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Project Proposal

Employee Management System

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1. Objectives

1.1. Purpose

The main objective of our project is to design and build an enterprise resource planning (ERP) system to manage and securely store personal and work-related information for employees and managers in a user-friendly interactive environment [33]. The system is meant to provide a portal for employees to access any administrative information they require while also allowing managers and Human Resources (HR) to be able to handle administrative tasks.

1.2. Functional Requirements

The system is a desktop application with three main levels of access: employees, managers, and human resources. Each staff member can access the system using personal credentials with different levels of authorizations depending on their position.

The system allows employees to view their own salary related information, schedule and current assigned project. The system allows employees to put in requests for equipment, vacation and to work from the office. The system does not allow employees to edit any information.

The system allows managers and administrative staff (HR) to view employees, respond to requests, make notes in an employee's file and provide yearly feedback. Managers can further keep track of projects and their details. HR has additional access to add, remove and edit employees in the system.

1.3. Non-Functional Requirements

The system will be developed using the Java framework Swing[17]. The system will follow a Model View Controller (MVC) design pattern and will run on Windows OS based devices [25]. It will have its own database hosted on an online remote MYSQL server[54]. It is developed using MYSQL [19] on MYSQL workbench [20] and it will be connected to the application using libraries such as Java JDBC[21]. A Github repository will be used to maintain and manage the code[22].

1.4. Plan for Measuring Progress

A Gantt chart has been created to show the development deadlines of the project [65]. The project has been divided based on the most important features. The Gantt chart also shows the division of tasks between team members. The aim is to have

60% of the development done by January. The development progress will be further tracked using Github.

Internal deadlines have been set to keep the project deliverables on track. These deliverables include any reports and documents required to be submitted over the course of the project. The deadlines set in the winter semester in January, 2023 are subject to change based on course work.

2. Background

The Employee Management System is meant to be an ERP (Enterprise Resource Planning System) which allows any staff member to access the system and handle day-to- day tasks. The idea to develop an ERP came from issues noticed in current ERP systems such as the Clearview[32] and Phoenix[4] systems. After researching and interviewing the users of current systems, our system is being developed to overcome any shortcomings. There are many ways to classify an ERP. ERP are based on company needs, whether the system is on-premise or cloud based, company size and industry specificity [34].

2.1. Ellucian Banner System

The banner system is a specialized ERP system made for schools and educational organizations. It has 3 modules: finance, students and human resources. It is also a hybrid on-premise and cloud based system and connects to many adjacent systems [37]. The adjacent systems can include hiring, reporting and pension systems as seen with Carleton university's implementation of the system. After an interview with the Carleton's head of HR, some pros and cons of the system can be defined.The system is extensive and more directly interfaces with the database to get information. One of the biggest drawbacks is the expandability of the system. The system requires multiple years of research and development to implement changes [38]. The system also does not have a proper information intake system such that the hiring system cannot send information to the banner system, requiring employees to be manually added. Employee files at Carleton were being stored physically until recently, and covid had a drastic impact on system's ease of use eliciting the system to be upgraded and employee information being stored in the system as of now [61].

2.2. Clearview Panasonic System

The Clearview Panasonic system is a restaurant based ERP system used to track inventory, manage employees, manage payroll, manage accounts receivable and connected to external point of sale systems [32]. The system seems to fall under the cloud based ERP and is also specialized towards restaurant systems [31]. The system is

mainly used by management and HR to handle administrative tasks. The current system works really well with managing employees and inventory. The few drawbacks found were not being able to track who is eligible for benefits, not being paperless and having to connect to external systems to do paystubs. The employee portal does not show any information about schedules or benefits, requiring email for both [62].

2.3. Phoenix System

It is the government of Canada's pay and benefits application with self-service features for both employees and managers. Employees can access information such as their pay stubs, paychecks, their schedules, and benefits[4]. Each employee is assigned to a manager and the manager is responsible for assigning the employee's work schedule, approving payable and non payable times, and editing timesheets. Employees have to use another different system to report their overtime requests and days off/vacation which is a major drawback because it is hard to navigate between two systems when everything could be merged into one system since all information is related. In addition to the integration issues, scalability issues make the system expensive to maintain[48].

2.4. Latest Technology

The current best ERP systems are Acumatica [48] and Oracle [47]. The Acumatica system is a versatile system which is designed based on the company's needs. The system can be deployed either on premise or cloud based. The company also has a very good set up to provide technical help. While the system is easily scalable, the pricing can be steep and not clear [46]. The Oracle netsuite ERP is a cloud based system [40] that provides very good scalability and has an easy to navigate interface. The Oracle system has very good report generating tools which can provide detailed information to a company [47].

2.5. Our System

As mentioned before, the system being created is to cover some of the drawbacks found in other systems. The system is an on-premise ERP and is not going to be specialized towards a certain industry. The system is catered towards mid-size companies that work on a project basis. Mid-level ERP’s are cost effective and reasonable for growing small and mid-size companies [42]. The system is going to include an employee portal, to give employees access to all relevant information about their position and workplace in one place. The system is to also automate the adding employees into the system without requiring manual intervention. The system is also built to keep employee information paperless. This system is also going to

include a report generating feature, which can be very useful to companies. Most of the features are meant to be compatible with a small company's needs, and are being developed to be easily specialized for mid-size companies.

3. Project Description

The system provides a User-friendly platform to help employees from different levels to manage day to day challenges and achieve the goal of their organization. After doing research and looking into existing management systems such as Phoenix[4], Clearview[32], and Carleton HR [37] and seeing the different features and pros and cons of these systems, it was decided that three levels of access to the system are needed to easily guide and manage information in the right direction. The three main levels of access are Manager view, Employee view, and HR view. Each view will be accessed via a username/password account and each view will have a different level of authorization depending on their position/job title.

Each view will contain standard pages such as Dashboard, Salary, schedule, and Request. As well as a landing page that every user must use to login into the system [67]. Other pages and tabs are designed based on the needs of each view. The system will store and manage the information of the users using a database. In order to make a use of the stored information and provide less manual work for the managers in keeping track of informations such as yearly salaries for each employee or their attendance, a real time generating reports feature will be developed to take the existing stored data and display it in the form of a chart, similar to Excel charts [57] or Microsoft PowerBi [58]. This feature is meant to help managers to keep paperless real time updated records of their employees. This feature will only be available in Manager and HR views as this is part of the managers daily tasks [67].

A major key feature in the HR view is using automation to automate the process of addition of new employees[67]. Most of the management systems we looked at in our research such as Phoenix[4] and Carleton HR system [37], as well as the people that were interviewed such as Terrence [61] and Kim [62] all lacked the automation feature and struggled with the onboarding process of new employees. Most of the work had to be done manually such as creating an account and storing information in the database or getting the employee's signature on forms such as contract and training. The HR manager user will use the Add Employee page to enter all the required information for the onboarding process, then use this information to add the new employees in the database and create a username and a temporary password for them. Also, sending them important forms to be signed, assigning a manager to them, and displaying information in the system which will be later available to the managers to review [67].

Employees from all levels will be able to view their schedule for the day. Also, both employees and managers will be able to keep track of what projects they are currently supervising/working on or have supervised/worked on. A notification system is set up for all three views, as well as other important pages[67].

4. Relevance to Degree

The relevant degree for this project is B.Eng. in Software Engineering. Both the team members are currently enrolled in B.Eng. in Software Engineering and have taken the same courses. This section will summarize the relevant skills that were learned in this program and the methods being utilized from the courses. The project is a software-only project involving the use of Java and a database. Both Java and SQL were studied to this degree. The relevant skills can be broken down into three categories: project planning, Java development and database.

4.1. Project planning

Project planning refers to organizing the project to ensure that the necessary features are included and have been set with realistic deadlines. It also refers to gathering all the information needed to implement the project in a way that is useful to the users and researching any technical requirements. The relevant courses are SYSC 3120 and SYSC 4106.

SYSC 3120: Software Requirements Engineering outlines how to research any project and model its requirements [23]. This course helped with finding the right people to interview and what kinds of questions to ask them. As the system is an employee based system, multiple HR and technical individuals who have worked with similar systems were chosen to be interviewed to fill in the gaps in the team's knowledge. This course has also taught us how to model these requirements, the main model we will be using is the UML diagram. Further models such as sequence diagrams and use cases will be used if the system requires them.

SYSC 4106: The Software Economy and Project Management is a course that outlines project management. The course showed team management and how to plan the project [23]. Using the skills learned in this course, the project has been set to be developed using an incremental model [29][30]. After the initial research phase, the project will be developed to a simple system that allows the user to send and receive requests. Which will be followed by the testing phase. After the first version of the system is completed, any further features being added will follow the same research, develop and test phase [24]. The main features for each phase are sending and receiving requests based on a notification system, generating charts and reports,

automation, adding necessary employee system pages with the last feature being improving the UI design.

4.2. Database

The most important part of the project is the database. As an employee system can contain information about thousands of employees, the project requires a database. COMP 3005: Database Management System [27] taught the basics of a database and running SQL commands [56]. This project will be using a SQL database. The main concepts that will be used from this course are designing a database using the entity relationship model [55] and creating a database.

4.3. Java Development

The largest part of the development is going to involve programming in Java. There are multiple courses in the software engineering program that not only have been purely in Java but also demonstrated coding standards and methods to implement code in an efficient manner.

Starting with SYSC 2004: Object Oriented Development taught the basics of object oriented programming, showing how to make the code modular and using iterative development [23]. The main concepts that are going to be applied in the project from this course are object oriented programing and test driven development. This course also introduced Java swing GUI which will help create the GUI of this project.

Next relevant course is SYSC 2100: Algorithms and Data Structures. This course was really important in introducing different collections, data structures, recursive and sorting algorithms [23]. The main skills learned from this course are effective use of data structures and algorithms that will play a big part in the development of the project. The relevant algorithms and data structures to use from this course will be decided during the research/implementation phase of each feature in the project.

SYSC 3110: Software Development Project is a course teaching different patterns, refactoring and writing readable and reusable code [23]. The model-view-controller pattern is going to be used as the model will be interacting with this system's database and will not be impacted by the view [25]. Other methods such as inheritance and template methods are going to be implemented whenever needed to make sure the code remains easy to read and edit. The biggest skill gained from this course is proper writing of code and refactoring to ensure the code is reusable, easy to debug and be used by others.

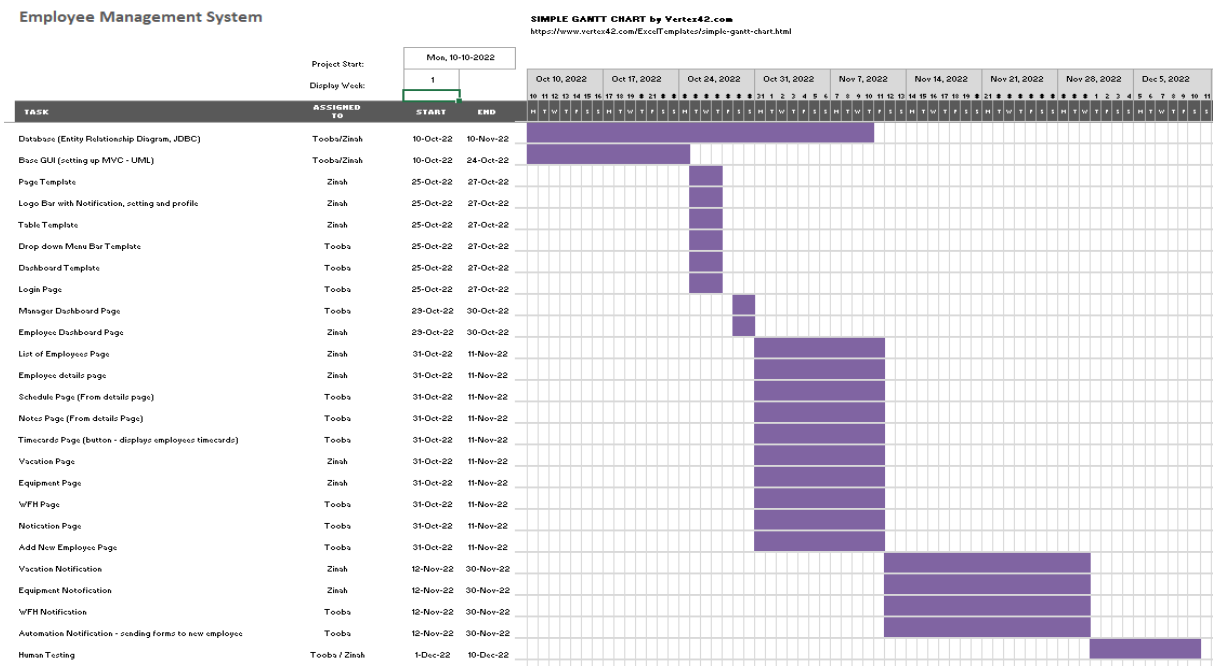
SYSC 3303: Real-Time Concurrent Systems course included concepts of concurrency, and real time systems. The use of datagram sockets will be used to implement the notification system which will involve sending and receiving requests [26].

5. Timeline

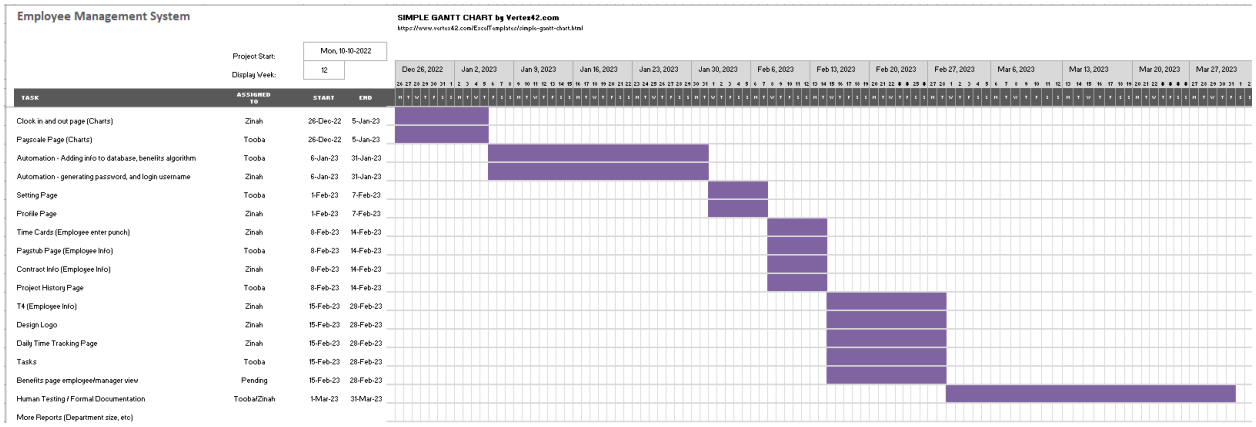
5.1. Gantt Chart

The Gantt chart shows the breakdown of the project by feature and shows the development deadline [Gantt Chart].

Semester 1:



Semester 2:



5.2. Internal Deadlines

The pink refers to internal deadlines. The orange refers to the actual deadlines. The white rows show the time that has been allotted to work towards the pink and orange deadlines.

Task	Start Date	End Date
Project proposal Progress Research Requirements Design	August 22, 2022	September 30, 2022
Draft Proposal Due	September 30, 2022	
Proposal Due Date	October 21, 2022	
Heavy Development	October 10, 2022	January 5, 2023
Draft Progress Report Progress	November 7, 2022	November 13, 2022
Draft Progress Report Due	November 18, 2022	
Progress Report Due	December 9, 2022	
Exam Break + Break	December 10, 2022	December 25, 2022
Oral Presentation Progress	January 2, 2023	January 15, 2023
Finalizing Development	January 5, 2023	March 15, 2023
Oral Presentation Day	January 24, 2023	
First Final Report Draft Progress	February 6, 2023	February 12, 2023
First Final Draft Progress Due	February 17, 2022	
Poster Fair Progress	February 13, 2023	March 5, 2023
Poster Fair Due	March 17, 2023	
Second Final Report Draft	March 6, 2023	March 19, 2023
Second Final Report Draft Due	March 24, 2022	
Final Report Progress	March 20, 2023	April 9, 2023
Final Report Due	April 12, 2022	

6. Risks

6.1. General Risks

The project includes multiple risk scenarios that could occur during the development phase. These risks include technical issues such as certain features not performing properly, debugging issues or issues with the design that had to be changed. There could also be delays in the schedule such as sickness or personal issues[65]. Due to the fact that most of these scenarios are out of the team's control, certain features were prioritized to be completed in the early phases of the development so that in the case of unexpected circumstances, the project could still have some of its main important features working. These features include the notification system, generating live reports, a fully working database, and manual operating of the HR (human resource) side. That way it is still possible to have a presentable working product even if it doesn't include quality of life features[67]. The phases of development is broken down as follows [65]:

- Phase A involves developing the database along with a basic GUI which communicates with the database.
- Phase B is implementing the notification system along with the basic HR functions in the month of November.
- Phase C is implementing the generating of reports and charts.
- Phase D is automating the addition of employees into the system, and generating their account .
- Phase E is implementing extra functionalities that are useful to an employee management system.

6.2. Security

A major risk in our system would be to allow remote control to our database for the purpose of testing. When configuring our database there is an option to allow remote control from different devices that are connected to the same network or from different networks. We might need to enable the option for a certain period of time to allow remote access to the database. This option will be closed when remote access will no longer be required. [13]

6.3. Database Backup

Another major risk is the database backup. During our interviews with Kim [62] and Terrence [61] we found that many companies tend to keep records of their previous employees even if those employees no longer work with the company anymore. A

scheduled backup of our database might be needed in order to keep track of the history of employee records. This backup could be done through MYSQL workbench [20] and if the backup fails then the system will be at risk of losing important information[16].

6.4. Duplication During the Automation Process

There is a chance of duplication when doing the automated addition of new employees [11]. If two managers added the same employee at the same time then the system should be able to recognize that it is the same person and not duplicate the information [12].

6.5. Multiple Access to the Database

Multiple access to our database will be enabled, but there is the risk of overwriting [9]. If two users made changes to the database at the same time, then the changes made by the first user can be overwritten by the changes made by the second user. This could cause concurrency problems in the database and affect the flow of the system [9]. One option is to allow only user use to edit the database at time or configure the database to handle conflicts and maybe remove duplicates or add new information without affecting the existing data [10].

7. Special Facilities

There are not many special facilities required by this project. Human testing is a definite requirement if the project is to be tested by external individuals. The other facility is the use of a remote MYSQL server which is a paid subscription.

7.1. Human Testing

The system is a software application which is built for users with none to minimum technical experience. This requires the project to be tested by users with no technical background. After the interview with Professor Hala [60] discussing the testing of the project, she recommended getting permission from the faculty as this is considered human testing of the lowest risk [59].

7.2. Database

The main choice for a database is SQL. It is a free database to use. The backup choice for the database is Azure. Azure is a subscription based service which includes access and use of a database that is maintained by Microsoft [46]. The reasoning for a backup database is to mitigate accessibility issues [28].

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9. People Interview

[60] Professor Hala - Human Centric Research Expert
[61] Terrence Odin - Director of Transformation and Technology
[62] Kim Plourde - Mcdonald's Administrative Manager
[63] Youssef Hojeij - M365 Technical Analyst
[64] James Sauve - Senior Programmer Analyst

10. Appendix

[65] Gantt Charts
[66] Design Iteration 1
[67] Design Iteration 2
[68] Splitting Work