SUDAN UNIVERSITY OF SCIENCE AND TECHNOLOGY
COLLEGE OF COMPUTER SCIENCE & INFORMATION TECHNOLOGY
COMPUTER SYSTEMS AND NETWORK DEPARTMENT

Pilgrims Tracking System

نظام تتبع الحجيج

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بسم الله الرحمن الرحيم

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PROPOSED BY:

Mo'men Hassan Missawi
Ruba Taj Elsir Aboud
Wail Osman El awad

SUPERVISOR: Date
Intsar Ibraheem Ahmed Alhaj **October 2015**

الآيـــــــــة

قـال تـعالــى:

(ذَلِكَ وَمَن يُعَظِّمْ شَعَائِرَ اللَّهِ فَإِنَّهَا مِن تَقْوَى الْقُلُوبِ)

صدق الله العظيم
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الحمدلله

الحمد لله رب العالمين، الحمد لله الذي أراد فقدر، وملك فقهر، وخلق فأمر وعبد فأثاب وشكر، وعصى فعذب وغفر، جعل مصير الذين كفروا إلى سقر، والذين اتقوا ربهم إلى جنات ونهر، ليجزئ الذين كفروا بما عملوا، والذين آمنوا بالحسنى

وأشهد أن لا إله إلا الله، وحده لا شريك له، له الملك، وله الحمد، وهو على كل شيء قدير

يارب

رضاك خير إلينا من الدنيا وما فيها يا مالك النفس قاصيها ودانيها

فنظرة منك يا سؤلي ويا أملنا خير إلينا من الدنيا وما فيها

فليس للنفس آمال تحققها سوى رضاك فذا أقصى أمانيها

وأشهد أن سيدنا وحبيبنا وشفيعنا محمد عبد الله ورسوله عليه أفضل الصلاة وأتم التسليم

DEDICATION

*First and last Praise is to **Allah**,*
To the soul of all my life, my lovely Mother,
*To my **father (Hassan)**, my first teacher,*
To all my brothers, sisters and colleagues.
Mo'men

*To the great man, the men marker, the generation educator and the school of life, my **father (Taj Alsir)***
*To my dear **mother**, the ornament of women, who cannot be described by articulated letters and connected words.*
*To the source of my happiness **sisters** and all my **friends**.*
Ruba

*To the greatest man ever my firs teacher my dear father (**Osman**),*
To the fountain of patience and optimism and hope, my Dear mother to all friends who encourage and support me,
All the people who knows me,
Wail

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*At the beginning and in the end all thanks belongs to **ALLAH**, we thank the almighty for giving us the will power and patience to complete this work; truly without his grace nothing is achievable.*
We are grateful to some people, who worked hard with us from the beginning till the completion of the present research particularly our supervisor **Intsar Ibraheem Ahmed Alhaj** *who has been always generous during all phases of the research, and we highly appreciate the efforts expended by:*
-Mohammed Khalfallah
-Arwa Aboud
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All the regards and respect to the light of the dark roads
Thanks to every teacher who have taught us
Throughout our college years and got us to where we are today.
The rest of university staff.
Thanks to all of our colleagues in the eighth batch, we are honored to have studied with such a batch…
For everyone knows our names, thank you

Abstraction

Technological advancements which have shown a substantial growth concerned with each and every field of humanity, the rapid development that has occurred in smart phones and tracking systems has become a very significant factor in achieving our daily tasks.

What distinguish modern technology that it is not limited to specific use or applications areas but it can be used according to our needs, one of these needs is locating and finding missing pilgrims.

A system of two parts was developed to solve the problem of missing pilgrims. The first part is an android application. The second part is a server that stores the information of pilgrims and monitors their movement.

After implementing the system and testing it, we able to find the missing pilgrims location and display them on a map, and detect if a pilgrim is lost and notify the authorities. On the side of system administrator a system was made for managing pilgrim's information's stored in the database, monitor and display reports.

By using this system we were able to reduce the problem of missing pilgrims.

المستخلص

مما لا شك فيه و ما لا يخفى على أي أحد منا التطور التكنولوجي المتسارع الذي يشهده عالم اليوم في شتى مناحي الحياة. و من هذا التطور التكنلوجي السريع في جانبين مهمين و هما الهواتف الذكية وأنظمة التتبع واللتان أصبح الاعتماد عليهما كبيراً جداً في إنجاز مهامنا اليومية.

ما يميز التكنولوجيا الحديثة أنها واسعة الاستخدامات و غير محصوره على تطبيق معين، أحد هذه التطبيقات يتمثل في كيفية تحديد موقع حجيج بيت الله الحرام الضائعين و تتبع مواقعهم أثناء أدائهم لمناسك الحج .

اقترحنا لحل هذه المشكلة إنشاء نظام من جزئين الجزء الأول و هو جزء العميل و هو عبارة عن تطبيق يعمل على أجهزة الهواتف الذكية التي تستخدم نظام التشغيل أندرويد. والجزء الثاني و هو عبارة عن نظام خاص بمراقبة مواقع الحجيج و إرسال إشعارات تنبيهيه للجهات المختصه تحتوي على موقع الحاج على الخارطه عند ضياعه .

بعد تطبيق النظام و إختباره تم التمكن من تحديد مواقع الحجيج الضائعين. و في الجزء الخاص بمدير النظام تم إنشاء نظام لإدارة بيانات الحجيج المخزنة بقاعدة البيانات و عرض تقارير عنهم و مراقبتهم.

LIST OF TERMS

Term	Description
GPS	Global Positioning System
Mobile App	Mobile Application
RFID	Radio Frequency Identification
WPS	Wi-Fi Based Positioning System
GSM	Global System For Mobile Communications
CID	GSM Cell Identification
BTS	Base Transceiver Station
LAC	Location Area Code
2D Position	Two Dimensions (Latitude, Longitude)
3D position	Three Dimensions (Latitude , Longitude ,Altitude)
SPS	Standard Positioning Service
iOS	Apple's Mobile Operating System
VOIP	Voice Over internet protocol
OS	Operating System
API Key	Application Programing Interface Key
SQL	Structured Query Language
PC	Personal Computers
JDBC	Java Database Connectivity
UML	Unified Modeling Language
PHP	Hypertext Preprocessing
HTML	Hypertext Markup Language
ID	Identification Number

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION:-

The Hajj is an annual Islamic pilgrimage to Mecca, and a mandatory religious duty for Muslims that must be carried out at least once in their lifetime by all Muslims who are physically and financially capable of undertaking the journey. It is one of the five pillars of Islam. The gathering during Hajj is considered the largest annual gathering of people in the world. The Hajj is a demonstration of the solidarity of the Muslim people. The word Hajj means "to intend a journey", which connotes both the outward act of a journey and the inward act of intentions.

But there is a problem of the loss of pilgrims during the performance of rituals and because of that may not be able to perform the rituals correctly. The technology can mitigate this problem by using GPS (Global Positioning System).

1.2 PROBLEM DEFINITION:-

Loss of large numbers of pilgrims, specifically the elderly and non-Arabic speakers due to lacks of tracking techniques and the procedures of reporting the missing pilgrims are not efficient enough. This problem can be solved by using GPS technique.

1.3 OBJECTIVES:-

This research has the following objectives:-

1. To develop a tracking and reporting system (mobile app) to mitigate the problem of losing pilgrims.
2. To registration the pilgrims that belonging to particular group guider.
3. To locate pilgrims on the map.
4. In the case of the pilgrim move away from the group guider specific distance (determined by group guider), the system notifies the group guider.

1.4 SIGNIFICANCE:-

This research has the following significance:-

1. Find missing pilgrims.

2. Faster way to access to the missing pilgrims.
3. Reduce the possibility of loss pilgrims.

1.5 SCOPE:-

This application allows to group guidance the following:-

1. Registration the pilgrims that belonging to particular group guider.
2. The group guider tracking his registered pilgrims.
3. Locate registered pilgrims on the map.
4. Notified the group guider if pilgrim is out of specific distance.

1.6 Thesis Layout:-

This research has the following Thesis Layout:-

Chapter 1 contains the introduction, problem, objectives, significance and thesis layout of the project.

Chapter 2 discusses general introduction to the tracking and some previous studies that related to our project.

Chapter 3 discusses the tools that will be used.

Chapter 4 System Description and analysis

Chapter 5 (Implementation) discusses the steps we took to create our project.

Chapter 6 contains the results, conclusion and recommendations.

CHAPTER 2

INTRODUCTION TO TRACKING

2.1 INTRODUCTION

This chapter contains two sections. The first part contains brief introduction to Tracking, The second part contains related studies.

2.2 INTRODUCTIONS TO TRACKING

2.2.1 Overview

Tracking is observing persons or objects on the move and supplying a location data to a model capable of displaying the location data, location tracking is not one, single technology. Rather, it is the convergence of several technologies that can be merged to create systems that track objects.

There are myriad tracking systems. Some are 'lag time' indicators, that is, the data is collected after an item has passed a point for example a bar code or choke point or gate. Others are 'real-time' or 'near real-time' like Global Positioning Systems (GPS).

Current technologies being used to create location-tracking and location-based systems include:

- **Global Positioning System (GPS)** is a space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the earth where there is an unobstructed line of sight to four or more GPS satellites. The system provides critical capabilities to military, civil, and commercial users around the world. The United States government created the system, maintains it, and makes it freely accessible to anyone with a GPS receiver.

- **Radio Frequency Identification (RFID)** - Small, battery-less microchips that can be attached to consumer goods, cattle, vehicles and other objects to track their movements. RFID tags are passive and only transmit data if prompted by a reader. The reader transmits radio waves that activate the RFID tag. The tag then transmits information via a pre-determined radio frequency.
  This information is captured and transmitted to a central database. Among possible uses for RFID tags are a replacement for traditional UPC bar codes.

- **Wi-Fi-based positioning system (WPS)** - Wi-Fi positioning takes advantage of the rapid growth in the early 21st century of wireless access points in urban areas. The localization technique used for positioning with wireless access points is based on measuring the intensity of the received signal (received signal strength or RSS. Typical parameters useful to relocate the Wi-Fi hotspot or wireless access point include the SSID and the MAC address of the access point.
  The Wi-Fi hotspot database gets filled by correlating mobile device GPS location data with Wi-Fi hotspot MAC addresses.

- **A GSM Cell ID (CID)** is a generally unique number used to identify each Base transceiver station (BTS) or sector of a BTS within a Location area code (LAC) if not within a GSM network.

2.2.2 Global Positioning System (GPS)

2.2.2.1 Overview

The Global Positioning System (GPS) is a satellite-based navigation system made up of a network of 24 satellites placed into orbit by the U.S. Department of Defense. GPS was originally intended for military applications, but in the 1980s, the government made the system available for civilian use. GPS works in any weather conditions, anywhere in the world, 24 hours a day. There are no subscription fees or setup charges to use GPS [1].

GPS is a system. It’s made up of three parts: satellites, ground stations, and receivers [2].

Satellites: act like the stars in constellations—we know where they are supposed to be at any given time [2].

The ground stations: use radar to make sure they are actually where we think they are [2].

A receiver: like you might find in your phone or in your parent’s car, is constantly listening for a signal from these satellites. The receiver figures out how far away they are from some of them [2].

2.2.2.2 How It Works

GPS satellites circle the earth twice a day in a very precise orbit and transmit signal information to earth. GPS receivers take this information and use triangulation to calculate the user's exact location. Essentially, the GPS receiver compares the time a signal was transmitted by a satellite with the time it was received. The time difference tells the GPS receiver how far away the satellite is. Now, with distance measurements from a few more satellites, the receiver can determine the user's position.

A GPS receiver must be locked on to the signal of at least three satellites to calculate a 2D position (latitude and longitude) and track movement. With four or more satellites in view, the receiver can determine the user's 3D position (latitude, longitude and altitude). Once the user's position has been determined, the GPS unit can calculate other information, such as speed, bearing, track, trip distance, distance to destination, sunrise and sunset time and more [1].

2.2.2.3GPS Accuracy

United state government is committed to providing GPS to the civilian community at the performance levels specified in the GPS Standard Positioning Service (SPS) of 3 meters horizontal accuracy [3].

2.3 PREVIOUS STUDIES

2.3.1 Securus eZoom

The eZoom is a small device that can be placed into your child's backpack or permanently mounted in the car. Using your PC and smartphone, you can check your child's location, create "safe" zones that will alert you if the device leaves these areas and even monitor the speed of the car your child in which your child is riding. Not just intended for tracking kids, eZoom can also be used to keep tabs on personal items as well [4].

Figure (2.1): eZoom device [4]

2.3.2 GPS Location Tracker

GPS Location Tracker covers most mobile devices, making it useful for tracking family members, as well as lost devices. This app lets you track family member's locations on your mobile phone and also see movements from prior days. All location history is cached in a secure server and is accessible via Internet or mobile browse [4].

Figure (2.2): GPS Location Tracker [4]

2.3.3 Life360

Life360 has established itself as a leading app for everyone in the family to use together. You can keep tabs on all family members using the app and also see when kids have arrived or left their destinations. Used as more of a family communication device than a GPS tracker, Life360 also enables group messaging and instant VoIP conference calls to enable everyone to stay in contact [4].

Figure (2.3): Life360 [4]

2.4 CURRENT HAJJ SYSTEM

Actually there is no any specific technical service until now used to help finding lost people or people that needs help precisely.

There are some of technical services like GPS in Transport buses but it's not helpful in our case of finding lost people, it used mostly to monitoring the drivers to determine their locations and to keep them in specific range.

but in fact in our case they use the most known traditional way by reporting the center of lost people or any of the police center and they do the usual procedure by filling a form which is consist of information and Descriptions of the lost person.

In the case of loss of a person for a long period of time procedures take other dimensions by reporting a special security authorities where they used phone tracking technology (track a cell phone), but this technique takes a lot of period of time.

It may come to be more complex mission if the lost person is small children or overage or he/she Unacquainted with Arabic or English languages.

2.5 Conclusion

This chapter dealt with background for tracking and the techniques that used in the tracking process, also dealt with previous studies and the system currently used in the Hajj.

CHAPTER 3

TOOLS AND TECHNIQUES

3.1 INTRODUCTION

This chapter dealt with the techniques and tools that will be used to achieve the objectives of the project, through dealt with technical or tool and exposure to explain the brief, and dealt with the most important advantages or disadvantages, if any.

3.2 TOOLS AND TECHNIQUES

3.2.1 Android Operating System

Android is a mobile OS (operating system), it is open source system based on the Linux kernel and currently developed by Google. With a user interface based on direct manipulation, Android is designed primarily for touchscreen mobile devices such as smartphones and tablet computers [5].

There are many advantages to developing for the Android platform:

- **Zero startup costs to begin development**. The development tools for the platform are free to download, and Google only charges a small fee to distribute applications on the Android Market.
- **Freedom to innovate**. The Android OS is an open-source platform based on the Linux kernel and multiple open-source libraries. In addition to building applications to run on Android devices, developers are free to contribute to or extend the platform as well.
- **Open distribution model**. Very few restrictions are placed on the content or functionality allowed in Google's Android Market, and developers are free to distribute their applications through other distribution channels as well.
- **Multi-platform support**. There are a wide variety of hardware devices powered by the Android OS, including many different phones and tablet computers. Development for the platform can occur on Windows, Mac OS or Linux [6].

3.2.2 Java

Java is a very popular programming language developed by Sun Microsystems; it is the global standard for developing mobile applications, games, Web-based content, and enterprise software [8]. Java is a C-language derivative, so its syntax rules look much like C's [7].

Some of the Java's important core features are:

- It's easy to learn and understand.
- It's designed to be platform-independent and secure, using virtual machines.
- It's object-oriented (It is close to the reality perceived in dealing with things) [8].

3.2.3 Global Positioning System (GPS)

GPS is a space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the earth where there is an unobstructed line of sight to four or more GPS satellites. The GPS is a great way for finding and keeping track of just about anything. The United States government created the system, maintains it, and makes it freely accessible to anyone with a GPS receiver [9].

3.2.4 Google Maps

Google Maps is a Web-based service that provides detailed information about geographical regions and sites around the world [10]. It offers satellite imagery, street maps, real-time traffic conditions, and route planning for traveling.

In October 2005 Google introduced a Java application called Google Maps for Mobile, intended to run on any Java-based phone or mobile device [11].

3.2.4.1 Google Maps API

Google launched the Google Maps API in June 2005 to allow developers to integrate Google Maps into their websites. It is a free service, and Over 1,000,000 web sites use the Google Maps API.

By using the Google Maps API, it is possible to embed Google Maps site into an external website, on to which site specific data can be overlaid [12].

3.2.4.2 Google Maps Key

Before start to develop any application that relies on Google Maps the developer must be register to get the API key, through which to use Google Maps in the Specified application, Then the developer determine the file that it will work .

There was a problems faced the developers when they use the Google Maps that they must obtained a special key for each file is used [13].

3.2.5 SQL (Structured Query Language)

SQL is a standard language used to access and manipulate databases in: MySQL, SQL Server, Access, Oracle and other database systems. (w3school) [14].

SQL consists of a data definition language, data manipulation language, and a data control language. The scope of SQL includes data insert, query, update and delete, schema creation and modification, and data access control.

Some of the SQL important features are:

- **Portable**: SQL is run in programs in mainframes, PCs, laptops, servers and even mobile phones. It runs in local systems, intranet and internet. Databases using SQL can be moved from device to another without any problems.
- SQL allows the user to create, update, delete, and retrieve data from a database.
- **Easy to learn and understand**: SQL mainly consists of English statements and it is very easy to learn and understand a SQL query.
- **Integrates with Java**: SQL integrates with Java by using an API known as JDBC (Java Database Connectivity).

3.2.6 UML (Unified Modeling Language)

UML first appeared in the 1990's as an effort to select the best elements from the many modeling systems proposed at the time, and to combine them into a single coherent notation. It has since become the industry standard for software modeling and design, as well as the modeling of other processes in the scientific and business worlds.

The UML is a tool for specifying software systems. Standardized diagram types to help you describe and visually map a software system's design and structure. Using UML it is possible to model just about any kind of application, both specifically and independently of a target platform.

The use of UML as a tool for defining the structure of a system is a very useful way to manage large, complex systems. Having a clearly visible structure makes it easy to introduce new people to an existing project [15].

3.2.6.1 Why Using UML

Some of UML features are:

- UML breaks the complex system into discrete pieces that can be understood easily.
- Handover the system to new team becomes easier.
- Complex system can be understood by the disparate developers who are working on different platforms.
- UML model is not a system or platform specific. It unifies all disparate developers under one roof [16].

3.2.6.2 UML Diagrams

3.2.6.2.1 Use Case Diagram

Use case diagram at its simplest is a representation of a user's interaction with the system that shows the relationship between the user and the different use cases in which the user is involved. A use case diagram can identify the different types of users of a system and the different use cases [17].

3.2.6.2.2 Sequence diagram

Sequence diagram is an interaction diagram that shows how processes operate with one another and in what order. A sequence diagram shows object interactions arranged in time sequence.

It depicts the objects and classes involved in the scenario and the sequence of messages exchanged between the objects needed to carry out the functionality of the scenario. Sequence diagrams are typically associated with use case realizations in the Logical View of the system under development. Sequence diagrams are sometimes called event diagrams or event scenarios [18].

3.2.6.2.3 Class Diagram

Class diagram is a type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, operations, and the relationships among objects [19].

3.2.6.2.4 Collaboration diagram

Is also called a communication diagram or interaction diagram, is an illustration of the relationships and interactions among software objects [20].

Communication diagrams represent a combination of information taken from Class, Sequence, and Use Case Diagrams describing both the static structure and dynamic behavior of a system [21].

3.2.6.2.5 State diagram

State diagram is a behavior diagram which shows discrete behavior of a part of designed system through finite state transitions. State machine diagrams can also be used to express the usage protocol of part of a system [22].

3.2.6.2.6 Object diagram

Is a diagram that shows a complete or partial view of the structure of a modeled system at a specific time.an object diagram focuses on some particular set of objects and attributes, and the links between these instances.

Object diagrams are derived from class diagrams so object diagrams are dependent upon class diagrams [23].

3.2.6.2.7 Component diagram

Component diagram depicts how components are wired together to form larger components and or software systems. They are used to illustrate the structure of arbitrarily complex systems [24].

3.2.6.2.8 Deployment diagram

Deployment diagram depicts a static view of the run-time configuration of processing nodes and the components that run on those nodes. In other words, deployment diagrams show the hardware for your system, the software that is installed on that hardware, and the middleware used to connect the disparate machines to one another [25].

3.2.6.2.9 Activity diagram

Activity diagrams are intended to model both computational and organizational processes. Activity diagrams show the overall flow of control [26].

3.2.6.3 Enterprise Architect

Is a program that is used to design and manage the schemes UML, this program is fast and easy to use, and it also features reduce the costs spent on the follow-up course of the project under development [27].

3.2.7 PHP (Hypertext Preprocessing)

PHP is an open source server-side scripting language designed for web development but also used as a general-purpose programming language [28].

Some features of PHP:-

- Fundamental feature of PHP that distinguish them from programming languages to the client side are that the program is executed and processed on the server and generate Internet pages and then return it to the customer.
- The client on the site does not recognize the main code.
- Also one of the important features of PHP they are easy to handle by novices, on the other hand offers many advanced features for users experienced [29].

3.2.8 HTML5 (Hypertext Markup Language)

HTML5 is a core technology markup language of the Internet used for structuring and presenting content for the World Wide Web [30].

3.2.9 Wamp Server

Wamp Server is a Windows web development environment. It allows you to create web applications with Apache2, PHP and a MySQL database. Alongside, PhpMyAdmin allows you to manage easily your database [31].

Some features of wamp server:-

- Easy to deal with and ease of use through user interface enables the management of databases.
- Do not exploit a large area.
- Stability and protection and high performance.
- Dose not needs a dedicated server to the device where it can be through the use of this program that the device server and client work works [32].

3.3 CONCLUSION

This chapter dealt with the most important techniques and tools that will be used to achieve the objectives of this research.

CHAPTER 4

SYSTEM DESCRIPTION AND ANALYSIS

4.1 INTRODUCTION

This chapter deals with a general description of the system and its functions and clarifies the system components, and also deals with detailed analysis of the operations of the system using the schemes UML.

4.2 SYSTEM DESCRIPTION

The system provides to the administrator the ability to Register users (pilgrims, guiders, and helper) also view, edit, and delete their information through a web page.

It' provides to the guider the ability to track the movement of pilgrims and Determine a specific distance, the system notify the guider and helper if one or more pilgrims moved away from guider Distance greater than the specified distance and display their location on a map. It also does a simple warning notification to pilgrim when he moved away from the guider.

4.3 SYSTEM ENVIRONMENT

Database has been created to store and update the users information and their current location (longitude and latitude) by using GPS in smart phones (client, server).

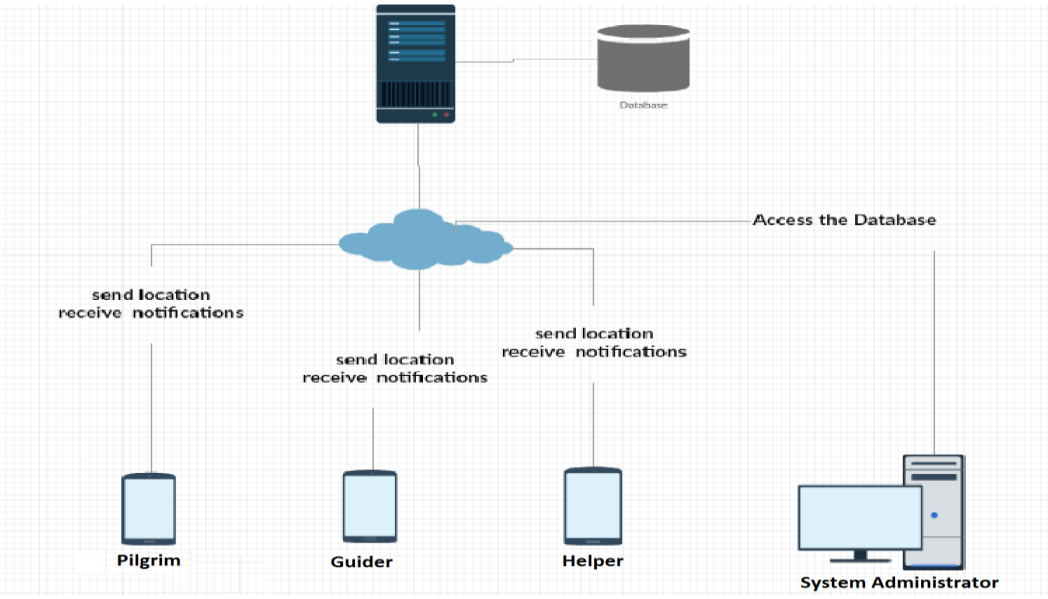


Figure (4.1): system environment

4.4 SYSTEM FUNCTIONALITY

System functions are divided into two main categories, functions provided to the system administrator and functions provided to the users.

4.4.1 System Administrator Functions

- **Add A New User (Pilgrim, Guide, And Helper)**

  It allows the system administrator to add a new user by identifying the basic information (id, name, phone number, registration date… etc.) and identify the type of user (pilgrims, guider, or helper).

- **Modify User Information**

  This feature allows modifying user information by entering user ID and then displays the information that can be modified.

- **Delete User**

  Allow to delete specific user by entering user ID.

- **Show All Users**

  It allows the system administrator to view all the user information by selecting the type of user and year of registration.

4.4.2 User Functions

4.4.2.1 System Functions Provides To the Guider

The system provides to guider the following functions:-

- **Set Safe Distance**

  It allows the guider to Identify specific distance.

- **Notify The Guider**

  Notify the guider of all pilgrims (belong to him) who out of safe distance and show their location on map.

- **Tracking Pilgrims**

  Track all pilgrims that belong to him and show their location on map.

- **Show Pilgrims**

  Show all pilgrims information that belong to him.

4.4.2.2 System Functions Provides To the Helper

The system provides to helper the following functions:-

- **Notify The Helper**

  Notify the helper of all pilgrims (Closest to him) who out of safe distance and show their location on map.

- **Tracking Lost Pilgrims**

  Track all pilgrims (Closest to him) who out of safe distance and show their location on map.

- **Show Pilgrims**

  Show all pilgrims information (Closest to him) who out of safe distance.

4.4.2.3 System Functions Provides To the Pilgrims

The system allows to the pilgrims to Send emergency alert to the helper when need to get a help.

4.5 SYSTEM COMPONENTS

The System components are divided into two categories, hardware and software

4.5.1 System Hardware Components

The hardware divided into two parts:-

- One part of the system is a device works as a server which is a computers with high specifications (random access memory, and hard disk)
- The other part of the system is a smart phone with GPS technique.

4.5.2 System Software Components

The software divided into two parts

- **User Part**

  This section uses the Android operating system used in smart phones, and requires that the device is supportive of the Global Positioning System, access to the Internet. This segment consists of the interface allows the user to deal with the system.

- **Administrator Part**

  Is a database that stores information about users, it was created using MySQL and is managed using PHP language. This segment consists of Web page that allows the system administrator to add, delete or modify users.

4.6 ANALYSIS USING UML SCHEMES

To analyze this system was used UML diagrams; it was illustrated symbols of these schemes in Appendix I in partial appendices, and has been used four schemes are:

4.6.1 Use Case Diagram

This scheme is used to identify the different types of users and representation their interaction with the system.

Figure (4.2): illustrates the use case diagram of the proposed system and processes that can be made

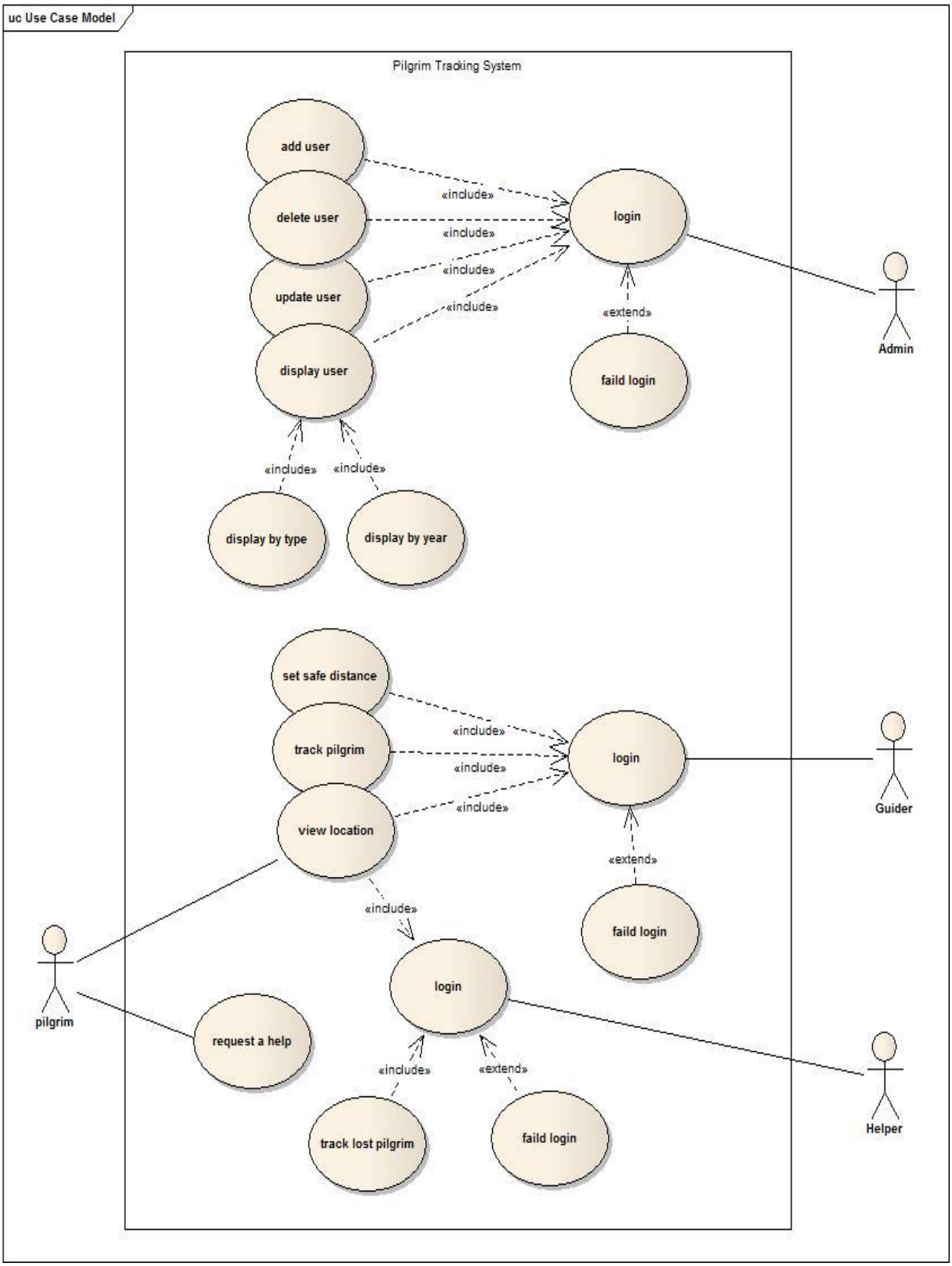


Figure (4.2): use case diagram

4.6.2 Sequence Diagram

This scheme is used to shows how processes operate with one another and in what order, and used to show the flow of data and messages between the various system components.

- Horizontal component in diagram illustrate the objects in the system.
- Vertical components illustrate the order of messages exchanged on the order they are presented in the system.

Has been used nine sequence diagrams in this system each of them illustrate function provided by the system whether to the system administrator or the users.

4.6.2.1 Login Process

The system asks the user to enter username and password to login to the system as shown in the table (4.1) and figure (4.3)

Table (4.1): login process

Use Case Name	**Login**
Actors	Administrator ,Guider, Helper
Preconditions	No
Main Flow Of Events	1. The system asks the user to enter username and password. 2. The user enters username and password. 3. The system checks the validity of the input information. 4. It is logged on to the system.
Post Conditions	The system displays a graphical interface containing all the basic operations that can be performed by the system user.

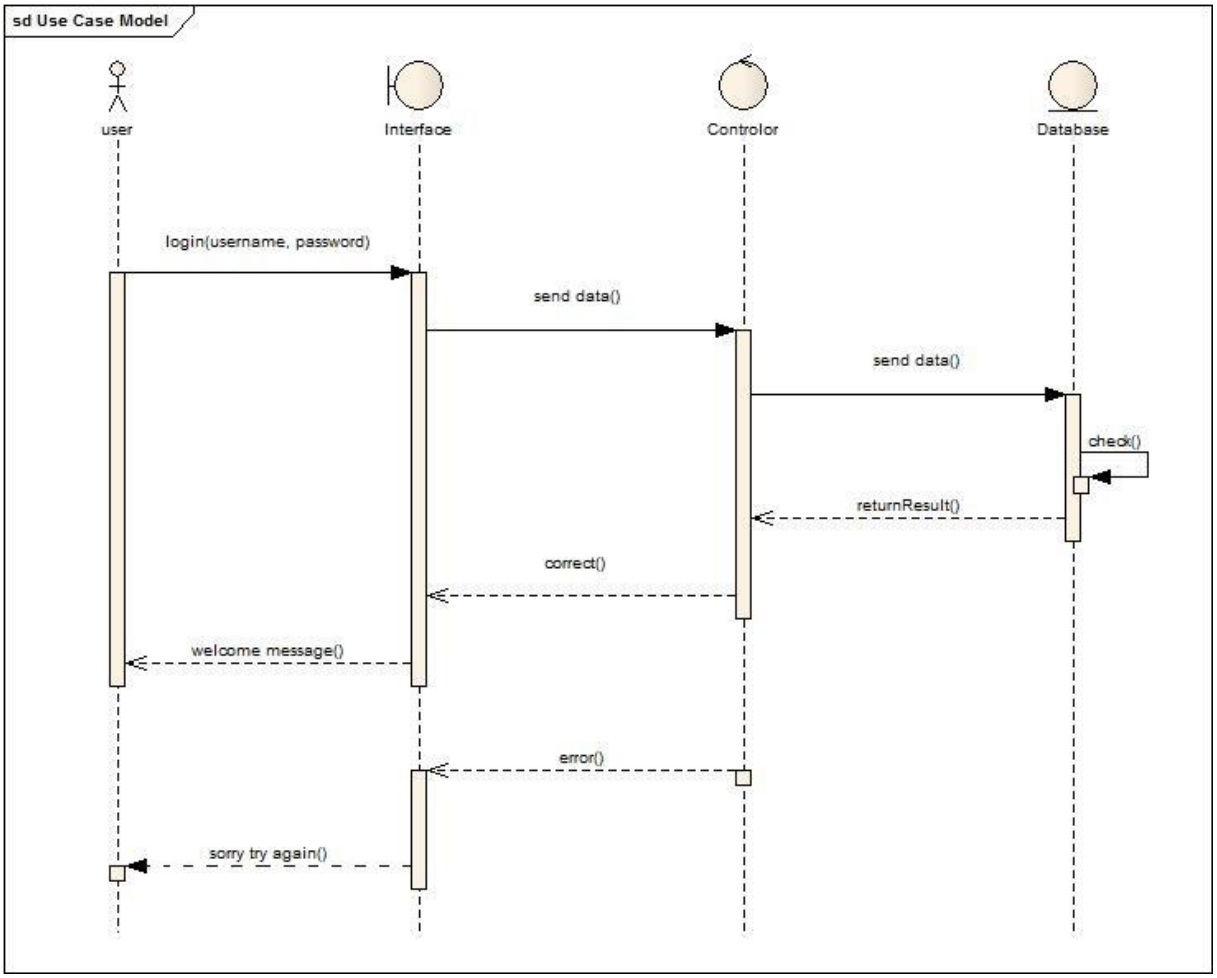


Figure (4.3): sequence diagram for login process

4.6.2.2 Add New User Process

After successfully login allows to the system administrator to add new user as shown in the table (4.2) and figure (4.4)

Table (4.2): add user process

Use Case Name	Add New User
Actors	Administrator
Preconditions	successfully login
Main Flow Of Events	1. The system administrator enters basic user information (name, phone, registration date…etc.). 2. The system checks from the non-recurrence of the ID. 3. After making sure there is non-recurrence of the ID It is added new user.
Post Conditions	The system displays message illustrate that the operation completed successfully.

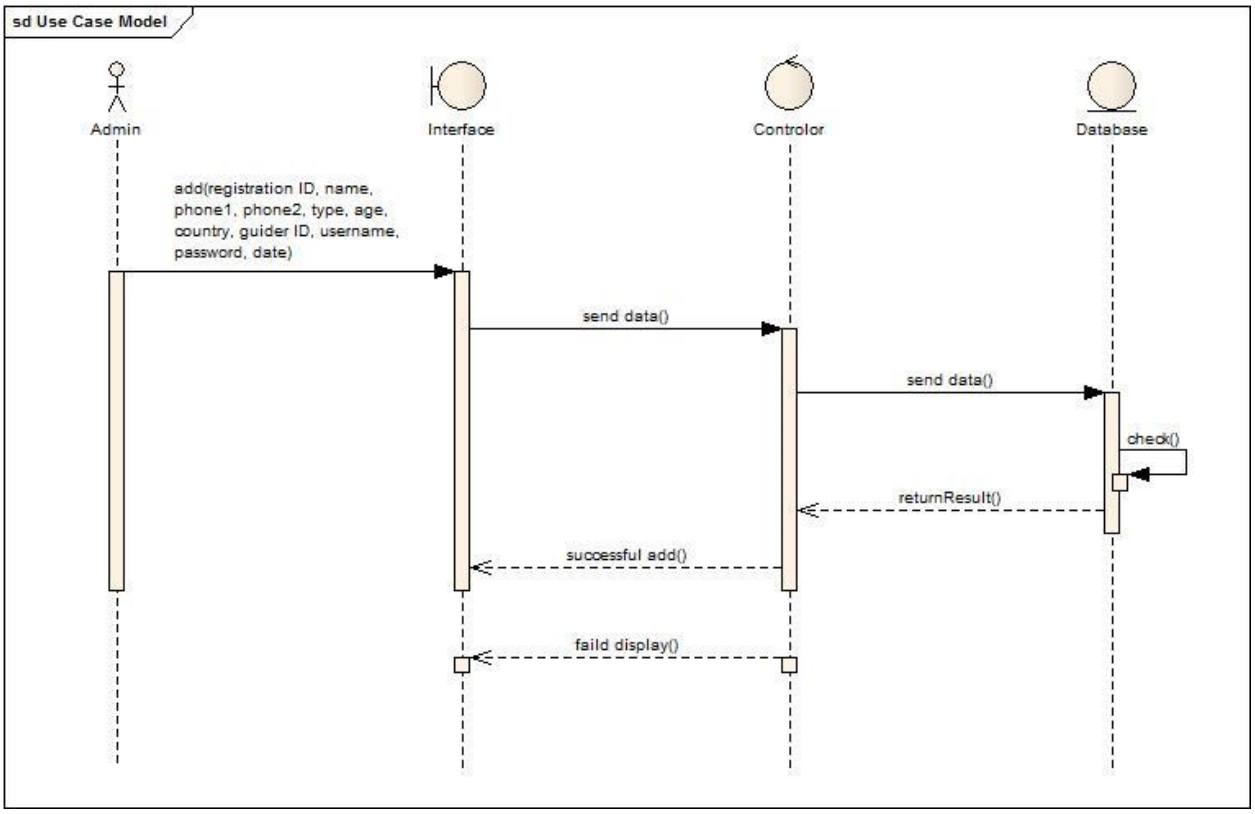


Figure (4.4): sequence diagram for add new user process

4.6.2.3 Delete User Process

After successfully login allows to the system administrator to delete user already exists as shown in the table (4.3) and figure (4.5)

Table (4.3): delete user process

Use Case Name	Delete User
Actors	Administrator
Preconditions	successfully login
Main Flow Of Events	1. The system administrator enter user ID to be deleted. 2. The system checks the validity of user ID. 3. After making sure from user ID it is deleted user.
Post Conditions	The system displays message illustrate that the operation completed successfully.

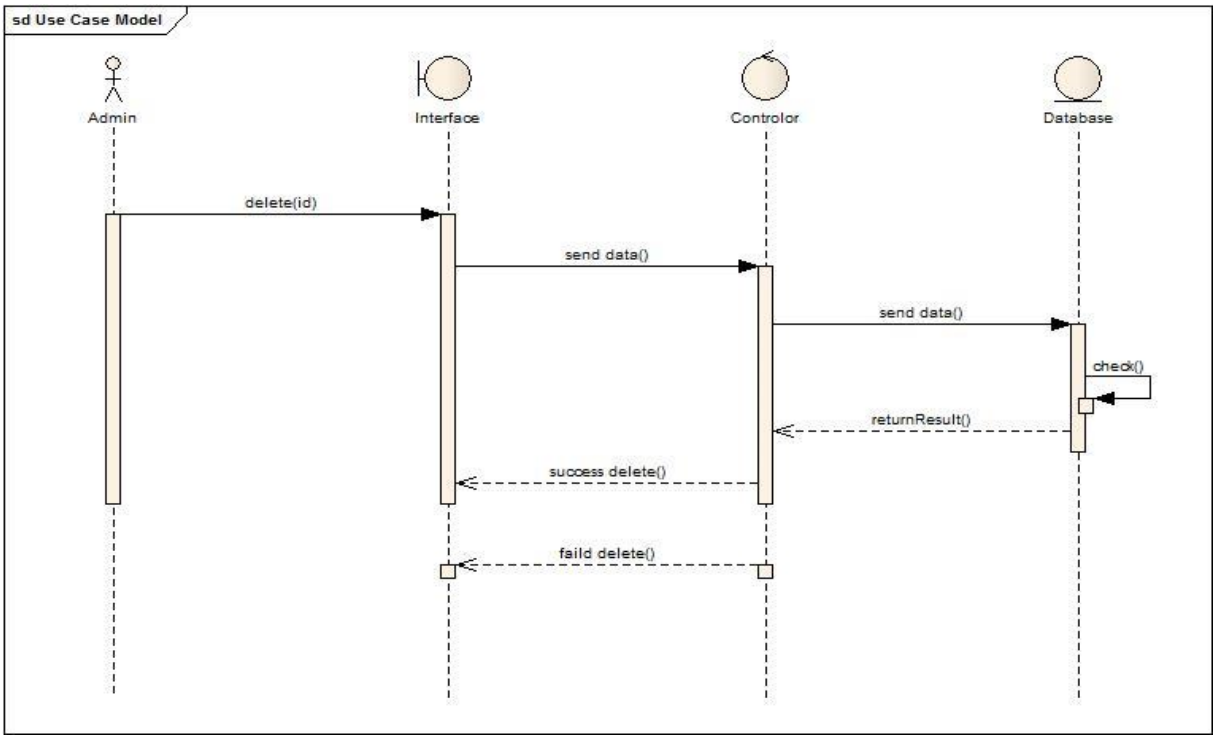


Figure (4.5): sequence diagram for delete user process

4.6.2.4 Update User Information Process

After successfully login allows to the system administrator to update user already exists as shown in the table (4.4) and figure (4.6)

Table (4.4): update user process

Use Case Name	Update User
Actors	Administrator
Preconditions	successfully login
Main Flow Of Events	1. The system administrator enter user ID to be updated. 2. The system checks the validity of user ID. 3. After making sure from user ID display user data and allow him updating it.
Post Conditions	The system displays message illustrate that the operation completed successfully.

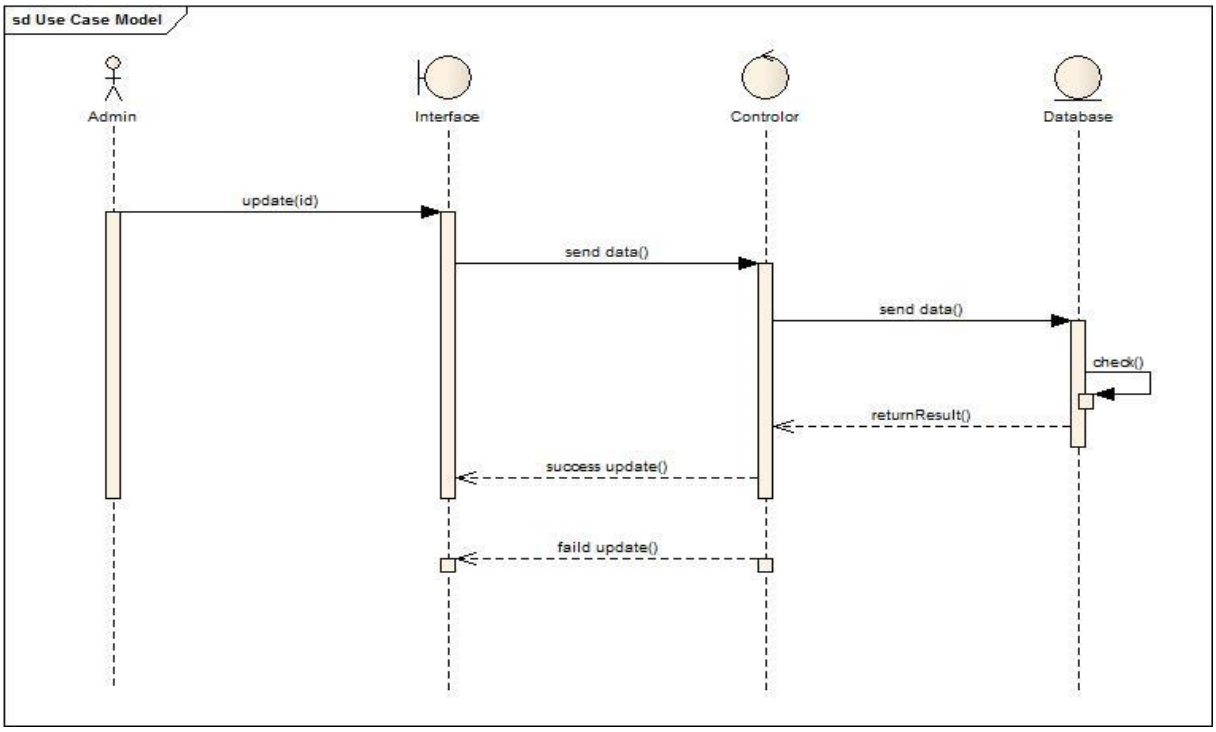


Figure (4.6): sequence diagram for update user process

4.6.2.5 Display User Information Process

After successfully login allows to the system administrator to display users information as shown in the table (4.5) and figure (4.7)

Table (4.5): display user process

Use Case Name	Update User
Actors	Administrator
Preconditions	successfully login
Main Flow Of Events	1. The system administrator enters user type and registration year to be displayed. 2. The system checks of the user type and registration year. 3. After that display table consist of user data.
Post Conditions	The system displays message illustrate that the operation completed successfully.

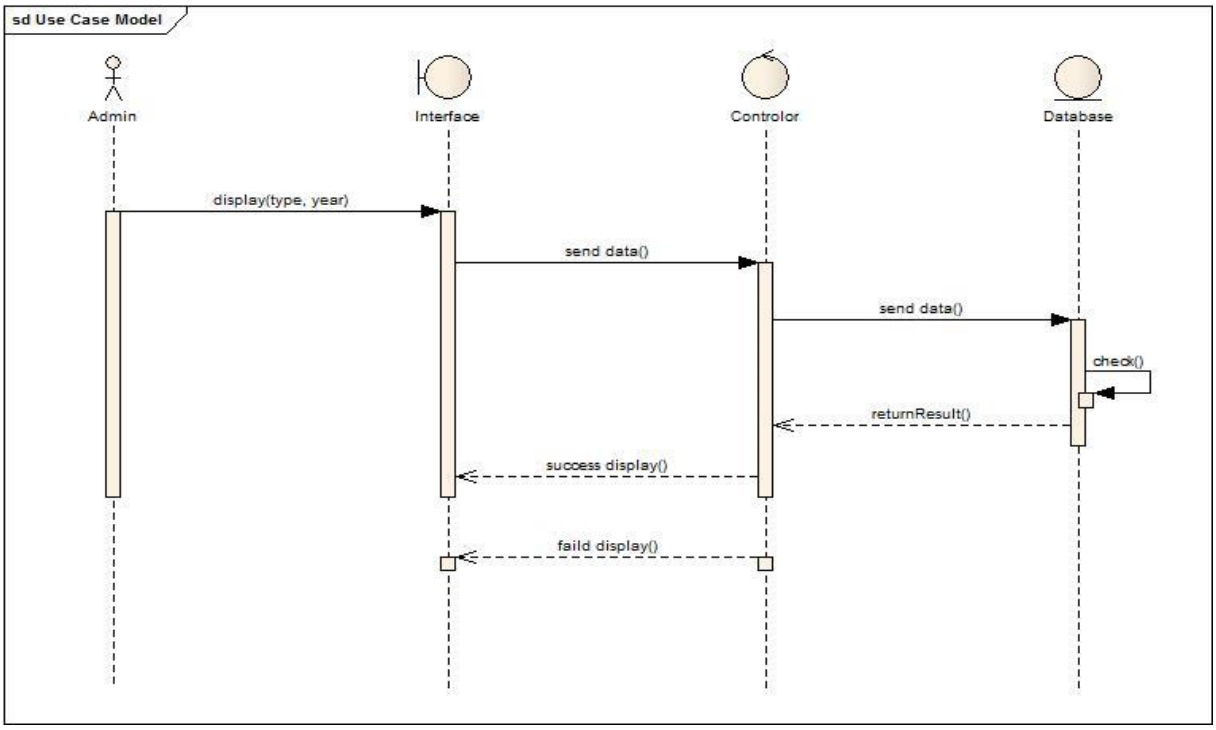


Figure (4.7): sequence diagram for display user process

4.6.2.6 Safe Distance Process

After successfully login allows to the guider to set safe distance as shown in the table (4.6) and figure (4.8)

Table (4.6): safe distance process

Use Case Name	Update User
Actors	guider
Preconditions	successfully login
Main Flow Of Events	1. The guider enters specific distance. 2. The system store this distance in database.
Post Conditions	The system displays message illustrate that the operation completed successfully.

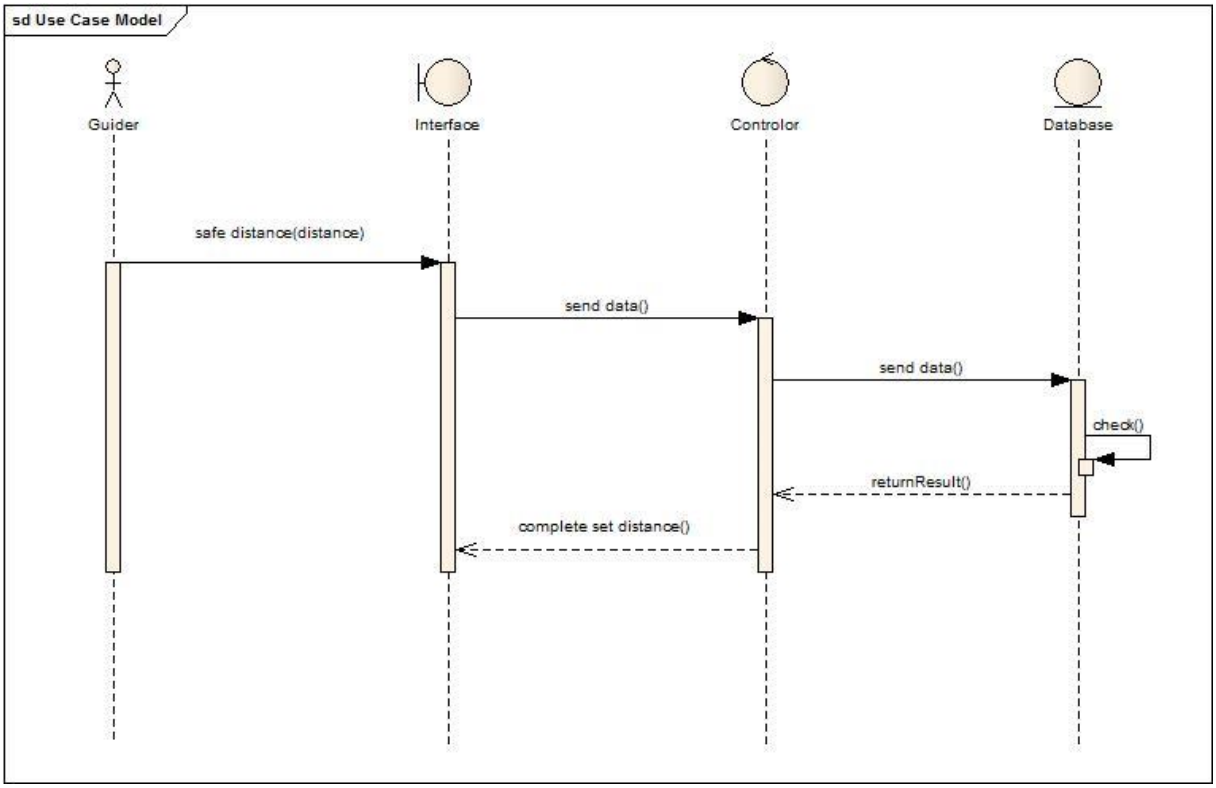


Figure (4.8): sequence diagram for safe distance process

4.6.2.7 Track Pilgrims Process

After successfully login allows to the guider to track pilgrims that belong to him as shown in the table (4.7) and figure (4.9)

Table (4.7): track pilgrims process

Use Case Name	Update User
Actors	Guider
Preconditions	successfully login
Main Flow Of Events	1. The system checks of the guider ID. 2. The system selects active pilgrims that belong to specific guider. 3. The system calculates the distance between guider and pilgrims. 4. After calculates the distance allow to the guider to show pilgrims location on a map.
Post Conditions	If the distance between guider and pilgrims greater than the specified distance the system notify the guider and helper.

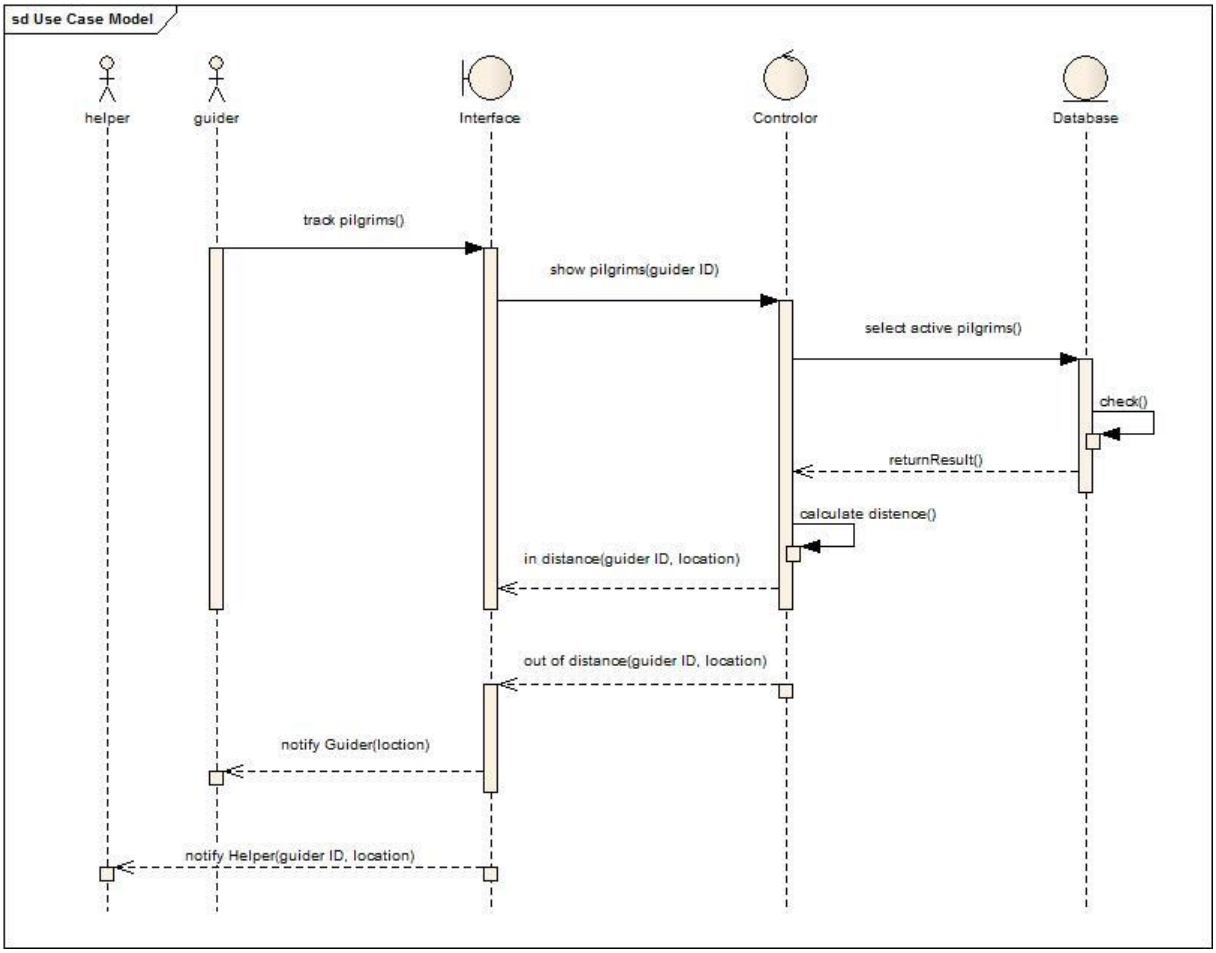


Figure (4.9): sequence diagram for track pilgrims process

4.6.2.8 Track The Lost Pilgrims Process

After successfully login allows to the helper to track pilgrims (Closest to him) who out of safe distance as shown in the table (4.8) and figure (4.10)

Table (4.8): track lost pilgrims process

Use Case Name	**Update User**
Actors	Helper
Preconditions	successfully login
Main Flow Of Events	1. The system checks of the guider ID. 2. The system selects pilgrims (Closest to him) who out of safe distance. 3. After that allow to the helper to show pilgrims location on a map.
Post Conditions	System displays the lost pilgrims.

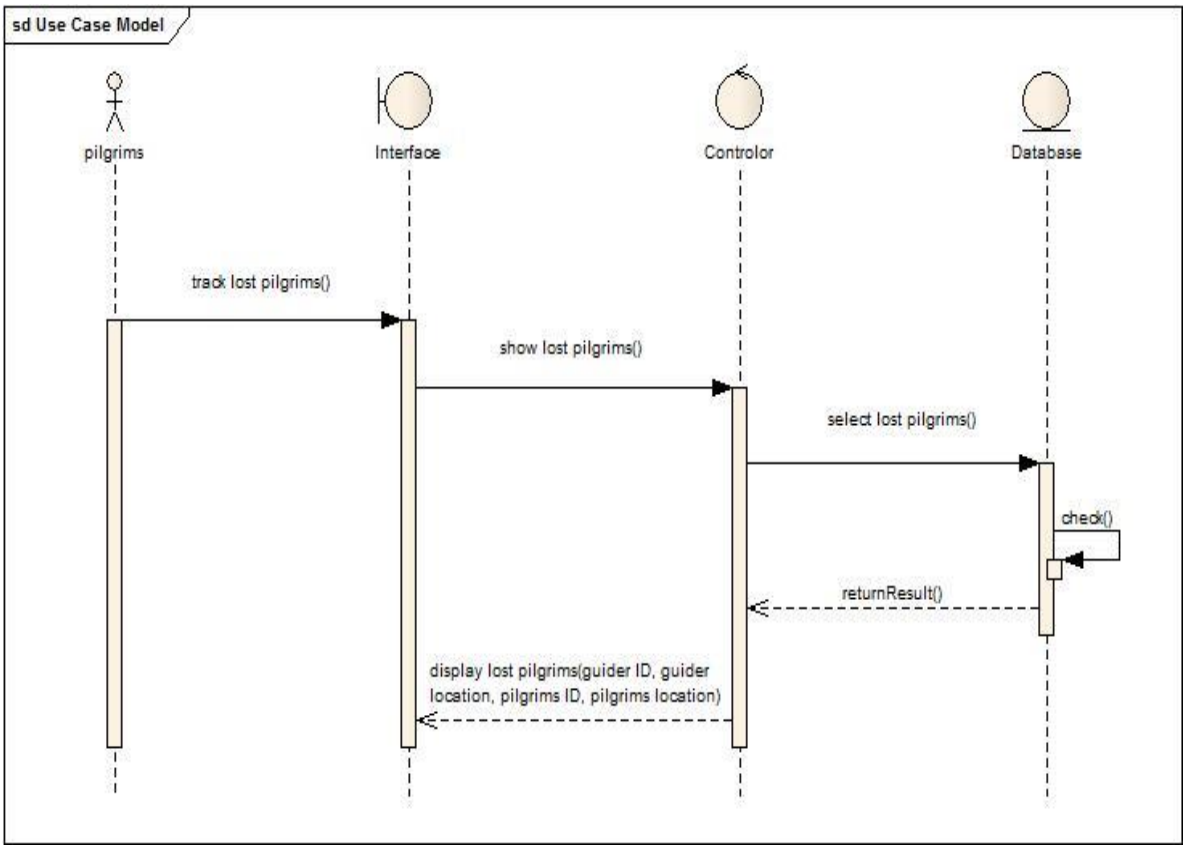


Figure (4.10): sequence diagram for track lost pilgrims process

4.6.2.9 Request a Help Process

The system allows to the pilgrims to asking for help from helper as shown in the table (4.9) and figure (4.11)

Table (4.9): request a help process

Use Case Name	Update User
Actors	Pilgrims
Preconditions	No
Main Flow Of Events	1. The system select to guider ID and guider location. 2. Pilgrims location and guider location on a map.
Post Conditions	System notifies the helper That there is pilgrim who needs help.

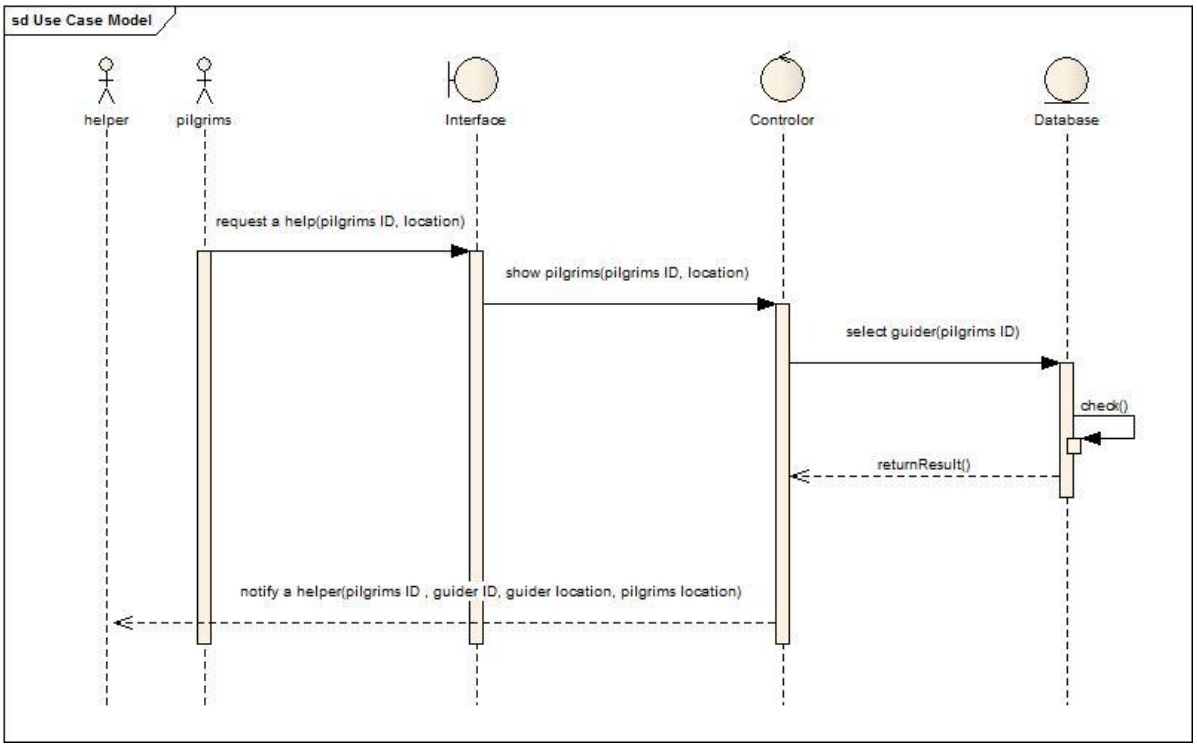


Figure (4.11): sequence diagram for request a help process

4.6.3 Activity Diagram

Activity diagrams are intended to model both computational and organizational processes. Activity diagrams show the overall flow of control.

Has been used four activity diagrams in this system, illustrate activity diagram for system administrator and users.

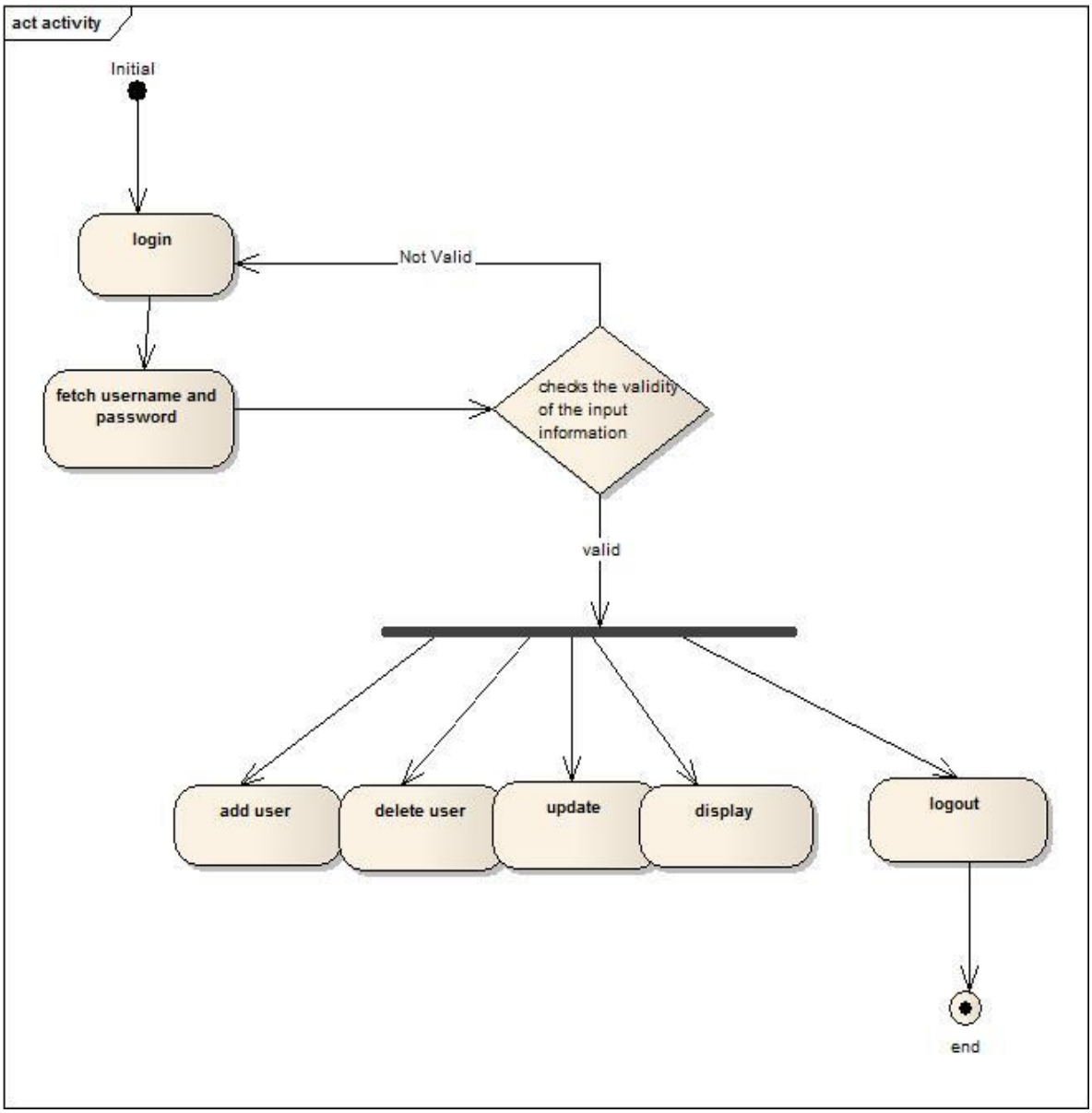


Figure (4.12): activity diagram for admin

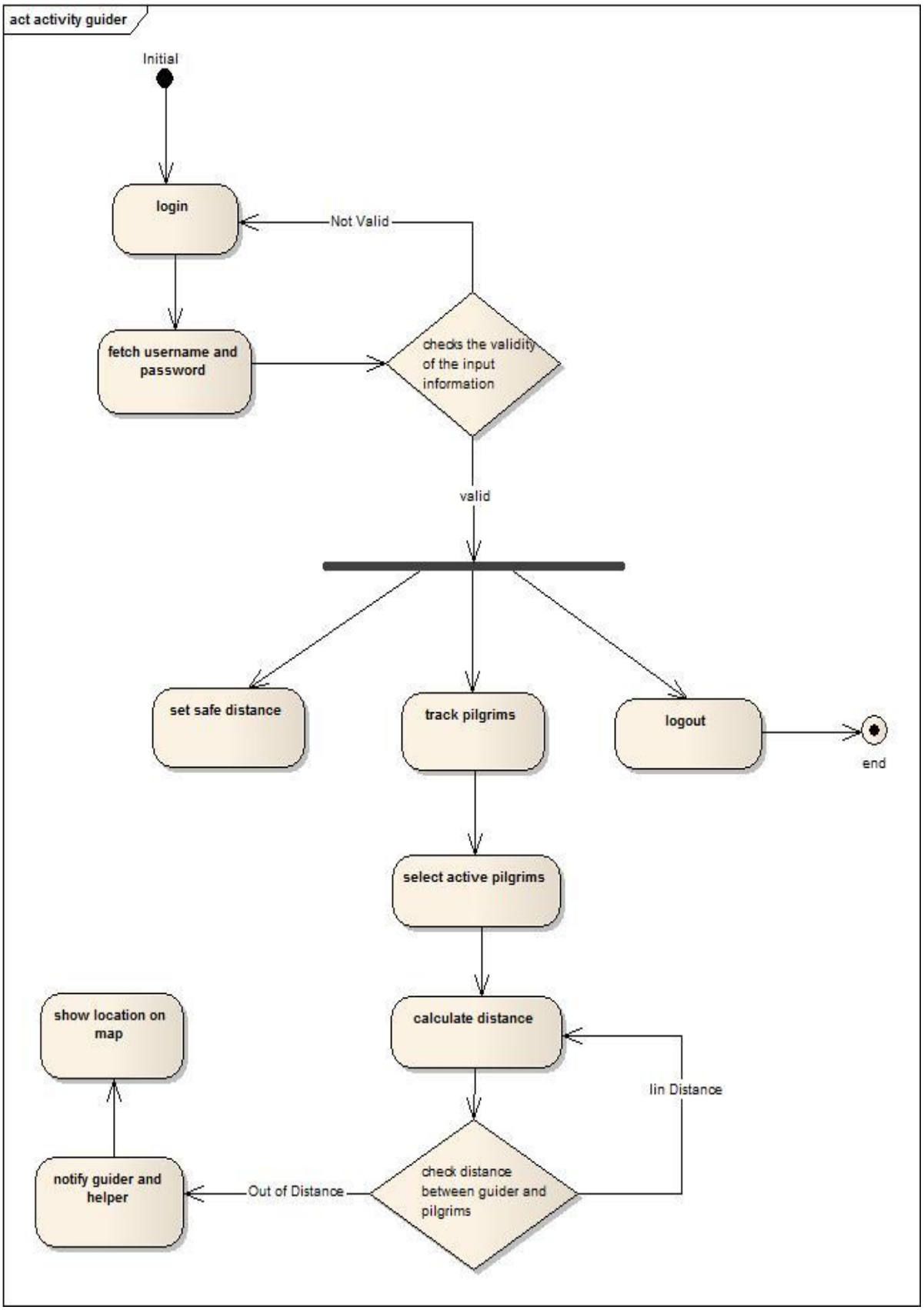


Figure (4.13): activity diagram for guider

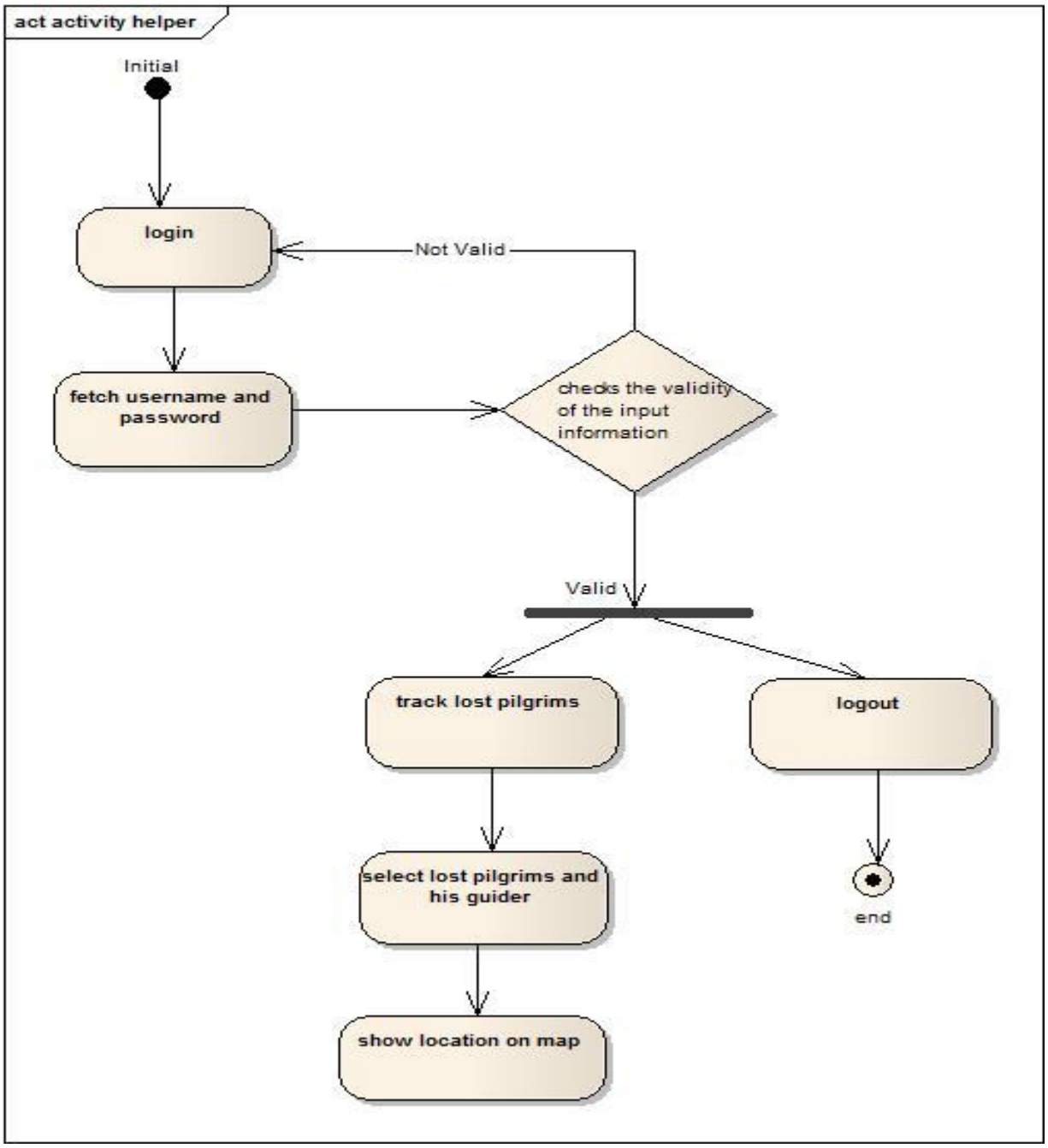


Figure (4.14): activity diagram for helper

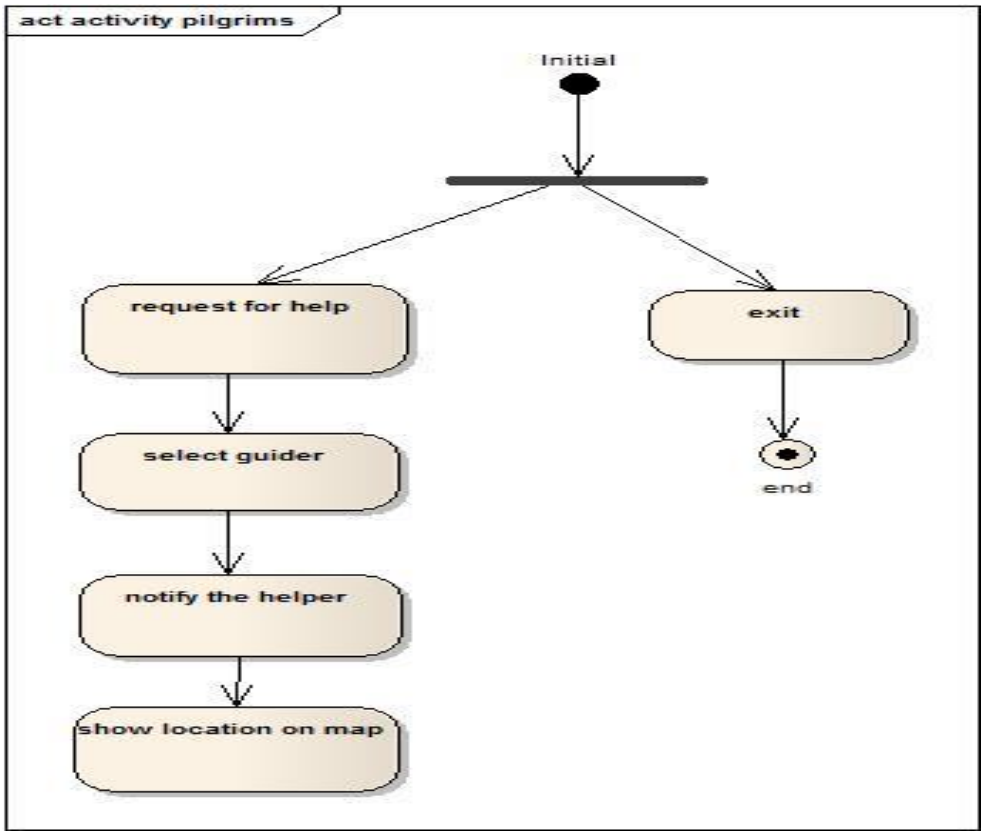


Figure (4.15): activity diagram for pilgrims

4.6.4 Deployment Diagram

Deployment diagram illustrate hardware and software used in the system and how these components interact with each other.

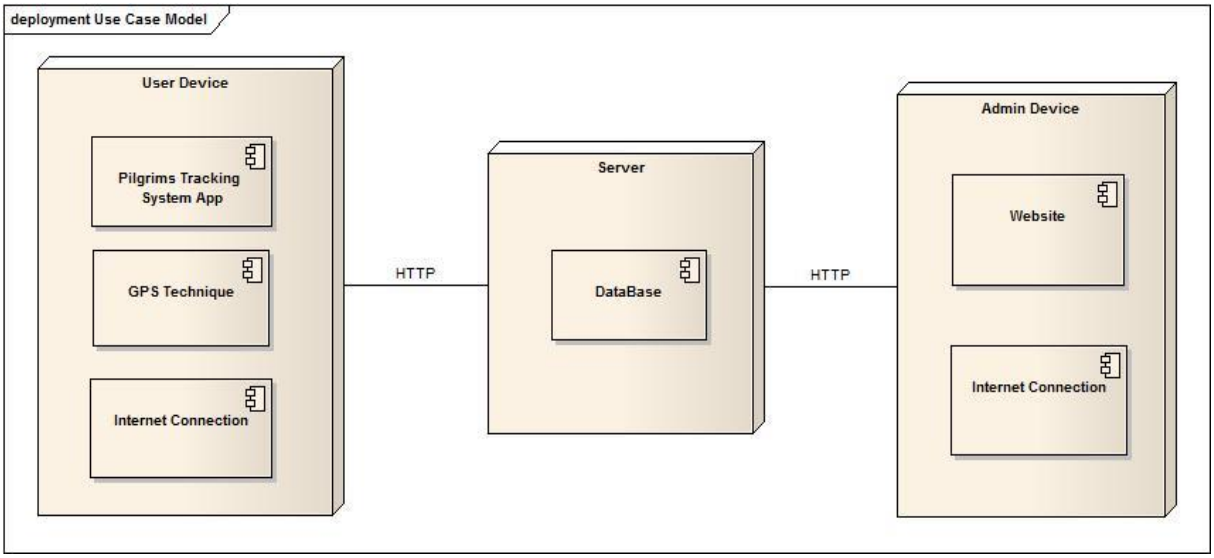


Figure (4.16): Deployment Diagram

4.7 DATABASE ANALYSIS

4.7.1 Database Structure

Table (4.10): user's information

NO.	Colum name	Colum name on database	Colum type	Colum size	Notes
1	Name	Name	char	20 bytes	-
2	Phone	phone_n	int	20 bytes	-
3	Registration ID	registration_id	int	30bytes	PK
4	Type	Type	char	20 bytes	-
5	Registration date	registration_date	char	20 bytes	-
6	Activate	Activate	char	20 bytes	-

Table (4.11): pilgrim's information

NO.	Colum name	Colum name on database	Colum type	Colum size	Notes
1	User ID	user_id	int	20 bytes	FK, PK
2	Guider ID	guider_id	int	20 bytes	FK
3	Phone	phone_2	int	20 bytes	-
4	Age	Age	int	20 bytes	-
5	Country	Country	char	20 bytes	-
6	Image	Image	char	65 k bytes	-

Table (4.12): guider's and helper's login information

NO.	Colum name	Colum name on database	Colum type	Colum size	Notes
1	User ID	user_id	int	20 bytes	FK, PK
2	Username	Username	char	20 bytes	-
3	Password	Password	char	20 bytes	-

Table (4.13): safe distance

NO.	Colum name	Colum name on database	Colum type	Colum size	Notes
1	Guider ID	guider_id	int	20 bytes	FK, PK
2	Distance	Distance	int	20 bytes	-

Table (4.14): location of users

NO.	Colum name	Colum name on database	Colum type	Colum size	Notes
1	User ID	user_id	int	20 bytes	FK, PK
2	Location	Location	char	20 bytes	-
3	Time	Time	char	20 bytes	

4.7.2 Class Diagram

Class diagram illustrate database tables, their attributes and relationships among tables.

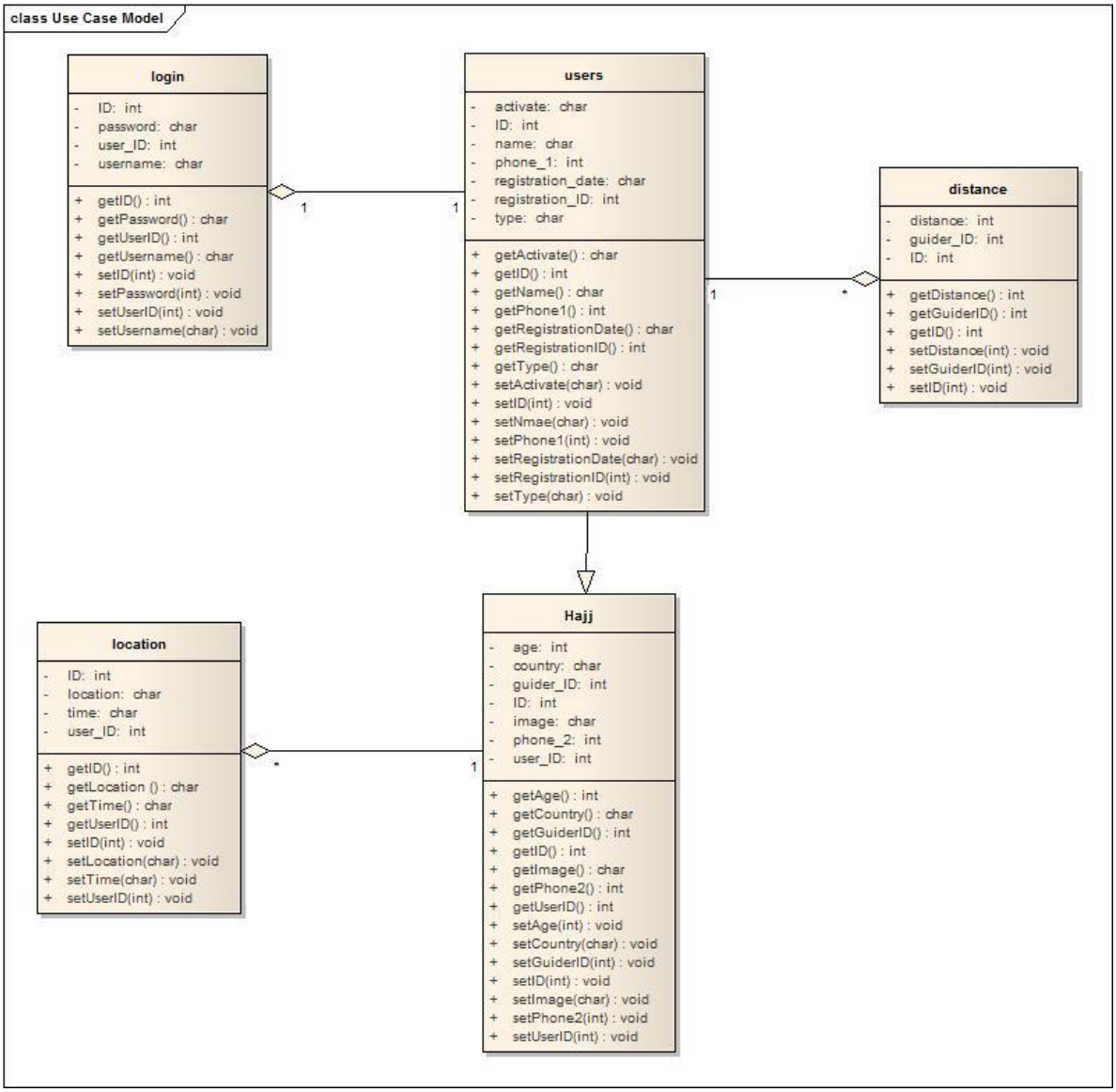


Figure (4.17): class diagram

4.8 CONCLUSION

This chapter dealt with a description and analysis of the system, where addressed to describe the system and processes provided by the system for the user and the system administrator, also addressed to the hardware and software components of the system. On the other hand, this section takes to analysis the operations of the system using the schemes UML.

CHAPTER 5

IMPLEMENTATION

5.1 INTRODUCTION

This chapter deals with the graphical interfaces for system administrator (Web site), explain the components of the site and how it works, and also deal with graphical interfaces for users simple explanation of her program and how they work.

5.2 SYSTEM ADMINISTRATOR INTERFACE

5.2.1 Login

First the system administrator must log to the system to be able to use the system as shown in figure (5.1).

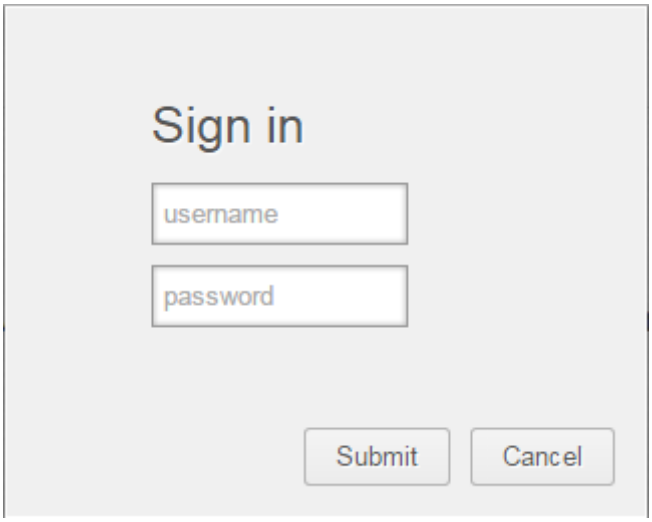


Figure (5.1): System administrator login

5.2.2 Home Interface

After logging to the system and verify the username and password, moves to administrator home interface it contains the operations of the system administrator (add user, delete user, update user, display user information) as shown in figure (5.2).

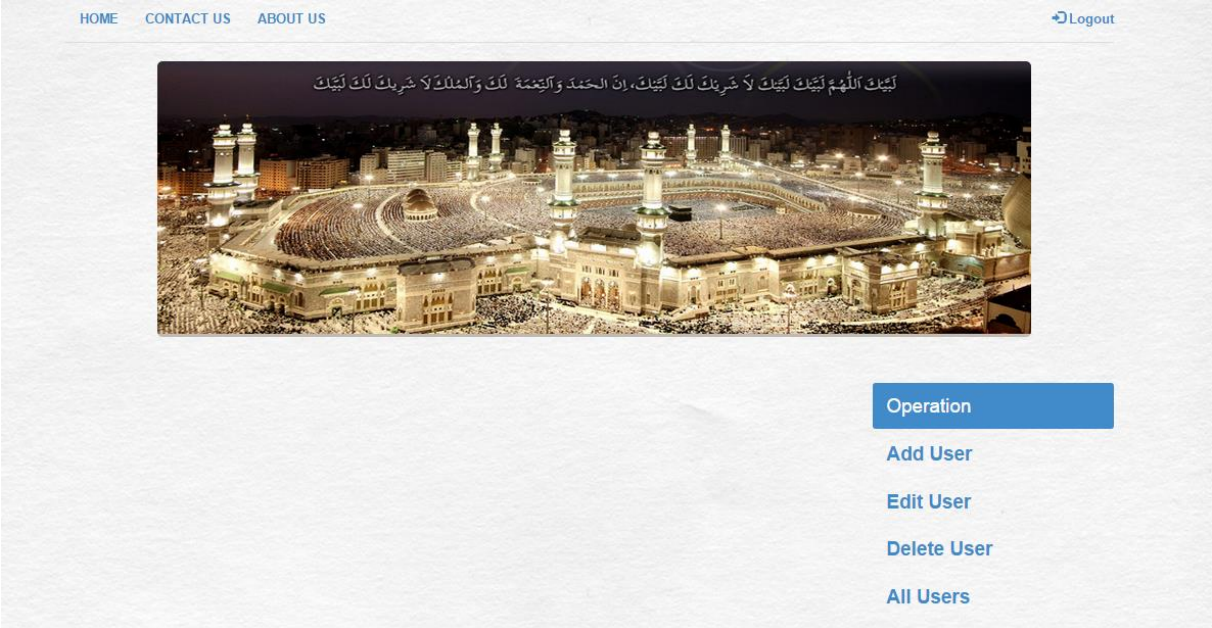


Figure (5.2): Administrator home interface

5.2.3 Add New User

When a system administrator pressed on (Add User), moves to add user interface. There are three types of user: pilgrims, guider, and helper.

5.2.3.1 Add New Pilgrims

System administrator enters pilgrim's data (name, phone1, phone2, age, registration date, country) and chooses the guider from list as shown in figure (5.3).

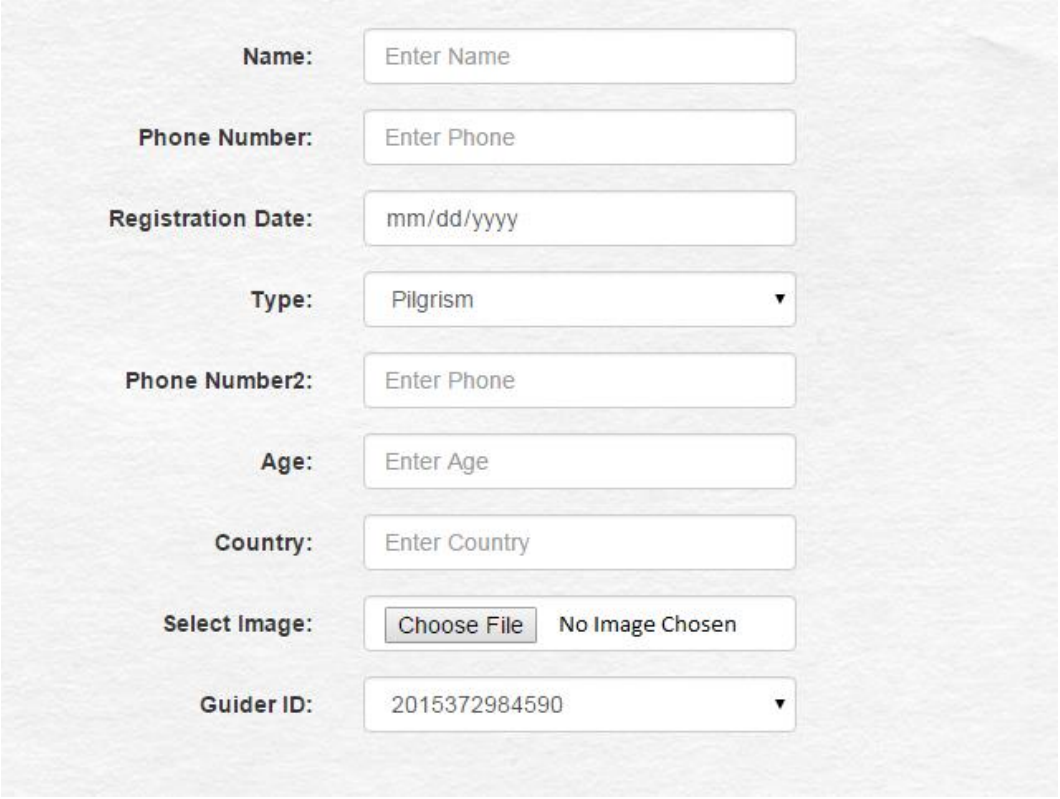


Figure (5.3): Add new pilgrims interface

5.2.3.2 Add New Guider

System administrator enters guider's data (name, phone, registration date, username, and password) as shown in figure (5.4).

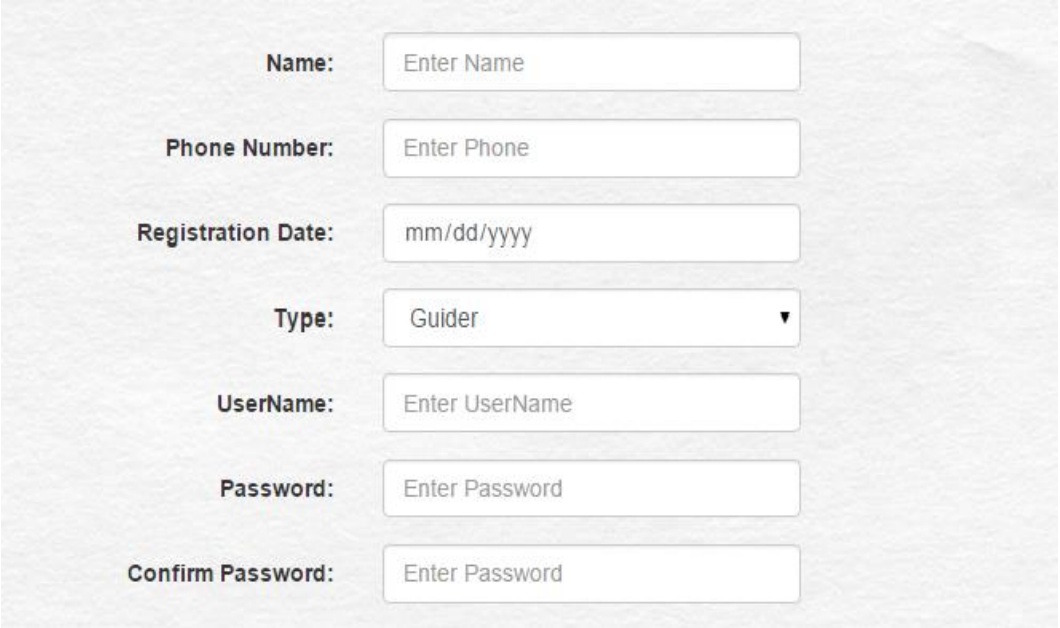


Figure (5.4): Add new guider interface

5.2.3.3 Add New Helper

System administrator enters helper's data (name, phone, age, registration date, username, and password) and chooses the guider from list as shown in figure (5.5).

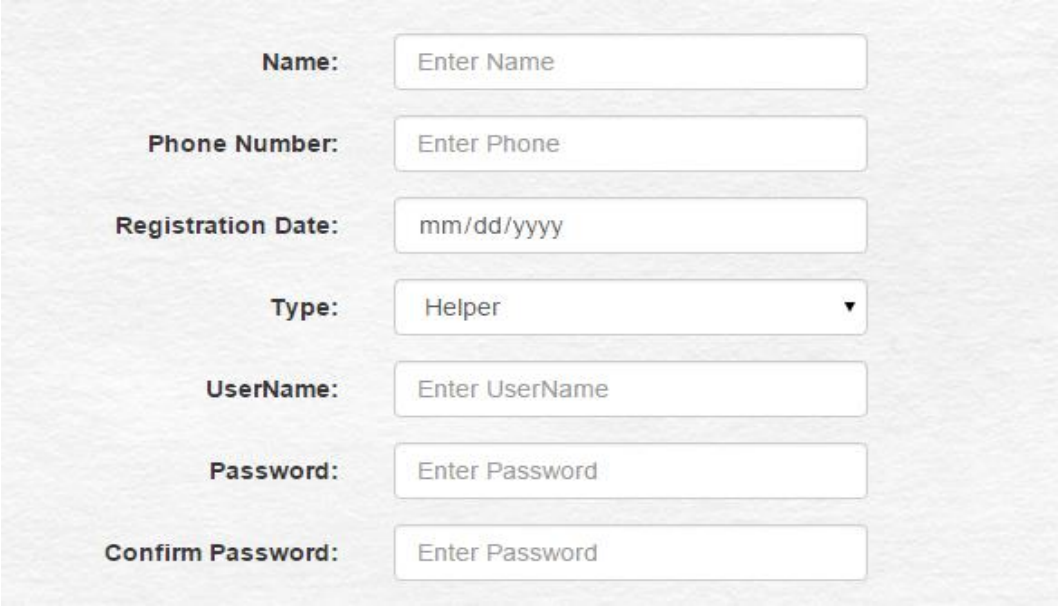


Figure (5.5): Add new helper interface

5.2.4 Update User

When a system administrator pressed on (update User), moves to update user interface. First the administrator enter user ID to verify the existence of the user as shown in figure (5.6), then display user data and allows the system administrator to modify it as shown in figure (5.7).

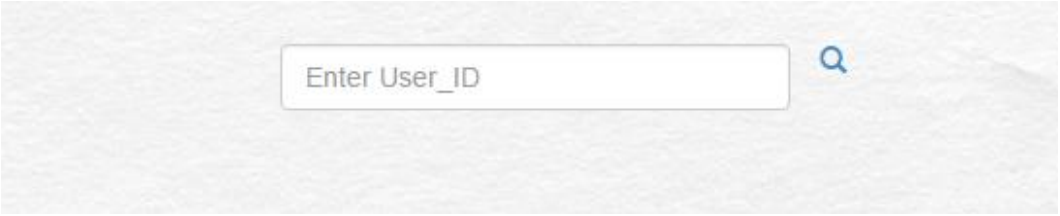


Figure (5.6): Search user by ID

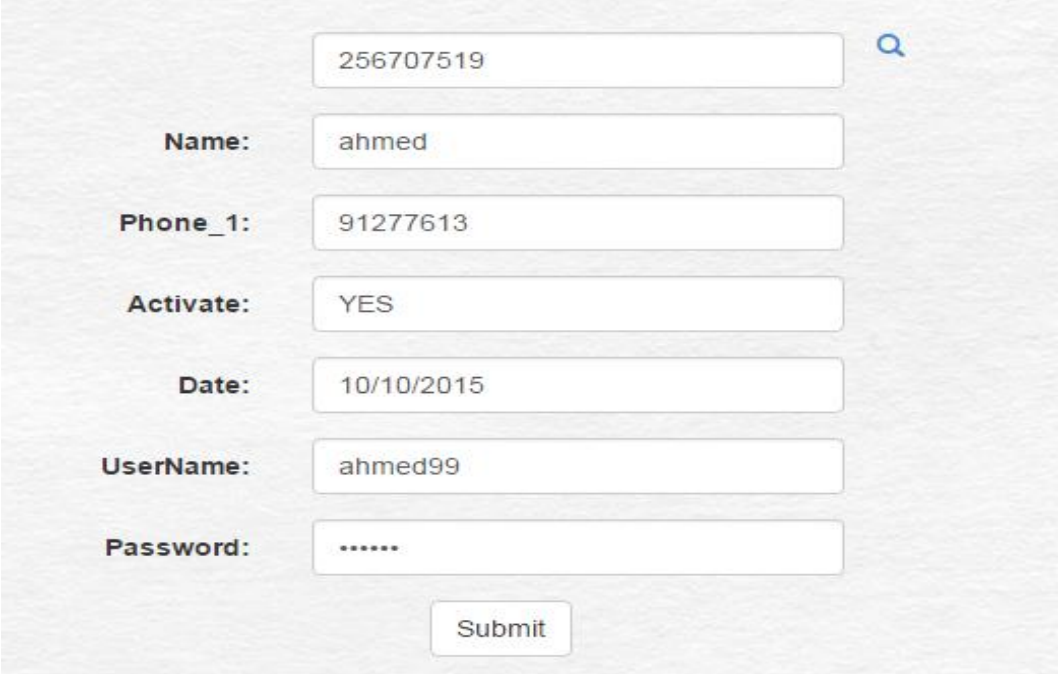


Figure (5.7): Update user interface

5.2.5 Delete User

When a system administrator pressed on (delete User), moves to delete user interface, then enter user ID to remove it as shown in figure (5.8).

Figure (5.8): Delete user interface

5.2.6 Display User

When a system administrator pressed on (display User), moves to display user interface. First the administrator choose the type of user(pilgrims, guider, helper) and enter the year as shown in figure (5.9), then display user information as shown in figure (5.10).

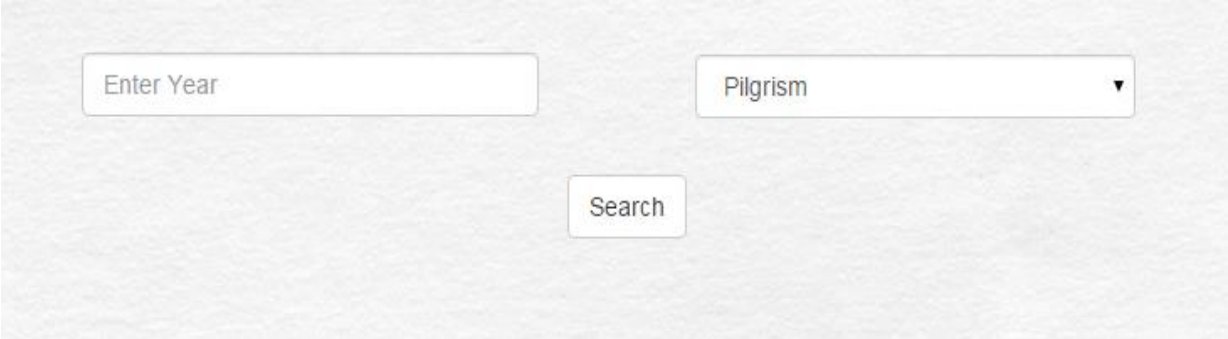
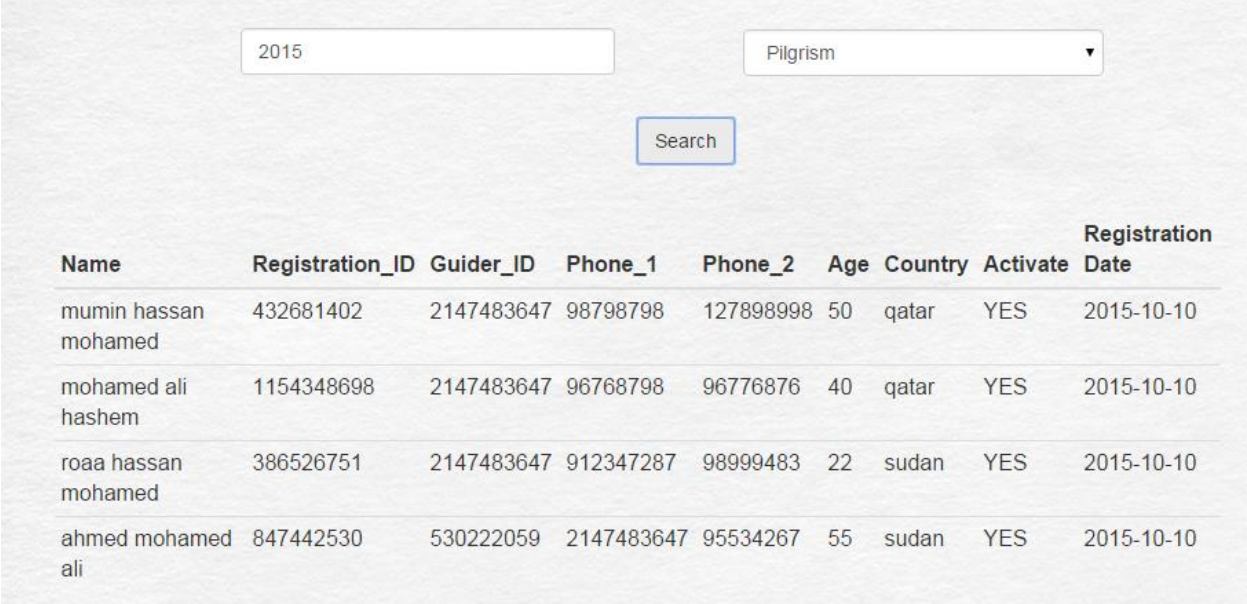


Figure (5.9): Search user by type and year



Name	Registration_ID	Guider_ID	Phone_1	Phone_2	Age	Country	Activate	Registration Date
mumin hassan mohamed	432681402	2147483647	98798798	127898998	50	qatar	YES	2015-10-10
mohamed ali hashem	1154348698	2147483647	96768798	96776876	40	qatar	YES	2015-10-10
roaa hassan mohamed	386526751	2147483647	912347287	98999483	22	sudan	YES	2015-10-10
ahmed mohamed ali	847442530	530222059	2147483647	95534267	55	sudan	YES	2015-10-10

Figure (5.10): Display user interface

5.3 USERS INTERFACE

First the user must install the application on his phone and the phone should be supportive of the GPS and the operating system must be Android OS.

5.3.1 Pilgrims Interface

5.3.1.1 Verification Interface

After installed the application, moves to verification interface, the pilgrims should enter registration ID to check it before moves to home page as shown in figure (5.11).

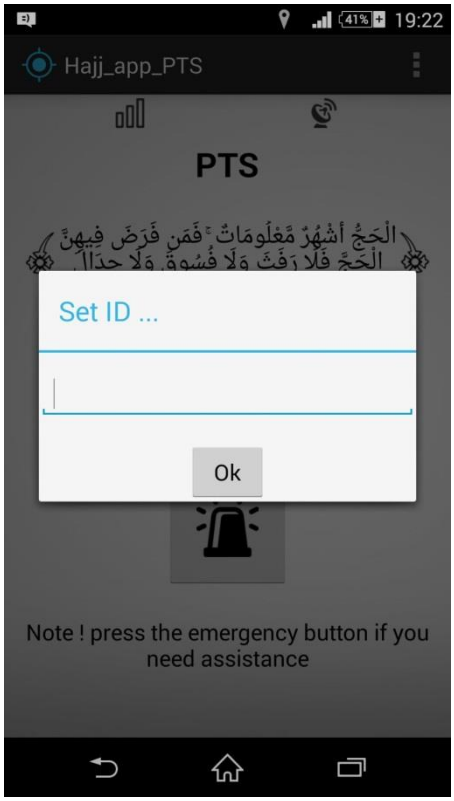


Figure (5.11): Verification interface

5.3.1.2 Home Interface

After installed the application, moves to pilgrim home interface, it contains the pilgrim location and emergency button allow it to request for help as shown in figure (5.12).

Figure (5.12): Pilgrim home interface

5.3.1.3 Warning Interface

The system send warning to the pilgrim if he moved away from the guider 80% from the distance that determine by guider as shown in figure (5.13), and send another warning if he move away from guider distance greater than the distance that determine by guider as shown in figure (5.14).

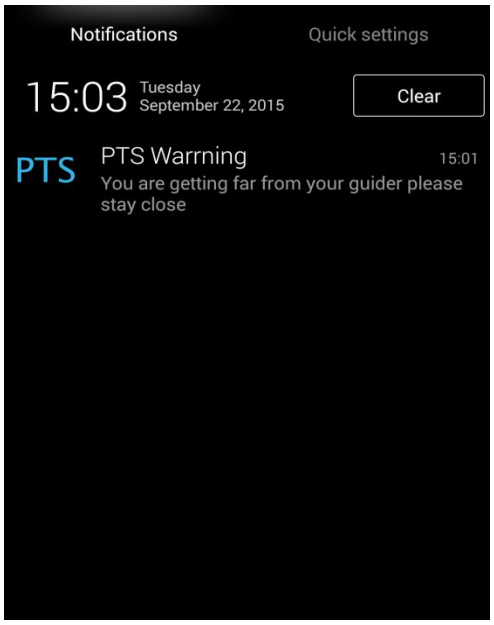


Figure (5.13): Warning notification

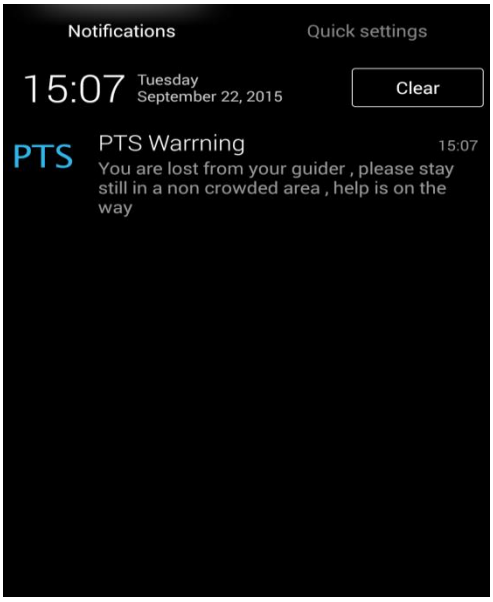


Figure (5.14): Warning notification

5.3.2 Login Interface

After installed the application, moves to login interface, the guider and helper must log to the system to be able to use the as shown in figure (5.15).

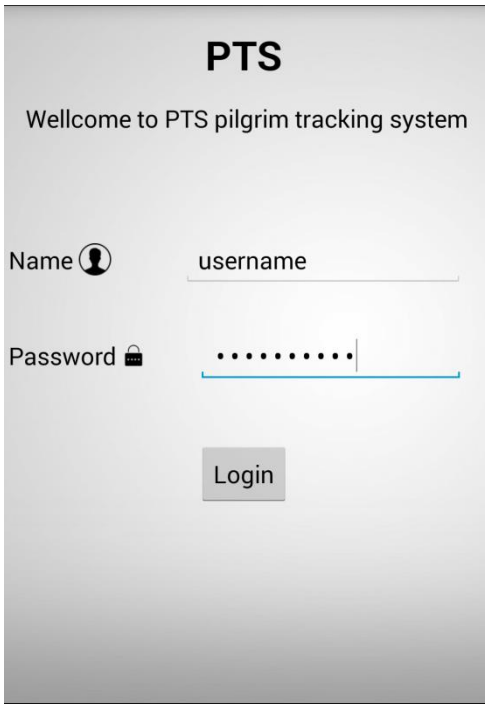


Figure (5.15): Login interface

5.3.3 Notification Interface

The system notify the guider and helper if one or more pilgrims move away from guider Distance greater than the specified distance as shown in figure (5.16).

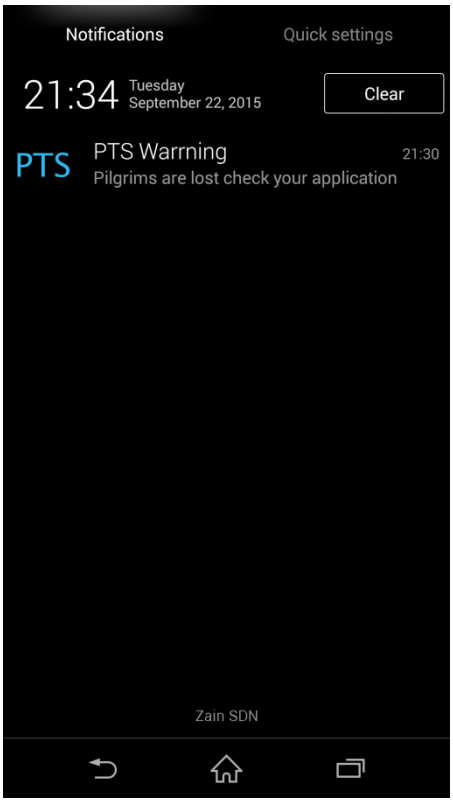


Figure (5.16): Notification interface

5.3.4 Guider Interface

5.3.4.1 Home Interface

After logging to the system and verify the username and password, moves to guider home interface it contains the guider location and operations of the guider (set safe distance, tracking pilgrims) as shown in figure (5.17).

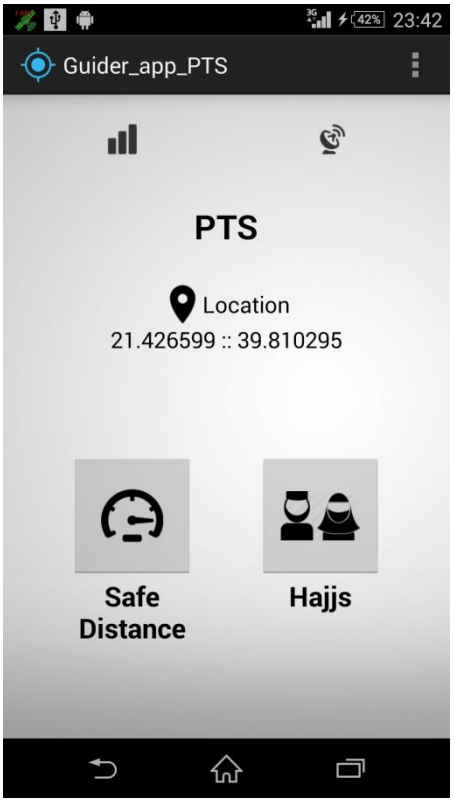


Figure (5.17): Guider home interface

5.3.4.2 Safe Distance Interface

When a guider pressed on (safe distance), moves to safe distance interface, and then enters the new distance as shown in figure (5.18).

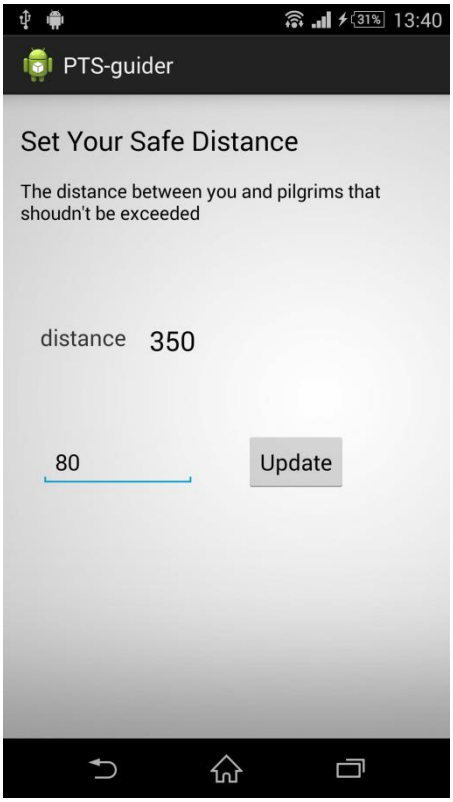


Figure (5.18): Safe distance interface

5.3.4.3 Tracking Pilgrims Interface

When a guider pressed on (hajj), moves to hajj interface, it contains the pilgrims that belong to the guider as shown in figure (5.19), and also contain a map button allow it to track the pilgrims and show there location on map as shown in figure (5.20).

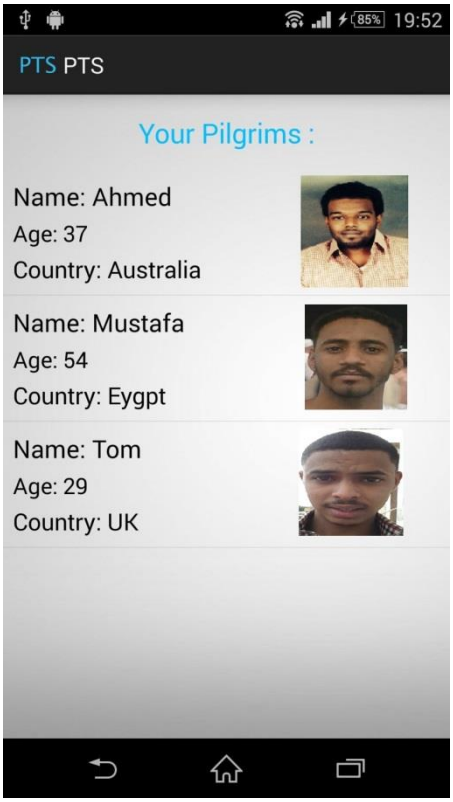


Figure (5.19): Pilgrims interface

Figure (5.20): Map interface

5.3.5 Helper Interface

5.3.5.1 Home Interface

After logging to the system and verify the username and password, moves to helper home interface it contains the helper location and operations of the helper (tracking lost pilgrims) as shown in figure (5.21).

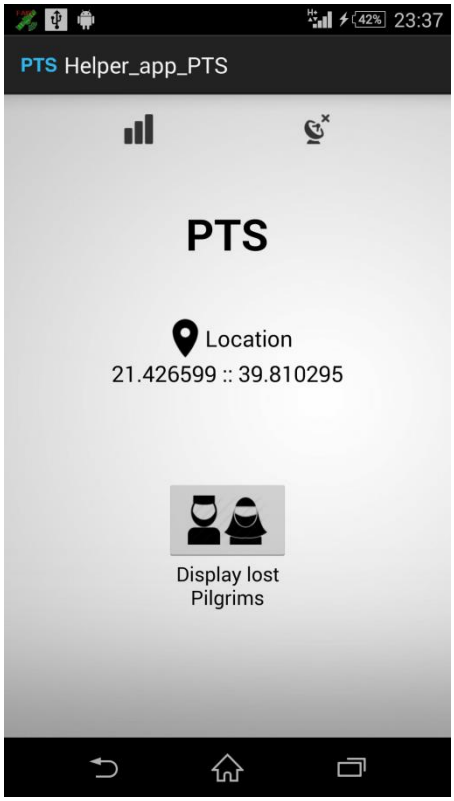


Figure (5.21): Helper home interface

5.3.5.2 Tracking Lost Pilgrims Interface

When a helper pressed on (lost hajj), moves to lost hajj interface, it contains the pilgrims that move away from guider Distance greater than the specified as shown in figure (5.22), and also contain a map button allow it to track the pilgrims and show there location on map as shown in figure (5.23).

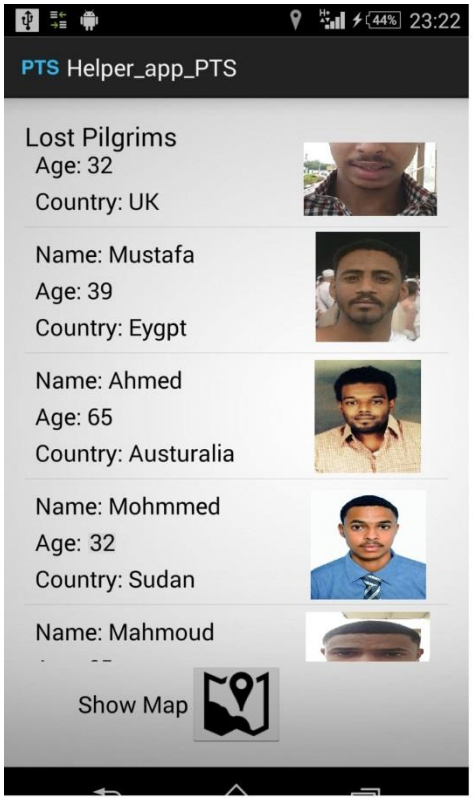


Figure (5.22): Lost pilgrims interface

Figure (5.23): Map interface

5.4 CONCLUSION

This chapter dealt with Application of the system and a review of the system interface of the system administrator and the users (pilgrims, guider, and helper).

CHAPTER 6

RESULTS, CONCLUSION AND RECOMMENDATIONS

6.1 INTRODUCTION

This chapter deals with the search results that have been accessible after conducting various tests on the system and recommendations for future research and studies.

6.2 RESULTS

The application was tested in android smart phone with GPS service and achieved the goals of the research successfully by:

- identified the locations of the pilgrims and their guiders and display them in the map According to the accuracy of GPS, which is acceptable to get perfect results, in terms of reducing space and time of search to find missing persons and find them as soon as possible In the case of loss, and track them all the time to reduce the incidence of loss.
- It also sends alerts and locations to the people in charge of tracking pilgrims when they are keeping their distance from the guider according to the specific distance seized by the guider.

6.3 CONCLUSION

The nature of human is to hope to the best plan for the worst. After testing the application and showing the result, the performance was as expected.

As we hope and expect it to be in the near future this application or similar a fundamental procedure for pilgrims because it benefits to regulate and facilitate the performance of hajj.

6.4 RECOMMENDATIONS

After the completion of this project and applied it, we recommend the following to improve the system:-

- More development of the system and make it work on more than one operating system for smart phones (e.g. IOS, Windows Phone) to keep up with technological evolution.
- Using independent wearable GPS trackers instead of smartphones embedded GPS.
- Coordinating with the security authorities to test the application on one of the pilgrims campaigns and extract statistics and reports to determine the effectiveness of the application and identify the problems to improve the system and make the service official and available.
- Generate reports that display information about missing pilgrims.

REFERENCES

[1] GARMIN**,** What is GPS, http://www8.garmin.com/aboutGPS/ access at 2015/5/9 11:30pm

[2] NASA, how does GPS work, http://spaceplace.nasa.gov/gps/en/ access at 2015/5/9 11:45pm

[3] U.S. government I, GPS, http://www.gps.gov/systems/gps/performance/accuracy/ access at 2015/5/9 12:05pm

[4] Mashable**,** Apps and Gadgets to Keep Track of Your Child**,** http://mashable.com/2013/07/15/child-tracking-apps/#Ipw2kyyI2PqG access at 2015/5/11 1:07pm

[5] Wikipedia, Android, https://en.wikipedia.org/wiki/Android_(operating_system) access at 2015/5/9 11:55pm

[6] Envatotuts**+,** Introduction to Android Development, http://code.tutsplus.com/articles/introduction-to-android-development--mobile-7 access at 2015/5/11 9:57pm

[7] IBM developerworks, Introduction to Java programming**,** https://www.ibm.com/developerworks/java/tutorials/j-introtojava1/ access at 2015/5/11 10:16pm

[8] Envatotuts**+,** Learn Java for Android Development**,** http://code.tutsplus.com/tutorials/learn-java-for-android-development- introduction-to-java--mobile-2604 access at 2015/5/11 10:18pm

[9] Streetdirectory, GPS, http://www.streetdirectory.com/travel_guide/12240/gps_vehicle_tracking/gps_a_tool_to_fit_our_worlds_need.html access at 2015/5/14 9:57pm

[10] Techtarget, Google Maps, http://whatis.techtarget.com/definition/Google-Maps access at 2015/5/15 10:30pm

[11] Wikipedia, Google Maps for mobile and other devices https://en.wikipedia.org/wiki/Google_Maps#Google_Maps_for_mobile_and_other_devices access at 2015/5/15 2:05pm

[12] Wikipedia, Google Maps API, https://en.wikipedia.org/wiki/Google_Maps#Google_Maps_API access at 2015/5/15 3:10pm

[13] https://developers.google.com/maps access at 2015/5/18 4:20pm

[14] Wikipedia, SQL, https://en.wikipedia.org/wiki/SQL access at 2015/5/24 11:10pm

[15] IBM developerworks, http://www.ibm.com/developerworks/rational/library/769.html access at 2015/5/26 12:40pm

[16] Sparxsystems, uml, http://www.sparxsystems.com/platforms/uml.html access at 2015/6/2 3:00pm

[17] wikipedia, use case diagram, https://en.wikipedia.org/wiki/Use_Case_Diagram access at 2015/6/2 3:20pm

[18] Wikipedia, sequence diagram, https://en.wikipedia.org/wiki/Sequence_diagram access at 2015/6/5 4:00pm

[19] Wikipedia, class diagram, https://en.wikipedia.org/wiki/Class_diagram access at 2015/6/5 5:10pm

[20] Techtarget, collaboration diagram, http://searchsoftwarequality.techtarget.com/definition/collaboration-diagram access at 2015/6/12 1:15pm

[21] Wikipedia, communication diagram, https://en.wikipedia.org/wiki/Communication_diagram access at 2015/5/14 1:34pm

[22] UML-diagrams, state machine diagrams, http://www.uml-diagrams.org/state-machine-diagrams.html access at 2015/6/14 1:50pm

[23] Tutorialspoint, UML object diagram, http://www.tutorialspoint.com/uml/uml_object_diagram.htm access at 2015/6/20 12:11pm

[24] Wikipedia, component diagram, https://en.wikipedia.org/wiki/Component_diagram access at 2015/6/20 1:10pm

[25] Agile modeling, deployment Diagram, http://www.agilemodeling.com/artifacts/deploymentDiagram.htm access at 2015/7/5 1:02pm

[26] Wikipedia, activity diagram, https://en.wikipedia.org/wiki/Activity_diagram access at 2015/7/5 1:16pm

[27] Abobker Osman, Akram Taj Alsir, Ahmed Hatim Adb Albagi-ATM Finder-Sudan university of science and technology-computer systems and network – august 2014

[28] W3schools, PHP introduction, http://www.w3schools.com/php/php_intro.asp access at 2015/7/10 11:38pm

[29] W3schools, PHP, http://www.w3schools.com/php access at 2015/7/10 1:30pm

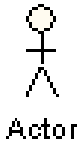
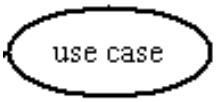
[30] Wikipedia, HTML5, https://en.wikipedia.org/wiki/HTML5 access at 2015/7/13 12:18pm

[31] Wampserver**,** start with wampserver**,** http://www.wampserver.com/en/ access at 2015/7/14 5:30pm

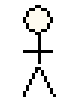
[32] Wampserver, introduction about wampserver, http://www.wampserver.com/en/ access at 2015/8/15 5:18pm

APPENDICS

Appendix (I) explain the symbols used in the modeling and analysis system using UML diagrams

			
User	connect	Connect task that depends on other	task

Explain the symbols used in (Use case Diagram)

					
User	User GUI	UML message	message Response	Program logic	database

Explain the symbols used in (Sequence Diagram)

				
End	Begin	Decision	Activity	Connect

Explain the symbols used in (Activity Diagram)