DATA MODELING FOR WEB-BASED MOBILE TRACKING SYSTEM OF INTERNALLY DISPLACED PERSON DURING CONFLICT

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Abstrak

Dalam tempoh dua dekad yang lalu, keluarga pelarian telah menjadi isu utama kepada banyak negara kerana peningkatan bencana alam, konflik bersenjata atau serangan pengganas. Ia memberi cabaran besar kepada kerajaan dan juga agensi yang menguruskan mereka. Banyak agensi melaporkan kesukaran menyediakan bantuan untuk keluarga berkenaan kerana mereka tidak dapat dikesan selepas mereka mendaftar di pusat atau kem perlindungan. Ini disebabkan oleh pergerakan rawak mereka atau kem yang terdedah kepada bencana alam atau serangan bersenjata. Kajian ini mencadangkan satu model keperluan untuk orang pelarian (IDP) berdasarkan temu bual dalam talian dengan pakar dari Pertubuhan Antarabangsa bagi Migrasi dan Pegawai Kerajaan yang bekerja secara langsung dengan keluarga pelarian ini. Keperluan ini digunakan untuk membangunkan aplikasi mudah alih berasaskan web untuk mengesan, mencari, mendokumenkan dan mengesahkan IDP. Penilaian telah dijalankan untuk mengukur kebolehgunaan aplikasi mudah alih ini. Hasil penilaian mendapati bahawa aplikasi mudah alih tersebut adalah relevan dan sesuai utk mengesan IDP. Hasil penilaian mendapati bahawa aplikasi mudah alih tersebut adalah relevan dan sesuai untuk mengesan IDP. Sumbangan utama kajian ini adalah keperluan untuk aplikasi mudah alih yang direka khas untuk mengesan IDP.

Kata kunci: Pemodelan data, Sistem pengesanan, Orang pelarian.

Abstract

The displaced families in the last two decades has become major issues in many countries due to the increase of natural disasters, armed conflicts or terrorist attacks. It presents great challenges to governments as well as the agencies which manage them. Many agencies reported the difficulty of providing relief to these families because they cannot be tracked after they registered in shelters or camps. It is due to random movement of the families, or the camp is exposed to natural disasters or armed attacks. This study proposes a requirement model for an internally displaced person (IDP) based on online interviews with experts from the International Organization for Migration and Government Officials who worked in direct contact with the displaced families. The requirements were used to develop a web-based mobile application to track, locate, document and verify IDP. An evaluation was conducted to measure the usability of the mobile application. The result of the evaluation suggested that the mobile application is relevant and suitable for tracking IDP. The main contribution of this study is the requirements for a mobile application that is designed specifically to track IDP.

Keywords: Data modeling, Tracking system, Internally displaced persons.

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CHAPTER ONE

INTRODUCTION

1.1 Introduction

ICT (which stands for information and communications technology) is a generic definition which is common to any and every communication technology or application. The usage of ICTs is found not only in technologies such as television, radio, cell phones and computers (along with network, hardware, and software) but also their auxiliaries in the form of services linked to them, such as video conference solutions and online learning. ICTs are usually mentioned in reference to particular categories such as healthcare, education, or libraries [1].

Large data gathering using ICT has seen an exponential rise in the past ten years or so. Political personnel requires it, organizations use it and can observe that the areas of logistics, finance, healthcare, etc. are resorting to data capture, and this is increasing rapidly. Social platforms such as Facebook and Twitter collect data on massive scales, and in all forms: photos, video, audio, as well as PI (personal information).Developments in ICT have resulted in extraordinary enhancements on mobile and smartphones. a mobile or smartphone can prove to be helpful to make calls in the absence of a fixed line. Smartphones have proved to be tools nonpareil in trade and commerce also. The inbuilt GPS facility can guide the users safely to their destination, and thus ensure that to attend the important appointments on time. It does so by coordinating GPS data with a focal mobile mast triangulation [2].

Global positioning system (GPS) tracking is made possible thanks to a system of orbiting satellites that work together to determine a device's location and time. Although once a rare technology after being first introduced in 1973, it is now common for most people with tablets or mobile phones to have some sort of assimilated GPS tracking system. As of 2005, all mobile phones have this technology, since the Federal Communications Commission (FCC) has made it a requirement [3].

With mobile tracking technology on a person's mobile device, there is an increased chance of first-aid responders and other emergency personnel locating both the device and its owner. When a person carries a cell phone with GPS technology, the system of satellites calculates the speed and time of the owner's cell phone signal, as well as its location. This dramatically increases the chances of the lost person being found quickly [4].The way to access has changed dramatically since there are increased access to other types of networking services. More mobile device users are using mobile applications to access the Internet instead of traditional browsers. This is due to the increased popularity of such devices and the constant demand for new applications [5].

In Iraq, the ICT links the private and public sectors so communication can be enhanced and improved. These connections being applied by the ICT should help with job creation, better schools, and improved productivity [6]. In addition, according to data from International Finance Corp (I.F.C.), Iraq's mobile phone usage has increased exponentially in just the last seven years. Mobile phone subscriptions have risen from approximately 400,000 in 2003 to over 21 million in 2010 big [7]. Iraq has also achieved significant improvements in the development of the ICT sector [8]. Despite still suffering the continual and on-going obstacles of security issues and political volatility.

Mobile phones present an excellent opportunity to collect and revise data as network coverage extends to all almost all of Iraq. Furthermore, there is an average of 1.56 mobile handsets per Iraqi family, making for a penetration rate of 75% [9]. Yet it cannot be ignored that information is only as relevant as it is current; real-time change presents the biggest challenge of any data collection process. A database may exist but still be redundant without reflecting the changes to a person's circumstances, such as relocation, marital status, even death [10]. Creating a bridge of communication between executives and customers is key in order to provide the best service. According to previously collected data, developing a process to monitor, collate, process, and revise information brings the user closer to that goal.

However, organizations in general are facing continues challenges to produce software with quality and more effective to compete with companies and under the increase of user demands, from software engineering perspective, identify the user performers and requirement is the first and most important step to creating better understanding to user need and demands to ensure reaching a level of satisfaction.

Data Modeling can be defined as the analysis of date object and the relationship between them, data modeling is the first step to designing the database and object-oriented programming initially start with the design the conceptual model which involve defining the relationships between all object and the second step is to create logical model before transforming to the physical schema. By analyzing the requirement modeling the date flows and the process of the target system, the researcher can define the specific task and function and non-functional task for the software [11].

1.2 Background of Study

Iraq has progressed in some cities like Dhi-Qar in the provision of e-government services [22], and many ministries there have provided services through the Internet. However, getting up-to-date, accurate and reliable data for decision making by government officials are not so easily achieved.

Recently, there are many displaced families in Iraq because of war and other natural calamities like flood. The main goal of the government is to provide the best support to as many families as possible in terms of lodging and monetary aid. It is difficult to get a complete up to date data from the families, as they will move on or be moved to other places if there are new conflicts or disaster in that location [23].

So even if the data collected are assumed to be completed and correct for the displaced families, the delivery of services and monetary relief cannot be given within the specified time as the displaced family now cannot be found after the second relocation. The data of the displace families need to be up to date and more importantly be able to show their current location for the disbursement of the financial aid [15].

People particularly vulnerable in areas or in situations of armed conflict are those who are forced to abandon their homes or flee settlements. These are known as internally displaced persons (IDPs). Displaced people face substantially higher mortality rates compared to the general populace. Furthermore, they have a continued greater risk of physical attack and are often without sufficient accommodation, food, and healthcare [12].

The vast majority of IDPs are females and kids who are particularly at risk of exploitation of their fundamental rights. Compared to refugees, the IDPs are more subject to conflict

zones and crossfires and face the threat of being used as hostages, shields, or targets by the belligerents [13].

As per government statistics, in Colombia, 6.5 million people were registered as IDPs during mid-year. Other nations where a substantial number of IDP populaces were sheltered or aided by UNHCR included Iraq (4.0 million), Sudan (2.3 million), Pakistan (1.6 million), South Sudan (1.5 million), the Democratic Republic of the Congo (1.5 million), Nigeria (1.4 million), and Ukraine (1.4 million) [14].

In Iraq the International Organisation for Migration (IOM) collected data from January 2014 to 5 November 2015, pertaining to the status and whereabouts of displaced Iraqi individuals. The organisation identified about 3,181,176 IDPs (530,196 families) across 103 districts and 3,542 locations in the country [12]. As per the IOM (2010) report updated in November 2015, the status of IDPs is as follows:

- 71% or 2,254,032 were placed in private dwellings
- 1,374,786 in rented accommodations
- 865,416 were with host families
- 567,372 were in critical shelters
- 286,884 in camps
- 236,856 in unfinished structures
- 132,714 were in religious buildings
- 163,020 in informal settlements
- 34,782 were in school buildings
- 13,830 in guesthouses/motels

Those whose accommodations are not yet known account for 2% of the total IDP populace (64,788) [12].

These IDPs moved around constantly and were displaced in multiple areas due to the armed conflict, which elucidates why the majority of government and non-government agencies which have gathered the data do not possess all the most recent facts and details of the displaced households, such as names of each family member, passport numbers, and date of birth, which have been stored manually or also on their individual servers. Furthermore, retrieving precise information is arduous, thereby making it tougher to help these families, particularly if the areas they shifted to are still insecure [15].

This data needs to be updated and categorized so as to be useful [16]. If a request is made for specific data, a long procedure of paper work is necessary to recover and utilize the data from the various agencies so a decision can be made to offer relief and monetary support for the displaced households [17]. Since these agencies are the sole sources for the necessary information to make decisions about these circumstances, the government and the organisations must create new systems and improve existing ones to gather, process, and update data and, in our case, assimilate with IDPs to reduce the difficulty in transferring information for decision making and ease the communication which is considered the key challenge [12].

A constantly round-the-clock updating system will improve the efficacy of the data-driven systems, and this can be defined as a series of steps that enhance the data quality by updating the existing data on an hourly basis. Other techniques are: standardize or

normalize the data, acquisition, error localization and rectification, record linkage, data assimilation, source trustfulness, and cost optimization [18].

Many changes have and will accrue while providing service to people in Iraq, including health, agriculture, and social services. These changes make it necessary that the data gathering process is enhanced from all sources such as institutions, ministries, and non-profit organizations, so that decision makers get solid, up-to-date data to ascertain the degree and amount of aid they can offer [16].

Data updating, however, is mainly used for its importance in its ability to synchronize with and display real-time happenings. The data is regarded by some researchers as a part of the whole data process since it shows the recent changes about the use of collected data [19]. Updating data can be highly valuable for displaced people since it can harness data from both government and non-government organizations that eliminate common problems in tracking IDPs in conflict areas [20]. The rise of iPad, Android phones, and other mobile platforms complements with the rise of organizational information systems' use of the mobile network as its major platform [21].

Although there are new technologies such as smartphones that comes with internet connection given by mobile companies, there are still many families who are not convinced to provide data because of fear, which is a hindrance for the advancements of governments offices [22]. Updated Data can help countries like Iraq, which is affected by flooding and threats of war that cause families to change locations frequently. It can help in sending displaced families the relief effort they need.

1.3 Problem Statement

According Taleb, Iqbal [23] and Sidi, F [24] and Al-Hammadany, H [25] and IOM [12] and UNHCR [15]. The lack of up-to-date data collected from different resources will make decision making difficult. Officials in Iraq face problems to get good quality data for decision-making as they still do not have the system to integrate all databases from various cities and ministries. Even if an official request report and calls are made to get any background information about something, it will consume time and money and often the decisions are never taken because of the inability to compile the data.

The current systems in Iraq are partially manual computerized and developed separately in another word not integrated [22]. However the main issue is the actual tracking of people who have either register manually [12] or to other agencies system [15], they often moved to different locations by other government and non-government agencies [20], and this make it difficult for providing relief funds and supplement as they cannot be tracked [15].

Government efforts to encourage and support IDPs to return to their homes is done through the provision of a one-time grant of USD 840 have only been partly successful. Of the IOM-assessed returnee families, only 44 % had applied for the grant with only 39 % actually received it. The vast majority of all the assessed families said they had received no other individual assistance [26].

Almost every IDPs have a mobile phone which they carry everywhere [9], plus the Iraqi broadcast media have evolved tremendously since 2003 [3]. Thus this study will propose a Web-based mobile applications system for IDPs, and identify, determine the system requirement model to track IDPs even if they moved to other locations.

Data modeling is the process of documenting a complex software system design as an easily understood diagram, using text and symbols to represent the way data needs to flow [27]. The diagram can be used as a blueprint for the construction of new software or for re-engineering a legacy application so building data model for IDPs helps define the problem, thus enabling the consideration of different approaches and to choose the best one. Furthermore, the path of achieving a successful application begins with effective exploring, understanding and examining sets requirement [28], however existing date modeling for the tracking system are limited to using the mobile application to identify the location and register using mobile application [29].

The lack of integrated tracking data modeling system who can who can link different stockholders in term of sharing information and provide services plus the lack of data modeling system who can provide multi-function in term of documenting and verifying the target person which represent IDP in this research [30] [31] [32] [33].

This study present the web-based mobile tracking data modeling system designed specifically for IDPs which can link multi stockholders who interest in helping the IDP and provide additional functions along with tracking position such as verifying and documenting the IDPs identification papers which consider anew adds to tracking system before distributing the funds and supplement, this data modeling system consider an attempt to assist IOM and government in avoiding redundancy and providing other organization with more accurate date about the displaced person.

1.4 Research Questions

In order to achieve the objective of the research, the following questions were formulated and listed below:

1) What are the data modeling requirement for web-based mobile application of IDPs?
2) How to develop the data modeling of web-based mobile application of IDPs?
3) How to validate the design of the web-based mobile application of IDPs?

1.5 Research Objectives

Thus the main objective of this study is to propose requirement model of mobile tracking for IDPs Iraq. The sub-objectives are as follows:

1) To identify the modeling requirements for the web-based mobile application of IDPs.
2) To design the data model using UML approach based on requirements identified.
3) To evaluate the model through prototype and experts.

1.6 Significance of Study

Governments of many countries now see the significance of data updating and treat it seriously. The researcher saw its importance first-hand while working for IOM when the institution was deciding on its shipment movement coordination for its humanitarian effort for IDPs. The researcher encountered how data transfer through several data sources such as government and non-government organizations can slow down, and even be a hurdle, to effective organizational decisions. This kind of research can help improve the organization's decision-making process for IDPs' benefit.

The significance of this study is to design requirement model for web-based mobile application of IDPs and then implement it as well as to help give input to other practitioners/government officials to improve their work on IDPs instead of relying on manually gathered reports, this study aims to provide system to track, document and verify displaced person to enhance the decision-making process in the IOM.

From this study, the researcher believes that there are many benefits to help solve the IDPs problems with web based mobile application first this model design to track displaced families in camp and to provide better service to them. Second, the model provides information or analysis of potential interactions between the problems of the people and the decision makers.

Web-based mobile tracking model considers the first data model design specifically for IDP and combines multi-function extracted from another system in order to provide a better design, on the other hand, this model design provides a link to multi-stakeholders who interested in helping IDP.

1.7 Scope of the Study

The scope of this study is to develop a requirement model of a mobile tracking application to track IDPs after locating them in Iraq based on interviewing two from IOM as well as 2 from the government officials using open-ended questions for system requirement. For the requirement model, the prototype is been developed and tested for functionality and usability issue by 30 users in three government and non-government who worked directly with IDPs in Iraq.

Assuming a hypothetical situation a family A is located in area B. and for any reason, this family moves from area B to area C the organization will have a problem locating this

family to distribute of financial aid. Thus, mostly this family will not get the money because their location is not updated in their database. Similarly, the recent spike of conflicts in the Middle East and other places have caused a huge wave of migration towards Europe which is estimated to involve more than 1,200,000 people from different countries. The EU is having a problem tracking the families who are already been located in different camps as some of the families have been relocated by the NGOs as well as other voluntary bodies [34]. Mobile application is proposed for many reasons and can be measured from a different perspective.

All these distinctive advantages of m-technologies provide further opportunities that enable government's officers and organization involved to render additional, highly efficient, and varied services to displaced families. This study focused on proposing a mobile application model for tracking displaced families to locate them from different camps when they move to other locations for whatever reasons so as to enable the families to be easily tracked for the distribution of aids, monetary or otherwise.

The prototype developed and tested for functionality usability issue involving 30 users from 3 different government and non-government organizations who been in touch with IDPs. After that, the phenotype will be reviewed by same experts involved in the system requirement.

1.8 Definition of Terms

- Data Models are fundamental entities to introduce abstraction in a DBMS. Data models define how data is connected to each other and how they are processed and stored inside

the system. The very first data model could be flat data models, where all the data used are to be kept in the same plane [35].

- Information and communications technology/technologies (ICT) is a generic statement to define the use of data and applied science in transmission, to alter data using an existing network to improve communication between civilians and companies [36].
- Internally displaced families (IDPs) are individuals with no choice but to escape or vacate their residence and migrate to other cities inside the country - specifically in places with armed conflict, in areas that are more likely to be damaged by the latter [37].
- Mobile tracking (Mobile phone tracking can be defined as the obtaining the real time position of a mobile phone, localization might occur either via multi-alteration of radio signals between (several) radio towers of the network and therefore the phone or just via GPS) [38].
- International Organisation for Migration (IOM) is an organization inside the government founded in 1951 as the Intergovernmental Committee for European Migration (ICEM) to assist in resettling individuals affected by the Second World War. In Iraq, IOM offers sanctuaries, employment help, and primary health care and psychosocial help to assist displaced individuals and aid them in reacquiring dignity. IOM Iraq also supplies technical assistance, such as government capacity building on concerns related to migration [39].
- United Nations High Commissioner for Refugees (UNHCR) is an agency of the United Nations assigned to assure honor for the rights of individuals escaping war and ill-treatment, and to obtain permanent solutions to their predicament [40].

1.9 Organisation of the Dissertation

This thesis provides the specifications for planning a portable tracking mechanism for lost families. This chapter sets the backdrop of the research.

Chapter 2 offers similar background and similar works on all large-scale research problems discussed in the thesis. Initially, the research offers the backdrop about the information and communications technology/technologies (ICT) and the portable tracking application along with charts of similar work in both subjects. Second, it emphasizes on the system development techniques and the most accepted techniques utilized in mobile application building. Third, it emphasizes on e-government and m-government as well as portable services in Iraq. Fourth, it emphasizes on displaced households and the recommended technique.

Chapter 3 offers the research approach of this study. It comprises four key stages to address the identified issue.

Chapter 4 explains the design and development of the prototype by using Object-Oriented approach using UML language and RAD methodology for development.

Chapter 5 explains the result for evaluation the functionality and usability test.

Chapter 6 discusses the conclusion of this research. In addition, the chapter includes the contribution of this research study and the limitation.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews the literature related to this study. The existing application for tracking purpose are explained in detail. It starts with the Data modeling and the role of ICT in general and narrows the research by explaining the mobile application and tracking systems Also, it explains the concepts involve in this study such as IDPs and the mobile services in Iraq. Technology continues to become more effective tool in tracking document and cargo and persons,

2.2 Data Modeling

The design and the manufacturing industries are constantly trying to come up with new products that can satisfy the customer's demands and tastes. Hence, identification of the user requirements is very important for the designing of the products. It has been seen that acquiring the user requirements from the product review is seen to be a good approach and it has some advantages over the commonly used methods like questionnaires and interviews. However, it is noted that the uncertainty is a generally less emphasized parameter in the modeling of the requirements. In an actual real-life designing scenario, the customers show different preferences for the product-related characteristics like the aesthetic value, functionality, and the price worthiness. Also, handling and managing the diversity of customer preferences is very important for the product designing companies for avoiding the expensive diversification procedure because of the increase in the attributes and the alternative product choices [41].

Moreover, the complicated software development procedure, used nowadays, would require the developers to apply multiple engineering approaches. Also, many different teams would need to use different forms of requirements modeling formalisms for expressing the requirements that are related to the allocated parts of any specific project. One team would have to specialize in the product-line requirements for the complete system (including the mandatory and the optional requirements along with all their dependencies), while the other teams would have to analyze and thereby develop any particular system part [42]. Hence, multiple teams would be required for determining and expressing the requirements of the project.

However, it is seen that using the IT developmental efforts for the achievement of the novel business goals is a very challenging process. Ideally, the IT projects and the solutions have to be aligned for answering the actual requirements of the business developmental targets. The IT systems are able to bring about process automation, support the business specialists as the process tools, contain very valuable business logic and the complicated business rules, and they also enable storing the vital information. It is seen that the IT projects can consume the company resources and are rarely completed in accordance with their defined schedule or budget, and also seldom deliver the pre-defined benefits. Based on the study of the huge software projects, it was observed that the average budget overrun was 66%, the schedule overrun was 33%, and the average shortfall benefit was 17% [43].

The Requirements Engineering (RE) involves identification of the stakeholders along with their specific requirements and documenting them in the form which is easy to analyze, communicate and implement. In this technique, the existing requirements modeling processes, frameworks, and tools are very high and it can prove challenging to choose the

most appropriate tool for the defined project [43]. The case study association has applied many requirements modeling techniques, like the Unified Modeling Language (UML) and the use case, business rules, and the non-functional requirements. The use cases are used for the model interaction that takes place between the consumer and the system [44].

The UML is a general software modeling language, which is used for describing and constructing different products that help in the software development. It enables the developers to explain and describe the products which are processed using the standard graphics mode. Being a general modeling language, the UML can provide many tools and means for expressing the actual world. In itself, it is a modeling technique and does not provide a material or effective modeling technique [45].

UML is a globally-accepted language for the software design blueprints. This language was first adopted as the standard in 1997 by the Object Management Group (OMG, which is an industrial standards body). Since then, it has been in use constantly in new and refined OMG UML formats. The 'UML-based modeling and design' is a very important and specialized curriculum subject in the study of the software engineering, and it helps to train the students involved in software development in the technical or the engineering fields. It also provides the developers with different models for characterizing the software in every development phases and for the developers to explain these phases [46]. Despite the fact that every developmental stage has a different model description to focus and characterize, the UML language provides an appropriate diagram for describing it. Using the developmental progress, the description for the earlier phase can be used in the later modeling phase. The UML also plays a very important role in the software production industries, while the subsequent curriculum is effective in the specialization of the software

engineering too [47]. Zhang, Lin [48] have stated that application of the UML object-oriented analysis and designing in any software system comprises of four different phases, which are as follows:

1. **Define Use Cases**

   The requirements analysis could include a detailed description of the associated domain processes, which could be written in the form of the use cases. The use cases are not some form of the object-oriented artifact, but they are the written stories. Furthermore, they are a very popular technique which is used in the requirements analysis and also form a major component of the Unified Process.

2. **Define a Domain Model**

   The object-oriented analysis is mainly related to the creation of an explanation of a domain from the object classification point of view. The domain decomposition involves identifying the ideas, attributes and the connections are considered to be noteworthy. The results are expressed in the form of a domain model that can be described in a diagram set which depicts the domain objects and concepts. It must be noted that the domain model does not describe the software objects, but it is only a visualization of the ideas in a real-world domain.

3. **Define Interaction Diagrams.**

   The object-oriented design involves the definition of the software objects along with their collaborations. One commonly used notation for illustrating these collaborations includes the interaction diagrams. They describe the message flow between the software objects and hence the appeal of the methods. The software object designs and

the programs take their inspirations from the real-world domains; however, they are not the direct simulations or models of a real-world.

4. **Design Class Diagrams**.

   Along with the dynamic view of the collaborating objects that is described in the interaction diagram, it can be very helpful to create the static view of class defamation using the design class diagrams. This involves the illustration of the methods and the class attributes. In direct contrast with the domain model, they do not depict the concepts of the real world; rather, the diagram shows the different software classes.

In the case of the IDPs, along with tracking any specific person, the model must include further details like the family name, the number of people and the current family situation along with their time of arrival at the camp and the time and reason they fled their houses and if the reasons involve a natural calamity like floods or an unnatural problem like armed conflicts.

2.2.1 Data Models Specification

According to The value of a large amount of location tracking data has received wide attention in many applications including human behavior analysis, urban transportation planning, and various location-based services (LBS). Nowadays, both scientific and industrial communities are encouraged to collect as much location tracking data as possible, which brings about many issues like it is challenging to process the queries on big location tracking data efficiently [49].

Currently, each project lead tracks information slightly differently. All researchers agrees that the data modeling tracking system should include the following information:

- Summary of the system.

- A detailed description of the system.
- Who identified the system?
- The date on which the system was identified.
- Which project the system is related to
- Who the system is assigned to?
- A current system of the issue.
- Priority of the system [2].

Next, the project leads to determine how information will be entered into the system. For this project, users must be able to:

- Create issues
- Assign issues
- Edit issues
- Create projects
- Maintain projects
- Create people
- Maintain people information
- Maintain project assignments

Based on information extracted, high-level conceptual data models will provide concepts for presenting data in ways that are close to the way people perceive data. The main aim of data models is to support the development of information systems by providing the definition and format of data [50]. There are many types of data models:

1. **Database model**

   A database model is a type of data model that determines the logical structure of a database and fundamentally determines in which manner data can be stored, organized, and manipulated. The most popular example of a database model is the relational model, which uses a table-based format.

2. **Entity-relationship model**

   An entity-relationship model (ERM), sometimes referred to as an entity-relationship diagram (ERD), is an abstract conceptual data model (or semantic data model) used in software engineering to represent structured data.

3. **Generic data model**

   Generic data models are generalizations of conventional data models. They define standardized general relation types, together with the kinds of things that may be related to such a relation type. Generic data models are developed as an approach to solving some shortcomings of conventional data models.

Data models can look very complex, as shown in Figure 2.1 data modeling can also be completed at 3 different levels [51].

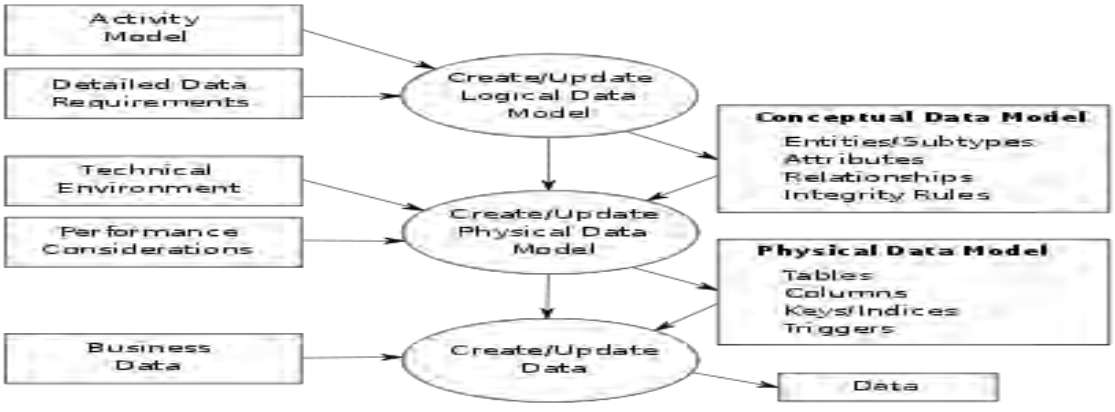

Figure 2.1. levels of Data Modeling

- **Conceptual Models** – Represent business concepts and ideas with no consideration for the technical design. Conceptual models definitely fall under the umbrella of *what* the business wants.
- **Logical Models** – Make the business concepts theoretically implementable in a database design, but still may not include all of the details of the physical database structure. Logical models fall right in the intersection of *what* the business wants and *how* the solution team will implement it.
- **Physical Models** – Specify the actual database tables and fields that are created as part of the database. Physical models are under the umbrella of *how* the database will be designed and implemented.

According to The value of a large amount of location tracking data has received wide attention in many applications including human behavior analysis, urban transportation planning, and various location-based services (LBS). Nowadays, both scientific and industrial communities are encouraged to collect as much location tracking data as possible, which brings about many issues like it is challenging to process the queries on big location tracking data efficiently [49].

2.3 Information and Communications Technology/Technologies (ICT)

The ICT is a commonly used term for all the communicating devices and their applications (like the cellular phones, television, radio, computer network hardware and/or software, satellite systems), in addition to several applications and services associated with them (like distance learning and video conferencing). Furthermore, the ICT has many applications in the computer-mediated network and in simple computing, which are used

by the companies for enabling all their businesses [36]. Many niche fields like the education, health care, and libraries are an essential part of the ICTs [1].

The ICTs are the front runners in the functioning and the expansion of many domains like the governmental departments, medical sciences, manufacturing, arts, transport systems, entertainment, all businesses, and many other fields. In the past 3-odd decades, ICTs have become very important in the normal day-to-day living. In lieu of the recent financial crisis in the world, many industrial, societal and governmental representatives have stated that ICT would help the world recover and help in economic reforms [1].

The European Commission has stated that besides possessing an inherent capacity of generating a better access to the information and communication in the less-catered public, the ICT plays a more prominent role in the technological sector. Many countries have a common perception that unless the technologically under-developed areas in the country would succeed, the rapid technological development in the developed nations would only aggravate the already present financial gap. Hence, in order to deal with this problem, many countries are setting up organizations which would help in the promotion of the ICTs. Moreover, even the United Nations is endorsing the ICTs for Development (ICT4D) for mending the gap seen in the digital divide between the countries [52].

Additionally, using a variety of communication technologies such as instant messaging and Voice over Internet Protocol (VoIP), people can connect with each other across continents in real-time. Worldwide communication and contact at a near-constant rate are possible using social networking sites such as Twitter and Facebook.

ICT is increasingly being used in work environments, in our learning institutions, and homes to a point where users encounter with ICT IS a daily basis [1].

Acquiring skills in ICT has become gradually more essential for several key reasons:

- The ICT systems people use for work and in their everyday lives require learning the skills, understanding and knowledge of concepts that may be unfamiliar to many [36].
- People are enabled to access and share information using ICT technologies such as the internet [53].
- Advancements in ICT has enabled and empowered people to access online education and distance learning [54].
- Opportunities for working collaboratively, independently, and/or autonomously on projects can be provided through the realization of ICT [55].
- Using appropriate ICT systems can assist businesses and companies in improving efficiency and reducing costs [56].
- Data and information can be stored, retrieved, updated and archived using ICT systems, making networks more efficient and reliable [57].

ICT systems and software are not restrained to any specific type of industry or business, especially in mobile applications designed to perform a particular function.

Mobile phone technology combined with ICT is helping to address the issues stemming from the necessity to maintain executive and customer communication and providing current information. Several studies have shown that in the standards of mobile phone data, processing, storage and updating, and in applications for communication, health care, and banking, ICT systems are considered a valuable tool [58].Integrated software systems usually found on PC platforms can be said to have spawned the mobile applications that are now an independent entity. Whether it is a game, banking app, or social media platform, each mobile application performs its own limited, segregated function. The specificity of

each application has become part of their appeal as a whole by allowing users to tailor and customize the functionality of their handset, although this may have been by initial necessity due to the limited hardware capabilities of early mobile devices [59].

In the case of Iraq, the promotion of the use of mobile application remains a unique challenge even when considering the staggering adoption rate of mobile phones and how this has transformed the way the population lives. Unsurprisingly, developed countries such as Iraq show more mobile application use in the public sector than in developing countries. As such, ICT and mobile applications present the perfect instrument to cultivate a system of collecting, processing and revising data in the area where wireless connection and low cost are the main customers draws [60].

2.4 Mobile Applications

Mobiles applications, generally called ‘applications’ or ‘apps’, are a form of application software built to run on a mobile device, such as tablet computer or smartphone [61]. Usually smaller, isolated software units with limited function, many mobile applications are designed to provide a facsimile to similar programs users are already acquainted with on their PCs. Apple Inc. has made a great success in the use of this software on its App Store, offering thousands upon thousands of apps for the iPhone, iPad and iPod Touch [4].

In modern world, there has been an increasing demand to use software applications for a variety of different uses. Applications can be broadly categorized according to their functionality; common applications use software that assists and validates the decision-making process, such as determining the dose of particular information [62]. Other widely used applications provide measured information targeted to a particular user group.

Additionally, by using dedicated devices programmed specifically or automatically, applications have been used to collect, follow, and monitor sets of related social interactions, behaviors, indices, and other contextual signals in real time. The ability for a populace and its government to establish communication and participate in topical events in developed countries is facilitated by the on-going acceptance of new application technologies. Developing countries, on the other hand, could greatly benefit directly through the relatively low cost of owning and operating a wireless device [63].

Finland provides us with an excellent example of a government making use of mobile devices. Any mobile phone can now be converted into an identity document, thanks to telecommunications firm from Finland. The unique subscriber identification module (SIM) found in every mobile phone can be programmed with personal information, turning each device into the mobile equivalent of a traditional paper passport. The current upgrade being performed by the Finnish government will enable the country's citizens to use their electronic ID cards to make secure transactions using their mobile phones, and it will even serve in place of a paper passport when it comes to travel [64].

M-devices are seen as the future of Information Technology since they allow two-way communication between a user and an organization. The two distinguishing features of M-technology are "Mobility" and "Wireless" [60].Although many software systems were initially developed as web applications and/or standalone applications, the increase in the popularity and use of mobile devices is driving companies to develop mobile-friendly versions of their (web) applications, either through responsive web design or by creating a native application [65]. There are many ways in which mobile applications are important:

- It has been shown that smartphone users check their phones once every 6.5 minutes on average – a total of almost 150 times a day [66].
- With thousands of people now reliant on the applications on their smartphones or tablets every day, demand is rising and developers are being forced to find reliable ways to make their offerings available on mobile [67].
- Mobile devices can now download a vast range of software from the internet thanks to their evolution into open software platforms [68].
- Mobile phones, PDAs, and other mobile devices present an affordable way for people to access the internet, and this opens up e-learning opportunities for many who are unable to afford a desktop computer [69].
- With regards to health, mobile technology can have both a widespread and economically beneficial impact. The cost of accessing, saving, modifying, and transferring digital content are low and can be achieved wherever and whenever. As a result, mobile health and wellbeing applications—or m-Health apps for short—are now a focal point for research. [65]. Table 2.1 reveals them-technological applications that the government frequently uses

Table 2.1

M-Technological applications used by governments [63]

Application	Government	Description
Wireless state portal	Canada	Provides a range of downloadable information, including emergency weather situations, and ensures the availability of government services through wireless and mobile devices
Wireless notifications	USA	Service enables PDAs and cell phones to receive energy notifications
Mobile traffic map		Equip users with a traffic map as well as entertainment during particularly slow traffic

SMS alerting services	Sweden	Uses SMS messages to supply provisional employees with job postings
Mobile tracking systems		Provides a mobile system that enables citizens to pay off parking fines
Tracking suspects	German	Tracks a suspect's movements through GPS and mobile phones
M-parking	Austria	Supervises parking by linking handheld devices to a central database
M-Police	Korea	Allows police officers to access information and print tickets immediately through mobile devices
M-local tax management system		Officers have the ability to retrieve tax information and submit the data into the local database directly
Download non-legally binding content	Japan	Information on tourism, disaster preparedness, and raising children is readily downloadable
SMS floods warning systems	Malaysia	Tracks the water level through the installation of an automatic measuring instrument. Affected residents are notified by the control center when water rises to a predetermined level
Tax declaration	Norway	Citizens are sent a completed tax declaration form beforehand and are able to send an SMS message that includes a distinct code if no changes need to be made. The tax declaration process is then finalized

2.4.1 Related Work (Mobile Application)

Smartphone are playing strong rule in our new modern world especially after adopting the Internet, technology improvements in the recent years increase the usability of it, moreover the size of the “Smart Phones” equal to our palm. Mobile applications play an important role in today’s communications as well as paved a path for the various modern techniques. Mobile Computing involves mobile communication, mobile hardware, and mobile

software [70]. Table 2.2 includes related work as well as several mobile applications that have been produced.

Table 2.2

Analysis of various mobile applications

Researchers	**Objectives**	**Methods**	**Outcomes**	**Limitations**
Fadhil, Nawar Abood [60]	This report aims to utilize new technologies such as mobile-based applications for the purpose of electing directors to the Ministry of Science and Technology.	Vaishnavi and Kuechler's methods were employed to create the planned scheme	Develop the Mobile-based Elections of Directors application (MED).	This report involves an electronic voting (e-vote) system, in which security is paramount during elections. This report will not dwell further on secure voting aspects.
Hameed, Ahmed Ghazi [63]	Decrease the number of explosive attacks in the country by employing technological advances and encouraging involvement by citizens in transmitting intelligence on suspect vehicles and Situations	Qualitative adaptation of new technologies	Design prototypes of mobile-based applications (M-POLICE)	Does not provide geolocation services to assist in shortening response times
Festersen, Pia Lock [65]	Develop re: Mind systems that are effective devices in reinforcing treatments of respondents	Various techniques	Design a mobile-based scheme for assisting	Does not provide an understanding of mobile-based

	identified with bipolar disorders		bipolar patients in monitoring themselves	applications to bipolar sufferers
Fenty, E M A [67]	Deliver a zakat may mobile-based browser application across multiple platforms using jQuery frameworks	Vaishnavi and Kuechler with Mobile Applications Developmental Lifecycle (MALC)	Design mobile-based applications for determining zakat may	Single-user application functions only via an API on additional sites
Feng, Xiang [68]	Recommend solutions for mitigating copyright attacks on mobile apps which builds on secure 3G architectures	Integrate 3G authenticated key agreements or AKA	Develop mobile-based run-time controls for regulating the operation of applications	The highly complex integration of OpenID solutions is among the primary concerns
Daddy, Roy [71]	Present the newest tourism-related content based on the latest news, favored tourist attractions and popular spots, and certain service provider deals	Conduct polls for mobile-based applications	Create mobile-based tourist applications (Visit-Samosir)	Some Indonesian regions do not encourage domestic tourists, and national coverage is incomplete
Setiabudi, Djoni [69]	Design examples of mobile-based e-learning applications running across multiple platforms	Various techniques	Design mobile-based e-learning applications	HTML and CSS plus JavaScript coding is inadequately supported by them.learning program
Yusof, Suhailah Mohd [66]	Deliver decision–support solutions utilizing forward-chaining practices to	Employ methodical metrics	Develop personalized financial	The suggested solutions only lend themselves to forward-

	enhance personal money-management and decision-making skills		planning applications	chaining practices
Howl, Tuck-soon [72]	Treatment and assessment of step time asymmetries (STA) in the aftermath of strokes	Qualitative observational technique	Develop mobile-based apps for treatments	Underrated the acuteness of time-based asymmetries

As shown in the preceding table of various mobile-based applications designed by diverse authors, there is evidently an absence of mobile-based applications to track people for improving decision-making.

2.5 Tracking Systems

Mobile phone tracking involves getting the current location of a phone, moving or stationary. This localization can happen through GPS or multi-alteration between the radio signals of several radio towers and the phone [73]. It can also be described as a way to exchange GPS and other position data between wireless devices [74].

Modern communication devices offer much more than just conversation and feature highly sophisticated technology. GPS tracking is one of the features found in modern cell phones [75].The wide variety of applications available to meet the needs of users is a large part of the growth of smartphone usage [76]. GSM and SMS technology are often used for wireless data transmission. Via GSM network and GSM modem, SMS technology provides users with vehicle location information [77]. The low cost of SMS has contributed to its popularity. It offers a reliable way to transfer and receive data, while also remaining convenient and accessible [78]. There are several phases of tracking a person:

- Tracking systems for patients (interesting and important research problems and wireless networking solutions. Pervasive health monitoring, pervasive healthcare data access, ubiquitous mobile telemedicine, and intelligent emergency management systems are among the pervasive healthcare applications [79].
- Motion Tracking System Design (for feature tracking, a motion-tracking algorithm was developed for real-time ultrasound imaging with image processing techniques) [80].
- Tracing Children, Elders, Persons with Disabilities, Pets (The automatic tracking and alerting scheme have two separate mechanisms - the tracking component and the automated emergency calls component) [81]. According to [82] there are 4 types of GPS Tracking Systems You Should Know About:

1. **Hardwired GPS Tracking Device**

   The hardwired Global Position System (GPS) tracking devices are used in the vehicles. They use the vehicle's battery power for operating. The unit's brain is hidden in the hood or the dashboard of the vehicle, and sometimes these devices also come with some antennae which are attached to the vehicles.

2. **GPS Loggers**

   The GPS loggers include the GPS devices which can record data that can be recovered at some later time. For instance; the GPS logger is used for tracking a shipment or a vehicle, however, this information can be available only if it uploaded manually to a computational device. These are called as the passive GPS tracking devices.

3. **Personal GPS Trackers**

   The personal GPS trackers are the tracking systems that resemble cell phones or small beepers. They are designed for clipping to the belts, be handheld or are tossed in the

purse for personal use. These devices are generally purchased for personal protection of children or even adults. Many of these personal GPS devices have a panic button for instantly alerting some family member or the authorities in the case of certain emergencies.

4. Real-Time GPS Trackers

The Real-Time GPS trackers include the GPS devices that constantly transmit the information which can be tracked by the users for determining their location at all times. They are sophisticated devices which require tracking services and a GPS tracking software. The real-time GPS devices use the satellite mapping for determining the position of the GPS devices.

2.5.1 Relevant Work (Mobile-Based Tracking)

The GPS is a very common feature in the handheld devices, and hence, many location-tracking applications are developed, which include the constant location-tracking of the children and the elderly people for safety purposes and for preventing them from getting lost, vehicle tracking and monitoring and even in the intelligent transportation systems. In recent years, Google Inc. developed the Android OS platform, which is a very open system and offers a high flexibility. This platform supports the development of a GPS tracking system by combing together several of the Google resources. Using the free navigational functionality of the Google Maps, many people prefer the free service provided by Google rather than choosing the paid services. The GPS needs no support by the internet network providers for accurate information, however, if it is used in combination with any type of network, the system accuracy can be greatly enhanced [70]. Table 2.3 shows the primary features and utilities of the mobile-based tracking systems used by several research groups:

Table 2.3

Mobile-based tracking systems and functions

Researchers	Problems	Solutions	Functionalities
Varandas, Luis C M [4]	Lack of geolocation services (e.g. GPS or GSM networks) to pervasively trace mobile devices in all environments	Develop m-tracking applications	Empowers users to trace mobile devices and alert them whenever these move outside an area radius centered on a point of interest
Almomani, Iman M [75]	Absence of multifunctional schemes to track vehicles and also personal activities within them	Develop vehicular tracking systems using browser-based tracking applications and mobile-based apps	Let users trace the stopped and moving positions of vehicular transports and their transit velocities
Shamsuzzoha, An [83]	Absence of the latest tracking data involving packages' shipping dates and locations	Develop a tracking scheme using mobile-based applications	Enables businesses to trace real-time deliveries between shipping points from start to end using e-mail, SMS, etc.
Kasim, Narimah [84]	Many building projects employ manual tracking practices in both material usage and resource management which involve awkward paper documentation, resulting in high human error rates	Develop schemes to trace material usage and manage construction timelines	Allows users to trace materials usage and ease resource management by reducing paper documentation, thus decreasing the costs of operations and products and shortening delivery cycles

Subpratatsavee, Puchong [85]	Deficiency of documentary information updates in the Science Faculty of the Si Racha, Kasetsart University at Thailand's Si Racha Campus.	Design applications to trace authorized documents in an administrative center	Assist the administrative center of the Si Racha Science Faculty at Si Racha in tracking updates to documents
Grifantini, By Kristina [86]	Sleep disorders result in higher accident rates and elevated risks of contracting infectious diseases, and obese and heart conditions	Design applications for tracking sleep quality	Present users with important figures about their sleep behaviors
Sankaranarayanan, Suresh [76]	Absence of updated information on bus and commuter schedules, and time-of-arrival estimates	Develop mobile-based transport tracking schemes	Empower passengers to track estimated transit and arrival schedules while providing them with mobile-based notifications to top-up stored credits
Punetha, Deepak [81]	The heavy expense of schemes to track children and the elderly, for improved security	Develop lower-cost tracking schemes for particular market segments	Allows budget-conscious users to track children, older people, and pets inexpensively
Zank, Markus [80]	The higher costs of schemes to precisely track real-time body positions and locomotive bodily movement	Design inexpensive systems to track persons and all local appendages, i.e. limbs, heads	Enables users to inexpensively track limb and foot positions and placements

IOM [12]	Absence of updated information on displaced refugees in the camps	Develop readily updatable personal information systems	Assist the International Organisation for Migration or IOM, in collecting relevant information on the locations and conditions of displaced refugees throughout the country
Our problem			
The absence of systems purposely built for tracking displaced families			Provincial investigations
International Organisation of Migration employs manual methods of updating information in their systems			IOM - 2010

The preceding table illustrates the absence of mobile-based applications for tracking IDP groups and the governmental and non-governmental agencies which are immediately engaged with the refugees.

2.5.2 Data Modeling (Mobile-Based Tracking)

The increase of mobile services along with mobile applications present big challenges in designing the application. These challenges like business strategies, limitation in mobile devices, communication problems, usability, thus, designing mobile application must be done according to studied plan based on the available requirement in order to meet the customers' satisfaction. Incorrect requirements will lead to mistakes in developing the application, not meeting market needs, and be out of schedule and bug-infested [87]. This research utility of the mobile-based tracking systems used by several research groups and show the models used by

- **Web-based post flood disaster missing people tracking information system.**

  This study proposed web based to show information about missing people during and post flood disaster to track and report missing people and to analyse the system

requirement of a Functional and Non-functional requirement after that provides the system Graphical User Interface (GUI) to reflexes a complete view of understanding the system behaves and working [88].

- **Use Case Diagram.**

  There are two actors are participating with a process while having different process in another aspect, the first actor is a user who includes Malaysian public, government institution, shelters, donors, passenger, and tourist. The second actor is Admin which has some other processes such as an ability to add delete to control the website data and overall. All of that is shown in Figure 2.2 of use case diagram bellow:

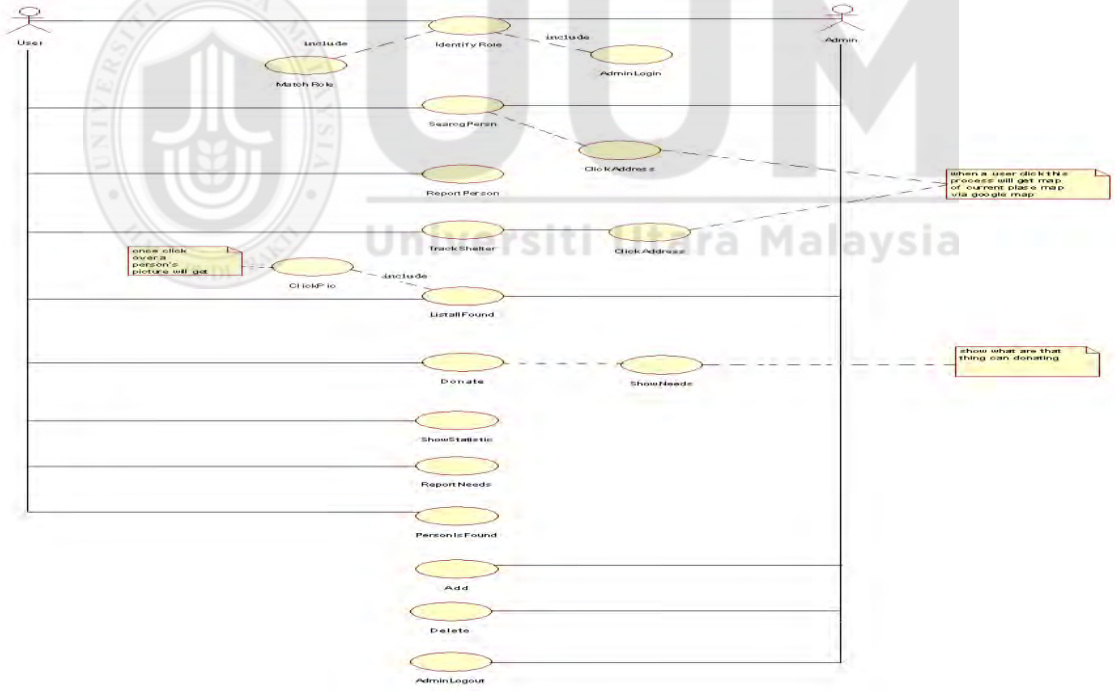

Figure 2.2.Use case Diagram [88]

- **Class Diagram**

  UML class model or diagram is a graphical representation which comprises of different classes, their attributes, methods and their relationships with each other. For the

creation of class model we need to extract the classes, attributes and methods from the natural language problem statement as see Figure 2.3 below:

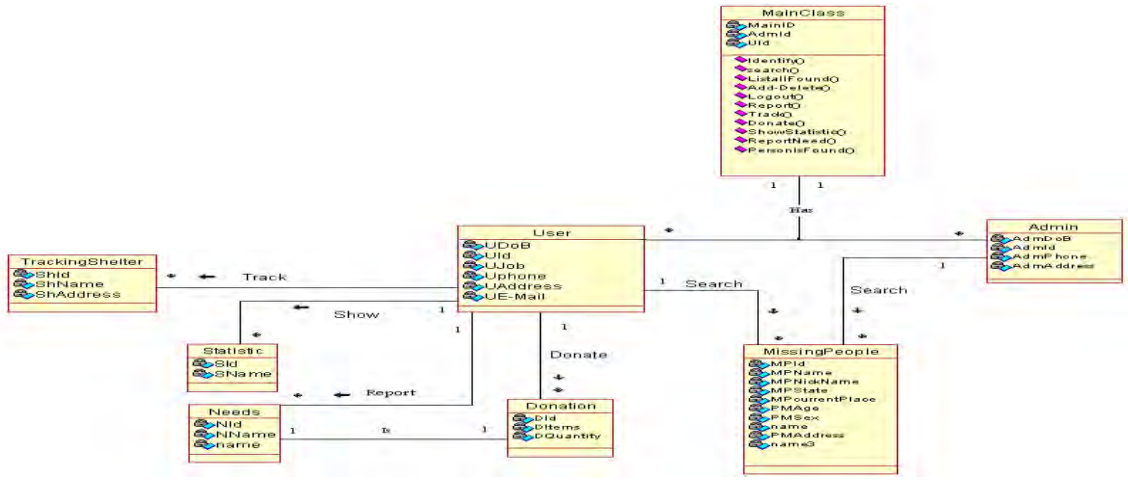

Figure 2.3. Class Diagram [88]

- **mTracker: A Mobile Tracking Application for Pervasive Environment**

  The tracking application, known as the mobile tracker, uses the Location-Based services (LBs) such as the GPS or the Global System for Mobile (GSM) network for tracking any mobile device. Based on the known geographical position, the application helps the user track any mobile device and it then sends alerts if the mobile deviates from the radius of the point of interest, which is defined previously by the administrator [89].

  - **System Requirements**

    Any mobile application possesses some specific requirements which are easily satisfied by the mTracker. Based on the ubiquitous computing principles, any user interface should be very easy to use with a minimal user input. The screen size and the orientation along with the stylus input minimisation can dictate an interface having large-sized buttons and proper font sizes which help in the on-the-move

applications using the LBs like the GPS or the GSM cells. The Fig. 2.4 describes the different mTracker requirements.

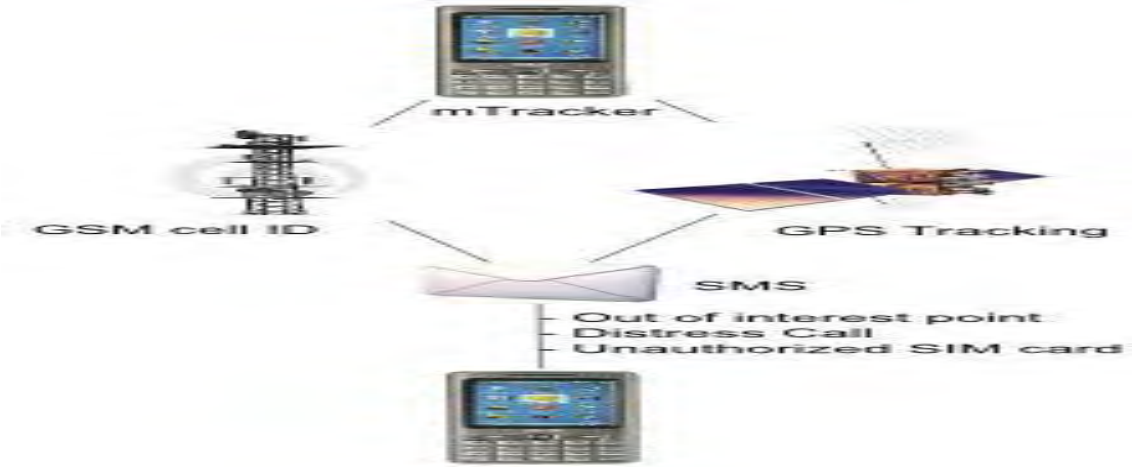

Figure 2.4. mTracker requirements [4]

- **mTracker UML diagram.**

  The application architecture and its working principle are centered on the use of GPS and GSM Cell ID. These are the most common technologies for these kinds of applications. The user interaction with mTracker, the corresponding UML diagram is shown in Figure 2.5.

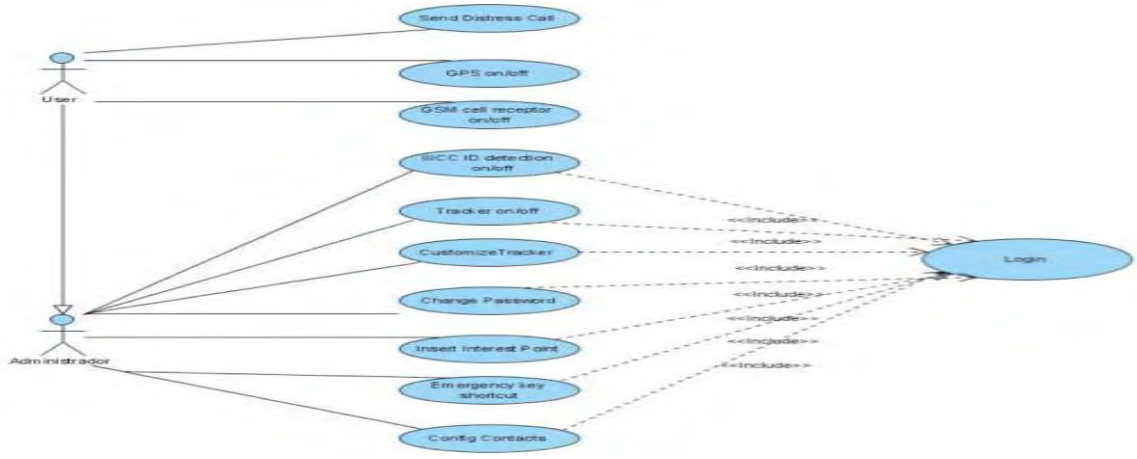

Figure 2.5. mTracker UML diagram [4]

- **Applying RFID and GPS Tracker for Signal Processing in a Cargo Security System** [74].

  A system (called as the Cargo Security System) is seen to consist of the web-based software, servers, and the databases. This system is seen to accept many delivery orders from different employers or shippers and gets them governmental approval if needed, delivers them to proper locations and then sends the response regarding their delivery to the source and the shipper. One advantage of using this type of system is that it centralizes all the shipping systems and makes it easy to track the shipments from the shipper to the receiver properly within a very short time.

  The product has been designed to keep a track of the cargo as can be observed by the shipper, carrier, and the receiver. Figs. 2.6 and 2.7 describe the requisite actions of the three players; i.e., the receiver, carrier along with the data administrator of the Cargo Security System.

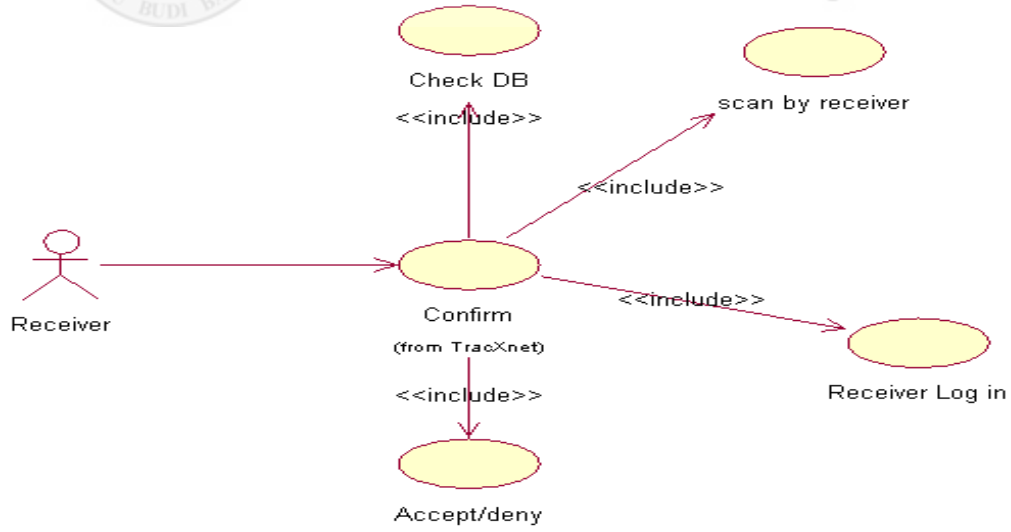

Figure 2.6. Use-case diagram shows the requirements of receiver

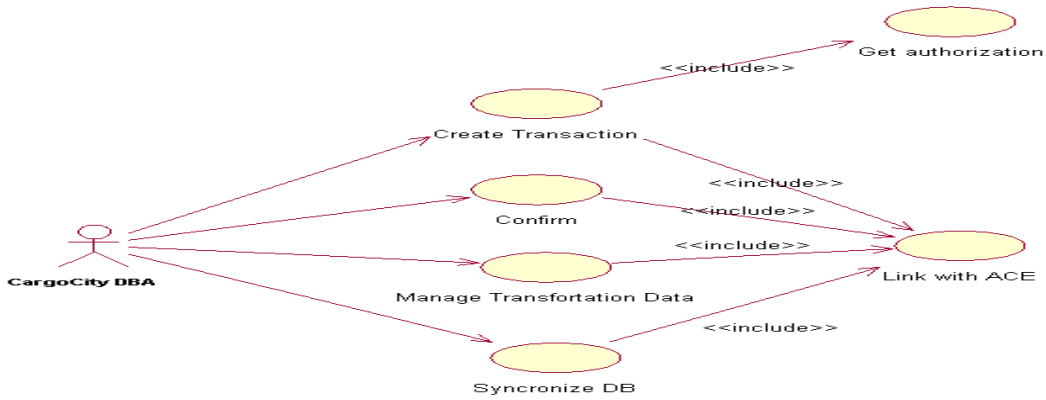

Figure 2.7. Use-case diagram shows the requirements of DBA [74]

2.6 E-Government and M-Government

E-government and M-government are both seen as powerful tools that give cost-effective and high-performance services and management in many counters. We have had so many discussions about E-government, and it has even become the basic guideline for government reform and renovation. On the other hand, M-government, as will be presented shortly, is seen by many as the most important subset of government services in the future [90].

2.6.1 E-Government

Like a lot of other contemporary concepts, researchers and specialists have multiple definitions of E-government. Nonetheless, most of them also generally define electronic government as:

- How the government uses information communication technologies to give citizens and businesses the chance to interact and conduct business with the government through various electronic media channels like telephone touch pad, smart cards, fax, self-service kiosks, EDI, and e-mail/the Internet. It studies how the government organizes itself, its administration, regulations rules, and frameworks that are

implemented to perform service delivery and to communicate, coordinate and integrate processes internally [91].

- The provision of public services through the intensive or generalized use of information technologies in the government, the improvement of the efficacy of its management, and the promotion of the values and mechanisms of democracy [92].
- The use of information and communication technologies (ICT) by the government agencies is also referred to as E-Government – this is true for concepts such as Wide Area Networks, mobile computing, and the Internet. Meanwhile, OECD stated that electronic government is a term used to refer to how the government uses information and communication technologies, and particularly the Internet, to be better [93].
- The phrase e-government is also used to explain how ICT is used to assist in government procedures, supply government services, and enhance people. The use of e-government increases with the provision of the web for public application [16].

In the past few years, Iraq has taken strong and solid steps towards the e-governance program. Some of its many goals are taking public services online and giving the citizens a chance to increase their participation in certain decision-making processes. This approach also improves transparency and effectiveness in the administration of the state. Four main services are provided by the program:

- The Citizen Services Portal's Section as a gateway for Iraqi Citizens.
- The Business Services Portal's Section as a gateway for Iraqi businesses.
- The Government Services Portal's Section as a gateway for Government Organisations in Iraq.

- The Non-Government Organizations (NGO) Services Portal's Section as a gateway for NGOs that are working in Iraq [94].

However, this step is not the first update to the services provided such as:

- Despite the limited ICT skills and infrastructure, the ministries of Higher Education and Scientific Research and Planning have been putting in lots of efforts to develop the information society. The former's focus is on increasing the level of higher education, including IT, in order for it to be competitive with local and international counterparts; the latter aimed to automate the workflow of the ministry by forming a general directorate. Building the directorate of Geographic Information in the Central Organization for Statistics and Information Technology (COSIT) became the first stage of the automation process. These directories were also connected to an internal information network. It is worth mentioning that specialized surveys on the use of ICT were conducted by COST on households and individuals. This laid down a national strategy for census and it covered the period of 2010–2014 [95].
- The Ministry of Interior is computerizing its systems by committing to the implementation of twelve projects. Some of these projects are maintaining and developing the ministry's website (http://www.iraqinationality.gov.iq/index_en.htm); starting the Iraqi Justice Integration System; creating a database management system that can be used by the Iraqi police; making use of the geographical information system; and developing a system for the workflow of passport issuance on top of the national card project. For most of these projects, work is already underway and the level of completion is different from one to another [17].

- A center for geographical information systems was also established by the Ministry of Water Resources, the ministry responsible for the management of water resources. The ministry gave special attention to workflow automation and in developing a number of systems and databases like the library database, hydrological stations database, the bidding system, and the ministry's projects system. A Technical Committee for Information and Communication Technology (TCICT) was set up in July 2005 to coordinate the efforts of the ministries, non-government organizations, and public agencies in building the information society. The TCICT has representatives from different ministries, namely: Central Informatics Organisation, Ministry of Information, and Ministry of Transportation [96].

However despite the fact that Iraq has started on its e-government initiatives more than ten years ago, [16] it is still struggling to stay updated and to be able to effectively create a bridge of communication between the decision makers and the people. It is still behind a lot of countries when it comes to the e-government rankings that were set based on a survey conducted by the United Nations in 2014 [97].

2.6.2 M-Government

There are many definitions of m–government according to different researchers and the varying nature of the research. Some of them are as follows:

- Mobile government (m-government) is seen as the next inevitable step in the evolution of the e-government. It is also a product of the growing popularity of mobile technologies (m-technologies) such as mobile phones, personal digital assistants (PDAs), and laptops that are operated by wireless networks. These technologies have

turned governments into mobile government (m-government) from being e-government [63].

- Mobile channels and similar technologies have helped the government provide timely, innovative, and personalized e-services by offering opportunities that were not present with just the conventional internet channel [98].
- Them-government is considered an extension or a supplement of e-government. It can be defined as 'a strategy that utilizes mobile devices as its implementing arm to provide services and information to government employees, businesses, citizens, and other organizations' [90].
- Due to distinctive benefits and features like mobility and wireless features, m-technology is the succeeding step in IT evolution. There is a higher advertisement for mobility. Mobile devices like PDAs, cellular phones, laptops, tablet PCs, and Blackberries give users freedom, especially from being physically tied up to the desktop. Despite the absence of specific connections, the "wireless" feature of m-technology still, makes the transmission of information between computers and data sources possible [99].

Moreover, governments now have new ways to deal with citizens and businesses using mobile platforms because of the recent developments in Internet technologies and services. In other words, the need for improved and more efficient government services will push the government towards m-government. Additionally, e-government is the best method to promote better interaction between citizens and their government in terms of improving efficiency, information accessibility, and bringing citizens and government officials closer. The term e-government can be described as the usage of ICT, specifically the Internet to

enable the access to government information and services [91]. Information communication technology (ICT) in terms of mobile telecommunications and the Internet has a lot of potential in giving more effective and efficient services regarding response and warning activities, especially in emergency situations such as the 9/11 terrorist attack [100].There are several ways by which mobile-based information systems or M-Service benefit first responders:

- Mobile devices allow first responders to perform better, act quicker, and make decisions faster.
- The development of wireless/mobile technology and communication trends gives a ubiquitous environment that can be deployed in different fields.
- The use of mobile devices fosters interactive communication mechanisms that make it possible to have just-in-time communication and collaboration among many residents and responders.
- The mobile-based emergency response system (MERS) uses mobile technologies in helping the government gather information and make decisions when responding to disasters [100].

M-government can be considered a subset of e-government. It represents the government's utilization of mobile and wireless communication technology to deliver services and information to citizens and firms. Sweden, for example, is considered to be one of the world's leading countries in m-technology. More than 95% of its population makes use of mobile phones. The country has made wide-range m-government services available. Some of its more novel projects include SMS applications that inform citizens about city job postings in Stockholm, government inspector service, a parking fee payments system that

is on mobile, mobile healthcare providers, tax services, and a wireless system map called Map Mate [63].

Set against this background is the high interest in the ICT sector in Iraq. Developing the infrastructure for this sector is an important part of the advancement of the other sectors, like the finance and the trade sectors that are dependent on electronic networks to get connections to banks and be able to transfer funds and conduct electronic transactions. Thus, it allows the education sector to use these technologies to conduct its projects in e-learning and create links with other Iraqi Universities. In turn, it is beneficial to the e-government project, a project that helps enhance the interactive, democratic, and transparent practices between the government and its citizens [22]. However, utilizing the Information and Communication Technology in government agencies is not easy, especially when faced with some challenges that could result in the failure of these new technologies.

2.7 Mobile Services in Iraq

There is still security and political instability in Iraq, and this ad up to the obstacles for development. Nonetheless, the country was still able to have tangible progress in building the ICT and mobile sector [8]. The Coalition Provisional Authority (CPA) established the Communication and Media Commission (CMC) on 20 March 2004. It issued the Order 65 by Paul Bremer, the U.S. Civil Administrator for Iraq. Media and communication in Iraq were controlled by the CPA. One could say that licensing and giving media outlets frequencies was done by the CPA. Based on international conventions and current best practices, the order of establishing the CMC was given. The responsibilities of the Communication and Media Commission are focused on:

- Regulating the broadcasting and communications services and networks, including but not limited to licensing, interconnection, pricing, as well as determining the basic conditions needed to provide public services.
- Coordinating, planning, identifying and distributing broadcasting frequency usage.
- Developing press mechanisms and controlling media designs.
- Developing, designing, and promoting electoral media rules.
- Promoting and supporting vocational rehabilitation, and implementing the guidelines for professional conduct on media topics.
- Developing and distributing media and communication policies, as well as suggesting regulations on the government and other concerned bodies [101].

Under section 3, named "Establishment", the commission was given exclusive power to manage Iraqi communication and media and to enforce codes, rules, and regulations that deal with the communication and media in Iraq. It says 1) .The licensing and regulation of Broadcasting, Telecommunications, Information Services, and other Media in Iraq will be the sole responsibility of the Commission. It shall adhere to the principles of objectivity, non-discrimination, transparency, proportionality, and due process as it performs its duties [102].

This commission was also given independence by the new Iraqi constitution and has been solely attached to the legislation branch. It is stated in Article 103 of the Iraqi constitution that: First: the Communication and Media Commission and the Endowment Commissions are independent institutions both financially and administratively. The work of each of these institutions shall be regulated by law. Second: "The Council of Representatives will be attached to the Communication and Media Commission" [3].

Nonetheless, there is continuous pressure on Iraq's economy because of the costs of financing war and the humanitarian costs resulting from the millions of people who were displaced and are now destitute. Iraq also relies heavily on oil prices, which have gone down recently. Making a significant investment in the telecoms sector is, therefore, becoming harder, given these demands on Iraq's economy. This is especially true given the fact that finances might have to be directed towards rebuilding damaged infrastructure. Once the civil unrest stabilizes and the government and operators can again focus on telecom and digital growth, the Iraqi telecom market will be able to offer many opportunities. A significant number of mobile phone users are yet to make use of mobile broadband at significant levels. Recently, 3G services were launched and the country also intends to adopt 4G LTE in the near future. Because Iraq also traditionally supports the use of fiber infrastructure, it will help create a strong backbone for the growth of telecom in the country. A keen interest in video streaming, social media, and potential e-commerce and e-banking services in the future has been observed in the younger and more educated population [103].

Moreover, there are also growth opportunities seen in the fixed line penetration, especially since it is only at 5.1% as of September 2012 [104]. There is mobile telephone service in nearly all of Iraq. There is an average of 1.56 mobile phones per Iraqi family, and penetration rate is relatively high at 75%. The percentage of Internet use by Iraqis was found to be at 3%, 39% of which is home use, 34% in Internet cafés and 26% in offices, educational institutions, and other places (as at November 2011). Iraq's approach to its ICT market is a single-regulator one. Both the telecommunications and the media markets are solely regulated by the Communication and Media Commission (CMC) [101].

2.8 Displaced Families

People who have no choice but to leave their homes; especially in cases of armed conflict, generally experience higher vulnerability in several areas. Generally speaking, displaced persons have higher mortality rates than the general population. They are also at a higher risk of physical attack, abduction, and sexual assault. Moreover, they are often deprived of adequate food, shelter, and health services. Women and children make up the overwhelming majority of internally displaced persons, and they are especially at risk of having their basic rights abused. Internally displaced people tend to remain near or become trapped in zones of conflict. They are often caught in the cross-fire and are more at risk of being used as targets, pawns, or human shields [14].

Based on data gathered from January 2014 to 5 November 2015, the International Organisation for Migration (IOM) was able to identify 3,181,176 internally displaced individuals (530,196 families) spread across 103 districts and 3,542 locations in Iraq [12].These conflicts have led many government organizations such as the Ministry of Migration and Displacement and non-government organizations like the International Organization for Migration (IOM) to try and help IDPs get shelter and other basic needs like medicines, blankets, and even financial compensation [105]. These conflicts are everywhere especially because direct attacks and suicide bombs or improvised explosive devices are present [63].

2.8.1 Effect on Displaced Families

The largest IDP populations can be seen in the following governorates of Iraq: Anbar, Dahuk, and Baghdad. These areas have a total of 1,559,742 individuals. Around 77% of

the total displaced population (2,440,176 individuals) comes from just three governorates: Anbar, Salah al-Din, and Ninawa [15].

Anbar is one of the cities that experienced attacks from extremists groups. Within just two weeks of intensified conflict between extremists and government forces, an estimated 114,000 Iraqis have fled Ramadi, the center of Anbar. Around 39,000 of them have stayed inside the province since many were not able to move further. About 54,000 went to Baghdad, 15,000 headed to Sulaymaniyah in Iraq's Kurdistan region, and 2,100 went to Babylon. At least 900 have reached Diyala, while some others are still trying to reach safety.

The displaced people inside the Anbar province continue to seek shelter wherever they can find it. Some of them end up in places such as Khalidiya, Amriyat Al Fallujah, and Al-Habaniyah. They often stay with host families or relatives. Sometimes they look for shelter in schools and mosques. In one community center in Al Habaniya, new arrivals have to share the space with people who have been previously displaced by older waves of violence. This leads to overcrowding. In more extreme cases, four families have to share one tent [106].

In February 2014, a dam 5km from Fallujah City in Anbar was seized by extremist groups. The armed groups controlled the dam for months. This particular dam was responsible for regulating the flow of the Euphrates River through 12 gates. The group closed the 8 gates that controlled the water supply to the south and opened the 4 gates that supply the irrigation channels in Abu Ghraib. This caused severe flooding in several areas in the Abu Ghraib district of Baghdad and the Fallujah district of Anbar. Farmers were forced to abandon their inundated agricultural land and thousands had to flee their homes.

As of the end of May, 7,085 displaced families have been identified by IOM. This is due to the flooding in 6 of the 18 governorates within Iraq: Anbar, Diyala, Baghdad, Kerbala, Salah-al-Din, and Qadissiya as shown in Figure 2.8. Because key informants in Abu Ghraib had difficulty providing the location of those displaced because of the flooding, these 7,000 families were not immediately included in May's figures of identified IDPs, which was currently estimated to be at 79,000 [20].

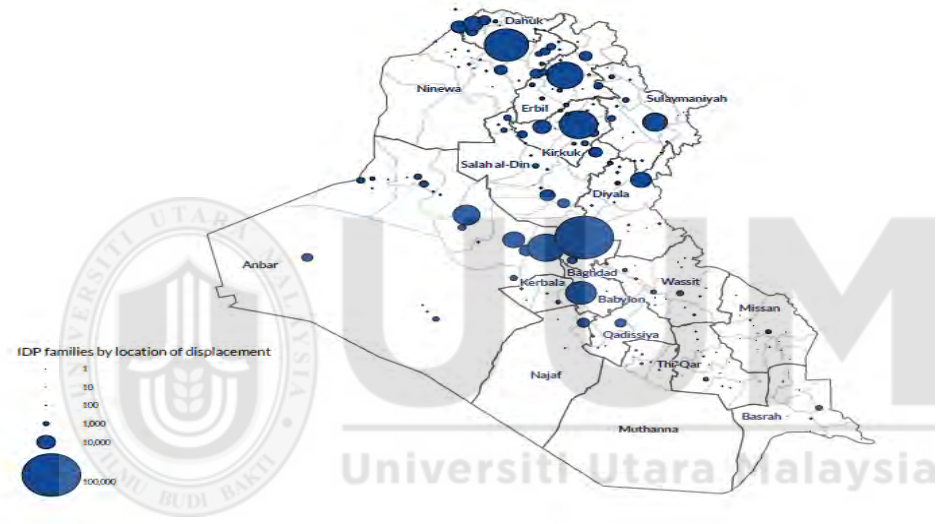

Figure 2.8. IDPS families count by district of displacement, November 2015 [12]

2.8.2 Iraqi Government Policy on IDPs

The crisis in Iraq can be identified as a protection crisis. One of the highest priorities is to try and help protect the most vulnerable people. The second challenge lies in providing life-saving services to millions of people. It has been estimated that 6.7 million people in Iraq are in dire need of essential health services.

About 50% of the displaced families urgently need shelter support. Around 700,000 people have to make do with living in unfinished and abandoned buildings, spontaneous

settlements, and makeshift collection centers. Although the Iraqi people have shown generosity by sharing their homes and resources, there are still rising social tensions. More people are becoming destitute, there is increased job competition, and basic commodities have become so expensive that families are finding it harder to purchase even their most basic needs [105]. There has been a drastic increase in food insecurity over the past six months, and it has remained a major challenge. Food aid is needed by about 4.4 million people. Emergency education is also a priority since almost 3 million children have been forced to quit school. There is an enormous risk for an entire generation of children, and this could potentially fuel tensions and violence in the future [107].

The Iraqi government sets aside a budget for displaced families and IDPs and it lets the Ministry of Migration and Displacement manage and distribute the funds and supplements to the families. The most common shelter type for IDPs outside of Anbar was renting. More than 50% (over 63,000) of the assessed, displaced population had rented living arrangements. The vast majority of renting IDPs was hosted in Baghdad, Salah al-Din, and Sulaymaniyah. It is worth noting though that only 40% of the IDPs in Baghdad were renting and 61% of IDPs in Salah al-Din were renting too. Almost all of the IDPs in Sulaymaniyah had rented accommodations. IDPs who have rented accommodations are at an increased risk of financial instability since most of them do not have a source of income during their displacement [14].

Assessments done in May 2014 revealed that the average cost per month for rental sites outside of Anbar was USD297. The highest average rent cost was found in Erbil and is set at USD406. The high costs can be attributed to the ratio of IDPs renting within the governorate and are compounded by the holiday season and the yearly increase in rental

costs. Around 48% of the time, the IDPs renting outside of Anbar did so without having any agreements or contracts. Notably, IDPs in Sulaymaniyah have not reported the lack of a rental agreement, while all IDPs in Kirkuk were renting without an agreement. Consequently, the United Nations and the government of Iraq revised the 2013 budget, which was set at USD293.7 million because of the increasing needs of the Syrian refugees. The budget was set at USD216 million in 2014, a decrease from the previous year. This meant less shelter construction for IDPs and refugee [15].

However, the armed conflict that took place in Anbar in early 2014 and the increasing violence across central Iraq that started in the middle of the year also affected the KR-I and persuaded UNHCR to start a supplementary appeal to increase the total budget in Iraq for 2014. This resulted in a budget that reached well over half a billion US dollars. For 2015, UNHCR approved Iraq's comprehensive budget at US 230.5 million. However, because of the evolving needs of the displaced people within the country, this amount is likely to increase. A supplementary appeal will be used to present additional requirements for 2015 that are not included in the comprehensive budget plan [15].

2.8.3 Problems Facing Supporting Families

Iraq has faced many challenges during the past year. These challenges are not limited to the security level but are also on the environmental level as well. These factors have resulted in a change of location of the IDPs.

IOM Iraq Chief of Mission Thomas Lothar Weiss stated that while the return of displaced Iraqis is encouraging, many returnees go back only to find their homes destroyed and to experience a lack of basic services in their neighborhoods. A tailored and comprehensive

response is needed by these populations. The UN Humanitarian Country Team, IOM, government authorities, humanitarian partners, and donors have been working together to address the needs of the returnees, as well as the current and newly displaced IDPs and host communities [108]. In the governorates of Anbar and Salah al-Din, the health problems faced by the IPDs were particularly evident. Anbar had 47% of the sites that had non-functioning health services and Salah al-Din had 36%. Outside of Anbar, it has been discovered that these assessed sites had no access to health facilities even before the crisis began. Reports of the situation within Anbar revealed that medical personnel was not able to report for work at the health facilities and that these health facilities were situated in an insecure area.

School attendance in Anbar is currently quite low compared to the nationwide averages. However, it is believed that attendance rates could increase as displacement prolongs. However, an assessment done in April and May revealed that IDP children were not attending primary and secondary school in 51% (316) and 52% of the assessed sites, respectively. Most of these sites were located in the Heet and Ramadi districts of Anbar, Sulaymaniyah district of Sulaymaniyah, and all districts of Salah al-Din [20].

Overall, very poor attendance rates were observed in the governorates of the Kurdistan Region of Iraq (Erbil, Dahuk, and Sulaymaniyah). In Dahuk, children in all the sites did not attend primary school, while in the Amedi district; only one location had IDPs attending secondary school. In Erbil, none of the sites reported having IDPs who were attending primary school, and only 1 location had IDPs who were attending secondary school. However, in Baghdad, only 1 out of 169 assessed locations had IDP children who were not

attending primary schools and 2 locations had kids who were not attending secondary school.

In many locations hosting IDPs throughout Iraq, the prices of commodities have risen. Regardless of the price increase, a large number of IDPs in the sites assessed by IOM still reported that they cannot afford adequate food for their families regularly. In Round II and III, 66% of the assessed sites had reports saying that IDPs were unable to afford adequate food. In governorates with the largest IDP populations, specifically Anbar, Sulaymaniyah, Baghdad, and Salah al-Din, this is an important issue. The districts of Fallujah and Hit in Anbar and in Sulaymaniyah district had the highest percentage of sites that cannot afford food items, while Baghdad (Al Resafa, Adhami, and Karkh districts) had the greatest numbers of locations that can afford food [12].

Around 71% of the assessed sites reported that Anbar Crisis IDPs were able to access food and infant formula. The Fallujah district of Anbar and the Tikrit district of Salah al-Din had the majority of the locations that reported the unavailability of infant food for IDPs. In Anbar, infant commodities were not available in 59% of the sites, while in Salah al-Din, 87% of the sites assessed reported such unavailability in an assessment done in the months of April and May. Throughout Iraq, and as supported by the findings of Round II, those displaced by the Anbar Crisis listed food items as part of their priority needs. Anbar Crisis IDPs did not have access to these main commodities: flour oil, rice, tea, sugar, milk, meat, and fruits, among others.

2.8.4 Issues with Data Collection Involving Internally Displaced Persons

There are several challenges face organization in term of collecting and updating IDPs data like:

- Restricted contact (IOM teams gather information constantly and convey reports once every two weeks. But restricted access and other limitations to operations can constrain data collection activity. The disparity in displacement numbers noted between periodic reports may be due to influential elements, e.g. increases in the precision of tracking displacements, the unceasing documentation of formerly dislocated groups, and insertions of data involving secondary group displacements [9].
- Deficiencies in organisation (The displaced population groups are recognised via procedures for collecting, verifying, triangulating, and validating information. Required to continue organizing more directly with agencies at the local, region, and federal level, to preserve a common and precise estimation of displacements across the country) [14].
- Requirements and stratagems to update IDP information (The situation has evolved markedly from 2015 plans and matching budgets for operations which were set in 2014. The entire affected populace of interest to UNHCR will number more than 3 million members by 2015. While the agency will stay occupied with all affected populations, its programs will mostly focus on protective measures for refugee groups. This Office will keep leading efforts to coordinate humanitarian relief for every refugee group as well as to update information) [15].
- Funding (The inability to meet requirements if funding also falls short. Assessments of possible interruptions are derived from the government's own operational evaluation

of the probable effects of a broad funding deficit. Different criteria underlie the estimates, such as contextual specifics, strategic focus, and the prior history of available resources in particular areas and activities) [12].

- Due to great trials, such as lack of employment and reliable income, the lack of data, and poor access to essential services as well as document services, IDPs are found in dismal circumstances. Those who have particular hardships can be assisted with unconditional cash allowances, enabling them to acquire food, rents, heating fuels, and other basic supplies [15].
- Nations attempting e-government implementations have labored to build the essential infrastructure to exploit new ICT tools. Even those developing nations willing to acquire these advantages do not all have the needed infrastructure to readily implement e-government services everywhere [91].

2.9 Summary

As a conclusion, this chapter is explained the main element lead to suggestion the mobile application as solution to proposed problem in Iraq, over the last years has it has been skyrocket increase in the number of IDPs in the whole world and this vino mine is been the main attention to all humanitarian organization plus the governments. To design a more effective mobile application to track IDPs it needs to take under consecration all the requirement needed in this model. It also has reviewed some related literature about mobile service in Iraq and the role of ICT and communication technologies with the highlight at some of the principles of design for existing Application, to help in the design of tracking system to improve the level of service provided to IDPs.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This part covers the methods of research employed, which involve the following stages: the recognition of the problem, suggestions, developments, evaluations, and conclusions. The methodology employed here is not just about gathering methods for use in a study. This investigation generally adopts design science methods (Vaishnavi & Kuechler Jr., 2007). The practice aims at constructing and evaluating systems which can meet organizational requirements, in that it is mainly concerned with the course of device development and the designs of the end product [109].

3.2 Research Procedures

Design starts with the recognition of problems, and current information is employed to offer suggestions for solutions, while the tests conducted on the device's execution are reliant on the solution sets proposed. This research stage is termed the development phase. Any and all functional attributes whether implicitly or explicitly suggested are utilized to assess the implementations in terms of whether these were partly or broadly effective. The course of the research initiative constantly iterates development, evaluations, and the resulting suggestion. The constraining arrow establishes how the reiterations range from cycles of partial completion to recognizing problems. The research-specific final design will ultimately be provided as part of the conclusions. Furthermore, the complete research schematic of this report is exhibited in Figure 3.1 as being dependent on design science methods and table 3.1 shows the justification for primary method utilized.

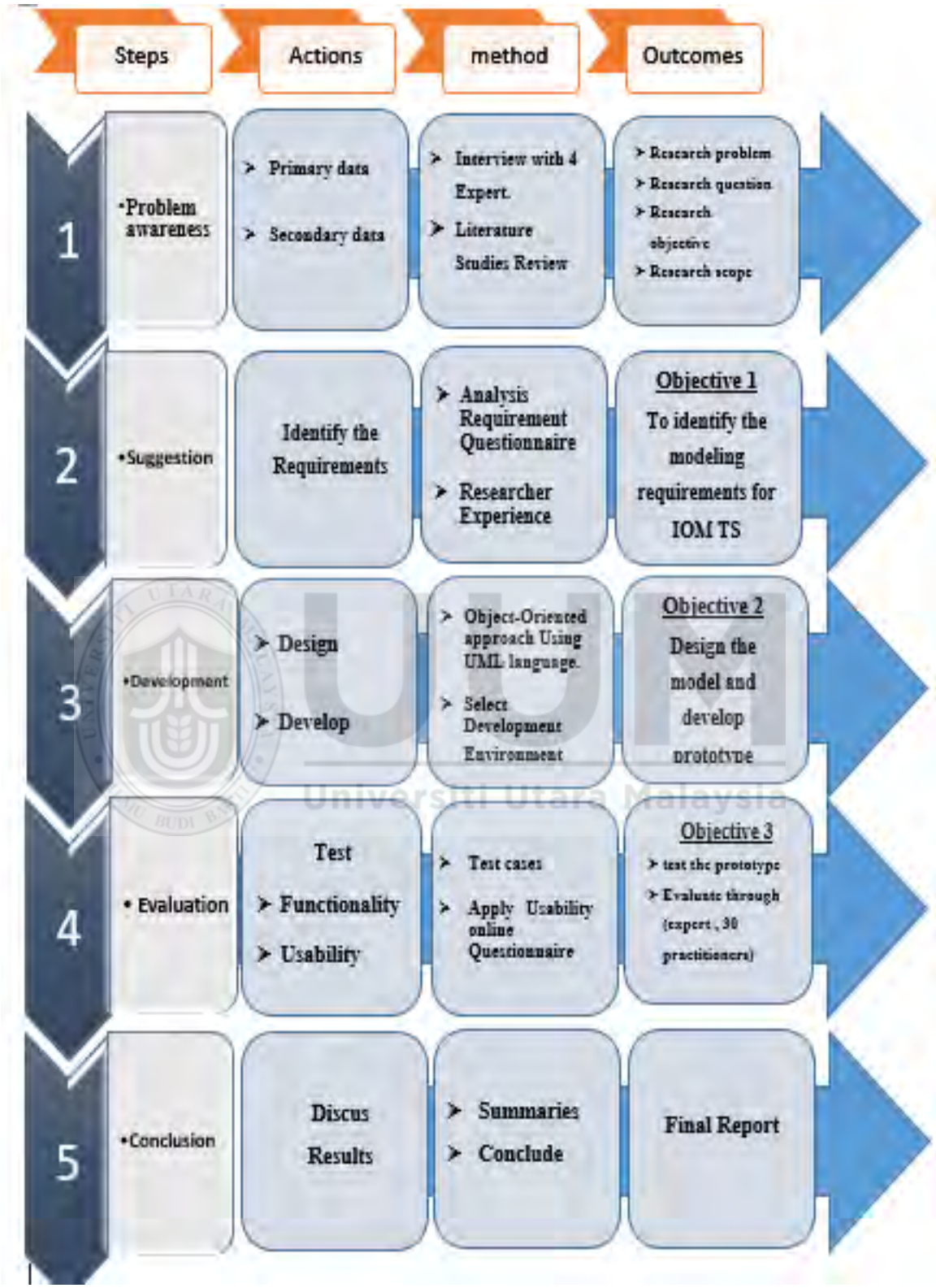

Figure 3.1. The Research Procedure

Two significant methods as outlined in Table 3.1 were employed to enhance procedures for researching proposed prototypes

3.2.1 Awareness of Problem

The main goal of the first stage in this research is to develop more understanding of the research scope and objective by gather more information about the main research issue, data is been collected by analyzing the literature review which represented by the Secondary data.

Primary data involves an online interview. According to Valacich, Joseph S. [110], open- or closed-ended questions can be used to gather information and requirements. Thus, to get more efficient data about the target system design, an interview involving 4 experts, 2 from IOM and 2 government officials, were conducted using Open-ended questions administered using modern technology communication. As shown Appendix B the questions were evaluated and approved by two evaluators, the first is expert in knowledge management, software development, software engineering and the second is an expert in Data mining & Machine Learning, Health Informatics, Climate Change. The online questionnaire with the IOM and government official's experts in IDPs was beneficial because it covers the research questions and objectives and problem statement and identifies the research scope along with covering the main requirements needed for the study. Based on the IOM and government information, the problem that needs the most priority be identified and the components needed for a model design is been recognized. Gathering information is at the core of systems analysis. Initially, the researchers need to gather information about the systems that are currently under design [110].

3.2.2 Suggestions

The implementation of the previous steps helps in term of making adequate suggestions. Moreover, some of the related works mentioned in chapter 2 are been considered in order to gain a thorough understanding of some of the helpful applications. Existing applications helped guide decisions about the research design principle to determine the appropriate design principle for the mobile tracking for IDPs and along with an analysis of existing application, the information extracted from the expert using modern technology was beneficial.

3.2.3 Development

In the development phase, the system was developed and implemented. First, the designing was carried out. This included the designing tasks to ensure that the functions were properly arranged under the category of artifacts, such as (the use case diagram, active diagram, class diagram, and logical diagram). In addition, the database design was outlined for refinement purposes. In order to design the model, the UML (Unified Modeling Language), which is a graphical language for visualizing, specifying, building and documenting the artifacts of software-intensive systems [46]. Was used in this study. Besides that, the design principles that make the app easy to use were also taken into consideration through the analysis of existing apps.

Based on the artifacts, it can be observed that development did take place. The prototype is capable of running on the desktop display, smartphone, and laptop. To work efficiently and be interactive with the user, the prototype in this study requires an environment that is outlined in Table 3.1.

Table 3.1

Prototype Development Environment

System requirement	Description
Program language	JSP and Android
Server	TOMCAT JAKARTA 8
Database	MySQL
Operating System	WINDOWS 7

The testing tool is TeamViewer which consider Quick Support allows the remote support of smartphones and tablets via TeamViewer software from any Windows or Mac computer. It is designed for IT support teams to quickly and easily diagnose and fix problems with these mobile devices while employees are offsite. Full remote control has been already available for mobile devices from Samsung, Sony, and others [111].

Once the prototype is finished, implementation starts before the beginning of the actual data collection. At this level, the study met its second objective, which is to develop and design a mobile tracking system IOM TS that can be used by users.

3.2.3.1 Validation Instrument (TeamViewer)

TeamViewer is a popular piece of software used for Internet-based remote access and support. TeamViewer software can connect to any PC or server for remote control your partner's PC as if you were sitting right in front of it [112]. Furthermore, it been confirmed that TeamViewer has a large impact on the data usage and transmission delay in accordance with the resolution and performance of the control target device as shown in Figure 3.2 [113].

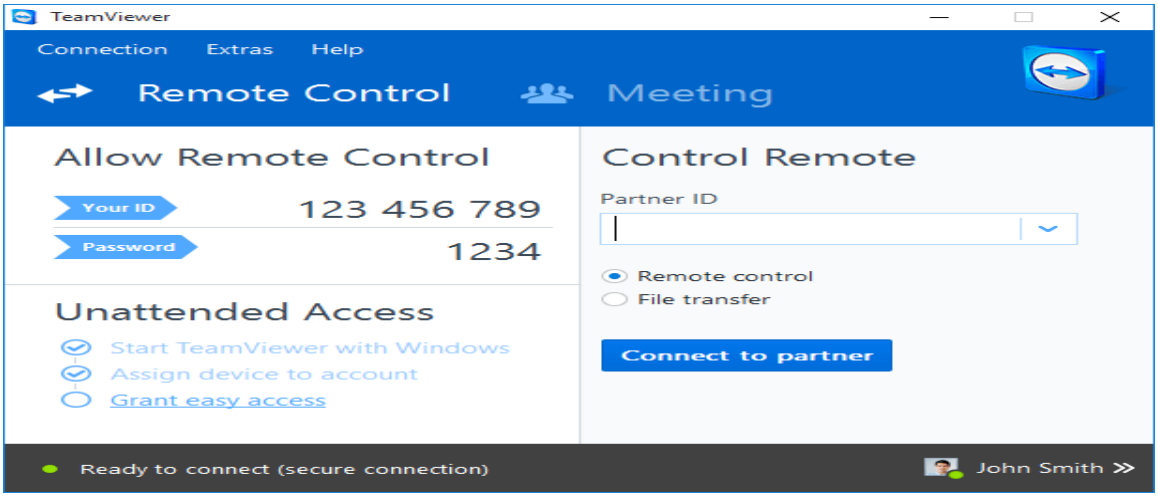

Figure 3.2. TeamViewer main interface

Choosing TeamViewer as validation instrument come for many reasons:

1. TeamViewer remote support, remote access, and online meeting software that the world relies on – 1 billion installations and 20+ million devices online at any time [114].
2. TeamViewer can be of the key requirements to provide an environment where one can acquire status data from devices and/or control the devices even in a resource-restricted environment [112].
3. TeamViewer provides remote control function and instant message (IM) service for the participants [113].
4. TeamViewer is one of the world's most popular providers of remote control and online meeting software [111].
5. TeamViewer also incorporates chat, audio and video communication between client and remote server [115].

3.2.4 Evaluation

Feature test is important because it helps identify the features that make the prototype effective and easy to use. Doing so will help increase the number of users. One of the most basic methods in evaluation is the test cases and usability study because it entails users to actually use and test the product [109].

3.2.4.1 Evaluation Method

The proposed system of this study evaluated using usability and functionality testing. 30 participants According to Sekaran, Uma [116] stated that 30 participants and above are sufficient for the distribution of a questionnaire to assess a particular study. Those participants are been chosen from three different government and non-government organizations were gathered for this purpose. Questionnaires distributed among the 30 users, the data collected from three government and non-government employees.

1. Ministry of Migration and Displacement.
2. National Operation Centre (government official).
3. An international organization of migration (IOM).

3.2.4.2 Evaluation of Mobile Tracking System (IOM TS)

The quality of mobile applications is an important part of the research in the development of mobile applications. The main purpose of the evaluation aspect is to meet the user requirements and needs. According to [117] the key elements in the development of mobile applications to meet user quality in term of design application user interfaces. Therefore, this study supported by using the self-administrative survey to evaluate the final product of the system and also highlighting the user needs.

3.2.4.3 Evaluating by the Functionality

Functional testing is a software testing process used within software development in which software is tested to ensure that it conforms to all requirements. Functional testing is a way of checking software to ensure that it has all the required functionality that's specified within its functional requirements [118]. Test cases are was performed by the developer, Appendix C has all the details of test cases and the form was adopted from Färnlycke, Isak [119].

3.2.4.4 Evaluating by the Usability Elements

Usability is defined as the attribute of a particular software fulfilling the need of the user so that it is intuitive, adaptable locally or globally, accessible even for the less abled, and provides a good user experience and easy to use [120]. Two main elements are been tested in usability which is easy to use and usefulness. As detailed in Appendix D The questions adopted from Sabah, Hayder [6] and A, Alghamdi Ahmad Ali [121] and Davis, Fred D [122] and Alzughoul, Mohammed Ahmed Hasan [123].The questions evaluated and approved by 3 evaluators.

3.2.4.5 Instrument of the Data Collection

The measurement instruments used for this study are the functionality and usability tests, the data is been gathered by an online survey such as google doc, is a free Web-based application in which documents and spreadsheets can be created, edited and stored online. Files can be accessed from any computer with an Internet connection and a full-featured Web browser using close-ended questionnaires it will provide the respondent with a defined set of answers. The response set can include categorical or scaled responses [124]. In short, the evaluation in this study included:

I. Functionality Test: As detailed in Appendix C there are six test cases adopted into the questionnaire to test all functions in IOM TS. The functionality test was carried out to ensure that the prototype functions as desired Färnlycke, Isak [119].

II. Usability test: As detailed in Appendix D, Usability is been measured according to two main elements (easy to use and usefulness) table 3.2.

Table 3.2

Instrument used to evaluate usability [125]

Usability	**questions**
Easy to Use	1. IOM TS is easy to use. 2. IOM TS is flexible use 3. IOM TS is simple to use. 4. IOM TS is user-friendly. 5. IOM TS requires the fewest steps possible to accomplish 6. I can use it without written instructions. 7. I learned to use it quickly 8. Easily remember how to use it. 9. I can use it successfully every time. 10. I always felt I knew what it was possible to do next 11. IOM TS feedback: It is helpful in the error message 12. My mistakes were easy to correct.
Usefulness	1. The IOM TS is useful. 2. When I use the IOM TS, I save my time. 3. It saves my effort when I use it the IOM TS. 4. The IOM TS gives me more control over the activities in my life. 5. Using the IOM TS app reach the user goal efficiently 6. The IOM TS makes the things I want to accomplish easier to get. 7. It does everything I would expect it to do.

3.2.4.6 Data Collection

The quantitative approach, in particular questionnaire, was been selected for attaining the objective of this study (evaluation part). Furthermore, 30 responders chosen from several organizations (government and non-government organizations) pertaining to the phenomenon under study.

More precise, the present study distributes the questionnaire to the practitioners. In addition, because this study focus on the critical issue (IDP), based on Sekaran, Uma [116], the judgment method will be more suitable for selected the right persons if only a limited number or category of people have the information that is sought As well as, because there are several restrictions such as financial and geographical issues, the online survey will be harnessed for gathering the raw data. [126].

3.2.4.7 Data Analysis

In this study, data collected from the users while they carried out the tasks referred to by the prototype and usability testing. After the participants had used the application analyzing the result will be conducted using questionnaire. All the questions in the questionnaire will be measured using the 5-Likert Scale. The format ranging will be from 1 to 5 (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree) [126]. And the raw data will be analysis by using statistical software such as SPSS v.23.

3.3 Summary

The methodology that this study will employ is outlined in detail in this chapter. There will be five stages, each of which will involve activities and output. It mirrors the objectives mentioned in Chapter 1, as well as the manner of gathering data through interviews and literature review. Furthermore, it states the use of the design science methods which

involves the design of novel or innovative artefacts and the analysis of the use and/or performance of such artifacts to improve and understand the behavior of aspects of Information Systems. In design science research, as opposed to explanatory science research, academic research objectives are of a more pragmatic nature. Research in these disciplines can be seen as a quest for understanding and improving

CHAPTER FOUR

MODEL DESIGN AND DEVELOPMENT

4.1 Introduction

This chapter has presented the steps of requirement gathering and design than the development of IOM TS system. Consequently, it has explained the details of functional and non-functional requirements of the system as well as the specification for all use cases. Moreover, it has listed the UML diagrams for both of system and application like use case diagram, activity diagram and class diagram sequentially. Finally, this chapter displays the user interfaces and its explanation for IOM TS.

4.2 Requirements Gathering for IOM TS

The definition of requirements for every system is the most important step to develop an efficient and effective system. The tracking system (IOM TS) requirements have been extracted from expert employees in IOM and Government officials who worked with IDPs. For requirements collection purpose, a survey has been designed and distributed to the employee to get their requirements to implement a complete system. Details explained in Appendix B.

The purpose of determining IOM TS requirements is to gather or capture *what* a system should do (not how). A requirement is "a statement of a system service or constraint or "a statement about an intended product that specifies *what* it should do or how it should perform [127]. The first step aims to understand as much as possible about the IOM and government users, their work, and the context of their work so that the system being built

will meet their goals. The second step aims to produce a set of requirements which are based on user needs and provide a foundation from which to continue with the design stage.

A service statement describes how a system should behave in response to an individual user or group of users (a community). A constraint statement expresses a restriction on the system's behavior (e.g. the system must run on a particular operating platform). Requirements are typically categorized with the researcher experience with IDPs as functional and non-functional. The service statements can constitute functional requirements and typically fall into requirements which describe the scope of the system, business functions, and required data structures. The constraint statements constitute non-functional requirements which can be divided into requirements addressing aspects such as usability. A further categorization of requirements is the following:

1. **Functional requirements** capture what a product/system should do. In particular, IOM TS is interested in tracking, documenting, verifying the IDP after registering them in the camp.
2. **Data requirements** capture attributes about the data involved during interaction with a system. IOM TS is interested in identifying requirements related to persistence, admin, IDP varication.
3. **Environmental requirement**s refer to the circumstances in which an interactive product/system will be expected to operate. The most important environmental requirement related to IOM TS is that it will be accessed via the Web and mobile application.

4. **User requirements** capture the requirements of the intended user group, the abilities, and skills of a user, the type of user, user preferences. The collection of attributes for a "typical user" is called a user profile.

Application's requirements down under two main categories, which are as follow:

i. Functional requirements.

ii. Non-Functional requirements.

4.2.1 Functional Requirements

The functional requirements are the functions or techniques used, for the application. They are given in Table 4.1 where:

- M: Mandatory.
- D: Desirable.
- O: Optional.

Table 4.1

Functional Requirement

REQUIREMENTS ID	REQUIREMENT DESCRIPTION	PRIORITY
IOM TS_1	**LOGIN**	
IOM TS_1_1	The users can login into the system using their username and password.	M
IOM TS_1_2	The system connects to database and verify the validation of (username and password).	M

IOM TS_1_3	The system redirects a user to his/her interface if the username and password are valid.	M
IOM TS_1_4	An error message will be displayed if the user entered invalid username and password.	M
IOM TS_2	**IDPs REGISTRATION**	
IOM TS_2_1	The IOM admin can create an IDP record by saving the information of paterfamilias such as (name, phone number, id) in the system database.	M
IOM TS_2_2	The system sends a download link of tracking application by SMS for paterfamilias.	M
IOM TS_2_3	The IDP complete the registration process by following the instructions.	M
IOM TS_2_4	The application provides an interface for paterfamilias (IDP) to fill the information record like (full name, family number, identification number, old address, the reason for displaced, current address, supplement details, documents copies).	M
IOM TS_2_5	The application display number of records for every member according to the family number.	M
IOM TS_2_6	The paterfamilias (IDP) fill the previous information of family members.	M
IOM TS_2_7	The application provides scanning tool to make copies of IDP's documents.	M
IOM TS_2_8	The application saves all the information and documents related to IDP in the system database.	M
IOM TS_2_9	The admin can verify the information and documents of IDPs	O
IOM TS_3	**IDPs MANAGEMENT**	
IOM TS_3_1	The system can edit the information of IDPs' record.	M

IOM TS_3_2	The system can delete the record of IDPs.	M
IOM TS_3_3	The admins can print the records and information of IDPs.	M
IOM TS_3_4	The IOM admin can transfer the record of IDP.	M
IOM TS_3_5	The admins can view the records of IDPs	
IOM TS_4	**IDPs TRACKING**	
IOM TS_4_1	The system determines the area range for every camp.	M
IOM TS_4_2	The system sends SMS for IDPs to inform them in the case of passing the boundaries of the camp area or if he back home.	M
IOM TS_4_3	The IDP can update his information according to a new address or back to the range area.	M
IOM TS_4_4	The system informs the IDPs about any supplement and money via SMS.	M
IOM TS_4_5	The system chooses the nearest point for IDPs camps for distributed the supplement.	M
IOM TS_4_6	The system sends SMS to inform IDPs about details of supplement such as (aid type, amount, distributed date, distributed point)	M
IOM TS_4_7	The system provides a Google Map to show the address for IDPs.	M
IOM TS_4_8	The system provides a printing tool for a list of records.	M
IOM TS_4_9	The system provides statistical reports of families.	M
IOM TS_4_10	The system sort the IDPs depend on the date of joining camp or supplement receive.	M
IOM TS_5	**MANAGE AUTHORIZED AGENCIES**	
IOM TS_5_1	The system can add a new authorized user of some agencies to the system database.	M

IOM TS_5_2	The system can edit the information of Authorized admin record of the agency.	M
IOM TS_5_3	The system can delete the record of Authorized admin.	M
IOM TS_5_4	The system can print the records and information of Authorized admin.	M
IOM TS_5_5	The system can search the record of Authorized admin.	M
IOM TS_6	**MANAGE SUPPLEMENT AND FUNDS**	
IOM TS_6_1	The system can add a new supplement details and fund for the system.	M
IOM TS_6_2	The system informs the IDPs about the new supplement and fund details.	M
IOM TS_6_3	The system can edit the information of supplement details and fund.	M
IOM TS_6_4	The system can delete the record of supplement and fund details.	M
IOM TS_6_5	The system can print the records and information of supplement and fund details.	M
IOM TS_6_6	The system can search for a specific supplement and fund details record.	M

4.2.2 Non-Functional Requirements

The non-functional requirement is some specific criteria that describe a methodical and pragmatic approach to system development and measure the quality attributes, such as security, usability, reliability, and performance. The non-functional requirements of IOM TS are listed in Table 4.2.

Table 4.2

Non-Functional Requirement

REQUIREMENT ID	REQUIREMENT DESCRIPTION	PRIORITY
IOM TS _7	**USABILITY ISSUES**	
IOM TS _7_1	The system must be easy to use and design the best user interface.	M
IOM TS _7_2	The system should be useful in the work	M

4.3 Requirements Elicitation and Data Collection

Deciding on which data collection techniques to use is often difficult and depends on a number of factors, whether the information required is qualitative or quantitative, this research uses questionnaires are a series of specific questions designed to elicit specific information from users. They produce quantitative data and are good for reaching large numbers of people with relatively low resources. However, questionnaires must be designed carefully to ensure that questions are correctly interpreted by respondents.

To achieve this goal, the survey has 17 different types of question as an open-ended question, multiple-choice question, and ratio scale question. System requirement questionnaire was evaluated by two experts, the first one is an expert in Data mining & Machine Learning, Health Informatics, Climate Change and the second in knowledge management, software development, software engineering. The Questionnaires was distributed to 4 experts from IOM and government officials Appendix B has survey copy with all question and the expert approval.

4.4 Internally Displaced Person Management Model

This task aims to understand the flow of system function, the tasks that they perform and the environment in which they perform these tasks. The whole point of any new product or service is to help people to do things better. These "things" can include activities such as carrying out work tasks, informing IDP using SMS, monitoring position, Figure 4.1 show the process of registering IDP and sending the mobile link using SMS all the way to monitoring position and distributing funds.

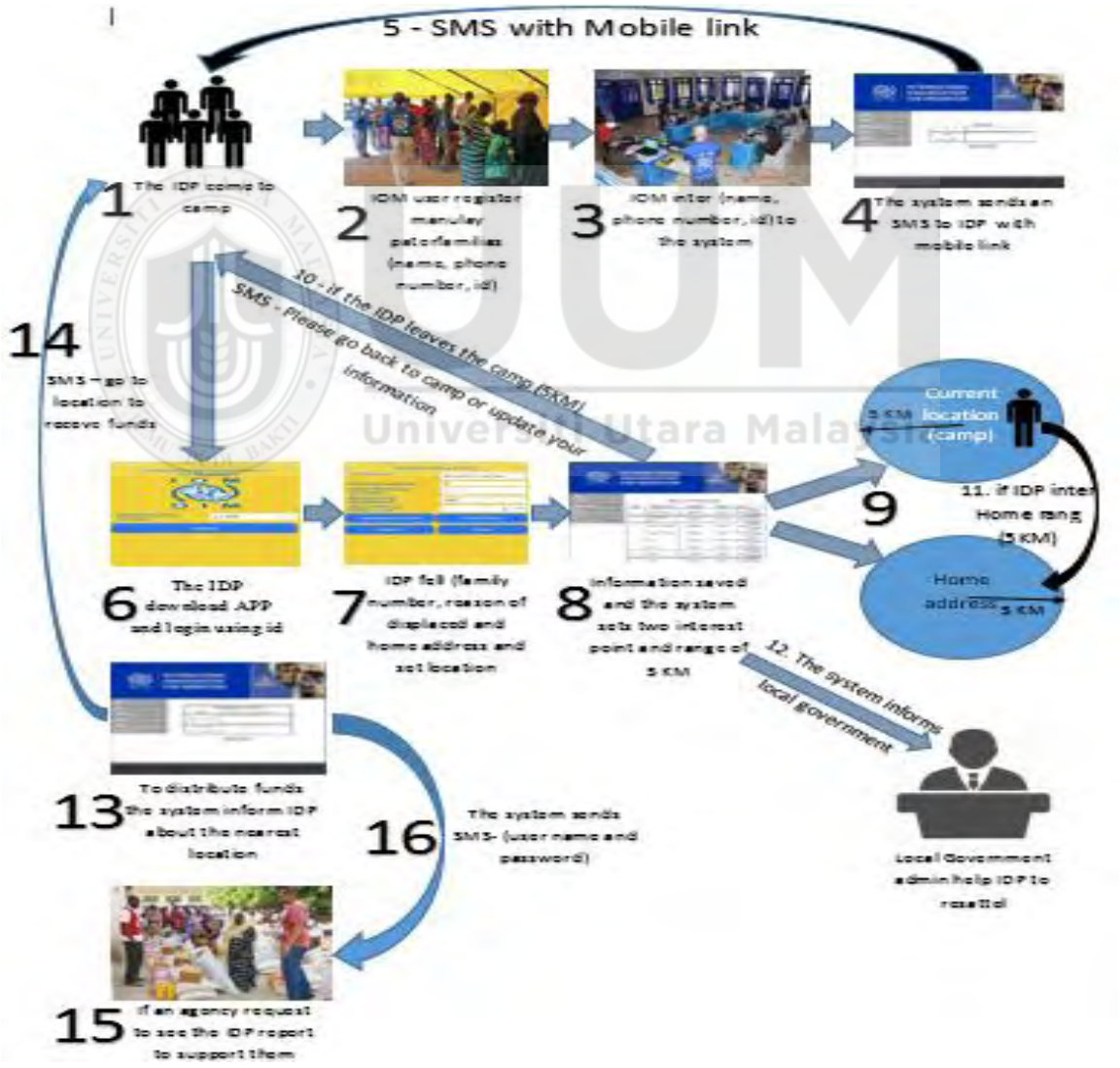

Figure 4.1. IOM TS management process

The system process of managing the displacement come as the main goal and the figure 4.1 this process well be explained in details as shown in Table 4.3 as follows:

Table 4.3

IOM TS management process

Step no	Description	Action
1	Displacing happened	When conflict or natural phenomena happen the displaced families come in large waves
Manual		
2	Gathering basic information	The IOM teams take (name, phone number, ID) for only the paterfamilias regardless of the family number
System		
3	Information interring	IOM teams enter (name, phone number, ID) into IOM TS SYSTEM
4	Information save	System save the record
5	First level of verifying the IDP	System send SMS to phone number (plz download the application using the link bellow and complete registration and upload your document)
6	IDP registrations	IDP download the mobile application
7	the second level of verifying the IDP and documenting	Login using his personal (ID) and fell the information (family number, reason of displaced, home address, upload personal document) Note (the application will offer number of records to befell according to family number)
8	The third level of verifying the IDP and documenting	information and the document save in the system and the IOM admin approved the information and document
9	tracking	Based on the information the system will save GPS (Latitude,Longitude) of two location (current location (camp) and home location based on address and set up range of 5 KM
10	tracking	1. If the IDP leaves the camp for whatever the reason and cross the 5 KM range. 2. The system sends SMS (plz go back to camp or update your information.
11	tracking	If the IDP leave the camp and enter the 5 KM range of home address (means he is back home)
12	tracking	The system send SMS to local government (this family go back home plz check their records in the system)
13	Funds distribution	1. If IOM admin want to distribute funds and supplements 2. the system check the current location

		3. the system check the nearest location of distribution
14	Funds distribution	1. The system sends SMS to IDP (plz go to this (location) at this (date) to receive your funds). 2. The system save the funds amount into IDP records.
15	Add agency	1. If an agency request to assist the IDP 2. The IOM admin add (username and password) for the user who represents the agency
16	Add agency	The system send SMS (username and password) to the agency to check only (search and report) of the IDP records

The process of IOM TS explain the steps in which displaced person flee from their area and register them in system along with the person in order to distribute the funds and supplements, on the other hand, figure 4.1 gave details about all the stockholders who represented by IOM admin and local government admin and authorized user admin process of connecting and use the system.

4.5 Requirements Analysis for IOM TS

Once IOM TS set of requirements has been drafted, these must then be analyzed to remove overlap or conflict. Requirements must also be grouped and organized appropriately to facilitate appropriate change control in following iterative cycles of system development Requirements are typically expressed as natural language statements. Task analysis is mainly used to investigate an existing situation and to envision new systems or devices. The aim of the technique is to understand what people are doing and why. The most widely used version is hierarchical task analysis. This identifies the activities performed within a task but not the sequence in which activities are performed. This is captured using methods such as a procedural analysis or a use case.

4.5.1 Design

In this phase the design principles of the IOM TS is accrued using The Unified Modeling Language (UML) which become the universally accepted language for software design blueprints. UML provides developers different models to characterize software in each development phases respectively, for developers to describe the different stages. Though each development phase has its different description focus of model to be characterized [48].

4.5.1.1 Use Case Diagram

The use case diagram is a graphic depiction which describes the interactions that take place between actors and IT systems during the execution of business processes. A use case is a methodology used in system analysis to identify, clarify, and organize system requirements. The aim of use case is to understand the processes in what the application do and its functionalities, as well as actors is who involved in that task. In this study, there are four types of actors which are as following.

1. **IOM Admin:** the main admin in the system which deals with the IDPs information and manages their issues.
2. **Local Admin:** they represent the local government in the home address. This type of admin can manage the returning process of IDPs for home, as well as, the funding process.
3. **Authorized User:** they represent the people from other agencies which is interested in participating in management of IDPs families.

4. **IDPs Person:** they are the displacement people and they represent the main actors in this application.

The complete interaction between the system's functions and the actors are explained in Figure 4.2 and figure 4.3 are the following:

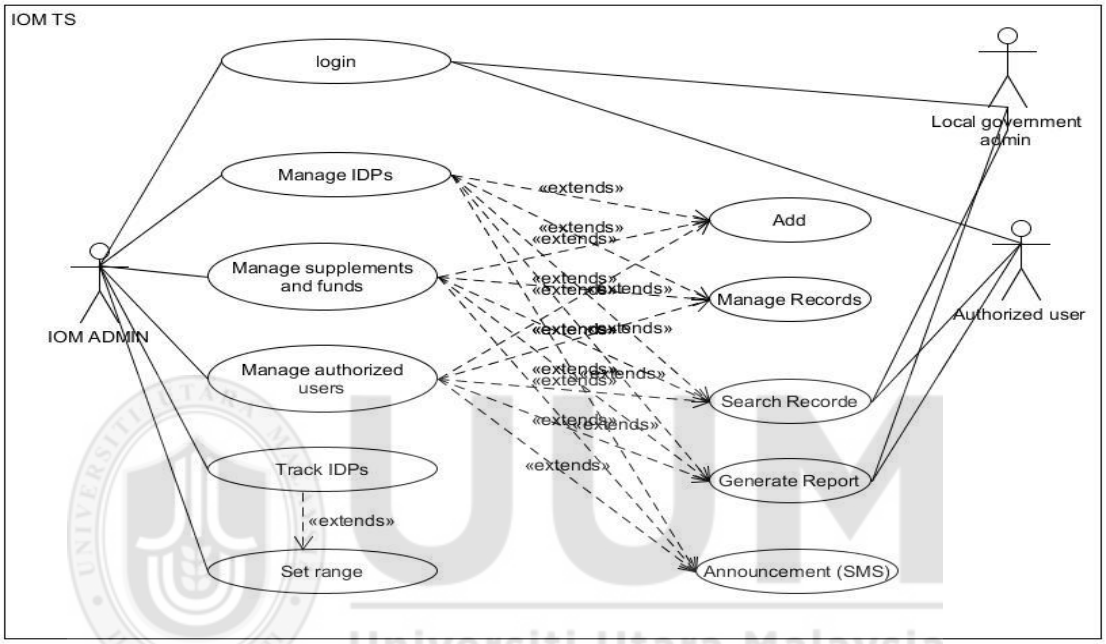

Figure 4.2. IOM TS Use case Diagram

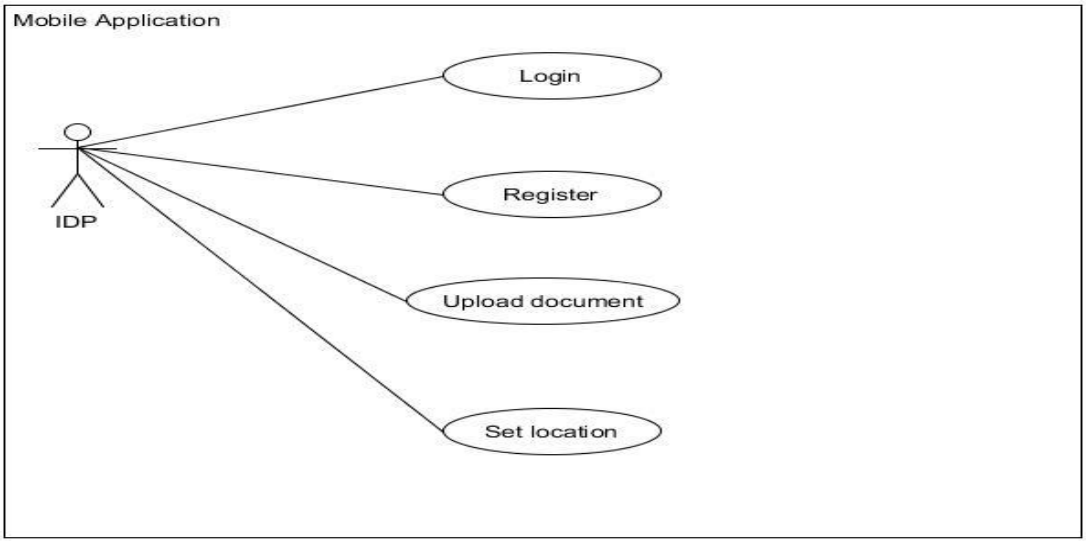

Figure 4.3. IOM TS Mobile Application Use case Diagram

4.5.1.2 Activity Diagram

An activity diagram is utilized for modeling a huge activity's sequential workflow by focusing on action sequences and respective action initiating conditions. It is shown the processes flow (flowcharts), and is used to summarize the activities of the system. The activity diagram of our system has been presented in figure 4.4 below.

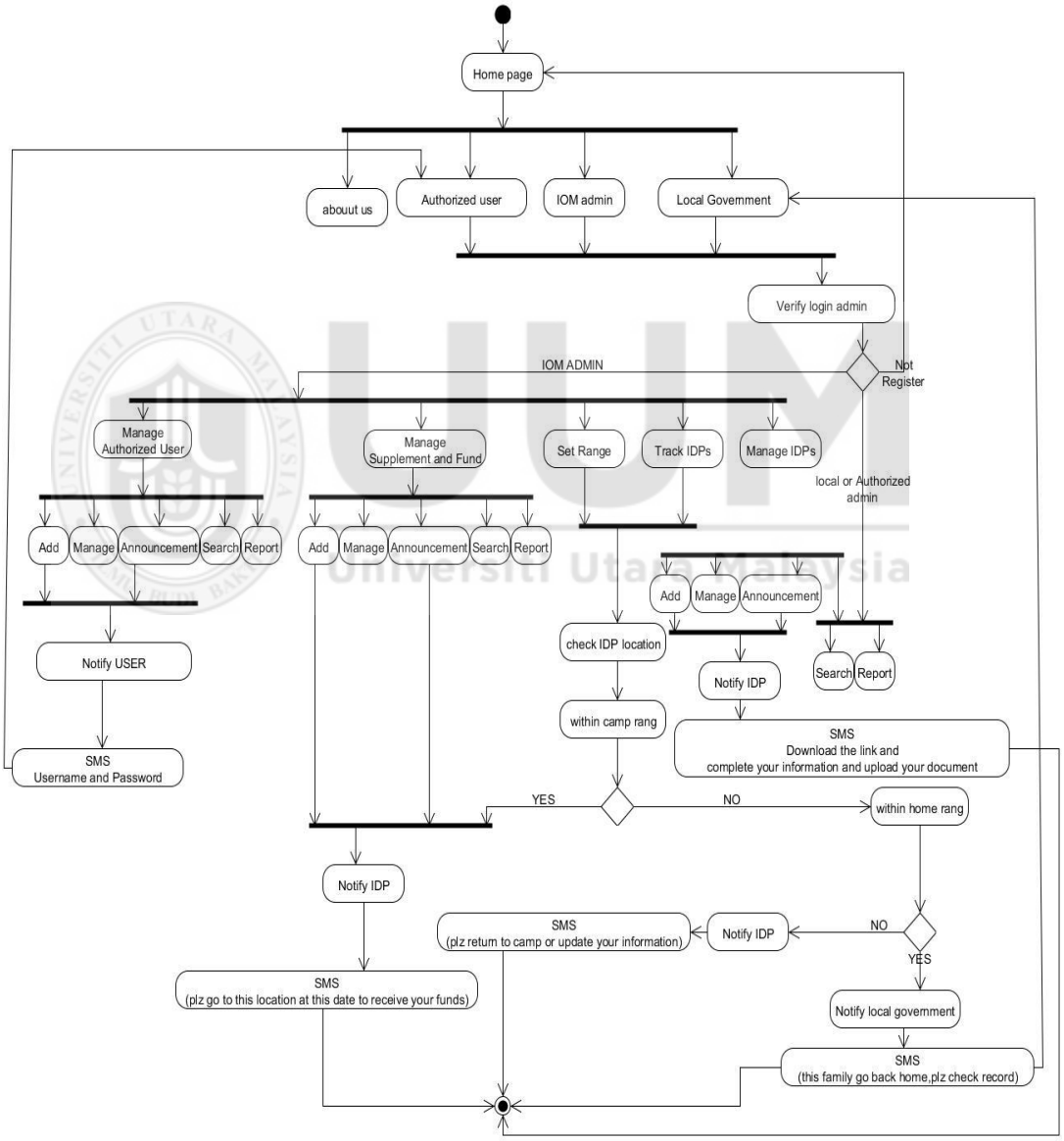

Figure 4.4. IOM TS Activity Diagram

4.5.1.3 Class Diagram

The class diagram refers to a static model which offers the summary of the application by describing the different classes, operations, application attributes and the relation between all the objects. This model has many uses like the modeling of the data structure and the detailed designs of the application. In Figure 4.5 below, we have described the different application classes and their interrelationships

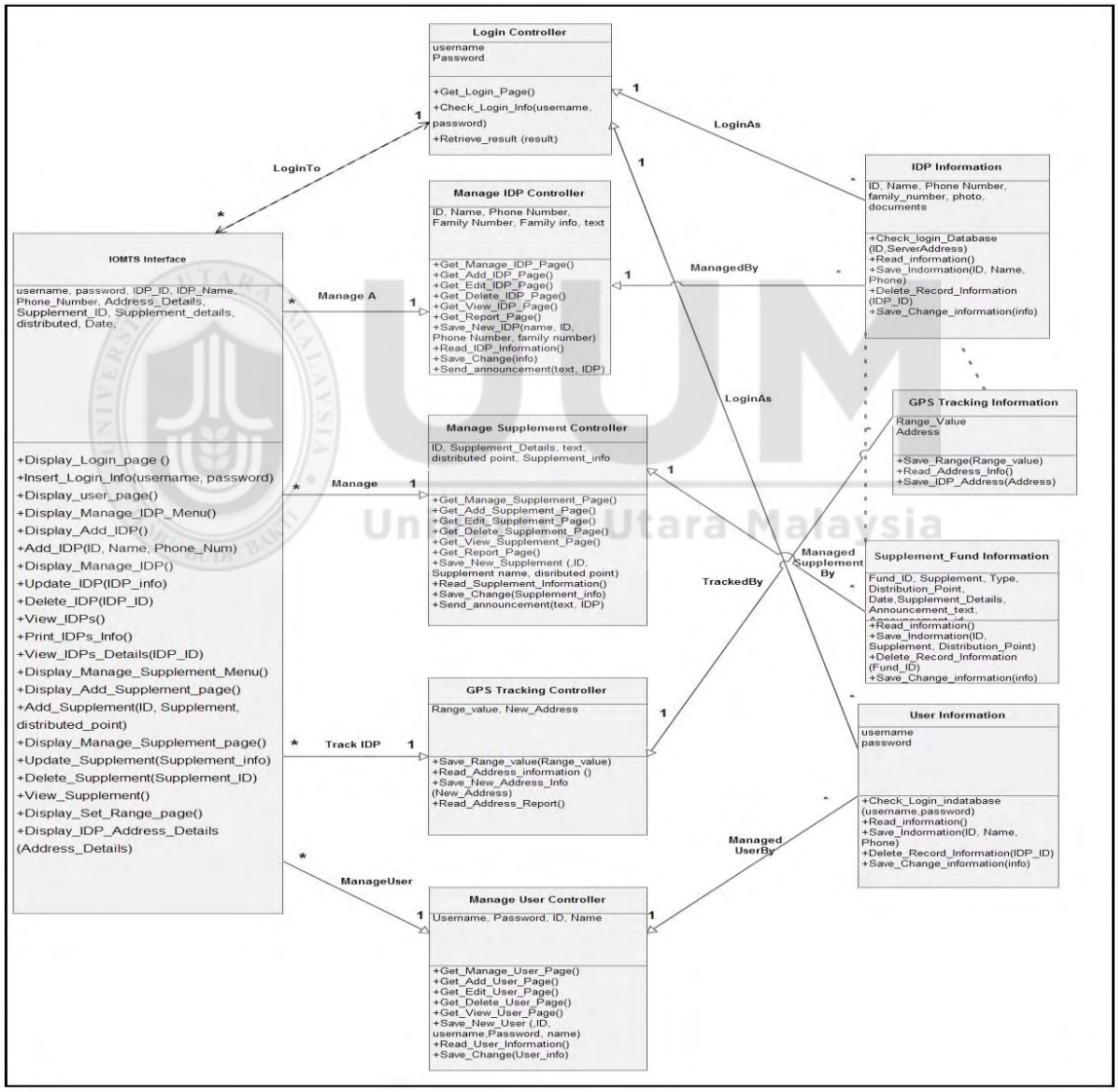

Figure 4.5. Class Diagram

4.5.1.4 Logical design

The process of logical design involves arranging data into a series of logical relationships called entities and attributes. An entity represents a chunk of information. In relational databases, an entity often maps to a table. An attribute is a component of an entity and helps define the uniqueness of the entity. Therefore after gathering the requirement from the expert in IOM and government officials then categorize and define this requirement according to the expert needs, analyzing these requirement is important to better understand the actor's role and the relationship between them, logical design is the next step as shown in Figure 4.6:

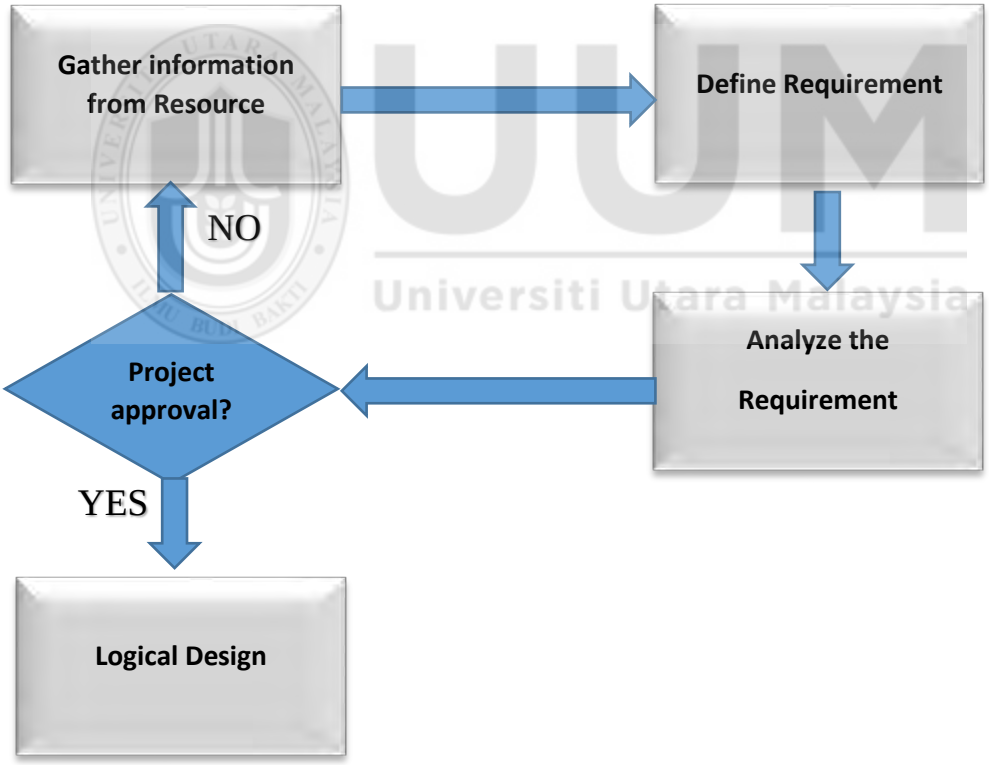

Figure 4.6. Guideline to Design Data Modeling

One output of the logical design is a set of entities and attributes corresponding to fact tables and dimension tables. Another output of mapping is operational data from the resercher source into subject-oriented information in study target data warehouse schema. You identify business subjects or fields of data, define relationships between business subjects, and name the attributes for each subject as shown in Figure 4.7.

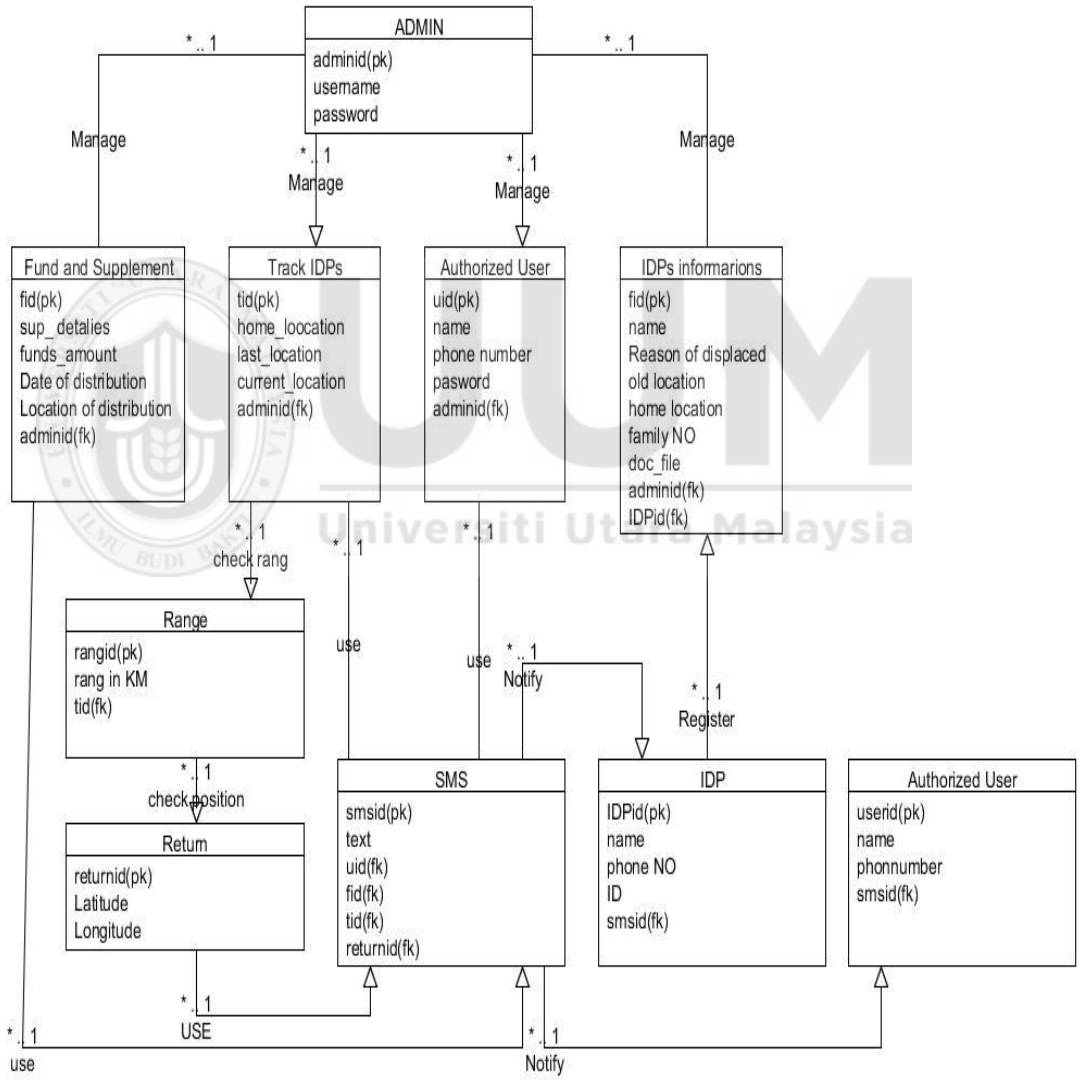

Figure 4.7 logical diagram for IOM TS

The elements that help you to determine the data warehouse schema are the model of our source data and your user requirements. Sometimes, Therese can get the source model from target organizations data model and reverse-engineer the logical data model for the data warehouse from this. The physical implementation of the logical data warehouse model may require some changes due to your system parameters-- the size of the machine, the number of users, storage capacity, type of network, and software.

4.6 Development

According to developing of tracking system and application in this study, Java Server Page (JSP) programming language has been used for the system. While Java Programming language has been employed under Android environment for mobile application in Android Studio tool. However, the prototype application has been implemented all the functional and non-functional requirements. The functions and interfaces of the system will discuss in details in the next section.

4.6.1 Home Page

The tracking system has been released with the English language. Homepage has the entrance links to different users' tasks as well as a description of system benefits and some statistical information about IOM details. On the other hand, the home page leads to the login page which offers login form and submits button. All above function has shown in the following figures.

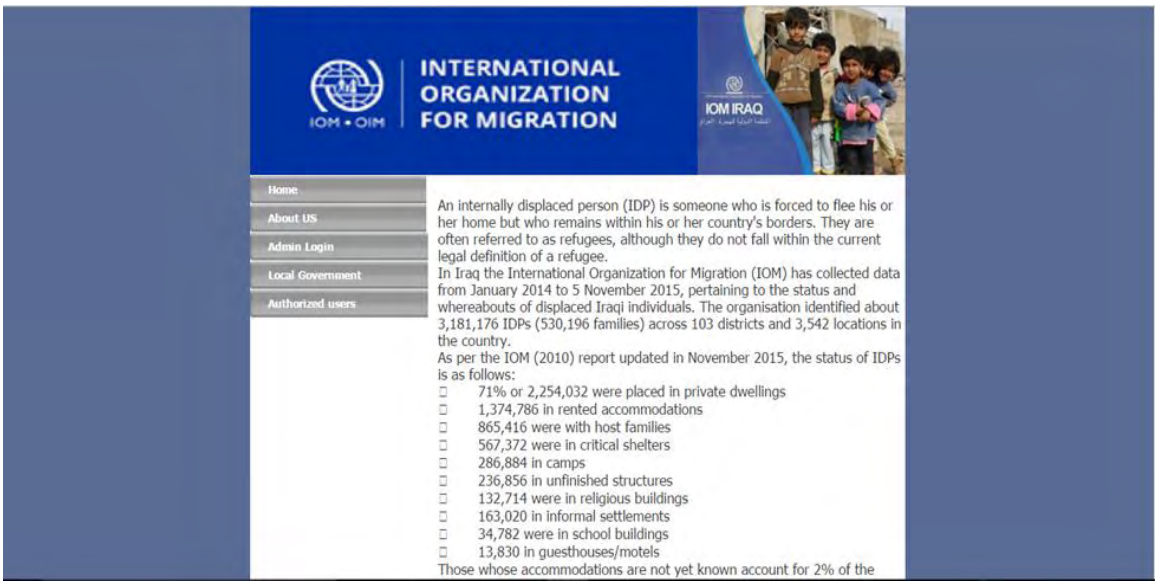

Figure 4.8. Home Page Interface

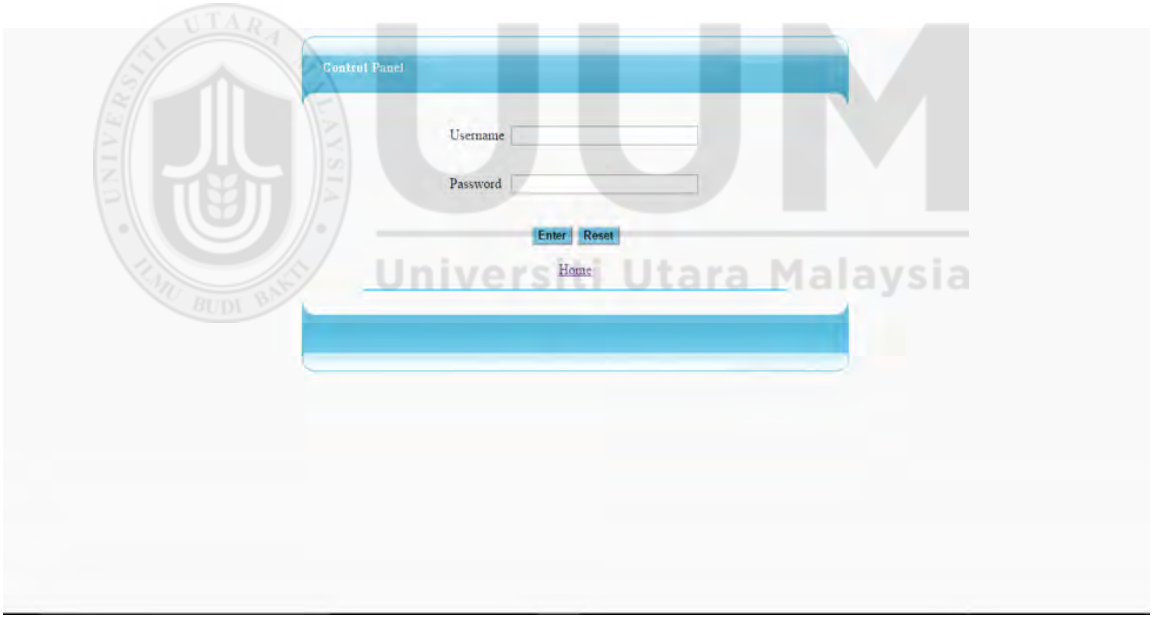

*Figure 4.9.*IOM TS Login Interface

4.6.2 Manage IDPs

After login of IOM admin successfully, the system redirects the user to his specific page of his tasks. IOM page has many links that deal with adding, editing, deleting, and view all

details of IDP records. The figures bellow shows all the interfaces Manage IDP function. The following figure shows the main page for IOM admin.

Figure 4.10. Manage IDPs Main Interface

On the other side, the following figure shows the main menu of managing IDP which has to add, editing, deleting, and viewing IDP. As well as displaying a reports about IDP details and search about specific IDP record. Moreover, the sending announcement for IDP users.

4.6.3 Track IDPs

The tracking IDP consists from main two parts which are setting boundaries of camp and GPS tracking for IDP and change the status of IDP if a return or not. As well as, the system informs the IDP by sending SMS message in case of the IDP is passing the range of boundaries. The IOM has the privilege of doing these tasks. The following figures have shown the setting range interface and GPS tracking for IDP.

Figure 4.11. Location Details of the IDP Interface

Figure 4.12. Location of each IDP Interface

4.6.4 Manage Fund and Supplement

This function does the fund and supplement aids for IDPs. It deals with the management of fund by adding, editing, view supplement details. Also, it offers reports about all fund

and supplement aids and announces the IDPs about details of supplement like distributing date and location. The following figures show the interfaces of managing fund function.

Figure 4.13. Manage Fund and Supplement main Interface

4.6.5 Manage Authorized User

Similar to manage IDP function, this function deals with adding, deleting, editing, search, and display reports about the users from other agencies who are authorized to access IDP information and reports as well as the reports about funds and supplement aid for IDPs. The figures bellow has shown the process of manage authorized users.

Figure 4.14. Manage Authorized User main Interface

Figure 4.15 add Authorized User main Interface

4.6.6 IOM TS Mobile Application

This application is designed for IDPs after receiving the SMS message of application with a downloadable link from the system. The IDP start the download and install the application, then following the instruction in order for complete the registration in the system. By entering the identification number of IDP the application will verify the user and display the application task. The application displays the registration form to IDP. After that, the IDP fill the required information and upload the required documents with the personal photo and press “Submit” to complete the registration process. Lastly, the application notifies the IDPs by receiving SMS messages about supplement details and change location. The figures bellow has shown the process of IDP registration.

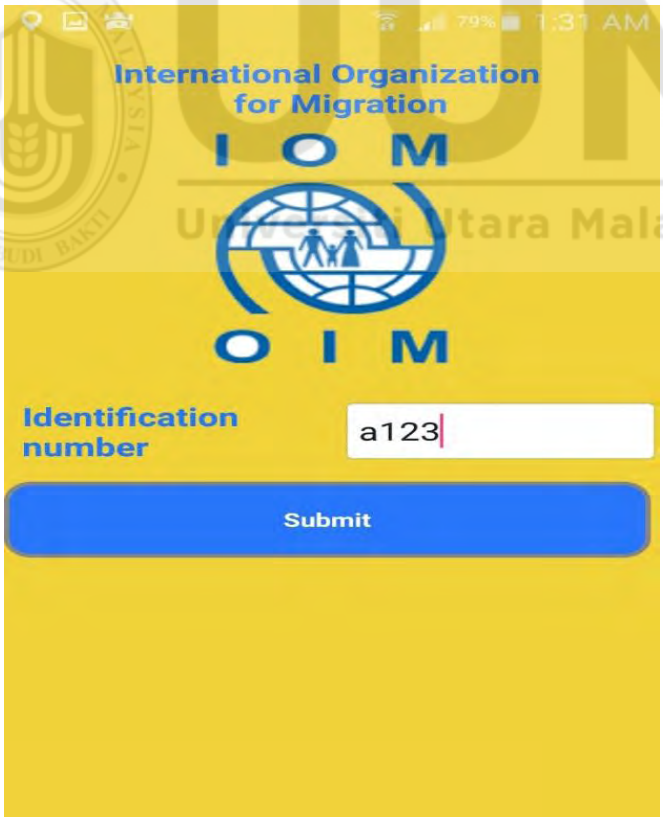

Figure 4.16. IOM TS mobile application login interface

Figure 4.17. IOM TS mobile application registration interface

4.7 Summary

In this chapter, we have focused on the requirements of the app IOM TS. It is seen that both of them are the set functional and non-functional requirements. This was then translated to the UML diagrams, which include case diagrams, activity diagrams, sequence diagrams, statechart diagrams, and the class diagrams consecutively. After designing the app, we developed a prototype to help the autistic children improve their communicating skills. Thus, the prototype was further explained using snapshots.

CHAPTER FIVE

MODEL EVALUATION

5.1 Introduction

The main objective of this chapter is to discuss the evaluation of the IOM TS, functionality, and usability testing was carried out (as outlined in Chapter 3) to determine the usability of the system [128]. Functionality is necessary, to ensure that the system works as intended before testing the usability, so that when users experience the system. The functional test uses the test case method that measures all functions in IOM TS [119], the procedures of testing were explained. Then, the results were discussed. To determine all the IOM TS functions, however for usability test was conducted using the TeamViewer which is a secure software package for remote control, desktop sharing, online meetings, web conferencing and file transfer between computers [115]. TeamViewer is a tool that makes it very easy to set up and use a Virtual Private Network connection that lets you take complete control of another computer from your own computer via the internet and used to share and control a display from PC to PC [112]. It enables two-way connections in which users can flip control back and forth. While TeamViewer is proprietary, it is free for non-commercial purposes [129].

5.2 Evaluation Procedure

The procedures for the usability test vary. The subsequent paragraphs explain these procedures in detail.

5.2.1 Functionality Test

The functionality test is a very important stage of the software development cycle. Each case ends with the process of evaluation and verification, a step that eliminates all the errors. The testing's primary goal is identifying and removing most of the system errors and forming a test suite that includes several test cases that were done during the maintenance phase. System errors are normally found in the system during different stages [130].

Therefore, in order to check for errors during these different phases, there should be testing at various levels. The developer of the IOM TS implemented the functionality test. Testing was done for every function of the prototype. Questions about the IOM TS functionality were posed to the users from IOM. Appendix C described the result of functionality test.

5.2.2 Usability Test

The usability test was carried out to ensure that users feel the IOM TS (through the requirements as extracted and explained in Chapter 4) is useful and that they feel it is easy to use. Hence, their perceptions on the usefulness and ease of use of the IOM TS were gathered. The study involved a sample of 30 users from 3 different government and non-government agencies. Furthermore for testing the system. Usability questionnaire was evaluated and approved by three experts, the first on is an expert in Software Testing and Evaluation, Mobile Application, Human & Mobile Interaction the second in Data mining & Machine Learning, Health Informatics, Climate Change and the third on in optimization algorithms, swarm intelligence, time series forecasting. Appendix C has the question plus the expert approval.

Furthermore, this research adopted TeamViewer which is a closed-source application designed for remote administration, remote support and conferencing. TeamViewer allows to see and control the remote desktop of another system installed with a corresponding server [115]. It can be difficult to achieve seamless control with this method due to transfer delay or bandwidth shortage [112].

5.3 Reliability For Easy to Use and Usefulness

According to table 5.1 explain, participants responded to 19 questions (Appendix D) the ease of use and usefulness of using IOM TS. However, Most of the participants using the IOM TS, which reported that they "agree or strongly agree" with that statement with the Mean score (M = 4.0333) and Standard Deviation (SD = .76489). While some participants felt uncomfortable using the IOM TS (M = 4.1000) and Standard Deviation (SD = .60743).

Table 5.1

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Usefulness Question 1	30	3.00	5.00	4.0333	.76489
Usefulness Question 2	30	3.00	5.00	4.1000	.75886
Usefulness Question 3	30	3.00	5.00	3.9667	.76489
Usefulness Question 4	30	3.00	5.00	4.2000	.71438
Usefulness Question 5	30	3.00	5.00	4.2333	.67891
Usefulness Question 6	30	3.00	5.00	4.1667	.64772
Usefulness Question 7	30	3.00	5.00	4.1000	.66176
Easy to Use Question 1	30	3.00	5.00	4.1000	.75886
Easy to Use Question 2	30	3.00	5.00	4.2000	.66436
Easy to Use Question 3	30	3.00	5.00	4.3667	.66868

Easy to Use Question 4	30	3.00	5.00	4.1000	.60743
Easy to Use Question 5	30	3.00	5.00	4.0667	.63968
Easy to Use Question 6	30	3.00	5.00	4.4667	.62881
Easy to Use Question 7	30	3.00	5.00	4.1000	.60743
Easy to Use Question 8	30	3.00	5.00	4.1667	.64772
Easy to Use Question 9	30	3.00	5.00	4.1000	.84486
Easy to Use Question 10	30	3.00	5.00	4.1333	.73030
Easy to Use Question 11	30	3.00	5.00	4.3667	.66868
Easy to Use Question 12	30	3.00	5.00	4.1000	.60743
Valid N (listwise)	30				

5.3.1 Cronbach's Alpha

Aspects using Cronbach's Alpha which developed by Lee Cronbach in 1951 to provide a measure of the internal consistency of a test or scale; it is expressed as a number between 0 and 1 [131]. Internal consistency describes the extent to which all the items in a test measure the same concept or construct and hence it is in SPSS for ease of use and usefulness in using IOM TS. Therefore presenting the reliability measurement was conducted using 19 questions and the obtained result was 0.807, Table 5.2 presents the total statistic of the ease of use and usefulness items.

Table 5.2

Reliability Statistics

Cronbach's Alpha	N of Items
0.811	19

5.4 Testing Result

This section describes the results gathered from the functionality test and usability test. Since they were carried out separately, the results are also discussed separately. First, the results of test cases and then the result of user usability test.

5.4.1 Results of Functionality Test

The functions in the IOM TS were tested one by one to ensure that the users are not distracted by any technical error that will influence their experience. The main test case is obtained information whether the IOM TS succeed or failed [118]. In Appendix C explain the result of test all IOM TS functionality.

It is found that the IOM TS easily and almost all users could login and use the interfaces according to admin privilege. Meanwhile, the study found that all additional function work perfectly. The result finds out that IOM admin able add and manage IDP as well as supplement and fund and the authorized users plus set range and track IDPs. The IOM TS is suitable to be implemented in real life in order evaluate the usability. It achieves objectives effectively.

5.4.2 Results of User Usability Test

This questionnaire for usability test divided into three sections (Section A, B, and C). Section A: is demographic information; Section B is the result of measuring the perceive of usefulness and section C result of measuring the perceive of easy to use of the IOM TS

5.4.2.1 Demographic Profile

1. Gender: The first section of the questionnaire focuses on general information about gender. Table 5.3 and Figure 5.1 shows the findings. It is seen that 21 participating

users were male, while only 9 were female. It represents the actual norm because of the security situation.

Table 5.3

Gender

Gender	Frequency
female	9
male	21
Grand Total	**30**

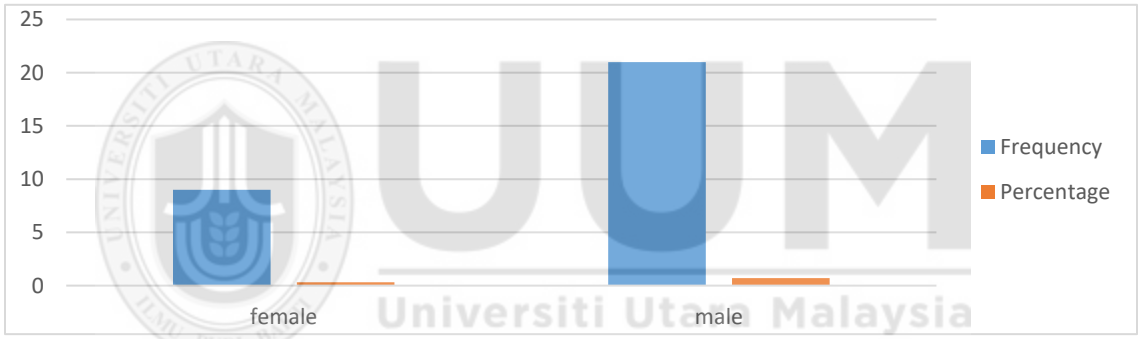

*Figure 5.1.*Gender Distribution

2. Age: Most of the participating 2 users aged between 18 and 22 years old and 21 between 23 and 35 years old and 6 between 36 and 45 years old In the remaining, 0nly one of them were above 45 years old. These details are illustrated in Table 5.4 and Figure 5.2.

Table 5.4

Age

Age	Frequency
18-22	2
23 -35	21
36- 45	6
46-55	1
Grand Total	**30**

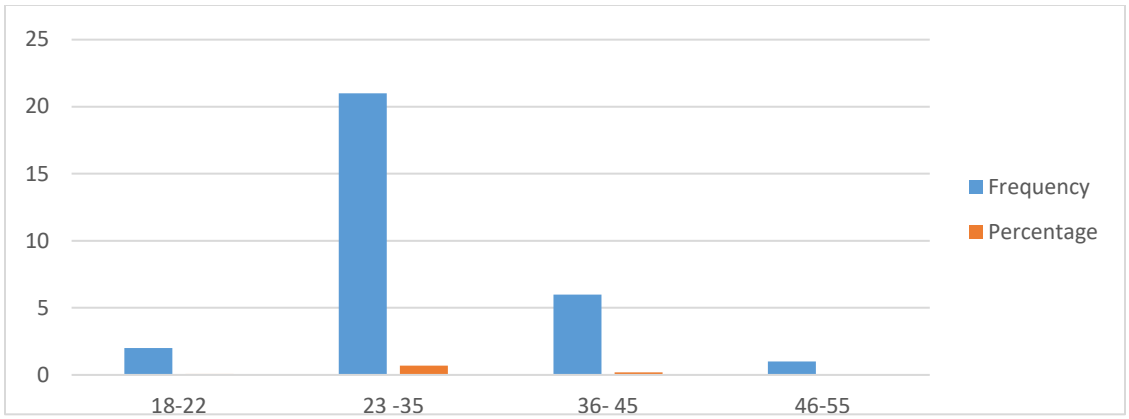

Figure 5.2: Chart for Age Distribution

3. Years of experience, the participating work with IDPs between 1 and 3 years and between 4 and 6 years are 14 for each while only two people work more than 7 years these details are illustrated in Table 5.5 and Figure 5.3.

Table 5.5

Years of experience

Years of Experience	Frequency
1 – 3 years	14
4 – 6 years	14
More than 7 years	2
Grand Total	**30**

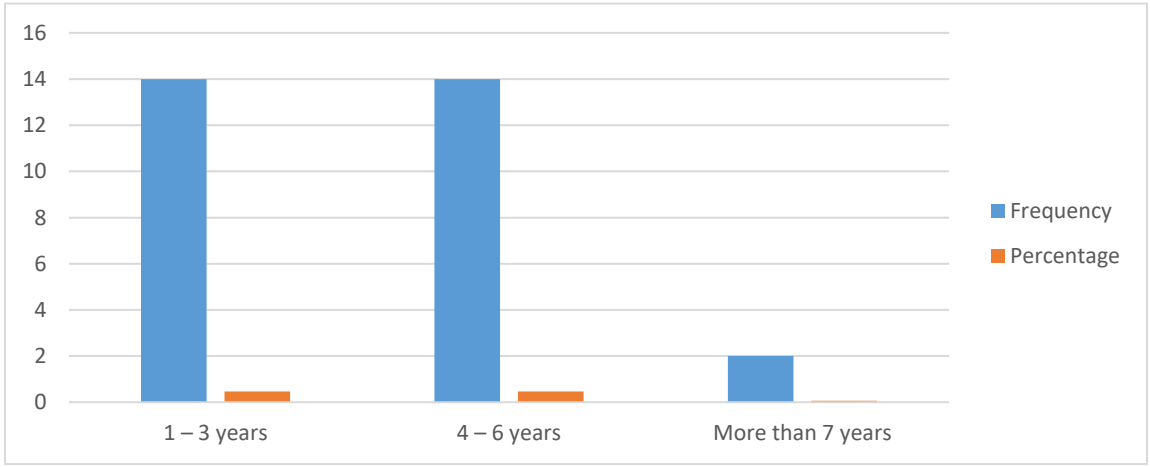

Figure 5.3. Years of experience

4. Designation, the participating work with IDPs have four designation according to the task given to him, as the table shows the most percentage is the coordinator who is responsible for set up connection and facilitate the IDPs and shipment movement from place to place , the Feld officer represent the ground teams who are responsible for getting the data and distribution of the shipment and the shipment escort is responsible for escorting the shipment from the import and export point to the camp and last is the data processor is tasked to processing the data extracted from the IDPs into the database. These details are illustrated in Table 5.6 and Figure 5.4.

Table 5.6

Designation

Designation	Frequency
Coordinator	12
Data interring	4
Field officer	11
shipment escort	3
Grand Total	**30**

Figure 5.4. Designation

5.4.2.2 Perceive Usefulness

The results of subjects‟ perceived usefulness of the IOM TS are discussed in this section. They are detailed by noting each question individually.

1. Usefulness Question 1

   The researcher asks whether the IOM TS is useful during the use, the results in Table 5.7, 13 of the subjects agree that it is. On top of that 9 strongly agree that it useful in their work. The remaining 8 are not sure.

Table 5.7

The IOM TS is useful

Scale	Frequency
Strongly Disagree	0
Disagree	0
Neutral	8
Agree	13
Strongly Agree	9
Grand Total	**30**

2. Usefulness Question 2

   The second question that if IOM TS save time when it been used, the results in Table 5.8, 13 of the subjects agree that it is. However, 10 strongly agree that it save time in work. The remaining 7 are not sure.

Table 5.8

*When I use the **IOM TS**, I save my time*

Scale	Frequency
Strongly Disagree	0
Disagree	0
Neutral	7
Agree	13
Strongly Agree	10
Grand Total	**30**

3. Usefulness Question 3

The third question that if IOM TS save effort when it been used, the results in Table 5.9, 13 of the subjects agree that it is. However, 8 strongly agree that it save effort in work. The remaining 9 are not sure.

Table 5.9

It saves my effort when I use it the IOM TS

Scale	Frequency
Strongly Disagree	0
Disagree	0
Neutral	9
Agree	13
Strongly Agree	8
Grand Total	**30**

4. Usefulness Question 4

The fourth question that if The IOM TS gives me more control over the activities in my work, the results was 14 of the subjects agrees that it is. However, 11 strongly agree that it gave control in work. The remaining 5 are not sure. As shown in Table 5.10.

Table 5.10

The IOM TS gives me more control over the activities in my work

Scale	Frequency
Strongly Disagree	0
Disagree	0
Neutral	5
Agree	14
Strongly Agree	11
Grand Total	**30**

5. Usefulness Question 5

The fifth question that using the IOM TS reach the user goal efficiently, the results was 15 of the subjects agree. However, 11 strongly agree that it gave control in work. The remaining 4 are not sure. As shown in Table 5.11.

Table 5.11

Using the IOM TS reach the user goal efficiently

Scale	Frequency
Strongly Disagree	0
Disagree	0
Neutral	4
Agree	15
Strongly Agree	11
Grand Total	**30**

6. Usefulness Question 6

The sixth question that if the IOM TS makes the things the user want to accomplish easier to get, the results was 17 of the subjects agree that it is. However, 9 strongly agree that it accomplish the goal designed for. The remaining 4 are not sure. As shown in Table 5.12.

Table 5.12

The IOM TS makes the things I want to accomplish easier to get

Scale	Frequency
Strongly Disagree	0
Disagree	0
Neutral	4
Agree	17
Strongly Agree	9
Grand Total	**30**

7. Usefulness Question 7

   The seventh question that if IOM ST does everything the user would expect it to do, the results shown in Table 5.13 explain that 17 of the subjects agree that it is. However, 8 strongly agree that it accomplish the goal designed for. The remaining 5 are not sure.

Table 5.13

It does everything I would expect it to do

Scale	Frequency
Strongly Disagree	0
Disagree	0
Neutral	5
Agree	17
Strongly Agree	8
Grand Total	**30**

5.4.2.3 Perceive Easy to Use

The results of subjects‟ perceived Easy to Use of the **IOM TS** are discussed in this section. They are detailed by noting each question individually

1. Easy to Use Question 1

   This question is clearly asks if IOM TS can be used easily. After analyzing the results, (Table 5.14), it was noted that around 13 people agreed while 10 strongly agreed) that IOM TS can be very easy in its usage. The remaining 7 were unsure.

Table 5.14

IOM TS is easy to use

Scale	Frequency
Strongly Disagree	0
Disagree	0
Neutral	7
Agree	13
Strongly Agree	10
Grand Total	**30**

2. Easy to Use Question 2

   IOM TS is very flexible in its usage making it very friendly. Therefore, this was asked in Question 2. The results shown in Table 5.15 indicate that 16 people found IOM TS very flexible (10 strongly agreed). However, 4 were unsure.

Table 5.15

IOM TS is flexible to use

Scale	Frequency
Strongly Disagree	0
Disagree	0
Neutral	4
Agree	16
Strongly Agree	10
Grand Total	**30**

3. Easy to Use Question 3

   Besides being flexible, the simplicity of the software is also one important parameter. The users are completely engaged when using IOM TS. Table 5.16 shows that a majority of the respondents agreed 13, and 14 strongly agreed that IOM TS was very simple. The remaining 3 people could not decide.

Table 5.16

IOM TS is simple to use

Scale	Frequency
Strongly Disagree	0
Disagree	0
Neutral	3
Agree	13
Strongly Agree	14
Grand Total	**30**

4. Easy to Use Question 4

   User-friendliness is a very important parameter that can attract users. Thus, it was asked in Question 4. After data analysis, the results have been shown in Table 5.17 that around 19 people agreed that IOM TS was user-friendly. Out of those, 7 strongly agreed. The rest of the 4 could not decide.

Table 5.17

IOM TS is user-friendly

Scale	Frequency
Strongly Disagree	0
Disagree	0
Neutral	4
Agree	19
Strongly Agree	7
Grand Total	**30**

5. Easy to Use Question 5

   Many of the IOM TS users are seen to vary between those who are very experienced in the use of computers and those who do not have a lot of experience. Hence, in Question 4, it is asked if the users need to decrease their steps for carrying out any task. The results have been shown in Table 5.18. Our results indicated that many people were

undecided 5, whereas the remaining 18 agreed. Out of these, 7 people strongly agreed that IOM TS decreases their tasks.

Table 5.18

IOM TS requires the fewest steps possible to accomplish

Scale	Frequency
Strongly Disagree	0
Disagree	0
Neutral	5
Agree	18
Strongly Agree	7
Grand Total	**30**

6. Easy to Use Question 6

Along with decreasing the number of steps, the written instructions have to be clear to the users so that they can use the software properly without any mistakes. However, it is seen that when the flow of the interaction with the IOM TS is clear, the users tend to skip all instructions. This displays a higher IOM TS usability. The developer asked if the users can use IOM TS software easily, without consulting the instructions. The results have been shown in Table 5.19, and they show that around 12 people while 16 strongly agreed that they skipped the instructions as the flow of the interaction was very clear for them. This decreased the amount of time they spent on IOM TS. The remaining 2 were undecided.

Table 5.19

I can use it without written instructions

Scale	Frequency
Strongly Disagree	0
Disagree	0
Neutral	2
Agree	12
Strongly Agree	16
Grand Total	**30**

7. Easy to Use Question 7

   It is seen that a usable IOM TS should be learned to use quickly. The developer has enquired about the learnability factor, thus determining if IOM TS was easy to learn. The results have been displayed in Table 5.20, and it is seen that 4 people could not decide, while the remaining agreed that IOM TS could be easily learned. Out of those, 19 agreed while 7 strongly agreed.

Table 5.20

I learned to use it quickly

Scale	Frequency
Strongly Disagree	0
Disagree	0
Neutral	4
Agree	19
Strongly Agree	7
Grand Total	**30**

8. Easy to Use Question 8

   The developer asked if the users remembered the steps for using IOM TS easily. After analyzing the data, the results were presented in Table 5.21, and it was seen that 4 of the people were unsure. However, out of the remaining 9 people strongly agreed while 17 agreed that they remembered the steps for using IOM TS.

Table 5.21

Easily remember how to use it

Scale	Frequency
Strongly Disagree	0
Disagree	0
Neutral	4
Agree	17
Strongly Agree	9
Grand Total	**30**

9. Easy to Use Question 9

When using the IOM TS, the users must succeed, every time they attempt using it. This reflects if they remembered the process to use it. The results were analyzed and tabulated in Table 5.22, and they showed that 9 were undecided. The remaining was satisfied with their IOM TS experience as they could successfully use it each time, 12 strongly agreed while 9 agreed that they successfully carried out their tasks when using IOM TS.

Table 5.22

I can use it successfully every time

Scale	Frequency
Strongly Disagree	0
Disagree	0
Neutral	9
Agree	9
Strongly Agree	12
Grand Total	**30**

10. Easy to Use Question 10

A simple and easy-to-use IOM TS should be clear enough so that the users realize the next step while carrying out certain tasks or what could be the subsequent step. Hence, Question 10 asked if the users knew what to do after the current step. The results were

tabulated in Table 5.23. It could be seen that 6 people were undecided, whereas 14 agreed and 10 strongly agreed that they were sure about the subsequent step.

Table 5.23

I always felt I knew what it was possible to do next

Scale	Frequency
Strongly Disagree	0
Disagree	0
Neutral	6
Agree	14
Strongly Agree	10
Grand Total	**30**

11. Easy to Use Question 11

To err is human; therefore, the IOM TS has to anticipate the human errors. Therefore, IOM TS must help people if they made errors. This question tends to determine if the error message were helpful. All the data was analyzed and the results were tabulated in Table 5.24, where it was seen that 13 people agreed and 14 strongly agreed that to the statement. However, 3 were undecided

Table 5.24

IOM TS feedback: It is helpful in the error message

Scale	Frequency
Strongly Disagree	0
Disagree	0
Neutral	3
Agree	13
Strongly Agree	14
Grand Total	**30**

12. Easy to Use Question 12

If the error messages were helpful, it must be easy to correct the errors made. This was asked in Question 12, the results of which are tabulated in Table 5.25. In general, people using the IOM TS felt that it was easy to recover from the errors made. 19 people agreed with this statement while 7 strongly agreed. However, the rest of the people 4 were undecided. The rate of people agreeing was comparatively low for this question, because at the time of the review, the participants had not faced any problems to determine if the IOM TS would help them from the errors or not.

Table 5.25

My mistakes were easy to correct

Scale	**Frequency**
Strongly Disagree	0
Disagree	0
Neutral	4
Agree	19
Strongly Agree	7
Grand Total	**30**

5.5 Results Discussion

From the result illustrated in table 5.1, the mean for each question was investigated It is seen that all questions have a high mean score, which is close to 4 or greater than 4. Besides, the standard deviations are small, less than 1. This explains that all statements regarding the IOM TS in the questionnaire are agreed by the subjects with very small bias or influence of other factors.

In Table 5.1, participants respond to 19 item (Appendix D) related to features test to measuring the perception on the increase of access. There was a mixed agreement found

among the respondents wherein 96.7% of the sample consented with the features helped them make the IOM TS more effective, easy to use and usefulness.

As illustrated in Table 5.1, participants responded to 19 items (Appendix C) related to functionality test. Most of the participants found all functions in the IOM TS work well as desired, in supporting users‟ tasks provided in the IOM TS.

Table 5.7 to 5.25 explain, participants responded to 19 items (Appendix D) the ease of use and usefulness of using IOM TS. However, the highest percentage of the ease of use and usefulness scores among the research participants was (combination of 'not sure or 'agree'). Most of the participants using the IOM TS, which reported that they "agree or strongly agree" with that statement with the Mean score (M=4.10) and Standard Deviation (SD=.662). While some participants felt uncomfortable using the IOM TS (M=3.73) and Standard Deviation (SD=.691).

An international organization of migration tracking system (IOM TS) models holds many promises in the field of tracking, documenting, verifying IDPs. However, existing models are limited with function as explained in chapter 2, which makes them of limited to tracking person only.

This research proposes a new IOM TS that addresses the weaknesses of current tracking system models. our proposed model consider fixable in term of use for tracking services, the Strongest advantage of web-based mobile application compared to other approaches is expected to be its ease of adaptation to the dynamic environment that characterizes several applications, particularly in saving data and easy of download. We illustrate the ability of the proposed approach in detecting person positions, and evolving user profiles from Web-

based application plus that all the requirements of IOM TS extracted from an expert who in direct contact with IDPs.

At the end the system is been designed according to requirement gathered from expert with displaced person and the requirement analyzed and translated into use cases and activity diagram and the logical database is been designed after the expert approval and then the design translated into coding and program who is been tested with 30 users worked in direct with displaced person, finally the design is been evaluated using quantitate approach. The system is considered fixable design and can be generalized to solve other problems like tsunami and other problems

5.6 Summary

This chapter analyzes the gathered data. Both aspects, functionality and user usability tests have been discussed in detail in terms of their procedure and results. While the procedures are clear, the results are reliable. Hence, this study in convinced that the results are highly representing feedbacks for the models obtained and discussed in Chapter 4 and translated into a prototype.

Based on the results in this chapter, the model is able to make the IOM TS perceived useful and easy to use by the subjects. Bot modules, for users and administrators respectively, have obtained high credits by the subjects.

CHAPTER SIX

CONCLUSION

6.1 Introduction

This chapter discusses the study and its achievement and. A prototype of International organization of migration tracking system has been developed called IOM TS. The system requirement modeling has been extracted from 4 experts represent government and non-government agencies, the model has been designed and developed as described in Chapter 4. Then comes the evaluation phase as described in Chapter 5. In the end, the results are discussed in Chapter 6.

6.2 Objectives Achievement

Having carried out the activities as outlined in Chapter 3 and explained in Chapters 4 and 5, this study has achieved all the stated objectives in Chapter 1. In conjunction, they are discussed in the following.

6.2.1 Objective 1

To identify the data modeling requirements for the web-based mobile Application of IDPs.

- The System requirement for International organization of migration tracking system (IOM TS) have been gathered successfully by set of questionnaire evaluated and approved by expert in Data mining & Machine Learning, Health Informatics, Climate Change and knowledge management, software development, software engineering, Questionnaires was distributed to 4 expert from IOM and government officials, then the result of the questions analyzed in order to determine the requirement needed for

the model, detail explained in in Chapter 4.(Questions and expert approvals is described in Appendix B).

6.2.2 Objective 2

To design the data model using UML approach based on requirements identified.

- Based on the System requirement gathered from 4 experts, the design of the International organization of migration tracking system IOM T**S** has been outlined. As an interactive system, it has been designed showing the classes and interaction through use cases, class diagrams, and interaction diagrams. The database design is also visualized, showing the relationships among the tables, Appendix A has the details of the expert approval.
- Having finalized the design, it was translated into a working prototype explained in detail in Chapter 4, so that users could get through the constructed model derived in Chapter 4. It is important because, without a working prototype, users will not be able to understand the model.

1. Functionality testing was important to make sure the system function work without Interruption or disruption and to satisfy the requirement needed by the stockholder (Appendix C).
2. Usability testing come after the functionality testing, 30 participants was chosen using judgment sampling from 3 different government and non-government agencies for this testing. **(**Appendix D).

6.2.3 Objective 3

To evaluate the model through prototype and experts along with phases of the study as follow:

6.2.3.1 Evaluation by Experts

Along with every phase of the research, the evaluation of the expert was necessary to make sure the system is building according to the right bath. The evaluation was as follows:

1. **Requirement Questionnaire (Appendix B)**

   A questionnaire is simply a 'tool' for collecting and recording information about IOM TS. It is mainly made up of a list of questions, but should also include clear instructions and space for answers or administrative details. System requirement questionnaire was evaluated and approved by an expert in Data mining & Machine Learning, Health Informatics, Climate Change and knowledge management, software development, software engineering, Questionnaires was distributed to 4 experts from IOM and government officials.

2. **System modeling (Appendix A)**

   Unified Modeling language (UML) is a standardized modeling language enabling developers to specify, visualize, construct and document artifacts of a software system. Thus according to system requirement UML been designed and evaluated and approved by 3 experts as detailed in Appendix A.

3. **Usability Questionnaire (Appendix D)**

   The aim of this questionnaire is to evaluate the user's satisfaction on the IOM TS in terms of perceived usefulness and perceived easy to use based on their interaction and using the system. Usability questionnaire was evaluated and approved by 3 experts as detailed in Appendix D**.**

6.2.3.2 Evaluation by practitioners

Usability testing is a way to see how easy to use something is by testing it with real users. 30 Users were asked using judgment sampling to complete tasks, to see where they encounter problems and experience confusion. Practitioners received an email with a survey to measure the usability after they use the system.

6.3 Contribution

Portable communication tools are turning out to be progressing in technology significantly and offer a greater number of options than just dialogue. One of those improvements is the Global Positioning System (GPS) tracking in mobile phones. GPS can be utilized to drive a vehicle through everyday traffic or find individuals and track human actions utilizing the auto GPS system [132].

This study will supply a measure of offerings in various perspectives.

6.3.1 Theoretical

- The IIOM TS consider the first model design specifically for IDPs and unlike other models, it combines multi functions not available in another system like documenting and verifying the users as well as link multiple stakeholders to one system.
- Designing and implementation of validated requirement model to track IDPs.

6.3.2 Practical contribution

- The system will help the IOM employee as well as government officials to improve E. service.
- The system considers the first model designed for displaced person and what make beneficial is the flexibility of the design in which can be generalized to attempt to

solve other problems that other counters suffer from like tsunami and armed conflict.

6.4 Limitations and Recommendations

The results obtained in this study are convincing. However, a few factors may have influenced the generalizability. Perhaps, the following are some of the factors, which may be possibly improved in future.

- Functions in the system were designed according to limited time and budget, however, some function needs to be upgraded like using the camera to take a picture of the document and then uploading. Scanning tool will provide a better quality of document uploaded.
- This study managed to gather 30 subjects in the evaluation, both for functionality and user usability tests. It was able to provide sufficient data. However, a bigger set of data may explain the findings in more detail. Hence, it is highly recommended that future studies consider users of various other countries, covering various services besides the immigration.
- For the purpose of this study, the prototype has been tested using limited environment for the real implementation, the web-based mobile application needs to be tested using online environment to provide a better result. For that purpose, more time and budget are required because more considerations including technical infrastructure should be planned and put in place.
- The data were collected quantitatively only. This study recommends that qualitative data would make the discussions more convincing. Hence, future studies should

consider observing users when they interact with the portal, and interview them. It is significant because they can provide deep elaboration on the findings.

6.5 Summary

Having discussed the achievement of the objectives, this study is confident that the contributions are significant. It gathers inputs from various sources in constructing the proposed model, which stands as a significant contribution to the body of knowledge. Other researchers may use the proposed model to further enhance in the future. Besides, it contributes to the society through the developed prototype.

While this study has achieved the stated objectives, some future considerations as addressed in the previous section should be taken into account in enhancing this initiative. This ensures that the IDPs get the real benefits.

If the efforts are really paid attention, coupled with sufficient investment, the level of service provided to IDPs will be improved because Iraq has been severing from different disasters.

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Appendix A

UNIVERSITI UTARA MALAYSIA

College of Arts and Science

School of Computing

Letter of UML approval

Thank you for your time and assistance

IOM TS for displaced families

Unified Modeling language (**UML**) is a standardized modeling language enabling developers to specify, visualize, construct and document artifacts of a software system. Thus according to system requirement UML been designed and evaluated and approved by 3 evaluators and expert as follows:

1. Text mining, Outlier detection, Graph based text representation.
2. Teleworking, ICT Policy and Social Impact, Rural ICT.
3. System analysis and design.

4.4.1.1 Use Cases Specification

This section shows each use case deeply such as description of cases, pre-condition, characteristics of use case, flow of events, post-condition, rules of use case, and constraint sequentially.

4.4.1.2 LOGIN (IOM TS_1)

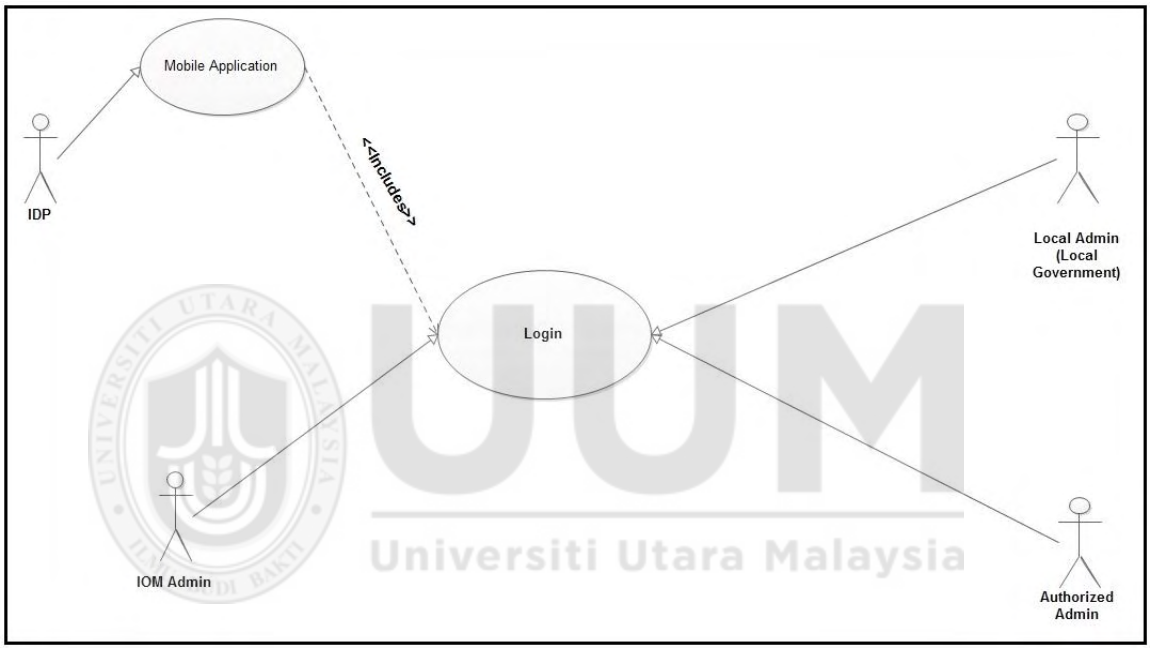

Figure 4.2. Login Use case Diagram

i. Brief Description

This use case is the main gate to use the functions of tracking application which guarantees that only premised users can enter to the tracking system according to authorization process. It provides interface to fill the login details (username and password). The system verify the login information to authorize the users and allow them for doing their specific tasks. There are four categories of involved users who are IOM admin, local admin, Authorized admin, and IDP person.

ii. Pre-condition

The users should have a valid login information (username and password) to use the system.

iii. Characteristic of Activation

The users fill the required login details with valid username and password and press on "Enter" button.

iv. Flow of Events

a) Basic Flow

1. The user press on login hyperlink from main menu in home page depend on its type.
2. The system display the login page for user.
3. The user fill the required username and password and press "Enter" button.
4. The system verify the validation of filled username and password and authorized them to their tasks.
5. The system display the specific page for the user depend on his/her type.

b) Exceptional Flow

Not Applicable.

c) Alternative Flow

1. The IDP press on login icon from home page of application.
2. The application display login page.

3. The IDP enter his/her ID and press “Enter” button.

4. The application verify the validation of ID and authorized them to their tasks.

5. The application display the main page.

v. Post-condition

The tracking application display the page of user’s tasks.

vi. Rules

Does not apply.

vii. Constraints

Does not apply.

4.4.1.3 MANAGE IDPs (IOM TS_2)

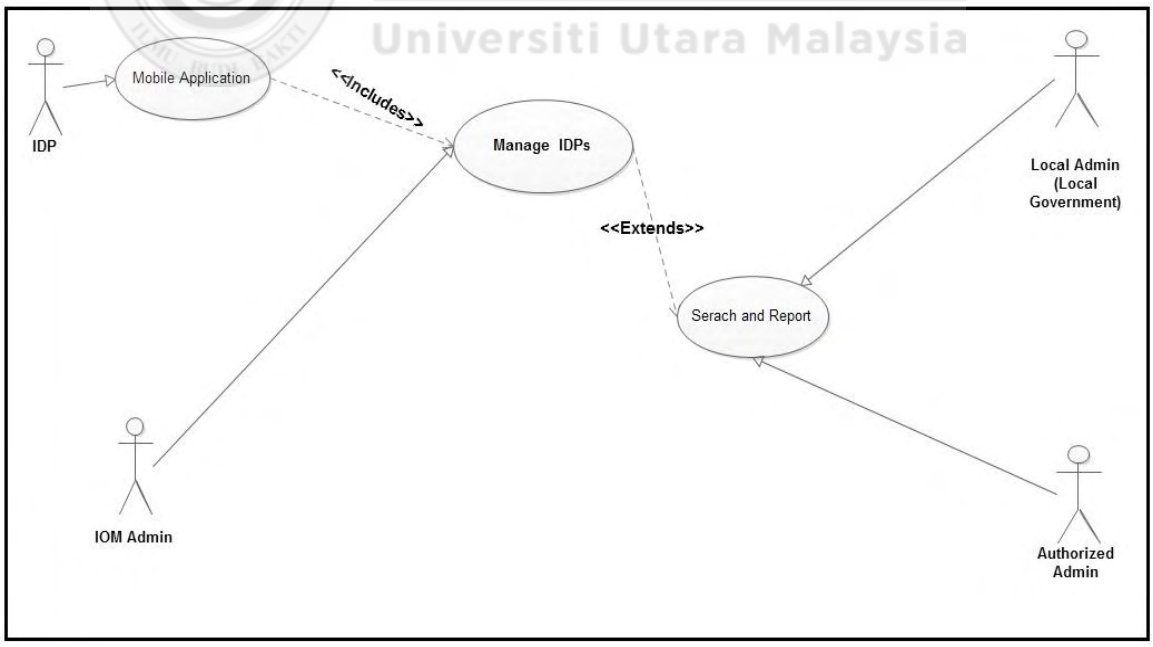

Figure 4.3: Manage IDPs Use case Diagram

i. Brief Description

This function has used to manage the records of IDPs families in the system and save their information and details in the database. It deals with adding, deleting, editing, show report, and search in the system. However, all actors are involved in the manage IDPs process who are IOM admin, Authorized user, local admin and IDPs person.

ii. Pre-condition

The actors login to system with valid information. Moreover, the IDPs download the application.

iii. Characteristic of Activation

The admin login to the system and the IDPs download the application.

iv. Flow of Events

a) Basic Flow

1. The IOM admin press on “Manage IDP” hyperlink from main menu.
2. The system display the sub menu of Manage ID.
3. The IOM admin press “Add IDP” hyperlink to display adding form.
4. The system display the Add IDP page to add new IDP record.
5. The IOM fill the required information of IDP (ID, Name, and Phone Number).
6. The IOM press “Submit” button to save the new record.
7. The application save the information of paterfamilias in the database.

8. The IOM press “Announcement” hyperlink to send application link.
9. The IOM press “Submit” button to send application link to IDP.
10. The application send SMS for IDP person with download link of application.
11. The admin can verify the validation of information and documents.
12. The admin accept the record by press “Accept” button.
13. The admin press “Manage IDPs” hyperlink from sub menu.
14. The system display the list of IDPs with management option.
15. The IOM admin press “Update” hyperlink to update selected record.
16. The application display editable field with the record’s information.
17. The IOM admin update the information of IDP’s record.
18. The IOM admin press “Submit” button.
19. The application saves the changes of information for selected record in the database.
20. The IOM admin press “Delete” hyper to delete selected record.
21. The application delete all details of selected record from database.
22. The admins press on “View” hyperlink to display the details.
23. The application display the information and documents of selected IDP record in different page.

24. The admin press on “More Details” to add all information and documents of IDP record.

25. The system display all details of selected IDP record (information and documents).

b) Exceptional Flow

1. IOM admin press “Reset” button to clear the content of adding form.

c) Alternative Flow

1. The IDP person download and install the tracking application.
2. The application display the instructions of registration.
3. The application display information form for IDP paterfamilias.
4. The paterfamilias fill the details of his family such as (full name, family number, identification number, old address, reason of displaced, current address, and supplement details).
5. The IDP press “Next” button to save the information.
6. The application display many information records for every family member depend on their number.
7. The paterfamilias (IDP) fill the previous information of family members.
8. The IDP person press “Next” to save family’s records.
9. The application display scanning tool for IDP to make a copy.
10. The IDP makes a copies for the required documents by provided tool.

11. The IDP press “Save” to save all information and documents.

12. The admins press on “Report” hyperlink to display a report about IDPs record.

13. The system display all IDPs records with print option.

14. The admins press “Search” hyperlink to find a specific IDP record.

15. The system display search form.

16. The admins type the IDP ID and press “Submit” button.

17. The system display all details of IDP record.

v. Post-condition

A new record has been added or an existing record has been managed.

vi. Rules

Does not apply.

vii. Constraints

Does not apply.

4.4.1.4 TRACK IDP (IOM TS_3)

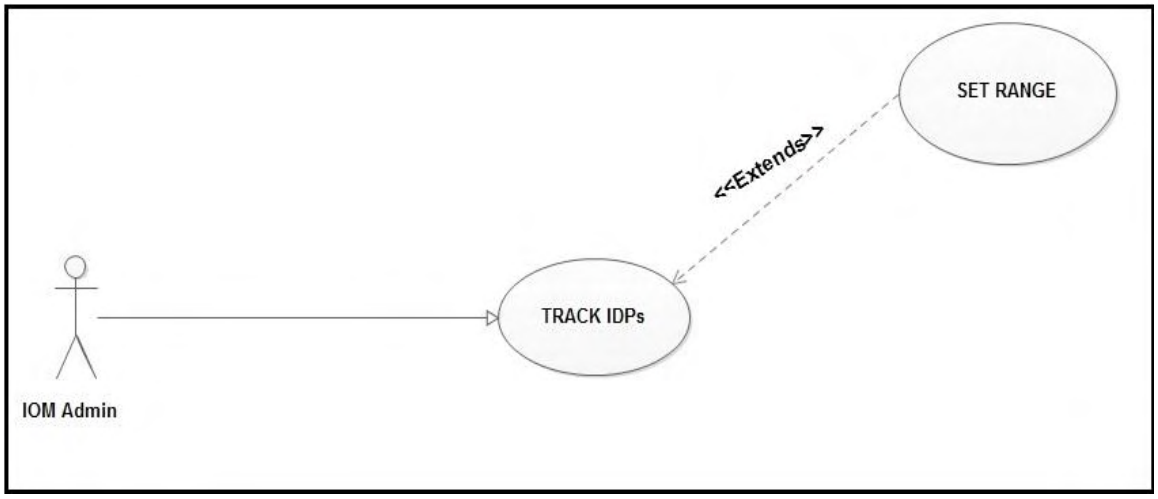

Figure 4.4. Track IDPs Use case Diagram

i. Brief Description

This use case is a core idea of this study. The IOM admin involved in this function. It deals with keeping tracking, communicate and update the address for IDPs to help them with supplement and money.

ii. Pre-condition

The actors login to application with valid information. The actor is IOM admin

iii. Characteristic of Activation

The actors is either IOM admin.

iv. Flow of Events

a. Basic Flow

1. The IOM admin press on “Track IDPs” hyperlink.

2. The system display list of details about the position (No, ID, last position, home position, current position, within the allowed rang, far from home address).

3. The system turn the record to red color for IDP who pass the allowed rang so that the admin can recognize it.

4. The system sends SMS message for IDPs automatically in case of passing the range of their area.

5. The massage contain instruction on either go back to camp or update your location.

6. The system saves the new address for IDPs in database.

7. The system provides (Google map) tools to show the location of the IDPs.

b. Exceptional Flow

Not Applicable.

c. Alternative Flow

1. The IOM admin press on “Set Range” hyperlink

2. The IOM admin determine the range area for camp and home in kilometer (km).

3. The admin press “Submit”.

4. The system saves the information of IDPs in the database.

v. Post-condition

The application keep tracking the IDPs and offer supplement details for them.

vi. Rules

Does not apply.

vii. Constraints

Does not apply.

4.4.1.5 MANAGE SUPPLEMENT (IOM TS _4)

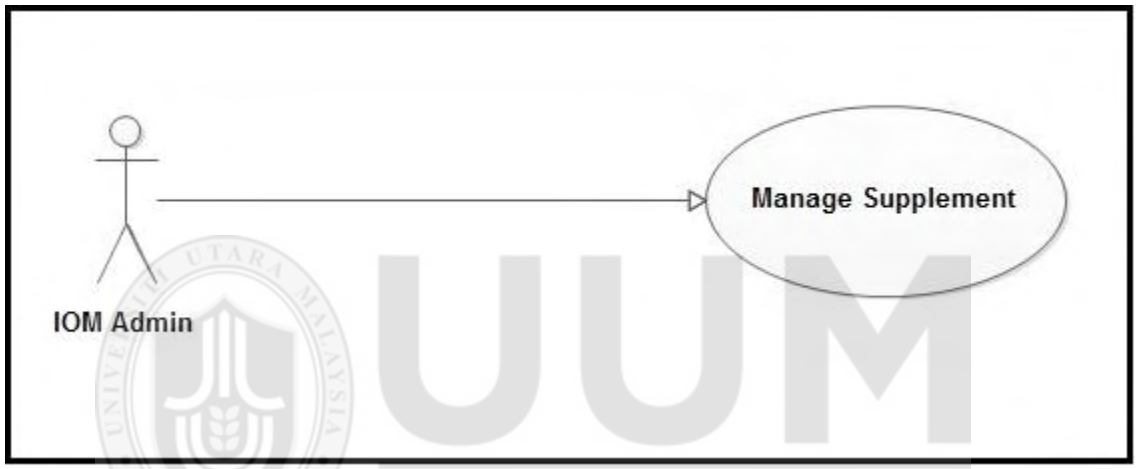

Figure 4.5. Manage Supplement Use case Diagram

i. Brief Description

This use case provides interfaces for IOM admins in the system with specific tasks. Manage supplements and funds use case deals with viewing details. It offers add, manage, report, search and announcement ability for IDP information for IOM admin. Additionally it offer update, delete and view details of supplements and funds.

ii. Pre-condition

The users login to application with valid information. The actor is either IOM admin.

iii. Characteristic of Activation

The users should be an admin.

iv. Flow of Events

b) Basic Flow

1. The IOM admin press on “manage supplements and funds” hyperlink.
2. The system display interface of multi options.
3. The IOM admin press “Add” hyperlink to save information in database.
4. The IOM admin fill the information of paterfamilias such as (id, supplement details, funds amount and location of distribution).
5. The IOM press “Submit” button to save the new information.
6. The system save the information of fund and supplement in the database.
7. The admin press “Manage” hyperlink to manage existing supplement details.
8. The system display a list of Supplement records with multiple options.
9. The IOM admin press “update” button to update selected record.
10. The system display editable field with the record’s information.
11. The admin edit some details and press “Submit” button.
12. The system save the change to the database.
13. The IOM admin press “Delete” button to delete selected record.
14. The system delete all details of selected record from database.

15. The admins press on “View” button to display the details.
16. The system display the supplement records with details.
17. The system provide sorting tool according to ether date of arrival to camp or amount received from agencies.
18. The IOM admin press “Report” button to check list record.
19. The system display list of records with “print” option.
20. The IOM admin press “Search” button to search for selected record.
21. The system display search screen for specific ID.
22. The admin type the ID and press “Submit”
23. The system display the personal or supplement details of selected IDP.
24. The IOM admin press “Announcement”.
25. The IOM admin check the list of families and press “submit”.
26. The system send SMS for IDP date and location of distribution.

c) Exceptional Flow

Not Applicable.

d) Alternative Flow

Not Applicable.

v. Post-condition

The list of records have been viewed and printed. Moreover, a specific record was deleted or updated.

vi. Rules

Does not apply.

vii. Constraints

Does not apply.

4.4.1.6 MANAGE AUTHORIZED USER (IOM TS _5)

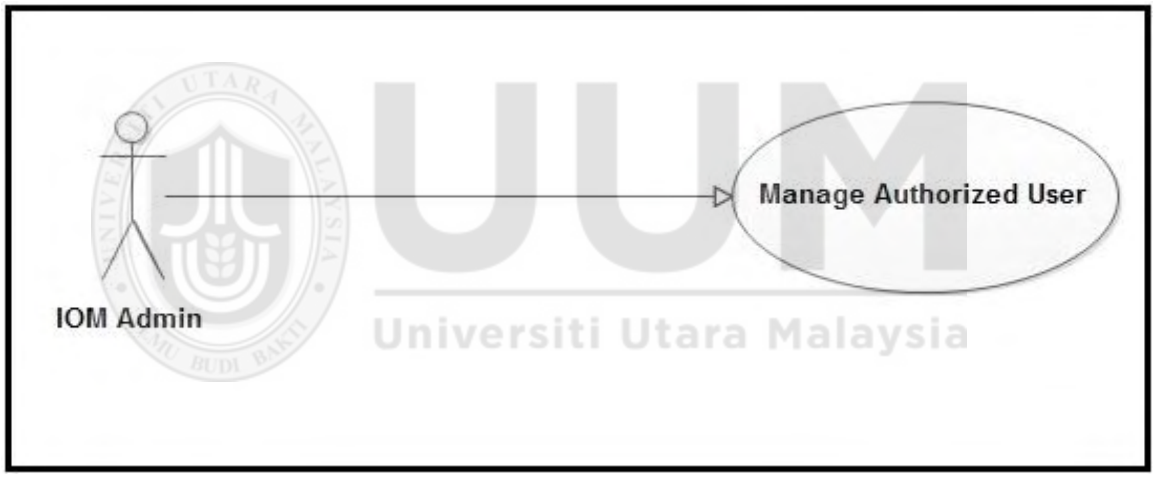

Figure 4.6. Manage Authorized user Use case Diagram

i. Brief Description

This use case provides interfaces for IOM admins in the system with specific tasks. Manage Authorized user use case deals with viewing details. It offers add, manage, report, search and announcement ability for agencies users who want to help in supporting the IDPs for IOM admin. Additionally it offer update, delete and view details of the agencies.

ii. Pre-condition

The admin login to system with valid information.

iii. Characteristic of Activation

The users should be an admin.

iv. Flow of Events

a) Basic Flow

1. The IOM admin press on “Manage Authorized user” hyperlink.
2. The system display interface of multi options.
3. The IOM admin press “Add” hyperlink to save information in database.
4. The system display adding page.
5. The IOM admin fill the information of paterfamilias such as (id, name, phone no and password) and press “Submit”.
6. The system save the information of user in the database.
7. The admin press “Manage” hyperlink to manage existing users’ details.
8. The system display a list of user records with multiple options.
9. The IOM admin press “Update” button to update selected record.
10. The system display editable field with the record’s information.
11. The admin edit some details and press “Submit” button.
12. The system save the change to the database.

13. The IOM admin press “Delete” button to delete selected record.

14. The system delete all details of selected record from database.

15. The admins press on “View” button to display the details.

16. The system display the supplement records with details.

17. The IOM admin press “Report” hyperlink to display list of record.

18. The system displays list of records with “Print” option.

19. The IOM admin press “Search” button to search for selected record.

20. The system displays search screen for specific ID.

21. The IOM admin enter the User ID and press “Submit”.

22. The system displays the user record with details.

23. The IOM admin press “Announcement”.

24. The IOM admin check the list of users and press “submit”.

25. The system sends SMS for user phone with (user id and password).

b) Exceptional Flow

Not Applicable.

c) Alternative Flow

Not Applicable.

v. Post-condition

The list of records has been viewed and printed. Moreover, a specific record was deleted or updated.

vi. Rules

Does not apply.

vii. Constraints

Does not apply.

Appendix B

UNIVERSITI UTARA MALAYSIA

College of Arts and Science

School of Computing

Requirement Questionnaire

Thank you for your time and assistance

IOM TS for displaced families

A questionnaire is simply a 'tool' for collecting and recording information about IOM TS. It is mainly made up of a list of questions, but should also include clear instructions and space for answers or administrative details. System requirement questionnaire was was distributed to 4 expert from IOM and government officials and evaluated and approved by 2 expert as follows:

1. Knowledge management, software development, software engineering.
2. Data mining & Machine Learning, Health Informatics, Climate Change.

Requirement modeling for web based Mobile Tracking system of Displaced Families During Conflict

An internally displaced person (IDP) is someone who is forced to flee his or her home but who remains within his or her country's borders. They are often referred to as refugees, although they do not fall within the current legal definition of a refugee.

In Iraq the International Organization for Migration (IOM) has collected data from January 2014 to 5 November 2015, pertaining to the status and whereabouts of displaced Iraqi individuals. The organization identified about 3,181,176 IDPs (530,196 families) across 103 districts and 3,542 locations in the country.

As per the IOM (2010) report updated in November 2015, the status of IDPs is as follows:

- 71% or 2,254,032 were placed in private dwellings
- 1,374,786 in rented accommodations
- 865,416 were with host families
- 567,372 were in critical shelters
- 286,884 in camps
- 236,856 in unfinished structures
- 132,714 were in religious buildings
- 163,020 in informal settlements
- 34,782 were in school buildings
- 13,830 in guesthouses/motels

Those whose accommodations are not yet known account for 2% of the total IDP populace (64,788).the difficulty faced by the IOM as related organization to help IDPs is to find them after they reported but when moved elsewhere for whatever reason , these agencies are responsible to provide support and help in the form of monetary aids.

The requirement for mobile application will be extracted from expert work in IOM and Government officials who worked with IDPs using these questioners.

1. How long have you been working with IDPs?
2. What are the displacing reasons?

3. Why tracking IDPs is important?
4. From your point of prospective, does the IDPs aware of using a hand phone?
5. What is the role of government and non-government agencies in providing services to IDPs?
6. What is the system currently using to track IDPs?
7. How do you feel about the current system used to track IDPs?
8. What are the problem facing agencies in term of tracking IDPs?
9. What do you think about a technology device based location (GPS) O to assist in locating IDPs?
10. What are the advantages of using technology as a tracking tool?
11. What is the functions needed in the system in order to make it successful?
12. What information you need the displaced person to provide in order to register in the system?
13. What is the requirement needed to track IDPs?
14. What is the average range of the maximum displaced persons camps?
15. Did your agencies share date with other agencies?
16. Who is the organizations involved in serving IDPs?
17. Do you think using IT or mobile application will improve the effectiveness of tracking IDPs?

Appendix C

UNIVERSITI UTARA MALAYSIA

College of Arts and Science

School of Computing

Functionality test

Thank you for your time and assistance

IOM TS for displaced families

Functional testing is a software testing process used within software development in which software is tested to ensure that it conforms to all requirements. Thus functionality test will be done by the developer to make sure the system function and fulfill the requirement.

Appendix C: Test Strategy

C. 1 IOM TS Test Strategy Document

This document is a tool for testing the International organization of migration tracking system **IOM TS**. The document describes the steps in the process with prerequisites, objectives, and the process of testing the system function.

Objectives:

- To test all factions included in the **IOM TS** web based mobile application for both the system and the mobile application.

Pre-conditions:

- The user of the web should be admin with valid (ID and password).
- The user of the mobile application should be register in the system with (ID and phone number)

Testing environment

- Windows 8, 8.1, 10, Google chrome browser.

Tools

- Pc or laptop for the web with internet connection.
- Smartphone with internet connection.

C.2 Functional Testing

Step No.	Case Description	Test data	Expected result	Status (pass/ fail)	Issues and faults
IOM TS_1	**IOM TS_1 LOGIN**				
IOM TS_1_1	The test case 1 explain the login process. Only registered users will have access into the website and mobile application	Website	The users can login into the system using their user name and password.	Pass	
IOM TS_1_2		Website	The system connects to database and verify the validation of (user name and password).	Pass	
IOM TS_1_3		Website	The system redirects a user to his/her interface if the username and password are valid.	Pass	
IOM TS_1_4		Website	An error message will be displayed if the user entered invalid username and password.	Pass	
IOM TS_2	**IDPs REGISTERATION**				
IOM TS_2_1	The test case 2 explains the admin registration process for IDP and the IDPs registration in mobile application	Website	The IOM admin can create an IDP record by save the information of paterfamilias such as (name, phone number, id) in the system database.	Pass	
IOM TS_2_2		Website	The system sends a download link of tracking application by SMS for paterfamilias.	Pass	
IOM TS_2_3		Website	The IDP complete the registration process by following the instructions.	Pass	
IOM TS_2_4		Website	The application provide an interface for paterfamilias (IDP) to fill the information record like (full name, family number, identification number, old address, reason of displaced, current address, supplement details, documents copies).	Pass	
IOM TS_2_5		Application	The application display number of records for every member according to family number.	Pass	
IOM TS_2_6		Application	The paterfamilias (IDP) fill the previous information of family members.	Pass	

IOM TS_2_7		Application	The application provide scanning tool to make a copies for IDP's documents.	Pass	
IOM TS_2_8		Application	The application save all the information and documents related to IDP in the system database.	Pass	
IOM TS_2_9		Website	The admin can verify the information and documents of IDPs	Pass	
IOM TS_3	**IDPs MANAGEMENT**				
IOM TS_3_1	The test case 3 explains the process of distributing supplement and funds and the and informing the families of date and amount and location of funs distributions	Website	The system can edit the information of IDPs' record.	Pass	
IOM TS_3_2		Website	The system can delete the record of IDPs.	Pass	
IOM TS_3_3		Website	The admins can print the records and information of IDPs.	Pass	
IOM TS_3_4		Website	The IOM admin can transfer the record of IDP.	Pass	
IOM TS_3_5		Website	The admins can view the records of IDPs	Pass	
IOM TS_4	**MANAGE SUPPLEMENT AND FUNDS**				
IOM TS_4_1	The test case 4 explains the admin managing supplements and funds for IDPs	Website	The system can add a new supplement details and fund for system.	Pass	
IOM TS_4_2		Website	The system informs the IDPs about the new supplement and fund details.	Pass	
IOM TS_4_3		Website	The system can edit the information of supplement details and fund.	Pass	
IOM TS_4_4		Website	The system can delete the record of supplement and fund details.	Pass	
IOM TS_4_5		Website	The system can print the records and information of supplement and fund details.	Pass	
IOM TS_4_6		Website	The system can search about a specific supplement and fund details record.	Pass	
IOM TS_5	**MANAGE AUTHORIZED AGENCIES**				
IOM TS_5_1	The test case 5 explains the admin registration	Website	The system can add a new authorized user of some agencies to the system database.	Pass	

IOM TS_5_2	process for news users who represent the agencies who offer their help in term of supporting the IDP	Website	The system can edit the information of Authorized admin record of agency.	Pass	
IOM TS_5_3		Website	The system can delete the record of Authorized admin.	Pass	
IOM TS_5_4		Website	The system can print the records and information of Authorized admin.	Pass	
IOM TS_5_5		Website	The system can search the record of Authorized admin.	Pass	
IOM TS_6	**IDPs TRACKING**				
IOM TS_6_1	The test case 6 explains tracking the IDPs position by the admin through Latitude and Longitude Coordinates using GPS.	Website	The system determine the area range for every camp.	Pass	
IOM TS_6_2		Website	The system sends SMS for IDPs to inform them in case of passing the boundaries of camp area or if he back home.	Pass	
IOM TS_6_3		Website	The IDP can update his information according to new address or back to the range area.	Pass	
IOM TS_6_4		Website	The system inform the IDPs about any supplement and money via SMS.	Pass	
IOM TS_6_5		Website	The system chooses the nearest point for IDPs camps for distributed the supplement.	Pass	
IOM TS_6_6		Website	The system sends SMS to inform IDPs about details of supplement such as (aid type, amount, distributed date, distributed point)	Pass	
IOM TS_6_7		Website	The system provides a Google Map to show the address for IDPs.	Pass	
IOM TS_6_8		Website	The system provides a printing tool for list of records.	Pass	
IOM TS_6_9		Website	The system provides a statistical reports of families.	Pass	
IOM TS_6_10		Website	The system sort the IDPs depend on date of joining camp or supplement receive.	Pass	

Appendix D

UNIVERSITI UTARA MALAYSIA

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School of Computing

Usability Questionnaire

Thank you for your time and assistance

IOM TS for displaced families

IOM TS

This questionnaire is divided into three sections (Section A, B and C). Section A: is demographic information; Section B is measuring the perceive of usefulness and section C measuring the perceive of easy to use of the IOM TS. This survey should only take 10-15 minutes to complete. Respondents are required to answer all the questions in order to complete the session. The aim of this questionnaire is to evaluate the user's satisfaction on the IOM TS in terms of perceived usefulness and perceived easy to use based on their interaction and using the system. Usability questionnaire was evaluated and approved by 3 evaluators as follows:

1. Software Testing and Evaluation, Mobile Application, Human & Mobile Interaction.
2. Optimization algorithms, swarm intelligence, timeseries forecasting
3. Data mining & Machine Learning, Health Informatics, Climate Change

UNIVERSITI UTARA MALAYSIA

COLLEGE OF ARTS AND SCIENCES

QUESTIONNAIRE

Research Title: "Requirement modeling for Mobile Tracking of Displaced Families During Conflict"

Dear Respondents,

I am a Master student from the College Of Arts and Sciences (CAS), University Utara Malaysia (UUM). This questionnaire is designed to measure two main element in usability which are easy to use and usefulness.

An internally displaced person (IDP) is someone who is forced to flee his or her home but who remains within his or her country's borders. They are often referred to as refugees, although they do not fall within the current legal definition of a refugee.

In Iraq the International Organization for Migration (IOM) has collected data from January 2014 to 5 November 2015, pertaining to the status and whereabouts of displaced Iraqi individuals. The organization identified about 3,181,176 IDPs (530,196 families) across 103 districts and 3,542 locations in the country.

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- 34,782 were in school buildings
- 13,830 in guesthouses/motels

Those whose accommodations are not yet known account for 2% of the total IDP populace (64,788).the difficulty faced by the IOM as related organization to help IDPs is to find them after they reported but when moved elsewhere for whatever reason , these agencies are responsible to provide support and help in the form of monetary aids.

International organization of migration tracking system **IOM TS** is system design to track and locate displaced person after they register in the system to facilitate distributing funds and supplement along with verifying the person to avoid redundant in distributing the supplements and to document the families' identification papers without the need of reaching them through mobile application.

I would appreciate if you could spend some time and thoughts in completing this questionnaire. I hope that you will cooperate and complete the following questionnaire to the best of your knowledge. Your responses will be considered confidential and used for research purposes only. There is no right or wrong answer. For your information, by completing this questionnaire, you will help the people who trying to assist the displaced families and to enhance their quality of service. Thank you for your willingness to participate in this study.

Best regards,
Talib Muhsen Elebe
Master degree candidate
School of Computing, College of Arts and Sciences (CAS)
University Utara Malaysia (UUM), Sintok 06010, Kedah Darul Alman, Malaysia
Date: _____.
Researcher e-mail address: albaze1975@gmail.com
Phone Number: 00601111830890

This questionnaire is divided into three sections (Section A, B and C). Section A: is demographic information; Section B is measuring the perceive of usefulness and section C

measuring the perceive of easy to use of the **IOM TS**. This survey should only take 10-15 minutes to complete. Respondents are required to answer all the questions in order to complete the session. The aim of this questionnaire is to evaluate the user's satisfaction on the **IOM TS** in terms of perceived usefulness and perceived easy to use based on their interaction and using the system.

Section A: Demographic Information

We would like to collect some information about yourself so that we can understand better your background in working with IDP (Please tick (✓) the appropriate box).

1. Your Gender: ☐Male. ☐Female.

2. Your Age: ☐18-22. ☐23 -35. ☐36- 45. ☐ 46-55. ☐ ≥ 56.

3. How long have you been working with displaced families? ☐ 1 – 3 years. ☐ 4 – 6 years. ☐More than 7 years.

4. What is your designation? Field officer ☐ Coordinator ☐ Data interring☐ shipment escort ☐

Section B: Perceive of Usefulness

We would like to understand your opinions about IOM TS usefulness to test how useful is the system in your work (Please circle the appropriate number based on a 5-point scale where 1= Strongly Disagree; 2= Disagree; 3= Neutral; 4= Agree; 5= Strongly Agree).

Please follow the numbers which denote the following answers to circle one answer for each question.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

Perceived Usefulness					
Questions	**Evaluation Rate**				
1. The **IOM TS** is useful.	**1**	**2**	**3**	**4**	**5**
2. When I use the **IOM TS**, I save my time.	**1**	**2**	**3**	**4**	**5**
3. It saves my effort when I use it the IOM TS.	**1**	**2**	**3**	**4**	**5**
4. The **IOM TS** gives me more control over the activities in my life.	**1**	**2**	**3**	**4**	**5**
5. Using the **IOM TS** app reach the user goal efficiently	**1**	**2**	**3**	**4**	**5**
6. The **IOM TS** makes the things I want to accomplish easier to get.	**1**	**2**	**3**	**4**	**5**
7. It does everything I would expect it to do.	**1**	**2**	**3**	**4**	**5**

*MW = International Organization of Migration Tracking System **IOM TS**.

Section C: Perceive of Easy to Use

We would like to understand your opinions about IOM TS easy to use to understand how easy is the system in term of using the interfaces and achieve the object in minimum effort, so (Please circle the appropriate number based on a 5-point scale where 1= Strongly Disagree; 2= Disagree; 3= Neutral; 4= Agree; 5= Strongly Agree)

Please follow the numbers which denote the following answers to circle one answer for each question.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

Easy to Use					
Information Quality	**Degree of Agreement**				
1. IOM TS is easy to use.	**1**	**2**	**3**	**4**	**5**
2. IOM TS is flexible use	**1**	**2**	**3**	**4**	**5**
3. IOM TS is simple to use.	**1**	**2**	**3**	**4**	**5**
4. IOM TS is user friendly.	**1**	**2**	**3**	**4**	**5**
5. IOM TS requires the fewest steps possible to accomplish	**1**	**2**	**3**	**4**	**5**
6. I can use it without written instructions.	**1**	**2**	**3**	**4**	**5**
7. I learned to use it quickly	**1**	**2**	**3**	**4**	**5**
8. Easily remember how to use it.	**1**	**2**	**3**	**4**	**5**
9. I can use it successfully every time.	**1**	**2**	**3**	**4**	**5**
10. I always felt I knew what it was possible to do next	**1**	**2**	**3**	**4**	**5**
11. IOM TS feedback: It is helpful in the error message	**1**	**2**	**3**	**4**	**5**
12. My mistakes were easy to correct.	**1**	**2**	**3**	**4**	**5**

*IOM TS = International Organization of Migration Tracking System **IOM TS**.

Your time and cooperation are highly valued

Thank you.