Mobile-based Recharging System for Printing Services based on Multi Agent Systems (MAS) for UUM Students

SAMI AHMAD MOSBAH ABUALHAYJAA

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Mobile-based Recharging System for Printing Services based on Multi Agent Systems (MAS) for UUM Students

A thesis submitted to Graduate School in partial fulfillment of the requirements for the degree Master of Science (Information Technology)

Universiti Utara Malaysia

By

Sami Ahmad Mosbah Abualhayjaa (802391)

KOLEJ SASTERA DAN SAINS
(College of Arts and Sciences)
Universiti Utara Malaysia

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ABSTRACT

Nowadays, mobile and web application have growth rapidly due to the current enhancement and development in the communication sectors. UUM is facing a lack in implementing and deploying the modern techniques for certain services such as recharging services, mobile banking application, and Web/WAP services, moreover, the current system for proving UUM student with the printing services is facing a difficulties to reach the students satisfaction which it's done by manual system and closing in a certain time. Otherwise, UUM students need to wait for long time till he/she get to use this service. Hence, this study proposes the using of Multi Agent Systems for simplifying and customizing the recharging process for the printing services over web and WAP application. Agent system has be used for classifying the client queries during the recharging process by converting the incoming signals to more understandable objects which reduce the lacks and mistakes during the recharging performance for the printing services. The study has been employed the research methodology based on object-oriented analysis and design by Whitten and Bentley (2007) that involves the use of RAD methods for system design. The system has been tested and evaluated based on test case method.

DEDICATION

Firstly, I would like to dedicate this work to the good pacemaker; who taught us to keen to seek the knowledge, our Prophet Muhammad (peace upon him).

I dedicate this humble work to my beloved father and mother; the spring of loyalty, affection, and dedication. They raised me on the principles of virtue, to my dear sisters, to my grandmother soul and to who had always encouraged me to knowledge and studying my dear grandfather Prof. Dr. Affif Abdelrahmann.

I dedicate this work also to my cousin Ayman Abu Alhayjaa "Abu Saad".

I am also expressing my great thankful to all my colleagues and friends at UUM, for their support, with whom I shared pleasant times, and all my family members for their encouragement and support all the period of my studying, and to my ABU ALHAYJAA family.

Your Son:

Sami Abu alhayjaa

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Praise to **ALLAH** for his guidance and blessing for giving me the strength and perseverance to complete this project. Also, my thanks to **ALLAH** who has seen me through to this level in my academic achievement; I would like to thank my supervisor **Mrs. ALAWIYAH BT ABD WAHAB** for kindly supervising this study, her guidance and constant motivation that has enabled me to complete my project work. Moreover, I would also like to thank my evaluator **Mrs. NOR IADAH BT YUSOP** for her suggestions and help, and **Dr. NOR LAILY BINTI HASHIM** for her suggestions.

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CHAPTER ONE

INTRODUCTION

This chapter elaborates the main idea of this work, why the study was conducted and what is the main element involved in the study. The first sub-topic describes the overall idea in this study through the scenario and motivation that lead to the implementation of the whole project. This is followed by the problem statement, research question, objectives, significance and scope of the study. The last sub-topic elaborates the way this thesis is organized.

1.0 Introduction

Technology has brought a lot of changes in our life. The emergence of the internet has made a lot of changes in our daily routines as a worker, teacher, student etc. From e-services to m-services, we are given a new way to manage our daily routines by a clicking of a mouse. Online recharging services is a sustainable web application can be reached and used through PC or mobile devices which presents the easy and faster way for simplifying the recharging process of the user equipments through different LAN and wireless devices. The using of this service (Recharging services) in different business and educational sectors has been customized based on the user's requirements. The usefulness of using such a technology (Online services, mobile services, and recharging services) presented in different terms such as; easy to access anytime and anywhere, require less efforts, and easy to use. This technology (Online

services, mobile services, and recharging services) enables users to access the internet at any time in any location (Lindberg et al., 2007).

Online services identified as sustainable applications for providing users with their needs (Shopping, booking, banking, etc) through different web and WAP device among certain server provides. Generally, the usefulness of using the online services has developed rapidly due to the development of the communication based services. However, a large number of online services used from single and multi client side for different purposes by obtaining the flexible access through multi port systems. Examples of using such services are the recharging and other reservation services which depend mostly on the web and WAP facilities.

The wide using of the Internet services has been growth rapidly due to the various development and implementations of the World Wide Web technology among different providers. The deploying of WWW led to a big mass of companies participating in a global online marketplace and the other practices in many fields (Cheverst et al., 2000). Although a lot of work has been done for providing a sustainable and better service able to be accessed through certain devices in different areas of electronic commerce, the existing systems are still far from using all the possible advantages of the Web such as; (display a certain information, managing user action, etc) as an information and commercial medium (Nielsen, 1998).

Currently, most electronic commerce transactions such as retailer to consumer are very simple, browse a catalog or the guide and make a selection, then pay with a credit card or other pay services (OASIS, 2004). There already exist several online

charging systems, allowing consumers to recharge their credit card through online services. Price and availability are the two mostly used criteria for matching the consumers' needs, which is not always leading to optimal solutions (Fullenkamp and Nsouli, 2004).

Today there is a huge development of information technology implemented in several online applications that can be used to support students and other users to get their needs. Furthermore, the development in the area of telecommunications provided the users and customers with the ability to browse information to and from different mobile units, e.g. cellular phones and PDAs. This new technology is forming a new industry with a focus on IT and mobility (Abowd et al., 1997). Most of these systems are built with this new technology combine: such as WAP technology, and Mobile device.

The Wireless communication, especially personal mobile devices, has seen tremendous growth over the past few decades. As a consequence, value-added data services, WAP based applications and Web services are in high demand (Mitra et al., 2004). But given the fact that it is the responsibility of the technology to ensure that its benefits reach the maximum number of people that helped to improve and enhance the online services in term of functional and non functional identifications (Polylab, 1998).

1.1 Problem Statement

In UUM, many services are given to students to assist them in their study. One of these services is printing services, which require recharging the student credits manually to be able o use this service. The current procedure for recharge student's credits is done by a shop service, but this shop stays open until 5:00 pm, after that the student have to wait until next day to recharge their credits. This procedure creates the feeling of dissatisfaction among students. Therefore, this study focused on the current lacks in recharging the student credit of printing services which presents of utilizing the traditional recharging methods that seems to be not useful for UUM students in term of time and efforts. It takes the students effort, time, and cost to recharge their credit for the printing services directly. Especially with the rapid growths of using wireless technology it has become necessary to provide better recharging services for UUM students to reduce these problems. Therefore UUM printing services should have an alternative way to satisfy student's needs from anywhere, anytime through using wireless technology. In addition, this study aims to enhance the following weaknesses:

- The current recharging system for the printing services in UUM unable to provide students with the flexible printing services which done manual recharging, and waste the time on students.
- Difficulties to manage the huge number of students at one time especially when this service stop at 5:00 pm.
- Unable to reach the user satisfaction.

1.2 Research Questions

This study aims to solve the following questions:

- What are the system requirements of recharging the student account for printing services?
- How to develop an alternative recharging system instead of the existing system?
- How to validate the recharging system for printing services?

1.3 Research Objectives

The research question provides this study with the understanding to the user requirements that need to achieve the study goals such as:

- To identify and model the requirements for designing a mobile-based recharging system for printing services.
- To develop a WAP-based recharging system for the printing services based on Multi agent systems.
- To test the WAP-based recharging system for printing services based on Multi agent systems.

1.4 Research Scope

The scope of this study justified the importance of the proposed mobile-based recharging system for the printing services based on multi agent systems (MAS). The MAS technique will be used in this study for converting the signal components to more classified objectives from different wireless devices such as laptop, pocket pc, and mobile. This study will be focused on providing UUM students with the useful services to reach the student's satisfaction. Figure 1.1 shows the propose architecture of the mobile-based recharging system for the printing services based on multi agent systems for UUM students.

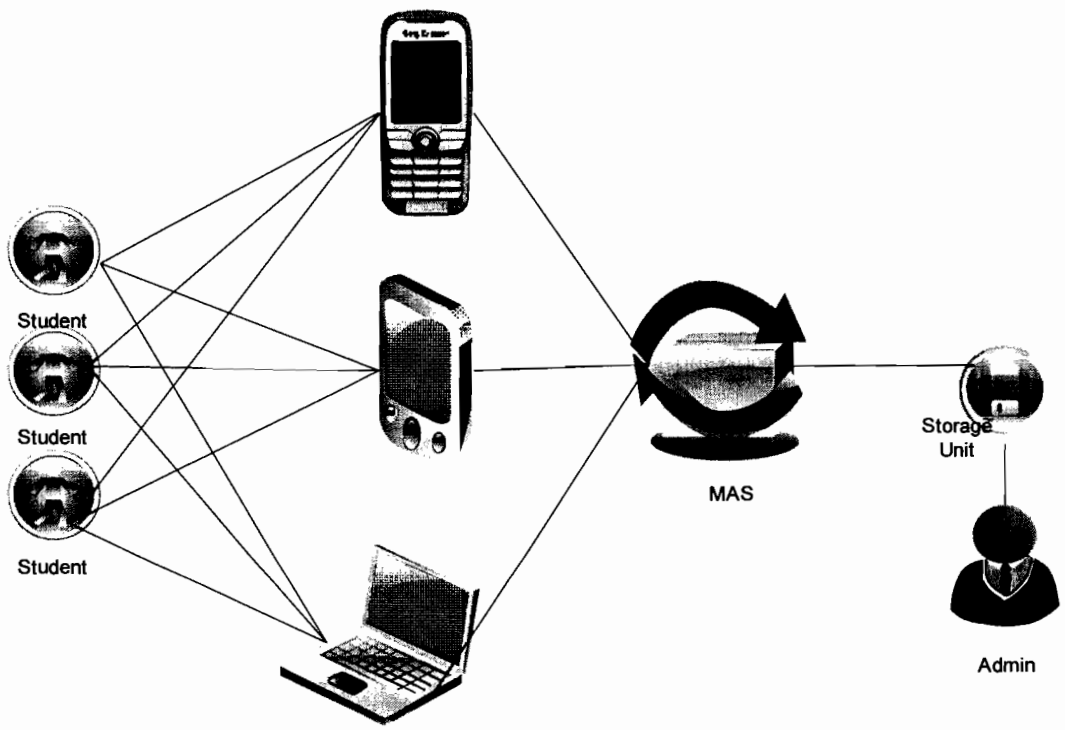


Figure 1.1: The propose system architecture

1.5 Research Significance

This study helps UUM students to do recharging their credit for the printing services. Determining the previous and related studies could provide a clear picture about the importance of implementing mobile-based recharging system for the printing services based on multi agent systems. In addition, some advantages can be provided from implementing the propose recharging system, such as:

- Improve issuance speed and accuracy: - using multi agent system in the proposed recharging system will simplify and convert the signal process between client and server.
- Streamline Users: - mobile-based recharging system for the printing services based on multi agent systems will streamline UUM students through wireless communication network.
- Reduce the mistakes and the effort: - mobile-based recharging system help on reducing the mistakes that can be detected during the recharging process for the printing services.
- Give the opportunity to other students who are not around or attending class.

1.6 Organization of the Thesis

Chapter One:

This chapter provides the outline of this study which presents the detail about the background of the study and the research problems that need to be solved. The objective, scope and its significance has been identified and described well.

Chapter Two:

Chapter two discusses the related literature on the issue of the online systems and other intelligent applications in different countries based on web and WAP technology.

Chapter Three:

This chapter describes the research methodology which is developed by Whitten and Bentley (2007) is adapted in this study. Overview of the methodology and the executive summary will briefly discuss.

Chapter Four:

This chapter presents and discusses the implementation of the proposed system to solve the current problem and the finding of this study.

Chapter Five:

This chapter discusses the evaluation process of the proposed system based on Test Case method to measure the system functionality.

Chapter Six:

The final chapter presents the conclusion to the study. Recommendations and directions of future work will discuss.

1.7 Summary

The research elements of this study have been addressed successfully in this chapter based on the existing recharging problem. This chapter described the motivation factors that lead to the selection of the area studied. It also explains the existing problem that need to solve, research question, objectives of the study, as well as its significances to the real world situation. These elements are important as it ignites the implementation of the project. The next chapter deals with the literature review which elaborates on related works that have been established in the different fields.

CHAPTER TWO

LITERATURE REVIEW

This chapter presents the literature review on the area of project studied. It conceptually gives an insight or reviews on the previous and existing works that have been conducted on the same area. According to the title of the project, this chapter is organized in three sections of subtopics. The first sections reviews on the introduction of the internet technology and its applications. Meanwhile, the second subtopic reviews on wireless technology based devices and background of agent systems. Other than that, the last subtopic reviews on related works.

2.1 Internet Technology

The Internet is a totally open and distributed environment which allows different types of service providers to provide different types of services on the network. The internet has traditionally been an educational and research oriented network with global access (Dimeas, and Hatziargyriou, 2004). Recently, the current enhancements in providing online services with the flexibilities have been growth in different online sectors which offers better inter connecting medium for data, different information, and sharing files (Subbarao, 1995).

The using of Internet application for different purposes has been modeled the needs for such applications to perform the customers or users needs which involved a certain requirements, within certain services users and customers able to manage and share their needs over these applications (Craig et al., 1999; Lixin, 2001).

Deploying other external technologies helped to emphasis the quality of these applications and generates customer's satisfactions among many uses (Pipattanasomporn et al., 2009; Poynder, 1998).

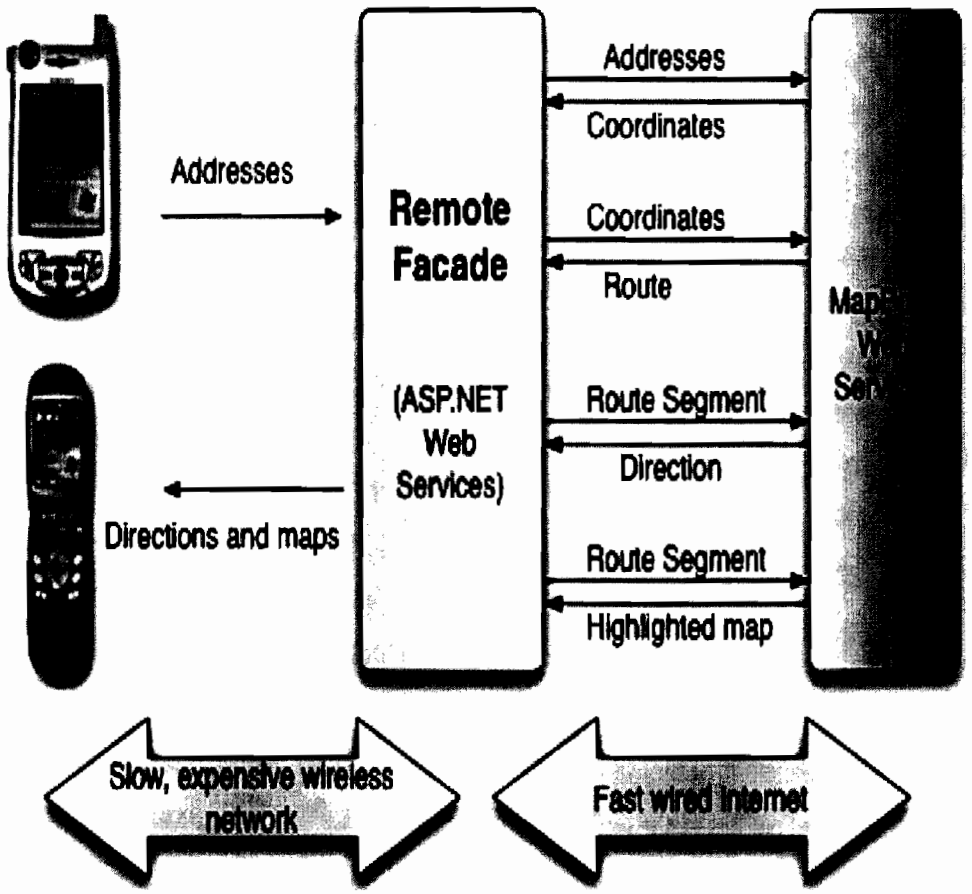


Figure 2.1: Internet technology towards wireless technology

Recently, Massively Multiplayer Online applications occupied the most useful application for customizing the customer's needs (Dimeas and Hatziargyriou, 2005; Endo and Yutaka, 2006).

2.2 Internet Technology based Services

The use of services, especially Web services, became a common practice. A Web service is defined as an autonomous unit of application logic that provides either some business functionality or information to other applications through an Internet connection (Patrick et al., 2009). Distributed within and across organizational boundaries and web service (WS) has become the de facto standard to expose the functions of business applications as services (San-Yih et al., 2008).

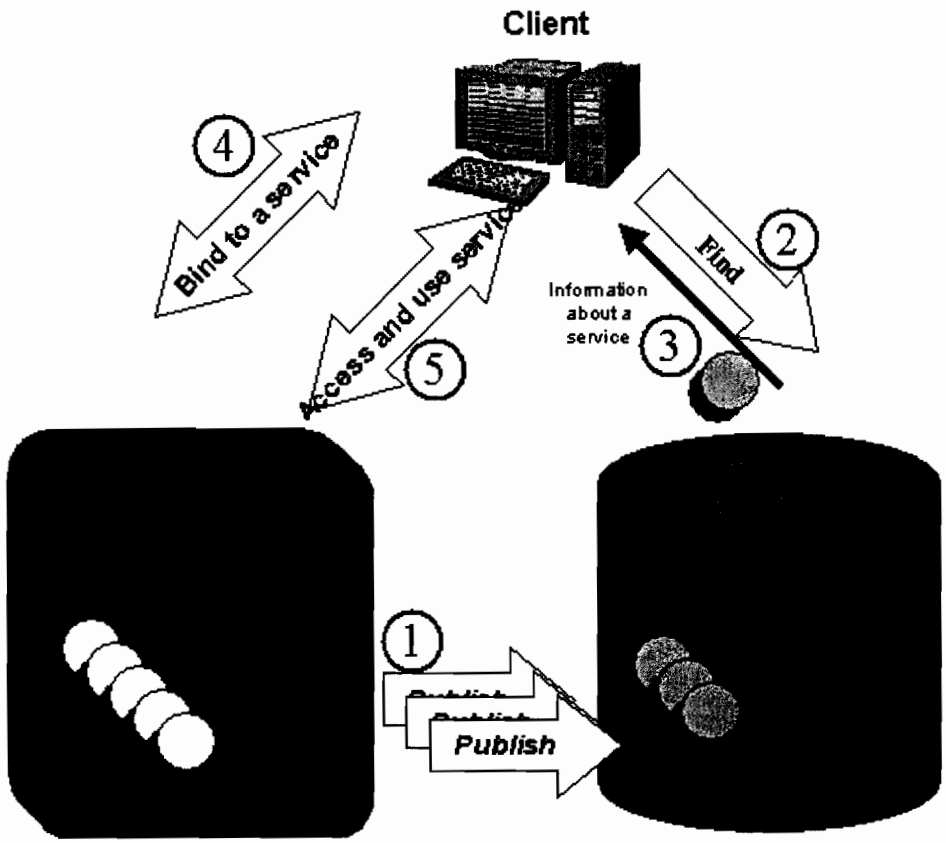


Figure 2.2: Internet technology devices

Industrial aims to provide and model its services in term of customers needs towards browsing the available items (Curry et al., 2007). Hence, it has been optimized a

certain services as a standards-based platform for distributing and transferring client requests among groups (Hwang et al., 2007). In the coming years, online application expected to integrate other techniques towards improving the user satisfaction on using online applications (Pat and Michael, 2008; Asif, 2007).

2.3 Wireless Technology

Wireless technology, which uses electromagnetic waves to communicate information from one point to another, can be applied to computers and other electronic devices. Although wireless technologies have been used in specific applications for decades, wireless networks have recently become much more widespread due to better technology and lower prices (Harris et al., 2001; Ashok, 2003).

2.3.1 Wireless Technology based Devices

Once the IEEE first defined wireless standards in the late 1990's, wireless networking became feasible for a wide range of business and personal applications. Wireless networking offers various advantages over wired connections, including mobility, connectivity, adaptability, and ease of use in locations that prohibit wiring.

Universities, airports, and major public places and government are currently taking advantage of wireless technology, and many businesses, health care facilities, and major cities are developing their own wireless networks. Since the cost of wireless networks has dropped dramatically in recent years, they are also becoming more

popular in home computing (Sasidhar, 2005). Figure 2.3 present the wireless connection within multi devices.

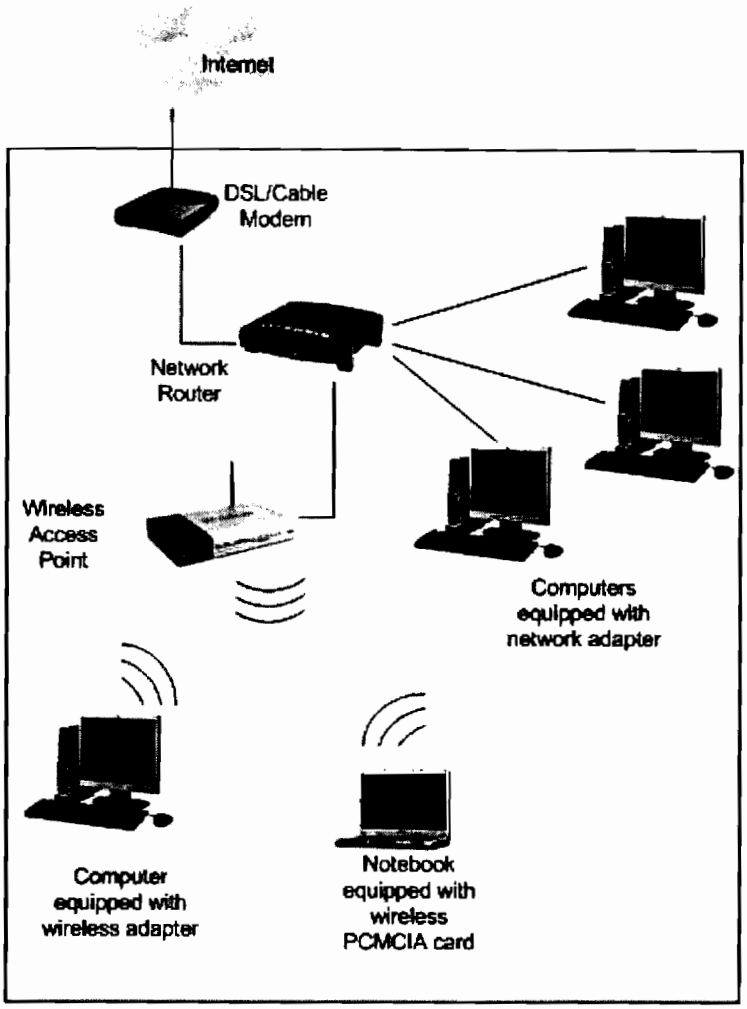


Figure 2.3: Simple wireless connection

2.4 Agent System

Agent and multi agent systems are new structural behaviors for simplifying and building distributed systems, these behaviors presents a certain pattern for controlling and monitoring the system components based on several mathematical and physical calculations to fit a certain goals (Chau et al., 2006).

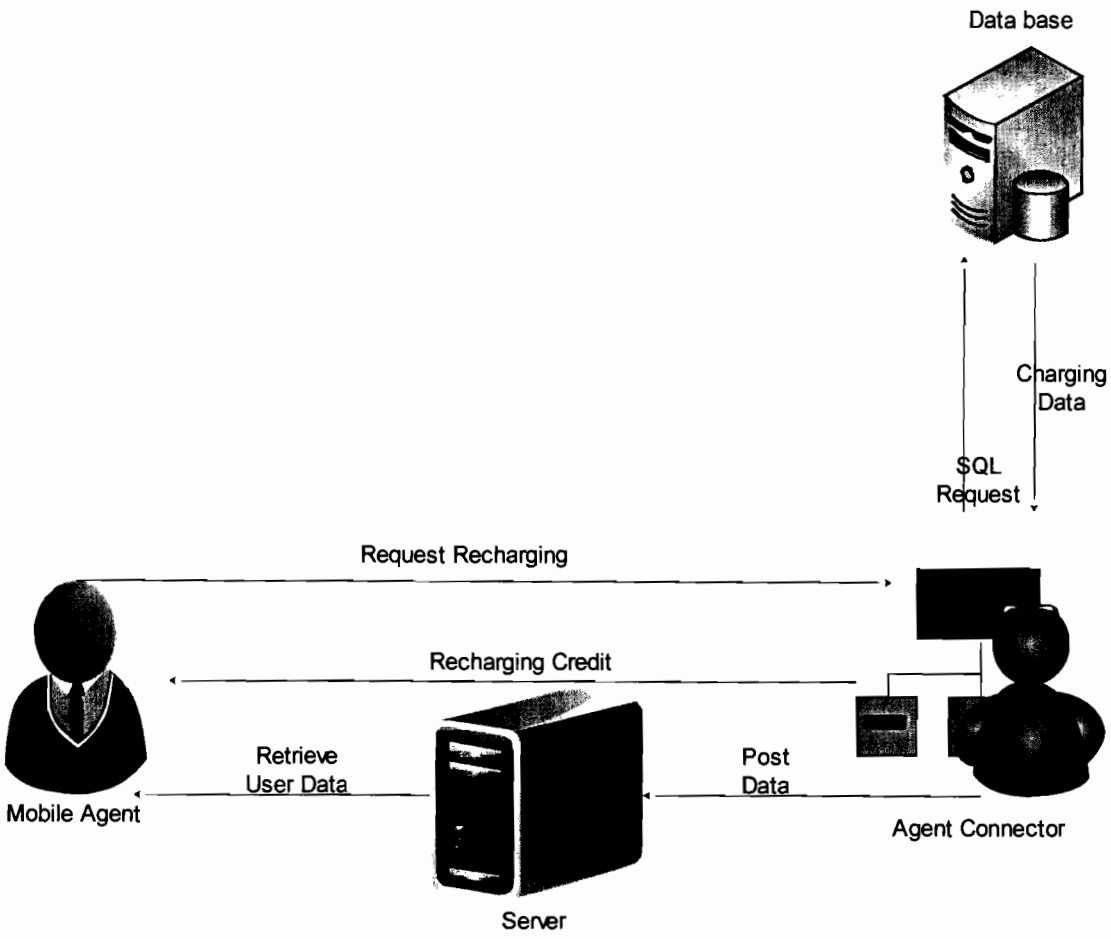


Figure 2.4: The proposed mobile agent

This study reports the proposed mobile recharging system based on agent technology. Its main components are databases, mobile agents, and agent connector to interface services with the mobile agent system.

The using of agents systems in the mobile services are often presented as the future of distributed computing in term of classifying and organizing the client requests. Different representation of agent activities introduce a new approach to the traditional client/server architecture, which hides the network complexity to the end-user and

makes data transfers asynchronous. Developing such a services based agent systems obtain a new classification of client queries where the overall network structure is dynamic, due to the mobility of computer component themselves like mobile phones, and the fact that servers providing new services.

This study justifies the importance of using agent systems in mobile application for recharging printing services, moreover, the study subjected to a lot of research at the moment, even if applications of it are not yet wide spread. Agent and multi agent systems are new structural behaviors for simplifying and building distributed systems, these behaviors presents a certain pattern for controlling and monitoring the system components based several mathematical and physical calculations to fit a certain goals (Nazaraf et al., 2009).

2.5 Related Works

A study by Petric et al. (2008) which reported the usefulness of using the wireless channels for utilizing better services of multimedia applications anywhere and anytime. This study has provided a model for wireless application based on agent systems which adapted to prevent the burdening of users with calculation of revenue for available services (Goldfarb and Tucker, 2008). This study justified the using of agent systems in mobile application for simplifying the client queries for automated business-driven service provisioning (Petric et al., 2008). Figure 2.5 shows the proposed mobile services based agent systems.

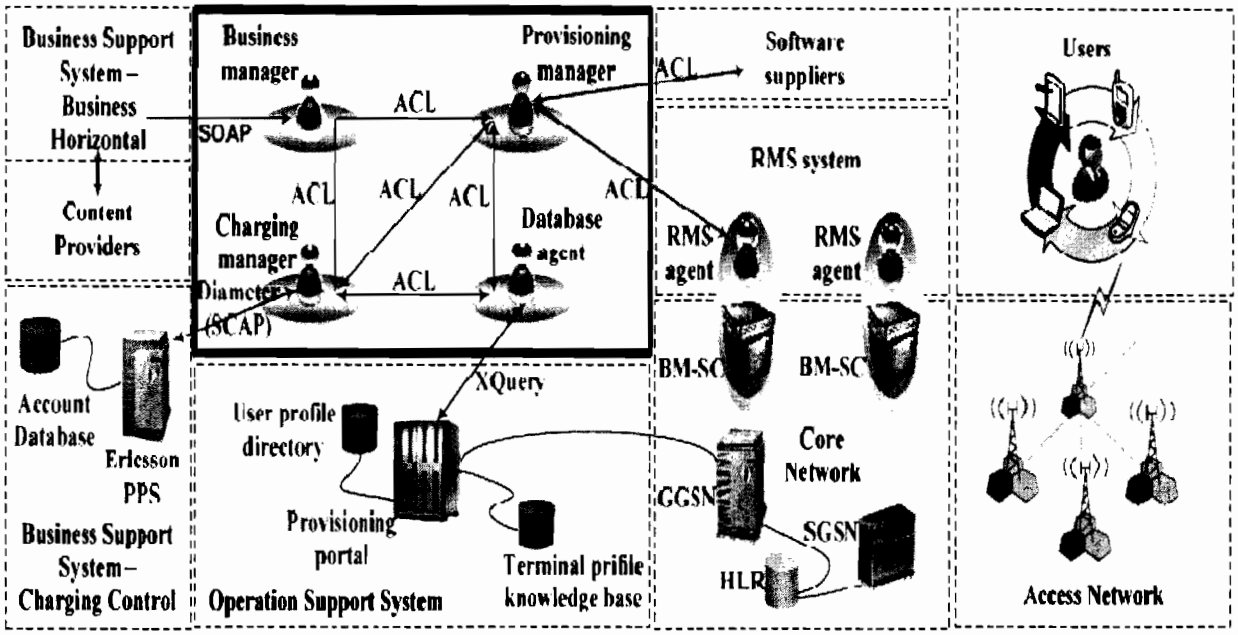


Figure 2.5: Mobile services based agent systems

Another study by Stuart et al. (2008) described the importance of the wireless sensors in delivering and receiving the communication signal over channels. This study has been focused on the using of mobile-agent that is sent to sensor nodes to perform intended interrogations, which can alleviate several limitations of the traditional sensing networks. Furthermore, the mobile-agent provides computation power to make near real-time assessments on the structural conditions. The proposed wireless sensor node is specifically designed to accept various energy sources, including wireless energy transmission (Stuart et al., 2008). Figure 2.6 presents the proposed wireless structure based mobile agent system.

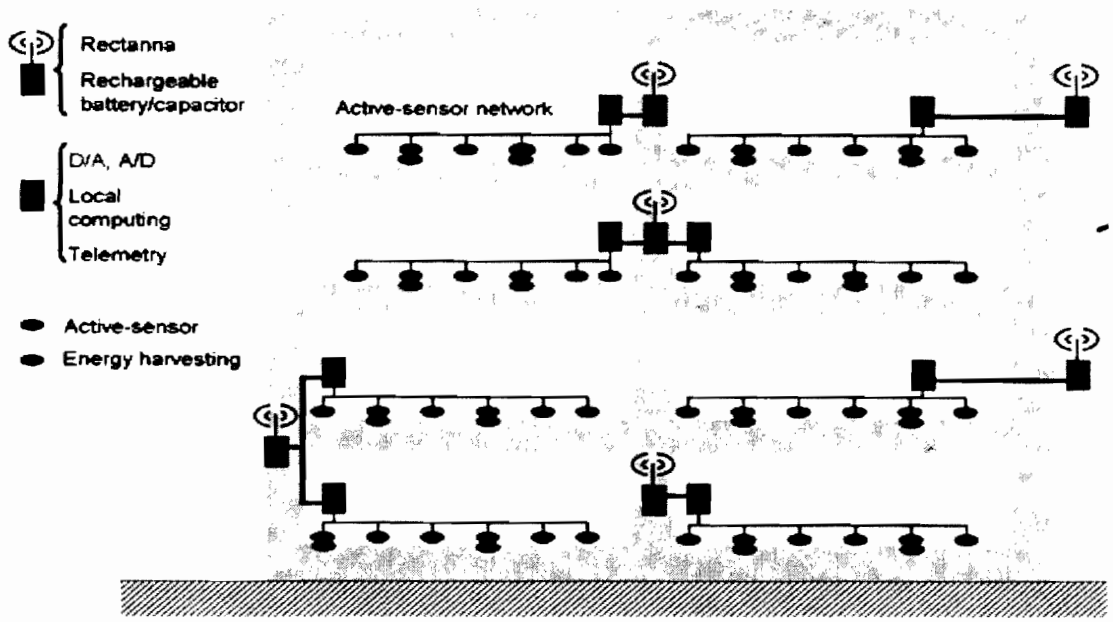


Figure 2.6: Wireless architecture based mobile agent system

In addition, a study by Onifade et al. (2009) stated the advantages of wireless communication technology in the Global System for Mobile Communication (GSM) networks based agent systems. This study also customized the using of GSM services for providing an inefficient bandwidth utilization and congestion during the transmission channel. This study aimed to provide a dynamic and flexible way of recharging GSM devices by prepaid users (device) even where recharge cards are not physically available. Moreover, the aim of utilizing agent systems was aimed to conserve power and improve bandwidth utilization by taking the confirmation processes off the mobile clients using the intermittent connectivity method of query processing and report feedbacks (Onifade et al., 2009). Figure 2.6 shows the proposed technique.

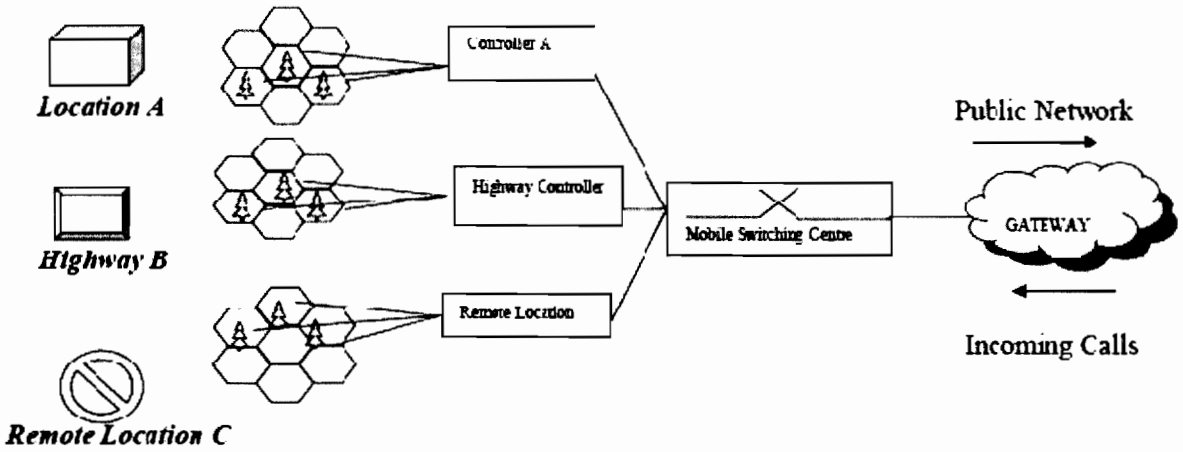


Figure 2.7: Recharging GSM devices

A study by Rinkesh et al. (2008) proposed a conceptual intelligent agent structure for simplifying the computing process based on online auctions. This study focused on the issues of online auctions in term of retrieving and generating the user queries. The study has successfully applied agent techniques along with a real-time trust management module for agent based online auction systems. However, sub-technique also generated using role-based access control mechanisms for managing and these queries.

Moreover, the study depends on different key components of the trust management module to finalize the managing issues of data between client and server, the proposed agent helps to secure and facilitate these transactions. Furthermore, this study employed a certain approach in order to generate the feasibility, the implementation process was conducting on real-time trust management module for agent-based online auction systems, and demonstrated how shill agents could be efficiently detected (Rinkesh et al., 2008).

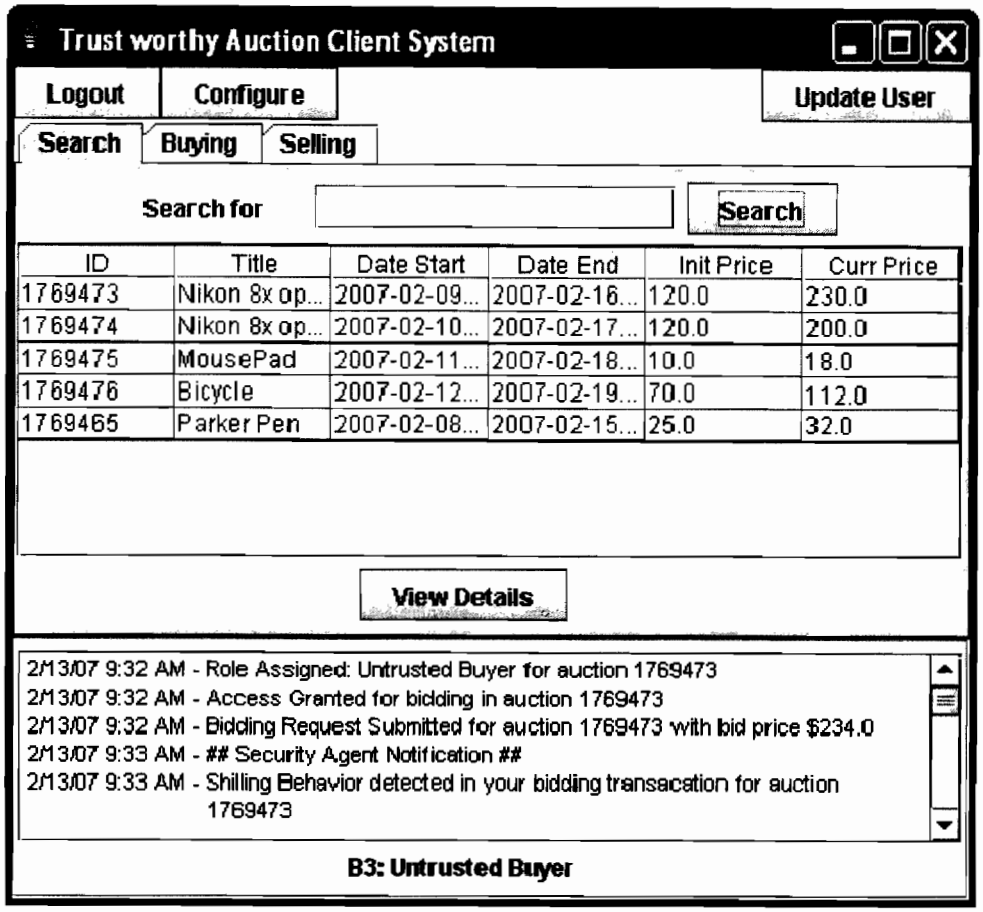


Figure 2.8: The proposed agent technique

Rinkesh et al. (2008) also discussed the design process of a distributed smart grid based on multi agent systems that provides intelligence to grid cycle. This study justified the needs of alternative methods for facilitating the retrieving process of grid along with agent elements. Furthermore, analysis and implementation of the proposed grid has been optimized successfully. The proposed technique specifies the exchange level of the data to be compatible with an IP-based network. The proposed technique applied an IEEE standard on Foundation for Intelligent Physical Agent (FIPA). In addition, the study demonstrates the use of multi-agent systems to control a distributed smart grid in a simulated environment. The obtained result showed that the

proposed distributed grid can improve the data transition over several communication channels when upstream outages are detected. The figure below shows the study frame work of distributed grid based multi agent systems.

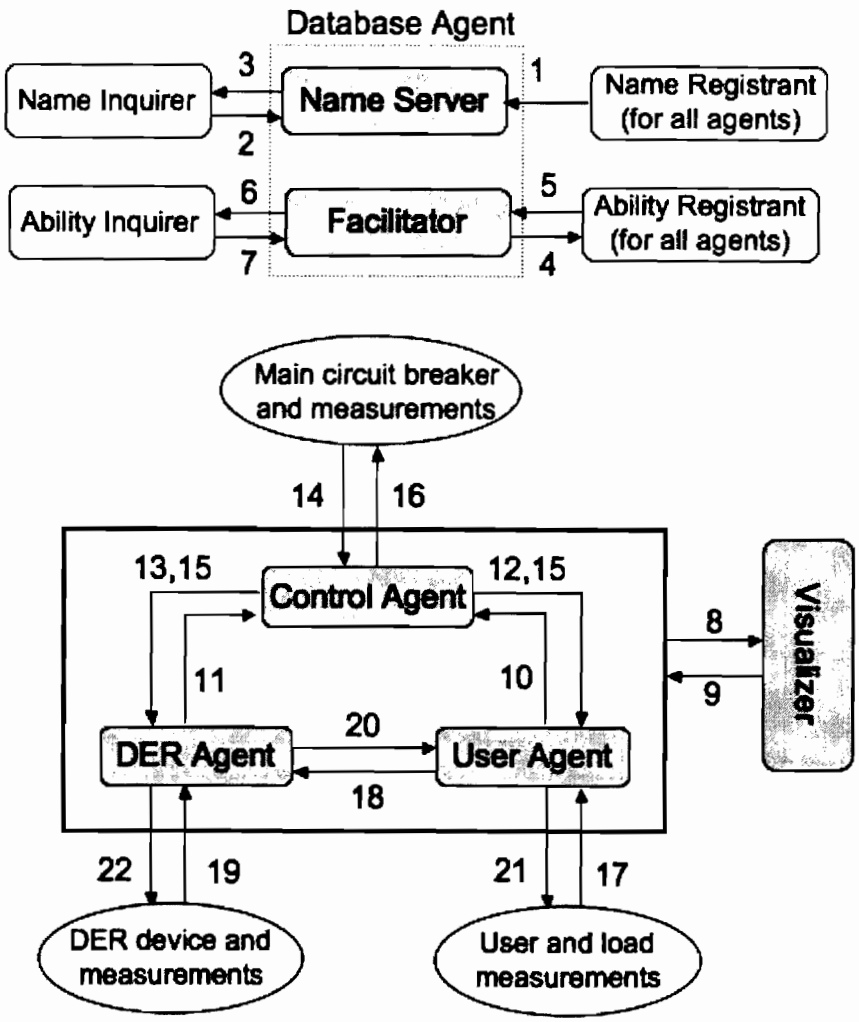


Figure 2.9: Distributed grid based multi agent systems

However, Kussul et al. (2002) addressed the importance of online services to demonstrate the user queries over specific patterns. This study propose a new method for detection and transferring user queries in more effective way which deals with agent systems. The proposed method presented a secure way for transferring user

queries over the grid. Nonetheless, the study used different types of intelligent agents based on using neural model of user behavior. This study has shown the experiments result of the proposed method in Institute of Physics and Technologies of National Technical University of Ukraine (Peng et al., 2007). The result presented the effectiveness of agent systems in the online services.

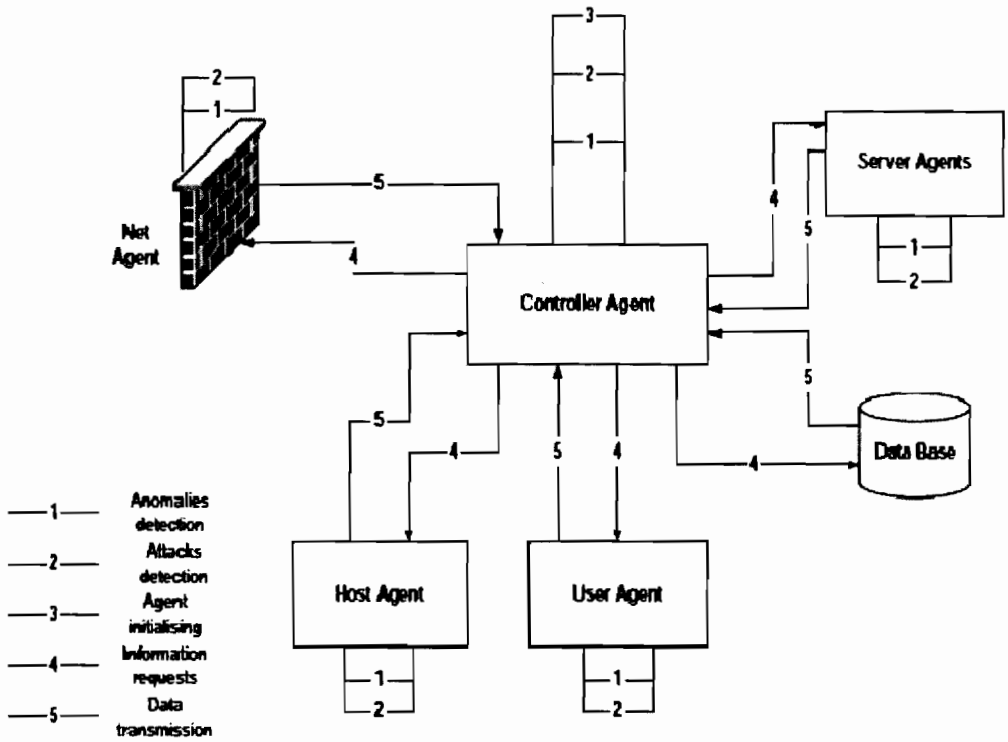


Figure 2.10: Proposed detection method

Moreover, a study by Vincent et al. (2009) justifies the issues of using the dynamic way to present and transfer data between client and server. Presenting the data elements in a dynamic way helps business, organization or establishment function effectively in a competitive environment. This study has presented a mobile application for posting advertising elements based agent classification; in more

effective way. The proposed system specifies the query objects of users from one host to another to make enquiry and place adverts. This model is designed with the assumption that each of the host grants access to the mobile agents.

Finally, a related study by Somchart et al. (2007) proposes an authentication approach to support multi-clients in using a multi-application based environment. The proposed approach was focused on the prime elements of the public key infrastructure (PKI) schema. The study has applied a Single Sign-On (SSO) and the Multi-Agent System (MAS) concepts to improve the authorization process along with multi-applications and multi-clients more dynamically and efficiently. The concern of this study is to re-organize client request in more understandable way, simplify the granting an access role to the client, and controlling a concurrent use of applications (Somchart et al., 2007).

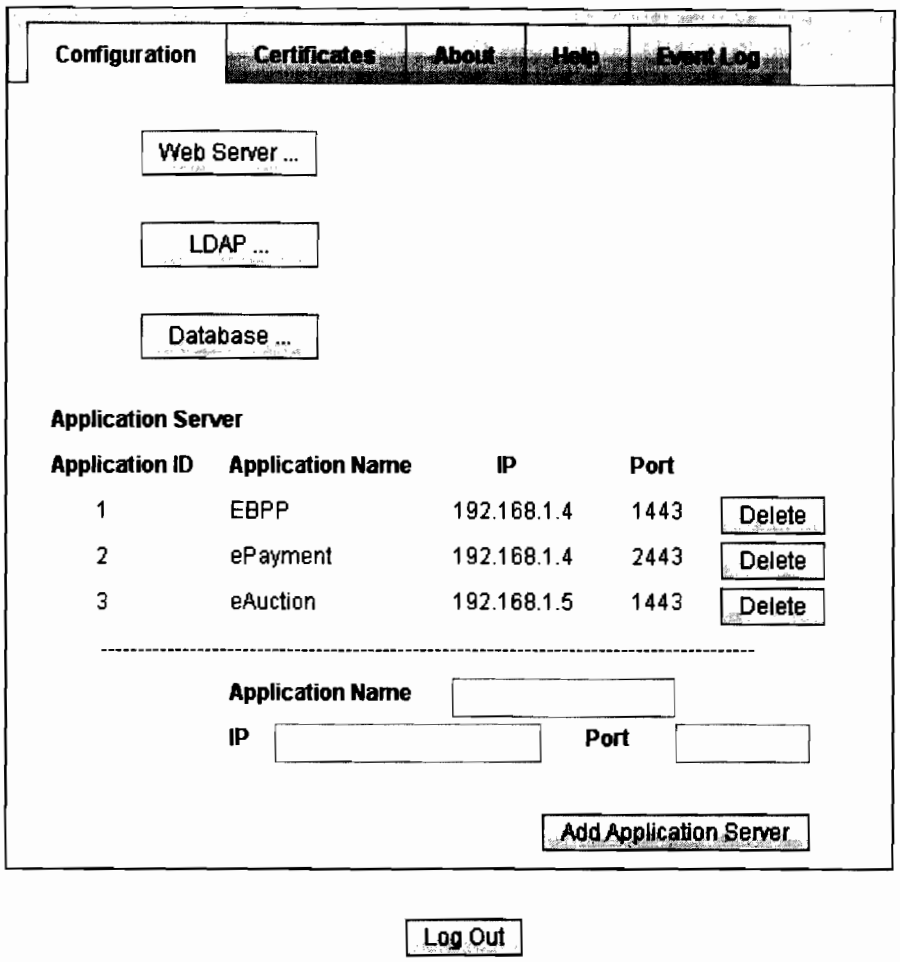


Figure 2.11: The authentication approach

2.6 Summaries

This chapter has discussed concept and definition of the internet technology over services and devices, and other issues regarding the web application architecture. An overview on wireless technology has been discussed also. Finally, this chapter has outlined the perception and previous related work, which eventually helped in determining the previous agent techniques in different online services, based certain approaches. The next chapters will discuss on research methodology

CHAPTER THREE

RESEARCH METHODOLOGY

This chapter discusses the methodology that has been adapted to this study. This study employed the research methodology that is adopted from object-oriented analysis and design by Whitten and Bentley (2007). This study has adapted and the main steps of the methodology. The phases of methodology section and summary section will discuss respectively.

The adopted research methodology includes four phases:

- Conducting analysis study to the current system.
- Designing the prospective system and interfaces' structure.
- Developing prototype.
- Testing prototype.

The following figure shows the aforementioned methodology's steps.

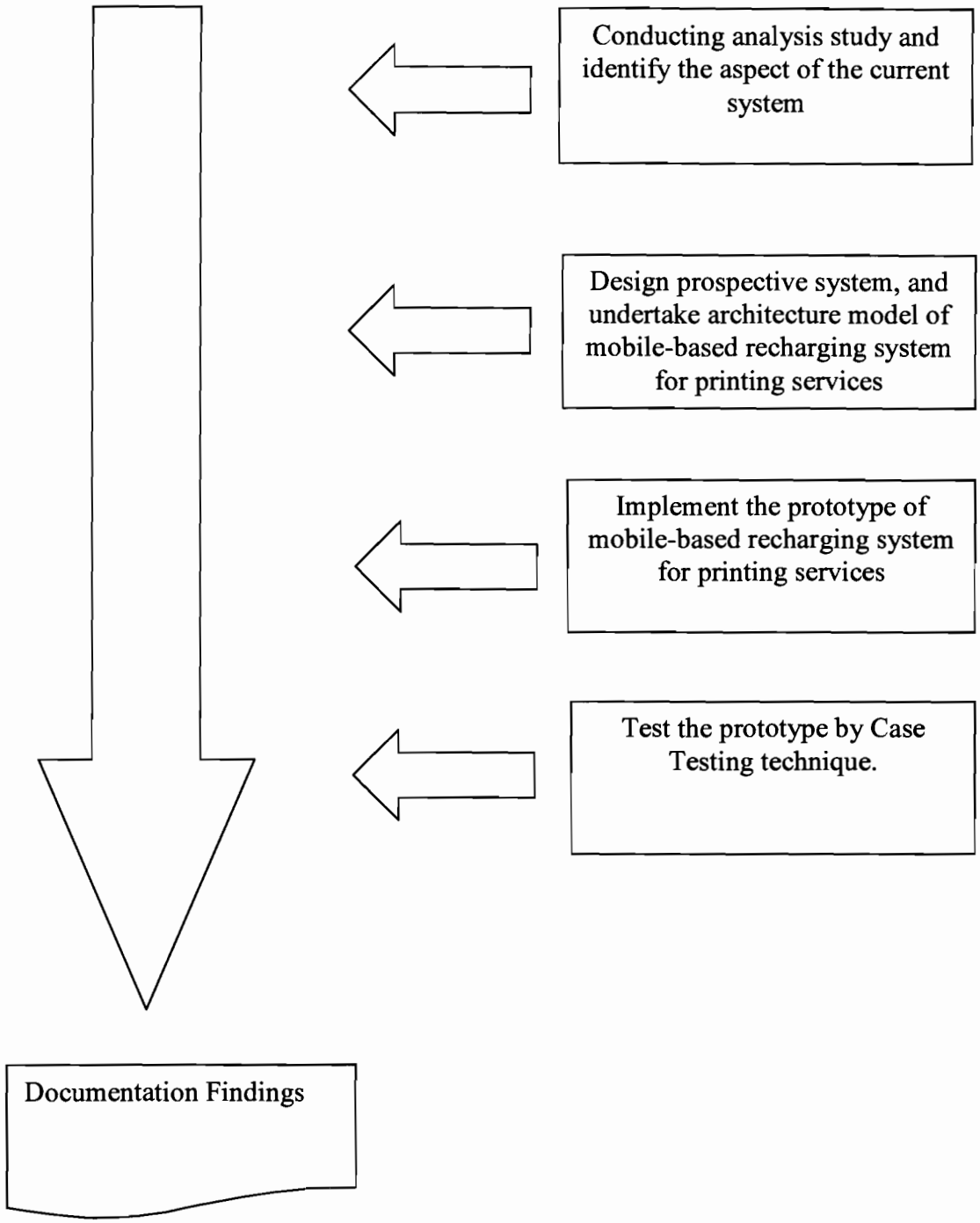


Figure 3.1: Research Methodology Phases (Whitten and Bentley, 2007)

3.1 Conduct analysis study to the current system

In this phase all information about the target system are gathered from primary and secondary resources to collect the related information and to collect business requirements for new system by interviews. During this phase the analyzing for current system has done and analysis current system procedure to reach the approaches to design the new prototype. In this phase, the steps that will occur are (Dennis and Wixon, 2003):

- Gathering business requirements by interviews.
- Indicate functional and non functional requirements.
- Creating use case specifications.

3.2 Design prospective system

The research methodology refers to the methods and techniques used by the researcher in doing the research. This research methodology used Rapid Application Development (RAD) method by Charles (1995), to describe the process of creating workable systems in a very short period of time. RAD applies the value of teamwork to the developers. This method adopted from Charles (1995), which contains seven phases (Scope of project, prototype, design, development, test, launch, and support). This study has been modified the selected development method based on the study objectives by covering the three phases from all (prototype, design and development).

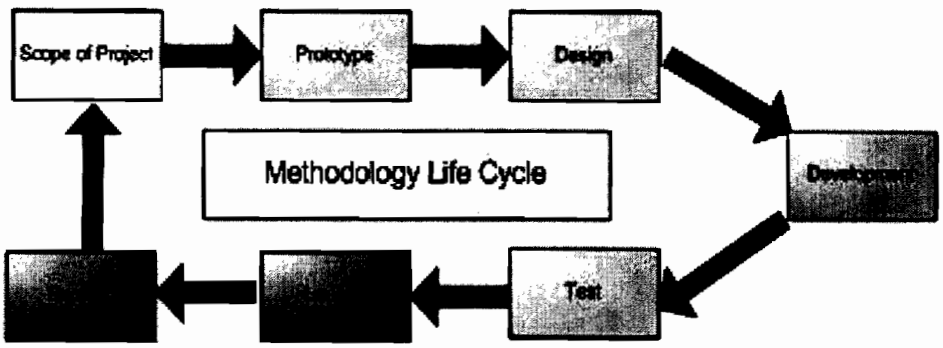


Figure 3.2: Rapid Application Development Method (Charles, 1995)

3.2.1 RAD Prototype Phase:

This phase concerned on identifying any usability issues, and freeze or change functionality based on GUI changes. In this case, awareness of the problem has been raised because of the need to mobile recharging system for UUM printing services based multi agent systems.

This phase illustrated how the current system works, determined & analyzed facts and documents how system should work to better support, develop a logical model of the proposed mobile-based recharging system for the printing services based multi agent systems.

3.2.2 RAD Design Phase

The design process determines how best to construct a project that delivers these requirements. Design is first concerned with the specification of the software architecture that defines the major software components and their relationship, design involves reaching a balance between requirements that conflict with each other within implementation environmental constraints.

The system design is for making decision for the system operation for the software, hardware and for network infrastructure. The output of this phase is the Tentative Design. The design of the system includes UML diagrams. The UML diagrams has been involved the use case diagrams, detailed sequence diagrams for each use case, and class diagrams. These diagrams have been presented later in this study based on Rational Rose software enterprise edition.

3.3 Implementation the Prototype

Implementation is essential part of the overall software process. Thus, this methodology has employed RAD development step to implement the proposed prototype. MySQL has been used for database design and JSP for interface design. At the end of this phase a prototype model of mobile-based recharging system for the printing services based multi agent systems has been achieved.

During coding, the programmers need to consider all the system requirements to be optimized successfully in the selected environment (UUM). The output of this phase has been generated into machine readable computer code. This is the critical phase in

the implementation of this project. The system has been developed using JSP language and MySQL to build the system database.

Implementation ended with a formal system test. The test data are crucial to this process. This step is one of the most critical steps in implementation because the cost of bugs can be reduced. The plan usually include the formal or informal post implementation review as well as a systemic way for identifying major and minor changes needs for enhancing the current recharging system for UUM students through their mobile devices. This phase was adopted the use test case to identify the input and the output from the proposed system and to minimize prototype from bugs and errors.

3.4 Testing the Prototype

Implementation ended with a formal system test. The test data are crucial to this process. Testing is one of the most critical steps in implementation because the cost of bugs can be reduced. The plan usually include the formal or informal post implementation review as well as a systemic way for identifying major and minor changes needs for enhancing the current recharging system for UUM students through their mobile devices. This phase was adopted the suing of use test case to identify the input and the output from the proposed system.

3.5 Summary

In sum, this research employed the research methodology by Whitten and Bentley (2007) as a guideline for the whole research process and this methodology has carefully choose RAD method in order to develop the prototype for this study. This study focuses on the four phases lead to produce the proposed mobile-based recharging system for the printing services. In the next chapter, the finding and testing of the proposed system will be discussed.

CHAPTER FOUR

SYSTEM ANALYSIS AND RESULTS

This chapter briefly discusses the analyze process of the proposed mobile recharging system for UUM printing services. The results of the study bring together the functionalities, interface, and generalized design principles for developing the proposed by presenting use case diagram, use case specification, sequence diagram, collaboration diagram, and user interface.

4.1 Analysis Phase Findings

This study has collect data through make interviews with some staff in Sultanah Bahiyah Library such Mr. Mohammed Nor bin Ahmad and the chief librarian Mr. Salehuddin Mustafa, these interviews are necessary to gathering information and to clarify the current system procedure . In addition, it assists to identify the functional requirements and the student requirements. The outputs of this phase have been addressed the system proposal that the business requirements should meet.

4.1.1 System Analysis

4.1.1.1 System Functional Requirements

Listed below are the functional and non-functional requirements of the system. In the priority column, the following short hands are used:

- M – Mandatory requirements (something the application must do)
- D – Desirable requirements (something the application preferably should do)
- O – Optional requirements (something the application may do)

MRS_01	**Student/ Registration Page**	
MRS_01_01	• The proposed system provides the ability for student to register their self into the proposed mobile recharging system by inserting their login details into the registration page. Students must register first before login to their page.	M
MRS_02	**User/ Login**	
MRS _02_01	• Both admin and students can login into their pages by inserting a valid username and password. User must insert a correct username and password to precede their operations.	M
MRS_03	**Student/ Manage Profile**	
MRS _03_01	• The proposed mobile recharging system provides students with the ability to change their profile details by inserting their new personal details and save into the system database.	M
MRS_04	**Student/ Charge Credit**	
MRS _04_01	• The proposed mobile recharging system,	M

	allows students to recharge their credit. This credit can be used later for the printing services.	
MRS _05	**Student/ View Credit**	
MRS _05_01	• Student is able to view and monitor their credit status over mobile devices by selecting the package.	M
MRS _06	**Admin / Manage Student**	
MRS _06_01	• Admin has the ability to manage the student's details by adding, updating, and deleting the student information from the system database.	M
MRS _07	**Admin / Manage Package**	
MRS _07_01	• The proposed mobile recharging system provides admin with the ability to manage the package details by adding, updating, and deleting the package details.	M
MRS _08	**Logout**	
MRS_08_01	• Both admin and students can logout from their pages by press on logout link.	

4.1.1.2 Non Functional Requirements

MRS _8	**Requirement for Performance**	
MRS _8_01	• The proposed mobile recharging system	M

	must perform its operations according to hardware & software used.	
MRS_9	**Availability**	
MRS_9_01	• The system should be available to all kind of users.	M
MRS_10	**Reliability**	
MRS_10_01	• The system should present the same selected sequence.	M

4.1.1.3 Use Case Diagram

Figure 4.1 highlights the proposed mobile recharging system use case diagram. The system has two prime users; students and admin. Bother users have their own functionality according to their level. Admin of the proposed mobile recharging system has the ability to manage the student and package details by adding, updating, and deleting the student and package information. Students of the proposed system have the ability to do registration before login into their pages. However, students also able to manage their profile, charge credit, and view their credit amount. Both users (Admin and Students) are unable to obtain these operations without login into their pages.

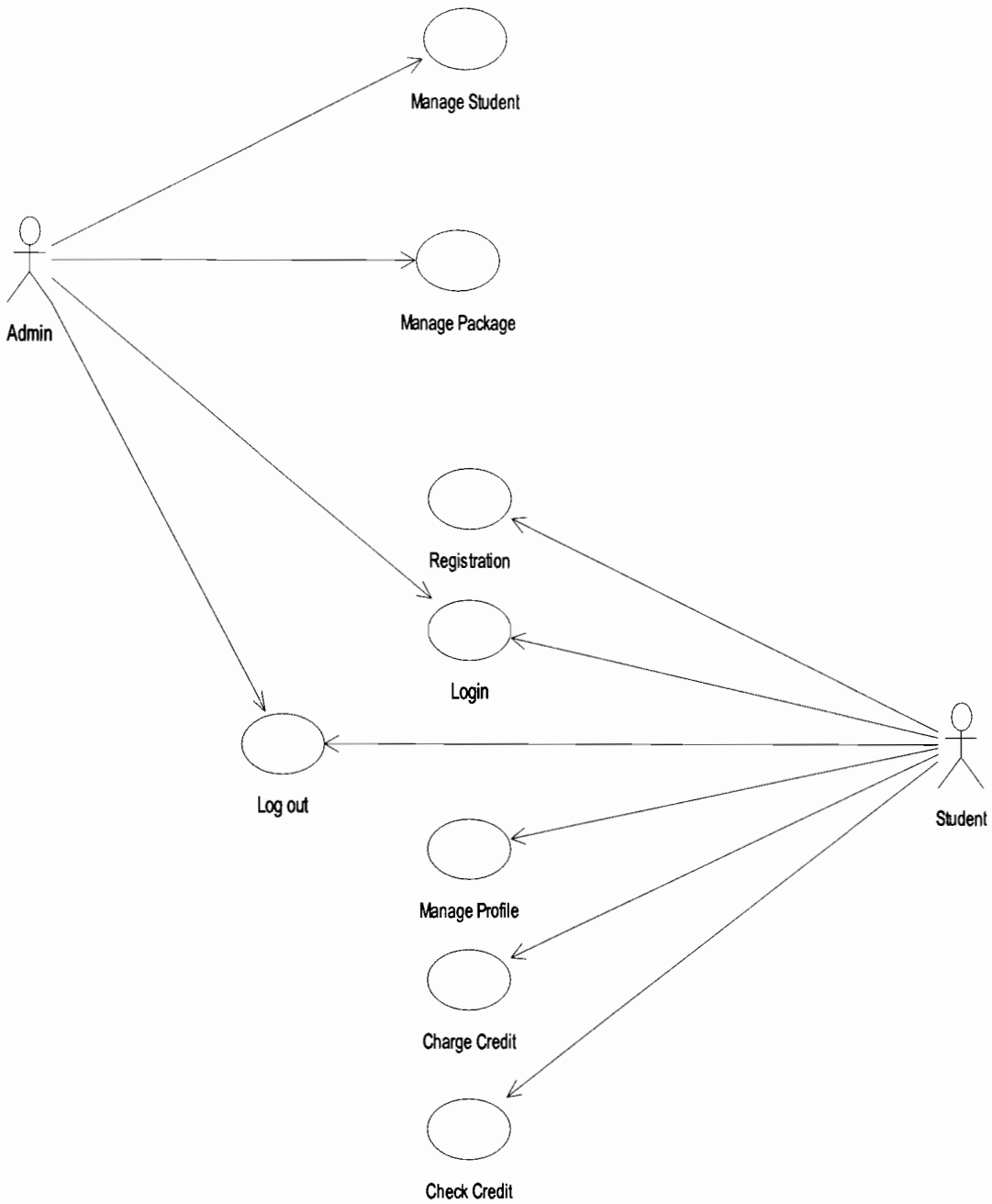
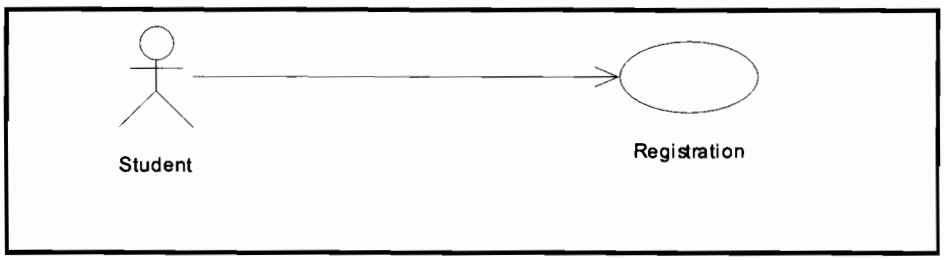


Figure 4.1: Mobile Recharging System Use Case Diagram

4.1.1.4 Use Case Specification

Student Registration



Brief Description

— This case is initiated by student who would like to register into the proposed mobile recharging system by inserting his/her details into the registration fields.

Pre-Condition

— Student has a valid username and password

The characteristics of activation

— Execution depends on student demand (Even driven). If the student desires to register into this service, he/she should select this use case.

Flow of events

Basic flow

The use case begins when student clicks on the registration link.

— Student will fill the registration details form.

— Student will press submit.

— The proposed mobile recharging system should respond to the student request and save the student details to be used later by the system admin and student.

Alternative flow

— Login

Exceptional flow

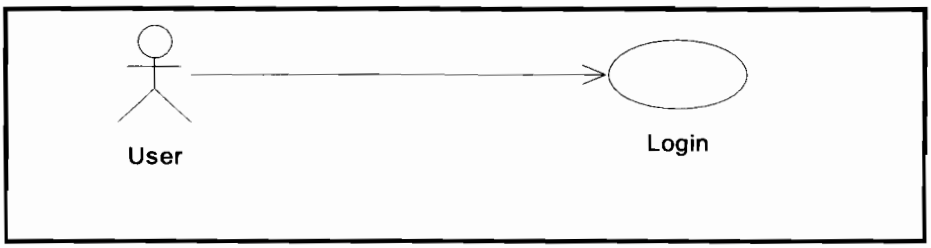
E-1-: Check Students Details

System will verify the student registration request. In case of incorrect information the system should display "Invalid Details".

Post-conditions

— Registration was successfully

Login



Brief Description

— This case is initiated by users which present both of admin and student who would like to access to his/her page. User will be able later to access his/her page after a successful login.

Pre-Condition

— User has a valid username and password

The characteristics of activation

— Execution depends on user (Admin and Student) demand (Even driven). If the user desires to login to his/her page, he/she should select this use case.

Flow of events

Basic flow

— The use case begins when user presses login button.

— User will insert the username and password.

— User presses the login button.

— The proposed mobile recharging system will respond to the user request and will view their pages.

Alternative flow

— Not Applicable

Exceptional flow

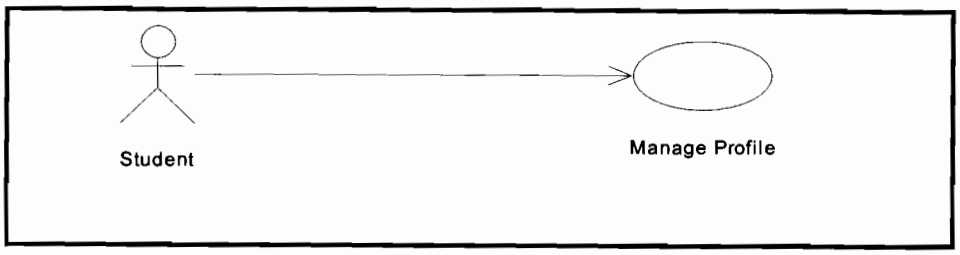
E-1-: Wrong Username and Password

System will verify the user login details. In case of incorrect information the system should display "Wrong Username and Password".

Post-conditions

— Login Success

Manage Profile



Brief Description

— This case is initiated by student who would like to manage his/her profile details by updating his/her personal details into the system.

Pre-Condition

— Student has a valid username and password

The characteristics of activation

— Execution depends on student demand (Even driven). If the student desires to manage the profile details, he/she should select this use case.

Flow of events

Basic flow

— The use case begins when student clicks manage profile link.

— Student will edit the profile details by filling in the profile form.

— Student will press submit.

— The proposed mobile recharging system will respond to the student request and will save the new profile information.

Alternative flow

— Check credit

— Charge credit

Exceptional flow

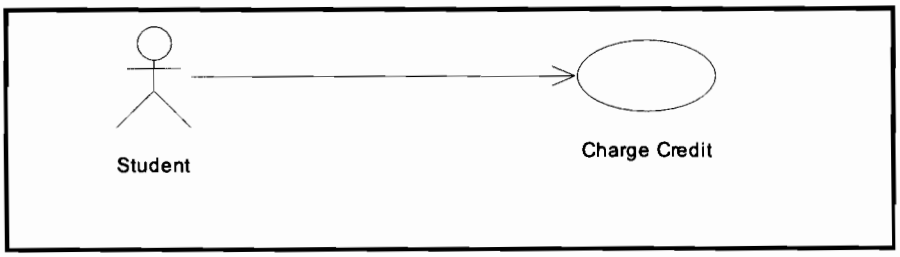
E-1-: Invalid Profile Details

System will verify the student edit profile request. In case of incorrect information the system should display "Invalid profile Details".

Post-conditions

— Profile edited successfully

Charge Credit



Brief Description

— This case is initiated by student who would like to recharge his/her credit amount for the printing services.

Pre-Condition

— Student has a valid username and password

The characteristics of activation

— Execution depends on student demand (Even driven). If the student desires to recharge the credit amount, he/she should select this use case.

Flow of events

Basic flow

— The use case begins when student clicks charge credit link.

— Student will select the package amount from the package form.

— Student will press submit.

— The proposed mobile recharging system will respond to the student request and will save the new credit balance information.

Alternative flow

— Check credit

— Edit profile

Exceptional flow

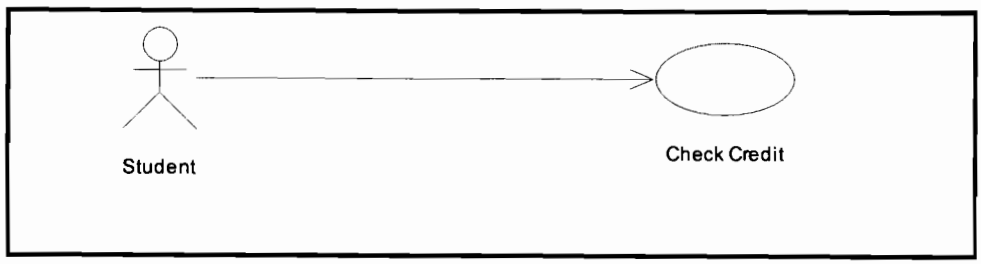
E-1-: Invalid Package

System will verify the student recharging request. In case of incorrect information the system should display "Invalid Package".

Post-conditions

— Credit charged successfully

Check Credit



Brief Description

— This case is initiated by a student who would like to view his/her credit balance details through his/her mobile devices.

Pre-Condition

— Student has a valid username and password

The characteristics of activation

— Execution depends on student demand (Even driven). If the student desires to view the credit details, he/she should choose this use case.

Flow of events

Basic flow

— The use case begins when a student presses the view credit button from the proposed mobile recharging system mobile page.

— System will respond to the student request and will retrieve the credit details.

— The system will display credit balance details to the students.

Alternative flow

— Not Applicable

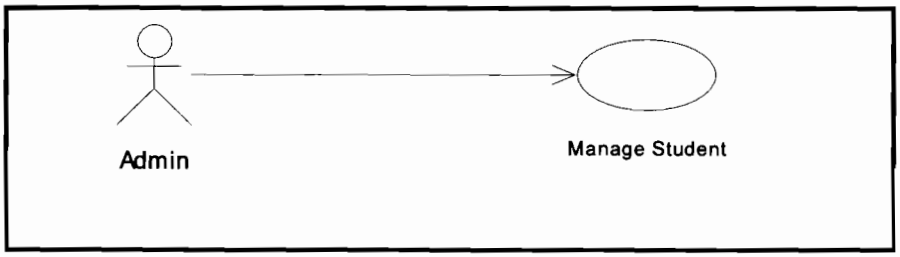
Exceptional flow

— Not Applicable

Post-conditions

— View credit details

Manage Student



Brief Description

— This case is initiated by admin who would like to manage the student details by adding, updating, and deleting the student details into the system database.

Pre-Condition

— Admin has username and password

The characteristics of activation

— Execution depends on admin demand (Even driven). If the admin desires to manage the student details, he/she should select this use case.

Flow of events

Basic flow

— The use case begins when admin clicks manage student's link.

— Admin will fill the new student details form.

— Admin will press submit.

— The proposed mobile recharging system will respond to the admin request and will save the new student information.

Alternative flow

— Edit student

— Delete student

Exceptional flow

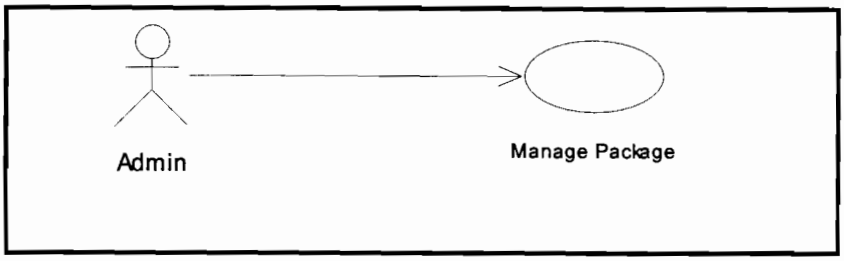
E-1-: Invalid Student Details

System will verify the admin add student request. In case of incorrect information the system should display "Invalid Student Details".

Post-conditions

— Student added successfully

Manage Package



Brief Description

— This case is initiated by admin who would like to manage the package details by adding, updating, and deleting the package details.

Pre-Condition

— Admin has username and password

The characteristics of activation

— Execution depends on admin demand (Even driven). If the admin desires to manage the package details, he/she should select this use case.

Flow of events

Basic flow

— The use case begins when admin clicks manage package button.

— Admin will fill the package details form.

— Admin will press submit.

— The system will respond to the admin request and will save the new package information.

Alternative flow

— Edit package

— Delete package

Exceptional flow

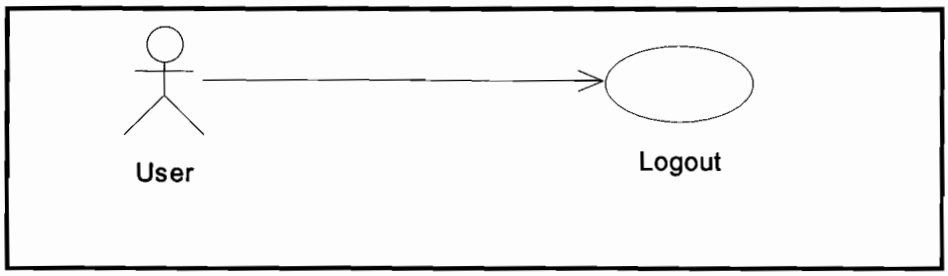
E-1-: Invalid Package Details

System will verify the admin add package request. In case of incorrect information the system should display "Invalid Package Details".

Post-conditions

— Package added successfully

Logout



Brief Description

— This case is initiated by users which present both of admin and student who would like to get out from his/her page. User will require access again to his/her page after make logout.

Pre-Condition

— Not Applicable

The characteristics of activation

— Execution depends on user (Admin and Student) demand (Even driven). If the user desires to logout from his/her page, he/she should select this use case.

Flow of events

Basic flow

— The use case begins when user presses logout button.

— User presses the login button.

— The proposed mobile recharging system will respond to the user request and will view their main page.

Alternative flow

— Not Applicable

Exceptional flow

— Not Applicable

Post-conditions

— Logout Success.

4.2 System Design

This phase concerned on identifying any usability issues, change functionality based on GUI changes. In this case, awareness of the problem has been raised because of the need to mobile recharging system for UUM printing services based multi agent systems.

This phase illustrated how to develop a logical model of the proposed mobile-based recharging system for the printing services based multi agent systems. The design phase of this project highlights two design issues (Logical and physical design).

4.2.1 Logical Design

Logical design is the phase where all functional features that have been chosen for the development of the system are described without regard of any computer platform.

The using of system development method in designing and developing the proposed mobile recharging system for UUM printing has been consisted the usefulness in understanding the whole system's functions especially during implementation or coding. For this project, Unified Modeling Language (UML) has been used as the techniques of notation to represent the system's requirements.

4.2.1.1 Sequence and Collaboration Diagram

4.2.1.1.1 Student Registration Sequence Diagram

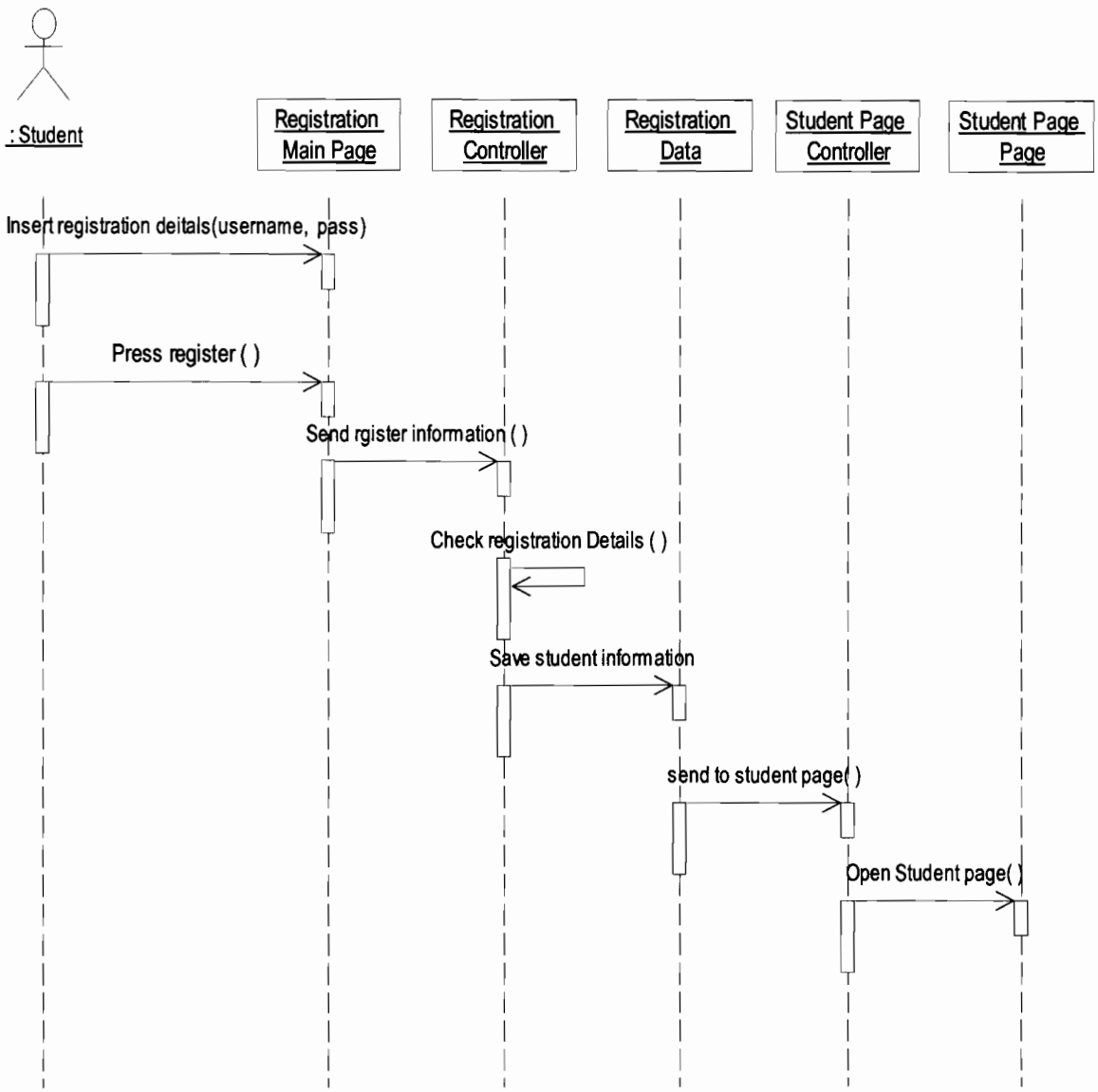


Figure 4.2: Registration Sequence Diagram

4.2.1.1.2 Registration Collaboration Diagram

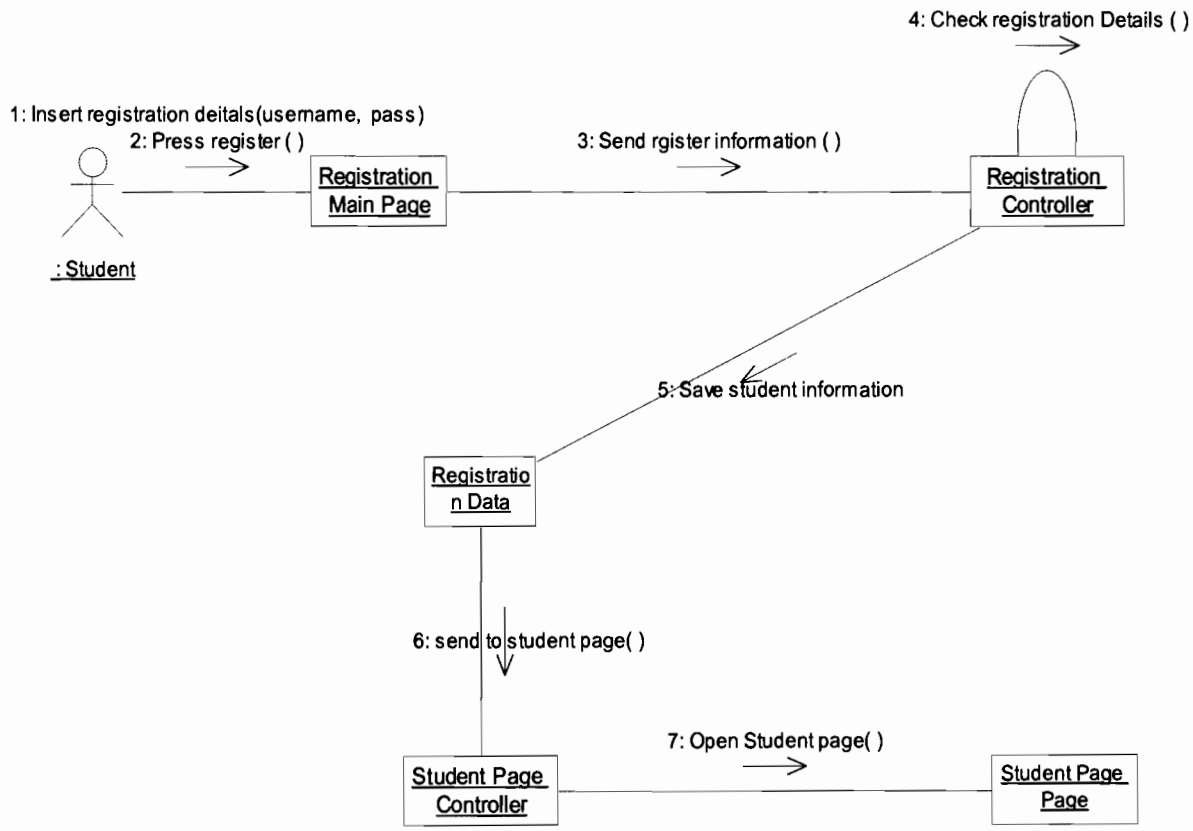


Figure 4.3: Registration Collaboration Diagram

4.2.1.1.3 Login Sequence Diagram

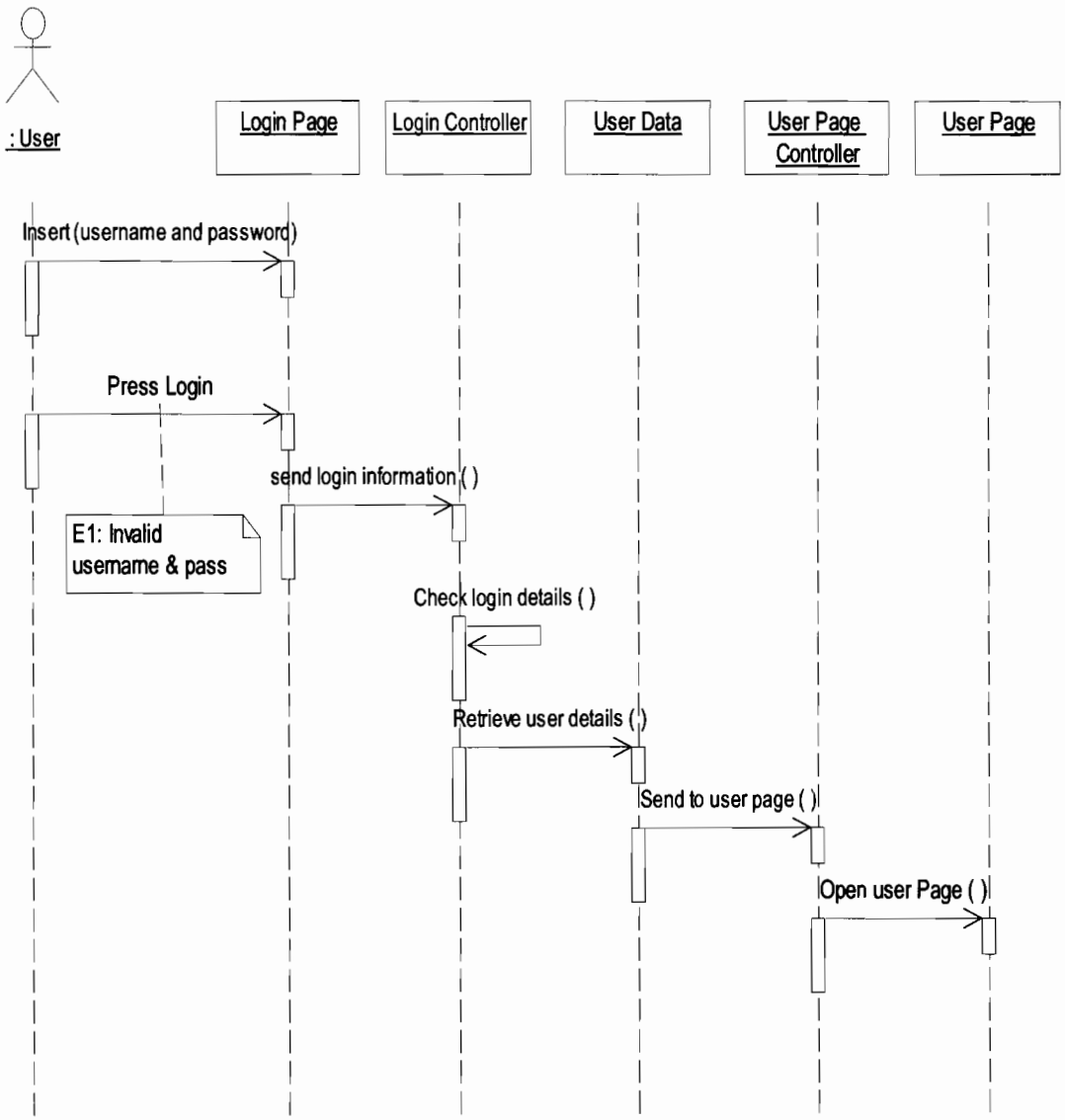


Figure 4.4: Login Sequence Diagram

4.2.1.1.4 Login Collaboration Diagram

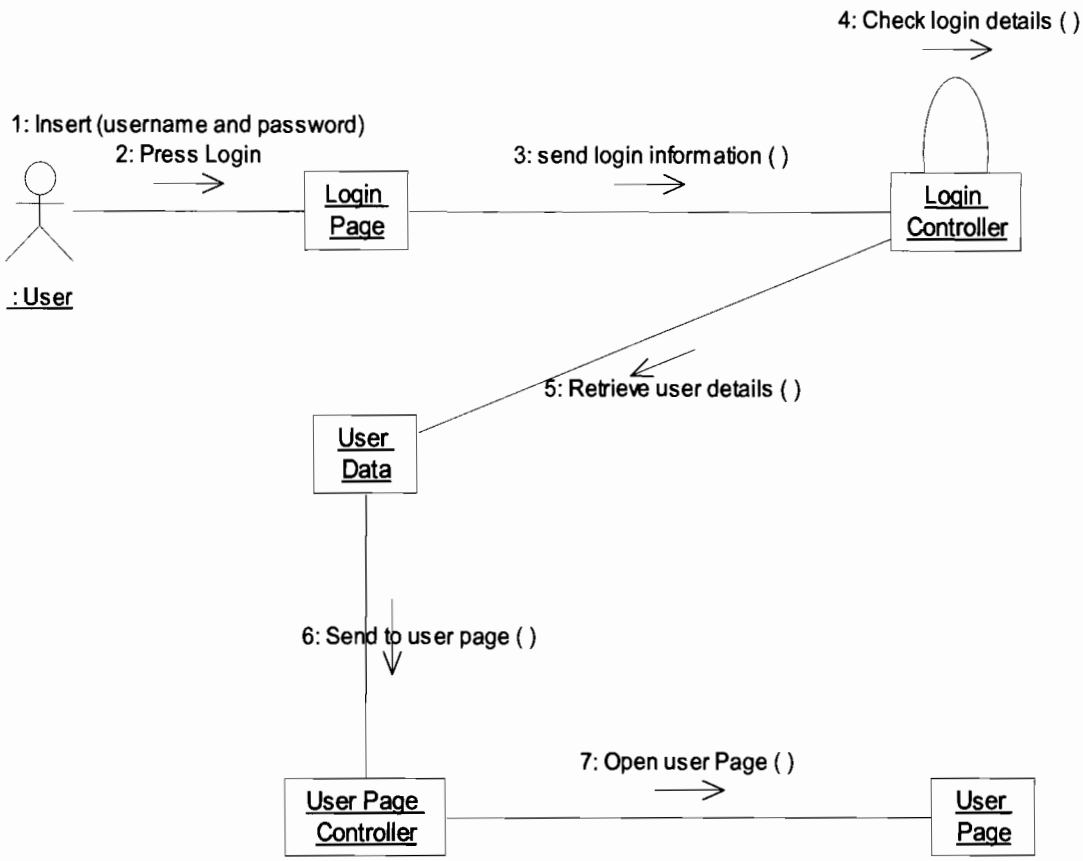


Figure 4.5: Login Collaboration Diagram

4.2.1.1.5 Manage Student Profile Sequence Diagram

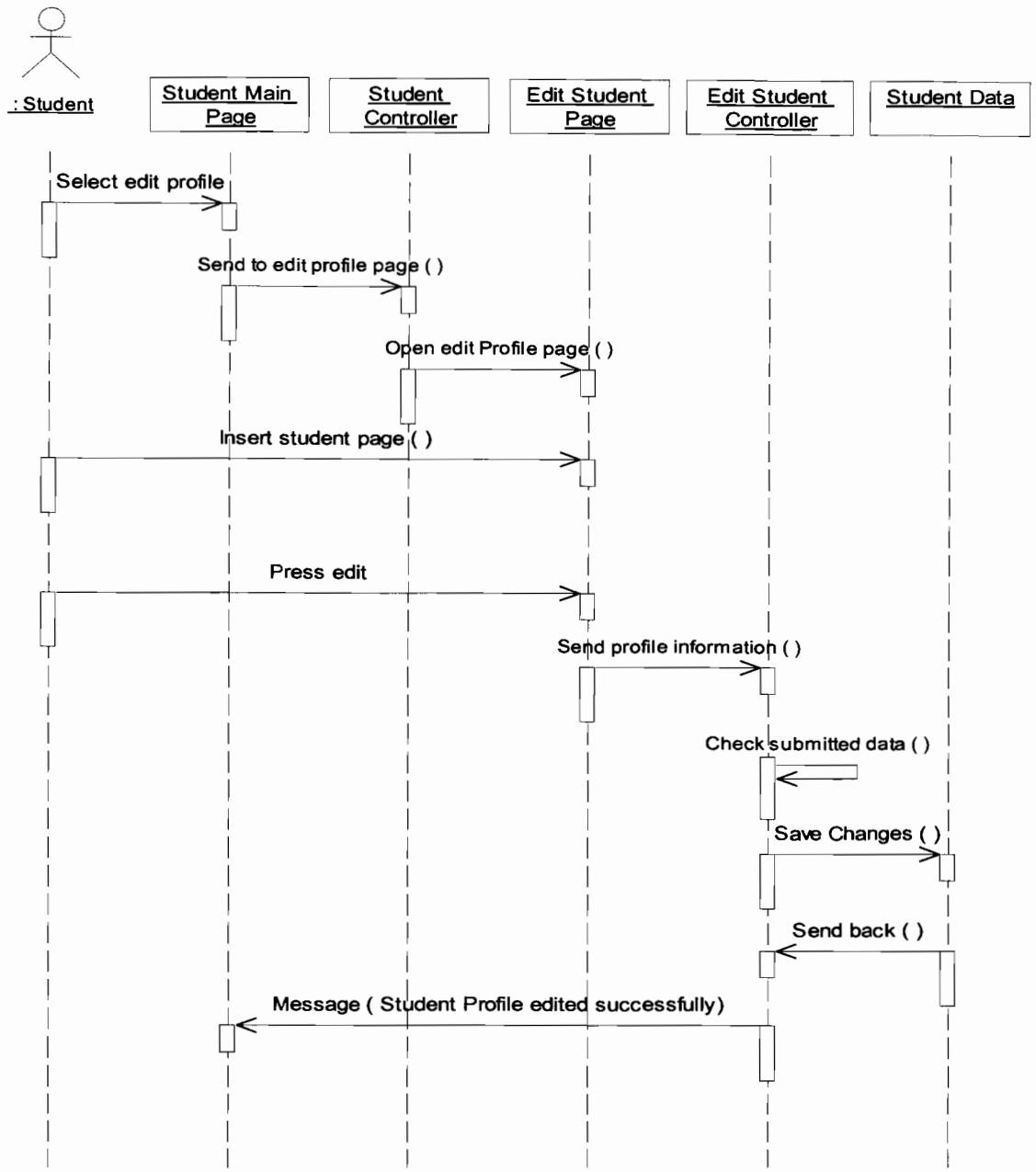


Figure 4.6: Manage Student Profile Sequence Diagram

4.2.1.1.6 Manage Student Profile Collaboration Diagram

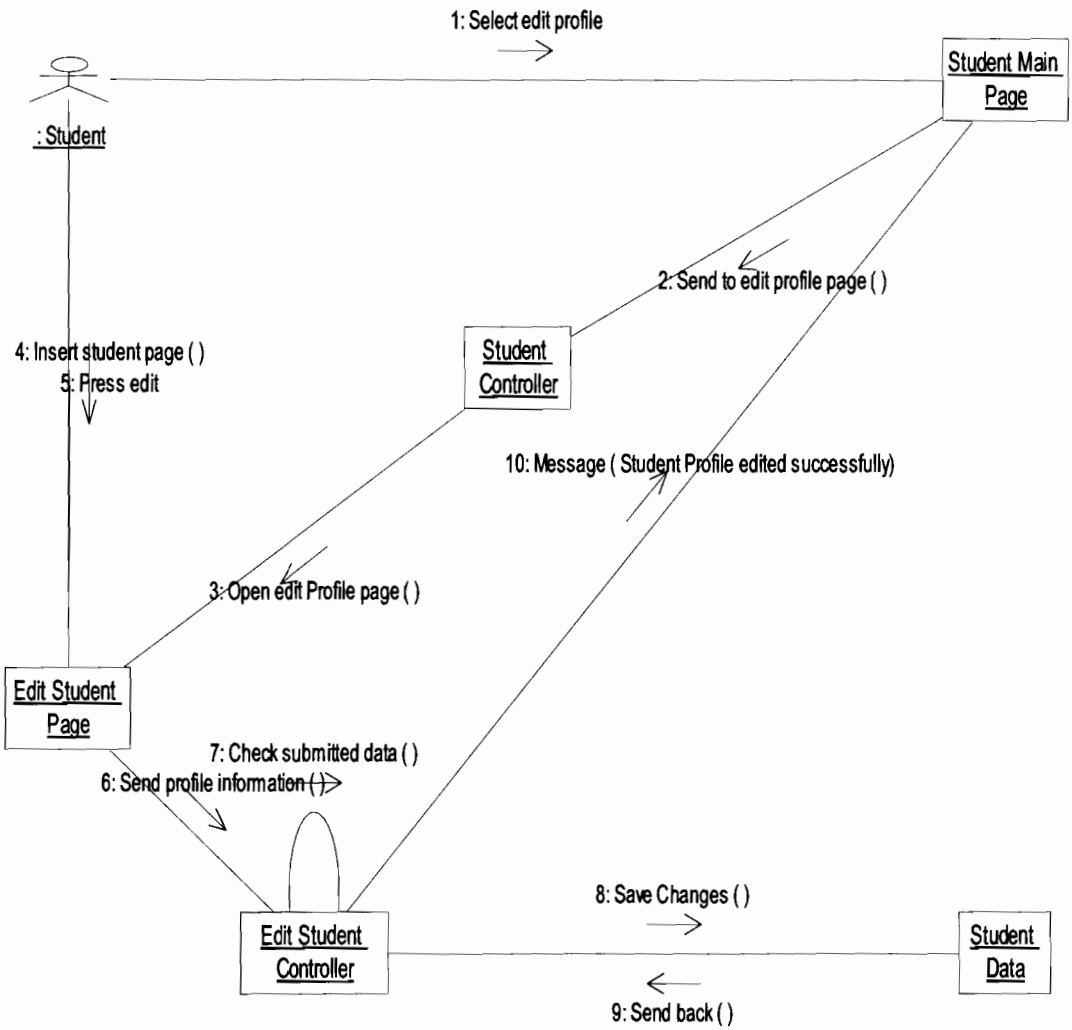


Figure 4.7: Manage Student Profile Collaboration Diagram

4.2.1.1.7 Charge Credit Sequence Diagram

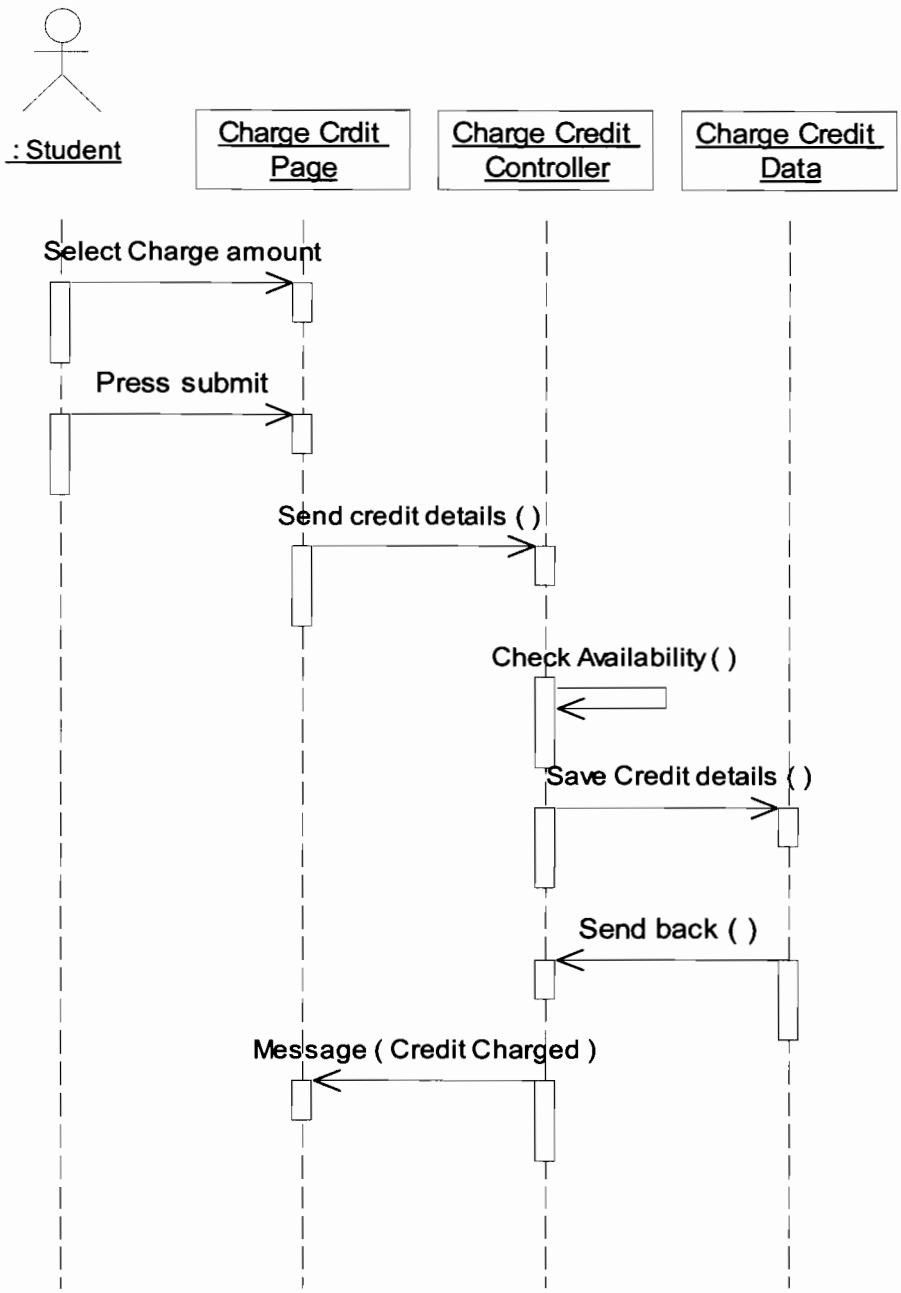


Figure 4.8: Charge Credit Sequence Diagram

4.2.1.1.8 Charge Credit Collaboration Diagram

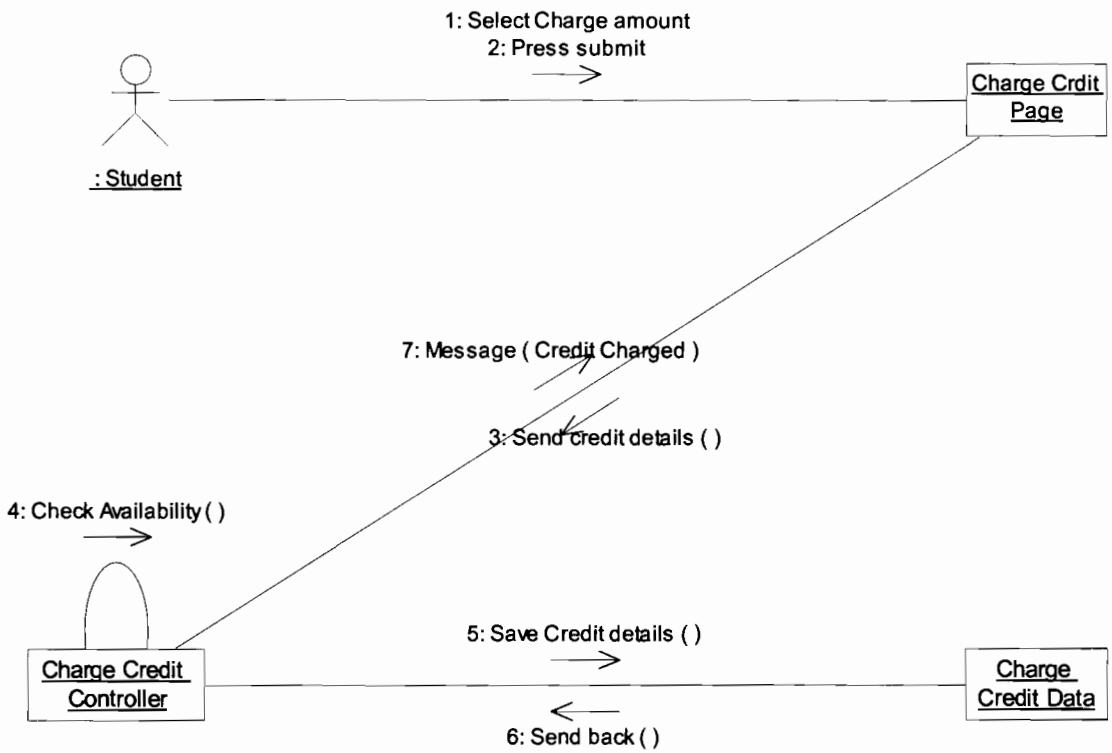


Figure 4.9: Charge Credit Collaboration Diagram

4.2.1.1.9 View Credit Sequence Diagram

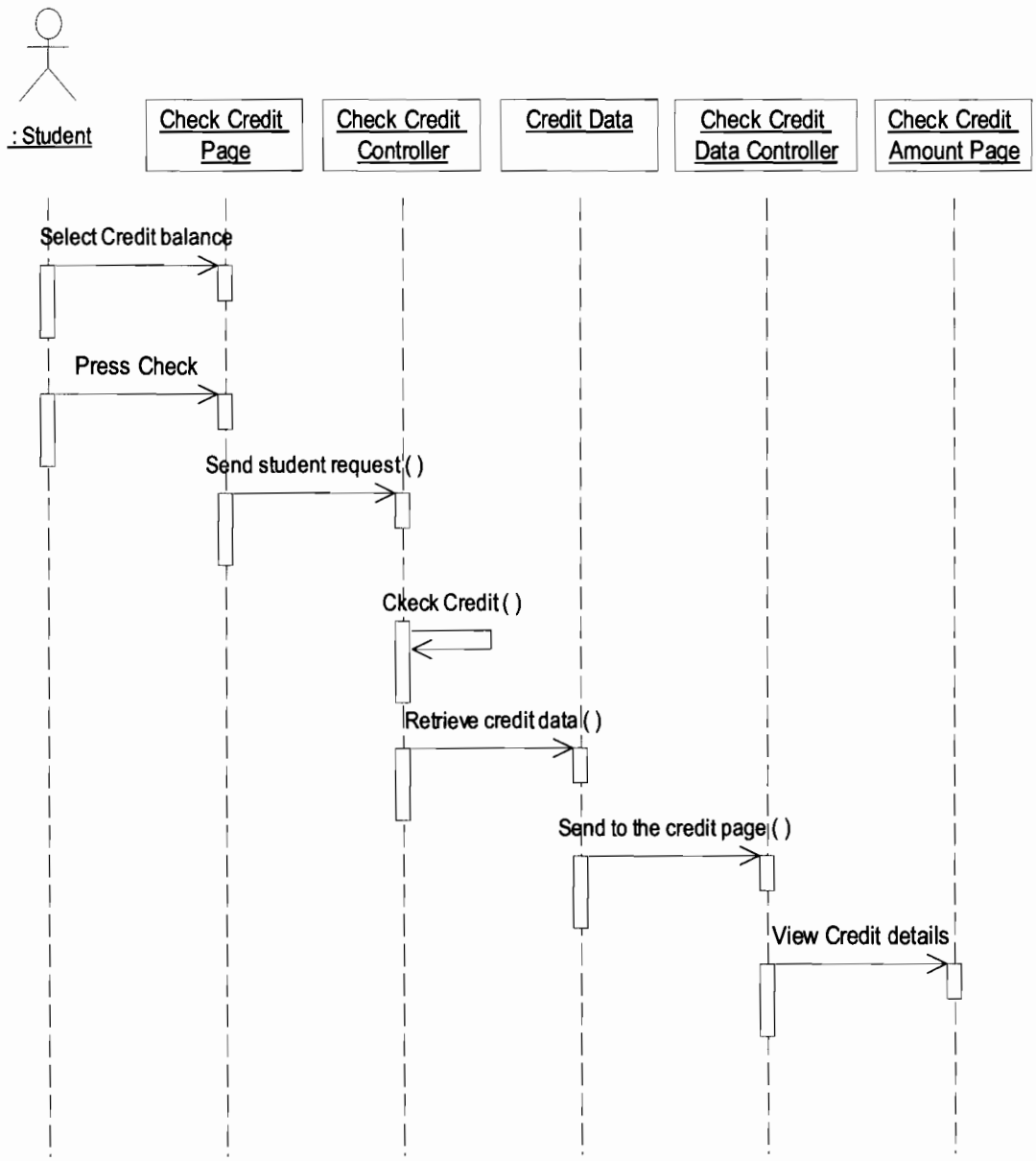


Figure 4.10: View Credit Sequence Diagram

4.2.1.1.10 View Credit Collaboration Diagram

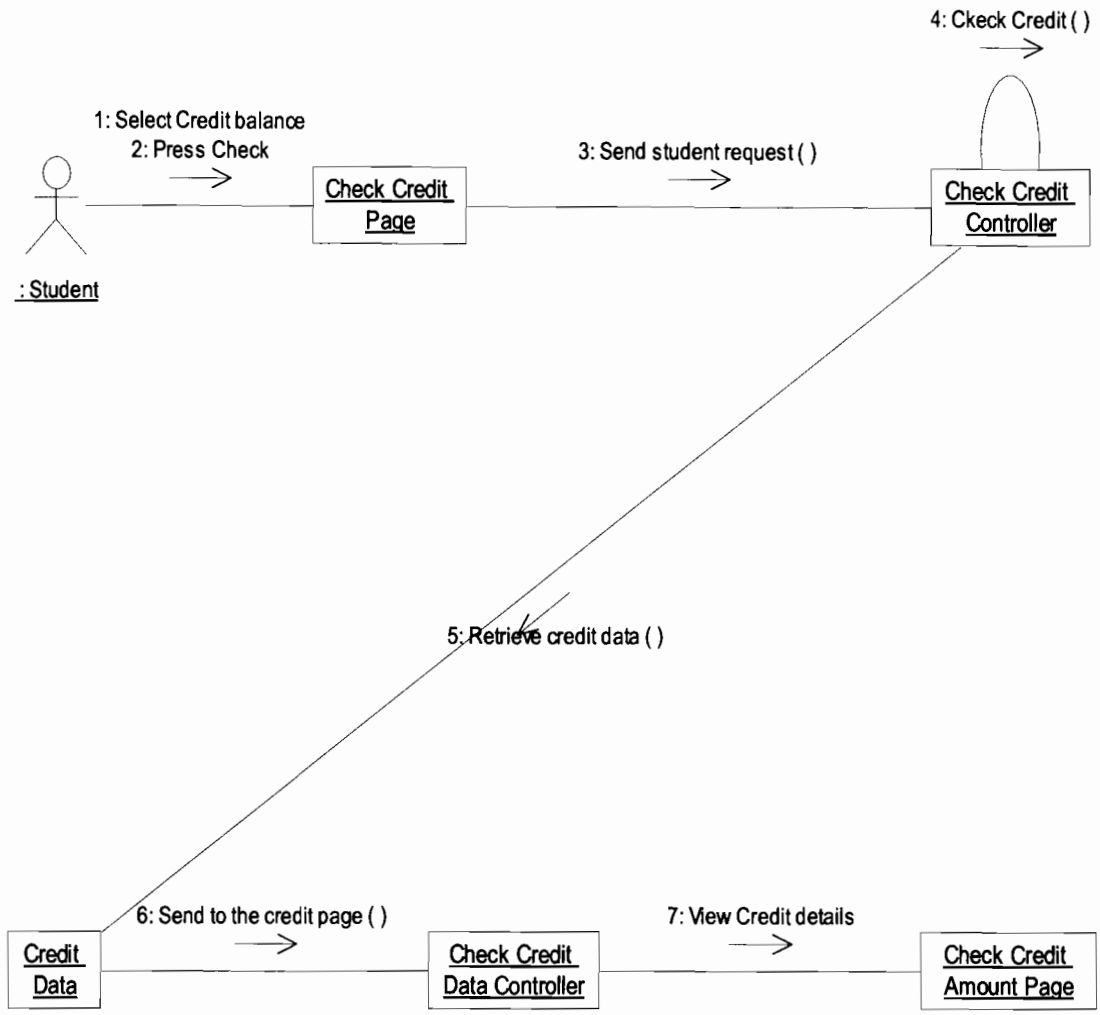


Figure 4.11: View Credit Collaboration Diagram

4.2.1.1.11 Manage Student Sequence Diagram

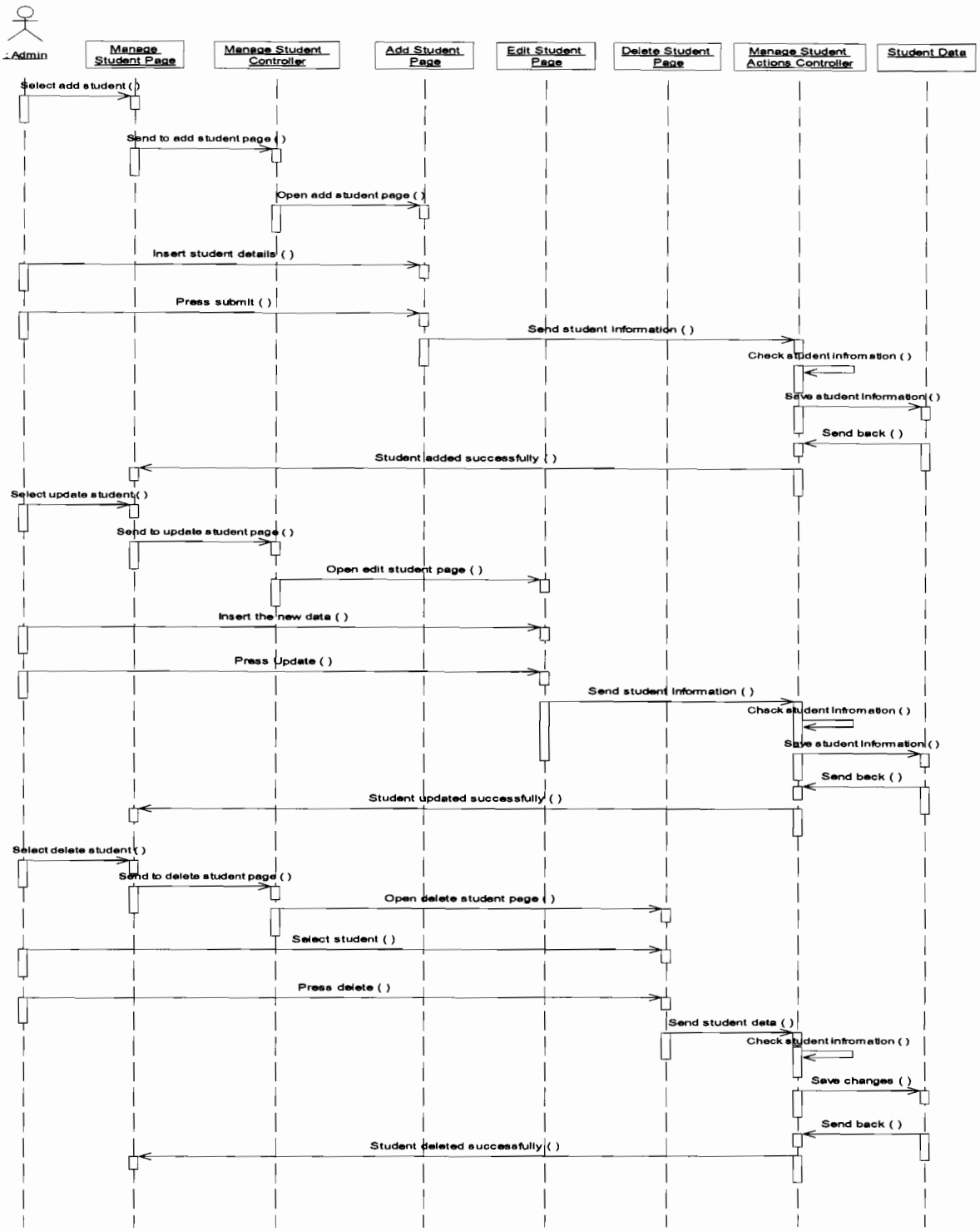


Figure 4.12: Manage Student Sequence Diagram

4.2.1.1.12 Manage Student Collaboration Diagram

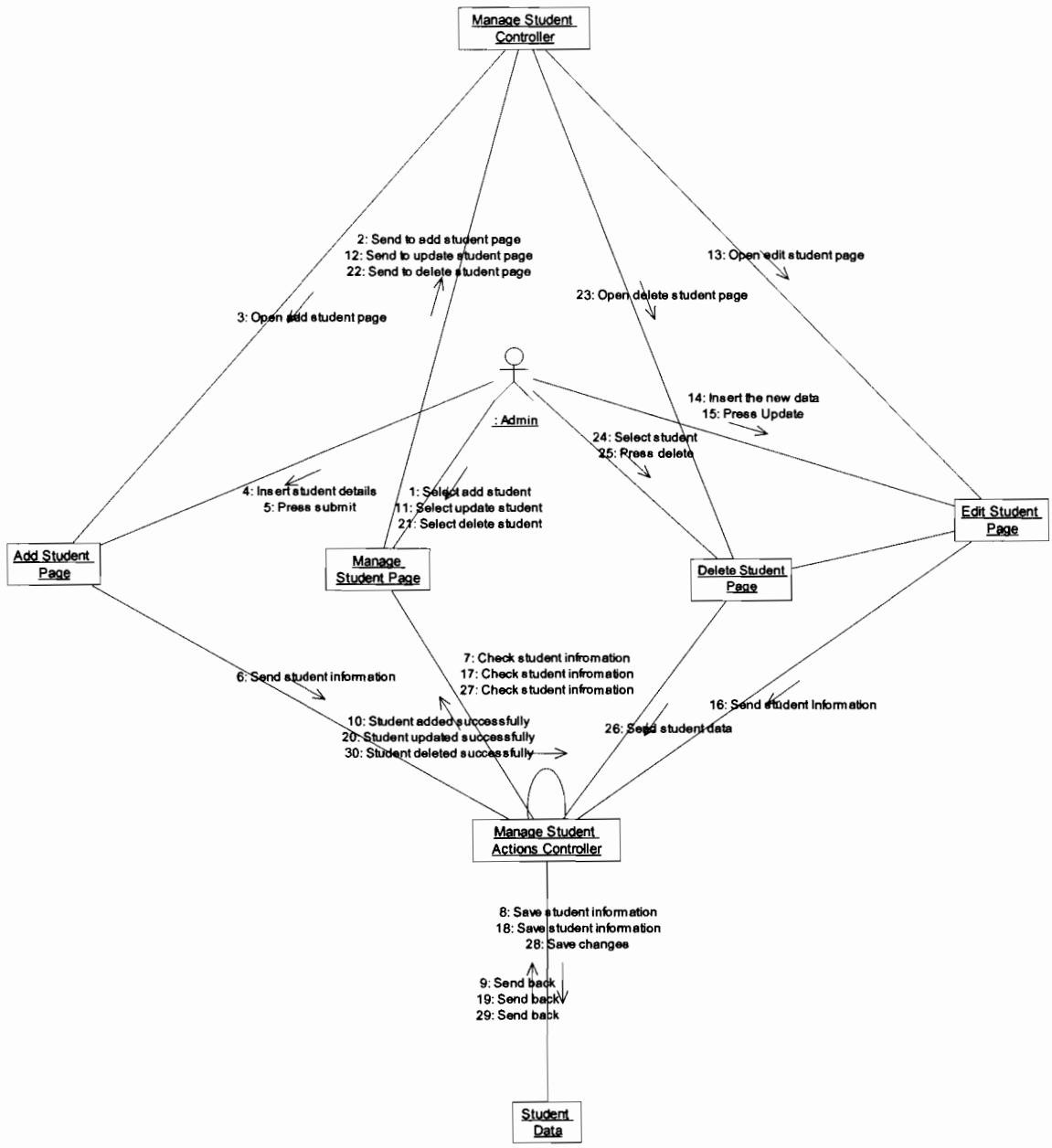


Figure 4.13: Manage Student Collaboration Diagram

4.2.1.1.13 Manage Packages Sequence Diagram

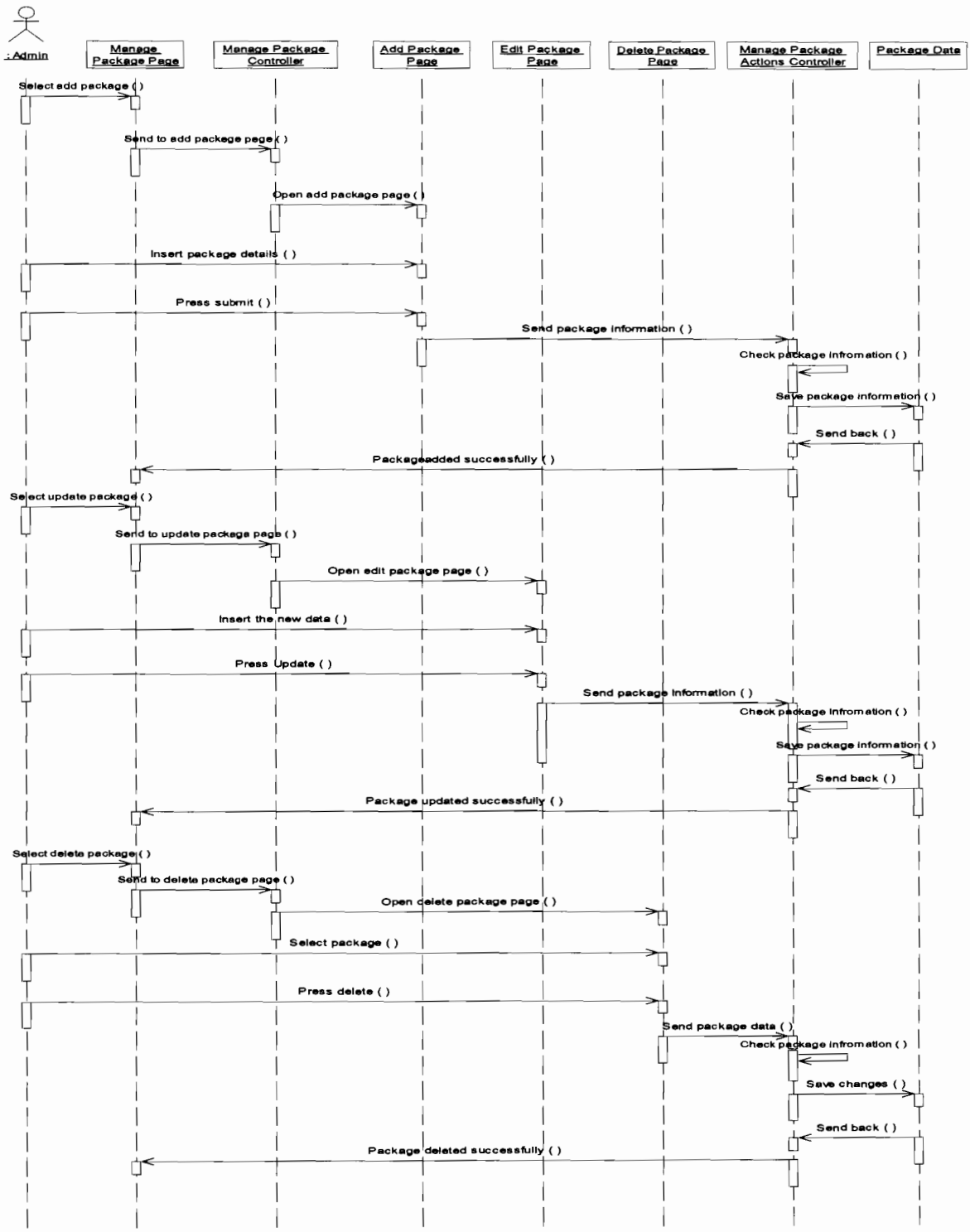


Figure 4.14: Manage Packages Sequence Diagram

4.2.1.1.14 Manage Packages Collaboration Diagram

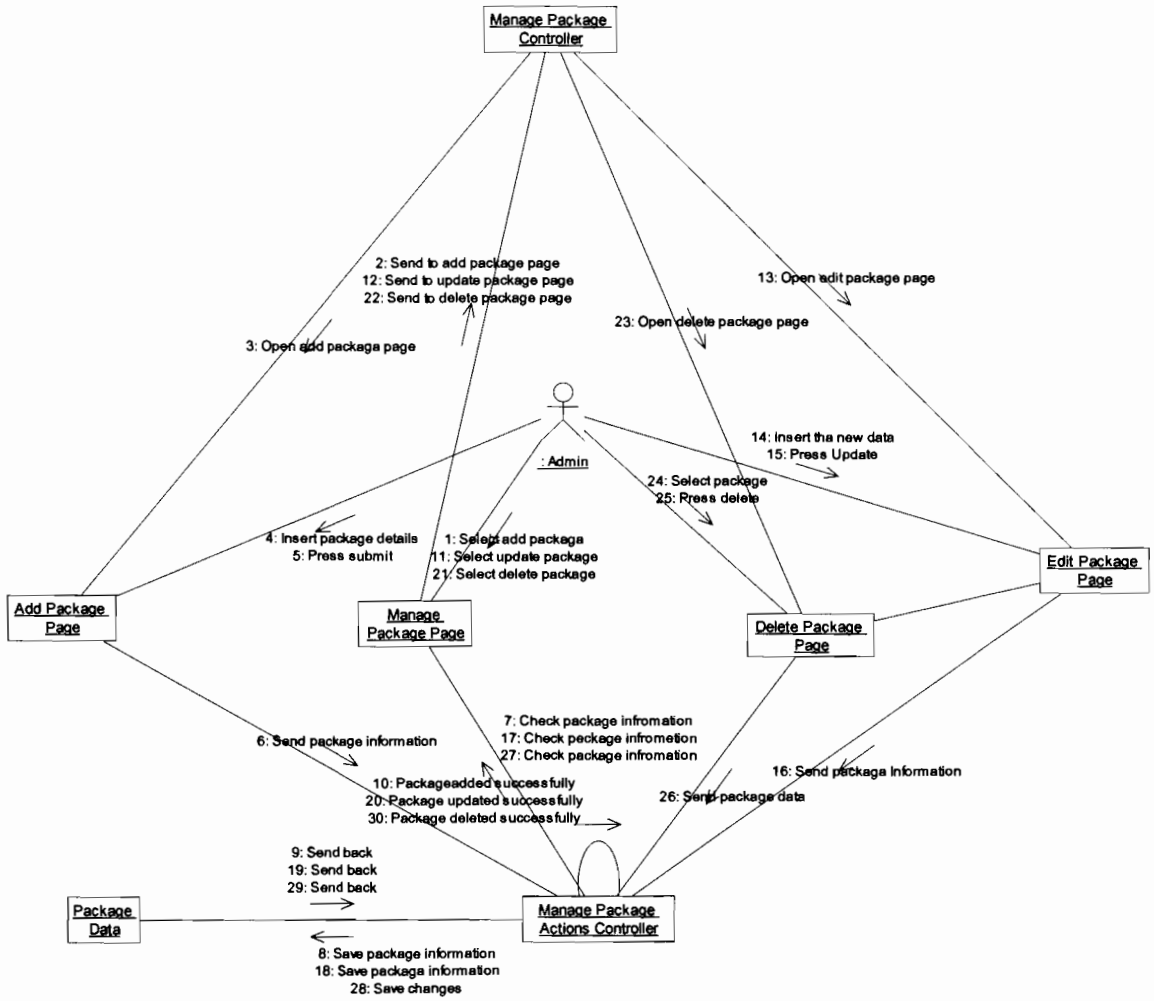


Figure 4.15: Manage Packages Collaboration Diagram

4.2.1.2 Class Diagram

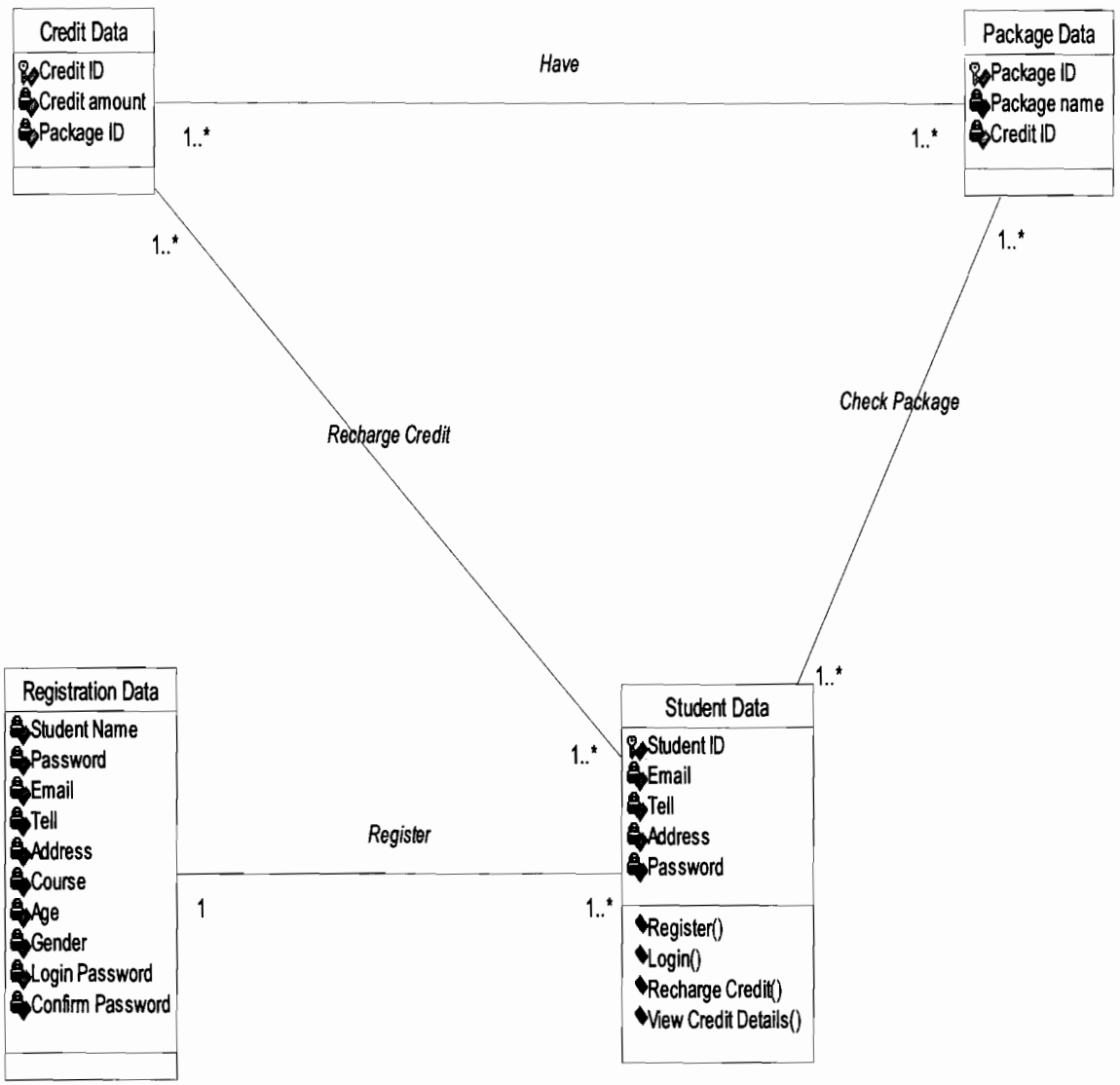


Figure 4.16: System Class Diagram

4.2.2 Physical Design

Physical design deals with the process of converting the logical design into a more technical specification of the system development. In designing the physical part of the system, all diagrams of data sources, data flows and data processing that was produced in the logical design was turned into a structured systems design. During physical design, the researcher determined which programming language and database system used as well as the determination of which hardware platform, operating system and network environment the system will run under. The specifications are as follows:

Table 4.1: Hardware and Software Specifications

Purpose	Hardware and Software Requirements
Programming Language	JSP (Java Server Pages)
Operating System	Microsoft Windows Operating System (Win95/Win98,Windows2000,WindowsME, WindowsXP)
Hardware	Monitor, CPU, RAM (16MB and above), Disk Space (minimum 12MB)
Database	MySQL

4.3 Coding

4.3.1 MRS

The proposed mobile recharging system presents the page layout for the cover page and subsequent pages. The cover page layout was split into three sections. These are:

a) Header

This section contains the titles of the proposed mobile recharging system.

b) Cover display

The mobile recharging system cover provides recognition of the prototype title, which would be updated, based on every mobile recharging system issue. There are different options for the students such as:

- Register for new account
- Login into admin and student page
- Manage student profile
- Charge credit
- View credit details

c) Headlines

This provides for student and admin with the flexibility to decide quickly whether the content is of interest to them without having to browse through all the functions inside the mobile recharging system that could help student to recharge and check their credit balance information. Refer to Figure 4.16-4.27 to view the student and admin interface.

4.4 Implementation

4.4.1 Registration Page

This page assigned for student who would like to register into the proposed mobile recharging system for the printing services by inserting their registration details to be saved and to build the student account page.

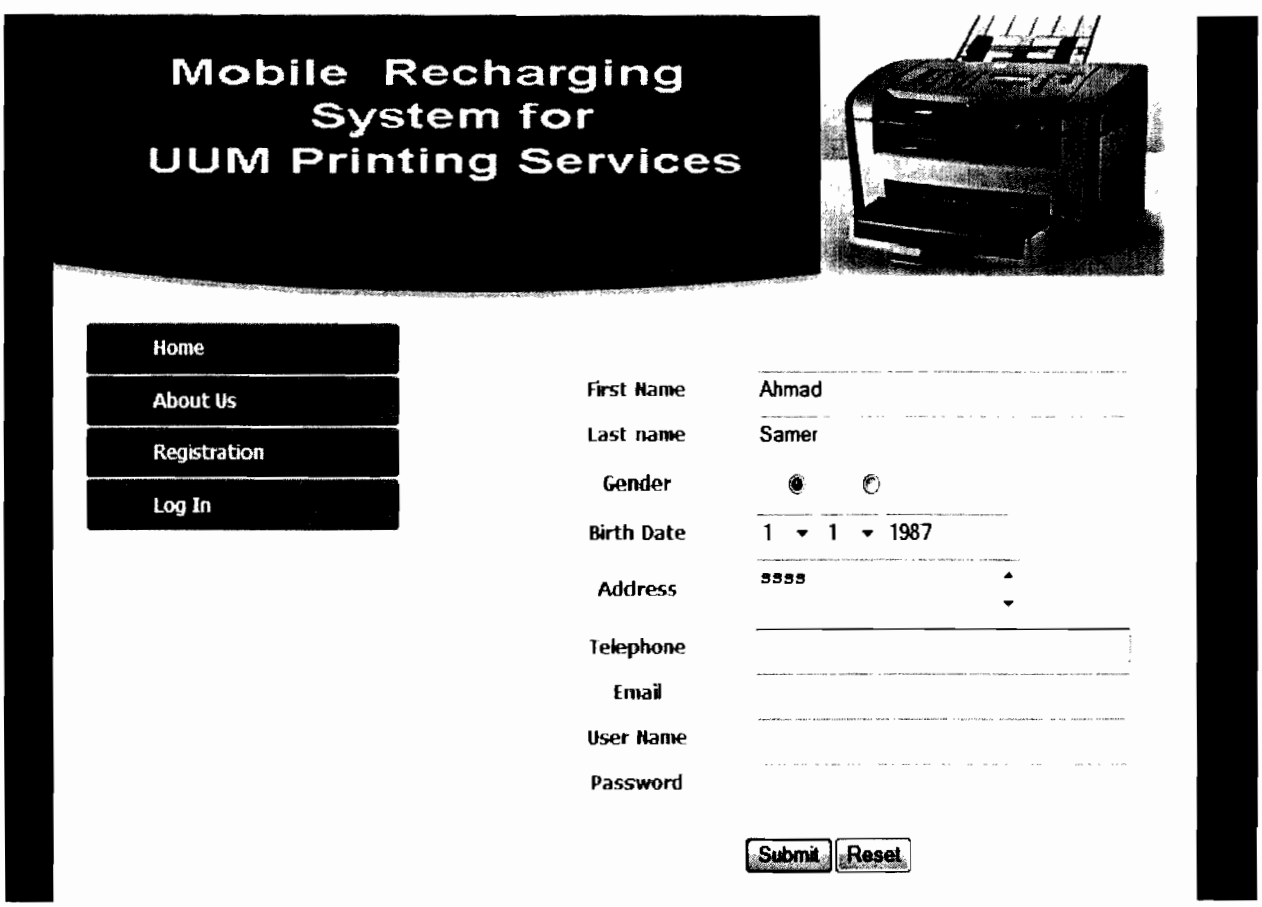


Figure 4.17: Registration Page

4.4.2 Login Page

This page assigned for student and admin to login through the proposed mobile recharging system. Figure 4.17 presents the admin login page. However, Figure 4.18 presents the student login page through their mobile device.

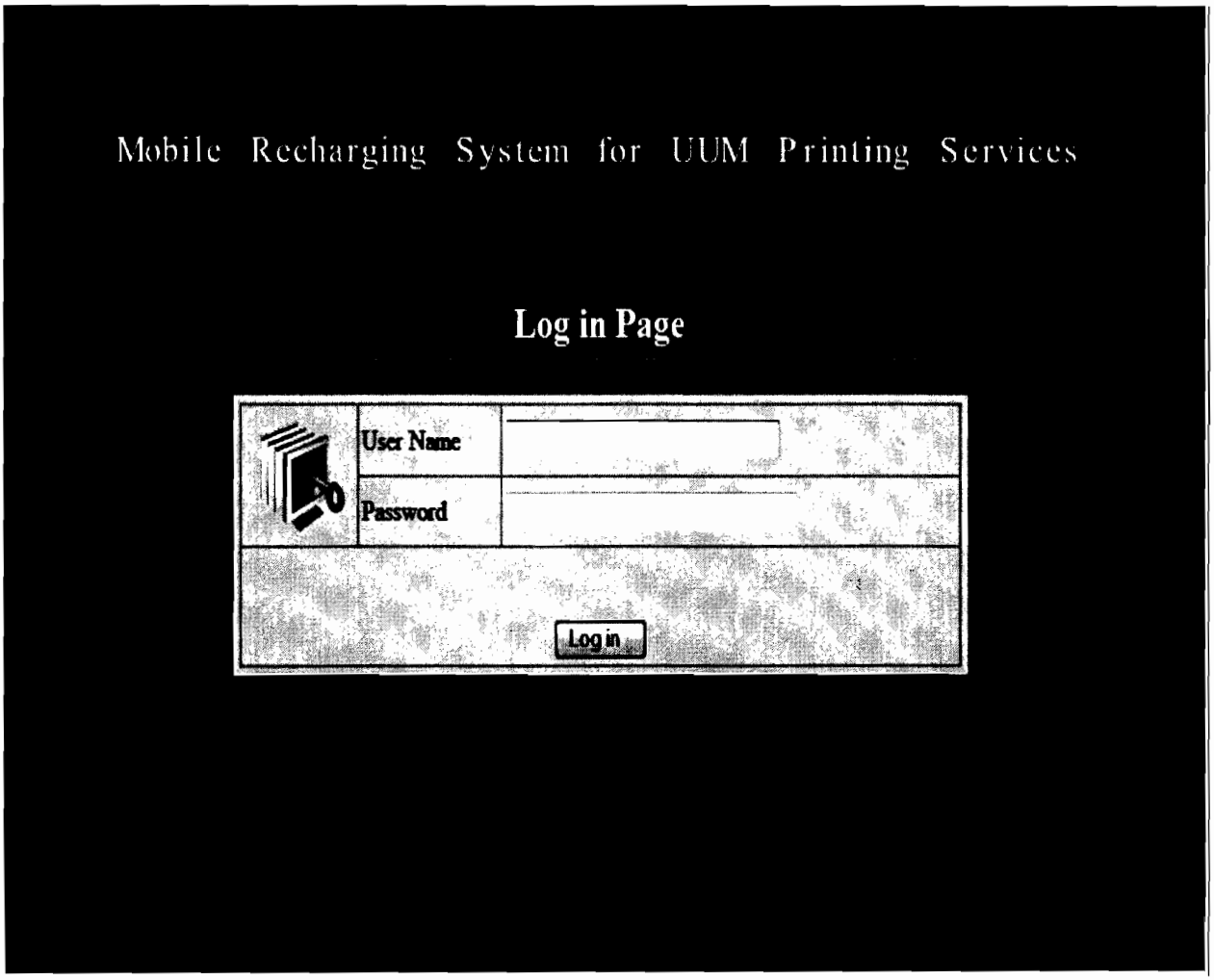


Figure 4.18: Admin Login Page

4.4.3 Manage Student Page

This page assigned for admin who would like to manage the student information by adding, updating, and deleting student information from the system database. Admin need to login first to obtain this operation through the proposed mobile recharging system for the printing services as presented in Figure 4.22. However, Figure 4.23 and 24 presents the editing and deleting student's details page.

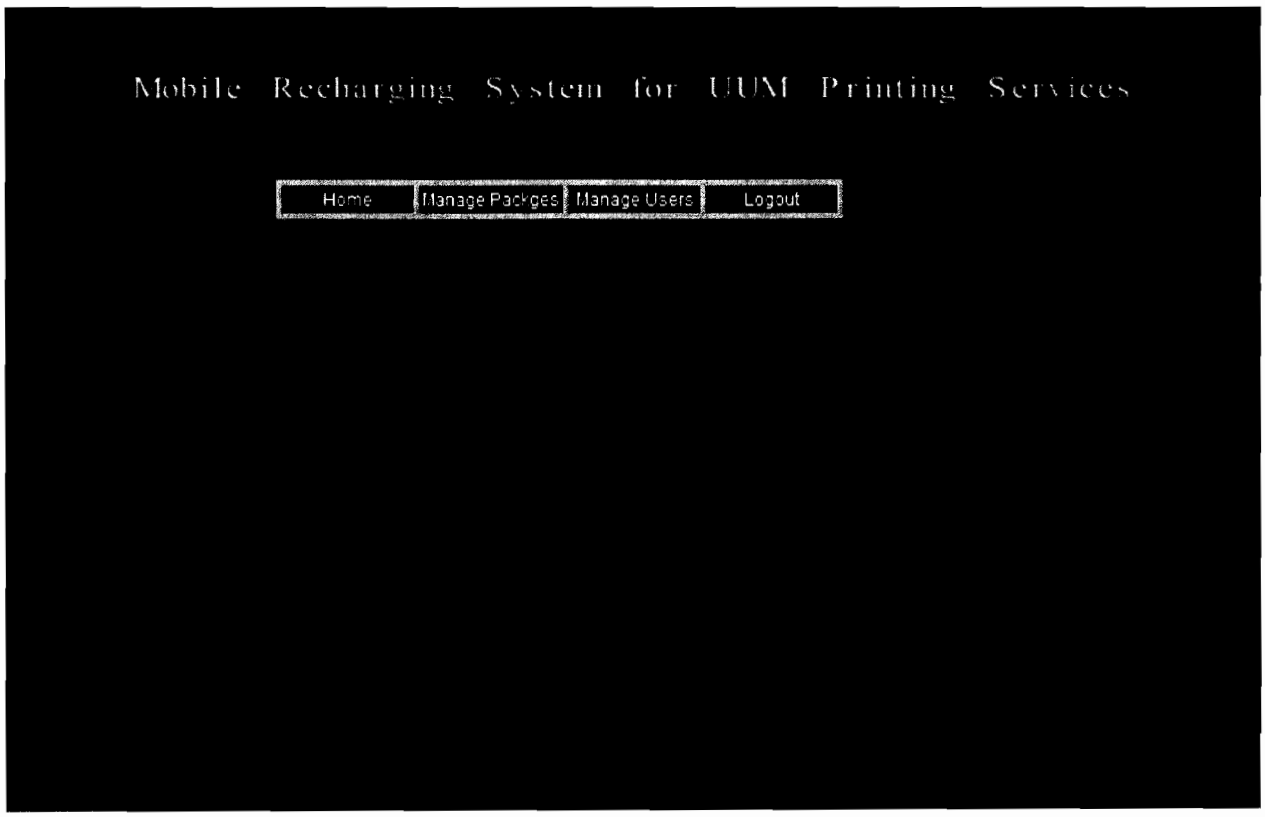


Figure 4.19: Manage Student Page

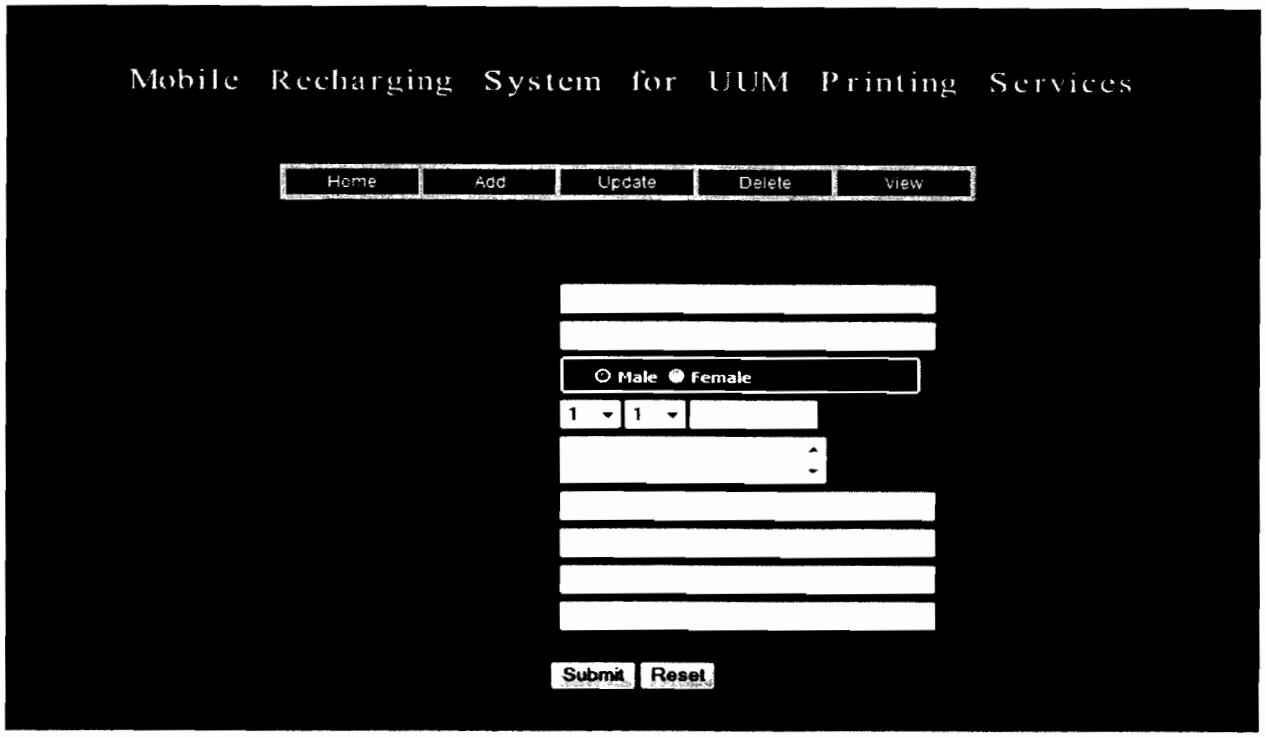


Figure 4.20: Add Student Page

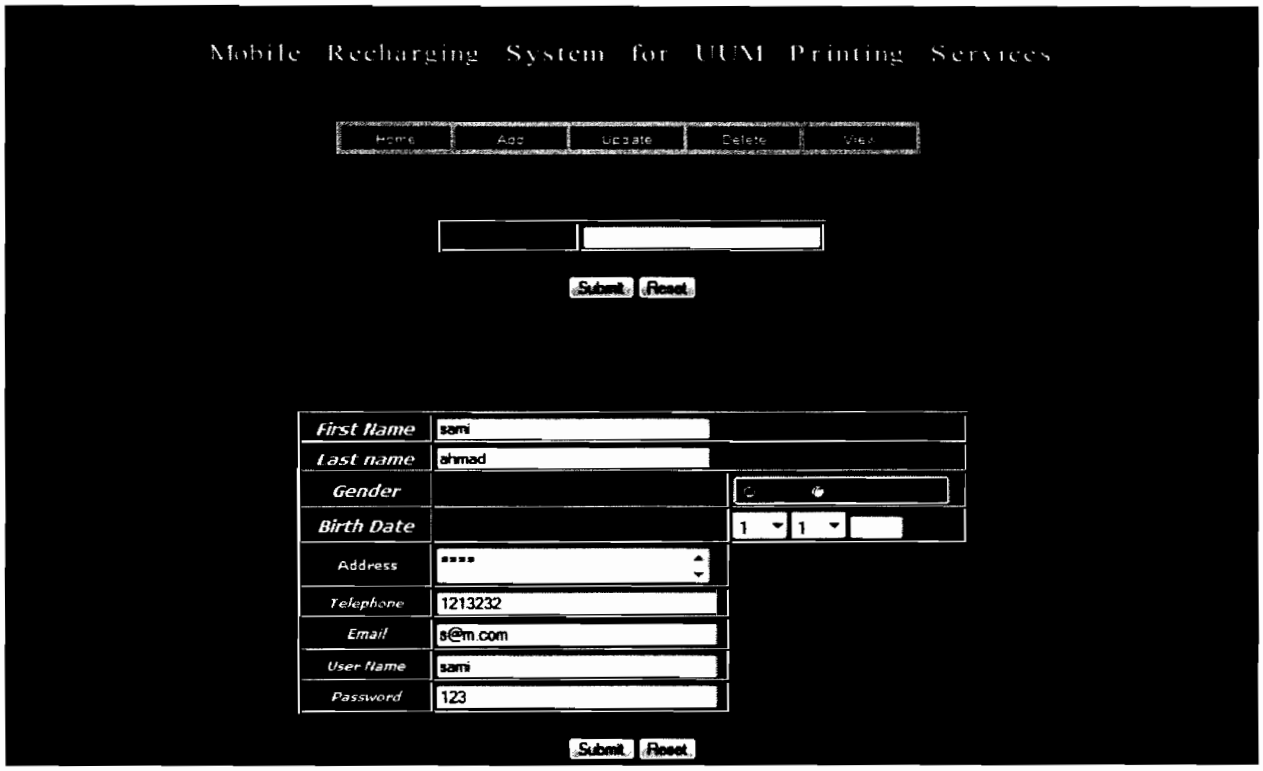


Figure 4.21: Update Student Page

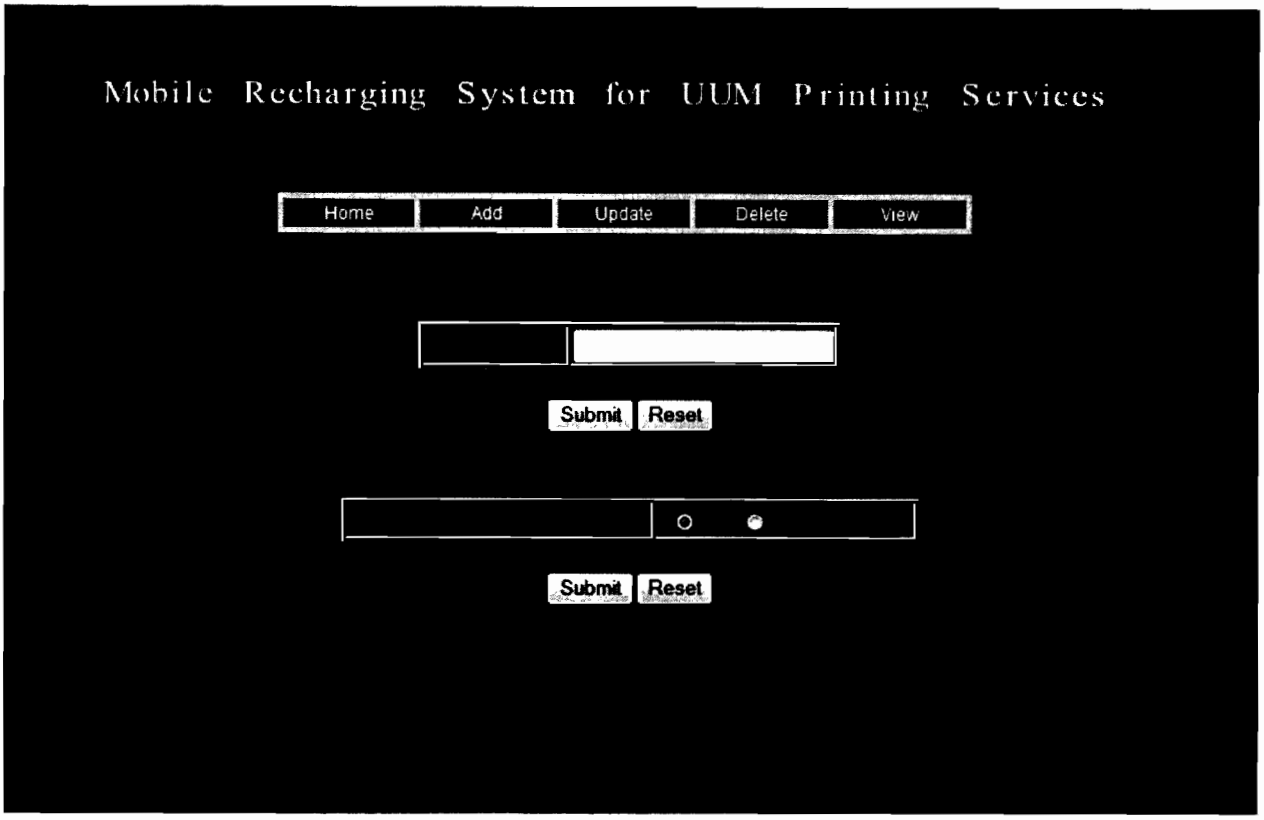


Figure 4.22: Delete Student Page

4.4.4 Manage Package Page

This page assigned for admin who would like to manage the package information by adding, updating, and deleting package information from the system database. Admin need to login first to obtain this operation through the proposed mobile recharging system for the printing services as presented in Figure 4.25. However, Figure 4.26 and 27 presents the editing and deleting package details page.

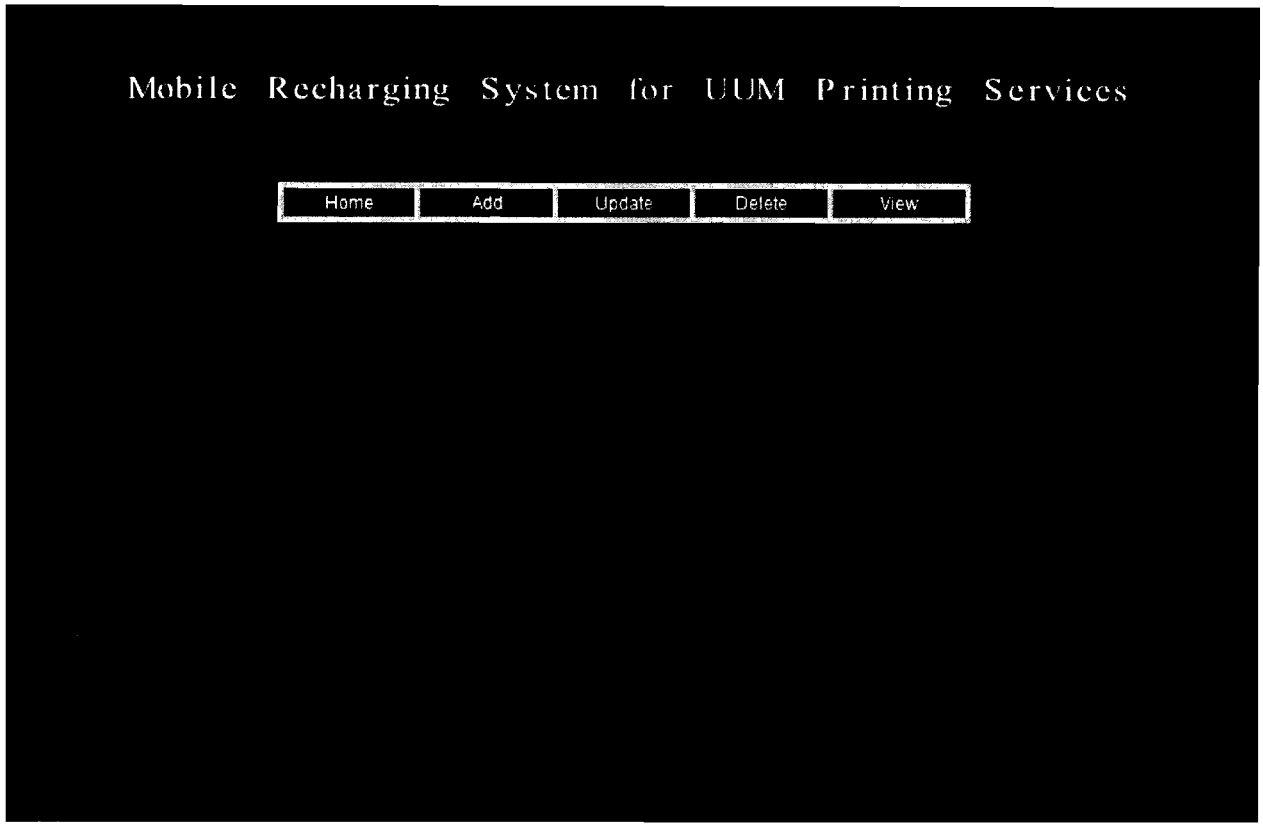


Figure 4.23: Manage Package Page

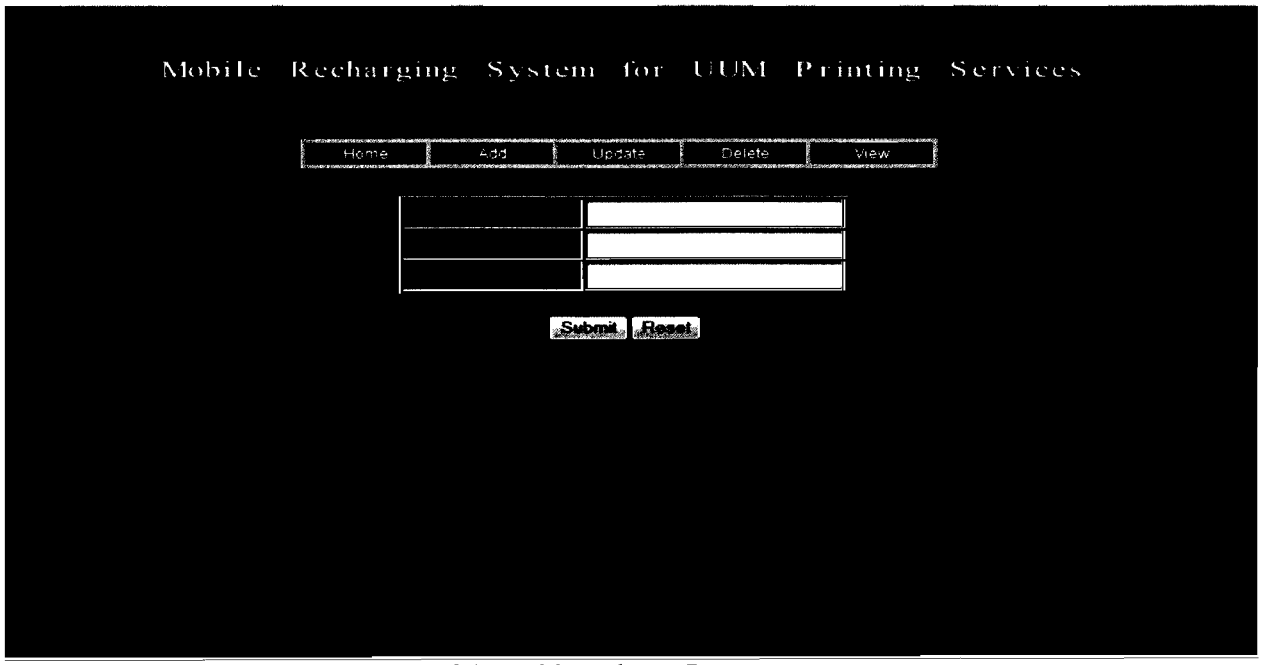


Figure 4.24: Add Package Page

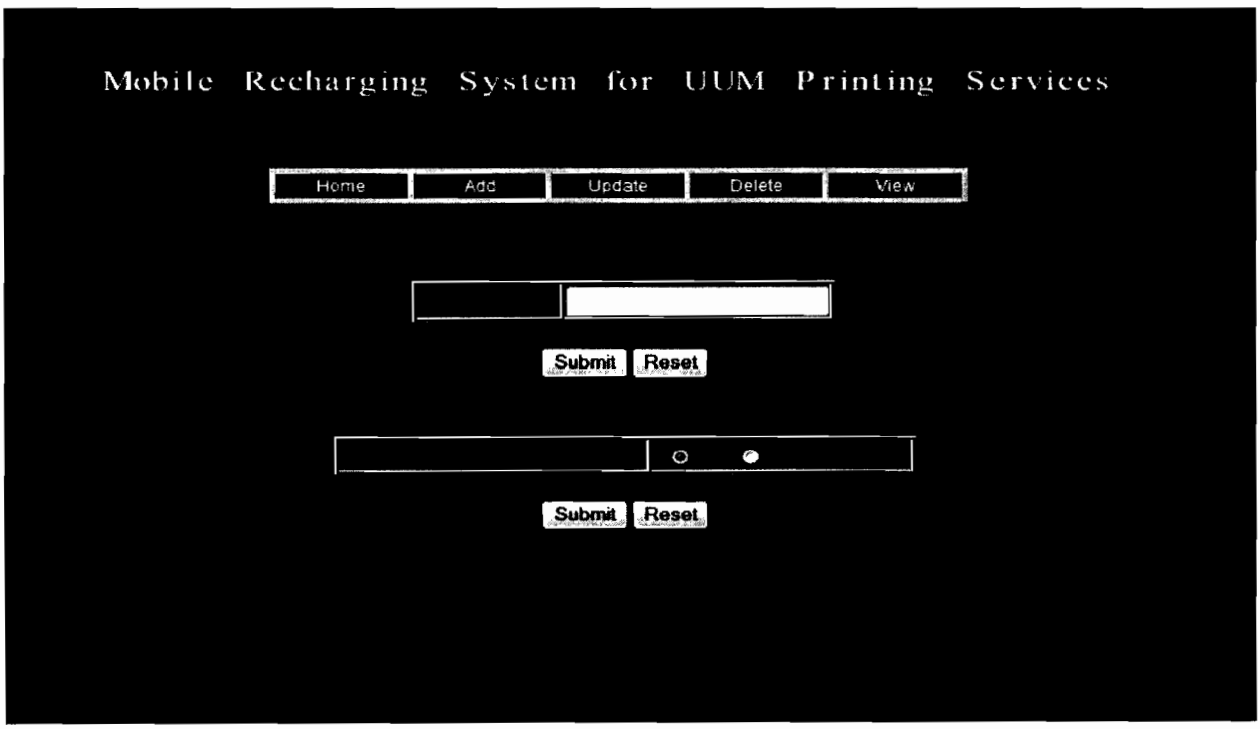


Figure 4.25: Delete Package Page

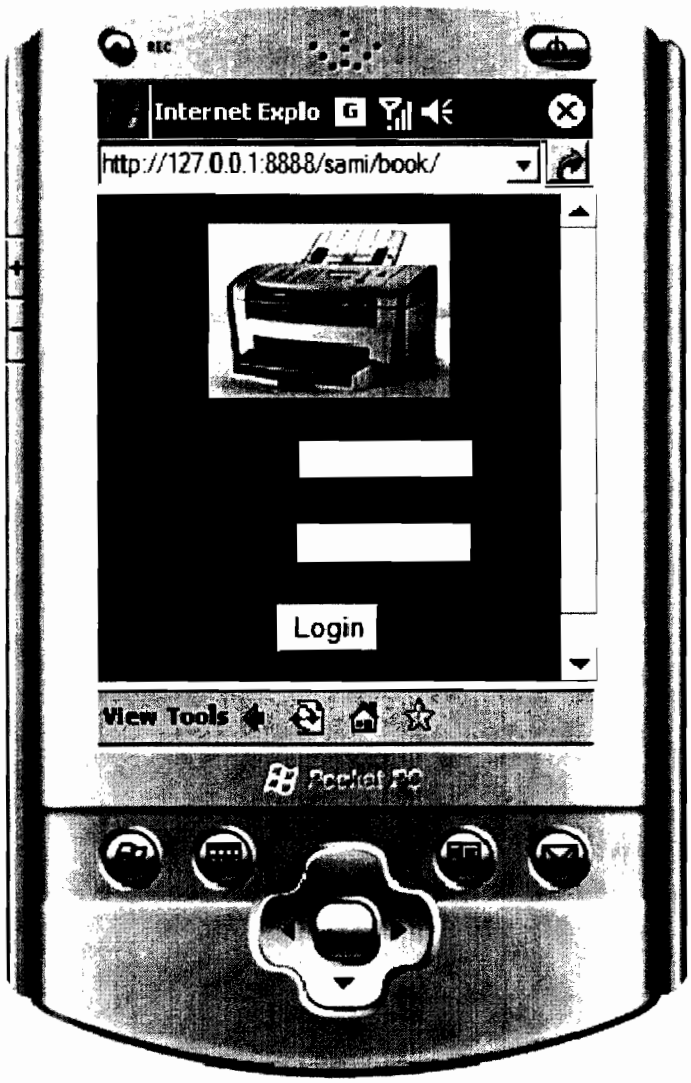


Figure 4.26: Student Login Page

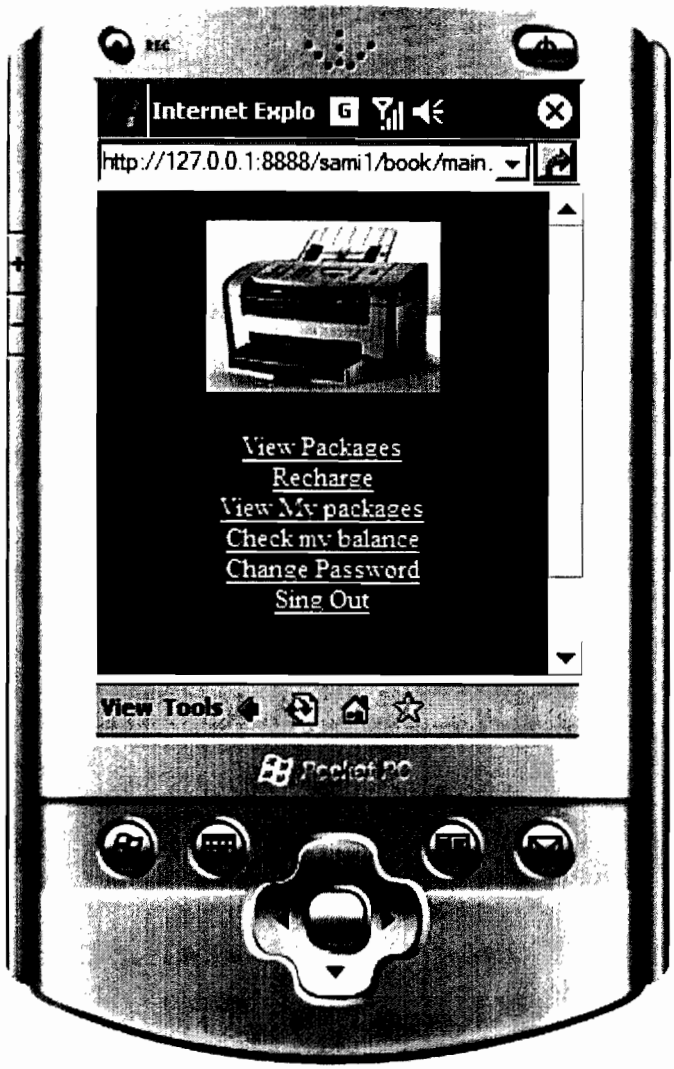


Figure 4.27: System Main Page

4.4.5 Charge Credit Page

This page assigned for student who would like to recharge their credit balance from the proposed mobile recharging system for the printing services by inserting the charging details through their mobile device.

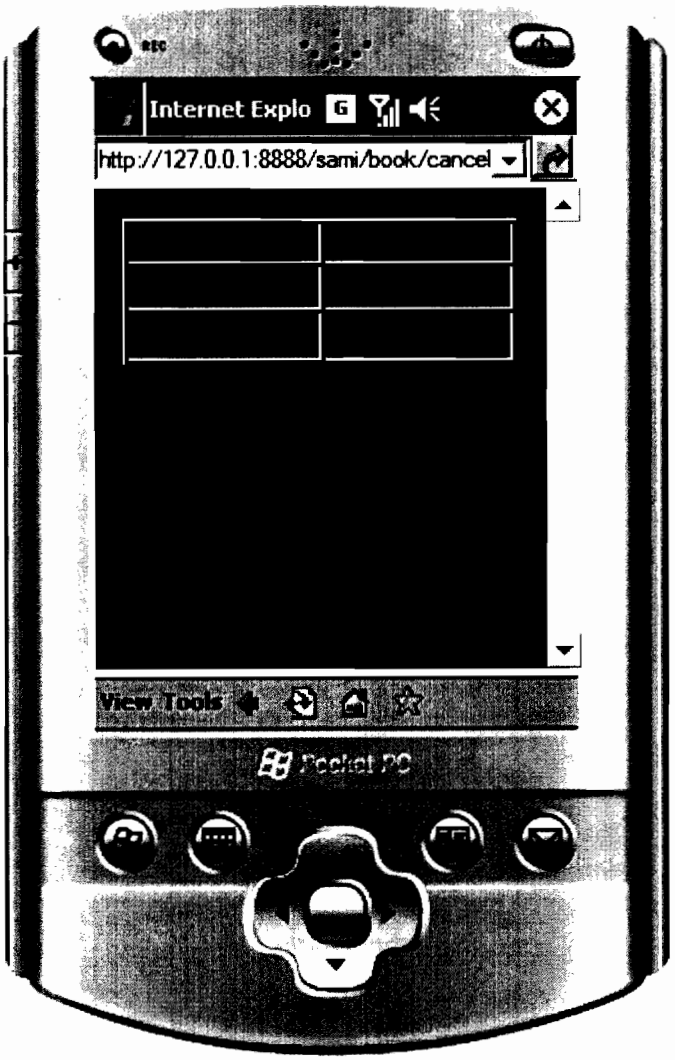


Figure 4.28: Charge Credit Page

4.4.6 View Credit Page

This page assigned for student who would like to view and display their credit balance details from the proposed mobile recharging system for the printing services by selecting the view credit details through their mobile device.

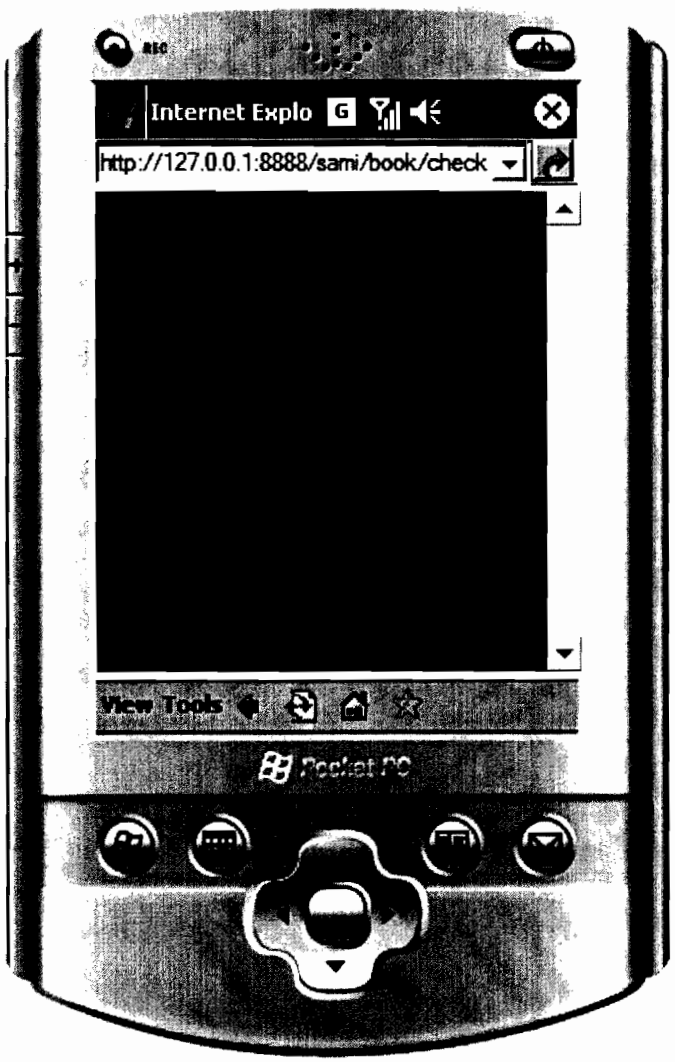


Figure 4.29: View Credit Page

4.5 Summary

This chapter presented the main issues about analyzing and designing process of the proposed mobile recharging system for UUM printing services. This chapter highlighted the main functional and noon functional requirements to design and develop the proposed mobile recharging system in term of admin and students needs. Furthermore, all of use case diagram, use case specification, sequence diagram, and collaboration diagram have been presented to give a good presentation regard the system activities.

CHAPTER FIVE

DISCUSSIONS

5.1 Introduction

This chapter illustrates the evaluation of the proposed mobile recharging system for UUM printing services based on multi agent systems. The system has been designed and developed based on JSP and MYSQL. After the developing phase system has been tested by running the system on mobile simulator (Pocket PC), admin functionality has been tested locally based on local host server.

Previously, the analysis and design of the proposed appointment system has been explained and gained the require diagrams. However, these diagrams indicated to carry out the basic view of the proposed system.

5.2 Application Testing

System testing performs testing on interaction of entire dialog components when all the components are combined for the first time. Use cases could be used as the basis of test cases for these elements as they evolve during deploying and developing phase, and it also can be excellent sources of system tests. Otherwise, the attempt to derive test cases will help to debug the use cases.

This study has employed the test design guideline from Collard who has demonstrated the development of test cases that is used in testing use case's event. Implementation of use case testing consists of generating the normal test case and negative test case, show the normal test case used to test against each normal mainstream process of use case.

5.2.1 Login use test case

Table 5.1: login use test case

Login	Username and password	Access to the user page	Correct username and password	7 May 2010 3:00 PM	M	Admin and Students

5.2.2 Registration use test case

Table 5.2: Registration use test case

Registration	Student name, email, password, passport number.	Add new student	Check student data	7 May 2010 3:20 PM	M	Student

5.2.3 Manage profile use test case

Table 5.3: Manage profile use test case

Manage Profile	Student name, email, password, passport number.	Edit student profile	Invalid profile details	7 May 2010 3:30 PM	M	Student

5.2.4 Charge credit use test case

Table 5.4: Charge credit use test case

Charge Credit	Credit package and amount	Credit is charged	valid package	7 May 2010 3:40 PM	M	Student

5.2.5 Check credit use test case

Table 5.5: Check credit use test case

Check Credit	Non	An Amount of Credit balance	An Amount of Credit balance	7May 2010 3:50 PM	M	Student

5.2.6 Manage student use test case

Table 5.6: Manage student use test case

Manage Student	Student name, email, password, passport number.	Add, delete, and update student details	Invalid student details	3 May 2010 3:60 PM	M	Admin

5.2.7 Manage package use test case

Table 5.7: Manage package use test case

Manage Package	Package name and amount	Add new package, edit package information, and delete package	valid package details	7 May 2010 4:00 PM	M	Admin

5.3 Conclusion

This chapter presented the evaluation of the proposed mobile recharging system for UUM printing services based multi agent systems, use test case has been used for testing the proposed system. The testing was indicated on the students and admin level. The testing has been determined the test data input, expected result, actual result, time and date, severity, and allocated to. The result justified that mobile recharging system functions are working properly.

CHAPTER SIX

CONCLUSION AND FUTURE WORK

This chapter reports the conclusion and future works on the proposed mobile recharging system for UUM printing services based on multi agent systems. The conclusion described in this chapter by addressing how this study achieved the goals, according to the objectives and problem statements. Finally, a brief recommendation offered as contributions to future enhancements also discussed.

6.1 Introduction

This study focuses on the issue of providing UUM students with the flexible services to recharge their credit of printing services. The prototype functionality testing was adopted based on the use test case method. According to that described in first chapter, this study aimed for the following goals:

- To identify and model the requirements for designing the mobile-based recharging system for printing services.
- To develop a WAP-based recharging system for the printing services based on Multi agent systems.
- To test the WAP- based recharging system for printing services based on Multi agent systems.

6.2 Problems and Limitations

The problems addressed the weakness of the current recharging facilities provided for UUM students. The proposed MRS is limited on UUM students for recharging their credit of the printing services.

The proposed mobile recharging system was tested using local host server, namely Internet Information Services (IIS). However, with limited financial resources no actual web server can be employed in testing the prototype.

6.3 Recommendations

A prototype of the proposed mobile recharging system was successfully developed using Java Server Pages (JSP) and other additional features that used to build the prototype in order such as; MYSQL server and Photoshop editor. The utilization for this prototype on the local host carry out some problems and limitations were encountered such as:

- Need to provide this system to browse anytime and anywhere.

- The prototype developed for and tested on the local host with internet explorer 8 version, therefore some of the test and illustration may be inconsistence on others web browsers types that require different additional browsers.

6.4 Future Work

The proposed mobile recharging system presents a useful solution for providing UUM students with the ability to recharge their printing credit anytime and anywhere through their mobile devices. It would be more effective to advice the one who needs to pursue some future works to follow every single step included in the project. The proposed mobile recharging system has the following features that will benefit the student among this UUM by:

- Provide the students with the ability to monitor the available balance of packages and time limit of recharging.

- Provides direct, simple access to the focused valuable content via few uploaded materials that students could be able to browse other services such as contacting with the admin by SMS services.

- Reduces the amount of vertical scrolling by simplifying the text to display.

The research measured the severity of MRS developing using test case that positively related to the using of MRS during the recharging process. It provides estimates of the research model and suggests which components of the adoption item will get more successful in another area. The research models are being pursued in the adoption of technology acceptance model to succeed.

This study recommends observing the advance level of the motivation and usefulness on using MRS for recharging student's credit of the printing services. In the dynamic

environment, the further studies have to look up the latest technology adoption and adoption in the universities toward using MRS facilities among different members.

Finally, in our view, these technology skills are so important for the information age, that their relative presence or absence will have a significant effect on an individual's career trajectory. In this respect we see the development of these skills as so important, that we do not see much of a chance that UUM students will thrive and be promoted without them.

6.5 Conclusion

This section presents the research conclusion of model the requirements for designing the mobile-based recharging system for printing services. The use test case was used to test the functionality of a proposed MRS.

According to the problem statements and research objective, the research has heavily getting involved in developing requirements of the proposed mobile recharging system for UUM printing services based on multi agent systems. This study has been successfully employed the System Development Research Methodology in developing and testing the proposed system. In order to make requirements more understandable the requirements have been modeled by using some of UML diagrams such as use case diagram, use case specification and sequence diagram to design the system requirement in order to illustrate the research objectives. The system has been implemented using JSP and MYSQL technology and testing result has been conducted based on the adopted use test case.

The results showed that using MRS among UUM students give meaning based on the design and user interface of MRS. In different departments innovate and implement new technologies could be presented in different ways for increasing the percentage of using agent systems in enhancing the workflow of the system components. This project will include a projection of the effect of using MRS to help UUM students in recharging their credit of the printing services.

Furthermore, this study results showed that MRS addressed strong functionality feature.

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