

# Human Resources Data Warehouse Management System

CSED 2020 graduation project

Project advisor : Prof. Dr. Yousry Taha



# 1. Project Scope & Motivation

# 1.1 Project scope

- Web Application provides several services for HR(s) and Managers to help them manage all aspects of the workforce in an efficient manner .
- provide interfaces for employees to be more involved with Hr and Managers in a transparent mechanism to guarantee integrity and a healthy work environment.
- use data warehousing to provide better performance and data analytics for decision making and prediction .




## 1.2 Project motivation

The workforce is the basic element of any corporation that if correctly analyzed and managed accurately can lead to prosperity of this entity and revolutionary predictions that may save resources or achieve massive profits if analytics were accurate enough to read the future.



## 1.3 Problem statement

- The amount of data is massive , highly variant and distributed over many databases that are not connected or mapped in a clear way that helps extracting valuable information .
  - the scatter of this data makes it difficult for HR employees to draw accurate purposeful analytics which might lead later on to taking wrong decisions that would cost the corporation an unnecessary resources (recruiting , time consuming ,...) or waste of already existed resources ( an excellent employee skills unused or a project with high profit gets rejected for wrong predictions based on inaccurate analytics).
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## 1.4 Solution proposed by the project

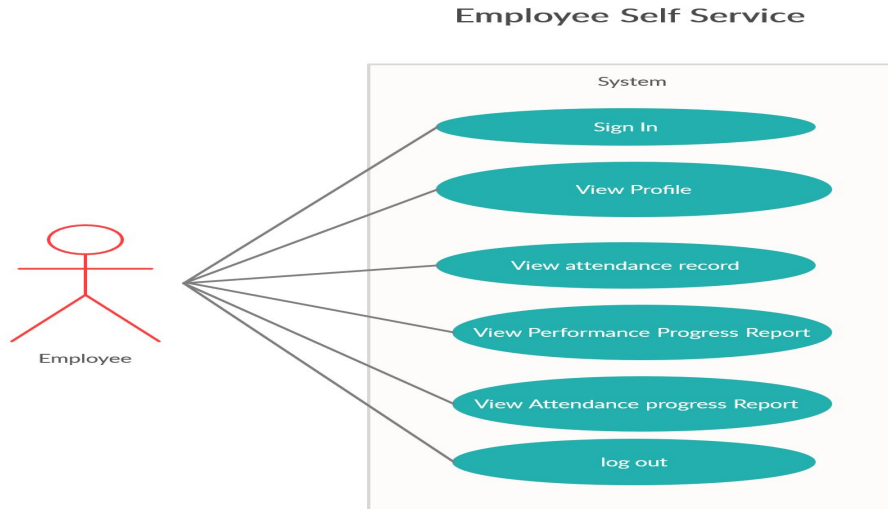
This data must be gathered in a Data-Warehouse that connects all variant aspects of the corporation where it can be managed dynamically, viewed, updated and analyzed applying data mining techniques with trusted predictions for better decision making and less HR employees.



## 2. Project Objectives

## 2.1 Employee self service

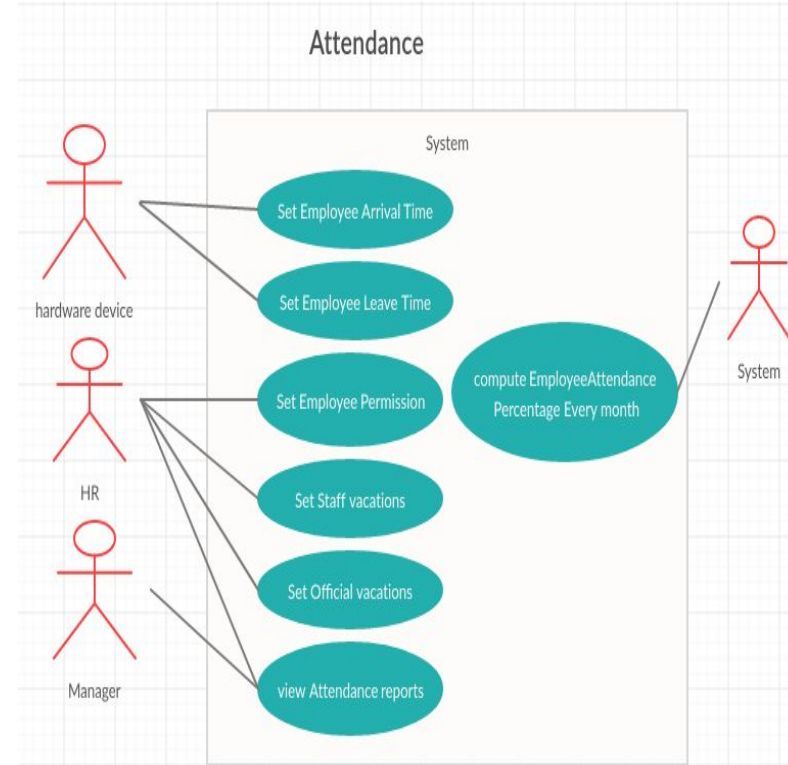
- Each employee is provided with a control panel to execute all eligible operations according to his position.
- Employee's panel gives him all access to his personal data , attendance, logging records , progress and performance charts.





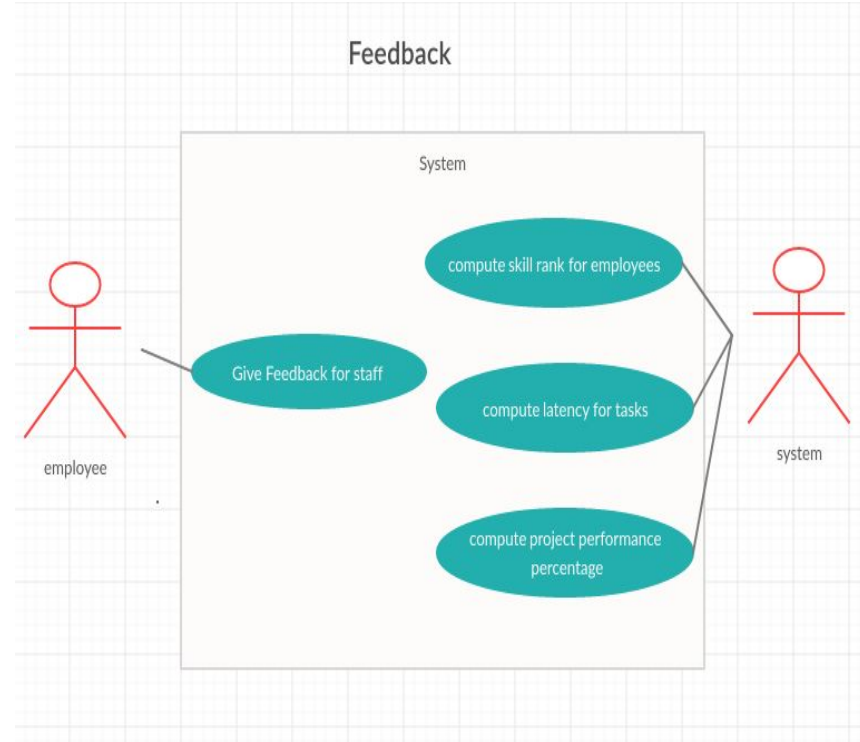
## 2.2 Attendance

- Each employee can view his attendance records with notes of (holidays , absence , presence and permissions).
- Each employee can get his attendance percentage records to monitor his progress over time.
- Hr employee can enter a permission , holiday or official vacation to be taken into account during calculating the employees' attendance percentage calculation.
- Hr and managers can view the attendance reporting over time for specific employees , departments or positions to monitor any drop in attendance or any out of regular observation.



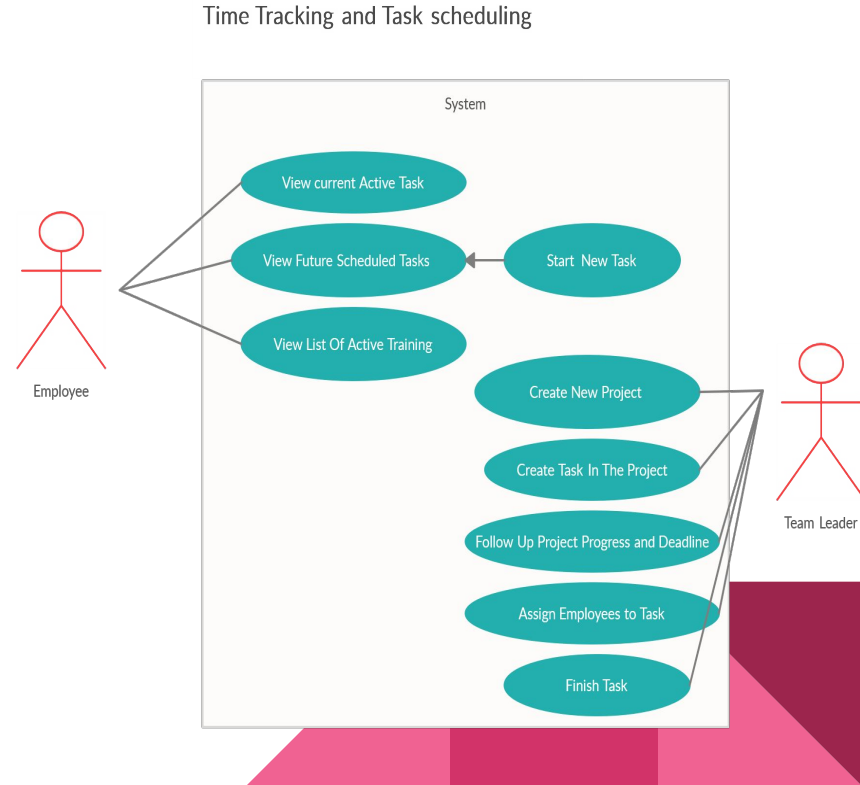
## 2.3 Feedback

At the end of every task , all members that worked on the task and the team leader must give feedback on the members skills. This feedback is taken into account on calculating both project and employee's performance.



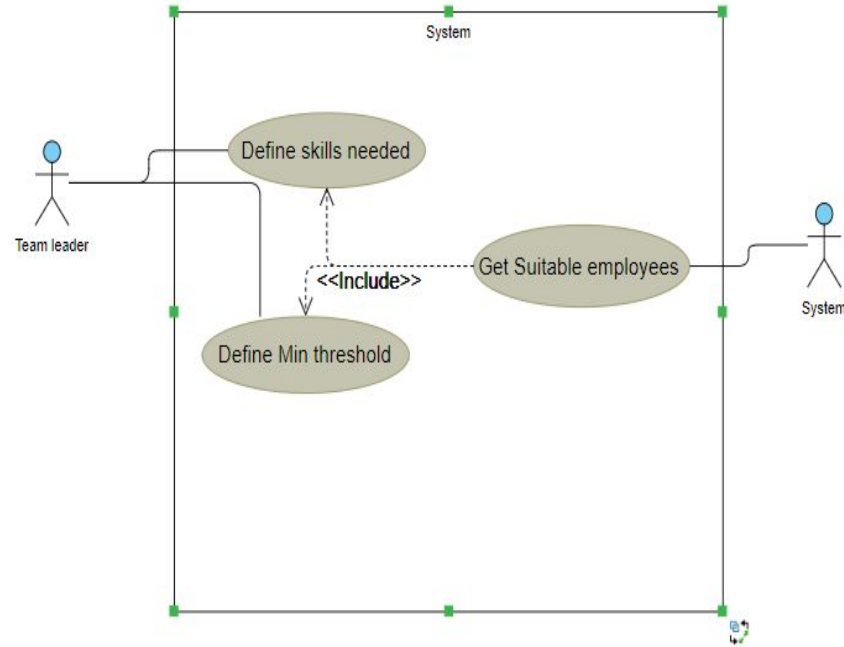
## 2.4 Time tracking and task scheduling

- Each employee can see his active tasks and the required task not started yet.
- Each employee can choose to start a task but only the team leader can end a task when he thinks it's over.
- If the deadline of the task is passed and it's not finished yet , the system would alert the employee.
- Each team leader can create a new project then create project tasks and assign employees to tasks which fit in slots of their time schedule in order to the time schedule to be consistent between tasks and training so that no 2 tasks or task and training can overlap.
- Each team leader would end the project when it's over.



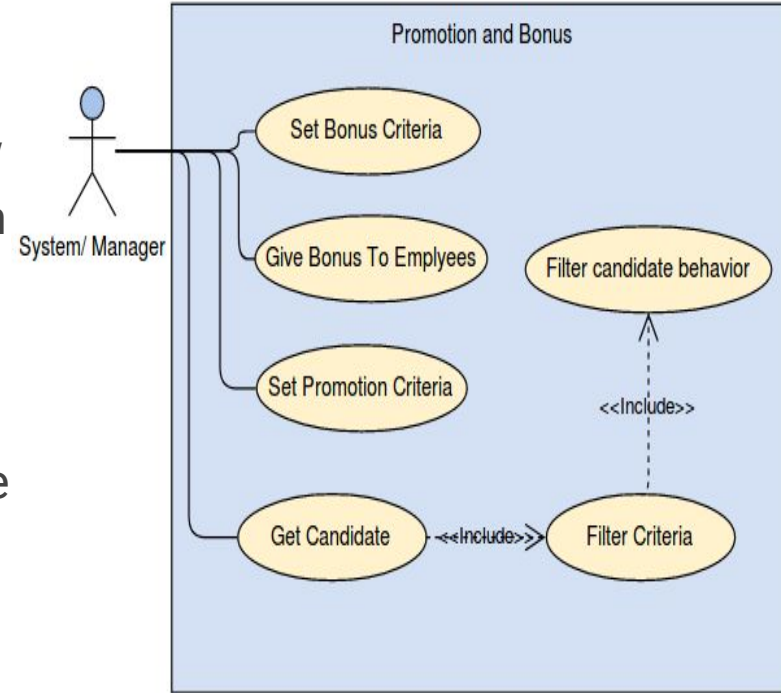
## 2.5 Talent Management

Each team leader would have a list of suitable employees for the task he's creating ready for him based on the skill level the task needs and both time management and skill rank of other employees in a specific department or position to choose from.



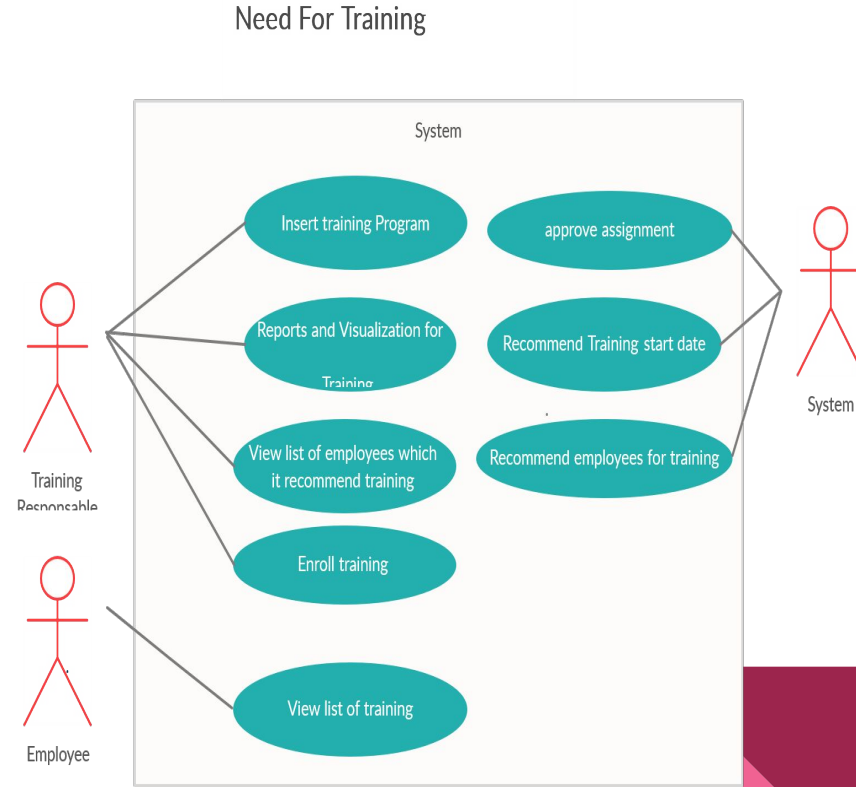
## 2.6 Bonus and promotion

- HR can enter criteria of the bonus then view a list of employees that earn the bonus then grant the bonus.
- The manager can enter criteria of the promotion and view list of employees who would fit the promotion then he can choose one of them and promote him to the new position



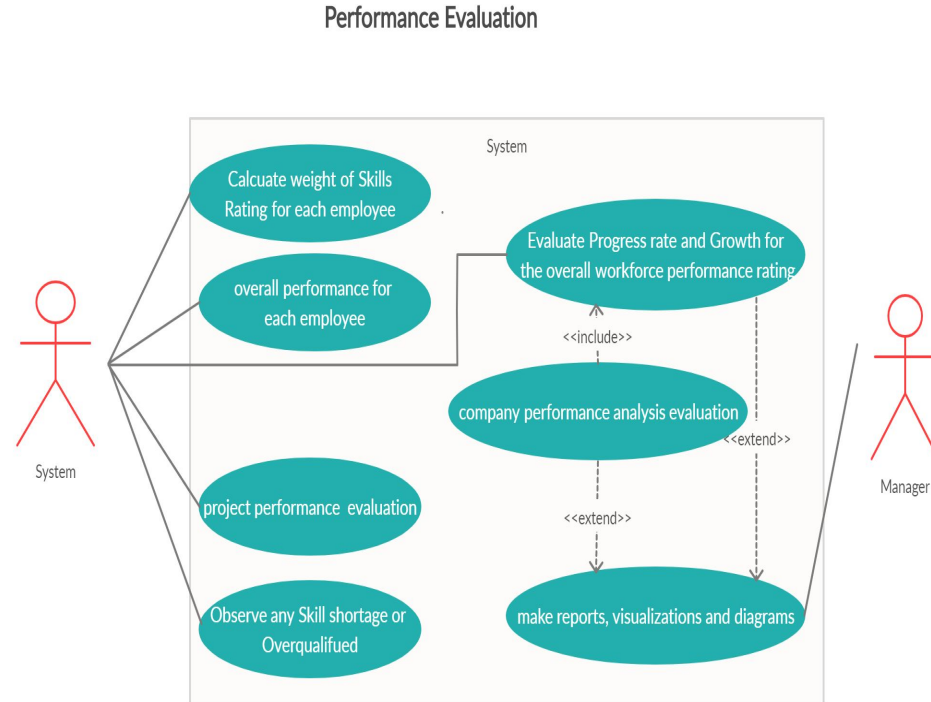
## 2.7 Need for training

- Each employee would view the list of training that he is currently enrolled in as a part of his time schedule.
- Hr can create new training , choose employees from a recommended employees list by the system of employees who need the training based on the skill rank and enroll them in training after system inspecting if their time schedule is suitable for the training time.



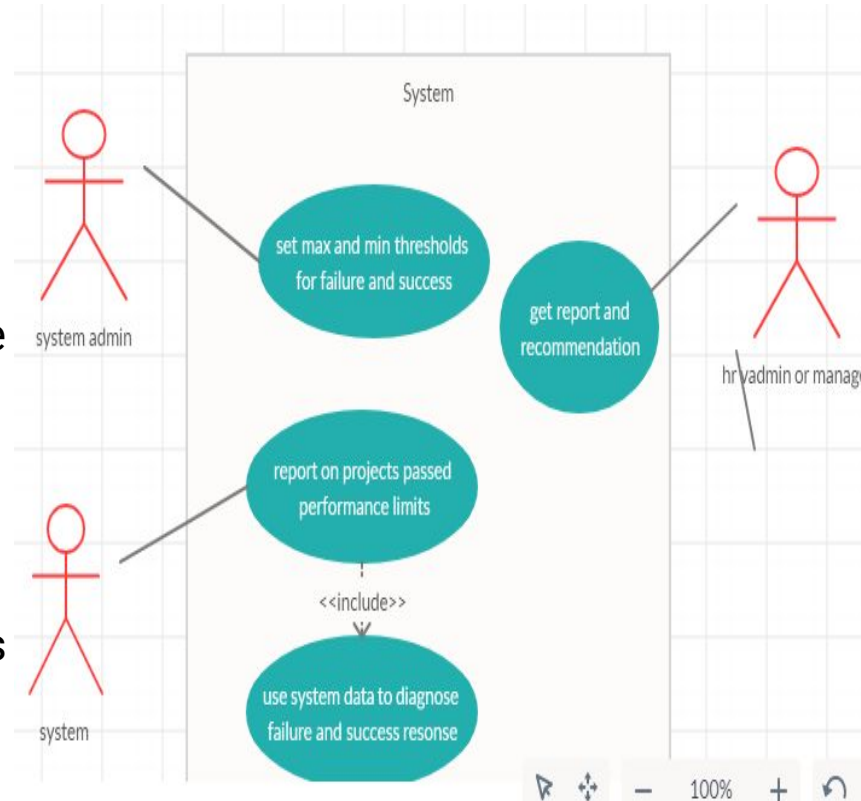
## 2.8 Performance evaluation

- Each employee can keep track of his skill rank and his performance progress through time.
- Hr employees can view employee's performance progress by employee, position or department.
- The manager can view collective progress reports for employees, projects and the company as whole.



## 2.9 Strength and weakness fields analysis

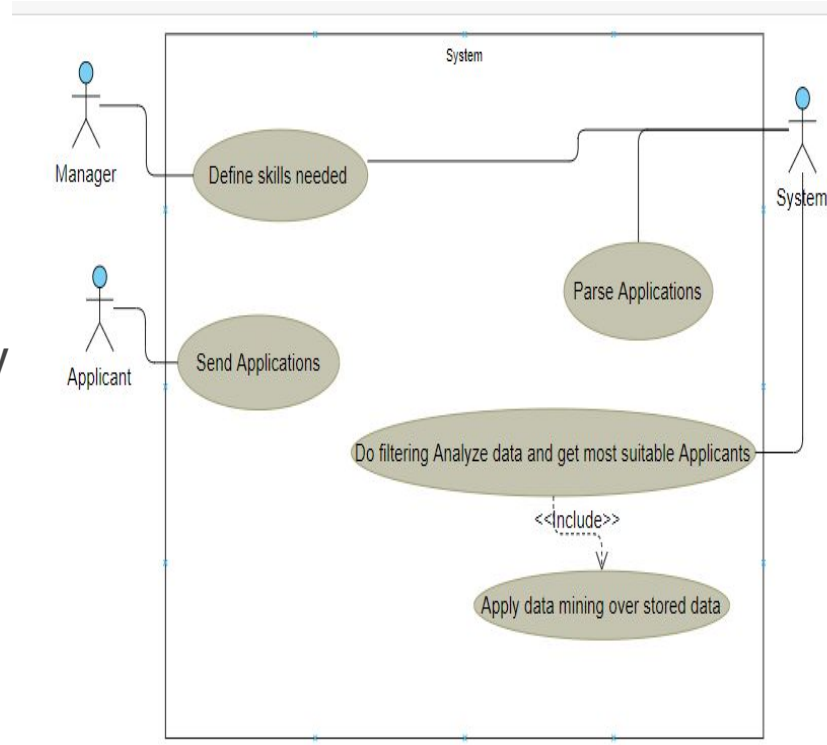
- Manager can view the departments of his company in order from strongest down and the most powerful skills in each department based on projects and employees performance of this department and relative skills.
- Manager can view the departments of his company in order from weakest up and the weakest skills in each department based on projects and employees performance of this department and relative skills.



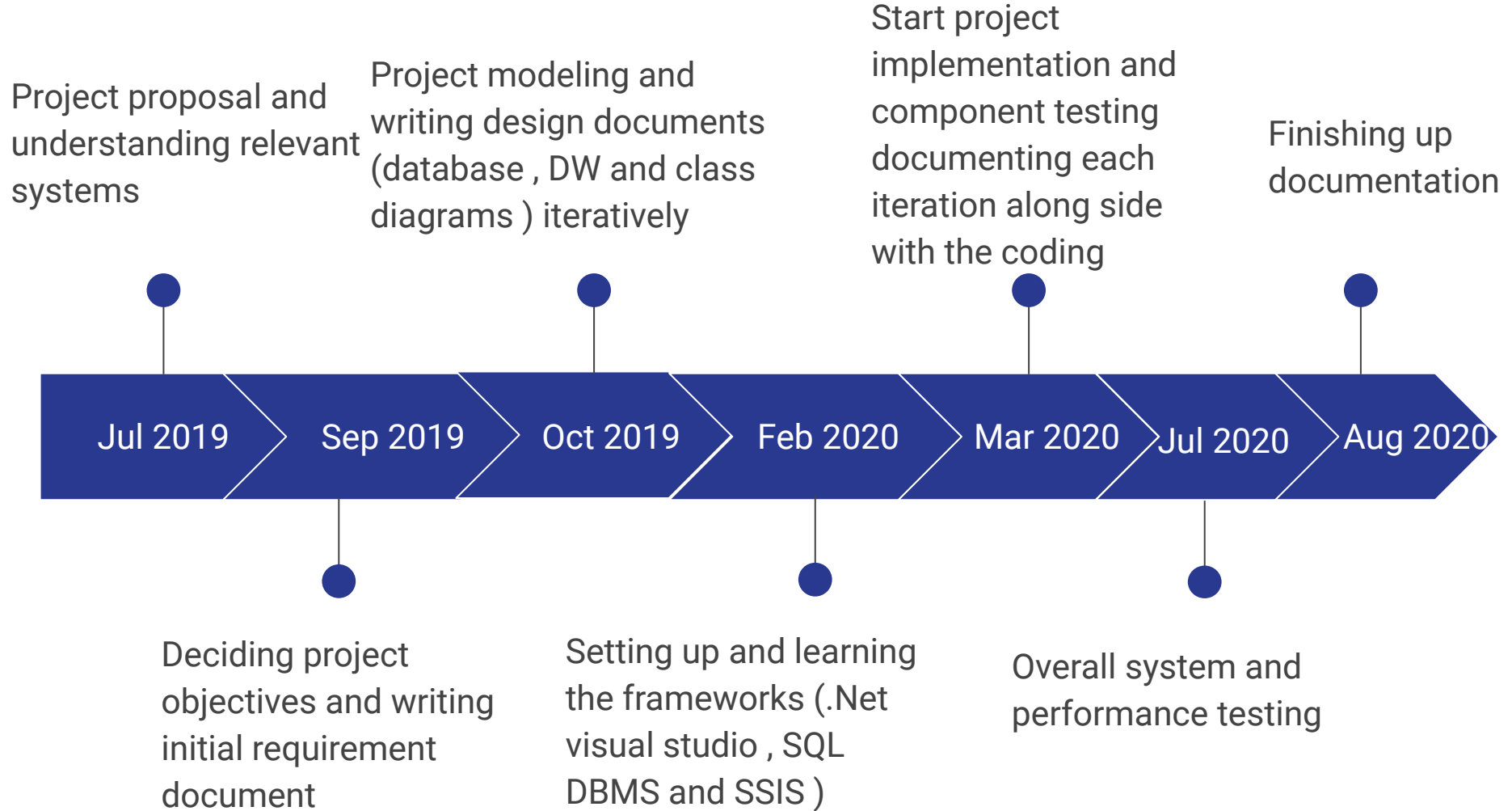


## 2.10 Recruitment

- Applicants can fill in the form with required data needed for the initial filtration process.
- Hr can view lists of recommended applicants based on job requirements they specified and the stored applications.
- Hr can hire new employees , register their data and give them their username and initial password.



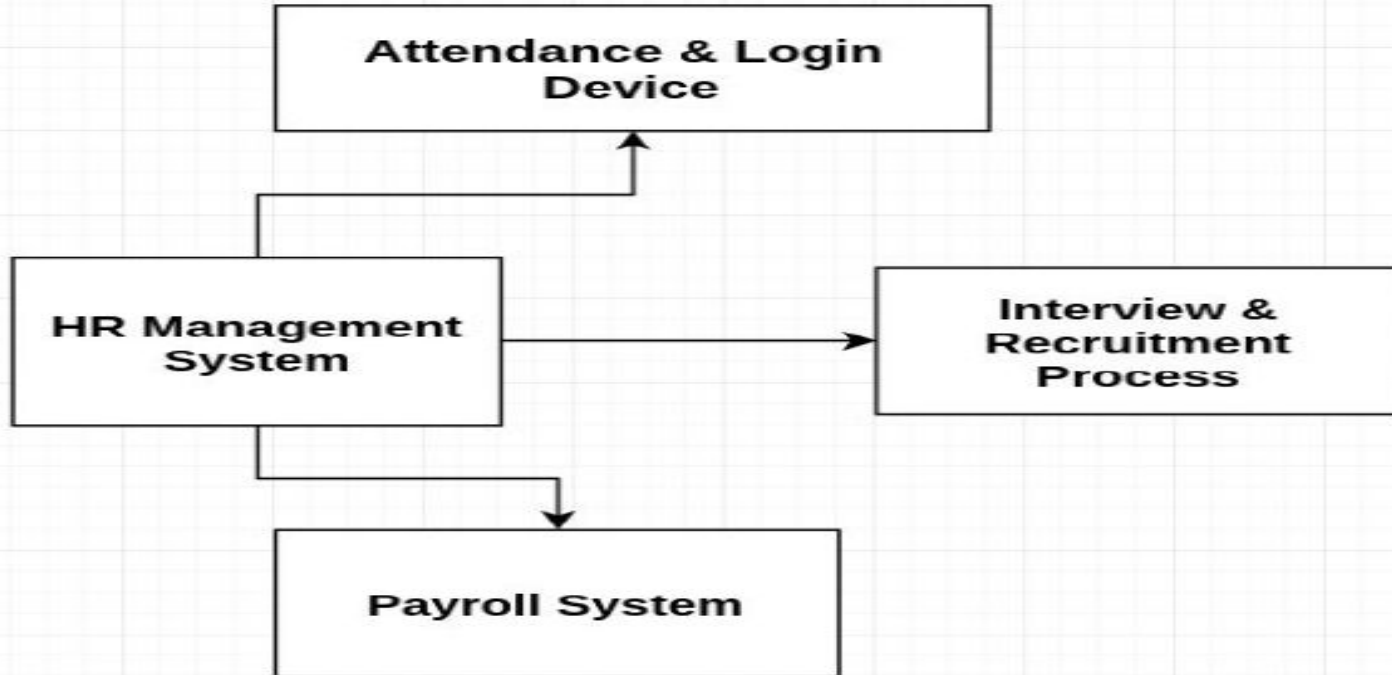
# 3. Time Plan



## 4. Design & Modeling

# 4.1 Context Modeling

# Setting system boundaries




## 4.2 Interactional Modeling

## 4.2.1 External interaction ( actors and stakeholders )



## 4.2.1.1 Managers can:

- Get performance progress reports for employees , projects , departments and positions.
  - Get Strength and Weakness Fields reports.
  - Set promotion criteria and get recommended employees for promotion.
  - View attendance reports for employees , departments and positions.
  - Update the data warehouse to add the new months records and update performance and skill ranks .
- 

## 4.2.1.2 HR Admin

- Set employee vacation ,permission and official holidays.
- View attendance reports for employees , department and positions.
- Insert training program and get recommended available employees.
- Enroll employees into training.
- Enter job requirements and get applicants recommandations
- Set bonus criteria and get employees that earn the bonus then grant bonus

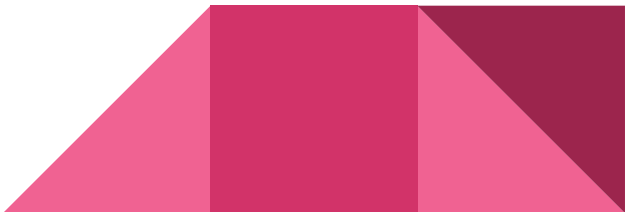


## 4.2.1.3 Team leaders can :

- Create a new project.
- Create a task in the project.
- Follow up project progress and deadlines.
- Assign tasks to employees.
- Mark tasks as finished.



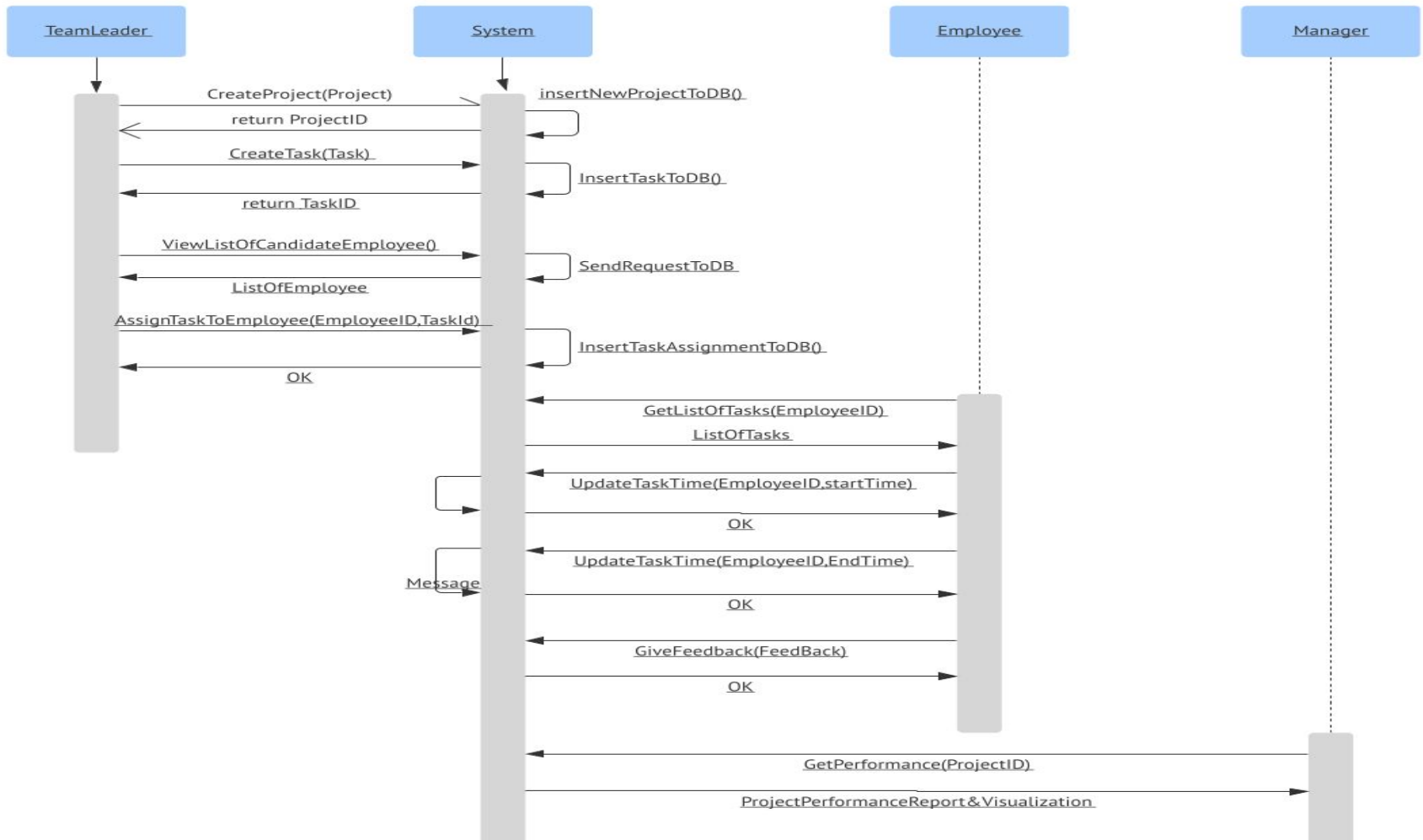
## 4.2.1.4 Employee

- Sign into the system and logout from the system.
  - View his/her profile and personal information.
  - Give feedback on tasks.
  - View current active tasks.
  - View future scheduled tasks.
  - View performance progress report.
  - View attendance progress report.
  - View his/her attendance record.
  - View list of active and available training.
- 

## 4.2.2 Internal Interactions

The next sequence diagram shows the interaction between the system components ( classes and database ) during the team leader operations to realise : project creation , task scheduling using talent management , feedback giving then performance analysis based on data from previous interaction sequence

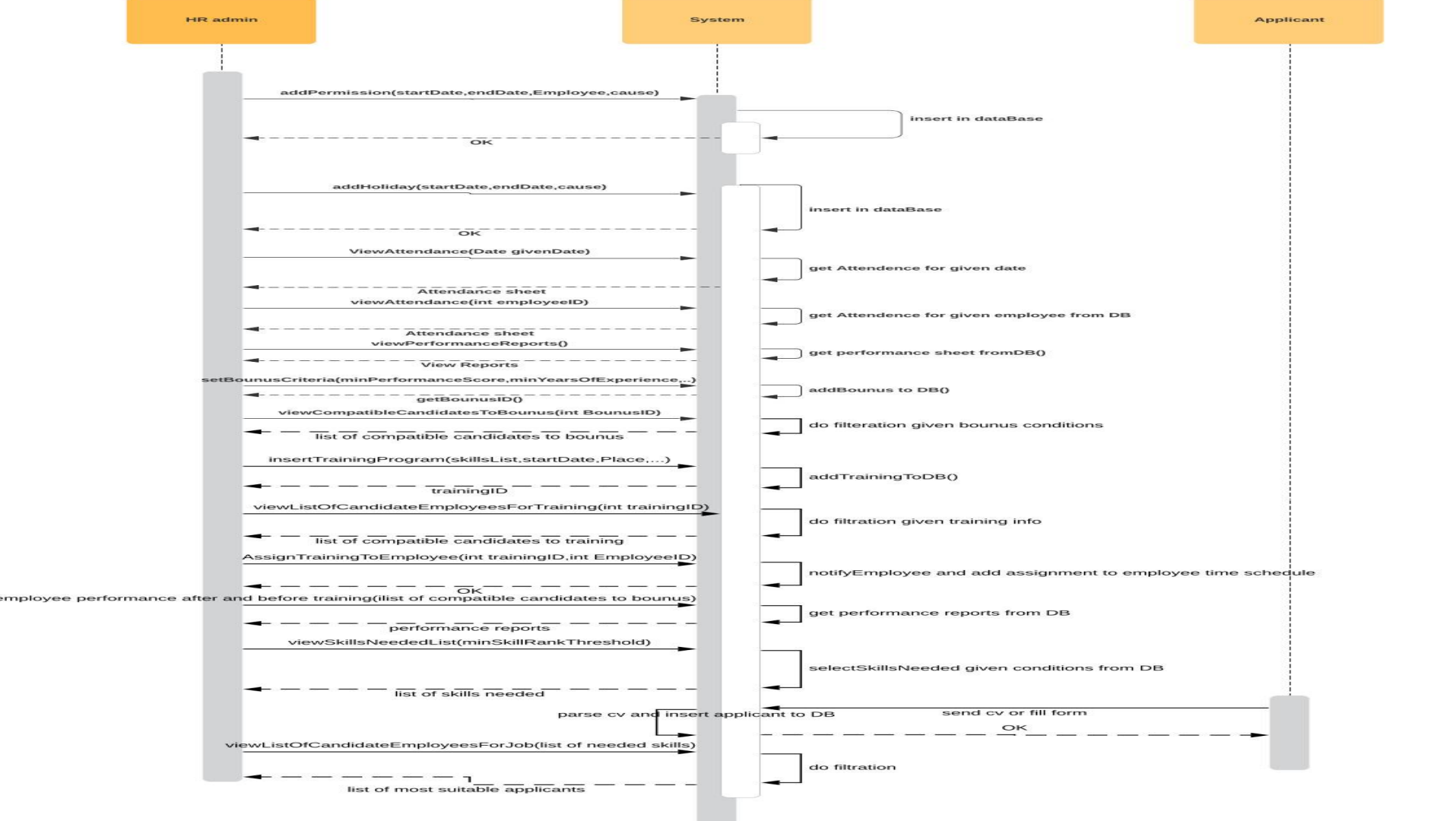




The next sequence diagram shows the interaction between the system components ( classes and database) during the HR operations sequence to realise : attendance controlling , performance and attendance progress reports viewing , training assignment and recruitment process .



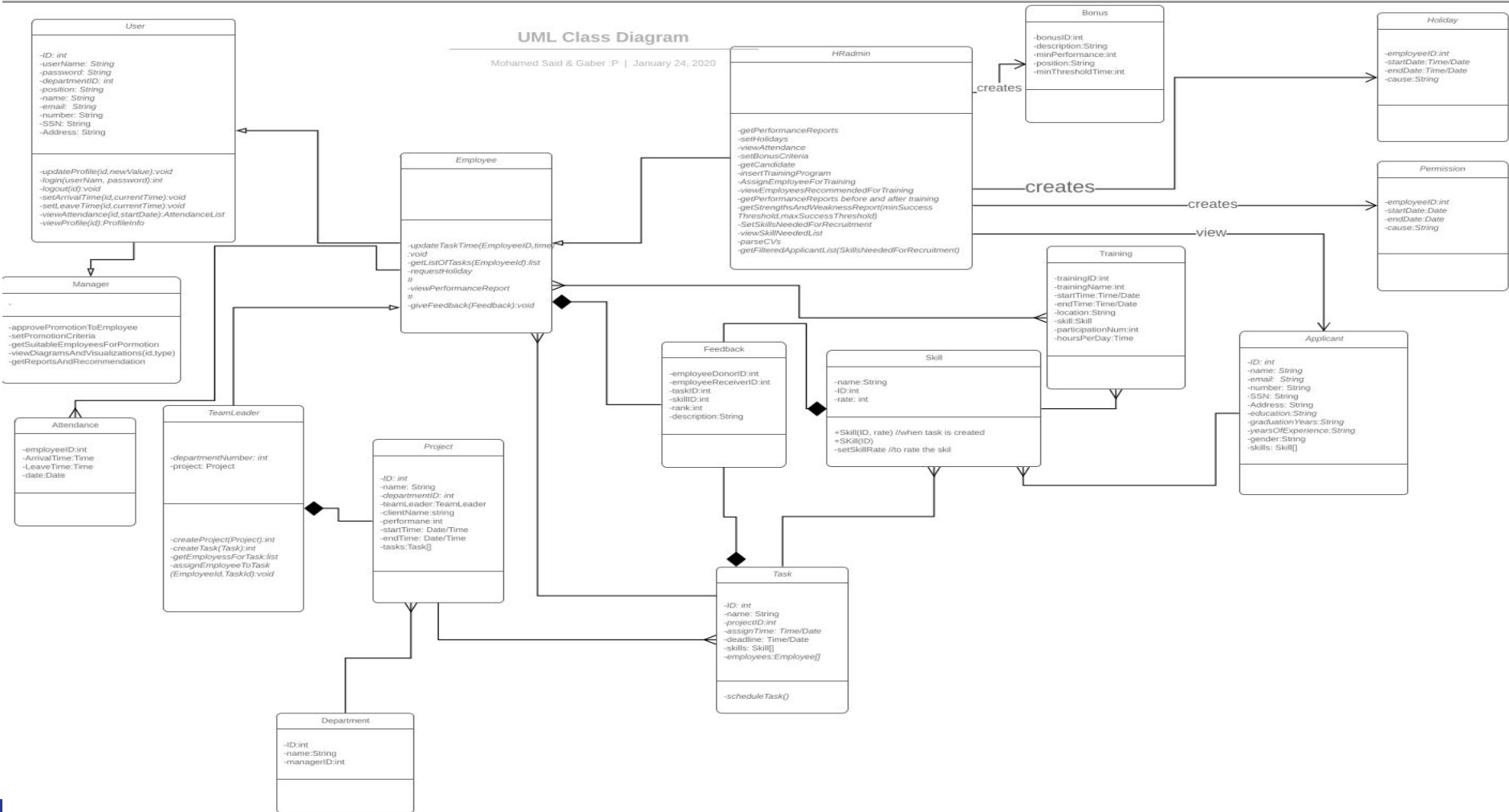




## 4.3 Structural Model

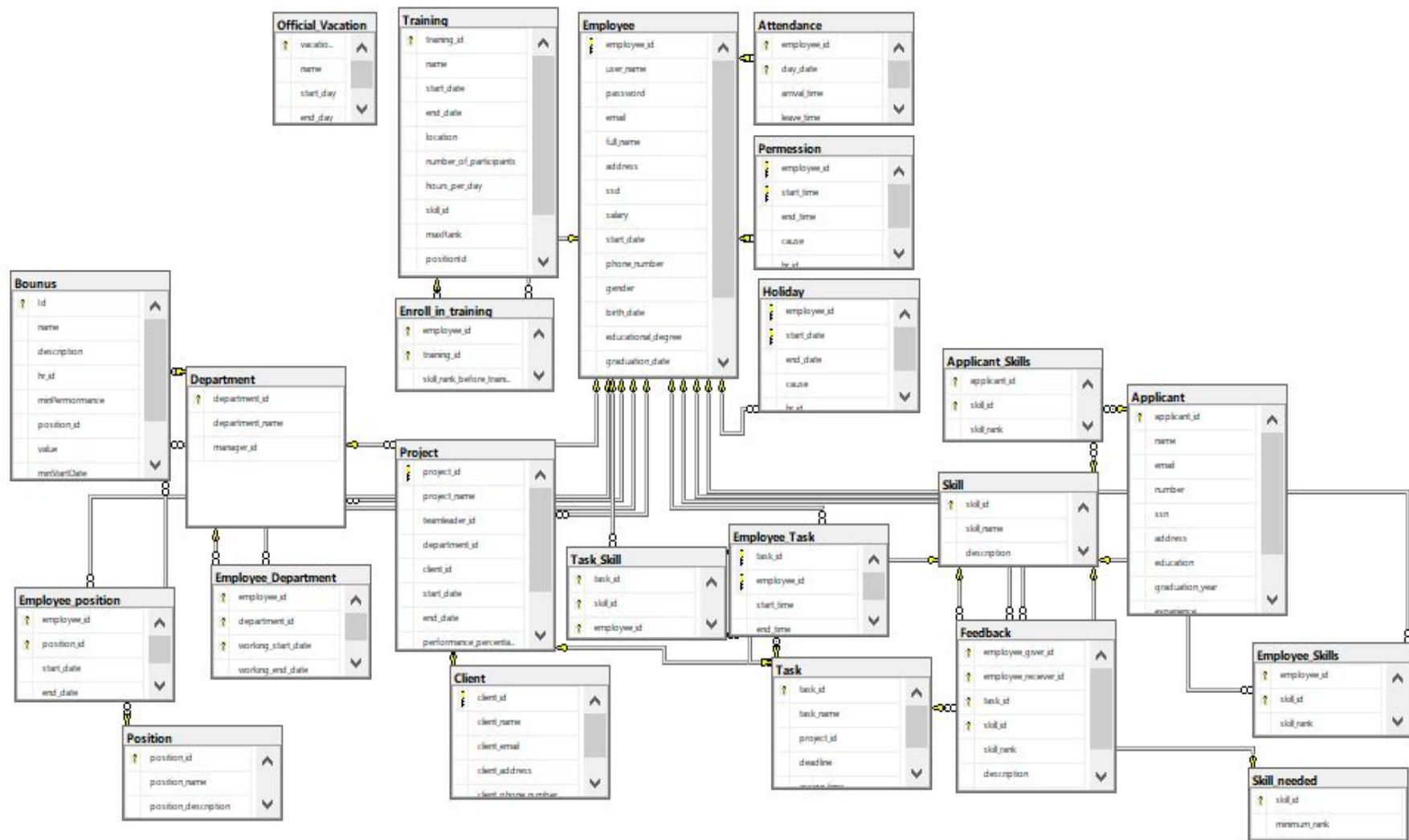
# UML Class Diagram

Mohamed Said & Gaber :P | January 24, 2020

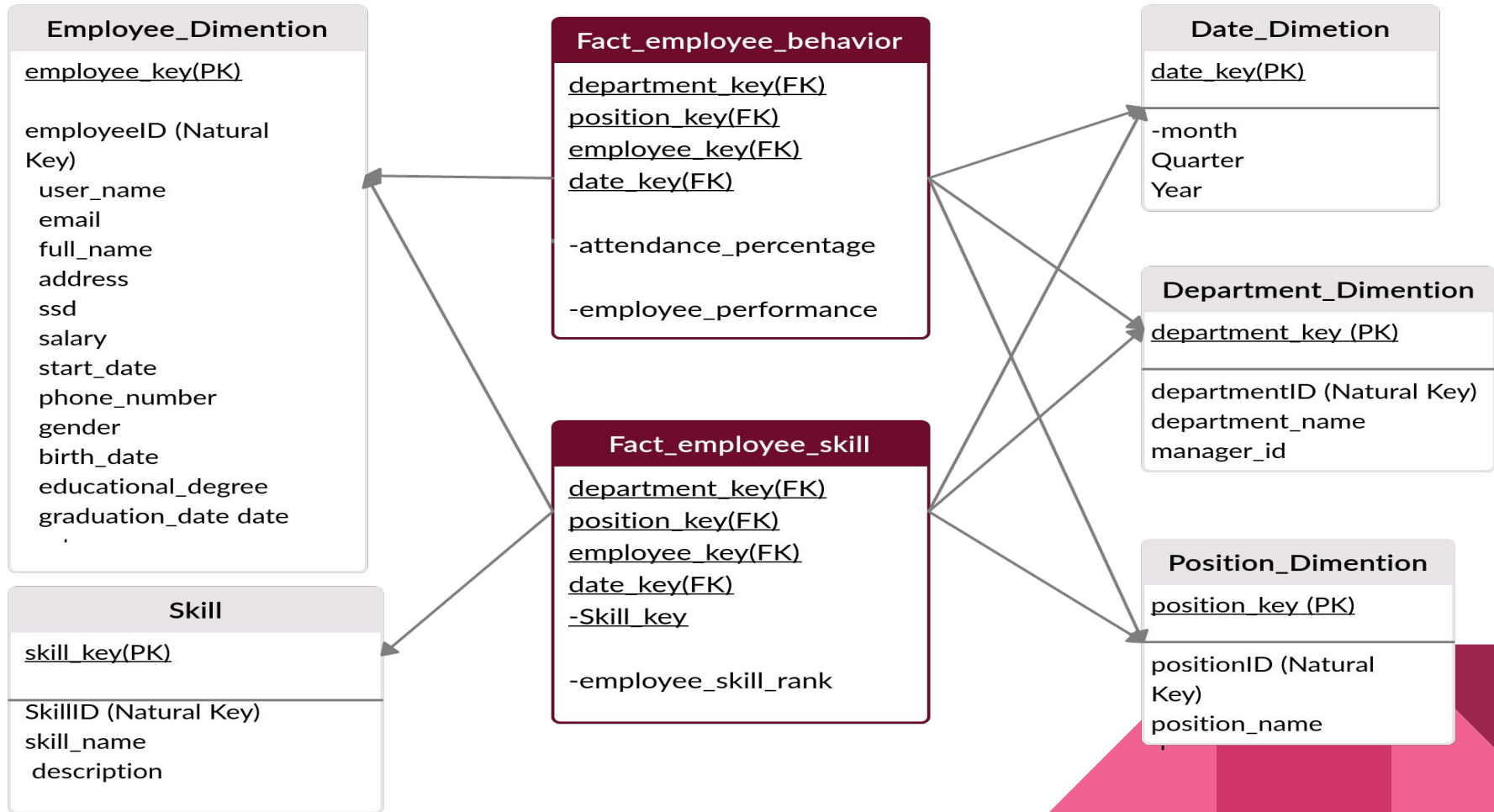


## 4.4 Architectural Design

## 4.4.1 Database Design

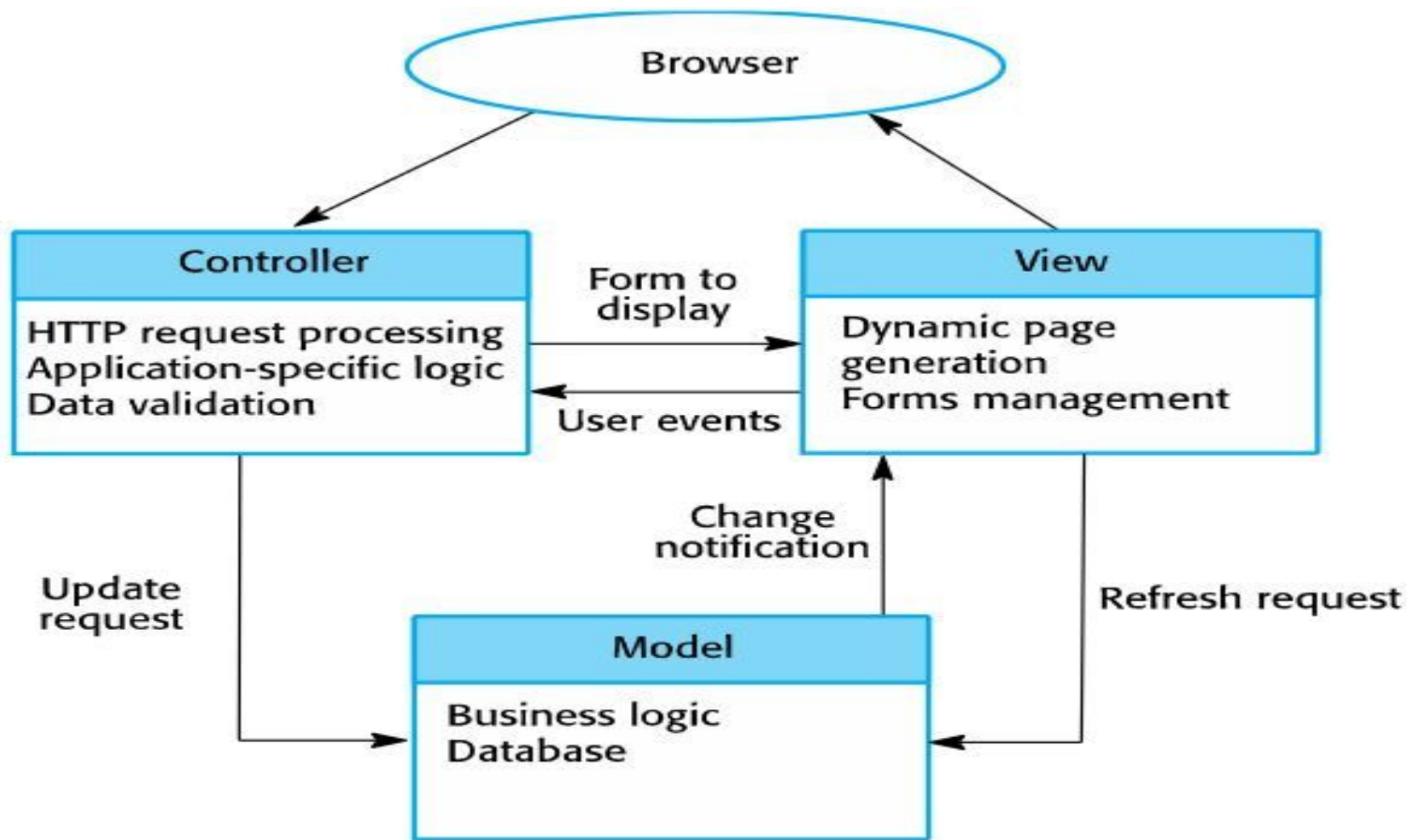


## 4.4.2 Data Warehouse design (star schema )





### 4.4.3 MVC Architecture For Component Interaction



# Why MVC ?

1. Faster development process.
2. Ability to provide multiple views.
3. The modification does not affect the entire model.



## 5. Tools Used

## Visual studio 2019

Support web application development for MVC architecture and database connections and manipulations and SSIS for data warehouse analysis in an efficient easy way which matches our project scope

## Microsoft SQL Server Management 2019

Database Management System that manages database implementation ,query manipulation and transaction and scripts execution.

Compatible with the visual studio setting for more consistent implementation

## SSIS

SQL Server Integration tool that supports data flows and implementing the data warehouse star schema design .

Also compatible with using SQL server DBMS and visual studio.

## 6. Implementation

# Agility for work and time management

We made use of the agile environment practice in managing the work which made it easier to work in parallel (front end , back end and database ) as all phases ( requirements identification , design and implementation ) were done in iterations and incrementally which made the system embrace the constantly changing requirements and design decisions and also made it maintainable and ready for new additions as additional increments with the minimum modifications.



# XP Practices for coding

We used some of the XP ( extreme programming ) practices such as :

**Pair programming** : we programmed in pairs so that code reviews are done constantly and it also supports collective ownership to all parts of the system and deep understanding of all aspects and issues.

**Repeated refactoring** : for the code to be simple and understandable to support the agility of the implementation process.





## Iteration 1 (2 weeks)

### **Build the infrastructure**

Database tables and relations built

The classes of the model part are generated and methods ready to be implemented

## Iteration 2( 1 Week)

### **Implementing Employee self service**

**3 pages :**

**Login** : any employee can log in to his profile using his username and password.

**Hire employee** : hr can insert new employee and enter his initial data to be able to log in later.

**View employee personal information** : ( name , position , department , contact info and skill scores , ..).

## Iteration 3(2 Weeks)

### **Implementing Need for Training**

3 web pages.

**Add training** : HR can create new training and insert its data.

**Training board** : HR can view and delete training.

**View Training Information** : for a single training , HR can view training information , view enrolled employees and assign any of them , view recommended employees based on the skill score and the employee free schedule and assign any of them , add an employee and check their availability.

## Iteration 4 (2 weeks)

### Build the Data warehouse tables and data flow

- ETL done from the database(extract , load , transfer )
- Data flow for each dimension is implemented
- Data flow for each fact table is implemented and queries for measure wait to be determined.

## Iteration 5 (2 Weeks)

### Implementing Employee Attendance

4 pages :

**Employee attendance** : each employee can view his attendance records in a specified time period.

**Attendance Reporting progress** : view progress charts and tables reporting the attendance percentage over time for a specified employee , position or department.

**Attendance reporting comparison** : compare attendance percentage among different employees ,departments or positions in descending order on carts.

**Insert permissions and vacations** : HR admin use this page to add permissions and holidays for a certain employee or add an official vacation for the entire company.

## Iteration 6(3 Weeks)

### Implementing Time tracking and task scheduling alongside with talent management

5 web pages.

**View Projects** : team leaders can view a list of ordered projects by latest due date and create a new project.

**View Tasks by team leader** : team leader can view tasks of active projects and add new tasks.

**New Task** : team leader can insert task data and skills and view recommended employees according to time schedule and skills needed then assign some of the recommended employees or a chosen other employee then specify skills practiced by each chosen employee to be evaluated later on.

**View Tasks by team leader** : team leader view task details and can mark the task as finished.

**Task Scheduling for employees** : each employee can view a list of active unfinished tasks and a list of coming unstarted tasks and start any of them.

## Iteration 7(1 week)

### Implementing Give Feedback

**2 pages:**

**Feedback :** each employee view list of feedback to give for each finished task that he was assigned to.

**Give Feedback :** for each task finished when clicking on the give feedback icon on the feedback page , the employee would see a form containing each employee in the task and a score to give on each skill.

## Iteration 8 (2 Weeks)

### Implementing Employee performance & bonus and promotion

**4 pages :**

**Performance Reporting progress :** view progress charts and tables reporting the performance percentage over time for a specified employee , or for employees in specific position or department.

**Performance reporting comparison :** compare performance percentage among different employees ,in specific departments or positions in descending order on carts.

**Insert bonus :** hr admin use this page to Insert new bonus and specify its criterion ( department , position and min performance percentage to earn the bonus ) then view list of employees deserving this bonus then approve the bonus.

**Insert Promotion :** hr admin use this page to insert new promotion and specify its criterion ( department , position and min performance percentage to earn the bonus ) then view list of employees deserving this promotion then choose one of them to promote , the new position of employee is inserted to the database automatically.

## Iteration 9(2 Weeks)

### Implementing Project and overall company performance & weakness and strength fields

**3 web pages.**

**Performance reporting comparison :** compare performance percentage among different projects ,in specific departments or for all departments within a selected time interval.

**Overall Company Performance :** compare performance percentage of the company over time in a selected time interval.

**Weakness and strength fields :** view weak and strength skills in each department and view strongest and weakest departments.

## Iteration 10(1 week)

### Implementing recruitment

#### 2 pages:

**Applicant form** : applicant enters his personal and professional information and skills list needed for job filtration by HR.

**HR recruitment** : HR can enter the desired skills and conditions for the job and get a list of applicants that fulfill these conditions and their contact information to carry on with the recruitment process.

# 7. Testing

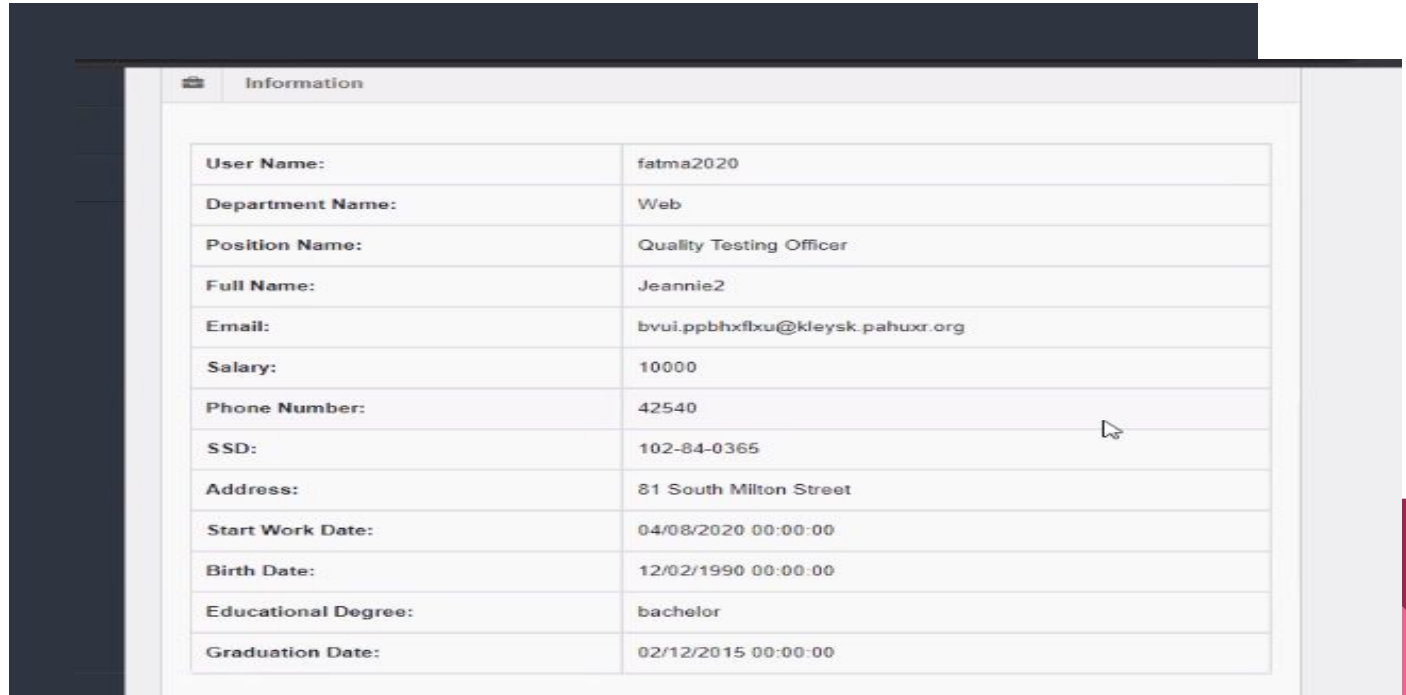
# Testing strategy

- 1) Unit and component testing were used during the implementation phase (test driven technique using pre written test cases )
- 2) System testing was performed in 2 directions :
  - Requirement testing (for functional requirements validation)
  - Performance testing ( for nonfunctional requirements validation)



# 7.1 Requirements Testing

## 7.1.1 Employee Self Service

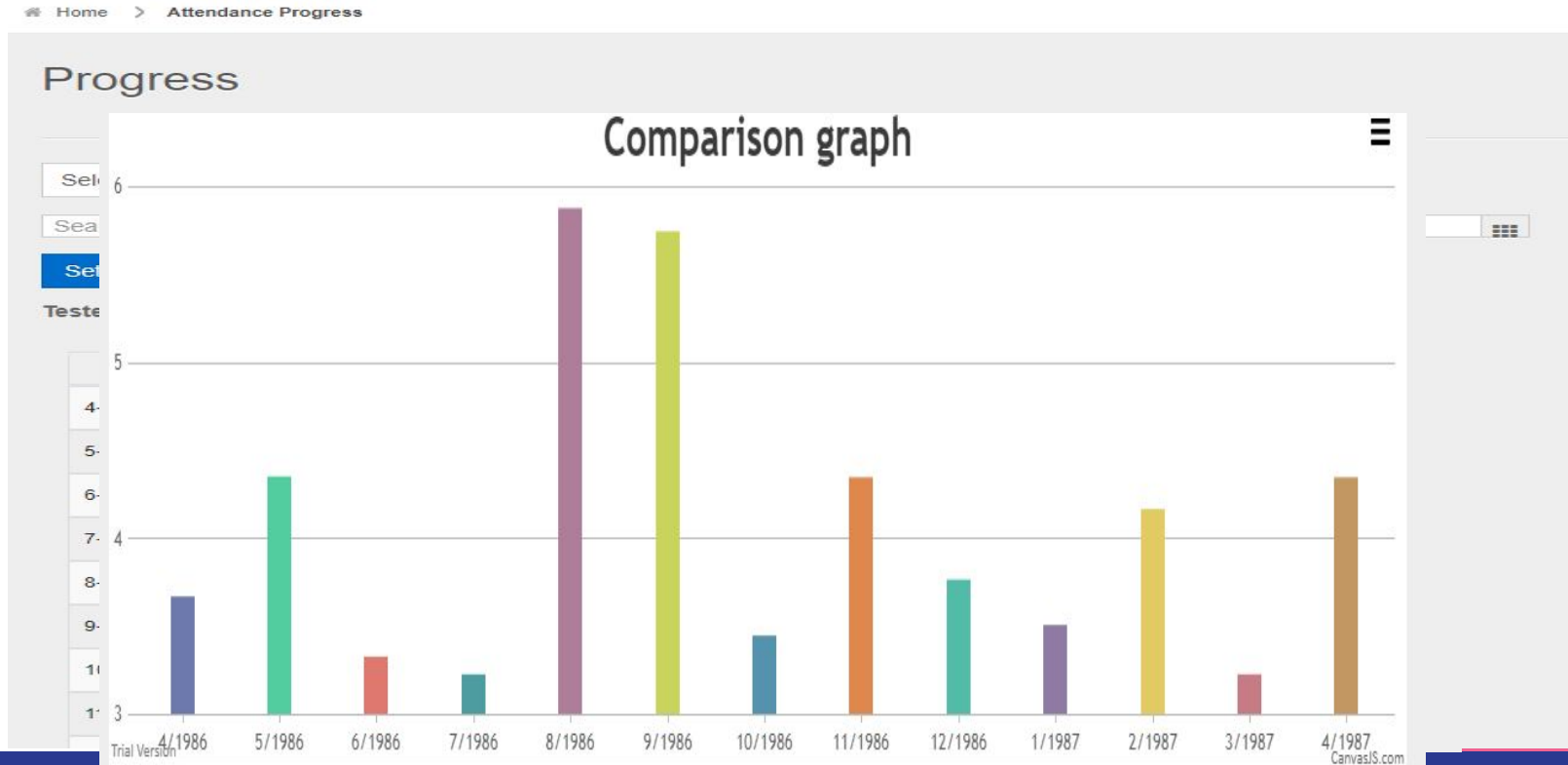


A screenshot of an 'Employee Self Service' web application. The interface features a dark blue header bar. Below it, a light gray sidebar contains a menu with a folder icon and the label 'Information'. The main content area displays a form titled 'Information' with a table of employee details. The table has two columns: a label column and a value column. The values include 'fatma2020', 'Web', 'Quality Testing Officer', 'Jeannie2', 'bvui.ppbhxfxu@kleysk.pahuxr.org', '10000', '42540', '102-84-0365', '81 South Milton Street', '04/08/2020 00:00:00', '12/02/1990 00:00:00', 'bachelor', and '02/12/2015 00:00:00'. A mouse cursor is visible over the 'Phone Number' field.

Information	
User Name:	fatma2020
Department Name:	Web
Position Name:	Quality Testing Officer
Full Name:	Jeannie2
Email:	bvui.ppbhxfxu@kleysk.pahuxr.org
Salary:	10000
Phone Number:	42540
SSD:	102-84-0365
Address:	81 South Milton Street
Start Work Date:	04/08/2020 00:00:00
Birth Date:	12/02/1990 00:00:00
Educational Degree:	bachelor
Graduation Date:	02/12/2015 00:00:00



## 7.1.2 Attendance



## 7.1.3 Feedback

Welcome User

Messages 5

Settings

Logout

Home > Feedback > Give Feedback

Cassandra68 - Fredrick70

Mickey4

Skill	Rank(1 to 5)	Message	
OOP	5	good at team work	Give

Jamey7

Skill	Rank(1 to 5)	Message	
Scientific computing	3	not v	Give

Next

# 7.1.4 Time Tracking and Task Scheduling

Home > Projects

Projects

+ New Project

Pr

Test F

Test F

Hilary

Casse

Dale

Diane

Mary

Eric

Darint

Viewing Task

List Of Employees

Employee Name	Phone Number	Email
Jeanine25	7839557581	araenhou0@yijgj.msusun.com
Roberta503	337992-0232	hlmy64@dtfas.com
Joann197	257879-6646	osyaazer@qmhsfc.com
Penny859	148298-6211	vsuniky.laqaqveeg@cwuxpwwkj.eojjpm.com
Pamela160	239508-9542	qrwencx17@ywmjxdjcz.qxnjwrt.net
Eli80	318-5816792	trhh2@qfdfrm.net

End Task

## 7.1.5 Talent Management

Recommended Employees

Employee Name	-		
Valerie	Scientific computing	5	<a href="#">Assign</a>
Lewis07	Scientific computing	5	<a href="#">Assign</a>
Eva997	Scientific computing	5	<a href="#">Assign</a>
Andrew17	Scientific computing	5	<a href="#">Assign</a>
Serena216	Scientific computing	5	<a href="#">Assign</a>
Glenda6	Scientific computing	5	<a href="#">Assign</a>
Christy	Scientific computing	5	<a href="#">Assign</a>
Glenda	Scientific computing	5	<a href="#">Assign</a>

[Add](#)

[Next](#)

## 7.1.6 Bonus and Promotion

Promotion

Strength And Weakness Fields

Company Performance

Project Performance

Maximum Skill Rank :

Minimum Performance Percentage :  99%

Minimum Attendance Percentage :

New Position :  Please select

Print

Table

User Name	Average Skill Rank	Performance Percentage	Attendance Percentage	
Jeremy	3	51.00%	30.00%	<a href="#">Promote</a>
Theresa375	5	70.00%	31.00%	<a href="#">Promote</a>

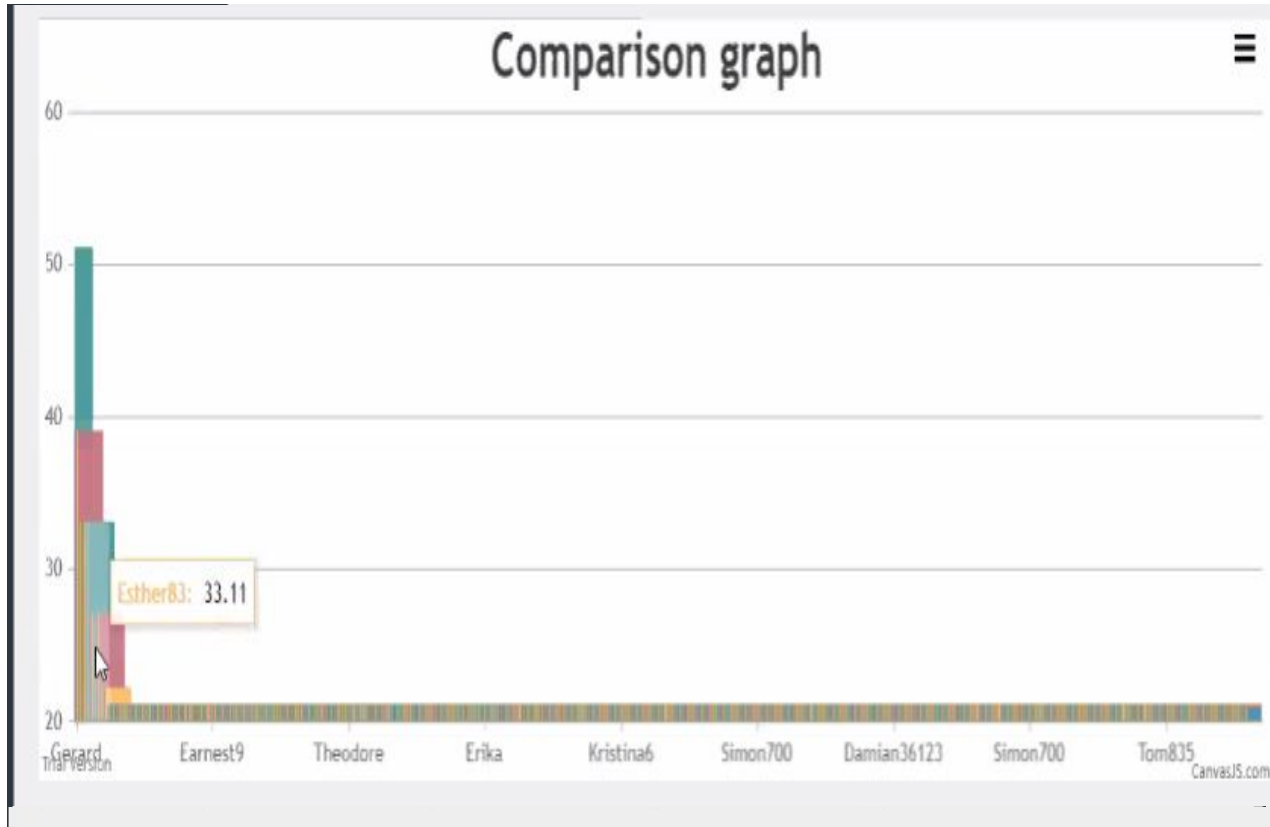
## 7.1.7 Training Management

The screenshot shows a web application for Training Management. On the left is a dark sidebar with menu items: 'Feedback', 'Holidays and Permissions', and 'Hire Applicant'. The main content area has a top bar with 'Add Training'. Below this is a section titled 'Recommended Employees' with a table containing columns: 'Employee Name', 'Email', 'Phone Number', and 'Address'. The table is currently empty. Below the 'Recommended Employees' section is a section titled 'Active Trainings'. It contains a table with the following data:

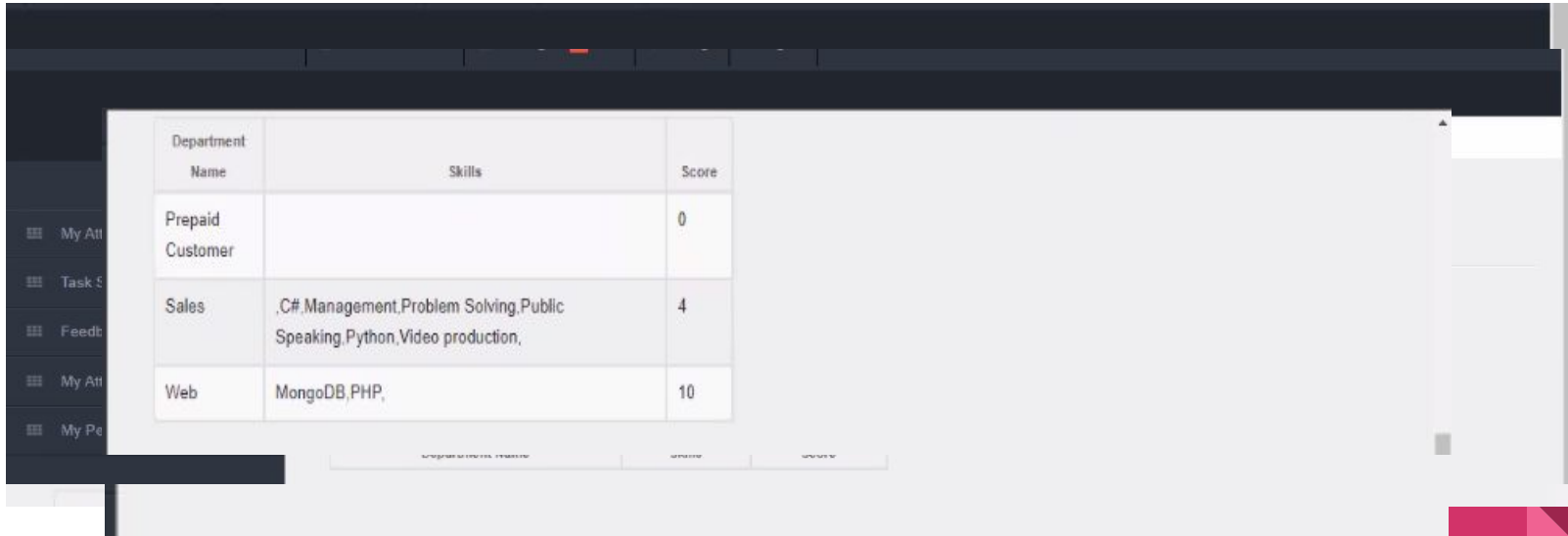
Training Name	Skill Name	Start Date	End Date
presentation skills, -	Leadership	01/08/2020 00:00:00	20/08/2020 00:00:00

An 'Activate Windows' watermark is visible in the bottom right corner of the application window.

## 7.1.8 Performance Evaluation



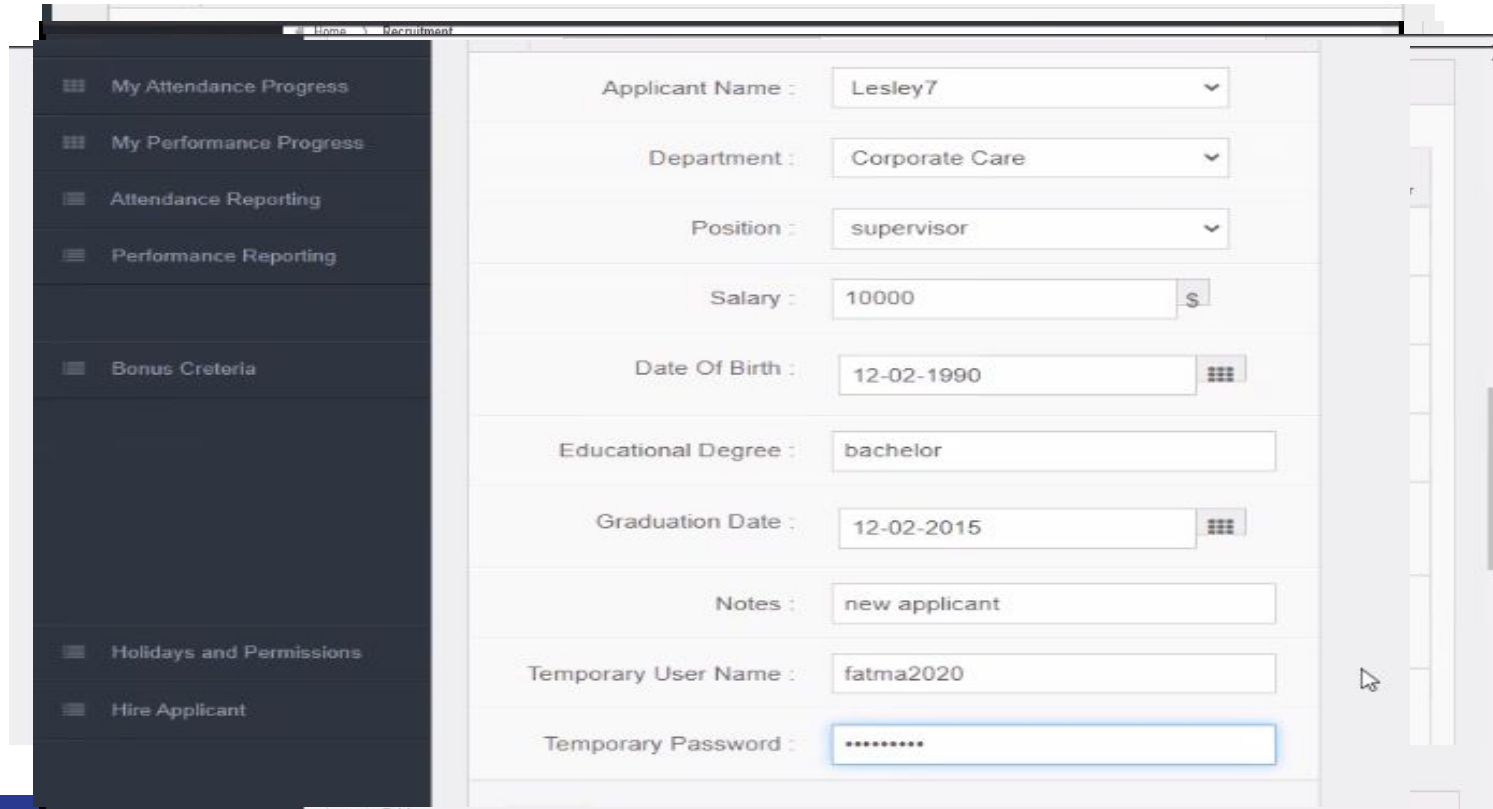
## 7.1.9 Strength and weakness analysis



Department Name	Skills	Score
Prepaid Customer		0
Sales	.C#, Management, Problem Solving, Public Speaking, Python, Video production,	4
Web	MongoDB, PHP,	10



## 7.1.10 Recruitment



The screenshot shows a web application interface for recruitment. On the left is a dark sidebar with navigation links. The main area contains a form with various fields for applicant information. The form is titled 'Recruitment' in the top navigation bar. The fields include dropdown menus for Name, Department, and Position; text inputs for Salary, Date of Birth, Educational Degree, Graduation Date, Notes, Temporary User Name, and Temporary Password. The Temporary Password field is currently masked with dots.

Home Recruitment

My Attendance Progress

My Performance Progress

Attendance Reporting

Performance Reporting

Bonus Criteria

Holidays and Permissions

Hire Applicant

Applicant Name : Lesley7

Department : Corporate Care

Position : supervisor

Salary : 10000 \$

Date Of Birth : 12-02-1990

Educational Degree : bachelor

Graduation Date : 12-02-2015

Notes : new applicant

Temporary User Name : fatma2020

Temporary Password : .....

## 7.2 Performance Testing

<b>Usability</b>	the system's interfaces are easy to use by any average employee with training period that won't exceed 2 weeks due to descriptive messages , warnings and interfaces.
<b>Performance</b>	the system has fast response to analysis and reporting and listing commands due to the efficient implementation of the DW and database transactions ( we only tested the system on local host so the performance might differ when deployed on a host server due to network and other technical complications )
<b>Maintainability</b>	the system is very highly maintainable as we lied the bases in the architecture , design , database procedures and backend implementation for very wide range of additions and modifications that can easily be added even when new functionalities are going to be introduced , the system would show great flexibility , readability and simplicity through requirement changes as we made sure to site a detailed system modeling and implementation documentation.
<b>Security</b>	security is partially achieved through password log in mechanism but there would be threats as authorization and token authentication mechanisms weren't applied as they were out of our interest scope that included DW design and implementation in real life application.
<b>Reliability</b>	the system wouldn't fail in the normal conditions and operations but in case of unpredicted input , the system behavior would be unpredictable and there's risk of system failure as input validation and testing wasn't thoroughly examined.



## 8. Conclusion and Future Work

# 8.1 Conclusion

The system is a very clear illustration to the implementation of a DW based application that can still be extended and lots of functionalities are realisable given the architectural design and the infrastructure ( DB ,DW and model ) implementation

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## 8.2 Future Work

- 1- Some extra functional requirements can be added ( training follow up , further data analysis and predictions ,...etc).
  - 2- Security can be increased through token authentication.
  - 3- More excessive testing can take place to make the system.
  - 4- More reliable and increases availability and failure mutiny.
  - 5- Input validation for non predictable inputs and behavior can be done.
  - 6- predictions using data mining and deep learning models can easily be introduced based on statistics and analytics provided by the system would be a great asset to add value to the current system
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# Team Members

Ashraquat Sheta

Fatma Ibrahim

Marina Zakaria

Abdelrahman Said

Mohamed Gaber

Mohamed Said

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