



WOLKITE UNIVERSITY
COLLEGE OF COMPUTING AND INFORMATICS
DEPARTMENT OF SOFTWARE ENGINEERING
PROJECT ON
FIRST AID GUIDANCE APPLICATION

BY

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Wolkite University, Wolkite, Ethiopia

May 2021 G.C



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**Submitted to Wolkite University in Partial Fulfillment of the
Requirements of Software Engineering Graduate Program in College of
Computing and Informatics**

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DECLARATION

This is to declare that First Aid Guidance Application project work which is done under the supervision of Mr. Bekretsyon Berhe (MSC.) and having the title First Aid Guidance Application is the solid contribution of: Honey Asrat, Bezawit Berihun and Marsilas Debebe. No part of the project has been reproduced illegally (copy and paste) which can be considered as Plagiarism. All referenced parts have been used to argue the idea and have been cited properly. We will be responsible and liable for any consequence if violation of this declaration is proven.

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APPROVAL FORM

This is to confirm that First Aid Guidance Application project submitted to Wolkite University College of Computing and Informatics Department of Software Engineering by: Honey Asrat, Bezawit Berihun and Marsilas Debebe is approved for submission.

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LIST OF ABBRIVATION

APP: Application

CPR: Cardiopulmonary Resuscitation

ERCS: Ethiopian Red Cross Society

GPS: Global Positioning System

ICRS: International Federation of Red Cross and Red Crescent Societies

ID: Identification

IOS: iPhone Operating System

Mongo DB: Mongo Database

MoHE: Ministry of Health Ethiopia

SDK: Software Development Kit

UI: User Interface

ABSTRACTS

First aid guidance is an application program which gives a basic first aid guidance to user of the system in clear and effective manner. The problem of the existing system is social discrimination, lack knowledge and awareness. In addition, the currently existing system is does not provide GPS service, does not contain emergency contact, ID of the user and it is does not contain optional languages and operates only in Android phones. In order to solve this problem, we will develop a user friendly, easy, comfortable and convenient system which can operate in both IOS and Android phone. The proposed system will result a brief first aid guidance in both English and Amharic language.

CHAPTER ONE

1. INTRODUCTION

First Aid is the initial service provided for an acute illness or injury, when advanced care procedures are not readily available. It is the immediate care given to a person who has been injured or suddenly taken ill. It includes home care if medical assistance is not available or delayed. It also includes well selected words of encouragement, evidence of willingness to help, and promotion of confidence by demonstration of competence. First Aid is intended to preserve life, alleviate suffering, prevent further illness or injury, and promote recovery. First Aid can be initiated by anyone in any situation.

Technology is increasing dramatically in almost every second of human life cycle. Developing the system using technology has a tremendous effect for human being, countries, organizations and enterprises. The information and communication technology provide new resource materials for expanding communication. The digital technology provides new resource materials for expanding information, communication and help. Which is in our case First Aid App that will give a basic first-aid for anyone in need. Currently, first aid service is given only by trained professionals mostly by Red Cross. We will develop a digitalized system that gives a basic first aid guidance for everyone who want to get enough basic knowledge and also for a person who should give a first aid help to anyone need emergency support might be is in danger. Although our system will have GPS module.

To develop the proposed system, we will use the leading mobile app development framework which is Flutter and it was launched by Google and is an open-source mobile development SDK. It is a popular cross-platform app development and is written in the Dart which is an Object-Oriented programming language. This mobile app will increase the awareness and knowledge of First Aid in the society. The fundamental importance of the proposed system is to provide First Aid Guidance for our society.



Figure 1-1. The universal first aid symbol [1]

1.1 Background

The Ethiopian Red Cross Society was established by government decree on 8 July 1935 and became 48th member of the International Federation of Red Cross and Red Crescent Societies on September 25 of the same year. The National Society is an independent organization established and recognized by law through a National Charter adopted in 31 October 1947. The Charter has undergone various parliamentary revisions, the last being that of 1999.

Millions of people are hurt or killed from injuries every year due to the lack adequate and timely assistance. Effectively, first aid reduces deaths, injuries and impact during disasters and daily emergencies. It provides an immediate response to an emergency, taking life saving measures until professional help arrives. Simple first aid skills, and the confidence to use them, can save lives and everyone, if properly trained, has the potential to save lives.

First aid is by no means a replacement for emergency services; it is a vital initial step for providing effective and swift action that helps to reduce serious injuries and improve the chances of survival. Taking immediate action and applying the appropriate techniques makes a difference when saving lives.

A lack of first-aid knowledge can increase the risks associated with domestic accidents. Recent researches show that 77% of people lack the knowledge and confidence to administer basic first-aid, and go straight for emergency call center.

❖ **Mission of ERCS**

To prevent and alleviate human sufferings through appropriate and timely humanitarian and development interventions, contribute to the wellbeing of humankind and prevalence of peace by mobilizing the public and partners in Ethiopia and around the World [2].

❖ **Vision of ERCS**

To be the leading humanitarian organization in Ethiopia in reaching the vulnerable by 2025 [2].

1.2 Statement of the problem

The consequences that we need first-aid can vary from person to person such as CPR, artificial respiration, swallowing tongue, stroke, car accident, bleedings, poison, heat and cold (fire and water), stings and bites, shock, burn and scalds, broken bones and fractures and so on.

The fundamental reasons that worsen the issue include lack of awareness, social discrimination, shortage of adequate First Aid Care Centers, shortage of emergency First Aid Care and insufficient knowledge about First Aid such as Life preservation, Prevent the situation from getting worse, Promoting recovery methods and functions. First Aid is like any other medical care, mostly advantageous especially when treated in early stage. But a lot of people are afraid to give a treatment and to get a treatment because of the social stigma or they are affected by their bashfulness and the lack of knowledge.

Currently Ethiopian Red Cross Society has Android mobile app. The problem of the existing system is listed below:

- Only run on Android Mobile Phones.
- Does not provide emergency calls for relative (friends) and emergency contact.
- It is not user friendly for users.
- It does not include Location Module.

The other problem in our country is the culture of going to health centers which are very poor because of fear of social discrimination, lack of First Aid equipment and lack of knowledge. It is also uncomfortable to go to health centers for illnesses that require simple help. In order to solve this

and other first aid related problems it is necessary to design and implement a new first aid application that includes the following functionalities such as: bilingual (English and Amharic), GPS service and first aid guidance.

1.3 Objectives

1.3.1 General Objectives

The main objective of this project is to develop a digitalized mobile application that guides how to save life, prevent further injury, and limit infection.

1.3.2 Specific Objectives

The specific objective of this project is as listed below.

- Identifying all the problems of the current existing system.
- Collecting and analyzing different resources to identify all functionalities of the proposed system.
- Developing an application that is bi-linguistic (English and Amharic).
- Testing of the developed system through different techniques before delivery.
- Maintain and develop the final product of the project.

1.4 Feasibility Analysis

We have examined the proposed system feasibility from different perspectives such as: - technical, operational, economic, cultural and legal.

1.4.1 Technical Feasibility

The project is technically feasible for development as the software development tools that we are going to use in developing the proposed application are freely available (open source) on the internet. Technically our app can operate in both IOS and Android device. The proposed system is technically feasible because:

- The development team is capable to develop the proposed system.
- The development team have the required material to develop the proposed system.

- The programming language we will use is capable to develop the system.

1.4.2 Economic Feasibility

The system we are going to develop is economically feasible. Because our application does not require any cost and once our application is installed in any IOS or Android device; it only requires an internet connection to access GPS service in our application.

Using our application, will reduce the time; wasted waiting until a professional person or Red-Cross arrive to a specific accident (injury) occurred place. Moreover, it will save an injured person's life. So, the proposed system is economically feasible.

❖ Tangible benefit:

- It can save lives.
- First aid kits are used properly.
- It can reduce recovery time.
- Cost reduction.

❖ Intangible benefit:

- Reduce resource consumption.
- Reduce injury time.
- Increase life span.

1.4.3 Operational Feasibility

The proposed system is easy, user friendly, comfortable and convenient system. Emergency situations that may require first aid can occur at any time and at anyplace; the proposed system gives basic first aid guidance for the users of the system. The proposed system is also compatible in both IOS and Android phones; which can be used effectively in every circumstance. Since our system is easy, user friendly, comfortable and convenient to use it do not require any training or support from professionals.

As long as we use Agile software development model to develop the model allows teams to be more flexible and to implement changes more quickly. The users of the system will be involved in the development of this project

by providing their opinion/feedback. Based on these points our proposed system is operationally feasible.

1.4.4 Cultural Feasibility

The proposed system is culturally feasible. Since one functionality of the proposed system is working in Amharic language; it is expected that the system must keep the culture of the environment. Although, our project does not have any influence regarding to cultural belief, practice and environment. Therefore, we can say that our project is culturally feasible.

1.4.5 Legal Feasibility

The proposed system is legally feasible. Our project is built up on the legal rule and regulation or law of first-aid which is stated by International Federation of Red Cross and Red Crescent Societies that is universally applicable and acceptable. Also, it follows the rule and regulation of MoHE. Therefore, we can say that our project is legally feasible.

1.5 Scope and Limitation

1.5.1 Scope of the project

The scope of the project consists three different basic first aid guidance these are diagnosis, treatment and quick disposal.

For diagnosis, the user must first know how the accident or sudden injury has occurred. This can be got from the victim if he can tell or from witnesses. We called it as the history of the circumstance. The next step is the user need to see the symptoms. Then, the user looks at the signs which are differences from normal conditions. Signs are the most reliable indications on which diagnosis can be based.

For treatment, the reason of the condition should be immediately removed with a view to avoid the condition from becoming worse. Special attention should be paid to cases of heart attack, shock, bleeding, snake bites, chemical burns and infant choking.

For quick disposal, the victim should either be examined by the doctor on the spot. If that is not possible then he should be immediately taken to his home or to a hospital according to conditions. The members of the victim's family or his relatives should be informed at once.

The proposed system operates in both IOS and Android phone. This project main focuses on:

- First Aid Guidance module. (I.e. CPR, Circulatory, Bleeding, Poison, Stings and Bites, Respiratory, Heat and Cold, Car Accident).
- Location module (GPS Service). For: - searching for the nearest hospital & knowing their current location.
- Language module. (I.e. English and Amharic).
- Emergency contact service.
- Making calls to emergency health centers.
- Making calls to user defined numbers.
- Display First Aid Guidance.
- Works both in Android and iOS operating system.

1.5.2 Limitation of the project

- The proposed system does not include the following tasks such as: - Doctors, Nurses, and First-Aid kits.
- The proposed system cannot give first-aid treatment by itself.
- The proposed system does not give guidance in voice.
- The proposed system does not provide detailed knowledge their characteristics and other limitations of the disease type.

1.6 Significance of the project

After the completion of this project it have the following significances:

- The proposed system helps to preserve life, promote recovery.
- The proposed system helps to protect the unconscious, prevent the escalation of illness or injury.
- The proposed system enables you to assist person who become injured in the event of accident or emergency situation.
- The proposed system will provide easy step by step instructions to help the user to give treatment for himself or others.

- The proposed system can be used if accident happens in workplaces, at home, in public space and at anywhere accident happens.
- Efficiently dealt with before a trained medical professional arrives to administer more specialized treatment.
- Can save lives in a quick response.

1.7 Beneficiary of the project

The proposed system is easy, user friendly, comfortable and convenient system that is beneficial for everyone who wants either knowledge or emergency first aid treatment. Though anyone who use our application is beneficial from the project.

Ethiopians are also beneficial from the project; because, our application can be used in Amharic language. Since it works in Amharic language any Ethiopian who is not able to understand and use English language can also use our application in Amharic language.

Ministry of Health-Ethiopia is also beneficial from the project; since one of the objectives of MoHE is improving health status our application is curtail to preserve life, prevent illness, and promote recovery these activities are directly related to improving health status which is the objective of MoHE. Therefore, MoHE is beneficial from the project.

Ethiopian Red Cross Society is also beneficial from our project. One of the purposes of the ERCS is to protect the lives and dignity of victims of armed conflicts and other situations of violence, and to provide them with assistance. Thus, ERCS is beneficial from our project.

End users of this app are also beneficial from our project. Because, our application provides basic first aid guidance that assists the users to acquire knowledge. Also, our app provides location module that is uses to know the user's current location and search for nearest hospital.

1.8 Methodology of the project

In order to achieve success in this project; and to accomplish the project on time and within the cost, we would follow different methodologies which are described below.

1.8.1 Data collection tools and techniques

❖ Observation

It is a useful data collection technique that assists the team to assess the manual system by participating or watching in the real work and forms used in the existing system.

❖ Document analysis

The team analyzes documents that related to first aid and some related previously done projects which are very important to develop our project. During the analysis of documents, we give special consideration to those documents which can bring more features to our system.

1.8.2 System Analysis and Design

In the system analysis and design phase of a project we will apply object-oriented software methodology (approaches) that examines requirements from the perspective of the class and objects found in the problem domain to develop our system. Although it is a popular technical approach to analyze, design an application system by applying the object-oriented programming as well as using visual modeling throughout software development life cycle to foster better communication between stakeholder and developer. Also, for better software quality. The reason that makes us to choose this methodology is that it promises to reduce development time, code reusability and this helps to reduce development time. It improves software maintenance, as we use modular development part of the system can be updated in case of issues without a need to make large scale changes.

1.8.3 System Development Model

We will develop the proposed system using Agile Model: - emphasis the focus on people; on individuals rather than on the roles that people perform. Unlike the waterfall development methodology, agile forgoes the documentation. It attempts to capture and use the dynamics of change inherent in software development in the development process itself rather than

resisting the ever-present and quickly changing environment. Agile methods presume that change is unavoidable and should be embraced throughout the product development cycle. These reasons make us choose this development model.

1.8.4 System Testing Methodology

Developing software is a complex process. In order to produce a complete quality software, we have to eliminate all faults and errors that may occur during development phases of the software. Although we have to test the system during the development process. To simplify the testing process, we follow different types of tests that break the testing process into distinct levels. These levels of testing are unit testing, integration testing, system testing and acceptance testing. In addition to these levels of testing we are also going to see Widget Testing which is available in flutter. Therefore, we are going to use these testing levels.

❖ Unit Testing

In this level of testing, we examine whether our projects functional requirement is done correctly or not and we examine our system module by module. Although, we examine the correctness of a piece of code (a function, in general) or a method of a class. Though, our development team will test the system throughout the development by module. Such as:

- Check whether the return type of the functions is correct.
- Check how the sub procedures or functions are called correctly.
- Check if the correct output is produced for different inputs.

❖ System Testing

In this level of testing process, we examine how our projects whole subsystem came together to achieve the desired goal (user's requirements of the system). Our goal in this testing level is to detect faults and risks that can only be exposed by testing the entire integrated system or some major parts of the system. Throughout this testing level the development team test the whole system by modularizing the system of the project.

❖ **Widget Testing**

In this level of testing we examine our projects correctness on terms of widget creation, rendering and interaction with other widgets as expected. This level of testing goes one step further and provides near real-time environment to find more bugs. And this helps to improve the quality of our application.

❖ **Integration Testing**

In this level of testing we examine whether our system modules are integrated each other or not. And we examine how different procedures of the system work together to achieve the goal of the subsystem. Throughout this testing level the development team test the integration of system modules each other. In addition, it involves unit testing, system testing and widget testing along with the external components of the app.

❖ **Regression Testing**

In this level of testing when new requirements arrive from the users of the system to modify the software; we examine either the modified code or a new feature added to the software affects the other part of the software application or not. Moreover, we examine for defect fixing as well as performance issue fixing. In order to do regression testing we will first debug the code to identify the bug. Once we find the bugs, we will make required changes to fix it, then we will do the regression testing.

1.8.5 Development Tools and Techniques

Development tools for our project contains software and hardware tools. In addition, it also contains documentation and modeling tool, deployment environment, programming language, and frontend and backend technologies.

• **Hardware Tools:**

- MacBook Air/Pro (128GB, 4GB RAM)
- Processor (1.6 GHz Dual-Core Intel Core i5)
- Backup Device (1TB hard disk)
- Output Device (Printer)

- **Software Tools:**
 - MacBook Catalina or Big Sur
 - Android Studio
 - XCode
 - Visual Studio Code
 - Chrome Browser
- **Documentation and Modeling Tools:**
 - Microsoft Office 2019
 - Star UML
 - Enterprise Architect
 - Other UML modeling tools
- **Deployment Environment:**
 - Play Store
 - Android phone
 - IOS phone
- **Programming Language:**
 - Dart

N.B: Dart is a client-optimized language for fast apps in any platform.

Client-Optimized Programming language is programming language optimized for building user interfaces with features such as the spread operator for expanding collections, and collection if for customizing UI for each.

- **Frontend Technology:**
 - Flutter
 - Dart
- **Backend Technology:**
 - MongoDB
 - Node.js

MongoDB and Node.js are used in developing and managing at the back-end. MongoDB software will be used for persistent data and backend management will be done by Node.js.

Node.js: -

- Is a server-side platform.
- Is an open source server environment.
- It allows you to run JavaScript on the server and It is free.
- Runs on various platforms.
- **Additional Tools:**
 - Adobe photoshop
 - Testing tools
 - GitLab
 - Other editing and designing tools

1.9 Document Organization

- Chapter one defines and describes concepts with regard to the introduction of the chapter that discusses problems in the existing system.
- Chapter two describes the existing system.
- Chapter three is about overview of proposed system which includes functional and non-functional requirements.
- Chapter four Consists of a flow of events which is the scenario, use case model with its description of the major use cases.
- Chapter five deals with system design. Which includes the overview of the system, design consideration, design goal, design tradeoffs, the architecture of the system, subsystem decomposition, persistent data management, and class interface.

CHAPTER TWO

2. DESCRIPTION OF THE EXISTING SYSTEM

2.1 Introduction of the existing system

Studying the existing system brings about an important contribution to the entire development process of the proposed system (IOS and Android mobile application that works in both Amharic and English language). Like helping to realize what is going wrong, what to change, what activity or practice to encourage, what alternative solution to propose in the new proposed system.

We have seen that currently, there are different application which are designed to help people during emergency. But those applications are not in use because they are not developed and designed according to the user need. Due to such problems most of people use manual ways of first aid guidance. By realizing such problems, we have proposed an alternative solution, designing and developing bilingual (using Amharic and English) first aid guidance application.

2.2 Users of the existing system

The user of those existing systems are any users who are supported by the existing systems in order to get access for first aid guidance. But when we talk about the users of existing systems, we can category them in to two. The first are some users which use the manual ways of first aid guidance at health centers and the second are those who uses the android based first aid medical applications.

- The users of the existing manual system can be: -
 1. **Patients:** The user may need to get first aid medical care or he may need to get advice, on how to face worsening conditions like emergency.
 2. **Health professionals:** are professionals such like doctors, nurses and others who give cares and advices for peoples who need their support.

Table 2-1. Users of manual existing system

Users	Responsibilities
Patients	<ul style="list-style-type: none"> • They should go to health centers to get proper health care. • They should follow every instruction they get from health professional.
Random person	<ul style="list-style-type: none"> • Should go to health centers to get information / guidance to learn. • Should act according to the way he learnt.
Health professionals	<ul style="list-style-type: none"> • Should give health care professionally. • Should assist people on how to treat themselves. • Should teach or give information properly for the users.

Table 2-1. Users of android based existing system

Users	Responsibilities
Anyone	<ul style="list-style-type: none"> • He/she should download an application and should follow the instructions properly. • Used as a guideline for anyone who is referring the system.
Health professionals	<ul style="list-style-type: none"> • Used as a guideline for health professionals.

2.3 Major Functions of the existing system

The major functions in the existing system are mostly referring and advising peoples to recover their life from worsening condition like emergency risks. The existing system can be categorized in to two different categories these are manual, android based.

The existing android based first aid guidance application is not specified to specific user because since it is an open source application anyone who has

a smart phone and has the interest to learn and read about first aid guidance can use those applications.

- The user of this application can be any person who uses the application for so many purposes such as: -
 - Uses the application for learning (to find more knowledge about first aid).
 - Some users use the application for academic education to promote their knowledge.
 - Some users use to learn how to recover life from a worsening condition which happens at emergency time.

In order to use the application a user needs to install the application to their smart phones.

Any person who go to health centers to get any first aid related service, he/she will get the service according to the existing system (manual ways).

2.4 Forms and other documents of the existing system

In this sub-topic have described some sample forms and documents interfaces of the existing system. Those are: -

First aid

- **Information to help you during a medical emergency.**
- **Products and services**
- **Anaphylaxis**
- **Animal bites: First aid**
- **Black eye**
- **Blisters: First aid**
- **Bruise: First aid**
- **Burns: First aid**
- **Cardiopulmonary resuscitation (CPR): First aid**
- **Chemical burns: First aid**
- **Chemical splash in the eye**
- **Chest pain: First aid**

Figure 2-1. Sample first aid app 1



Figure 2-4. Sample first aid app 4

2.5 Drawbacks of the existing system

- **Functionality:** The existing system is less functional in our country due to language problems.
- **Time taking:** The existing manual system takes too much time from users to get guidance.
- **Not user-friendly:** The existing system is not user friendly it is complicated to use.
- Not compatible with IOS phones since it works only Android devices.
- The existing system does not contain GPS module.
- The existing system does not provide emergency call services for relatives and friends and it does not allow user to save contacts of their relatives and friends.

2.6 Practices of the existing system

The strong sides that we need to preserve from the existing system are: -

- Freely available.
- It has information about different helping application.
- Easy installation (Installation procedure is not complicated).

2.7 Business rule of the existing system

In the existing system there are two different business rules those are: -

- Manual existing system:
 - **BR1:** Patients should visit health centers nearby to get any service.
 - **BR2:** Patients information should be registered.
 - **BR3:** Patients take a proper health care in accordance with their health status.
 - **BR4:** Health professionals will take care on the case.
 - **BR5:** After he diagnosis the patients' health status; the health professional either give a treatment or teach the patient on how to save himself and others from first aid worsening conditions.
 - **BR6:** The patient gets the treatment or acquire knowledge about the problems happened to him and treat himself and help others by its knowledge.
- Automated existing system (mobile application):
 - **BR1:** On the device open play store.
 - **BR2:** Search or browse for the application.
 - **BR3:** Select an item (application he wants)
 - **BR4:** Select install option and install the application.
 - **BR5:** Follow on the screen instruction to complete installation and get the application.

CHAPTER THREE

3. PROPOSED SYSTEM

The proposed bilingual android and IOS based first aid guidance application (English, Amharic) is designed to reduce the problems which are occurred in the existing system like usability deficiency and misunderstanding problem due to constraints of language. So, this application has the ability to work in Ethiopian National Language (Amharic); In addition to the international language which is English. This increases understandability and functionality and decrease misunderstanding concepts because of deficiency in language efficiency and is good enough to give the following some advantages to users.

- The system has a simple and attractive user interface.
- Increase the knowledge of how to solve suddenly accidents: - the proposed system gives description about how to use first aid application treatment for any emergencies.
- Provide medical advice: - the proposed system gives some medical advises and the user can get health-related advice.
- Minimize the risks after accident: - the proposed system guides how to give first aid for an accident and this minimizes the risks occurred in the patient after the accident.
- Reduce the workload: - the proposed system provides first aid guidance; so, this reduces the workload in different health centers.
- Reduce the time-wasting: - users of the proposed system can access the proposed system in their fingertips using electronic device this reduces the time-wasting at health centers.

3.1 Functional Requirements

The interaction between the system and its environment (user) contained in the proposed system. The following are the functionalities of the proposed system:

- The proposed system shall provide first aid guidance for: - CPR, Circulatory, Bleeding, Poison, Stings and Bites, Respiratory, Car Accident, Heat and Cold.
- The proposed system shall provide first aid guidance for the users of the system.
- The proposed system shall provide GPS service for users.
- The proposed system shall provide GIF based guidance for most serious first aid issues such as: - respiratory, heart attack, adult CPR, child CPR, infant CPR.
- The proposed system must allow users to select the language they want to use.
- The proposed system must allow the users to select and get the guidance they want from the category.
- The proposed system must allow users to make calls to relatives (friends) and user-defined emergency number.
- The proposed system must allow users to save user-defined emergency contacts.

3.2 Non-functional Requirement

The user-visible aspects of the system of the proposed system. The following are non-functional requirements of the proposed system to be developed: -

3.2.1 User Interface and Human Factors

The user interface of the proposed system is attractive, user interactive, simple to understand, easy to use and user-friendly interface in which users can easily use and perform their tasks. This thing comes from knowing our users, understanding their goals, skills, and tendencies. Once we know about our user, we will consider the following when designing our interface:

- Keep the interface simple, avoid unnecessary things, be purposeful in page layout, and strategically use color and texture.
- Create consistency and use common user interface elements.

3.2.2 Hardware Consideration

The software product to be developed should run on both Android-based and iOS-based modern hardware smartphones and tablets. Also, the proposed system should work in modern devices that have more than 1 GB RAM.

3.2.3 Accuracy

The level of accuracy in the proposed system will be better due to the reduction of error. The system will give the correct and error-free output for the users when they want to get service.

3.2.4 Interoperability

The proposed system is view able and can fit in any standard mobile phones and tablets; in both android and iOS operating system.

3.2.5 Performance Consideration

The proposed system gives guidance by categorizing related guidance's to users in order to save time; the performance of the system is defined by the type of functionality the user is intended to use. Though, the user can get guidance within 2 seconds only for guidance information.

3.2.6 Availability

The proposed system can be distributed easily on any smart mobile phones and the user can also get the mobile application from play store once it is deployed. Moreover, users can share the application using any sharing platforms. And also, the system is available for user 24/7, anywhere and via mobile phones and tablets.

3.2.7 Usability

The proposed system is more usable in our country since it works in Amharic and English languages.

3.2.8 Performance

The proposed systems back-end will be built by using Node.js and Node.js uses event driven, non-blocking I/O model that makes it lightweight and efficient.

CHAPTER FOUR

4. SYSTEM ANALYSIS

The system analysis model contains three models: -functional, object and dynamic models. Use case diagram describes the functional model. Class diagram describes the object model. Dynamic model is described by sequence, state chart and activity diagrams.

4.1 System Model

In this chapter different types of requirement modeling techniques are used to better describe the system's functionality and we study requirements of the system in detail in order to classify its key components to create a system that will attain its goals in effective way and if any errors occur it will help trace the error easily by that help in achieving the desired goal. The models planned to be used are use-case diagram, activity diagram, sequence diagrams, state diagrams and class diagrams.

4.1.2 Use Case Model

This Use Case Model capture the functional system components. Because Use Case Models are simple in nature, this Use Case Models are a great way to storyboard flows with users and define the system requirements being modeled and help write the scenarios later used in testing.

4.1.2.1 Use Case Diagram

The system has two actors and each actor can perform the following specific action: -

- Admin
 - Admin can upload the application on play store.
 - Admin can accept feed-back from the system users.
 - Admin can maintain the application.
- User
 - User can select language he wants to use.
 - User can select guidance category he/she wants to use.

- User can access guidance information type.
- User can access emergency contact service.
- User can access GPS service.

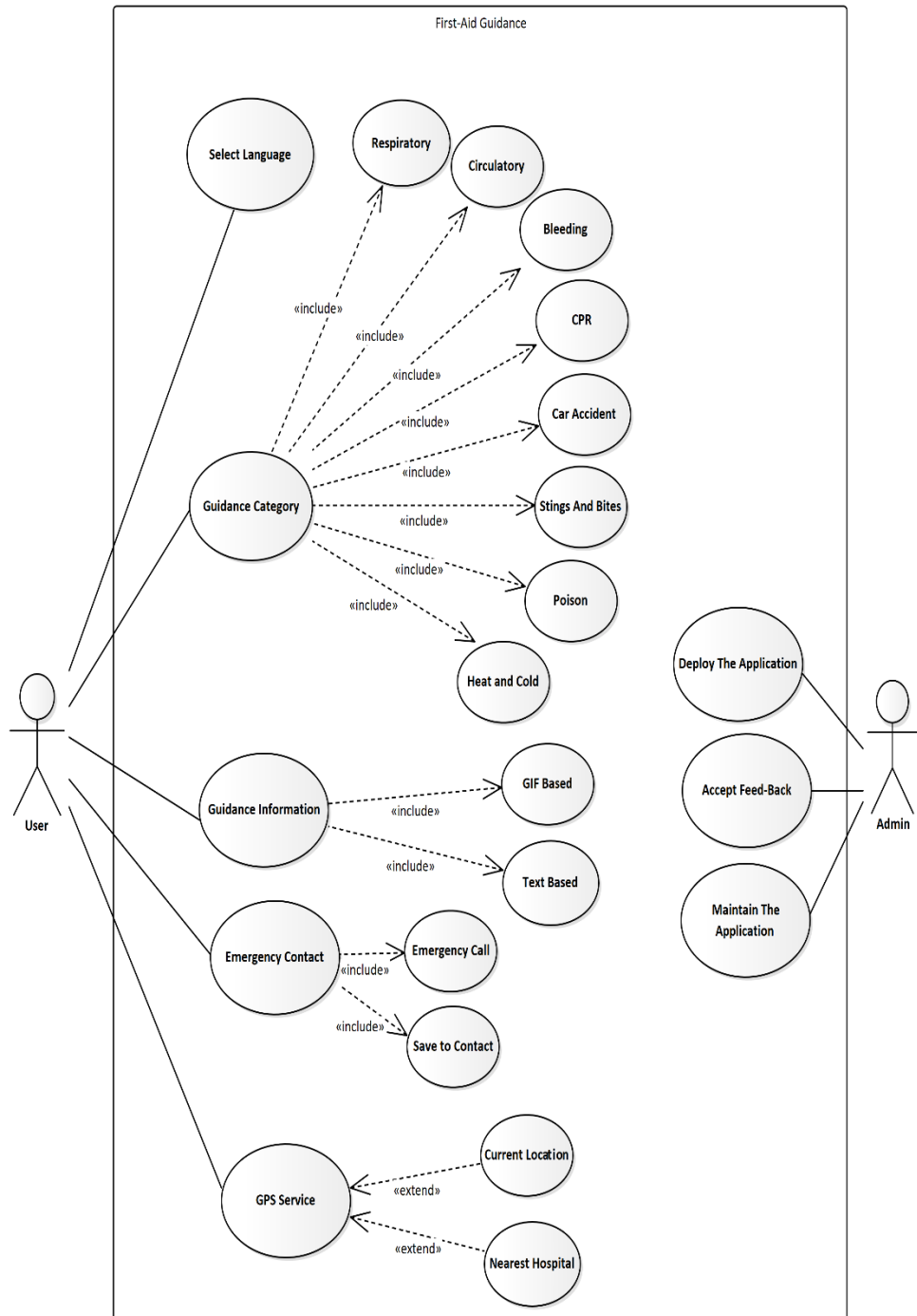


Figure 4-1. Use case diagram.

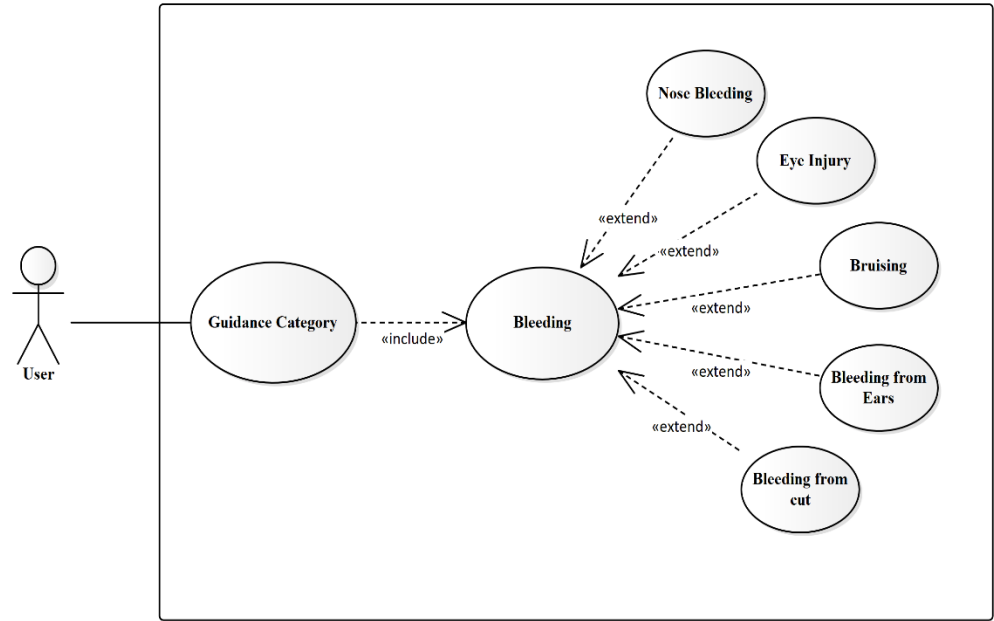


Figure 4-2. Detail Bleeding use case diagram.

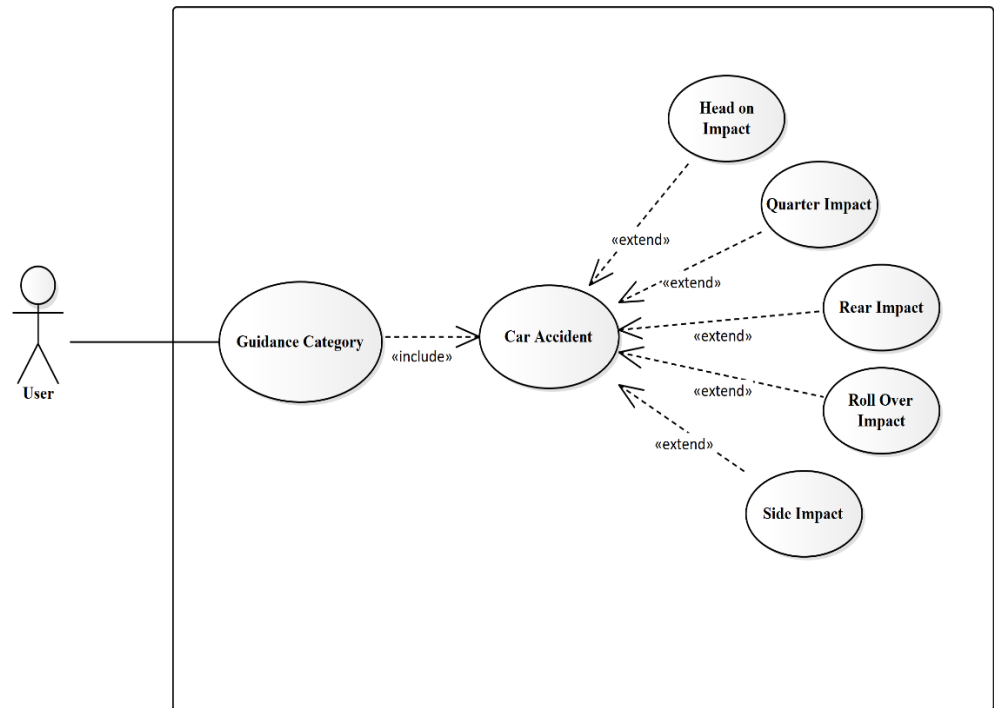


Figure 4-3. Detail Car Accident use case diagram.

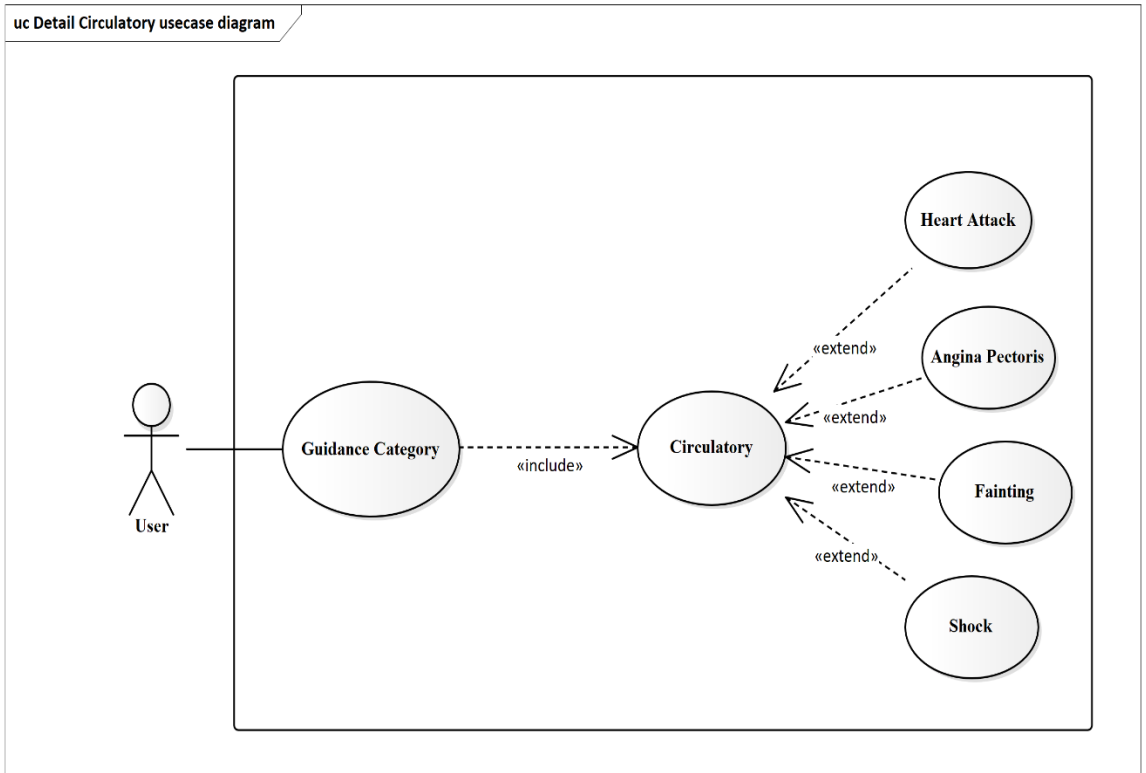


Figure 4-4. Detail Circulatory use case diagram.

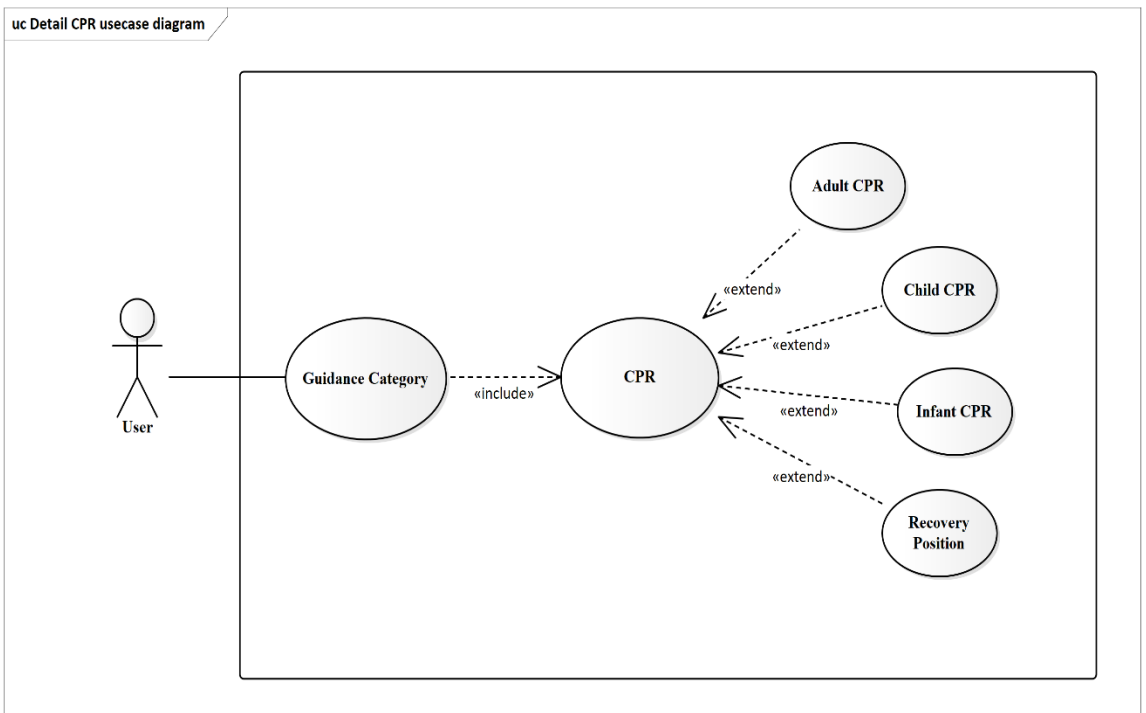


Figure 4-5. Detail CPR use case diagram.

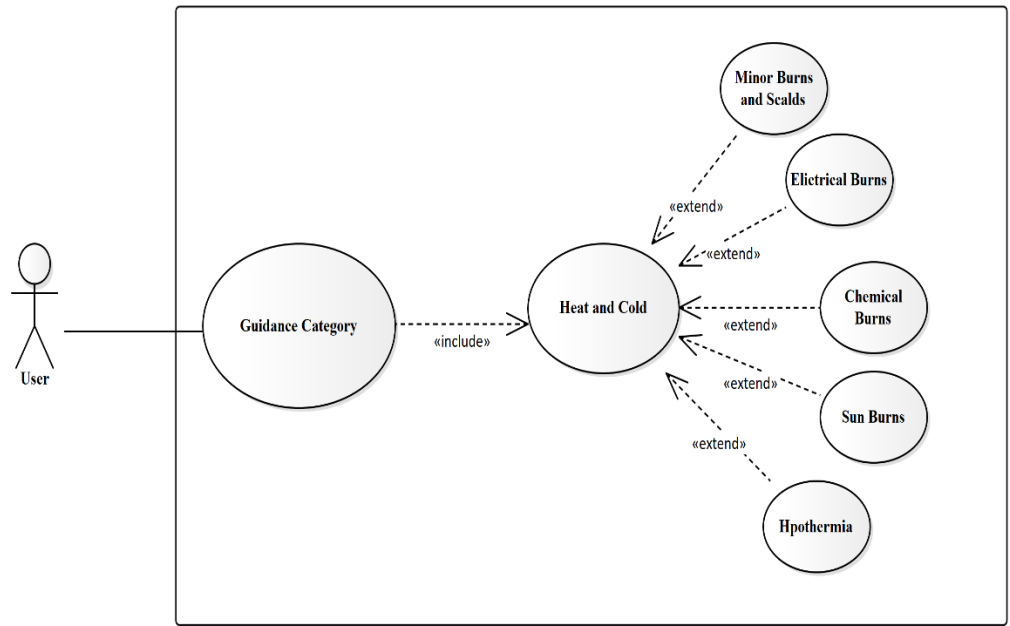


Figure 4-6. Detail Heat and Cold use case diagram.

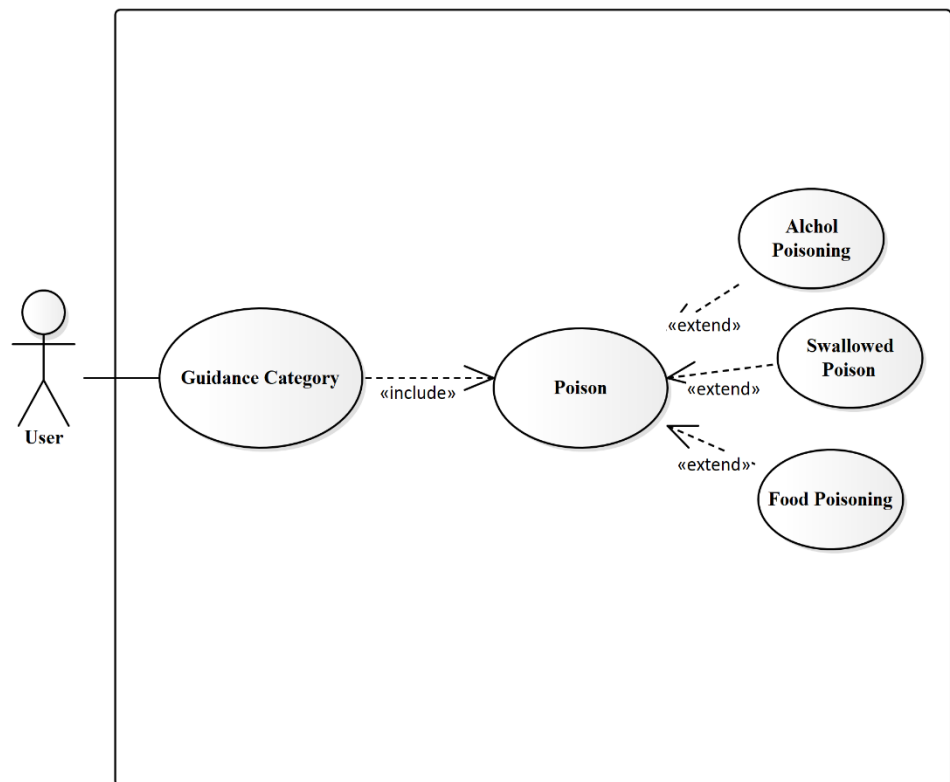


Figure 4-7. Detail Poison use case diagram.

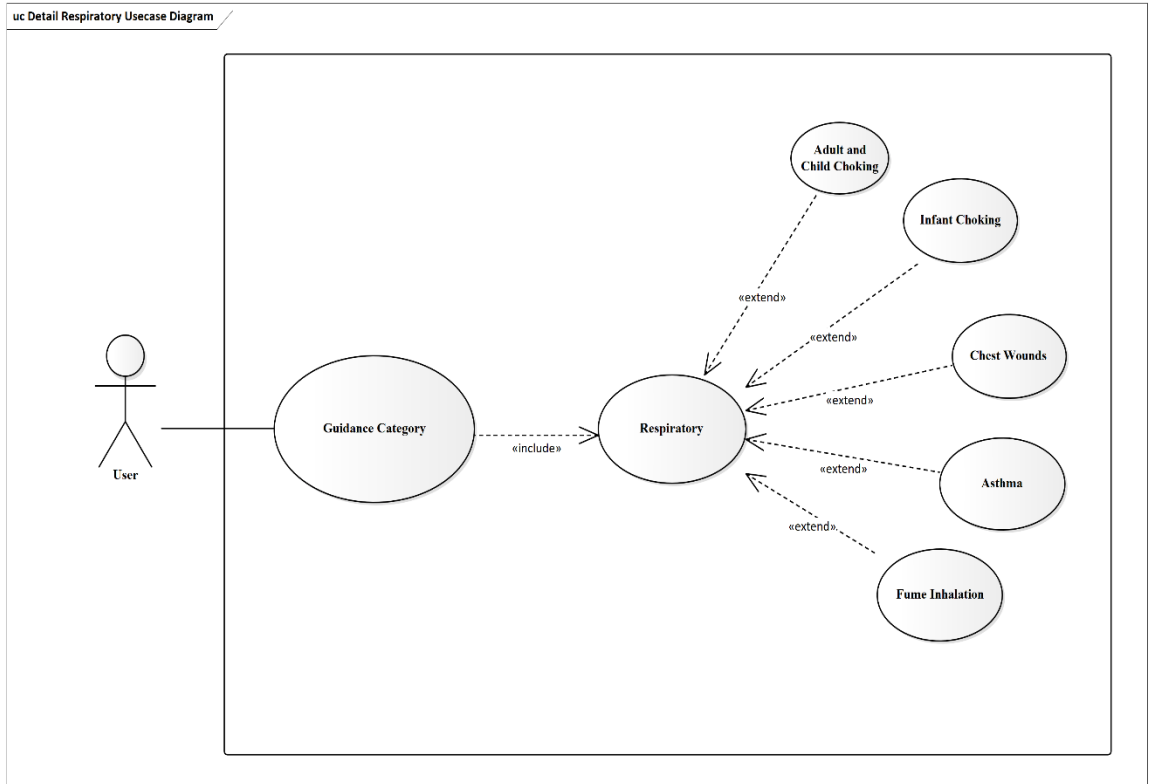


Figure 4-8. Detail Respiratory use case diagram.

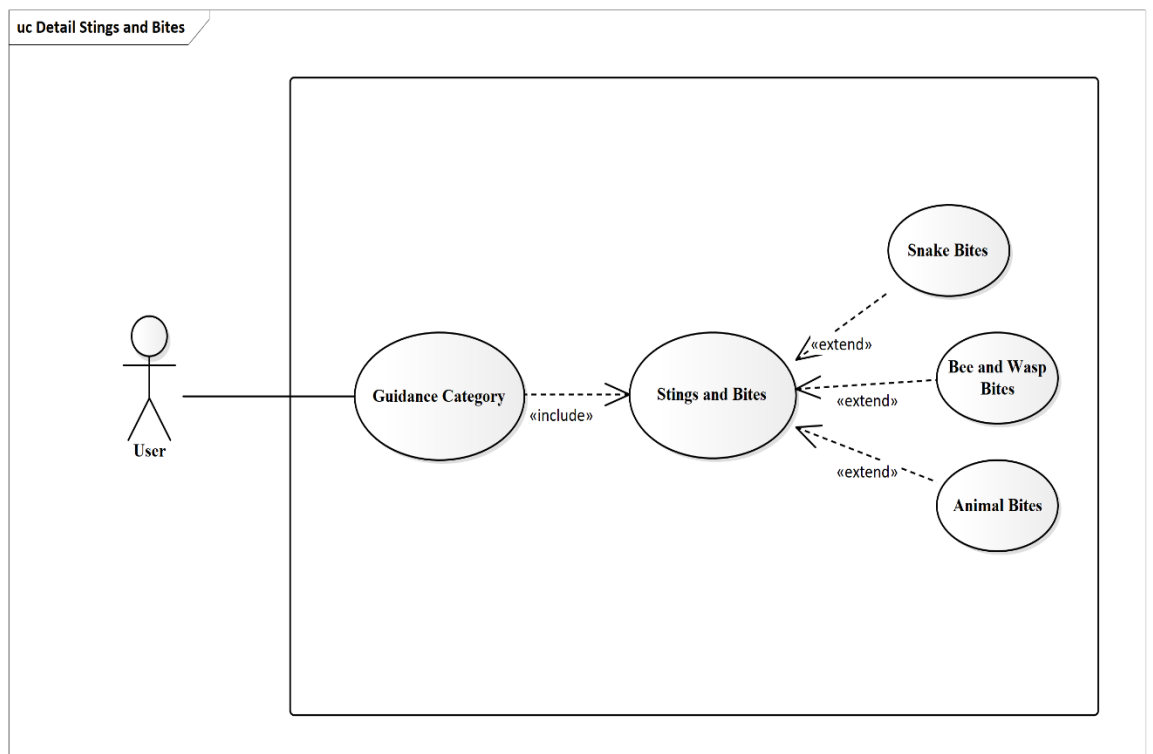


Figure 4-9. Detail Stings and Bites use case diagram.

4.1.2.2 Use Case Description

The use case description is used to detail description of the use case what and how the use case works in order to perform user and system functionality. In this project, we discussed detail use case description as shown table 4.1 to table 4.19 below

Table 4-1. Use case description of selecting language

Use case name	Select Language
Use case number	001
Description	The user selects language for preferred languages.
Actor	User of the application.
Precondition	Start the application.
Normal Flow	<ol style="list-style-type: none">1. User selects language he wants to use.2. User gets service with the language he selected.
Alternative flow	Default language
Post condition	Getting service according to his selection.

Table 4-2. Use case description of guidance category

Use case name	Guidance Category
Use case number	002
Description	The user selects a guidance category he/she wants to use.
Actor	User of the application.
Precondition	Start the application and select language. Start the application. I.e. if application is already installed.

Normal Flow	User selects guidance category. User gets service from the category he selected.
Alternative flow	Back to the home page.
Post condition	Getting service.

Table 4-3. Use case description of guidance information

Use case name	Guidance Information
Use case number	003
Description	The user gets (view) a guidance information.
Actor	User of the application.
Precondition	Selecting guidance category.
Normal Flow	Start the application. Selecting guidance category. Selecting guidance information, he/she wants to access.
Alternative flow	Back to the home page.
Post condition	Getting guidance information service.

Table 4-4. Use case description of emergency call

Use case name	Emergency Call
Use case number	004
Description	The user selects emergency call from navigation bar or simply clicks call button to access emergency call service.
Actor	User of the application.
Precondition	Start the application.

Normal Flow	User fills emergency relative contacts. User access emergency call number that is provided by the application. User clicks call button to make a call.
Alternative flow	Back to the home page.
Post condition	Call service.

Table 4-5. Use case description of save contact

Use case name	Save Contact
Use case number	005
Description	The user saves relative (other) contacts he/she wants to save.
Actor	User of the application.
Precondition	Select Emergency Call.
Normal Flow	Start the application. Select emergency call service. Fill contact saving form. Click save button.
Alternative flow	Back to the home page.
Post condition	Emergency contact number.

Table 4-6. Use case description of know current location

Use case name	Current Location
Use case number	006

Description	The user knows his/her current location.
Actor	User of the application.
Precondition	Start the application.
Normal Flow	Start the application. Click the navigation bar. Turn on mobile data or connect to WIFI. Click the GPS service. Click the location button.
Alternative flow	Back to the home page.
Post condition	Know current location.

Table 4-7. Use case description of search for the nearest hospital

Use case name	Nearest Hospital
Use case number	007
Description	The user search for the nearest.
Actor	User of the application.
Precondition	Start the application.
Normal Flow	Start the application. Click the navigation bar. Turn on mobile data or connect to WIFI. Click the search button.
Alternative flow	Back to the home page.
Post condition	Get the nearest hospital.

4.1.2.3 Use Case Scenario

A use case scenario, or for short scenario, describes a real-world example that shows how the users of the system interact with a system. It describes

the step, event, and/or action which occur during the interaction. Use case scenario can describe in detail how the business rule of the system works; but not it does not indicate how they're performed.

Table 4-8. Use case scenario for select language

Scenario Name	Select Language
Participating Actor	Mr. Ephrem
Initial Assumption	Install application and open the application.
Normal Flow	<ul style="list-style-type: none"> • Mr. Ephrem opens the application. • The application displays language selection starting page. • Mr. Ephrem selects the language he wants to use. • The application starts by the language Mr. Ephrem selected. • End use case.
Alternative Flow	Nothing

Table 4-9. Use case scenario for current location

Scenario Name	Current location
Participating Actor	Mr. Tibebemelecot
Initial Assumption	GPS service should be displayed.
Normal Flow	<ul style="list-style-type: none"> • Mr. Tibebemelecot click the navigation bar. • The application displays navigation bar options (lists). • Mr. Tibebemelecot selects GPS service option. • The application displays GPS service page. • End use case.
Alternative Flow	Nothing

Table 4-10. Use case scenario for car accident

Scenario Name	Car Accident
Participating Actor	Mr. Tadesse
Initial Assumption	Guidance Category should be displayed.
Normal Flow	<ul style="list-style-type: none"> • Mr. Tadesse opens the application. • The application displays home page. • Mr. Tadesse selects the guidance type he wants to use from the guidance category. • The application displays the selected guidance information. • End use case.
Alternative Flow	Back to the home page.

Table 4-11. Use case scenario for emergency call

Scenario Name	Emergency Call
Participating Actor	Mr. Zegeye
Initial Assumption	Emergency call service should be displayed.
Normal Flow	<ul style="list-style-type: none"> • Mr. Zegeye click the navigation bar. • The application displays navigation bar options (lists). • Mr. Zegeye selects Emergency Call service option. • The application displays Emergency Call service page.

	<ul style="list-style-type: none"> • Mr. Zegeye accesses an activity he wants to get. Such as: - calling to emergency number, save either emergency or relative contact and calling to relative contact. • End use case.
Alternative Flow	Back to the home page.

4.2 Object Model

An object model enables the creation of an architectural software or system model prior to development or programming. In our system we use object model like class diagram and data dictionary.

4.2.1 Class Diagram

Class diagrams capture the static structure of Object-Oriented systems, that used to show the structure of a system rather than how they behave. They identify what type of classes there are, how the different class in a system interact to each other.

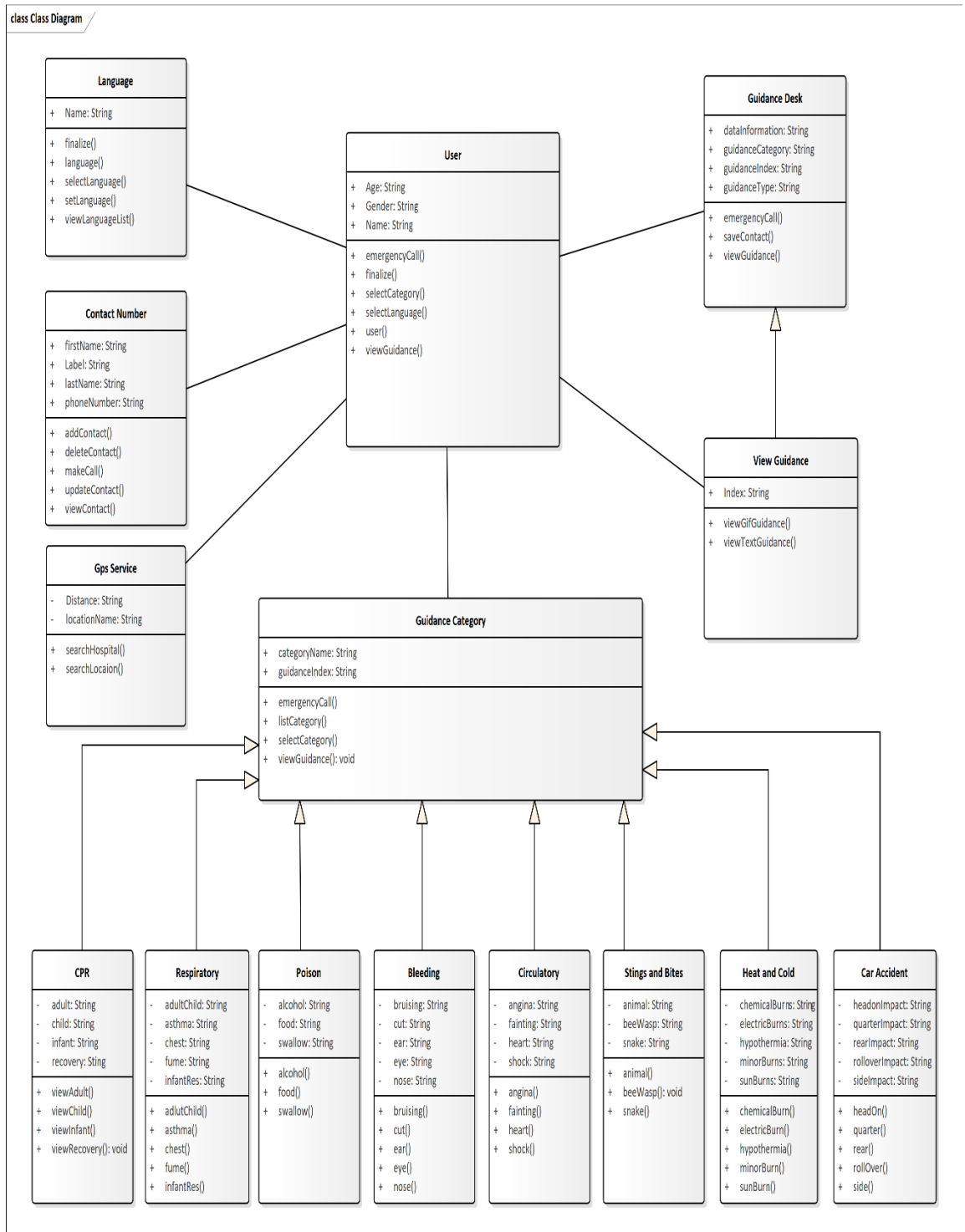


Figure 4-10. Class diagram

4.2.2 Data Dictionary

A data dictionary is a collection of descriptions of the data objects or items in a data model for the benefit of programmers and others who need to refer to them. A first step in analyzing a system of objects which users interact is

to identify each object and its relationship to other objects and for our application, the data dictionary needs to hold the following objects information.

Table 4-12. Contact Number Data Dictionary

Attribute	Data Type	Data Size	Constraint	Description
firstName	String	20	Not Null	Contact number's first name
lastName	String	20	Not Null	Contact number's last name
phoneNumber	String	20	Primary Key	Unique identification for contact number.
Label	String	15	Not Null	Contact's label such as: - mobile, work, home, work fax, home fax, pager, main, no label and other.

Table 4-13. Guidance Desk Data Dictionary

Attribute	Data Type	Data Size	Constraint	Description
dataInformation	String	max	Not Null	Guidance information container.
guidanceCategory	String	20	Not Null	Guidance category container.
guidanceIndex	String	20	Primary Key	Unique identification for guidance desk.
guidanceType	String	15	Not Null	Selected guidance type.

Table 4-14. Guidance Category Data Dictionary

Attribute	Data Type	Data Size	Constraint	Description
categoryName	String	20	Not Null	Contact number's first name
guidanceIndex	String	20	Primary Key	Unique identification for guidance category.

4.3 Dynamic Model

In our system we have used dynamic model to represent the behavior of an object over time. These are sequence diagram, activity diagram, state diagram.

4.3.1 Sequence Diagram

The following sequence diagrams represent the sequence of each functionality of our system.

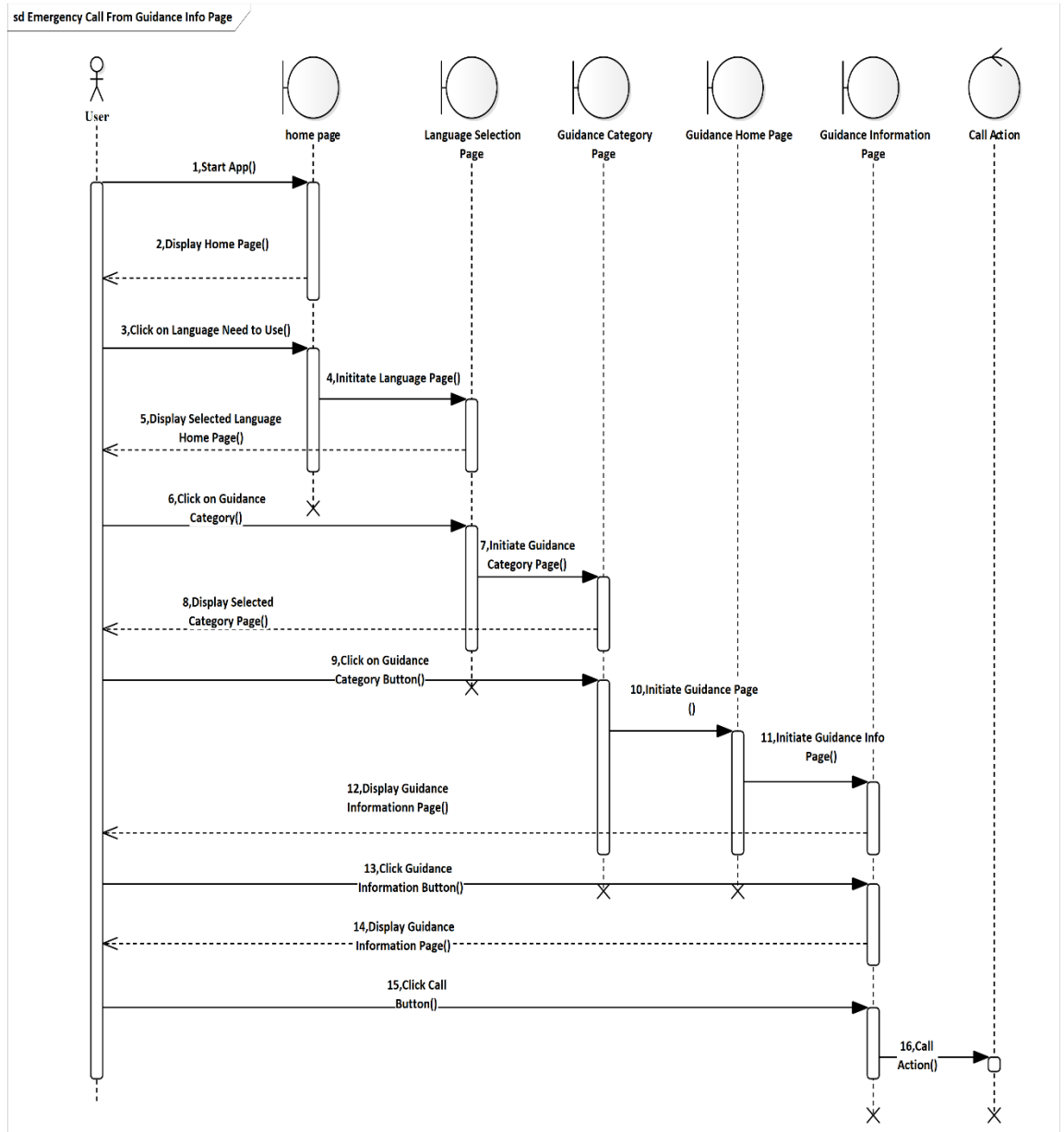


Figure 4-11. Emergency Call from Guidance Information Page Sequence Diagram

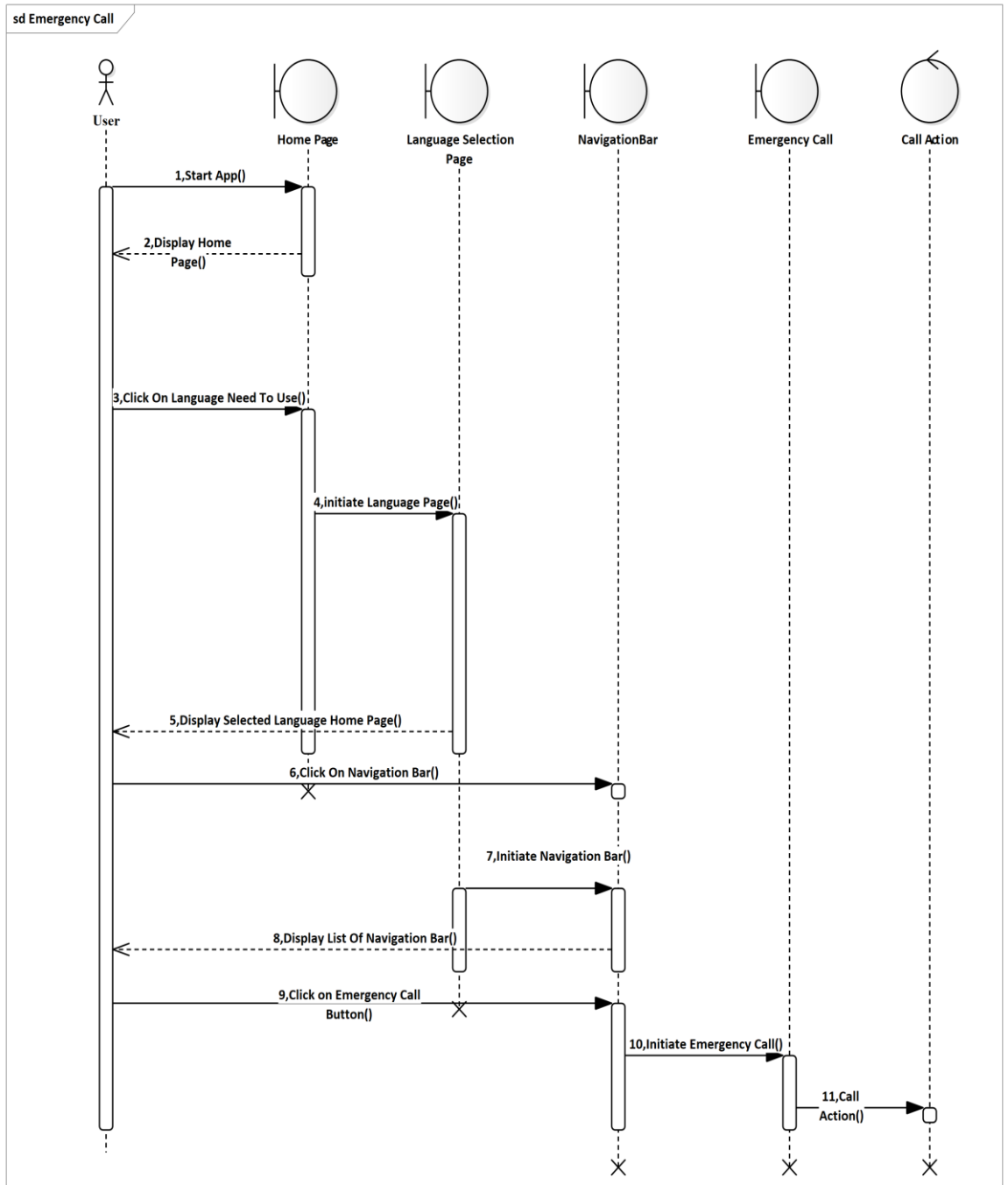


Figure 4-12. Emergency Call Sequence Diagram

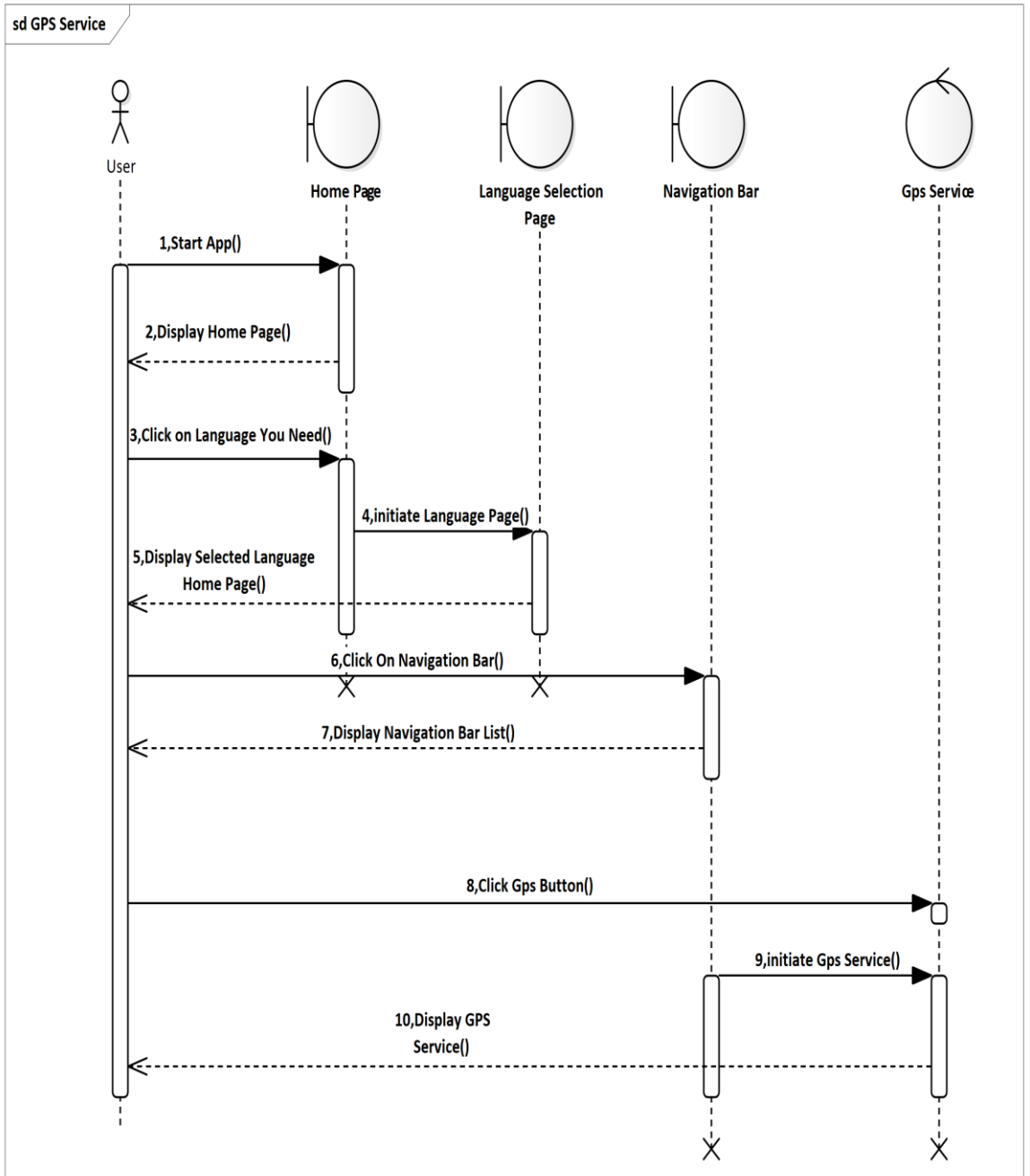


Figure 4-13. GPS Service Sequence Diagram

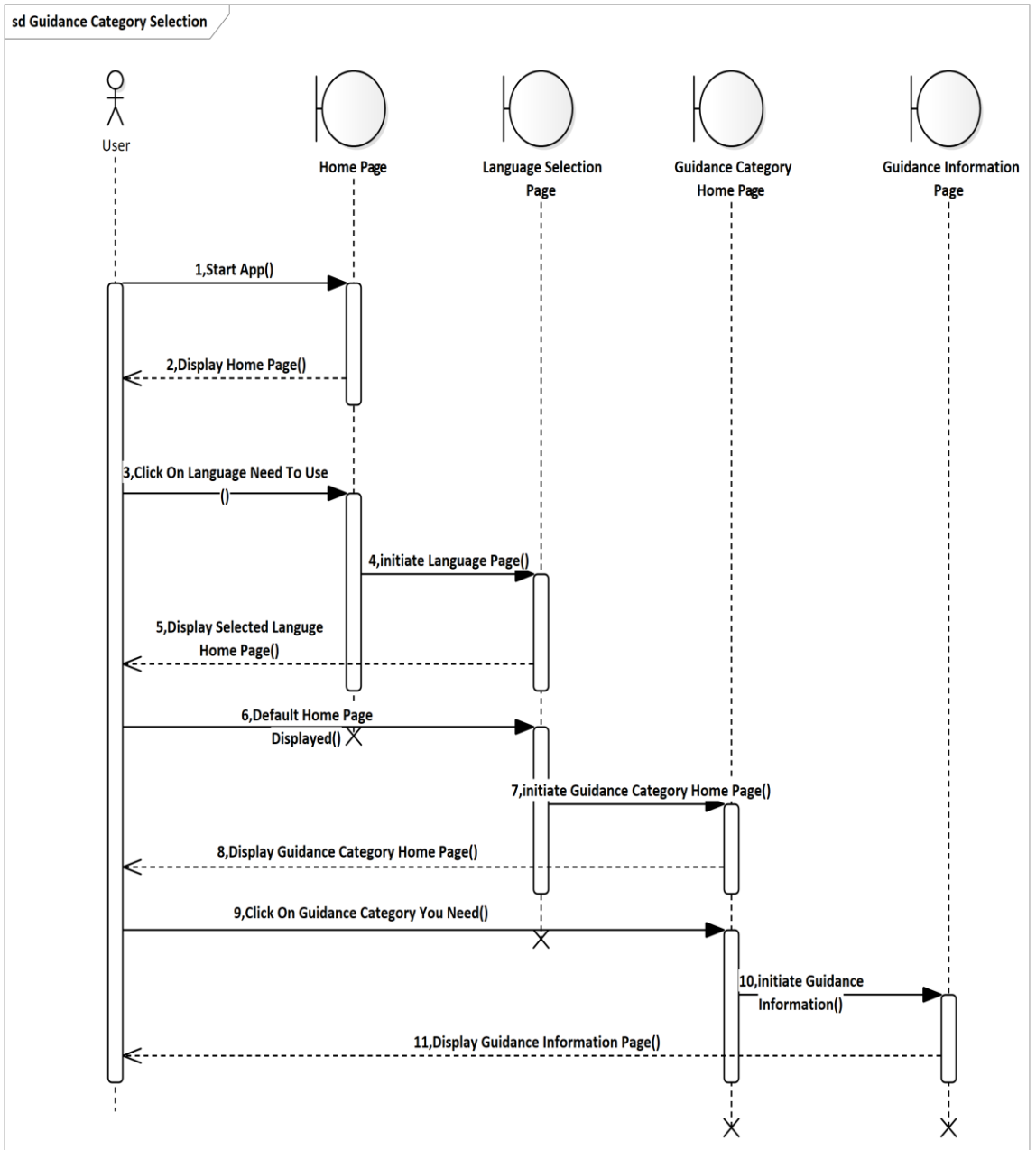


Figure 4-14. Guidance Category Selection Sequence Diagram

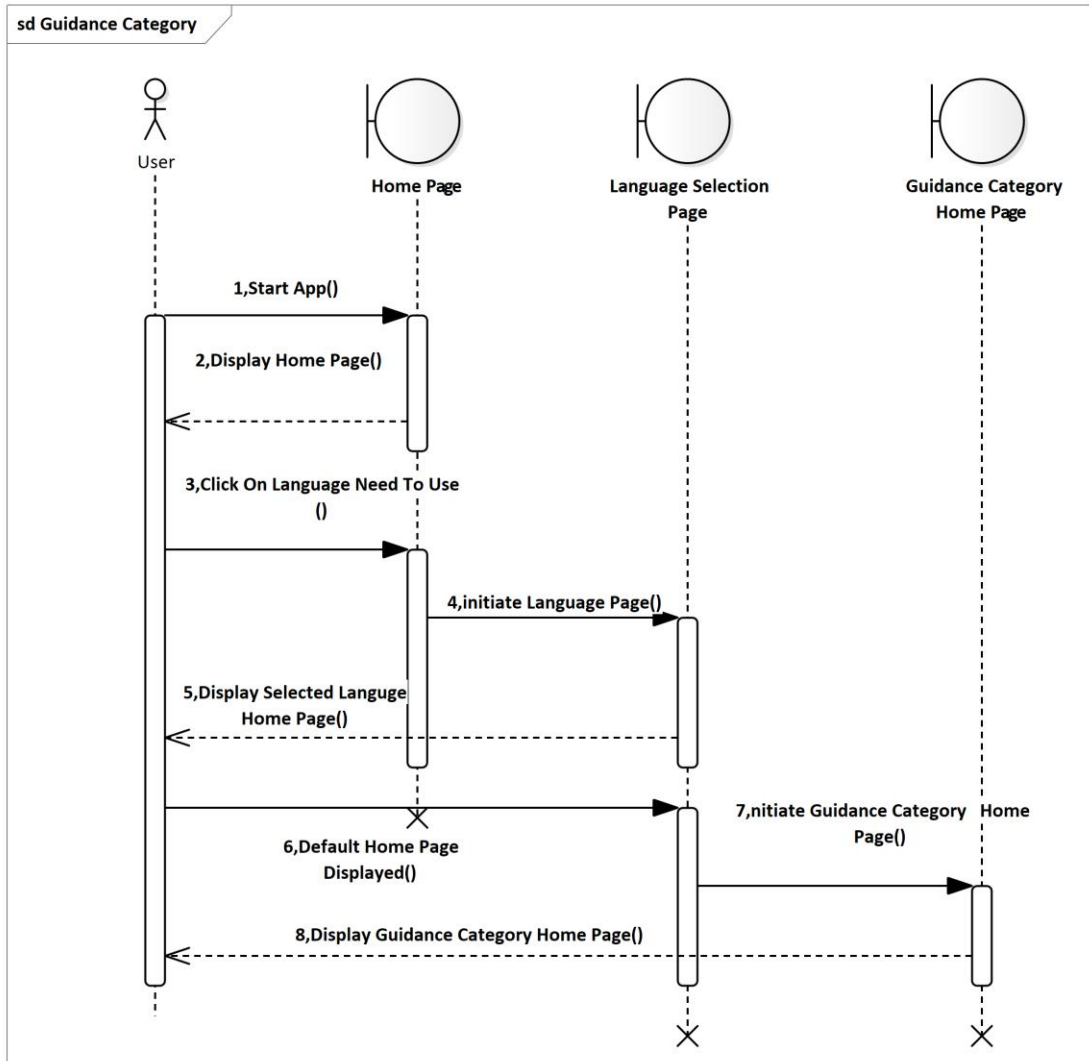


Figure 4-15. Guidance Category Sequence Diagram

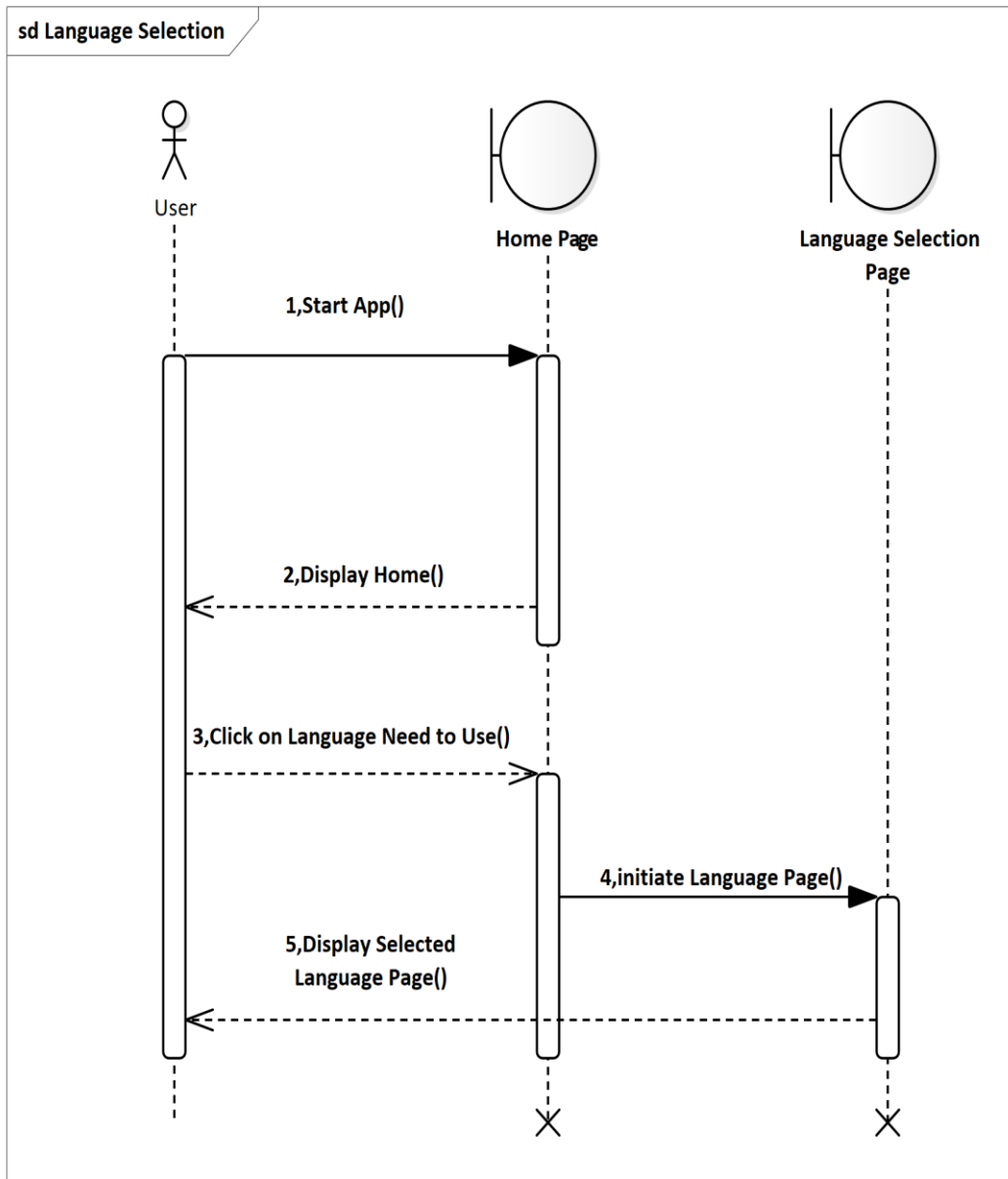


Figure 4-16. Language Selection Sequence Diagram

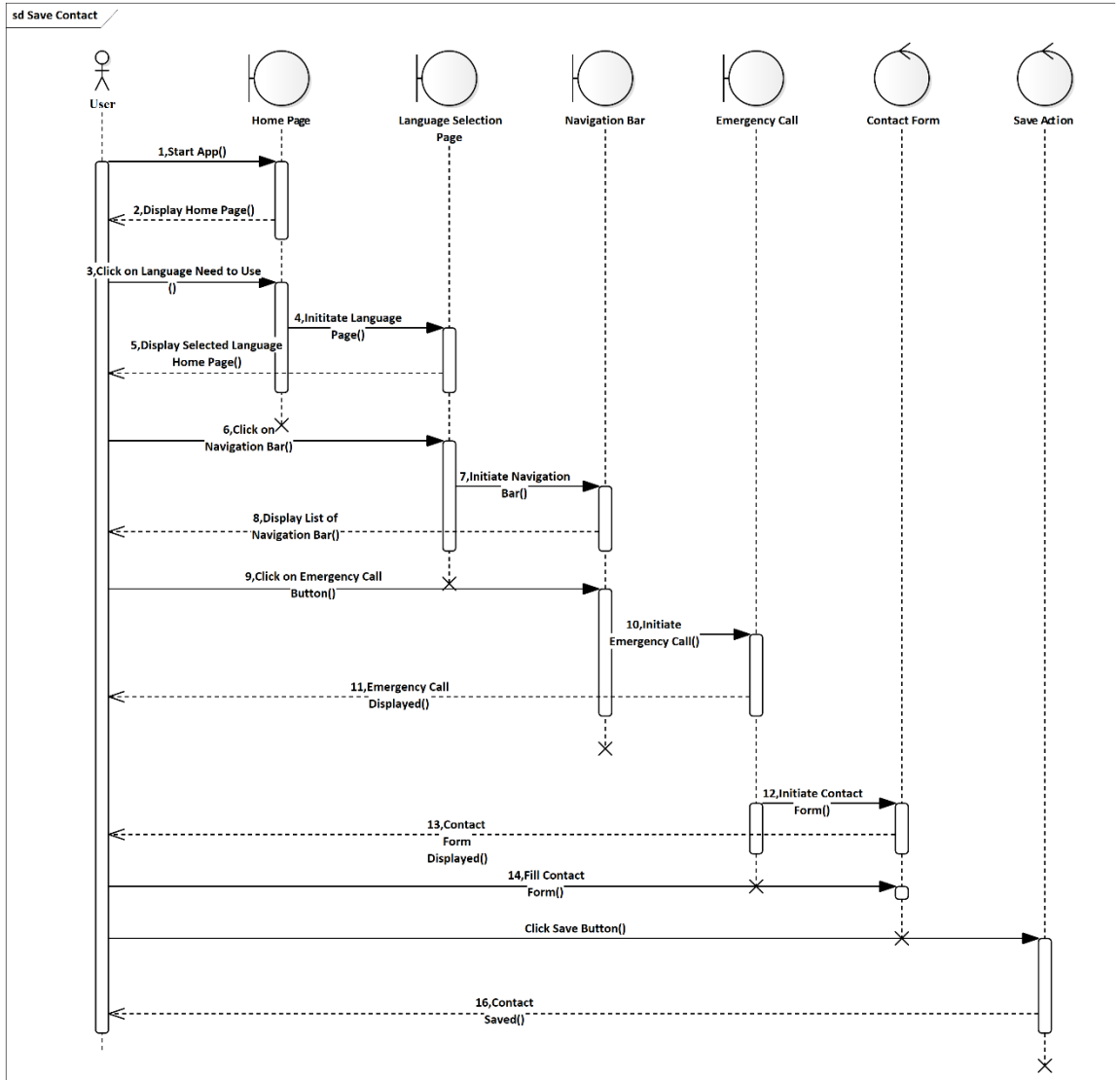


Figure 4-17. Save Contact Sequence Diagram

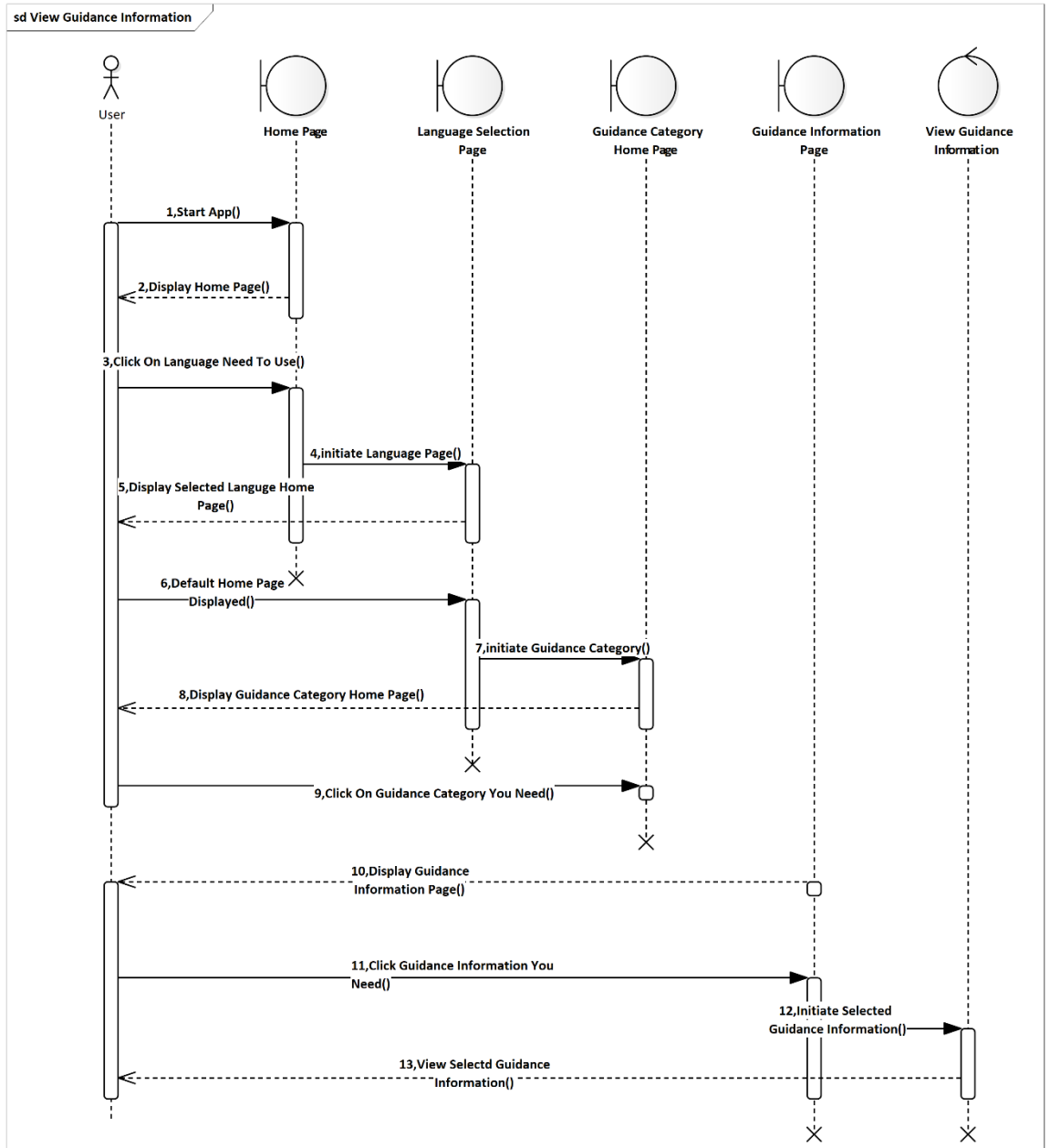


Figure 4-18. View Guidance Information Sequence Diagram

4.3.2 Activity Diagram

Activity diagrams are the object-oriented equivalent of flow charts and data-flow diagrams from structured development. Activity diagrams describe the workflow behavior of a system.

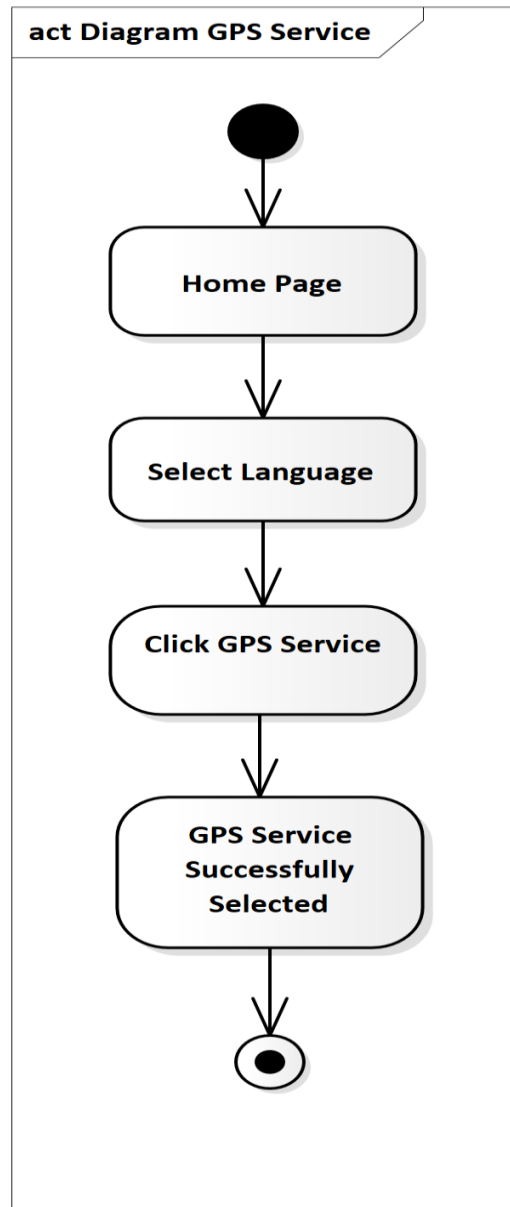


Figure 4-19. GPS Service Activity Diagram

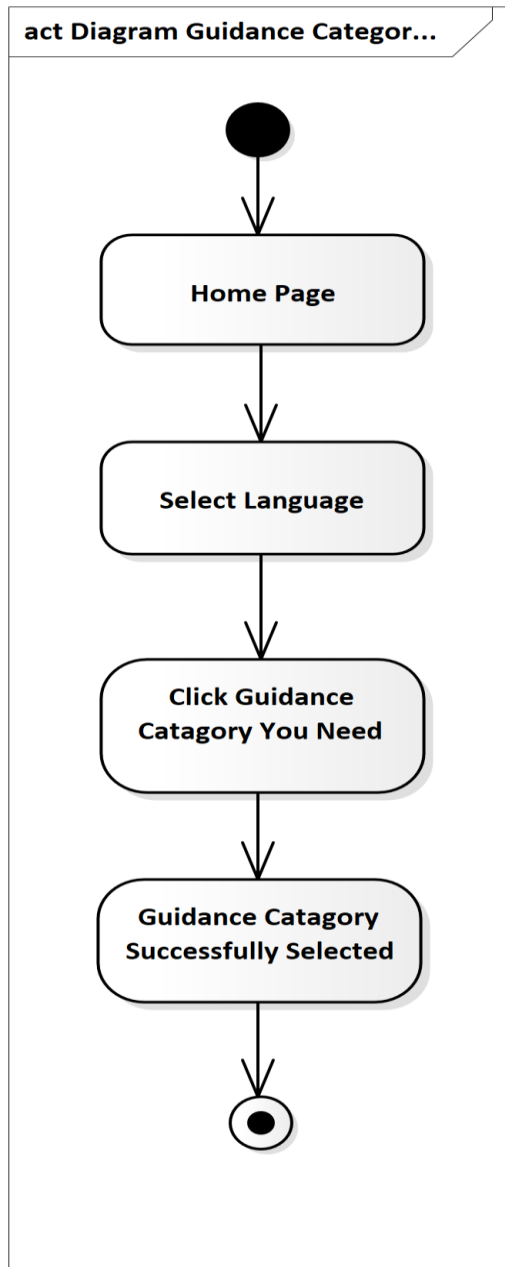


Figure 4-20. Guidance Category Selection Activity Diagram

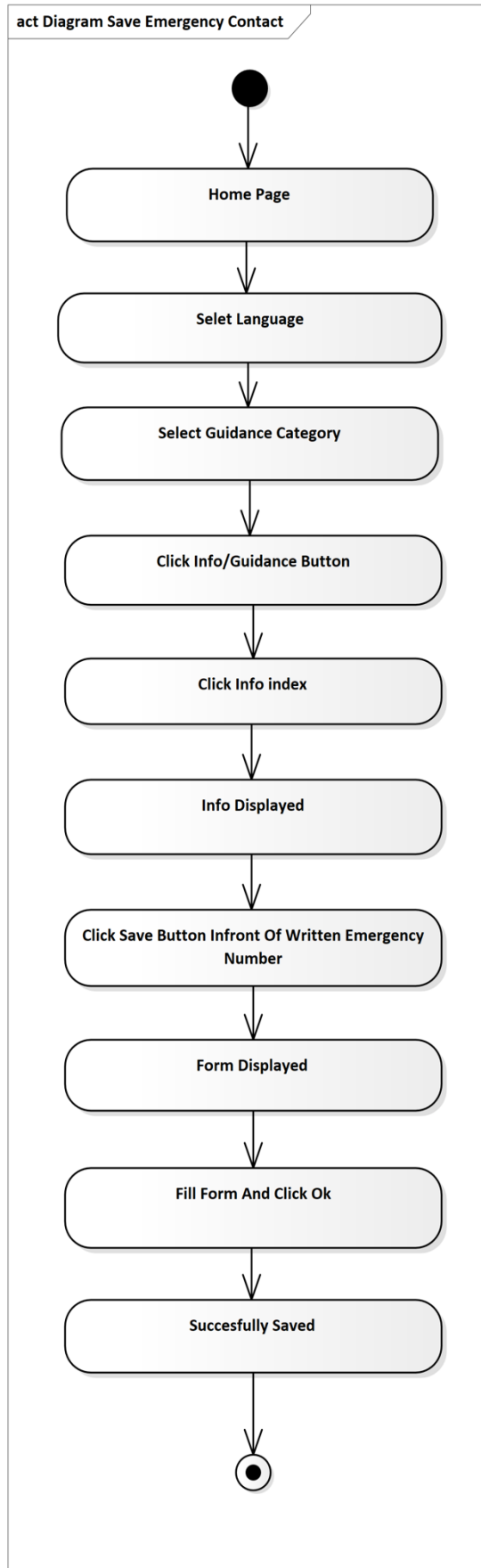


Figure 4-21. Save Emergency Contact Activity Diagram

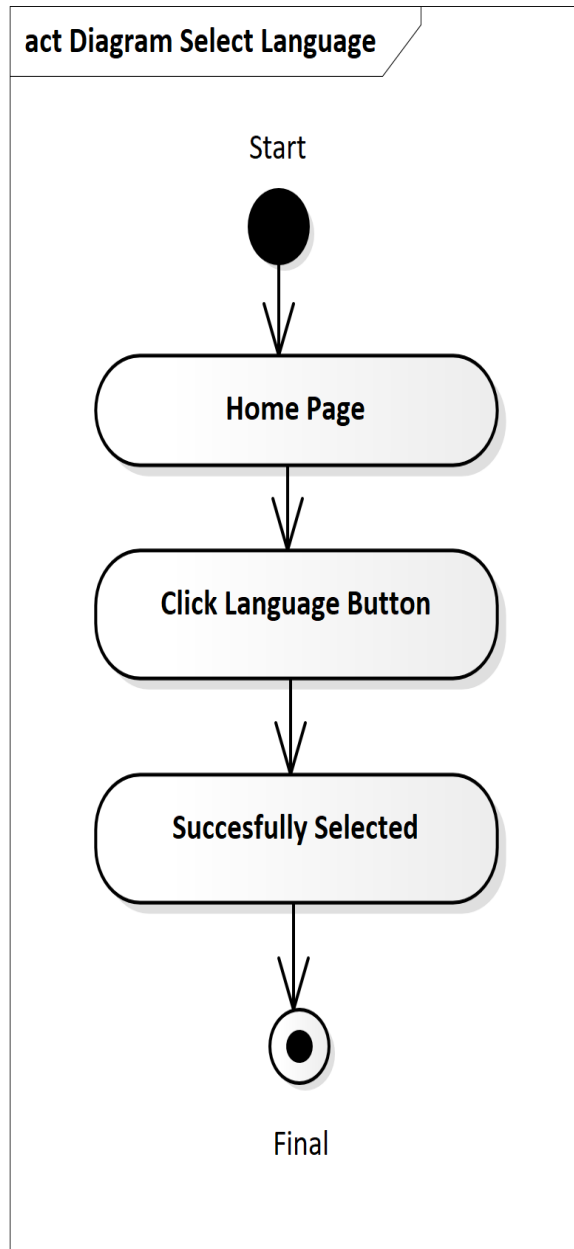


Figure 4-22. Select language Activity Diagram

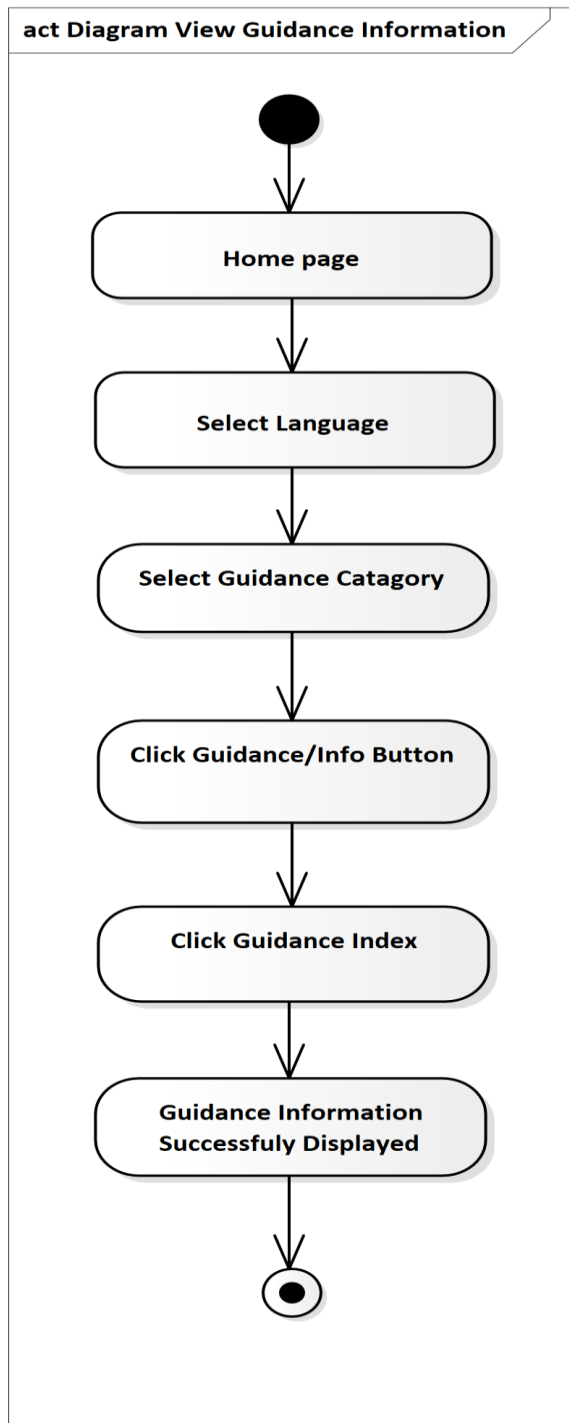


Figure 4-23. View Guidance Information Activity Diagram

4.3.3 State Chart Diagram

A state diagram is type of diagram that describes the behavior of the system. It is essential to understand the instant condition or “run state” of a model when it executes.

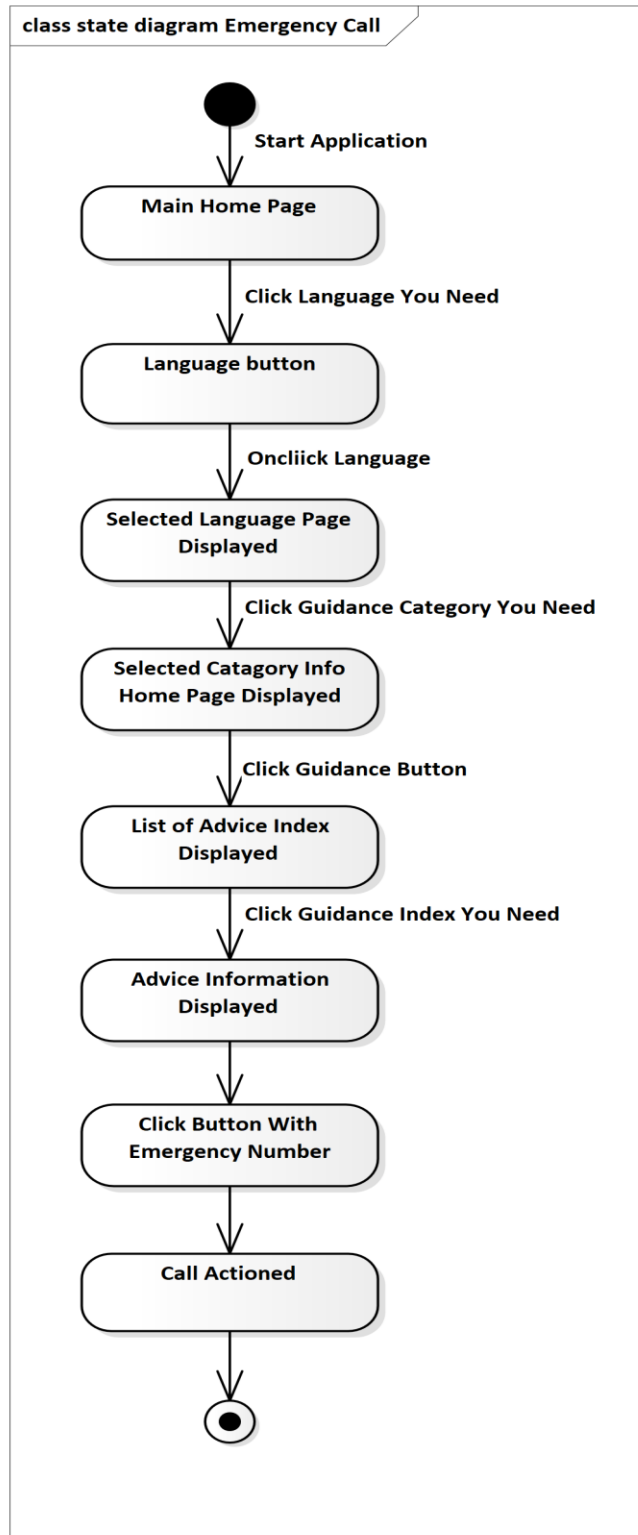


Figure 4-24. Emergency Call State Chart Diagram

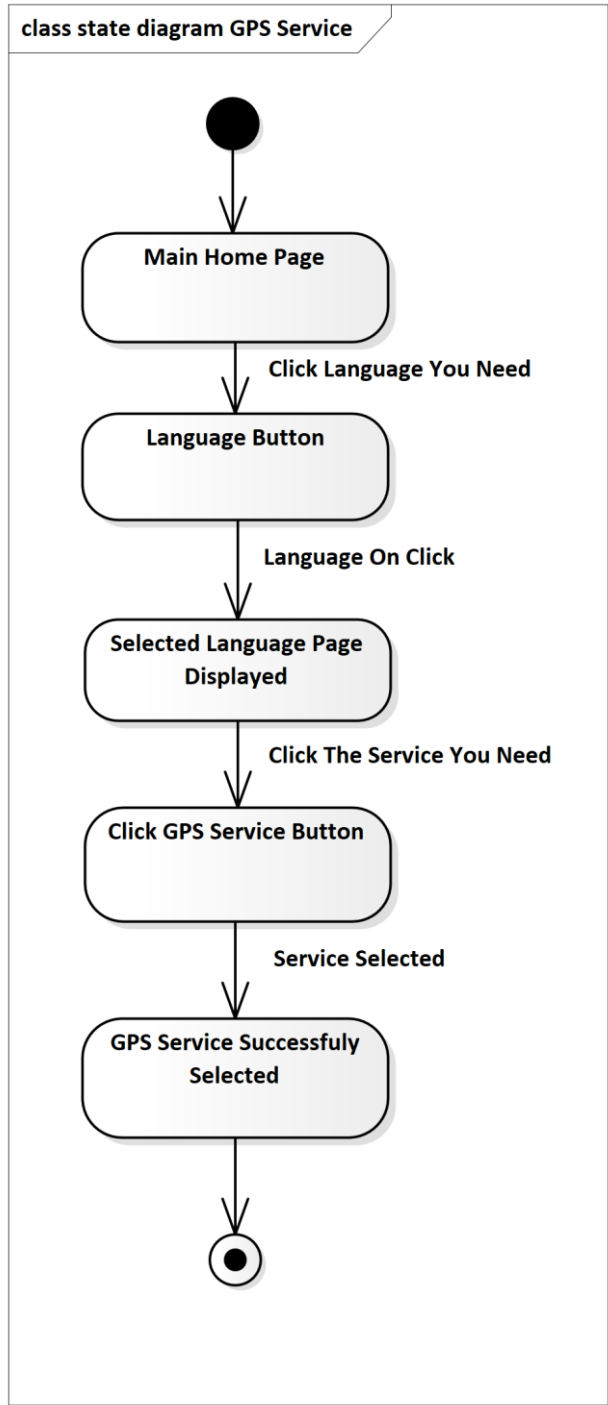


Figure 4-25. GPS Service State Chart Diagram

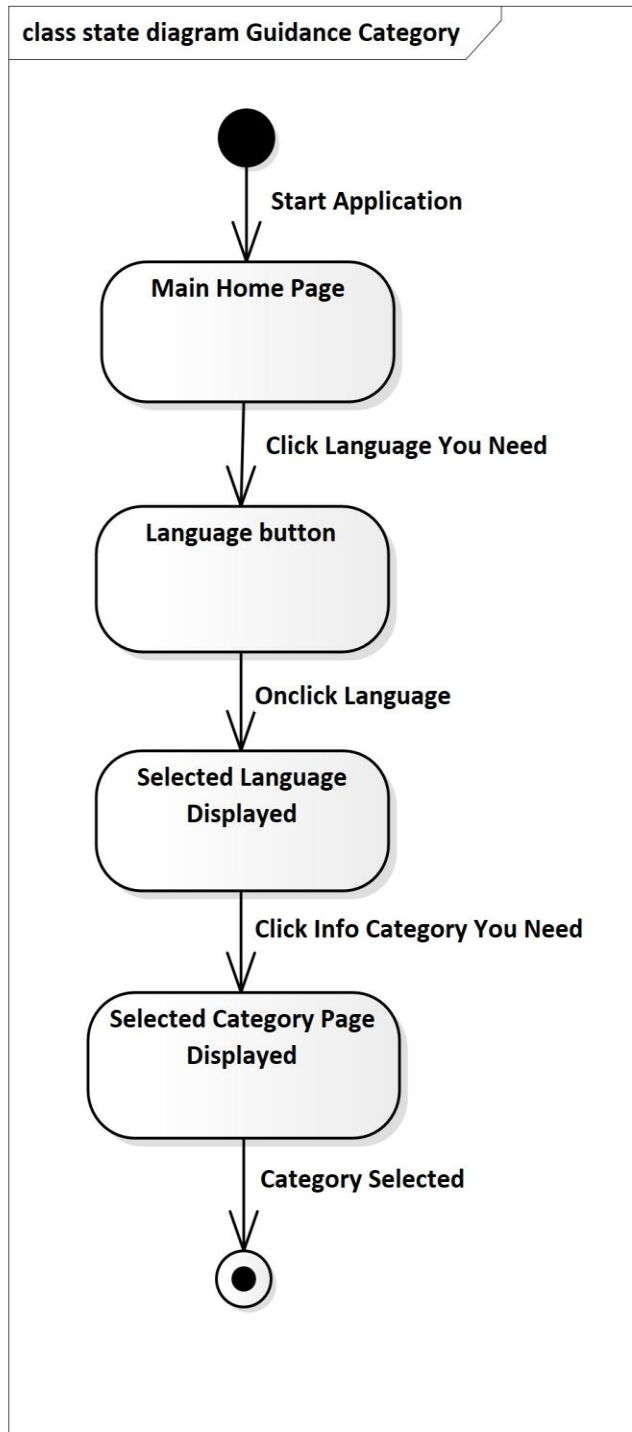


Figure 4-26. Guidance Category State Chart Diagram

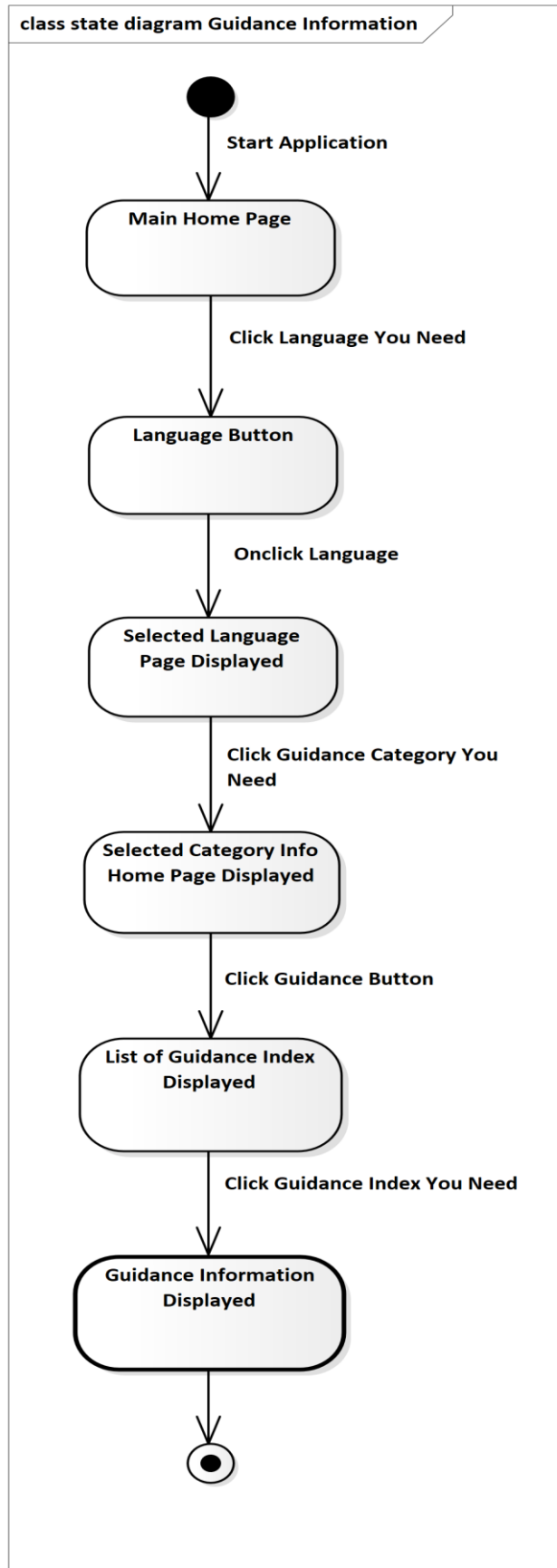


Figure 4-27. Guidance Information State Chart Diagram

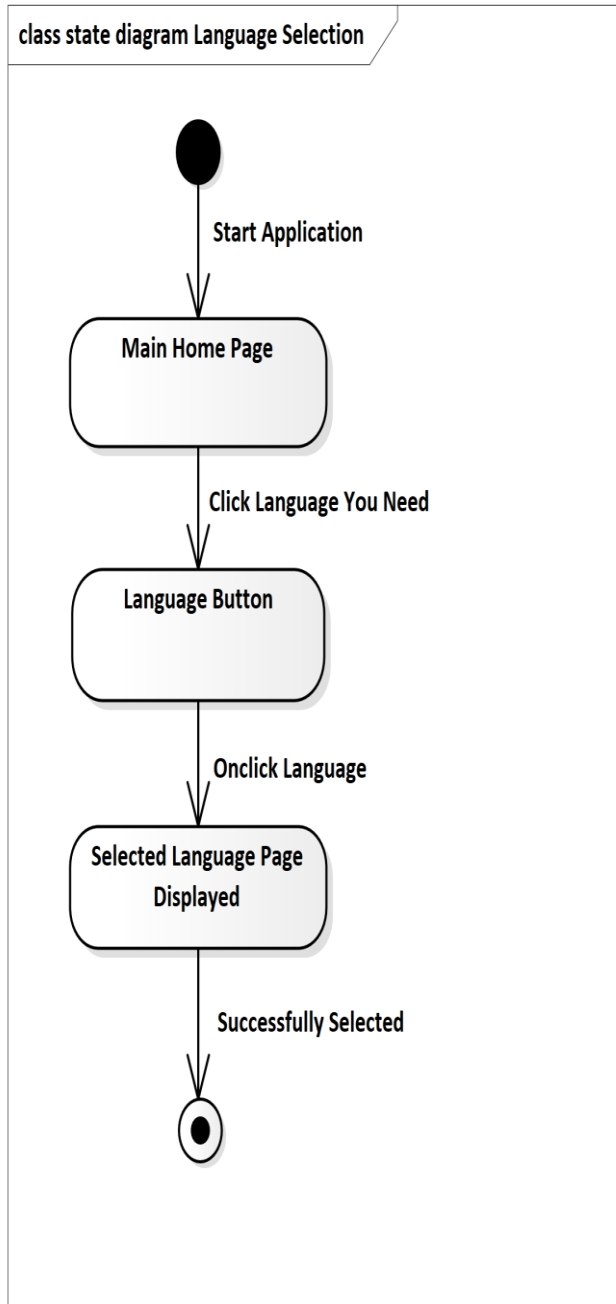


Figure 4-28. Language Selection State Chart Diagram

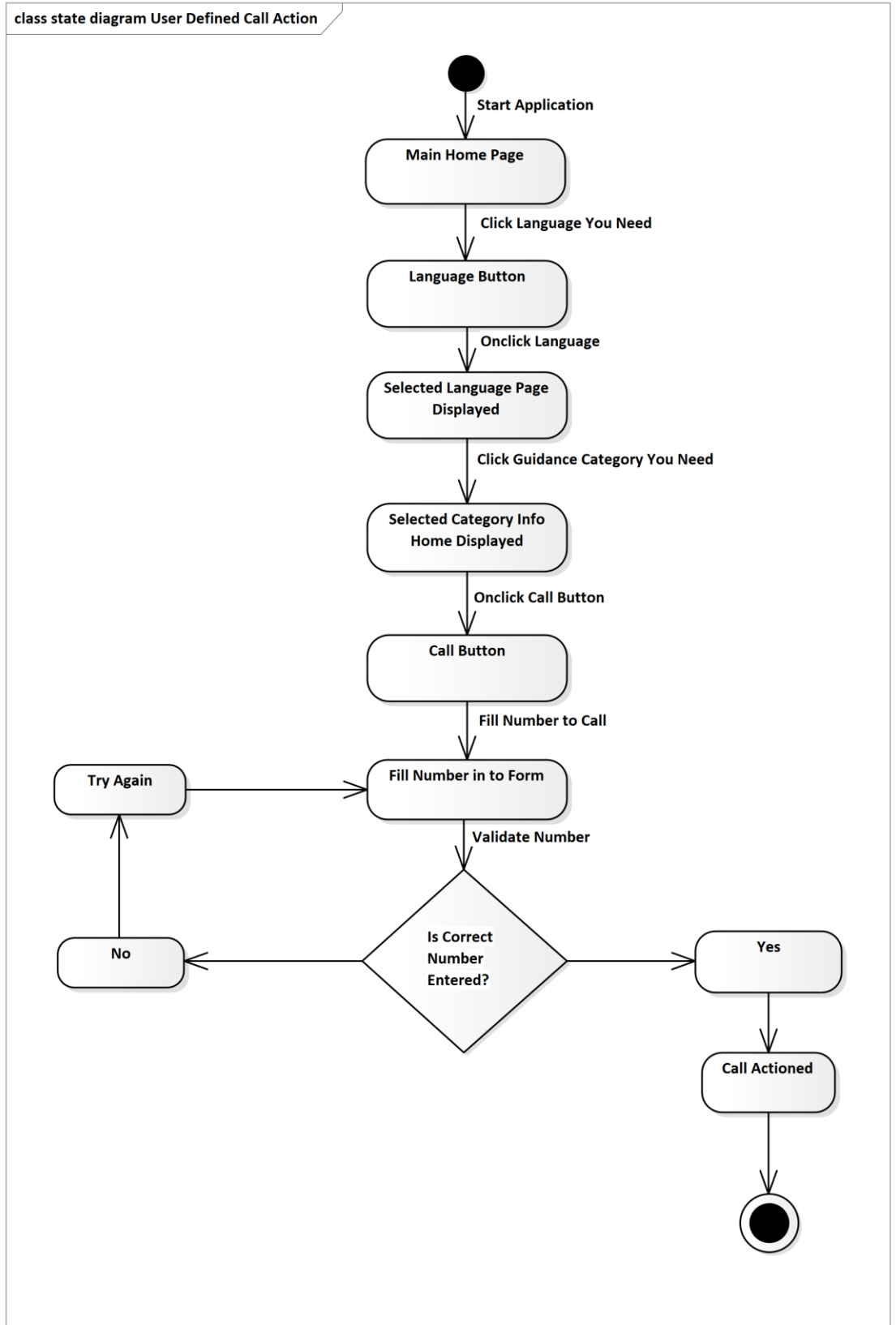


Figure 4-29. User Defined Call Action State Chart Diagram

CHAPTER FIVE

5. SYSTEM DESIGN

This chapter phase describes the current software architecture, proposed software architecture, hardware/software mapping and mapping for each database design, component diagram, and design level deployment, persistent data management etc.

5.1 Design Goals

The goal of designing the proposed application development is mainly to produce a piece of application software that can be used in both Android and iOS phone for the purpose of first aid guidance using understandable language. System design is an important part of an application development process which makes the implementation of the proposed application very easy. The objective of design is to model a high-quality system; the design goals is derived from nonfunctional requirements. The design goals specify the qualities of the system that should be achieved and addressed during the system design.

Some of the criteria which will be considered during the design process is shown below: -

5.1.1 User interface and human factors

The proposed system is user friendly, ease to use and convenient system for everyone who is in need of to use and to get advice/assistance from the application and whoever is using the application can easily interact and access the information without any difficulties.

5.1.2 Performance

The system does perform the task with high performance that every user can use it without to worry about anything and also the system performs its operation without depending specific type of operating system as a result of this users can install the system anytime anyplace where ever it is needed with both a kind of platform they going to use.

- **Response time:** The system should be responsive; these indicates that a maximum number of tasks with minimum time. The proposed

system will fetch different data from the database within few seconds

- **Throughput:** The proposed system will process the customer request within a fixed period (few second).

5.1.3 End User Criteria

The end user criteria specify the qualities of the system from users' point of view.

5.1.4 Usability

Usability is an extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use. The system shall be designed and developed in such a way that it is easily understood and used by any mobile phone user. Its layout needs to match the layout the user is familiar with. Moreover, it shall also be more users friendly by providing guidelines and appropriate messages when an error occurs. Users can be able to use it easily and in addition since it uses different language that user knows well it is widely usable by Ethiopian people.

5.1.5 Cost

The proposed application perfectly reduces the cost of user payment for the material in manual system of assisting first aids. Also, it reduces cost of user since it doesn't require network connection unlike the current some mobile application.

5.1.6 Maintenance Criteria

The maintenance criteria determine and discuss the difficulties that the system of that the system might face while being in use. The question of adding components to the system and modifiability are the ones to be considered in the maintenance criteria.

- **Modifiability:** - The application needs to be easily modifiable. It shall enable any change in its design and configuration with minimum effort whenever the need arises and this all reached through the help of manual documentation.

- **Extensibility:** The application needs to be easily extendible. If it is needed to add new functionality, it is achieved by integrating the new functionality to the existing system.
- **Portability:** The proposed system is developed to provide service in any smartphones regardless of their version and platform. The system works in any Android or iOS smartphone environment. In addition, the system can also be installed in a computer that have a mobile emulator (such as Blue stack).

5.1.7 Dependability criteria

Dependability criteria off a system deal with the system crashes and dealing with availability is one of these criteria.

- **Availability:** - As the application is designed to work on mobile devices, it should always be active and functioning until the battery life ends. And also, as long as there is an internet connection the system will be available always.
- **Reliability:** - the system provides a reliable information which is presented on both Android and iOS, and this is maintained by mongo DB. The proposed system provides a standard guidance about first aid.

5.2 Current System Architecture

The current system is paper based system that is unorganized and currently there is no software architecture which represents the way of this first aid guidance to the people and also currently, there are different applications which serve as first aid applications, but the major limitations of such application is that needs internet connection. The system architecture of currently available mobile is shown below:

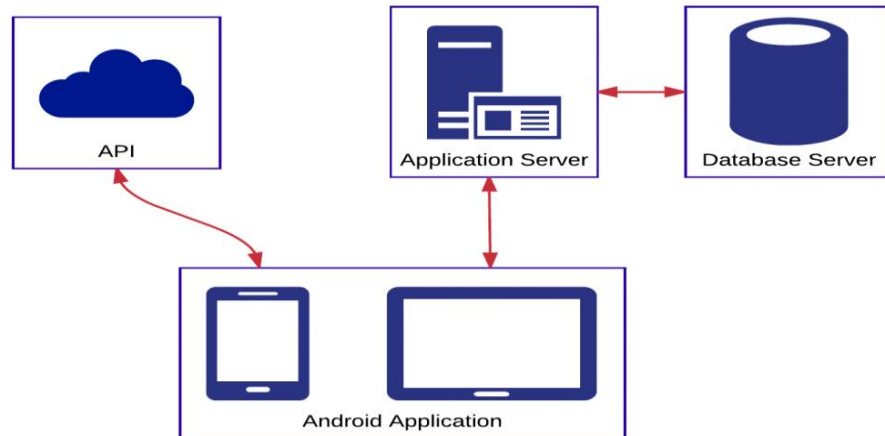


Figure 5-1. Current System Architecture

The above UI shows currently existing system architecture in which most of available mobile application works.

5.3 Proposed System Architecture

The proposed system consists of three-tier architecture that organizes application into three logical and physical computing tiers; namely, these are presentation tier, or user interface; the application tier, where data is processed; and the data tier, where the data associated with the application is stored and managed. The presentation tier is the user interface and communication layer of the application, where the end user interacts with the application. Its main purpose is to display information and to collect information from the user. The application tier, is also known as the logical tier or middle tier, is the heart of the application. For example, when user wants to either watch GIF based guidance information or save emergency contact; he/she either click play button or save button to perform the action. Logic tier or middle tier is application layer which interacts with data layer and sends information retrieved from database to the presentation layer. The data tier, sometimes called database tier, data access tier or back-end, is where the information processed by the application is stored and managed. The proposed system architecture is shown below:

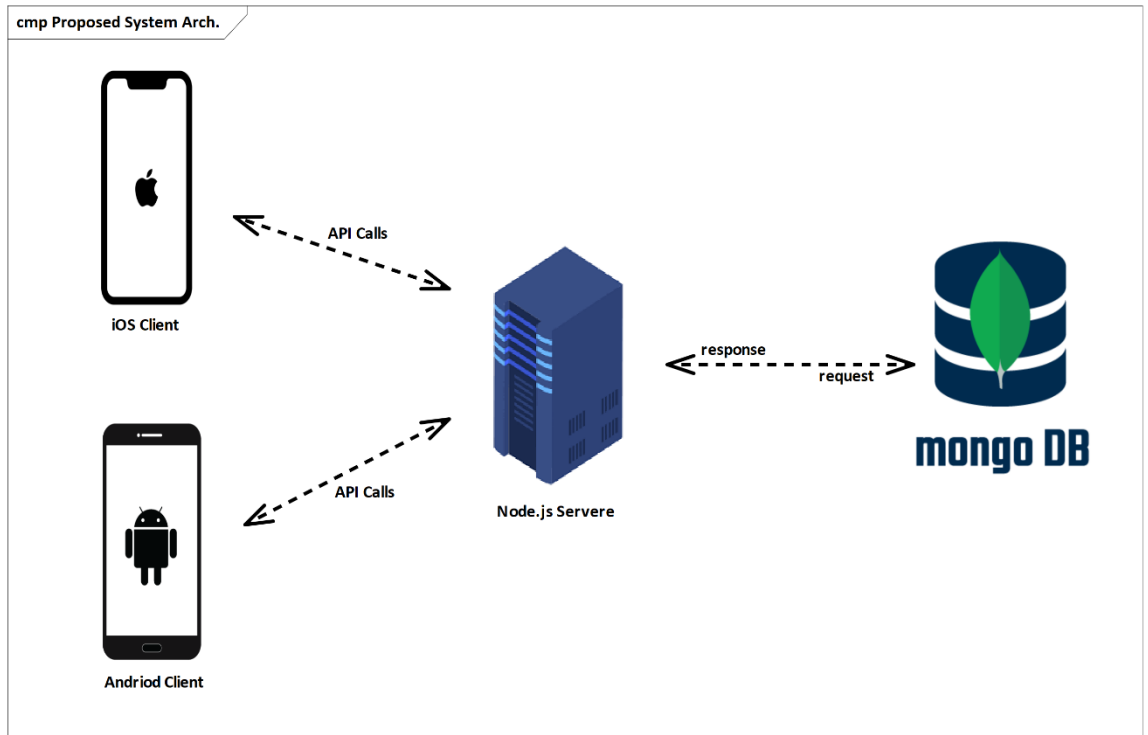


Figure 5-2. Proposed System Architecture

5.3.1 Subsystem Decomposition and Description

In this phase the whole application/system will be decomposed into its components sub-systems or sub-application, analyzing separately and then aggregating them back into complete system.

- **Languages selection sub-system:** - In this sub-system the user needs to select his/her relevant language to interact with the application through understandable input and output
- **Guidance category sub-system:** - In this sub-system the user needs to select information category he/she needs to access from the application and this sub-system information categories are like CPR, Car accident, Poison, Bleeding, Stings and Bites, and circulatory will be included.
- **Call sub-system:** - In this sub-system the user of the application needs to enter either emergency number or his/her relative phone to call.

- **Save contact sub-system:** - In this sub-system the user of the application opens information page and save the emergency number from advice page to nearby contacts.
- **GPS service sub-system:** - In this sub-system the user of the application opens the GPS service and get the access to know their current location and able to find the nearest health care centers.

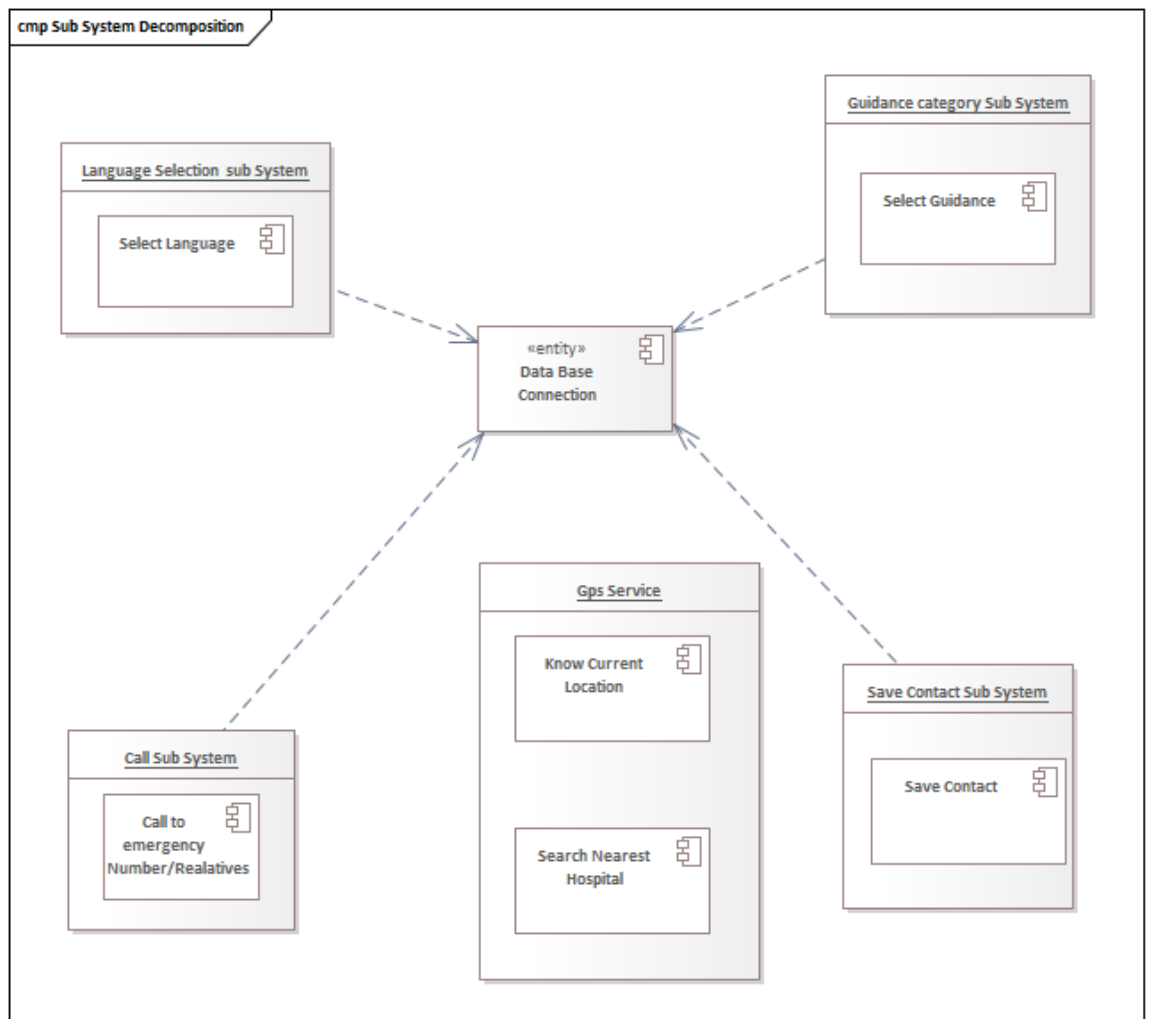


Figure 5-3. Subsystem Decomposition

5.3.2 Hardware/Software Mapping

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

connect the disparate machines to one another. You want to create a deployment diagram for applications that are deployed to several machines. It also shows how the software and the hardware components work together.

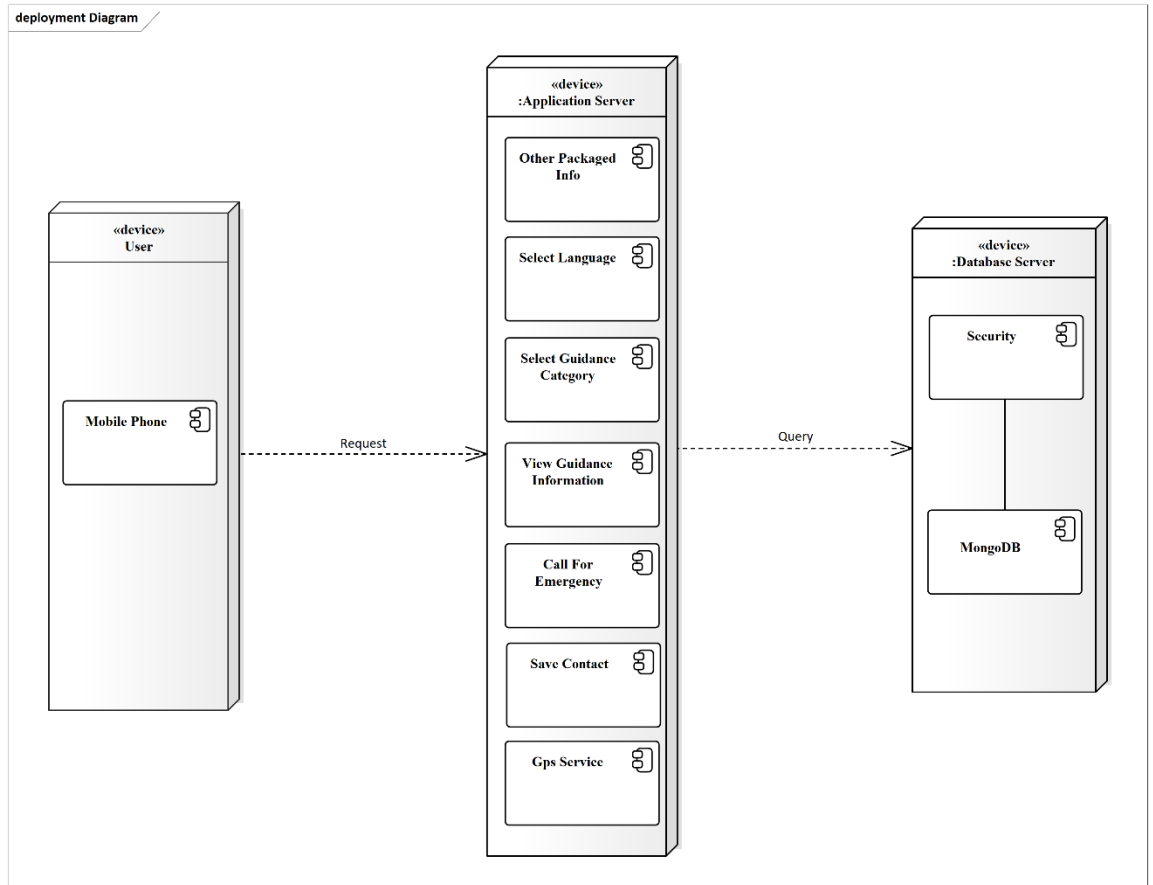


Figure 5-4. Deployment Diagram

5.3.3 Detail Class Diagram

In the detail class diagram, we have included attributes, methods, association, roles, dependency and multiplicity (cardinality and optimality) of our system. The following table shows the detail class diagram of our system.

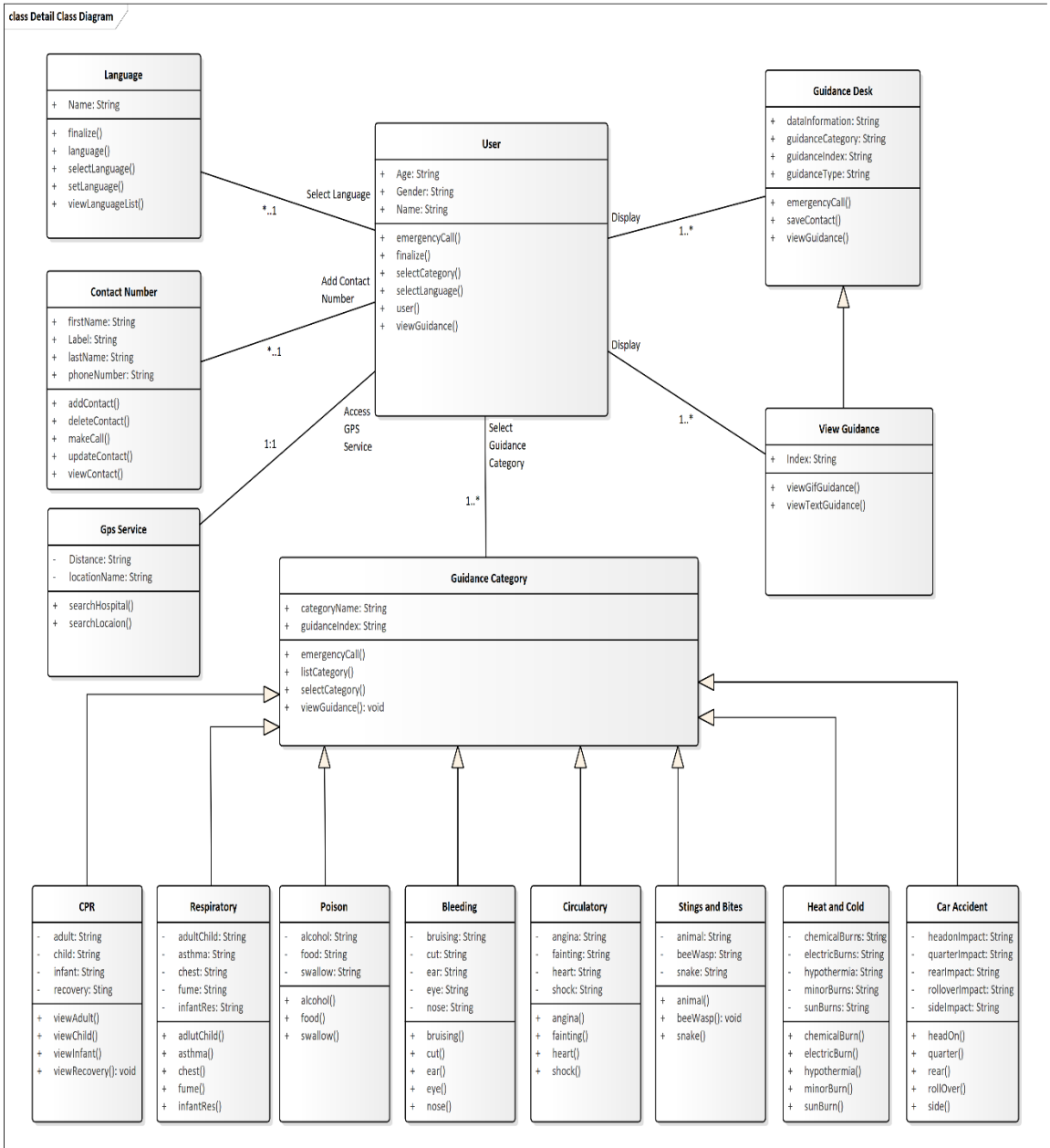


Figure 5-5. Detail Class Diagram

5.3.4 Persistent Data Management

In this particular project we have used persistent data management (persistent modeling) to describe the persistent data aspect of the system. The following figure indicates the persistent data management of the system.

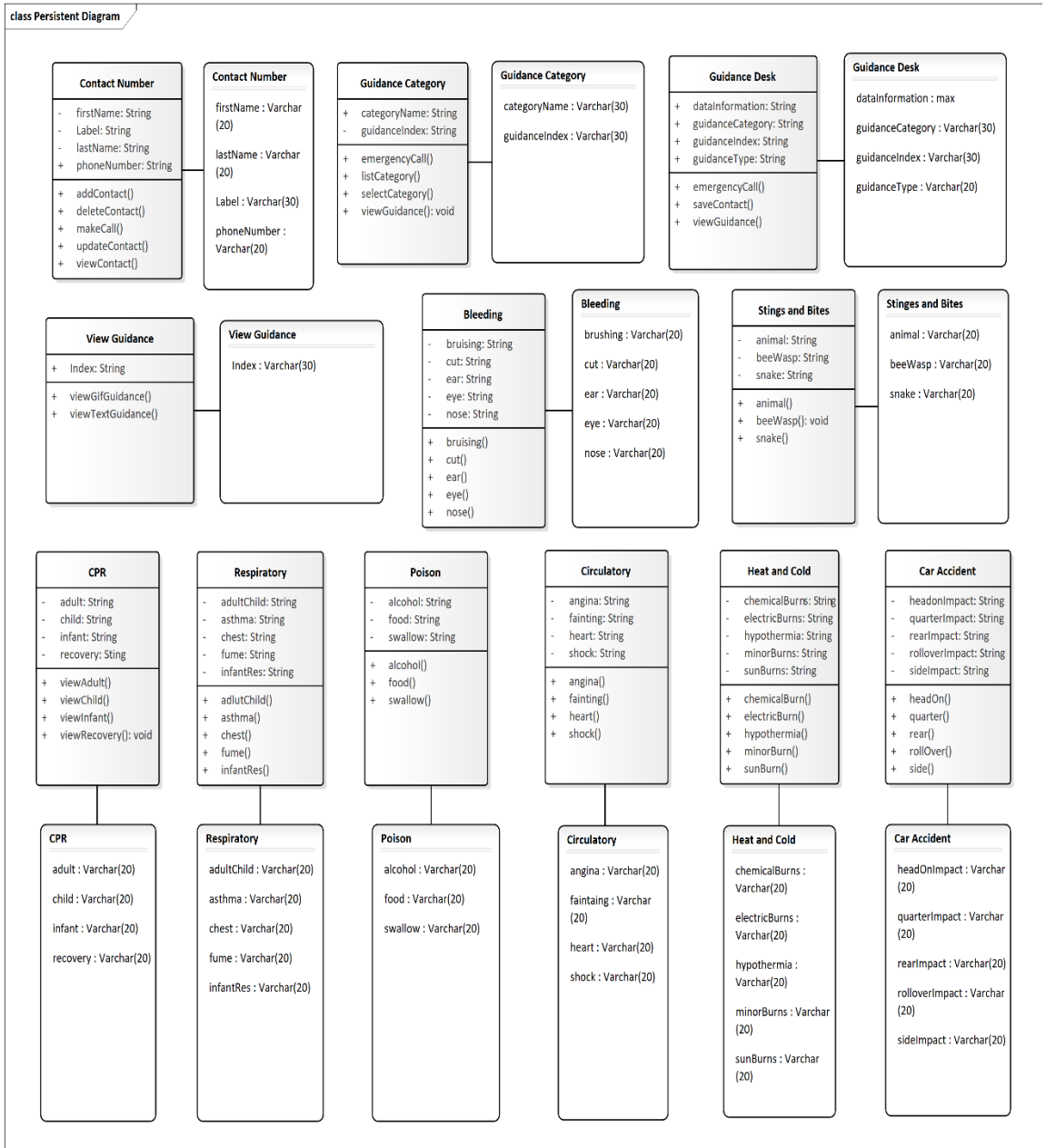


Figure 5-6. Persistent Diagram

5.3.5 Access Control and Security

Access control is just letting the right person to access the application functionality and in the proposed system (First Aid Guidance Application which is bilingual (English and Amharic)). Since, it is an application developed for everyone who uses smart phone and has interest to know and learn about first aid guidance and how to use first aid guidance. It does not need to divide the access privileges in between the users of the application so its access privilege is equal for every users of the application.

- **User Privilege:** the users of the system should have to install the application in order to use it. They have a privilege to access the system functionalities that are provided for the users of the system.
- **Security:** the system secures that any change to system can be only made by the system administrator.

5.4 Packages

Packages organize classes that belong to the same category or provide similar functionality. In our system we have categorized packages into different category as shown in the figure below:

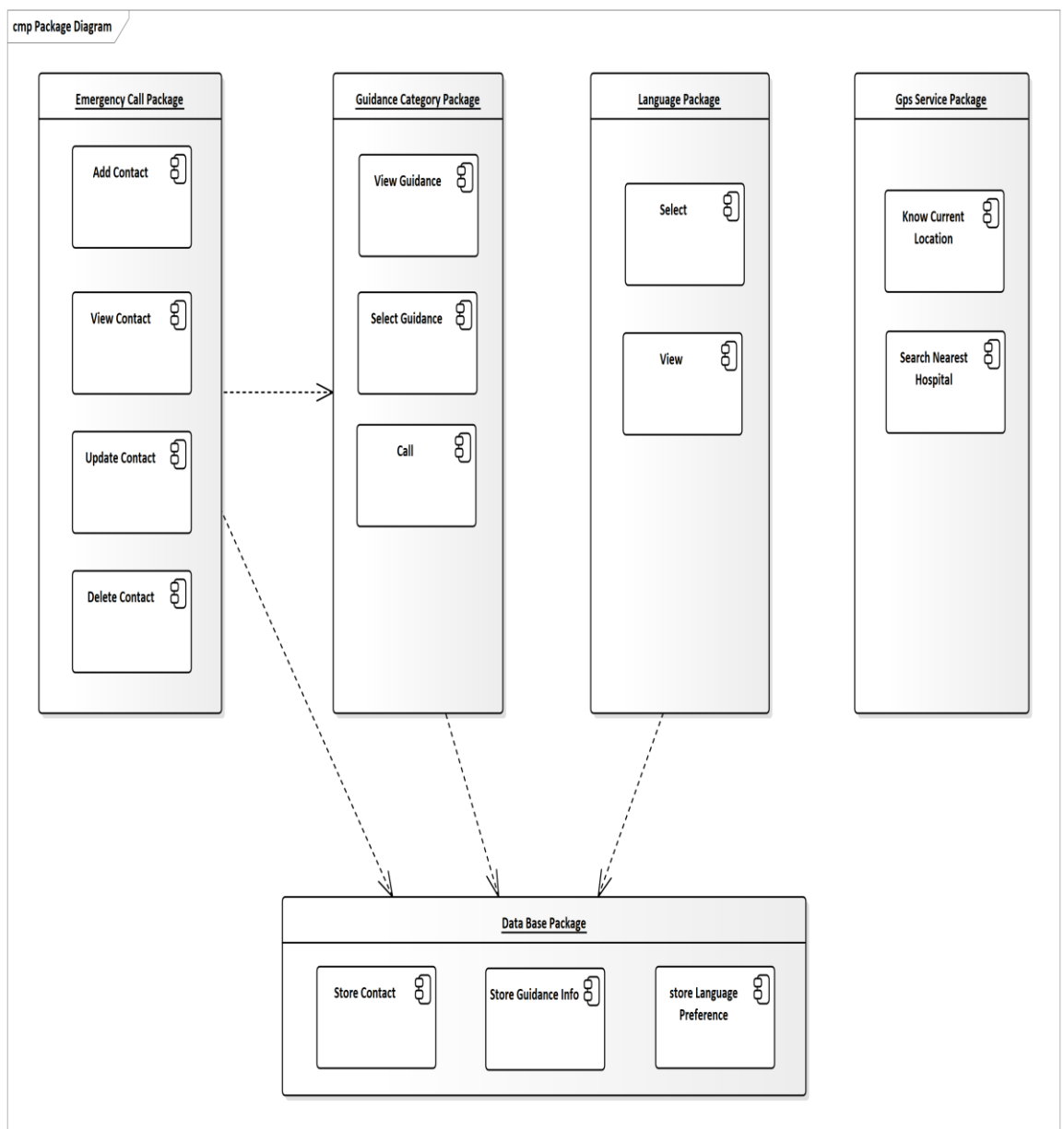


Figure 5-7. Package Diagram

5.5 Algorithm Design

Algorithms are designed to show the flow of programs in the system. They are semantic driven rather than syntax driven. That means, the rule of syntax is not represented as other programming language but it has a complete meaning as that of syntax-based programming language. In addition, algorithms show the flow and steps of logic in each function. This design part is important in the coding part of implementation. Some of the algorithms are listed below:

Example: -

- Select Language:
 - Start Application.
 - **If** language selection page displayed.
 - User selects the language he wants.
 - **If** user selects Amharic, **then** the system displays Amharic Home Page.
 - **Else if** the user selects English, **then** the system displays English Home Page.
 - **Else**, re-open the application and try again.
- Select Guidance Category:
 - Start Application.
 - Select relevant language.
 - **If** category page displayed.
 - Select information category you need.
 - Else, try again
- Emergency Contact:
 - Start Application.
 - Select relevant language.
 - Click navigation bar.
 - **If** navigation bar list displayed.
 - Select Emergency Contact
 - **Else**, try again.

5.6 User Interface Design

User interface design (UI) or user interface engineering is the design of user interface for machines and software, in our project for mobile devices, with the focus on maximizing the user experience. The goal of user interface design is to make the user's interaction as simple and efficient as possible, in terms of accomplishing user goals (user-centered design). So, in our project First Aid Guidance Application we have designed user interfaces that increase the user experience.

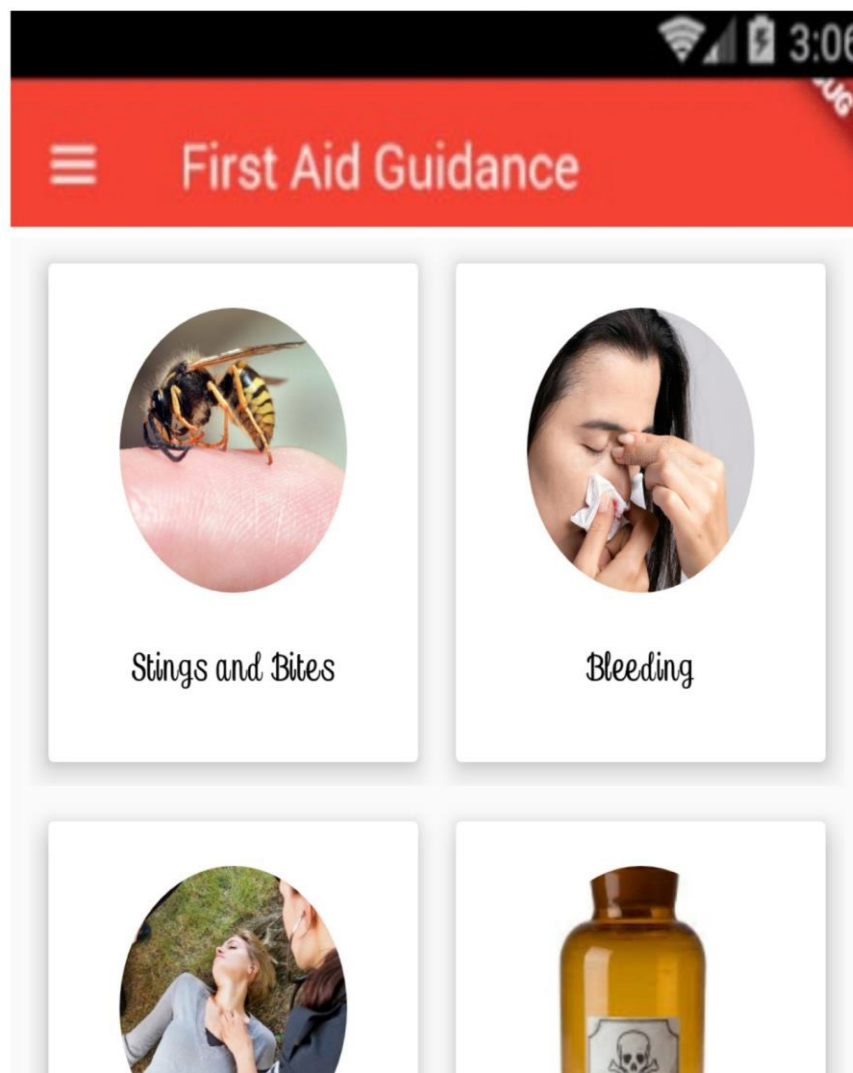


Figure 5-8. Application Home Page UI

The above UI shows how the application home page (guidance category) looked like. In which the user of the system selects from the guidance category to get guidance he wants.

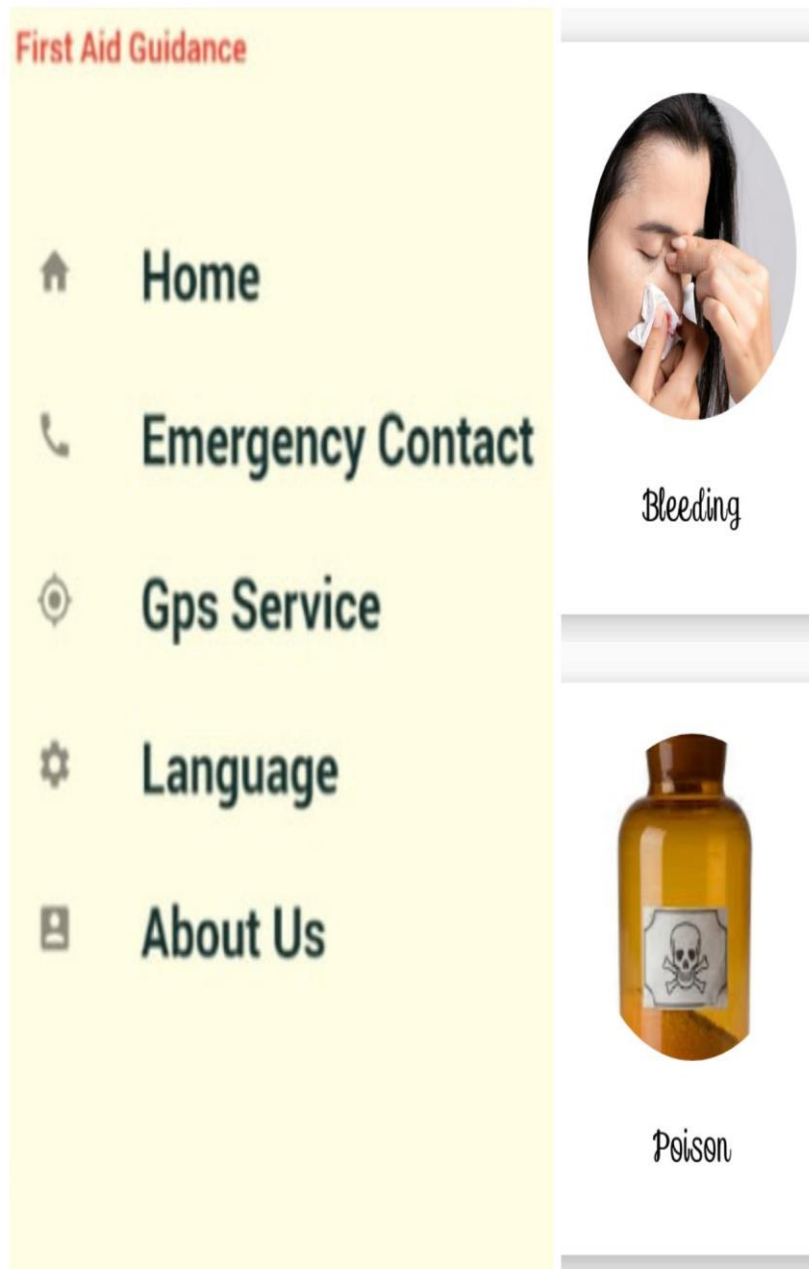


Figure 5-9. Application Navigation bar UI

The above UI shows how the application navigation bar looked like. Which allows user of the system to select additional functionalities from the navigation bar lists.

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APPENDICES A

Existing system form 1:

☰ First Aids and Emergency Techniq...



First-Aid Myths



First-Aid Basics



Emergency Response



Preventive Measures



Common In-Home Incidents



Outdoor Events



Anywhere Events



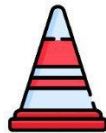
Serious Incidents



Common Conditions



Emergency Events



One for the Road



First Aid at Work

Existing System form 2:

