WEB BASED STUDENTS' ATTENDANCE SYSTEM (WSAS)

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WEB BASED STUDENTS' ATTENDANCE SYSTEM (WSAS)

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ABSTRACT

A web based students' attendance system is an appropriate solution for teachers and parents to inform the parents about their students' attendance status in school via SMS and Email services as well as to enhance the communication between teachers and parents. Research Design Methodology was adopted in this project with its five stages, which includes: Awareness of problem, Suggestion (integrated with System Development Methodology), Development (integrated with Object Oriented Development Life Cycle approach), Evaluation, and Conclusion. The prototype was developed to determine, analysis, test, and validate the user's requirements in order to rate the usability test of this system. Furthermore, the prototype was evaluated by using USE questionnaire and the usability results was presented and discussed as well.

ACKNOWLEDGEMENTS

“In The Name of ALLAH the Most Gracious and the Most Merciful”

First and foremost, all praise to AllAH (SWT), the almighty, and the most gracious and most merciful, without those divine guidance and blessing, I would not have been able to even begin, let alone complete, such a complex and confounding undertaking.

My sincere thanks go to my supervisor Mr. Azizi bin Abas for all guidance, support, and ideas that helped me to achieve this project on time. I will always be thankful to you, Terimah Kasih !.

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LIST OF ABBREVIATIONS

Acronym	Definition
3G	Third Generation
ANSI	American National Standards Institute
BS	Base Station
CMS	Content Management System
DBMS	Database Management System
DCL	Data Control Language
DDL	Data Definition Language
DML	Data Manipulation Language
GSM	Global System for Mobile communications
HTML	Hypertext Markup Language
HTTP	Hypertext Transfer Protocol
ID	Identification
IIS	Internet Information Services
IMAP	Internet Message Access Protocol
IS	Information Systems
ISO	International Standards Organization
JSP	Java Server Page
JVC	Java Virtual Machine
MAC	Media Access Control
MIS	Management Information Systems
MS	Mobile Station
MSC	Mobile Switching Center
MVC	Model – View – Controller
NFS	Network File System
POP	Post Office Protocol

RIFD	Radio Frequency Identification
RUP	Rational Unified Process
SMS	Short Message Service
SMSC	Short Message Service Center
SMTP	Simple Mail Transfer Protocol
SPSS	Statistical Package for the Social Sciences
SQL	Structured Query Language
UK	United Kingdom
UML	Unified Modeling Language
URLs	Uniform Resource Locators
USB	Universal Serial Bus
WCMS	Web Content Management Systems
WSAS	Web Based Student's Attendance System

CHAPTER ONE

INTRODUCTION

This chapter gives an overview about this project. The chapter sheds light on problem statement, research objectives, research questions, scope, and significance of this project.

1.1 OVERVIEW

There is no doubt that the education plays a vital role in development of a nation and most of developed countries have adopted the development of education to keep abreast of progression in different fields. According to Alam (2009), education has contributed through improved participation in economics, culture and social roles in society as well as improved understanding of an individual by means increasing people's awareness of their environments.

In education area, technology plays several roles such as accessing to the resources of educational, sharing the resources of academic, improving the quality of learning, and improving efficient management of education. Hence, the application of technology can be divided into two main areas: the learning process and the management of the learning process (Twinomugisha, 2003). Internet is the most important technology that can be widely used as a tool to communicate between different locations regardless what kind of operating system and machine that are used to access the information. Therefore, most organizations have tended to use the web-based application due to

valuable of this kind of application (Udin, Arif, & Saman, 2001). Using web application is useful for educational community that would to exchange and access the information about pedagogic activities as well supporting teaching administrative work (Gomes & Gouveia, 2003). Information technology has provided many services for mangers to manage, access, and report the information easily and quickly. whereas, telecommunication nets have provided the managers with a wide range of information resources (Uline, Tschannen-Moran, & Perez, 2003).

According to Yuen, Law, & Wong (2003), information systems have several uses such as increasing effectiveness, increasing managerial effectiveness, and gaining superiority in competitions. One of main aims of school management information systems is to provide support for the managing and educational activities by processing information. Telem (1999) defined school management information systems as "*a management information system designed to match the structure, management task, instructional processes and special needs of the school*".

A significant changes have occurred in working styles and roles of managers due to introduction of school management systems to schools (Telem, 1999). School management have been changed in different areas due to using of school management information systems such as decision making, communication, workload, HR management, and planning (Gurr, 2000). As well, school management information systems help the manager to manage the school in various ways such as making long term plans, determining performances of teachers, distributing resources, and forming educational methods of future (Telem, 1991; Telem & Buvitski, 1995). In this way,

school management information systems can also be used as a tool to initiate and use educational leadership of the manager (Telem, 1999).

In addition, school management information systems have played a vital role in helping the managers to make decisions efficiently, especially when they get up-to-date information and accurate information (Christopher, 2003). Decision making is most important in educational management. Therefore, decision making is needed in the complicated and unexpected situations of school affairs. The role of school management information systems is to provide information that would to make decisions in accordance with goals of school and to make easy controlling of the activities to obtain the goals (Christopher, 2003; Telem, 1991; Telem & Buvitski, 1995).

1.2 PROBLEM STATEMENT

One of major problems that schools may face is how to deal with student absenteeism and truancy effectively (DeSocio et al., 2007). Actually, there are many reasons or factors that prevents students to do not attend and these factors can be ranked from a lack of community support, unsupportive school environment, family problems, and health problem (Teasley, 2004). The problem of student absenteeism in school systems that may involve all ages, and there is some evidence that attendance rates are going to be improved (Reid, 2003).

It has been noted that absenteeism problem has begun in primary school and continued to secondary school, which requires to an early intervention to overcome this problem (Reid, 2005). Hence, the schools are looking for the families to work together to

find out ways in which they can sure that the students will attend to schools regularly. As well, within group effort, schools are in contact with the families constantly with regards to students' attendance (Teasley, 2004).

Surely, the students' attendance in school is still far from perfect (Romer, 1993). There is a lack of school attendance data and a lack of consistency in the definition and measurement of non-attendance (Bourke, Rigby, & Burden, 2000). Large schools are more prone to have problems with students' attendance than small schools (Epstein & Sheldon, 2002). School staff spends too much time to prepare and record students' attendance daily.

Recording data manually has many problems (Richard, 2005). Sometimes, the students' attendance records are missing as well as it will be very difficult for teachers to look at students' attendance records one by one. Also school staff is wasting their time in taking students' attendance by calling names or signing on paper, this conventional way has become undesired (Ervasti, Isomursu, & Kinnula, 2009).

Furthermore, parents may face some obstacles to get information about their children when they don't attend to school. According to (Epstein & Sheldon, 2002) , the communications between parents and school's staff can increase student attendance and reduce absenteeism.

Due to the importance of students' attendance, many researchers have suggested some techniques that can be used to overcome the students' attendance problem or to reduce the possibility of students' absence. One of these techniques is automating a student class attendance using Radio Frequency Identification (RIFD) technology (Ansari, Navada, Agarwal, Patil, & Sonkamble, 2011; Gatsheni, Kuriakose, & Aghdasi,

2007; Lim, Sim, & Mansor, 2009; Silva, Filipe, & Pereira, 2008; Yeop Sabri, Abdul Aziz, Mohd Shah, & Abd Kadir, 2007). In addition, fingerprint verification can be used to check students' attendance (Ma, Pan, Cao, & Shen, 2010; Shafi, Khan, Munir, & Baloch, 2010) or by using mobile phone (Jamil, 2011).

Nowadays, parents are suffering from lack of time to know what's going on for their children and keeping in touch with school because of pressures of work or life. Parents are concerned about absence of their children that would reflects on their children's behavior and their educational attainment at school, especially in the critical age stages, such as teenage.

Most of schools rely on register the students' attendance manually and send the report at end of each semester. Thus, parents are in dire need to a modern technological means in order to ensure that their children are attended to school or not as well as to save parent's time and money. In addition, these technologies means are needed to enhance the communications between teachers and parents.

1.3 RESEARCH QUESTION

This research carried out relevant questions for designing and developing a prototype of Web Based Students' Attendance System (WSAS). The research questions are hereby stated below:

a. What are the user requirements models for developing a prototype of WSAS?
b. How to analysis and validate the requirements models?

1.4 RESEARCH OBJECTIVES

The main objective of this project is to design and develop a prototype of WSAS and support this prototype by email and Short Message Service (SMS) technologies. This can be achieved through the following sub-objectives:

a. To determine and analysis the requirements models for a prototype of WSAS.
b. To develop and evaluate the requirements models for a prototype of WSAS.

1.5 RESEARCH SIGNIFICANCE

Designing and developing a prototype of WSAS has several significances as stated below:

a. Parents can check their children's attendance to school anytime anywhere as long as they are connected to internet without having to visit the school that in turn save parents' time and money.
b. Enhancing the communication between teachers and parents that would create a partnership in which everyone is working toward the same goal of helping the children achieve success.
c. Reducing teachers' workload through reducing the tasks that can be done by teachers such as preparing teaching materials, setting and marking assignments and tests, keeping students' records, and so on.

1.6 SCOPE OF STUDY

The scope has been defined to meet the objectives of this project. A prototype of WSAS will be developed for Sintok Secondary School and will be used by teaching staff members and parents. The number of students enrolled in the school is around 672 students annually and the number of teaching staff members is 50 teachers.

The scope of this study will focus on students' attendance. The attendance notification will be sent by teachers through an email and SMS to parents to notify the parents that the students are absent. As well, SMS will be used in an emergency situation in case something bad has happened to student or in case the teaching staff wants to meet the parents for something else. The scope of the study is to come up with users' satisfaction (teachers, parents) of the implementation of a prototype of web based student's attendance system.

During the developing a prototype of WSAS, the open source software such as MySQL and Apache web server will be used as well as JavaScript language and Rational Rose 2000 software.

1.7 ORGANIZATION OF PROJECT

This project is presented in six chapters. An overview of the contents of chapters will be as follows:

Chapter one: Gives a brief introduction to this project. The chapter sheds light on problem statement, research objectives, research questions, scope, and significance of this project.

Chapter two: Presents the literature review related to design and development a prototype of web based students' attendance system.

Chapter three: Focuses on research methodology, the research design methodology was adopted with its five stages which includes awareness of problem, suggestion, development, evaluation, and conclusion.

Chapter four: Presents design and analysis of the project that includes system user's requirements, system design and prototype development. Furthermore a detailed description of the prototype is given which includes use case diagram, sequence diagram and activity diagram using Unified Modeling Language (UML) notation.

Chapter five: Describes the prototype development and evaluation. Detailed description of development and evaluation of the requirement model is tested. Evaluation of the requirement model prototype was done through use of a structure questionnaire.

Chapter six: Discusses the conclusion of project with recommendations for future works.

CHAPTER TWO

LITERATURE REVIEW

This chapter covers all topics related to a WSAS through reviewing past literatures, books, and electronic resources. The chapter sheds light on web based applications, adopt suitable web architecture, content management system, school management information systems, the requirements in school management, School absenteeism, and related works.

2.1 WEB BASED APPLICATIONS

According to Robert Auger (2004) defines a web application as "*A software application, executed by a web server, which responds to dynamic web page requests over Hypertext Transfer Protocol (HTTP)*". The World Wide Web offers a new way to store, collect, share, process, exchange, and use of information. Therefore, the effects of the Web can be touched in most aspects of our life. Thus, the effects can be divided into two parts: part one includes the opportunities that will be provided by web technology such as information availability, accessibility, and flexibility. Whereas, part two focuses on the challenges may face in using web technology such as the way to find the right information and tools from a large resources available and learning to use the existing tools that are keep changing over the time (Yao, 2008).

According to Yao (2008), the web technology has several benefits such as providing distributed infrastructure for information processing, delivering in time, secure

information and tools with a user friendly interface, and has no time or geographic restrictions, which means that the users can access the information anytime and anywhere. Ziemer (2002) argues that the reasons of preferring of web applications over the traditional applications are:

- **Accessibility of web applications**. Due to availability of web applications on several platforms as well as web browser are packaged with most operating systems nowadays, the web applications have become more accessible.
- **Lowest costs of maintenance and deployment**. Web applications are running in web browsers, so installing client software in each computer is not needed. As well, modifications of codes can be only on web server that resides the web applications. Hence, web applications guarantee the reducing of cost and time in comparing with traditional client/server applications.

2.1.1 SMS Technology

SMS can be defined as "*is a globally accepted wireless service that enables the transmission of alphanumeric messages between mobile subscribers and external systems such as electronic mail, paging, and voice mail systems*" (NewNet, 1999). The first message has been sent on 3 December 1992 by Neil Papworth using a personal computer to Richard Jarvis. It has been sent over Vodafone Global System for Mobile Communications (GSM) network in the United Kingdom (UK) (Saxena & Chaudhari, 2011). SMS was designed to be as part of the GSM digital mobile phone standard, nowadays, it has become available on a wide range of networks including Third Generation (3G) networks. SMS is depending basically on store-and-forward technology.

Due to the rapid development in mobile communication, SMS is widely used in business and social messaging as useful tool because it offers a fast and cheap technology. Up to 1120 bits alphanumeric messages can be transmitted between mobile phones and external systems (Agoyi & Seral, 2010).

SMS has several benefits such as delivering of notifications and alerts, message delivery is guaranteed, reliable, low-cost communication, and screening of messages and returning calls is selective way (Amor, 2002). As well, it is simple, easy to use, extensive in coverage, and can reach citizens anywhere anytime (Wangpipatwong, Chutimaskul, & Papasratorn, 2005).

SMS is a simple technology and it possible for people understand the mechanism of sending and receiving messages as illustrated in Figure 2.1. Simply, the sender Mobile Station (MS) sends a message; the message goes through Base Station (BS) that provides the radio infrastructure for wireless communications. BS is then sends the message to Mobile Switching Center (MSC) that route and switches all traffic into and out of the cellular system. Then message is sent to SMS Center (SMSC) that represents as a centralized store-and-forward server that in turn accepts and stores message, retrieves account status, and then forwards message to the intended recipient (Katankar & Thakare, 2010).

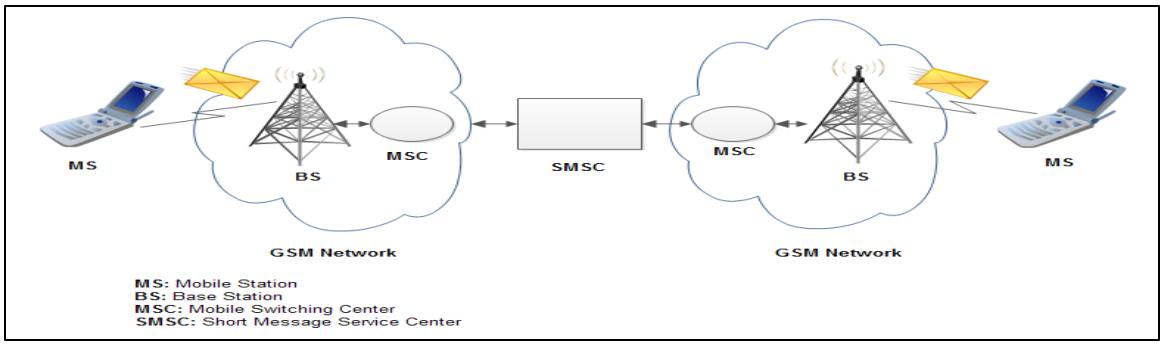

Figure 2.1: SMS Architecture (Katankar & Thakare, 2010)

2.1.2 Email Technology

The first email message was sent in 1971 by Ray Tomlinson, he was used @ sign to indicate to the user was at some host rather than being local (Tomlinson, 2004). Email is a mail that transmits electronically via computer and the major feature of email is its asynchrony, which means that the user can compose , sends, and reads the message anytime anywhere as long as is connected to internet (Frehner, 2008). There is no doubt that the email system represents as a communication backbone for different kinds of automated information delivery systems such as supply chain management, transaction processing , and other critical business processes. Furthermore, email is the most used application for the typical corporate user. Based on a survey that conducted by Osterman Research in 2010, they found that the typical user spends 134 minutes per day working in email or about 28% of an eight-hour day as well the typical user sends a mean of 43 emails and receives 123 email in a typical day. Must take into account that the introduction of Smartphones and other mobile devices have increased of using email by typical user (Research, 2010) .

Email is a communication tool that is a widely used in comparing with other communication tools. Therefore, it has many advantages such as easily to use, fast in delivering messages, asynchronous communication which means that the communication does not occur at the same time and the recipient can read the message anytime, inexpensive or free service, large files or documents can be attached and sent easily, and is a useful factor for communicating between long distances and different world time zone. In contrast, it has disadvantages as well such as low level of security and privacy (Wisker, 2009).

Figure 2.2 attempts to simplify how an email can be sent and received. In *sending messages*, the user agent who composes the message is a client of a Local Simple Mail Transfer Protocol (SMTP) server. The user agent passes each outgoing message to the SMTP server for delivery through using SMTP protocol that is responsible for delivery message. The local SMTP server uses mail routing table to determine a route for each message and then forwards the message to the next SMTP server on the chosen route. When the domain name in the message address matches the local domain, the SMTP server delivers the message to local recipient by storing it in a mailbox file on a local disk or file server. In *reading message*, the user agent who reads the message is either a client of the local file server or a client of a mail delivery server such as a Post Office Protocol (POP) server or Internet Message Access Protocol (IMAP) server. The user agent reads the message directly from the mailbox file through Network File System (NFS) protocol which allows the user agent to access the files from local file server. in the latter case, the User Agent requests information about the contents of the user's mailbox file from a POP or IMAP server and receives messages from those servers for presentation to the user through POP protocol and IMAP protocol which they are designed to access and retrieve the messages (Coulouris, Dollimore, & Kindberg, 2005).

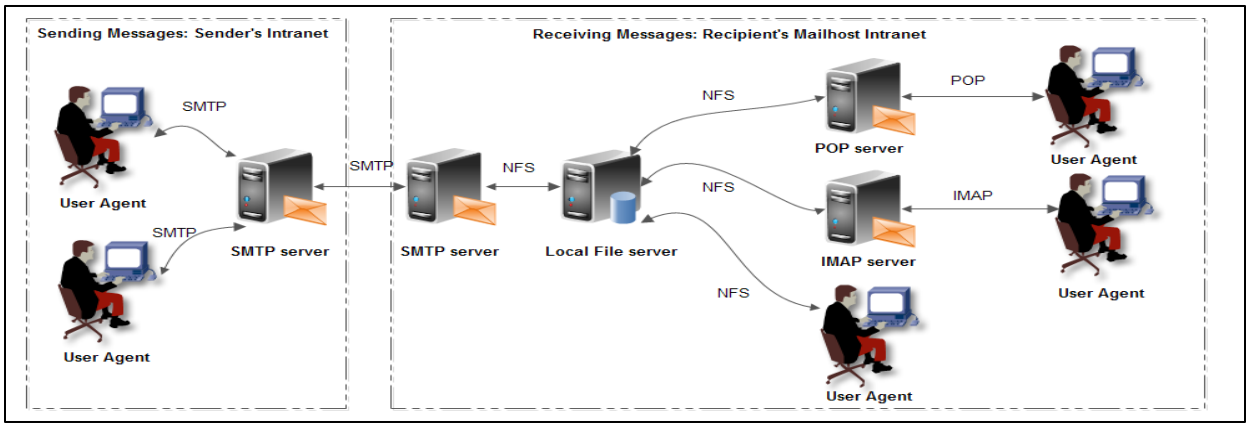

Figure 2.2: Email Architecture (Coulouris et al., 2005)

2.2 ADOPT SUITABLE WEB ARCHITECTURE

Adopt suitable web architecture is extremely important before going to designing the web application. Redesigning the web application after development will incur more cost, time, and effort.

2.2.1 Three-Tier Architecture

Web application architecture is also known as three-tier application architecture. Web application architecture is divided into three tiers as shown in Figure 2.3 (Liu, Heo, & Sha, 2005):

- **Web Server**: is also known as Presentation Tier. Requests from clients will be received by web server and at the same time a complex dynamic content requests will be forwarded to Application Server (Logic Tier). Responses from the Application Server will be received by Web Server and it will be sent back to the clients. Internet Information Services (IIS) and Apache are typical Web Server.

- **Application Server**: is also known as Logic Tier. Requests from Web Server will be received by Application Server which in turn look up for information in database and processes the information. The processed information will be sent back to the Web Sever where this information has been formatted to be displayed on client's machines. Apache Tomcat, Sun Java System Application Server, BEA WebLogic, IBM WebSphere, and JBOSS are typical Application Server.
- **Database Server**: is also known as Data Tier. All web sites information is stored in this tire which includes user accounts, customer orders, and reports. Oracle, Microsoft SQL Server, Sybase, IBM DB2, MySQL, and PostgreSQL are typical Database Server.

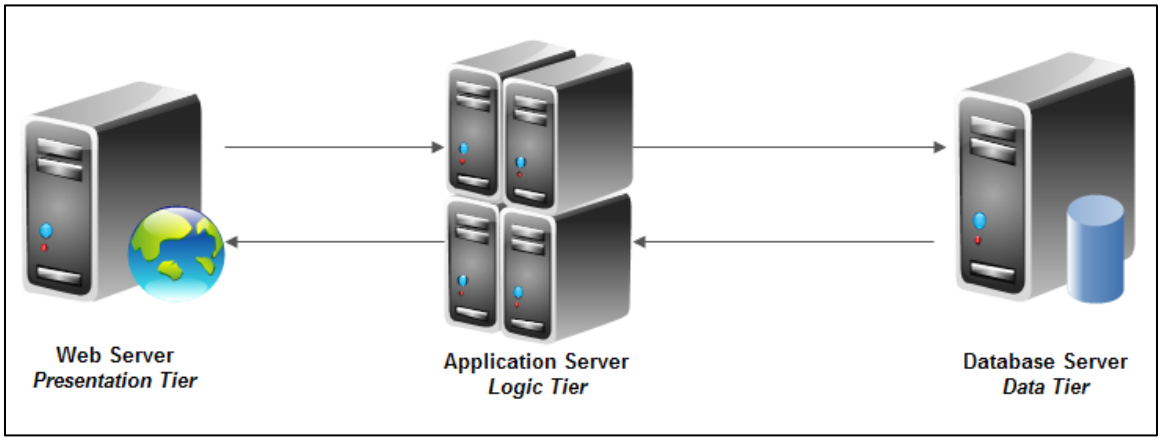

Figure 2.3: Three-tier Architecture (Liu et al., 2005)

According to (Hatzigaidas, Papastergiou, Tryfon, & Maritsa, 2003), three-tier architecture has several advantages such as scalability due to an additional resources can be added to improve performance, easy deployment, separation of user-interface-control and data presentation from application logic, independence of clients which means any redefining of information will not influence clients, clients are require less of

software, and secure system. On the other hand, three-tier architecture has several disadvantages such as structure complexity, setup and maintain is difficult, and influenced by performance due to the physical separation of application servers and database servers (Kambalyal, 2010).

2.2.1.1 Web Server Technology

According to (Berners-Lee, Masinter, & McCahill, 1994), there are three technologies that are used in the web :

a. **The Uniform Resource Locators (URLs)** which allows any type of information to be retrieved from any place in the internet. It interprets by Web browser to identify the location of information.
b. **HTTP** is a set of rules that defines how Web browser and Web server communicate with each other over a TCP/IP connection (Berners-Lee & Connolly, 1995). It allows many different programs to work together over internet.
c. **The Hypertext Markup Language (HTML)** is a basic language of the World Wide Web, which every Web browser must be able to interpret (Yeager & McGrath, 1996). It allows a multimedia Hypertext to be created by authors that can be used by any Web browser. (Yeager & McGrath, 1996), simplify how web server woks, as shown in Figure 2.4:

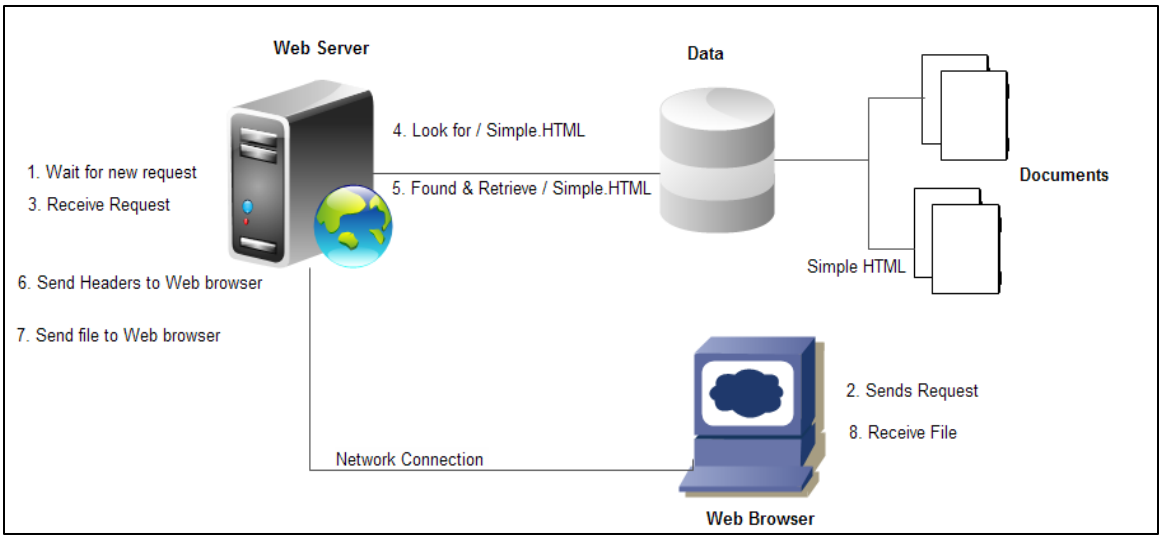

Figure 2.4: Simplified Flow of the Web Browser and Web Server (Yeager & McGrath, 1996)

2.2.1.2 Application Server Technology

As mentioned before, there are typical application's servers are used in web application. One of these application servers is Apache tomcat server. Therefore, it necessary to talk about Apache tomcat server because it will be used to develop a prototype of web based student's attendance system.

According to (Vukotic & Goodwill, 2011), Apache tomcat server "is an open source, java based-web application container that was created to run Servlet and Java Server Pages (JSP) web applications". The functionality of Tomcat is to provide a Java Virtual Machine (JVC) and to provide web server software that would support that environment to make it accessible on the Web (Ellis, 2004). The architecture of Apache tomcat server as shown in Figure 2.5:

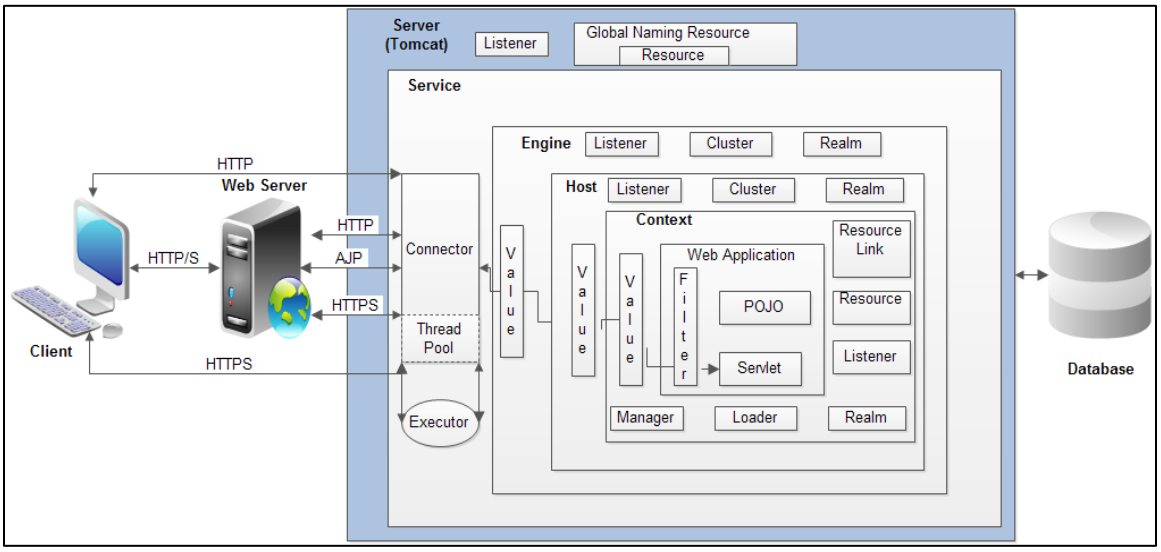

Figure 2.5: Apache Tomcat Server Architecture (Chopra, Li, & Genender, 2011)

The Apache tomcat server architecture can be divided into a set of containers, as the following:

- **The Server**: server is a Tomcat itself and an implementation of server interface.
- **The Service**: each service is consisting of a grouping of connectors and a single container. The role of connectors is to manage the connection between client and Web server whereas the single container accepts the requests from connectors and processes this request then presents them to the appropriate host.
- **The Connector**: it connects the application with client as well as it represents a connection point where requests are received from clients and assigned a port on the server.

- **The Engine**: it represents the Catalina Servlet engine. The HTTP headers are examined in this container to select the virtual host or context to pass the requests.
- **The Host**: it differentiates the virtual hosts by a fully qualified host name.
- **The Context**: is known as Web application. It implements the context interface and it includes informing the engine or hosts of the location of folder root of the application as well as it may include specific error pages that allows system administrator to configure error messages (Chopra et al., 2011).

2.2.1.3 Database Server Technology

Database can be defined as "*a shared collection of logically related data, and a description of this data, designed to meet the information needs of an organization*" (Connolly & Begg, 2005). As long as the database is used in every system, it needs to a software system to interact between it and user's application programs, this software system is named Database Management System (DBMS). DBMS provides many facilities such as allowing the users to define the database through Data Definition Language (DDL), allowing the users to insert, update, delete, and retrieve through Data Manipulation Language (DML), and providing the users to control access to database through Data Control Language (DCL) such as security system, integrity system, concurrency control system, recovery control system, and user-accessible catalog (Connolly & Begg, 2005).

In 1986, a standard for Structured Query Language (SQL) was defined by the ANSI (American National Standards Institute) and the ISO (International Standards Organization) and the first version was SQL-86 or SQL1 (Anca Dobre, 2010). According to Connolly & Begg (2005), SQL can be defined as " *an example of transform-oriented language, or a language designed to use relations to transform inputs into required output*". SQL can be either a stand-alone programming language or with other languages such as Java, C++, COBOL, etc. The major components of SQL are:

- **DDL**: it defines the database structure and other metadata related things through using DDL statements, which includes: CREATE DATABASE, CREATE TABLE, DROP TABLE, and ALTER TABLE.
- **DML**: it uses for updating and retrieving data through using DML statements, which includes: SELECT, INSERT, UPDATE, and DELETE.
- **DCL**: it controls to access to database through using DCL statements, which includes: GRANT and REVOKE.

MySQL server is one of typical database servers. Thus, due to use of MySQL in developing a prototype of WSAS, it necessary to give an overview about the architecture of MySQL server. The MySQL server is consisting of three layers, as illustrated in Figure 2.6:

- **First Layer**: it represents the topmost layer, which contains the services. These services are fulfilling needs of the network-based client/server tools or servers such as connection handling, authentication, security, etc.
- **Second Layer**: It represents the MySQL's brain in this layer, which includes the code of query parsing, optimization, analysis, and all built-in

functions. As well, most functionality that are provided across storage engines are reside in this layer such as stored procedures, triggers, and views.

- **Third Layer**: it includes storage engines, which are responsible for storing and retrieving all data in MySQL (Schwartz et al., 2008).

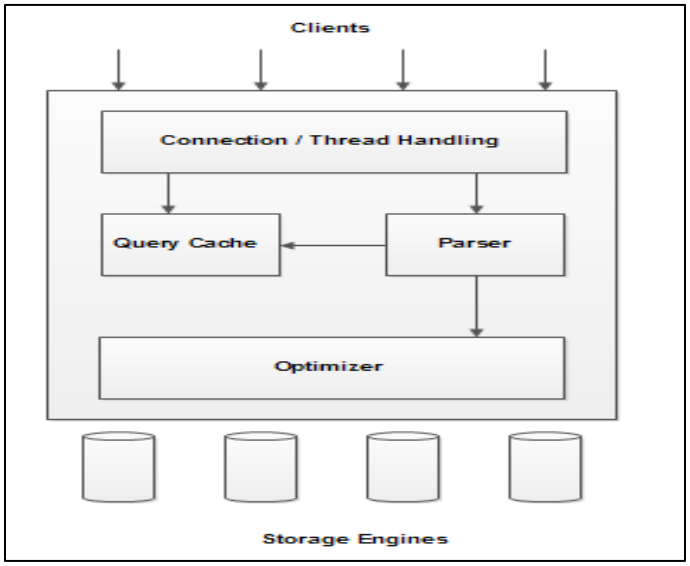

Figure 2.6: A Logical View of the MySQL Server Architecture (Schwartz et al., 2008).

2.2.2 Model-View-Controller (MVC) Architecture

The concept of Model-View-Controller (MVC) has been introduced by the Smalltalk-80 in 1971. MVC is one of design patterns that use to solve a recurring design problem (Vlissides, Helm, Johnson, & Gamma, 1995). MVC is divided into three parts: Model, View, and Controller. An application has three main layers: Presentation (UI), application logic, and resource management. In MVC, presentation layer is divided into View and Controller (Gulzar, 2002).

- **Model**: Model object is a part of application where an application's data is implemented in this part. The main function of model object is to manage the data and behavior of application's data as well as, often, stores and retrieves the model state in database.
- **View**: displays the application's user interface (UI) where application's user interface is created from the model data.
- **Controller**: handles and responds user interaction. Controller takes user input, manipulates the model, and selects a view that displays user interface (Oracle, 2011).

According to (Morales-Chaparro, Linaje, Preciado, & Sanchez-Figueroa, 2007), MVC creates two cycles, as illustrated in Figure 2.7:

a. User → Controller → View → User:

The user interacts with application that in turn sent to Controller. Controller responds and sends a message to the View that updates its information then sends it to the user.

b. User → Controller →Model → View → User

The user interacts with application that in turn sent to Controller. Controller updates the state of model. View is updated to fit the model then sends it to the user.

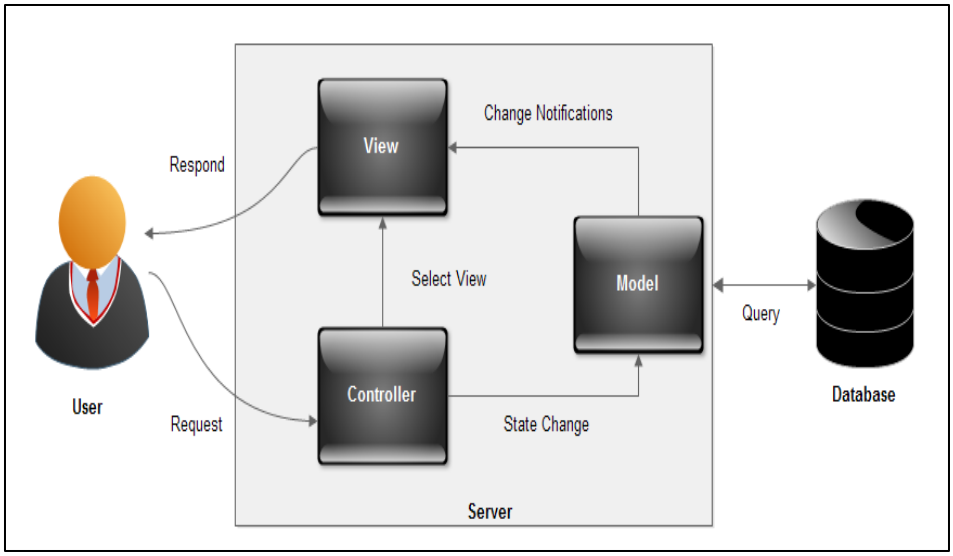

Figure 2.7: MVC Architecture (Morales-Chaparro et al., 2007)

MVC has several advantages such as reduce complexity, increase flexibility, reusability and maintainability (OSS, 2008).

2.3 CONTENT MANAGEMENT SYSTEMS (CMS)

The term “content management" emerged in the mid-1990s. Content management has various meanings depend on today's marketplace. Content management can be defined as "*is a set of processes and technologies that support the evolutionary life cycle of digital information. Digital content may take the form of text, such as documents, multimedia files, such as audio or video files, or any other file type which follows a content lifecycle which requires management* " (Rosenblatt & Dykstra, 2003). Content Management System (CMS) can be defined as “*is a tool that enables a variety of (centralized) technical and (decentralized) non-technical staff to create, edit, manage and finally publish (in a number of formats) a variety of content (such as text, graphics, video,*

documents etc.), whilst being constrained by a centralized set of rules, process and workflows that ensure coherent, validated electronic content" (Nakwaski & Zabierowski, 2010) .

There is a wide range of benefits that can be obtained by implementing a CMS such as empower content, decrease costs, increase revenues, improve accountability, and maintain consistency (Hill, 2010a) .

2.3.1 Principle Elements of CMS

According to Rutger Engelhard (2003), CMS is a tool that allows any user (without IT background) in an organization to manage and update web site without asking a help from the webmaster. The user interacts with two elements in CMS - "Front-end " and " Back-end". Figure 2.8 illustrates the principle elements of a CMS:

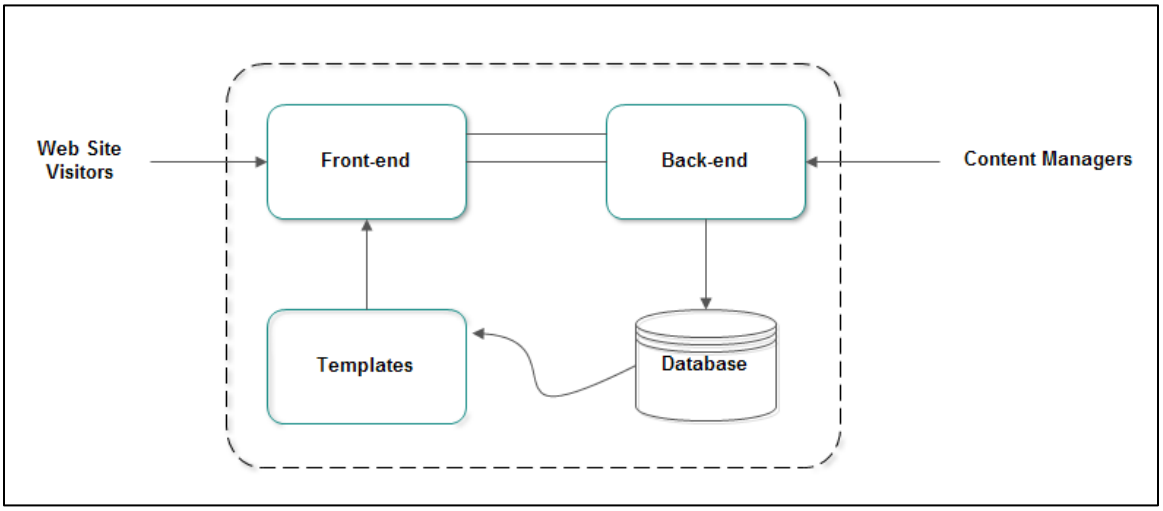

Figure 2.8: Principle Elements of a CMS (Rutger Engelhard, 2003)

- **Front-end**: it acts as a user interface and represents a web site that includes web pages, documents, images, forms, multimedia and other common forms of web content.

- **Back-end**: is an easy-to-use interface that allows any user (non-technical) to edit or enter content. The server takes the content after updated by user and insert it into appropriate template then presents it on the Front-end. Back-end can be reached through a website but accessing to it requires an authorization, therefore, a different level of authority will be provided.
- **Template:** is a structure that formats and displays content of a particular web page upon user request and it represent the backbone of a web page where web page contents are embedded into it.
- **Database**: is a key of content management systems and acts as central warehouse for retrieving templates, contents, metadata, etc. Also, it able to store metadata that includes author information, publishing, creation, indexing information, and other content-related data.

2.3.2 Functions of CMS

Hill (2007), classified the CMS's workflow into three stages, as illustrated in Figure 2. 9:

- **Creation**: in this stage, the initial content is entered into the CMS. The manager may assign all details of the task such as outputs, workflow, etc. or maybe these assigned tasks are picking up by an author. Thus, the content will be constructed and will be sent to management stage that in turn reviewing the content. The content will be created as XML data that can be used in other purposes throughout the enterprise. The users involved in this stage are managers, administrators, and authors.

- **Management**: in this stage, the content will be edited, assembled, translated, and reviewed. Meanwhile, the content may be passed through decisions of approval or rejection by the appropriate users such as editors, reviewers, and approvers before sending it to the publication stage.
- **Publication**: in this stage, after getting the approved content from management stage, the content will be displayed in an existing template that would eliminate the time that is needed to format content to fit the design of page. The content is then sent to staging where the content is seen as if it were delivered in its chosen forms. Also in this stage, workflow may be improved by adding features such as automatic expiration and archiving of information.

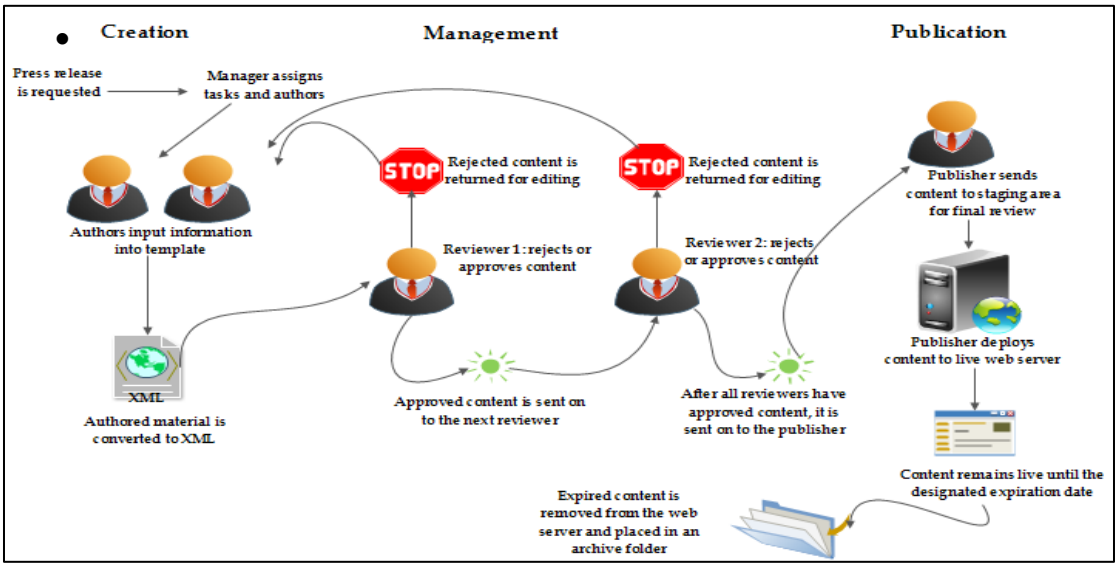

Figure 2.9: CMS Functional Scope and Content Life Cycle (Hill, 2007)

2.3.3 With CMS Versus Without CMS

Comparing between CMS and traditional methods is needed to illustrate the vital role played by CMS. Hill (2010a) summarized the differences through a several aspects as the following:

- **New page creation**: With a CMS, a new page will be created based on a predetermined default and all links will be automatically updated as well a full audit will be available that in turn provides a quick overview about the history of content changes. Without a CMS, a new page will be created as a copy of an existing one. All context links and site map will be updated manually.
- **Content consistency**: With a CMS, Templates are separated from page content and firmly the consistency will be maintained throughout the site. As well, display consistency will be imposed by the CMS. Without a CMS, Template and content are inseparably tied together that in turn it makes difficult to update changes across the entire site. As well, display consistency will be imposed by the developers.
- **Workflow processes**: With a CMS, Workflows are built to reflect all business processes. Workflow engine records all comments on each step accurately. Once the final approval is made, the content will be published online automatically. Without a CMS, Workflow is done via email. Emails will be sent to different persons in an organization and once subsequent approvals are made, the content will be published online manually.

- **Publishing times**: With a CMS, Content will be published immediately once final approvals are made. Without a CMS, publishing content may takes several days depend on the webmaster time.
- **Legal compliance**: With a CMS, compliance is imposed by the system maintaining records. Without a CMS, compliance is left up to the team members.

2.3.4 Web Content Management Systems (WCMS)

According to Nakwaski & Zabierowski (2010), CMS has several types, the most common types are such as Web Content Management Systems (WCMS), Enterprise Content Management Systems, Document Content Management Systems, Transactional Content Management Systems, Integrated Content Management Systems, Publications Content Management Systems, Learning Content Management Systems. Liduo & Yan (2010), defined WCMS as "*CMS software, implemented as a Web application, designed for creating and managing HTML content. WCMS is also a tool, which allows a variety of centralized and decentralized technology, non-technical staff in certain restrictions of rules, processes and workflow to create, edit, manage and control a large, dynamic collection of Web material (HTML documents, images and video), Which facilitates content creation, content control, editing, and essential Web maintenance functions*". Organizations are increasing demand for WCMS to improve development speed, flexibility, and cost effectiveness for web applications (Souer, Honders, Versendaal, & Brinkkemper, 2008) .

Four major functions should be in a complete WCMS: content integration, content intelligence, content management and content distribution (Liduo & Yan, 2010).

- **Content integration**: allows the user to find different information forms from different systems, information could be data, graphics, documents, etc.
- **Content intelligence**: it represents as core function module that used to classify the content archive as well it helps the user to locate information quickly.
- **Content management**: it represents as main function modules that supports the content management process, which includes content creating and editing , information, documents as well to provide collaboration tools to create content, such as web pages productions tools, data conversion HTML tools , etc.
- **Content distribution**: it allows user to receive the published information at the same time, web information portal for example and other ways.

Actually, WCMS provides the needed infrastructure for members in an organization to contribute and collaborate effectively on content. Thus, five things should be considered when going to evaluate and select the appropriate content management system, these things are total lifecycle cost, accessibility, scalability, security, and flexibility (Hill, 2010b).

2.4 SCHOOL MANAGEMENT INFORMATION SYSTEMS

The concept of Management Information Systems (MIS) is a combination of the technical skills of computer science with the management skills. MIS is also called Information Systems (IS) (Buche, 2010). Information systems has many contributions in school management, such as enhancing the learning environment in a professional way, supporting programs effectively, simplifying the process of teaching, working in team, and identifying the student's needs (Gurr, 2000; Pegler, 1992). Telem (1999) defines school MIS as "*a management information system designed to match the structure, management task, instructional processes and special needs of the school*". School MIS play a vital role in increasing efficiency and effectiveness through saving the time and facilitating to find the alternative solutions for complex problems (Visscher & Wild, 1997).

Furthermore, significant changes in roles and managers working styles have occurred due to introduction the school management information systems to school (Telem, 1999) . In other word, a big role has been played by school management information systems to change school management in various areas such as decision making, workload, and planning and responsibility (Gurr, 2000) . Thus, this role helped managers in determining the school's aims, making long term plans, evaluating teachers' performance, and distributing available resources (Telem, 1991; Telem & Buvitski, 1995).

In addition, school management information systems provide a various resources of information through different reports that can be obtained from the database that in

turn helps in making decisions in accordance with school's aims as well as facilitating the control of activities to achieve the school's aims (Telem, 1991; Telem & Buvitski, 1995).

2.5 THE REQUIREMENTS IN SCHOOL MANAGEMENT

First of all, the term" Requirements" must be defined despite that there is no standard definition of what requirements are. Requirements can be defined as "*a specification of what should be implemented. There are descriptions of how the system should behave, or of a system property or attribute. They may be a constraint on the development process of the system*" (Wiegers, 2009) . Also, requirements can be defined as "*The process of producing documented and agreed requirements by means elicitation, specification, analysis, and review of requirements*" (Hood, Wiedemann, Fichtinger, & Pautz, 2008). Without requirements, there is no facility to verifying the validity of program design (Kovitz, 1999). There is no facility to connect the program logically to customer's wishes. Requirements is something that is required from computer to do to its users that may include specific functions, attributes, or principles that must be provided by system to be merit (Kulak & Guiney, 2004).

Requirements can be classified into two categories: Functional requirements and Nonfunctional requirements. Functional requirements related to those actions that must be performed, without taking into account the physical constraints as well specifying behavior of input and output of the system. Whereas, nonfunctional requirements define the other attributes that the system must do, these attributes could be such as reliability, usability, performance, and so on (Bittner & Spence, 2003). Functional requirements are users' needs from the system to do, are simply functions and features. Nonfunctional

requirements focus on hidden areas of the system which are important to users although they may not aware of it (Kulak & Guiney, 2004). Functional requirements describe functions and services of the system in accordance with the user's goals. Nonfunctional requirements are wide term which encompasses both qualities such as usability and constraints such as time (Favre, 2003).

User requirements indicate to the features or attributes that the product should have or how it should be performed from the viewpoint of users (Courage & Baxter, 2005). User requirements describe the solution from the viewpoint of end-user. It documents the daily tasks that performed by the end-user as features to be offered by the solution (Verzuh, 2011). Establishing and documenting user's requirements are important that they lead into the designing process of the system itself. Therefore, a brief summary of the tasks will be included by user requirements that are supported by system as well as providing the functions to support them (Maguire & Bevan, 2002). (Maiden, 2008) defines user requirements as "*a good user requirement comes from a user or from other type of stakeholder and expresses a property of the domain or business process that the introduction of a new system will bring about*".

Dean Leffingwell (2003) defines requirements management as "*a process of systematically eliciting, organizing, and documenting requirements for a complex system*". As well, Hood et al. (2008) define requirements management as " *the set of procedures that support the development of requirements including planning, traceability, impact analysis, change management and so on*". Requirements management can act as a basis for the system when the system is under development and considered as one of risk factors in order to complete the project successfully (Aalst et

al., 2007). Managing requirements consist of capturing requirements, retrieving and modifying requirements, prioritizing requirements, and tracing requirements (Pollice, Augustine, Lowe, & Madhur, 2003) .Requirements management is went close to the perspective of processes and techniques (Aouad & Arayici, 2010).

2.6 SCHOOL ABSENTEEISM

There are many factors that contribute in school absenteeism such as family problems, psychological problems, illness, school phobia, and problem with teachers ((Clark, Borg, Calleja, Chircop, & Portelli, 2005). Absenteeism hurts student who are frequently absent fall behind in academics and miss important socialization concepts that enhance their ability to understand and follow directions or, ultimately, plan for the future as well as it hurts other students through requiring more individual attention from teachers. Moreover, Absenteeism hurts the community because of students who are truant are more likely to be involved in criminal activity (Education, 2000). School absenteeism can also be described under various terms such as truancy and school phobia, terms that together can provide greater understanding of school absenteeism. Truancy, by definition, is the act of staying away from school without permission (Mccray, 2006). School phobia, on the other hand, has been defined as an irrational fear or anxiety about attending school (Chitiyo & Wheeler, 2006).

2.7 RELATED WORKS

Nowadays there are a lot of researches that tried to address the students' attendance problem by using some different techniques that would to overcome this

problem or to reduce the possibility of students' absence. Some of researches focused on using of RFID technology, here is some examples of these researches:

- Lim, Sim, & Mansor (2009), they built a prototype that includes RFID technology, RFID usually consists of RFID reader and tag. Simply, the prototype is working by placing the students their RFID tag on the RFID reader to take their attendance and the prototype can use RS232 or Universal Serial Bus (USB) to connect the Database that installed in PC. Whereas, Gatsheni, Kuriakose, & Aghdasi (2007); Silva, Filipe, & Pereira (2008); Yeop Sabri, Abdul Aziz, Mohd Shah, & Abd Kadir (2007), they built their prototype by using RFID technology in combination with internet hotspot (hotspots established using the wireless local area network). Information from a Student's ID card is electronically collected automatically from either a bag or pocket when the student enters the classroom and then entered into a register.

In addition, some researches focused on fingerprint verification over network. Ma, Pan, Cao, & Shen (2010); Shafi, Khan, Munir, & Baloch (2010), they built their prototype to check students' attendance through verification of their fingerprint and then the report goes over network (Wireless communication) to the host computer where the Database is installed.

Moreover, there are some researches focused on mobile phone. Jamil (2011) has built a prototype based on software program installed in instructor's mobile phone that allows reading Media Access Control (MAC) addresses and ID numbers of all students' mobile telephones which are saved in a Berkeley DB and sends a text-file to all those MAC addresses to query for their attendance. The students' mobile phone should be Bluetooth enabled and not switched off in order to respond to the query that sent by the instructor's mobile phone. The

instructor's mobile phone receives all MAC addresses and ID numbers from students' mobile telephone. All information will be automatically saved in Berkeley DB and a single message will be sent to instructor's mobile phone to indicate which MAC address/ID number has not responded on specific date and time.

Therefore, some drawbacks that can be taken on these techniques as follows:

a. These techniques are somewhat complex and it costs a lot of money due to the numbers of equipment that can be used in construction of the system.
b. Easy to cheat these kinds of techniques through giving the student his/her card to his/her colleague without being attended.
c. These techniques lack to communicate with parents.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 INTRODUCTION

A research can be defined as "*a systematic approach to obtaining and confirming new and reliable knowledge*" (Ethridge, 2004). Whereas a methodology can be defined as "*the systematic analysis and organization of the rational and experimental principles and processes which must guide a scientific inquiry*" (Runes, 1983). In other words, a research methodology is a set of methods, procedures that is used to conduct a systematic research for a thesis or dissertation. Thus, the major purpose of methodology is to be able to reach an important result that will contribute in area of research. In fact, the definition of terms "Research" and "Methodology" is broad definition and there is no standard definition for both.

Therefore, research design methodology will be adopted in this project because this methodology is accepted and recommended among researchers in information system design developed by Vaishnavi & Kuechler (2007). Moreover, this methodology stresses the creation of knowledge latent in the method as well as it emerged in an analysis of the processes latent in any effort of design. This methodology consists of five phases as illustrated in Figure 3.1: Awareness of problem, suggestion, development, evaluation, and conclusion.

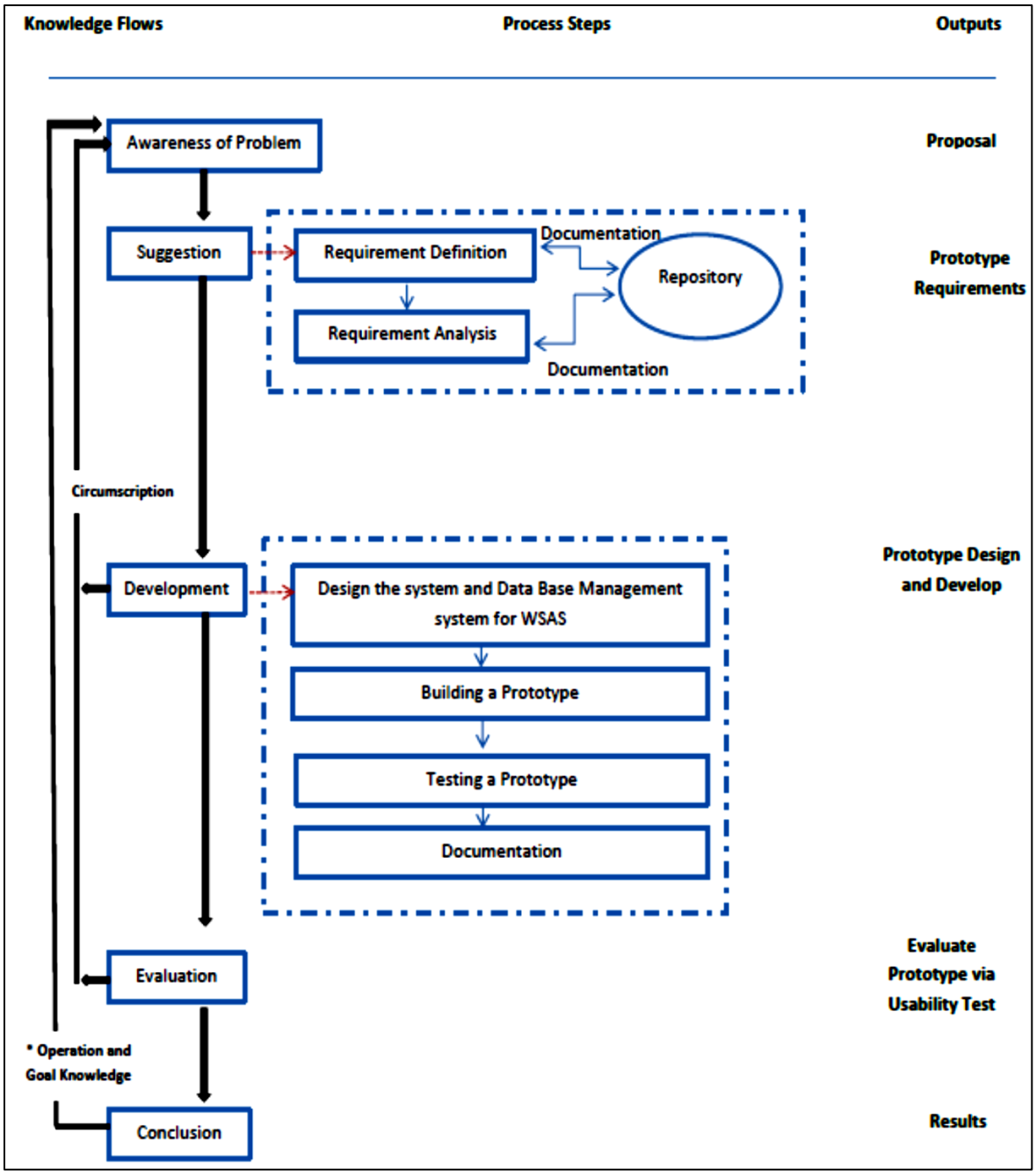

Figure 3.1: Research Design Methodology (Vaishnavi & Kuechler, 2007)

3.2 AWARENESS OF PROBLEM

In the awareness of problem phase, the problem should be identified and defined. Hence, this phase determines the study domain, the problem, objectives, scope in order to come up with the proposal of the study. The Analysis of the current system of students'

attendance system in school was conducted as well as the problem and scope was identified. In addition, this study was scheduled and literature review was carried out and any related resources to the study were gathered such as white paper, books, proceedings, and electronic resources. Furthermore, data collection is an integral part of this phase. Data collection can be defined as "a critical step in problem solving. Without good data we are often only guessing at solutions" (Associates, 1995) . Data collection helps us to have a deepest understanding for what is really happening to processes or services as well as it helps us to focus our efforts on knowing the factors that in turn make a difference. As well, it saves our time, efforts, and resources effectively. Data collection can be done through different methods such as an observation, analysis content, questionnaire, schedule, and interview (Kumar, 2008). Hence, in this phase, the data requirements of the user have been collected through performing the following procedures:

3.2.1 Interviews

The interview method allows the researchers to have a good knowledge about research domain and research problem that would to allow the researchers to come up with good solution to the problem (Fryer, 2001). Interviews were conducted in Sintok Secondary School in order to get an accurate data from administrative staff, teachers, and parents. Based on interviews have been conducted with Mdm. Suzana Muhammad who is responsible for students' attendance at Sintok Secondary School and teaching staff, they stated that the number of classes during the school hours are eight classes and they students are required to attend these classes. Regarding to current system of students' attendance, she stated that the process is carried out manually only once time in the

morning before 9 AM and they do not check it again as well as the students' attendance data are saved manually in attendance sheet as an archive. Usually, in case the student does not attend to school or the student may leave the school after break time, they inform their parent through using Telephone or by sending letter to parent by student's friends or student's neighbors. Moreover, Mdm. Suzana Muhammad has stated that they do not report the students' attendance daily, it sends after 10 days to the parent or relative. She stated that the school is in dire need to a system that would solve many problems they may face and to save efforts and time for both teachers and parents.

3.3 SUGGESTION

The Suggestion phase is intimately connected with awareness of the problem (proposal). The designing and developing a prototype has been initialized in accordance with users' requirements and system's requirements in this phase. To define and identify the users' requirements and system's requirements, a System Development Methodology (Whitten, Bentley, & Diltman, 1998) was adopted with its two phases, which are requirements definition and requirements analysis.

3.3.1 Requirements Definition

This phase is the fundamental process of understanding why an information system should be built. User's requirements indicate to the features or attributes that the product should have or how it should be performed from the viewpoint of users (Courage & Baxter, 2005). Hence, user's requirements were captured through the interviews that

were conducted with Mdm. Suzana Muhammad who is responsible for students' attendance at Sintok Secondary School and teaching staff.

3.3.2 Requirements Analysis

This is an important process because if the requirements have not been analyzed well, the delivered system will not meet the users' expectations. Based on the interviews, a prototype of a WSAS must have these functions in order to fulfill the users' requirements:

a. To facilitate the work of administrative staff and teachers to record and save the student's attendance data in database management system of school.
b. To facilitate the work of administrative staff and teachers to give an accurate data about student status such as absent, attend, and late.
c. To ensure that the information of students' attendance are shared between administrative staff, teachers, and parents anytime anywhere.
d. To ensure that the SMS and Email technologies are working correctly.
e. To ensure that the prototype is secure and only who has the authorization can access the system.

Table 3.1 illustrates the environment for developing the prototype:

Table 3.1: Prototype Development Environment

Programming Language	JavaScript
Database	MySQL Server

Operating System	Windows 7
Computer Browser	Internet Explorer 9
SMS Service Provider	Maxis

Table 3.2 illustrates the minimum hardware requirements for developing the prototype:

Table 3.2: Hardware Requirements

RAM	2 GB
Processor	2 GHz
Free Hard Drive Space	2 GB

3.4 DEVELOPMENT

Object Oriented Development Life Cycle approach (George, Batra, Valacich, & Hofer, 2004; Whitten & Bentley, 2008) was adopted in this phase with its four phases, which are design system and database phase, building prototype, testing prototype, and documentation.

3.4.1 Design system and Database Phase

This phase represents the architecture of design process which is used to map the specifications. In this phase, the prototype will be developed to simulate system with its parts (hardware and software) in order to verify and measure what is expected from system to do according to the requirements before the constructing the final system

(Jafari & Sheehan, 2003). According to (Process, 1998; Robal, 2002), The Rational Unified Process (RUP) is a software engineering process, enhances team productivity, creates and maintains models, a guide how to use UML effectively, supported by tools, and captures many of the best practices in modern software development. The RUP organizes software projects in respect of workflows and phases, each one of them consists of one or more iterations, so that design ideas can be tested and validated as well as risks can be decreased in the early lifecycle steps. Furthermore, The RUP is a framework that also can be implemented on iterative Web applications modeling (Robal, 2002). Design and development of WSAS has been divided into two stages during this phase:

- **First Stage**: During this stage, the business case which includes risk assessment, resources needed estimation, and time table have been established for developing a web based students' attendance system as well as delimiting the scope and constraints. The users' requirements and main functionalities have been described by use cases as well all external entities that interact with the system will be defined. Hence, supposed to be completed 10 -20% of an initial use case model.
- **Second Stage**: The purpose of this stage is analyzing the problem domain, defining system architecture through understanding the whole system, and system use cases through drawing a scenario such as activity diagram, sequence diagram, collaboration diagram and class diagram. Definitely, in this stage, it helped to determine the technology that can be used for the

developing a prototype of WSAS. Hence, supposed to be completed 70 - 80% of an initial use case model.

Moreover, the database has been created to present all types of query provided by MySQL. Creation of database was synchronized with design steps.

3.4.1.1 Design phase deliverable

The deliverable of this phase is a model of solution domain; it described details of how the prototype will be built.

3.4.2 Building Prototype

In this phase the implementation was demonstrated the functionality of the prototype. The development processes involves transforming the analysis and design the model into executable form, the chosen software tool was used to develop the prototype. During the coding phase there will be a component testing to ensure that all components work properly before combining all of as them as the whole system. As well, the remaining components and application features such as SMS and email technologies will be developed and integrated into system as well as these features must be tested thoroughly.

3.4.2.1 Deliverable building prototype phase

In object oriented construction phase documentation for the program source code as well as build the database for web based students' attendance system which will store data of students and user of the system.

3.4.3 Testing Prototype

The main purpose of conducting testing is to evaluate the prototype. System testing will performed on the interaction of the entire dialog components when all the components combined for the first time.

3.4.3.1 Deliverable testing prototype phase

The deliverable of this phase is WSAS.

3.4.4 Documentation

A report on the design and develop a prototype of WSAS has been written, which includes detailed description and information about WSAS. Finally, a complete documentation has been prepared about the WSAS.

3.5 EVALUATION

Once a prototype of web based students' attendance system is constructed, the prototype will be evaluated according to criteria that are implicit and frequently made explicit in the Proposal (Awareness of Problem phase). Generated ordinal test case usability testing and negative test cases will test on every use case via the perspective prototype. One of usability testing methods which are would be made in Sintok Secondary School with administrative staff, teachers, and parents in order to measure the users' satisfaction that can be measured by four variables: usefulness, easy to use, easy of learning, and satisfaction which reflect the users' satisfaction and efficiency of the prototype.

3.6 CONCLUSION

This phase includes the results that have been analyzed based on four variables that have been chosen to measure users' satisfaction.

CHAPTER FOUR

SYSTEM ANALYSIS AND DESIGN

This chapter sheds light on design and analysis of the project that includes system user's requirements, system design and prototype development. Furthermore a detailed description of the prototype is given which includes use case diagram, sequence diagram, activity diagram, and class diagram using UML notation as well as a detailed description about database design which includes identify relation types and determine attribute domains.

4.1 SYSTEM REQUIREMENTS

Without requirements, there is no facility to verifying the validity of program design (Kovitz, 1999). There is no facility to connect the program logically to customer's wishes. Requirements is something that is required from computer to do to its users that may include specific functions, attributes, or principles that must be provided by system to be merit (Kulak & Guiney, 2004). Requirements can be classified into two categories: Functional requirements and Nonfunctional requirements.

4.1.1 Functional Requirements

Functional requirements describe functions and services of the system in accordance with the user's goals. Table 4.1 summaries the functional requirements for the system. In the priority column, the following shorthands are used:

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

Table 4.1: Functional Requirements for WSAS

No	Requirement ID	Description	P.R
	WSAS_01	**Login**	
1	WSAS_01_01	Allow the administrator, teacher, and parent to enter username and password and allow the system to verify the username and password	M
	WSAS_02	**Logout**	
2	WSAS_02_01	Allow the administrator, teacher, and parent to exit from the system	M
	WSAS_03	**Manage Teacher Information**	
3	WSAS_03_01	Allow the administrator to add new teacher	M
4	WSAS_03_02	Allow the administrator to update teacher information	M
5	WSAS_03_03	Allow the administrator to view teacher information	M
	WSAS_04	**Manage Parent Information**	
6	WSAS_04_01	Allow the administrator to add new parent	M
7	WSAS_04_02	Allow the administrator to update parent information	M
8	WSAS_04_03	Allow the administrator to view parent information	M
	WSAS_05	**Add Attendance**	
9	WSAS_05_01	Allow the teacher to add students' attendance	M
	WSAS_06	**Update Attendance**	
10	WSAS_06_01	Allow the teacher to update students' attendance	M
	WSAS_07	**View Attendance**	
11	WSAS_07_01	Allow the teacher and parent to view students' attendance	M
	WSAS_08	**Emergency SMS**	
12	WSAS_08_01	Allow the teacher to send an SMS to parent for an emergency situation or for something else	M
	WSAS_09	**Update Profile**	
13	WSAS_09_01	Allow the parent to update his/her profile	M
	WSAS_10	**View Profile**	
14	WSAS_10_01	Allow the parent to view his/her profile	M

4.1.2 Non-Functional Requirements

Nonfunctional requirements focus on hidden areas of the system which are important to users although they may not aware of it such as reliability, performance, security, and so on. Table 4.2 summarizes the non-functional requirements for the system.

Table 4.2: Non-Functional Requirements

No	Requirement ID	Description	P.R
	WSAS_01	**Reliability**	
1	WSAS_01_01	The system must perform and maintain its functions in routine circumstances.	M
	WSAS_02	**Security**	
2	WSAS_02_01	The system must prevent unauthorized users to access the system	M
3	WSAS_02_02	Authorized users must be provided with user ids and passwords	M
	WSAS_03	**Performance**	
4	WSAS_03_01	Performance requirements are concerned with quantifiable attributes of the system such as response time, throughput availability and accuracy	M
	WSAS_04	**Usability**	
5	WSAS_04_01	The system should provide a coherent user interface that is consistent with the organization interface	M
6	WSAS_04_02	The system must be obvious, allowing the user to navigate the system easily	M

4.2 SYSTEM DESIGN

The prototype has been designed based on the users' requirements and the detailed analysis of the system. Design system describes how the system will be operated, in terms of software, hardware, and network infrastructure. The system design includes UML notation diagrams that consist of use case diagram, sequence diagram, activity

diagram, and class diagram. To obtain these diagrams, a Rational Rose 2000 Enterprise Edition has been used during the development stage.

4.2.1 Use Case Diagram

Use case diagrams are used to show the functionalities that will be provided by the system as well to show which user that will communicate with the system (Bennett, McRobb, Farmer, & MacRobb, 2006). The two actors are involved in this system, which are: Teacher and Parent. Figure 4.1 shows the use case diagram of WSAS.

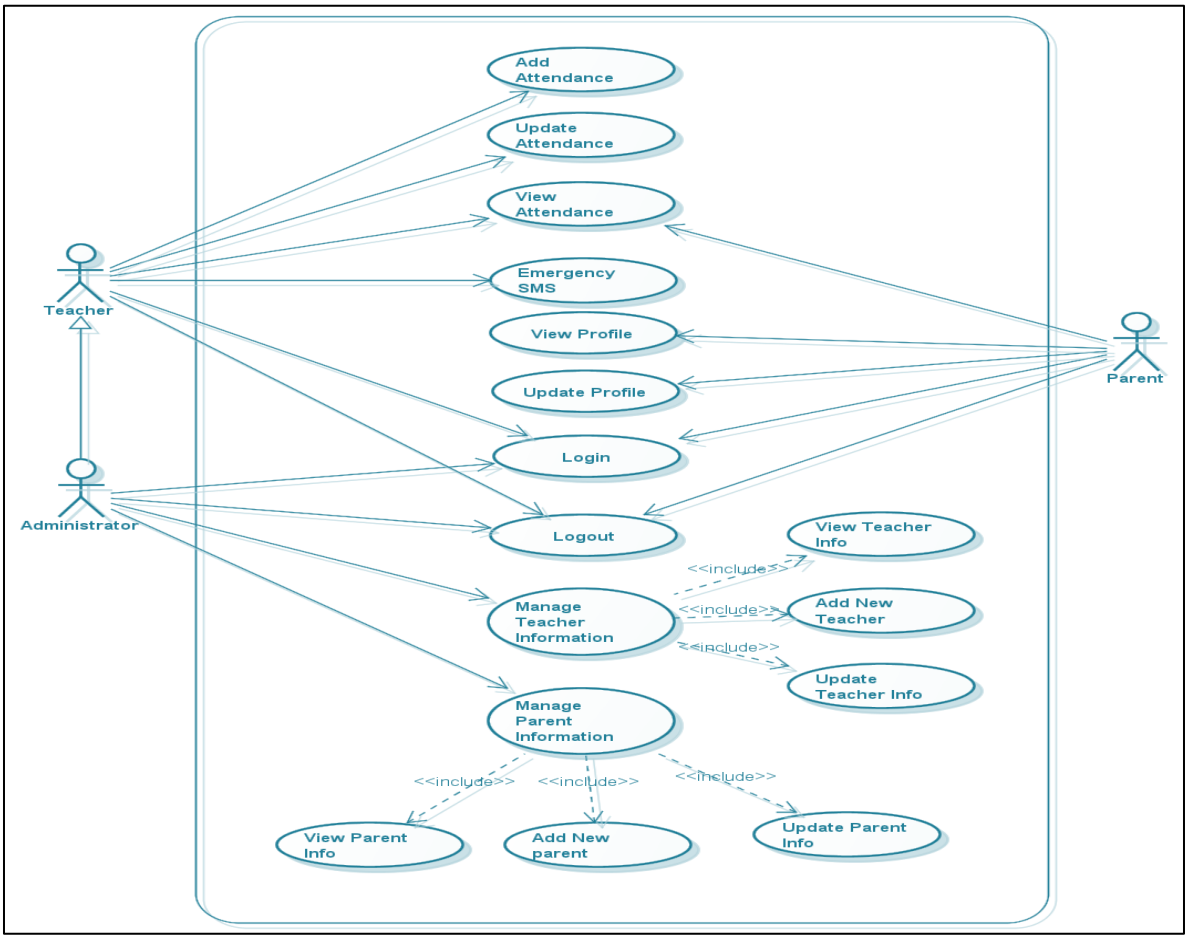

Figure 4.1: Use Case Diagram for WSAS

4.2.2 Use Case Specification

A use case specification describes the sequence of events within a use case. in use case specification, the implementation details should not be described as well as how the functionality will be implemented (Kroll & Kruchten, 2003). Figure 4.2 shows a use case specification for administrator login and the other use cases specification are available in the Appendix A.

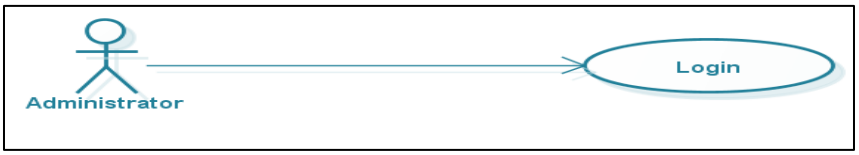

Figure 4.2: Use Case Specification for Administrator Login

- **Brief Description:** Allow the administrator to type username and password to enter the system.
- **Actor:** Administrator.
- **Requirements:** WSAS_01_01.
- **Pre-Condition:** Username and password must be valid.
- **Flow of Events:**
  1. **Basic Flow:**
     - Login form will be displayed by the system.
     - Administrator will type username and password [A1].
     - The system will validate the username and password [E1].
     - If login process is successful, the system will redirect the administrator to administrator menu page.
  2. **Alternative Flow:**
     - [A1]: Administrator may click on homepage link before clicking on login button.
  3. **Exceptional Flow:**

- [E1]: If the administrator entered invalid username or password, the system will display an error message.

- **Post-Condition:** Display the menu page of the administrator.

4.2.3 Activity Diagram

Activity diagram can be used to represent different aspects of a system and can be used to model the system functions that can be represented by a use case. Also, it can be used to model the detail of how the particular operation will be carried out. Definitely, it is the most useful tool to model business activities in the early stages of a project (Bennett et al., 2006). Figure 4.3 shows the activity diagram for Administrator login and the other activity diagrams are available in the Appendix B.

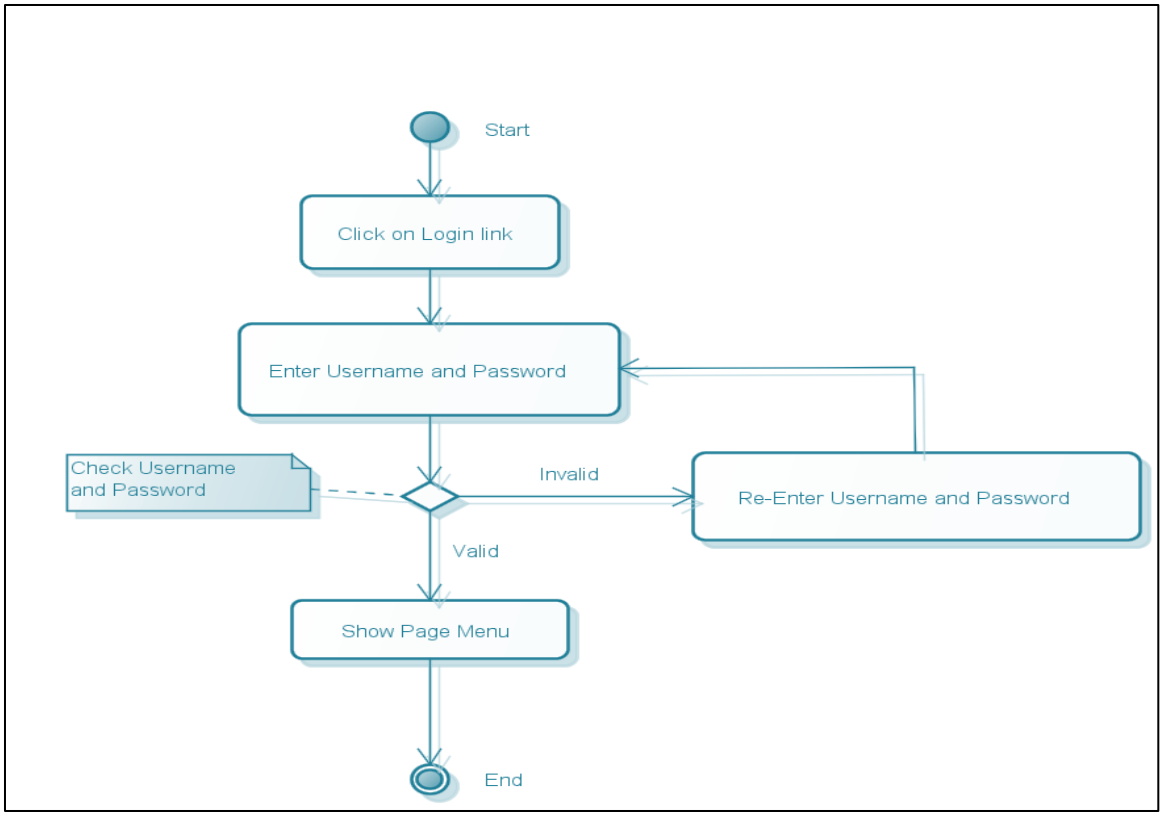

Figure 4.3: Activity Diagram for Administrator Login

4.2.4 Sequence Diagram

Sequence diagram describes an interaction between objects that arranged in a time and describes an interaction that is described by a partially ordered sequence of the message between objects (Bell, 2004; Bennett et al., 2006). Figure 4.4 shows a sequence diagram for administrator login and the other sequence diagrams are available in the Appendix C.

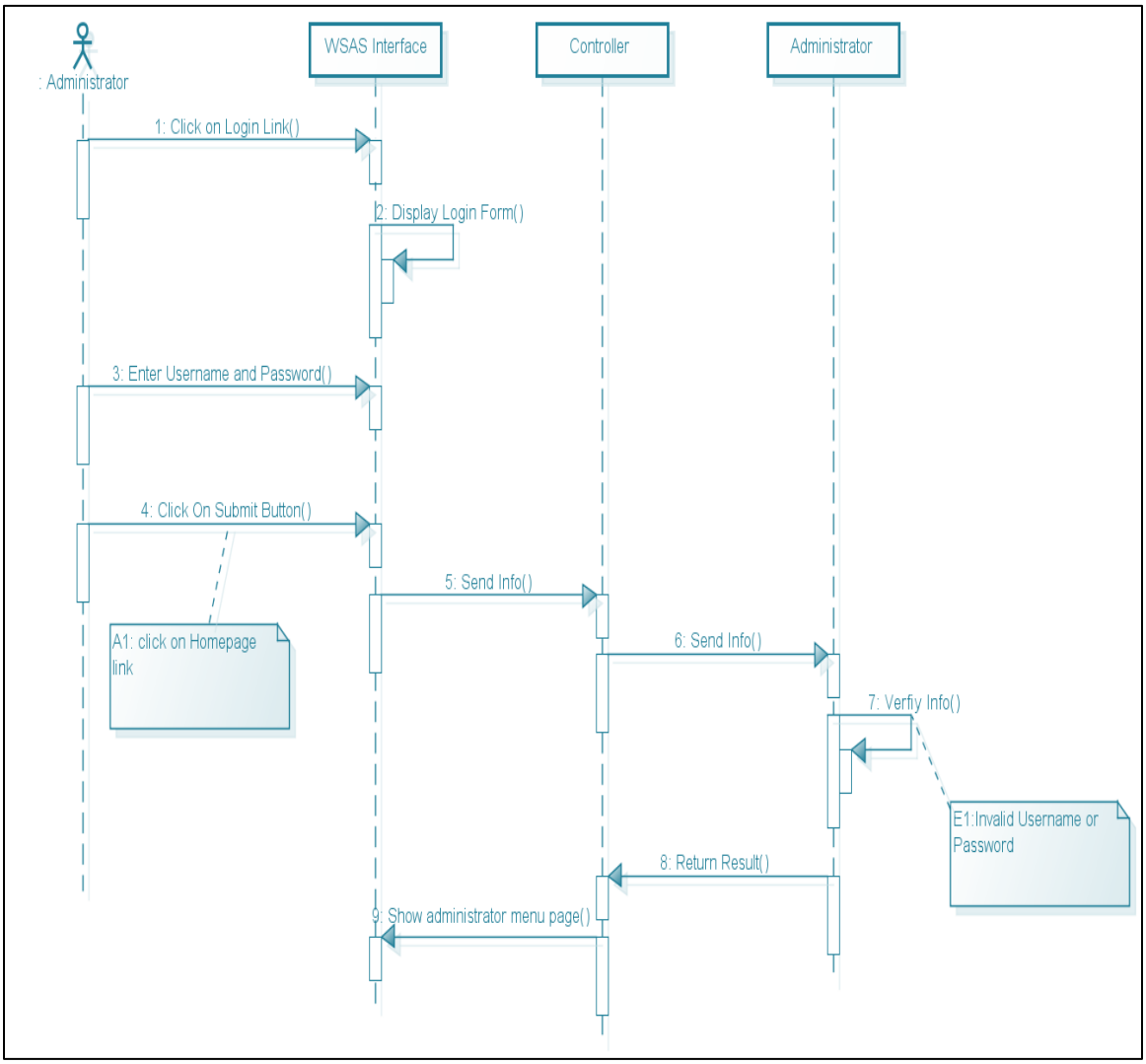

Figure 4.4: Sequence Diagram for Administrator Login

4.2.5 Collaboration Diagram

Collaboration diagram is also called as Communication diagram. Actually, collaboration diagram has many similarities to sequence diagram and for the direct interactions they express the same information in a different format. The most significant difference between them is that a collaboration diagram clearly shows the link between the lifelines that participates in a collaboration (Bennett et al., 2006). Also, it illustrates the relationships between objects and the messages that will be interconnected between them in order to accomplish some activity (Grady, 2006). Figure 4.5 shows a collaboration diagram for administrator login and the other collaboration diagrams are available in the Appendix D.

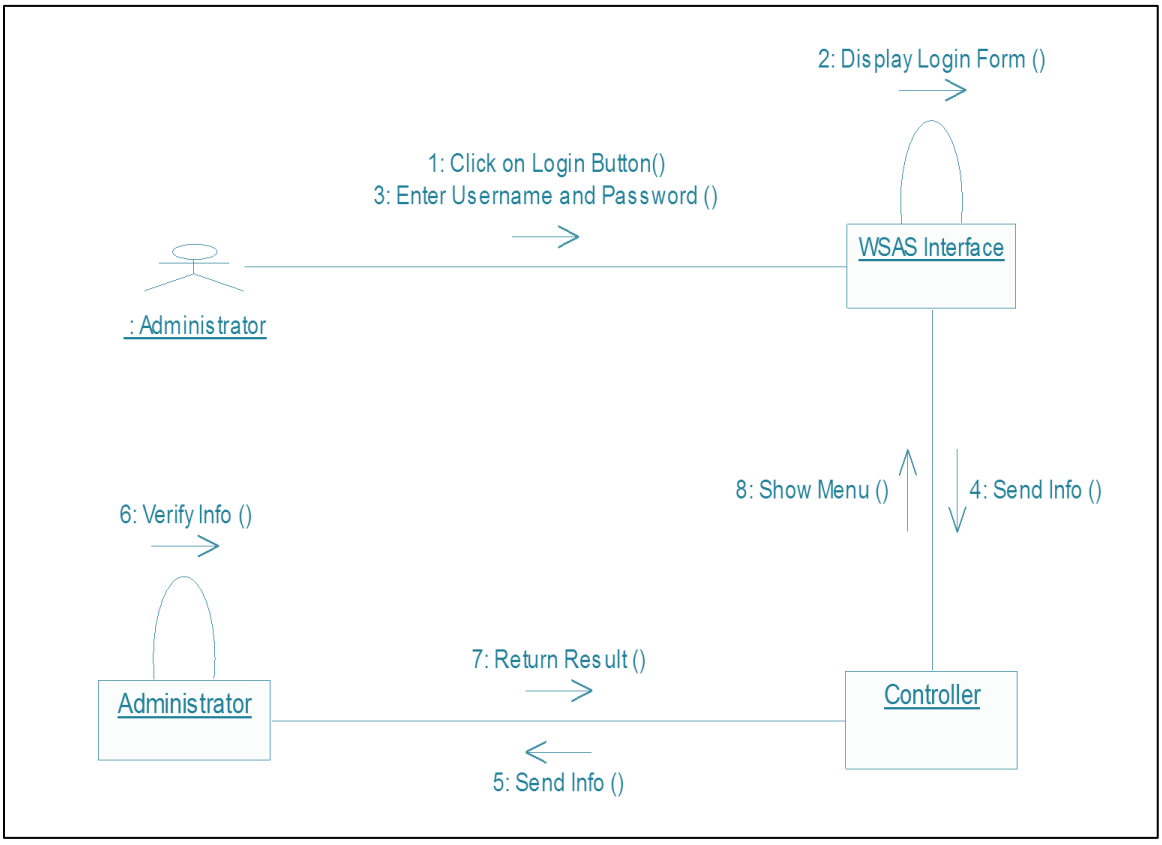

Figure 4.5: Collaboration Diagram for Administrator Login

4.2.6 Class Diagram

Class diagram shows static aspects of a system in terms of the classes of objects in the system, relationships between these classes and constraints on the relationships (France & Rumpe, 1999). Figure 4.6 shows a class diagram for WSAS.

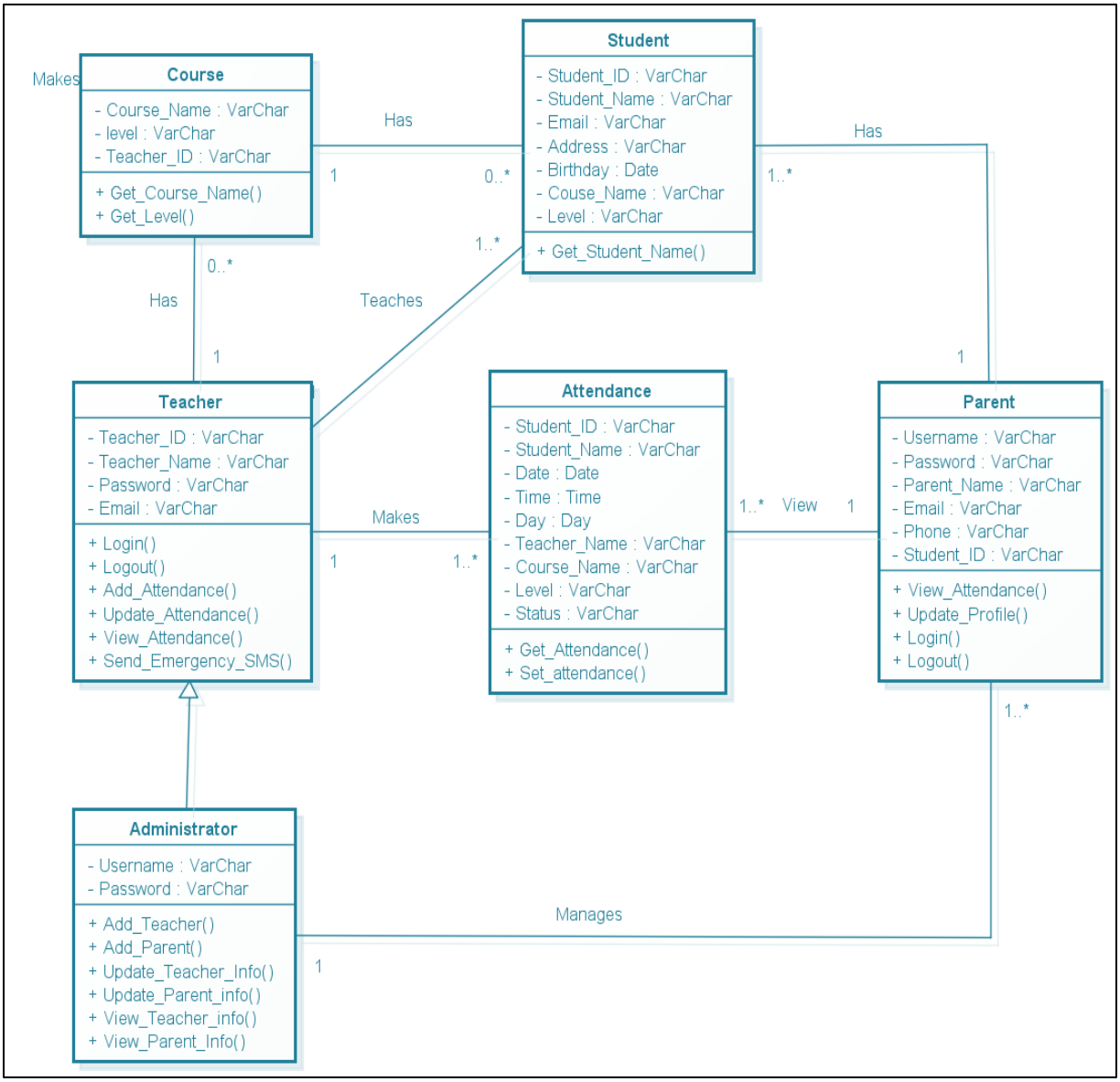

Figure 4.6: Class Diagram for WSAS

4.2.7 Database Design

The database has been created by using MySQL. The database of WSAS consists of six tables, which are: teacher table, administrator table, parent table, student table, course table, and attendance table.

The conceptual database design is a process to design an information model related to the organization where the database system will be developed. In this case, the organization refers to Sintok Secondary School. The conceptual database design includes the following processes:

a. Identify relation types.

b. Determine attribute domains.

4.2.7.1 Identify relations

The objective of this process is to underline all relationship that exists between identified entities in the system as shown in Table 4.3.

Table 4.3: Identify Relations

Entity Type	Relation Type	Entity type	Cardinality	Participation
Administrator	* Manages	Teacher	1:M	T:P
Administrator	* Manages	Parent	1:M	T:P
Teacher	Has	Course	1:M	T:P
Teacher	Teaches	Student	1:M	T:P

Teacher	Makes	Attendance	1:M	T:P
Course	Has	Student	1:M	T:P
Parent	Has	Student	1:M	T:P
Parent	View	Attendance	1:M	T:P

T: Total.

P: Partial.

* Manages (Add, Update, View).

4.2.7.2 Determine attribute domains

The objective of this process is to determine the attribute domain that has the same property in terms of data size and type as shown in Tables in Appendix F.

CHAPTER FIVE

PROTOTYPE DEVELOPMENT AND EVALUATION

5.1 INTRODUCTION

This chapter focuses on the development of prototype and the results that were gathered during the validation of prototype. The usability guideline was adopted during the development of prototype. Thus, the functions of prototype were matched with the user's requirements.

5.2 PROTOTYPE DEVELOPMENT

Prototype development is an important step to ensure that the functionalities of the prototype are matching with the user's requirements. The prototype was developed based on the characteristics that have been given in system analysis and design chapter. The prototype was developed by using MySQL server and Apache Web Server as well using JavaScript language.

Figure 5.1 depicts the homepage of the application. The administrator, teacher, and parent can select login link that will redirect him/her to login page in order to allow them to enter the system.

Figure 5.1: WSAS Homepage

Figure 5.2 depicts the administrator login page. This page allows the administrator to enter username and password to enter the system. In case the administrator has entered invalid username or password, the system will display an error message to inform him/her that entered invalid username or password. Also, this page allows the administrator to go back to the homepage.

Figure 5.2: Administrator Login Page

Figure 5.3 depicts the homepage of administrator. This page allows the administrator to manage teacher's information and parent's information. Once the

administrator clicks on manage teacher information button or manage parent information button, the new page will be displayed to manage teacher or parent information.

Figure 5.3: Administrator Homepage

Figure 5.4 depicts the homepage for administrator to manage teacher's information. This page consists of three main functions that allow the administrator to add, update, and view teacher's information. Add, update, and view pages for managing teacher's information are available in Appendix E.

Figure 5.4: Administrator Homepage for Managing Teacher's Information

Figure 5.5 depicts the homepage for administrator to manage parent's information. This page consists of three main functions that allow the administrator to add, update, and view parent's information. Add, update, and view pages for managing parent's information are available in Appendix E.

Figure 5.5: Administrator Homepage for Managing Parent's Information

Figure 5.6 depicts the teacher login page. This page allows the teacher to enter username and password as well as to select the class name and level. In case the teacher has entered invalid user name or password and selected invalid class name or level, an error message will be displayed. Also, this page allows the teacher to go back to the homepage.

Figure 5.6: Teacher Login Page

Figure 5.7 depicts the teacher homepage. This page consists of four functions that allow the teacher to add attendance, update attendance, view attendance, and to send emergency SMS for parent.

Figure 5.7: Teacher Homepage

Figure 5.8 depicts add attendance page. This page displays a list of all students' name registered in the class and allows the teacher to set student's attendance status. It gives the teacher three options to select student's attendance status, as follows: attend, absent, and late. Once the teacher finished taking students' attendance, the teacher clicks on add button that allows the system to send an email and SMS to the parent where the student status is absent or late as well as a confirmation message will be displayed to teacher to inform him/her that the email and SMS have been sent successfully.

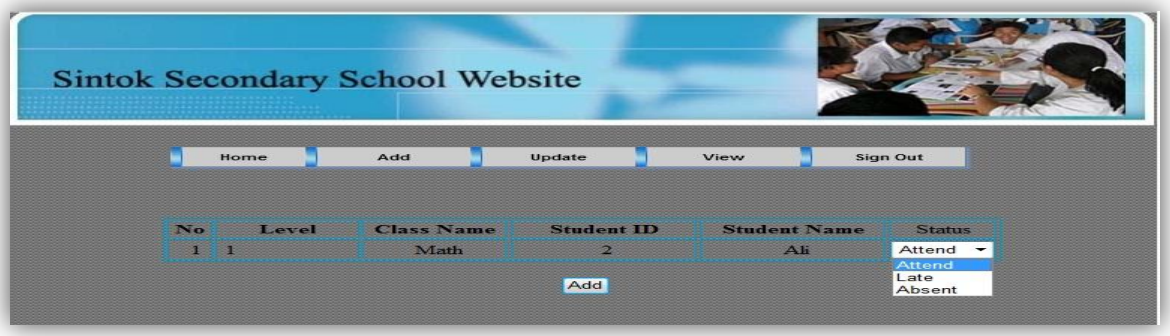

Figure 5.8: Teacher Add New Attendance Page

The format of SMS and email that have been sent to parents will be shown as illustrated in Figure 5.9:

Dear Parent,
Your son "*student name*" for class "*class name*" attendance status is "*student status*".
Regards,
Date: "*Date*"
Time: "*Time*"

Figure 5.9: SMS and Email Format

Figure 5.10 depicts teacher update attendance page. This page allows the teacher to search for student ID in specific date that needed to be changed and once the student ID is found, the system will display a new form that includes the current status of student, so the teacher can change the student status from drop list and then clicks on update button.

Figure 5.10: Teacher Update Attendance Page

Figure 5.11 depicts teacher view attendance page. This page allows the teacher to search for attendance from specific date to specific date. Once the teacher clicks on view

button, the new form will be displayed that lists all attendance information as well as it allows the teacher to click on print button to print out the attendance information.

Figure 5.11: Teacher View Attendance Page

Figure 5.12 depicts teacher emergency SMS page. This page allows the teacher to send an emergency SMS to the parents. Once the teacher clicks on select fathers' link, the new form will be displayed to allow the teacher to select one or more fathers of students to send an emergency SMS.

Figure 5.12: Teacher Emergency SMS Page

The parent's pages are available in Appendix E.

5.3 EVALUATION OF THE PROTOTYPE

5.3.1 Usability Test

Usability means the product must work quickly and easily in order to accomplish users tasks. Testing usability means that the users who work with the product's functions to meet their needs (Dumas & Redish, 1999). In other words, usability test is a research tools or a term that refers to a process that people are employed as testing participants in order to evaluate the degree of product by its functions (Rubin & Chisnell, 2008).

Therefore, the functionalities of the prototype were tested against the requirements list and Lund (2001) USE questionnaire was used to evaluate the usability of the prototype. The questionnaire is available in Appendix G.

5.3.2 Data Analysis

Data analysis process can be defined as "*a sequence of steps that lead from planning to data collection to making informed conclusions based on the resulting data*"(Peck, Olsen, & Devore, 2011). In this study, IBM Statistical Package for the Social Sciences (SPSS) statistics 19 software was used to analysis the data that was collected. The number of respondents is 30 persons and they were divided into two groups: parents and teachers, so that the questionnaire was distributed to the respondents equally. As well, the questionnaire was divided into two categories: general information and system aspects, where general information was divided into two parts: part (A) related to parents and part (B) related to teachers.

Table 5.2 summarizes the responses of parents to the questions in part A. 80% of parents (12 out of 15) mentioned that computer is available at home, 73.3% of parents (11 out of 15) mentioned that the internet is available at home, 73.3 % of parents (11 out of 15) mentioned they know how to use computer and internet, 86.7 % of parents (13 out of 15) mentioned that they have own mobile, 53.3% of parents mentioned (8 out of 15) that they prefer to be informed about their student's attendance by SMS and Email together, and 80% of parents (12 out of 15) mentioned that this prototype can enhance communication between them and teachers.

Table 5.2: General Information – Part A Frequencies

NO	Description of Question			Frequency	Percent
Q1	Availability of Computer at Home	Valid	Yes	12	80.0
			No	3	20.0
			Total	**15**	**100.0**
Q2	Availability of Internet at Home	Valid	Yes	11	73.3
			No	4	26.7
			Total	**15**	**100.0**
Q3	Knowing Computer and Internet	Valid	Yes	11	73.3
			No	4	26.7
			Total	**15**	**100.0**
Q4	Has Own Mobile	Valid	Yes	13	86.7
			No	2	13.3
			Total	**15**	**100.0**
Q5	Technology Preferred	Valid	**SMS**	**5**	**33.3**
			Email	2	13.3
			Both	8	53.3
			Total	**15**	**100.0**
Q6	Enhance Communication	Valid	Yes	12	80.0
			No	3	20.0
			Total	**15**	**100.0**

Table 5.3 summarizes the responses of teachers to the questions in part B. 86.7% of teachers (13 out of 15) mentioned they know how to use computer and internet, 86.7 % of teachers (13 out of 15) mentioned that this prototype can reduce their workload, and 73.3% of teachers (11 out of 15) mentioned that this prototype can enhance communication between them and parents.

Table 5.3: General Information – Part B Frequencies

NO	Description of Question			Frequency	Percent
Q1	Knowing Computer & Internet	Valid	Yes	13	86.7
			No	2	13.3
			Total	**15**	**100.0**
Q2	Reduce Workload	Valid	Yes	13	86.7
			No	2	13.3
			Total	**15**	**100.0**
Q3	Enhance Communication	Valid	Yes	11	73.3
			No	4	26.7
			Total	**15**	**100.0**

Table 5.4 summarizes the responses of respondents to the questions related to the system aspects part. 53.3% of respondents (16 out of 30) were agreed that the prototype helped them to be more effectiveness, 63.3% of respondents (19 out of 30) were agreed that the prototype helped them to be more productive, 53.3% of respondents (16 out of 30) were strongly agreed that the prototype is useful, 66.7% of respondents (20 out of 30) were agreed that the prototype gave them more control over the activities, 60% of respondents (18 out of 30) were agreed that the prototype made the things they want to accomplish easier to get done, 56.7% of respondents (17 out of 30) were agreed that the prototype saved their time when they used it, 53.3% of respondents (16 out of 30) were

strongly agreed that the prototype met their needs, 60% of respondents (18 out of 30) were agreed that the prototype did everything they would expect it to do, 50% of respondents (15 out of 30) were strongly agreed that the prototype was easy to use, 56.7% of respondents (17 out of 30) were strongly agreed that the prototype was user friendly, 56.7% of respondents (17 out of 30) were strongly agreed that the prototype was required the fewest steps possible to accomplish what they wanted to do with it, 50% of respondents (15 out of 30) were agreed that the prototype was flexible, 56.7% of respondents (17 out of 30) were agreed that the using prototype was effortless, 53.3% of respondents (16 out of 30) were agreed that they can use the prototype without written instructions, 50% of respondents (15 out of 30) were agreed that they don't noted any inconsistencies as they used it, 53.3% of respondents (16 out of 30) were agreed that they can recover from mistakes quickly and easily, 60% of respondents (18 out of 30) were agreed that they can use the prototype successfully every time, 53.3% of respondents (16 out of 30) were agreed that they learned to use the prototype quickly, 50% of respondents (15 out of 30) were strongly agreed/agreed that they easy remember how to use the prototype, 46.7% of respondents (14 out of 30) were strongly agreed/agreed that they quickly become skillful with the prototype, 53.3% of respondents (16 out of 30) were strongly agreed that they satisfied with the prototype, and 63.3% of respondents (19 out of 30) were agreed that the prototype was worked the way they wanted it to work.

Table 5.4: System Aspects Frequencies

			Strongly Agree	Agree	Natural	Disagree	Strongly Disagree	Total
Usefulness	Q10	Frequency	14	16	0	0	0	30
		Percent	46.7	53.3	0	0	0	100
	Q11	Frequency	11	19	0	0	0	30

		Percent	36.7	63.3	0	0	0	100
	Q12	Frequency	16	14	0	0	0	30
		Percent	53.3	46.7	0	0	0	100
	Q13	Frequency	10	20	0	0	0	30
		Percent	33.3	66.7	0	0	0	100
	Q14	Frequency	12	18	0	0	0	30
		Percent	40	60	0	0	0	100
	Q15	Frequency	13	17	0	0	0	30
		Percent	43.3	56.7	0	0	0	100
	Q16	Frequency	16	14	0	0	0	30
		Percent	53.3	46.7	0	0	0	100
	Q17	Frequency	10	18	2	0	0	30
		Percent	33.3	60	6.7	0	0	100
Easy to Use	Q18	Frequency	15	14	1	0	0	30
		Percent	50	46.7	3.3	0	0	100
	Q19	Frequency	17	10	3	0	0	30
		Percent	56.7	33.3	10	0	0	100
	Q20	Frequency	17	12	1	0	0	30
		Percent	56.7	40	3.3	0	0	100
	Q21	Frequency	13	15	2	0	0	30
		Percent	43.3	50	6.7	0	0	100
	Q22	Frequency	13	17	0	0	0	30
		Percent	43.3	56.7	0	0	0	100
	Q23	Frequency	14	16	0	0	0	30
		Percent	46.7	53.3	0	0	0	100
	Q24	Frequency	13	15	2	0	0	30
		Percent	43.3	50	6.7	0	0	100
	Q25	Frequency	14	16	0	0	0	30
		Percent	46.7	53.3	0	0	0	100
	Q26	Frequency	12	18	0	0	0	30
		Percent	40	60	0	0	0	100
Easy of Learning	Q27	Frequency	13	16	1	0	0	30
		Percent	43.3	53.3	3.3	0	0	100
	Q28	Frequency	15	15	0	0	0	30
		Percent	50	50	0	0	0	100
	Q29	Frequency	14	14	2	0	0	30
		Percent	46.7	46.7	6.7	0	0	100
Satisfaction	Q30	Frequency	16	14	0	0	0	30
		Percent	53.3	46.7	0	0	0	100
	Q31	Frequency	11	19	0	0	0	30
		Percent	36.7	63.3	0	0	0	100

Table 5.5 gives a clear analysis of the descriptive statistics of the variables that they were uses in the evaluation of the prototype. The range of the mean in this study was from 1.4667 to 1.7333.

Table 5.5: Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Q10	30	1.00	2.00	1.5333	.50742
Q11	30	1.00	2.00	1.6333	.49013
Q12	30	1.00	2.00	1.4667	.50742
Q13	30	1.00	2.00	1.6667	.47946
Q14	30	1.00	2.00	1.6000	.49827
Q15	30	1.00	2.00	1.5667	.50401
Q16	30	1.00	2.00	1.4667	.50742
Q17	30	1.00	3.00	1.7333	.58329
Q18	30	1.00	3.00	1.5333	.57135
Q19	30	1.00	3.00	1.5333	.68145
Q20	30	1.00	3.00	1.4667	.57135
Q21	30	1.00	3.00	1.6333	.61495
Q22	30	1.00	2.00	1.5667	.50401
Q23	30	1.00	2.00	1.5333	.50742
Q24	30	1.00	3.00	1.6333	.61495
Q25	30	1.00	2.00	1.5333	.50742
Q26	30	1.00	2.00	1.6000	.49827
Q27	30	1.00	3.00	1.6000	.56324
Q28	30	1.00	2.00	1.5000	.50855
Q29	30	1.00	3.00	1.6000	.62146
Q30	30	1.00	2.00	1.4667	.50742
Q31	30	1.00	2.00	1.6333	.49013
Valid N (listwise)	30				

Table 5.6 summarizes the reliability test for prototype. Reliability test is performed in order to assure that the prototype will operate without failure throughout its expected life and maintains his performance and functionality as well.

Table 5.6: Summary of Reliability Test

Variables	Cronbach's Alpha	Cronbach's Alpha Average
Usefulness	0.843	0.785
Easy to Use	0.727	
Easy of Learning	0.729	
Satisfaction	0.831	

As shown in above table, the average of alpha coefficient for the four variables is 0.785 which indicates that these variables have relatively high internal consistency. As known, the reliability coefficient should be 0.7 or higher to be acceptable.

CHAPTER SIX

CONCLUSION AND RECOMMENDATION

6.1 INTRODUCTION

The main aim of this study is to develop, test, and validate a requirement model in order to fulfill the users' requirements for students' attendance system. This objective was achieved through the system analysis and design of a prototype and then the development of prototype for students' attendance system. Therefore, the list of requirements was validated through evaluating the prototype that was developed. As well, the results from evaluation of the prototype were discussed in detail in the previous chapter. Thus, this study can be a reliable reference in case any other schools want to apply this system.

6.2 LIMITATIONS

There are some obstacles and limitations encountered during the developing a prototype for web based students' attendance system. Some of these limitations are itemized below:

- Due to time constraint, this prototype is not fully functional system. It only supports the basic functionalities of the prototype and this prototype does not include the non-functional requirements such as security, performance, and so on.
- The number of respondents was limited due to time constraint as well as it was so difficult to interview all teachers and parents.

- The number of SMS was limited due to service provider.

6.3 RECOMMENDATIONS AND FUTURE WORKS

This study has achieved its objectives but some suggestions are listed below in order to enhance the body of knowledge in this area and to develop a full functional system for school as well. So, it is recommended that the future work should include the following suggestions:

- Inclusion of non- functional requirements such as security through supporting password expiration periods and disabling accounts to prevent additional attacks in case the system was hacked, platform issues, performance, and so on.
- Integration this model with school management system that would enhance and support the functionalities of school management system and make it an integrated system.

6.4 SIGNIFICANCE AND CONTRIBUTION

This study has successfully created a functional requirement model prototype for web based students' attendance system. The design and the prototype presented in this study can be used as guide for the development of the automation system for secondary schools in Malaysia. The outcome of this study is very important to the body of the knowledge. Furthermore, schools in the country that are planning to implement web based students' attendance system in future can use this model as guideline.

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APPENDIX A

USE CASE SPECIFICATION

1. Use case specification for administrator logout

- **Brief Description:** Allow the administrator to exit from the system.
- **Actor:** Administrator.
- **Requirements:** WSAS_02_01.
- **Pre-Condition:** There is no pre-condition.
- **Flow of Events:**
  1. **Basic Flow:**
     - Administrator clicks on logout button.
     - If logout process is successful, the system will redirect the administrator to Homepage.
  2. **Alternative Flow:** There is no alternative flow**.**
  3. **Exceptional Flow:** There is no exceptional flow.
- **Post-Condition:** Display the Homepage.

2. Use case specification for administrator to add new teacher

- **Brief Description:** Allow the administrator to manage teacher information by adding new teacher.
- **Actor:** Administrator.
- **Requirements:** WSAS_03_01.
- **Pre-Condition:** The login process was successful and teacher ID does not exist.
- **Flow of Events:**
  1. **Basic Flow:**
     - Administrator clicks on manage teacher information button.
     - The system will display a new page which consists of four buttons: add, update, view, and home.
     - Administrator clicks on add button and fills the displayed form [E1] [A1] then clicks on submit button.
     - If add teacher process is successful, the system will show a success message and redirect the administrator to manage teacher information page.
  2. **Alternative Flow:**
     - [A1]: Administrator may click on reset button before clicking on submit button or click on other button from manage teacher information page.
  3. **Exceptional Flow:**
     - [E1]: If the administrator entered a teacher ID that is already exists in database, the system will display an error message.
- **Post-Condition:** A new teacher has been added.

3. Use case specification for administrator to update teacher information

- **Brief Description:** Allow the administrator to manage teacher information by updating teacher information.
- **Actor:** Administrator.
- **Requirements:** WSAS_03_02.
- **Pre-Condition:** The login process was successful and teacher ID does not exist.
- **Flow of Events:**

4. Basic Flow:

- Administrator clicks on manage teacher information button.
- The system will display a new page which consists of four buttons: add, update, view, and home.
- Administrator clicks on update button and enter teacher name in the displayed form [E1] [A1].
- If teacher name is found, the system will display a result form.
- Administrator clicks on update button [A2].
- The system will display a teacher information form.
- Administrator fill the displayed form and click on submit on [E2] [A3].
- If update teacher process is successful, the system will show a success message and redirect the administrator to manage teacher information page

5. Alternative Flow:

- [A1]: Administrator may click on reset button before clicking on submit button or click on other button from manage teacher information page.

- [A2]: administrator may click on other button from manage teacher information.
- [A3]: Administrator may click on reset button before clicking on submit button or click on other button from manage teacher information page.

6. Exceptional Flow:

- [E1]: If the administrator entered a teacher name that does not exists in database, the system will display an error message.
- [E2]: If the administrator entered a teacher name that is already exists in database, the system will display an error message.

- **Post-Condition:** Teacher information has been updated.

4. Use case specification for administrator to view teacher information

- **Brief Description:** Allow the administrator to manage teacher information by viewing teacher information.
- **Actor:** Administrator.
- **Requirements:** WSAS_03_03.
- **Pre-Condition:** The login process was successful.
- **Flow of Events:**
  1. **Basic Flow:**
     - Administrator clicks on manage teacher information button.
     - The system will display a new page which consists of four buttons: add, update, view, and home.
     - Administrator clicks on view button [A1].
     - The system will display a teacher information form.
  2. **Alternative Flow:**
     - [A1]: Administrator may click on other button from manage teacher information page.
  3. **Exceptional Flow:** There is no exceptional flow.
- **Post-Condition:** Teacher information has been viewed.

5. Use case specification for administrator to add new parent

- **Brief Description:** Allow the administrator to manage teacher information by adding new parent.
- **Actor:** Administrator.
- **Requirements:** WSAS_04_01.
- **Pre-Condition:** The login process was successful and parent ID does not exist.
- **Flow of Events:**
  1. **Basic Flow:**
     - Administrator clicks on manage parent information button.
     - The system will display a new page which consists of four buttons: add, update, view, and home.
     - Administrator clicks on add button and fills the displayed form [E1] [A1] then clicks on submit button.
     - If add parent process is successful, the system will show a success message and redirect the administrator to manage parent information page.
  2. **Alternative Flow:**
     - [A1]: Administrator may click on reset button before clicking on submit button or click on other button from manage parent information page.
  3. **Exceptional Flow:**
     - [E1]: If the administrator entered a parent ID that is already exists in database, the system will display an error message.
- **Post-Condition:** A new parent has been added.

6. Use case specification for administrator to update parent information

- **Brief Description:** Allow the administrator to manage teacher information by updating parent information.
- **Actor:** Administrator.
- **Requirements:** WSAS_04_02.
- **Pre-Condition:** The login process was successful and parent ID does not exist.
- **Flow of Events:**
    1. **Basic Flow:**
        - Administrator clicks on manage parent information button.
        - The system will display a new page which consists of four buttons: add, update, view, and home.
        - Administrator clicks on update button and enter parent name in the displayed form [E1] [A1].
        - If parent name is found, the system will display a result form.
        - Administrator clicks on update button [A2].
        - The system will display a parent information form.
        - Administrator fill the displayed form and click on submit on [E2] [A3].
        - If update parent process is successful, the system will show a success message and redirect the administrator to manage parent information page
    2. **Alternative Flow:**
        - [A1]: Administrator may click on reset button before clicking on submit button or click on other button from manage parent information page.

- [A2]: administrator may click on other button from manage parent information.
- [A3]: Administrator may click on reset button before clicking on submit button or click on other button from manage parent information page.

3. **Exceptional Flow:**
   - [E1]: If the administrator entered a parent name that does not exists in database, the system will display an error message.
   - [E2]: If the administrator entered a parent name that is already exists in database, the system will display an error message.

- **Post-Condition:** Parent information has been updated.

7. Use case specification for administrator to view parent information

- **Brief Description:** Allow the administrator to manage teacher information by viewing parent information.
- **Actor:** Administrator.
- **Requirements:** WSAS_04_03.
- **Pre-Condition:** The login process was successful.
- **Flow of Events:**
  1. **Basic Flow:**
     - Administrator clicks on manage parent information button.
     - The system will display a new page which consists of four buttons: add, update, view, and home.
     - Administrator clicks on view button [A1].
     - The system will display a parent information form.
  2. **Alternative Flow:**
     - [A1]: Administrator may click on other button from manage parent information page.
  3. **Exceptional Flow:** There is no exceptional flow.
- **Post-Condition:** Parent information has been viewed.

8. Use case specification for parent login

- **Brief Description:** Allow the parent to type username and password to enter the system.
- **Actor:** Parent.
- **Requirements:** WSAS_01_01.
- **Pre-Condition:** Username and password must be valid.
- **Flow of Events:**
  1. **Basic Flow:**
     - Login form will be displayed by the system.
     - Parent will type username and password [A1].
     - The system will validate the username and password [E1].
     - If login process is successful, the system will redirect the parent to parent menu page.
  2. **Alternative Flow:**
     - [A1]: parent may click on homepage link before clicking on login button.
  3. **Exceptional Flow:**
     - [E1]: If the parent entered invalid username or password, the system will display an error message.
- **Post-Condition:** Display the menu page of the parent.

9. Use case specification for parent logout

- **Brief Description:** Allow the parent to exit from the system.
- **Actor:** Administrator.
- **Requirements:** WSAS_02_01.
- **Pre-Condition:** There is no pre-condition.
- **Flow of Events:**
  1. **Basic Flow:**
     - Parent clicks on logout button.
     - If logout process is successful, the system will redirect the parent to Homepage.
  2. **Alternative Flow:** There is no alternative flow**.**
  3. **Exceptional Flow:** There is no exceptional flow.
- **Post-Condition:** Display the Homepage.

10. Use case specification for parent to update profile

- **Brief Description:** Allow the parent to update his/her profile.
- **Actor:** Parent.
- **Requirements:** WSAS_09_01.
- **Pre-Condition:** The login process was successful and parent ID does not exist.
- **Flow of Events:**
  1. **Basic Flow:**
     - Parent clicks on update button and fills the displayed form [E1] [A1] then clicks on submit button.
     - If update parent process is successful, the system will show a success message and redirect the parent to parent menu page.
  2. **Alternative Flow:**
     - [A1]: Parent may click on reset button before clicking on submit button or click on other button from parent menu page.
  3. **Exceptional Flow:**
     - [E1]: If the parent entered a parent ID that is already exists in database, the system will display an error message.
- **Post-Condition:** Parent information has been updated.

11. Use case specification for parent to view profile

- **Brief Description:** Allow the parent to view his/her profile.
- **Actor:** Parent.
- **Requirements:** WSAS_10_01.
- **Pre-Condition:** The login process was successful.
- **Flow of Events:**
  1. **Basic Flow:**
     - Parent clicks on view profile button [A1].
     - The system will display a parent information form.
  2. **Alternative Flow:**
     - [A1]: Parent may click on other button from parent menu page.
  3. **Exceptional Flow:** There is no exceptional flow.
- **Post-Condition:** Parent information has been viewed.

12. Use case specification for parent to view attendance

- **Brief Description:** Allow the parent to view his/her student's attendance from specific date to specific date.
- **Actor:** Parent.
- **Requirements:** WSAS_07_01.
- **Pre-Condition:** The login process was successful and the date must be valid.
- **Flow of Events:**
  1. **Basic Flow:**
     - Parent clicks on view attendance button.
     - The system will display attendance information form.
     - Parent selects student name then select the date.
     - Parent clicks on view button [E1] [A1].
     - If view attendance process is successful, the system will display the attendance information about student [A2].
  2. **Alternative Flow:**
     - [A1]: Parent may click on reset button or other button from parent menu page.
     - [A2]: Parent may click on Print button.
  3. **Exceptional Flow:**
     - [E1]: if Parent entered invalid date, the system will display an error message.
- **Post-Condition:** students' attendance information has been viewed.

13. Use case specification for teacher login

- **Brief Description:** Allow the teacher to type username and password and select the class name and level to enter the system.
- **Actor:** Teacher.
- **Requirements:** WSAS_01_01.
- **Pre-Condition:** Username, password, class name, and level must be valid.
- **Flow of Events:**
  1. **Basic Flow:**
     - Login form will be displayed by the system.
     - Teacher will type username and password and select the class name and level [A1].
     - The system will validate the username, password, class name, and level [E1].
     - If login process is successful, the system will redirect the teacher to teacher menu page.
  2. **Alternative Flow:**
     - [A1]: Teacher may click on homepage link before clicking on login button.
  3. **Exceptional Flow:**
     - [E1]: If the teacher entered invalid username or password and select invalid class name or level, the system will display an error message.
- **Post-Condition:** Display the menu page of the teacher.

14. Use case specification for parent logout

- **Brief Description:** Allow the teacher to exit from the system.
- **Actor:** Teacher.
- **Requirements:** WSAS_02_01.
- **Pre-Condition:** There is no pre-condition.
- **Flow of Events:**
  1. **Basic Flow:**
     - Teacher click on logout button.
     - If logout process is successful, the system will redirect the teacher to Homepage.
  2. **Alternative Flow:** There is no alternative flow**.**
  3. **Exceptional Flow:** There is no exceptional flow.
- **Post-Condition:** Display the Homepage.

15. Use case specification for teacher to add attendance

- **Brief Description:** Allow the teacher to add students' attendance for each class.
- **Actor:** Teacher.
- **Requirements:** WSAS_05_01.
- **Pre-Condition:** The login process was successful.
- **Flow of Events:**
    1. **Basic Flow:**
        - Teacher clicks on add button.
        - The system will display a list of all students in the class.
        - Teacher changes the student attendance status and then click on add button [A1].
        - If add attendance process is successful, the system will show a success message and redirect the teacher to teacher menu page.
    2. **Alternative Flow:**
        - [A1]: Teacher may click on other button from teacher menu page.
    3. **Exceptional Flow:** There is no exceptional flow.
- **Post-Condition:** Students attendance status has been added.

16. Use case specification for teacher to update attendance

- **Brief Description:** Allow the teacher to update students' attendance.
- **Actor:** Teacher.
- **Requirements:** WSAS_06_01.
- **Pre-Condition:** The login process was successful and student ID and date are valid.
- **Flow of Events:**
  1. **Basic Flow:**
     - Teacher clicks on update button.
     - The system will display update form.
     - Teacher will type student ID and select the specific date then click on submit button [E1] [A1].
     - The system will display student's attendance information and status [A2].
     - Teacher changes the student attendance status and then click on update button.
     - If update attendance is successful, the system will show a success message and redirect the teacher to the teacher menu page.
  2. **Alternative Flow:**
     - [A1]: Teacher may click on reset button or other button from teacher menu page.
     - [A2]: Teacher may click on other button from teacher menu page.
  3. **Exceptional Flow:**
     - [E1]: if teacher entered invalid student ID or invalid date, the system will display an error message.
- **Post-Condition:** Student's attendance status has been updated.

17. Use case specification for teacher to view attendance

- **Brief Description:** Allow the teacher to view students' attendance.
- **Actor:** Teacher.
- **Requirements:** WSAS_07_01.
- **Pre-Condition:** The login process was successful and date is valid.
- **Flow of Events:**
  1. **Basic Flow:**
     - Teacher clicks on view button.
     - The system will display attendance form.
     - Teacher selects the specific dates then click on submit button [E1] [A1].
     - If view attendance is successful, the system will display students' attendance information form [A2].
  2. **Alternative Flow:**
     - [A1]: Teacher may click on reset button or other button from teacher menu page.
     - [A2]: Teacher may click on print button.
  3. **Exceptional Flow:**
     - [E1]: if teacher selected or entered invalid date, the system will display an error message.
- **Post-Condition:** Students' attendance information has been viewed.

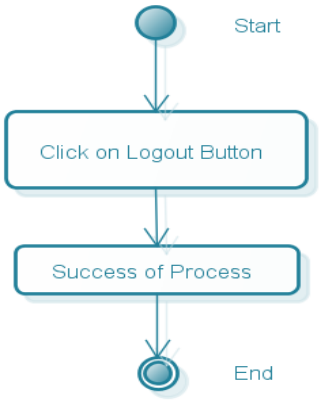
18. Use case specification for teacher to Emergency SMS

- **Brief Description:** Allow the teacher to send emergency SMS to parent.
- **Actor:** Teacher.
- **Requirements:** WSAS_08_01.
- **Pre-Condition:** The login process was successful and date is valid.
- **Flow of Events:**
  1. **Basic Flow:**
     - Teacher clicks on emergency SMS button.
     - The system will display emergency SMS form.
     - Teacher clicks on select users [A1].
     - The system will display new form that includes all fathers' name on the class [A2].
     - Teacher selects the father's name then click on close button.
     - Teacher enters the text message in the text field then click on submit button [A3].
     - If SMS has been sent successfully, the system will display a success message.
  2. **Alternative Flow:**
     - [A1]: Teacher may click on other button from teacher menu page.
     - [A2]: Teacher may click on check All button, uncheck all button, reset button, or close button.
     - [A3]: Teacher may click on reset button or other button from teacher menu page.
  3. **Exceptional Flow:** There is no exceptional flow.
- **Post-Condition:** Students' attendance information has been viewed.

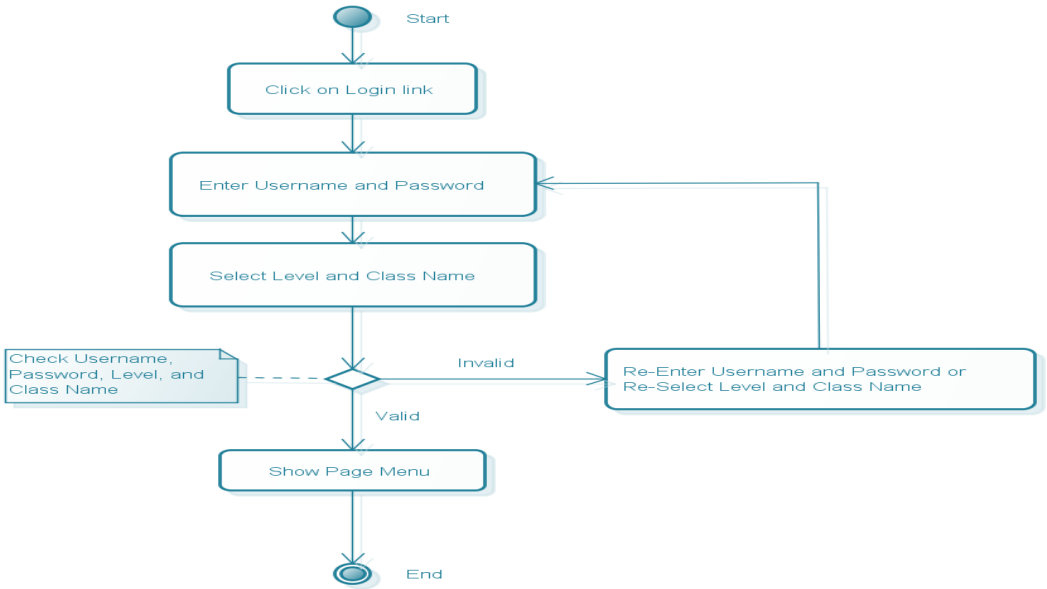
APPENDIX B

ACTIVITY DIAGRAM

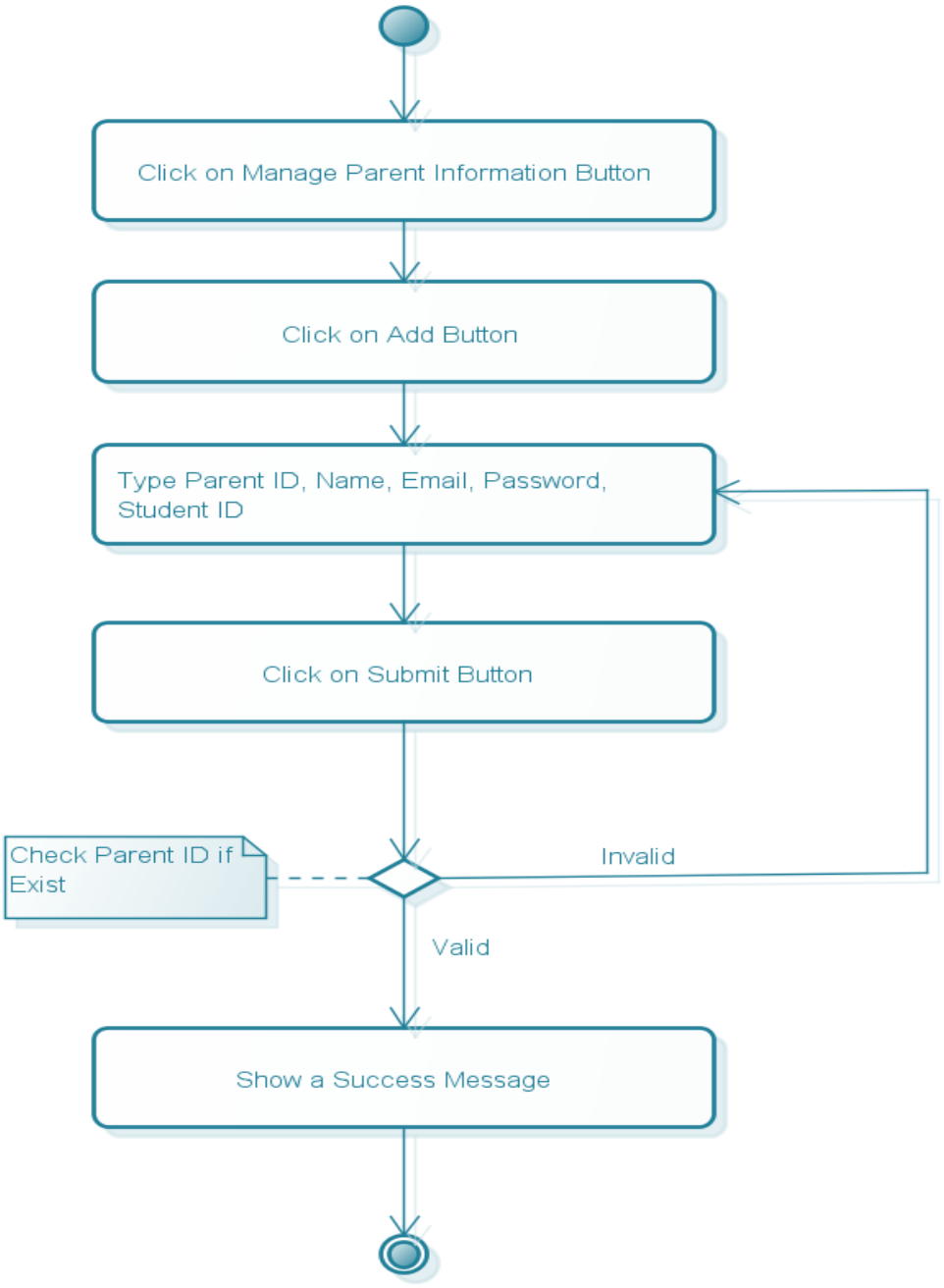
1. Activity diagram for administrator/teacher/parent logout



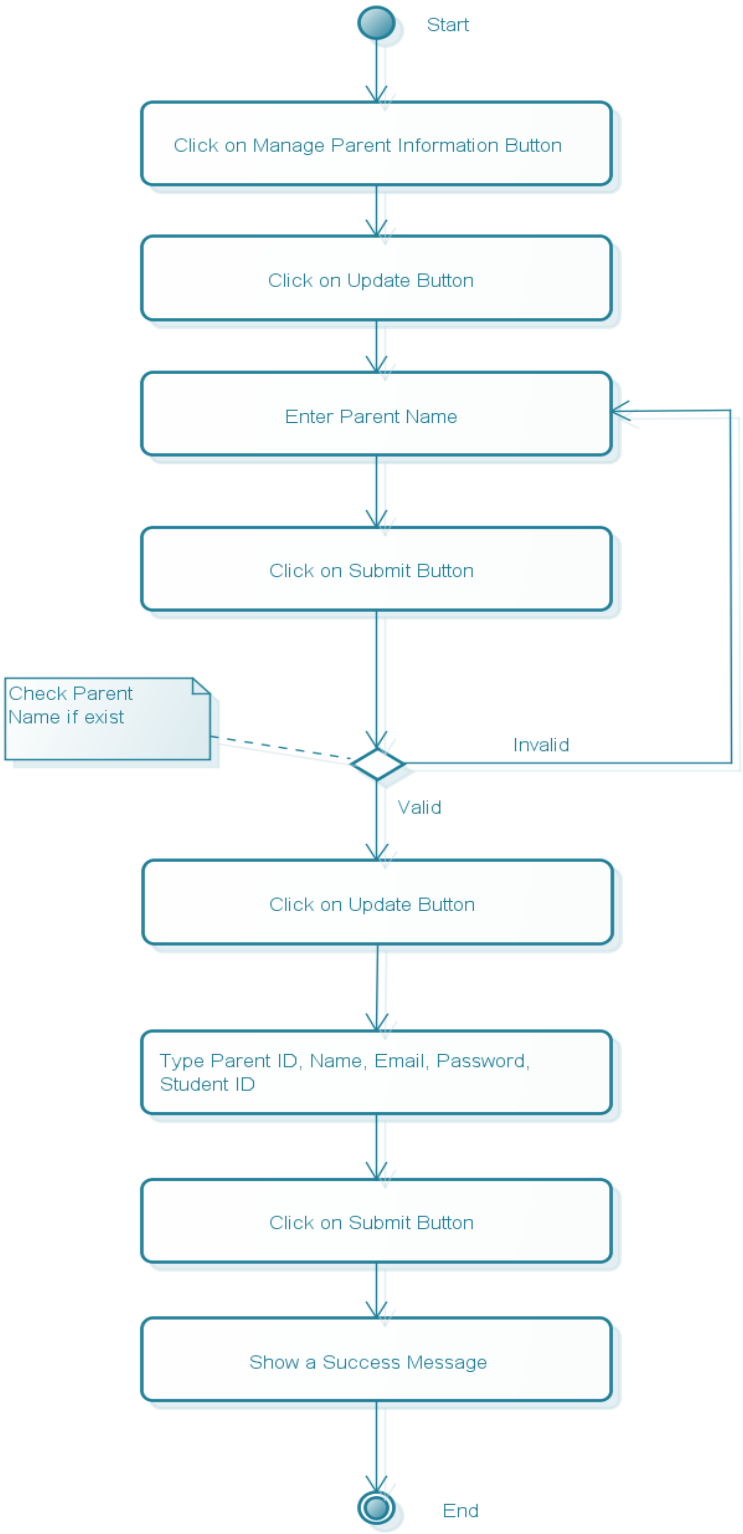
2. Activity diagram for teacher login



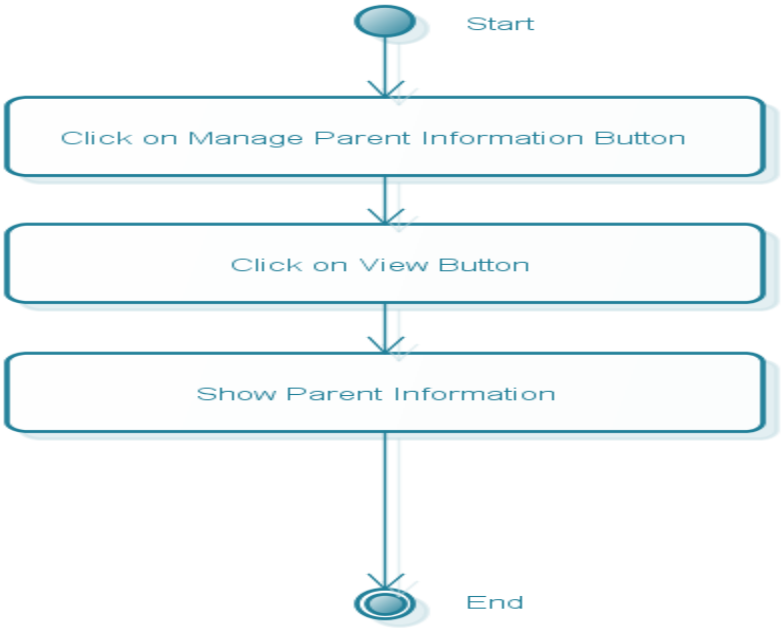
3. Activity diagram for administrator to add new parent



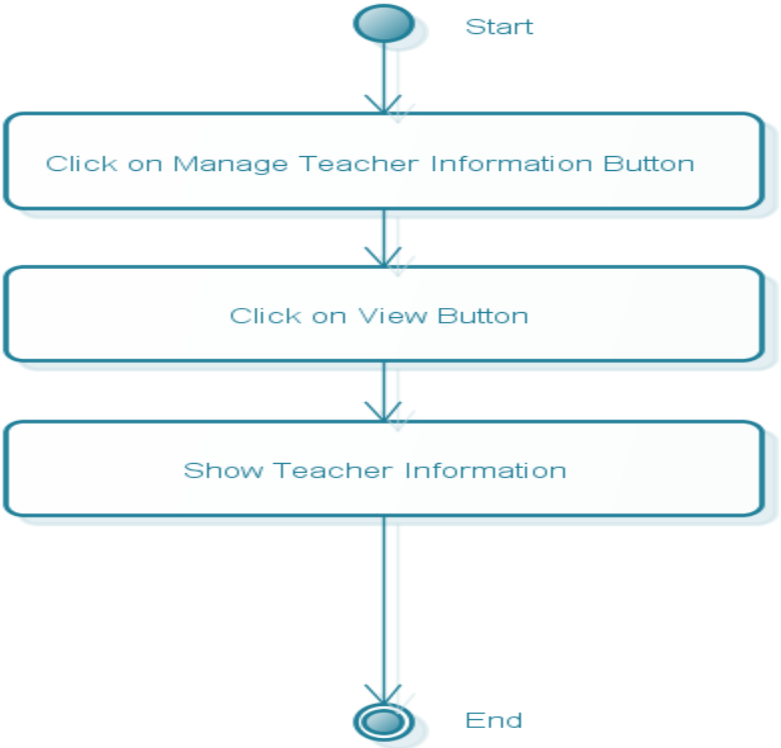
4. Activity diagram for administrator to update parent information



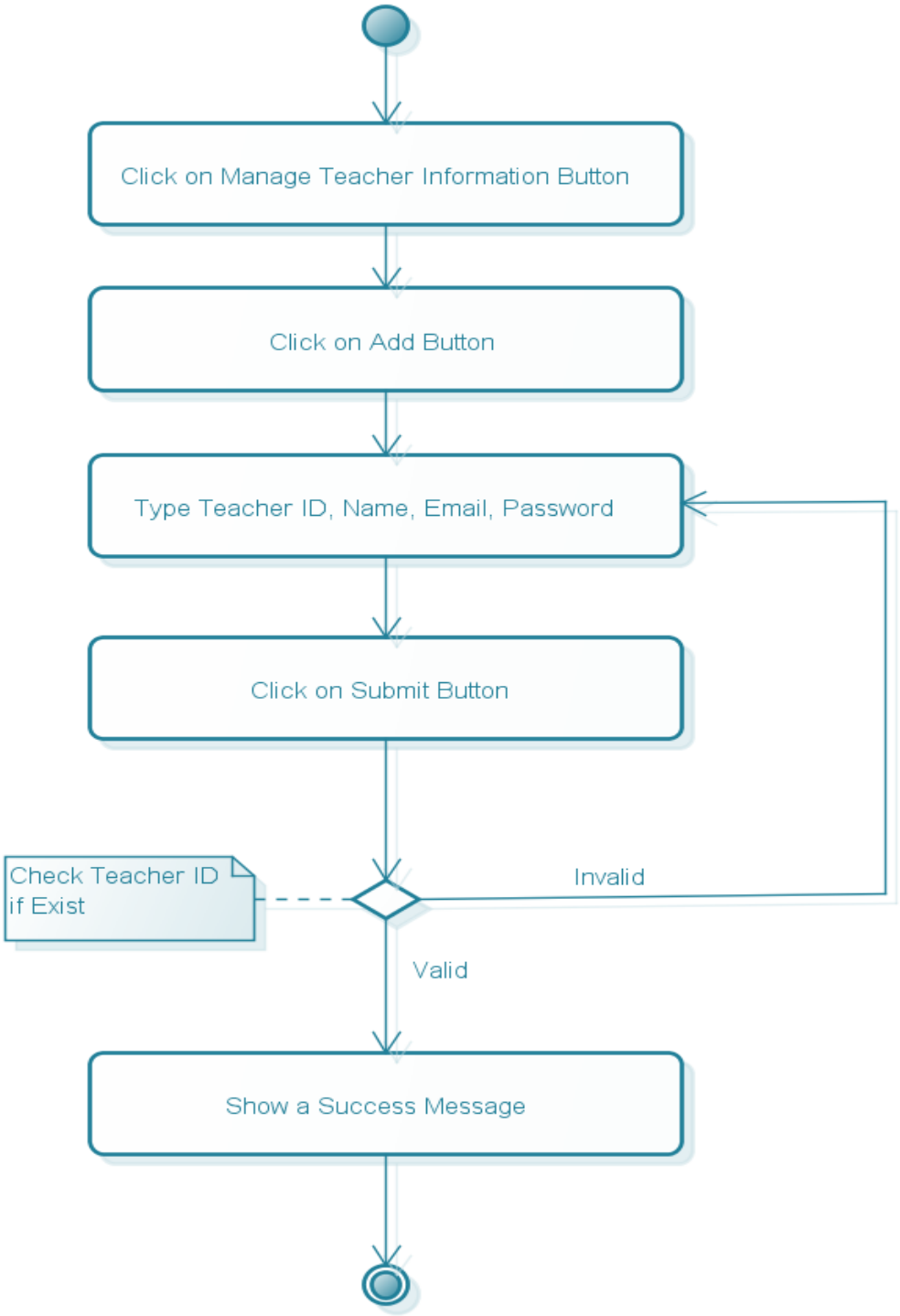
5. Activity diagram for administrator to view parent information



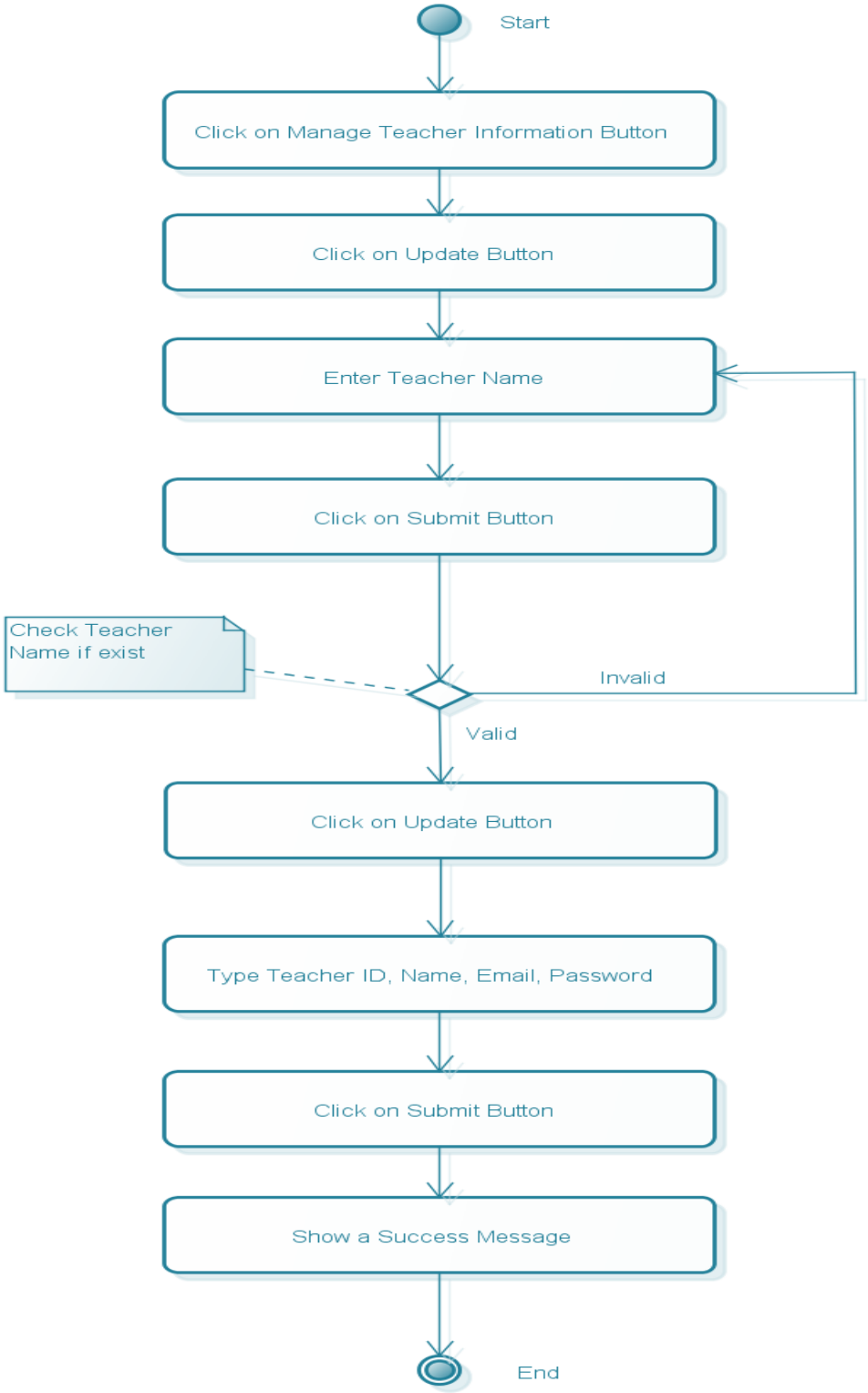
6. Activity diagram for administrator to view teacher information



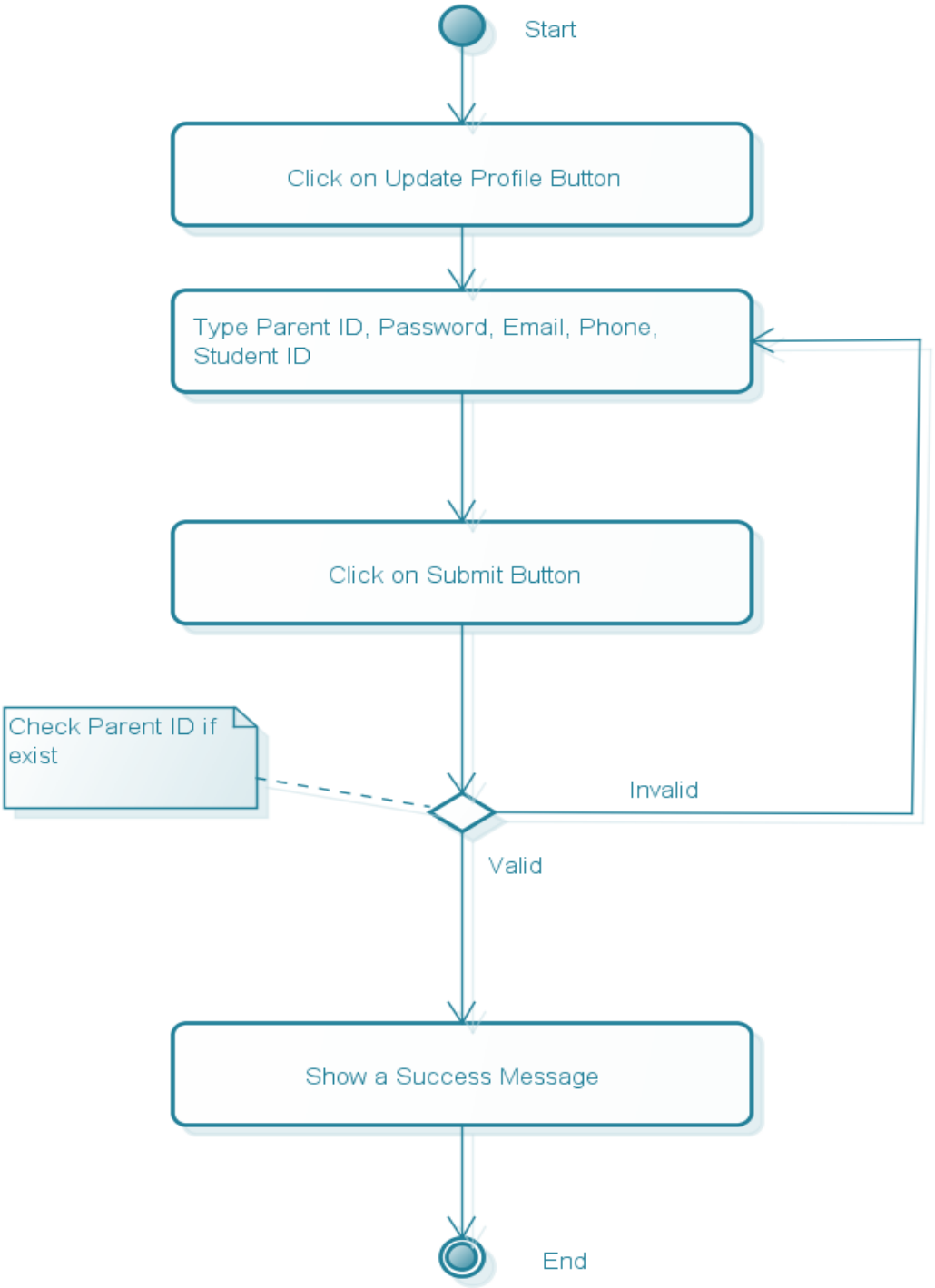
7. Activity diagram for administrator to add new teacher



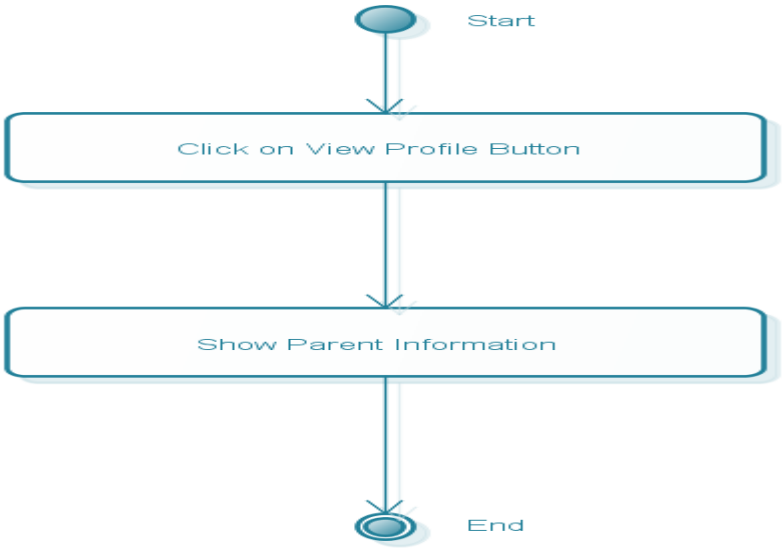
8. Activity diagram for administrator to update teacher information



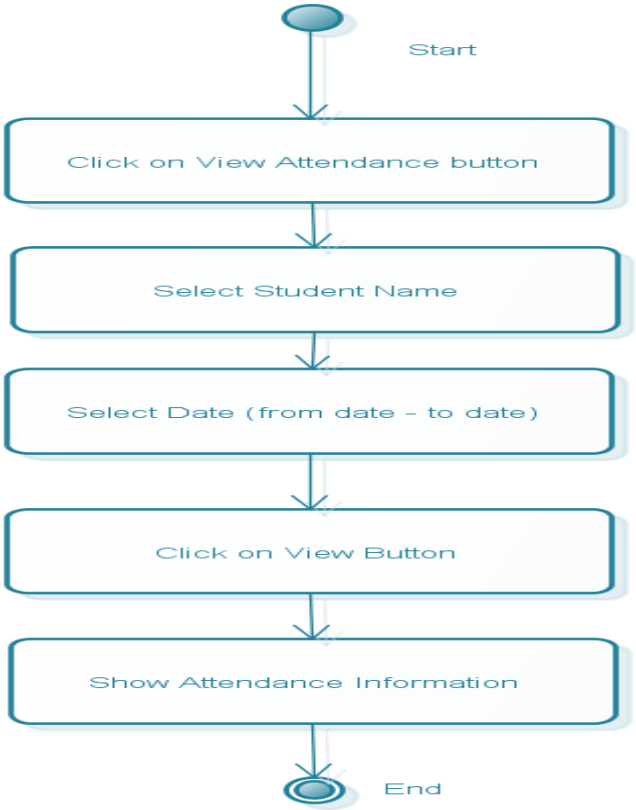
9. Activity diagram for parent to update his/her profile



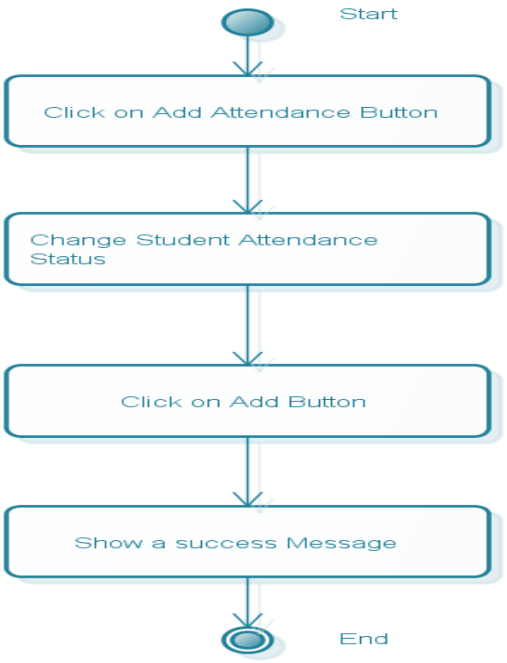
10. Activity diagram for parent to view his/her profile



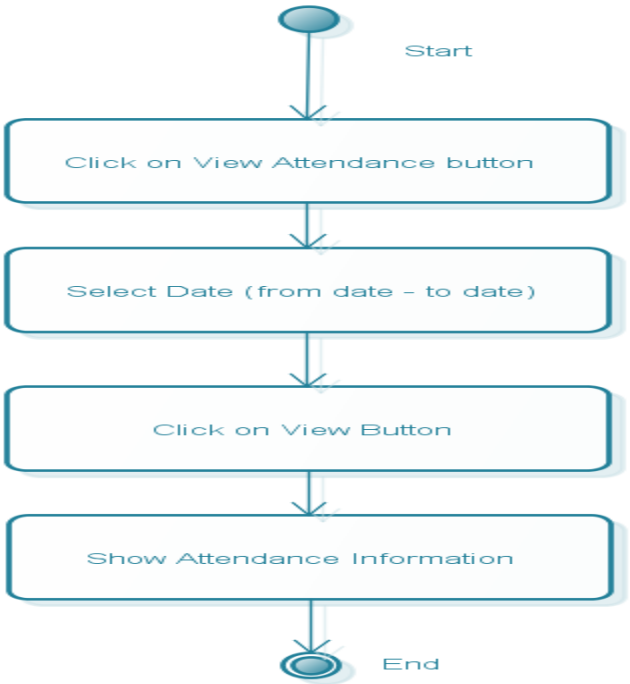
11. Activity diagram for parent to view students' attendance information



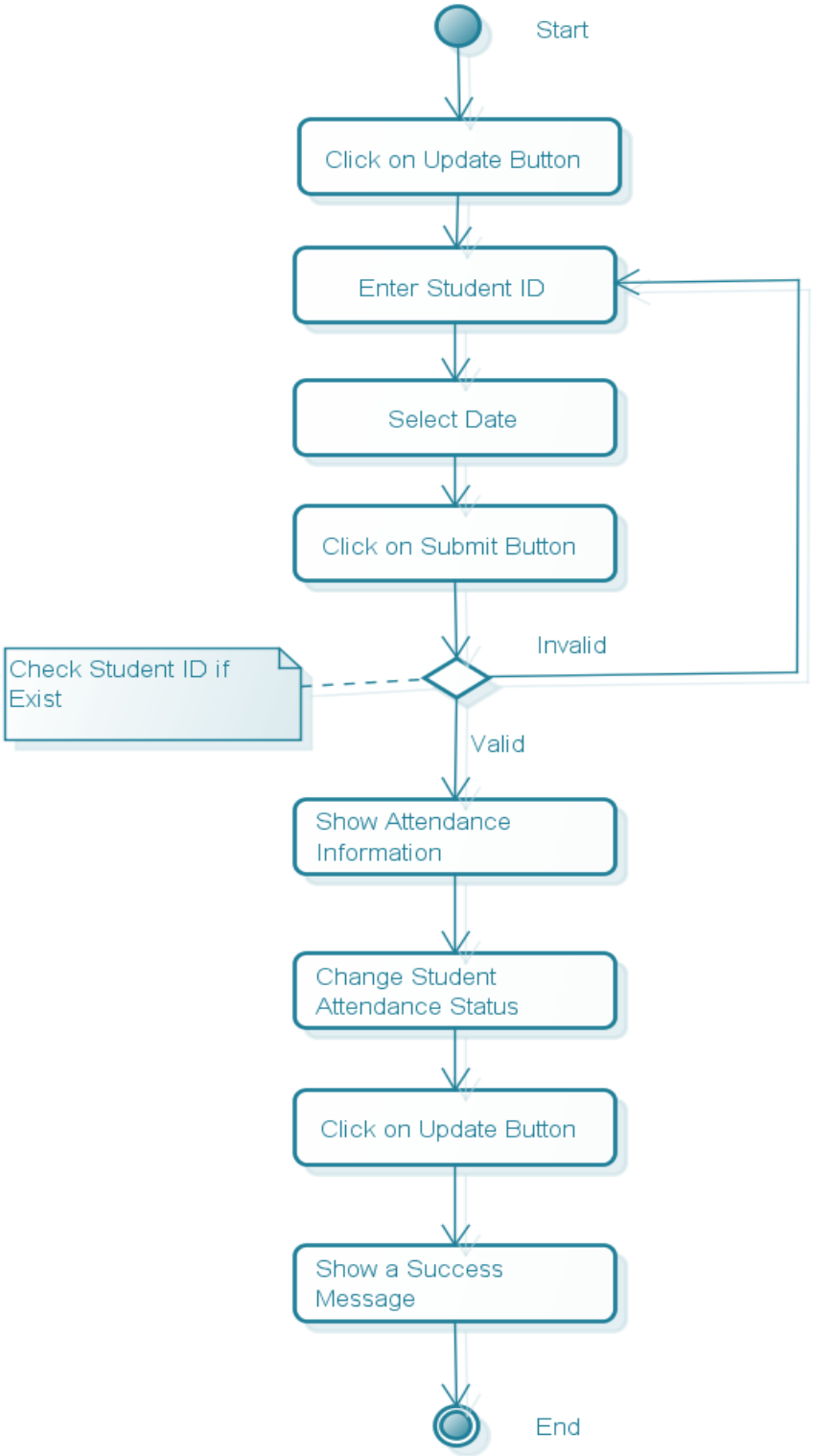
12. Activity diagram for teacher to add attendance



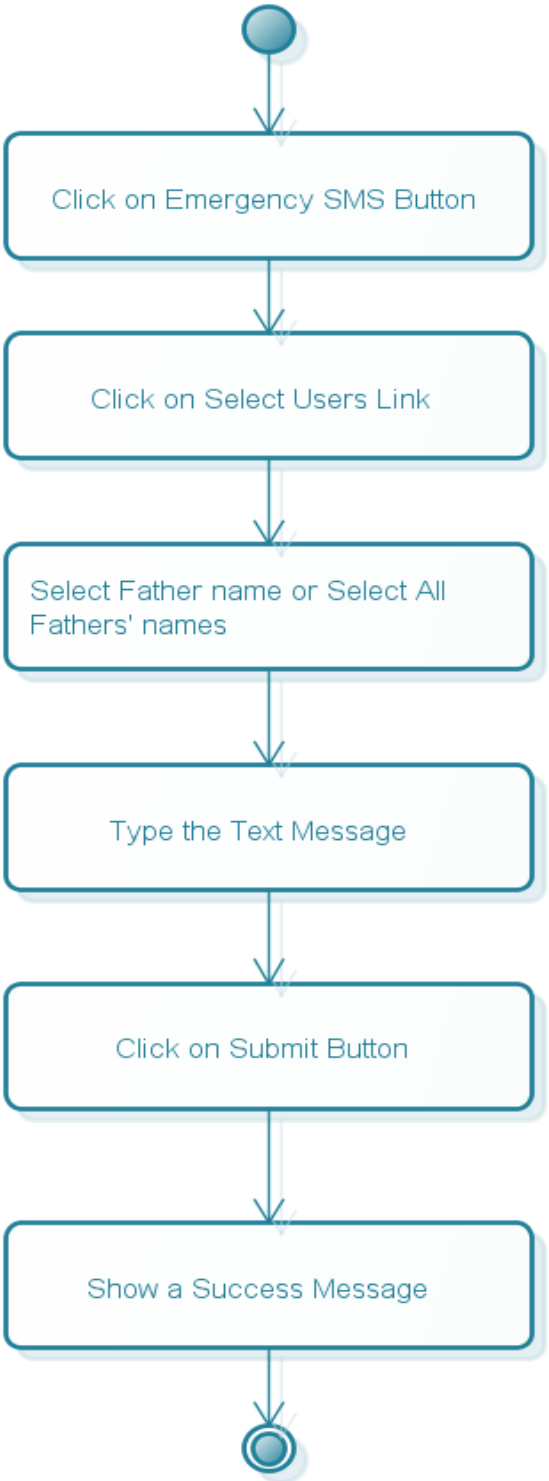
13. Activity diagram for teacher to view attendance



14. Activity diagram for teacher to update attendance



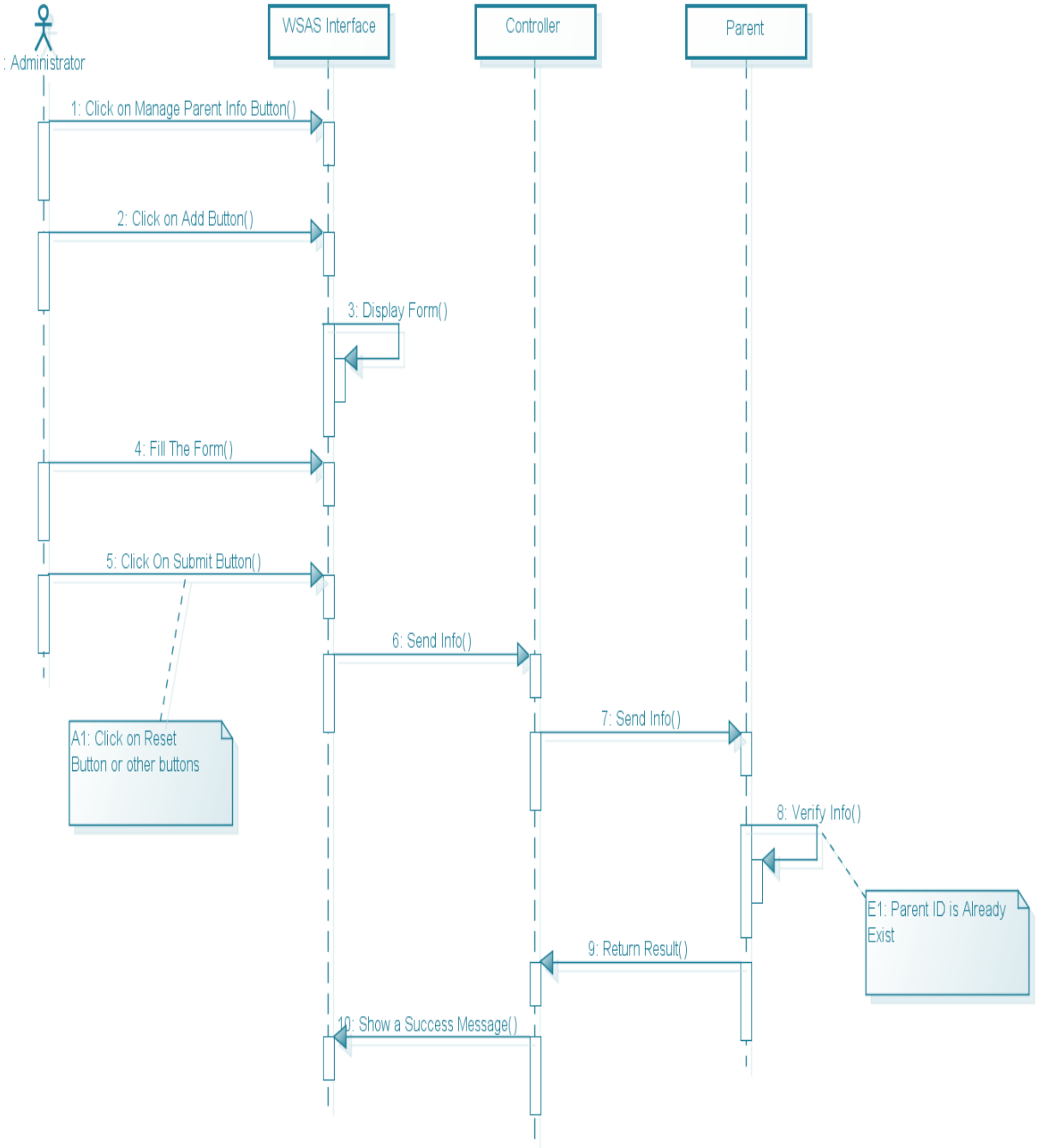
15. Activity diagram for teacher to emergency SMS



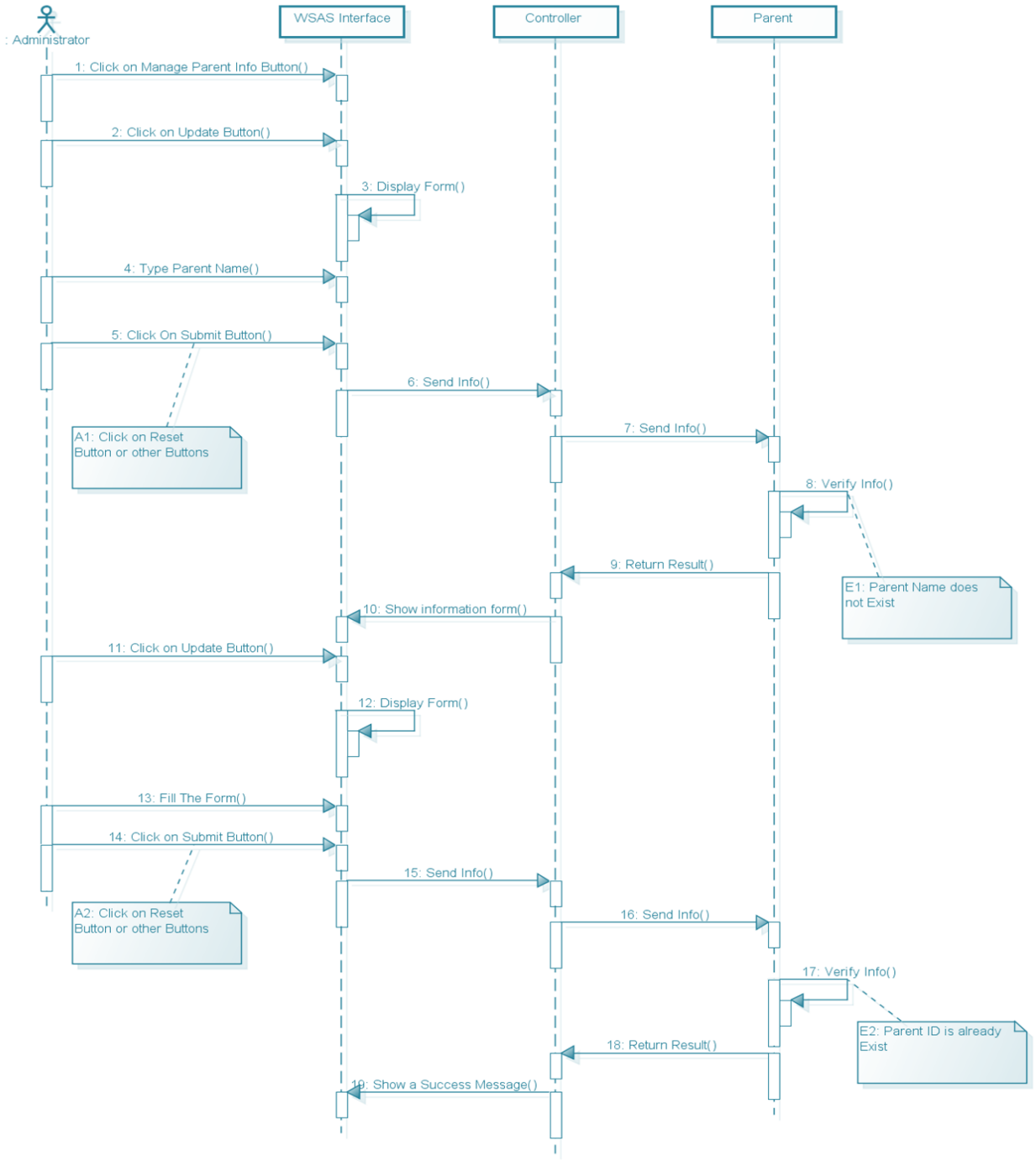
APPENDIX C

SEQUENCE DIAGRAM

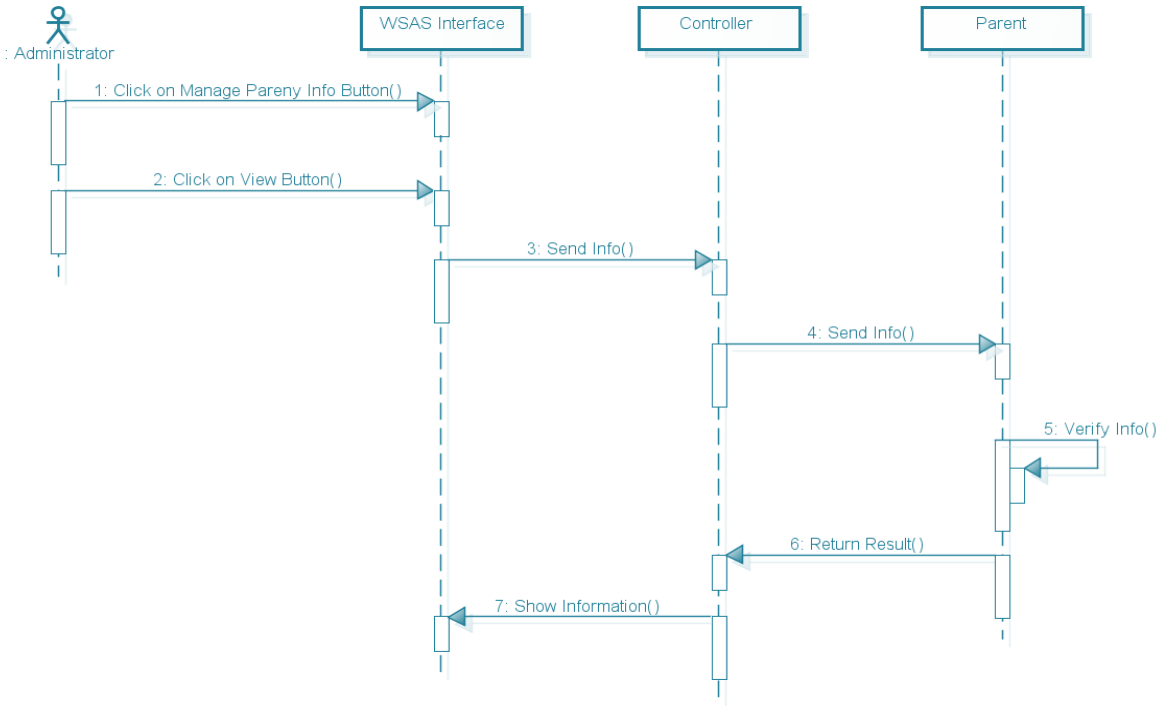
1. Sequence diagram for administrator to add new parent



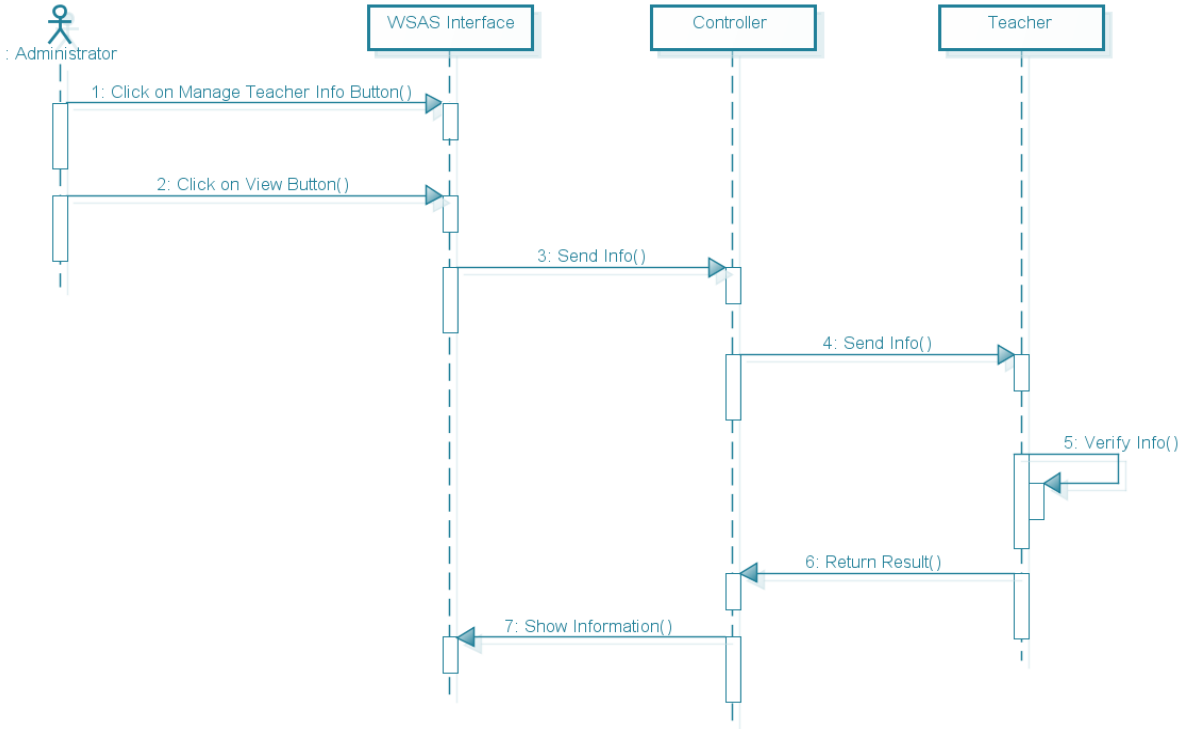
2. Sequence diagram for administrator to update parent information



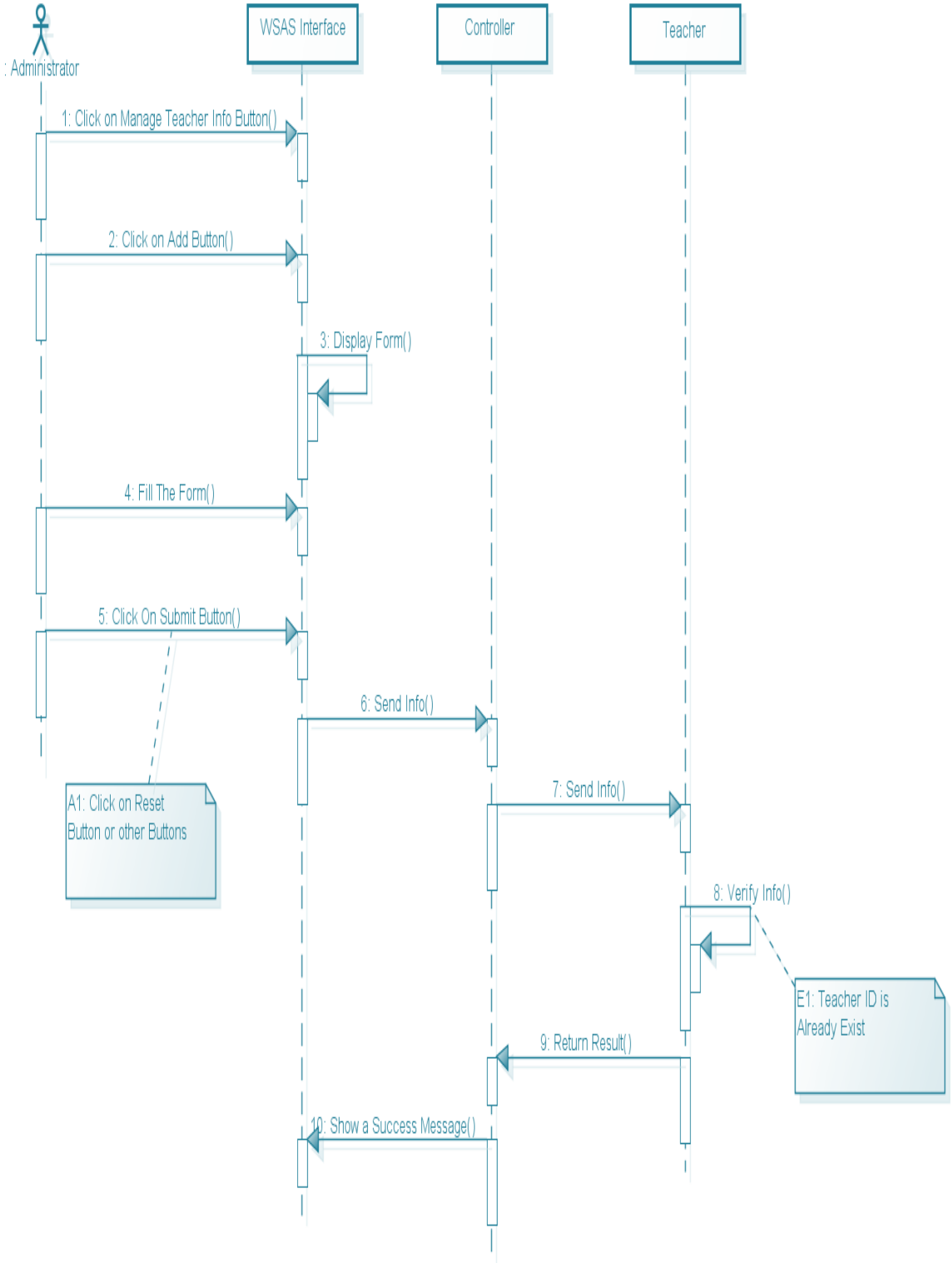
3. Sequence diagram for administrator to view parent information



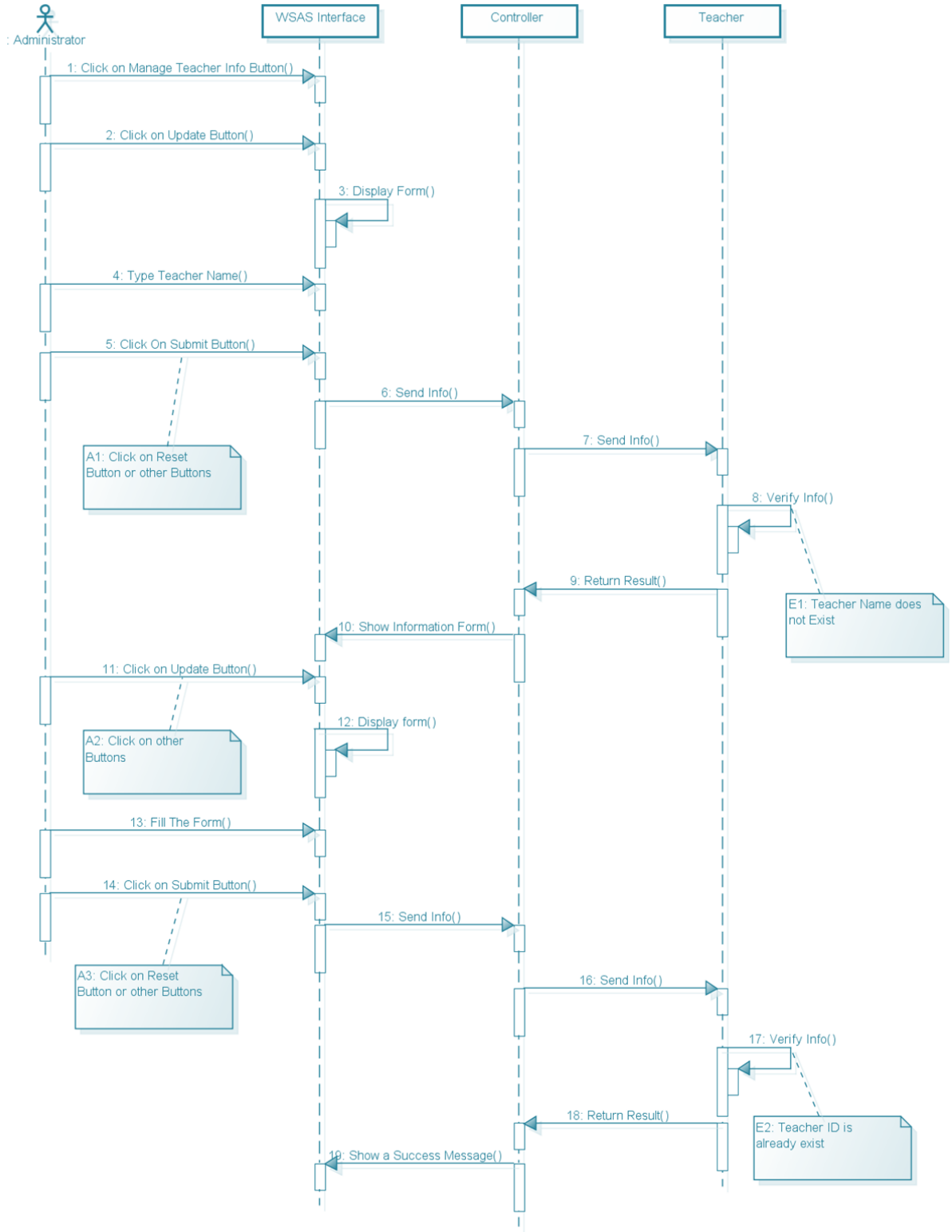
4. Sequence diagram for administrator to view teacher information



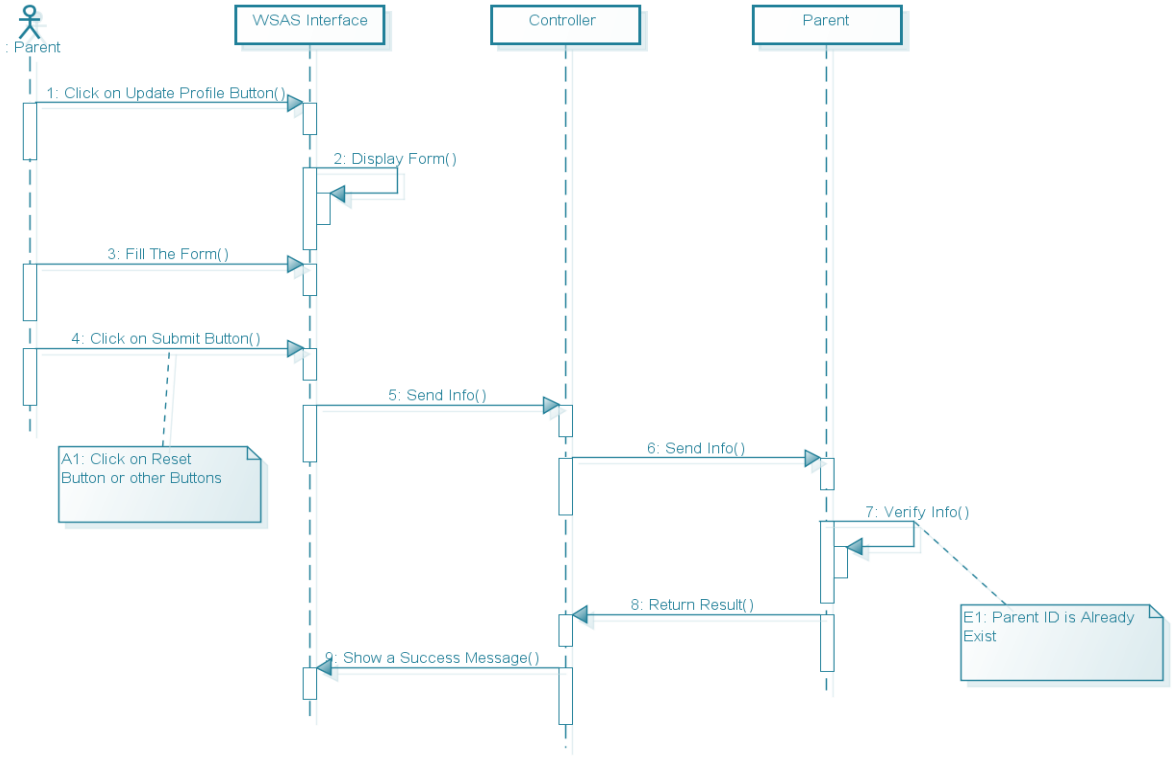
5. Sequence diagram for administrator to add new teacher



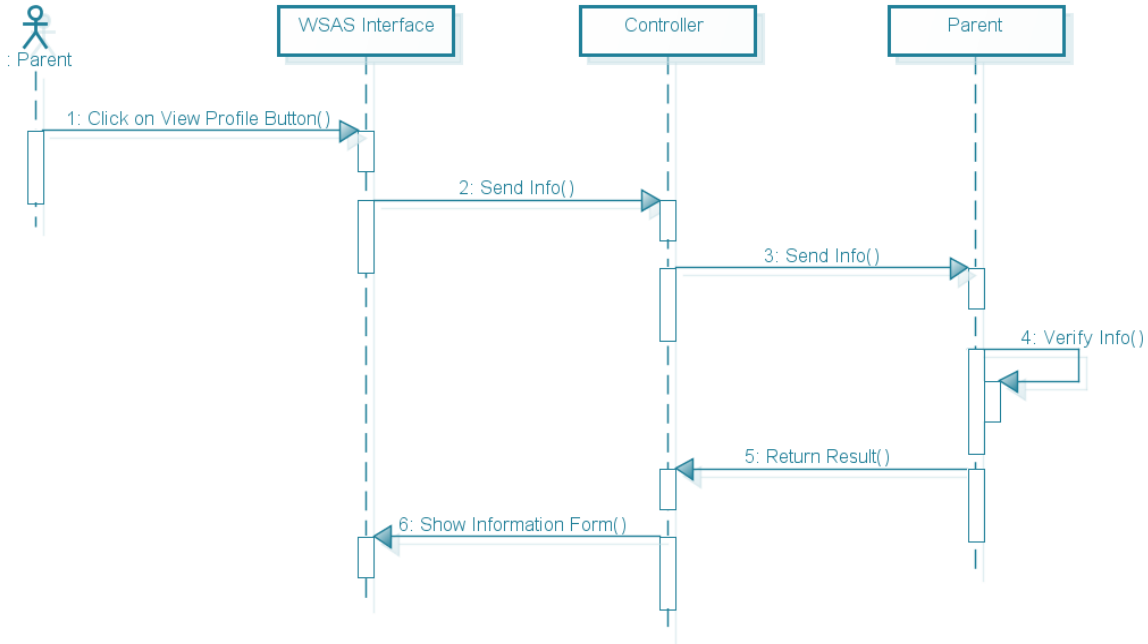
6. Sequence diagram for administrator to update teacher information



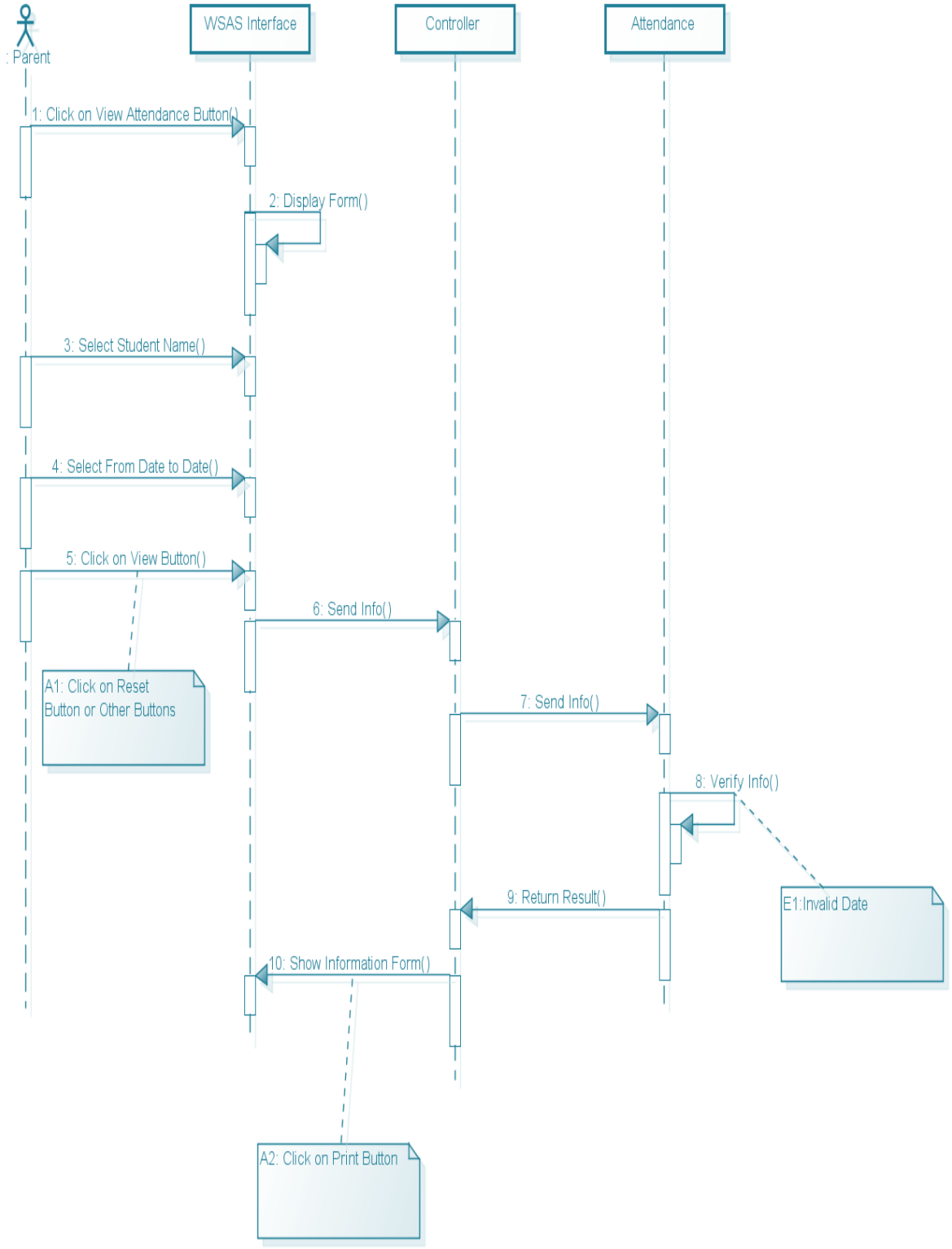
7. Sequence diagram for parent to update his/her profile



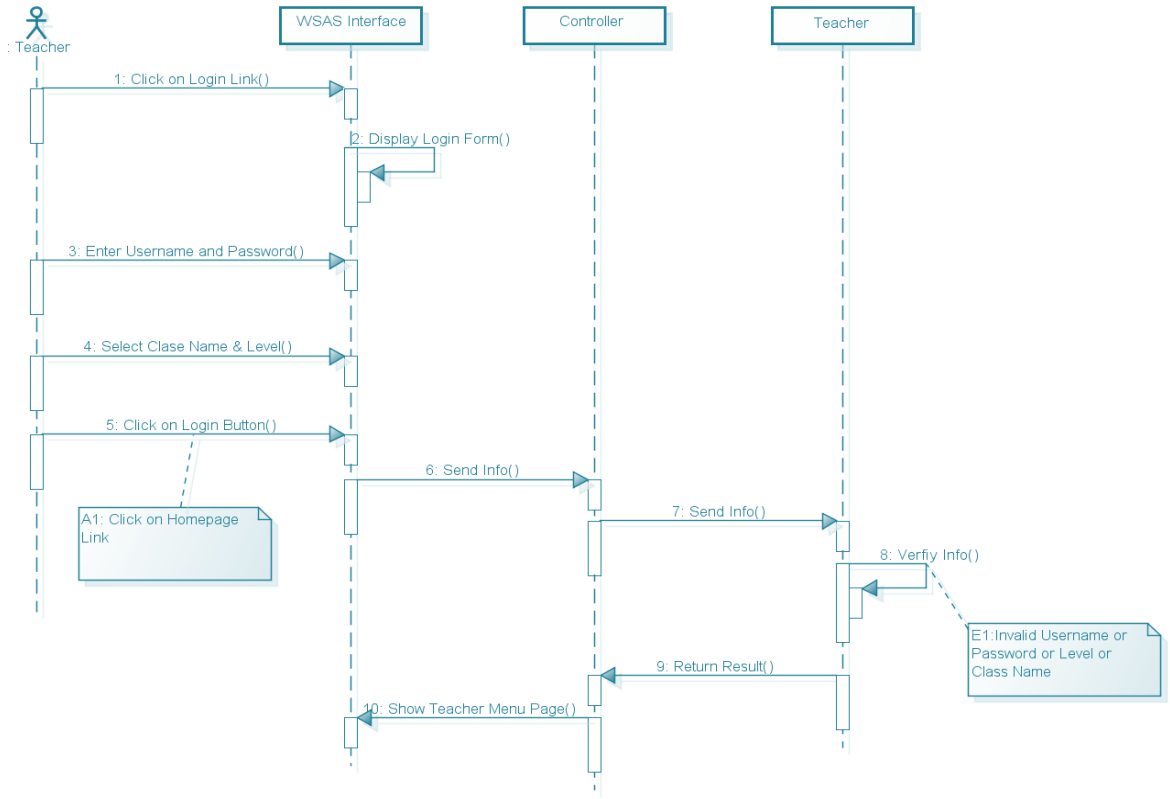
8. Sequence diagram for parent to view his/her profile



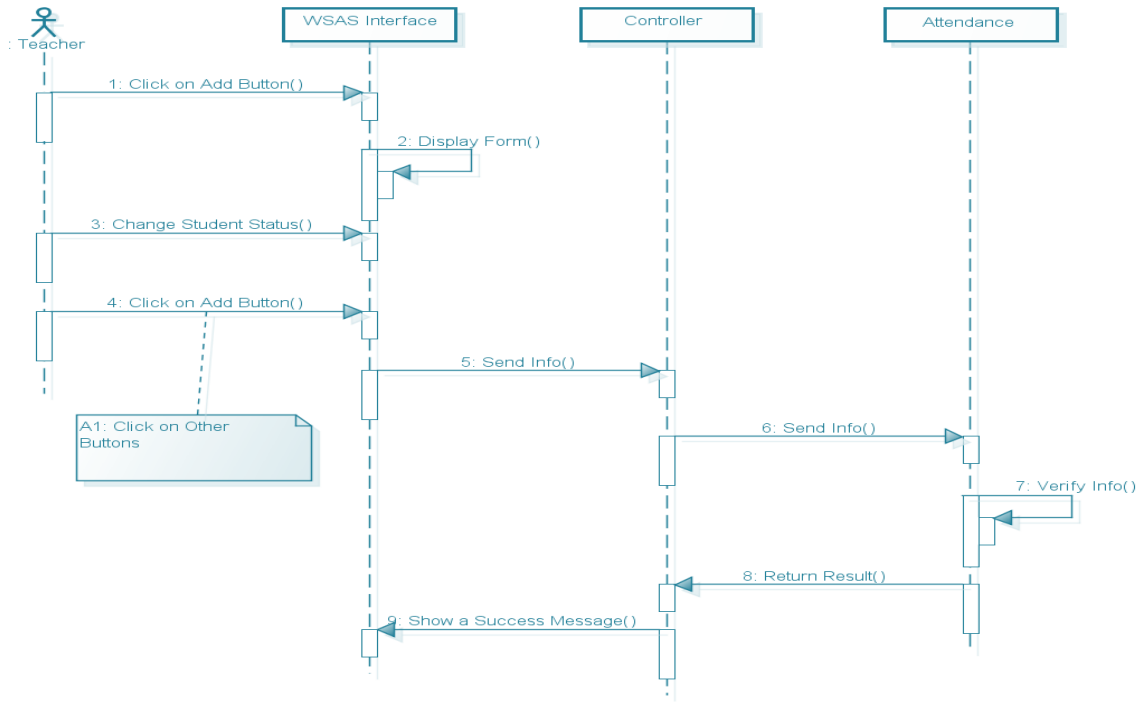
9. Sequence diagram for parent to view attendance



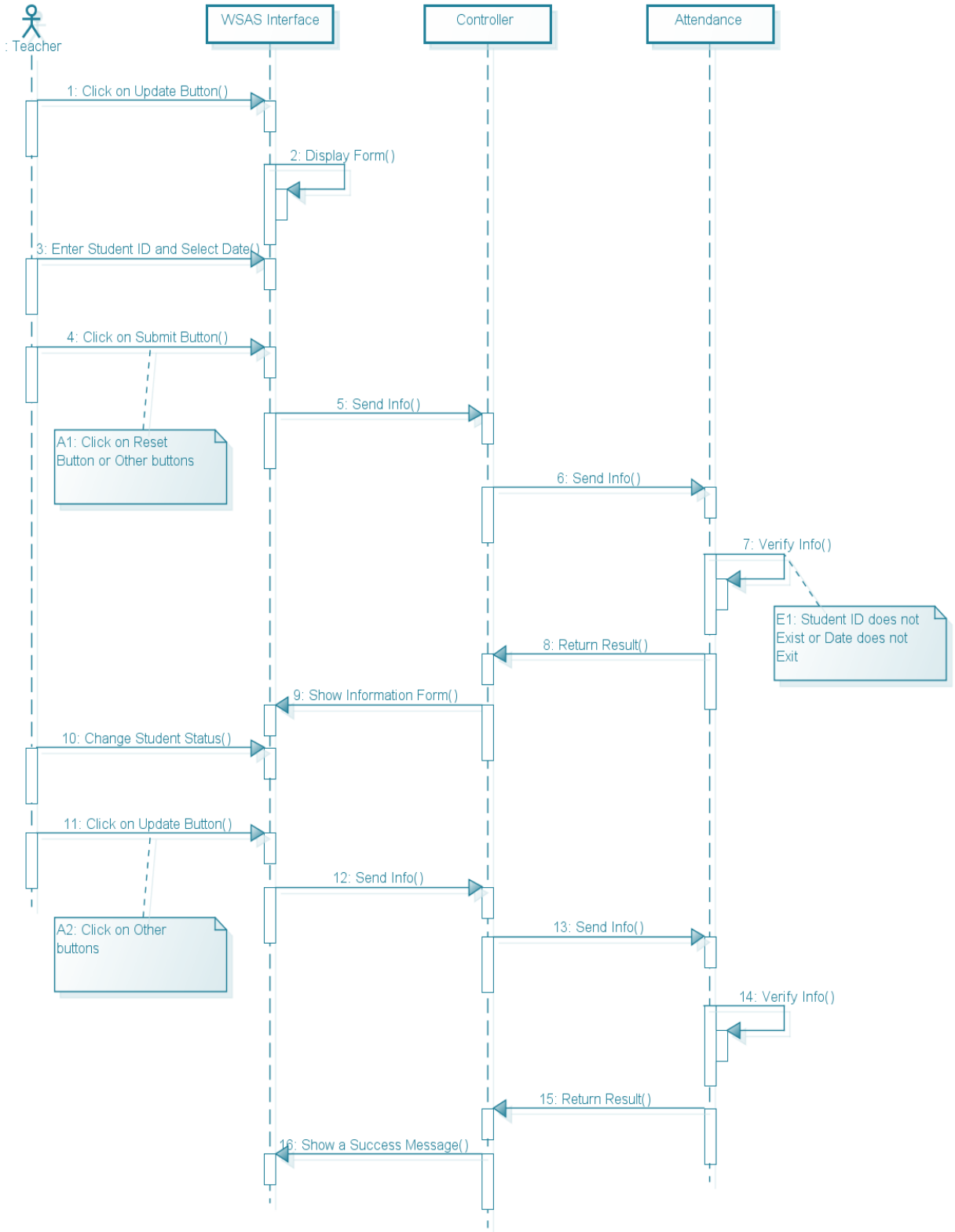
10. Sequence diagram for teacher login



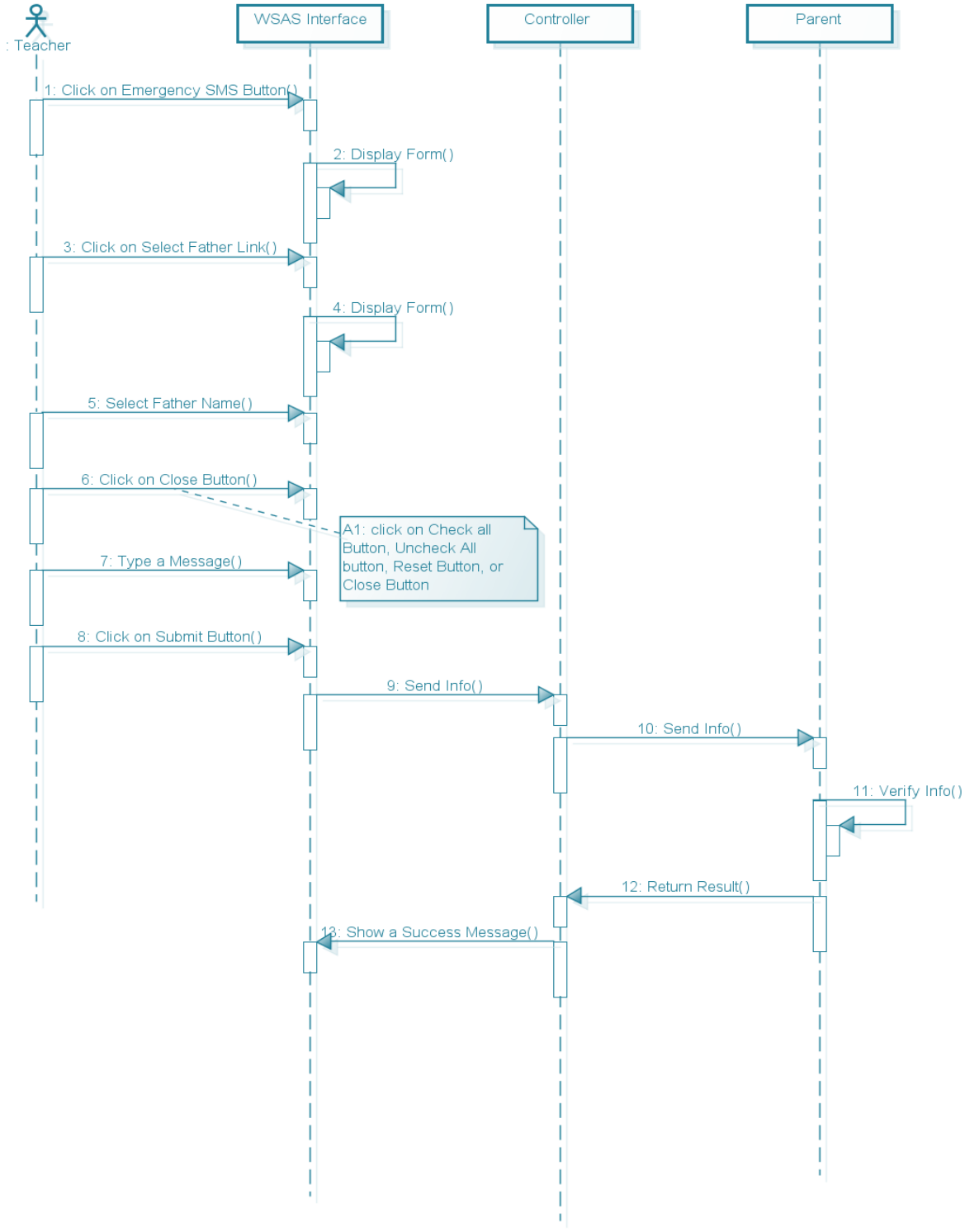
11. Sequence diagram for teacher to add attendance



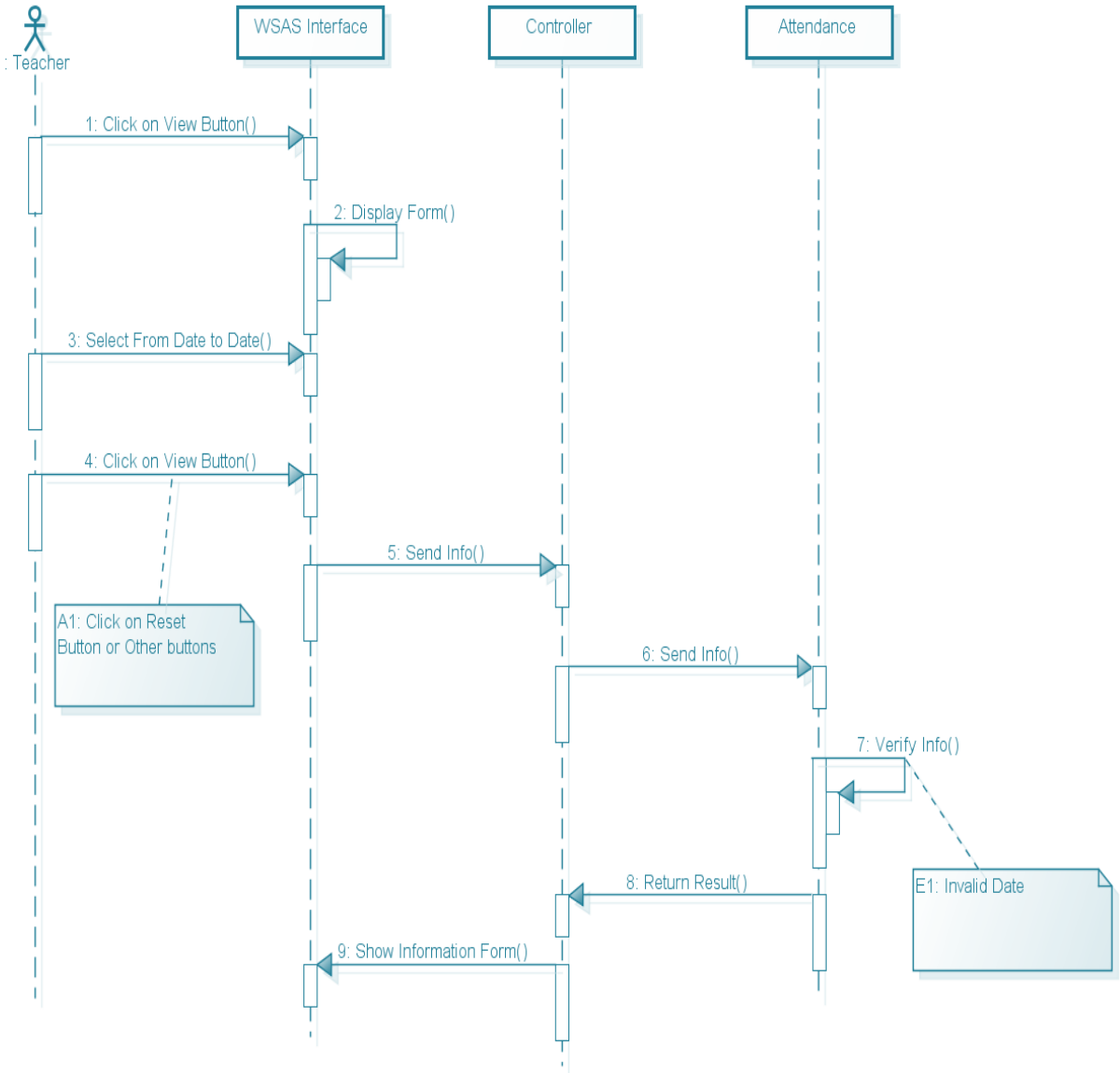
12. Sequence diagram for teacher to update attendance



13. Sequence diagram for teacher to send emergency SMS



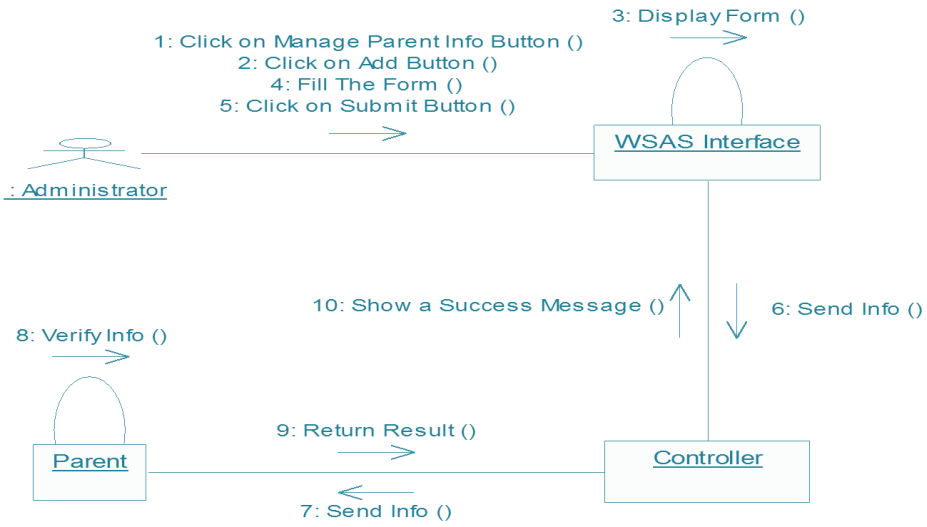
14. Sequence diagram for teacher to view attendance



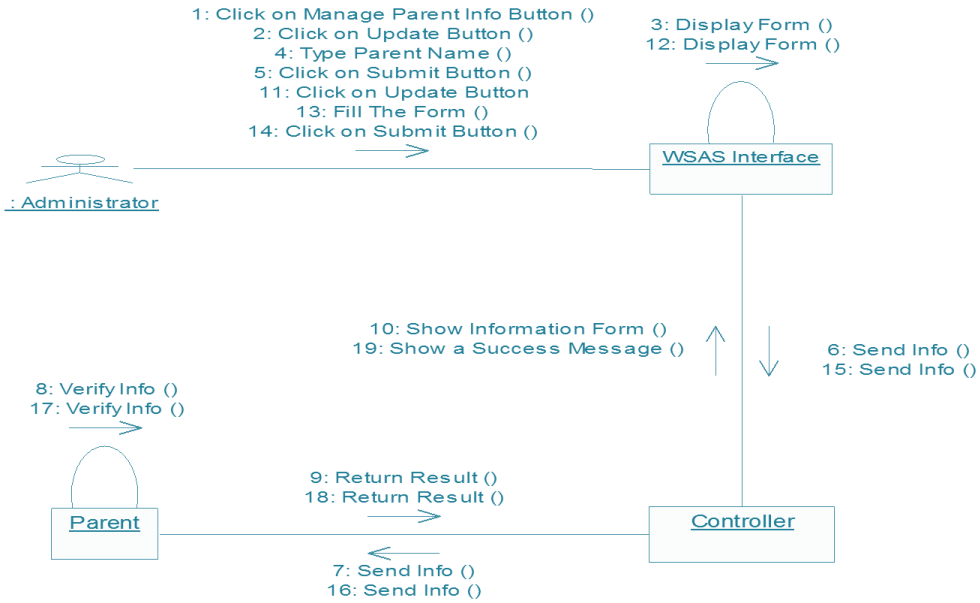
APPENDIX D

COLLABORATION DIAGRAM

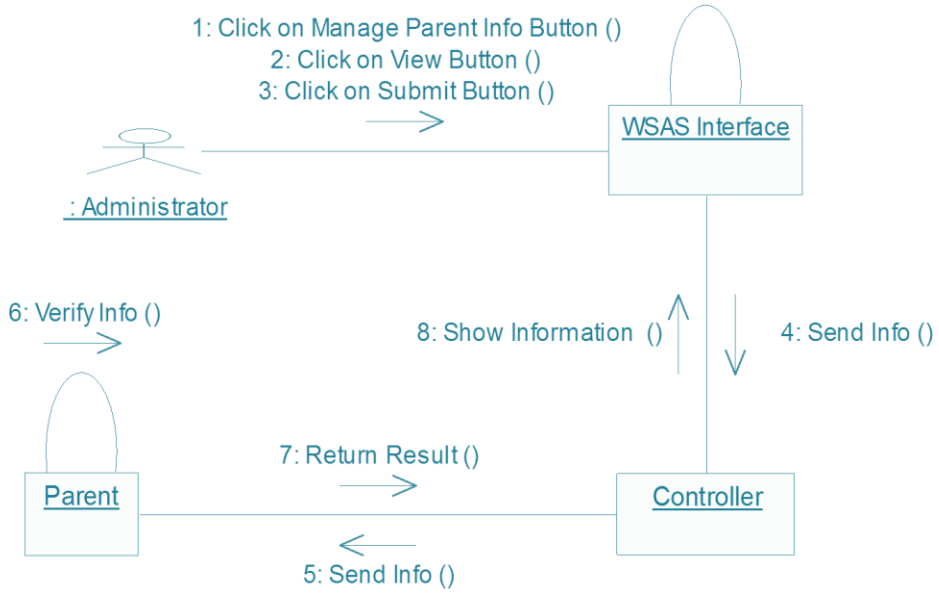
1. Collaboration diagram for administrator to add new parent



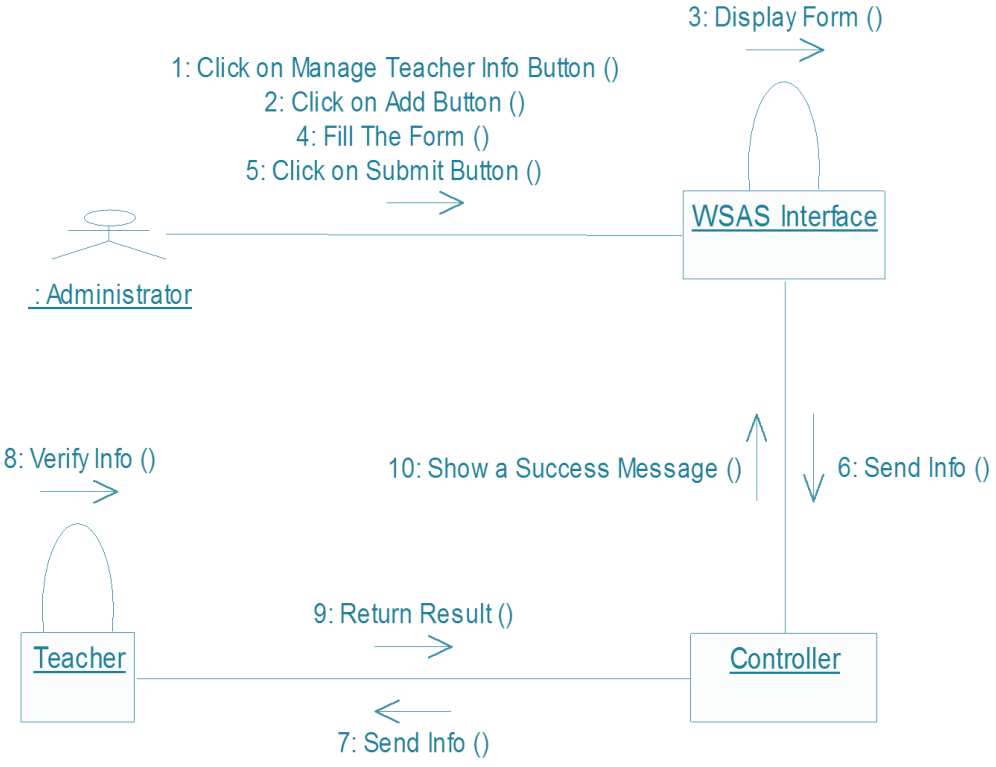
2. Collaboration diagram for administrator to update parent information



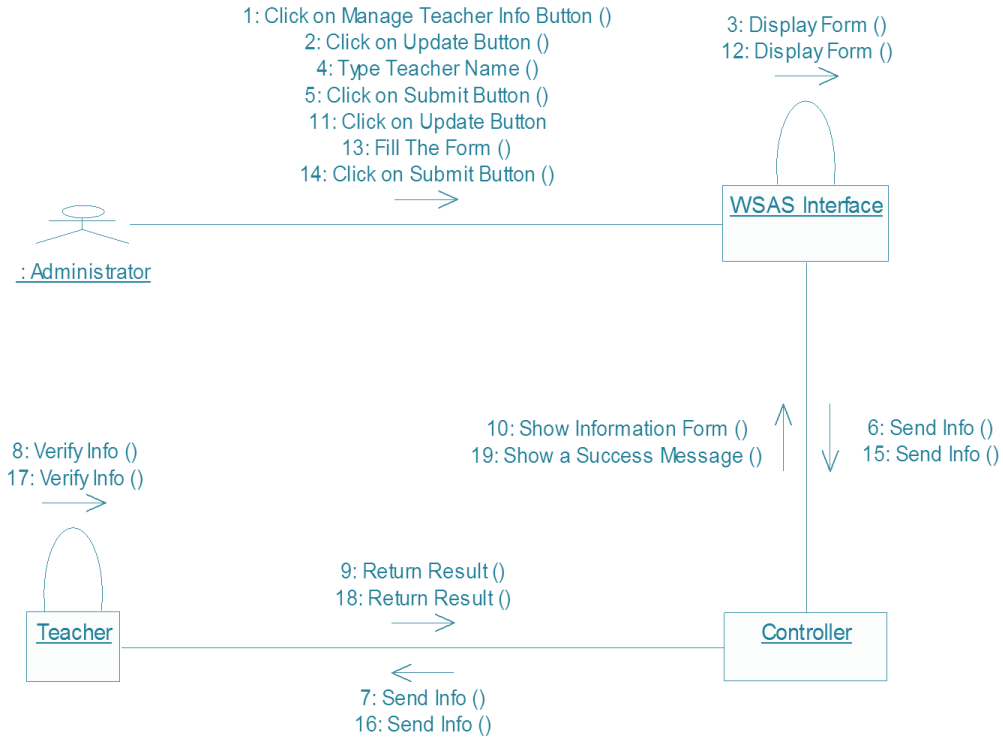
3. Collaboration diagram for administrator to view parent information



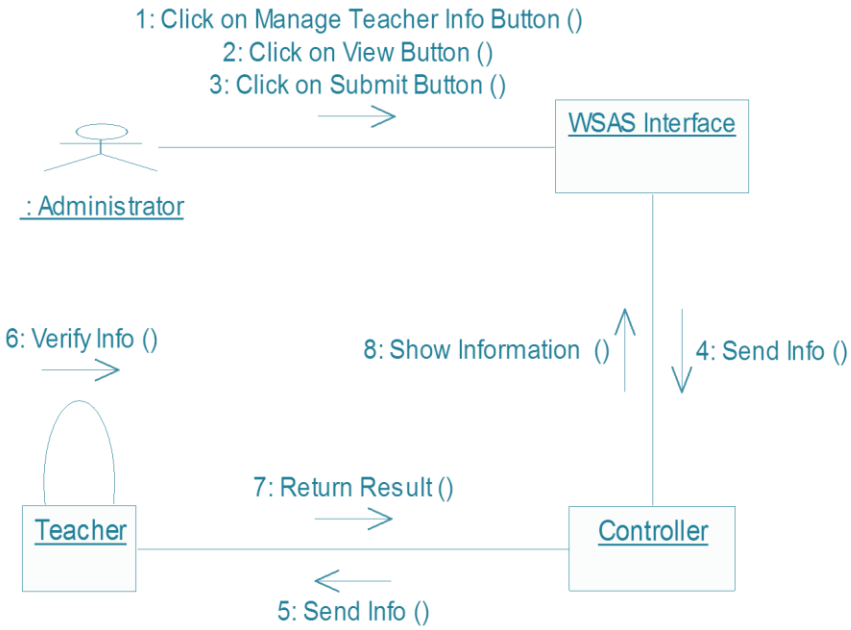
4. Collaboration diagram for administrator to add new teacher



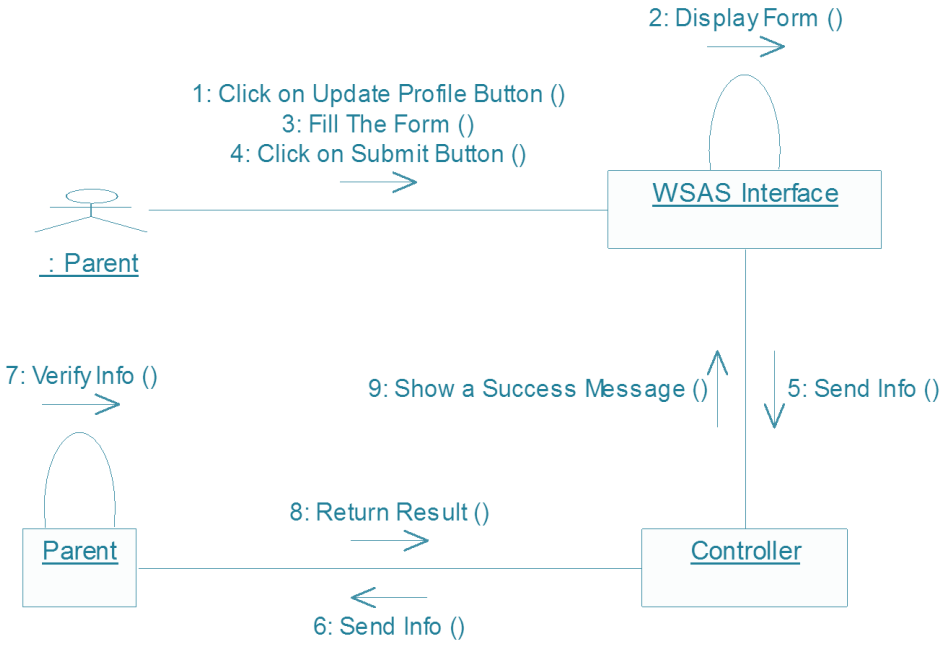
5. Collaboration diagram for administrator to update teacher information



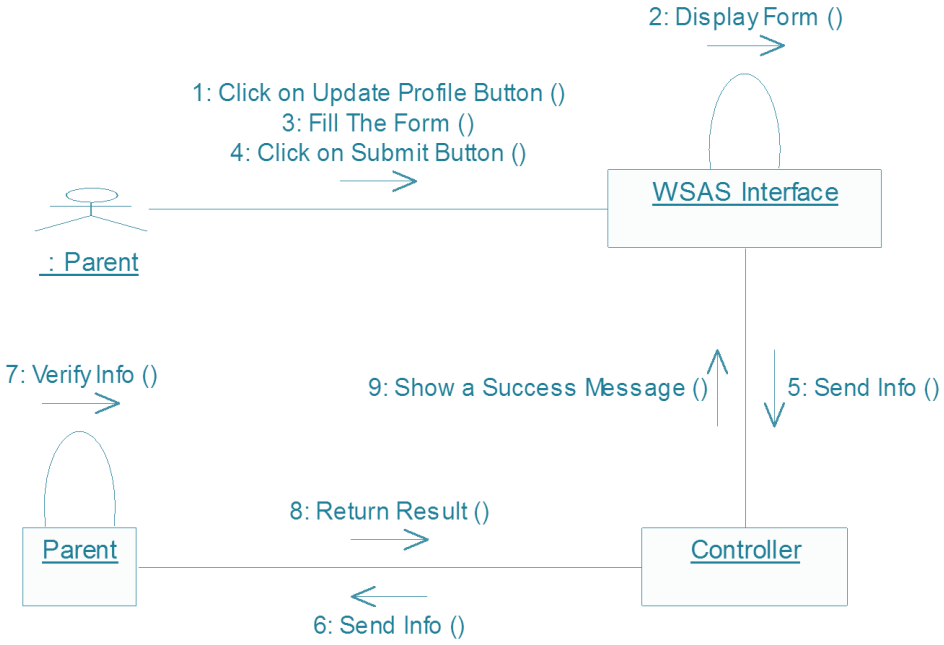
6. Collaboration diagram for administrator to view teacher information



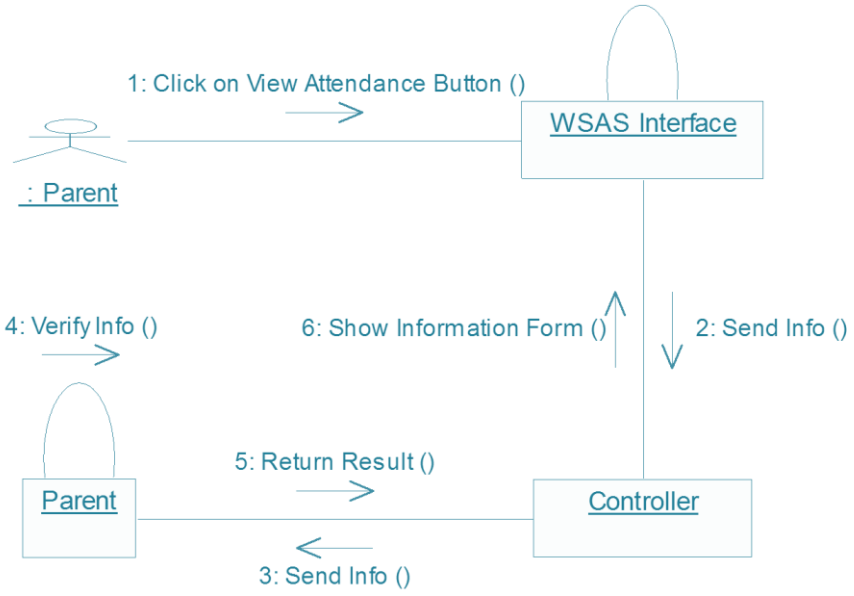
7. Collaboration diagram for parent to update his/her profile



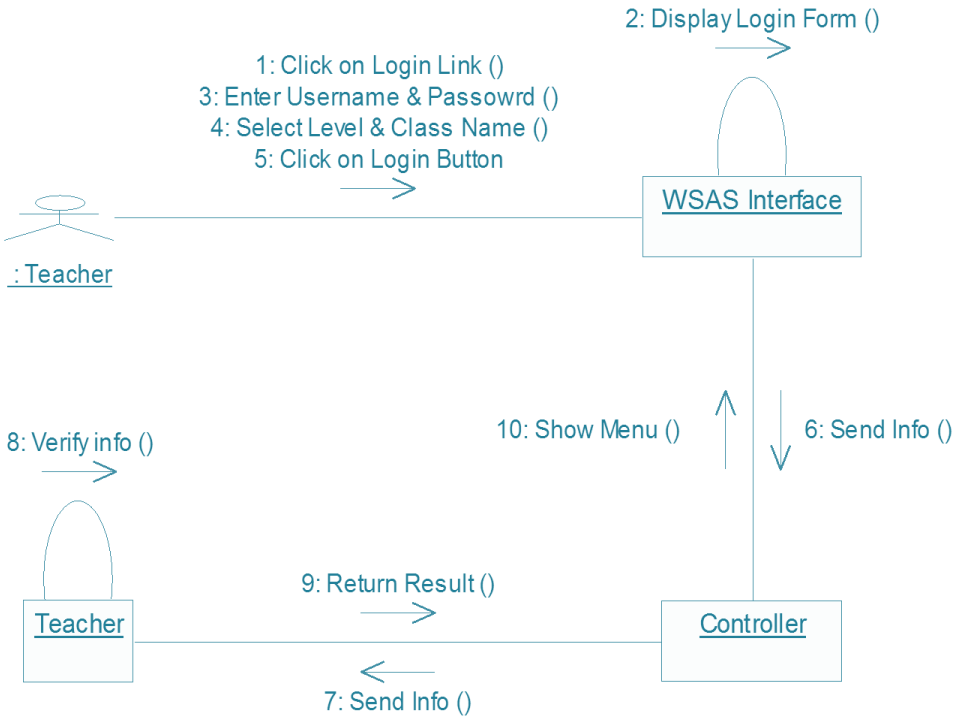
8. Collaboration diagram for parent to view attendance



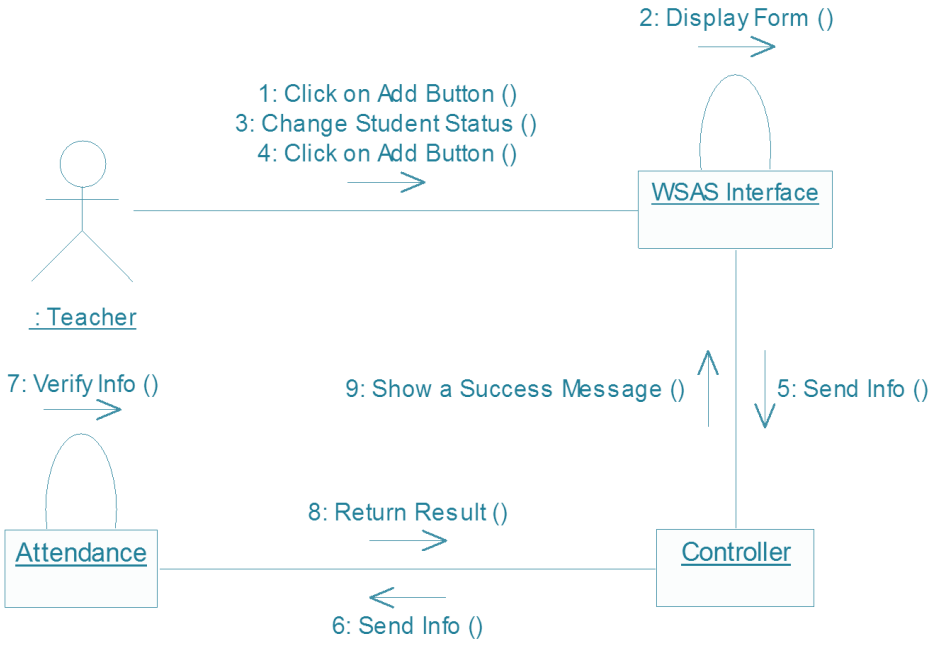
9. Collaboration diagram for parent to view his/her profile



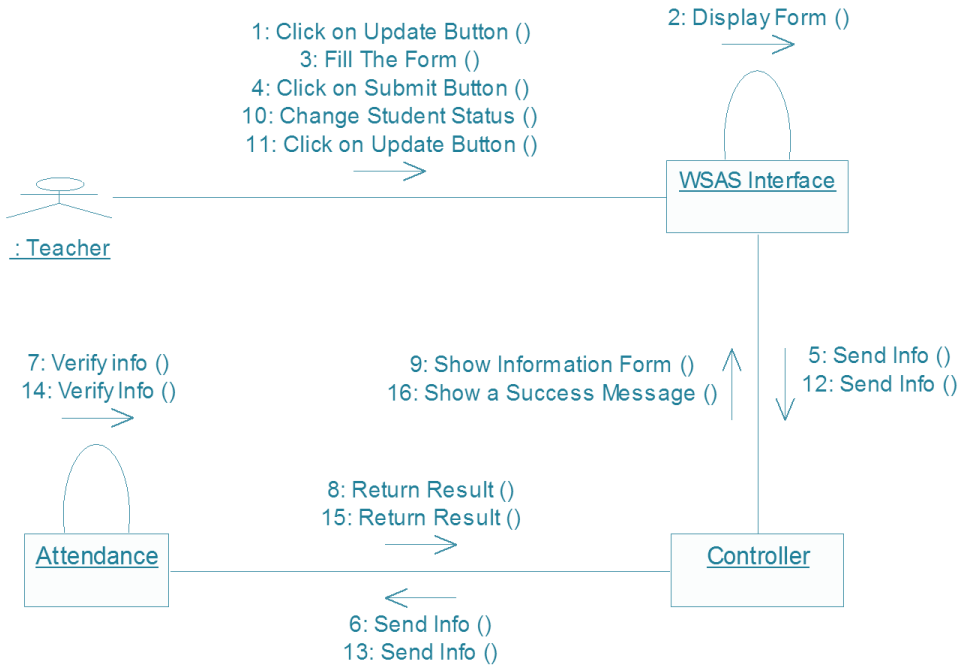
10. Collaboration diagram for teacher login



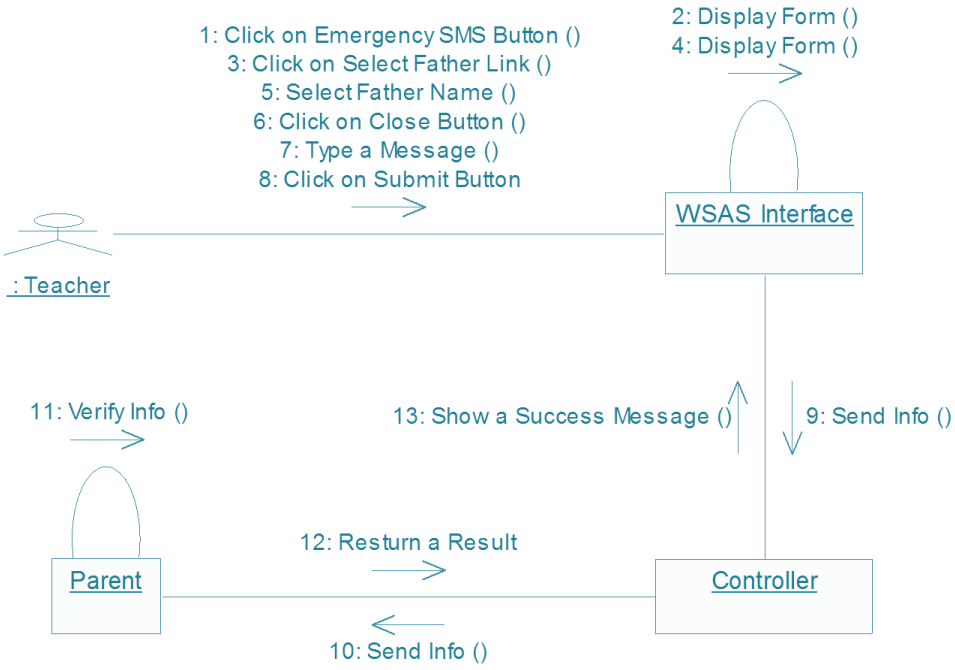
11. Collaboration diagram for teacher to add attendance



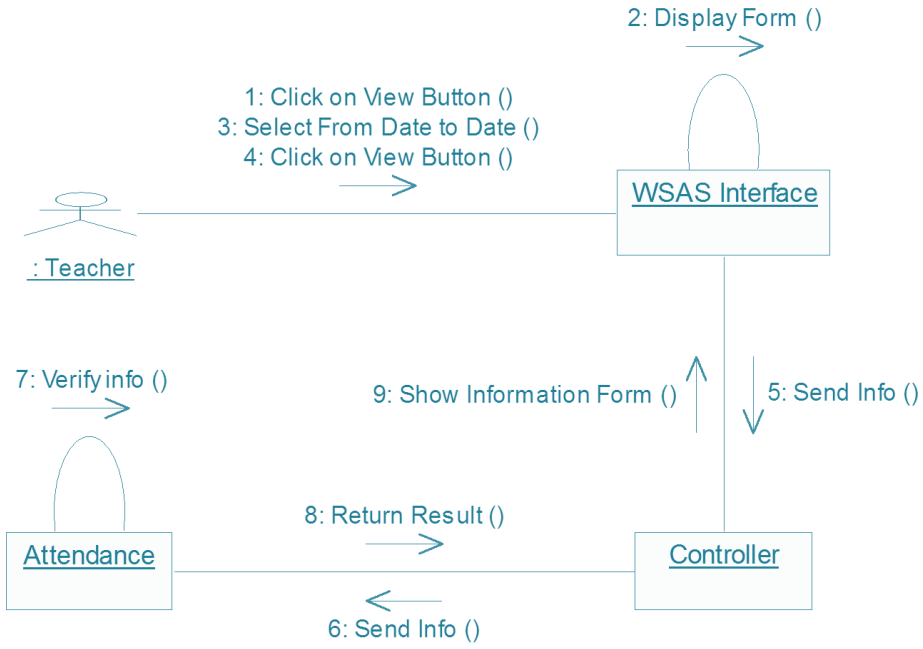
12. Collaboration diagram for teacher to update attendance



13. Collaboration diagram for teacher to send emergency SMS



14. Collaboration diagram for teacher to view attendance



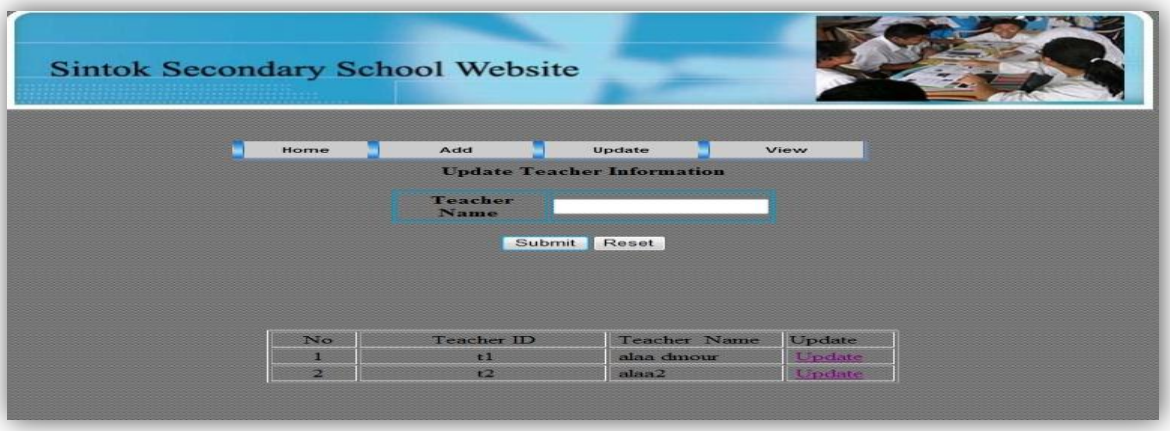
APPENDIX E

PROTOTYPE DEVELOPMENT

1. Administrator homepage for managing teacher's information /add new teacher page

The above figure depicts administrator homepage for managing teacher's information. This page allows the administrator to add a new teacher. Once the administrator finished filling out the form and clicked on submit button, the system will display a success message in case the new teacher ID doesn't exist before.

2. Administrator homepage for managing teacher's information /Update teacher information page



The above figure depicts administrator for managing teacher's information. This page allows the administrator to update teacher's information. The administrator enters the teacher name then clicks on submit button to search for it. The new form will be displayed that includes the name of teacher or other matching names. The administrator clicks on the teacher name that he wants to update it then a new form will be displayed that includes teacher's information then the administrator can update the teacher's information.

3. Administrator homepage for managing teacher's information /View teacher information page

The above figure depicts administrator homepage for managing teacher's information. This page allows the administrator to view all teachers' information.

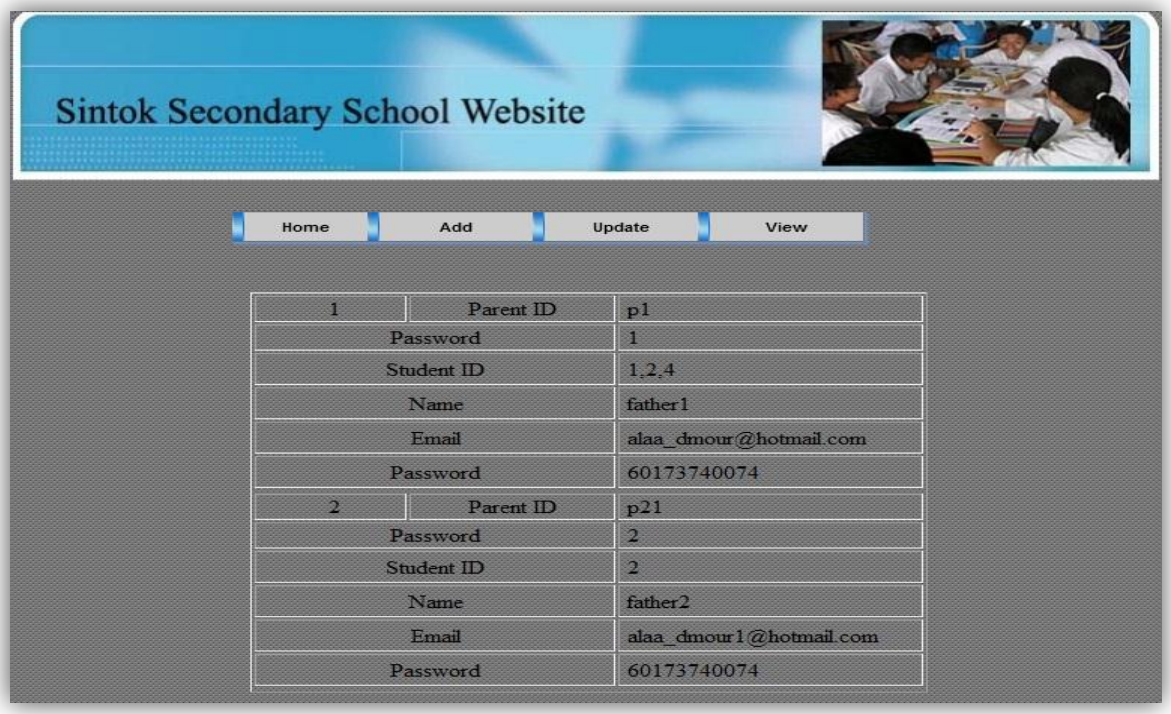
4. Administrator homepage for managing parent's information /add new parent page

The above figure depicts administrator homepage for managing parent's information. This page allows the administrator to add a new parent. Once the administrator finished filling out the form and clicked on submit button, the system will display a success message in case the new parent ID doesn't exist before.

5. Administrator homepage for managing parent's information /Update parent information page

The above figure depicts administrator for managing parent's information. This page allows the administrator to update parent's information. The administrator enters the parent name then clicks on submit button to search for it. The new form will be displayed that includes the name of parent or other matching names. The administrator clicks on the parent name that he wants to update it then a new form will be displayed that includes parent's information then the administrator can update the parent's information.

6. Administrator homepage for managing parent's information /View parent information page



The above figure depicts administrator homepage for managing parent's information. This page allows the administrator to view all parents' information.

7. Parent login page

The above figure depicts the parent login page. This page allows the parent to enter username and password to enter the system. In case the parent has entered invalid username or password, the system will display an error message to inform him/her that entered invalid username or password. Also, this page allows the parent to go back to the homepage.

8. Parent homepage

The above figure depicts the parent homepage. This page consists of three main functions that allow the parent to update his/her profile, view his/her profile information, and to view students' attendance information.

9. Parent update profile page

The above figure depicts parent homepage for updating profile information. This page allows the parent to update their information. Once the parent finished updating their information and clicks on submit button, a success message will be displayed in case this process has been done successfully.

10. Parent view profile page

The above figure depicts parent homepage for viewing profile information. This page allows the parent to view their profile information.

11. Parent view attendance page

The above figure depicts parent homepage for viewing attendance information. This page allows the parent to view their students' attendance information. The parent selects the student name in case he/she has more than one student at schools then selects from specific date to specific date and then clicks on view button to view their students' attendance information. The new form that will be displayed has an option to allow the parent to print out the students' attendance information.

APPENDIX F

TABLES

1. Administrator's Table:

Domain	Characteristics
Username	Consists of 50 varchar
Password	Consists of 50 varchar

2. Teacher's Table:

Domain	Characteristics
Teacher_ID	Consists of 50 varchar
Teacher_Name	Consists of 50 varchar
Password	Consists of 50 varchar
Email	Consists of 50 varchar

3. Parent's Table:

Domain	Characteristics
Parent_ID	Consists of 50 varchar
Parent_Name	Consists of 50 varchar
Password	Consists of 50 varchar
Email	Consists of 50 varchar

Phone	Consists of 50 varchar
Student_ID	Consists of 50 varchar

4. Student's Table:

Domain	Characteristics
Student_ID	Consists of 50 varchar
Student_Name	Consists of 50 varchar
Email	Consists of 50 varchar
Address	Consists of 50 varchar
Birthday	Consists of 50 varchar
Course_Name	Consists of 50 varchar
Level	Consists of 50 varchar

5. Attendance's Table:

Domain	Characteristics
Student_Name	Consists of 50 varchar
Student_ID	Consists of 50 varchar
Teacher_Name	Consists of 50 varchar
Date	Consists of 50 varchar
Time	Consists of 50 varchar
Day	Consists of 50 varchar
Course_Name	Consists of 50 varchar

Status	Consists of 50 varchar
level	Consists of 50 varchar

6. Course's Table:

Domain	Characteristics
Teacher_ID	Consists of 50 varchar
Course_Name	Consists of 50 varchar
Level	Consists of 50 varchar

APPENDIX G

QUESTIONNAIRE

Questionnaire for Testing and Evaluating Web Based Students' Attendance System (WSAS)

WSAS is developed to be informed about the students' attendance status at school via Email and SMS technologies. The aim of this questionnaire is to evaluate the system and to rate your satisfaction of using this system. Once you finished testing the system, a questionnaire will be given to you to answer all questions. The questionnaire consists of 31 questions into two sections, which are:

1. General Information.
2. System Aspects.

Some of questions are easy and some are more difficult, so, do not worry if you cannot understand them. Once you find them, it will be clarified to you.

Part 1: General Information

A. This section is used only by parent :

Please tick [✓] in appropriate blank field:

1. **Do you have a computer at home?**

Yes:…….. No:……

2. **Does internet access available at home?**

Yes:…… No:……

3. **Do you know how to use of computer and internet?**

Yes:…… No:……

4. **Do you have your own mobile ?**

Yes:…… No:……

5. **Which one you prefer to be informed about your student status at school through?**

Mobile(SMS):…….. Email:……. Both:……..

6. **Do you think that this system can enhance the communication between you and teachers?**

Yes:…… No:……

B. This section is used only by teacher:

Please tick [✓] in appropriate blank field:

7. **Do you know how to use of computer and internet?**

Yes:…… No:……

8. **Do you think that this system can reduce your workload?**

Yes:…… No:……

9. **Do you think that this system can enhance the communication between you and student's parent?**

Yes:…… No:……

Part 2: System Aspects

Please tick [✓] in appropriate blank field:

Usefulness					
	Strongly Agree	Agree	Natural	Disagree	Strongly Disagree
10.It helps me be more effectiveness					
11.It helps me be more productive					
12.It is useful					
13.It gives me more control over the activities					

14.It makes the things I want to accomplish easier to get done					
15.It save me time when I use it					
16.It meets my needs					
17.It does everything I would expect it to do					
Easy to use					
	Strongly Agree	Agree	Natural	Disagree	Strongly Disagree
18.It is easy to use					
19. It is user friendly					
20. It requires the fewest steps possible to accomplish what I want to do with it					
21. It is flexible					
22. Using it is effortless					
23. I can use it without written instructions					
24. I don't note any inconsistencies as I use it					
25. I can recover from mistakes quickly and easily					
26. I can use it successfully every time					
Easy of Learning					
	Strongly Agree	Agree	Natural	Disagree	Strongly Disagree
27. I learned to use it quickly					
28. I easy remember how to use it					
29. I quickly became skillful with it					
Satisfaction					
	Strongly Agree	Agree	Natural	Disagree	Strongly Disagree
30. I am satisfied with it					
31. It works the way I want it to work					

Date:…….. **Time:**……. **Signature:**……

Thank you for your value time to participate with us, and make it achievable and possible.