DEVELOPING MOBILE APPLICATION FOR SCHOOL INFORMATION SYSTEM WITH CLOUD COMPUTING

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ABDULLA JASSIM YASSIN ALDARWISH

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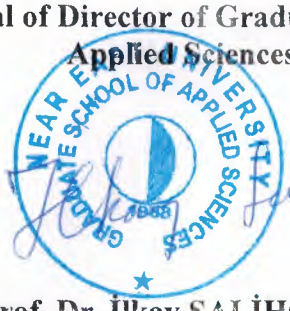

Prof. Dr. İlkay SALİHOĞLU

We certify this thesis is satisfactory for the award of the degree of Masters of Science in Computer Information Systems

Examining Committee in Charge:

Prof.Dr. Rahib Abiyev	Committee Chairman, Department of Computer Engineering, NEU
Prof.Dr. Doğan İbrahim	Department of Computer Information Systems, NEU
Assoc.Prof.Dr. Nadire Çavuş	Supervisor, Department of Computer Information Systems, NEU
Assist.Prof.Dr. Seren Başaran	Department of Computer and Instructional Technology Teaching, GAU
Assist.Prof.Dr. Hüseyin Bicen	Department of Computer Education and Instructional Technology, NEU

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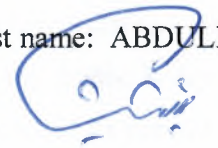
Signature: 

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To my parents....

ABSTRACT

Information technology has a significant role in the education sector. Information system in schools has an important role in building a positive partnership between parents and school, as well as contributing into the management of the school. However the development of information technologies increased complexity and costs of the infrastructure. The high cost of purchasing infrastructure for information systems constitutes a problem facing schools with limited budget. The major aim in this thesis is to establish a channel of communication for school members by developing an Android mobile application for school information system using cloud computing. The developed system provides services for school, students, and parents by making communication among school (teacher), parent and student easier, and the user can get the information needed from school without formal request. The services provided in the system are: Manage user account, manage classes, manage courses, classes search, search, password, academic calendar, attendance, behavior incidents, grades, ınfo, login history, news, private messages, photos, schedule.

The system consist of two parts such as server and client. The main purpose of the server is to manage the connection between the mobile application and the database. The client is the aplication on Android mobile phone. There are four types of users with different privilages: Administrator (have full authority), teachers (can perform student related tasks), students (only view their own data), parents (only view their child's data). In this application Java programing language is used together with PHP Web Application language in order to write the server part of the system. The SQL database language was used to retrieve data from MYSQL Server Database.

The developed school information system is helpful to families such that the families can get information about the status and development of their children from anywhere and at any time of the day. At the same time, the students and parents can see the school news easily and instantly. The developed system offers set of features to help the school in managing the information system and building a positive partnership with parents. The application increases the level of communication with the parents, and such features enable parents to follow school activities, monitor their child's behavior, verify possible absences, learn the grades etc. with the help of a mobile device anytime and anywhere. The

developed system relies on cloud computing that provides a good opportunity for schools with limited budgets to use the application.

Keywords: School information system, mobile application, mobile cloud, communication, school management

ÖZET

Enformasyon teknolojisinin eğitim alanında önemli rolü bulunmaktadır. Enformasyon sistemleri, ebeveyinler ile okulun pozitif ilişki kurmaları açısından ve ayrıca okul idaresi bakımından çok önem taşımaktadırlar. Fakat, Enformasyon teknolojisinde olan son gelişmeler sayesinde hem sistemler daha karmaşık olmuş hem de fiyatları artmıştır. Fiyatların yüksek oluşundan dolayı birçok okul, kısıtlı harcamalarından dolayı Enformasyon teknoojisine gerekli yatırımı yapamaz hale gelmiştir. Bu tezin ana temeli, Android tabanlı ve cloud kullanan bir mobil sistem geliştirerek okul üyeleri arasındaki iletişimi sağlamaktır. Geliştirilmiş olan sistem sayesinde öğrenciler, ebeveyinler, ve öğretmenler arasındaki iletişim kolaylaşmış ve kullanıcılar okul hakkında herhangi bir bilgiye kolaylıkla ulaşabilmektedirler. Sistem şu servisleri sunmaktadır: Kullanıcı giriş-çıkışklarının kontrolü, sınıfların kontrolu, verilen derslerin kontrolü, sınıf arama, akademik takvim, notlar, bilgi, sisteme giriş kayıtları, haberler, özel mesajlar, fotoğraflar vs.

Sistem iki bölümden oluşmaktadır: Server ve client. Server'in esas amacı mobil uygulama ve veritabanı arasındaki iletişimi kurmaktır. Client ise kullanıcının mobil cihazıdır. Sistemde dört değişik kullanıcı bulunmaktadır: İdareci (tam yetkili), öğretmen (sadece öğrenci ile ilgili işlem yapabilir), öğrenci (sadece kendi verilerini görebilir), ve ebeveyin (sadece kendi çocukları ile ilgili veriyi görebilir). Client bölümünde Java programlama dili ve bununla birlikte PHP ağ uygulama dili kullanılmıştır. Server bölümünde ise SQL veritabanı kullanılmıştır.

Geliştirilmiş olan okul idare sistemi, ailelelerin kendi çocukları hakkında anında ve herhangi bir yerde, herhangi bir zamanda bilgi almalarını sağlayacağı için ailelere faydalı olacağı düşünülmektedir. Ayni zamanda, sistem öğrencilerin ve ebeneyinlerin okul ile ilgili haberleri anında gömelerini sağlamaktadır. Sistem, ebeveyinler ve okul arasındaki iletişimi artırıp ebeveyinlerin çocuklarının davranışları hakkında anında haber almalarını da sağlamaktadır. Aynı zamanda, çocuklarının okula zamanında gidip gitmediklerini de kontrol etmelerine yardımcı olmaktadır. Geliştirilmiş olan sistem cloud tabanlı olup sınırlı harcama durumunda olan okullara bu sistemi kullanabilmeleri için olanak sağlamaktadır.

Anahtar kelimeler: Okul enformasyon sistemi, mobil uygulama, mobil cloud, iletişim, okul idaresi

TABLE OF CONTENTS

CHAPTER 4: SYSTEM ANALYSIS

LIST OF FIGURES

LIST OF ABBREVIATIONS

3G:	Third Generation
AAA:	Authentication, Authorization, Accounting
API:	Application Programming Interface
ASP:	Active Server Pages
BBM:	Blackberry Messenger
BTS:	Base Transceiver Station
CPU :	Central Processing Unit
CSS:	Cascading Style Sheets
C-TAM-TPB:	Combined TAM And TPB
ENISA:	European Union Agency for Network and Information Security
GPRS:	General Packet Radio Service
GPS:	Global Positioning System
HA:	Home Agent
HTTP:	Hyper Text Markup Language
IaaS:	Infrastructure as a Service
ID:	Identifier
J2ME:	Java 2 Micro Edition
JME:	Java ME, A Java Platform
JSON:	JavaScript Object Notation
MAvBT:	Mobile Application via Bluetooth Wireless Technology
MRTPS:	Manage Relation and communication between the Teacher, Students and Parents

NIST:	National Institute of Standards and Technology
PaaS:	Platform as a Service
PDA:	Personal Digital Assistant
PIM:	Personal Information Manager
RAM:	Random-Access Memory
R-JSON:	Reverse JavaScript Object Notation
S3:	Simple Storage Service
SaaS:	Software as a Service
SMIP:	Student's Mobile Information Prototype
TAM:	Technology Acceptance Model
TPB:	Theory of Planed Behavior
UI:	User Interface
URI:	Uniform Resource Identifier
UTAUT:	Unified Theory of Acceptance and Use of Technology
XML:	Extensible Markup Language

CHAPTER 1

INTRODUCTION

Information management for companies or academic institution has become a necessary feature to keep up with the developments in information technology and media. Therefore information systems has become very important and useful for all sectors. The most important reason for using information systems is the speed in the exchange of information and the provision of adequate information. Scientific institutions, including schools need systems to manage the data and relationships between stakeholders (Hohlfeld, Ritzhaupt & Barron, 2010). The school information system constitutes the topic of this thesis. The author developed school information system with the aim of helping the students and parents to communicate with school easier compared to how it was before. This system was developed based on cloud computing, as well as author designing and developing new mobile application for school information system. The limitations faced by previous systems and mobile applications was into account, such as the limitations in mobile device resources (processor limitation, capacity of storage, battery life) (Gao & Zhai, 2010). This thesis focuses on the challenges in the development of mobile applications and the requirement of school information systems, and it first discusses the implementation of the appropriate solutions for challenges, and then how the requirements of school information systems can be met. The thesis takes advantage of the cloud computing characteristics and presents it as one of the solutions to difficulties and talks about the limitations such as reducing costs, providing unlimited storage space and high computing capabilities, as well as the implementation of the processing outside mobile resource as an important feature, as it frees from the limited processing in mobile and the preservation of the battery life (Verma, 2012; Hung, Tuan-Anh & Huh, 2013).

1.1 Thesis Problem

The traditional ways of communication between parent and teacher in school information system such as phone, messages, mobile and emails are no longer sufficient to meet the growing need for information from school (Gefu & Yuan, 2013). Based on the limitations on these traditional methods such as not being available for use all the time from anywhere, the amount of information that is provided by school to parents is argued to be insufficient. In addition to this, there are sometimes the high cost of communication.

Therefore, addressing these issues requires finding an easy, simple and effective way to provide solution to the traditional communication means between parents and teachers, and one of the solutions is to develop school information system based on cloud computing.

1.2 The Aim of the Thesis

The aim of this thesis is to develop mobile application for school information system using cloud computing. It provides communication means between school, parents and students in a more efficient manner and less costly compared to the traditional means or methods. The developed mobile application provides special features that are using to manage the system and communication between users (administrator, teachers, parents and students), from anywhere and anytime.

1.3 The Importance of the Thesis

The importance of the thesis is to provide a system based on mobile application to be a communication means among the school (administrator and teachers), parents and students. This application offers features, which help in building a partnership between the school and parents to improve the education experiences of the students (Ho et al., 2013). Furthermore, mobile application works are based on cloud computing, which provides a good opportunity for schools that do not have large budgets and allows them to adopt an information system without the need to buy infrastructure for the operation of the system. It also reduces the expenses of maintenance and updating of infrastructure (Marston et al., 2011).

It is worth mentioning there are more than 1.2 million applications developed for various mobile operating systems until now (Hurbean & Fotache, 2013) this is a positive indicator for the importance of mobile applications and the extent of spread. The application developed in this thesis is distinguished from many other applications because it provides the off line mode feature when internet outage, and this is a solution for applications that work by the internet (Gunawan & Pardamean, 2013). The off line mode feature is based on a mini database that keeps the last data updated sent from servers. The application synchronizes with the main database when it works with online mode.

1.4 Limitations of the Study

This thesis has the following limitations

1. This study is limited by the date that starts from October 2013 until April 2014 depending on the application developed in this study.
2. This study discusses the features in mobile application developed in the practical chapter.
3. The application in this study is limited to Android mobile platform.

1.5 Overview of the Thesis

This section briefly explains the components of the thesis:

Chapter One: It displays the object and purpose of the thesis and its importance, as well as the obstacles and difficulties that face the work in this thesis. The first quarter also contains the explanation of the contents of the coming chapters of the thesis.

Chapter Two: This chapter presents the related studies to school information system and mobile school information system, in addition to studies related to cloud computing.

Chapter Three: This chapter provides the basic concepts of school information system and the overall structure of the administration to school information systems. In addition, it provides some of the basic concepts of cloud computing, mobile application and mobile cloud computing.

Chapter Four: This chapter reviews current mobile school information systems. A detailed illustration of these systems and the technologies used by them will be provided and explained.

Chapter Five: This chapter explains how the proposed system is implemented. Technical issues related to the software and hardware used by the proposed system will be illustrated.

Chapter Six: This is the final chapter in the thesis. It is a review of all the chapters of the thesis. This chapter includes recommendations, and possible future work identified through the research.

CHAPTER 2

RELATED RESEARCH

2.1 Overview

The major aim in this thesis is to establish a channel of communication for school members by developing and designing mobile application for school information system. This mobile application provides information and data upon the request to all members in educational environment (students, parents, teachers and school authority). Therefore, it is helpful to review the field of school information systems, and describe the current situation of this field, also it will be useful to describe the limitations of school information systems and discuss possible improvements.

2.2 School Information and Management Systems

Sharma's (2008) study displayed the conception and the importance of involving teachers, students, parents and community in school management. Moreover, the author points out the most important reasons for sharing the community in school management as follows:

- Parents have a right to be involved in managing schools where their children receive education.
- Schools can learn intimate knowledge of children from their parents.
- Involvement of community can improve school accountability and make school more responsive to community needs.
- Enhancing community and parents participation in the school may help to increase student's outcome.

In her study, Sharma considers the involvement of community in school management as a part of success in the education development and reforms, this strategy is to improve the school but not the end solution.

Hohlfeld, Ritzhaupt and Barron (2010) discussed the determining role of information and communication technology to communicate among families, schools and communities by presenting a conceptual framework for uniting families, schools, and community members using information and communication technology, and uses data collected in Florida from the 2003 to 2007 school years. This study has collected data during the four school years from several online databases provided by the Department of Education, Florida to the

public for research purposes. The data collected were merged by school years, school code and school type (Elementary, middle, and high schools), after that the date was tested by using logistic models with repeated measures for categorical variables. The results of study varied because rapid changes of hardware technology and proliferation during the study years, the results can be divided into:

- *Tools used to communicate:* The most widely used method of communication was print media. Followed by school websites. Then radio broadcasting, television, and hotline communications.
- *The members involved in technology planning process:* The number of member community who actively contribute to technology planning has increased.

Zhou et al. (2011) suggested to manage the primary and secondary schools based on principle of digital campus, which contains scientific openness principles, digital, standardization, and intelligent. The authors suggest a model to manage primary and secondary school. Depending on the functions, this model is divided into five systems:

- *User login system:* This system needs registy-card for each school administrator, teachers, students and parents to login.
- *Intelligent decision system:* This system mainly depends on monitoring and recoding data and information in database center for evaluation, exchange and intelligent alarm system.
- *Request system:* This system provides data and information for school authority, students and parents.
- *Foundation database center:* The database center includes students' information, teachers' information and all school information and data.

Ho, Hung and Chen (2012) discussed the factors influencing on teacher behavior by adopting communication between parents and teachers by using mobile phone messages, through applying and comparing the models of user intentions analysis to use a system which improves the communication between parents and teachers in Taiwan. To achieve a successful implementation of parent-teacher communication, the authors propose adopting three models: Technology of Acceptance Model (TAM), combined TAM and Theory of Planed Behavior (TPB) (C-TAM-TPB), and Unified Theory Acceptance and Use of Technology (UTAUT) to turn teacher behavior to use the system, these models explore the teachers behavior while using the mobile phone message to communicate with parents.

- *TAM:* This model affects whose decision about using the system by explaining ease-of-use and useful system.
- *C-TAM-TPB:* This model includes detailed social, attitudinal, and control influences in a decomposed TPB mode and provides a brief explanation about the use of IT behavior.
- *UTAUT:* This model considers three direct factors of intention to use (performance expectancy, effort expectancy, and social influence) and one direct factor of using behavior (facilitating conditions).

When authors applied intentions models, they found a mismatch in the determinants with using information technology in TAM, C-TAM-TPB, and UTAUT. Therefore, all three models were revised and modified, the models were construct to avoid confusing substantive differences between models with measurement.

Os4ed Company (2013) designed and implemented an open source web application called Open School Information System (Open SIS), Open SIS provided solution services for school information system. This application can be hosted on web or in the cloud. The designer used HTML, CSS3 and PHP program languages to develop Open SIS web application. The OS4ED Company provides services by a team of experienced consultants for implementation and provides solutions to customers. There are more than 50 educational institutions around the world that use Open SIS. The core features provided by Open SIS web application are:

- Student Demographic,
- Contact Information,
- Scheduling,
- Gradebook,
- Reports/Report Designer,
- Report Cards,
- Transcripts,
- Health Records,
- Attendance,
- Parent Portal,
- Security,
- End-of-the-Year Processing (rollover).

2.3 Mobile School Information System

Idwan (2009) developed mobile application, which is called Mobile application via Bluetooth wireless technology (MAvBT); this application uses a Bluetooth technology to enhance student-teacher interaction. The MAvBT application provided tools to share data and information through the mobile phone Bluetooth feature.

The system architecture consists of application server, client application and a website.

- The application server uses a function dedicated to execute and handle the client (MAvBT mobile application) requests and responding to client.
- The website is designed for teacher to manage the system in server (add, edit and share data and information) and to obtain feedback.
- The client application is used on student's mobile phones and provides information by access server via Bluetooth Radio Technology.

The designers implemented server application by using Active Server Pages (ASP) with C-Sharp language and implemented client mobile application by using Java 2 Micro Edition (J2ME) language. This system allows student to access the information by several options such as (Announcements, Search Mode, Student, Course, Office and Send Note).

Alzaza and Yaakub (2011) developed mobile application program called Student's Mobile Information Prototype (SMIP), the purpose of this application is to keep the students in touch with the education environment regardless of time and place. The designer developed the application adapting the scientific research methodology (discovering a problem, suggesting a solution, development, evaluation and conclusion). The SMIP application is based on wireless application protocol technology and developed by using. NET Framework language (Microsoft Visual C#.NET and ASP.NET). The architecture of SMIP Figur 2.1 includes three parts:

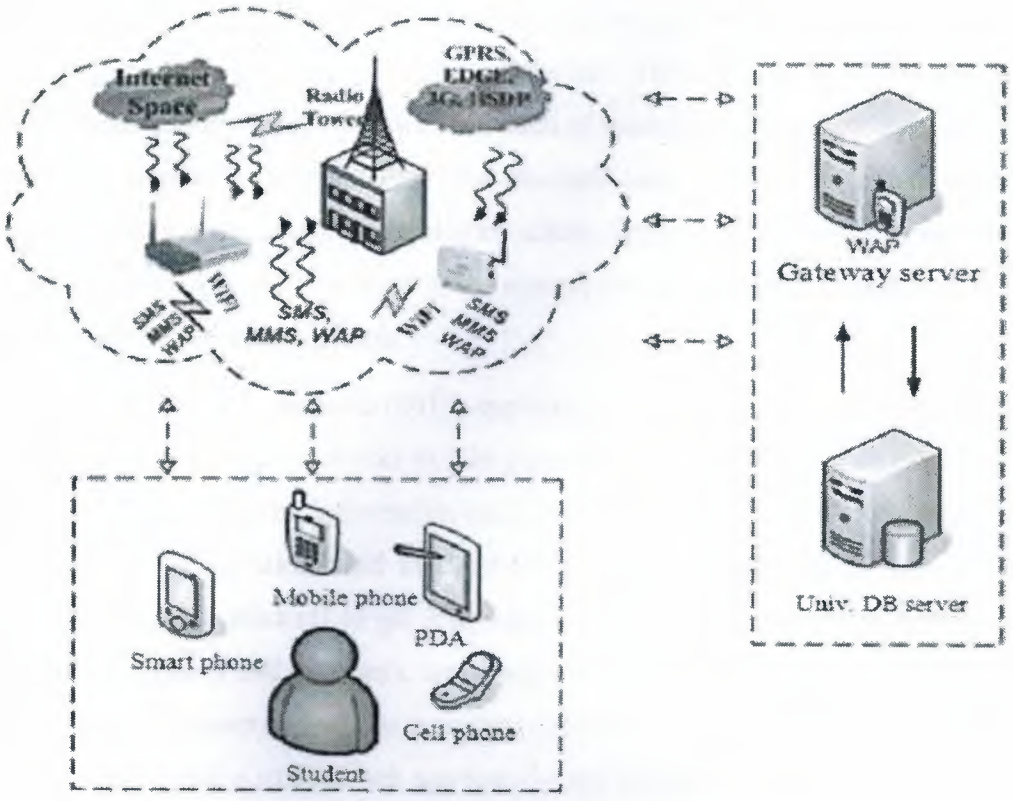

Figure 2.1: SMIP Architecture (Alzaza & Yaakub, 2011)

- *Server:* The server part includes the database, this part provides the information to the SMIP via the wireless media part.
- *Media:* Student can access to the server part via the wireless media by using mobile phone or PDA.
- *Client*: This part consists of the devices used by student to access the SMIP application.

The SMIP application provides the following eight services to students:

- Course registration,
- Course announcement,
- Exam result,
- Calendar,
- Finance statement,
- Student profile,
- Instructor profile,
- Library loan services.

Montanaro (2012) designed and developed a system to communicate between teacher and student by creating quizzes and showing results. This system includes screens for instructors and another screen for students, each of teachers and students can access via a mobile device or desktop computer. The designer used ASP, HTML5 and CSS3 for developing the system, these technologies allow display system on any handheld or desktop computer. The main features of the system are courses, topics, questions, quizzes, managing quizzes, results, and tools.

Antic, Jovanovich and Cvetanovic (2013) explained the development of an application for the iPhone mobile device that works in IOS platform to communicate with e-student Web application for accessing the information and presenting it on iPhone User Screen (UI). E-student is a web application used in the Metropolitan University in London, this web application allows the students to get information about exam scheduling, their marks for all subjects, professors and assistants, and feedback about teaching, etc. The authors' have analyzed the requirements of mobile e-student application presented on the iPhone mobile device, which adapted e student web application, and divided it depending on the function performed in mobile e student application:

1. The functions present the information and data on mobile user screen, which include exam scheduling, marks for all subjects, professors and assistants, feedback about teaching, and the student finances data.
2. The functions depend on system design, which is divided into three parts:
   a) Analysis of Application programming screen (API).
   b) Number of API requests.
   c) Secure authentication and authorization.

The IOS e Student mobile application contains five tabs (features), Report View Controller, Finances View Controller, Application View Controller, Professor View Controller, and Feedback View Controller. These tabs appear after Login view controller by checking correct data entered via e Student Web application and API. All View Controller used HTTP protocol to send and reserve request by "Get" and "Post" method included in API for achieving communication with e Student Web application.

Gunawan and Pardamean (2013) presented a design and implement mobile application for school academic information system, this mobile application Mobile School Information System (MSIS) provides information for students, parents and school authority. Also, the

MSIS open doors to facilitate communication among students, parents and school authority. The designers developed the application depending on the incremental model and divided the application into several modules. The BBM application is based on Blackberry Messenger (BBM) feature, which is available via BlackBerry mobile connection. Mobile School Information System includes the application of these modules:

- Class Schedule
- Academic Calendar
- Class Dismissal
- Scoring
- Extracurricular
- News
- Attendance
- Library Account
- Student Profile
- Map
- Private Message (PM)

2.4 Mobile Cloud Computing

Gao and Zhai (2010) discussed the limited resources of mobile devices that address large operations related to the educational process, therefore they proposed an architectural model that applies the concept of cloud computing in the development of an education system mobile, this model is based on Hadoop (an open-source software framework used for storage and large scale processing of datasets on clusters of hardware). This model is divided into five layers:

- *User layer:* This level includes the architecture of cloud computing application that displays a variety services for the client.
- *Application layer:* It is a cloud-computing platform that consists of application software and services which provide the features of cloud to the user.
- *The logic layer:* Is the core management layer of cloud computing infrastructure; also, it is responsible for resource management.
- *Virtual Resources Layer:* The virtualization is a main design technology applied to all cloud structure. They use virtualization technology to made pooling resource

from software, hardware and services to provide appropriate services to users through the network.

- *Physical layer:* This layer supports the basic environment that includes computers infrastructure, storage, network interconnection devices and database resources.

The author applied the model depending on four computer clusters (master server cluster with monitoring, compute, storage and application node clusters) to manage different functions in cloud computing platform. In this model, the user uses mobile phone to interact with the system, the system provides many cloud resources for users. All high performance processes use Map Reduce API of Hadoop framework in the background after that the results are given to the users. Therefore, of this article inferred the combination between cloud computing and mobile to promote the mobile app system to more wide and powerful applications.

Singh and Dhindsa (2013) implemented a platform architecture for connecting mobile phones with internet based Services, this architecture is designed to include middleware server for increasing the interaction between mobile phone clients and internet based web services, and deployed on cloud platforms to enhance the reliability, scalability and supporting smart phones connecting to internet services. In this study, the authors focus on two challenges in mobile phone clients to access to internet based services (bandwidth/latency problem and mobile loss of connection problem). To overcome the previous problems listed, the authors suggested the following features in Cloud Computing architecture to enhance the interaction between internet Web Services and mobile clients:

- *No loss of connection:* Creating cached copies of the service results and stored on mobile clients and the middleware, when the connection between mobile clients and middleware is lost. The stored cache is used and the data is returned after reconnecting.
- *Bandwidth/Latency:* Converting service results format from XML to R-JSON (Reverse JavaScript Object Notation) and removes unnecessary data results from the middleware.

The middleware is responsible for processing, transferring between internet web servers and mobile client, and converting the information from XML format to Reverse JavaScript Object Notation (RJOSP) format. Apache HTTP client, MySQL database and PHP API are used in the middleware.

Verma, Dubey and Rizvi (2012) explain the interaction of mobile devices with cloud technology by the services provided in the cloud such as sharing resources, content. In addition to how the cloud technologies are exploited in mobile for educational purposes. In this paper, the authors determined the challenges in mobile cloud and proposed solutions for their challenges, mobile cloud challenges are:

- *Lowering network latency:* Any kinds of processing delay in the network data.
- *Bandwidth:* The amount of data transfer between two points in a period of time.
- *Network costs:* Monitoring network conditions.

Proposed Solutions for Mobile Cloud challenges:

- *Lowering network latency:* Moving applications to cloud reduces the number of nodes that the data needs to pass, as a result possible latency effects are reduced.
- *Bandwidth:* The constantly upgraded technology of the IP-based 4G wireless broadband network as the ultimate goal.
- *Dynamic network monitoring:* Using the recently new intelligent deployment technology such as HTML5 that offers data caching, this may reduce the network latency.

Asrani (2013) presented a review of the mobile cloud computing background and architecture of mobile cloud computing, Asrani also presented the applications that can be used in a mobile cloud technology such as (mobile commerce, mobile healthcare, mobile gaming and other uses). The author expected some future issues in the developments of mobile cloud computing which needed to be addressed to move this technology to the next level. The issues are as follows:

1. *Low bandwidth:* The users' number of mobile and cloud are increasing radically while the bandwidth is still limited, therefore, the author suggested incorporating 4G technologies to overcome this issue.
2. *Standard screen:* The cloud screens are based on the web and not designed for the mobile therefore there is no integration between the screens.
3. *Quality of service:* Cloud computing provides many services to PC but cannot directly shift this service to mobile devices because there are some limitations in mobile device (network disconnection and signal attenuation).

4. *Service convergence*: In future, the mobile users in some cases need more than single cloud service inside mobile device. Hence, they need to explore the convergence service for unifying the multiple clouds included in mobile.

2.5 Summary

There are many applications developed for various mobile operating systems until now. Therefore, to develop a unique application for a mobile phone requires a great effort, and hard study. Author reviewed previous studies and research related to the field of school information systems, which focus on the latest research fight.

CHAPTER 3

THEORETICAL FRAMEWORK

3.1 Overview

This chapter provides the basic concepts of school information systems and the overall structure of the administration to school information systems. In addition it provides some of the basic concepts of cloud computing (characteristics, cloud computing service layers and deployment models), and mobile application, mobile application types, mobile cloud computing (architecture of mobile cloud computing and advantages of mobile cloud computing). Finally, this chapter provides information about mobile school information systems.

3.2 School Information Systems

The concept of the information system has become very prevalent in the field of education. The computer-assisted information system provides useful tools in the learning environments such as School Information System (SIS). In addition, it is fast, reliable and can store a large amount of data, then it can also share information and allow students and teachers to access the Internet (Becta, 2003). Visscher (2000) defines School Information System as an information system based on computer devices, consisting of computer applications and data that supported computer to enable storage, retrieval, manipulation and distribution of data to support school management. Gunawan and Pardamean (2013) define school information systems as an academic system developed and implemented for improving the efficiency of information storage and retrieval for school authority, students and parents. In Peking University, SIS studies combining communication, computer and network technologies for school to integrat the resources management and unifying access control by user to all information resources in school (Zhou et al., 2011).

The School Information System can be considered as the use of advanced and modern information technology (computer, network and communication technology) for integrating the environment, resources and activities of the school to enhance the efficiency of traditional school and expand traditional school function, to make an integrated and comprehensive educational environment, to improve the quality of research, teaching and management purposes. The SIS system consists of a set of applications that

rely on school data designed and implemented for the purpose of facilitating and improving the efficiency of storage, retrieval and distribution of information to the student, parent and school.

3.2.1 School information system structure

School information system is divided into models, each model includes one or many functions, these models and functions make the structure of SIS easy to use and develop. Following the SIS models:

1. **Member Management:** According to Cheng et al. (2010), this model is the most important part of the system, it includes three main services, and the services in this model are related to the user's account and user's privileges. The service types of registered users are as follows:
   - *Administrator user*: This user has the full authority of system control, the administrator can add, remove, edit and control of the other different users, and manage all information and resources in system.
   - *Users with the right of developing the resource*: This user could use the services (functions) in the model, to develop system resources.
   - *Normal users*: The normal user can browse the latest system information, download resources, and submit messages.
2. **Resource Management:** This model is the basic and core part of the system, all data, information and resources in the system are processed in this part (Guan, Shi & Wu, 2012). This model includes the function of uploading data and information to system, the tool of data and information download, resources organized by different categories. This model allows for the administrator user and the users with the right of developing the resource. They can also add, delete, edit or search for required resources.
3. **News Management:** This model is designed to publish latest news about the whole school (Idwan, 2009), news part consists of the important events or announcement or news about the school. The system administrator can add, delete, edit and manage all the content of this model.
4. **Message management:** This model provides a communication platform for all registered users (Gunawan & Pardamean, 2013). The users can send and receive message with some features such as one or more receiver, message type etc.
5. **System management:** The function of this model is to manage and maintain of system information (Cheng et al., 2010). It includes the basic system information, data backup,

safe management, system configuration, user rights management, registration management etc. The administrator mainly does these jobs.

3.2.2 School information system types

The school information system is a sub group of management information systems, which is used in educational organizations. School information system consists of subsystems, divided in principle to systems that focus directly on the support of the teaching and learning process (Learning Management System – E-learning) and the systems that serve for the administration and instructional decisions (Assessment Information System and Administrative Information System) (Breiter & Light, 2006).

- *Learning Management Systems:* They aim at the direct support of the learning and teaching process (e learning). All e-learning material or systems can be controlled individually or consist of materials made available for teacher and student.
- *Administrative Information Systems*: These systems consist of basic data and information that start from student records, addresses, schedules and timetables, to accounting and financial planning.
- Assessment Information System: They include information about standardized tests, projects, student works and all activities classroom based assessments (i.e. designed by the teacher).

3.3 Cloud Computing

Cloud computing is one of the distributed computing model, it is not a new technology. Cloud computing provides resources as a service that are not shared by the participants, cloud computing resources are priced and provided *"on-demand"*. The members can choose from a range of services available in cloud computing such as (servers, data storage, high performance computing). In addition it is very easy to define the resources in services such as Storage, CPU, RAM, etc. in cloud computing model (Shriwas, Gupta & Sinhal, 2012).

The popularity of cloud computing has recently increased, because of the flexibility offered in cloud computing to users by choosing the services and identification of resources, and paying only for used services. This feature has provided an opportunity for institutions with limited income, and small and medium businesses to reduce the enterprise cost.

Cloud computing is a general term developed to compile many techniques, at the same time, to provide services over the internet. There are many experts' viewpoints to these techniques that have been compiled. For example, the National Institute of Standards and Technology (NIST) defines cloud computing as a set of configurable computing resources (networks, servers, applications, storage, services, etc.) are shared and accessed on-demand network. It also can be released with the minimum management effort (Patrick & Gallagher, 2011). Cloud computing was also defined by the European Network and Information Security Agency (ENISA) as service model for providing IT on-demand, always based on distributed computing and the virtualization technologies (Catteddu & Hogben, 2009). After reviewing the definitions of cloud computing, it is seen that it involves the concept of outsourcing of data and/or computing resources with the ability to expand gradually. The following section highlights the essential characteristics of cloud computing paradigm.

3.3.1 Cloud computing characteristics

The NIST has identified the essential characteristics of Cloud computing that distinguish it from other computing paradigms (Takabi et al., 2010; Patrick & Gallagher, 2011; Gupta & Chug, 2013). The essential characteristics are:

- On-demand self-service,
- Ubiquitous network access,
- Location independent resource pooling,
- Rapid elasticity,
- Measured service.

3.3.2 Cloud computing services

Cloud computing services are classified into three models depending on the services provided. The layers are platform as a service (PaaS), Software as a service (SaaS) and infrastructure as a service (IaaS). Figure 3.1 shows cloud service layers (Patrick & Gallagher, 2011; Gupta & Chug, 2013; Shastri, et al., 2013):

1. ***Infrastructure as a service (IaaS):*** This layer provides customer with the various hardware services related with the fundamental resources of cloud computing. These include storage, processing, networks, virtualized machines and other fundamental cloud resources where the consumer is able to run and deploy software. This layer represents a foundation or basic block for the PaaS and SaaS layer.

2. ***Platform as a service (PaaS):*** The middle layer of cloud computing services is PaaS. This layer provides an environment for consumer to create and deploy programs on the cloud using programming languages, libraries, tools, and services supported by the cloud provider.
3. ***Software as a service (SaaS):*** This layer provides the consumer with applications running on cloud infrastructure, the consumer can access the applications in this layer through either a web browser (e.g., email), or a program screen. In this layer, the consumer cannot control or manage the underlying cloud infrastructure (storage, network, servers or operating systems), the consumer has some limited control of settings and user configuration.

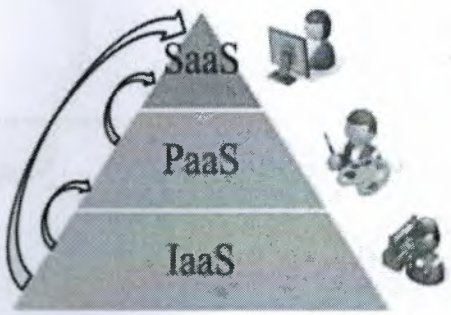

Figure 3.1: Cloud service layers (Delgado, 2010)

3.3.3 Cloud computing deployment model

There are three different cloud service deployment strategies depending upon the way provided computing services to customers, such as location of cloud services, security requirements, and the ability of manage the services, and customization capabilities. The deployment strategies or types are (Lokhande & Meshram, 2013; Pund & Deshmukh, 2012; Shimba, 2010):

1. ***Public Cloud:*** In the public deployment cloud model, the infrastructure and resources of the cloud are accessible for anyone. In this model, customers can choose the security level they need. Figure 3.2 shows the structure of deployment model.
2. ***Private Cloud:*** A private cloud is a deployment model for cloud services. This type of clouds is used by organizations that do not want to share the resources by unknown third parties. In this model, the cloud resources may be located within the client organization premises or off-site. Figure 3.2 shows the structure of deployment model.
3. ***Hybrid Cloud:*** A hybrid cloud is a model of deployment which combines two different clouds model public cloud and private cloud, Hybrid cloud allow organizations to use

more than one model of cloud deployment such as putting important data in a private cloud, and publish the general data in public cloud. Figure 3.2 shows the structure of deployment model.

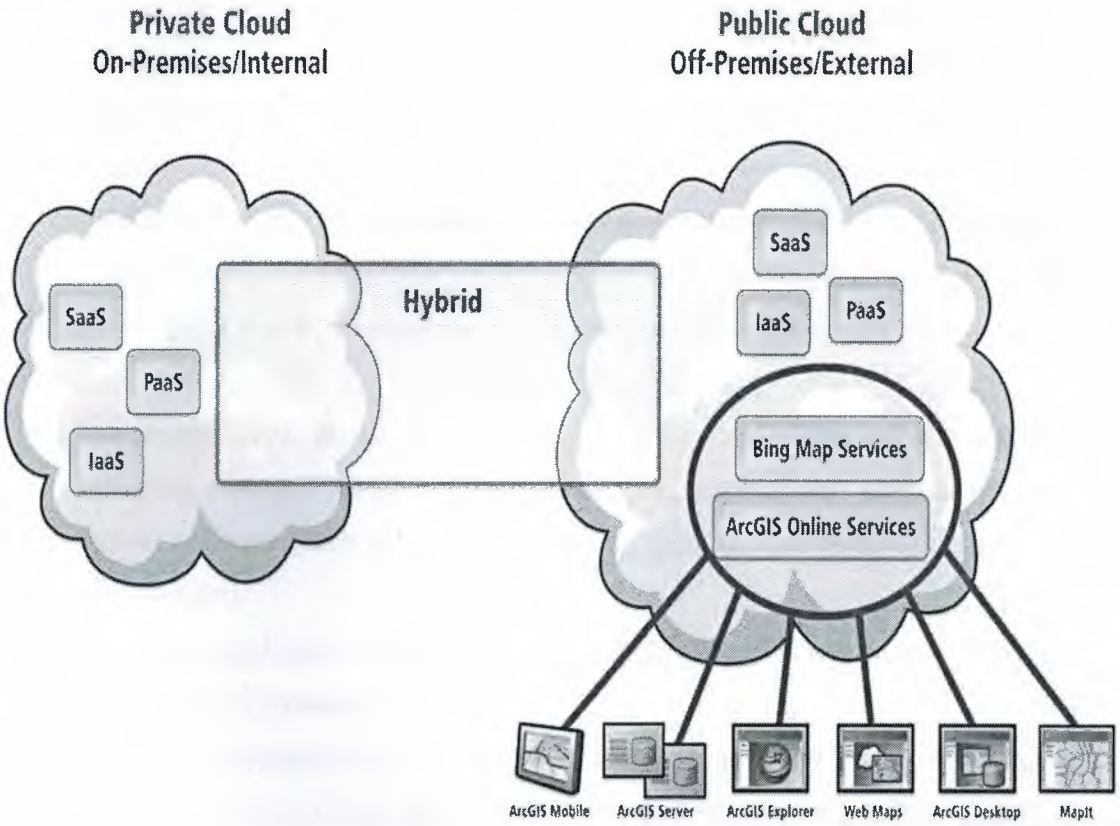

Figure 3.2: The structure of cloud deployment model (Kouyoumjian, 2010)

3.4 Mobile Application

During the recent period, the rapid development in mobile phone technology has become notable. In addition, the high prevalence of mobile phone handsets in all circles of society led to an increasing demand for mobile applications in all fields (entertainment, service, sport, health, education, commercial, etc.) because of the distinctive and useful services available by mobile application features.

A mobile application is a set of code written in a programming language to run on a mobile device to operate in the performance of a particular function designed for it (Salz & Moranz, 2013). The mobile applications are installed on a mobile device by an operating system such as (contact application, message application, calculator etc.) or downloaded and installed by the mobile owner such as (Messenger application, Facebook application, games, etc.).

3.4.1 Types of mobile application

The proliferations of mobile devices and platforms represent a set of challenges on how to build the application and how to efficiently implement them. The developer should decide which strategy is the best to develop the application adopted in the application state. Essentially, the developer can choose from the following three different mobile application approaches, each of them has advantages and disadvantages (Huang & Chang, 2012):

1. ***Native Mobile Application:*** A native mobile application is built and developed for use on a particular operating system or device. A native mobile application is downloaded from an online store and installed on the device. Mobile native applications are written in Objective C, JAVA or other programming languages (Abhineet, 2012).

   Advantages:

   - The native applications can benefit from the capabilities of the device, including on-board hardware (such as camera, graphics and GPS) and other mobile software (such as contacts, calendar, picture/video gallery, e-mail and file manager).
   - The native application has the ability to run offline on the device and users get the highest performance at all times.
   - The native applications have attracted the user attention more than others because the place of logo application in the mobile screen list provides visibility on a daily basis.
   - The native applications provide multi touch - double taps and other User Interface (UI) gestures for users.

   Disadvantages:

   - Long development time,
   - Complex development,
   - High development cost,
   - No portability (applications cannot be used on other platforms).

2. ***Mobile Web Application:*** A mobile web application is a web application developed for smartphones and tablets, and accessed through web browser in the mobile device. The mobile web application is built with the three core technologies (HTML, CSS and JavaScript) (Singh & Dhindsa, 2013). The mobile web applications are based web browser and able to run on any mobile platform (ISO, Android, Windows mobile and etc.).

Advantages:

- the main advantage of mobile web application is universal application (compatible with any mobile device platform).
- One copy of mobile web application for many platforms that means it is cheap, easy, and fast to build.
- Simple to access by URL through mobile browser (no need for downloading application to mobile).

Disadvantages:

- The limited capacity of mobile browsers compared with traditional desktop browsers.
- Limited access to the hardware and software on a mobile device and incompatibility with personal information or control of the other mobile app. also, it cannot support heavy and complex custom graphics (gaming, etc.).
- Incompatibility in browser on some mobile devices.
- Web applications need to connect in general, so the quality of the connection affects the performance of the application, in addition, the application stops when you disconnect(This changes with HTML5, the application does not stop when contact is lost) (Verma, Dubey & Rizvi, 2012).

3. ***Hyper Mobile Application:*** In addition to build native apps customized for specific platforms or create application works on any device through a browser, there is also a third option: blending the two approaches in a hybrid application. With the hybrid application, much or all of the user screen that appears in the mobile browser window, with the native application wrapped around it to provide access to device functions that are not available through the mobile browser (Salz & Moranz, 2013).

   This ability to combine mobile web applications with native mobile applications can significantly reduce the development time and cost, minimizing the custom coding work. The hybrid application looks like the native application for mobile users; it is downloaded from an app store, stored on the mobile device, and launched like a native application. But there is a huge difference to developers because rather than rewriting the entire application for each mobile platform, they write at least some of the code in HTML5, CSS, and JavaScript, and reuse it across different devices (Huang & Chang, 2012).

3.5 Mobile Cloud Computing

In recent years, cloud computing has attracted the attention of both industry and academia. Cloud computing is a collection of resources and software programs providing services through wired and wireless network. It provides smooth service to the customers by providing an integrated platform, combining software and hardware.

With the beginning of the widespread use of cloud computing, the mobile devices shared this pervasion. The mobile devices can access to cloud computing resources via wireless network, 3G or GPRS technology, Mobile cloud computing defined as the availability of cloud computing services in a mobile ecosystem. This incorporates many elements, including consumer, enterprise, femtocells, transcoding, end-to-end security, home gateways, and mobile broadband-enabled services (Qureshi, Ahmad & Rafique, 2011). The mobile cloud computing at its simplest form refers to an infrastructure where both the data storage and data processing happen outside of the mobile device. Mobile cloud applications move the computing power and data storage away from mobile phones and into the cloud, bringing applications and Mobile cloud to not just smart phone users but also a much broader range of mobile subscribers (Dinh, Niyato & Wang, 2011). Mobile cloud computing also defined by Marinelli (2009) as extension of cloud computing with a new ad-hoc infrastructure based on a mobile device.

The impact of mobile devices is similar to the personal computers in cloud computing, taking into consideration the high prevalence of mobile devices with huge number of mobile applications, which are daily issued. That led to extend the resources of mobile application through cloud computing platform resources for a new paradigm for mobile applications and made the user experience better.

3.5.1 Mobile cloud computing architecture

The mobile cloud computing architecture consists of four core parts (mobile, network operator, internet service providers, and cloud computing). Mobile devices are connected to the networks of mobile via base stations (e.g. satellite, access point, or base transceiver station (BTS)) that establish and control the connections (air links) and functional screens between the mobile devices and network operator. The mobile users' requests and information (location and ID) are transmitted to the central processors that are connected to servers providing the mobile network services.

After that, the subscribers' requests are delivered to a cloud through the Internet. In the cloud, cloud controllers process the requests to provide mobile users with the corresponding cloud services. These services are developed with the concepts of utility computing, virtualization, and service-oriented architecture (web, application and database servers) (Dinh, Niyato & Wang, 2011). Figure 3.3 shows Mobile Cloud Computing Architecture.

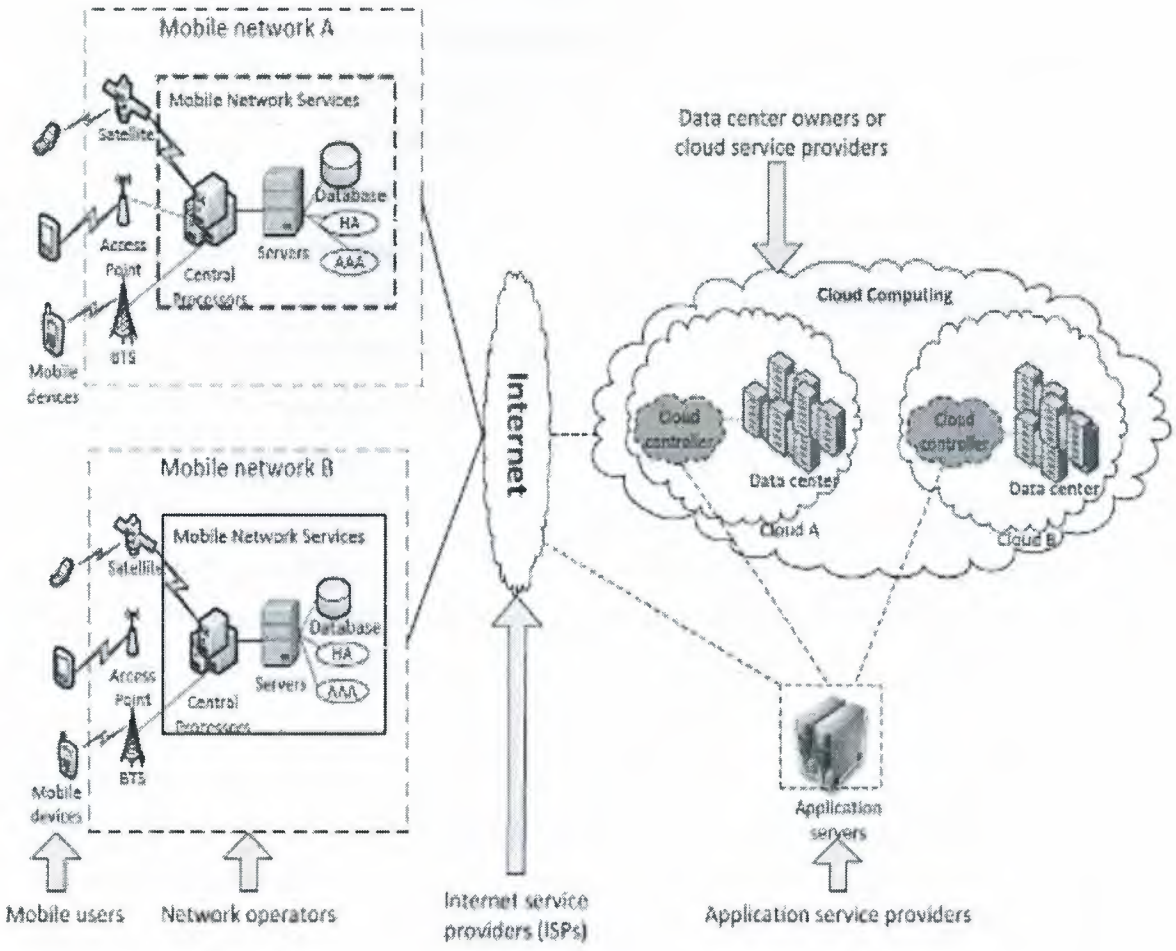

Figure 3.3 Mobile cloud computing architecture (Kotwal & Singh, 2012)

3.5.2 Advantages of mobile cloud computing

As, cloud computing provides a solution for many challenges such as mobility, communication, portability, etc. The advantages of mobile cloud computing were describe as following:

1. ***Extending battery lifetime***

   One of the major concerns for mobile devices is battery lifetime. Several solutions have been proposed to reduce power consumption such as enhancing the CPU performance and managing the screen and disk in an intelligent manner. However, these solutions may not be feasible for all mobile devices because they require changes in the mobile device structure, or require a new hardware to a mobile device that results in an increase of cost. Mobile cloud computing is proposed to calculate offload technique designed to deport the large computations and complex processing from devices of limited resource (mobile devices) to cloud servers. This avoids mobile devices to run applications with the longtime of execution which leads to a large amount of power consumption (Dinh, Niyato & Wang, 2011).

2. ***Improving data storage capacity***

   Storage capacity is also one of several constraints of mobile devices. Mobile Cloud Computing has been developed to enable mobile users to store/access to large data on the cloud through internet. An example of storage service is Amazon Simple Storage Service (S3) which supports file storage and sharing. With mobile cloud, users can save a considerable amount of storage space and power on their mobile devices since all images are sent and processed on the clouds. Flickr and ShoZu are successful mobile photo sharing applications based on cloud computing. Facebook is not only a successful social network application today; but also a typical example of using cloud in sharing video and images (Mehta, Ajmera & Jondhale, 2013).

3. ***Improving reliability***

   One of the reasons that increase and improve user reliability to run applications and store data on the cloud is that data are stored and packed up on a number of computers. This way reduces the chance of data loss on mobile devices. In addition, there are many other services that improve the user reliability such as protecting copyrighted digital contents (video, clip, music, etc.) from the unauthorized distribution. In addition, mobile cloud computing inherits some advantages of cloud services for mobile such as dynamic on-demand provisioning, scalability, multi tenancy, ease of integration (Dinh, Niyato & Wang, 2011).

3.6 Mobile School Information System

Evolution of mobile devices not only led to increase the demand for personal applications, but also led to increase the demand for these applications by companies, banks and government departments, as well as educational institutions. One of these applications is the school information systems; they develop an application for administration to schools in with the mobile phone is an effective way to improve the educational process, because of the features available in the mobile phone.

3.6.1. Mobile school information system challenges

The proliferation of portable devices companies and different operating systems is leading to the emergence of a range of challenges to the use of mobile phone applications in the effective areas, these challenges include:

1. *Limitation recourse:* Despite great advances in phone technology, sources of mobile phone (Storage, CPU and Battery life) are still limited (Wang, Lin & Pedram, 2013; Sharma, Kumar & Trivedi, 2013).
2. *Phone operating system:* Multiple operating systems of mobile phone is a challenge for application developers, in addition to different development environment (Android, IOS, Windows phone, etc.) and different development languages (Java, Object C, C#, etc.) (Kovachev, Cao & Klamma, 2011).
3. *Connection loss:* One of the main challenges when developing a school information system is the way of communication and how user access data and information, as well as the alternatives when connection is lost (Gunawan & Pardamean, 2013).

3.6.2 Mobile school information system advantages

Using mobile device in the school information systems provides many benefits to the learning environment and students, especially now that mobile phone technology is constantly evolving. The advantages are (Idwan, 2009; Alzaza & Yaakub, 2011; Montanaro, 2012; Gunawan & Pardamean, 2013):

1. Easy access to (data and information) and communication between the educational environment and the community.
2. Increasing the efficiency of the educational process by the introduction of parents, leading to improve the level of student.
3. Mobile school information system keeps students in touch with parents and the education environment regardless of time and place.

4. This system provides a simple and easy way to directly or indirectly connect with parents.

3.7 Summary

This chapter provides some basic information and concepts related to mobile phone (mobile application types and mobile cloud computing), in addition to some concepts of school information systems and challenges in the use of mobile phone, which leads to take advantage of cloud computing to improve the use of mobile school information systems and overcome some of the system challenges.

CHAPTER 4

SYSTEM ANALYSIS

4.1 Overview

This chapter explains the school information system developed by the author, through describing system analysis and design, documentation of the proposed system. It is the most suitable way to understand the system through explaining technologies used in system and system developing phases. Analyzing the system makes the system understandable by users.

4.2 System Architecture

The system architecture is shown in Figure 4.1. It is divided into two parts:

- Server side
- Client side

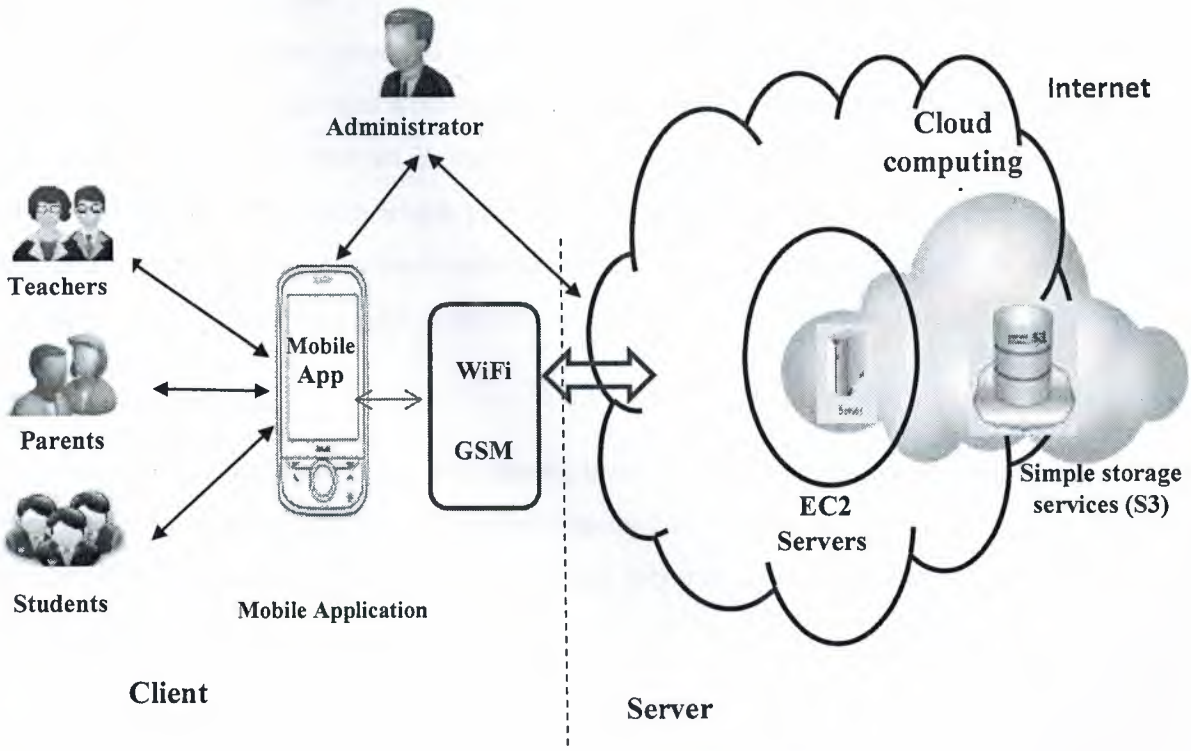

Figure 4.1: The developed system architecture

Server Side: It includes the services provided in cloud computing. The author used the system services provided by Amazon Company Elastic Compute Cloud (EC2) and Simple storage services (S3). The author chose Amazon company because it is one of the famous cloud computing companies and it provides all cloud computing services layers (SaaS, PaaS and IaaS), in addition, it provides great flexibility in the choice of the characteristics of the services provided, such as in EC2 serves the customer to choose the operating system (Window server, Linux, Ubuntu) and S3 serves the customer to choose any capacity of storage.

Server side is responsible for allowing the client to access to the information after the validated access tokens, In addition, it provides a set of tools that allows the administrator and authorizes teachers to add, modify, delete the information provided by the system such as (News and Announcements, grades, photos, etc.). It is worth mentioning that the administrator can access to the system (Server side) via Remote Desktop by computer, or through browser to prepare initial setting of the system.

Client Side: It is related to users who have permission to use the features system in depending on the user type (administrator, student, parents and teacher). The client user can access all information provided from the server (News and announcements, grades, photos, etc.). User can also send a message to another user in system. The client can access to the server through the internet in mobile (GSM or WiFi) or messages. The client side consists of mobile application which provides user screens through it client can get the data, and manage it through contact with the servers, when communication outage mobile application uses the mini data base in mobile resource.

4.3 System Description

This system consists of three major subsystems; these systems cooperate with each other to do customer jobs and services, each system has several models (sub-systems) that work together with different functions. Each subsystem job will be explained in the following section:

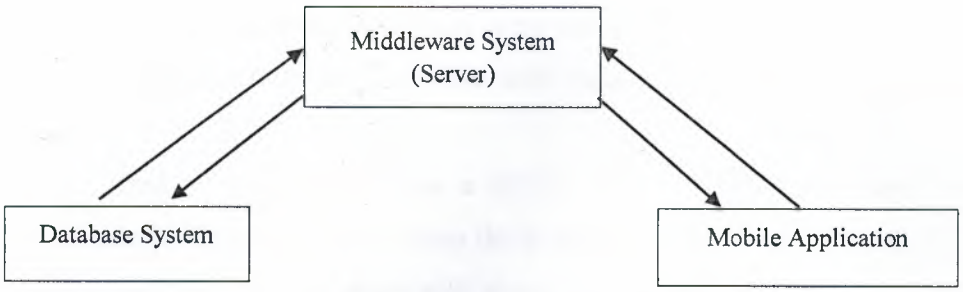

Figure 4.2: The developed system description

Figure 4.2 describes the main parts of the system and the cooperation among them to run a system as follows:

1. ***Mobile application***: It is part of school information system that offers several features for the end user (administrator, students, teachers and parents). These features provide services to users through the exchange of information between the application and the database by server. In order to implement the proposed architecture with client side, the application uses native libraries on mobile for accessing device resources. The client application can be divided into three layers, UI, SQLite database and controller. The application can be interacted with the user through the UI. The controller is the key coordinator among the UI, SQLite database and middleware. The controller responds to the user's request on UI to get data (JSON format) from the middleware to view on UI and store data in SQLite database after the data appear on UI.
2. ***Server:*** The main purpose of this part of the system is to manage the connection between the mobile application and the database, in addition to a set of mathematical and statistical operations and verification of information. This part of the system provides a set of sub-programs that work on receiving and responding the requests from mobile applications and database which hosted in virtual servers in cloud such as Middleware server, middleware acts as a proxy through which mobile users are allowed to access the database and cloud computing services, when making the processes outside the mobile in servers by middleware then the results return a large part of the mobile energy to the application consumer. The role of the middleware is to organize and manage the transfer of data between the mobile applications, cloud computing and the database, technically the process is done through the following steps The middleware responses for mobile application request, the request format is Simple Object Access Protocol (SOAP) or JSON and it delivers the service result to the mobile

application. Middleware execution starts with an HTTP *"GET"* or *"POST"* request with a URL path that contains identifier with data, the following steps explain the middleware:

a) The mobile application sends a HTTP *"GET"* When the request contains insensitive data or *"POST"* when the request contains sensitive data,
b) The middleware server deals with interactions to the Web Services,
c) Middleware exchanges data and requests with the mobile applications by JSON format,
d) The middleware sends data and information to server format by SOAP or JSON depending on data if request type *is "POST",*
e) The middleware returns the optimized result to the mobile application with noticing whether the operation is successful or not.

3. ***Database system:*** The database is part of the information system used for managing data system and there is other operations, including storage and archiving information and retrieval by student. There are two types database in the developed system, the first one (MySQL) which located in cloud, all system data stored on it. And the second one (SQLite) which is located in mobile recourse, part of data system stored on it.

4.4 System Technologies

A set of technologies that offer many improvements and flexibility in the use of school information system, will be clarified in the next section.

4.4.1 Mobile application technology

The developed system is mainly based on a mobile phone, because the mobile device properties are like the available ones in the mobility with user, pocket size, allow access to internet, easy to use, etc. The author used set of mobile development technologies and tools to develop application for the system. The most important techniques and tools that have been used are:

- ***Eclipse:*** Integrated development environment tools is used to help the developer to develop application and programs the version of eclipse 4.2.1 which used by developer in the thesis.
- ***Android SDK:*** The different in libraries in the Android system depend on the versions. (SDK) libraries are development tools necessary to build and test

applications for Android, The application that was developed in Android 4.0 API level 14 or above.

- ***Application development language:*** the author developed mobile application in this thesis by Java programing language with Android API.

4.4.2 Server technology

One of the main characteristics of the system developed that computing does not depend entirely on mobile resources, but a large part is in the cloud, that cloud computing services provides services and technologies. In addition the most important technology services used in server side are:

- ***Elastic Compute Cloud (EC2):*** EC2 is a virtual machine (VM) hosted on Amazon company servers in America or Europe, also the virtual machine in EC2 is called instance, the reason for choosing Amazon company as the cloud computing services provider is that; in Amazon EC2 the user can choose the appropriate operating system for instance (windows, Linux or Ubuntu). In addition, EC2 provides platforms for Database, web server and web application architectures (Amazon, 2013). The author used EC2 servers in the system to apply the server application (middleware codes), and hosting database. EC2 provides a range of features that enable the selection of appropriate services for the system in terms of the available cost.
- ***PHP Language:*** PHP is programming language used for programming the middleware, which used to link and exchange the information between the mobile application and the database.

4.4.3 Database

- ***MySQL:*** It is an open source relational database management system. It is based on the structure query language (SQL), which is used for adding, removing, and modifying information in the database.
- ***Simple Storage Service (S3):*** The Amazon Simple Storage Service (S3) was choose, because this service provides a storage space for unlimited amounts of data. Data stored in the form of files in buckets, each bucket has a unique key, each key and buckets are one object. S3 provides characteristics that allow the share of the data in the bucket or a particular data, in addition, S3 supports data download from S3 through HTTP or Bit Torrent Screen (Amazon, 2013). S3 is used in the system

to store images and files for the system that does not need to process, S3 services provide several options to determine the storage capacity and the amount of data that moves and which can be used on demand.

4.5 Mobile Operating Systems

A mobile operating system (OS) runs on a smart phone, tablet, PDA or other mobile devices. The smart phones combine some features of a personal computer with cellular technology such as wireless networking, Bluetooth, GPS navigation, touch screen, music player, camera, and other features. The mobile OS controls all these features and provides to the users the accessing ways and interacting with them (Ballagas & et al., 2006). The major mobile OSs platforms are Android, IOS, Windows Phone and BlackBerry, based on the market shares. The share of Android is 79.3%, IOS is 13.2%, Windows Phone is 3.7%, BlackBerry OS is 2.9% and other platforms 1.0% (ABI, 2013), Figure 4.3 shows the marketing of each smartphone operating systems.

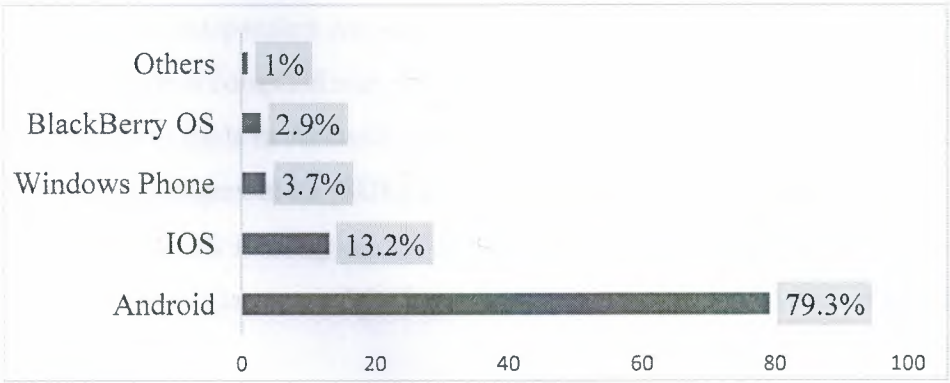

Figure 4.3: Smartphone operating systems market share (ABI, 2013)

The task of the development process is to choose the mobile platform and understand the different requirements based on the uniqueness of this mobile device. Therefore, in this thesis, the author selected Android platform to develop the system. The reason for choosing Android platform in this application because it is the most prevalent and open source.

4.5.1 Android

Android is a comprehensive open source platform designed by Google and owned by Open Handset Alliance. This alliance aims to accelerate innovation in mobile computing and offer consumers a richer, less expensive, and better mobile experience. Android is a Linux-

based operating system, mainly used for running mobile devices such as smart phones and tablet (Butler, 2011). Android is an operating system and a complete software for mobile devices. Android APIs are a rich set of system services that provides easy access to several features like telephony, location, web, Wi- Fi, media, camera, etc.

4.5.2 Android advantages

The android platform features for mobile devices are the reason to choose Android for developing mobile application in the system, the most important advantages for Android, are (Hall & Anderson, 2009):

- Android is based on an open-source Linux operating system. In addition, Android is an open-source platform that anyone can contribute.
- Application development language in Android platform is Java language and Java language is characterized by (Oracle & Java, 2013)
  - easy to understand and learn,
  - object-oriented,
  - platform-independent and secure,
  - Java code is compiled and run by Virtual Machine.
- Development tools in Android platform are free, of easy access and download, the software development kit (SDK) and Eclipse development environment.
- The Android OS running on the mobile devices from different manufacturers of mobile devices (Samsung, LG, Sony Ericsson, Huawei, etc.), which made it widely spread.

4.5.3 Programming language

Mobile applications can be written in several different programming languages and it depends on the mobile phone platform, to write the client part used Android applications in Java, IOS object C, Windows Mobile C Sharp etc. Therefore, in this application Java programing language is used, in addition to PHP Web Application languages to write the server part of the system and used SQL Database languages to retrieval data from MYSQL Server Database.

4.6 Application Features

The author developed system to provide services for school (administrator and teachers), student, and parents by making communication among school, parent and student easier, and the user can get the information needed from school without formal request. The services provided in the system are:

- ***Login Mode:*** This feature allow student and parent to use the application with two mode *offline* and *online*. User must be select the mode from login screen. The features which work with offline mode it's used to view information. The login mode is common feature for the student and the parent.
- ***Manage Accounts:*** Through the feature of manage accounts the user can create account for application users (teachers, students and parents), and enter user data such as name, class, etc. This feature work online mode only and used by administrate user only.
- ***Manage Classes:*** Through the feature of manage classes the user can create classes and determine the students number in class, in addition to the possibility of modifying and deleting classes. This feature work on lien mode only and used by administrate user only.
- ***Manage Courses:*** Through the feature of Manage Courses the user can add courses, and course information such as the teacher name, course name etc. This feature work on lien mode only and used by administrate user only.
- ***Classes Search:*** Through classes search feature, the user can find classes and access to students and parents in each class. This feature work on lien mode only.
- ***Search:*** This feature used to make quick to find student or parent. This feature work on lien mode only and it is common feature for administrate and teacher.
- ***Password:*** This feature allows the user to change the password of the user account. This feature work online mode only and it is common feature for all application users type.
- ***Academic Calendar*:** This feature provides for all application users type the important dates and all school events including school assignment due dates, exams and school holidays, national holidays and other school calendars are displayed. Parent and student can use this feature work with online and offline mode.

- ***Attendance:*** Attendance feature used by teachers to set absence for students with all details such as verified the absence by the parents and late times etc. Attendance is common feature parent and student, and they can used this feature work with online and offline mode.
- ***Behavior:*** Through behavior feature, parents can follow-up the student behavior regarding any positive or negative incidents with the teacher. Parent can use this feature with online and offline mode.
- ***Grades:*** In this feature, parents and students easily access and review all grades for student courses. On another hand, teachers can add any type of grades (quizzes, project, monthly exam, mid exam, final exam, etc.) to student. Parent and student can use this feature with online and offline mode.
- ***Info:*** This feature provides all information about student (student information, communication address, address and parents information, etc.) and school information (School name, type, contact info, address, telephone, mobile, etc.). The information in this part are periodically updated by the school or by request from the student's parents. The Info is a common feature for all application users type, parent and student can use this feature with online and offline mode.
- ***Login History:*** This feature in the mobile application gives the history of user visits for each login. From this feature, school can follow up the amount of application use by parents and students. The Login History is a common feature for all application users type, parent and student can use this feature with online and offline mode.
- ***News:*** This feature delivers news sent from the school to students and parents. This feature divided into three parts, namely News, Events, and Announcements, the first part is the News, this part publishes the latest news of school (ex. School Activities, school team news, etc.). Events is the second part to publish school events (ex. Competitions, sporting events, etc.) and the last part is Announcements to publish school announcements. All information in this feature are added from the system administrator or users who have permission from the administrator. Parent and student can use this feature work online and offline mode.
- ***Messages:*** This feature allows all application users type to send and receive messages between each other, with the option to send messages at a certain time.

This feature makes communicate more easily between students and parents with school staff. This feature work with online mode only.

- ***Photos:*** In this feature, the user can store and view all the photos that schools uploaded of events, activities, etc. Only school can upload photos to system, and the uploaded photos are stored in a cloud. This feature work online mode only.
- ***Schedule*:** This feature provides to students and parents to view class schedules easily. In addition school can manage all schedules items quickly. The schedules is a common feature for all application users type and parent and student can use this feature work with online and offline mode.

Table 4.2: common feature for users

Common Features	**Users**
Search Classes Search	Administrator and Teachers
Behavior	Administrator, Teachers and parents
Login Mode	Parents and Students
Academic Calendar Attendance Grades Info Login History Messages News Password Photos Schedule	Administrator, Teachers, Parents and Students

4.7 UML Use-Case Diagrams

The analysis of use-case, illustrates the way how system behaves, how the sequence of actions for each request is applied, and relations between the user and other subsystems. Here how the user can get the benefits of the system through some of potential usage scenarios is explained.

4.7.1 Administrator actions

The administrator manages all characteristics and features of the system see Table 4.2. In addition to assign the privileges to teachers and add, update, delete system member (student, parent, teacher and managers). The Figure 4.4 shows all administrator actions; the following are the characteristics that are used by administrator:

- ***Manage Account***: Administrator actions in Manage Account feature, include adding users, such as teachers, parents and students also the administrator may enter initial users' data (name, surname, mobile number, address, etc.), and the administrator can edit users accounts.
- ***Manage Classes:*** Administrator actions in manage classes feature include adding classes and classes information (the class name should have a unique name, e.g. Class a1, class a2 etc.), editing class and removing classes (no enrolled students will be in a class).
- ***Manage Courses:*** Administrator actions in Manage Courses feature include adding, editing and removing courses. In addition to insert course information (name, class, teacher, date, state etc.).
- ***Search:*** The administrator can use search feature to find student or parent information.
- ***Classes Search:*** The administrator can use classes feature, to access classes information.
- ***Message:*** The administrator can use private message to communicate with other users
- ***Password:*** The administrator can use password feature to change his/her password.
- ***Schedules:*** The administrator can do all functions in schedule feature add, remove and edit information (set the class courses time and location) in timetable for school classes.

- ***Photos:*** The administrator can do all functions in photos feature (upload and remove) photo from the cloud and set information for photo (title, date, related with).
- ***Login History:*** The administrator and teachers can view the login information (date, time) for each student to know which features of the application were visited more.
- ***News:*** The administrator can do all functions in News feature including add, remove and edit News, Events, Announcements (news title, Date, type and details) for school.
- ***Academic Calendar:*** The administrator can do all functions in Academic Calendar feature add, remove and edit information (title, date, event and notes) in the school academic calendar.
- ***Exit:*** This feature allows the user to close the application.

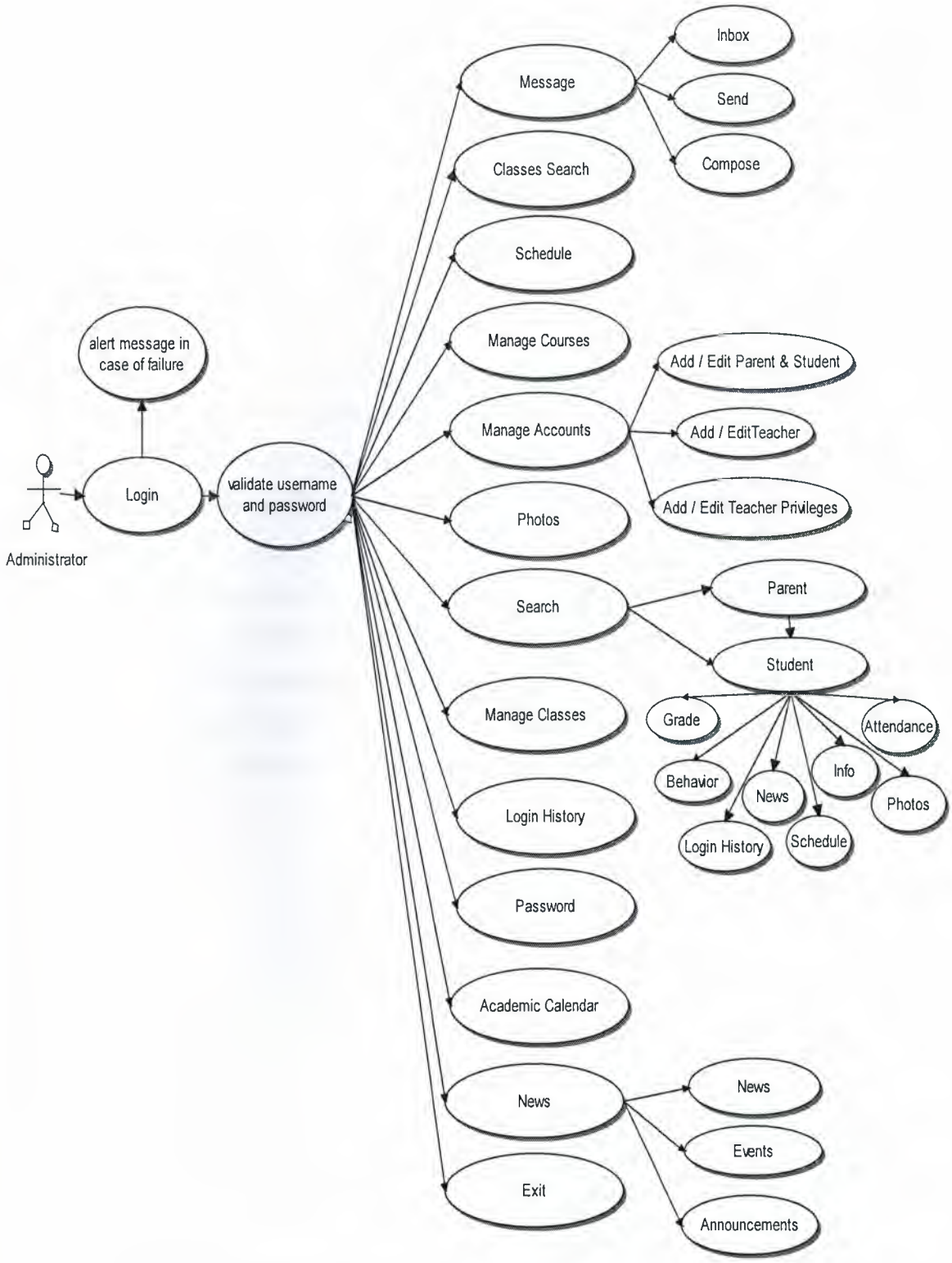

Figure 4.4: UML Use-Case diagram for administrator actions

4.7.2 Teacher actions

The system provides a set of features such as adding, editing deleting student grades and providing the attendance and absences to be kept. These features are in addition to the common features shown in Table 4.2.

The characteristics that can be used by the teacher are explained below:

- ***Grades:*** The teacher actions in grades feature include assigning student grades, by two ways, the first is assigning grades to students individually, and the second way is assigning grades to students collectively.
- ***Attendance:*** The teacher actions in attendance feature include recording student attendance, and checking the verification from parent.
- ***Behavior:*** The teacher can use behavior feature that is provided by the Application, this feature allows the teachers to update or add behavior incident for students in the class or school.
- ***Login History:*** The teachers can view the login information (date, time) for each student and which of the features of the application were visited.

In addition, just like the administrator, the teacher can browse and use other features provided by application which are (News, search, classes search, photos, academic calendar, login history, schedule, message and password). Figure 4.5 shown all actions of the teacher.

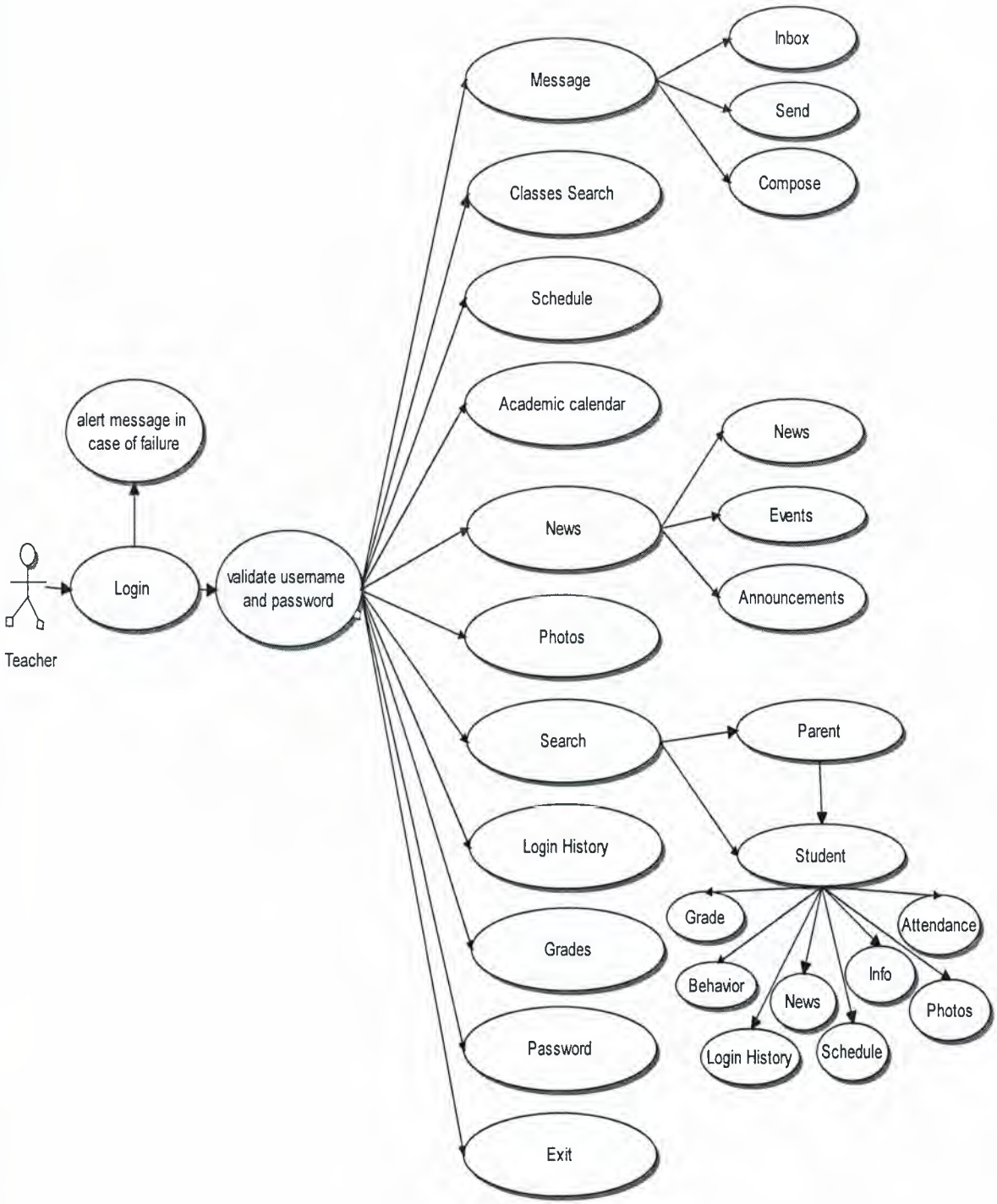

Figure 4.5: UML Use-Case diagram for teacher actions

4.7.3 Student actions

The students actions in application features are grades, attendance, schedule, academic calendar, login history, message and news the same features used by the administrator but in students actions just viewing without editing. These features are in addition to the common features shown in Table 4.2. Figure 4.6 shows all actions of the student:

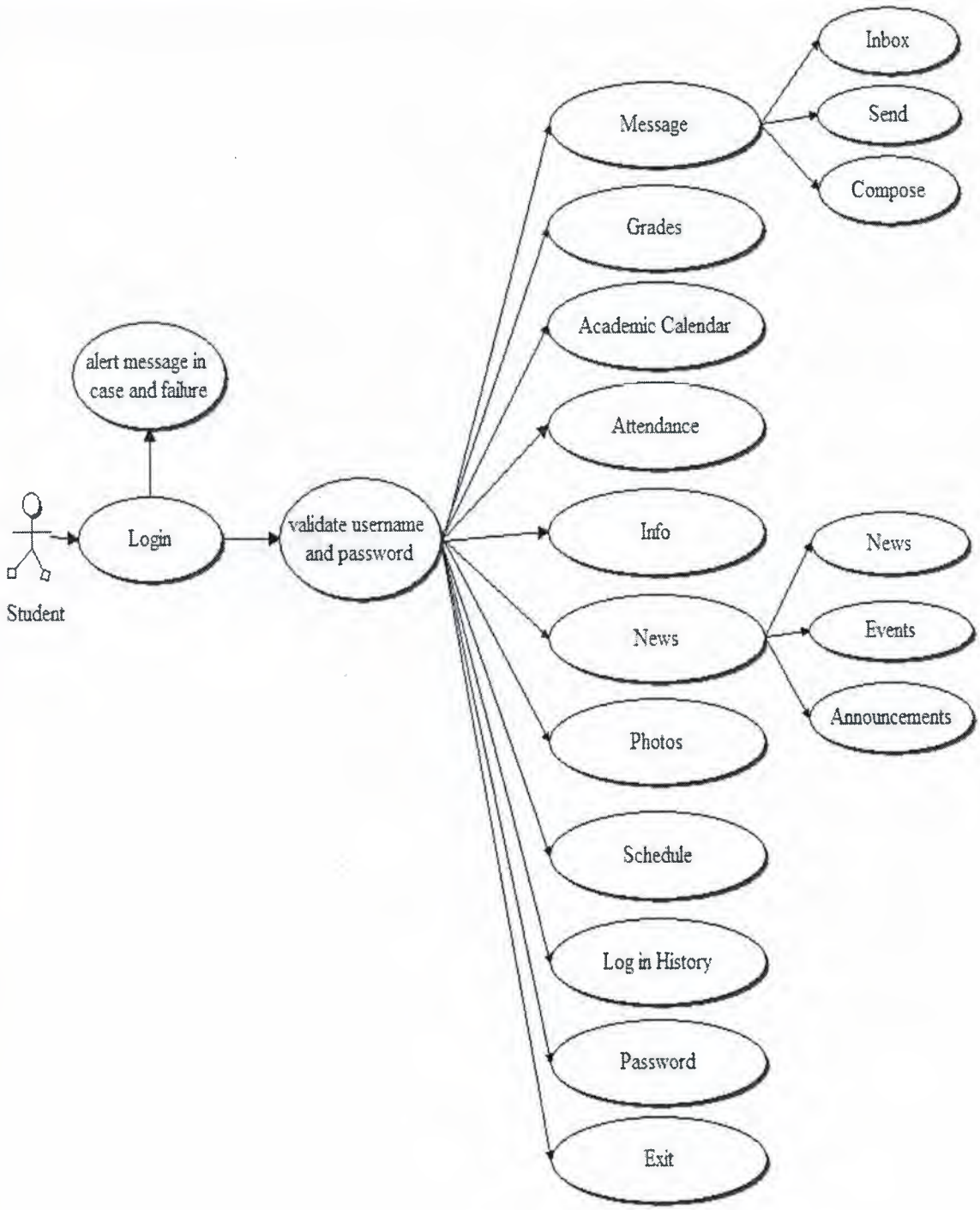

Figure 4.6: UML use-case diagram for student actions

4.7.4 Parent actions

The parents actions in application features are grades, info, photos, password, attendance, schedule, academic calendar, login history, message and news which are used also by the administrator but in parent actions just viewing without editing. In addition, there are features specified for parent such as behavior and login history. These features are in addition to the common features shown in Table 4.2. Figure 4.7 shows all actions of parent.

Figure 4.7: UML use-case diagram for parent actions

4.8 Database Design

The system depends on a database to store and retrieval all information and data needed by the system. The system database consists of 19 tables. The database is designed in a MySQL Server 5.2. The Table 4.1 shows the database content:

Table 4.1: List of database tables

Table Name	Definition
Academic_calender	This table stores the important dates of the academic calendar and all school activities, including school holidays, exams, etc.
Attendances	This table stores student attendance and absence, with the date and the student absence type.
Behavior	This table stores all information about the student's behavior.
Check_info	This table used by the system to store information about private messages and news features.
Course	This table stores all courses information.
Grade	This table contains all information about the grades for courses and degree type.
Login_history	This table automatically storing the information of each application login by user
News	This table stores all school news with the type of this news (News, Events and Announcements).
Parent	This table stores all information related to student parent such as name, address, etc.
Photos	This table stores information about photos (name, type, related, and URL in cloud services).
Private_message	This table shows the content of all massages sent and received
Privileges	This table stores user privileges for using application functions (add, delete and edit).

Schedule	This table stores weekly schedule for courses with the time and location of the classroom.
School	This table stores information about school authority (teachers information).
Student	This table stores all information related with student such as name, surname, parent, address, etc.
Users	All application users should have a record in this table. This table shows the content of user account.
Visitor_register	This table filled automatically after the user logs on to the system. The information in this table refers to the services used by users and the time of using or visiting.
Grade_Type	This table content form grade categories and percentage for each category.
Classes	The school classes name and information store in this table.

4.8.1 Entity relationship diagram

The most important step of systems analysis is to clarify the relationships between entities in the system (an application), including the application that uses the patrol operations, such as updating and usage should be clarified the design of the application database through Relationship Diagram which shows all the relationships and entities in the application. Figure 4.8 shows the Entity Relationship Diagram for the developed mobile system.

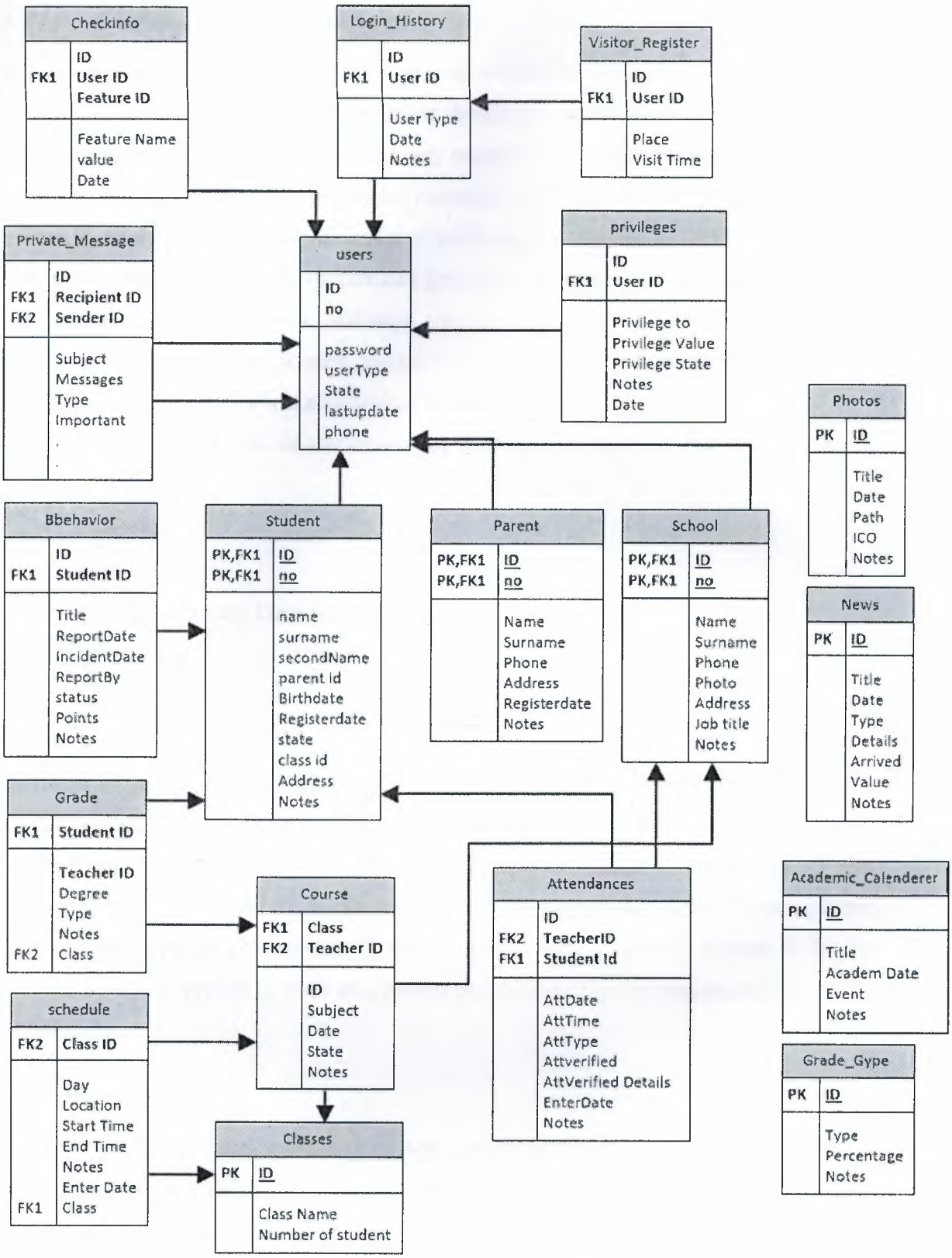

Figure 4.8: Entity relationship diagram

4.9 System Development Methodologies

A large application development project should include the adoption of systems analysis and design methodology. More experience developer should be provided in order to achieve different required objectives. In many respects, developing applications for mobile is similar to other software development; common issues include integration with device hardware, as well as the traditional issues of performance, security, reliability, and storage limitations. Moreover, mobile applications present some additional requirements that are less common with traditional software applications, such as power consumption, complexity of testing, user screens, potential interaction with other applications, sensor handling and native and hybrid applications (Wasserman, 2010).

There are various software development methodologies or models. They are as follows (Dahiya, 2010):

- Parameter,
- Waterfall,
- Rapid Application Development (RAD),
- Prototyping,
- Incremental,
- Spiral.

In thesis project, the author used RAD methodology because it is the best fit for this project especially there is one developer and reduced development time in addition to increase reusability of components. The main reason why RAD is the best fit for this project is that this project is highly interactive with four clearly defined user groups: admin, teacher, parent and students. The RAD methodology is also of a great fit for the way the developer prefers to work on a project in that broken up into manageable iterations (Montanaro al et., 2012).

4.10 User Interface

Using UI principles and guidelines is very important to develop and design mobile application, because the UI design can be helpful for users to increase their performance and grasp application. A simple user screen and usable interaction design will definitely support the application popularity. Providing an intuitive and user-friendly screen is a challenging task. This challenge is even harder when it comes to mobile phones such as devices that have limited interaction possibilities and smaller display size. Therefore, the

designer needs a motivational design strategy to be included in the mobile application. The designer chooses a motivational design strategy that depends on Attention, Relevance, Confidence and Satisfaction (ARCS) due to its suitability of design strategies for mobile applications (Seraj& Wong, 2012).

4.10.1 Design arguments

Two attributes should be considered in developing a mobile application. In this case, users and usability of the application are the two points highlighted by the researchers (Grasso &Roselli, 2005; Seong, 2006):

Users: User is the most important attribute that needs to be evaluated by the developer before further developing a mobile application. Thus, developers should examine users' characteristics in terms of age, gender, and the level of education and their familiarity with the mobile devices. These terms can help designers and developers to be aware of the user's attitudes and the expectations of a mobile application. Evaluating the users before further development is significant so that it helps users to use the application at ease. Otherwise, any complex methods of using and interacting with a mobile application will cause difficulties for the users. In this system, there are two types of users:

- Intermittent (e.g. Teacher, student, parent),
- Professional (e.g. School administrator).

Usability: In the mobile application adopted, Usability is an attribute to define the quality of user screen design and interaction of an application. Usability can be measured by the quality of users' experience during the interactions with the screen of an application (Seraj, & Wong, 2012). The reasons to choose usability are (Fetaji, 2008):

- Reducing the time and cost of training,
- Increasing learning performance and users' satisfaction,
- Reducing the errors that the user encounters during interaction with the system,
- Improving quality of screen interaction.

Therefore, a set of design principles should be followed to provide an acceptable mobile application in terms of usability level. Moreover, the user screen limitations of a mobile application such as small screen size, poor resolution, limited storage facility and lower processing capacity. As a result, the screen must be designed in a simple way without any complexity and the application must not involve high processing capacity.

4.10.2 Principle of user screen design

The principles of User Interface Design (UID) according to ISO 9126-4 (2004) and Motiwalla (2007) which is used in mobile application in this thesis can be considered for designing and developing a mobile application as follows:

1. Navigation should be simple and clear from a page to any particular section. In short, navigation should be consistent throughout all pages in an application.
2. Reduce scrolling frequently.
3. Application should be user-friendly and allows users to understand how the application works in a few minutes (ease of use).
4. Similar actions and information need to be located in similar positions. For instance, similar buttons must be found in similar positions for the whole pages of the application.
5. Flexibility of the display is the significant property for usability of screen design.
6. User control of the learning application should be allowed by the learners.

4.11 Summary

This chapter explains system parts such as mobile application developed by the author through the UML diagrams for all user types (administrator, teachers, student and parent), and explains the services provided by system for users. In addition to describe the technologies used in system in client and server side such as cloud computing (EC2 and S3), programs language and mobile platform.

CHAPTER 5

SYSTEM IMPLEMENTATION

5.1 Overview

The developed mobile application for school information system is used to Manage Relation and communication between the Teacher, Students and Parents (MRTPS). MRTPS allows access to student and school information anytime and from anywhere by smart phone. The most important part of any system is system implementation. It describes the various functionalities step by step under each module with their outputs. In this chapter, a description of the system with snapshots will be given to illustrate the use of the system.

5.2 Stakeholders

In MRTPS stakeholders have been classified into four categories, classification depends on the user requirements with regard to application functionality and features, and next section explains categories of stakeholders.

1. **Administrator**

   The administrator responsibilities are manage, maintain and configure system (initial settings).

2. **Teacher**

   The teacher is the user title in MRTPS, used by the people who communicate with the student directly in school and update students' information in the system.

3. **Parent**

   The parent is the user title in MRTPS, used by the persons who are responsible for the student, parents can follow student education level in addition to connect parents with the school.

4. **Student**

   The teacher is the user title in MRTPS, the student is the backbone of the application, and student uses the application to communicate with the school in and out school hours.

5.3 Administrator

MRTPS system is managed by administrator, with a number of steps and tasks:

1. Server configure,
2. Import database structure to system,
3. Insert initial school information,
4. Add users,
5. Create user privileges.

The previous five points describe administrator functions or tasks in the system before using the application. On the other hand, administrator tasks in the application are managed by the following screens.

5.3.1 Login screen

The administrator user is part from the school therefore administrator should select "School" option in login screen, and then enter the user ID and password to login. The user ID must be numerical character. There is an option called "Remember Me" which used to save user ID, password and login type, so that the user can login anytime without having to rewrite the login details. Figure 5.1 shows the administrator login screen options.

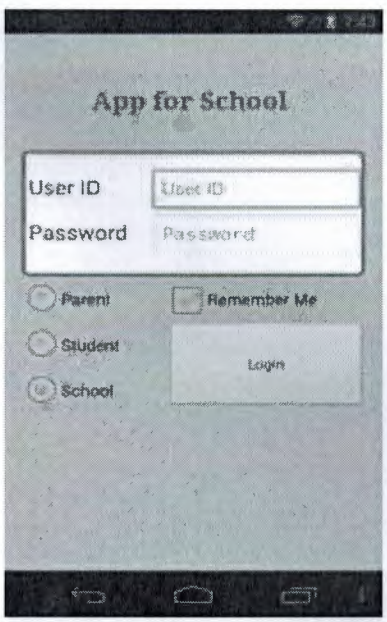

Figure 5.1: Snapshot of the administrator login screen

5.3.2 Home screen

Home screen appears after login screen. In this screen, the administrator can control all application features, on top of the home screen, some user information (user name, user ID and phone number), in addition to user photo, home screen contains the following features with the "*Exit*" button to go out from application Figure 5.2 shows administrator home screen features:

- Messages
- Classes Search
- Schedule
- Academic calendar
- Manage Classes
- Manage Courses
- Manage Account
- Search
- News
- Photos
- Grades
- Login History
- Password

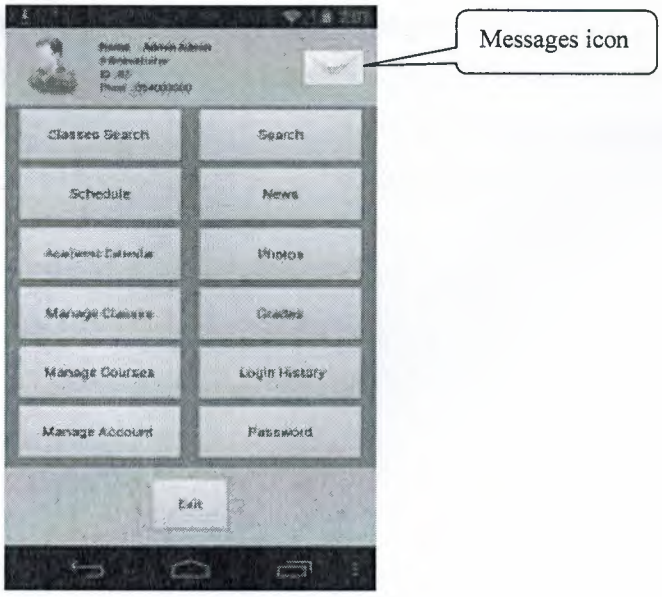

Figure 5.2: Snapshot of the administrator home screen

The following section of the chapter will explain the features that could be used by only administrator and the teacher who has permission from the administrator.

Manage Classes: This feature allows the administrator to manage classes feature (add, edit and delete). To add or edit class *"Manage Classes"* button in administrator home screen (Figure 5.2) must be pressed. Then Manage Classes screens will appear as shown in Figure 5.3a, Manage Classes screen consists of add icon button ( ) on right top of the screen and search field for classes and under the classes list.

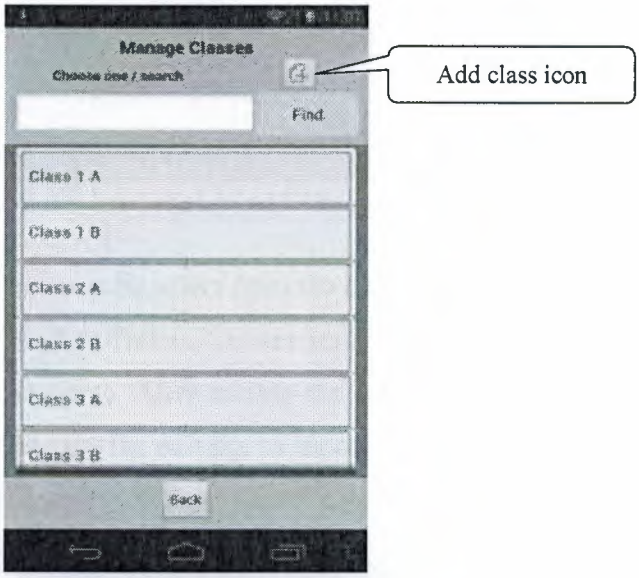

Figure 5.3a: Snapshot of manage classes screen

To add a class add icon button must be pressed in Manage Classes screen. Then Add Class screen will appear as shown in Figure 5.3b, which consists of two information fields (class name and number of student) after filling information fields, *"Add"* button must be pressed on to add new class or *"Cancel"* button to cancel the adding operation.

Figure 5.3b: Snapshot of add class screen

To edit or delete a class, the class must be select from the list. Then Edit/Delete screen will appear as shown in Figure 5.3c. Edit/Delete Classes screen consists of two information fields (class name, number of student). After editing the information fields to edit class, *"Edit"* button must be pressed to save the editing, to cancel the editing/deleting operation, "*Cancel"* button must be pressed, and to delete a class *"Delete"* button must be pressed.

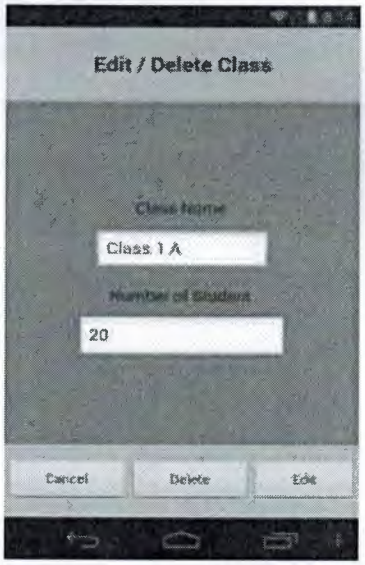

Figure 5.3c: Snapshot of edit/delete class screen

It is worth mentioning, the class name should be unique therefore, the system checks class name before adding or editing and if there are similar class names, the operation will stop and there is a message will appear to the user is shown to change the class name as shown in Figure 5.3d.

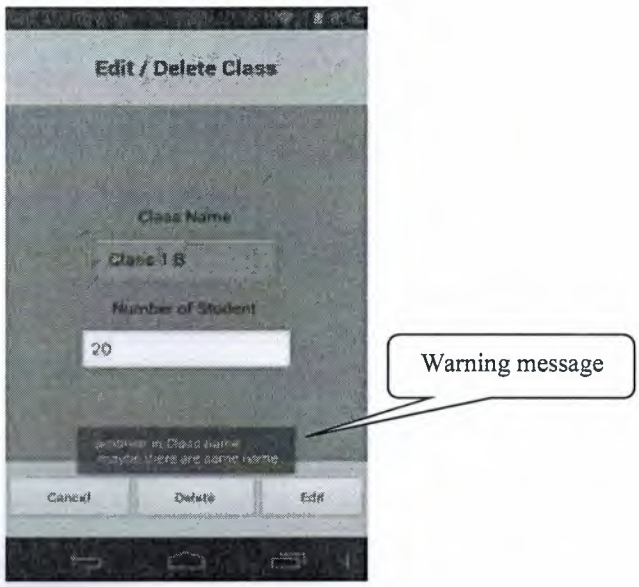

Figure 5.3d: Snapshot of add/edit wrong class name screen

Manage Courses: The administrator uses this feature to manage courses for each class in school. The administrator can add, review and edit course information. For adding or editing a course in the system *"Manage Courses"* button in administrator home screen (Figure 5.2) must pressed. Then Class Search screen for manage courses will appear as shown in Figure 5.4a. The Class Search screen consists of "*Find*" button beside text box whose use is to find classes, under "*Find*" button classes, there is a class list, and in the bottom of screen, there is "*Back*" button for move to previous screen.

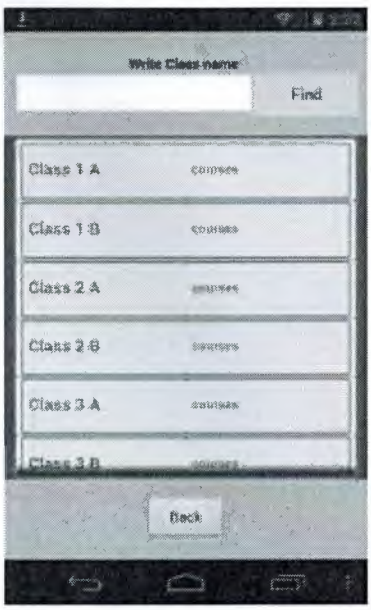

Figure 5.4a: Snapshot of class search screen

To add or edit courses a class must be select form the list in Figure 5.4a. Then Manage Courses screen will appear as shown in Figure 5.4b. Manage Courses screen consists of add icon, "*Find*" button beside text box used to find course by cpurse name, courses list and "*Back*" button.

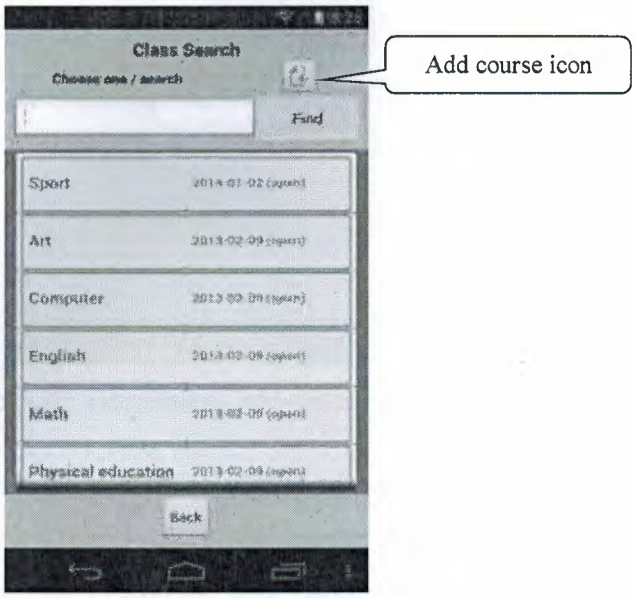

Figure 5.4b: Snapshot of manage courses screen

For add course, add icon button must be pressed. Then Add Course screen will appear as shown in Figure 5.4c. Add Course screen consists of information fields (name, date, state, teacher id and note) and two buttons are *"Add"* and "*Cancel*". After filling information field, "*Add"* button must be pressed to add course or "*Cancel"* button to cancel the adding operation.

Figure 5.4c: Snapshot of add course screen

To editing course, the course name should be selected from the list in Manage Courses screen (Figure 5.4b). Then Edit Course screen will appear as shown in Figure 5.4d, it is similar to Add screen, after filling or editing information in fields to save the editing, *"Edit"* button must be pressed or *"Cancel"* button to cancel the editing operation.

Figure 5.4d: Snapshot of edit course screen

The course information should be unique. Therefore the system checks course information before adding or editing, if there are similar the information of course the operation stops and there is a message will show to the user to check information as shown in Figure 5.4e.

Figure 5.4e: Snapshot of add/edit error course screen

Manage Accounts: This feature accessed by pressing on *"Manage Accounts"* button in administrator home screen (Figure 5.2). Manage Accounts screen shown in Figure 5.5a consists of three buttons *"Add/Edit Parent & Student", "Add/Edit Teacher" and "Assign Teacher Privileges"* and *"Back"* button for moving to previous screen.

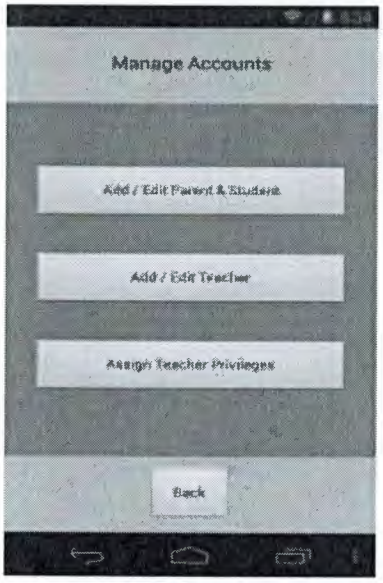

Figure 5.5a: Snapshot of manage accounts screen

- ***"Add/Edit Student & Parent"*** button in Manage Accounts screen must be pressed to add and edit parent or student, then Add/Edit Parent & Student screen will appear as shown in Figure 5.5b. Add/Edit Parent & Student screen consists of add icon button and two tabs *"Parent", "Student"*. Under the tabs, there is *"Find"* button beside text box use to search for parent or student.

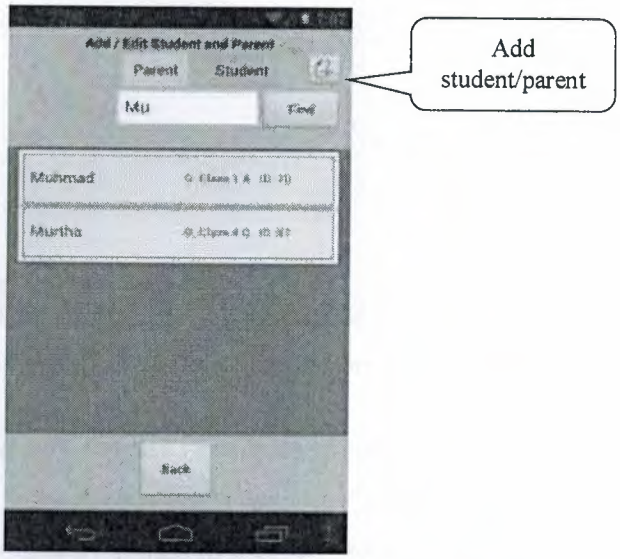

Figure 5.5b: Snapshot of add/edit student and parent screen

After choosing user type *"Parent" or "Student"* by pressing on tape. The add icon button must be pressed to access Student Info - step1 screen as shown in Figure 5.5c. Student Info - step1 screen consists of three information filed (name, father name and surname) under the fields there is class combo list. The combo list consist from classes name that are currently in the system and number of students enrolled in the class currently, this feature enables the teacher to know the vacant places in each class.

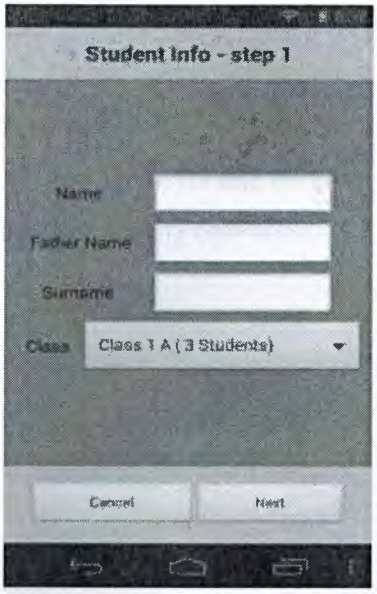

Figure 5.5c: Snapshot of student information step 1 screen

Student information must be non-repeated (unique) to avoid repeated addition for the same student. If the student information is not unique, the addition process will not go on. Then Alert screen will appear as shown in Figure 5.5d which contains of all student information. After filling the information fields and choosing a class from combo list (Figure 5.5c). *"Next"* button must be pressed to access to student Info- step2 screen or *"Cancel"* button to cancel the adding operation.

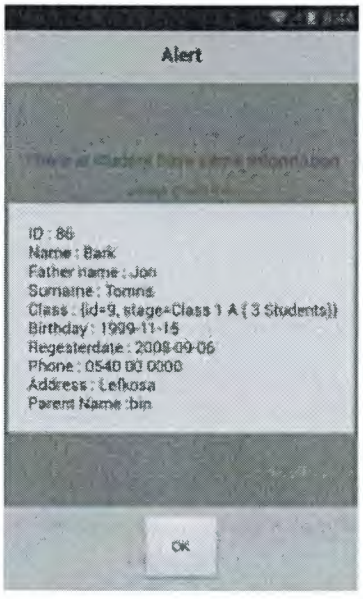

Figure 5.5d: Snapshot of alert screen

When Student Info- step2 appears as Figure 5.5e which consists of five information fields (birthday, register day, phone, address and parent ID). After filling information fields, *"Add"* button must be pressed. Then Successful screen will appear as shown in Figure 5.5f which consists of user name, ID and password, or pressing *"Cancel"* button in Student Info- step2 to cancel the adding operation.

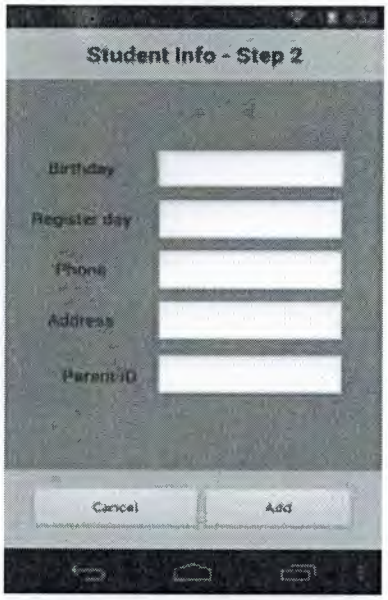

Figure 5.5e: Snapshot of student information step2 screen

Figure 5.5f: Snapshot of successful screen

Editing on student start from Add/Edit Student & Parent screen. Choosing student mode after press on student tap on the top of screen (Figure 5.5a). Then determine the student must be edited by select it from students list after found student by using

"*Find*" button and text box (Figure 5.5b). After that Student Info-step1 screen as shown in Figure 5.5g will appear which consist form student information fields same fields in add student screen but with information. To complete editing operation user must be press on *"Next"* button to access to Student Info- step2 as shown in Figure 5.5h which consist form information fields. To save the editing user must be press on *"Edit"* button. Then Successful screen will appear as Figure 5.5f.

Figure 5.5g: Snapshot of student information step 1 screen

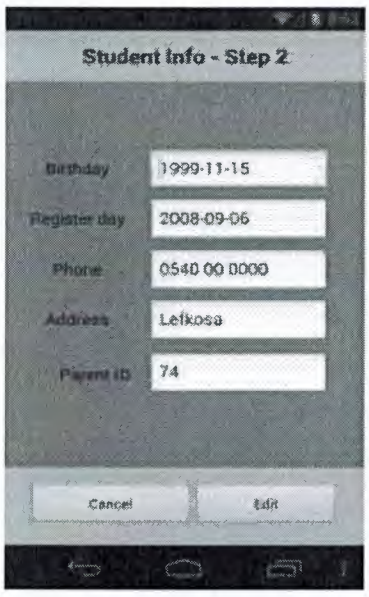

Figure 5.5h: Snapshot of student information step2 screen

To add parent must be pressing on *"Parent"* tab in Add/Edit Student & Parent screen (Figure 5.5b). Then add icon button must be pressed. Add Parent Information screen will appear as Figure 5.6a. After filling information in Add Parent Information screen press on *"Add"* button to add parent or press on *"Cancel"* button to cancel the adding operation.

Figure 5.6a: Snapshot of add parent information screen

To editing parent account start from Add/Edit Student & Parent screen by choosing *"Parent"* tab and *"Find"* field then select parent from list (Figure 5.5b). Edit Parent Information screen will appear as shown in Figure 5.6b. After finishing editing *"Edit"* button must be pressed or *"Cancel"* button to cancel the editing operation.

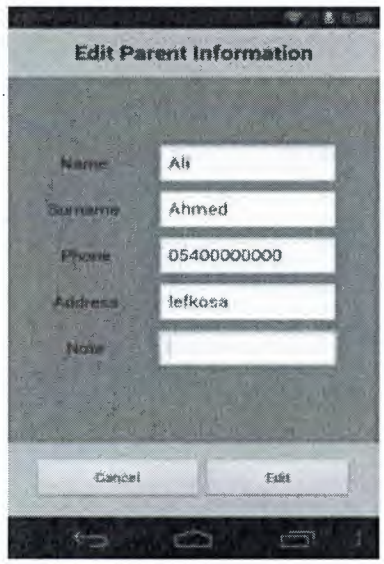

Figure 5.6b: Snapshot of edit parent information screen

After Add or Edit process complete on parent account, Successful screen will appear as shown in Figure 5.5f which consists of user name, ID and Password.

- ***"Add/Edit Teacher"*** button in manage accounts screen (Figure 5.5a) used to add teacher to system by the mobile application. After pressing on this button, the Add/Edit Teacher screen will appear as shown in Figure 5.7a which consists of add icon button and *"Find"* button beside text box. *"Find"* button and the text box use to searching and selecting teacher from teacher list. In the bottom of Add/Edit Teacher screen there is *"Back"* button for moving to previous screen.

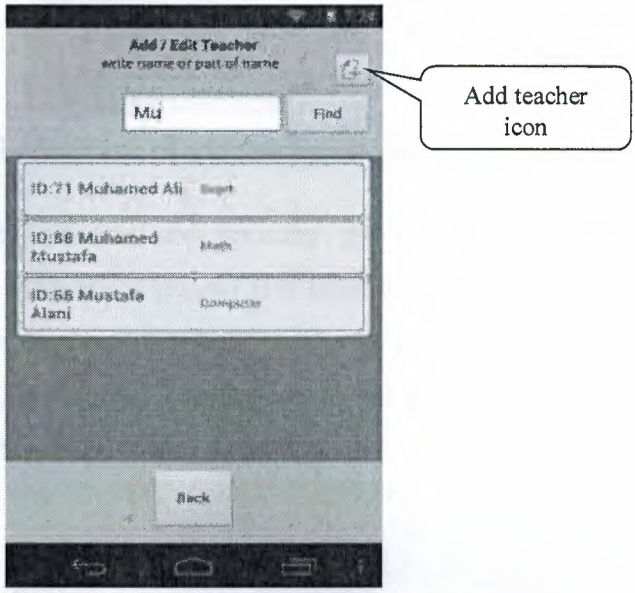

Figure 5.7a: Snapshot of add/edit teacher screen

To add Teacher must be pressed on add icon button in Add/Edit Teacher screen. Add Teacher Information screen will appear as shown in Figure 5.7b, which consists of five information fields. After filling teacher information press on *"Add"* button to add teacher or *"Cancel"* button to cancel the adding operation.

Figure 5.7b: Snapshot of add teacher information screen

To edit teacher account, the administrator pressing *"Find"* button after write name or part of name in text box then select teacher that must be modified from teacher list. Edit Teacher Information screen will appear as shown in Figure 5.7c. Edit Teacher Information screen is same with Add Teacher screen but with fields filled and *"Edit"* button must be pressed to save the editing operation.

Figure 5.7c: Snapshot of edit teacher screen

After add or edit teacher Successful screen will appear as shown in Figure 5.5f which consists of user name, ID and password.

- *"**Assign Teacher Privileges**"* button in manage accounts screen (Figure 5.5a) used to assign privileges to teacher user. After pressing *"Assign Teacher Privileges"* button Teacher List screen will appear as shown in Figure 5.8a. Teacher List screen are consists of "*Find*" button with text box that used to search for teacher must be privileges modified. After selecting the teacher, List of Privilege screen will appear as shown in Figure 5.8b which consists of from *"Add"* icon and list of teacher privileges.

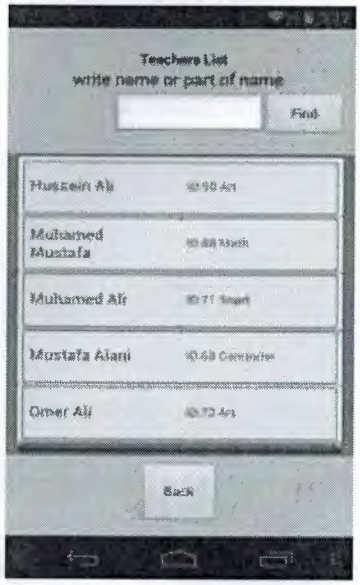

Figure 5.8a: Snapshot of teacher list screen

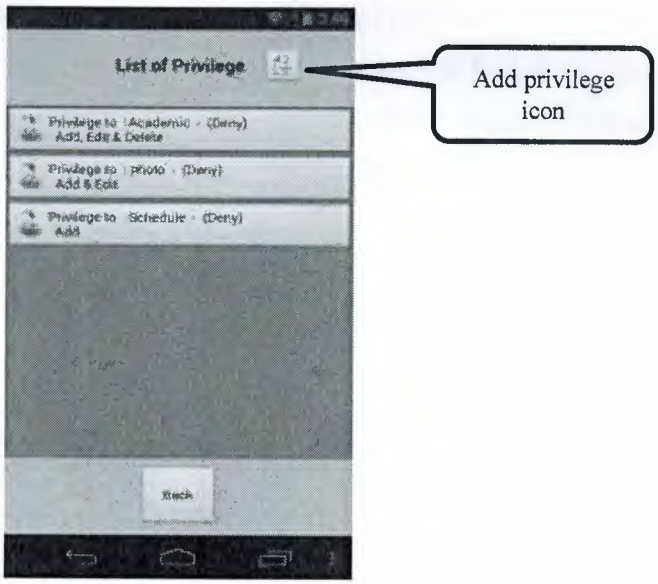

Figure 5.8b: Snapshot for list of privilege screen

To add new privileges add icon button in privilege screen (Figure 5.8b) must be pressed. The Assign Privilege screen will appear as Figure 5.8c which consists from

three-combo list (privilege to, privilege type and privilege state). After selecting the options from the three combo lists the "*Set*" button must be pressed to complete assigning process or "*Cancel*" button to cancel the assigning operation.

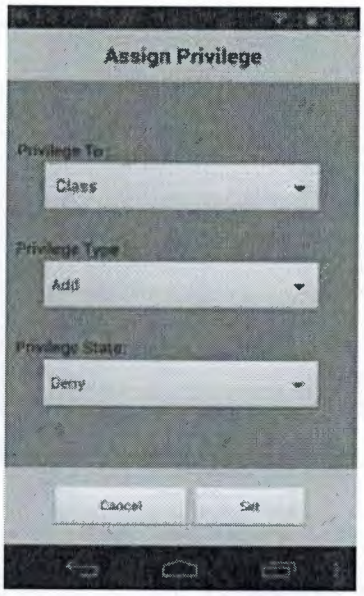

Figure 5.8c: Snapshot of assign privilege screen

It is worth mentioning privilege options feature in the application provides a list of privileges which teacher does not have it. Then to edit teacher privileges the administrator must be select the teacher from Teacher list screen (Figure 5.8a). List of Privilege screen (Figure 5.8b) will appear, and then select privilege wont edited the Edit Privileges screen will appear as Figure 5.8d which includes the same components of Assign Privilege screen (Figure 5.8c). After finish editing process "*Edit*" button must be pressed or "*Cancel*" button to cancel the editing operation.

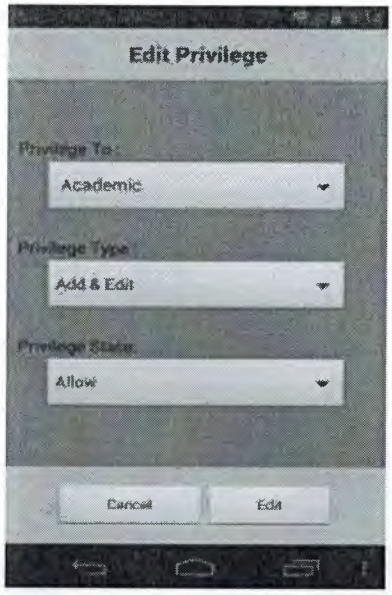

Figure 5.8d: Snapshot of edit privilege screen

Schedule: This feature lets administrator add, review, edit and delete information in the schedule table for each classes in the school. To use this feature administrator should be press on *"Schedule"* button in administrator home screen (Figure 5.2). Then Class Search screen will appear as Figure 5.9a. This screen consist from *"Find"* button with text box and class list. After select class from the list Schedule screen will appear as Figure 5.9b. Schedule screen consist from add icon and five tabs which is the week study days and list of courses.

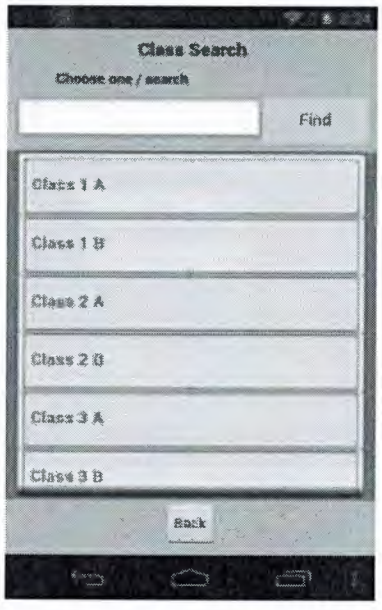

Figure 5.9a: Snapshot of class search screen

Figure 5.9a: Snapshot of schedule screen

To add new item to the schedule administrator must be press on add icon button in Schedule screen (Figure 5.9b), Add Schedule screen will appear as Figure 5.9c. This screen consist from two combo list (Day and Course) and there are three information fields (Location, start time and end time). After filling information press on "*Add*" button to save or *"Cancel"* button to cancel the operation.

Figure 5.9b: Snapshot of add schedule screen

To edit or delete item in schedule administrator must select course from the course list in Schedule screen (Figure 5.9a). Edit/Delete Schedule screen will appear as Figure 5.9d.

Edit/Delete Schedule screen consist form schedule information which is filled in Add Schedule screen. To delete must be press on *"Delete"* button and for editing press on *"Edit"* button to save the editing.

Figure 5.9d: Snapshot of edit/delete schedule screen

Academic calendar: Administrator actions in school academic calendar feature are (add, review, edit and delete), to use this feature, the administrator must press on *"Academic Calendar"* button in administrator home screen (Figure 5.2). Academic calendar screen will appear as shown in Figure 5.10a. Academic calendar screen consist from add icon button and academic events list.

Figure 5.10a: Snapshot of academic calendar screen

To add an event should be pressed add icon button in Academic Calendar screen (Figure 5.10a). Add Academic Calendar screen as shown in Figure 5.10b will appear. This screen consists from four information fields are title, event, note (all of this information is normal string) and Date is date format. After filling information must be pressed on *"Add"* button to save the information or *"Cancel"* to cancel add operation.

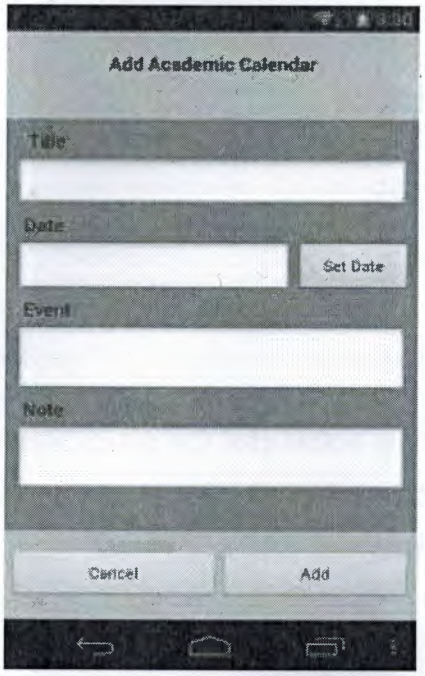

Figure 5.10b: Snapshot of add academic calendar screen

On another hand, to edit or delete event user must be select event from events list in Academic Calendar screen (Figure 5.10a). Then Academic Calendar Details screen will appear as Figure 5.10c which consist form two icons on the top of screen are edit icon ( ) and delete icon ( ), and under the icons event details.

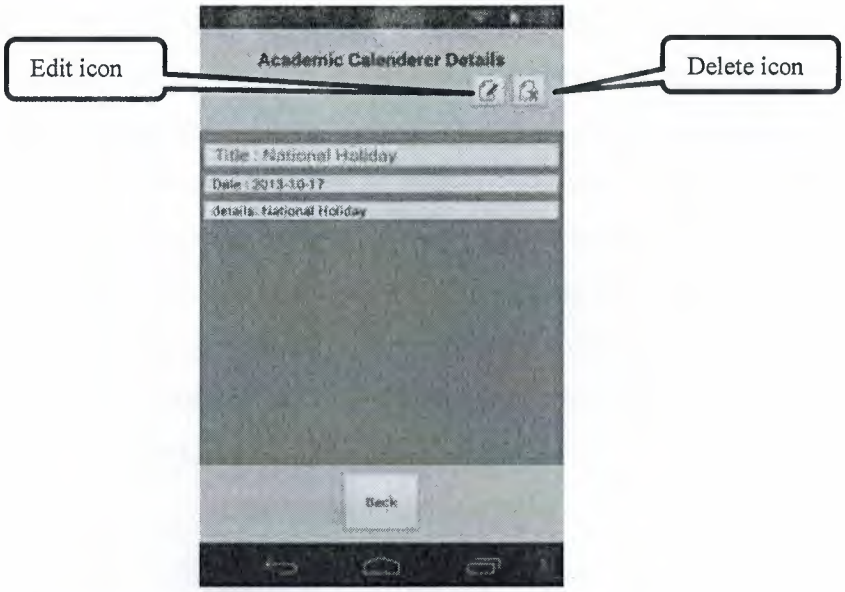

Figure 5.10c: Snapshot of academic calendar details screen

To edit even user must be pressed on the edit icon button to view Edit Academic Calendar screen as Figure 5.10d. This screen consist from four information fields same Add Academic Calendar screen, these fields filled with information want be edited. Then to save the editing must be pressed on *"Edit"* button.

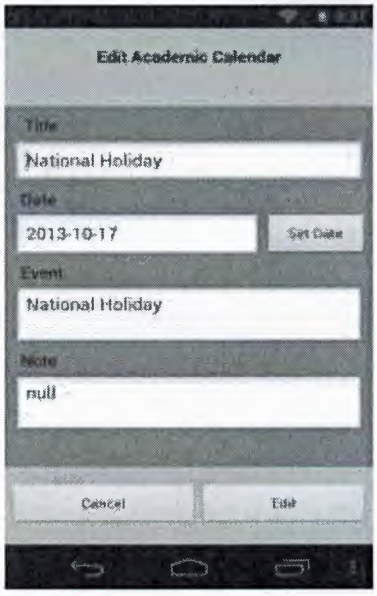

Figure 5.10d: Snapshot of edit academic calendar screen

On the other hand, to delete event must be pressed on the delete icon button on Academic Calendar Details screen (Figure 5.10c).

News: Administrator to publish all news type of school uses this feature. The administrator can manage and index information in this part of the system. This feature is divided into three sections news, events and announcements. The information in this feature are title, date, details, newsreader (all users, parent or student), and news important value. To use this part of system the user should press *"News"* button in administrator home screen (Figure 5.2). The News screen will appear as shown in Figure 5.11a. News screen consists of add icon button on top right of the screen and under add icon there are three tabs *"News"*, *"Event"* and *"Announcement"*, in the bottom of screen there is *"Back"* button for moving to previous screen.

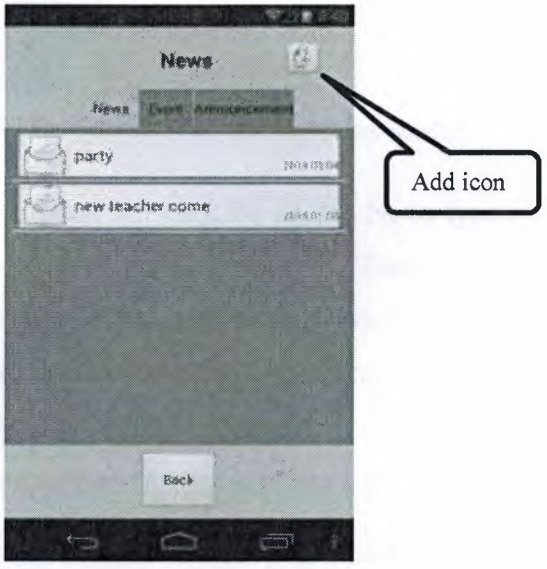

Figure 5.11a: Snapshot of news screen

To add News, Event or Announcement add icon button in News screen (Figure 5.11a) must be pressed. The Adding screen will appear as shown in Figure 5.11b. This screen consists of three options (news, event and announcement) and two options buttons (important and reader), and three information fields (date, title and details). The first step in creating or adding any element in News feature one option must be chosen from (news, event or announcement) options to determine under which tab the addition will be. Then determine the important value of (News or Event or Announcement) by select value from *"Important"* combo list. On the other hand, to determine the news readers by select item from *"Readers"* combo list. The other information fields must be filled (date, title and details). After that must be pressed on *"Add"* icon to complete adding process or, *"Cancel"* button to cancel the adding operation.

Figure 5.11b: Snapshot of adding news screen

For editing or deleting News administrator must be chosen News type by pressing on one of the tabs from the three tabs in News screen (*"News", "Event"* and *"Announcement"*). Then select item from list in News screen. After that, News Details screen will appear as shown in Figure 5.8c. The News Details screen consists of news details and two buttons on the top of screen are edit icon and delete icon under icon.

Figure 5.11c: Snapshot of news details screen

To edit News must be pressed on edit icon button in News screen (Figure 5.11a). The Edit News screen will appear as shown in Figure 5.8d which is the same as Adding screen but

with the information to be modified in fields and options. After editing operation to save *"Edit"* button must be pressed or *"Cancel"* button to cancel the editing operation. On other hand to delete news must be press on delete icon button in News Details screen (Figure 5.11c).

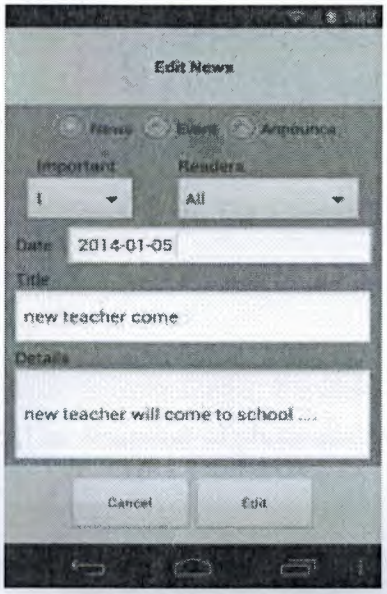

Figure 5.11d: Snapshot of edit news screen

Photos: Administrator can access to photo feature by pressing on *"Photos"* button in home screen (Figure 5.2). After pressing Album Photo screen will appear as Figure 5.12a which consist form add icon and albums list. To add photos to the system administrator must be press on add icon then Upload Photo to Cloud screen will appear as Figure 5.12b which consist form information filed Enter title and date. Administrator chose the photo must be uploaded by pressing on *"Choose file"* button. After selecting photo administrator must be press on *"Upload Photo"* button to complete adding operation or to cancel the operation must press on *"Back"* button.

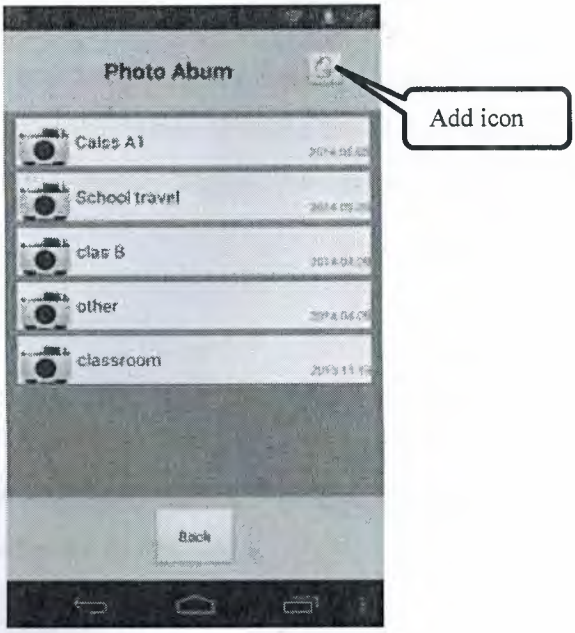

Figure 5.12a: Snapshot of photo album screen

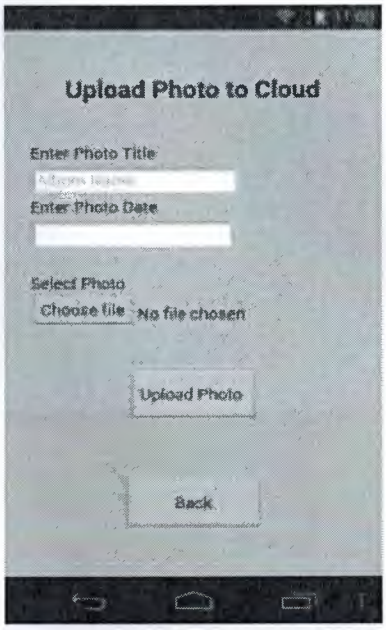

Figure 5.12b: Snapshot of upload photo to cloud screen

5.4 Teacher

Teacher functions or tasks in application are updated the information related to students in the system such as grades, attendance, behaviors, etc. also there are features in system shared between teacher and administrator such as messages, login history, etc. Administrator determines teacher privilege in the application.

5.4.1 Login screen

The teacher's login screen it is not differ much from the administrator screen, therefore teachers apply same administrator conditions to login, but the difference is in the features that used by teacher and administrator. Figure 5.1 shows administrator screen login options.

5.4.2 Home screen

Teacher home screen appears after success login to system, this screen is more like the administrator home screen. Teacher uses features in this screen to update the information and data about student in system. Figure 5.13 shows Teacher Home screen features. The features normally used by teacher are as follows:

- Messages,
- Classes Search,
- Search,
- Schedule,
- News,
- Academic Calendar,
- Photos,
- Grades,
- Login History,
- Password.

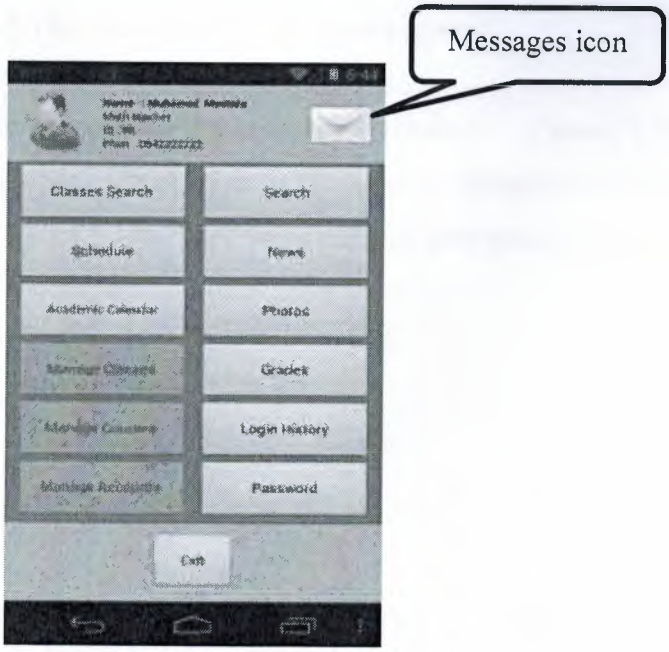

Figure 5.13: Snapshot of teacher home screen

The following section of the chapter will explain the features that could be used by the teacher.

Search: This feature is useful for the teacher to find a student or parent user in the system and to access to their own information. To use Search feature *"Search"* button in teacher home screen (Figure 5.13) must be pressed. Then Search screen will appear as shown in Figure 5.14a. Search screen consists of two tabs (*"Parent"* and *"Student"*) in the top of the screen, under the tabs there is *"Find"* button and text box which is used to search on students or parents by write name or part of name. There is a small checking box beside the text box use to change search mode from *"ID"* to *"Name"* or vice versa.

Figure 5.14a: Snapshot of name search screen

The First step in Search feature is choose group search (*"Student"*, *"Parent"*) from the tabs, then to determine search mode (default mode is by name) to change to ID a small box must be pressed as shown in Figure 5.14b. Then write name or part name (or user ID) and press on *"Find"* button to get the result.

Figure 5.14b: Snapshot of ID search screen

Classes: The teacher uses this feature with previous feature (search) to filter search result by searching in specific class or view all students in class. Also there is an option in this screen to search on class name to find which class teacher want to view. Search by classes Search feature is used to make the search process easier and reduce search delay time. First step in Classes feature is press on *"Classes Search"* button in teacher home screen (Figure 5.13). Then Classes screen will appear as Figure 5.15a which consist from *"Find"* button with text box and list of classes. Also in the bottom of Classes screen *"back"* button for moving to previous screen.

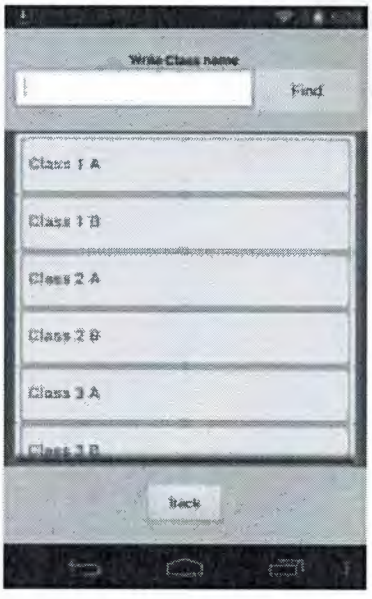

Figure 5.15a: Snapshot of classes screen

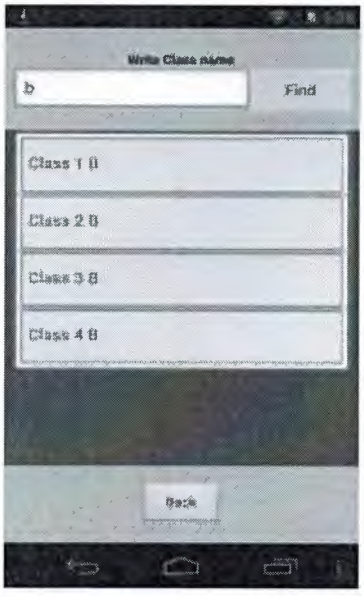

Figure 5.15b: Snapshot of classes screen

Attendance: This feature used by teacher to assign student absent or late form school or classroom. The teacher can manage Attendance feature such as add, review, edit and delete. The options information in this feature are attendance type (absent or late), *"Date"* (Date format), Time (normal characters), verified (or unverified) check box, verified by (normal characters) and note. To use Attendance feature, the teacher should chose student from student list in Search screen (Figure 5.14a) to access to Student Home screen shown in Figure 5.16. *"Attendance"* button in Student Home screen (Figure 5.16) must be pressed. Then Attendance screen appears as shown in Figure 5.16a. Attendance screen consists of add icon button on top of the screen, under add icon button there are two tabs (*"Absent"* and *"Late"*) and under the two tabs there are two other tabs (*"Verified"* and *"Unverified"*) and in the bottom of screen there is *"Back"* button for moving to previous screen.

Figure 5.16: Snapshot of student home screen

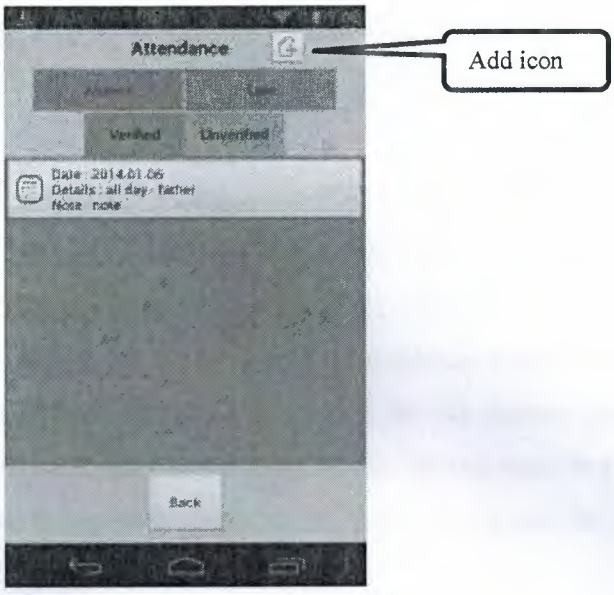

Figure 5.16a: Snapshot of attendance screen

To assign new state of absent or late to student add icon button in Attendance screen (Figure 5.16a) must be pressed. The Add Attendance screen will appear as shown in Figure 5.16b. this screen consists of two options (absent and late) under the two options there are two information fields (date and time) under the two fields there is a small check box (verified) under the verified box there are two information fields (verified by and note).

Figure 5.16b: Snapshot of add attendance screen

To assign new absent or late, teacher set the date, time, verified check box if (absent and late) verified by parent. The teacher must be mentioned person information who verified

student (absent or late). If there is any note it must be written in note field. Then *"Add"* button must be pressed to add the attendance or *"Cancel"* button to cancel the adding operation.

To edit and delete in Attendance feature *"Verified" or "Unverified"* tabs must be pressed in Attendance screen (Figure 5.16a). Then absent or late list will appear and the teacher select item from the list in Attendance screen (Figure 5.16a). The Edit/Delete Attendance screen will appear as shown in Figure 5.16c. Edit/Delete Attendance screen is the same as Add Attendance screen (Figure 5.16b) but the information for the chosen item to make editing or deleting on it. after that, to save the changes *"Edit"* button must be pressed and to delete *"Delete"* button must be pressed or *"Cancel"* button to cancel the editing the operation

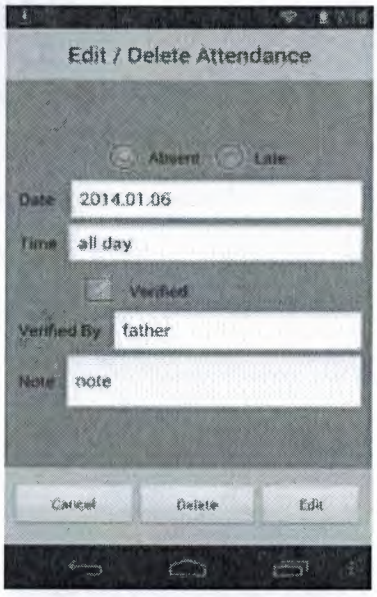

Figure 5.16c: Snapshot of attendance edit and delete screen

Behavior: The teacher use this feature to assign specific behavior for student in the system. After pressing on *"Behavior"* button in Student home screen (Figure 5.16), Behavior screen will appear as Figure 5.17a that consists of add icon button on top of screen and behavior list.

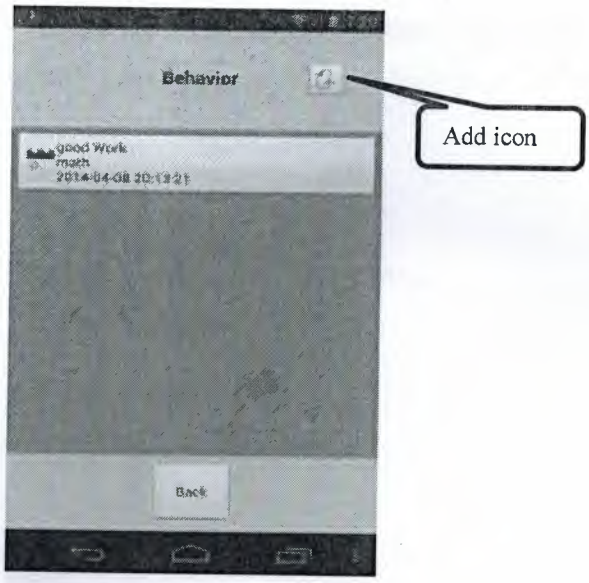

Figure 5.17a: Snapshot of behavior screen

To add new behavior must be press on add icon button in Behavior screen (Figure 5.17a). The Add Behavior Incident screen will appear as Figure 5.17b which consists of six information fields (title, incident date, report by, status, point and note). After filling information field to add the behavior must be pressed on *"Add"* button or *"Cancel"* button to cancel the adding operation.

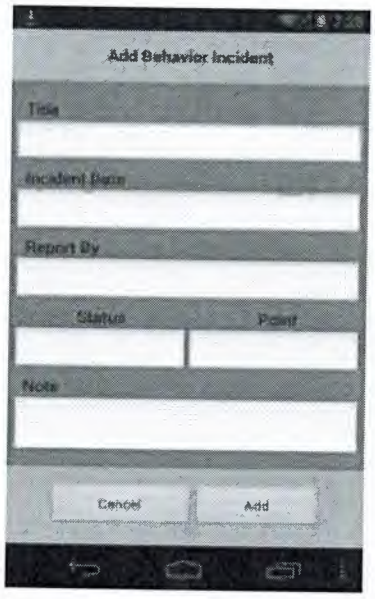

Figure 5.17b: Snapshot of add behavior screen

On other hand, when the teacher wants to edit behavior the *"Behavior"* button in Student home screen (Figure 5.16) must be pressed, then select behavior form behavior list in

Behavior screen (Figure 5.17a). The Behavior Details screen will appear as shown in Figure 5.17c, which consists of edit icon button and delete icon button under the buttons behavior details.

Figure 5.17c: Snapshot of behavior details screen

To complete editing process edit icon button in Behavior Details screen (Figure 5.17c). Edit Behavior screen with the information to be modified will appear as Figure 5.17d. After editing fields to save the edit information *"Edit"* button must be pressed or *"Cancel"* button to cancel the editing operation. For deleting process, delete icon button in Behavior Details screen (Figure 5.17c) must be press.

Figure 5.17d: Snapshot of behavior edit screen

Grades: This feature used by teacher to assign different grades to student. The teacher can manage grades feature by add, review, edit and delete degree. There are two ways to assign grades to student.

The first one is to assign grade for all students in class, teacher must be press on *"Grade"* button in Teacher home screen (Figure 5.13). Class search screen will appear as shown in Figure 5.18a, select class name from this screen. The Degrees Information screen will appear as Figure 5.18b. Degrees Information screen consist form two combo list, chose course name from select course and chose degree type from select degree type. After that teacher must be pressed on *"Next"* button. The Add Degree screen will appear as Figure 5.18c which consist form students names and ID with blank text box beside each name to insert the degree. To save the adding degree must be press on *"Add Degrees"* button.

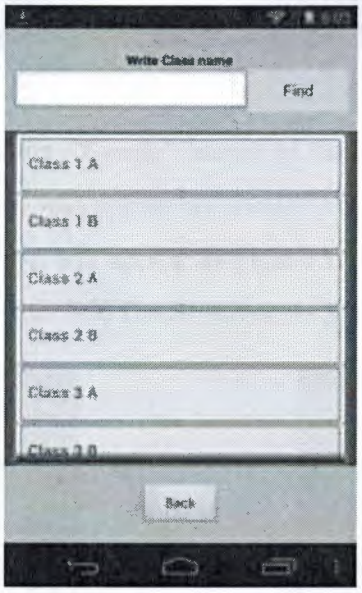

Figure 5.18a: Snapshot of class search screen

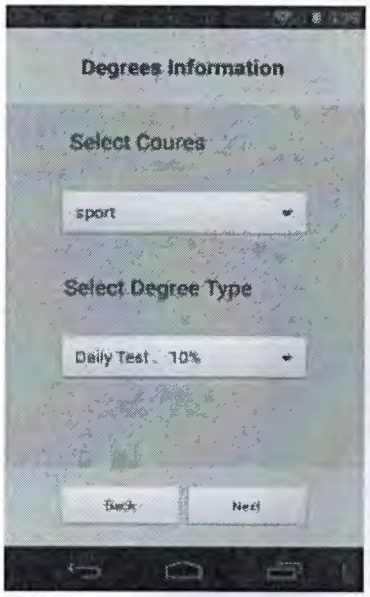

Figure 5.18b: Snapshot of degrees information screen

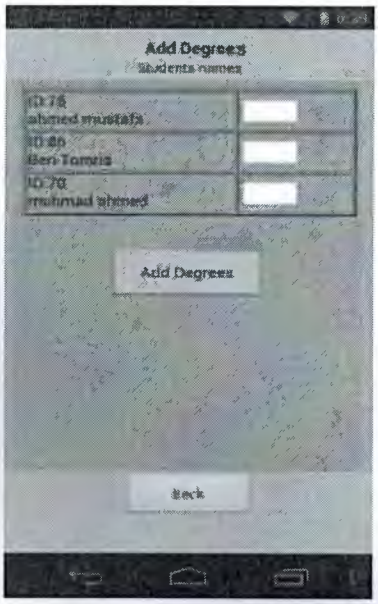

Figure 5.18c: Snapshot of add degree screen

The second way to add solo grade *"Grade"* button in Student home screen (Figure 5.16) must be pressed. Courses screen will appear as shown in Figure 5.18c, then select course from the courses list. Grads screen will appear as Figure 5.18d which consist form add icon button must be pressed to access to Add Grade screen as shown in Figure 5.18f.

Figure 5.18c: Snapshot of courses screen

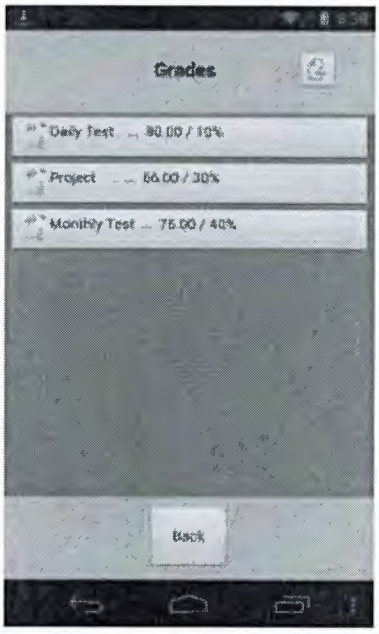

Figure 5.18d: Snapshot of students grades Screen

To complete degree adding, the degree type must be determined first form combo list, and then write in *"Degree"* box under combo list. Finally to finish adding process *"Add"* button must be pressed on or *"Cancel"* button to cancel the adding operation.

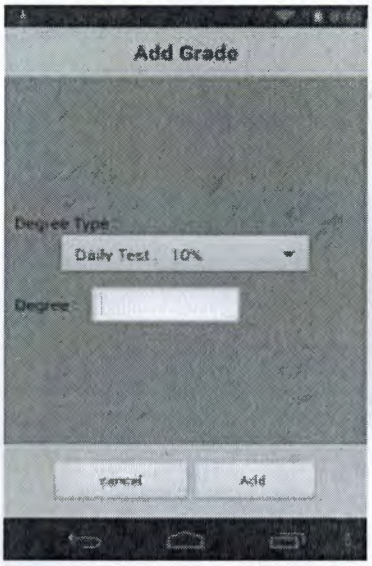

Figure 5.18f: Snapshot of add degree screen

On other hand, to grade editing the first step starts form Grade screen as shown in Figure 5.18d. By selecting degree type form list in Grade screen. Degrees List screen will appear as shown in Figure 5.18g. After select the degree which must be modified. Edit/Delete Degree screen as shown in Figure 5.18h will appear. This screen consist from two boxes first one the degree want be modified and the second box write note by teacher. To save editing *"Edit"* button most be pressed or *"Cancel"* button to cancel the Editing operation, finally to delete degree, "*Delete*" button must be pressed.

Figure 5.18g: Snapshot of degree list screen

Figure 5.18h: Snapshot of edit and delete degree screen

It is worth mentioning the teacher user can add, modify and delete his courses degrees, and can only view the courses degrees of other teachers.

5.5 Parent

The developed school information system designed to be easy in use for parents to keep them stay connected with the school to get information about students and school events. This application provides a new useful options to parent such as use it in offline mode, in

other word the parent can load information needed in mobile and could view it any time and wherever without need internet.

5.5.1 Login screen

Login users options such as parent user in Login screen as shown in Figure 5.19. One of the options its determine user type (student, parent, teacher) after select parent user type application screens color will be change. There is a useful feature in login screen its *"Remember Me"* which used to save user ID, password and login mode option its used to determine login mode (*"Offline"* or *"Online"*), so that the user can login anytime without having to rewrite the login.

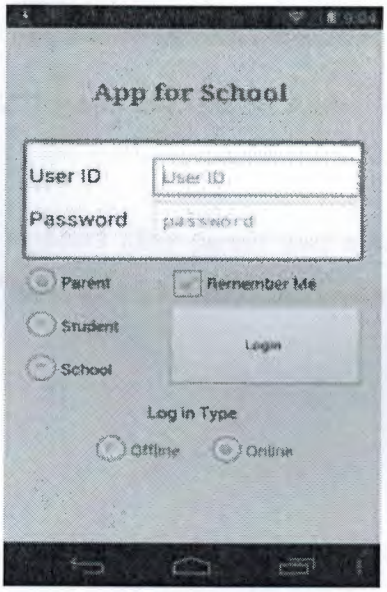

Figure 5.19: Snapshot of parent login screen

5.5.2 Student list screen

Student List screen is appear after success login to application. The success allows parent to view information for more than one student by using single user ID and password through student list screen. In addition to, this screen also contain two icons the first Message icon use to communicate with school or other users by message and the second *"Password"* button is use to change user password. Figure 5.20 shows parent students' list screen.

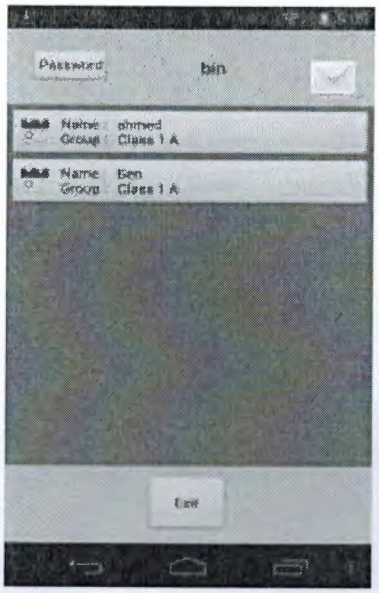

Figure 5.20: Snapshot of parent student list screen

5.4.3 Home screen

Home screen as Figure 5.21 appears after parent user select student from Student List screen. This screen content of feature button that related with student, these buttons are:

- Behavior,
- Schedule,
- Attendance,
- News,
- Academic calendar,
- Photos,
- Grades,
- Login history.

Moreover, in the top of the screen there are some information lines about the student.

Figure 5.21: Snapshot of student home screen for parent screen

5.6 Student

The latest in stakeholders of school information system series the student, the student's behavior and activities are the most important information in the system. Student user screens provide viewing information, in addition to communicate with school or other users by messages feature.

5.6.1 Login screen

Login users options such as student user in Login screen as shown in Figure 5.22a. One of the options its determine user type (student, parent, teacher) after select student user type application screens color will be change. There is a useful feature in login screen its "*Remember Me*" which used to save user ID, password and login mode option its used to determine login mode (*"Offline"* or *"Online"*), so that the user can login anytime without having to rewrite the login

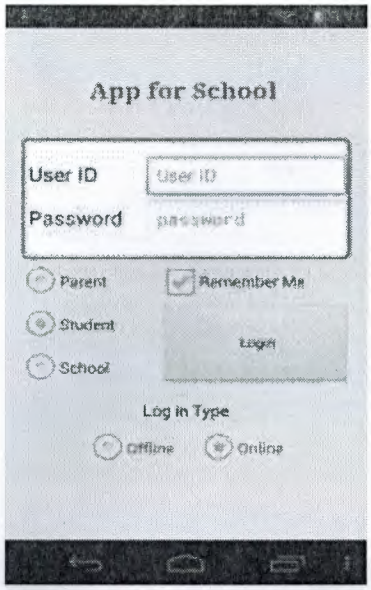

Figure 5.22a: Snapshot of student login screen

5.6.2 Home screen

Student Home screen appears after success login to system. The content in this screen same Student Home screen for parent. On top of screen content of student photo and some brief information beside photo. The features normally used by student are as follows: Figure 5.22b shows Student Home screen features.

- Messages,
- Schedule,
- News,
- Attendance,
- Academic calendar,
- Photos,
- Grades,
- Login History,
- Password,
- Info.

Figure 5.22b: Snapshot of student home screen

5.7 Common Characteristics of Application

There are some features used by all users of application (teachers, students and parents), accordingly in this section of the chapter, each of these features will be explained:

Messages: This feature allows the application users to communicate with each other directly by sending and receiving massages. This feature consists of three parts *"Inbox"*, *"Send"* and *"Compose"* as shown in Privet Message screen Figure 5.23a.

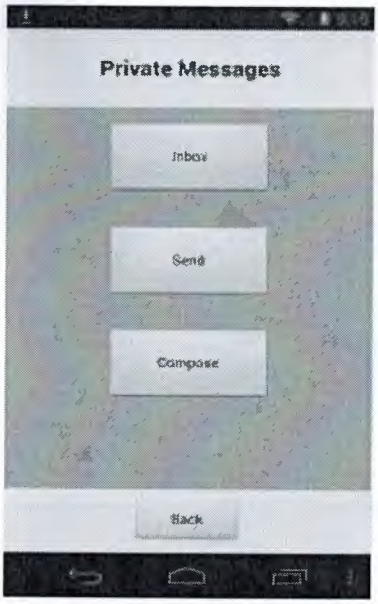

Figure 5.23a: Snapshot of privet message screen

The inbox part contains a list of the messages that received from other users. Figure 5.23b shows inbox screen, the second part contains the messages sent from the user, Figure 5.23c shows Send screen, after choosing message from inbox list or send list the Message Details screen will appear as Figure 5.23d.

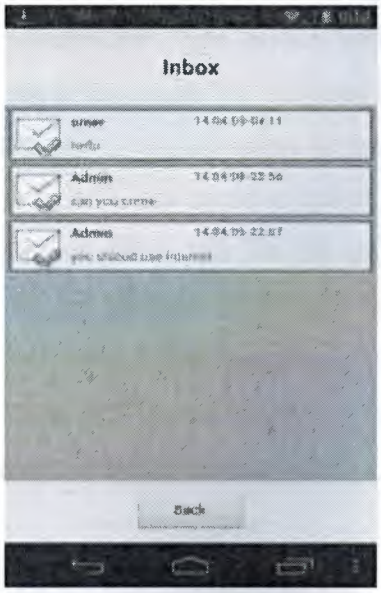

Figure 5.23b: Snapshot of inbox screen

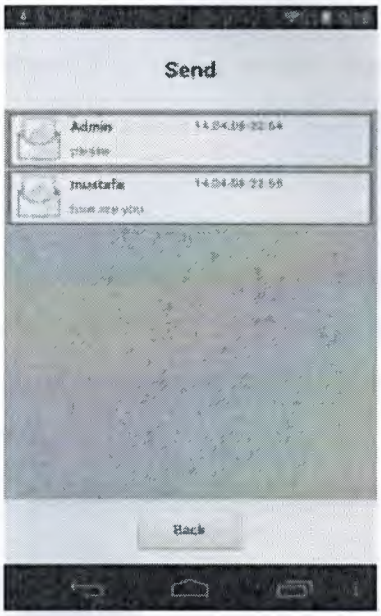

Figure 5.2c: Snapshot of send screen

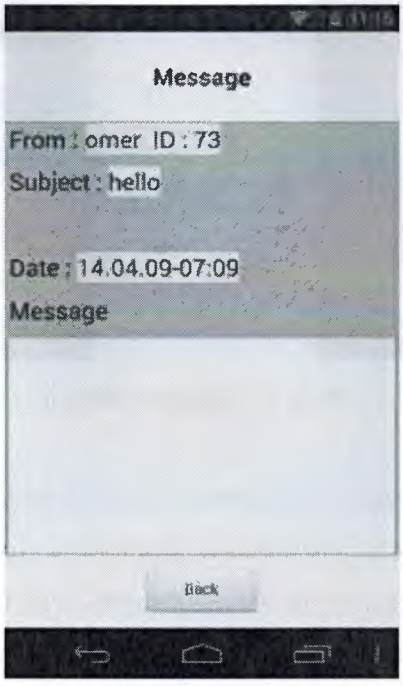

Figure 5.23d: Snapshot of message details screen

To send message user must press on *"Compose"* button in Privet Message screen (Figure 5.23a) to access to Compose Message screen as Figure 5.23e. This screen provides to user options for sending messages to other users in system. The Composed Message screens consist from ID box, user write recipient ID. If user do not have recipient ID there is another way by the name of Recipient through *"Select"* button. After pressing on *"Select"* button Select User Type screen will appear as Figure5.23f, which consist from three options use to determine the recipient from any group student, parent or school, and use the text box to write recipient name or part of name, then user must be press on *"Find"* button to access to recipient name to select it. After that, Compos Message screen will appear whit Recipient name and ID. To complete the compose message steps user must write subject for his message in Subject box, then set date by and time of message sending, finally user write his message in Message box. To send the message user must press on "*Send*" button or "*Cancel*" button to cancel the process.

Figure 5.23e: Snapshot of compose message screen

Figure 5.23f: Snapshot of select user screen

Schedule: This feature is used by all application users to view courses timetable to all days in the week and work each login mode (online and offline mode). There are five buttons in this screen, which are school days (from Monday to Friday). When choosing any day a course list will appear as sorted by courses time. Figure 5.24 shows Schedule screen.

Figure 5.24: Snapshot of schedule screen

News: All application users can surf school news (news, events, and announcements). This feature displays a list sorted by date news and when the user read one news from news list the news icon will change to recognize it, this feature use to determine which news has been viewed by user. In addition, the parents and students can reach to News in both login mode (online and offline mode).

Figure 5.25a: Snapshot of news screen

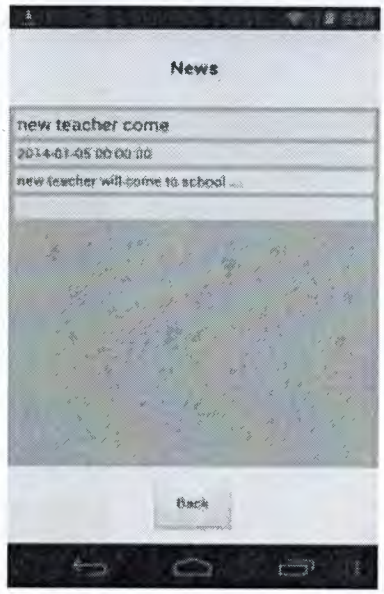

Figure 5.25b: Snapshot of news details screen

Academic calendar: School calendar screen contains start dates of the semesters, holidays, events, celebrations and dates of examinations are arranged by dates. This feature it is available for all users, the parents and students can reach to Academic calendar in both login mode (online and offline mode). Figure 5.26a shows academic calendar main list and details screen as Figure 5.26b.

Figure 5.26a: Snapshot of academic calendar screen

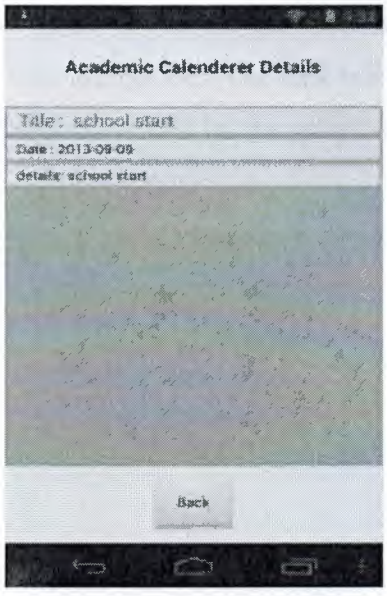

Figure 5.26b: Snapshot of academic details screen

Login history: Each user in the system has this feature, the login history shows brief information about user login time to the system (date and time). Figure 5.7 shows login history screen.

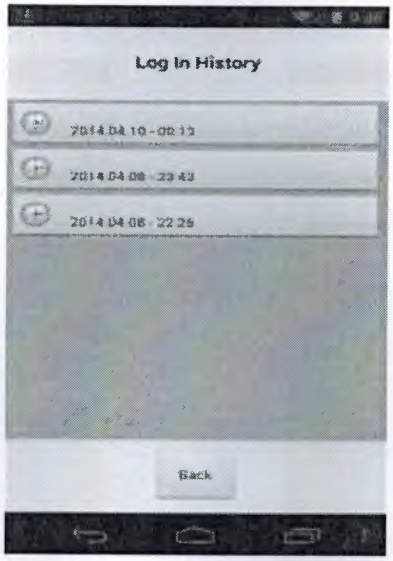

Figure 5.27: Snapshot of login history

Attendance: The student absences are recorded in this feature, attendance feature divided into two tab student Absents and student late (the font color of tab content change to red after click), and under each tab there is two sub tab verified and unverified (the color of sub tab button will change to blue after click). The first tab is the absence and the second tab is late, the sub tab verified and unverified by the parent. Figure 5.28 shows Attendance screen.

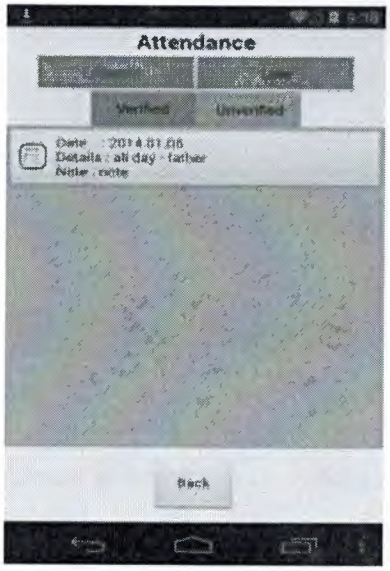

Figure 5.28: Snapshot of attendance screen

Grades: system user can use Grades feature, users can get course grades after choosing course name from Courses list screen, list will appear consist from course grades type, value and grade percentage for final grade of course. Figure 5.29a shows student courses screen and grades categories screen as Figure 5.29b.

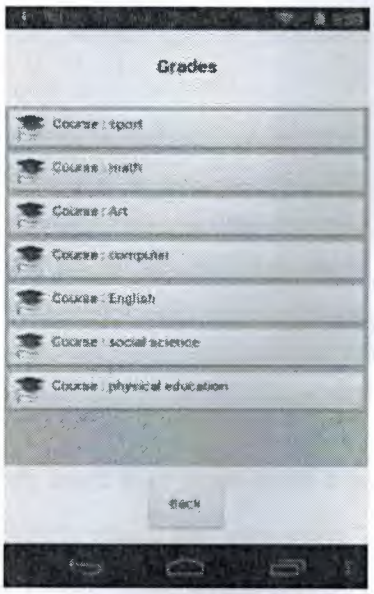

Figure 5.29a: Snapshot of student courses screen

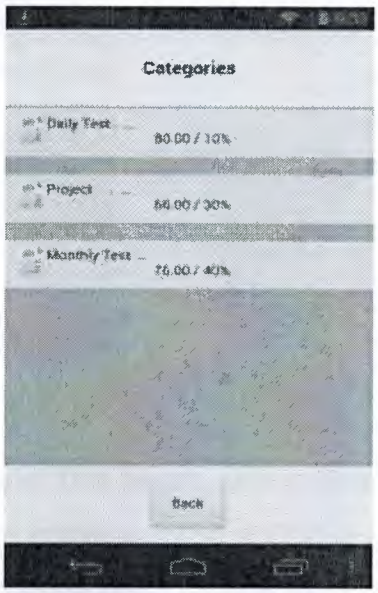

Figure 5.29b: Snapshot categories screen

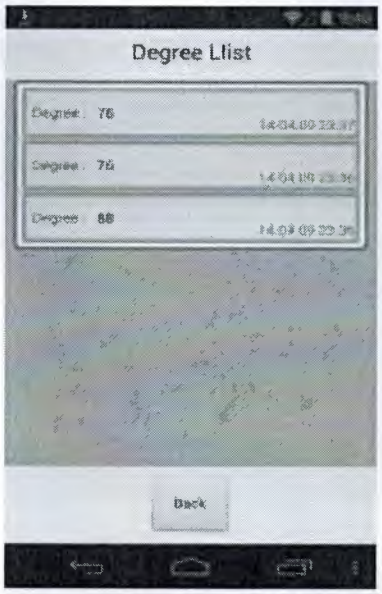

Figure 5.29c: Snapshot of degrees list

Info: The users can find all account information in system and school information in this screen, such as (user name, ID, phone, address, etc., and school name, phone, address, etc.). Figure 5.29 shows info screen.

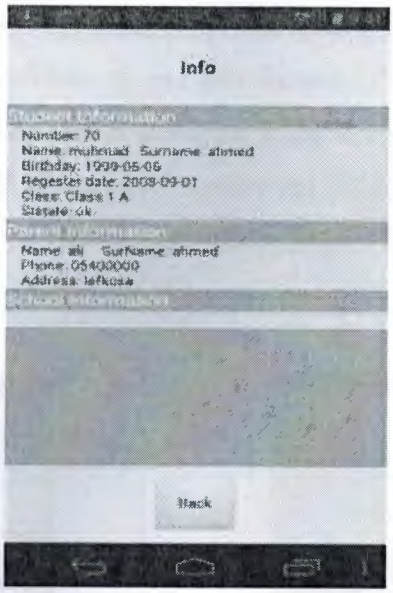

Figure 5.29: Snapshot of info screen

Password: Each user must have a password to login. This feature used to change login password by pressing on *"password"* button in Home screen to access to Change password screen as Figure 5.30, which consists of three information fields (current password, enter new password and re- enter password). After filling information to save the changes *"Save"* button must be pressed or *"Cancel"* to cancel operation.

Figure 5.30: Snapshot of change password

Photo: This feature allows users application to review the pictures published by the school to cover events and school activities, to use this feature *"Photos"* must be pressed, after pressing photo Albums screen as shown in Figure 5.31a will appear which consists of a list of photo albums. Users select album title to view the photos as shown in Figure 5.31b. Then pressing on the photo to be viewed as shown in Figure 5.31c.

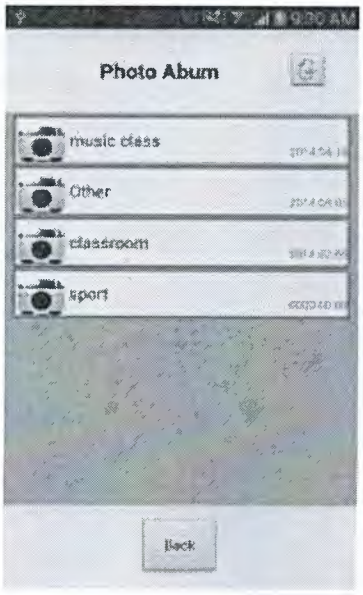

Figure 5.31a: Snapshot of photo album screen

Figure 5.31b: Snapshot of photo list screen

Figure 5.31a: Snapshot of photo screen

5.8 Summary

The MRTPS is mobile application using as a main part in the system, this chapter clarifies the stakeholder of the application, and on the other hand, it illustrates the features of the application and the privilege of the users. Through application, screens control the feature of the application for each user so it clarifies the structure of screens and its distribution to the administrator, teachers, parents and students. In addition to explaining the operations executed by users of the application and the purpose of feature, chapter five explains the work of the application and its characteristics and who are the beneficiaries of the application.

CHAPTER 6

CONCLUSIONS & RECOMMENDATIONS

6.1 Conclusions

This thesis, through development of the mobile application (MRTPS) for school information system, attempted to provide effective means of communication between parents and school, tools for assisting in managing school information system. The author took into account the problems and limitation in previous communication means between school and parents when developing MRTPS application. MRTPS relies on cloud computing that provides a good opportunity for schools with limited budget to use the application. Cloud computing provides important advantage such as reducing the costs of buying infrastructure for the system and high flexibility in controlling of system capabilities. Furthermore, the MRTPS application offers set of features to help the school in managing the information system and building a positive partnership with parents. Application features can be described as to manage class, courses and user accounts, allow the possibility of adding and editing classes, courses, and teachers as users accounts for school through smart phone anywhere and anytime.

In addition to other features such as messages, classes search, schedule, academic calendar, search, news, photos, grades, login history, password, which are provided by the application to increase the level of communication with the parents, these features enable parents to follow school activities, monitor the students behavior, the verification of absences, grades and etc. with the help of a mobile device anytime and anywhere. It is worth mentioning that the MRTPS application works with two mode such as offline and online. In offline mode, MRTPS works without internet connection by using mini database in mobile resource, which it then re synchronizes with the main database in cloud when the internet connection is back. In online mode, MRTPS works with internet. After comparing MRTPS with other specialized applications in the field of school systems, found that MRTBS provides most features of the other applications in a one application, as well as MRTPS provide features are not available in other applications, which highlighted in Table 7:1. Moreover, the table shows the difference between MRTPS and others application in four-feature category (Mange features, School features, Communication features and Support features).

Table 7:1 Comparing features

Features	MRTPS	SMIP	Idwan	M-SIS
Management Features				
Manage User Account	√	×	×	×
Manage Classes	√	×	×	×
Manage Courses	√	×	×	×
Classes Search	√	×	√	√
Search (Student/ Parent)	√	√	√	√
Change Password	√	×	×	×
Communication Features				
Attendance	√	×	×	√
Behavior	√	×	×	√
Grades	√	√	√	√
Private Messages	√	×	√	√
Schedule	√	×	×	√
School Features				
Academic Calendar	√	√	√	√
Login History	√	×	×	×
Photos	√	×	×	×
News	√	√	√	√
Info	√	√	×	√
Library services	×	√	×	√
Health Records	×	×	×	×
Finance statement	×	√	×	×
Map	×	√	×	√
Support Features				
Support Cloud computing	√	×	×	×
Work in Offline/ Online	√	×	×	√
The Total of Features				
22	18	8	6	14

6.2 Recommendations

The school information system in this thesis provides interfaces for mobile application which run on Android, therefore it is important to move towards developing interfaces for

an application that runs on another mobile system such as IOS, Windows mobile and Black Berry. A survey can be contacted at schools to collect options of teachers, parents and students from real life so that, the developed mobile & school information system can be improved further based on the results of the survey.

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Appendix A

USER MANUAL

System Overview

MRTPS is a mobile application developed by the author. MRTPS aimed to allows the possibility for the users (teachers, parents and students) to exchange information and communicate with each other, also it provides features to help the administrator to manage the system from mobile. The application used cloud services such as data stored, and data retrieval. MRTPS operates based on Android operating mobile system.

The user's manual consists of three sections:

- *Application requirements*

  The minimum requirements for running MRTPS on mobile are:

  1. Mobile devices with android 4.0 operating system or more.
  2. The application is compatible with Android 4.1.2 API level 16.
  3. The application requires connection to Internet on mobile.
  4. The screen resolution and size it should be 240dpi - 480x800.

- *Getting and installing Application*

  The user can get a MRTPS application from the site of a school or received an email with application as an apk file format. The apk file should be installed on the mobile device. For specific instruction on how to install application on specific device refer to device's manual. User ID and password are delivered to user from school.

Appendix B

CODE TO LOAD IMAGE FROM AMAZON S3

The following code used in system by developer for accesses Amazon S3 library to load images.

```
HTML

<!DOCTYPE html><html>

    <head>

    <script type="text/javascript">

      function callDoCancle() {
           var result = Android.doSomething("Cancel");
    }

      callDoSomething();
</script>

    </head>
    <body    width= '100%'  bgcolor='#E6E6FA'>

         <form action="http:index.php" method='post'
enctype="multipart/form-data">

            <Table align='center'    >

                 <tr>
                       <td>  <br><br><br><br> </td>
                 </tr>
                 <tr>
                       <td >Enter Photo Title </td>
                 </tr>
                 <tr>
                       <td> <input type='text' name='title'/> </td>
                 </tr>
                 <tr>
                        <td>Enter Photo Date </td>
                      </tr> <tr> <td> <input type='date'
name='photoDate'/> </td>
                 </tr>
                 <tr>
                       <td> <br><br></td>
                 </tr>
                 <tr>
                       <td  >Select Photo  </td>
                 </tr>
                 <tr>
                       <td> <input type='file' name='file'    style="
```

```
height: 2em;"/></td>
                    </tr>
                    <tr>
                          <td> <br><br><br></td>
                    </tr>

                    <tr >
                          <td align="center"><input type='submit'
value='Upload Photo to S3'  style="   height: 3em;"
onclick="this.disabled=true;this.value='Sending, please
wait...';this.form.submit();" /></td>
                     </tr>
                    <tr>
                          <td> <br><br><br><br> </td>
                     </tr>
                    <tr >
                          <td align="center"><input type='button'
onclick='callDoCancle()' style="width: 8em;  height: 3em;" value="Back"
/></td>
                     </tr>
               </Table>


      </form>
      </body>

</html>
-----------------------------------------------------------------

PHP
if($_SERVER['REQUEST_METHOD'] == "POST")
{
$PhTitle = $_POST['title'];
$PhDate =$_POST['photoDate'];

$name = $_FILES['file']['name'];
$size = $_FILES['file']['size'];
$tmp = $_FILES['file']['tmp_name'];
$ext = getExtension($name);

if(strlen($name) > 0)
{
// File format validation
if(in_array($ext,$valid_formats))
{
// File size validation
if($size<(1024*1024))
{
include('s3_config.php');
//Rename image name.
$actual_image_name = time().".".$ext;

if($s3->putObjectFile($tmp, $bucket , $actual_image_name,
S3::ACL_PUBLIC_READ) )
      {
            $msg = "S3 Upload Successful.";
```

```
        $s3file='http://'.$bucket.'.s3.amazonaws.com/'.$actual_image_name;
                // echo "<img src='$s3file'/>";
                echo 'S3 File URL:'.$s3file;

                include('Photo_Add.php');

                //header( 'Location: Successful.html' );

        }
        else
                $msg = "S3 Upload Fail.";

}
else
$msg = "Image size Max 1 MB";

}
else
$msg = "Invalid file, please upload image file.";

}
else
$msg = "Please select image file.";

}
```

Appendix C

JSON CODE FOR CONNECT TO DATABASE

This code used by the developer for connect the system to the database in server via used "GET" and "POST" method.

- **GET**

```
   //GET request method


DefaultHttpClient httpClient = new DefaultHttpClient();

                        String paramString =
URLEncodedUtils.format(params, "utf-16");

                        url += "?" + paramString;

                        HttpGet httpGet = new HttpGet(url);

                        HttpResponse httpResponse =
httpClient.execute(httpGet);

                        HttpEntity httpEntity =
httpResponse.getEntity();

                        is = httpEntity.getContent();
```

- **POST**

```
//POST request method

                        DefaultHttpClient httpClient = new
DefaultHttpClient();

                        HttpPost httpPost = new
HttpPost(url);

                        httpPost.setEntity(new
UrlEncodedFormEntity(params));


                        HttpResponse httpResponse =
httpClient.execute(httpPost);

                        HttpEntity httpEntity =
httpResponse.getEntity();

                        is = httpEntity.getContent();
```