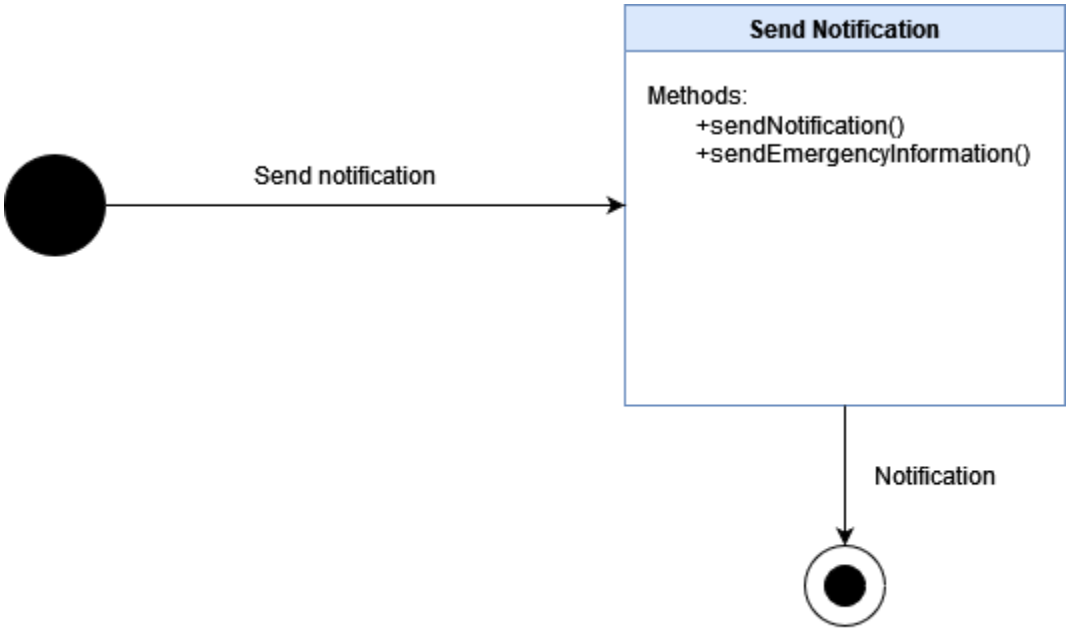


Figure: State Transition Diagram for Notification Class

Reports Class:

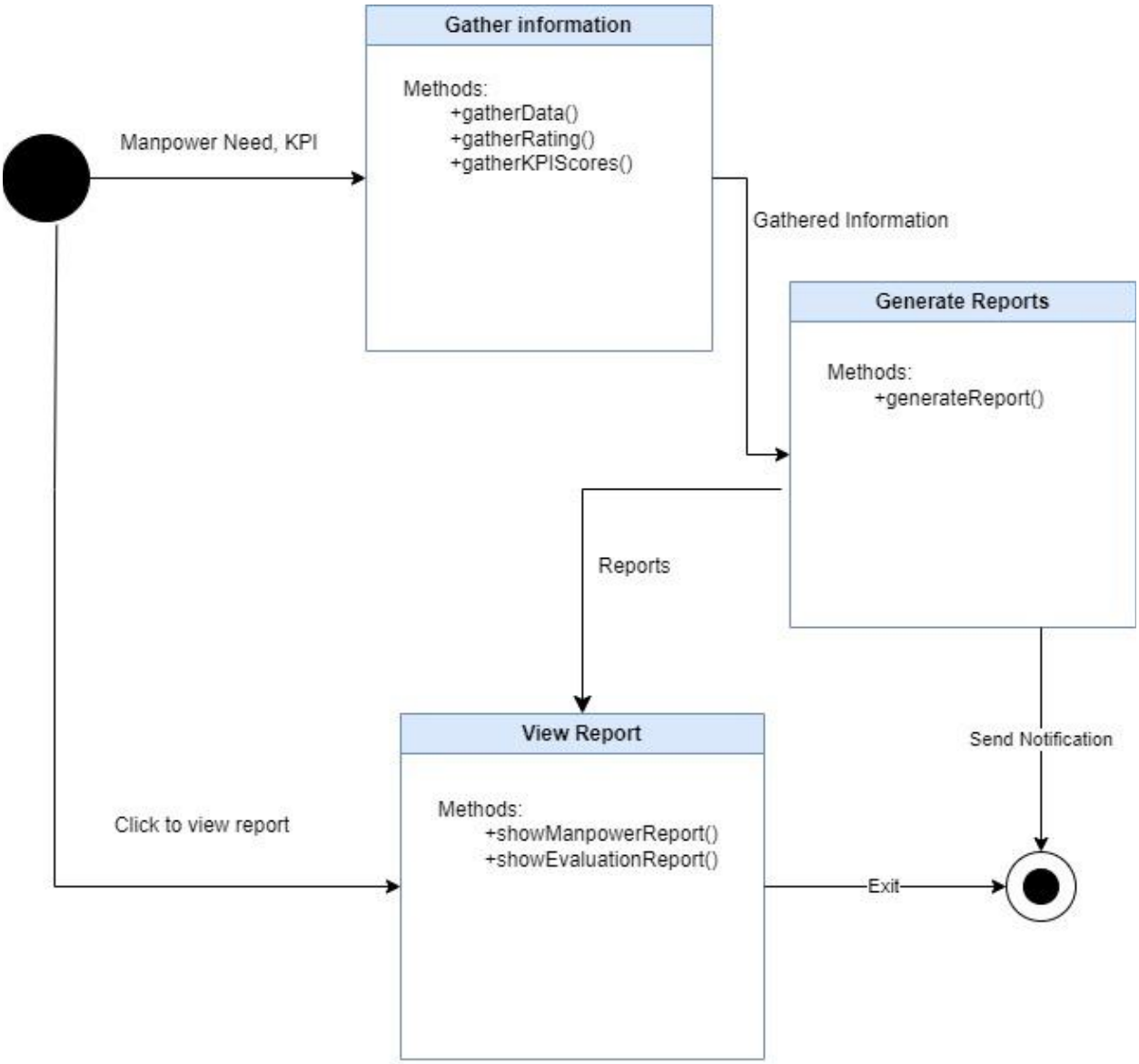


Figure: State Transition Diagram for Reports Class

Rewards Class:

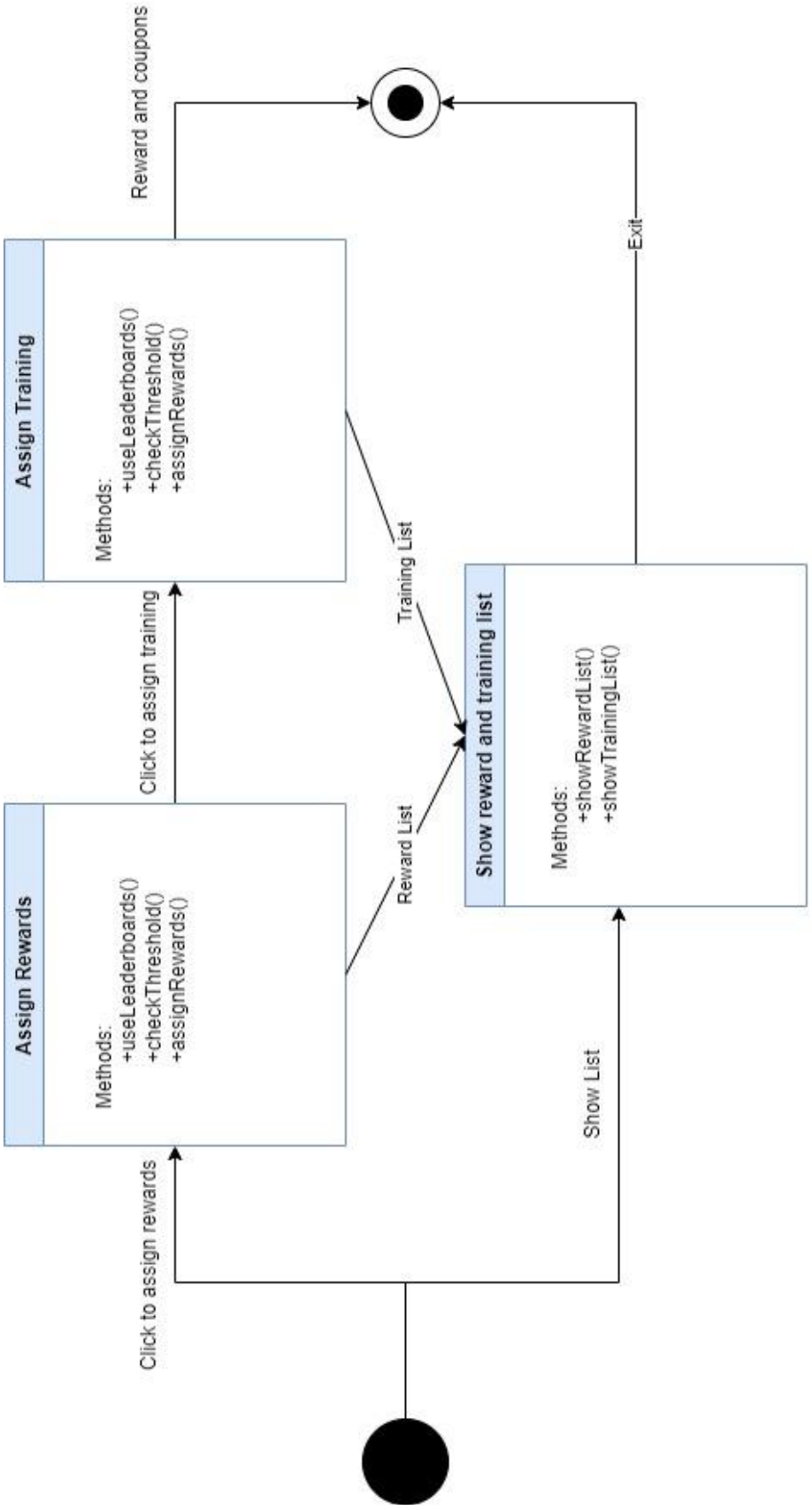
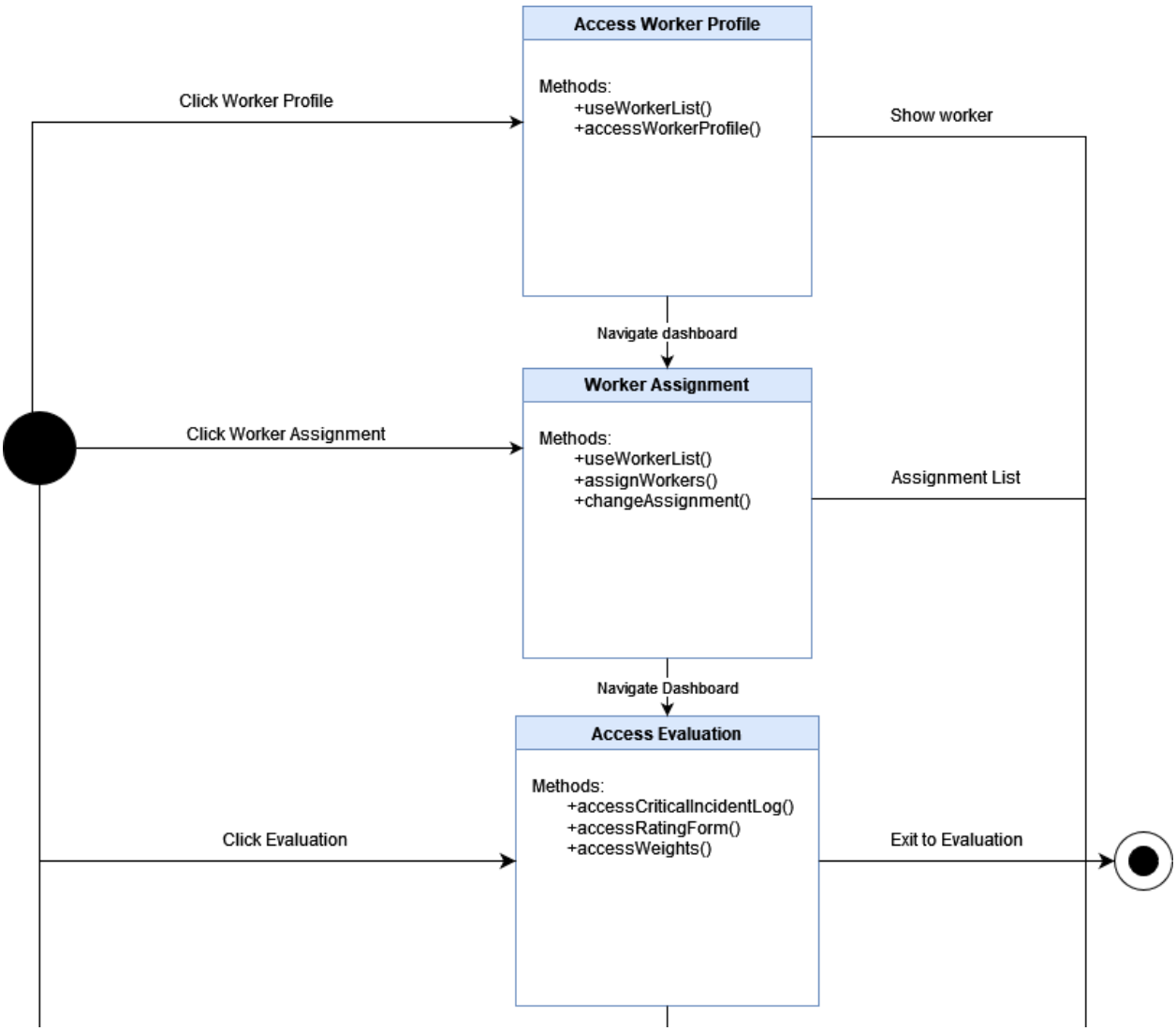


Figure: State Transition Diagram for Rewards Class

Manager Class:



Manager Class (Continued):

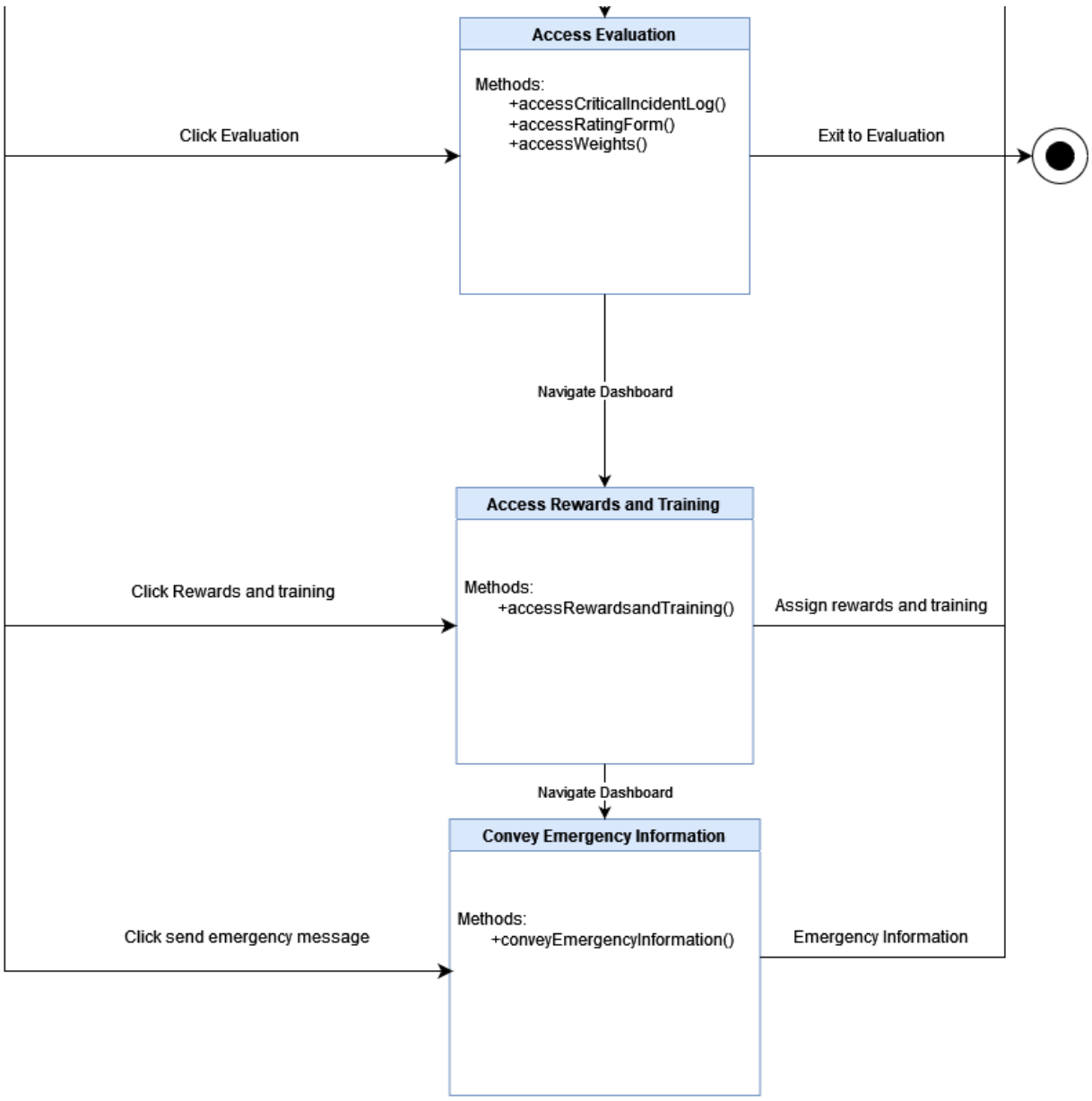


Figure: State Transition Diagram for Manager Class

Supervisor Class:

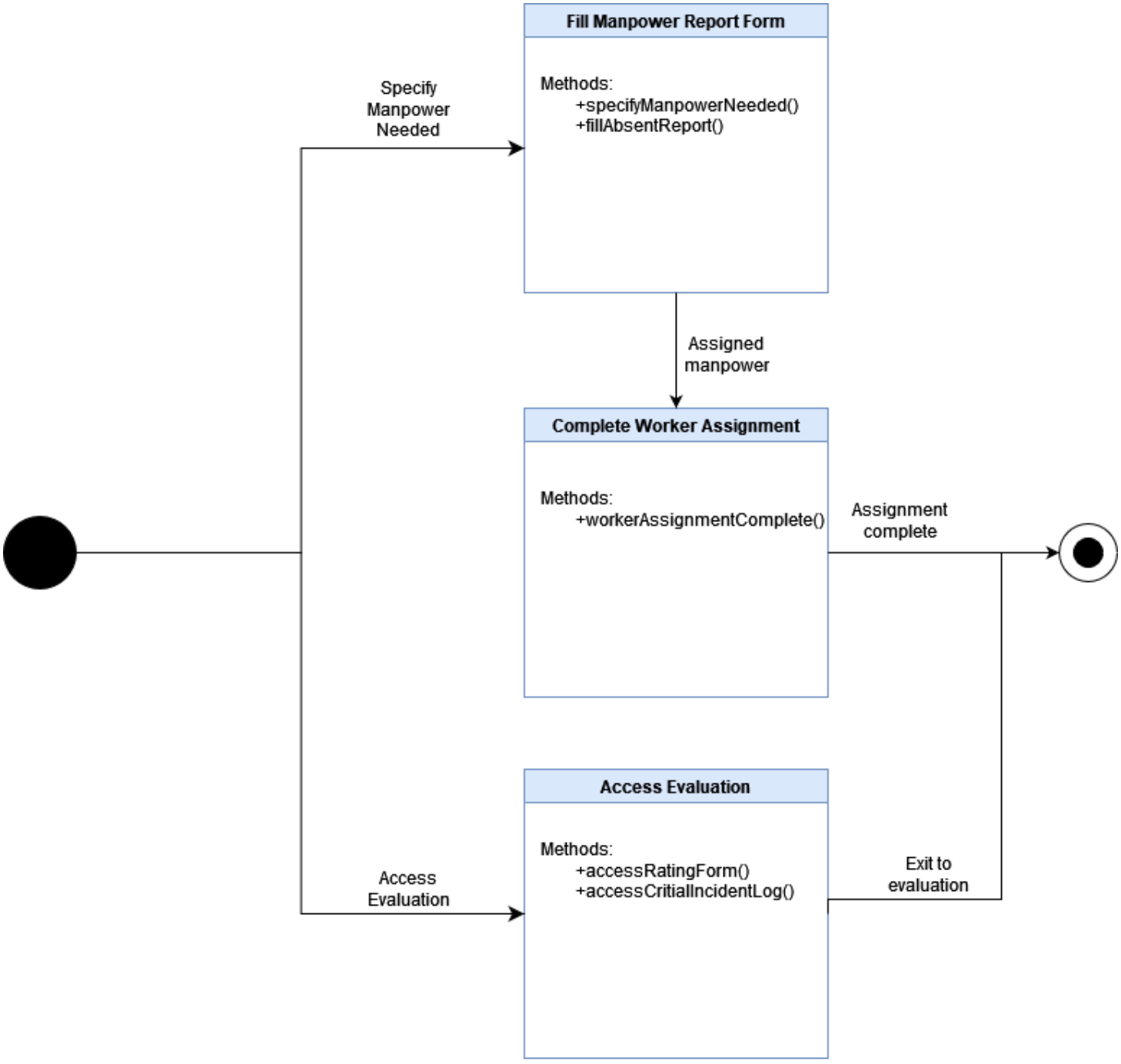


Figure: State Transition Diagram for Supervisor Class

Employees Class:

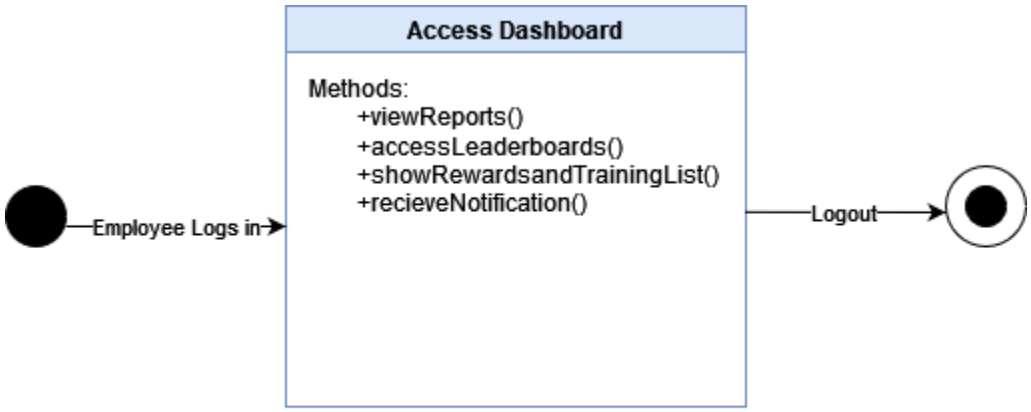


Figure: State Transition Diagram for Employees Class

Workers Class:

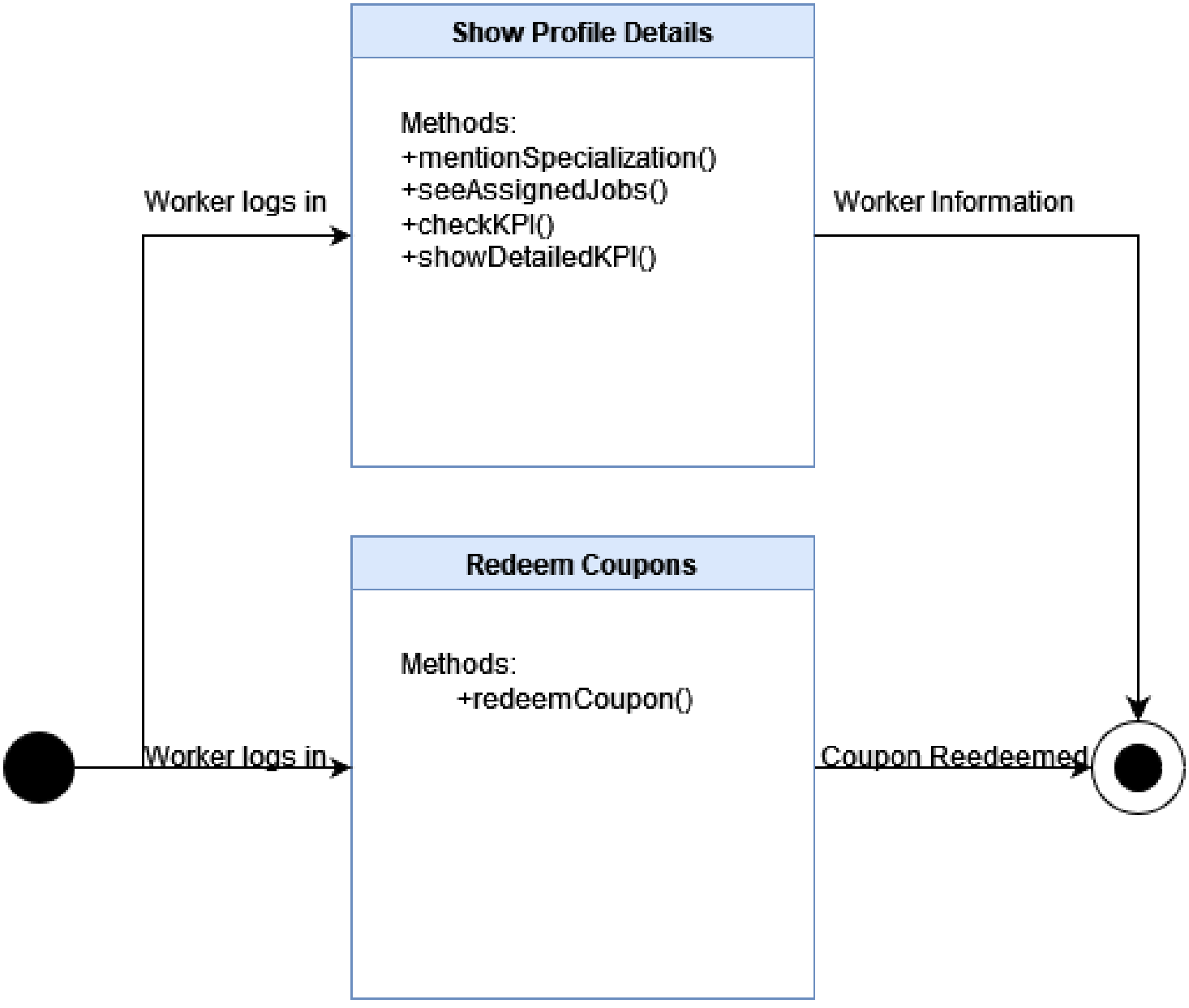


Figure: State Transition Diagram for Workers Class

Activity Recognition Class:

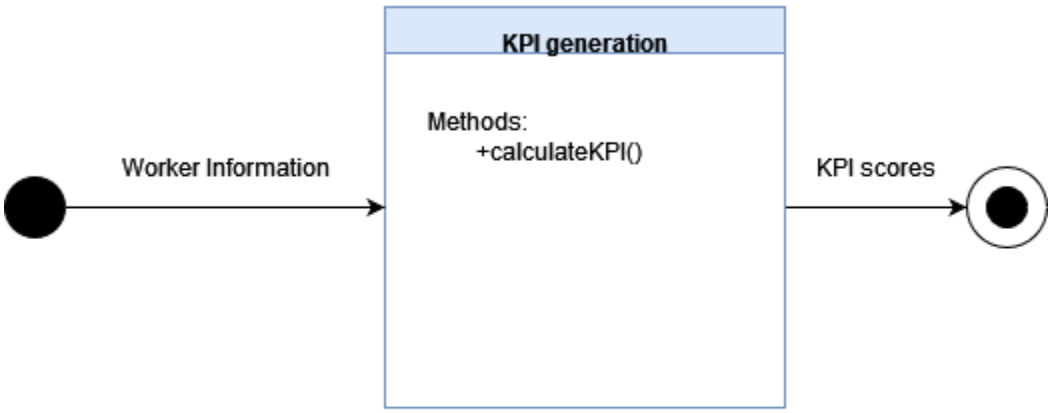
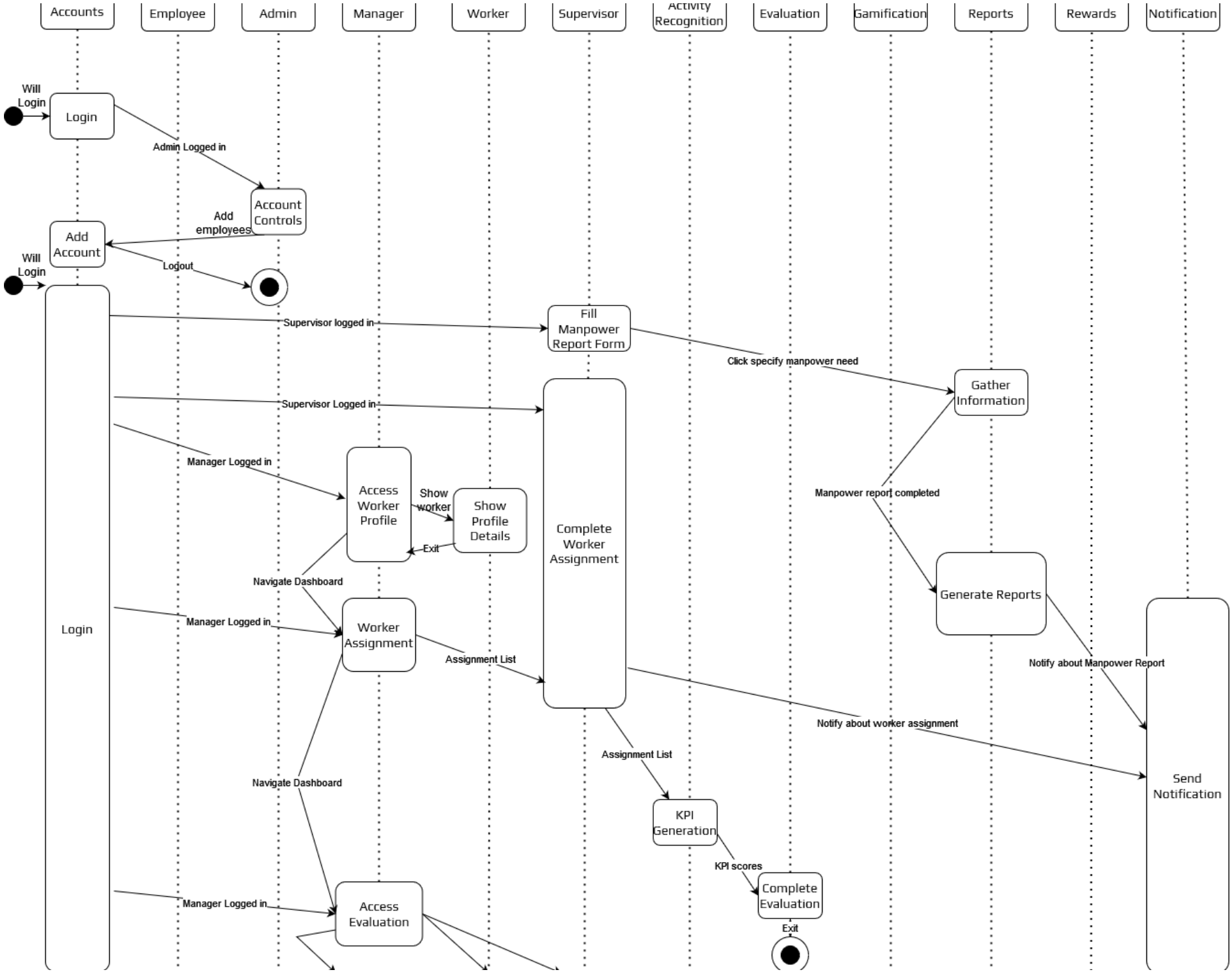
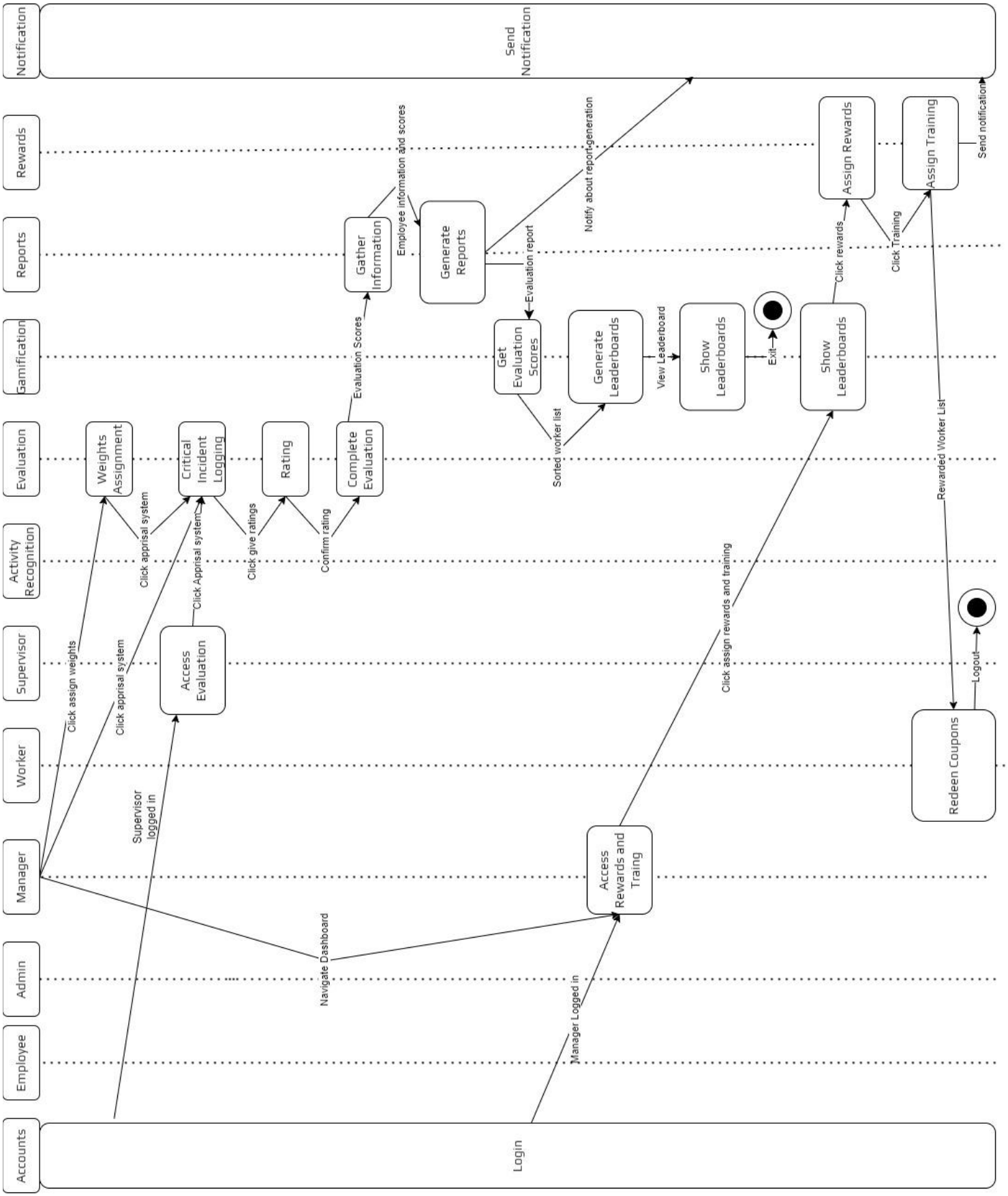
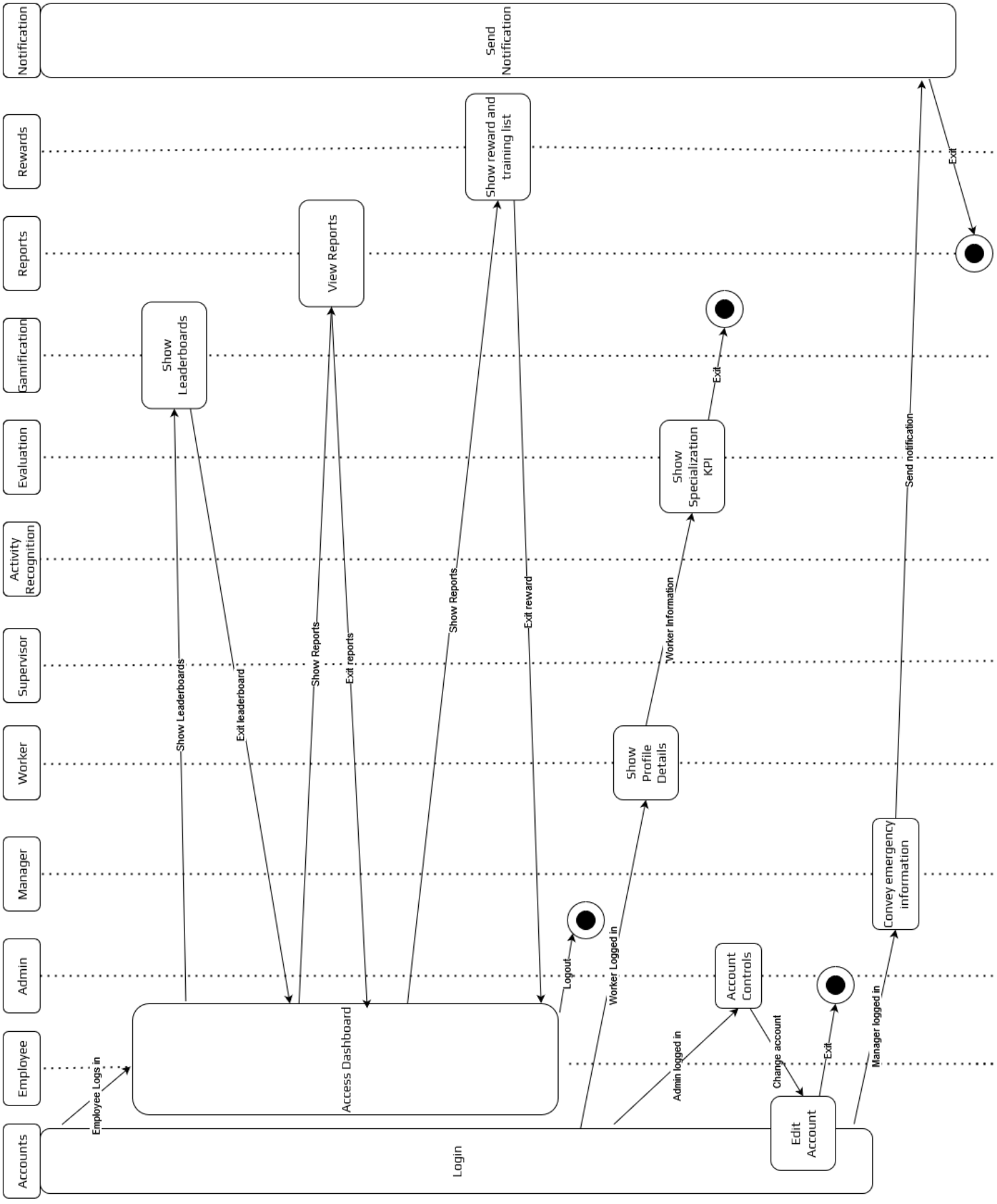


Figure: State Transition Diagram for Activity Recognition Class

7.3 Sequence Diagrams


Accounts
Employee
Admin
Manager
Worker
Supervisor
Activity Recognition
Evaluation
Gamification
Reports
Rewards
Notification
Will Login
Login
Admin Logged in
Account Controls
Add employees
Add Account
Logout
Will Login
Login
Supervisor logged in
Fill Manpower Report Form
Click specify manpower need
Gather Information
Supervisor Logged in
Complete Worker Assignment
Manager Logged in
Access Worker Profile
Show worker
Show Profile Details
Exit
Manpower report completed
Generate Reports
Navigate Dashboard
Manager Logged in
Worker Assignment
Assignment List
Notify about Manpower Report
Notify about worker assignment
Send Notification
Assignment List
KPI Generation
Navigate Dashboard
KPI scores
Complete Evaluation
Exit
Manager Logged in
Access Evaluation

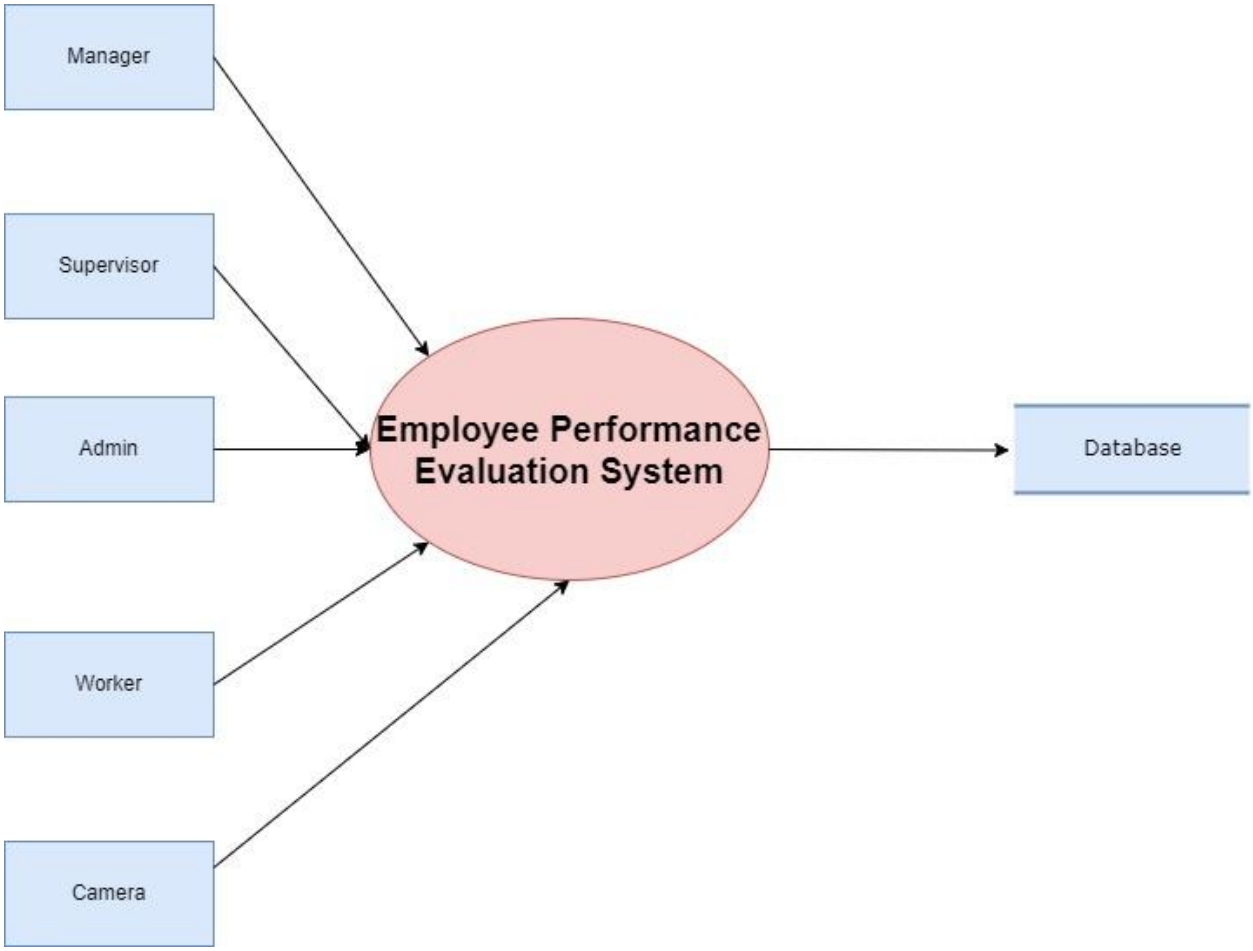

Accounts
Employee
Admin
Manager
Worker
Supervisor
Activity Recognition
Evaluation
Gamification
Reports
Rewards
Notification
Login
Send Notification
Weights Assignment
Critical Incident Logging
Rating
Complete Evaluation
Gather Information
Generate Reports
Get Evaluation Scores
Generate Leaderboards
Show Leaderboards
Show Leaderboards
Assign Rewards
Assign Training
Access Evaluation
Access Rewards and Traing
Redeen Coupons
Click assign weights
Click apprisal system
Click apprisal system
Click Apprisal system
Click give ratings
Confirm rating
Evaluation Scores
Employee information and scores
Evaluation report
Notify about report generation
Sorted worker list
View Leaderboard
Exit
Click rewards
Click Training
Send notification
Rewarded Worker List
Logout
Click assign rewards and training
Supervisor logged in
Navigate Dashboard
Manager Logged in


Notification
Rewards
Reports
Gamification
Evaluation
Activity Recognition
Supervisor
Worker
Manager
Admin
Employee
Accounts
Send Notification
Show reward and training list
View Reports
Show Leaderboards
Show Specialization KPI
Show Profile Details
Convey emergency information
Account Controls
Edit Account
Access Dashboard
Login
Employee Logs in
Show Leaderboards
Exit leaderboard
Show Reports
Exit reports
Show Reports
Exit reward
Worker Information
Exit
Logout
Worker Logged in
Admin logged in
Change account
Exit
Manager logged in
Send notification
Exit

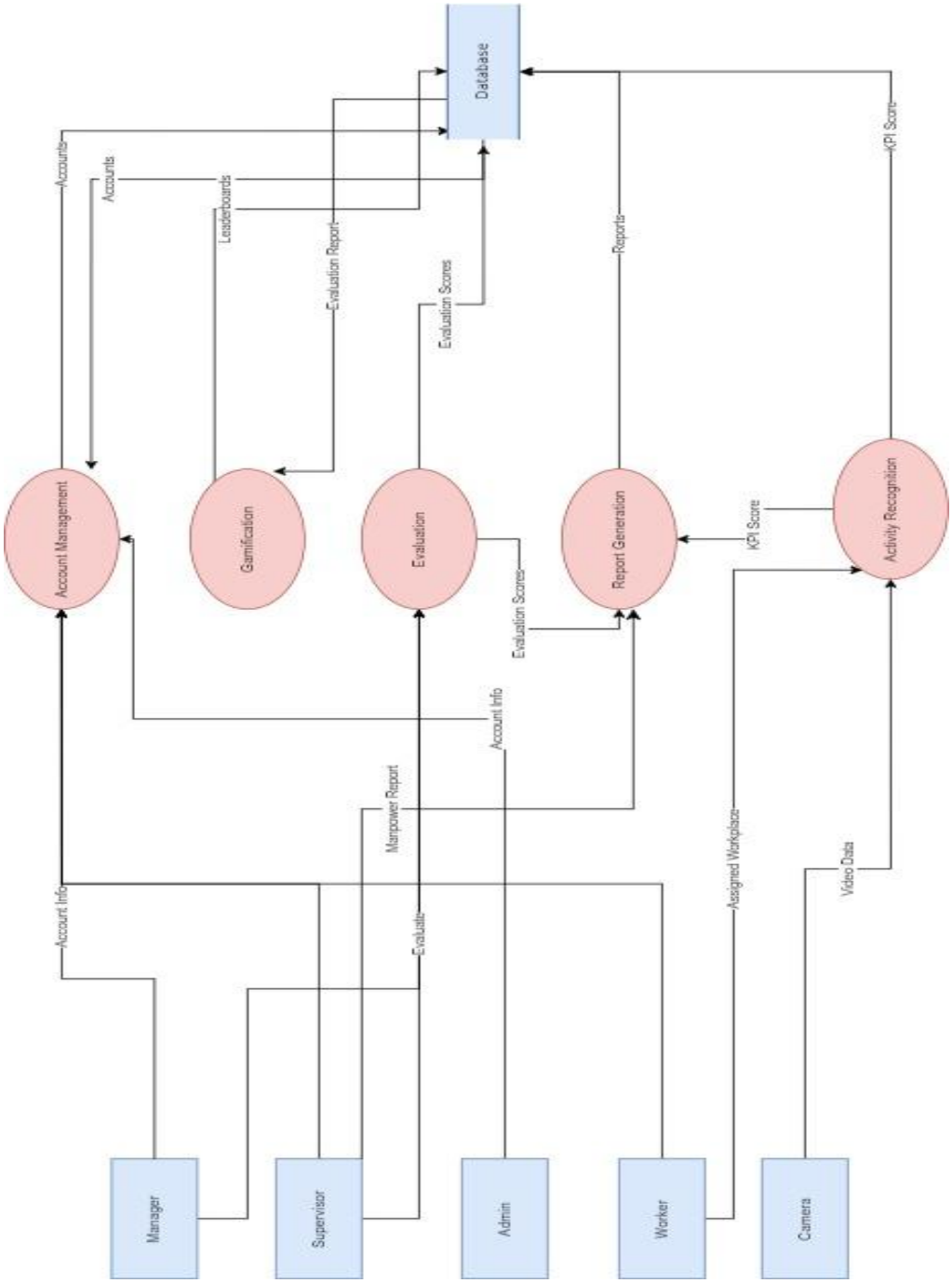
8. Data Flow Diagrams

A data-flow diagram is a visual representation of how data moves through a system or a process. A data flow diagram (DFD) shows how information moves through any system or process. It displays data inputs, outputs, storage locations, and routes between each destination using predefined symbols such as rectangles, circles, and arrows as well as brief text labels.

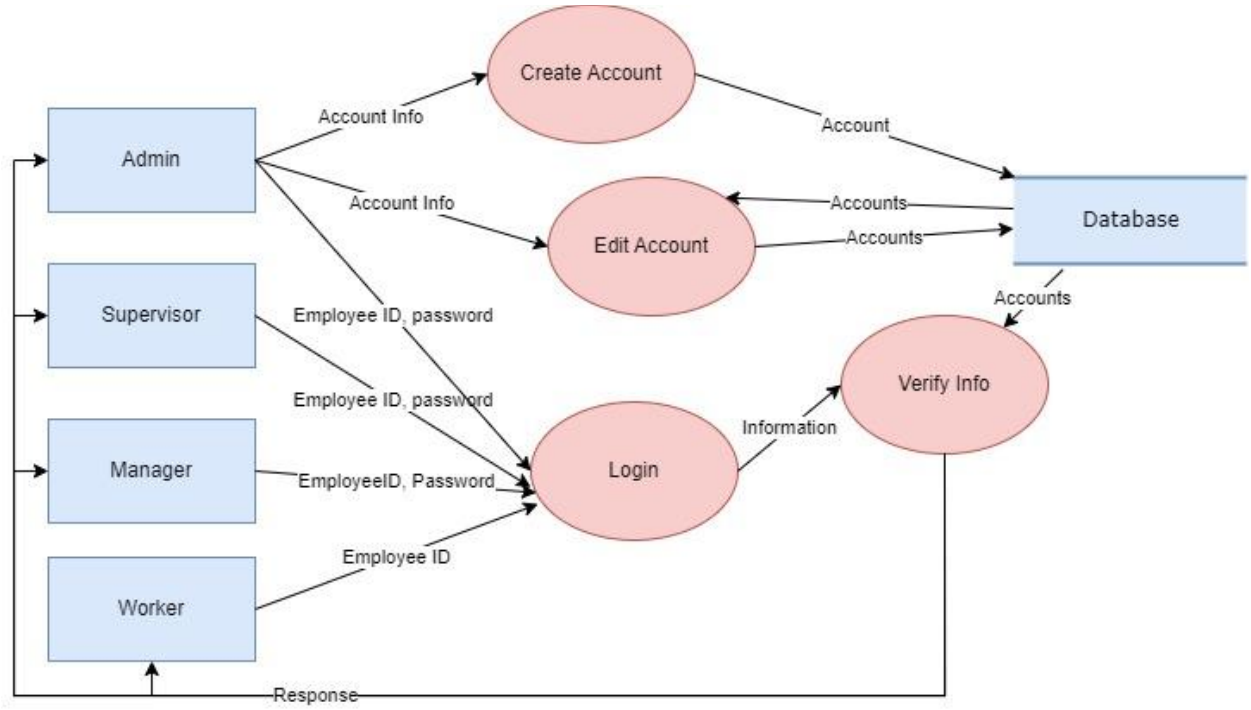
Level 0: Employee Performance Evaluation System



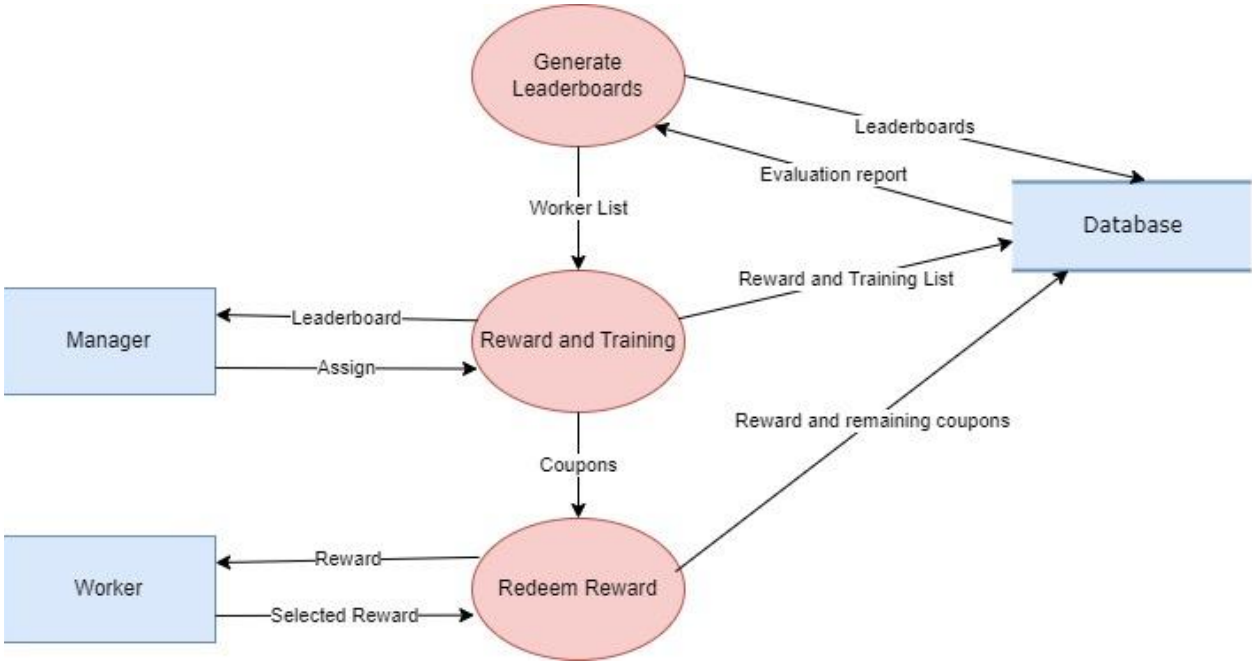
Level 1: Employee Performance Evaluation System



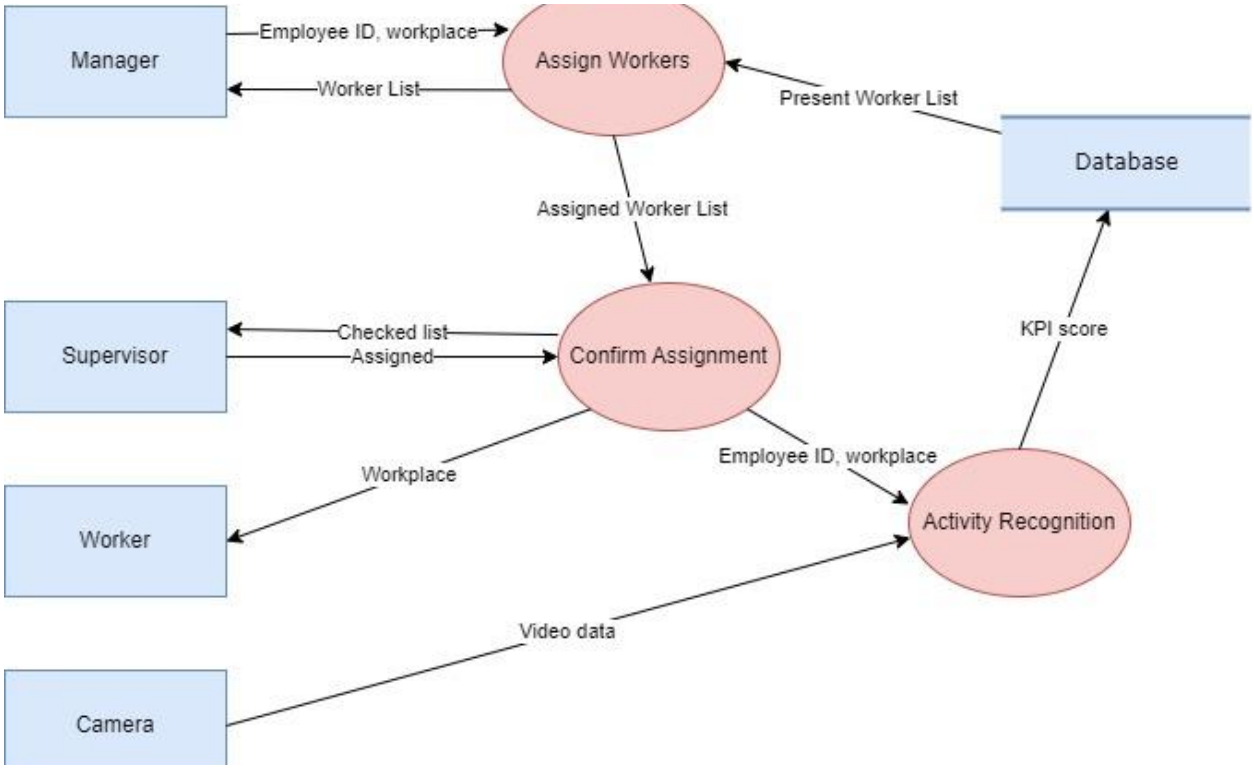
Level 2: Account Management



Level 2: Gamification



Level 2: Activity Recognition



Level 2: Report Generation