WOLAITA SODO CITY ADMINISTRATION

Title: Wolaita Sodo City Web Based Water Billing Management System

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Abstract

This analysis document will prepared to describe and explains what the proposed system will do and how it works. City water supply services management have focused on improvements in the environment and has been applied in city planning, public transport systems, parks and recreational spaces, low-income and housing areas where people feel most deprived of the basic for life services. The general objective of the project is to design automate system and to assess/survey the customers‟ satisfaction level with regard to Sodo water supply service provision focusing people from different settlement, income and educational groups. This helps to see partly if the service provision has variations in availability, quality and quantity as per the parameters and identify areas where customers would like to be improved. Besides, the paper has tried to see the existing policy framework in relation to water service in urban areas. The project is carried out in the case of Sodo City. Both primary and secondary data sources were used to compile this project. The main cause of dissatisfaction in the city is water shortage and continuous interruption. The existing source of water supply in Sodo city is ground water source treated, and distributed through network. However, this source lacks reliability, accessibility and sustainability. Even" **Liqimissia"** water project production is not sufficient to the existing population those in the Sodo City. Infrastructure is handed over to the city administration, which

is then responsible for establishing a City Water Supply and Sewerage Service, also referred to as a City Water Utility. These autonomous public enterprises are responsible for the management of city piped schemes. The general manager of a City Water Utility is responsible for organizing, directing and administering the activities of the utility and its staff within the different sections (human resources development, finance and property administration, operation and maintenance, etc.).

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Chapter-One

1. Introduction

1.1. Background of the Project:

Water is the vital resource and is a basic need for human being and their natural environment; like: food production, drinking purposes sanitation and many other uses. Different international agreements have recognized the access to clean water and sanitation as basic human right [1]. Despite the efforts of numerous international commitments, a significant number of populations are lacking access to safe water and sanitation. In developing countries 1.1 billion people have inadequate access to water, and 2.6 billion people lack basic sanitation [2]. Due to the lack of access to safe water and basic sanitation at least 1.6 million children under the age of five die every year [2]In developing countries the wide inequality in opportunity has worsened the access problem; the poor has less access to safe water and sanitation; consume less, pay more for the service and suffer more from water related diseases. The situation in Africa, particularly in sub Saharan Africa is worst. In urban areas access through household connection is as low as 16% .A Project by American arms corps engineers reported that African economic loss due to lack of safe access to water .The water and sanitation coverage in Ethiopia is one of the lowest in Africa. Sodo City is one of the fast urbanizing centers in the country; the rate is higher than the national average. The office is still mindful of the fact that without satisfied customers, we cannot have raving fans. There is obviously a strong link between customer satisfaction and loyalty, and that’s why it must regularly measure and track changes in customer Satisfaction. With better understanding of customers' perceptions related to the services, it can determine the actions required to meet customers' needs.

Measuring customer satisfaction also helps to promote an increased focus on customer requirements and stimulates improvements in the work practices and processes. Under this standard we are required to identify parameters that cause customer satisfaction or dissatisfaction and consciously measure them. The sanitation situation of the city is in poor condition; in the city there is no sewerage system, the liquid and semi solid wastes are disposed off at uncontrolled open dumping areas such as, rivers open fields and agricultural farms in environmental and health hazardous way because there is no treatment plant or liquid waste disposal site.

1.2. Statement of the Problem

The existing system of the city has different problems. These are difficulty of modifying customer information, time consumption because of manual work for simple tasks such as identifying customer name, status etc., lack of security in terms of accessing of the customer information by anybody, errors happened since the work has done manually (lack of accuracy), lack of reliability since the work is done manually and buying the paper, pen, pencil and etc. needs more cost and more labor.

1.4 General Objectives

The general objective of this project is to automate web-based water supply service management system for wolaita Sodo City.

1.4.1 Specific Objectives:

The specific objectives were:

- ✓ To study the existing system
- ✓ To collect data from different data source
- ✓ To analyze data gathered with respect to system requirements
- ✓ To design the new system for water supply service management system
- ✓ To implement the new system
- ✓ To generate different required reports

1.6. Scope of the Project

The scope of this project is clearly stated below because of what the system is expected to perform. The proposed system will cover the following main tasks:

- Manage accounts (create, update and delete accounts).
- Generate different required reports.
- Add newly coming customers.
- Online payment for water supply services.
- Provide information to customers
- The system can be work text based (English language).

1.7. Significance of the Project

In light of the problem statement, assessing the subject "customer satisfaction" in regard to water supply service provision will have some paramount importance on account of the following justifications. There are a number of reasons considered to be the causes for customer satisfaction or dissatisfaction with urban water supply service. The results of this project will add to the current knowledge on the satisfaction/dissatisfaction level of customers" based on a certain parameters and distribution and equity aspects in relation to sustainability of the service. Currently, the technical and financial aspects are thought to be the main barriers for the improved service. The findings also will provide information for concerned bodies and serves as a basis for taking action and develop strategies and programs to mitigate dissatisfaction been included.

1.8 Feasibility of the New System

1.8.1 Economic Feasibility

The proposed web-based water supply service management system is economically feasible because:

- The system requires very less human power and equitable distribution
- The system will provide fast and efficient automated and interactive environment.
- The system has had GUI interface which is user-friendly system.
- This project is economically feasible because its anticipated benefit is greater than the expected cost.

Budget break down

1) Tangible costs

The tangible costs to be acquired in developing the system are:-

- Cost schedule which includes hardware development cost.
- Software development cost
    a. Hardware Cost schedule

This cost contains the various types of costs in which we spent for the development of the project or the University covers some of the hardware expenses.

The following table lists the different costs schedule that we spent in the process of the development of the system.

Resources	Amount	Unit Price	Total Price
Pen	6 pens	10 Birr	60 Birr
Printing	40pages and above	3Birr	120 Birr
Flash disk	1	330Birr	330 Birr
Laptop	1	25000Birr	25000 Birr
Network cable	5m	40	200 Birr
Total			25710 Birr

Table 1 Schedule

For this project we will use different software.

Type of Software's	Price
Microsoft windows 7/8.1/10	Free download
Microsoft Office	by the College
MySQL from WAMP	Free down load
Edraw for UML 11.0/Microsoft Visio /Rational Rose	Free download
Notepad++	Free download
Total	0.00 Birr

Table 2 Softwares

b. Intangible Costs

Those are costs which are un countable. The intangible costs to be acquired in developing the system are: -

Human Knowledge

Our knowledge that we will spent to develop the system may not be measureable in terms of money.

1.8.2 Technical Feasibility

We will have technical knowledge about:

- PHP to write the code or implementation with WAMP local host server.
- Mysql to build the database to store the information about the system.
- Requirement analysis to know the stockholders constraint for their satisfaction

- Unified Modeling Language (UML) model to do analyzing and designing in good manner.

The technical requirement for the inventory management system in order to do their operation by the new computerized system:

- Skill to provide training for the client

1.8.3 Operational Feasibilities

It determines how the proposed system satisfied the organizations need and it also offers Secure, accurate and efficient system to the organization.

The system in which we had being developing is also compatible to all operating systems and web browsers.

1.9 Methodology for the project

1.9.1 Fact Finding Techniques

The Methods and techniques we will use to analyze the existing system and designing web based system includes, interview, document analysis and practical observation. Those methods which help us to gather the required data to analyze our project and those methods selected due to the time and the organization's willingness.

1.9.1.1 Primary source

1. **Interview**

We will implement our data collection in our selective area was making interview with the organization's stakeholders. We have the chance to make interview with wolaita zone water and Sewerage office manager Mr._**Kidist Fanta**_ we tried to under stood the existing system in the foundation and give us more information about the existing problem and work flow in the foundation.

2**. Onsite Observation**

It helps us to get real information how the organization performs its function and this helps to strength the data that gathered through interview and document analysis. We had done on site observation in the organization and tried to get full information.

Secondary source

The data for the web based water supply management will be collected from water supply management offices and individual project designer and the data for financial analysis was collected from water utility. Other spatial data is also collected from different maps, Municipalities, utilyl office, urban development bureau and others. Ground verification works are also conducted.

1. Document Analysis

This technique provides information on how the existing system works. Therefore, documents are related to the existing system of the organization has assessed.

1.10 System Analysis and Design technique

In this project, our team has used object-oriented system development methodology (OOSD) for the design. Our team selected Water flow Model to develop our system. B/c Water flow Model has the following important:

- To decrease the cost of software maintenance.
- To simplify the design and implementation of our system.
- To enable a high degree of reusability of designs and of software codes.
- To increase consistency among analyzer, designer and programmer.

This technique has several phases some of them are:

I. Object Oriented Analysis (OOA)

During this phase the team we will used to model the function of the system (use case modeling), find and identify the business objects, organize the objects and identify the relationship between them and finally model the behavior of the objects in detail.

II. Object Oriented Design (OOD)

During this phase our team we will used Edraw software to refine the use case model and rational rose for designing the sequence, collaboration, activity diagrams and to model object interactions and behavior that support the use case scenario.

1.11 Development Tools

For the development of our project we will have used the two types of materials those are software tools and Hardware tools.

1,11.1 Software tools

Activities	Tools/ Programs
Client side coding	HTML/DHTML/XML
Client side scripting	JavaScript
Platform	MS Windows or Linux
Database server	Mysql
Web server	Wampserver
Server-side scripting	Php
Browsers	IE 5.5/6.0/7.0, Mozilla Firefox 3.0./opera
Editors	Macromedia Dreamweaver, MS Excel,
Documentation	MS Word, MS Excel
User Training	MS PowerPoint, Video Player
Varied technologies	As per the technical requirement in future

Table 3 Tools

1.11.2 Hardware tools

In this project we will have used some computer and related peripherals that will be used during the hardware development phase. The development system has been used because it can accommodate multiple users, maintain large volumes of information and support a rich assortment of hardware tools.

- Personal Computer: - Dell computer, Toshiba, Hp Lenovo and etc…
- Flash Disk:8GB above
- Network Cable:cat5 and above
- Processor:2.5GHZ and above
- Hard Disk:465GB and above
- RAM:4GBand above
- Screen: 800X600pixel resolution.

1.12 Limitation of the Project

The new system only includes activities in Wolaita Sodo city water supply management office and it doesn't consider other places. The new system only works in text based and does not use on speeches.

Chapter Two

2.1 Introduction to the Existing System

This section describes how the existing system of the Wolaita Sodo Water Service and Billing system actually works with related to the area on which the project tried to address. It describes the Sodo City water service and billing system problems associated with the existing system and also to suggest the possible ways of solving the problems. The current Wolaita Sodo City Water Service and billing system is manual. The customer directly goes to the billing office and looks for different consumption services given by the office. In some forms there are intermediate persons (meter reader) between the customer and the billing office. In the present scenario water meters are deployed in all houses. The current procedure with regard to the billing process for water is not a fully automated system. It involves manual processes from the time the Meter reader starts reading the meter until the system is updated with the current reading. A meter reader visits a house, does the meter reading, and then manually calculates the amount considering the units consumed. Back in the office a data entry officer enters the meter readings into the system manually and a bill generated and given to customers. Then the customer must go to the water supply service to pay the bill according to their usage. The procedure is far from satisfactory and it is believed a better system using available technologies would definitely be an advantage.

Under this chapter also deals with analyzing the purpose, goals, objectives and function of the existing system on water service and billing system. It produces a broad outline of the proposed system that identifies the function to be performed and the technical aspects that the system must fulfill and briefly describe the existing system functionality, problem of the existing system. It also deals with the functional and non- functional requirements of the proposed system. During this phase, the analyst must become fully aware of the root problems and must develop enough

knowledge about the existing system to enable an effective solution to be proposed. The first exercise is assembling of the formal requirement for the proposed system. The second exercise is logical modeling that allows the analysis to view the current system by focusing on what it does instead of how it does.

2.2 Players in the Existing System

Some of players in the existing system are:-

Administrator

Manager

customer

Officer

Meter Reader

2.3 Major Functions/Activities in the Existing System

The Major Activities Done in Existing System are listed below

Major activities for water service and billing system are:-

Input: - inputs for water service and billing system are name, phone, meter number, customer name, meter, meter read, current read, previous read, consumption fee, per consumption fee, total fee and date (date, month and year) the place where the customer live (block and sub city).

Process: - the meter reader fills information in the prepared form in the billing office. Also fill the necessary information and to provide service and bill by appearing physically.

Output: - as an output the customer receives the bill in manual or hardcopy.

Major activities for water service or meter providing system are:-

Input: - inputs for online water service and billing system are name, phone, meter number, customer name, meter fee and date (date, month and year) the place where the customer live (block and sub city).

Process: - the customer fills the information.

Output: - as an output the customer gets meter and meter maintenance services.

2.4 Business Rules

Existing system has its own business rule and regulations. In every organizations or institutions there are rules and policy, which used to govern all activities in specified work flow, control the work flow, and performed in the work environment. So Wolaita Sodo City Water Service and billing system has its own business rule and regulations of water service providing and billing.

This rule and regulations must be fulfilled by customer as well as system officers, to view and provide services to customers. The rules are:-

For Wolaita Sodo City Water Service and billing system

Customer must have a unique ID (identification card).

Business rule is a rule in which the organization uses it to perform any activities or invoice. Water meter is the property of the Authority therefore only the Authority has the right to install, to remove, to change, transfer and to clean to inspect a water meter.

The customer shall notify the authority as soon as he/she is aware that the meter is broken or has been damaged.

The Authority shall demand the payment of the water charge from the customer According to its tariff and the consumption of water as show by the meter.

Unless it is proved that the meter is not making correct reading, or is broken, the reading shall be accepted by the Authority and the customer.

Where the correctness of the meter is doubtful the customer may request the inspection of the authority.

The authority may also at any time inspect the meter as its own initiative.

Where the customer fails to pay the require water charge, the Authority shall give him two consecutive periods of months within punishment and finally the water bill removes from customers.

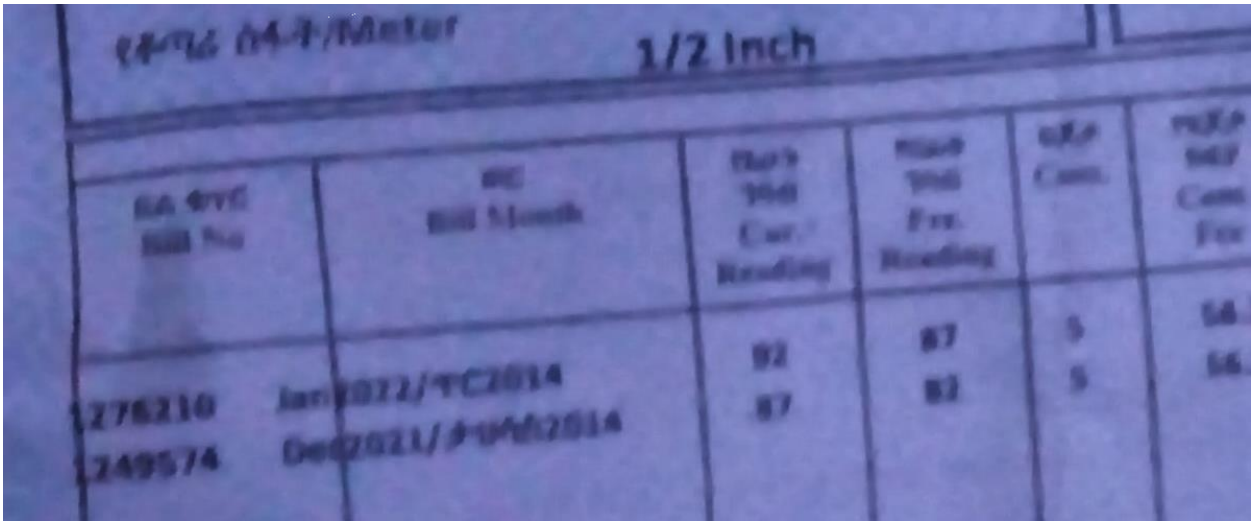
2.5 Report Generated in the Existing System

Current system of Wolaita Sodo City Water Service and billing system in Wolaita City is manual. From this system we take some forms of the existing system as they are

2.6 Forms and other Documents of the Existing Systems

Forms and other Documents of the Existing System The following are forms and other documents used in the existing system. Contract for supply of water:

Date, full name, address, woreda, kebele, house no, placement no, house phone no, mobile no, email, service type, purpose of water is to be signature, contract no, application tariff, and authority sign.



2.7 Bottlenecks of the Existing System

Existing system (web based Wolaita Sodo City Water Service and billing system) needs web browser and personal computers, but the manual system is more difficult for Wolaita Sodo City Water Service and billing. There are a lot of problems in the existing system as compared to the proposed system. Here the problem is that the accuracy in reading of the units consumed is very erroneous. This happens due to various factors such as: -

We don't get an accurate reading of the consumption in units at the end of the month due to improper functioning of hardware in some parts and hence there is also no easy way to make repairs timely.

The payment of the users is not in timely manner and hence the whole system is not properly organized. Even if the user wants to pay there is not facility to payment method which can be achieved quickly.

These problems can be seen from the following perspectives like performance, information, economic, control, efficiency and services given by the existing system to the users, by using the PIECES framework as follow: -

2.7.1 Performance (response time)

Since the existing system is manual, it takes long response time. For example when one customer needs to get services or it needs any necessary material he/she must appear physically in the places and it takes long time. The acceptable response time for a particular task is large. But in the proposed system problems can be solved by the new system at a time.

2.7.2 Input (Inaccurate/redundant/flexible) and Output (Inaccurate)

Input

Meter read does not contain their full information on the papers.

Receive the incorrect/redundant meter read and payment bill.

To fill incorrect customer name, customer identification number, block number, phone number, address, sub city or kebele and the specific time.

Out Inaccurate

Dual or more bill receipt can be printed.

Incorrect amount of payment

Incorrect calculation.

2.7.3 Security and Controls

In the existing system security and control is somewhat unexpected outcome. It is difficult to control the system because there is no privilege in data accessing. Here the necessary reports may not generate at exact time so it may occur security violence. The system shouldn't provide sufficient protection for access and manipulation of the records associated with the system. So it is not easily protected and used properly the resource.

2.7.4 Efficiency

In manual operation, most of the activities are prone to wastage of resources like papers, man power, transportation cost, time etc. to produce the corresponding outputs. This makes the current system inefficient while utilizing resources. There should be a mechanism that reduce wastage of resources and that make the system to be efficient. As a result the new system will reduce wastage of resources and make it efficient. The existing system has less efficiency than the proposed system. Data management facilities are limited and the reporting schemes are not according to the specific needs of the users.

2.8 Practices to be preserved

The system displays all the customer and meter details such as customer name, meter ID, Previous read, current read, date, address, and others.

The system allows the customer to know services and billing that is available for his/her meter read.

The system takes the detail information about the customer.

Wolaita Sodo City Water Service and Billing System require a valid form of customer and meter information.

Checks the availability of the services (billing, maintenance and providing meter).

Strength in the Existing System

There are activities that are considered as strength of the existing system or practices to be preserved Employees data, Register form, Bill calculating formula, Water preservation support agreement and Report generating form.

Weakness in the Existing System

It can only provide required information of the users after a long period of time (takes a lot of time to perform a specific task).

- Materials registration, viewing information etc. Time consuming when registered as a customer of the company.
- Time consuming to prepare a bill.
- Input (Inaccurate/redundant/flexible) and Output (Inaccurate)
- Problem in getting monthly (timely) Report about customer, consumption and bill gaining incorrect customer bill.
- Security and Control Storing data is not secure, because the existing system uses access and excels as a front end.
- Anyone who opens the computers, in which the system is installed and used, can access all the contents of the database why because every activity is performed in a single computer, activities are not secure.
- It causes dissatisfaction of customer.

Tariff Range

It is the amount of money charged for the service provided to the potential end user or customer. Here is the tariff range:

1 Meter read (1 meter cube) = 8 birr

Meter monthly charge =8 birr

Formula= 1 m3*8+8 birr/month

2.9 Proposed Solution for Existing System

The proposed system solves the problem of the existing system. The proposed system benefits both customers and the water supply service. The customers may not go to the service provider to pay the bill and there is no queue at the service provider to pay the bill they only pay with mobile banking simulation by using mobile phone at their home when station sent the bill amount with SMS/email or other channels. Accurate meter reading no estimate reading in the proposed system. In addition to this, the system reduces the number of civil servants who read water meter units of the customer monthly. The proposed system consists of three main components:

Web based water meter system for measurement and control of water consumption.

Server application to manage the measurements and prepare invoices and bills. In addition to that, the application performs some predefined control operations

A database is created which contains meter number, customer name, mobile number and previous month's readings. Validation can also be done to prevent any malpractices in the existing system.

Web based Water billing system must fulfill the requirement of giving effective services in terms of speed, accuracy, response time, efficiency, etc.

The proposed system stores all the information about water service and billing on the database other than paper file.

2.10 Requirements of the Proposed System

2.10.1 Functional Requirements

Functional requirements are fundamental building block requirements. It is a statement of exactly what the system must do. The new system will take care of the following functional requirements.

The development of a wireless billing SMS model is expected to make the life of a utility-bill payer easy

The system must avoid estimate reading of the customers water usage

The system must avoid queue around the water supply service to pay the bill

The system shall allow water station database to have record, store and update the customer's information

The system shall allow digital water flow sensor meter to count the water usage in digital form

The system must store the amount water usage

The system must send the amount of water usage within a month using SMS to the water station database

The system shall allow water station database to calculate/generate the individual bill amount according to their usage

The system shall allow water station database to send the bill amount to the customer's with SMS. The system shall allow customers to pay the bill with mobile banking in mobile phone. The above have mentioned are the functionalities of the system will do.

Performance Requirements:

The system capable to increase total throughput speed under an increased load when resources are added.

Enable the users to create, modify, or even to delete his/her account if it is necessary.

The system can generate information and forms for user to access Friendly.

System can clear older data when our storage of system is full

Input Related Requirements*:*

There will be accurate and flexible input mechanisms.

The input form must include name, date, time, ID, customer login detail and others

Collecting the information of the customer who is need service

The administrator must enter the password so that access is given only to him to view the details of the student.

Process Requirements*:* There will be efficient storage and easy traceability/giving an outline/ and customer must have his/her own account to cancel or modify his/her data.

During service providing or getting the customer should fill correct and appropriate information in the specified.

Places and a code will generate used for access securely. If there is no code any one can delete others persons reservations.

Output Related Requirements*:* Since the input is effective the output is also effective. There will be accurate display of service reports in accordance with the query process accessibility is possible for whom who has an account and no one can view information unless matched successfully. If the match is successful, account of the customer or service ID will be displayed and can view and information. If the match is unsuccessful, inappropriate message displayed. A new code will be generated for the service.

Storage Related Requirements:

There will be efficient storage and the entire processed system can stored in the data base.

2.10.2 Non-functional Requirement

Non-functional requirement describe invisible aspects of the system that are not directly related to the system. Unlike functional requirement the non-functional requirement deals with additional quality of the system such as:

Availability: The system is available for 24 hours. Unless some failures an internet connection problem occurs or light goes off, our system is available at any time.

Reliability: The system will consistently perform its intended function.

Efficiency: The system is efficient based on the concept of resource consumption.

Easy to use: Our system is user friendly and understandable by customers who know how to use the mobile banking.

Service: The service that the website provides is easily understandable by customers who know how to use the internet. Moreover, the project is frequently measured in cost and time.

Scalability: Any increase in the number of user shall not degrade system availability to an extent noticeable by any users.

Performance :-

Performance requirements define acceptable response times for system functionality. Response time of the web based water service and billing system should be within seconds most of the time. Response time refers to the waiting time while the system accesses, queries and retrieves the information from the databases

The load time for service and billing interface shall take no longer than seconds.

The login information shall be verified within seconds.

Response time of the system will not take long almost seconds

The system should support many user to get service at a time

The system is work 24 hours per day seven days in a week which means the system is always work.

User Interface:

The window format and the forms prepared for the information are easy to the customers they can easily understand.

The system shall be design according to standards and the system shall replace existing system.

Wolaita Sodo City Water Service and billing system shall provide an easy-to-use graphical interface similar to other existing services system so that the user does not have to learn a new style of interaction. The best thing in the input design is to achieve all the objectives mentioned in the simplest manner possible and creating reports for displaying and storing information.

Security and Access Permissions:

Only system administer has the right to change system parameters, such as time change, user account, charge rate and others. The system should be secure and must use encryption to protect the databases.

Users need to be authenticated before having access to any personal data.

Each customer and officers should have the privilege to access the system.

Backup and Recovery:

If the connection between the user and the system is loss the system will automatically save the filled information and the remaining can enable by the administrator by contacting the customer using phone.

Both databases used for customer account and service provider are production databases.

WSCWSB System shall be able to recover from hardware failures, power failures and other natural disaster and rollback the databases to their most recent valid state

Resource

The main non-functional resource is: - Server in back end and operating system in the platform and an application on the system. In the other case on of the most and available resource is internet access.

Chapter 3

3. System Analysis

3.1 INTRODUCTION

Systems are created to solve problems. One can think of the systems approach as an organized way of dealing with a problem. In this dynamic world, the subject System Analysis and Design (SAD) mainly deals with the software development activities. System analysis is a process of collecting factual data, understand the processes involved, identifying problems and recommending feasible suggestions for improving the system functioning. This involves studying the business processes, gathering operational data, understand the information flow, finding out bottlenecks and evolving solutions for overcoming the weaknesses of the system so as to achieve the organizational goals. System Analysis also includes subdividing of complex process involving the entire system, identification of data store and manual processes. (National Institute of Open Schooling, 2014).

3.2 System Requirement Specifications (SRS)

Requirement means different things to different people depending on the context in which it is used, to some people it means careful elicitation and specification of the users need towards the development of any application such that the content, navigation and structure of any application focus on the users, while some viewed it as just system requirements without considering the user as the main target. Basically requirements are categorized into software, hardware and user requirements. Software requirement is a sub-field of software engineering that deals with the elicitation, analysis, specification, and validation of requirements for software. The software requirement specification document enlists all necessary requirements for project development. Hardware requirement involve elicitation and specification of all the equipment needed to design the project while user requirement specifies what the users are in need of with regard to the new system.

3.3 ANALYSIS OF THE CURRENT SYSTEM

The analysis of the current system at the Wolaita Sodo City Water Service and Billing system was conducted by document sapling and interviewing the users of the existing system (Billing Officer, Cashiers and Consumers) for clearer understanding of the current system. All the steps currently for registering of consumers, billing of consumers, distribution of bills, collection of monthly charges and generation of monthly report is completely manual and offline system. The

problems of the current system are: There is no efficient means of registering and managing of consumer information. Also distribution of bills to consumers is another problem because the consumers may not receive their bills in time or even not received at all or it can be delayed by the bill officials. In the current manual system consumers can only pay their monthly charges at specific bank or the water board hence causing long queue every month and time consuming. Another problem of the manual system is that some cashier use fake receipt to collect monthly charges from consumers hence causing great lost to the organization.

3.3.1 ANALYSIS OF THE INPUT

The input requirements include information that must be presented to the system by the user to enable it performs its operations properly. The input requirements for the current system include:

Name of the Consumer(s).

Address of the Consumer(s).

Email Address of the Consumer(s).

Phone Number of the Consumer(s).

Ledger number (used to identify every Consumer).

Meter Reading(s)

3.3.2 ANALYSIS OF THE OUTPUT

Output is what the system gives back to you or the result of your process when the right inputs are in place. The output of the current system is through the Registration and billing of consumer monthly as well as distribution of those bills. Other output includes payment of the monthly charges and monthly report generation.

3.3.3 Use case diagrams

Use Case is a formal way to capture and to express the interaction and dialogue between system users (actors) and the system itself. The Use Case diagram creates tracks of various functions and those who interact with the functions within a theoretical application. This will help to show the key concepts, their properties and their relationships as classes, attributes and associations respectively (Bennett Simon et al, 2006). With the use case model, the key actors in the domain can be easily identified such as admin, cashier and consumer whom are related to the system. A Use Case diagram is useful for describing requirements of a system in the analysis, design, implementation and documentation stages. The administrator is the only user that performs the administrative job, starting from Adding cashier, manage cashier, manage consumer, set price, view feedback and monthly report generation. The cashier bill consumer and the consumer can

register with the system, view and pay monthly charges as show in the use case diagram below. The diagram below shows the Use Case of this project work.

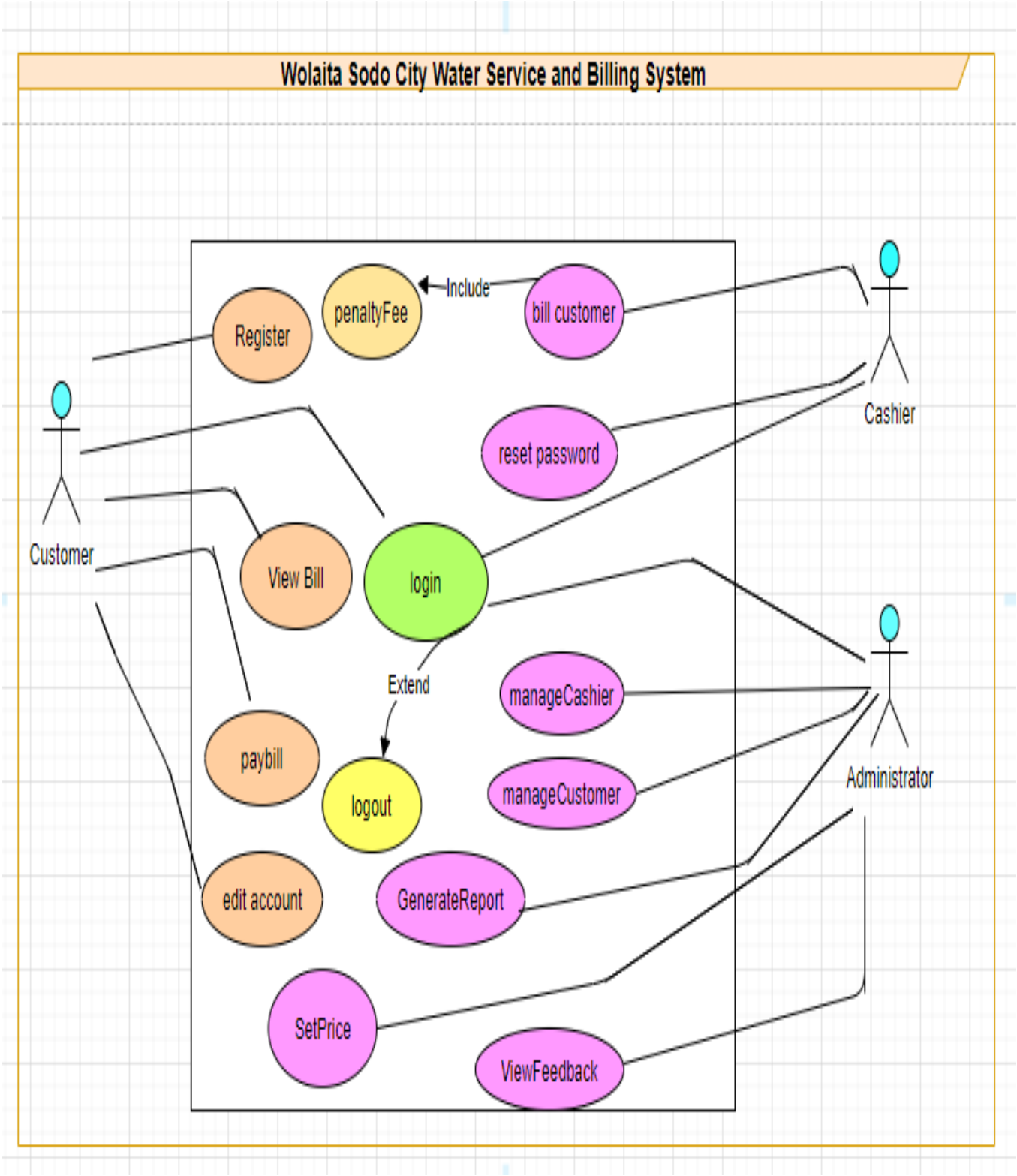


Figure 1 Use Case Diagram

Description of Manage Cashier use case.

Use case number	UC1

Use case name	**Manage Cashier**	
Actor	Admin	
Include	Login	
Extend	---------	
Description:	Manage cashier information details	
Precondition	Admin should login into the system by inserting user name and password.	
Basic course of action	**User action**	**System response**
	2. The Admin clicks on manage cashier information 4.End use case	1. The Authentication Controller loads the Admin's home page. 3. The View Controller displays personal information of the Cashier

Table 4 Manage cashier use case

Description of Manage customer use case.

Use case number	UC2
Use case name	**Manage customer**
Actor	Admin
Include	Login

Extend	--------	
Description:	Admin manages the customer information	
Precondition	Admin should login to the system with his user name and password.	
Basic course of action	**User action**	**System response**
	2. The admin click on manage link 4.The admin will fill the form 8.End use case	1. Perform Authentication Controller opens the Admin's home page. 3. Perform Receive controller will display manage form that contain the following :- customer Id manage case selection address Meter ID Meter Read history Payment history Year and date 5.Perform Receive controller validate will check the filled form 6. The Model will send the request to customer. 7.The Model will display successful message
Alternative course of action	5.1. If the form is not filled with correct data the system will loopback to step 4 and messaged the admin what type of error has been occurred.	

Table 5 Description of Manage Customer

Use case number	UC3
Use case name	**Set Price**
Actor	Admin
Include	Login
Extend	-------
Description:	customer receive the new price request which comes from the admin

Description of Receive transfer request use case

Precondition	Customers should login to the system with their own usernames and password.	
Basic course of action	**User action**	**System response**
	2. The admin clicks on set price link 4. The customer check the check box either price changed or not 6. End use case	1. Perform Authentication controller opens the admin's home page. 3.Perform change controller will display all requests by price list 5. The Set Model will automatically send response.

Table 6 Description of Set Price

Description of Apply forgive request use case

Use case number	UC4
Use case name	**View Feed-Back**
Actor	Admin
Include	Login
Extend	--------
Description:	The Admin view all feedback from customers and cashier

Precondition	Admin should login to the system with his user name and password.	
Basic course of action	**User action**	**System response**
	2. The Admin click on Feedback link. 4.The admin view comments 6.The use case ends	1. Perform Authentication controller opens the Admin's home page. 3. Displays controller the comment box 5.The Receive Model sends the displays feedbacks

Table 7 Description of View Feed-Back

Description of Generate Report use case

Use case number	UC5	
Use case name	**Generate Report**	
Actor	Admin	
Include	Login	
Extend	-------	
Description:	Admin generates reports to stakeholders.	
Precondition	Admin should login to the system with the user name and password.	
Basic course of action	**User action**	**System response**
	2. The admin clicks on Report link 4. The admin types the customer name and id number.	1. Perform Authentication controller opens the admin's home page. 3. Perform generate controller will display report forms 5. Perform generate controller will report for customer with provided information. 6.The Admin model displays required customer information

	7..End use case	
Alternative course of action	5.1 If the generate result not matches, the system will loop back the user to step 4 and messaged that it couldn't found generated result.	

Table 8 Description of Generate Report

Description of Bill Customer use case

Use case number	UC6	
Use case name	**Bill Customer**	
Actor	Cashier	
Include	Login	
Extend	---------	
Description:	Bill customer for water service after the end of their service.	
Precondition	Cashier should login to the system with the user name and the password.	
Basic course of action		

	User action	System response
	2. Cashier clicks the bill link. 4. The cashier fill the form 7.End use case	1. Perform Authentication opens the Cashier home page. 3. Perform bill controller display billing form that contain the following :- Meter ID Customer ID and Name Payment history Bill ID Date and year 5. Perform billing controller validate the filled form 6. The billing the bills to the selected user.
Alternative course of action	5.1. If the filled data's are incorrect the system displays error message and point were the error is occurred.	

Table 9 Description of Bill Customer

Description of Calculate Penalty use case

Use case number	UC7
Use case name	**Penalty**
Actor	Cashier
Include	Login
Extend	---------

Description:	calculate penalty for the customer	
Precondition	cashier should have connection, and they should login to the system	
Basic course of action	**User action**	**System response**
	2. The system cashier clicks the penalty button. 4.The cashier selects from the drop down list 6. The cashier fills the form. 10. End use case	1. Perform Authentication controller opens the cashier's home page. 3. Do penalty controller displays the drop down list to select the user Meter ID Amount Reason Date Customer Name and ID 5. Do penalty controller will display customer penalty form that contain the customer information 7. Do penalty controller will check the filled forms. 8. The cashier model will calculate penalty of the user 9. The cashier model will display successful message.
Alternative course of action	7.1 If the form is not filled correctly go back to step 6	

Table 10 Description of Penalty

Description of Register use case

Use case number	UC8
Use case name	**Registration**

Actor	Customer	
Include	Login	
Extend	-------	
Description:	Changing or updating an account and prisoner whenever the user wants to change due to many problems.	
Precondition	System administrator should login to the system with their usernames and passwords.	
Basic course of action	**User action**	**System response**
	2. User clicks on register button. 4.The user will fill the form 8.End use case	Perform Authentication controller load the user's home page. 3.The Do_Register controller displays form that contain the following :- ID Name Address Service Meter ID Email Phone House number 5.The Do_Register controller check the filled form The Do_Register controller changes the user account. customer Model display successful message

Alternative course of action	6.1 If the form is not filled with correct data's the system will loopback to step 4 and messaged the user what type of error has been Occurred.

Table 11 Description of Register customer information

Description of view bill use case

Use case number	UC9	
Use case name	**View Bill**	
Actor	Customer	
Include	-------	
Extend	-------	
Description:	Viewing Bill	
Precondition	Customer should login to the system user name and password.	
Basic course of action	**User action**	**System response**
	2. The customer view bill as explained in registering new user use case 4.End use case	1. Perform Authenticate controller opens the customer's home page. 3. The Bill Model displays successful message

Table 12 Description of View Bill

Description of Pay Bill use case

Use case number	UC10

Use case name	**Pay Bill**	
Actor	Customer	
Description:	Customer can pay fees	
Precondition	customer should click on the link in the system	
Basic course of action	**User action**	**System response**
	1. The customer opens the home page. ` 2. The customer click on pay bill form 4.end use case	3. The controller will display payment amount

Table 13 Description of Pay Bill

Description of Edit Account use case

Use case number	UC11	
Use case name	**Edit Account**	
Actor	Customer	
Description:	Login and can edit his/her account in the system.	
Precondition	customer should have internet connection.	
Basic course of action	**User action**	**System response**

	1. The customer opens the customer's home page. 2. The customer clicks on edit account button 4. The customer fills the form 5.The customer clicks on edit button End use case	3. Perform edit controller will display an available form which contain the following :- customer name meter type service address house number email phone 6. Perform edit controller will validate the filled form 7.The edit model will displays successful modified message
Alternative course of action	6.1. If the form is not filled correctly go back to step 4 of basic course of action.	

Table 14 Description of customer Edit account

Description of Login use case

Use case number	UC12	
Use case name	**Login**	
Actor	System administrator, Cashier, and Customer	
Include	-------	
Extend	Logout	
Description:	Logging in to the system	
Precondition	System administrator, Cashier, and Customer should have log in to the system with the user name and passwords.	
Basic course of action	**User action**	**System response**

	1. The User opens the page. 3. The User fills the login form. 4. The user clicks on Login button. 9.end use case	2. Perform Authentication controller will display login form that contain the following :- User name Password 5.The Do_Login controller will validate the username and password is correct 6. Do_Login controller logs the users. 7.The Account model displays welcome message
Alternative course of action	5.1 If the form is not filled correctly the system display error message and go back to step 3 and warn the user.	

Table 15 Description of login use case

Description of Logout use case

Use case number	UC13	
Use case name	**Logout**	
Actor	System administrator, Cashier, and Customer	
Description:	Logout and back to the login page.	
Precondition	System administrator, Cashier, and Customer should be on their home page to logout	
Basic course of action.	**User action**	**System response**
	1. The user click logout button. 3.end use case	2. Do_Logout controller will return to the login page.

Table 16 Description of logout use case

3.4 Dynamic model

3.4.1. Sequence Diagram Modeling

Sequence diagram modeling is used to show the interactions between objects and actors in a timely sequence manner. Sequence diagrams are used to model usage scenario of one or more use cases and alternative course of events for a single use cases. Below are a sequence diagrams for each the above use case documentation.

Sequence diagram for login use case

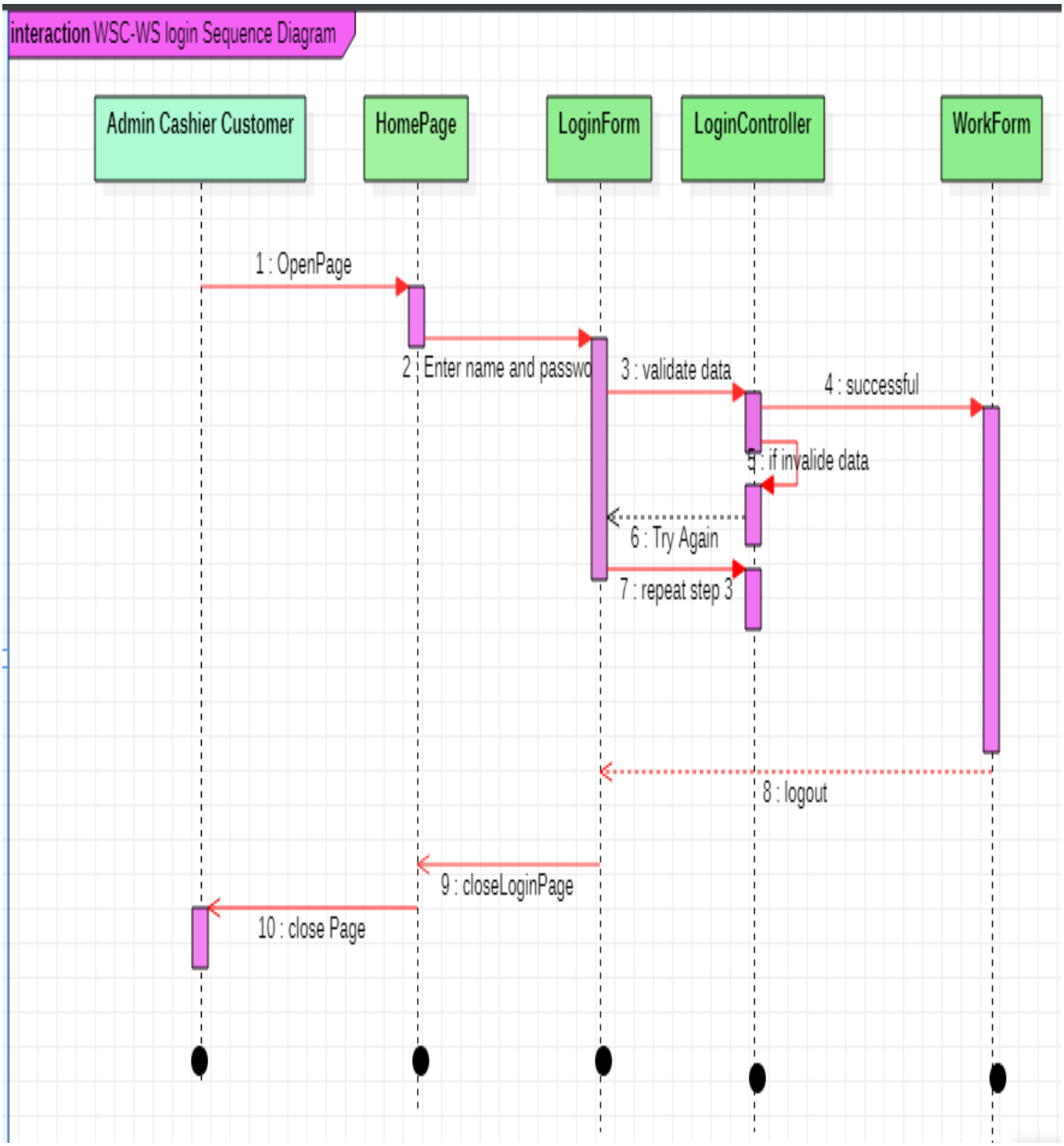


Figure 2 Login Sequence Diagram

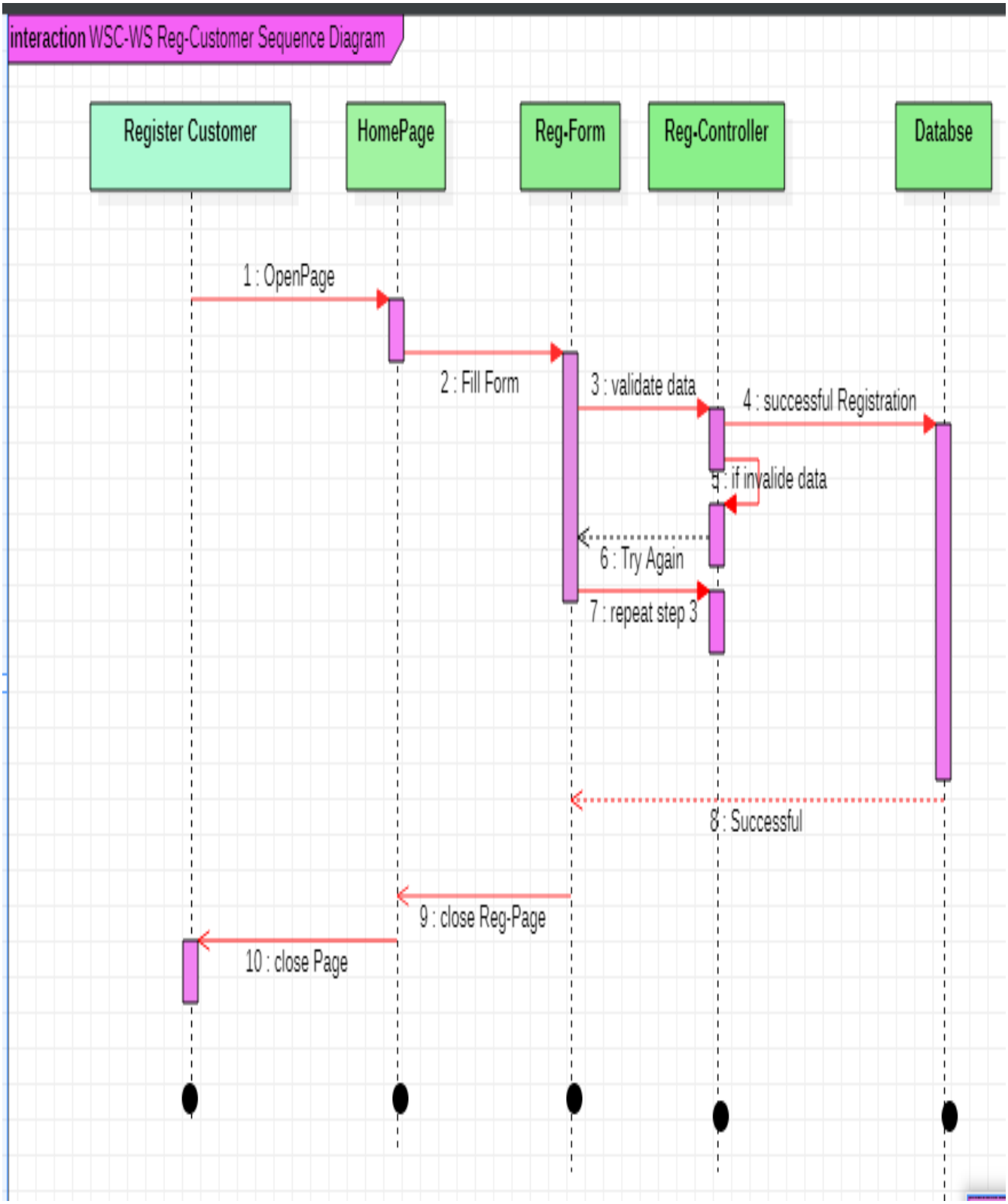


Figure 3 Customer Registration Sequence Diagram

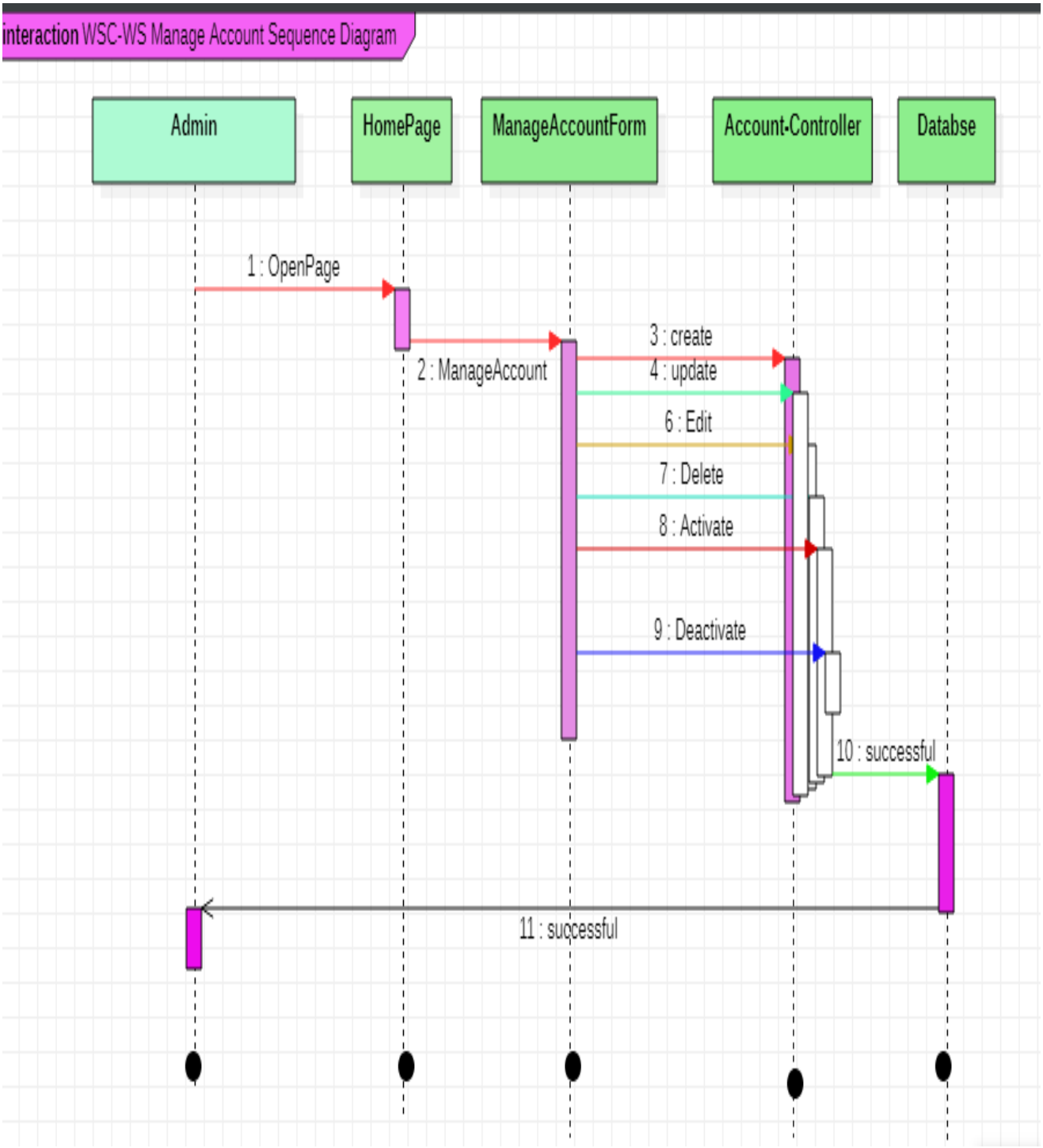


Figure 4 Manage Account Sequence Diagram

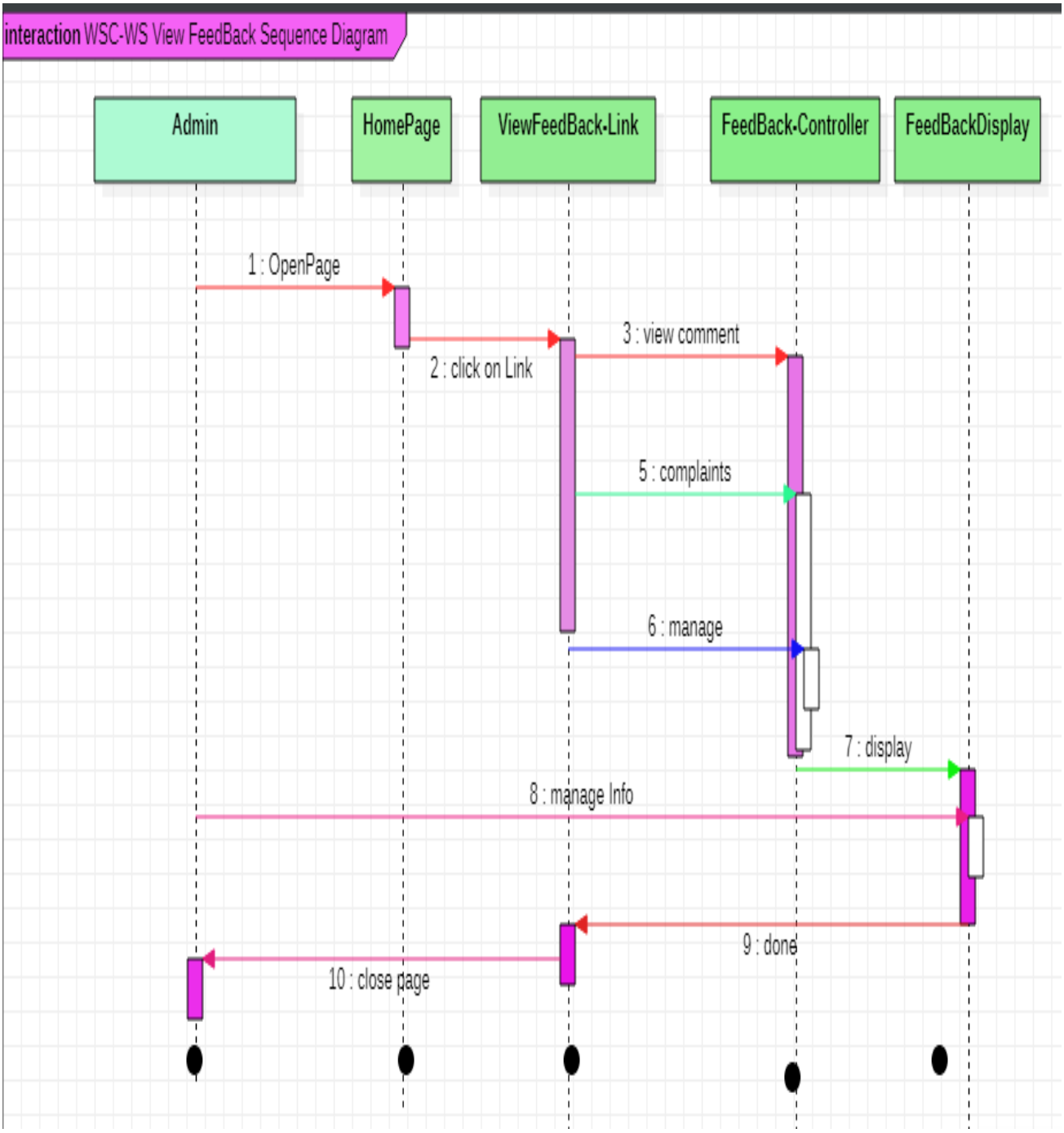


Figure 5 View Feed Back Sequence Diagram

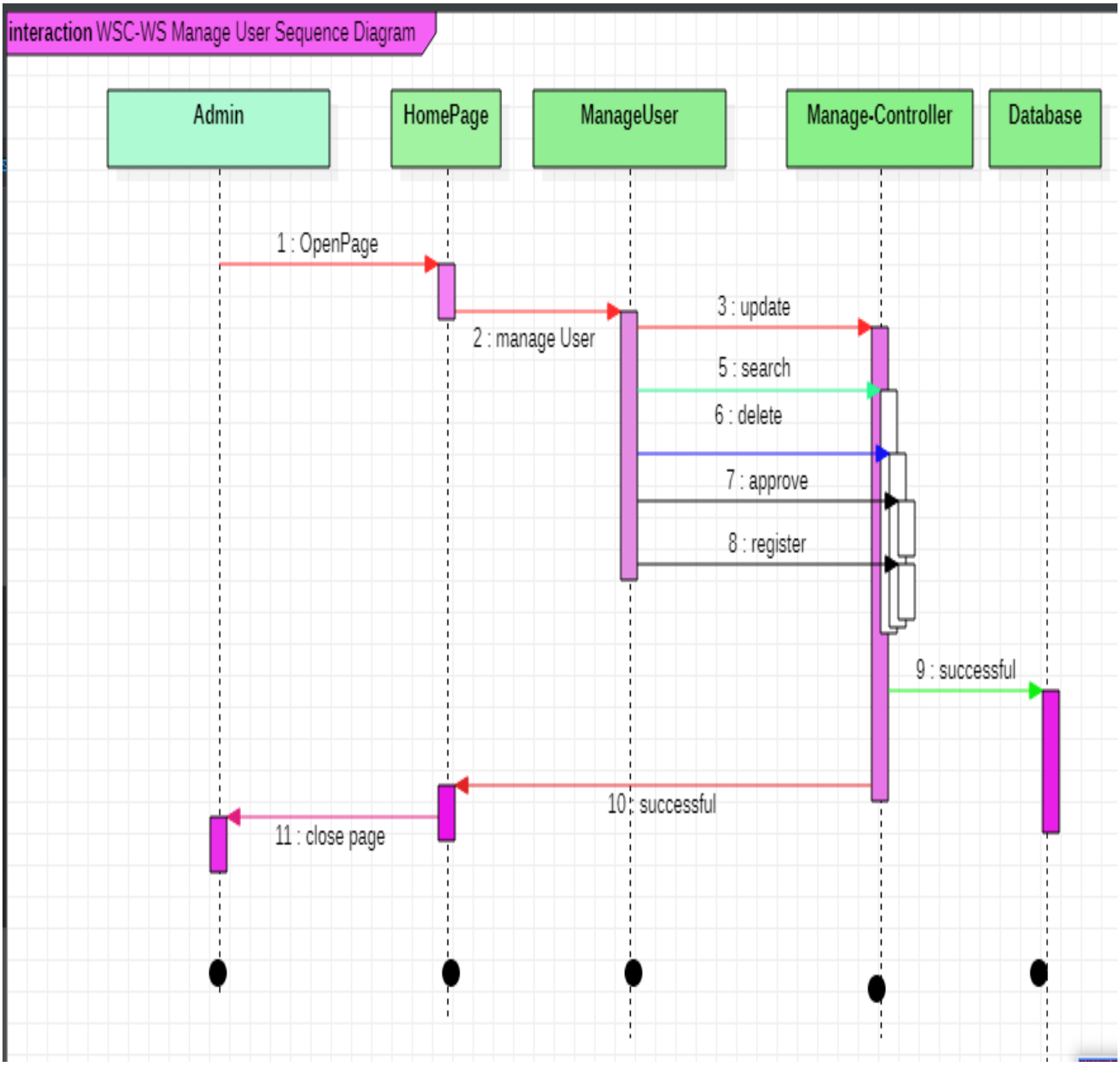


Figure 6 Manage User Sequence Diagram

3.5 Activity Diagram

Activity diagram is used to document the logic of a single operation/method, a single use case or the flow of logic of a business process. It is equivalent to flowchart and data flow diagram from structured development. It is a UML diagram that is used to model high level business process or transition between states of a class. Activity diagram shows the series of activities which are done in single use cases basic course of action, several use case basic course of action or alternate course of a single use case. Activity diagram is one of the five

diagrams in the UML for modeling the dynamic aspect of systems. It is essentially a flowchart, showing flow of control from activity to activity.

Activity Diagram for Login (Admin, Cashier, Customer)

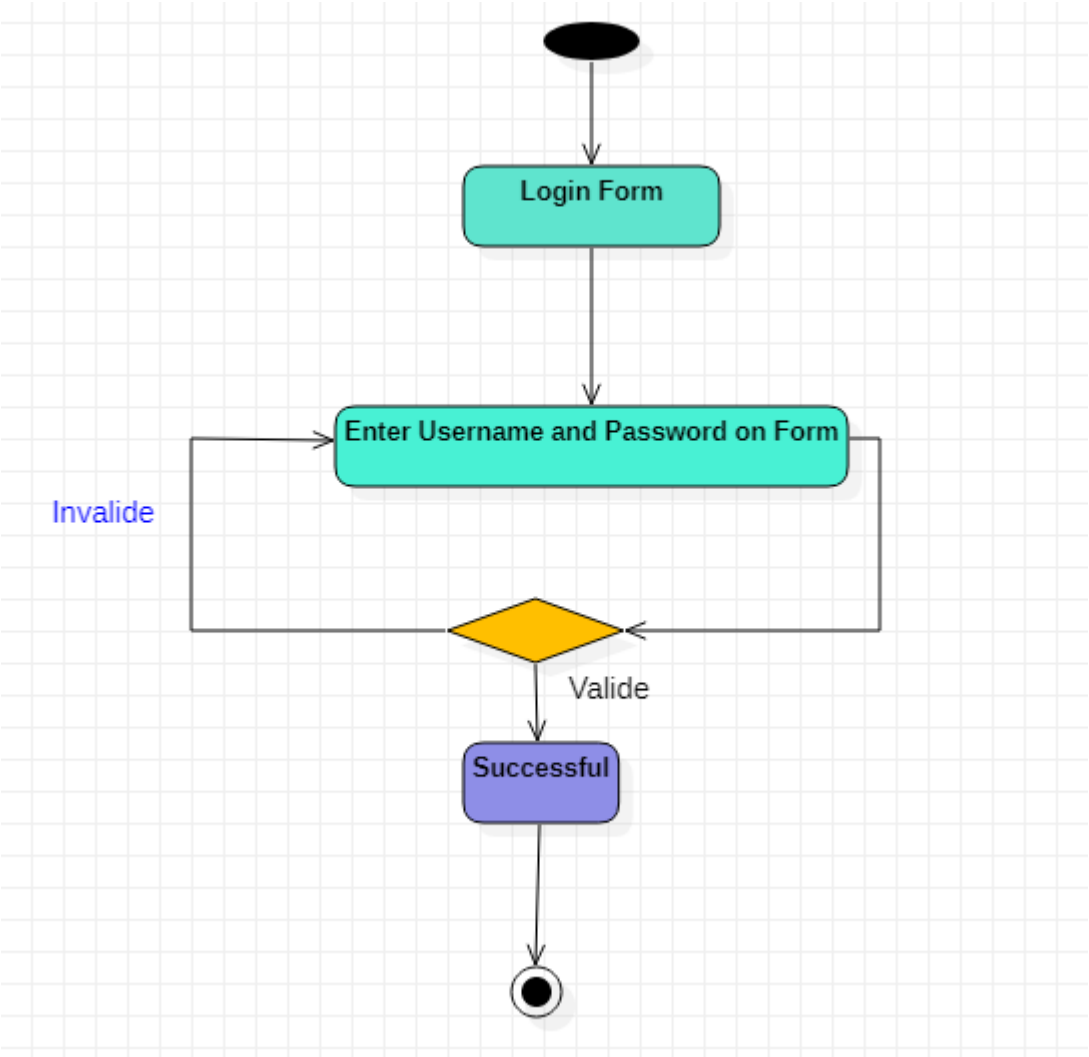


Figure 7 activity diagram for login use case

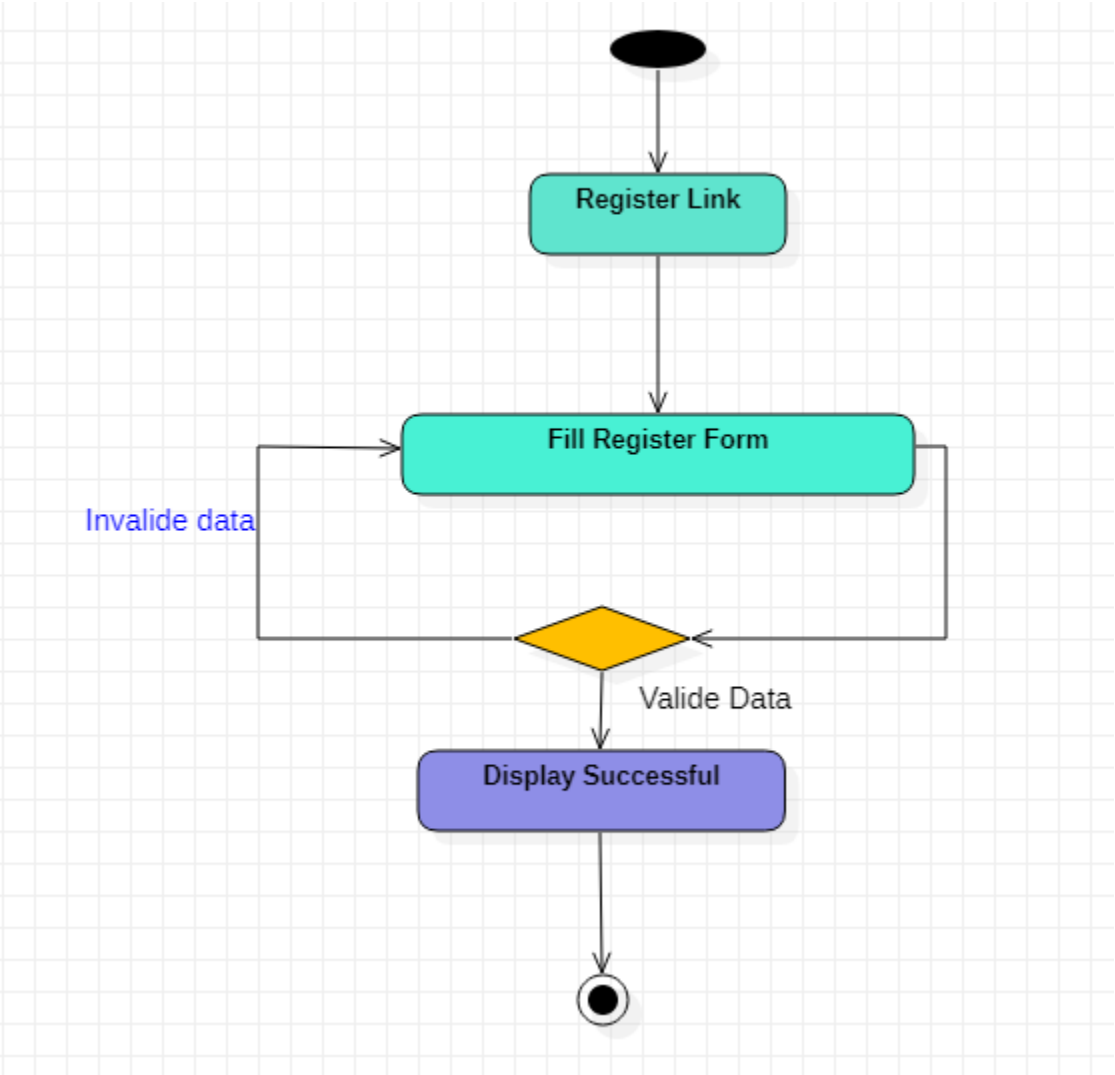


Figure 8 activity diagram for Register use case

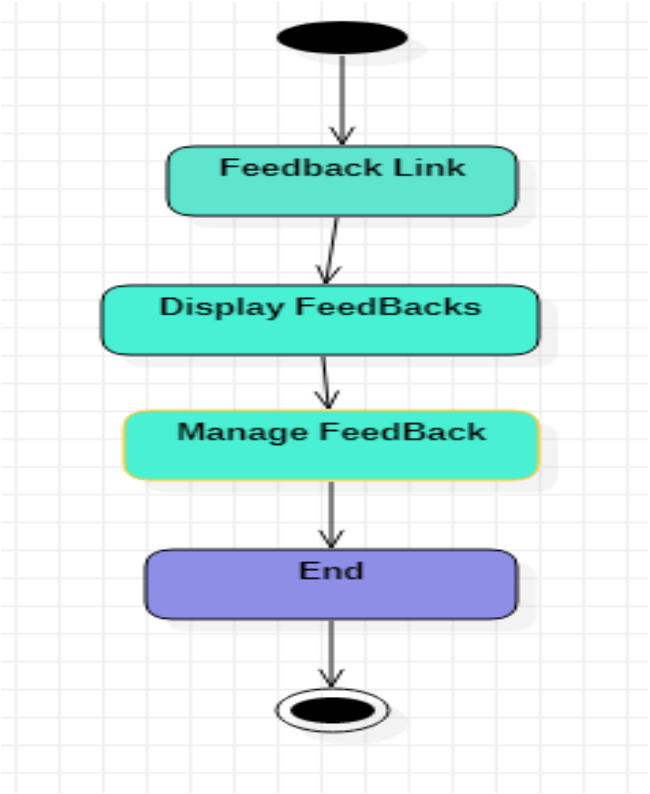


Figure 9 activity diagram for View Feed Back use case

CHAPTER 4

4 SYSTEM DESIGN

4.1. Introduction

This chapter of the project document which provides a system design of this project. This chapter contains and describes about Component modeling, Deployment diagram,

User interface prototyping design, Database design and Class mapping. The purpose of designing is to show the direction how the Application is built and to obtain clear and enough information needed to drive the actual implementation of application. It is based on understanding of the model the Application built on system design also focuses on decomposing the system in to manageable parts.

4.2 Over View of System Design

The student online water billing system in general has the client server architecture. The water billing system the client sends the request to the billing system and the billing system response to the client. The following diagram shows some over view of the system design of water billing system

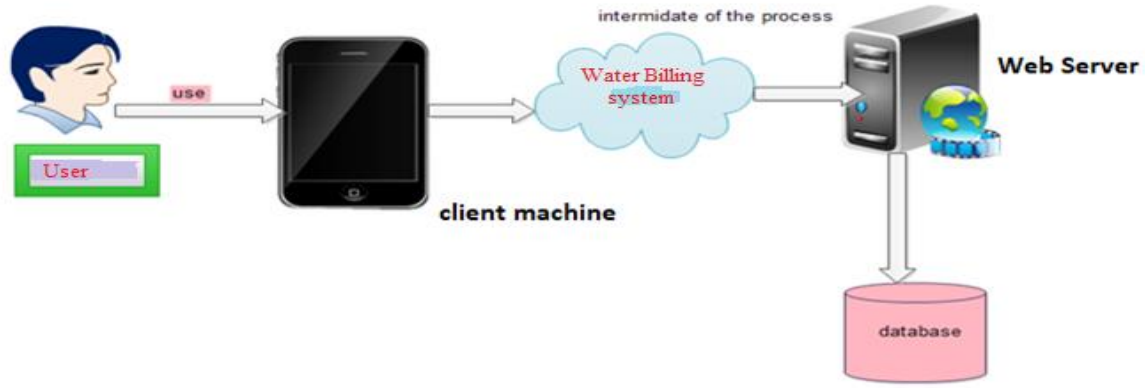


Figure 10 Over view of system

4.3. Design Goals

The objectives of designing are to model a system with high quality. Implementing of high quality system depends on the nature of the design created by the designer .If one wants to make changes to the system after it has been put in to operation depends on the quality of the system design. So if the system is designed perfectly, it will be easy to make changes to it. The goal of the system design is to manage complexity by dividing the system in to manageable pieces. Some of the goals are listed below.

Modifiability: The system should be modifiable to modify different services depending on the need of the user.

Flexibility: The system should be changeable to suit new condition or situation.

Efficiency: The system must do what it supposed to do efficiently without the problem.

Accessibility One of best feature of proposed system is its accessibility.

Users can access the current information being everywhere in the country as well as on internet. To trace some of its best features related with accessibility like:

It accessible without geographical location limitation

It is accessible without time limitation – user can share their idea every time.

Information or the same information accessed by multiple users at the same time.

4.4 proposed software architecture

The main aim of this project is to automate the current manual or semi-manual water billing system and it will solve the problems that are in the manual or semi-manual system. This system saves resources by doing all things used in water billing system; and counts the result for each user correctly. Also in security side our system is secured because, it needs User name and Password. The system will be used for viewing users' profiles. When aiming this system we consider the following significance aspects:

Reduce the time and task required to perform the operation within the water billing area.

It will change the manual processing to computerize system.

It will provide speed, efficient, Flexibility, reliability, and security for the system users.

For users, better satisfaction of the speed provided by the system billing online.

And it improved the moral (motivation) of the users to use the new technology.

The general architecture of the software looks like the following picture. At the top layer the user interface of the system is set and then online billing application login. Finally, at the back end, the online water billing data is placed.

Presentation tier: the top most level of the application. It translates tasks and result to something the user can understand.

Logical tier/middle tier: coordinate the application, process commands, make logical decision and evaluation, and performs calculations. It also moves and performs data between presentation and data access tier.

Data access tier: store and retrieve data from database. It provides data persistence mechanism to access the database without installing database dependent drivers and libraries on the client device. The architecture is shown as follows

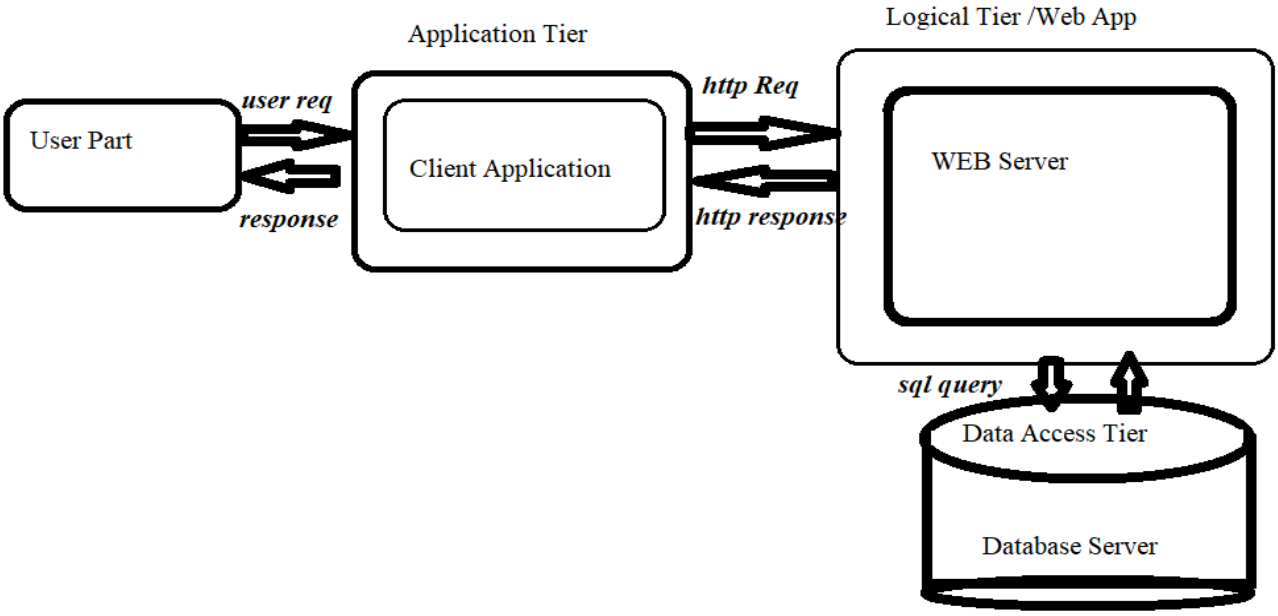


Figure 11 proposed software architecture

4.5 System Decomposition

System decomposition is undertaken to reduce the complexity of the system and gaining insight into the identity of the constituent components. The system is decomposed in to sub-systems which are a collection of classes, associations, operations, events and constraints that are closely interrelated with each other. In this step of the project, we are decomposing the system into subsystem according to the main services it accomplished. The following descriptions are used to express briefly our system using subsystem.

1. Registration sub system

Includes users registration, administrator registration and cashier registration

2. Manage cashier sub system

Includes add, search, update, approve and cancel cashier

3. Manage customer sub system

Includes add, search, update, approve and cancel customer

4. Manage Account sub system

Used to change some user name or password of the user

Includes change user name, create account, change password

5. Cancel sub system

Includes cancel members, cancel customer and cancel cashier

6. Billing sub system

Used to give a calculate bill

Used by the cashier

Includes calculate payment, give bill, take money etc.

7. Report sub system

Includes payment, meter read, current read, previous read, total charge and penalties charge

8. Add Notices sub system

Used to add notices

Added by administrator

Give full information about billing system

9. Set price sub system

Used to add unit price, total price and penalty charge

Add by the Admin

Used to know customer and cashier

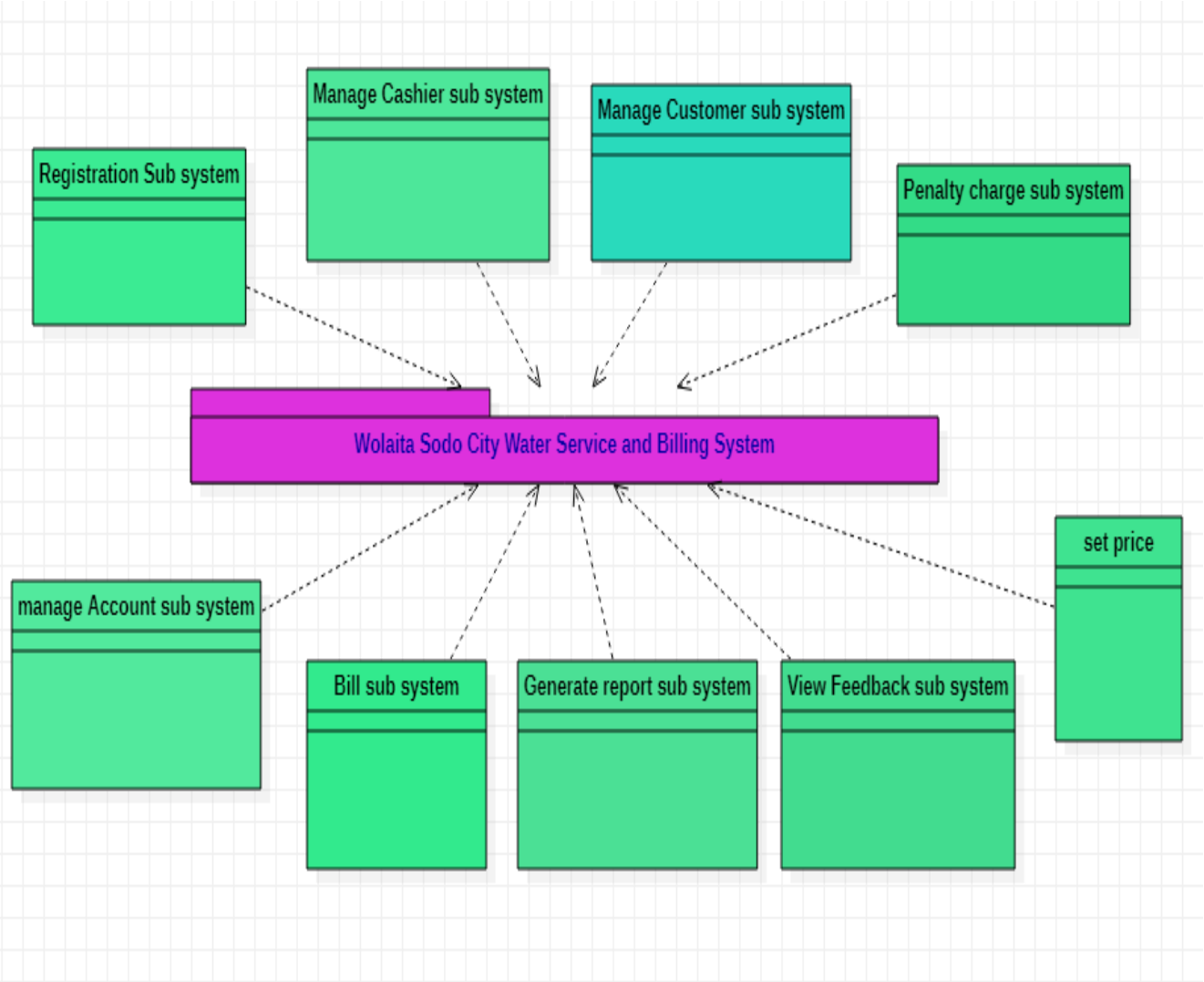


Figure 12 Decompose Sub systems

4.6 Deployment Diagram

4.6.1 Hard ware and software architecture mapping

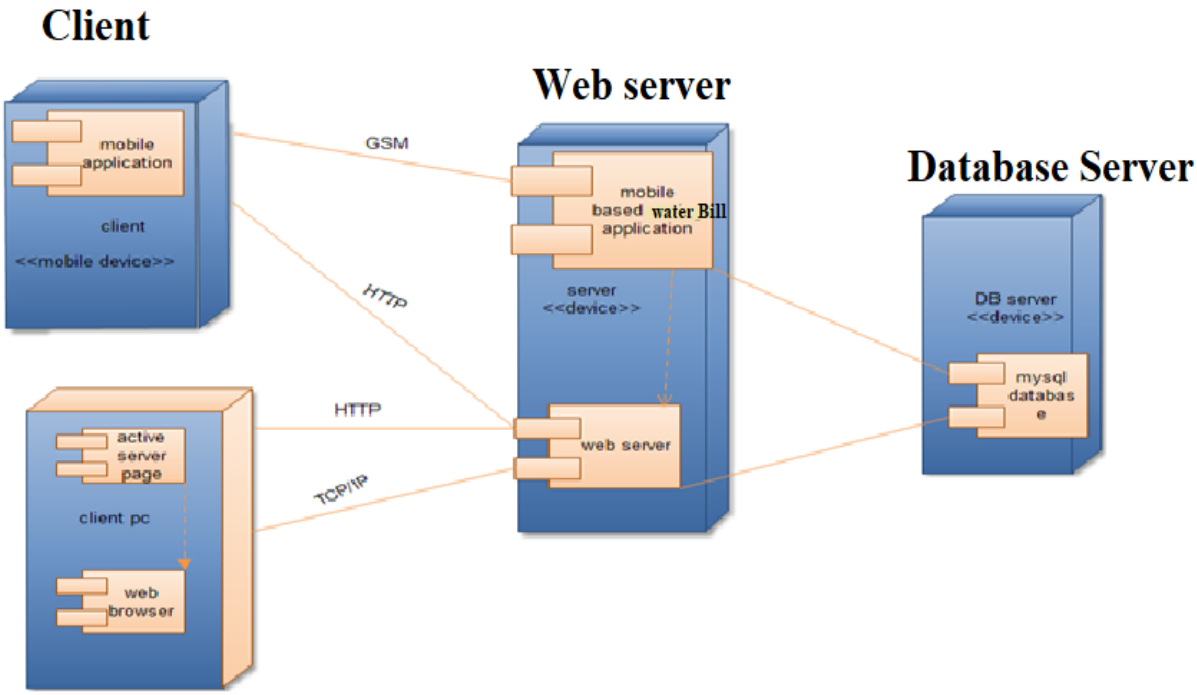


Figure 13 : Hard ware and software architecture mapping

4.7 Persistent data management

Persistent data is a data structure that previous and current versions may be required. Persistent data exists outside of an application's active memory, typically in a database or flat file system. Data is the most important asset of any computer application. The main point of our application is to enable a person to access its data. In order to store and access data persistently we identified the major tables that will be implemented on the application. The Persistent model mapping and relationship among the identified tables of each are shown as follow:

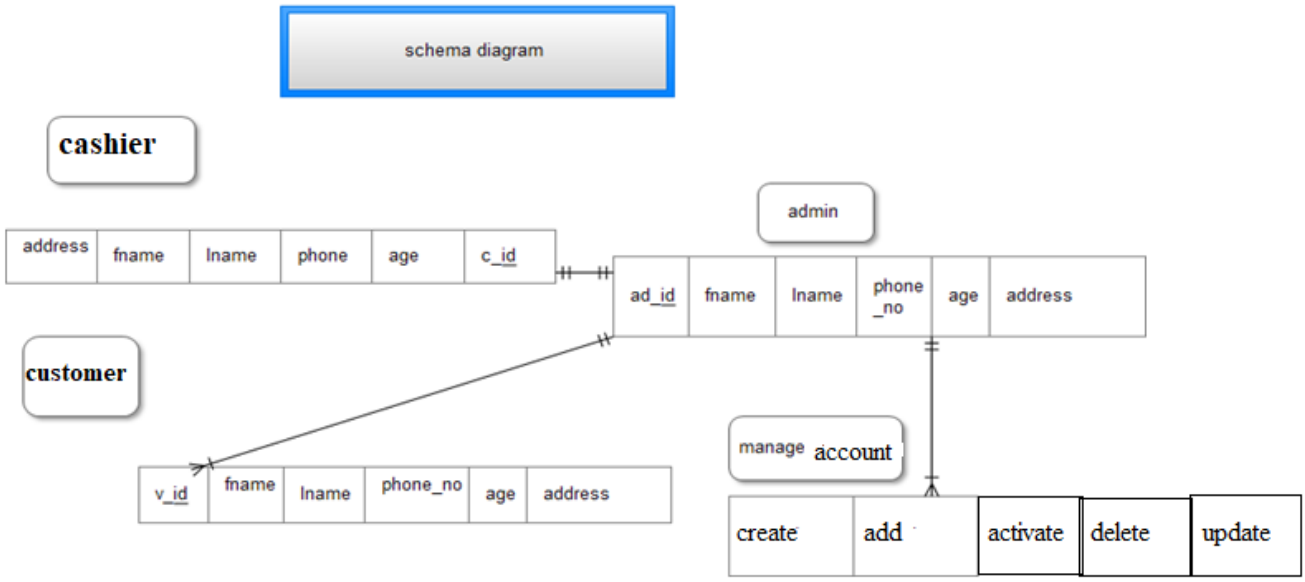


Figure 14 Persistent data management

4.7.1 Database design

Database design is transforming an E-R model and their data specifications design into a normalized relation. A relation is a named, two _ two _ dimensional tables of data, having set of named columns and an arbitrary number of unnamed rows, Each column in a relation corresponds to an attribute of that relation and each row of a relation corresponds to a records that contains data values for an entity. Well-structured relation corresponds to records that contain a minimum amount of redundancy and allows users to insert, modify and delete the rows without errors or inconsistencies. It is the process of converting complex data structures into simple, stable data structures using a process called normalization.

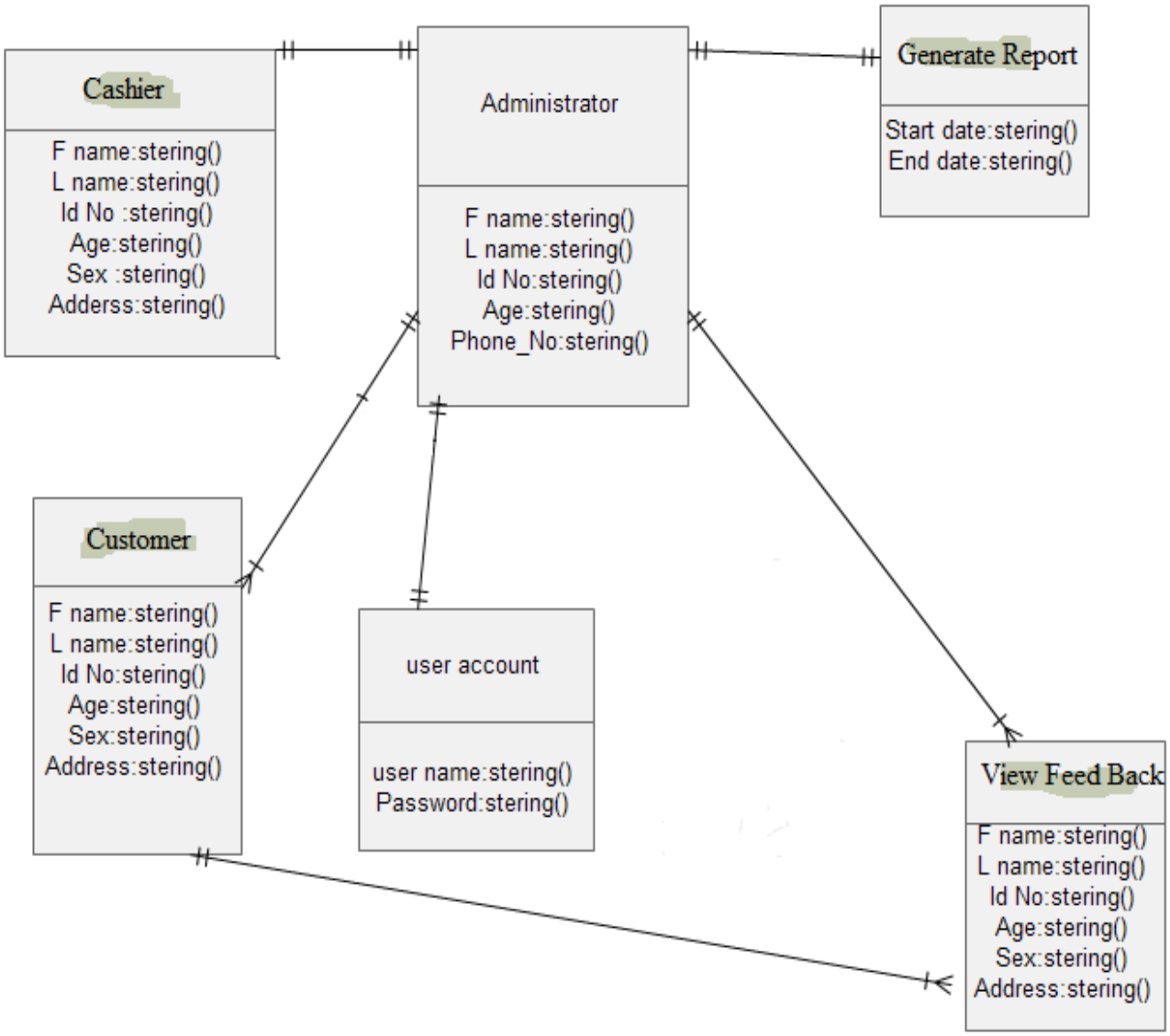


Figure 15 Database design

4.7.2 ER DIAGRAM

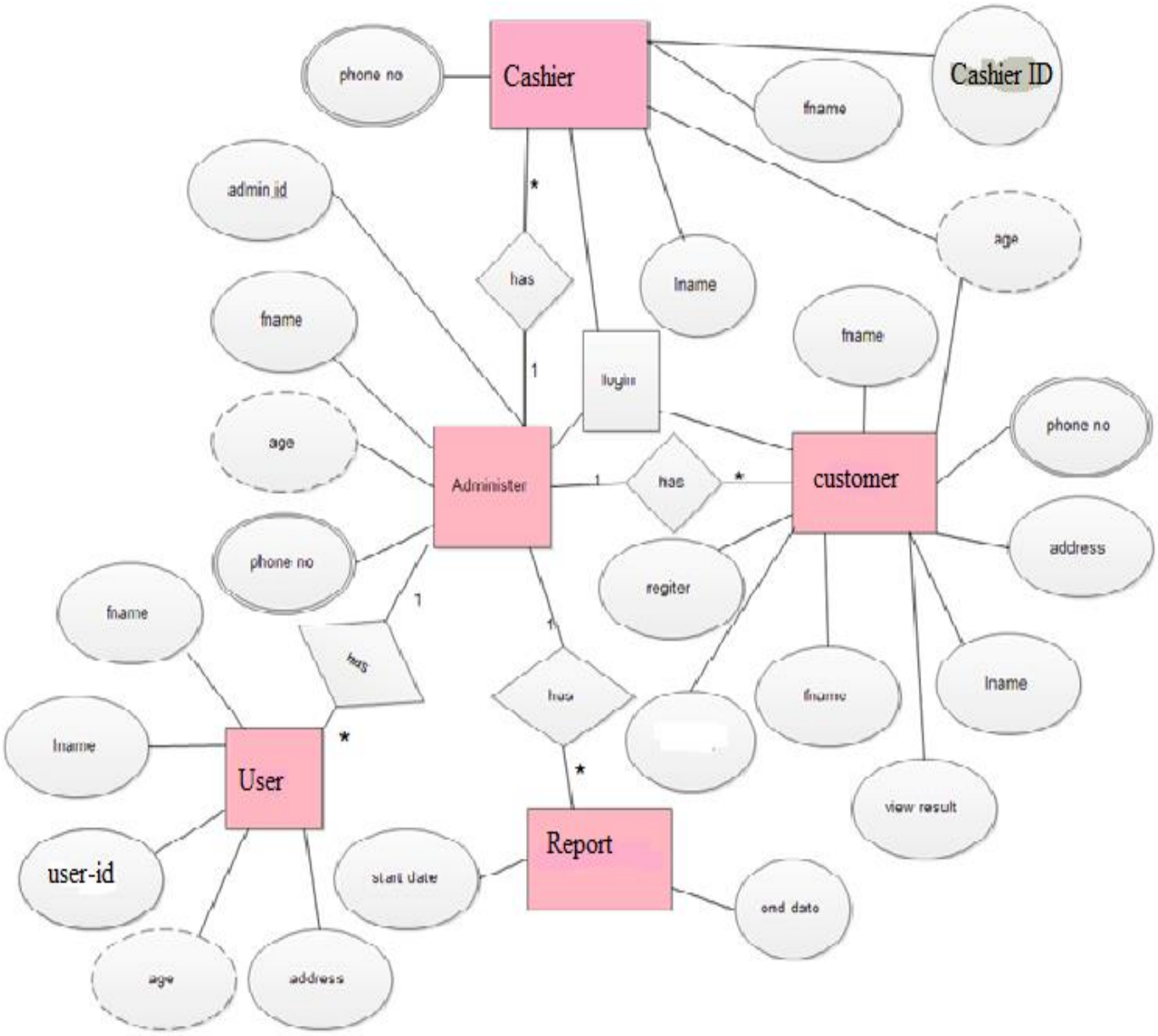


Figure 16 ER diagram

4.7.3 Component Diagram

Component diagrams are used to describe the physical artifacts of a system. This artifact includes files, executable, libraries, etc. The purpose of this diagram is different. Component diagrams are used during the implementation phase of an application. However, it is prepared well in advance to visualize the implementation details.

Initially, the system is designed using different UML diagrams and then when the artifacts are ready, component diagrams are used to get an idea of the implementation.

This diagram is very important as without it the application cannot be implemented efficiently. A well-prepared component diagram is also important for other aspects such as application performance, maintenance, etc.

Before drawing a component diagram, the following artifacts are to be identified clearly −

- Files used in the system.
- Libraries and other artifacts relevant to the application.
- Relationships among the artifacts.

After identifying the artifacts, the following points need to be kept in mind.

- Use a meaningful name to identify the component for which the diagram is to be drawn.
- Prepare a mental layout before producing the using tools.
- Use notes for clarifying important points.

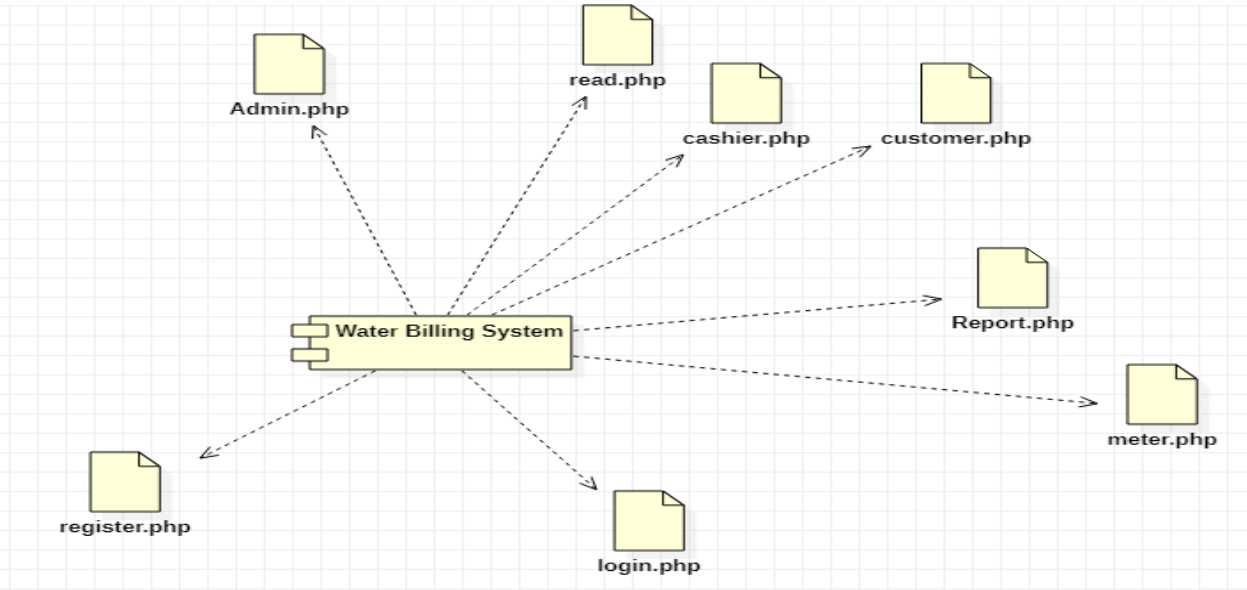


Figure 17 Component Diagram