WOLKITE UNIVERSITY

COLLEGE OF COMPUTING AND INFORMATICS

DEPARTMENT OF COMPUTER SCIENCE

TITLE OF THE PROJECT

WEB-BASED FACILITY MANAGEMENT SYSTEM FOR WOLKITE UNIVERSITY

BY

S. NO	NAME	ID
1	TEMESGEN ASICHENEK	CIR/088/11
2	GETASEW TESERA	CIR/051/11
3	BIRTUKAN YSMEWU	CIR/027/11

PROJECT ADVISOR: KEBEDE NIMANI(MSc)

March 2022

WOLKITE UNIVERSITY

COLLEGE OF COMPUTING AND INFORMATICS

DEPARTMENT OF COMPUTER SCIENCE

TITLE OF THE PROJECT

WEB-BASED FACILITY MANAGEMENT SYSTEM FOR WOLKITE UNIVERSITY

SUBMITTED TO DEPARTMENT OF COMPUTER SCIENCE

IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE

DEGREE OF BACHLER OF SCIENCE IN COMPUTER SCIENCE

BY

S. NO	NAME	ID
1	TEMESGEN ASICHENEK	CIR/088/11
2	GETASEW TESERA	CIR/051/11
3	BIRTUKAN YSMEWU	CIR/027/11

PROJECT ADVISOR: KEBEDE NIMANI(MSc)

Wolkite University, Wolkite, Ethiopia

March,2,2022

DECLARATION

This is to declare that this project work which is done under the supervision of **Kebede Nimani (MSc)** and having the title **web-based facility management system for WKU** is the sole contribution of: Temesgen Asichenek, Getasew Tesera, and Birtukan Ysmewu No part of the project work has been reproduced illegally (copy and paste) which can be considered as Plagiarism. All referenced parts have been used to argue the idea and have been cited properly. We will be responsible and liable for any consequence if a violation of this declaration is proven.

Date: _____

Group Members:

Full Name	Signature
1. Temesgen Asichenek	_____
2. Getasew Tesera	_____
3. Birtukan Ysmewu	_____

APPROVAL FORM

This is to confirm that the project report entitled “web-based facility management system for Wolkite University” submitted to Wolkite University, College of Computing and Informatics Department of Computer science by: Temesgen Asichenek, Getasew Tesera, and Birtukan Ysmewu is approved for submission.

Advisor Name	Signature	Date
---	---	---
Department Head Name	Signature	Date
---	---	---
Examiner 1 Name	Signature	Date
---	---	---
Examiner 2 Name	Signature	Date
---	---	---
Examiner 3 Name	Signature	Date
---	---	---

ACKNOWLEDGEMENT

We would like to thank GOD for giving us the strength and health to complete this project. And also, grateful to our advisor Mr. Kebede Nimani for his motivation and constructive guidance from the beginning of problem formulation to the completion of the project. We would also thank Mr. Tsegaye Sehalemariyam and WKU Facility Management workers for devoting their golden time by explaining and providing information and giving written documents.

Table of Contents

LIST OF FIGURES

LIST OF TABLES

LISTS OF ABBREVIATIONS

BR	Business Rules
CSS	Cascading Style Sheet
GUI	Graphical User Interface
HTML	HyperText Markup Language
JS	Java Script
LAN	Local Area Network
MD5	Message-Digest 5
MYSQL	My Structure Query Language
OOA	Object Oriented Analysis
OOD	Object Oriented Design
OO	Object Oriented
OOP	Object Oriented Programming
OOSA	Object Oriented System Analysis
PHP	Personal Home Page
SMS	Short Message Service
SQL	Structure Query Language
UML	Unified Modeling Language
VS Code	Visual Studio Code
WKU	Wolkite University

XAMPP Apache Server

ABSTRACTS

The facility management in WKU uses a manual process system. When users need to overtake an item and return the item they must go to the office and record what they want manually, that's the way it is making the process too late. Which requires the employee to use paper-based recording files to know the status of each user and to perform the process in the system. The system should ensure the user's satisfaction need usage must be overtaken shortly moreover it must be time saving and precise form.

CHAPTER ONE

1 INTRODUCTION

The facility management system for WKU is giving many services those are maintenance, campus safety and security, campus beauty and clealiness and difference services for its users which is found in that campus that needs the desirable issue that facilitates the teaching and learning processes in a university.

All facilities are acquired through purchasing by the WKU governor and resource suppliers with appropriate facility management. These properties are distributed based on formal request forms. The current system gives vast service however it uses a manual management system which leads the system to be inefficient. As part of the effort to bring an efficient and modern facility management system in the facility management of WKU. The new system should be designed and implemented that enables properties to be controlled and managed properly.

1.1 Background of facility Management

As education plays an important role in the development of a country, one of the objectives that the Ethiopian ministry of education targeted is quality education development in WKU to attain its mission. So, it is unquestionable to get better computer-based applications to achieve fast and high-quality facility management. WKU is a big academic institution having a large number of employees, but still, it has a manual facility management system. So, it is unable to serve the university employees effectively.

The project entitled facility management system in WKU for management of the facility in the campus has been formed since 2004 E.C [1]. The project takes care of all the requirements of the facility in a university to facilitate the whole activities in a good manner of responsibility and equal sharing of the resource. This system is governed by the vice president and the facility

directorate. At the present, an information system is necessary for the facility Offices. The project uses information technology for managing all of the facility data. That makes more performance and more reliability of data in facility managing system.

1.2 Statements of the problem

Due to an unorganized database about the facility management, no one can commentate similarly at similar issue the university losses much money and time every year. This led to time delays to assign the management to users. On the other hand, there is the case where more than two individuals participate in the same task of facility distribution in this case consumers' manpower. Facility distributions preparation and allocation for the facility are inefficient and time-consuming which results in delays and frustration, especially for users in the university.

The employee discourages the work activity. This means the man who is responsible is not working successfully because of inefficient information retrieval, and difficulty to generate reports because of the existing system data stored manually. Nowadays cross-checking the manual documents of the owner is done by document identification method which is very difficult. Data backup is another problem of the existing system, so, it is difficult to back up the data if it damaged the manual storage.

1.3 Objectives of the Project

1.3.1 General objectives

The main objective of our project will be to develop a web-based facility management system for WKU.

1.3.2 Specific objectives

The following are the specific objectives:

- Identifying the problem under the existing system are time delay, inefficient, information retrieval, difficulty to generate reports, and data redundancy.
- To solve the problems listed above in the facility management system.
- Identify and analyze the requirement of the new system.
- Design the requirement gathering for the system.
- To build up a system that allows updating, generating a report, sending the request, creating an account, manage employers and customers. Deleting of data records regarding for facility management system.
- To minimize the time and employees load on file retrieving process.
- Designing a back-end database that can hold all the information of the system users and resources.
- To build Well normalized and filtered Database system to avoid data redundancy and be flexible for the speedy search of users' information when needed.
- Documenting the whole system.
- To design-friendly user interface
- Implement, test, and install the new system in a good manner.
- To use a secondary database, a copy of the original database, for backup purposes.

1.4 Feasibility Analysis

1.4.1 Operational feasibility

The facility management system is intended to provide every user-friendly and easy-to-use interface, which is beneficial for both the users as well as the operators who help in providing support for the system. This system should also be easily acceptable between the users and administrator, as there is no need for any special skill set for using the system except illiterate.

1.4.2 Technical feasibility

In technical feasibility, we notified that our new system can be implemented with current technology and the user has enough experience using that technology. Technical feasibility addresses three main things:

- Is the technology practical
- Do we currently pass the necessary technology?
- The ability to do on the technologies
- Our system is technically feasible.

1.4.3 Economical feasibility

Since the system is developed as part of project work, there is no manual cost to spend for the proposed system. Also, all the resources are already available, which indicates the system is economically possible for development.

The facility user also need not waste their money as travel expenditure to find the facility it can help easily to get simply by report method to the facility managers so the proposed system is economically feasible.

1.5 Scope and Limitation of the Project

The project provides especially to capture facility by providing seeking and order to their needs. It is self-contained and works efficiently. It provides simple database systems rather than complex ones for high requirements and it provides good and easy GUI (graphical user interface) to both new as well as experienced users of the computer. The project will be supposed to implement storage of facility details so that a large collection could be maintained with minimum storage space.

1.5.1 Scope of the project

The system will be used for any Ethiopian university facility management system. But we will develop this system based on the WKU facility management process, so it will be used by others by customizing the system.

1.5.2 Limitation

- The system cannot support SMS notifications. If the employee working in the field.
- The system does not support video and graphical text message exchanges when reports generate.

1.6 Methodology

1.6.1 Data gathering methodology

Data collection methods are the most important part of our project to find the main requirements of a system and how to understand the system is doing. To gather the information, we used data collection methods that mentioned as follow: -

- **Interview**: to gather information from representatives of the facility management to get crucial information we need for the project and also from direct users regarding the procedures of facility registration and distribution system
- **Questionnaires**: We prepare questionnaires for the WKU facility directorate office and we get enough information about the existing system.
- **Observation**: to understand the system process we have been seeing the store of facility recourse and we have been asked the manager the way how they have been done to the system.

1.6.2 Design methodology

Analysis and design of the system using an object-oriented approach. We need a method for analyzing a problem to be solved, a plan for the design of the solution, and a construction method that minimizes the risk of error. We have chosen the object-oriented approach (OO) to follow for our proposed system. Object-oriented programming (OOP) is an approach to designing modular reusable software systems. A module is a component of a larger system that interacts with the rest of the system in a simple and well-defined manner. The object-oriented approach is a logical extension of structured programming, a module containing data.

An object is a kind of self–sufficient entity that has an internal state (the data it contains) and that can respond to messages (call to its subroutines). We select object-oriented programming because it produces solutions that are

- Easier to write.
- Easier to understand
- Contain fewer errors
- Reduction of development time
- Reduction of time and resources required to maintain existing systems

Object-oriented design methodology has two phases: -

1. **Object-Oriented Analysis (OOA):**

During this phase, the team looks at the problem domain to produce a conceptual model of the information that exists in the area analyzed. And these model the functions of the system (use case modeling), identifying the business objects, organizing the objects, and also the relationship between them, and finally model the behavior of the objects.

2. **Object-Oriented Design (OOD)**:

During this phase the model interactions and behaviors that support the use case scenario, and finally update object model to reflect the Implementation environment. And also transforms the conceptual model produced in object-oriented analysis to take account of the constraints imposed on our system format, so that we will use this phase to refine the use case model to reflect the implementation environment.

1.6.3 Testing methodology

Before directly deploying this system, the team will perform different testing for its functionality. First, the team tests each unit at each phase. So, if a problem is encountered it will immediately be fixed. Then our group performs integration testing to check whether the system addresses all the functional requirements. The System was tested using the following system.

Alpha testing: -In this testing method, the system is tested by giving the correct input.

Beta testing: -In this testing method, the team forces the system to be tested for incorrect data input. If any failures occurred while testing the system in all the above testing methods, the team take immediate correction beginning where this fault occurred before jumping to the next workshop so that it meets the goal. If all the above testing methods are carried out and found to be valid the system is directly deployed.

Unit testing: -After developing an individual program module or component it would test it to ensure that it works according to the specification, operates within acceptable parameters, and meets the appropriate standards.

Integration Testing: -When several components are complete; it tests to ensure that they integrate well with each other, the operating system, and other components.

1.6.4 Development Environment and programming Tool

Programming languages, tools, and techniques used for the development of the facility system:

- Visual Studio Code (VS Code) for writing source codes.
- PHP (We use PHP language for the system development, and our system (software) compatible on all hardware platforms such as windows & Linux)
- MySql server
- Apache server module
- HTML, CSS, JavaScript, markup language for front end
- XAMPP server for back end
- Sniping tools Image capture to help users how to use the system.
- Microsoft Office to write document

1.6.5 System Development Model

We select software development life cycle models is iterative because of the following reason:-

- The iterative process starts with a simple implementation of small sets of software requirements.
- Iteratively enhances the evolving version until the complete system is implemented and ready to deploy.
- It doesn't attempt to start with a full specification of requirements instead development begins by specifying and implementing just part of the software which is then reviewed to identify further requirements

1.7 Benefits of the project

The main purpose of this project is to develop an application that enables the user to apply for facilities that match their qualifications in an easy, cost-effective, and timely manner. That means it enables the facility user to search for facility resources anywhere at any time inside the campus. The new system helps handle the important task of the employee recruitment process. Users which are applicants can access the system using any computer at any place. They can apply for the facility resource via the internet and check their application status easily. Facility users are kept in the database system that is more secure because the system is only accessed by authorized users. The system enables the process like updating, editing, and adding new data to be easier and faster Benefits of the system: -

- Reduces paperwork for all parties
- Minimizes errors in ordering facility resource
- Provides a comprehensive record of each transaction of the facility
- Improves efficiency of the system accessibility of resource
- Gives chefs and managers time to focus on other activities of the management system of the facility.
- Provides to report purchase and fulfillment data which can be analyzed for spend patterns and supplier performance
- Easy and quick to use
- Provides a reliable ordering system which is available recourse
- Greater flexibility - items can be added to the distributing facility basket at any time.
- Hosted in the facility primary internet access Serve Fully scalable system to meet customers' demands on the facility.

- Facilitates growth strategies and operational change

As a project, these computerized financial management systems have the following tangible and intangible benefits.

Tangible benefit is a benefit that can easily be quantified. Our system provides tangible benefits such as Increase speed of activities to the system.

- Easy to calculate item amount of facility recourse
- Decreases workload
- Increased efficiency & effectiveness of the information
- Problems & Error reduction

Intangible Benefits: - refers to items that cannot easily be measured in terms of money and with certainty. It cannot be determined the exact amount of money consumed. Intangible benefits are as follow: -

- Improved user satisfaction
- Time-saving
- Motivate employees
- Decision-making based on quality information etc.

Tangible cost

To get accurate information about materials the project team observes the market directly. From our project point of view, the following items are considered tangible. Because you can easily measure them in terms of money. These costs include:

- Hardware cost
- Software cost

CHAPTER TWO

2 EXISTING SYSTEM

2.1 Introduction of Existing System

In the existing system, all the activities are performed manually and it's tedious moreover has to be taken of every facility resource transaction with the users. Presently, all the access is maintained on paper, which increases the additional tasks of maintaining the paperwork. A report is later prepared manually on a pre-defined format printed on paper. In the existing system, most facility management systems view available resources or apply for the facility at the facility management can be done for which facility user has to go the get and check the available resource at a facility management system announcement by a report on facility directorate [1]. This way of finding a facility consumes, the time and budget of a university.

The facility services collect information about and select to give appropriate support for most facility service insecure distributions. So that register the selected beneficiary facility with their full details and order or ask the manager to provide goods and items for the selected people then the manager approved and forwards the request to the store manager to distribute services of the facility to the users. Therefore, the store manager checks the availability of goods and items whether it found in the store or not. If it is sufficient take and distribute else the distributor of the facility asks the requisition store manager. The manager orders the request of the distributor to the procurement officer then they ensure that sufficient supplies of goods and items with the required quantity, in the right place, and at the right time when performing the purchasing process after this process the facility manager gets the facility and he can distribute all recourse of facility to all around the teaching and learning issue of WKU [1].

2.2 Users of an existing system

The existing system is not securely supported since it is manual; it needs the number of users to manage the overall function of the system and it is not Effective and clear. Those actors in the existing system are: -

- **Manager:** -a person who directs that coordinates or manages the facility directorate of the facility [1].
- **Employer:** - a person who works in a professional manner of facility tasks in facility directorate that overtake the task through the facility management system [1]**.**
- **Users:** - User who needs service of the facility through the campus for the resource of facility management information system [1].
- **Storekeeper:** - a person who manage and order the item resource of the facility system that are stored in the storage hall [1].

2.3 The major function of an existing system

The existing facility management system currently is functioning using a manual system. Firstly, the user requests their needs to the storekeeper and the purchaser approves the request. And also, the store manager checks the item whether it is found in the system or not. If the requested item exists the user fills the form and takes the item that he/she needs. But if the requested item has existed, the store manager permitted the store manager to buy the requested item and the manager announce to the user the item you need is coming [1].

2.4 Documents of the existing system

Wolkite University liquid generator fuel, oil, and lubrication request, an authentication form.

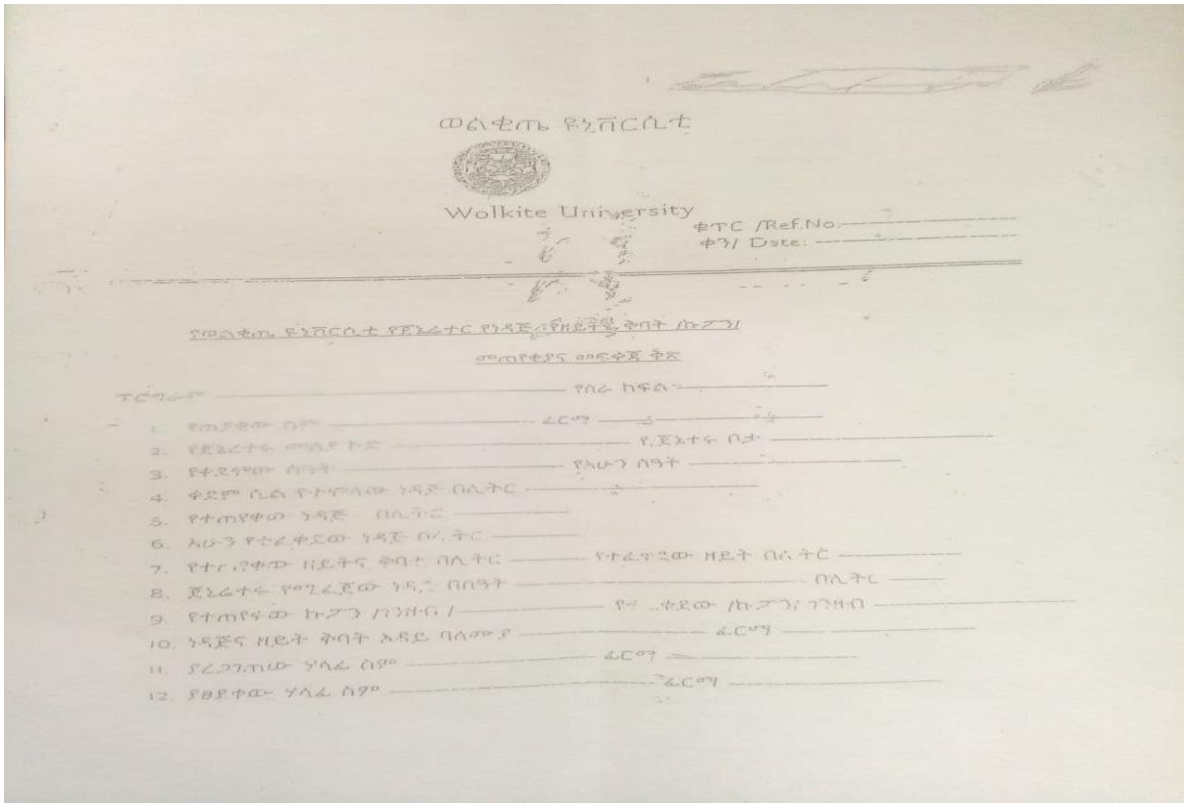

Figure 2. 1 liquid generator fuel, oil and lubrication request, an authentication form.

In Wolkite university facility management system development and management (directorate) repair request form.

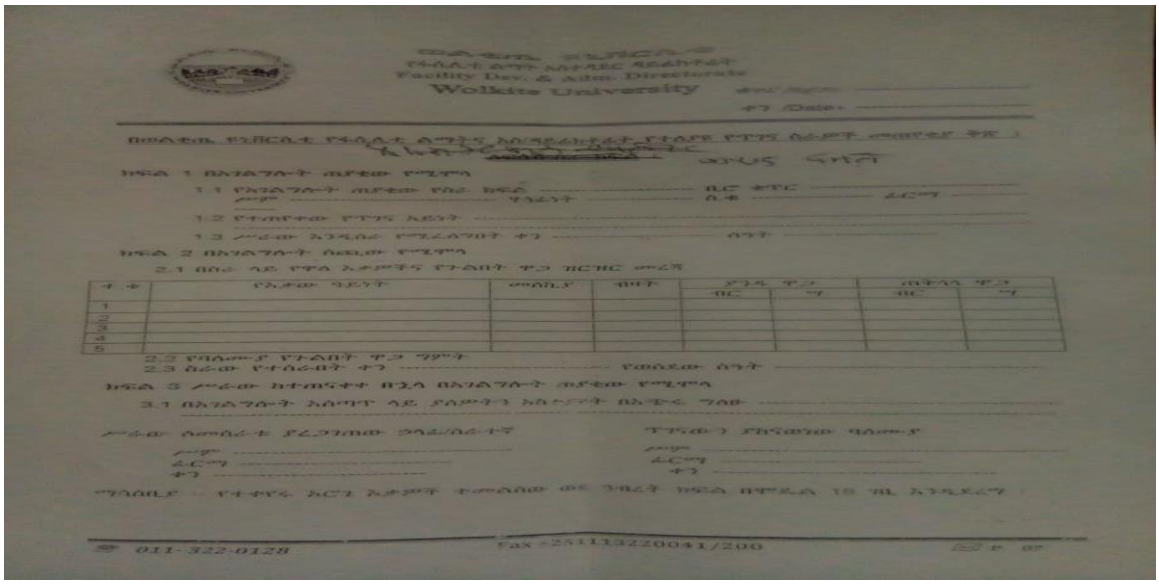

Figure 2. 2 repairs request form

Wolkite University property management department item request form.

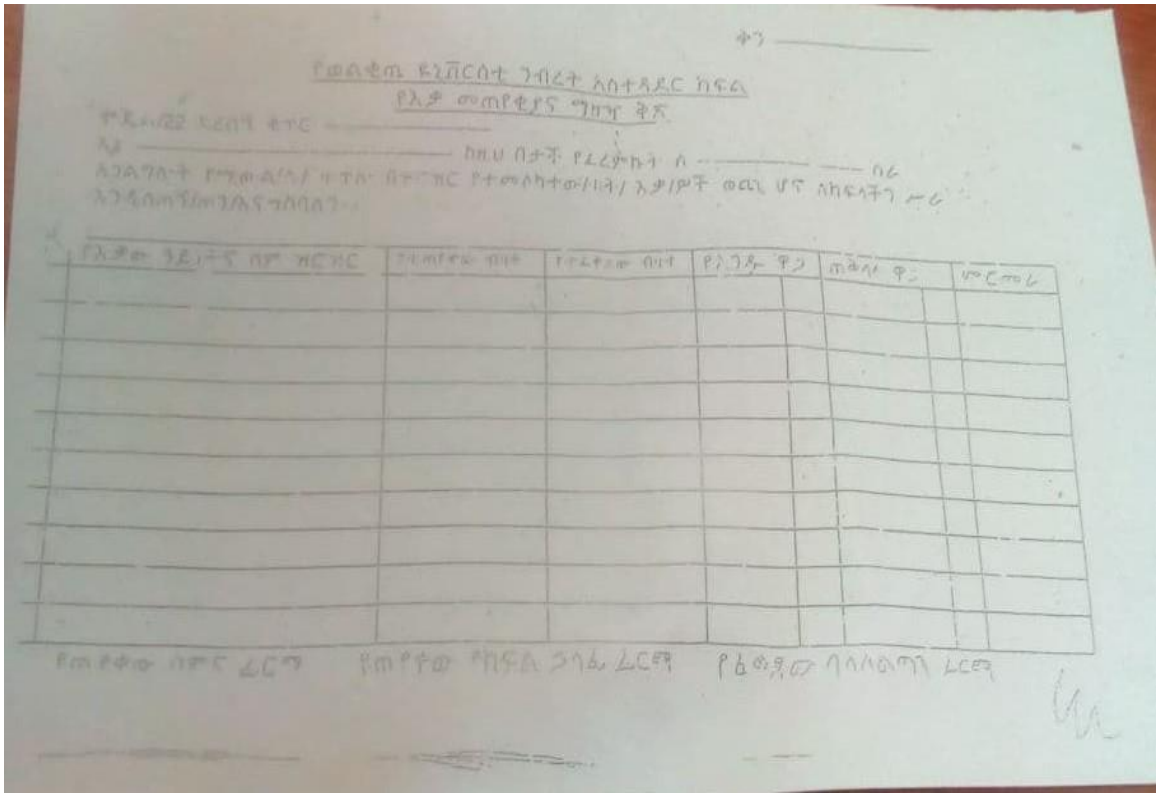

Figure 2. 3 Item request form

2.5 Drawbacks of the existing system

- **Performance**

The performance of the existing system takes time delay because it is difficult to access data from the stored document. And also, it is slow time, and energy-consuming.

- **Security and Controls**

Every record of the existing facility management system is stored manually, so, it is difficult to control and secure these manual records since it doesn't have any authentication and authorization system.

- **Efficiency**

Due to the operation that is done by the hand most of the activities are caused to high consumption of resources like papers, manpower, time, etc. This makes the existing system costs are too high.

- **Information retrieval**

Data are not easily accessible due to places in different locations. Difficult to change and edit.

2.6 Business rules

The Business rules are statements about the facility directorate organization's way of doing business and they reflect business policies. Organizations have policies to satisfy the business objective, make good use of resources, and conform to laws or general business conversions. Business rules become a requirement that is they may be implemented in software as a means of requirements of this software system.

The existing system includes the following operating principles or rules:

- **BR1**: the employee must have a valid id/badge, salary.
- **BR2**: employee is signs attendance every day twice.
- **BR3**: Employee gets an additional fee if he/she is done over time.
- **BR4**: They have to be punctual and must be accountable to the facility directorate and manager.
- **BR5:** They must have good conduct**.**
- **BR6:** user must have a valid id/badge to get services from the facility.
- **BR7:** the employer must be obligate to pay the cost price when he loses the resource of the facility if he uses the resources for his self-need he is so accountable.

CHAPTER THREE

3 PROPOSED SYSTEM

3.1 Overview of the Proposed System

To overcome the problem stated in chapter two and the statement of the problem, we initiate developing a web-based facility management system for WKU, so the new system should be designed and implemented to know facility information properly. It has many advantages such as faster access, storage, and retrieval of data, being cost-effective, user-friendly, more secure, and involving less manpower.

3.2 Functional Requirement

Functional requirements specify particular results of a system. This should be contrasted with non-functional requirements which specify overall characteristics such as amount and reliability of facility management. A functional requirement describes the application architecture of a system. The following are the functional requirements of the facility management system.

The system shall allow the actor to:

- Log in to the system.
- Manage accounts.
- Manage users, storekeepers, technicians, employees, and items.
- Generate report.
- View reports, requests, responses, and feedback.
- Send responses, requests, and feedback.
- Update his/her profile.
- Change his/ her password.
- Log out from the system.

3.3 Non-Functional Requirements

A non-functional requirement is a requirement that specifies criteria that can be used to judge the operation of a system, rather than specific behaviors. It defines how a system is supposed to be. Non-functional requirements are often called qualities of a system. A non-functional requirement is a statement of how a system must behave; it is a constraint upon the system's behavior. Generally, the following are some of the non-functional requirements of the system.

3.1.1 User Interface and Human Factors

Users can easily input and retrieve their profile and need information. This works as an interface between the user and the system by properly guiding the user on how to use it and perform operations. The system interface that will be developed must be interactive and easily understandable. And also, you can add here level of expertise of the users.

3.1.2 Hardware considerations

The hardware that is consumed by the new system is a computer machine that is used for all the operations of the system. The Software product to be developed should run on existing standard computers. The system is portable that can run on any type of computer, browser and operating system.

3.1.3 Security Issues

The system is much secured based on the username and password for all user activity. Nobody can access the system without the authorized person. Passwords that are not visible cannot be accessed by anyone because the passwords are encrypted by MD5 encryption. Because the MD5 algorithm is a very simple and easy-to-follow manner, and it offers much more assurance of data security.

3.1.4 Performance Requirements

- Performance characteristic: During the time of accessing the system response time will be short.

- User interface loaded within a minimum second. Because of Bootstrap template is responsive.
- Authentication must have been performed in a few seconds why because there is front-end authentication and back-end authentication.
- SQL transaction is performed in a few seconds. When we implement the project net requests send to the database so the response can have done within seconds.

3.1.5 Error Handling and Validation

Errors could arise from users and the system. Errors that occurred from the wrongdoing of users will be handled by appropriate exception handling mechanisms. Generally, if an error occurs, the system will identify the error and notify the user so that he/she can take the appropriate corrections rather than terminating the system and the system must handle the error and should display an error message if the user inputted the characters that are mismatched to corresponding data types.

3.1.6 Quality Issues

- Maintenance: The facility Management System is being developed in PHP. PHP is an object-oriented programming language and shall be easy to maintain.
- Reliability: - The Facility Management System service should not access without authenticating the user.
- Portability: -The Facility Management System shall run in any type of operating system(window, Linux, Mac, and so on).
- Standards Compliance: - The graphical user interface of the system shall have easily understood by the user (have consistent look and feel graphical user interface).

3.1.7 Backup and Recovery

The system includes a secondary database, a copy of the original database, for backup purposes. If the original database fails or is damaged by any man-made or natural disasters, then a secondary database will be used for recovery purposes.

3.1.8 Physical Environment

The system is deployed on the university's main server and any authorized user can access the system by using a web browser.

3.1.9 Resource issue

The resource issue will not be a problem in the system. Users can use the system by using the web browser and the deployment of the system will be in the WKU server so there will be no resource issue to implement and use the system.

3.1.10 Documentation

This Facility Management System will provide two types of system documentation. These are internal and external documentation. System documentation addresses programmers, system developers, owners, and users. Programmers include those who are currently working on the project as well as those who give support and maintain the system including the system administrator.

- Internal Documentation: This contains program source code.
- External Documentation: This also contains, use case models, the class, and interaction diagrams

CHAPTER FOUR

4 SYSTEM ANALYSIS

System analysis is conducted to study a system or its parts to identify its objectives. It is a problem-solving technique that improves the system and ensures that all the components of the system work efficiently to accomplish its purpose [2]. The analysis model contains three models: functional, object, and dynamic models. The functional model can be described by use case diagrams. Class diagrams describe the object model. The dynamic model can also be described in terms of sequence, and activity diagrams [2]. For this project, we have described the analysis model in terms of the functional model and dynamic models using use case, sequence diagrams, Activity diagram, and class diagram.

4.1 System Model

Object-Oriented System Analysis (OOSA) looks at the problem domain, to produce a conceptual model of the information that exists in the area being analyzed. The result of the object-oriented analysis is a description of what the system is functionally required to do, in the form of a conceptual model [3]. That will typically be presented as a set of use cases, activity diagrams. The purpose of the object-oriented analysis is to develop a model that describes computer software (Website) as it works to satisfy a set of customer-defined requirements.

4.1.1 Use Case Model

A use case is a methodology used in system analysis to identify, clarify, and organize system requirements. The use case is made up of a set of possible sequences of interactions between systems and users in a particular environment and related to a particular goal [4]. The use case is a list of steps, typically defining interactions between a role (known in UML as an actor) and a system, to achieve a goal. The actor can be a human or an external system.

- **Modeling the Functions of the system (Use Case Modeling)**
  - The main activities that are performed in this part will be:
    - Identifying if there are any additional actors and use cases,
    - Constructing a use case model, and
    - Documenting the use case course of events.
  - Use Case represents an interaction between a user (human or machine) and the system.

4.1.2 Use Case Diagram

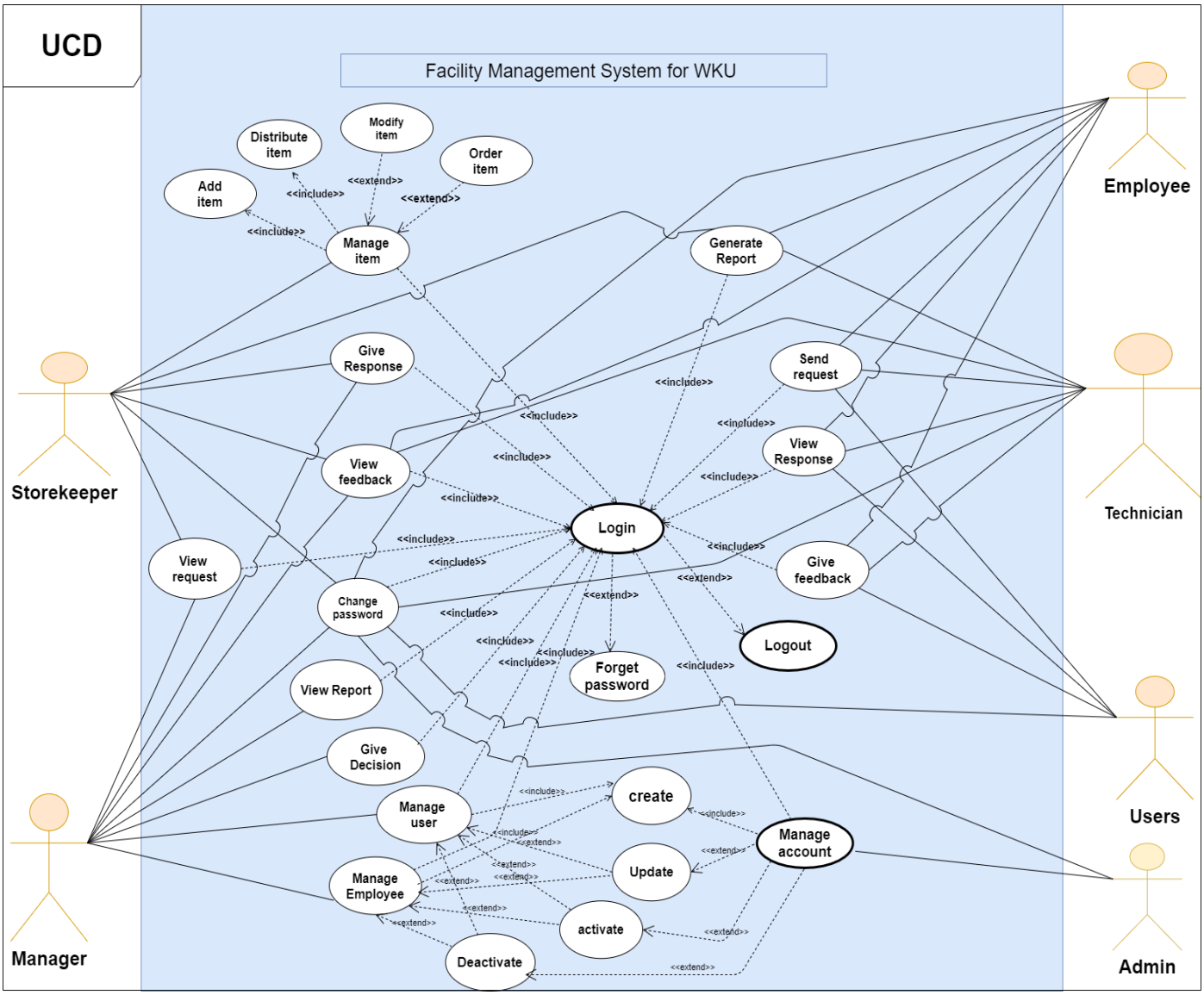

Figure 4. 1 Use case diagram

4.1.1 Use Case Description

Table 4. 1 log In

Use case name	Log In
Participating actor	Facility manager, employee, storekeeper, admin, and user.
Entry condition	The user opens the home page of the system.
Basic course of action	step1. The user wants to log in to the system. step2.The system displays the form step3. The user inputs his/her username and password into the facility system. Step 4. The facility system verifies that the user is eligible to log in to the system (account checking in the database). step5. The user login into the system. step6. use case end
Alternative course of action	4a. The system determines that the password or username is incorrect The system updates the user's period of time and the number of login failures and prompts the user to re-enter the username and password. 4a1.The system determines that the re-entered password is incorrect. The system provides the option for the user to retrieve a forgotten password.
Exit condition	When the user clicks the logout button.
Pre-condition	The user has a user name and password.
Postcondition	The user login into the system and do in the system the allowed

Table 4. 2 Add Item

Use case name	Add Item
Participating actor	storekeeper
Entry condition	The manager activates the received item form.
Pre-condition	The manager should log in to the system
Basic course of action	1. The storekeeper clicks add item button. 2. The system displays add item form 3. The storekeeper enters details of the new item. 4. The system checks the validation criteria 5. The item is stored in the database 6. Use case end
Alternative course of action	4a. If there is an invalid entry 1. Then the system displays an error message and allows the facility to re-enter the correct data.
Exit condition	When the storekeeper closes the form
Post condition	The item is added to the database.

Table 4. 3 log out

Use case name	log out
Participating actor	Facility manager, employee, storekeeper, admin, and user.
Entry condition	The user stays on the home page of the system.
Basic course of action	1, The user stays on its home page. 2, The user wants to log out of the system. 3. The user clicks the log out button 4. The user logout from the system. 5. use case end
Exit condition	When the user clicks the logout button.
Pre-condition	The user stays on the home page of the system.
Post condition	The user logout from the system.

Table 4. 4 View Request

Use case name	View request
Participating actor	Manager, employee, and storekeeper.
Entry condition	The manager, employee, and storekeeper activate the view request form.
Pre-condition	The actor should log in to the system.
Basic course of action	1. The actor clicks the view request button 2. The system displays the view request form. 3. The actor clicks the view detail button. 4. The system displays the requested detailed information. 5. The actor view request. 6. Use case end.
Exit condition	When the actor closes the form.
Post condition	The actor views the requested information.

Table 4. 5 Send request

Use case name	send request
Participating actor	Employee and user.
Entry condition	The actor activates send a request form.
Pre-condition	The actor should log in to the system.
Basic course of action	1. The actor clicks send request button. 2. The system displays send a request form. 3. The actor fill information to the request form 4. The actor selects the storekeeper/ manager/technician to send the request 5. The actor clicks the send request button 6. use case end
Alternative course of action	5a. If the requested item is not existing b. The system displays not found message
Exit condition	When the actor closes the form.
Post condition	The data send to the storekeeper or manager and save the data to the database.

Table 4. 6 Update Item information

Use case name	Update Item.
Participating actor	storekeeper
Entry condition	The storekeeper activates the form to update
Pre-condition	The storekeeper should log in to the system
Basic course of action	1. The storekeeper clicks the update item button. 2. The system displays the update search item form. 3. The storekeeper inserts the item code or name to search for the updated item. 4. The system displays the update form. 5. The storekeeper fills in the updated information and clicks the update button 6. The system validates the updated information 7. The item will be updated 8. use case end
Alternative course of action	6a. If there is any invalid information 1. Then the system displays an error message 2. The system displays the entry form and Allows the storekeeper to re-enter the correct item name.
Exit condition	When the storekeeper close the form
Post condition	The item will be updated and stored in the database.

Table 4. 7 View feedback

Use case name	View feedback
Participating actor	Manager, storekeeper, and employee
Entry condition	The actor activates form.
Pre-condition	The actor should log in to the system.
Basic course of action	1. The actor clicks the view feedback button. 2. The system displays the view feedback form. 3. The actor clicks the view detail feedback button. 4. The system displays the feedback.
Exit condition	When the actor closes the form.
Post condition	The actor views the feedback.

Table 4. 8 View items

Use case name	View item
Participating actor	storekeeper
Entry condition	The storekeeper needs to view the item information.
Pre-condition	The storekeeper should log in to the system.
Postcondition	Retrieve stored items and view the item list.
The basic flow of the event	1. The storekeeper clicks the view item button 2. The system displays the search view item form. 3. The storekeeper fills the view item name and clicks the view button. 4. The system displays the items that are stored in the system. 5. Then the actors see the list of items. 6. Use case end
Alternative course of action	4a. If the requested item is not existing b. The system displays not found message
Exit condition	When the actors close the displayed view item

Table 4. 9 Create an account

Use case name	Create account
Participating actor	Admin
Entry condition	The actor activates the form.
Basic course of action	1. The actor clicks create account button 2. The system displays the create account form. 3. The actor fills the attributes of the beneficiary 4. The actor clicks the save account button 5. The system will check the filled form. 6. The system is saved to the Database 7. The system will display "account created successful message". 8. use case end
Exit condition	When the actor exits from the form.
Pre-condition	The actor should log in to the system.
The alternative course of action	5a. If the entered attribute is incorrect. 1. display error massage 2. Admin re-enter attributes into the system.

Table 4. 10 Search for the item

Use case name	Search for item
Participating actor	storekeeper
Entry condition	The actors activate the form.

Basic course of action	1 User wants to search and view items 2 The system displays the search item form. 3 The actors insert the search name to the form and click the search button 4 The system displays the information of search item 5 use case ends
Exit condition	When the manager, employer, and users close the form.
Pre-condition	The storekeeper should log in to the system.
Postcondition	The storekeeper searches the item by the click search button.
An alternative course of action	3a. If the entered item name is incorrect. 1. system display error 2. system directs the user to the request entry form to enter valid data

Table 4. 11 View Report

Use case name	View Report
Participating actor	manager
Description:	The system allows the facility manager to view the report.
Pre-condition	The manager is login to the system
Basic course of action	1. The manager clicks the view report button. 2. The system displays the form. 3. The manager detail report button. 4. The system displays detailed report information. 5. The manager views detailed report information. 6. use case end.
Postcondition	The manager views the report
Exit condition	When the manager closes the form.

Table 4. 12 Manage user

Use case name	Manage user
Participating actor	Manager
Entry condition	The manager activates the form.
Pre-condition	The manager should log in to the system.
Basic course of action	1. The manager clicks the manage user button. 2. The system displays the manage user form. 3. The manager searches the user by entering the user id. 4. The system displays the user info page. 5. The manager can enable/disable/ the user. 6. Step5.end use case.
An alternative course of action	4a. If the user is not existing in the database. b. The system displays not found message
Exit condition	When the manager closes the form.
Postcondition	When the manager enables/disables the user.

Table 4. 13 add employee

Use case name	Add employee	
Actor	Manager	
Description:	The manager will add a new room with new attributes to the system.	
Basic course of action	**User action**	**System response**
	1. The manager will log in to the system. 2. The manager clicks the add employees' button.	

	4. The system manager will fill out the form and add the employee button. 8. End of use case.	3. The system will display the ' add employees' form. 5 The system will check all fields of the form are filled or not. 7. The system stored the employee information in the database
Alternative course of action	5a. If entered same filed invalid 1. display error massage 2. All fields are filled correctly to show a successful message.	

4.2 Object Model

4.2.1 Class Diagram

This section discusses Analysis classes and their variations, including templates and instantiated classes, and the relationships between classes association and the contents of classes (operations). Class diagrams show the static structure of the model, in particular, the things that exist (such as classes and types), their internal structure, and their relationships to other things [5].

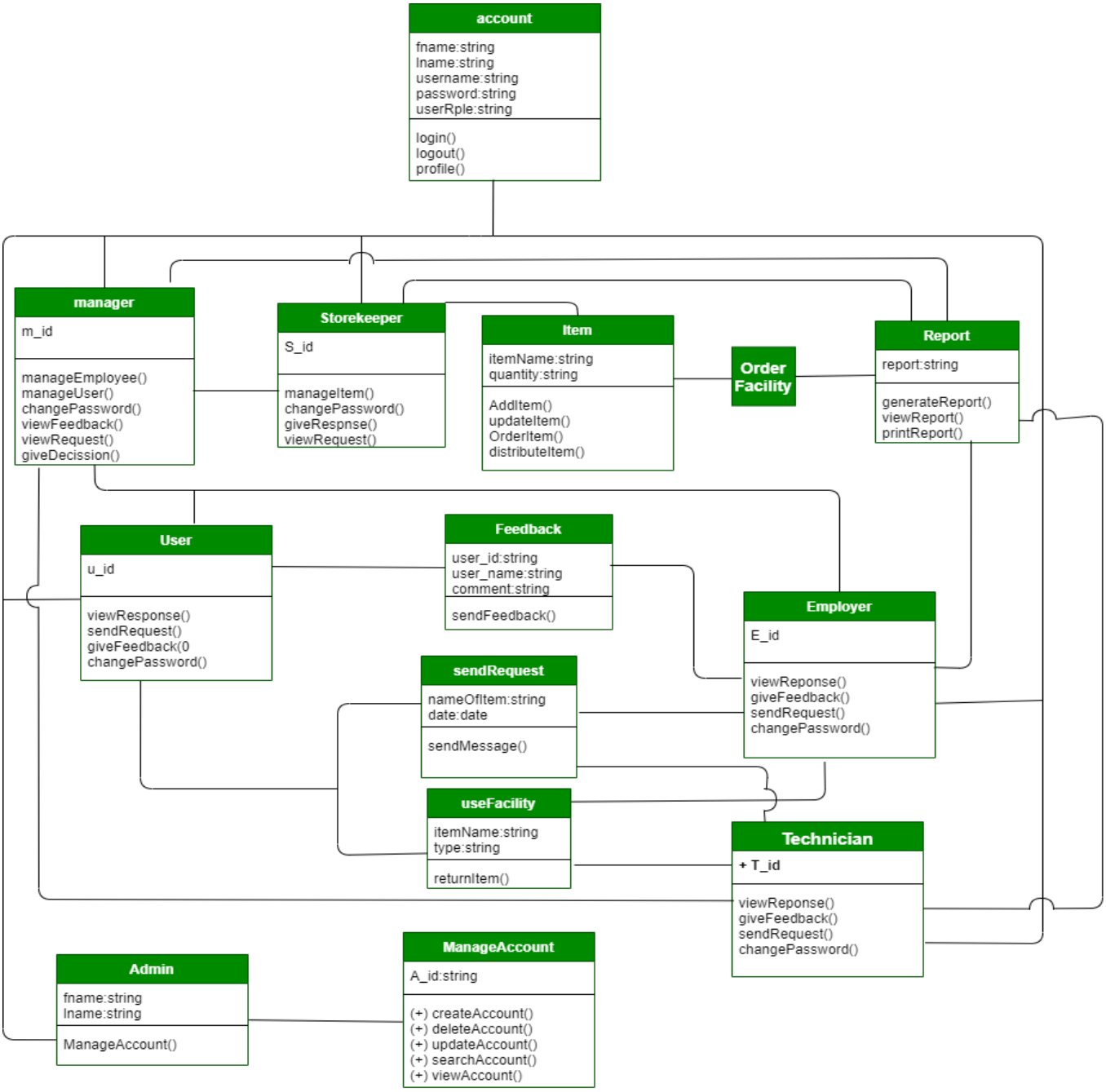

Figure 4. 2 Class diagram

4.2.2 Data Dictionary

Table 4. 14 manager table

Column name	Data type	Primary key	Null value
Id	Varchar (20)	□	No
first name	Varchar (20)		No

last name	Varchar (20)		No
Birth date	Varchar (20)		No
Email	Varchar (20)		No
Gender	Varchar (20)		No
Phone	int		No
State	Varchar (20)		No
Salary	Float		No
Nickname	Varchar (20)		Yes

Table 4. 15 Employer table

Column name	Data type	Primary key	Null value
E_Id	Varchar (20)	□	No
First name	Varchar (20)		No
Last name	Varchar (20)		No
Age	Int		No
Phone	int		No
Sex	Varchar (20)		No
location	Varchar (20)		No
city	Varchar (20)		No
street	Varchar (20)		No
salary	float		No
Email	Varchar (25)		No

Table 4. 16 Technician table

Column name	Data type	Primary key	Null value
T_Id	Varchar (20)	□	No
First name	Varchar (20)		No
Last name	Varchar (20)		No
Age	Int		No
Phone number	int		No

Sex	Varchar (20)		No
location	Varchar (20)		No
city	Varchar (20)		No
Street address	Varchar (20)		No
salary	float		No
Email	Varchar (25)		No

Table 4. 17 Storekeeper Table

Column name	Data type	Primary key	Null value
Id	Varchar (10)	□	No
First name	Varchar (20)		No
Last name	Varchar (20)		No
Phone number	int		No
Location	Varchar (20)		No
Age	Int		No
Sex	Varchar (20)		No
Nickname	Varchar (20)		Yes
Salary	Float		No
Email	Varchar (20)		No

Table 4. 18 User table

Column name	Data type	Primary key	Null value
Id	Varchar (10)	□	No
First name	Varchar (20)		No
Last name	Varchar (20)		No
Nickname	Varchar (30)		Yes
Address	Varchar (20)		No
Phone number	int		Yes
Age	Int		No
Sex	Varchar (20)		No
Email	Varchar (20)		No

4.3 Dynamic models

4.3.1 Sequence diagram

A **Sequence diagram** is an interaction diagram that shows how processes operate with one another and in what order. It is a construct of a Message Sequence Chart [6]. A sequence diagram shows object interactions arranged in a time sequence. It depicts the objects and classes involved in the scenario and the sequence of messages exchanged between the objects needed to carry out the functionality of the scenario. Sequence diagrams are typically associated with use case realizations in the Logical View of the system under development. Sequence diagrams are sometimes called event diagrams or event scenarios [6].

The main purpose of a sequence diagram is to define event sequences that result in some desired outcome. The focus is less on messages themselves and more on the order in which messages occur; nevertheless, most sequence diagrams will communicate what messages are sent between a system's objects as well as the order in which they occur [6].

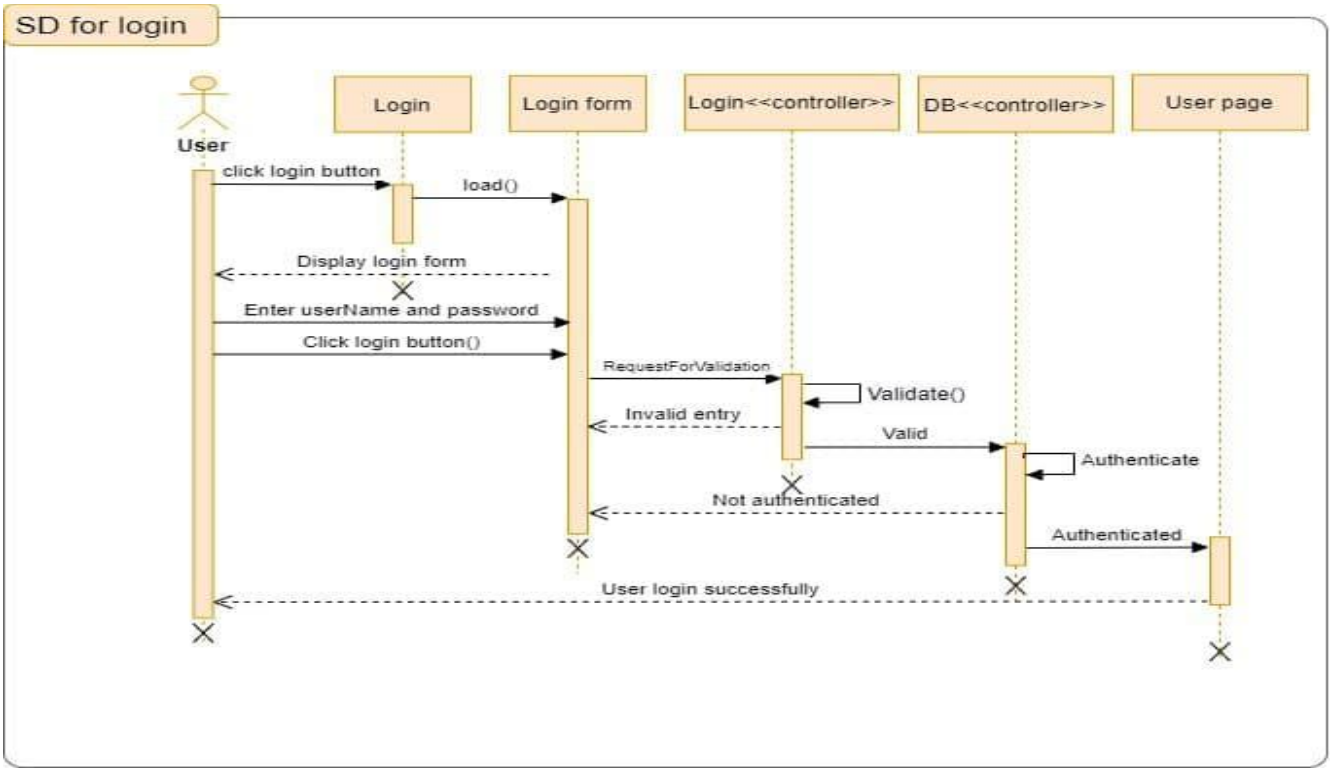

Figure 4. 3 Sequence diagram for login

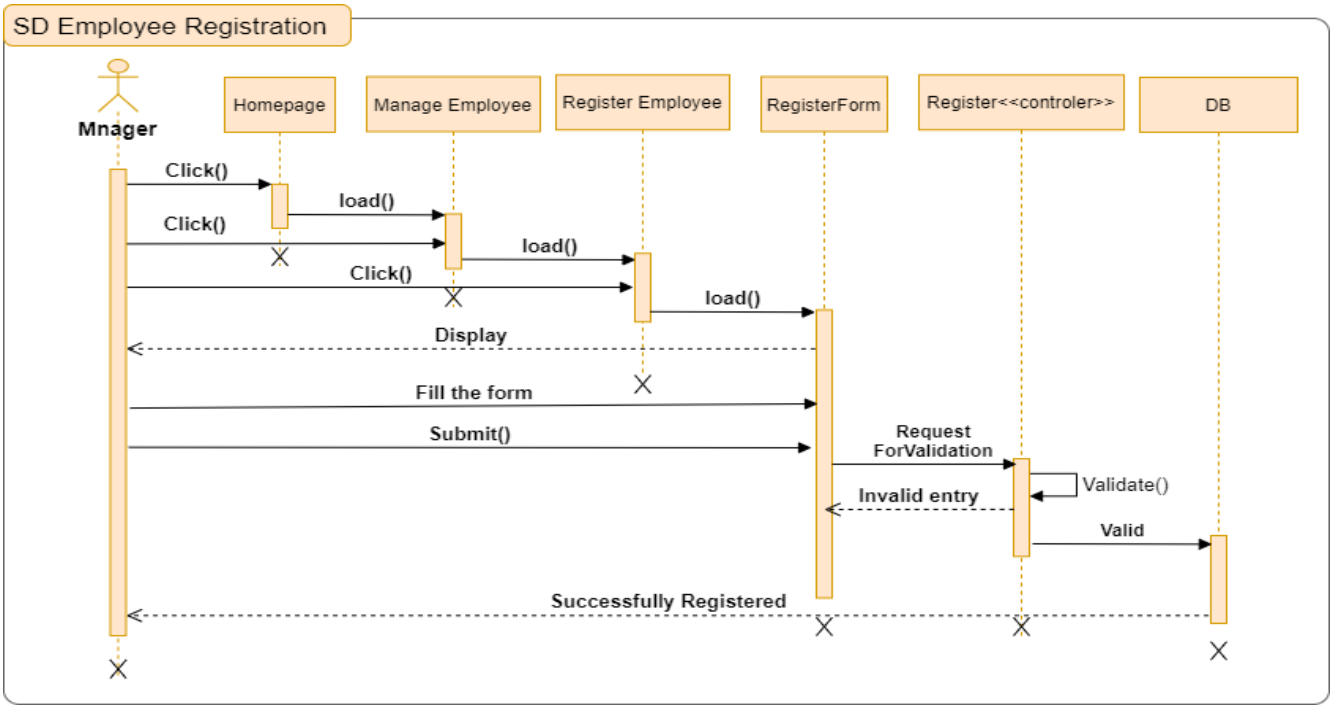

Figure 4. 4 Sequence diagram for Employee registration

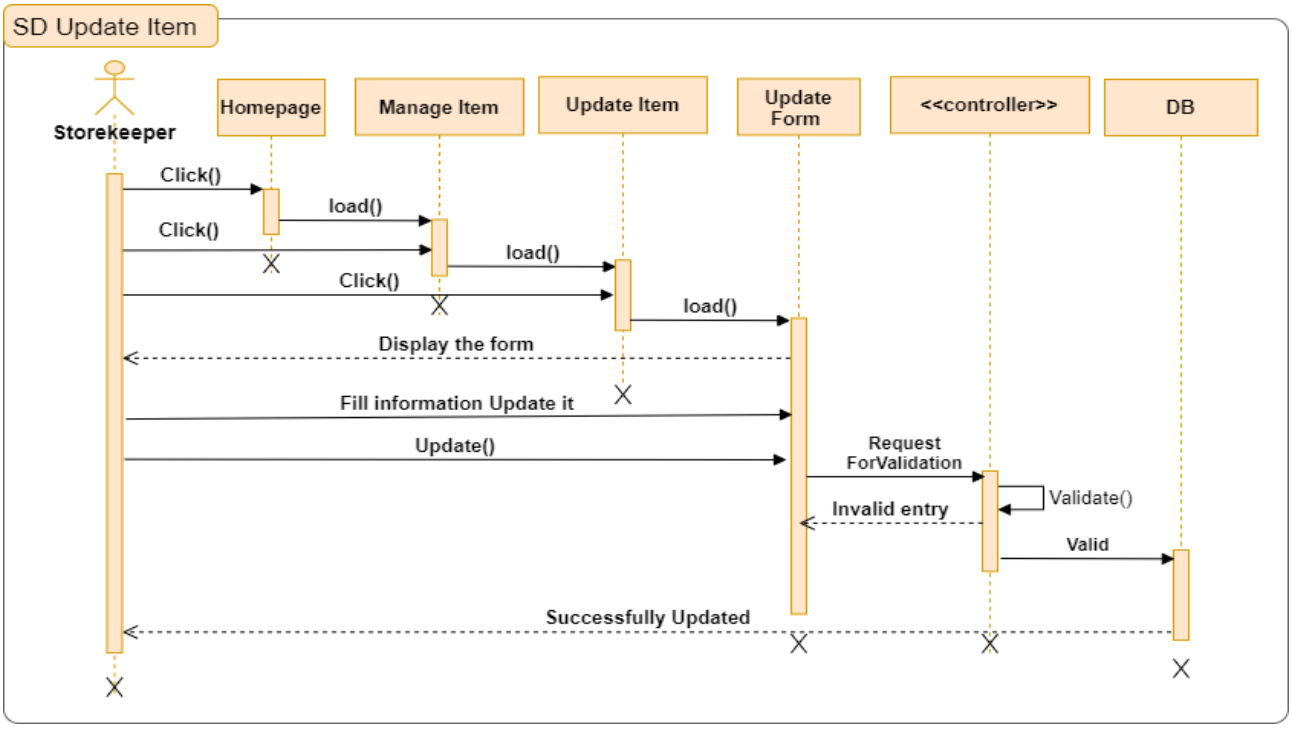

Figure 4. 5 Sequence diagram for update items

4.3.2 Activity diagram

The activity diagram is another important diagram in UML to describe dynamic aspects of the system. An activity diagram is a flow chart to represent the flow from one activity to another activity [7]. The activity can be described as an operation of the system. So, the control flow is drawn from one operation to another. This flow can be sequential, branched, or concurrent [7]. Activity diagrams deal with all types of flow control by using different elements like fork, join, etc. The purposes of the activity diagram can be described as:

- Draw the activity flow of a system.
- Describe the sequence from one activity to another.
- Describe the parallel, branched, and concurrent flow of the system.

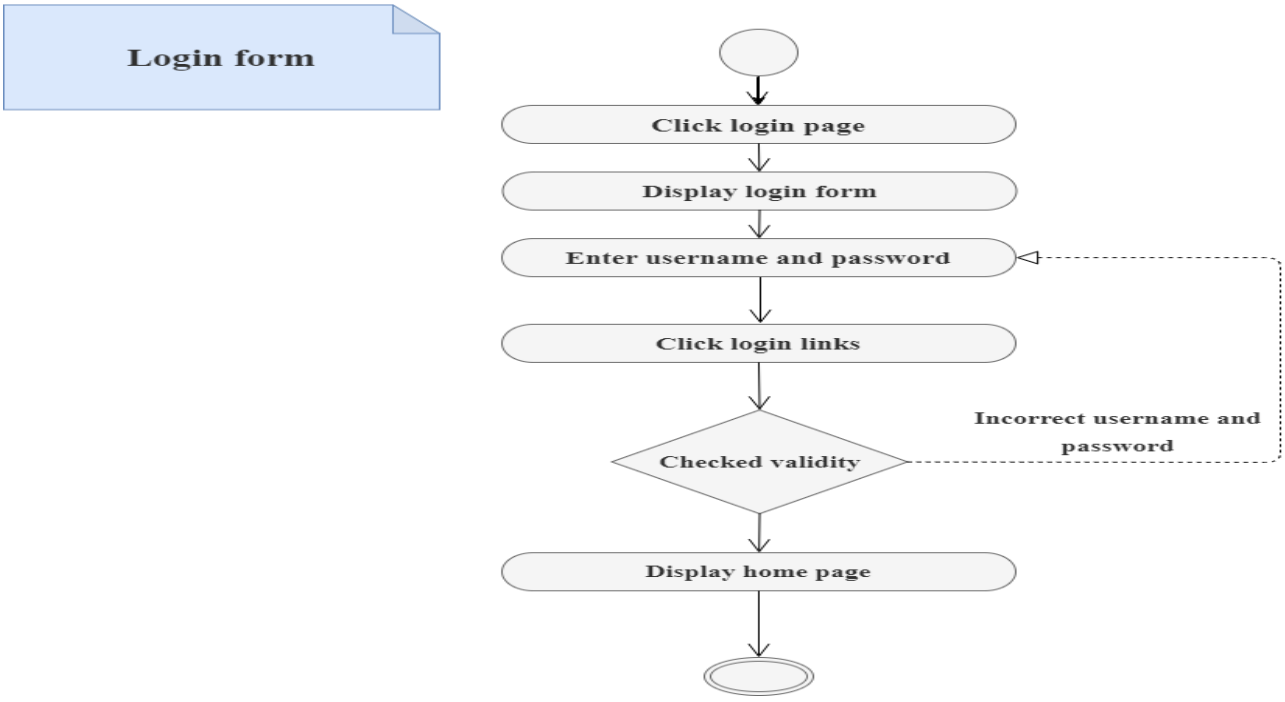

Figure 4. 6 Activity diagram for login

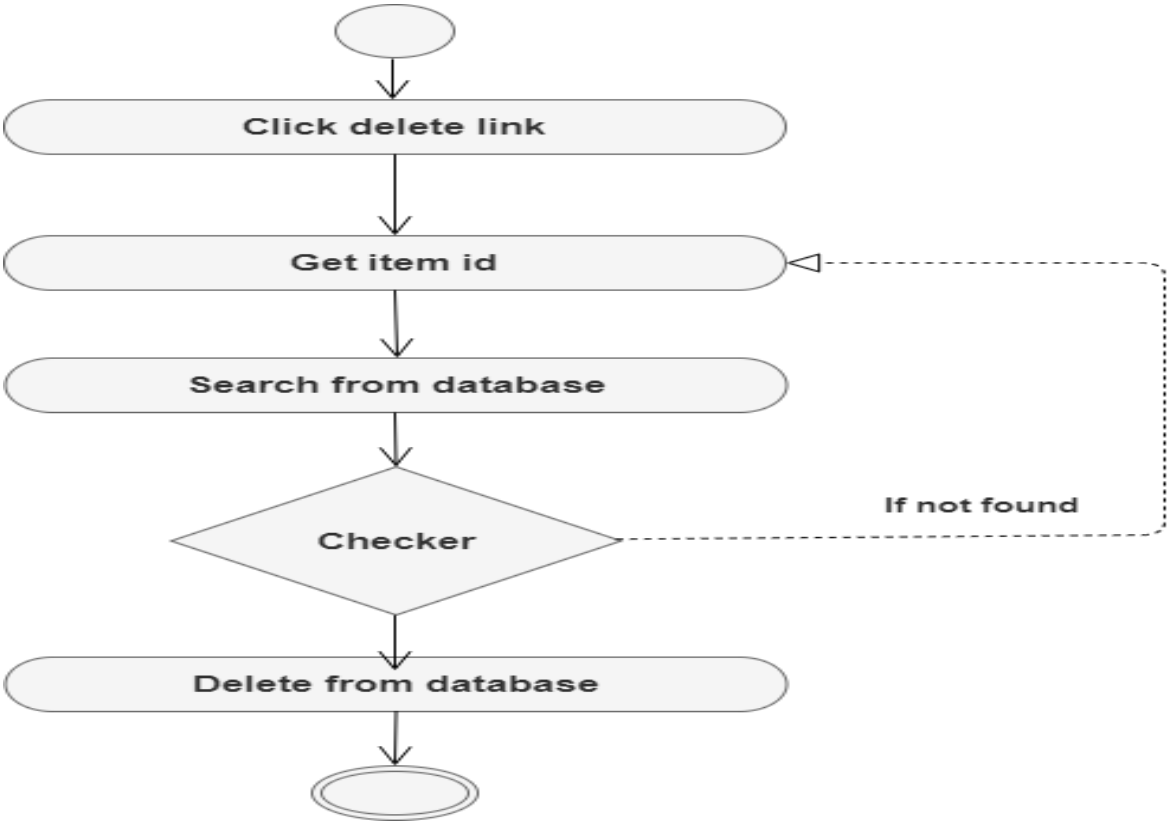

Figure 4. 7 Activity diagram for delete item

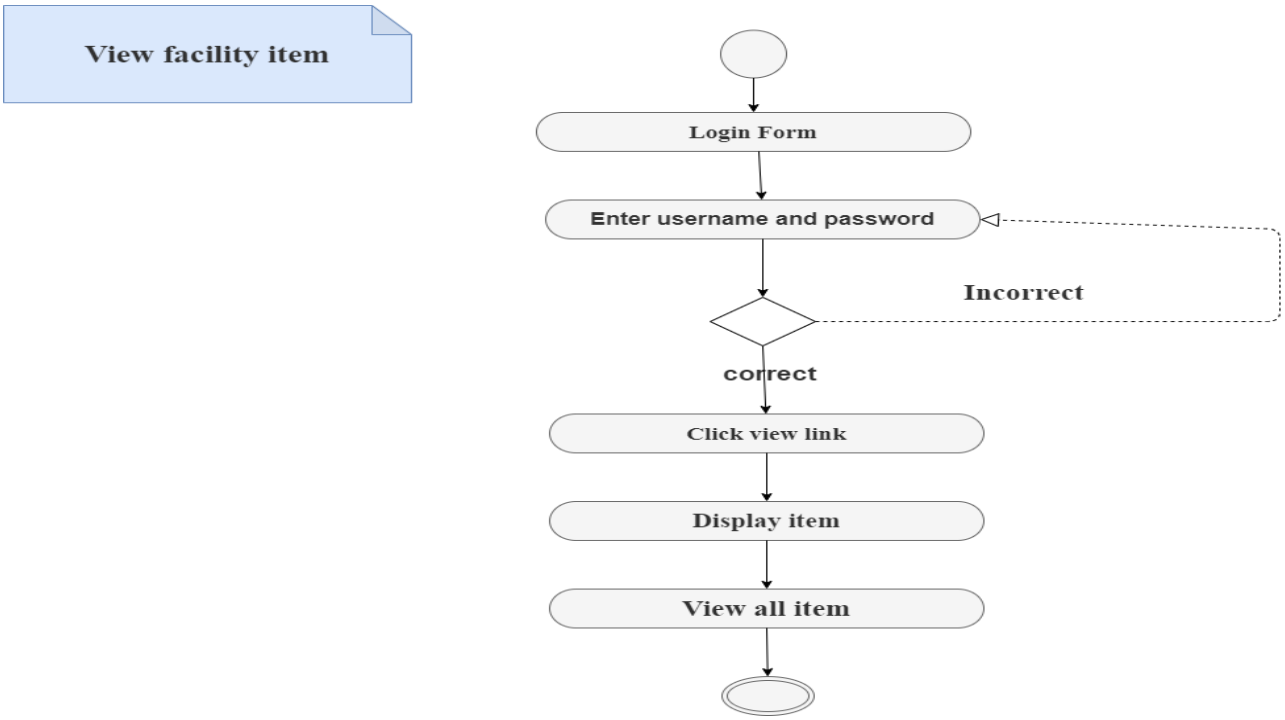

Figure 4. 8 Activity diagram for view facility item

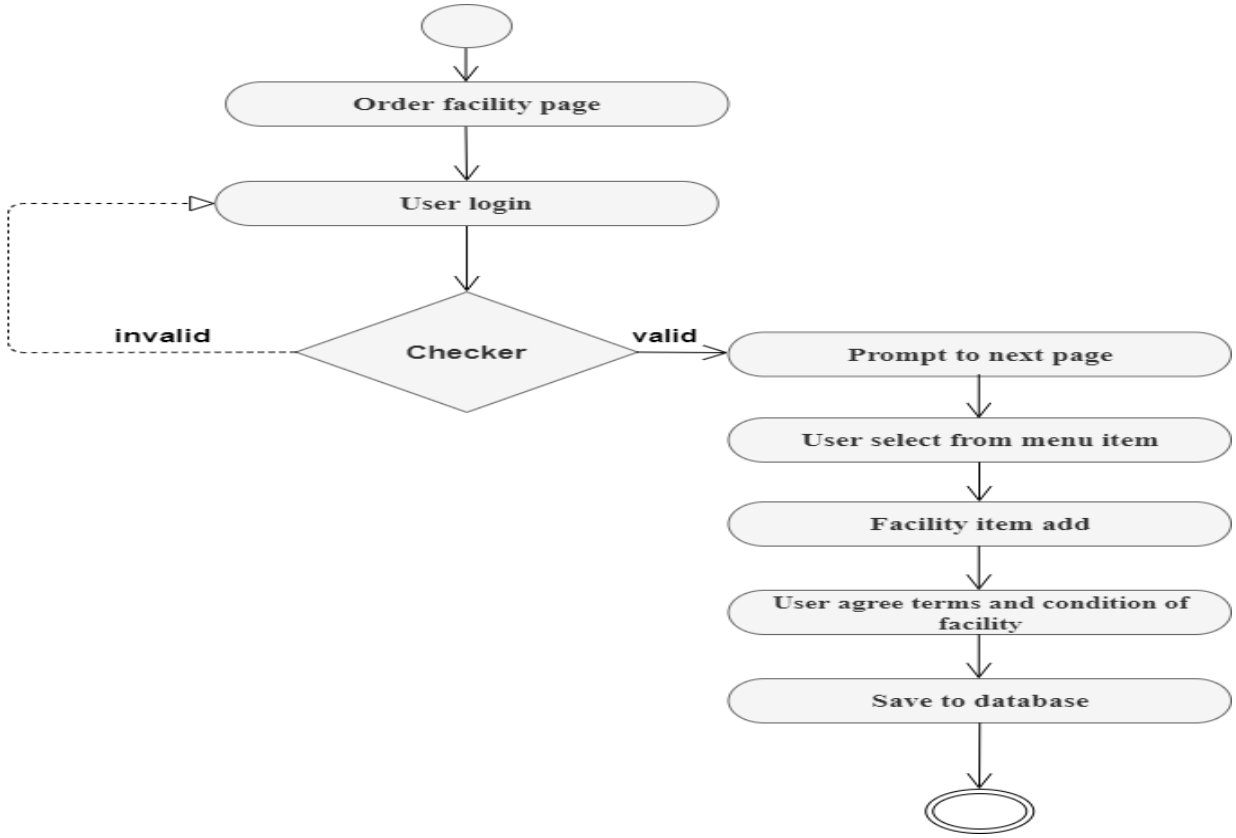

Figure 4. 9 Activity diagram for order facility

CHAPTER FIVE

5 SYSTEM DESIGN

In designing a process of facility system describing, organizing, and structuring system components at the architectural design level and detailed design level of facility resource. It converts functional models from analysis into models that represents the solution. This chapter describes the system design for a facility management system. In this phase, we illustrate the design goal of the project, component diagram, deployment modeling, and persistence model.

System design is the transformation of the analysis model into a system design model [8]. This is the System Design document defining the component, modules, interfaces, and data for a system to satisfy specific requirements documents to the facility management system [8]. The document includes system design, design goals, the architecture of our system, deployment design, and class interface [8].

5.1 Design Goals

The Design Goals specify the qualities of a facility management system that should be achieved and addressed during the design of the system.

- **User interface and the human factor**: - the system will have an easy and clear graphical user interface (GUI). Since the graphical user interface is simple, clear, and has clear user guide links and buttons, users who have little computer basic skills or with little training can use the system. In addition to simple and clear usage, the system graphical user interface (GUI) is more attractive for users and interactive to use the system. Our system has a simple and clear guide for users where to click or what to select to perform the desired action.
- **Hardware consideration**: - the hardware requirements of our system are considerably affordable and accessible. The system will use computer devices and deployment servers. These devices are already available. No need for a supercomputer or complex electronics devices.
- **Security issue**: - the user of our system will be only allowed users. Users must be registered into the system unless and otherwise, the system will not allow users for security purposes. Data editing or removing process is also performed by only users who have administrative

roles. Username and password validation rules are also part of the security policies of the system. The system will strongly withstand malicious attacks.

- **Performance consideration**: - performance of our system will be efficient. The response time and memory requirements are less to perform its tasks. The system will handle as many as possible users at a time. It required considerable response time. It can provide the desired service within a short period of time.
- **Error handling and validation**: - The systems can able handle exceptions that may happen while the user uses the system. It handles exceptions of data duplication to save memory space errors related to the facility management system.
- **Quality issue**: - Our system will be reliable by handling exceptions when the user uses the system as mentioned before and by performing its function consistently. In the quality assessing the users will be involved by a feedback mechanism in which they can give comments on the system. The system will have no quality issues.
- **Backup and Recovery**: - Data backup and recovery are the processes of backing up data in the event of a loss and setting up security systems that allow us to recover data as a result. It requires the copying and achieving of computer data to make it accessible in case of data corruption or deletion. The system will use physical (copy of physical database files that stores database information in another location and forms the foundation of the database recovery mechanism) and logical data (contains the logical data that is extracted from the database and consists of tables, procedures, views, and functions) backup and recovery mechanisms.
- **Physical environment**: - The system is deployed on the university's main server and any authorized user can access the system by using a web browser.
- **Resource issue: -**the resource issue will not be a problem in the system. Users can use the system by using any electronic device with the browser and the deployment of the system will be in the WKU server so there will be no resource issue to implement and use the system.
- **Documentation**: - For a system user-level document is provided that the users can read the document to know how to use the system and what functionality should the system support the user. And also, the development process is provided that users can read to know about the process and what type of model the developer uses to develop the system.

5.2 Proposed System Architecture

The architecture chosen for the system is three tiers. The first layer runs on the client-side, the second layer at the middle layer, and the third layer will be the database system. The system will run using web technology. This architecture provides greater application scalability, high flexibility, high efficiency, lower maintenance, and reusability of components. Since each tier runs on a separate machine, it improves systems performance.

- **Client Tier/ Presentation tier**

On the client-side, there are five kinds of users. The first user is the System Admin. This person is responsible for adding critical data to the system, controlling and activating the system. The second user is the Storekeeper. This person is responsible for registering items, distributing items, and managing items. The third client is the User; the responsible of this client is to send requests, view responses, and give feedback. The interface used by the user is the web form. The fourth user is an Employee; a person who works in a professional manner of facility tasks in the facility directorate that overtakes the task through the facility management system**.** The fifth user is the manager; a person who directs that coordinates or manages the facility directorate of the facility.

- **Middle Tier/Application tier**

The middle tier will contain the core parts of the facility management system, i.e., the webserver and business logic. The web server will handle all requests coming from the client machines. The requests are different with their type, for example; request for data insertion, request for report generation, and others. It is also the webserver which the responses are forwarded to the client machines.

The business logic part will hold the process and core functions that will be implemented in the system. When the data is submitted from the client machines, first it will be handled by the functions of the web server and then transferred to the business logic for processing. Again, the business logic processes the data and sends it either to the database or back to the web server, this is determined by the type of service required.

- **Data Tier/Database tier**

The system uses one database; this database is the repository consisting of the application data. It is here that all the database tables will be stored.

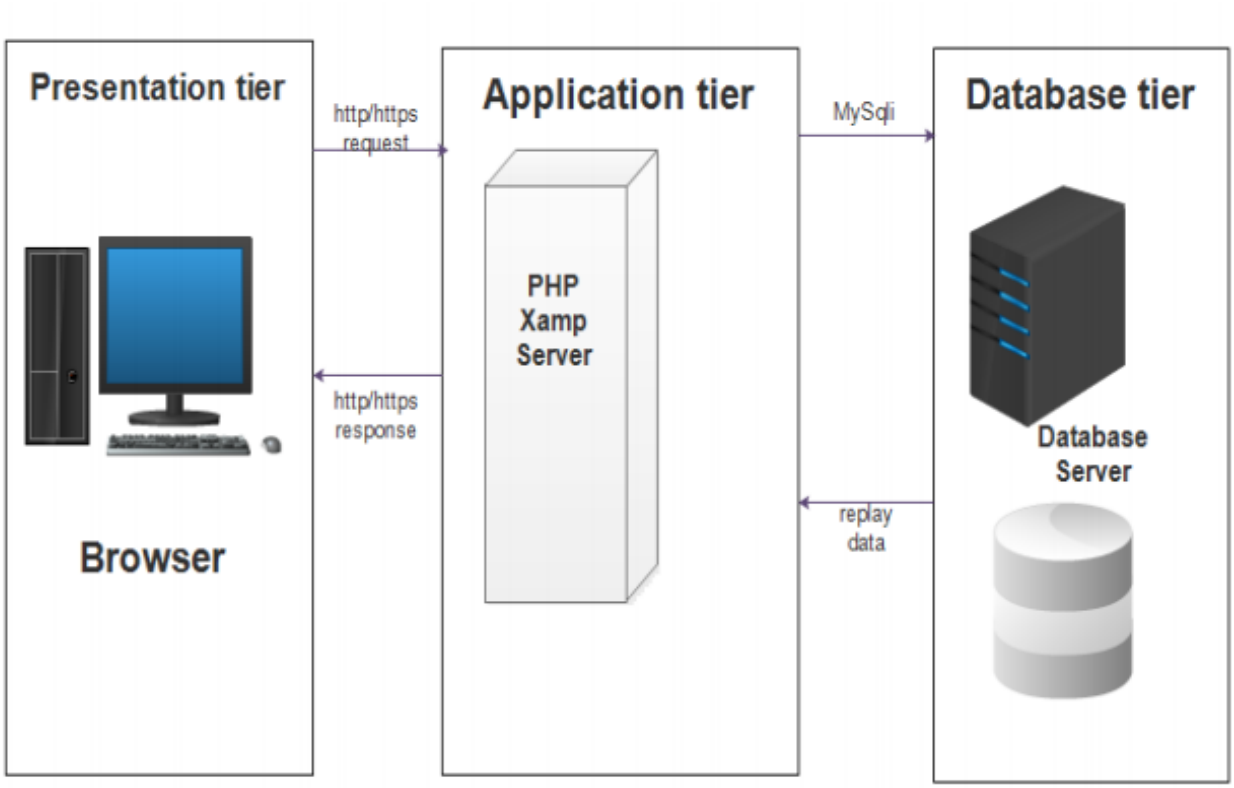

Figure 5. 1 Proposed System Architecture

5.2.1 Sub-System Decomposition and Description

In Subsystem decomposition, we reduce the complexity of the facility system. The subsystems that we take the classes that our systems contain and the operation performed in the class. The following are subsystems: -

- Report subsystem: This subsystem allows for managing information and performs this operation of the report.
    - Generate report
    - View report
    - Print report
- System administration subsystem: this subsystem manages information regarding the administration and performs the following operations.
    - Manage account
    - Manage users
    - Manage employees

    - Update profile
- Database Connection Subsystem: this subsystem is used for established connections between facility class and database management system.
- Feedback subsystem: This subsystem allows for managing feedback and performs the following operation.
    - Give feedback
    - View feedback
- Manage account subsystem: This subsystem allows for managing an account and updating a profile.
    - Create account
    - Activate account
    - Deactivate Account
    - View account
    - Update profile
- Item management subsystem: This subsystem allows for managing the registration process and performs the following activity.
    - Register items
    - Update items
    - Order items
    - Distribute items
    - Search items
    - View items
- Request Response subsystem: This subsystem allows for managing requests and responses and performs the following activity.
    - Send request
    - View request
    - Give response
    - View response

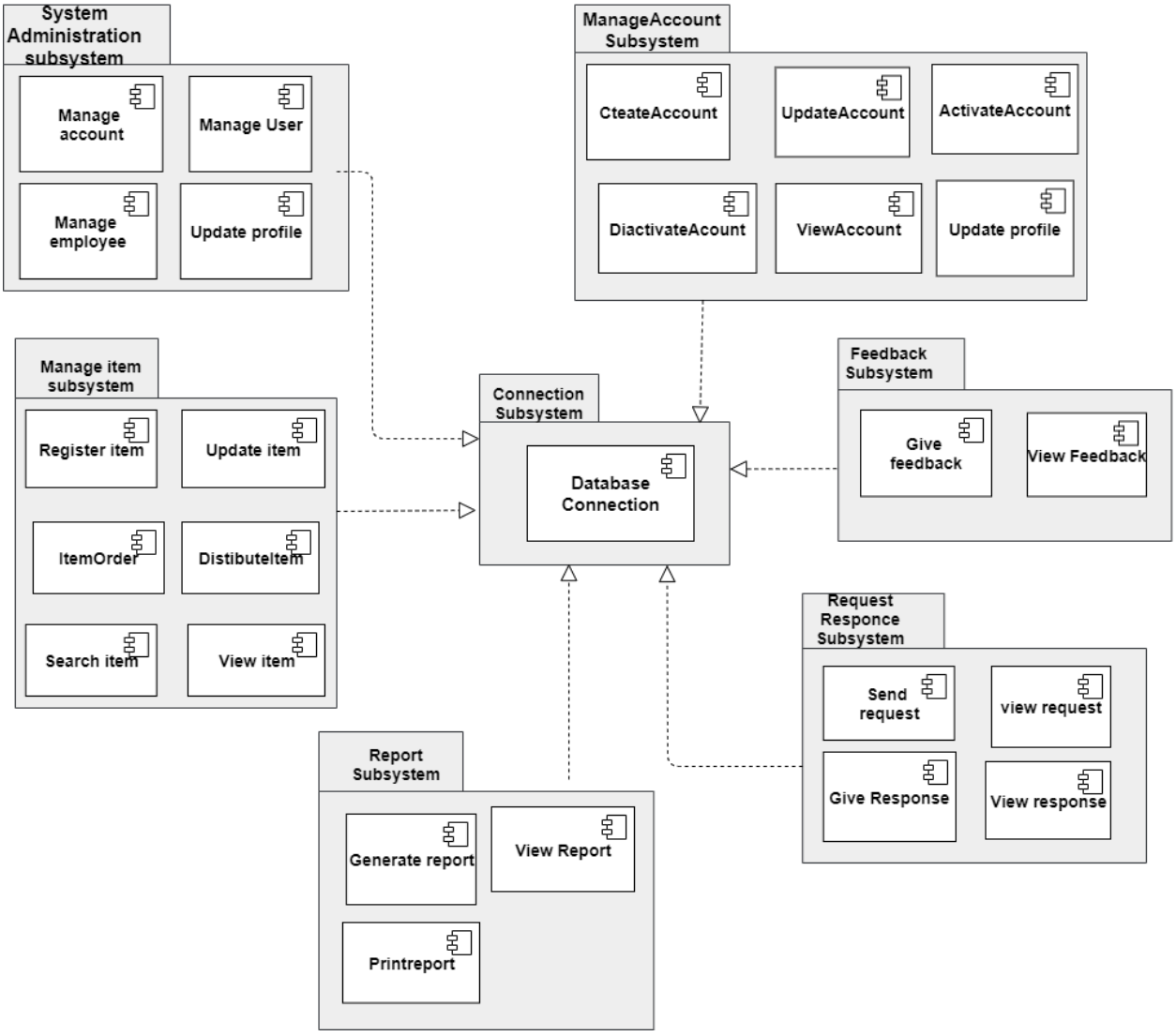

Figure 5. 2 Component diagram

5.2.2 Hardware/Software mapping

Wolkite University facility management system will be web-based that will be accessed through Wolkite University LAN. the webserver will run over Xamp Server, the programming language used to develop this product will be PHP and some scripting language such as hypertext markup language (HTML), Javascript (JS) and we have used MYSQL the database management system.

The hardware/software map shows how the facility management system and the hardware components work together. Their interaction can be shown by using a deployment diagram which shows a static view of the run-time configuration of processing nodes and the components that run on those nodes.

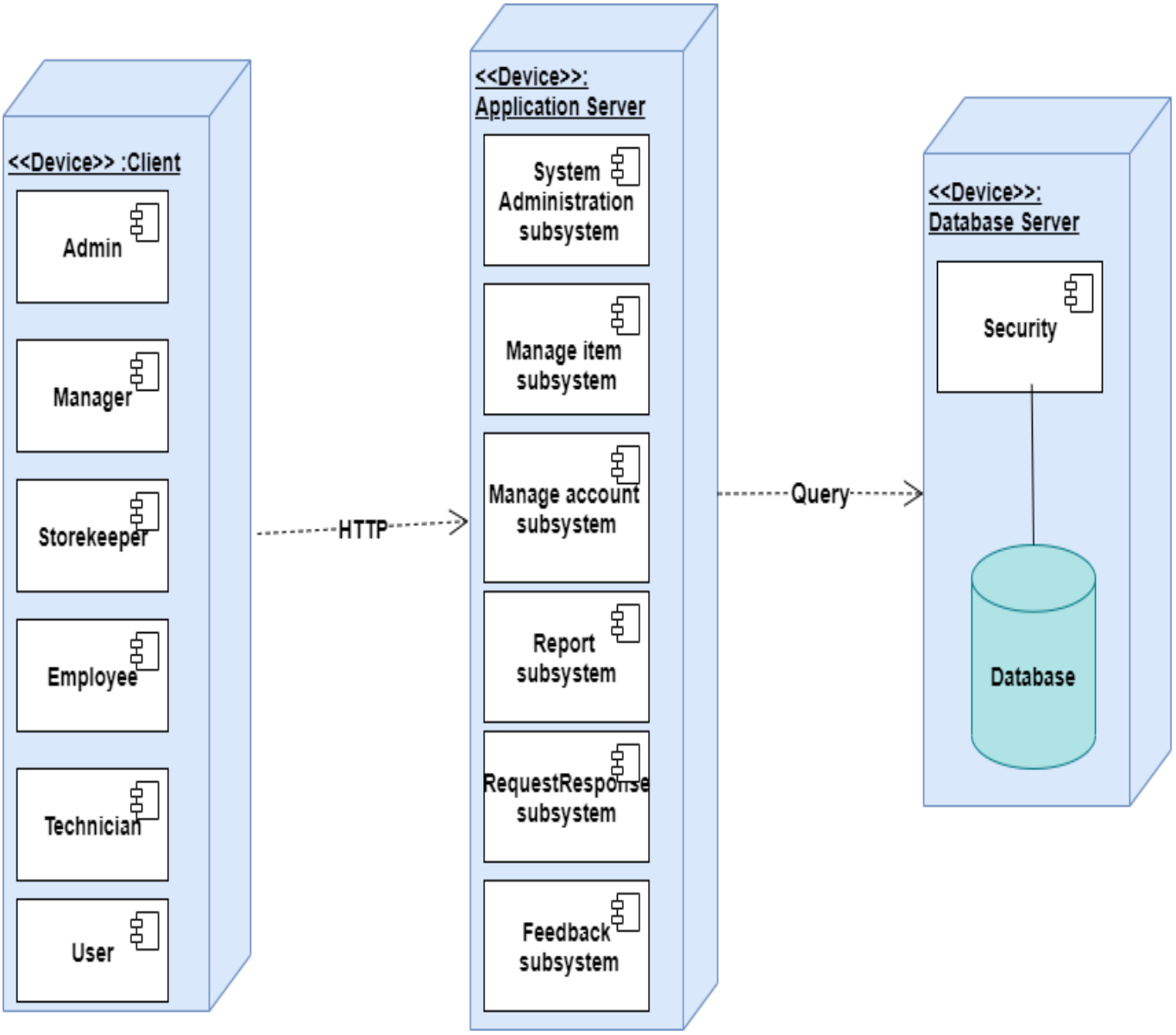

Figure 5. 3 Deployment Diagram

5.2.3 Detailed Class Diagram

Diagrams are used to represent the structure of the system in terms of objects, their notes, and the nature of the relationship between classes. It shows the static features of the actors and does not represent any particular processing. It is an abstraction of the real environment-class of, user and Administrator.

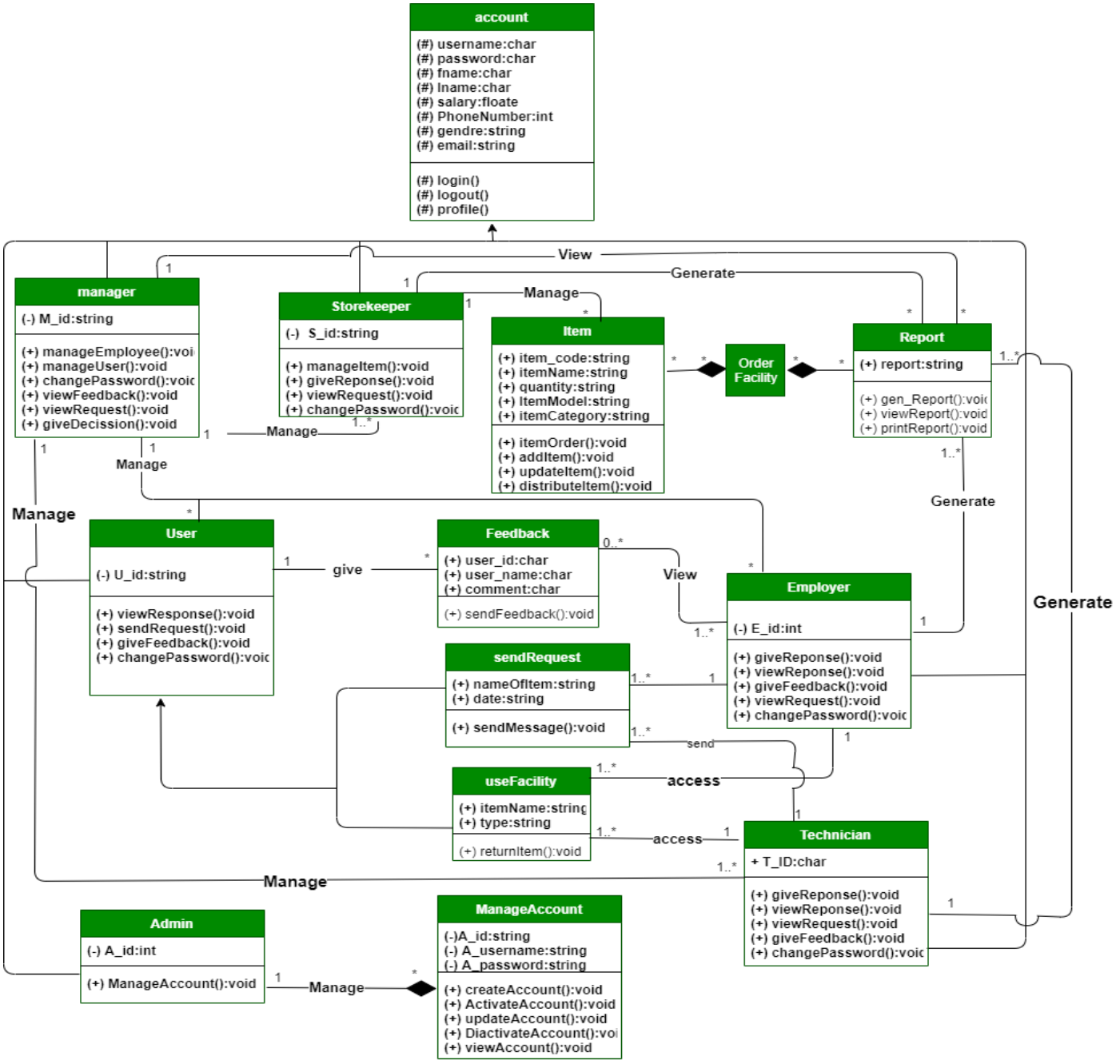

Figure 5. 4 Detailed Class Diagram

5.2.4 Persistent Data Management

Persistence data encapsulate the capability to store, retrieve, and delete objects/data permanently. In the current database system, we have used different tables as objects and each object is related to each other. This schema enables data manipulation activity such as select, search, delete, update on the database. The following tables indicate the persistence data management of the system.

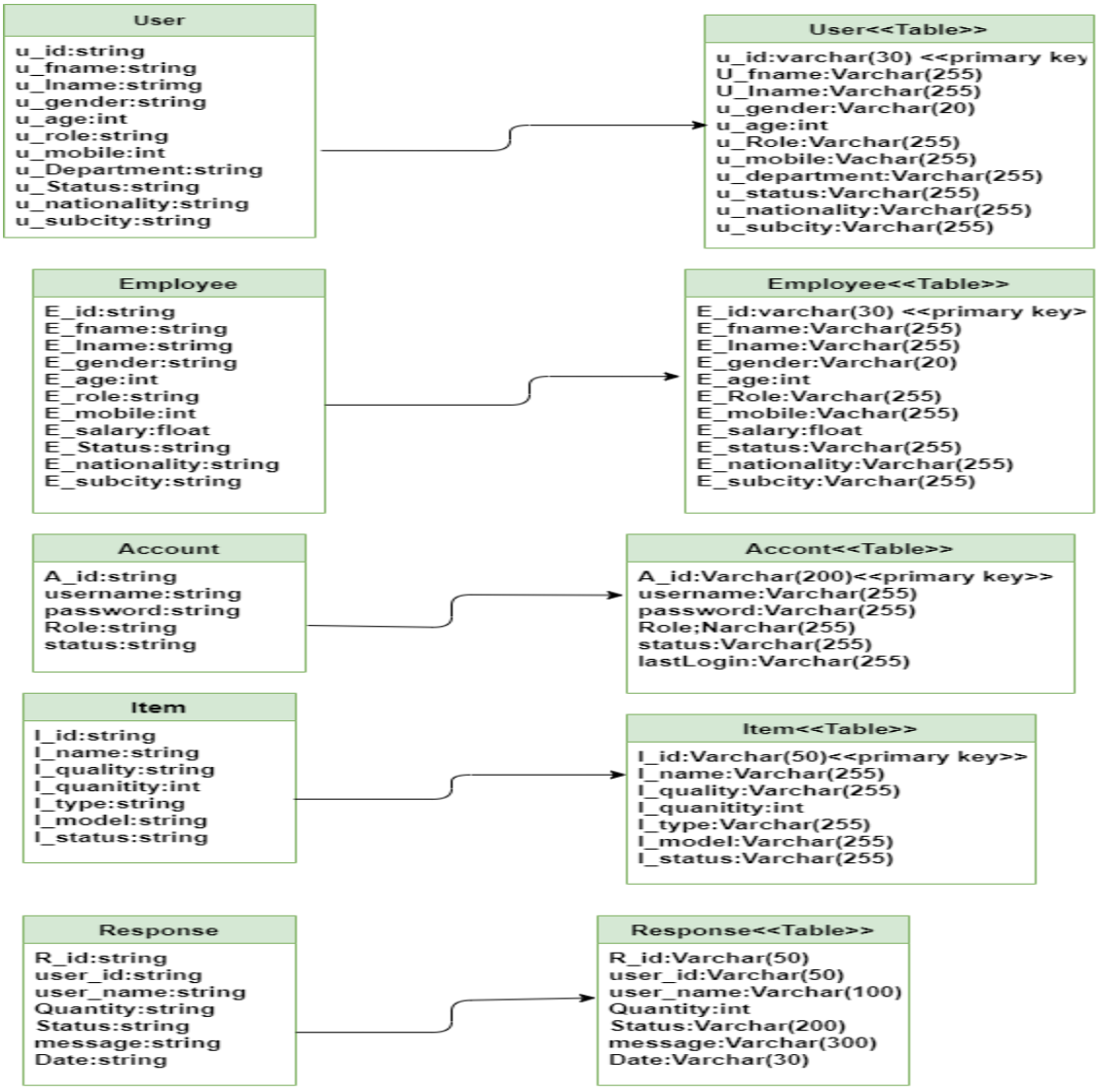

Figure 5. 5 Persistent diagram

5.2.5 Access control and security

Access control is a way of limiting access to a system or physical or virtual resources. In computing, access control is a process by which users are granted access and certain privileges to systems, resources, or information. In access control systems, users must present credentials before they can be granted access. In physical systems, these credentials may come in many forms, but credentials that can't be transferred provide the most security.

Table 5. 1 Access Control and Security

Function	Actor				
	customer	employee	storekeeper	manager	Admin
Create user account					✓
Manage account					✓
send Request	✓	✓			
Register employee				✓	
Request view			✓	✓	✓
Send response			✓	✓	✓
view response	✓	✓			
Manage item			✓		
Order item			✓		
Generate report			✓		
Send feedback	✓	✓			
View feedback			✓	✓	✓

5.3 Packages

A package diagram is a kind of structural diagram that shows the arrangement and organization of model elements in the system. It can show both structure and dependencies between subsystems or modules and shows the different views of a system. We use package diagrams to structure high level system elements and organized the large system into sub-modules [9]. We use packages in the system: -

To simplify complex class diagrams into classes package groups.

To group logically related UML elements.

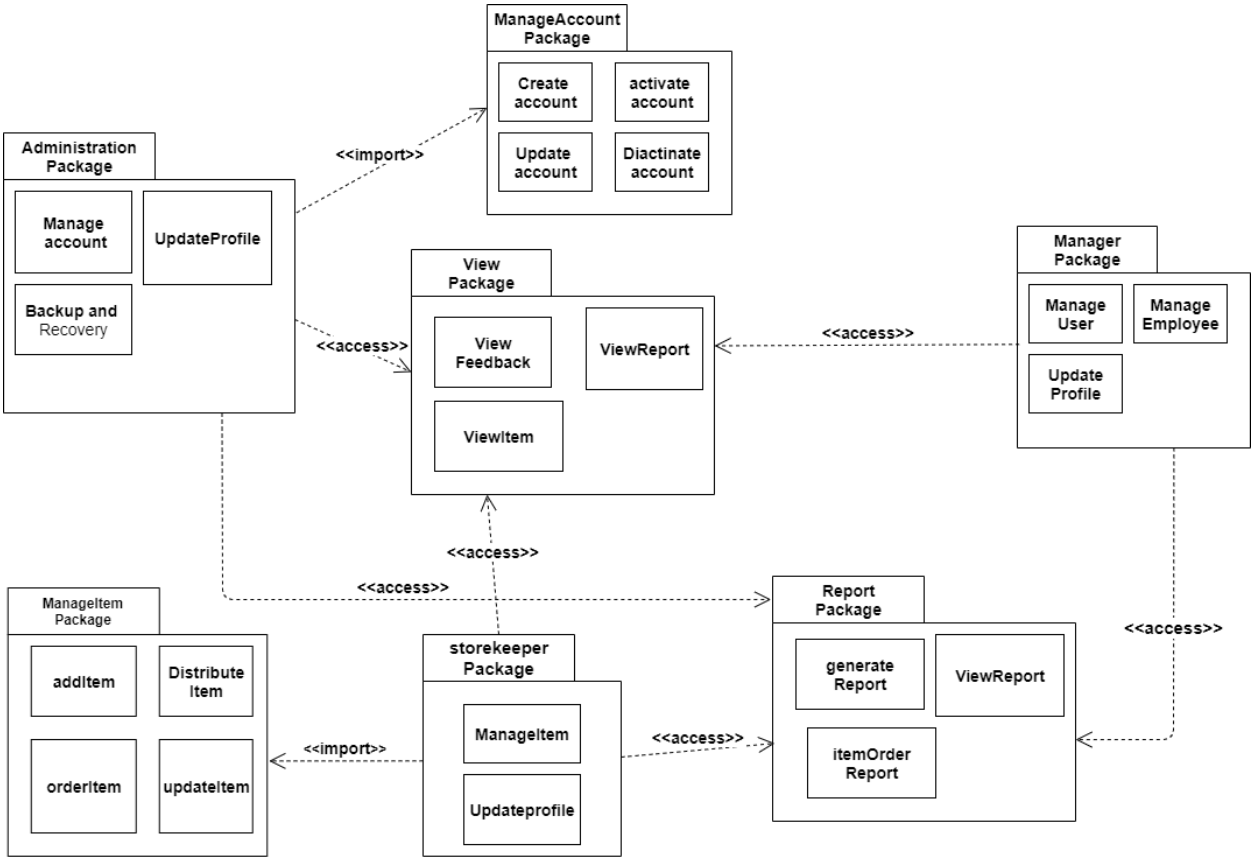

Figure 5. 6 Package diagram

5.4 Algorithm Design

It defines the algorithm required for each element of the architectural design to accomplish its tasks.

Pseudocode for **login**

Method name: **login**

Begin

If (user click the Login button)

Fill Login Form

If (valid)

Redirect to an authenticated page

Allow performing the privileged task

Else

Display error message.

Redirect to login page

Ask the user to refill the form

End if

End if

END

Pseudocode for **logout**

Method name: **logout**

Begin

If (the user login to the system)

then click the logout link

Delete cookies and display the home page

End if

End

5.5 User Interface Design

With the focus on maximizing the user experience, we have designed the user interface diagram. We put some user interface simulations for our facility management system. We design the user interface of our system to make the user's interaction as simple and efficient as possible. The following are some user interfaces of our system.

Figure 5. 7 Home page user interface

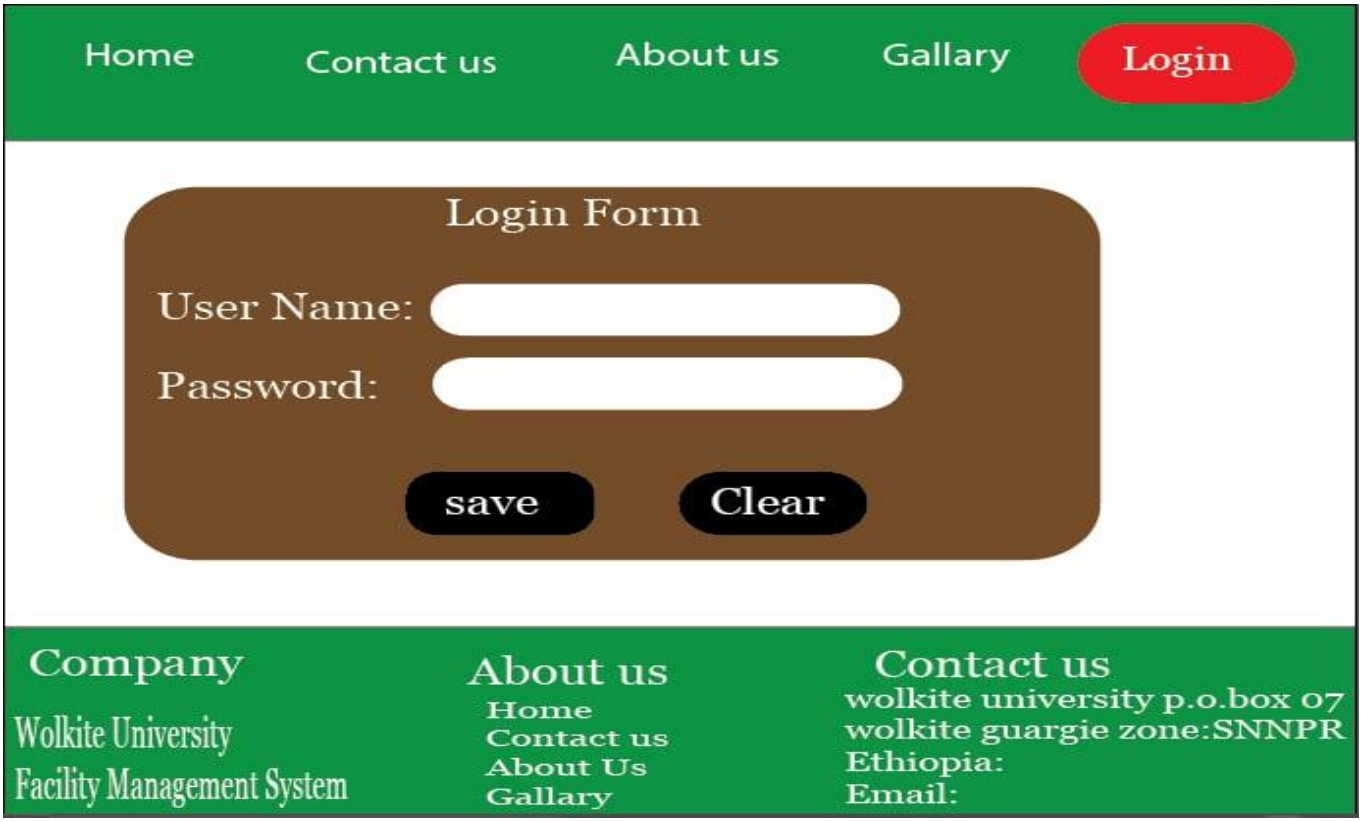

Figure 5. 8 Login user interface

Figure 5. 9 Employee registration form

Figure 5. 10 Item registration form

References

[1] W. F. DIRACTORAT, "Facility Management System Principle guideline," *Wolkite University Facility Management System Principle,* p. full, 2022.

[2] "Tutorialspoint," 1 2022. [Online]. Available: https://www.tutorialspoint.com/system_analysis_and_design/system_analysis_and_design_quick_guide.htm. [Accessed 2021/2022].

[3] "WIKIPEDIAN," [Online]. Available: https://en.wikipedia.org/wiki/Object-oriented_analysis_and_design. [Accessed 2021/2022].

[4] "TECHTARGATE," [Online]. Available: https://searchsoftwarequality.techtarget.com/definition/use-case. [Accessed 2021/2022].

[5] "santos.cs.ksu.edu," [Online]. Available: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjEgs_k3aX2AhVb8LsIHdefACUQFnoECAMQAQ&url=http%3A%2F%2Fsantos.cs.ksu.edu%2F771-Distribution%2FReading%2Fuml-section3.21-51.pdf&usg=AOvVaw2juYgoY2DQZ_MzFMSnFKLw. [Accessed 2021/2022].

[6] "VISUAL PARADIYM," [Online]. Available: https://www.visual-paradigm.com/guide/uml-unified-modeling-language/what-is-sequence-diagram/. [Accessed 2021/2022].

[7] "TUTORIALEPOINT," [Online]. Available: https://www.tutorialspoint.com/uml/uml_activity_diagram.htm#:~:text=Activity%20diagram%20is%20another%20important,an%20operation%20of%20the%20system.. [Accessed 2021/2022].

[8] "TutorilPoint," [Online]. Available: https://www.tutorialspoint.com/system_analysis_and_design/system_design.htm. [Accessed 2021/2022].

[9] "Lucidchart," [Online]. Available: https://www.lucidchart.com/pages/uml-package-diagram. [Accessed 2021/2022].