

Employee Benefits Management System

for Banking Institutions

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February 2023

Declaration

We declare that this report is my own work and has not been submitted in any form for another degree or diploma at any university or other institution of tertiary education. Information derived from the published or unpublished work of others has been acknowledged in the text and a list of references is given.

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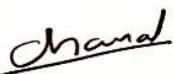
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Abstract

With modern approaches to management and organisational behaviour, the employee is considered as the most important resource of any organisation. It is one of the main functions of the top management of any organisation to keep their employees happy and motivated. Banks, in particular, are famous for the many benefits and perks that they provide for their employees - both financial and non financial. However, a deeper analysis in the benefits that are provided by Sri Lankan banks shows that even though many benefits are approved for the betterment of employees, the management of these benefits is not always done in an efficient manner. Most banks do not have automated systems for the perks that they provide for employees, resulting in frustration and demotivation when employees try to apply for these perks. Therefore, the main objective of this project is to create a system that can ensure efficiency, ease and accuracy when the employees want to make use of these benefits.

For this purpose, this system is considering four major benefits that banks provide for their employees, namely, loan facilities, medical claim facilities, welfare vehicles and holiday homes. This system, named MyBank allows the employees of the bank to apply for these benefits through a single, unified system. This means that they no longer have to fill out forms manually and hand them over to the bank. It also means that they don't have to contact the vehicle owners or holiday homes over the phone to check availability. Instead, they can simply get this information from the system. This makes the entire process much easier for them and since they have easy access to the perks that the bank provides, they will feel more motivated to work as well.

The waterfall model is used for the development of this project. The system will run on a PC in a Windows environment and it can also be accessed through a mobile device since it is designed to be mobile responsive. The database is designed using SQL.

Through this system, it is possible to allow employees to make use of the provided benefits with ease and this will help increase the overall efficiency of the bank as well.

Acknowledgement

The completion of this report would not have been possible if not for the kind support and help of many individuals. I would like to extend my sincere thanks to all of them through this acknowledgment.

I am highly indebted to the different employees of the banks I have had interviews with, such as the Bank of Ceylon and National Development Bank, for the information they provided and their patience in helping me with this matter.

I would also like to thank Hroizon Campus, Malabe and the lecturers who assisted me by providing guidance during the preparation of this report, as well as the Center for Open and Distance Learning of the University of Moratuwa for their guidance in this endeavour.

I am grateful to my supervisor, Mr Chamal Gunasinghe for his guidance and constant supervision as well as for providing necessary information regarding the project and also for his support in completing this report.

I would like to express my gratitude towards my parents for their kind co-operation and encouragement which help me in the completion of this report.

I would like to express my special gratitude and thanks to my fellow students for giving me support and attention during the preparation of this report.

My thanks and appreciations go to all those who took the time and effort to encourage me and guide me in completing this document.

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1. Introduction

1.1 Overall Introduction

Employees are the most important resource of any organization. A person who is highly satisfied at work feels positively about their work, whereas a person who is less satisfied feels negatively about their work. Job satisfaction is the difference between the amount of rewards employees receive and the amount they believe they should be received [3]. Most banks are generous in the benefits and remuneration that they provide to their employees. For example, banks provide a separate loan scheme for their employees, vacation homes, medical claim facilities and more. However, most banks do not have a streamlined and unified system that can manage all the benefits that they provide to their employees. As a result, some of these processes are handled manually, or employees have to access many different systems to claim these benefits. This results in time wastage and lack of efficiency within the organization, as well as the frustration of the employees. By creating a system to address these issues, the bank can save resources and the employees can spend their valuable time in working towards achieving corporate goals and objectives.

1.2 Purpose

This project report is documented for the purpose of providing an overarching and in-depth perspective into the software created as the final project of the Bachelor of Information Technology Degree program conducted by the Center of Open and Distance Learning, University of Moratuwa. The system created for this purpose is named “Employee Benefits Management System” (EBMS).

This report was written for the purpose of explaining each and every step of the System Development Cycle that was followed in the completion of the project. It explains in detail, the aims and objectives of the project and how these aims and objectives were

achieved. The technologies and methodologies that are used for the completion of the project are explained in detail. In addition, this report also shows how the testing of the system was done as well as the results of these tests, and whether or not the initial objectives of the project have been achieved. In this report, all functionalities that were actually implemented for the project are listed, and their performance is contrasted with the functionalities' original agreed-upon scope. It describes the outcome that was obtained and its effective resolution.

1.3 Scope of the project

This project's primary goal is to develop an web-based application that can address the issue of banking institutions' ineffective employee benefit management processes. By these means, time wastage is decreased, and the procedure is more efficient.

Following are the objectives of developing this system:

- Conducting a critical analysis of literature that is available about systems similar to the one being proposed.
- To conduct a thorough study of technologies that can be used to create the employee benefits management system.
- To design and develop a mobile application that can streamline employee benefit management to address the current problem of lack of efficiency of the employee benefit management process.
- To evaluate and run tests on the system to ensure that all functional and non-functional requirements are working as required.

Benefits of this system include:

- Increased employee efficiency as they do not have to spend time applying for and following up on applications that are needed to obtain the benefits provided for them.
- Increases the goodwill of the employees towards the organization.

- There will be less room for error, specially in processes such as loan management of employees.
- It will be easier for employees who are pensioners to access the benefits that are allocated to them.
- Reduces time wastage within the organization.
- Gives the organization a reputation as one that invests on the well-being of its employees, which will result in a better pool of candidates being willing to apply for employment of the bank.

Expected deliverables of this project –

This project was done with the aim of creating a web-based system that has the ability to do the following four main functionalities:

- Employee loan Management
- Processing of medical claims
- Application and approval of holiday homes for employees
- Application and approval of welfare vehicles for employees

1.4 Intended Audience

This document is intended to be read by developers, project managers, marketing staff, users, testers as well as documentation writers. It gives an overview of the objectives of the system and it gives an overall idea as to what the final product is like, and what it is capable of.

1.5 Approach used

This project was carried out using the waterfall approach of project management. Although this approach is generally considered simplistic, it was decided that this is the best option for this particular project. This is because, if the project is short, the technology is well-understood, the needs are fixed, well documented, and unambiguous, the waterfall approach can be beneficial and predictable. The waterfall strategy can result

in better predictable costs, timelines, and scope. Since this project is done within a limited timeframe with limited stakeholders, this approach was suitable for this project. The following were the benefits of using the waterfall model for this project:

- Each stage of development must be finished before moving on to the next. This allowed the completion of each functionality before moving on to the next one.
- This is suitable for smaller projects with clearly specified criteria. Since this project is done by one person and not a team, with very specific criteria, the waterfall method was very relevant.
- Before finishing each stage, quality assurance tests (verification and validation) should be conducted.
- Each step of the software development cycle involves thorough documentation. Several documents were produced and submitted throughout the development cycle such as the interim report, software requirements specification and so on.
- Software updates were made throughout the development process.

Steps	Description
Requirement Analysis	This phase included selecting a project area to focus on , selecting a project topic, as well as exploring literature relevant to the selected area. It also included looking into similar systems and preparing the project proposal. In addition, a Software Requirements Specification document was also prepared in this phase.
System Design	In this phase, a technological review was carried out to find the most suitable technologies to carry out the project. Furthermore, the inputs, outputs, processes, and features of the project were also identified. A project plan was prepared and diagrams such as use case diagrams, ER diagrams and activity diagrams were prepared and an interim report was submitted.

Implementation	During this phase, the project was implemented using the relevant technologies. The backend and the frontend of the system were programmed and both were connected to the database.
Testing	Testing of the system and all its functionalities were done in two methods: <ul style="list-style-type: none"> • Unit testing was done once each functionality was finished. • System integration testing was done once the entire system was finished.
Deployment	The system was put into action once completed.
Maintenance	Maintenance is carried out to ensure continued proper functioning of the system.

1.6 Assumptions

The Employee Benefits Management System was created with certain assumptions about its functions in mind. They are listed below.

- This project functions under the assumption that all the benefits management processes for bank employees are done from within the bank itself, with stakeholders that are a part of the bank. It does not take into account external parties such as publicly-available transportation services like Uber or PickMe, vacation homes that are not owned by the bank, vehicles that are not owned by the bank etc.
- It is assumed that the bank employees who are using this system will have the necessary skills to make use of it, or that they will be given the necessary training.
- The project assumes that the employee data that is available in the EBMS database corresponds with the data that is available in the bank's HRIS, and in all other employee records of the bank.

- It is assumed that the employees that this system is created for are all permanent and fully-functioning employees of the bank, and that they are all eligible for the benefits provided by the bank (i.e. that none of the employees who use this system are contractors or part-time workers who do not fall under the purview of the benefits program provided by the bank)
- It is assumed that the bank that uses this system will either follow the benefits provision schemes and methods that are enabled in this system. If this is not the case, the bank will use this as a generic model which will then be customized to suit the requirements of that particular bank.

1.7 Summary of important outcomes

- Four employee benefits processes were automated (loans management, medical claims management, holiday homes booking and vehicle booking).
- The system allows the employee to apply for these benefits and the administrators in charge of each process oversee and approve each request in a case-by-case basis.
- It was discovered that automating the entire loan management process is very complicated so the scope had to be limited to accommodate the time constraints that were faced during the completion of this project.

2. Background/Literature Review

2.1 Context and motivation of the project

One of the best methods to increase employee job satisfaction is to ensure good management of employee benefits for bank personnel. For the sake of this project proposal, The Bank of Ceylon has been used as the case study.

According to the Bank of Ceylon Annual Report of 2020, employees receive a variety of very appealing benefits, including medical assistance programs, pension plans, widow, widower, and orphanage funds, educational assistance, and more. These benefits include diverse loan programs (such as housing loans, vehicle loans, computer loans, solar power loans, investment loans, and unified general loans at concessionary rates), medical assistance programs, and pension programs [4]. Additionally, a sizable sum of money has been set aside for this bank's staff benefits. There is a net asset for employee benefits of 13,318,122 LKR[4]. This sum represents the 2014 Bank of Ceylon Pension Fund's net retirement benefit assets as well as the pensions for widows, widowers, and orphans.

The sums of money allotted for various employee benefits each year are shown in Table 1. As can be seen, the bank has set aside a sizable portion of their annual budget for the benefit of its staff. However, it was observed during the process of obtaining data for this project that several employee perks are challenging for employees to get due to irregularities at the ground level.

As at 31 December	Bank		Group	
	2020 LKR '000	2019 LKR '000	2020 LKR '000	2019 LKR '000
Net Employee Benefit Liabilities				
Bank of Ceylon Pension Trust Fund [Note 47.1.3]	23,392,461	14,685,437	23,392,461	14,685,437
Provision for terminal gratuity [Note 47.3]	479,163	370,415	923,904	725,555
Provision for encashment of medical leave [Note 47.5]	803,217	601,634	803,217	601,634
Total net employee benefit liabilities	24,674,841	15,657,486	25,119,582	16,012,626
Net Employee Benefit Assets				
Bank of Ceylon Widows' / Widowers' and Orphans' Pension Fund [Note 47.2.3]	9,915,229	10,452,943	9,915,229	10,452,943
Bank of Ceylon Pension Fund-2014 [Note 47.4.3]	3,402,893	3,022,510	3,402,893	3,022,510
Total net employee benefit assets	13,318,122	13,475,453	13,318,122	13,475,453

Table 1 Net employee benefit assets of Bank of Ceylon – 2020 Source: Bank of Ceylon Annual Report 2022

This project's primary and overarching goals were to identify the weaknesses of a bank's human resource information system and to develop a system that can address those weaknesses. Two Bank of Ceylon employees—the retired Branch Manager and the Deputy General Manager of Human Resources—were interrogated in order to acquire

information. Appendix A contains the questionnaire that was created for the interview with the deputy general manager of human resources.

With the information acquired during the interview, it became clear that while the bank budgets money for employee perks, the HRIS should be improved to handle the application and provision of the benefits. The procedure of issuing employee loans is carried out through the HRIS, according to the Deputy General Manager's interview, however the system is overworked due to all the other tasks it is performing. Additionally, it is difficult to issue employee loans because there are so many various kinds of loans available, and the loan amounts vary widely depending on the person's paygrade and hierarchy position within the bank. Due to this, it is challenging to modify the currently in use system to account for the quantities required, and occasionally the bank's human resources department must make accommodations based on the HRIS's capabilities rather than conforming to the types of loans that the bank is able to offer.

It was also observed that some employees, notably older and elder staff, find it challenging to use the web-based HRIS that is now available. Some workers may not receive benefits they are entitled to as a result of a lack of digital literacy, or they may apply for these benefits and encounter a variety of difficulties. Therefore, the goal of this project is to develop a system that is easier for employees to utilize.

It was also discovered during the second interview with the retiring branch manager that the systems available for a few other employee benefits are not at all automated. For instance, documentation is still used for all medical claims. Forms must be physically filled out and submitted with prescriptions by bank workers. It takes a long time to do this. Additionally, services like renting vacation houses and providing vehicles for employee welfare are inefficient because they are not automated. The application process is particularly challenging for retired employees because they must frequently make separate trips to a bank branch to submit their applications. Employees would benefit considerably and be more satisfied with their jobs if these processes were automated and made more efficient.

2.2 Other case studies from Sri Lankan Banks

2.2.1 National Development Bank

National Development Bank PLC was the first institution taken into account (NDB). An employee interview served as a means of gathering information about the bank. NDB currently lacks a mechanism that would fully automate the bank's employee loan management procedure. But some steps in the procedure are automated. For loans that workers get from the bank, this bank also offers some special rates. When an employee applies for a loan, NDB has a separate web-based system that checks their eligibility for the loan. This system, called "Oasis," is a private system that can only be accessed by bank staff.

Employees must submit their loan requests through the Oasis system if they want to borrow money from the bank. The information provided by the employee—such as the type of loan required, the timeline for payback, etc.—will be processed by this system. The system will forward the request to several bank divisions, including those in charge of human resources, loans, and credit cards (to check outstanding payments by the employee). For the employee to be qualified for this loan, it must be approved by each of these departments.

The Oasis system will no longer be needed after the loan eligibility has been verified. From that point on, manual labor will take over this process. The employee does have the choice to apply for the loan using the Neos app, which is the online banking app accessible to all NDB clients (not just employees). However, the majority of the subsequent steps, including the recovery section and housing inspection paperwork for housing loans, are completed through manual paperwork. This system's flaw is that it only automates the very first step, leaving the majority of the procedure to be completed manually.

Additionally, details about NDB's medical claims procedure were acquired. Its claims are not processed prescription-by-prescription, in contrast to Bank of Ceylon. Simply divided into two payments of 45,000–55,000 LKR every two years, all employees are paid. It is anticipated that this sum of money will be used to pay for prescription drugs and medical appointments. However, an insurance company takes over the entire process if the employee is admitted to the hospital. Currently, Sri Lanka Insurance does this (SLIC). Once an employee is admitted, they must call the bank's SLIC and HR department to let them know. The SLIC assumes control after the patient is released, handles the payment after receiving the pertinent hospital invoices. Refund requests for hospital stays or medicines do not use a web-based system. This system's disadvantage is that the employee is paid a set salary whether they need it or not. If the bank has a system that can quickly handle every prescription, they can save money on paying employees who don't need the full amount for their medical requirements and utilize that money to aid employees who do need the full amount but are inconvenienced by the limit.

NDB also has a vehicle rental program. PickMe is used to accomplish this. Employees can use PickMe to rent a car, enter the code provided by the bank, and the trip will be considered business-related, thus there is no cost to the employee. The PickMe app is the system being used in this situation.

2.2.2 Commercial Bank

The Commercial Bank was the other bank that was considered. Depending on the employee's grade, different loans are issued to different people. There are numerous loan options, including mortgage, auto, and consumption loans. The loan application process is not fully automated with this bank either. The bank's e-loan system can be used by the employee to apply for a loan. There, he or she can select the loan's type, needed payment, length of repayment, and other factors.

The time period allotted for repayment varies as well (for a housing loan, it is about 20 years and for vehicle loans about 8 years etc). The employee can also decide how much of their money can be used to pay off the loan using this technique. 60% is the maximum.

However, some of the process's steps need manual labor. Parts of the procedure that are still manual include handling paperwork related to house inspections, sending documents for approval, and monitoring loan status.

According to the employee's position in the hierarchy and their grade, there are also restrictions on the amount of medical bills that can be claimed. For the purpose of covering the cost of prescriptions and doctor visits, employees are given 30,000 LKR over the course of a year, divided into numerous installments. There is no separate computer system needed for this. This technique was implemented since it is challenging to review each prescription and process reimbursement. However, approving prescriptions is simple with an automated system, and this can also help the bank save money. An employee must speak with the head office to request an increase in their credit card limit when they are admitted to the hospital. They can then use that card to pay the bill, and the bank will settle the account and issue a refund. This also doesn't require a special system. The employee must use personal funds to cover the balance of the hospital bill if it exceeds the bank's allotment.

2.3 Problem and stakeholders

What is the problem?

Lack of efficiency of the current system for managing employee benefits. There is no centralized system that is available for employee benefit management only, and this results in time wastage and frustration among employees.

Who is affected by the problem?

All bank employees, bank management, and by extension customers of the bank as well.

Why is it necessary to solve this problem?

Solving this problem will lead to increased loyalty of employees towards the bank, and will improve overall efficiency of all processes of the bank.

2.4 Constraints

The complexity of the loan management system - Loan processing is a complex process that cannot be entirely automated and has to be done with heavy human intervention. In addition, the availability of many different types of loans with different process complicates the process as well.

Time – The project has to be done within a limited period of time, which results in having to limit the scope of the project as well.

A system such as this has to work hand-in-hand with other systems of a bank, such as payroll processing systems and HRIS. There is difficulty in creating this system to be stand alone because of this reason.

2.5 Critical evaluation of existing solutions in comparison to EBMS

2.5.1 HRIS of Bank of Ceylon vs EBMS

This system manages a variety of organizational functions, including collecting employee information, processing performance reviews, offering a venue for certain staff training events, and more. Because there are so many various interest rates available for different levels of employees, loan management is only done to a limited extent, and the system is frequently overloaded. Processing medical claims is a largely manual operation. Employees manually complete out medical claim forms after receiving claimed invoices from the consultative physicians or hospitals they visit. The requisite funds are subsequently transferred to the employee's account after being sent to the appropriate bank authorities. The documentation is manually filled out when renting vacation houses and welfare vehicles as well.

This system's disadvantage is that some tasks, such filling out medical claim papers and welfare vehicle request applications, must be done by hand. This is a rather inconvenient way of doing these things in a world that is going paperless. Transferring these documents from one location to another is also very difficult. As a result, the EBMS has made these features completely paperless and simple for all organization employees to access by filling out these applications in the system itself, without using paper. Additionally, it cuts down on time and resource waste.

2.5.2 NDB's *Oasis* vs EBMS

The disadvantage of using services like Sri Lanka Insurance and PickMe in the aforementioned system is that, because an outside party manages funds, the income earned through this process must also be shared, or else the outside party must be compensated for their services. The bank will suffer an income loss as a result of this. The suggested system would make sure that these functionalities are carried out with little to no contact from outside parties in order to prevent this. Through the EMS, it is possible to ensure that that the transaction stays within the bank, that there is no currency conversion or sharing with third parties, the bank's income will stay within the bank.

2.5.3 Loan Processing and Medical Insurance Systems of Commercial Bank vs EBMS

From the details given in the previous section about the Commercial Bank, it can be seen that, since it is difficult for employees to access these facilities, the fact that this bank lacks a single system that can handle all employee benefit-related tasks can be problematic. The EBMS can carry out all duties, including loan administration and processing medical claims, using an unified system to increase productivity and accuracy of the job completed.

2.5.4 HRIS of United Commercial Bank Ltd (UCBL) in Bangladesh vs EBMS

- Reporting and analysis of personnel data is one of the features offered by this human resource information system (HRIS).
- Business-related documents, such as employee handbooks, emergency evacuation procedures, and safety rules.
- The management of benefits, such as enrollment, status changes, and personal information updates.
- Complete connection with the company's accounting and finance tools, including payroll.
- Controlling resumes and keeping track of applicants.

Welfare in the context of employee benefits refers to anything provided in addition to compensation that is done for an employee's comfort and improvement. In an effort to improve the standard of life for employee families, UCBL provides assistance in the form of housing programs, health benefits, and locations for education and recreation. The HRIS contains information on the different types of welfare, the chart of accounts, the time frame, bank information, the general statement, the financial statement, the contribution ledger, the profit distribution, the loan issue, and the final settlement [2].

This system unifies all of the employee benefits into a single framework, making it a good model to adopt for the suggested system as well. The EBMS, however, has a lesser scope than the HRIS of UCBL because it only aims to handle employee welfare and not the other aspects of human resource management, making it easier for employees to use and less complicated for the business to run.

2.5.5 HRIS of Kenya Commercial Bank vs EBMS

This solution enables HRIS-based employee learning, in which workers receive training online. Additionally, it permits a decision-making process based on the HRIS, in which executives receive assistance in using the HRIS to make important decisions. The process of employee performance reviews is managed by this system. According to this study, 60.9% of the participants stated that technology based on electronic computer tools was

primarily used in the bank to appraise them, whereas 29.7% thought it was done manually. In this research article, there is not much mention of a system that is specifically responsible for managing employee benefits [1].

Although this bank's operations have been digitalized, the document makes no mention of any HRIS components that deal with the benefits offered to employees. However, other aspects of human resources have gone digital. By developing a single, unified, digital system to manage all employee benefits, the EBMS makes up for shortcomings like these.

2.6 Methods and tools used

For coding the front end of the system, the language that is employed is PHP. For the back end too, the coding will be done through PHP, using Visual Code. Testing was done to a certain extent using JMeter, which is a load testing tool that is generally used to test web applications, as well as with the aid of test cases. Databases are created using MySQL, through PHP MyAdmin.

2.7 Research Questions

- How can we increase the efficiency of process such as providing medical claims to employees and other employee benefits?
- Is it possible to automate all the employee benefits that are given to bank employees?
- Which parties, and how many parties, within the bank should be given the authority to manage the employee benefits?

3. Specification and Design

3.1 Introduction

This section shows the design of the system with the help of various diagrams (use case, activity, data flow and entity relationship).

3.2 Main Features of the System

3.2.1 Loan Management System

With the help of this system's features, bank employees can apply for two different types of loans, namely distress loans and housing loans. The system will hold records of the employees according to their employee level, employment status (working/retired), pay grade, personal details and so on. The loan amounts are calculated by the software using the provided criteria. The system provides a loan application form that the employee may fill out and submit to the system. The employee may also upload any relevant supporting files.

In the back end, the loan has to be approved mainly by two parties: the inspection officer and the loan administrator. The employee's loan application will only be approved if both parties approve it. This will be informed to the employee through the system.

3.2.2 Medical Claim Management

Medical claims come in different types. They are available for births, surgeries, medical exams, and a variety of other events. The choice of what kind of medical claim to submit is entirely up to the employee and varies according to their need. The employee is allowed to fill out an application form and submit it to the system. The employee can submit supporting documents, including prescriptions as .pdf files.

From the back end, the medical claims administrator will examine the documents and approve or reject them as necessary.

3.2.3 Holiday Home Application Management

There are vacation properties available for use by staff members who travel across the nation. The employee is permitted to complete a form for the vacation house and reserve the home for a specific amount of time and a specific number of guests. The employee is permitted to pay a discounted sum when it is necessary in some circumstances. The system shows the employee that the reservation has been made. This is a low priority functionality.

From the backend, the holiday homes administrator can approve or reject the employee's request as necessary and can also generate a receipt for the reservation.

3.2.4 Welfare Vehicles Application Management

Workers can reserve welfare vans using the system at a discounted rate to use for long trips. The worker is permitted to select a vehicle and complete a form to reserve the needed vehicle, and they are notified after the reservation has been confirmed.

From the backend, the vehicle administrators can add and remove vehicles and then accept and reject reservations as necessary.

3.3 Requirements of the System

3.3.1 Loan Management System

Stimulus/Response Sequences

- Choose type of loan required
- Fill in personal details

- Fill in details about finances
- Add supporting documents
- Click submit
- Await approval

Functional Requirements

- Should allow employee to fill in personal details
- Should allow employee to fill in details about finances
- Should allow employee to add supporting documents
- Should allow employee to submit
- Should allow relevant administrators to provide approval

3.3.2 Medical Claim Management

Stimulus/Response Sequences

- Choose type of medical claim
- Fill in personal details
- Fill in details about illness and treatment
- Upload supporting documents
- Senior officers evaluate and approve the request

Functional Requirements

- Should allow employee to choose type of medical claim
- Should allow employee to fill in personal details
- Should allow employee to fill in details about illness and treatment
- Should allow employee to upload supporting documents
- Should allow medical administrators to evaluate and approve the request

3.3.3 Holiday Home Application Management

Stimulus/Response Sequences

- Choose the holiday home to book
- Enter the necessary personal details
- Click book home
- Await approval
- Pay for the home

Functional Requirements

- Should allow employee to choose the holiday home to book
- Should allow employee to enter the necessary personal details
- Should allow employee to book home
- Should allow holiday home administrator to approve the request
- Should allow generation of booking receipt

3.3.4 Welfare Vehicles Application Management

Stimulus/Response Sequences

- Select a welfare vehicle
- Enter the details necessary
- Book the vehicle
- Check booking status

Functional Requirements

- Should allow employee to select a welfare vehicle
- Should allow employee to enter the details necessary
- Should allow employee to book the vehicle
- Should allow employee to check booking status

3.3.5 Employee Account Management

Stimulus/Response Sequences

- Add employee details
- Click register

Functional Requirements

- Should allow administrator to add employee details and click register

3.4 System Design

This section shows the diagrams that were created for the purpose of conceptualizing the functions of the system as well as the justification of these structures.

3.4.1 Use Case Diagrams and Activity Diagrams

3.4.1.1 Loan Management System

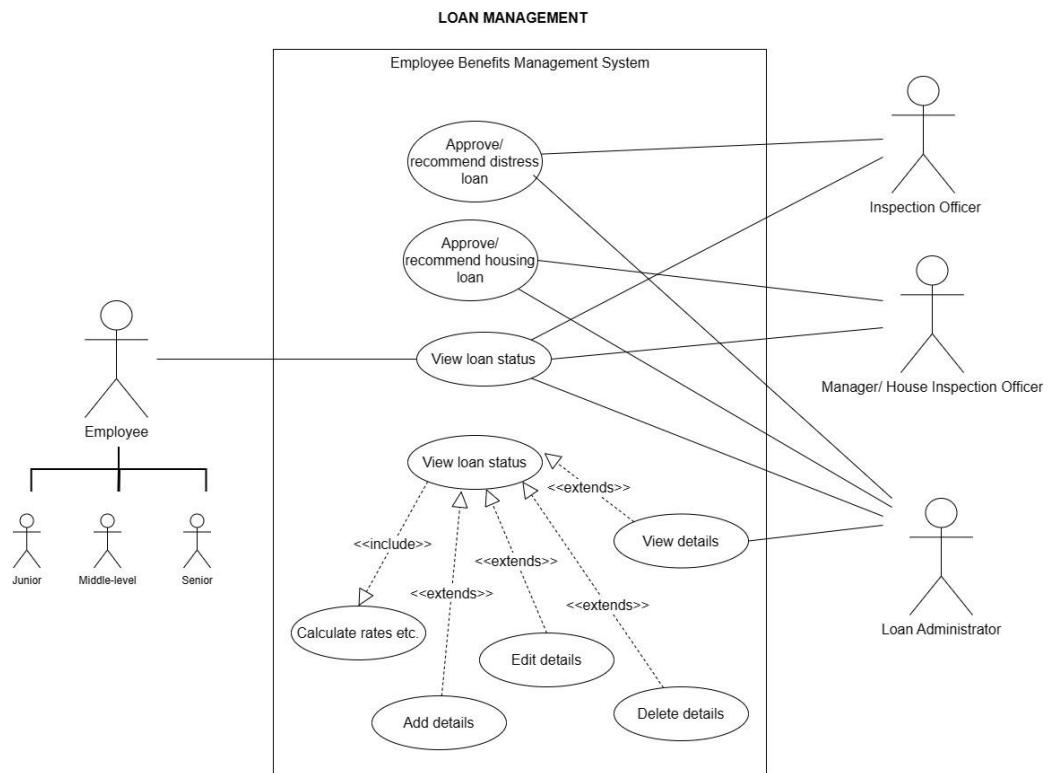


Figure 1 Use case diagram for loan management system

Activity Diagram for Loan Management

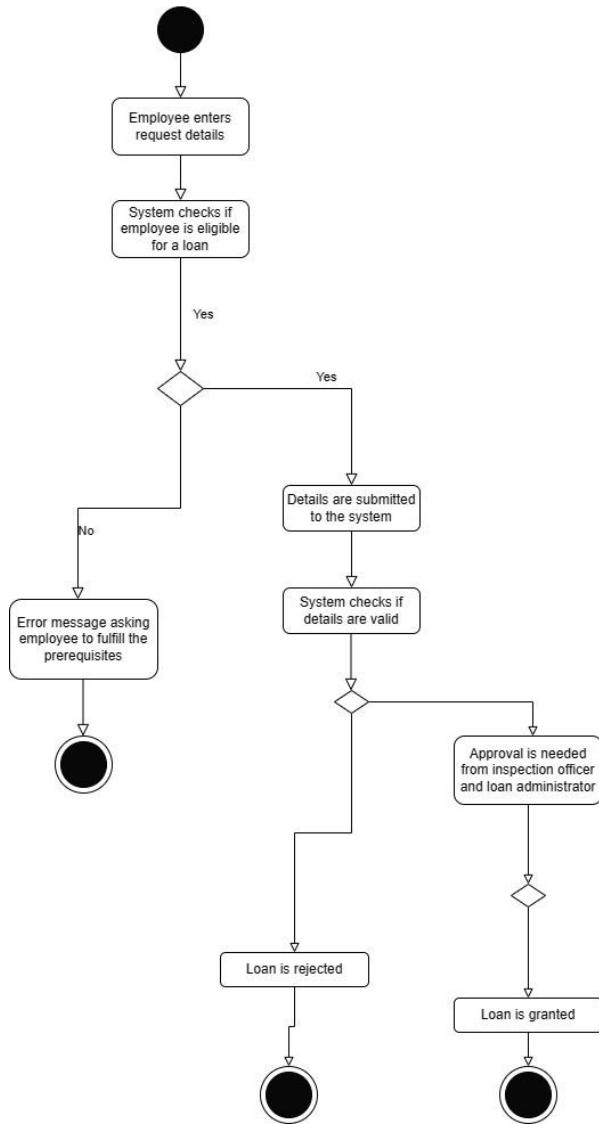


Figure 2 Activity diagram for loan management system

The loan management functionality of this system allows the employee to apply for two types of loans:

- Distress loans
- Housing loans

The user (employee) has been divided to three types because the interest rate that is applied to each employee depends on their employee type (junior, middle-level or senior).

Distress loans have to be approved by two people: the inspection officer (this can be the manager, or someone authorized by the manager) and the loan administrator.

Housing loans have to be approved by two people as well: the house inspection officer or the manager and the loan administrator. In the case of housing loans, there can be more approvals that need to be done depending on the amount of the loan, but in this system, this has been limited to two users for the sake of limiting the scope of the project.

There are multiple administrators who have to provide approval to each process, because loan management is a fairly complicated process and cannot be done by one person alone. In addition, there is also a functionality for the super admin to add new administrators if the need arises, as advised during the prototype evaluation stage.

In addition, the employee is able to activities such as apply for the loan and view its status. The administrators' main jobs include perusing the submitted documents and providing approval.

3.4.1.2 Medical Claim Management

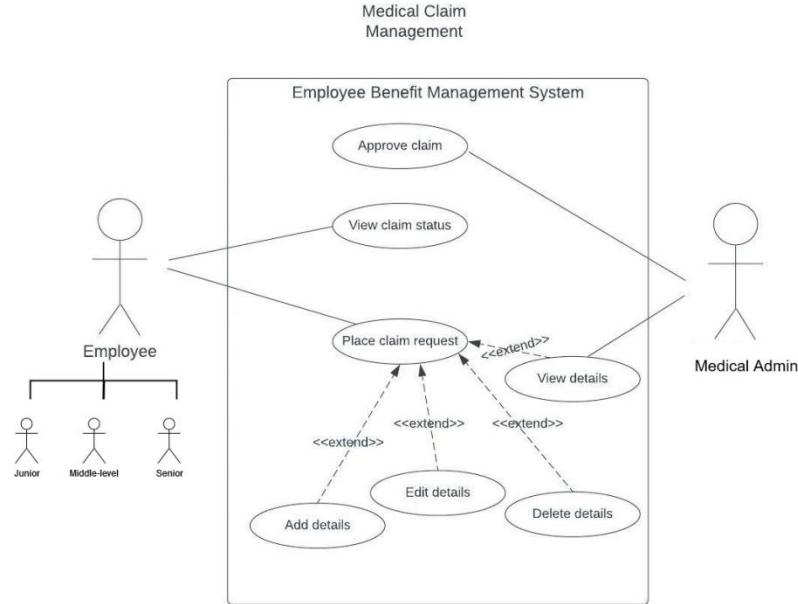


Figure 3 Use case diagram for medical claim management

Activity Diagram for Medical Claim Request

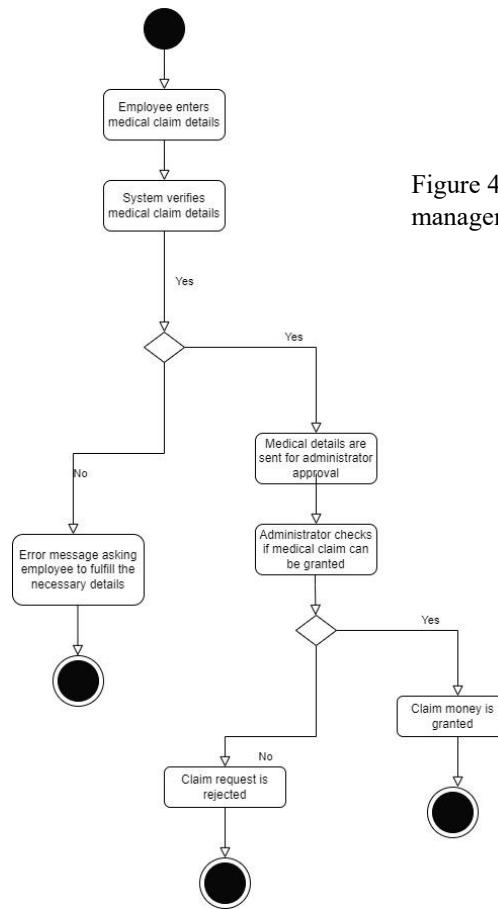


Figure 4 Activity diagram for medical claim management

In this use case diagram, it can be seen that the backend is managed by the medical admin, and this role is separate from that of other admins. This admin cannot access other parts of the backend of the system; he is only in charge of medical claims management. Here too, employees are divided into different types and the percentage of the money they claim will depend on the type of the employee.

3.4.1.3 Holiday Home Application Management

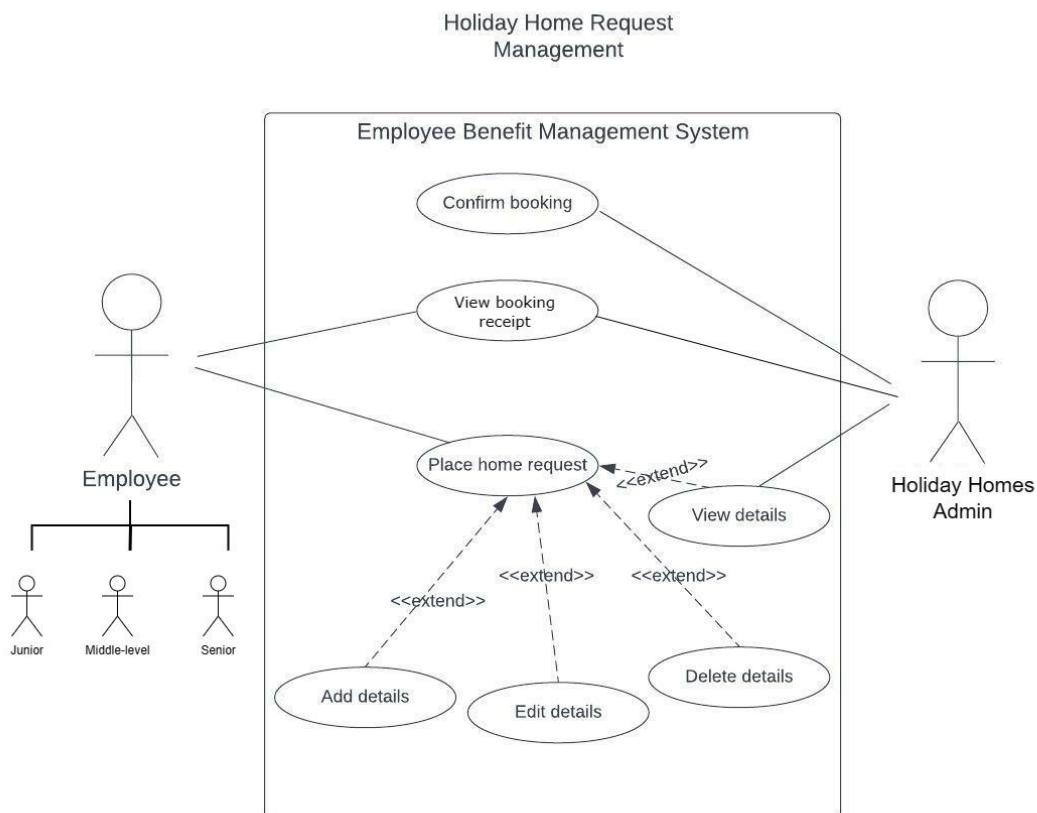


Figure 5 Use case diagram for holiday home management

Activity Diagram for Holiday Home Request

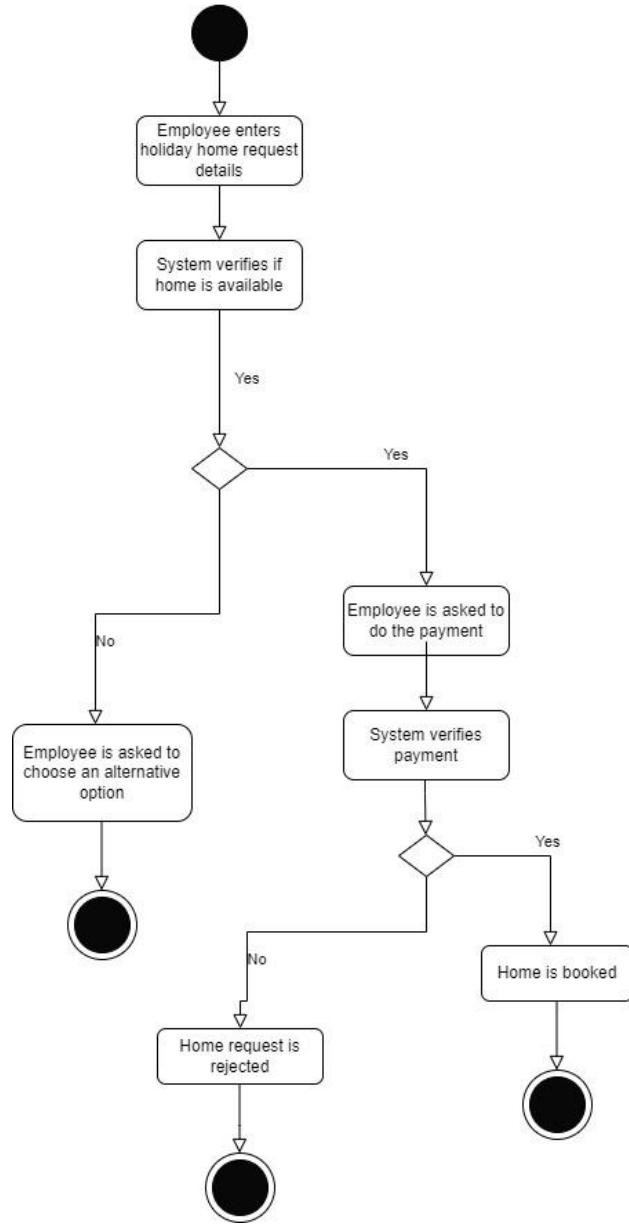


Figure 6 Activity diagram for holiday home management

The ‘holiday homes admin’ is the name of the backend administrator for this functionality. This administrator is distinct from everyone else and is only in charge of managing holiday home bookings. By doing this, it will be made sure that no administrator is overworked.

Although the bank personnel are split up into three categories, the benefits offered to each category are the same. Employees in all categories are provided access to holiday homes because this is typically how it is done in banks.

3.4.1.4 Welfare Vehicles Application Management

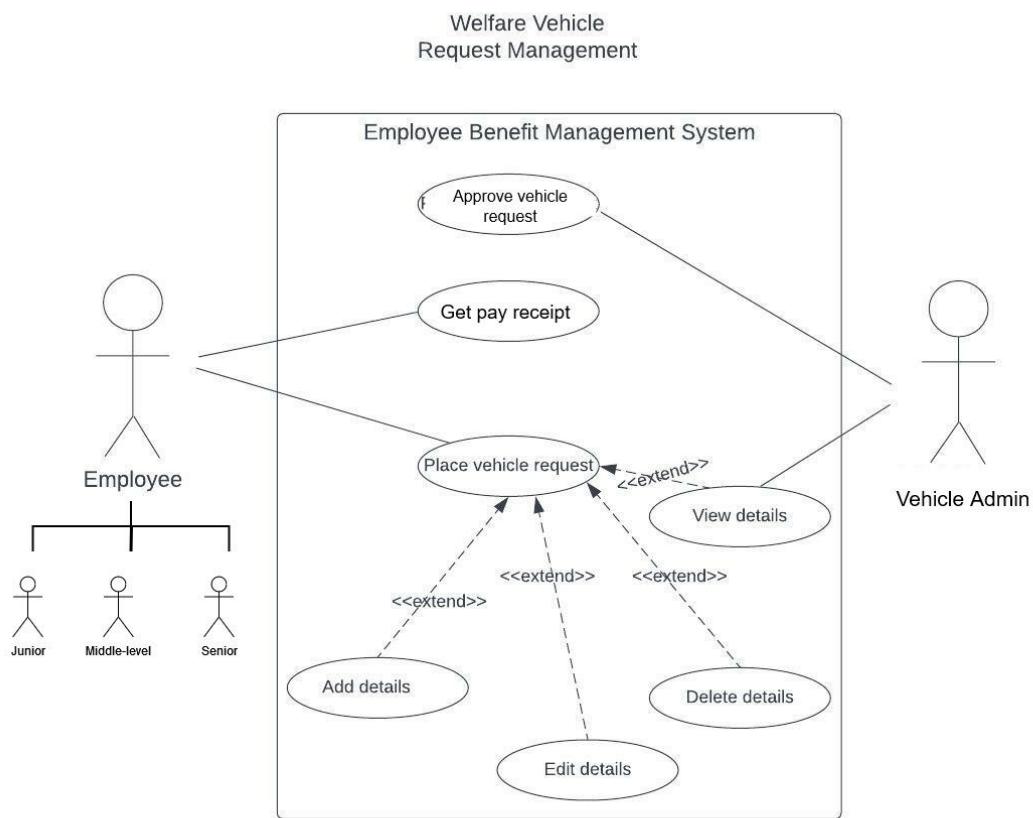


Figure 7 Use case diagram for welfare vehicle management

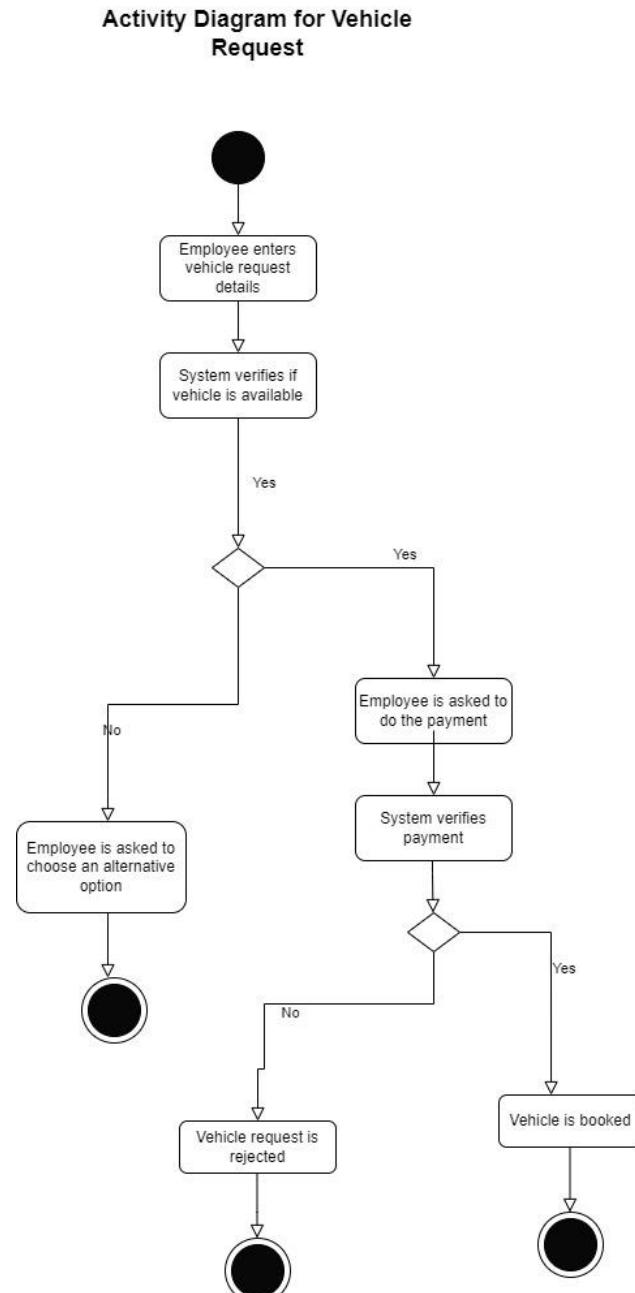


Figure 8 Activity diagram for welfare vehicle management

This functionality too has a separate backend administrator for it, called the ‘vehicle admin’. This administrator is separate from all others and is only in charge of welfare vehicle management. This will ensure that each administrator is not burdened with too much work.

The employees are divided into three categories, however, like in the previous functionality; the benefit provided to the employee does not change between categories. Welfare vehicle facilities are given to employees irrespective of category, as this is generally how it is done in banks in real life.

3.4.1.5 Login

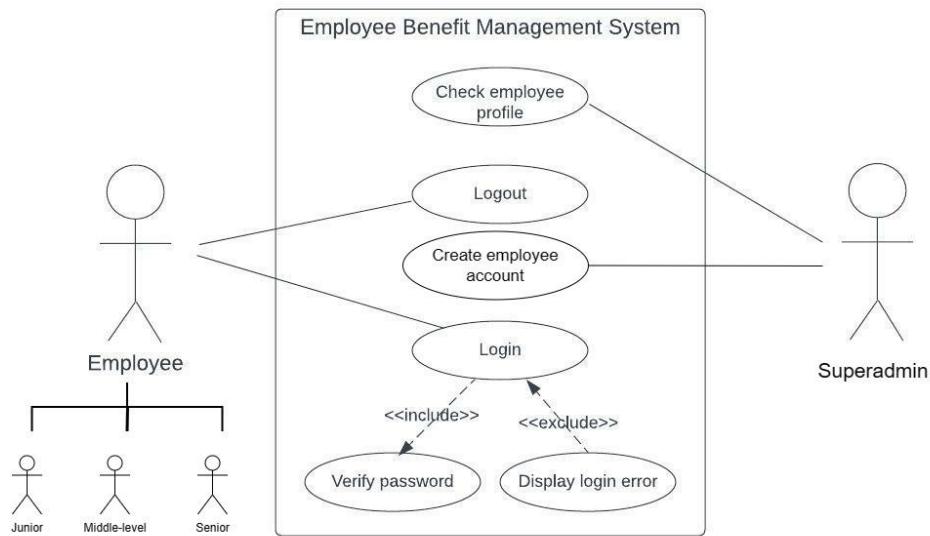


Figure 9 Use case diagram for login

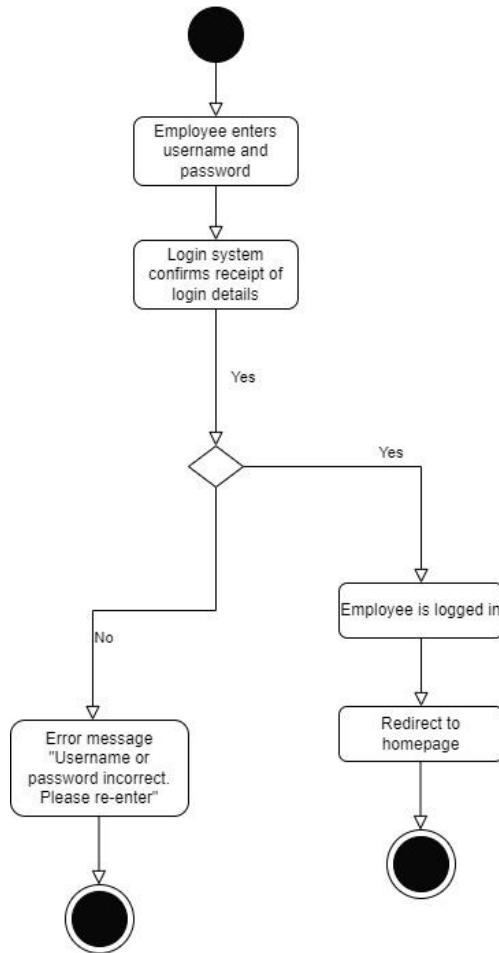
Activity Diagram for Employee Login

Figure 10 Activity diagram for login

The employees are given a unique password and email that they can use to login.

Employee accounts are created and managed by the super admin himself. In addition to this, the super admin also has access to a facility that allows him to add new admins with various functionalities. This facility is allowed to ensure that the admins are not overwhelmed with work when they are in charge of complex functionalities.

3.4.2 High level use case diagram

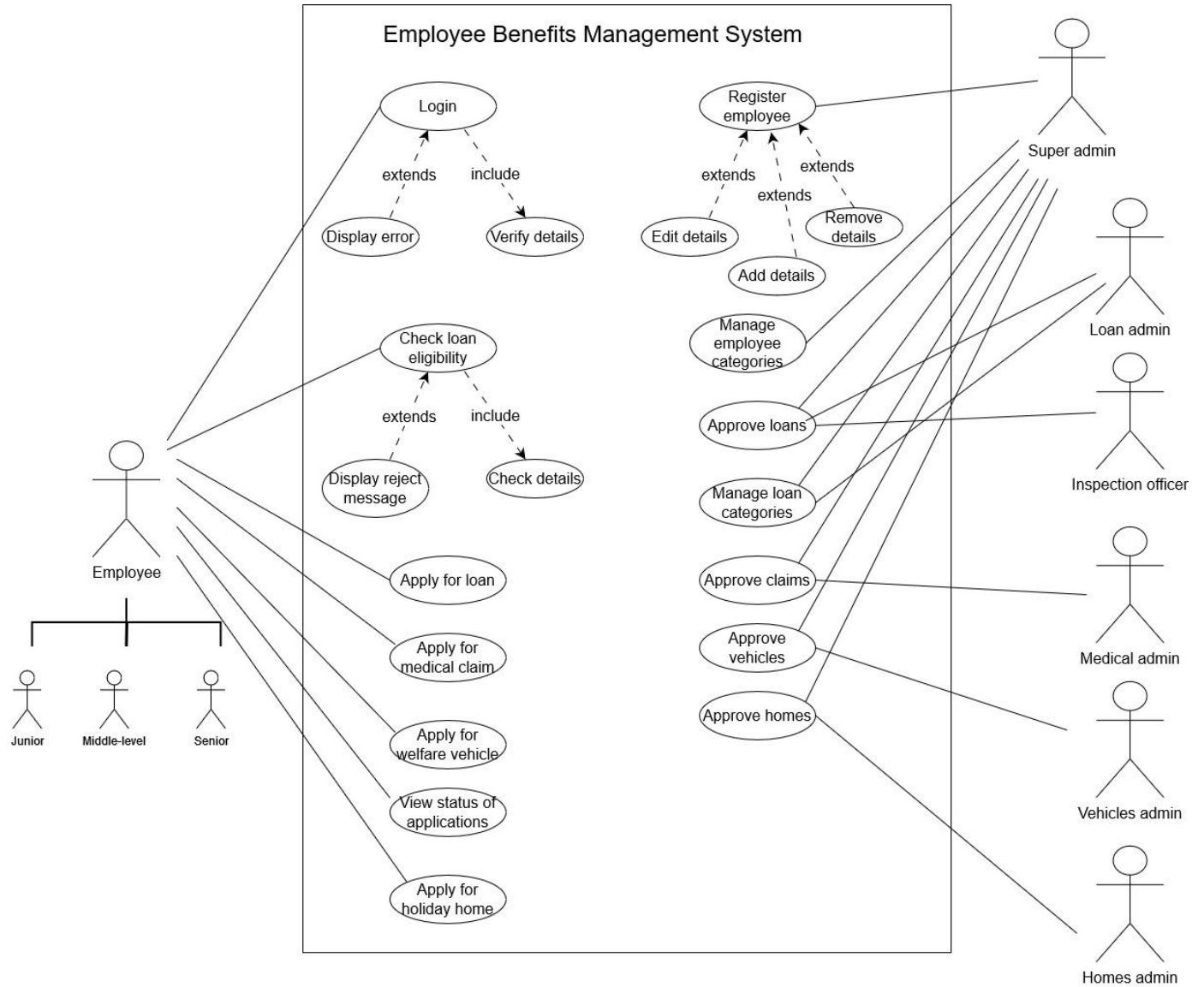


Figure 11 High level use case diagram for EBMS

3.4.3 Data Flow Diagram

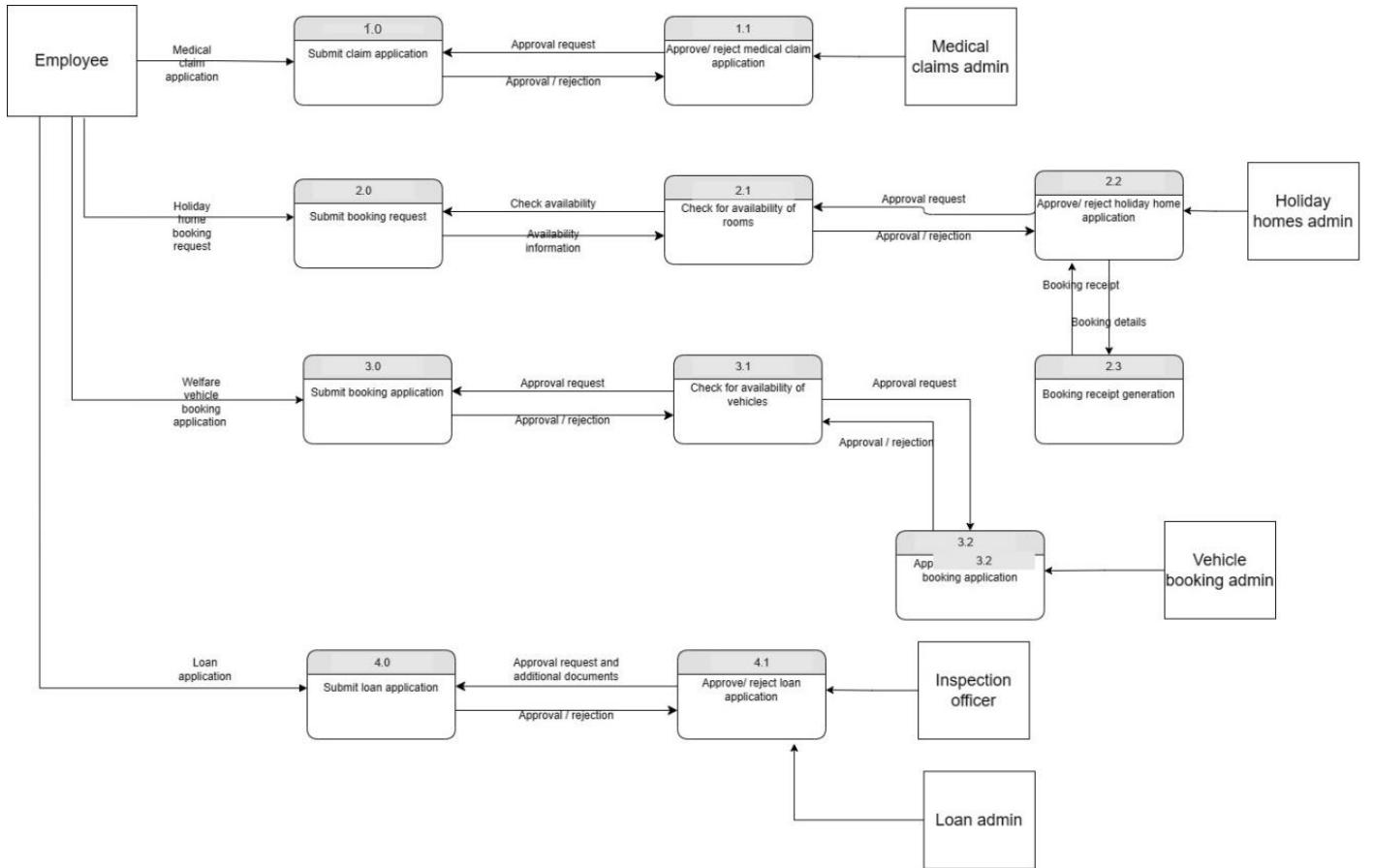


Figure 12 Data flow diagram for EBMS

The data flow diagram shows how data and information flows across the system. Most information such as details from medical claims, details from vehicle requests and home bookings all flow from the front end of the system to the back end. The information is submitted by the front end user (employee) and is sent to the back end, where it is evaluated by the back end users, who are the admins (medical admin, loans admin etc.). Using the submitted information, the administrators make certain decisions such as whether to approve a claim or not. This is then communicated to the employee again through data that flows from the back end to the front end.

3.4.4 ER Diagram

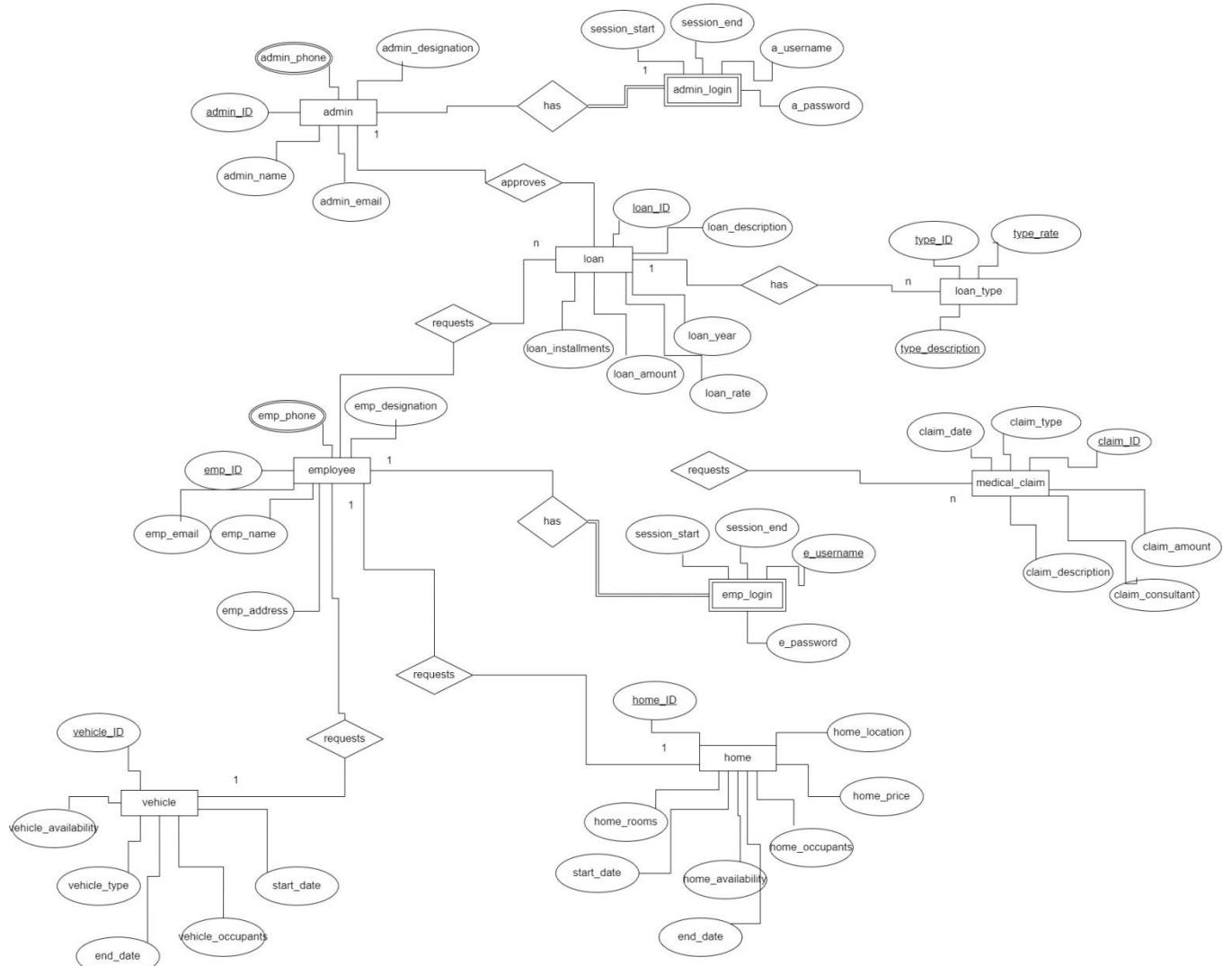


Figure 13 ER diagram for EBMS

The ER diagram gives an overview of the system including all its actors and the main functionalities it carries out. The actors in the front end are the employees of the bank who are categorized into junior, middle-level and senior employees. There are many different admins for the man different tasks that are available in the system such as loans admin, medical claims admin, holiday homes admin and so on.

4. Implementation

4.1 Important pieces of code

This section describes the functions of some important pieces of code from the system.

4.1.1 Database Connectivity

```

1      <?php
2
3      $con = mysqli_connect("localhost", "root", "", "ebms1");
4
5  ?>
6

```

The connection of the SQL database is placed in a separate file called db.php. This code is called in each page whenever necessary.

4.1.2 Login with encryption

```

9      include_once('includes/db.php');
10
11     if (isset($_POST['submit'])) {
12         $errorMsg = "";
13         $username = $con->real_escape_string($_POST['username']);
14         $password = $con->real_escape_string(md5($_POST['password']));
15
16        if (!empty($username) || !empty($password)) {
17            $query = "SELECT * FROM admins WHERE admin_email = '$username'";
18            $result = $con->query($query);
19            if($result->num_rows > 0){
20                $row = $result->fetch_assoc();
21                $_SESSION['ID'] = $row['admin_id'];
22                $_SESSION['ROLE'] = $row['admin_role'];
23                $_SESSION['NAME'] = $row['admin_name'];
24                header("Location:index.php");
25                die();
26            }else{
27                $errorMsg = "No user found on this username";
28            }
29        }else{
30            $errorMsg = "Username and Password is required";
31        }
32    }

```

The above code shows part of the code that is used for the backend login. It uses a hash algorithm (MD5) to encrypt the password when it is sent inside the SQL database. It is common to store passwords in a hashed format to prevent third parties from reading them. By using the hash function, it is possible to give an extra layer of security for the user information. This way, the only people who know the password are those who created it, and the user himself. The user is also given a specific role, because there are different levels of admins and the privileges they are given differ accordingly.

4.1.3 Hiding functionalities from admins

```

135      <?php if ($_SESSION['ROLE'] == '3' || $_SESSION['ROLE'] == '1') { ?>
136      |   <li><!-- li begin -->
137          |       <a href="#" data-toggle="collapse" data-target="#loan_type"><!-- a href begin -->
138          |           <i class="fa fa-fw fa-edit"></i> Loan Types
139          |           <i class="fa fa-fw fa-caret-down"></i>
140          |       </a><!-- a href finish -->
141          |       <ul id="loan_type" class="collapse"><!-- collapse begin -->
142              |           <li><!-- li begin -->
143                  |                     <a href="index.php?insert_loantype"> Insert Loan Type </a>
144                  |             </li><!-- li finish -->
145                  |             <li><!-- li begin -->
146                      |                         <a href="index.php?view_loantype"> View Loan Type </a>
147                      |                 </li><!-- li finish -->
148                  |             </ul><!-- collapse finish -->
149              |         </li><!-- li finish -->
150          |     <?php } ?>
151
152
153      <?php if ($_SESSION['ROLE'] == '4' || $_SESSION['ROLE'] == '1') { ?>
154      |   <li><!-- li begin -->
155          |       <a href="#" data-toggle="collapse" data-target="#claims"><!-- a href begin -->
156          |           <i class="fa fa-fw fa-book"></i> Medical Claims
157          |           <i class="fa fa-fw fa-caret-down"></i>
158          |       </a><!-- a href finish -->
159          |       <ul id="claims" class="collapse"><!-- collapse begin -->
160              |                   <li><!-- li begin -->
161                  |                     <a href="index.php?view_claims"> View Claims </a>
162                  |             </li><!-- li finish -->
163              |                   <li><!-- li begin -->
164                  |                     <a href="index.php?approve_claims"> Approve Claims </a>
165                  |             </li><!-- li finish -->
166              |             </ul><!-- collapse finish -->
167          |         </li><!-- li finish -->
168      <?php } ?>

```

Activate Wir

This piece of code is part of the side bar page. The field/options that are visible to each admin in the sidebar depends on their user role. The user role is stated in the database. As an example, the medical admin can only see the sections of the system that deal with medical claims management. This way, the work that has to be done within the system is properly delegated among the admins. Only the relevant people have access to each section so it also increases security.

4.1.4 Approval/ rejection of claims

```

161      <?php
162
163      if(isset($_POST['approve'])){
164
165          $status = $_POST['status'];
166          $update_claim = "update claims set status=1 where claim_id='$claim_id'";
167          $run_claim = mysqli_query($con,$update_claim);
168
169          if($run_claim){
170              echo "<script>alert('This claim has been approved')</script>";
171          }
172      }
173
174      if(isset($_POST['reject'])){
175
176          $status = $_POST['status'];
177          $update_claim = "update claims set status=2 where claim_id='$claim_id'";
178          $run_claim = mysqli_query($con,$update_claim);
179
180          if($run_claim){
181              echo "<script>alert('This claim has been rejected')</script>";
182          }
183      }
184
185      ?>

```

This code shows the php code that is run when the medical claim admin approves or rejects a certain medical claim. The status of the claim turns into ‘1’ or ‘2’ depending on whether or not the medical admin approved the claim. This is updated in the SQL database and depending on that, the user can view the status of the claim from the front

end of the system, from the “Claims history” section. The system also provides a notification to the admin, based on whether or not the claim is accepted.

4.2 Challenges that were encountered during the project

- Complexity of the loan management functionality of the bank made it difficult to automate the entire process
- Time constraints required that the scope of the project is limited to fit the timeline of the final year of the degree.
- Difficulty is designing a system to address all the shortcomings seen the systems that were explore during the literature review and background study.

4.3 Components of the project

4.3.1 Software components

Following are some of the major interfaces of the project:

The screenshot shows a web browser displaying a loan application form. The URL in the address bar is `localhost/sithmi final pro 19/Web/loansapplication.php`. The page has a blue header with a 'WELCOME' button, a 'Logout' link, and a 'My Account' button. Below the header, there's a navigation menu with links for 'HOME', 'LOANS', 'MEDICAL CLAIMS', 'HOLIDAY HOMES', and 'WELFARE VEHICLES'. On the left, there's a sidebar titled 'LOAN SERVICES' with links for 'Loan Dashboard', 'Loan Calculator', 'Loan Details', 'Eligibility', and 'Apply'. The main content area is titled 'Loan Application Form' and contains a note: 'Please calculate your loan amount using the loan calculator before applying'. It includes fields for 'Name', 'Email', 'Loan Amount', 'Loan Interest', 'Basic Salary', and 'Years'. There are also back and forward navigation buttons at the top left of the browser window.

Figure 14 Loan application interface

Through the above interface, the employee can fill the details of the loan they need to apply for and then submit it for approval.

Figure 15 Holiday home application

The employee can apply for a holiday home through this. The employee's personal information is already filled.

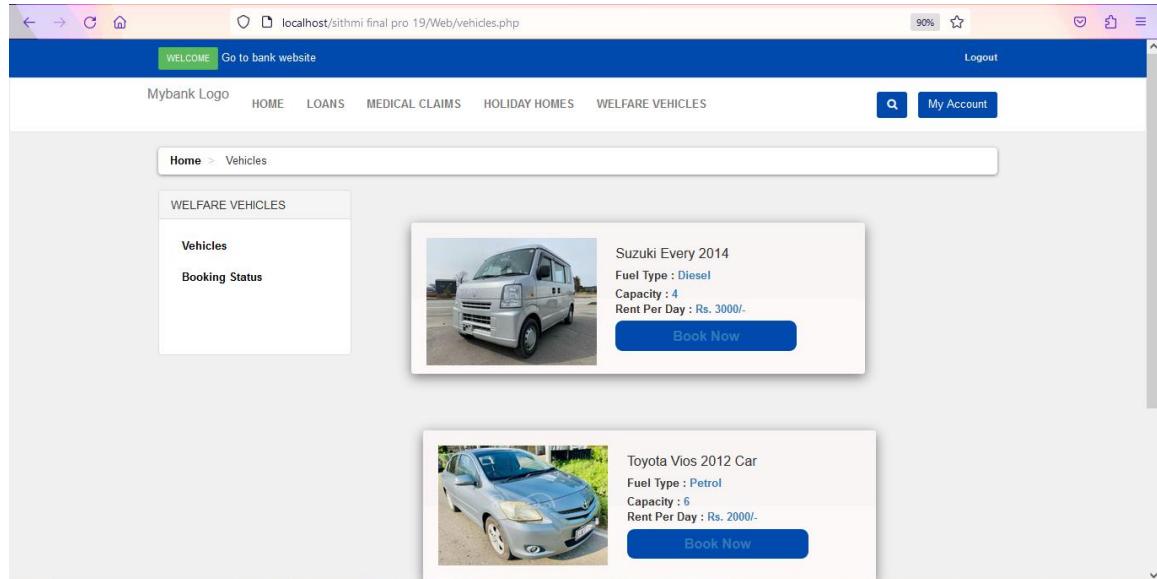


Figure 16 List of available vehicles

This page shows the employee the vehicles that are available for hire.

The screenshot shows a web browser window with the URL `localhost/sithmi final pro 19/Web/vehicle_booking2.php?id=2`. The page has a blue header bar with a 'WELCOME' button, a 'Logout' button, and a 'My Account' button. Below the header, there's a navigation menu with links for 'Mybank Logo', 'HOME', 'LOANS', 'MEDICAL CLAIMS', 'HOLIDAY HOMES', and 'WELFARE VEHICLES'. The main content area has a breadcrumb navigation 'Home > Vehicles'. A modal window titled 'BOOKING' is open, displaying the vehicle type as 'Toyota Vios 2012 Car'. The modal contains several input fields: 'BOOKING PLACE' (with placeholder 'Enter Your Destination'), 'BOOKING DATE' (with placeholder 'mm / dd / yyyy'), 'DURATION' (with placeholder 'Enter Rent Period (in days)'), 'PHONE NUMBER' (with placeholder 'Enter Your Phone Number'), and 'DESTINATION' (with placeholder 'Enter Your Destination').

Figure 17 Vehicles application

By filling this application, the employee can request to hire a vehicle.

The screenshot shows a web browser window with the URL `localhost/sithmi final pro 19/Web/medical.php`. The page has a blue header bar with a 'WELCOME' button, a 'Logout' button, and a 'My Account' button. Below the header, there's a navigation menu with links for 'Mybank Logo', 'HOME', 'LOANS', 'MEDICAL CLAIMS', 'HOLIDAY HOMES', and 'WELFARE VEHICLES'. The main content area has a breadcrumb navigation 'Home > Medical Claims'. A sidebar on the left under 'CLAIM SERVICES' lists 'Claim Application', 'Claim History', 'Something', and 'Somthing'. The main content area contains a 'Claim Application' form with fields: 'Employee ID' (value: 9876), 'Medical Condition' (empty), 'Claim Type' (empty), 'Claim Amount' (empty), 'Consultant Name' (empty), 'Supporting Document' (with a 'Browse...' button and placeholder 'No file selected.'), and a large 'Claim Details' text area.

Figure 18 Medical claims application

By filling this application, the employee can request a medical claim.

The screenshot shows a web-based administrative interface for registering employees. The URL in the browser is `localhost/sithmi final pro 20/Web/admin_area/index.php?insert_employee`. The left sidebar has a dark theme with various menu items like Dashboard, Loans, Loan Types, Medical Claims, Welfare Vehicles, Holiday Homes, employees, and Log Out. The main content area is titled "Register Employee" and contains a form with the following fields:

- Employee ID
- First Name
- Last Name
- Employee Type (dropdown menu: Select a an employee type)
- Employee Category (dropdown menu: Select an employee category)
- Employee Image (button: Browse... No file selected)
- Employee Address
- Email Address
- Employee Password
- Phone number
- Basic Salary
- Date of Birth

Figure 19 Register employee

This page in the backend allows the super admin to register a new employee.

The screenshot shows a web-based administrative interface for managing room bookings. The URL in the browser is `localhost/sithmi final pro 20/Web/admin_area/approve_homebookings2.php`. The left sidebar has a dark theme with various menu items. The main content area is titled "Room Booking" and displays a table titled "New Room Bookings".

#	Name	Email	Room	Bedding	Meal	Check In	Check Out	Status	More
9112	Anil Herath	anil@gmail.com	Superior Room	Single	Room only	2022-12-04	2022-12-05	Not Conform	Action
9113	Herath Edirisinghe	herath@gmail.com	Deluxe Room	None	Breakfast	2022-12-21	2022-12-22	Not Conform	Action

Below the table, there is a section titled "Booked Rooms" with a count of 0. A watermark at the bottom right corner reads "Activate Windows Go to Settings to activate Windows."

Figure 20 Approve home bookings

This page in the backend allows the holiday homes admin to view and approve or reject holiday home reservation requests.

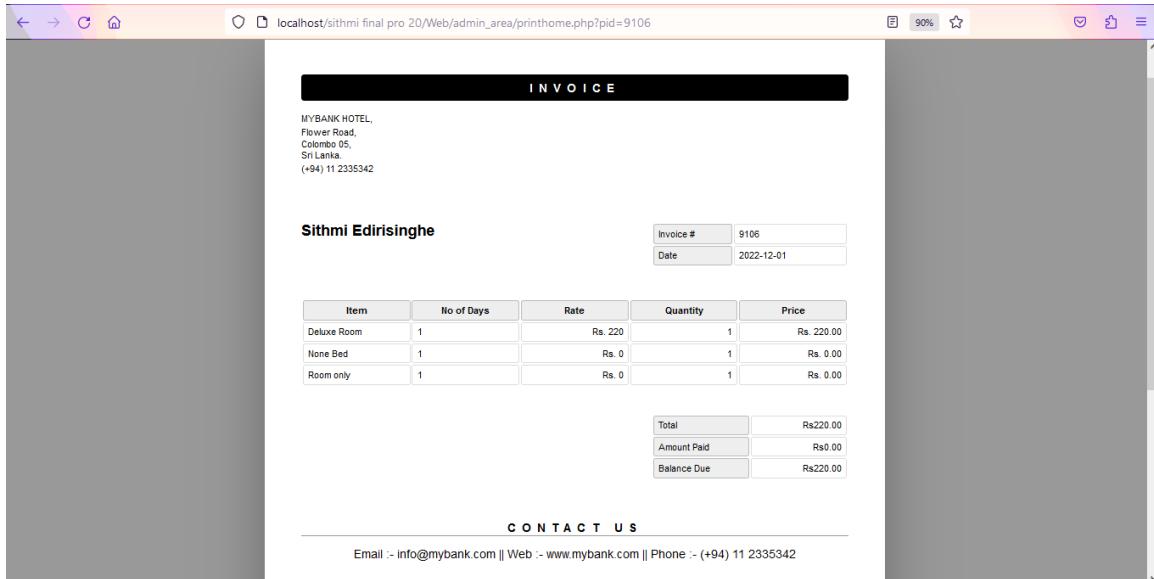


Figure 21 Holiday homes invoice

This is the invoice that is generated according to the employee's reservation request.

The screenshot shows the 'Administrator Area' dashboard with a sidebar containing links for Dashboard, Loans, Loan Types, Medical Claims, Welfare Vehicles, Holiday Homes, employees, and Log Out. The main content area is titled 'Dashboard / View Categories' and shows a table of medical claims. The table has columns for Claim ID, Employee ID, Medical Condition, Claim Amount, Take Action, and Delete Claim. The claims listed are:

Claim ID	Employee ID	Medical Condition	Claim Amount	Take Action	Delete Claim
1	343	Cholesterol	4500	Take Action	Delete
2	9876	Blood pressure	5000	Take Action	Delete
3	97748	Blood pressure	4000	Take Action	Delete
4	9876	fdg	34543	Take Action	Delete

Figure 22 Medical claims approval page

This page in the backend allows the medical admin to view and approve or reject medical claims.

4.3.2 Hardware components

No extra hardware component is required for this project and the system can be accessed through both a mobile phone (since the site is mobile responsive) as well as a larger device.

4.3.3 Database components

The database was done through SQL and the following diagram shows an overview of the tables of the database.

Table	Action	Rows	Type	Collation	Size	Overhead
admins	Browse Structure Search Insert Empty Drop	5	InnoDB	utf8mb4_general_ci	16.0 Kib	-
booking	Browse Structure Search Insert Empty Drop	9	InnoDB	utf8mb4_general_ci	48.0 Kib	-
cars	Browse Structure Search Insert Empty Drop	5	InnoDB	utf8mb4_general_ci	16.0 Kib	-
categories	Browse Structure Search Insert Empty Drop	2	InnoDB	utf8mb4_general_ci	16.0 Kib	-
claims	Browse Structure Search Insert Empty Drop	4	InnoDB	utf8mb4_general_ci	16.0 Kib	-
contact	Browse Structure Search Insert Empty Drop	0	InnoDB	utf8mb4_general_ci	16.0 Kib	-
employees	Browse Structure Search Insert Empty Drop	10	InnoDB	utf8mb4_general_ci	16.0 Kib	-
employee_types	Browse Structure Search Insert Empty Drop	3	InnoDB	utf8mb4_general_ci	16.0 Kib	-
payment	Browse Structure Search Insert Empty Drop	5	InnoDB	utf8mb4_general_ci	16.0 Kib	-
room	Browse Structure Search Insert Empty Drop	14	InnoDB	utf8mb4_general_ci	16.0 Kib	-
roombook	Browse Structure Search Insert Empty Drop	3	InnoDB	utf8mb4_general_ci	16.0 Kib	-
slider	Browse Structure Search Insert Empty Drop	4	InnoDB	utf8mb4_general_ci	16.0 Kib	-
12 tables	Sum	64	InnoDB	utf8mb4_general_ci	224.0 Kib	0 B

4.4 Technologies used

PHP is used for programming the frontend and backend. Initially, it was proposed to use Java and create the frontend as a mobile app. However, considering the fact that functionalities such as loan applications and calculations are more easily done through a web-based system, it was discussed and decided during the interim evaluation to use PHP for both the frontend and the backend and to create the system as a web-based system. In addition, the bootstrap framework is also used, along with Javascript in some instances like for the loan calculator. SQL is used for the database.

PHP is beneficial for the following reasons:

- PHP is open source and can be easily used without extra payments.
- PHP has a wide variety of libraries, some of which, such as the Dompdf library, are used in this project
- PHP is flexible and can be used to create mobile responsive projects, like this one
- PHP has excellent speed, and it said to be almost three times as fast as languages such as Python.
- PHP is scalable and can be used for large websites. Since one of the main advantages of PHP is that it loads fast, it also means the users in the system won't experience long wait times.

5. Results and Evaluation

5.1 Results gathered from the project

By automating the process of applying for the benefits provided to bank employees, it is possible to make the system more efficient.

It is necessary to have multiple back end administrators since having only one will be a security issue, and will result in too much work for one person.

The loan management functionality cannot be entirely automated due to its complexity so the scope had to be limited to fit the timeline.

5.2 Test cases

This section shows some test cases that were carried out to test the functionalities of the system.

5.2.1 Login test case

Test Case ID: EBMS01					
Tested Component: Login					
Module Name: Login					
Tested Area: Functionality of the login					
Test no	Test Description	Steps to Test	Expected Results	Actual Result	Status
TL001	Login to system	Provide the email and password and click login in button. (Admin)	Admin will be allowed to log in and redirect to admin dashboard	Admin is redirected to admin dashboard	Pass
TL002	Login to system	Provide the email and password and click login in button. (Employee)	Employee will be allowed to log in and redirect to website homepage.	Employee is redirected to website homepage	Pass
TL003	Login with empty fields	Provide empty fields and click Log in button	Show an error message	Error message is displayed	Pass
TL004	Login with false email	Provide wrong email and try to login	Show an error message	Error message is displayed	Pass
TL005	Login with false password	Provide a correct email and a wrong password and then click sign in	Show an error message	Error message is displayed	Pass

5.2.2 Medical claim application test case

Test Case ID: EBMS03
Tested Component: Medical Claims
Module Name: Claims
Tested Area: Functionality of filling medical claims application

Test no	Test Description	Steps to Test	Expected Results	Actual Result	Status
TM001	Fill all fields properly	Fill all fields properly and press submit	Claim is submitted, a message says that claim is submitted and to await approval.	A message says that claim is submitted and to await approval	Pass
TM002	Submit claim with empty fields	Leave all the fields empty and click submit	Error message appears	Error message appears	Pass
TM003	Submit the claim with no supporting documents	Submit without uploading pdf files to the supporting documents field	Error message appears	Error message appears	Pass
TM004	Submit file type other than pdf	Upload file type other than pdf and click submit	Error message appears requesting to submit only pdfs	Error message appears requesting to submit only pdfs	Pass
TM005	Add non-numbers to claim amount	Type letters in the claim amount field	Error message appears requesting to enter only numbers	Error message appears requesting to enter only numbers	Pass
TM006	Employee number is automatically appeared when medical claims page is opened	Open medical claims section	Employee number is automatically appeared	Employee number is automatically appeared	Pass

5.2.3 Vehicle booking application test case

Test Case ID: EBMS04
Tested Component: Vehicle booking
Module Name: Vehicles

Tested Area: Functionality of filling vehicle booking application					
Test no	Test Description	Steps to Test	Expected Results	Actual Result	Status
TV001	Fill all fields properly	Fill all fields properly and press submit	Booking request is submitted, a message says that request is submitted and to await approval.	A message says that request is submitted and to await approval	Pass
TV002	Submit request with empty fields	Leave all the fields empty and click submit	Error message appears	Error message appears	Pass
TV003	Add wrong booking dates	Add a return date that precedes the booking date and click submit	Error message appears	Error message appears	Pass
TV004	Add wrong data for phone number	Add text in the phone number field and submit	Error message appears	Error message appears	Pass

5.2.4 Holiday home booking application test case

Test Case ID: EBMS05					
Tested Component: Holiday home booking					
Module Name: Holiday homes					
Tested Area: Functionality of filling holiday home booking application					
Test no	Test Description	Steps to Test	Expected Results	Actual Result	Status
TH001	Fill all fields properly	Fill all fields properly and press submit	Booking request is submitted, a message says that request is submitted and to await approval.	A message says that request is submitted and to await approval	Pass
TH002	Submit booking	Leave all the fields empty	Error message appears	Error message appears	Pass

	with empty fields	and click submit			
TH003	Add wrong booking dates	Add a check out date that precedes the check in date and click submit	Error message appears	Error message appears	Pass
TH004	Wrong verification code	Type in a verification code that is not the same as the one displayed and click submit	Error message appears	Error message appears	Pass
TH005	Employee personal information appears automatically	Open the holiday homes page	Employee personal information appears automatically	Employee personal information appears automatically	Pass

5.2.5 Insert employees test case

Test Case ID: EBMS06					
Tested Component: Employee					
Module Name: Insert employees					
Tested Area: Functionality of inserting employees					
Test no	Test Description	Steps to Test	Expected Results	Actual Result	Status
TI001	Fill all fields properly	Fill all fields properly and press submit	The employee is entered to database	The employee is entered to database	Pass
TI002	Submit request with empty fields	Leave all the fields empty and click submit	Error message appears	Error message appears	Pass
TI003	Add wrong text to phone number field	Add letters to the phone number field and press submit	Error message appears	Error message appears	Pass
TI004	Add wrong	Add a file type other than jpg	Error message appears	Error message appears	Pass

	file type for employee image	for image			
TI005	Add wrong text to basic salary field	Add wrong text to basic salary field and press submit	Error message appears	Error message appears	Pass

5.2.6 Approve vehicles test case

Test Case ID: EBMS07					
Tested Component: Approve vehicles					
Module Name: Vehicles					
Tested Area: Functionality of approving vehicle hiring requests					
Test no	Test Description	Steps to Test	Expected Results	Actual Result	Status
TI001	Fill all fields properly	Fill all fields properly and press submit	Booking request is submitted, a message says that request is submitted and to await approval.	A message says that request is submitted and to await approval	Pass
TI002	Submit request with empty fields	Leave all the fields empty and click submit	Error message appears	Error message appears	Pass
TI003	Press approve for a vehicle that is already approved	Add wrong text to basic salary field	Error message appears	Error message appears	Pass
TI004	Press return for a vehicle that is already returned	Press return for a vehicle that is already returned	Error message appears	Error message appears	Pass
TI005	Press approve for a vehicle that is already	Press approve for a vehicle that is already	Vehicle is approved	Vehicle is approved	Pass

	vehicle that is pending approval	approved			
TI006	Press return for a vehicle that is not returned	Press return for a vehicle that is not returned	Vehicle is returned	Vehicle is returned	Pass

5.3 Critical evaluation of test cases and results

Testing was done through unit testing, where the functionalities of the system were tested one by one. Then they were also tested once they were connected, in integration testing. Finally, in system testing, the entire system was tested. Most features provide positive results when tested. There are, however, tests that have not been carried out due to time constraints, such as whether the loan calculator hold true for very large numbers.

6. Future Work

Banks are, in general, complex and structured institutions. Even something as localized as a rural bank will have complex inner workings. Although this project has achieved its overall aim of automating the benefits programs available for employees, it has not entirely accounted for the many complexities and hierarchical structures within the banks. In addition, while it has accounted for the presence of some of the external entities involved in the benefits programs, it has not accounted for all of them. This was due to reasons such as time constraints and the need for a limited scope in which to work within (which was part of the feedback given during the prototype evaluation).

Following are several future additions that can be made to the system to increase its profitability and success in the banking industry, as well as to make it further viable for industrial use.

1. For the purpose of limiting the scope, this system has only taken into three major categories of employee, namely;
 - a. Junior employees

- b. Middle-level employees
- c. Senior employees

While this categorization is the bedrock of the employee hierarchy of most banking institutions, there are other categorizations that would ideally need to be taken into consideration, specially during the provision of loans. During the background study, it was discovered that these categorizations mainly affect two of the major functionalities of the project, namely, medical claims management and loan management.

With medical claims, the interest rates and the payment periods differ not just according to employee category, but also with service time and promotions that they have accumulated over the years of service. In addition, there are other factors that would ideally have to be taken into consideration. For example, there might be employees whose promotions have been suspended due to malpractice accusations or various other reasons. In cases such as those, it is necessary to suspend their loan privileges and maybe certain other privileges as well. Currently, this system is unable to account for such categorizations. Future works would ideally account for such factors.

2. With regards to holiday homes management, it is a normal practice for the holiday homes to be functioned in a way that allows the owners to give accommodation not only to bank employees but also other outside people as well, for example other pilgrims. The bank employees will be given priority. However, in instances where there are no bookings by bank employees, external parties will be given accommodation. However, they will not be given the discounted rates that bank employees are given. Currently, the system only accounts for bookings made by bank employees. For future work, it is possible to add a functionality that will allow this same system to provide bookings for external parties as well.

This will reduce the need for a separate system for bank employees and external parties and will streamline the booking process. It will also allow the holiday

homes to be more profitable as they will be catering to different parties and will not have unnecessary free days in which there are no reservations.

3. In the developed system, medical claims are validated in a way that they are capped at a certain maximum price. However, even very large medical claims are entertained in banks (such as claims for major surgeries and extended hospital stays). In instances such as these, they need to be approved by a separate party in the main branch of the bank/ corporate headquarters. Currently, the approval is done by a medical claims administrator, but this system can be further improved to send large claims across to a senior officer in headquarters and to get full or partial reimbursement for costly medical procedures.
4. Welfare vehicles booking is, in comparison, the least complex process of this system. However, it too can be further improved by adding a few more features. Currently, this system only allows the employee to hire a vehicle for a concessionary rate. The driver comes along with the vehicle. However, practically, it is also possible to hire only the vehicle without the driver, for an even lower rate. This is applicable, for example, if the employee already has a driver or would prefer to drive himself. Such a feature can be added during future works, and this would provide the employee with more options and make things easier for the employee.
5. For future plans, it is also possible to add a payment gateway to the holiday homes and vehicle booking functionalities so that it is possible for the customers to pay directly through the system.

7. Conclusions

The main objective of this system was to increase the efficiency of processes within the bank and provide employee motivation by creating a single, unified system that can be used by bank employees to apply for and gain employee benefits provided by the bank. By automating processes such as applying for medical claims and welfare vehicles, it was possible to eliminate the need to use paper and other manual methods. Previously, bank employees need to travel to the bank itself to submit these applications and then contact the bank to check the status of these services. This is especially difficult in instances such as an employee being sick and unable to travel but needing to claim a prescription. With the use of this system, this process is made much easier. It is also beneficial specially in the contemporary situation where there is a paper shortage.

While the project was being done, it was discovered that automating loans is a complicated tasks. Loan management of employees is less complicated than that of normal account holders because the installments are deducted from their salaries and no separate payment needs to be done. In addition, there is less need for recovery officers since employees are much more accessible than general customers of the bank. However, employees too are required to go through several approval processes, specially for complicated loan plans such as loans given for pensioners, loans given for solar panel installments. Therefore, since the project scope had to be limited, I only focused on two types of loans, namely distress loans and housing loans. These are relatively less complicated because they require the approval of two parties. Although it was not possible to automate all the functionalities of loan management of the bank, even the amount of work done makes the loan process much easier and contributes to the efficiency of the processes of the bank.

Overall, the project has helped achieve the objectives of making the employee benefits more accessible to the employees of the bank, since bank employees no longer need to call several different places and fill out many different forms to make use of simple services such as holiday homes.

8. Reflection

Engaging in this project gave me insight into the corporate world and how information technology has been integrated in the functioning of the banking industry. The problem I addressed in this project is one that I identified long before this project started, when I watched several family members who are bank employees struggle to use the benefits that were provided to them, with a system that was largely manual and inefficient. It gave me great pleasure to apply the knowledge that I gained through this degree to provide a solution to this real-world problem, specially since I had, since some ago, believed that this is an issue that needs to be addressed by the banking industry.

Although the system I have developed is not able to provide an all-encompassing solution to the problem that I have identified, it take some crucial steps towards making the employee benefits management process much more efficient than it currently is. Working on this project also made me understand the importance of being self-taught in many aspects of education and that being able to research and find things out on my own is a crucial skill as an undergraduate, as well as for the rest of my life. I look forward to further developing this system to include the many other functionalities that banks carry out in real life.

Table of Abbreviations

List of Abbreviations

EBMS	Employee Benefits Management System
HRIS	Human Resource Information System
BOC	Bank of Ceylon
NDB	National Development Bank

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Appendices

Appendix A - Questionnaire that was used for the interview with the Deputy General Manager of Human Resources

QUESTIONNAIRE REGARDING THE HRIS OF BANK OF CEYLON

ABOUT THE HRIS

Is there an HRIS, or is this part of the overall system that is used in the bank?

If so, what are the major tasks done by the HRIS/ system? (ex Payroll • Time tracking • Recruitment • Leave handling • Employee information handling • Performance appraisal handling • Training and development handling • Grievance handling ?)

Is it only the HR department that has access to this system, or do all employees have access (- but different levels of access, maybe?)

What steps are taken to ensure security of this system?

How has the digitisation process positively impacted the HR functions of the organisation?

ABOUT OVERALL DIGITISATION OF THE BANK

Which method is more prevalent in the work within the bank: digital or manual? What digital platforms does the bank use in day to day activities?

Name some tasks that simply **cannot be done** without the aid of digital technology.

Name some tasks that **can be done**, and are done without the aid of digital technology.

Name a few tasks that were previously done manually, but were recently digitised.

Have there been instances where employees have either been laid off, or where they have been assigned to different positions because the job they previously did was taken over by technology?

Do you think that there are certain tasks that are currently done digitally, that would be more effective when done manually?

How are new employees given training in using the digital technology? How are already existing employees given training in using digital technology? Do these two training process differ, or are they the same? 15

When hiring new employees to the bank, what level of digital competency is expected from them? How is this level of digital competency tested?

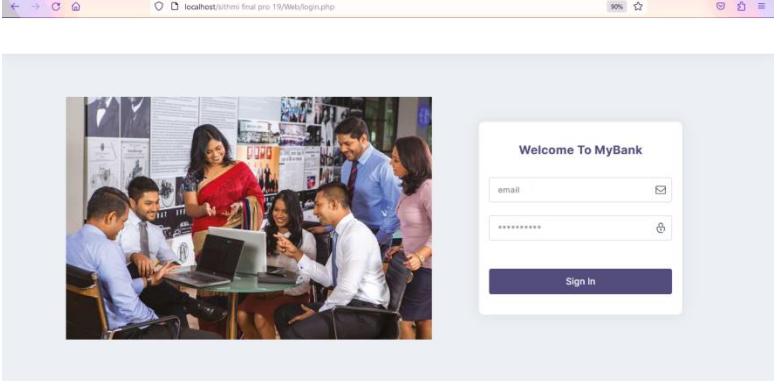
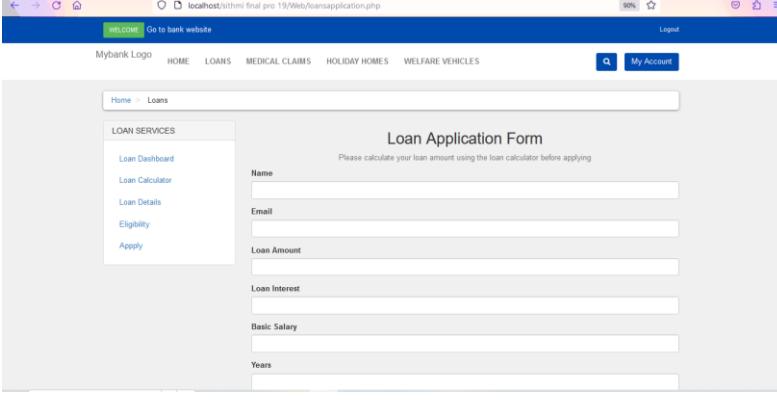
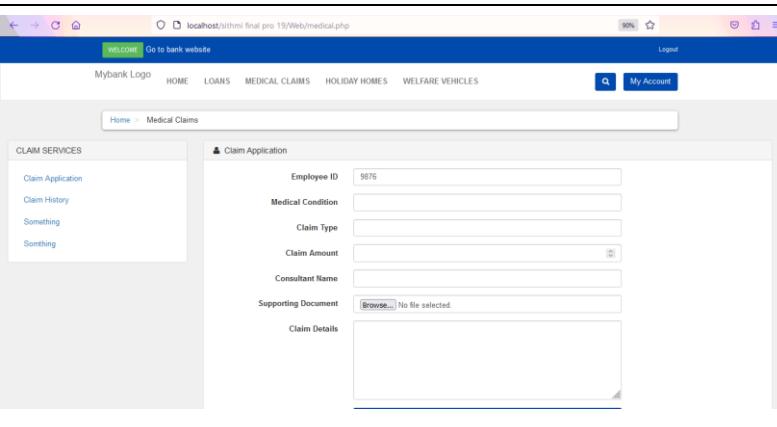
What challenges has the management faced in getting employees used to digital technology?

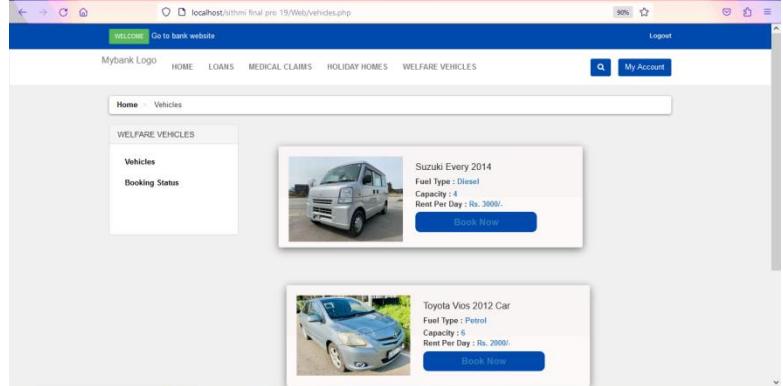
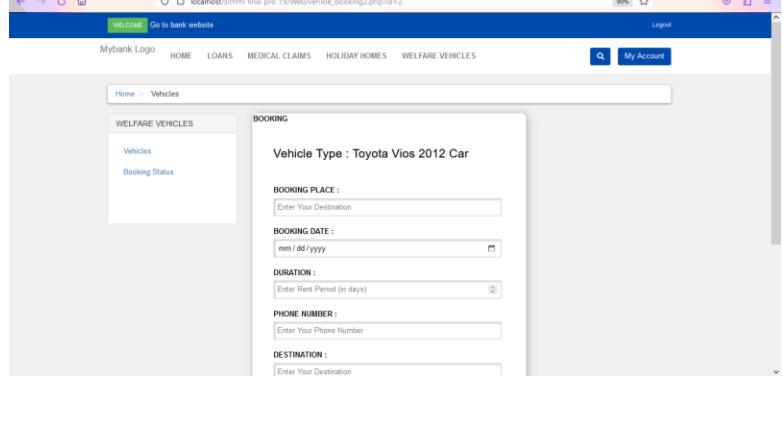
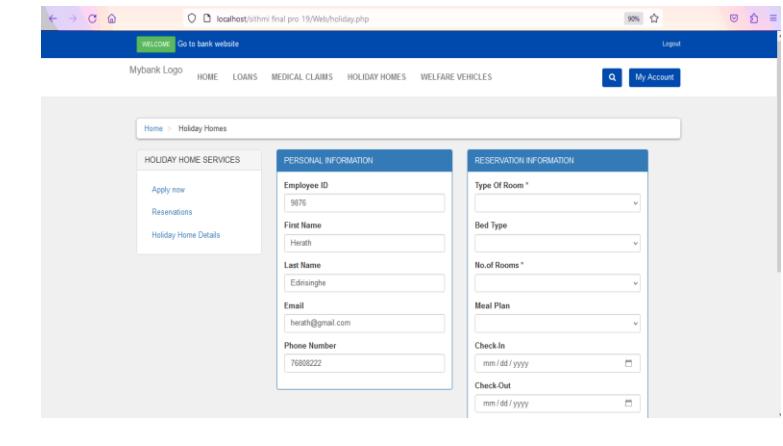
What were the challenges that the lower-level employees faced with the recent digitisation?

When changes are made to the digital technology by the upper management, how is this communicated to lower-level employees (including other branches of the bank)

How much of the organisation budget is allocated for digitisation and digital technology (including training of employees)?

Appendix B – User Manual for Employees

	<p>You can login through this interface by providing the email address and password that was provided by the administrator upon your initiation to the organization.</p>
	<p>By filling out this form, you can apply for a loan. Make sure to use the loan calculator to see how much will be deducted from your salary per installment.</p>
	<p>By filling out this form, you can apply for a medical claim. Fill out the form and await approval. You can check the status of the claim from the “Claims History” section.</p>

	<p>This shows the available vehicles. Click Book Now once you choose a vehicle. It will redirect you to the page shown next.</p>
	<p>Fill out this form to reserve the chosen vehicle and await approval.</p>
	<p>By filling out this form, you can apply for a holiday home.</p>

Appendic C- Interim Report and Software Requirements Specification

Interim Report

for

Employee Benefits Management System for Banking Institutions

Version 2.0

Prepared by EMSN Edirisinghe

E1941315

Center for Open and Distance Learning,

University of Moratuwa

10.10.2022

Declaration of Candidate

“I declare that this is my own work and this report does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text. Also, I hereby grant to University of Moratuwa the non-exclusive right to reproduce and distribute my report, in whole or in part in print, electronic or other medium. I retain the right to use this content in whole or part in future works.”

Signature:

A handwritten signature in black ink, appearing to read "Raj".

Date: ...10.10.2022.....

Declaration of Supervisor

The above candidate has carried out work for the Bachelors of Information Technology Degree report under my supervision.

Name of the supervisor: ...Mr Chamal Gunasinghe.....

A handwritten signature in black ink, appearing to read "chamal".

Signature of the supervisor:

Date: ...10/10/2022.....

Acknowledgement

The completion of this report would not have been possible if not for the kind support and help of many individuals. I would like to extend my sincere thanks to all of them through this acknowledgment.

I am highly indebted to the different employees of the banks I have had interviews with, such as the Bank of Ceylon and National Development Bank, for the information they provided and their patience in helping me with this matter.

I would also like to thank Hroizon Campus, Malabe and the lecturers who assisted me by providing guidance during the preparation of this report, as well as the Center for Open and Distance Learning of the University of Moratuwa for their guidance in this endeavour.

I am grateful to my supervisor, Mr Chamal Gunasinghe for his guidance and constant supervision as well as for providing necessary information regarding the project and also for his support in completing this report.

I would like to express my gratitude towards my parents for their kind co-operation and encouragement which help me in the completion of this report.

I would like to express my special gratitude and thanks to my fellow students for giving me support and attention during the preparation of this report.

My thanks and appreciations go to all those who took the time and effort to encourage me and guide me in completing this document.

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Revision History

Name	Date	Reason For Changes	Version
Interim Report Version 2.0	10.01.2023	The suggestions given during the interim evaluation with regards to the diagrams were incorporated into this version.	2.0

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List of Abbreviations

EBMS	Employee Benefits Management System
HRIS	Human Resource Information System
BOC	Bank of Ceylon
NDB	National Development Bank

1. Introduction

1.1 Overall Introduction

In the modern world, banks are every nation's primary financial institution and play a significant role in the economy. Maintaining a sound and stable economic and financial system is a crucial responsibility for banks, along with using money in a way that benefits the financial system. This will support a nation's continued economic stability. A bank's personnel are its most important resource, just like in any other firm. The effectiveness of the staff is what decides the bank's growth and whether or not it can continue to compete in the financial industry. Therefore, it is crucial to make sure bank personnel are happy with their positions.

Since bank employees play a significant role in a nation's economic development and financial management, it is crucial to maintain their happiness in order to ensure that they perform successfully. A person who is highly satisfied at work feels positively about their work, whereas a person who is less satisfied feels negatively about their work. Job satisfaction is the difference between the amount of rewards employees receive and the amount they believe they should be received [3]. Employees are therefore more likely to be productive at work if they feel good about their occupations. Employee perks are one of the key strategies for maintaining employee satisfaction.

Employees are therefore more likely to be productive at work if they feel good about their occupations. Employee perks are one of the key strategies for maintaining employee satisfaction. The banking industry offers its employees a wide range of advantages, including loans, medical coverage, holiday bonuses, and much more. More employee satisfaction will result from effective management of these benefits.

In order to decrease employee irritation and boost job satisfaction, this project proposal intends to develop a system that can make the employee benefits administration process within a banking

institution effective and simplified. This issue is significant since assuring bank employees' job happiness has a direct impact on the bank's performance, and by extension, the entire economy.

1.2 Background Study

Several different case studies from different Sri Lankan banks have been taken as examples within this background study and are elaborated upon the in the next sections.

1.2.1 Bank of Ceylon

According to the Bank of Ceylon Annual Report of 2020, employees are provided many attractive benefits such as diverse loan schemes (such as Housing loans, vehicle loans, computer loans, solar power loans, investment loans and unified general loans at concessionary rates), Medical assistance schemes, Pension schemes, Widow, Widower and Orphanage fund, Education assistance and much more [4]. In addition to this, a massive amount of funds are allocated for the purpose of employee benefits of this bank. The net employee benefit asset is 13,318,122 LKR'000 [4]. This amount represents net retirement benefit assets of Bank of Ceylon Pension Fund-2014 and Bank of Ceylon widows'/ widowers' and orphans' pension. Table 1 shows the amounts of money allocated for various employee benefits in each year. As it can be seen, the bank has allocated large amounts from their annual budget for the purpose of benefitting employees of the bank. However, in the process of gathering information for this project, it was discovered that certain employee benefits are difficult for employees to obtain due inconsistencies at the ground level.

Table 1: Net employee benefit assets of Bank of Ceylon – 2020 Source: Bank of Ceylon Annual Report 2022

As at 31 December	Bank		Group	
	2020 LKR '000	2019 LKR '000	2020 LKR '000	2019 LKR '000
Net Employee Benefit Liabilities				
Bank of Ceylon Pension Trust Fund [Note 47.1.3]	23,392,461	14,685,437	23,392,461	14,685,437
Provision for terminal gratuity [Note 47.3]	479,163	370,415	923,904	725,555
Provision for encashment of medical leave [Note 47.5]	803,217	601,634	803,217	601,634
Total net employee benefit liabilities	24,674,841	15,657,486	25,119,582	16,012,626
Net Employee Benefit Assets				
Bank of Ceylon Widows'/' Widowers' and Orphans' Pension Fund [Note 47.2.3]	9,915,229	10,452,943	9,915,229	10,452,943
Bank of Ceylon Pension Fund-2014 [Note 47.4.3]	3,402,893	3,022,510	3,402,893	3,022,510
Total net employee benefit assets	13,318,122	13,475,453	13,318,122	13,475,453

The initial and broader aim of this project was to find out of the shortcomings of the Human Resource Information System of a bank, and to create a system that can provide solutions to these shortcomings. For the purpose of gathering information, two employees of the Bank of Ceylon were interviewed: the Deputy General Manager of Human Resources, and a retired Branch Manager.

With the data gathered at the interview, it became apparent that while the bank allocates funds for employee benefits, there can be improvements in the HRIS in handling the process of applying for and providing the benefits. In the interview with the Deputy General Manager, it was stated that the employee loan providing process is done through the HRIS, however, the system is overburdened by all the other functions it is carrying out. In addition to this, providing employee loans is complicated because there are many different types of loans that are provided, and the amounts provided vary greatly according to the position of the employee in the bank's hierarchy and the employee's paygrade. Due to this, the system that is already available is difficult to customize according to the amounts needed, and occasionally, the human resources department of the bank has to create compromises according to the capabilities of the HRIS, rather than adhering to the types of loans that the bank is able to provide.

In addition, it was also mentioned that certain employees, particularly senior and elder employees, have difficulty in working with the HRIS that is already available, which is a web based one. Due to the gap in digital literacy, some employee may miss out on gaining benefits that they deserve, or

they may experience various frustrations in applying for these benefits. This project, therefore, aims to create system that is more user-friendly for employees as well.

During the other interview of with the retired Branch Manager, it was also realized that the systems available for certain other employee benefits are not automated at all. For example, all medical claims are still done through paperwork. Bank employees are required to fill out physical copies of forms and submit them with prescriptions. This is a time-consuming process. In addition, services like booking holiday homes and welfare vehicles provided for employees are not automated processes, and are inefficient. This process is especially difficult for retired employees, as they have to constantly make separate trips to a branch of the bank to submit applications to gain these benefits. If these processes are automated, and made more efficient, it would be greatly beneficial for employees, and it would increase their job satisfaction.

1.2.2 National Development Bank (NDB)

The first bank that was taken into consideration was National Development Bank PLC (NDB). Data was gathered about the bank by interviewing an employee. Currently, NDB does not have a system that completely automated the process of employee loan management in the bank. However, certain portions of the process are automated. This bank too, provides certain concessionary rates for the loans that employees obtain from the bank. NDB has a separate web-based system which has the function of checking the employee's eligibility for the loan when applying. This system is named "Oasis", and it an internal system that is only accessible by the employees of the bank. When an employee plans to apply for a loan from the bank, he or she is required to make the request through the Oasis system. This system will process the data given by the employee, such as type of loan needed, the repayment time and so on. The system will send the request to various departments within the bank such as the HR department, the loan department and the credit card department (to check outstanding payments by the employee). The loan has to be approved by all these departments in order for the employee to become eligible to get this loan.

Once the eligibility for the loan has been checked, the functionality of the Oasis system ends. From there on, this process will then be taken over through manual work. The employee does have the option of applying through the Neos app, which is the online banking app which is available for all NDB customers (not dedicated to employees), in applying for the loan. However, most of the processes from there, such as housing inspection documentation for housing loans, and the recovery section is done through manual paperwork. The drawback that is identified in this system is that it only automates the very first part of the process, while the rest of it is done mainly manually.

In addition to this, information was also gathered about the medical claims process of NDB. Unlike Bank of Ceylon, its claims are not done on a prescription-by-prescription basis. All employees are simply given a 45,000-55,000 LKR payment, broken down into two parts and paid twice a year. This amount of money is expected to be used for buying medicine and doctors' appointments. However, if the employee is admitted to the hospital, this entire process is taken over by a insurance company. Currently, this done by Sri Lanka Insurance (SLIC). Here, once an employee is admitted, they have to inform the SLIC and the HR department of the bank through a call. After being discharged, the SLIC takes over, the relevant hospital bills are submitted to them, and they handle the payment from there. There is no web-based system involved in claiming refunds for either prescriptions, or hospital stays. The drawback in this system is that the employee is paid a certain amount whether they require it or not. If the bank has a system that can process each and every prescription easily, they can save money on employees who do not require the given amount for their medical needs and use that money to help employees whose needs are greater and who are inconvenienced by the limit set upon them.

NDB also has a system for vehicle hiring. This is done through PickMe. Employees can hire a vehicle through PickMe and then enter a code given by the bank, and then the trip will be regarded as a business trip, and the employee is not required to pay. Here, the system that is used is the PickMe app.

1.2.3 Commercial Bank

The other bank that was taken was the Commercial Bank. The loans that are given to employees vary based on the grade of that particular employee. Different loan schemes are available such as

housing loan, vehicle loan and consumption loan. In this bank too, the loan process is not entirely automated. The employee is allowed to apply for the loan through the e-loan system in the bank. There, he or she can choose the type of loan, amount required, how long it will take for them to pay it back and so on. The amount of time allowed to pay it back also differs (for a housing loan, it is about 20 years and for vehicle loans about 8 years etc). This system also allows the employee to choose how much of their salary can be allocated to pay off the loan. The maximum is 60%.

Some parts of the process, however, are done manually. Sending documents for approval, handling documentation regarding house inspections, keeping track of the loan status are parts of the process that are not yet automated.

When it comes to medical bill claiming, this is also subject to limits according to the grade of the employee in the hierarchy. Employees are provided about 30,000 LKR for one year, broken down into several installments to pay for prescriptions and doctors' appointments. This does not involve a dedicated computer system. This system has been put into place because the process of examining each prescription and reimbursing is difficult. However, with an automated system, approving prescriptions is easy to do, and this can help the bank save money as well.

When an employee is admitted to the hospital, they have to contact the head office and get their credit card limit increased to a certain amount. They can then pay the bill using that card, and the bank then settles the bill and reimburses. This too, does not involve a dedicated system. If the hospital bill exceeds the limit given by the bank, the employee has to pay the remaining amount from their personal funds.

1.2.4 Concluding remarks

As previously mentioned in the introduction, job satisfaction of employees is directly related to the productivity of the organization. By improving the job satisfaction of employees, the productivity of the bank will be increased and thus, the bank will be able to make a greater contribution to the economy of the country.

By the information provided to me by these bank employees, I was motivated to create a system that can carry out the process of employee benefit management in a much more efficient, but much more user friendly manner.

With the knowledge and experience gathered by me in the previous semesters of the Bachelor of Information Technology degree, I believe I can create an Android-based mobile application that can connect all the necessary stakeholders of the bank, and make this process much more efficient than it currently is.

1.3 Problem Statement

The primary problem with the present employee benefit management system is that it is not very effective. There is no single system available for just managing employee benefits. While some processes, like loan benefits, are carried out via the HRIS, others are manually completed using only paperwork. The entire system is time-consuming, difficult to use, and inefficient. It also causes a lot of unnecessary obstacles for the staff members. In addition to this, due to the size and scale of the banking institution, there are management difficulties and discrepancies in the current system. Employees become frustrated as a result, which lowers their level of job satisfaction.

The goal of this system is to centralize the flow of this data in order to better manage the records of all existing benefits used by banking employees, as well as create a platform through which employees can apply for benefits offered by the bank. This platform will feed data into a centralized cloud-based system, accessible from anywhere, which will reduce costs, improve efficiency, and accelerate the entire process.

1.4 Motivation and Significance of the Project

The existing manual process is time consuming and inefficient, and the digitalization of this process will be beneficial to all stakeholders.

1.5 Aims and Objectives

The overall vision for this project is to modernize this internal process of the bank, in keeping with the digitalization strategy, which is popular among many banks these days. For this purpose, this system intends to digitalize documentation, create a centralized database for audit and compliance purposes, improve accessibility to the benefits offered to bank staff, improve employee loyalty, commitment, and morale, increase bank turnover via Employee benefits scheme.

1.5.1 Aim:

The main aim of this project is to create an Android-based mobile application that can address the issue of lack of efficiency in the employee benefit management processes of banking institutions, in order to make this process more streamlined and reduce time wastage.

1.5.2 Objectives:

- Conducting a critical analysis of literature that is available about systems similar to the one being proposed.
- To conduct a thorough study of technologies that can be used to create the employee benefit management system.
- To design and develop a mobile application that can streamline employee benefit management to address the current problem.
- To evaluate and run tests on the system.

2. Literature Review

2.1 Critical Evaluation of 5 existing solutions

This literature review makes use of five systems are, to a certain extent, similar to the one that is being designed within this project. Three of these considered systems are ones that belong to local banks in Sri Lanka (these have also been elaborated upon in the background study), and the other two are drawn from research papers.

In addition to this, the initial literature review that was designed for this project has also been added to Appendix 5.7 for purposes of further reference.

2.2 – HRIS of Bank of Ceylon

2.2.1 Summary of the Features

This system handles many different functionalities of the organization such as managing employee details, handling performance reviews, providing a platform for certain employee training sessions and so on. Loan management is done only to certain extent, and the system is often overwhelmed due to the many different interest rates that are available for different levels of employees. The medical claims processing job is handled mostly manually. Employees get claimed bills from the consultant doctors or hospitals they go to, and manually fill out forms for medical claims. These are then sent to the relevant authorities within the bank and the amount of money necessary is transferred to the employee's account. While booking holiday homes and welfare vehicles as well, the paperwork is filled out manually.

2.2.2 Comparison between proposed system and HRIS of Bank of Ceylon

The drawback of this system is that certain functionalities such as filling out medical claim forms and welfare vehicle request forms are done manually. In a world that is becoming increasingly paperless, this is an extremely old-fashioned and inconvenient method of carrying out these tasks. There is a lot of hassle in transferring these documents from one place to another as well. Therefore, the proposed system aims to make these functionalities entirely paperless and easily accessible to all employees of the organization. It will also reduce wastage of time and material.

2.3 – *Oasis* (National Development Bank)

2.3.1 Summary of the Features

When an employee applies for a loan, NDB has a separate web-based system that checks their eligibility for the loan. This system, called "Oasis," is a private system that can only be accessed by bank staff. Employees must submit their loan requests through the Oasis system if they want to borrow money from the bank. The information provided by the employee—such as the type of loan

required, the timeline for payback, etc.—will be processed by this system. The system will forward the request to several bank divisions, including those in charge of human resources, loans, and credit cards (to check outstanding payments by the employee). The *Oasis* system is no longer working after the loan eligibility has been verified. From that point on, manual labor will take over this process. The employee does have the choice to apply for the loan using the *Neos* app, which is the online banking app accessible to all NDB clients (not just employees). However, the majority of the subsequent steps, including the recovery section and housing inspection paperwork for housing loans, are completed through manual paperwork. This system's flaw is that it only automates the very first step, leaving the majority of the procedure to be completed manually.

Simply divided into two payments of 45,000–55,000 LKR every two years, all employees are paid. It is anticipated that this sum of money will be used to pay for prescription drugs and medical appointments. However, an insurance company takes over the entire process if the employee is admitted to the hospital. Currently, Sri Lanka Insurance does this (*SLIC*). Once an employee is admitted, they must call the bank's *SLIC* and HR department to let them know. The *SLIC* assumes control after the patient is released, and handles the payment after receiving the pertinent hospital invoices.

NDB also has a vehicle rental program. *PickMe* is used to accomplish this. Employees can use *PickMe* to rent a car, enter the code provided by the bank, and the trip will be considered business-related, thus there is no cost to the employee. The *PickMe* app is the one being used in this situation.

2.3.2 Comparison between proposed system and *Oasis*

In the above-mentioned system, the drawback of using services like Sri Lanka Insurance and *PickMe* is that since an external party handles finances, the income generated through this process is also shared, or else the external party has to be paid for their services. This will result in a loss of income for the bank. To avoid this, the proposed system will ensure that these functionalities are done without or with minimal interaction with external parties. This can make sure that the transaction stays within the bank itself and that there is no currency exchange or sharing with other parties, and this will result in the bank's income remaining within the bank itself.

2.4 – Loan Processing and Medical Insurance Systems of Commercial Bank

2.4.1 Summary of the Features

The bank's e-loan system can be used by the employee to apply for a loan. There, he or she can select the loan's type, needed payment, length of repayment, and other factors. The time period allotted for repayment varies as well (for a housing loan, it is about 20 years and for vehicle loans about 8 years etc). When it comes to medical claims, there is no process to separately approve each and every medical claim. Instead, the bank allocates a certain amount of money to each employee per year, for medical purposes. This amount is given to them, regardless of whether they have medical needs or not. The drawback here is that the bank will be wasting money on employees who do not actually need this service, and they might not be allocating enough money for employees who have actual and severe medical needs.

2.4.2 Comparison between proposed system and Loan Processing and Medical Insurance Systems of Commercial Bank

This bank does not have a single unified system that can carry out all the employee benefit-related activities and this can create problems since it is inconvenient for employees to access these facilities. The proposed system intends to carry all the tasks such as medical claims processing, loan management etc. through a single system, to improve efficiency and accuracy of the work done.

2.5 - HRIS of United Commercial Bank Ltd (UCBL) in Bangladesh

2.5.1 Summary of the Features

This human resource information systems (HRIS) offers

- Reporting and examination of personnel data.
- Records pertaining to the business, including employee handbooks, emergency evacuation protocols, and safety regulations.
- The administration of benefits, including enrollment, status modifications, and personal data updates.

- Full integration with accounting and financial software used by the business, including payroll.
- Management of resumes and applicant monitoring.

In terms of employee benefits, anything done for an employee's comfort and improvement that is supplied in addition to their pay is referred to as welfare. For employee families, UCBL offers aid in the form of housing programs, health benefits, and facilities for education and recreation in an effort to raise their level of living. The type of welfare, the chart of accounts, the time period, bank information, the general statement, the financial statement, the contribution ledger, the profit distribution, the loan issuance, and the final settlement are all included in the HRIS. [1]

2.5.2 Comparison between proposed system and HRIS of United Commercial Bank Ltd (UCBL)

This system contains all the benefits provided for employees within a single system and this is a good model to follow for the proposed system as well. However, the scope of the proposed system is smaller than the one of the HRIS of UCBL, as the proposed system only intends to handle employee welfare and not the other parts of human resource management, for the purpose of ease of use for the employee and less complicated functioning of the organization.

2.6 – HRIS of Kenya Commercial Bank

2.6.1 Summary of the Features

This system allows HRIS Based Employee Learning, where employees are provided training through technology. In addition it allows an HRIS based decision making process where executives are given support in making high level decisions through the HRIS. This system handles the employee performance appraisal process. According to this study, 60.9% of the respondents were of the view that the electronic computer based tools technology was mostly applied in their appraisal in the bank and 29.7% believed it is done manually. There is little mention of a system that is dedicated to handling employees' benefits in this research paper. [2]

2.6.2 Comparison

Although there digitization within the processes of this bank, the paper does not mention any components of the HRIS that are dedicated to dealing with benefits provided to the employees. Other human resource functions, however, are digitized. The proposed system aims to make up for deficiencies such as these by creating a single, unified, digitized system to handle all employee benefits.

3. Project Plan and Initial Design

The system will first be designed as UML diagrams, as this helps to create a framework to base the application upon and since it also helps to identify the actors of the system. Then, the system will be created through the relevant technologies. Android Studio will be used to create the front end, which will be used by the employees, and PHP will be used to create the back end, which will be used by the administrators. After completion, the project will be tested using testing technologies.

3.1 Components of the System

3.1.1 Software Components and Tasks

3.1.1.1 Front end of the system

The front end of the system is reserved for the use of bank employees and provides services such as loan requests, medical claim requests, holiday home requests and vehicle requests.

Figure 1 and figure 2 show the form that employees have to fill to request a loan from the bank. These details will then be sent to the central database and the approval process will be done by the administrator.

Figure 3 shows the form the employees have to fill to reserve a holiday home. The employee will also be allowed to pay for this through the application.

Figure 4 shows the interface that the employee uses to apply for a vehicle. The approval of this request will be done by the administrator.

Loan Application

Personal Details	Financial Details
Name:	<input type="text"/>
Employee number:	<input type="text"/>
NIC:	<input type="text"/>
Mobile number:	<input type="text"/>
Address:	<input type="text"/>
Email:	<input type="text"/>
Upload NIC copy:	<input type="button" value="Upload pdf"/>
<input type="button" value="NEXT"/>	

Figure 1 Loan application form 1

Loan Application

Personal Details	Financial Details
Preferred branch:	<input type="text"/>
Repayment method:	<input type="text"/>
Amount:	<input type="text"/>
Repayment period:	<input type="text"/>
Monthly income:	<input type="text"/>
Other income:	<input type="text"/>
Employment:	<input type="text"/>
<input type="button" value="SUBMIT"/>	

Figure 2 Loan application form 2

Holiday Home Application

Employee ID:	<input type="text"/>
Start date:	<input type="text"/>
End date:	<input type="text"/>
Location of home:	<input type="text"/>
Number of rooms:	<input type="text"/>
Number of occupants:	<input type="text"/>
Purpose of stay:	<input type="text"/>
<input type="button" value="SUBMIT"/>	

Figure 3 Holiday home request form

Vehicle Application

Employee ID:	<input type="text"/>
Start date:	<input type="text"/>
End date:	<input type="text"/>
Destination:	<input type="text"/>
Distance:	<input type="text"/>
Number of travellers:	<input type="text"/>
Type of vehicle:	<input type="text"/>
<input type="button" value="SUBMIT"/>	

Figure 4 Vehicle request form

3.1.1.2 Back end of the system

This side of the system is used by the administrators only. It allows them to register employees into the system, approve their requests, and view them as well. Figure 6 shows the loan dashboard where administrators can see a summary of all loan activities of employees.

Register Employee Loans Home bookings Medical Claims Vehicle Booking	Register New Employee Employee ID Employee Name Start date Gender Marital status Address Phone Email Education Grade Position <input type="button" value="Submit"/>
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Figure 5 Register new employee

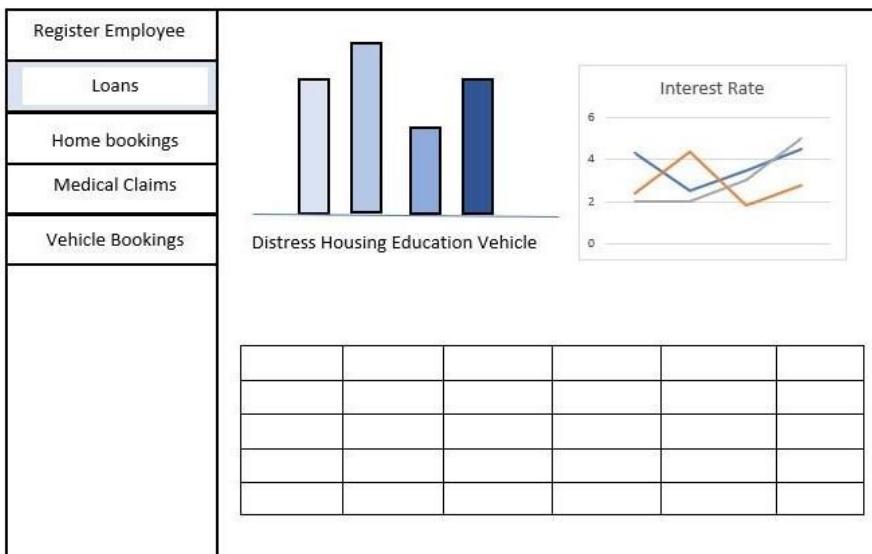


Figure 6 Loan Dashboard

3.1.2 Database Component

All databases required for this project will be created using MySQL and linked to the application using PHP codes. The following table shows the tables of the database that will be created for this software:

Table 2 Database of the system

EBMS_database															
Table name	Table description														
admin	<p>Contains details of the administrators of the system</p> <p>Data fields and data types:</p> <table border="1"> <tr><td>admin_name</td><td>- VARCHAR(100)</td></tr> <tr><td>admin_email</td><td>- VARCHAR(50)</td></tr> <tr><td>admin_username</td><td>- VARCHAR(100)</td></tr> <tr><td>admin_ID</td><td>- INT(10)</td></tr> <tr><td>admin_designation</td><td>- TEXT(100)</td></tr> <tr><td>admin_password</td><td>- VARCHAR(100)</td></tr> </table>	admin_name	- VARCHAR(100)	admin_email	- VARCHAR(50)	admin_username	- VARCHAR(100)	admin_ID	- INT(10)	admin_designation	- TEXT(100)	admin_password	- VARCHAR(100)		
admin_name	- VARCHAR(100)														
admin_email	- VARCHAR(50)														
admin_username	- VARCHAR(100)														
admin_ID	- INT(10)														
admin_designation	- TEXT(100)														
admin_password	- VARCHAR(100)														
loan_type	<p>Contains the details of the types of loans. They will be added to the database by the administrator.</p> <p>Data fields and data types:</p> <table border="1"> <tr><td>type_name</td><td>- VARCHAR(100)</td></tr> <tr><td>type_description</td><td>- LONGTEXT</td></tr> <tr><td>type_ID</td><td>- VARCHAR(10)</td></tr> <tr><td>type_interest</td><td>- INT(10)</td></tr> <tr><td>type_years</td><td>- INT(10)</td></tr> </table>	type_name	- VARCHAR(100)	type_description	- LONGTEXT	type_ID	- VARCHAR(10)	type_interest	- INT(10)	type_years	- INT(10)				
type_name	- VARCHAR(100)														
type_description	- LONGTEXT														
type_ID	- VARCHAR(10)														
type_interest	- INT(10)														
type_years	- INT(10)														
loan_details	<p>Contains details of all the loans taken by employees.</p> <table border="1"> <tr><td>l_name</td><td>- VARCHAR(100)</td></tr> <tr><td>l_description</td><td>- LONGTEXT</td></tr> <tr><td>l_ID</td><td>- VARCHAR(10)</td></tr> <tr><td>l_interest</td><td>- INT(10)</td></tr> <tr><td>l_years</td><td>- INT(10)</td></tr> <tr><td>l_total</td><td>- INT(20)</td></tr> <tr><td>l_installments</td><td>- INT(20)</td></tr> </table>	l_name	- VARCHAR(100)	l_description	- LONGTEXT	l_ID	- VARCHAR(10)	l_interest	- INT(10)	l_years	- INT(10)	l_total	- INT(20)	l_installments	- INT(20)
l_name	- VARCHAR(100)														
l_description	- LONGTEXT														
l_ID	- VARCHAR(10)														
l_interest	- INT(10)														
l_years	- INT(10)														
l_total	- INT(20)														
l_installments	- INT(20)														
employee_registration	<p>Contains the details of the employees who have been registered in the system by the administrator. These details will be provided by the administrators in the registration page, once a new employee is brought into the bank.</p> <p>Data fields and data types:</p> <table border="1"> <tr><td>emp_name</td><td>- VARCHAR(100)</td></tr> <tr><td>emp_ID</td><td>- INT(10)</td></tr> </table>	emp_name	- VARCHAR(100)	emp_ID	- INT(10)										
emp_name	- VARCHAR(100)														
emp_ID	- INT(10)														

	<table border="1"> <tr><td>emp_address</td><td>- TEXT(100)</td></tr> <tr><td>emp_city</td><td>- VARCHAR(50)</td></tr> <tr><td>emp_email</td><td>- VARCHAR(50)</td></tr> <tr><td>emp_username</td><td>- VARCHAR(50)</td></tr> <tr><td>emp_password</td><td>- VARCHAR(50)</td></tr> </table>	emp_address	- TEXT(100)	emp_city	- VARCHAR(50)	emp_email	- VARCHAR(50)	emp_username	- VARCHAR(50)	emp_password	- VARCHAR(50)											
emp_address	- TEXT(100)																					
emp_city	- VARCHAR(50)																					
emp_email	- VARCHAR(50)																					
emp_username	- VARCHAR(50)																					
emp_password	- VARCHAR(50)																					
claim	<p>Contains the details of the medical claims made by employees. These details will be submitted by employees.</p> <p>Data fields and data types:</p> <table border="1"> <tr><td>c_name</td><td>- VARCHAR(100)</td></tr> <tr><td>c_ID</td><td>- INT(10)</td></tr> <tr><td>c_description</td><td>- LONGTEXT</td></tr> <tr><td>c_type</td><td>- VARCHAR(50)</td></tr> <tr><td>c_amount</td><td>- INT(20)</td></tr> <tr><td>c_date</td><td>- DATETIME</td></tr> <tr><td>c_status</td><td>- VARCHAR(50)</td></tr> </table>	c_name	- VARCHAR(100)	c_ID	- INT(10)	c_description	- LONGTEXT	c_type	- VARCHAR(50)	c_amount	- INT(20)	c_date	- DATETIME	c_status	- VARCHAR(50)							
c_name	- VARCHAR(100)																					
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c_description	- LONGTEXT																					
c_type	- VARCHAR(50)																					
c_amount	- INT(20)																					
c_date	- DATETIME																					
c_status	- VARCHAR(50)																					
holiday_home	<p>Contains the details of the holiday home requests made by employees.</p> <p>Data fields and data types:</p> <table border="1"> <tr><td>h_name</td><td>- VARCHAR(100)</td></tr> <tr><td>h_description</td><td>- LONGTEXT</td></tr> <tr><td>h_ID</td><td>- INT(50)</td></tr> <tr><td>h_location</td><td>- LONGTEXT</td></tr> <tr><td>h_startdate</td><td>- DATETIME</td></tr> <tr><td>h_enddate</td><td>- DATETIME</td></tr> <tr><td>h_occupants</td><td>- INT(50)</td></tr> <tr><td>h_payment</td><td>- INT(50)</td></tr> </table>	h_name	- VARCHAR(100)	h_description	- LONGTEXT	h_ID	- INT(50)	h_location	- LONGTEXT	h_startdate	- DATETIME	h_enddate	- DATETIME	h_occupants	- INT(50)	h_payment	- INT(50)					
h_name	- VARCHAR(100)																					
h_description	- LONGTEXT																					
h_ID	- INT(50)																					
h_location	- LONGTEXT																					
h_startdate	- DATETIME																					
h_enddate	- DATETIME																					
h_occupants	- INT(50)																					
h_payment	- INT(50)																					
vehicle	<p>Contains details of vehicles requested by employees.</p> <p>Data fields and data types:</p> <table border="1"> <tr><td>v_name</td><td>- VARCHAR(100)</td></tr> <tr><td>v_description</td><td>- LONGTEXT</td></tr> <tr><td>v_ID</td><td>- INT(50)</td></tr> <tr><td>v_startlocation</td><td>- LONGTEXT</td></tr> <tr><td>v_endlocation</td><td>- LONGTEXT</td></tr> <tr><td>v_distance</td><td>- LONGTEXT</td></tr> <tr><td>v_startdate</td><td>- DATETIME</td></tr> <tr><td>v_enddate</td><td>- DATETIME</td></tr> <tr><td>v_travellers</td><td>- INT(50)</td></tr> <tr><td>v_payment</td><td>- INT(50)</td></tr> </table>	v_name	- VARCHAR(100)	v_description	- LONGTEXT	v_ID	- INT(50)	v_startlocation	- LONGTEXT	v_endlocation	- LONGTEXT	v_distance	- LONGTEXT	v_startdate	- DATETIME	v_enddate	- DATETIME	v_travellers	- INT(50)	v_payment	- INT(50)	
v_name	- VARCHAR(100)																					
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v_endlocation	- LONGTEXT																					
v_distance	- LONGTEXT																					
v_startdate	- DATETIME																					
v_enddate	- DATETIME																					
v_travellers	- INT(50)																					
v_payment	- INT(50)																					

	v_payment	- INT(50)	
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3.1.3 Hardware Component

This software does not require any specific hardware requirements in order to view and handle its user interfaces, and the backend can generally be run on a machine with memory (RAM) of minimum 1 G, preferably 4 GB. The front end mobile app requires an Android smartphone.

3.2 Proposed Methodology

The first step of project design is to identify the actors of the system and draw rough sketches of each process that will be carried out. This has been done with the aid of UML diagrams and these diagrams are attached in Appendix 5.2, 5.3 and 5.4. Once the diagrams are complete, wireframe sketches of certain important interfaces were created, as shown in the following diagrams. These sketches will act as guidelines through the programming process of the system.

The database for the entire system will be created using phpMyAdmin. It will be a MySQL database and will create the records and tables that are mentioned in the above sections. After the creation of the database, Android Studio will be used to program the application. In addition, software such as Adobe XD can be used to assist in User Interface design as well. The backend of the system will be web-based and will be created using PHP. This will be the side of the system that will be used by the administrator.

After coding, software testing methods are used to check if all the functional and non-functional requirements of the system are being met by the system. Modifications will be done according to the results of these tests. A user guide will also be created to ensure that the functionalities of the application can be better understood by the user.

3.3 Technologies Adapted

For coding the front end of the system, Android Studio will be used, and the language that is employed will be Java. For the back end, the coding will be done through PHP, using Visual Code.

Testing will be done using JMeter, which is a load testing tool that is generally used to test web applications.

Databases will be created using MySQL, through PHP MyAdmin.

3.4 Test and Deployment Plan

Since this system is not created with affiliation to a particular organization, testing and deployment will be carried out independently. Test cases have been written for the purpose of making testing easier and are attached to Appendix 5.5. In addition, the load testing software JMeter will be used to test this system as well. Each and every functionality expected from the system will be tested in order to ensure proper functioning. Necessary modifications will be made and validation will be done as well.

4. Bibliography

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[2]S. Rhaman, “A Study on the Effectiveness of HRIS of United Commercial Bank Ltd (UCBL),” Feb. 2020, Accessed: Oct. 10, 2022. [Online]. Available: [http://dspace\(uiu.ac.bd/handle/52243/2530](http://dspace(uiu.ac.bd/handle/52243/2530)

[3]S. P. Robbins and T. Judge, *Organizational Behavior*, 18th ed. Pearson Australia, 2020.

[4]Bank of Ceylon., “Bank of Ceylon Annual Report 2020,” Redworks, 2020. [Online]. Available: <https://web.boc.lk>

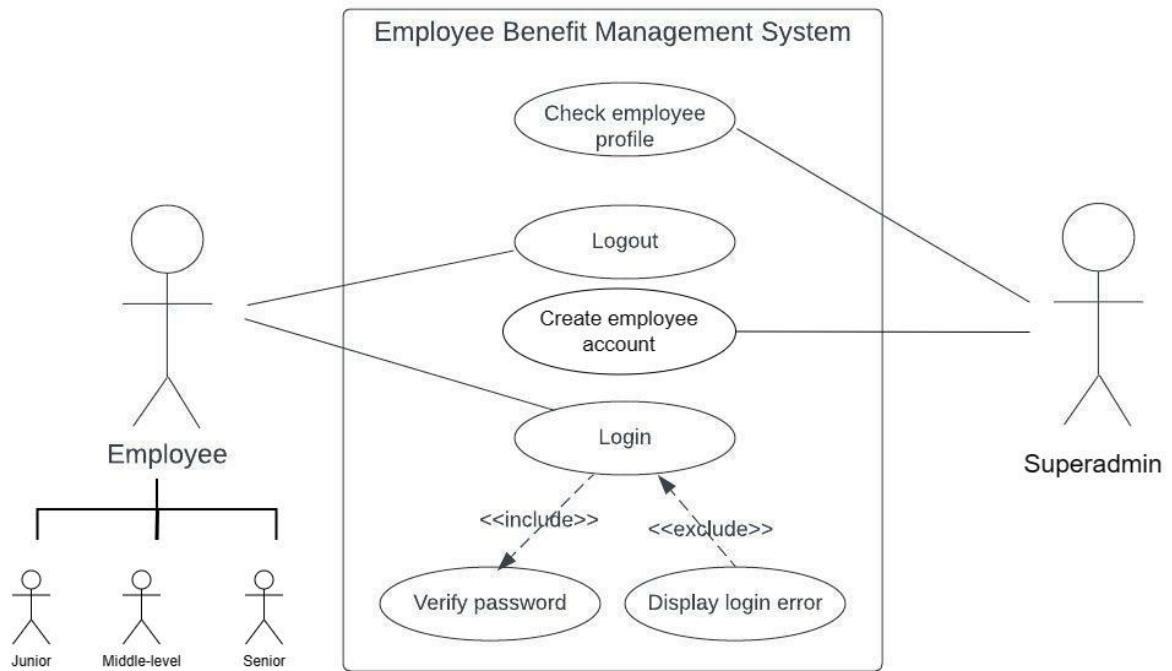
5. Appendix

Extra documentation to support this report are attached to the appendix. In addition, the previously submitted SRS and Literature review are also attached.

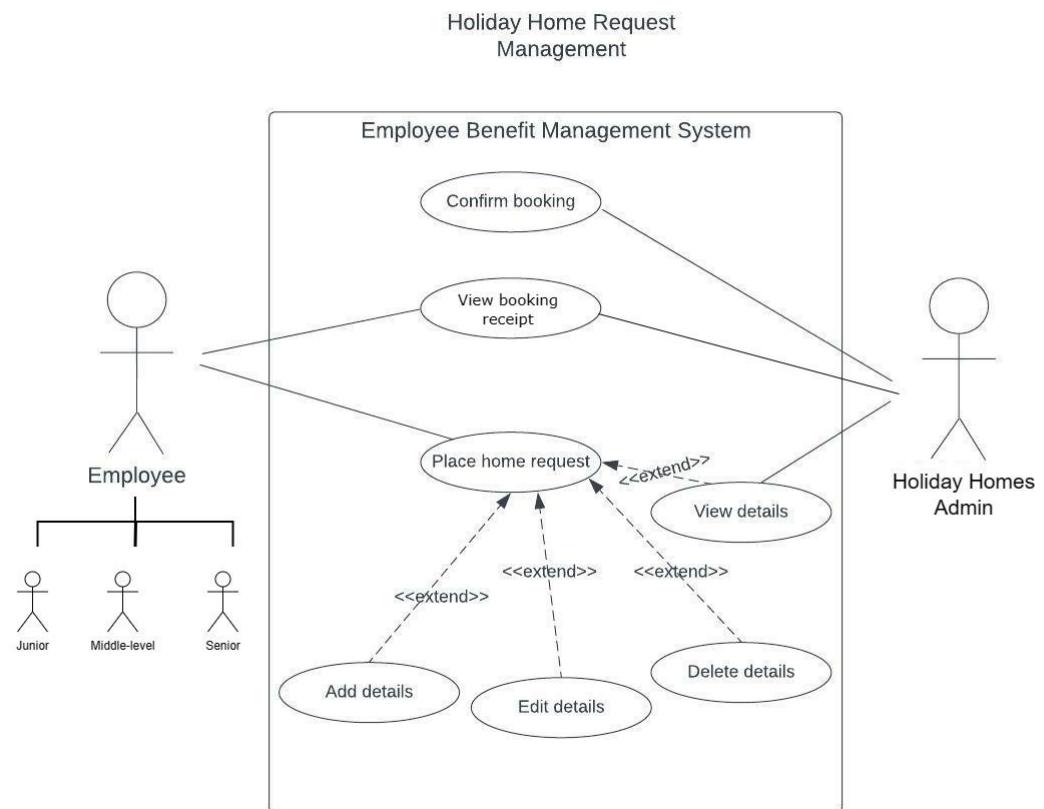
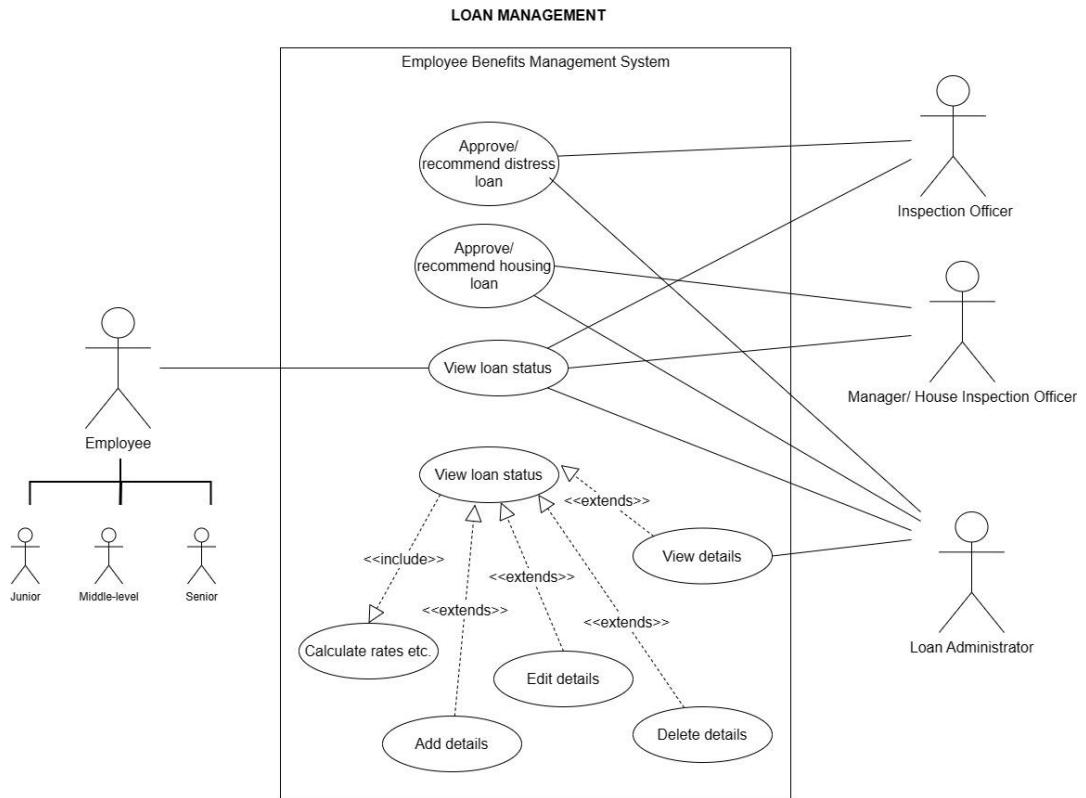
5.1 Gantt Chart

Months	March	April	May	June	July	August	Sep	Oct	Nov	Dec	Jan 2023
Planning											
Design											
Coding											
Testing											
Delivery											

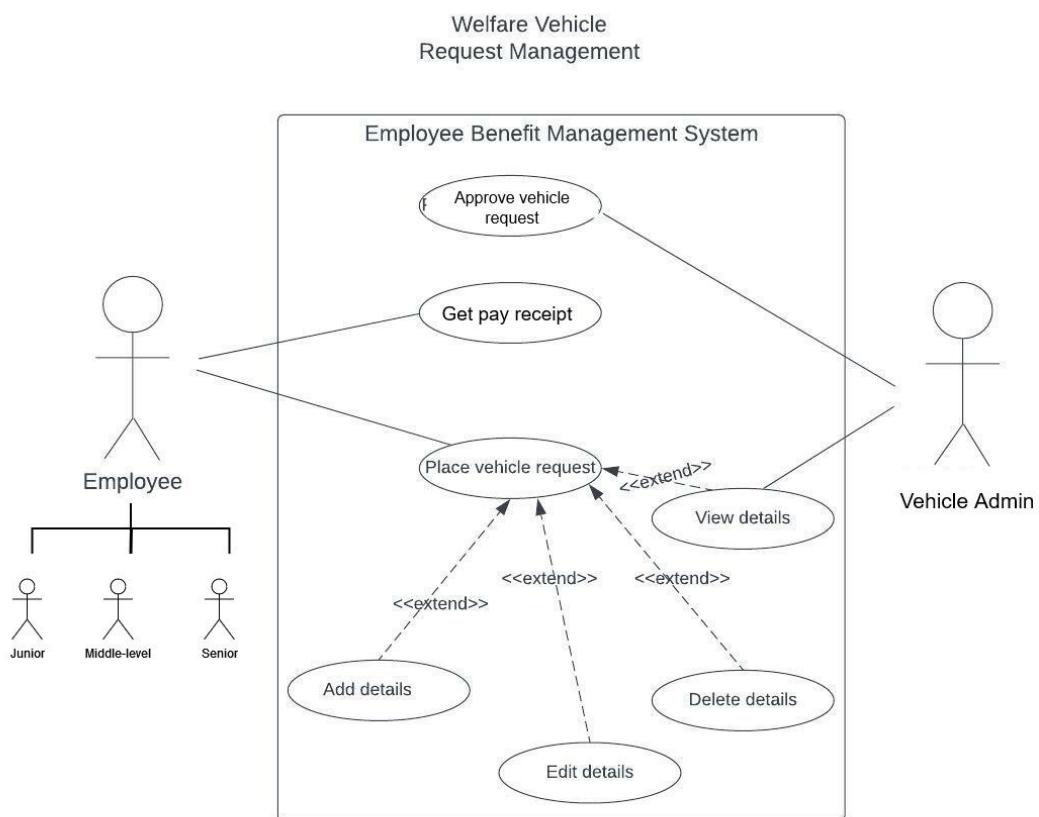
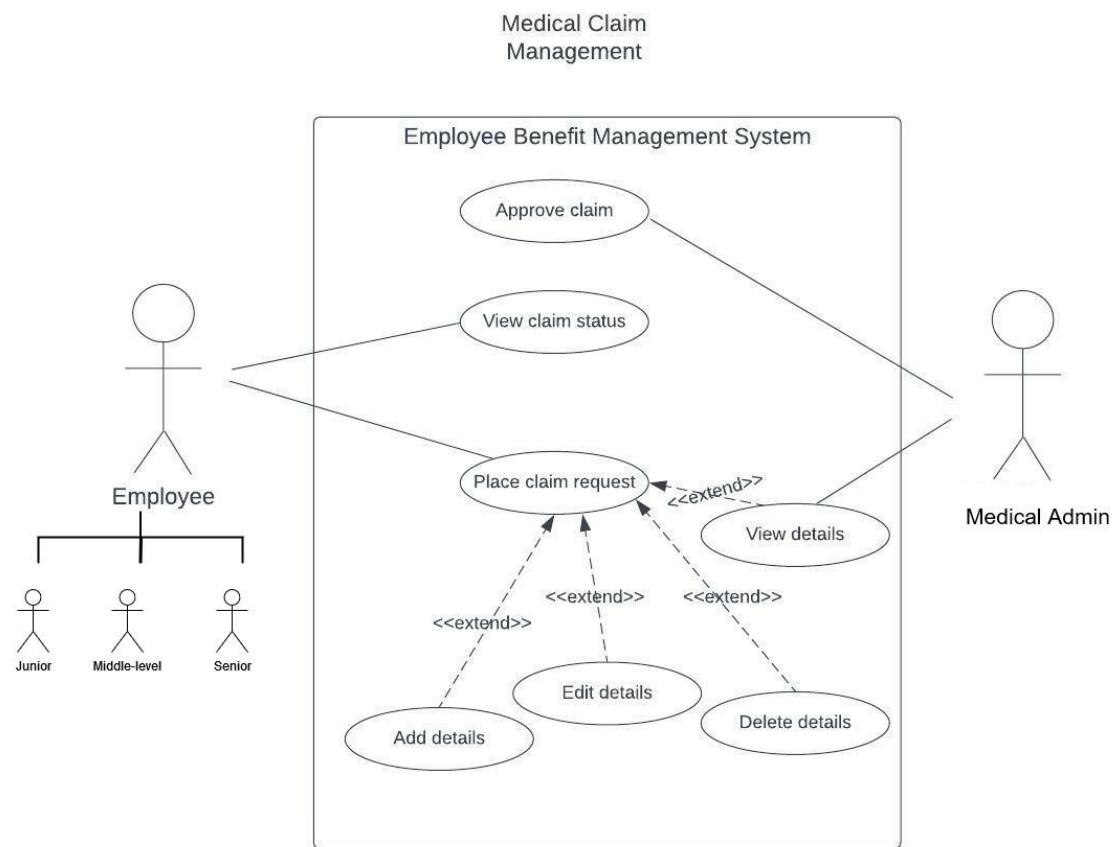
5.2 Use Case Diagrams

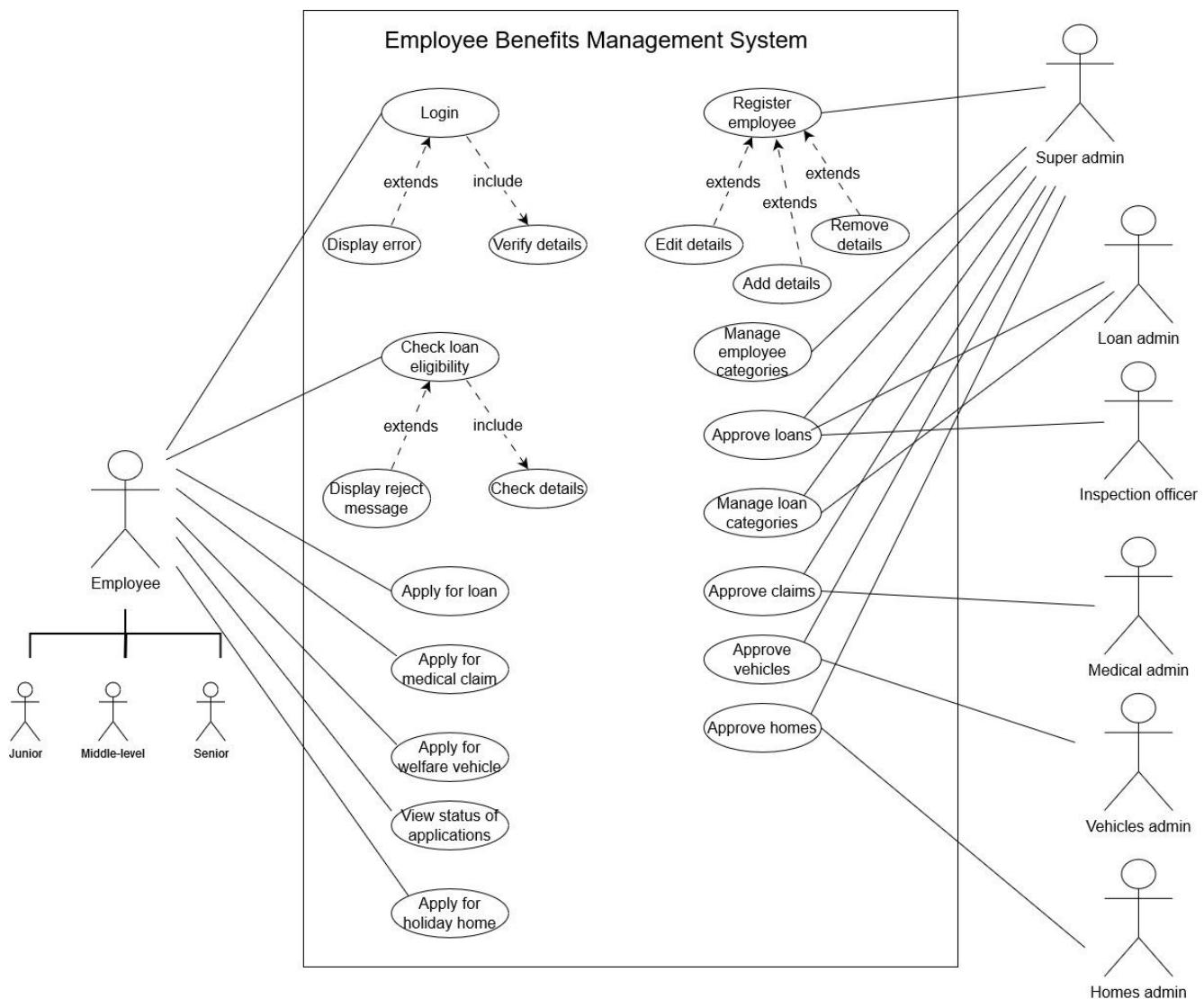


Interim Report for Employee Benefits Management System for Banking Institutions



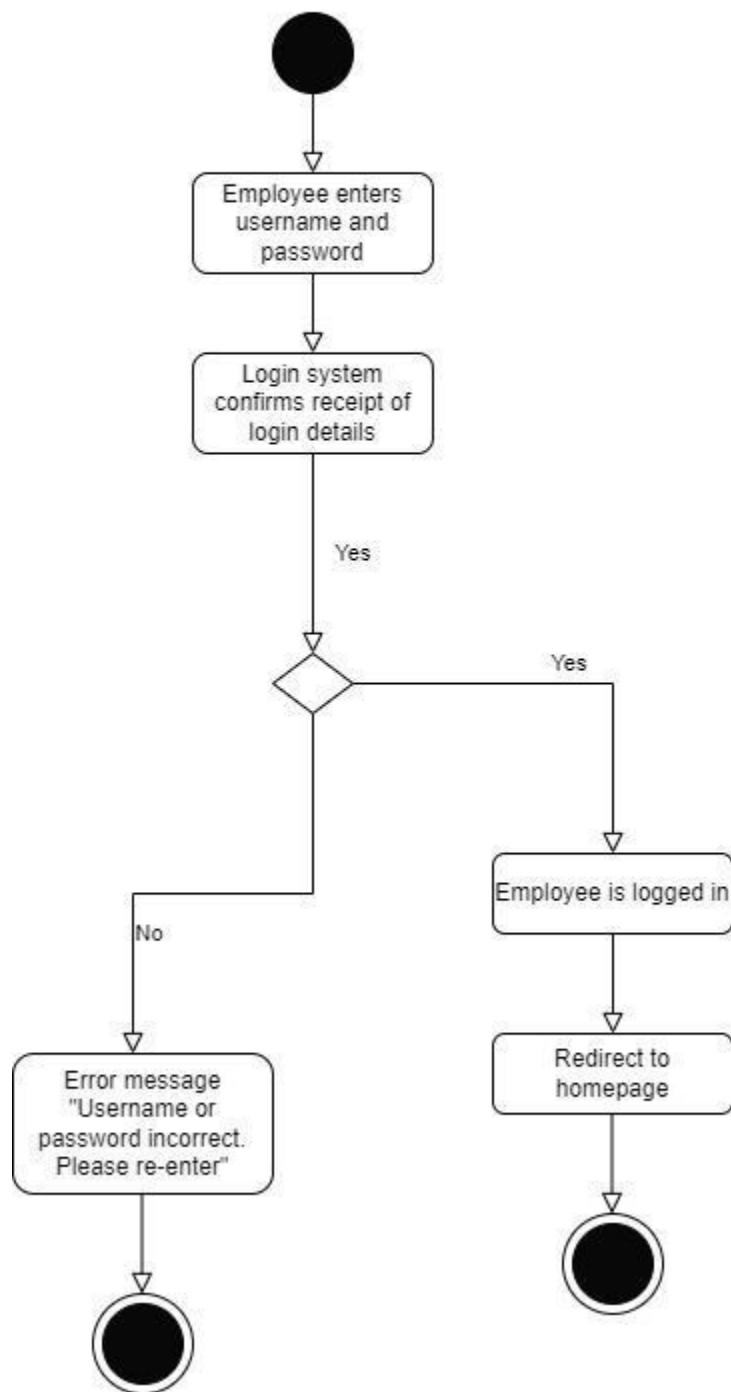
Interim Report for Employee Benefits Management System for Banking Institutions



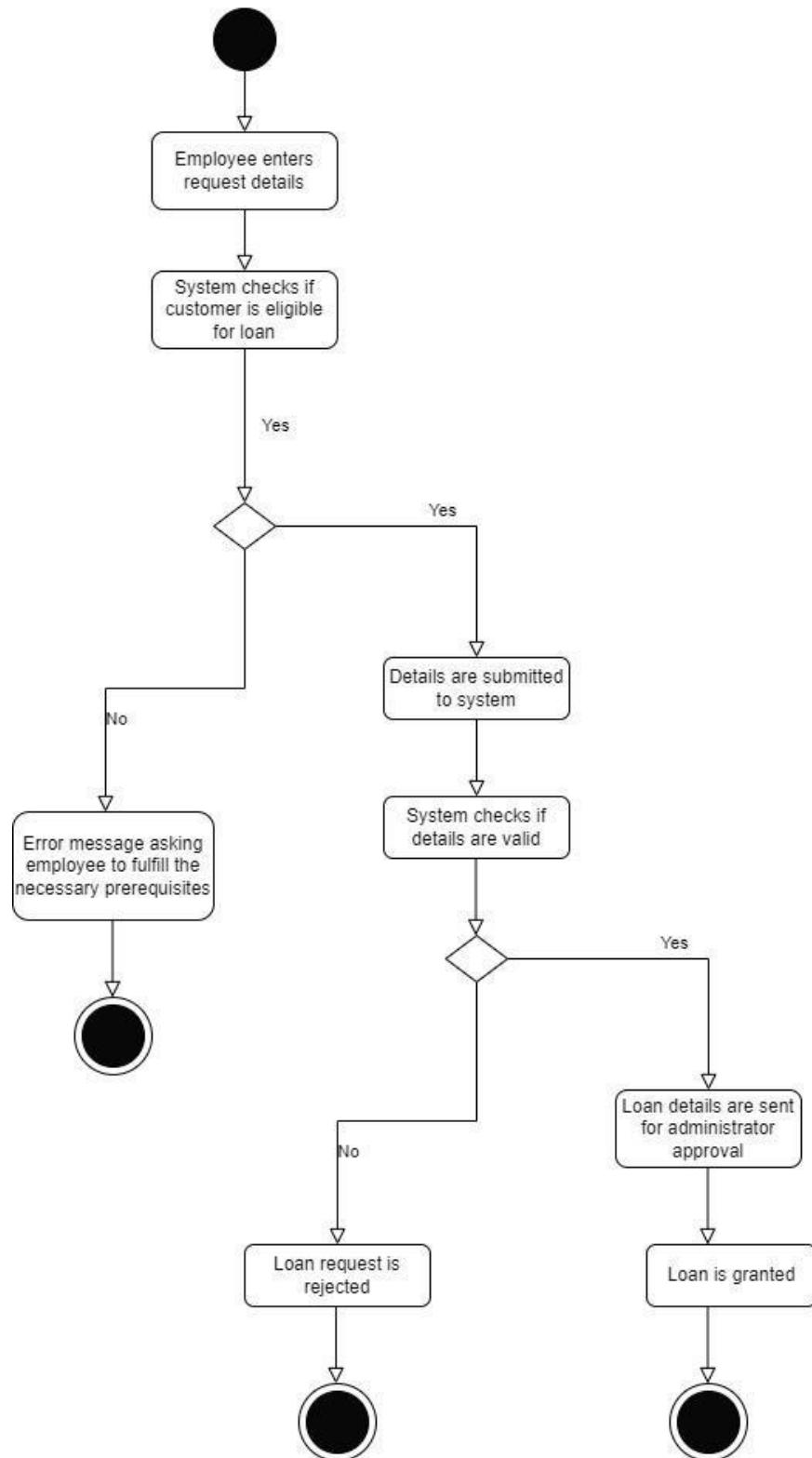


5.3 Activity Diagrams

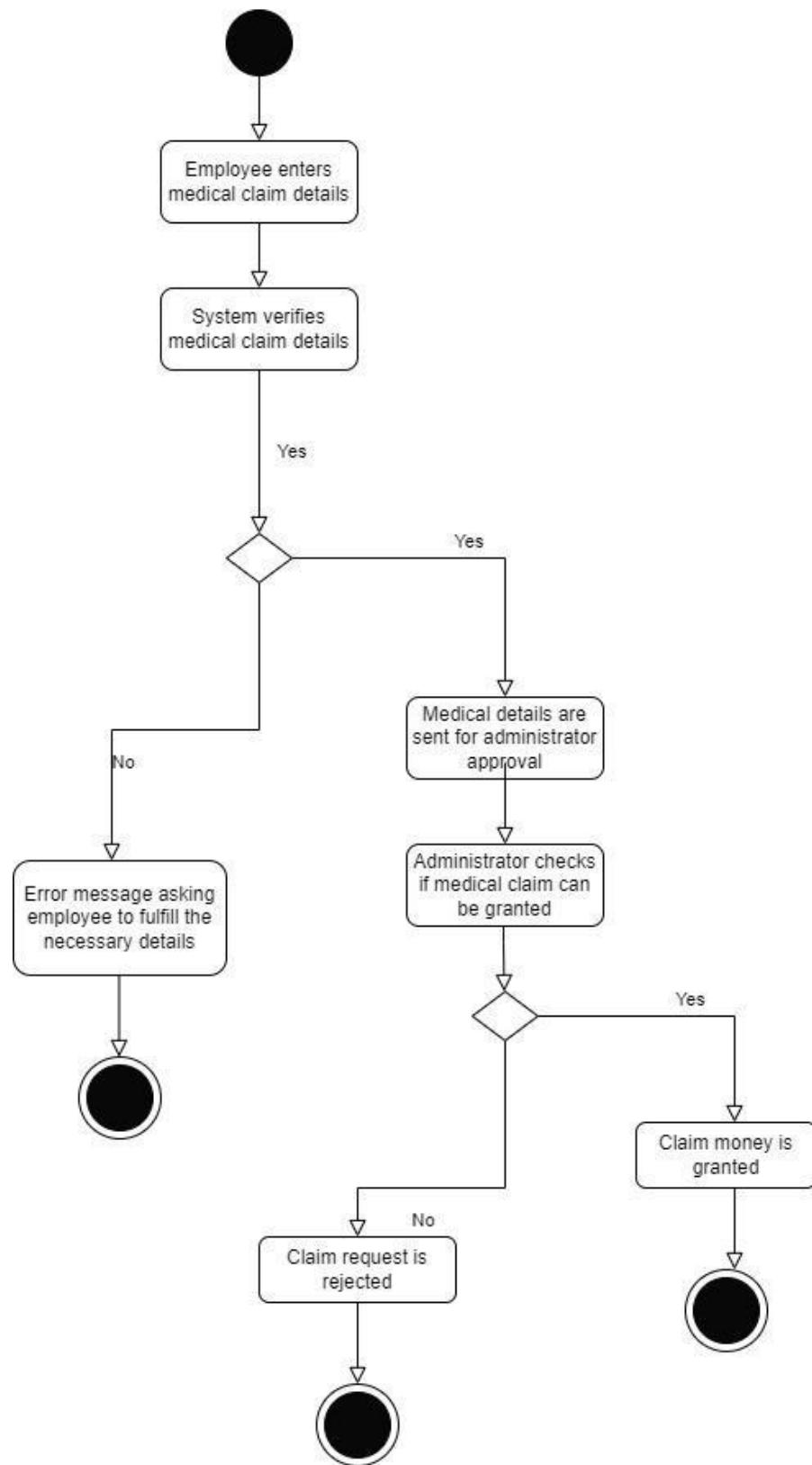
Activity Diagram for Employee Login



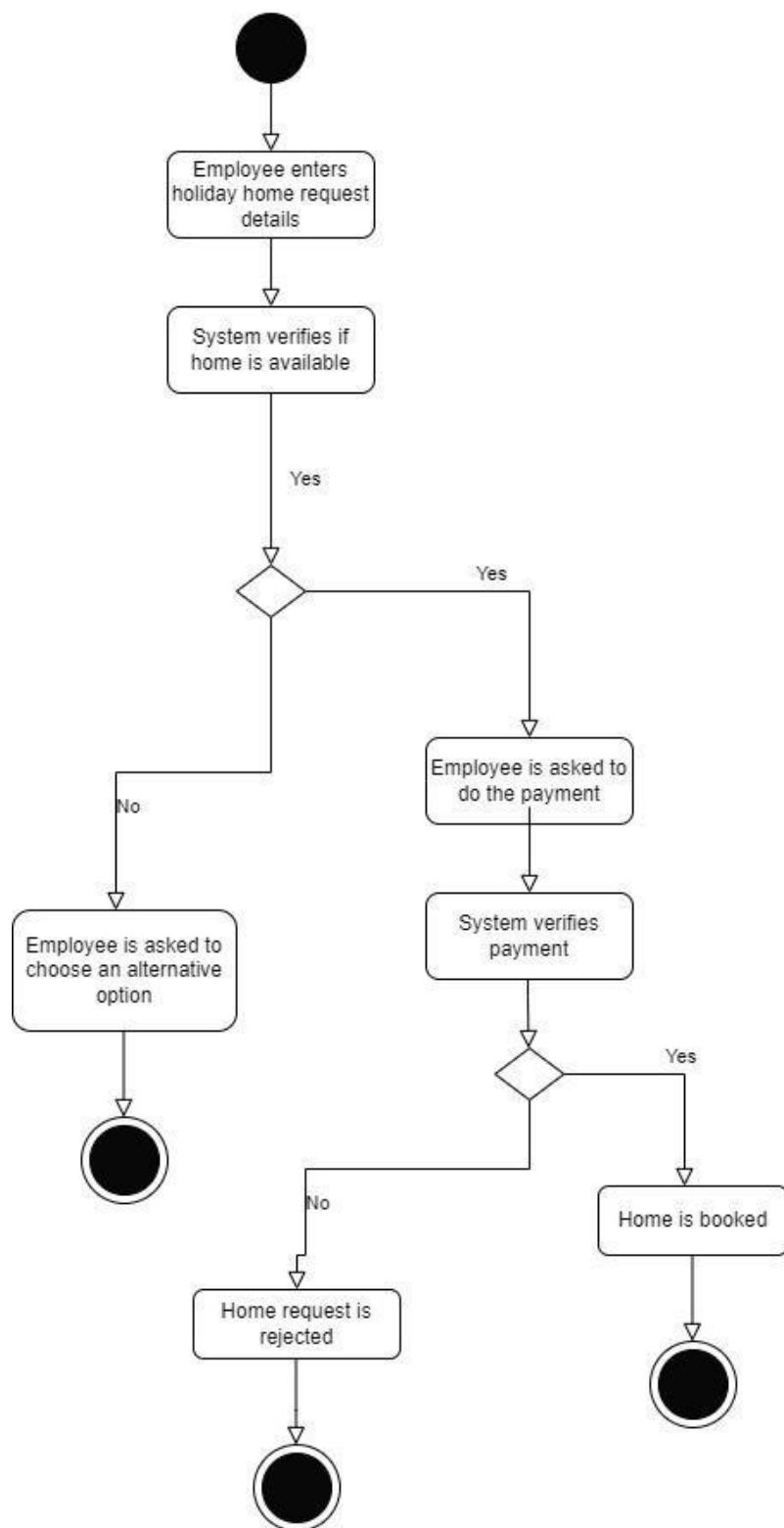
Activity Diagram for Loan Request



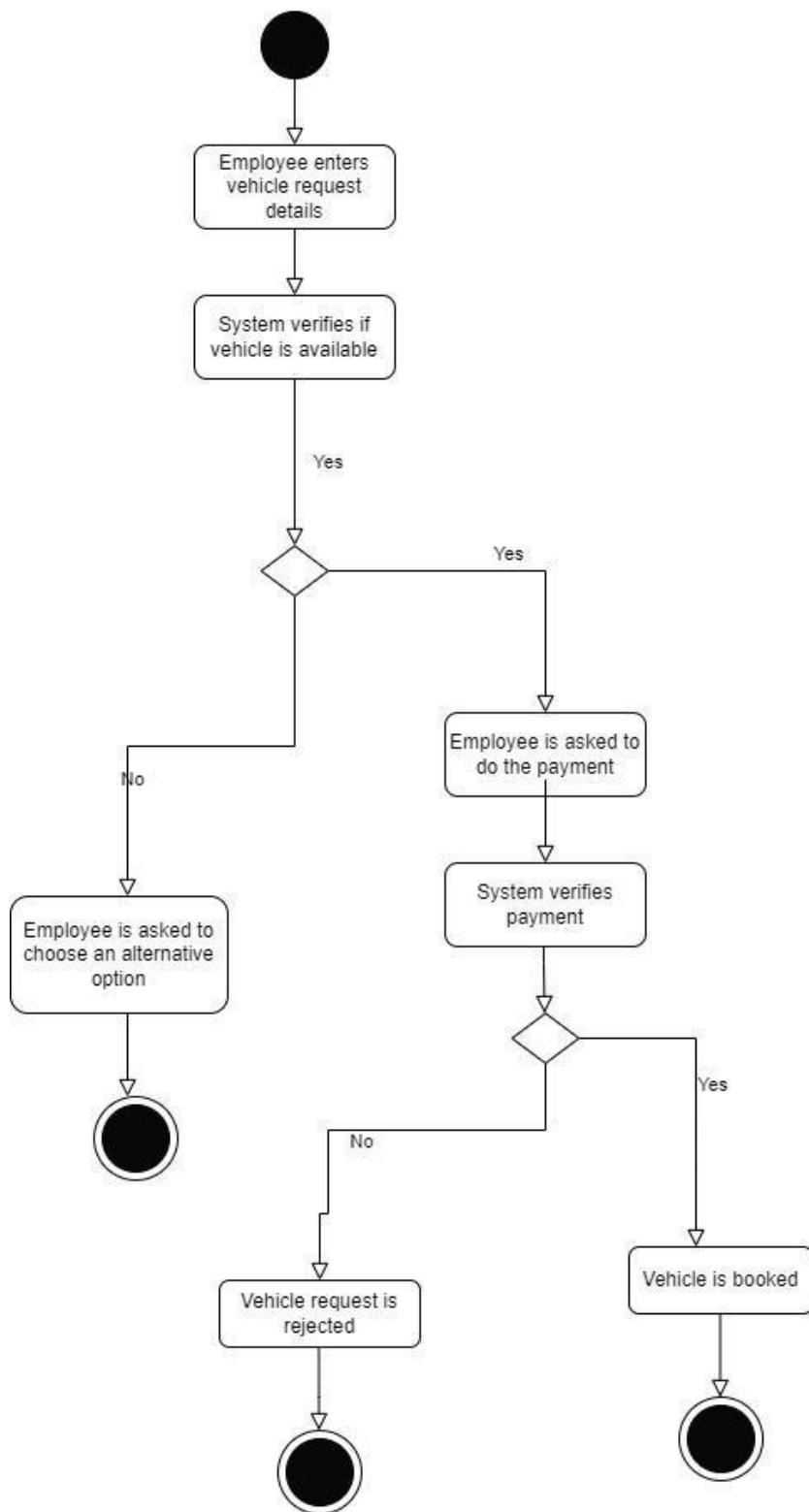
Activity Diagram for Medical Claim Request

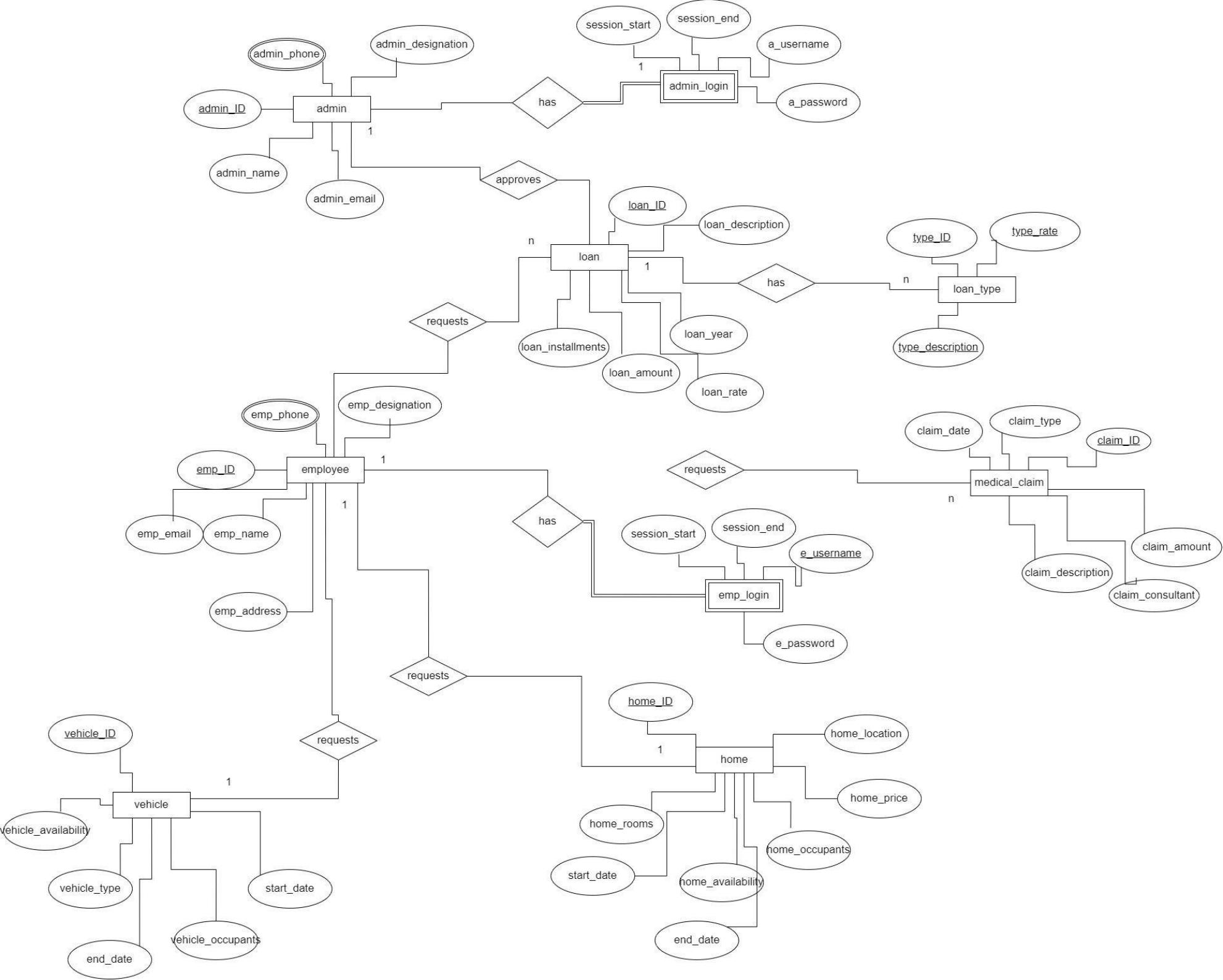


Activity Diagram for Holiday Home Request



Activity Diagram for Vehicle Request





Test case for EBMS

Project Name	EBMS
Module	Checking functionalities
Created by	Sithmi Edirisinghe
Created date	16/08/2021

Test Case ID	Test Description/Test case name	Prerequisite	Test Steps	Input Data	Expected Result	Actual Result	Status	Severity	Priority	Executed by	Comments
TC_EBMS_Register_001	Enter valid first name, last name, email, password, confirm password	Needs to be an employee of the bank	1. Enter valid first name 2. Enter valid last name 3. Enter valid password 4. Reenter valid password 5. Complete captcha 6. Click sign up	Sithmi, Edirisinghe, abc@gmail.com, ABC123123123, ABC123123123	Successful login	As expected	Pass	Medium	High	Sithmi Edirisinghe	
TC_EBMS_Register_001	Enter valid first name, last name, email, password, confirm password	Needs to be an employee of the bank	1. Enter valid first name 2. Enter invalid last name 3. Enter valid password 4. Reenter valid password 5. Complete captcha 6. Click sign up	Sithmi, Edirisinghe, abc@gmail.com, ABC123123123, ABC123123123	Message as "Please enter valid details."	As expected	Fail	Medium	High	Sithmi Edirisinghe	
TC_EBMS_Login_001	Enter valid email, invalid password	Valid EBMS account is	1. Enter valid email 2. Enter valid password	abc@gmail.com, ABC123123123	Successful login	As expected	Pass	Medium	High	Sithmi Edirisinghe	
TC_EBMS_Login_002	Enter valid email, invalid password	Valid EBMS account is	1. Enter invalid email 2. Enter valid password	ab##c@gmail.com, ABC123123123	Error message "Please enter valid password"	As expected	Fail			Sithmi Edirisinghe	
TC_EBMS_Book_001	Enter valid full name, email, retype email, country	Valid EBMS account is needed, have to be logged in	1. Enter valid full name 2. Enter valid email 3. Reenter valid email 4. Select country 5. Click "Book now"	Sithmi Edirisinghe, abc@gmail.com, abc@gmail.com, Sri Lanka	Successful reservation	As expected	Pass	Medium	High	Sithmi Edirisinghe	
TC_EBMS_Book_002	Enter valid full name, email, retype email, country	Valid EBMS account is needed, have to be logged in	1. Enter valid full name 2. Enter invalid email 3. Reenter valid email 4. Select country 5. Click "Book now"	Sithmi Edirisinghe, ab\$\$*c@gmail.com, ab\$\$*c@gmail.com, Sri Lanka	Error message as ""Please enter a valid email address so we can send you your booking confirmation.""	As expected	Fail	Medium	High	Sithmi Edirisinghe	
TC_EBMS_Pay_001	Verify payment functionality of holiday home reservation page (valid details)	Valid EBMS account is needed, have to be logged in	1. Select payment method 2. Enter valid card holder name 3. Enter valid credit/debit holder number 4. Enter expiry date 5. Valid CVC/CVV 6. Click "Pay"	EMSN Edirisinghe, 1562 3748 3547 3647, 12/21, 684	Successful payment	As expected	Pass	Medium	High	Sithmi Edirisinghe	
TC_EBMS_Pay_002	Verify payment functionality of holiday home reservation page (invalid details)	Valid EBMS account is needed, have to be logged in	1. Select payment method 2. Enter valid card holder name 3. Enter invalid credit/debit holder number 4. Enter expiry date 5. Valid CVC/CVV 6. Click "Pay"	EMSN Edirisinghe, 1562 37abc48 3547 3647, 12/21, 684	Error message "Please enter valid c	As expected	Fail	Medium	High	Sithmi Edirisinghe	

Software Requirements Specification

for

Employee Benefit Management System for Banking Institutions

Version 1.0

Prepared by EMSN Edirisinghe

Centre for Open and Distance Learning,

University of Moratuwa

07.09.2022

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1. Introduction

1.1 Purpose

This Software Requirements Specification document is written for the purpose of describing the functionalities and the requirements of the proposed Employee Benefit Management System for a bank. This is the very first version of this document and has not yet been subjected to revisions. This system provides a way for bank employees to claim the benefits that are allocated for them in an efficient manner, and this system will contain four functionalities (which will be described in detail later). This SRS documents all the requirements that are needed for each of these four functionalities.

1.2 Intended Audience and Reading Suggestions

This document is intended to be read by developers, project managers, marketing staff, users, testers as well as documentation writers. It gives an overview of the objectives of the program and it gives an overall idea as to what the final product will look like.

1.3 Project Scope

This project's primary goal is to develop an Android-based mobile application that can address the issue of banking institutions' ineffective employee benefit management processes. By these means, time wastage is decreased, and the procedure is more efficient.

Since bank employees play a significant role in a nation's economic development and financial management, it is crucial to maintain their happiness in order to ensure that they perform successfully. A person who is highly satisfied at work feels positively about their work, whereas a person who is less satisfied feels negatively about their work. The gap between what employees actually receive in compensation and what they believe they should receive reflects their level of job satisfaction (Robbins & Judge, 2013, p. 58). Employees are therefore more likely to be

productive at work if they feel good about their occupations. Employee perks are one of the key strategies for maintaining employee satisfaction.

Employees are the most important resource of any organization. Most banks are generous in the benefits and remuneration that they provide to their employees. For example, banks provide a separate loan scheme for their employees, vacation homes, medical claim facilities and more. However, most banks do not have a streamlined and unified system that can manage all the benefits that they provide to their employees. As a result, some of these processes are handled manually, or employees have to access many different systems to claim these benefits. This results in time wastage and lack of efficiency within the organization, as well as the frustration of the employees. By creating a system to address these issues, the bank can save resources and the employees can spend their valuable time in working towards achieving corporate goals and objectives.

Following are the objectives of developing this system:

- Conducting a critical analysis of literature that is available about systems similar to the one being proposed.
- To conduct a thorough study of technologies that can be used to create the employee benefits management system.
- To design and develop a mobile application that can streamline employee benefit management to address the current problem of lack of efficiency of the employee benefit management process.
- To evaluate and run tests on the system to ensure that all functional and non-functional requirements are working as required.

Benefits of this system include:

- Increased employee efficiency as they do not have to spend time applying for and following up on applications that are needed to obtain the benefits provided for them.
- Increases the goodwill of the employees towards the organization.
- There will be less room for error, specially in processes such as loan management of employees.

- It will be easier for employees who are pensioners to access the benefits that are allocated to them.
- Reduces time wastage within the organization.
- Gives the organization a reputation as one that invests on the well-being of its employees, which will result in a better pool of candidates being willing to apply for employment of the bank.

1.4 References

Robbins, S. P., & Judge, T. (2020). *Organizational Behaviour* (18th Edition). Pearson Australia

2. Overall Description

2.1 Product Perspective

This is an independent system which is reserved for the exclusive use of bank employees only. This system will take the form of both an Android app.

The employee must first register for the app using the bank's provided employee number and personal information. The registration request will be authorized if the employee details are accurate and valid, which is connected to the main employee details table that is accessible in the bank's HRIS.

2.2 Product Features

The following are the main functionalities of the system:

- Employee loan Management (Loan calculation, application, and loan status updates)
 - This functionality of this app allows bank employees to apply for various loans that are available for them, such as vehicle, housing, land purchase, computer, education and many more.
- Processing of medical claims

- Medical claims are provided for doctor consultations, surgeries, childbirth and much more.
- Application and approval of holiday homes for employees
 - Holiday homes are available for the use of employees who go on vacation in different parts of the country, and they can apply for these through the system.
- Application and approval of welfare vehicles for employees
 - Employees are allowed to book welfare vehicles through the app, in order to get vehicles for long trips at a discounted rate.

2.3 User Classes and Characteristics

Employees – These users are always permanent employees of the bank, and these benefits are not provided for temporary employees, such as ones who are hired on a contract basis. Employees who have access to this system belong to three categories:

- Clerical – they have the least privileges
- Officers – they have more privileges.
- Executives and specialist job positions – they have the most privileges and at certain instances, they are called in for approval of benefits of the lower employees, such as loan approvals.

Administrators – They handle the administrative matters of the system such as registering employees.

2.4 Operating Environment

This system will run as an Android-based application.

2.5 Design and Implementation Constraints

Corporate policies about various functionalities of the bank might change with time and the state of the economy of the country and this will be a constraint to the implementation of this product.

2.6 User Documentation

A small user manual will be provided along with the system. A training session will also be conducted through online means.

2.7 Assumptions and Dependencies

This product is designed under the assumption that the bank in question has straightforward and unchanging policies in its different functionalities such as providing loans for employees. However conditions such as interest rates of such loans might change.

3. System Features

3.1 Employee Loan Management

3.1.1 Description and Priority

This app's functionality enables bank employees to apply for a variety of loans that are available to them, including those for a car, a house, a piece of land, a computer, a college degree, and many more. Depending on the employee's employee level, employee status (working/retired), job experience, and pay grade, the app will display the loans that are available to them. The software determines the loan amounts in accordance with the given specifications. The app offers an application form that the employee may complete to request a loan, and it will then send that request to the appropriate department in the bank's head office. The worker might also upload any pertinent supporting documentation. The decision to approve or reject the loan will subsequently be made by the appropriate executive authorities. This is a high priority functionality as it involves the management of finances.

3.1.2 Stimulus/Response Sequences

- Choose type of loan required
- Fill in personal details

- Fill in details about finances
- Add supporting documents
- Click submit
- Await approval of loan officer

3.1.3 Functional Requirements

- Should allow employee to fill in personal details
- Should allow employee to fill in details about finances
- Should allow employee to add supporting documents
- Should allow employee to submit

3.2 Processing of medical claims

3.1.1 Description and Priority

There are many distinct forms of medical claims. They are offered for medical checkups, operations, births, and many other things. In addition to the employees, their families are also covered by the claims. The employee is free to decide what kind of medical claim they will submit and for whom. The employee is permitted to complete an application form with all of these facts and turn it in to the operations manager of the provincial office they are affiliated with. The employee can use the built-in camera feature to take pictures of the supporting papers, such as prescriptions, and submit them. This is a medium priority functionality.

3.1.2 Stimulus/Response Sequences

- Choose type of medical claim
- Fill in personal details
- Fill in details about illness and treatment
- Upload supporting documents
- Senior officers evaluate and approve the request

3.1.3 Functional Requirements

- Should allow employee to choose type of medical claim
- Should allow employee to fill in personal details
- Should allow employee to fill in details about illness and treatment
- Should allow employee to upload supporting documents
- Should allow senior officers evaluate and approve the request

3.3 Application and approval of holiday homes for employees

3.1.1 Description and Priority

There are vacation properties available for use by staff members who travel across the nation. The employee is permitted to complete a form for the vacation house and reserve the home for a specific amount of time and a specific number of guests. The employee is permitted to pay a discounted sum when it is necessary in some circumstances. Through a payment gateway, the employee can pay. The app then sends a message to the vacation's owner and notifies the employee that the reservation has been made. This is a low priority functionality.

3.1.2 Stimulus/Response Sequences

- Choose the holiday home to book
- Enter the necessary personal details
- Click book home
- Await approval
- Pay for the home

3.1.3 Functional Requirements

- Should allow employee to choose the holiday home to book
- Should allow employee to enter the necessary personal details
- Should allow employee to click book home

3.4 Application and approval of welfare vehicles for employees

3.1.1 Description and Priority

Through the app, workers are able to reserve welfare vans at a discounted rate to use for lengthy journeys. The employee is allowed to fill out a form to reserve the required car, and they are informed when the reservation is verified. This is a low priority functionality.

3.1.2 Stimulus/Response Sequences

- Select a welfare vehicle
- Enter the details necessary
- Book the vehicle
- Pay for the vehicle

3.1.3 Functional Requirements

- Should allow employee to select a welfare vehicle
- Should allow employee to enter the details necessary
- Should allow employee to book the vehicle
- Should allow employee to pay for the vehicle

3.5 Registration of employees

3.1.1 Description and Priority

Employees are registered to the system by the administrator when they are onboarded to the organization as permanent employees.

3.1.2 Stimulus/Response Sequences

- Add employee details
- Click register

3.1.3 Functional Requirements

- Should allow administrator to add employee details and click register

4. External Interface Requirements

4.1 User Interfaces

4.1.1 User Interfaces for Employees

4.1.1.1 Login

Allows employees to login to the app

4.1.1.2 Apply for Loans

Allows employees to request, apply for, evaluate the status of their loans.

4.1.1.3 Apply for Medical Claims

Allows the employees to apply for medical claims

4.1.1.4 Apply for vacation homes

Allows employees to apply for vacation home

4.1.1.5 Apply for welfare vehicle

Allows employees to apply for vehicles.

Apply for Medical Claim

Name:

Employee number:

Type of claim:

Claim for:

Consultant name:

Claim price:

Supporting documents:

Figure 1 Medical claim application interface

4.1.2 User Interfaces for Administrator

4.1.2.1 Login

Allows administrators to login to the system

4.1.2.2 Register new employee

Allows administrator to add new employees to the system once they have been onboarded.

4.1.2.3 View loan dashboard

The employees at the higher level, such as executive officers, will be able to view a dashboard that has overall loan details, such as the amount spent on each type of loan by the bank, the types of loans provided by the bank, the amount of money allocated from the bank budget for this purpose.

4.1.2.4 View and approve employee loan requests

Allows the administrator and senior employees to view and approve of loan requests.

4.2 Hardware Interfaces

This system only needs simple input and output devices such as a touchscreen.

4.3 Software Interfaces

The following databases will be created for this system:

- Administrator details database
- Employee details database
- Loan details database
- Medical claim details database
- Welfare vehicle database
- Holiday homes database

4.4 Communications Interfaces

This software does not require any specific communication requirements in order to view and handle its user interfaces.

5. Other Nonfunctional Requirements

5.1 Performance Requirements

Performance requirements indicate acceptable response times for system functionalities.

- The time taken to load user interfaces shall be 2 seconds or less.
- Time taken for login detail verification shall be 5 seconds or less.

5.2 Security Requirements

All employee information and their financial details have to be kept confidential by the system.

5.3 Software Quality Attributes

Reliability

In order for the system to be reliable, it need to be error free, with all of its input field having validation constraints so that unreliable information cannot be entered to the system.

Availability

Being an Andriod-based a system, the system is easily available for anyone who has an Android phone.

Security

Different types of users are given a varying range of privileges, ensuring the security of the system.

Maintainability

The program code has to be clear, precise, well organized and explained with comments so that it is easy to maintain the software and to do any changes if necessary.

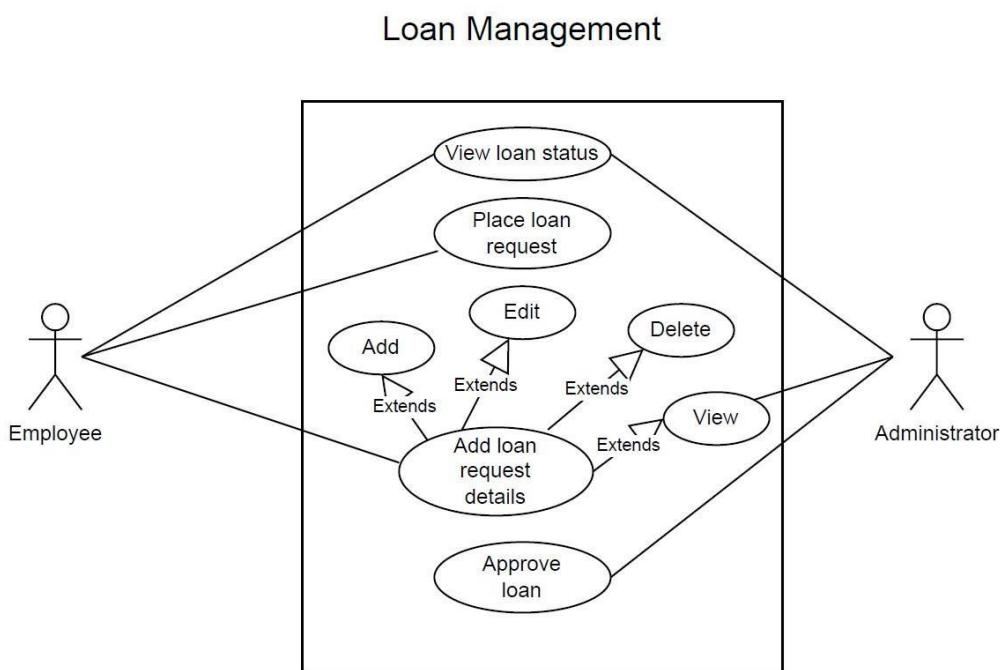
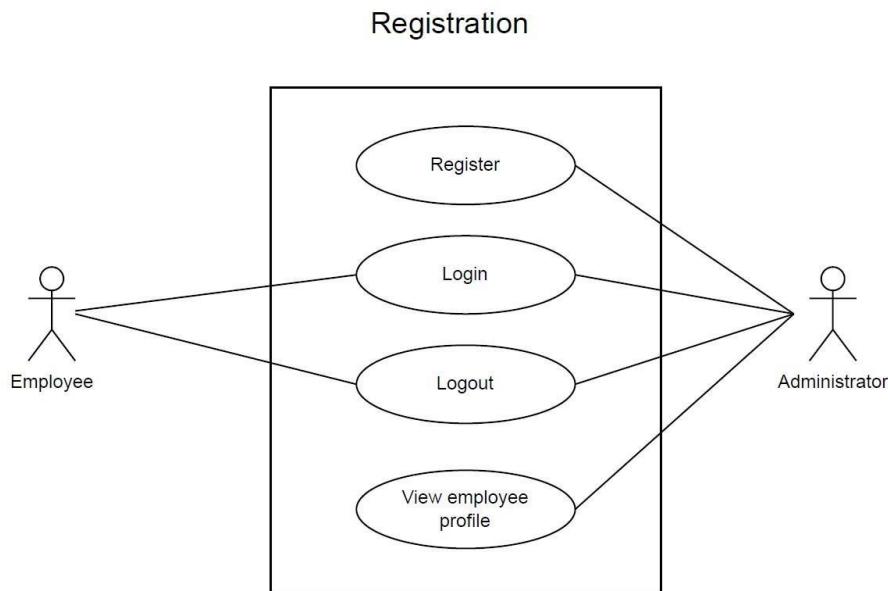
Portability

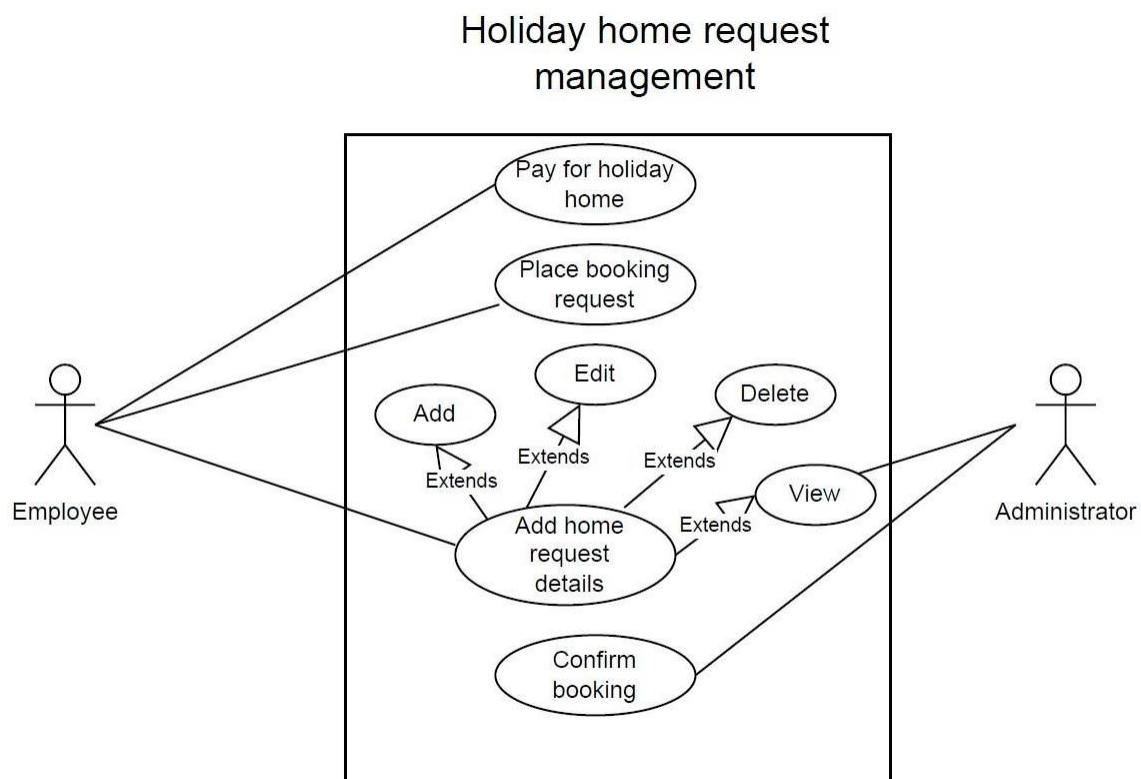
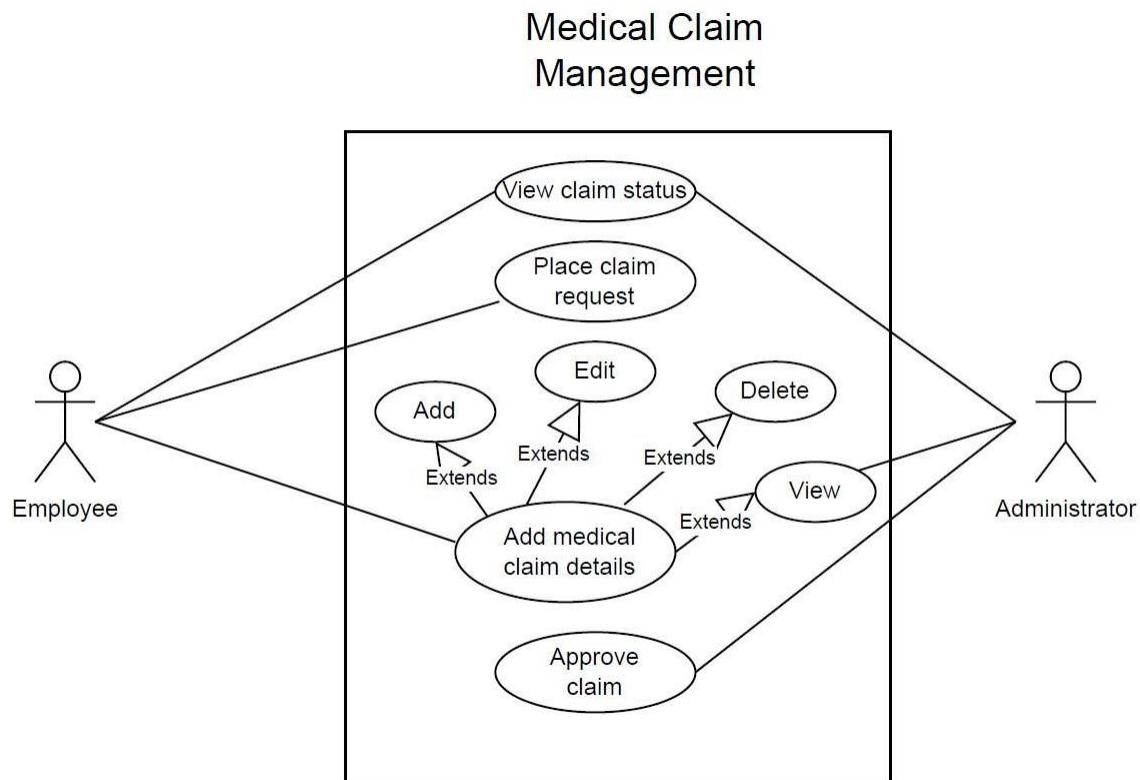
The android app is easily accessible from anywhere there is an internet connection and an Android device.

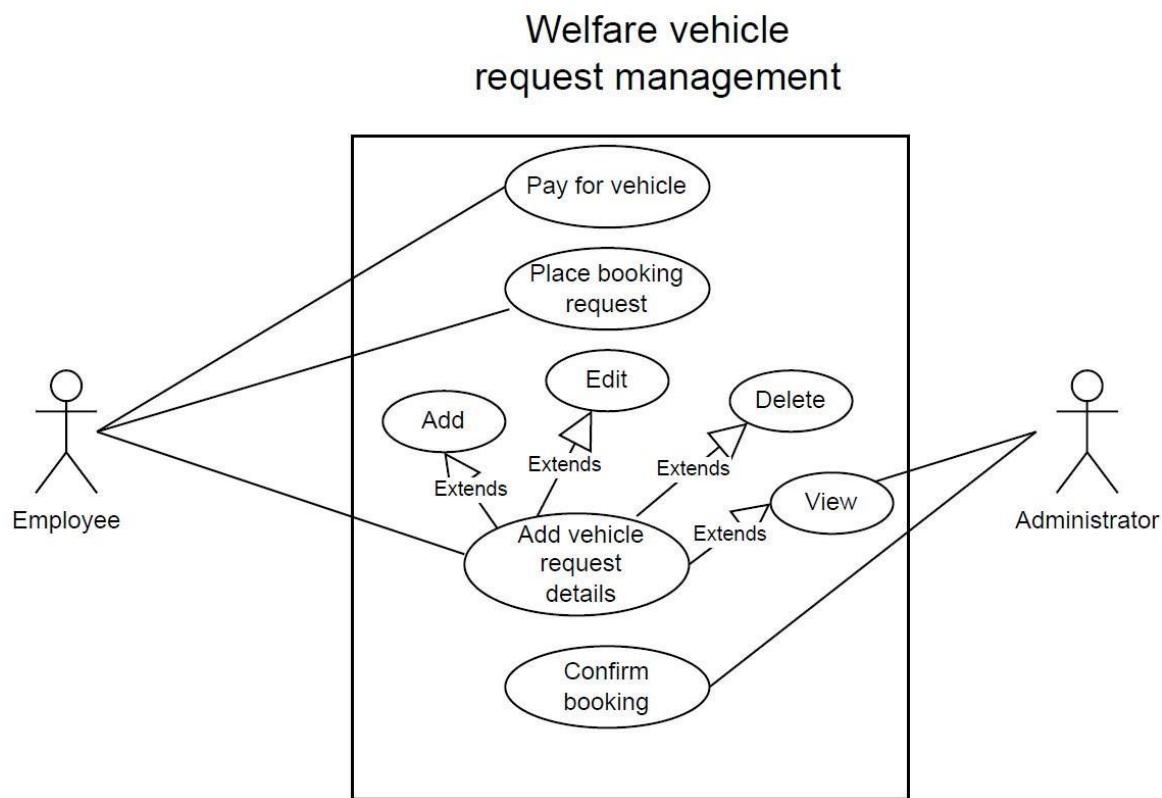
6. Other Requirements

Appendix A: Analysis Models

USE CASE DIAGRAMS







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PART B

Banking and Information Technology: A Literature Review

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Received January 2015

Abstract

The banking sector is important for the economic development of a country, and therefore it is necessary that it is up to international standards. Previously, all work in banks were done manually but now, with the advent of technology, a lot of work is automated. The automation of work of banks has resulted in higher productivity, higher efficiency and higher profits for the banking sector, and has also made the lives of customers much easier. Today, the banking sector uses many different types of technologies such as Robotic Process Automation, Artificial Intelligence, Blockchain technology and much more. However, it must be noted that the digital divide between different people in the society is a huge problem and it results in poor economic growth, as most underprivileged people do not have access to banking technologies.

Keywords

Artificial Intelligence, Robotic Process Automation, Machine Learning, Quantum Computing, E banking, Automated teller Machine (ATM), Blockchain Technology, Cryptography

1. Introduction

The banking industry is a very important part of the economy of any country but it faces numerous challenges in the developing world. One such force is the information technology revolution. In today's world, technology is critical to a company's success. In the banking industry we can't think about the future without IT and communication. The use of IT can revolutionize the day to day workings of banks. Information technology facilitates advanced product development, improved market infrastructure, and the deployment of dependable and efficient risk management approaches, as well as assisting financial institutions in reaching out to far away and diverse markets (Sharma & Mittal, 2018, p. 42). The internet has had a huge impact on bank service delivery methods. The internet has grown in importance as a means of delivering banking products and services. Information technology benefits the banking sector in three ways: it saves consumers and workers time, it reduces costs, and it promotes network transactions.

The introduction of the Internet ushered in an electronic revolution in the worldwide banking industry. The dynamic and adaptable nature of this communication channel, as well as its widespread reach, has aided in the exploitation of a wide range of banking activities. As a result of creative e-business models, new banking intermediaries have developed, offering whole new sorts of banking services. For banks in the United States and Europe, the Internet has become one of the most important distribution channels for banking products and services.

The trend toward electronic delivery of banking products and services is driven in part by consumer demand and in part by the global banking industry's increasingly competitive environment. Customers' behaviors have changed as a result of the Internet, and they now demand more tailored products/services at a reduced price.

2. Applications of IT in the Banking Sector

Banks have been hesitant to update their systems for a long time, and with good reason. They use contemporary systems as a result of years of continuous innovation in order to address instant consumer needs. However, this has resulted in the adoption of separate systems for transaction, savings, investment, and loan accounts. These are all separate systems which are not always interconnected. This is incompatible with the digital age, when banks face competition from technology-based financial institutions.

Banks and other traditional financial service providers have been forced to take up the trend of digitalization and innovation efforts. So they now make use of cutting-edge technologies to assure a customer-centric approach rather than a traditional product-centric approach, and an open platform foundation. This paper will explore various new technologies used in the banking sector, such as quantum computing, e banking, robotic process automation and more.

3. E banking

E banking is extremely popular in today's world, and has become even more popular with the advent of COVID-19 because people were not able to leave their houses to visit banks, and therefore had to resort to online banking methods.

3.1. What is e banking?

Through e banking, banking products and services are supplied to customers via electronic channels. Automatic teller machines (ATMs) and telephone transactions have been used in electronic banking for a long time, but today the technology has improved even more. The invention of the internet provided a new delivery channel that has made banking transactions easier for both clients and banks. Customers benefit from the internet because it provides faster access, is more convenient, and is available at all times, no matter where the customer is (Nitsure, 2004, p. 5377). It is efficient and cost-effective for banks. Following are some trends in the ebanking field:

(a) Cheque truncation system (CTS)

The goal of this system was to stop the need to physically send cheques from one branch to another. An electronic image of the cheque was sent to the other branch, together with all necessary information such as the unique number, the date on cheque, and so on. This has helped to reduce the time it takes for cheques to clear, as well as the expense and time of physically sending cheques. Furthermore, this procedure provides a quick clearance of cheques (Gupta & Yadav, 2017, p. 3).

(b) Smartcard banking

Smartcard banking involves the use of electronic cards such as ATM cards, debit cards, and credit cards to complete banking activities. Customers can do activities like getting cash, making transfers, getting account information and changing personal identification numbers without having to visit a bank branch in person with this banking system. Smart card services are available in public places like grocery stores, clothing shops, supermarkets. Different types of cards such as credit cards and debit cards are available(Gupta & Yadav, 2017, p. 3).

(c) Automated teller machines (ATMs)

Customers utilize ATMs by inserting a plastic card into the machine. The customer's information is stored on a magnetic strip on these plastic cards. They are used for balance inquiries, cash withdrawals, and other services. To use an ATM, the customer must have a valid customer ID and password. Debit cards are accepted by ATM machines as well as ATM cards. This helps to fulfill the concept of 'Any Time Banking' and 'Any Where Banking' (Gupta & Yadav, 2017, p. 3).

(d) Core banking solutions (CBS)

CBS refers to a bank's branch network, which allows customers to access their accounts from any branch of the bank, even if they did not originally create their account in that branch. Because all of the branches were connected, data could be managed from a single location. The computerization of bank branches began with the introduction of computers to automate branch operations under core banking solutions (Gupta & Yadav, 2017, p. 4).

(e) Internet banking

Internet banking (virtual banking) is an electronic payment system that allows financial institution customers to do transactions on the bank's website. They can access the bank's services via the Internet while sitting in their homes or offices. Online banking enables banking from anywhere, at any time. Customers can benefit from internet banking by using it to create or close accounts, to pay bills, transfer money, apply for loans and more (Gupta & Yadav, 2017, p. 4).

4. Artificial Intelligence in the Banking Sector

In recent years, machine learning and artificial intelligence applications in the financial sector have been booming. These institutions have used their vast potential to provide business solutions in front end and back end operations in banks in order to increase efficiency and improve customer experience.

4.1. Definition of Artificial Intelligence

John McCarthy, who is the father of Artificial Intelligence defines it as, "The science and engineering of making intelligent machines, especially intelligent computer programs" A.I. is the process of creating intelligent computer software and systems that replicate human thought, learning, and problem-solving abilities by researching how humans think, learn, and solve problems. In other words, computers' Intelligent Quotient (IQ) and Emotional Quotient (EQ) are being created as a result Artificial Intelligence (Donepudi, 2017, p. 84).

4.2. Applications of Artificial Intelligence in the Banking Sector

AI is becoming very popular in the international banking system because of its potential to generate high profits and increase security within this sector. There are several applications of Artificial Intelligent that are prevalent in the financial sector today.

(a) Anti-Money Laundering

Anti-Money Laundering (AML) refers certain rules that are enforced for preventing gaining of income in illegal ways. This can be done through artificial intelligence (AI)-based systems, which are clever at detecting AML patterns. These systems are precise and fast and several countries are already recognizing the value of AI in fraud detection. The National Stock Exchange of India uses machine learning and AI to identify market patterns, and for surveillance to avoid frauds in trading platforms (Donepudi, 2017, p. 85).

(b) Personalized Banking

Personalized banking provides customers greater access and comfort. It gives customized services to clients, using tools like chatbots that provide self-help answers, and this makes the banks hotlines less busy as well. Voice-controlled virtual assistants can help customers with transactions they are conducting. They do activities like checking balances, making payments, or searching up account activities. There are also AI system that can record personal income, monthly expenses, and spending habits, and then provides financial advice (Donepudi, 2017, p. 85).

4.3. Why must banks use AI?

Today, we have entered the AI-powered digital age. It has become possible for various sectors to use AI because of dropping data storage and processing costs, gaining more access and connectivity for people across the world, and rapid advancements in AI technologies. Banks are financial institutions that shoulder the country's economy. Therefore, using AI can be extremely beneficial to them. These technologies can lead to increased automation. They can be used for risk mitigation, can often outperform human decision-making in terms of speed and accuracy. AI has the potential to make banks more secure and increase their efficiency of work, while giving each customer a personalized service. This can help increase the market share of banks and help them to rise in today's economy.

5. Quantum Computing in the Banking Sector

Many financial organizations are now researching the possibility of applying the quantum leap, which is the introduction of large-scale quantum computation, to the banking sector. This is used for applications such as Portfolio optimization and derivative pricing (Bank Treasury Risk Management, 2021).

5.1. Definition of Quantum Computing

A quantum computer is a computer that uses quantum particles to process information. Qubit (quantum bit), is the smallest unit of information and can simultaneously have the values 0 and 1.

A quantum computer is more effective at certain types of data-intensive applications and calculations that would be difficult to do on a classical computer. On the other hand, some calculations that are simple to perform on a conventional computer are now more expensive to conduct on a quantum computer. Due to this, quantum computer applications have to be built as hybrid architectures, where quantum calculations are incorporated in a classical framework (Bank Treasury Risk Management, 2021, p. 2).

5.2. Quantum Banking

Quantum computing is used in the financial sector to a certain extent already and more research is underway on how quantum applications can be used for increasing the effectiveness of the banking industry. This is leading to a moment in time that is called the 'quantum leap', which is said to be a time in which quantum computers will be available in large scale for use in practical applications in the real world.

Quantum banking can happen in different fields such as optimization problems, simulations, cryptography and modelling.

5.3. Algorithm optimisation

Quantum computing can be used to optimize certain models that are currently being used. The models and algorithms currently used to estimate the price of a financial instrument or portfolio only comprise a subset of the factors required to fully characterize the dynamics. When the number of instruments, drivers, and targets increases, portfolio optimization becomes more complex and time demanding, and may be difficult to do with a classical computer. Therefore, quantum computing is used to apply techniques such as multi-objective optimization which are expected to improve the performance of the algorithms (Bank Treasury Risk Management, 2021, p. 3).

5.4. Cryptography

Cryptography is highly used in the banking industry. Currently, finding the prime factors of very large numbers is a very important process in cryptography and systems rely on this. Although this calculation is a major contributor in ensuring the security of the system, it is very slow when done using classical computers. However, quantum computers have the ability to run the Shor's algorithm which provides an exponential increase in speed compared to classical algorithms. Therefore, if a quantum computer that has sufficiently high processing capacity is built, it can be used to ensure security of systems (Bank Treasury Risk Management, 2021, p. 3).

6. Blockchain Technology in the Banking Industry

Blockchain technology is an open, distributed ledger that efficiently and permanently records transactions between two parties, in a secure manner. A blockchain is made up of individual data blocks that include a sequence of connected transactions that are linked together in a certain and pre-specified order. Without the need for a centralized authority or middlemen, all parties involved can share a digital ledger across a computer network. As a result, processing transactions via blockchain is faster than using the conventional methods. One of the many potential benefits of blockchain in banking is its speed. It is not only providing increased efficiency, but also increased transparency and security. This technology can help to prevent or minimize crimes such as money laundering, terrorism financing, and tax-evasion.

In two ways, blockchain technology can help in situations like the three mentioned above. To begin, blockchain can assist by lowering regulatory and compliance costs while increasing transparency of the transactions that are done, which allows banks to change these arrangements. Blockchain technology can be used in conjunction with cryptocurrencies to avoid transactions correspondent banks (which provide services on behalf of other banks) entirely, which will allow tiny banks to engage in peer-to-peer transactions with global markets. Because of its permanent and decentralized properties, this emerging technology has the potential to fulfill both goals (Rust, 2019, p. 187).

7. Robotic Process Automation in Banking

In the financial sector, Robotic Process Automation (RPA) is defined as the use of robotic applications to supplement (or replace) human operations. RPA assists banks and accounting departments in automating repetitive manual operations, allowing employees to focus on more important activities and gaining a competitive advantage for the company (Romão, Costa, & Costa, 2019, p. 2).

The capabilities of a basic rule-driven robotic process automation are restricted. It just follows the rules to complete things in a consistent manner. Banks use intelligent automation to improve RPA by incorporating artificial intelligence technology such as machine learning and natural language processing. RPA software is able to manage complex procedures, comprehend human language, discern emotions, and adjust to real-time data as a result of this.

7.1. Advantages of Robotic Process Automation

Traditional IT initiatives frequently necessitate the installation of new infrastructure before they can begin. RPA in banking, on the other hand, requires essentially no additional infrastructure. Banks can start reaping the benefits by leveraging existing IT infrastructure. Banks can speed up their procedures by implementing RPA across numerous activities and divisions. According to research, banks can save up to 75% on some operational operations while simultaneously increasing efficiency and quality. Banks have been able to cut paperwork as a result of data digitization. RPA can scan through relevant data and extract strategic analytical findings fast. RPA can assist banks in improving their customer service. Customers no longer need to contact customer service to find answers to numerous common concerns. Customers' problems can be swiftly analyzed by RPA robots, and answers to their questions can be provided quickly.

8. The Economic Effect of Technological Progression on the Banking Industry

It has been reported that IT advancements appear to have enhanced productivity in banks by increasing speeds in processing electronic payments, which has resulted in significant cost reductions for the bank—in some cases by more than 50% throughout the 1990s. Due to purposes of convenience, a large number of customers have changed from paper to electronic payments. The use of credit scoring technology also appears to have benefited "marginal applicants" (those not as privileged as others) who might not otherwise be eligible for bank financing. Technology has also been used to determine the best kind of loan scheme for each customer, according to their financial status and requirements. Thus, banks utilizing this kind of technology provided more small loans with relatively high interest rates and riskier credit ratings than banks that did not utilize the technology. Such a discovery would be difficult to record using classical methods (Berger, 2002, p. 167).

In addition to that, with the advancement of digitisation, institutions have been able to improve the user experience and improve banking as it moves towards a customer-centric approach. This is achieved by using analytical technologies to provide people with products and services that are suited to their needs. So it is necessary to have a thorough understanding of the customer's preferences as well.

Banks have also been able to increase the efficiency of their day today work by implementing cutting-edge technologies such as banking applications for smartphones. They want to eliminate human errors in consumer interactions in this way. Because all of the data and signatures are collected accurately the first time, digitalization in the processes results in significant improvements, and reduces the likelihood of mistakes being made by bank employees.

Financial institutions sometimes lose the number of customers as a result of the loss of trust in traditional banking. However, this problem was solved with the rise in the usage of banking applications and online banking by consumers. Therefore it is evident that banks will need to adapt their business practices to avoid losing clients.

9. Digital Divide and Banking Technologies

Despite all these new technologies, the problem of digital divide in online banking services is hardly ever taken into consideration, and there is a lack of research in this area as well. While people who have access to Internet can thrive with the use of new banking technologies, under privileged people are still suffering from not being able to access the services provided by the banks. They may not have mobile phones to access e banking services, or they may not have the knowledge to use ATMs. This will further increase the digital divide between people.

In the domain of banking, the digital divide has massive consequences. It affects everything from checking account balances, depositing paychecks, and paying bills to more complex operations like checking credit ratings, applying for loans, and obtaining unemployment benefits.

Without the capacity to access financial documents online, these already time-consuming procedures become even more so. People who don't have constant internet connection have less interactions with their banks or creditors—and they have to have hour-long phone calls. This gap is also detrimental to the economy, as it provides less opportunity for people below the poverty line to rise above it. Therefore, steps need to be taken to bridge this digital gap.

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