Wollo University

Kombolcha Institute of Technology (KIoT)

College of Informatics

Department of Software Engineering

A project submitted to the Department of Software Engineering for partial Fulfillment of the Requirement for the Degree of Bachelor in Software Engineering

Project Title: GPS location indicator for Wollo University (KIoT)

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KIoT, Wollo, Ethiopia 2014 E.C

Declarations

We hereby declare that our project in titled "GPS location indicator for KIoT" is original and not submitted / Published by any individual/ Organization.

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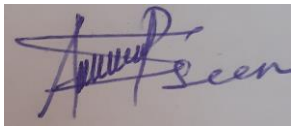
1.Name: Ashenfai Workie Date: 07/20/2022 Sign: 

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3. Name: _____ Date:07/20/2022 Sign: _____

4. Name: _____ Date:07/20/2022 Sign: _____

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List of Abbreviation's, Acronym and symbols

- API - Application Program Interface
- CLI – Command Line Interface
- FAQ - Frequently Asked Questions
- GPS – Global Positioning System
- iOS - IPhone Operating System
- JSX - eXtensible JavaScript
- KIoT - Kombolcha Institute of Technology
- LBS- Location Based Service
- QSR - Quality System Regulation
- SDS - System Design Specification
- SRS - System Requirement Specification
- UI – User Interface
- UML – Unified Modeling Language
- VsCode - Visual Studio Code

Abstract

Location based services offer many advantages to the mobile users to retrieve the information about their current location and process that data to get more useful information near to their location. Our proposed system GPS based location service provide the users a set of service which originate from the geographic location of Kombolcha Institute of Technology university through the user's mobile device. Using these services, it is possible for the users to find the exact destination places where they want to go and to tracking their own location. These services can also originate in the user's mobile device itself in order to satisfy location-based requests like finding areas of interest, helping them find nearby places, checking where they are. In this project we will discuss how to implement these geolocation service in KIoT. It will also be a useful resource to team members seeking to expand their knowledge in this field.

Keywords: Location Based Service (LBS), Positioning, Geolocation, GPS, SRS.

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አቅጣጫን መሰረት ያደረገ አገልግሎት ለሞባይል ተጠቃሚዎች ብዙ ጥቅምን ይሰጣል ፣ ተጠቃሚውን ያለበትን አቅጣጫ እንዲያውቅ ማድረግ እና ካለበት አቅጣጫ ጋር የተያያዙ ቦታዎችን እንዲያውቅ መረጃ በመስጠት ተጠቃሚውን ይረዳል፡ ይህ አሁን ላይ የምናበለፅገው የአቅጣጫ መጠቆሚያ ሶፍትዌር አፕሊኬሽን በተጠቃሚው ስልክ ላይ በመጫን ፤ መነሻ ያደረገው ከኮምቦልቻ የቴክኖሎጂ ተቋም ዩኒቨርሲቲ ምድራዊ አቀማመጥ በመነሳት ነው፡፡

ይህን አገልግሎት በመጠቀም፤ ተጠቃሚው መሄድ የሚፈልግበትን ወይም መነሻ ቦታውን መሰረት በማድረግ መድረሻ ቦታውን በትክክል እንዲያውቅ በማድረግ ነው፡፡ ይህ አገልግሎት በተጠቃሚው ስልክ ላይ በመነሳት ተጠቃሚው በሚልካቸው ጥያቄዎችህ አማካኝነት ያሉበትን ቦታ በማሳወቅ፤ መሄድ የሚፈልጉበትን ቦታ በመፈልግ እና ከቦታው ጋር ተቀራራቢ የሆኑ ቦታዎችን በማቅረብ ተጠቃሚውን ማርካት ነው፡፡ በአጠቃላይ፤ እዚህ ፕሮጀክት ላይ እምናየው ነገር እንዴት ከኮምቦልቻ የቴክኖሎጂ ተቋም ዩኒቨርሲቲ ምድራዊ አቀማመጥ በመነሳት ሶፍትዌሩን ማበልጸግ ይቻላል እሚለውን ነው፡፡በጨማሪም ደግሞ ለቡድን አባላቶቹ በዚህ ፕሮጀክት ላይ እውቀታቸውን እንዲያሰፉ ለመርዳት ነው፡፡

Chapter 1 Introduction

1. Introduction

Kombolcha Institute of Technology (KIoT) is one of branch of Wollo University, uses a different computerized and web based systems to facilitate a better education and community development service. The institute has been developed many systems, the staffs and students are now easily can access the system. Currently fresh-man students and a new employee gets an information through different mechanism about the institute. But some of things are used manual based system. Example when a fresh man or new employee wants to go somewhere inside the campus, by asking someone where the location of he wants to go? By this reason the institute fresh man students or new employees gets implicit information due to having different places, the proposed system is motivated to solve to this kind of problem using mobile based application, on the institution any one can access the GPS location indicator for KIoT mobile application, the system is developed in react native language, the system has different user friendly interface and focuses on the detail information of the institution with some of employee personal profile.

1.1 Background of the organization

Wollo university is one of the federal university in Ethiopia currently rank 14 across the country. It is a 2nd generation University in Ethiopia located at South Wollo Zone of the Amhara State [1]. Currently, the Wollo University offers under graduate and master's program.

The University has two campuses, the main campus is located at Dessie and the Kombolcha Campus is located in the City of Kombolcha, some 26 kilometers south east of the Dessie Campus. Since 2011, the Kombolcha Campus (Kombolcha Institute of Technology, KIoT) has developed its own uniqueness, complexity and potential beginning to play its strategic role in the evolving industrialization of the city and of the area. Owing to this standing, the Ministry of Education designated it as the Kombolcha Institute of Technology (KIoT). As this niche increasingly became a source of strength, an increasing number of students began to enroll in the institute posing increasing demands for changes in leadership, managerial attention and structure.

1.2 Existing System of the project

The existing system of KIoT have its own purpose, the students or the employee can ask anyone to get the required information or by using location signs. The existing system performs the following functions with manual system and this leads to get less and implicit information. Because of the manual system can be difficult to ask anyone, time consuming, and there could be lack of communication. This is the result of lack of computerized system or web based system.

1.3 Statement of the problem

In Wollo University (KIoT), there are many technology infrastructures, by providing good service to student, employee's and other users. But we observed half of its work is done manually based system, it known the existing system takes more time than computerized systems.

When we come to our proposed system, we mainly focus on location based service. Everyone knows it is difficult if we don't know the destination place or the exact location where we want to go. In this project we are going to develop a system that can solve those problem, because the existing system can't have fulfilled the user technology facilitates.

The current problems in the existing system include:

- There is no any developed system, that can locate a specific places using geolocation system.
- It is not easy to find the exact location for new user, because it is tedious and tiresome.
- The time wastage to the user, because they don't know the destination place is.

From the above listed problems are some of the existing system, and there are described in the greater detail on the existing system. We are motivated to develop suck kind manual systems by replacing with automated GPS location indicator mobile application to anyone on the institute.

1.4 Proposed System

GPS module is responsible for getting the exact location in the form of latitude and longitude from the satellite [2]. The proposed system will conduct GPS accuracy test by comparing and computing the distance of consecutive coordinates with the actual point.

The proposed system for GPS location indicator is mainly focus on to easily find a specified location using their smartphone android device for KIoT student and employee. If users don't know finding a specific place is ambiguous and tiresome, so our system is being initiated to solve such kind of problems for KIoT users.

The Location based indicator system is a real life problem solving application. Both the admin section and the user section are designed in such a way that both parties enjoy the facilities of the application. The GPS indicator mobile application uses the Google Maps API is to display the exact location on the map using smartphone application and determine the estimated distance and time to arrive at a given destination. The proposed system can minimize the effort of users to finish road assignments within a minimal time.

1.5 Objective

1.5.1 General Objectives

The general objective of the system is to develop automated mobile application based GPS location indicator application for Kombolcha Institute of Technology.

1.5.2 Specific Objectives

The specific objective of our project is as follows:

- Determine the technical and operational feasibility of alternative approaches
- To study analysis, the existing system
- To gather requirement
- To fulfill stakeholder needs by depending on requirements.
- To design the analyzed implementation and testing deployment.

1.6 Scope and limitation of the project

1.6.1 Scope

The project is designed to meet the functionality of specific **GPS location** when the user needs to go somewhere, **voice response** when the user wants to know where the exact place he/she arrived or near places depending on user inputs, **measuring distance** when user wants to know how much distance left to arrive to the destination**, placement modify** when a place change is required, and the other; User are able to search a place where wants to go, the system is allowed to see the staff profile to user, the system is accessible inside the university because our main target is GPS location

indicator for KIoT users, the system is supported for only main target places of the campus like: colleges, administration building, services, training areas, and dormitory.

1.6.2 Limitations

- The system is only supported in English language
- The system is specifically designed to access only inside the institute.
- The system is accessible for only located places doesn't display every places like individual blocks, building rooms and others.

1.7 Methodology for the project

System development methodology

In our project the system development methodology, we used to build our system with React native that is built in JavaScript library and framework because of:

- The features and uses of JavaScript make it a powerful tool for creating mobile applications. The React Native is the widely used JavaScript framework for creating mobile applications. Using React Native, we can build mobile applications for different operating systems. We do not require writing different codes for the iOS and Android operating systems. We only need to write it once and run it on different platforms.
- JavaScript is a light-weight object-oriented programming language and JavaScript used both on the server-side and client-side allows us to make our mobile apps so interactive.
- We select to develop our system using React native framework rather than others because of:
    - React Native has a number of open-source libraries of pre-built components which can help you further speed up the development process.
    - The React native for iOS and Android platforms use much less of the memory space, as the cross-bridge linking is not required and most of the codes are used during run-time.
    - Since React Native uses JSX, a developer isn't required to learn complex languages such as Objective-C and Java to develop an app.
    - React native allows you to create with in a single JavaScript codebase that will work on different mobile devices.

We use different software editing tools for coding like; VsCode, Sublime Text and for UI and prototyping like; Mockplus, Edrawmax, Enterprise Architect and others tools.

1.7.1 Data collection and fact-finding techniques

Interviewing: Most analysis use interviewing as a primary way of gathering requirements in information system requirements. We have used to gather, facts, opinions, truths of users about the current system.

Observation: To understand directly hoe the existing system works currently, we have used observation. We observed user's interaction with existing problems.

Existing data: the existing data includes, signs or symbols, we gather an additional measurements method.

1.7.2 System analysis and design approach

System Analysis:

In the proposed system the system analysis helps us to analyze and organize the system elements of the project. The different models we used for our project are:

Use case diagram: One of models we used in our system is a use case diagram, to define the interaction between the external actors and the system to attain a particular goal.

There are three basic elements that make up a use case:

- **Actors**: Actors are the type of users that interact with the system.
- **System**: Use cases capture functional requirements that specify the intended behavior of the system.
- **Goals**: Use cases are typically initiated by a user to fulfill goals describing the activities and variants involved in attaining the goal

Class diagram: we use the class diagram to structure a system, by showing different system class, attribute, operation or methods, and the relation between objects of the system.

Activity diagram: An activity diagram visually presents a series of actions or flow of control in a system similar to a flowchart or a data flow diagram. Activity diagrams are often used in business process modeling. They can also describe the steps in a use case diagram. Activities modeled can be sequential and concurrent.

Sequence diagram: Sequence diagrams describe interactions among classes in terms of an exchange of messages over time. Like

- Model high-level interaction between active objects in a system
- Model the interaction between object instances within a collaboration that realizes a use case
- Model the interaction between objects within a collaboration that realizes an operation
- Either model generic interactions (showing all possible paths through the interaction) or specific instances of interaction (showing just one path through the interaction)

System Design*:* - To design the system the project team has choose Object Oriented Modeling techniques and Unified modeling language tools. Design models are:

Deployment diagram: We used to visualize the topology of the physical components of a system, where the software components are deployed.

Component diagram: In the proposed system the component diagrams help us to build the organization and wiring of the physical components in a system. Component diagrams are often drawn to help model implementation details and double-check that every aspect of the system's required functions is covered by planned development.

Generally, the model that we are describing above can:

- Enables us to comprehensively model a system before we develop it.
- Modification of the object implementation is easy because objects are loosely coupled.
- Understanding of the structure is easy because object oriented modeling and tools used to represent real world entities.
- Direct manipulation of architectural components is possible because several object oriented programming languages exist.

1.7.3 Technology requirements

Software Requirements

The software requirements are the software's used to develop our system.

- Edrawmax: To create our system database, symbols, generally we used to design model of the project.
- Enterprise architecture: To create specifically, class diagram, state flow chart, component diagram and others.
- Microsoft Word 2021: we used to write and edit SRS project documentation.

- Vs Code, Sublime Text: Those software tools to create the real implementation of the project by writing a code.
- Google Chrome, Mozilla Firefox: Those browsers to run and test our project actual code and to access additional information of the project using React Native Expo and React Native CLI.
- Firebase: firebase is a backend we used to store user's data like users details and other metadata.

Hardware Requirements

The hardware requirements are the hardware tools used to develop our system.

- PC – 8 GB RAM, Core i5, Processor 2.4 Ghz- we used laptops and computers to develop and run system project.
- Flash – we used flash to transfer file.
- Network cable – we used network cables for internet connection
- Smartphone – we used smart phone to run our system mobile application.

1.8 Feasibility Study

We can say our project which is mobile based application development for KIoT GPS location indicator system is feasible because it can fulfill all the requirement of good software which are technical, operational, economical, and legal feasible.

1.8.1 Technical Feasibility

Technical issues involved are the necessary technology existence, technical guarantees of accuracy, reliability, ease of access, data security, aspects of future expansion for the GPS location indicator mobile application system and it is also compatible with modern technology.

- The proposed system will be user friendly and will be easy to use.
- The proposed system is capable of providing adequate response and regardless of the number of users.
- The proposed system is being modular to the administrator.
- As far as the hardware and software is concerned, the proposed system is completely liable with proper backup and security.

Hence, we can say that the proposed system is technically feasible.

1.8.2 Operational Feasibility

This GPS based location indicator for KIoT system University will attain its desired objectives. It can solve the problems in locating different specific places; therefore, it will minimize the amount of effort to do all through manually. It is not only important to evaluate whether the proposed system can work, but also evaluate whether a system will work. Furthermore, the system is designed and implemented in an improved and better designed way of UI and UX. The system is easy to operate and to work with, which literally means a better way of operating is provided by the system, assuring that the system is feasible. The solutions to a current problem come possibly close to a perfect fit with the organizational structure and be able to solve other arising problems. Therefore, we can say that the proposed system is operationally feasible.

1.8.3 Economic Feasibility

After developing this project, it has its own benefit for the university members. Since this project is going to mobile application based, there is save time and make comfortable environment for the user. The economic feasibility could be tangible or non-tangible. The economic analysis is considered to as cost/benefit analysis to evaluating the effectiveness of the proposed system.

1.8.4 Legal Feasibility

The legal feasibility for our project is compliance with all legal requirements must be ensured. The proposed system obeying legal requirements is mandatory. This includes investigating whether legal requirements apply to both project activities and project results, the system implements the legal requirements. Therefore, the proposed system is legally feasible.

1.8.5 Political Feasibility

The system to be developed is not conflict with any government directives, because it gives services for the students and new employee effectively and efficiently, all the stakeholders also agreed before the system developed. So the users are profitable and the system will be politically feasible.

1.9 Risk assessment strategy

We used different risk assessment strategies as a continuous process for our project to identify its strategic risk and understand how those risks are being managed through the development life cycle of the project. We have used four risk strategies to handle our project risk during its development

Avoid: The best thing we can do with a risk is avoid it. If we can prevent it from happening, it definitely won't hurt our project.

Mitigate: If we can't avoid the risk, we can mitigate it. This means taking some sort of action that will cause it to do as little damage to our project as possible.

Transfer: One effective way to deal with a risk is to transfer to someone.

Accept: When you can't avoid, mitigate, or transfer a risk, then you have to accept it. But even when you accept a risk, at least you've looked at the alternatives and you know what will happen if it occurs.

Table 1.1 Risk assessment strategy

Id	1
Risk	Conflicting on user requirements
Role	All team members
Probability	Low
Impact	Medium
Risk Strategy	Accept
Description	We were arguing to each other about our system user requirements, ion how to develop our system, and which one requirement is better and meet with user requirements.
Solution	We turn those conflicts to a problem solving exercise

During the development of the project we face different risks. Which includes: -

- **Time management problem**: Though we are facing this problem, we solve this problem by working cooperatively, divide our time by schedule for each phase of the project and we try to use this schedule effectively
- **Failure of electric power and internet connectivity**- we try to solve this by taking back up to external storage devices.

1.10 Significance of the project

Significance of the system are:

- To get explicit information about staff or employee with the exact GPS location.
- Minimize time wastage for getting the specific location.
- To help a freshman or new employee can easily access with confidence, and without any excitement.
- To communicate (using email, phone call) easily with staff (employee) using staff profile information.

- The KIoT university will initiate to focus on a such kind on computerized system by replacing the existing once.

1.10.1 Beneficiary of the project

The proposed system gives a service that are based on the location of a mobile user as determined by the device's geolocation. Up on the completion of the project, the beneficiaries of the project are, freshman students, new comer employee, member of the project team and Wollo university (KIoT).

- Project team member's: The project team members got benefit out of the project by getting software development experience.
- User: The new system makes the system users benefited by providing the users with nearest point or objects in a given location, user friendly interface, decreasing wastage of time. The application provides a service and information that are most relevant to the user at that location.
- KIoT: The proposed system is beneficial for KIoT by providing a real execution and interactive location service application initiate the institute to closely communicate with technology based services and in addition to develop other related latest software applications by replacing the manual works to minimize cost and to reduce time wastage to get a service.

Generally, when users and organization are familiar with how the geolocation service application interact, they have a strong desire to get new ideas about technologies that makes life easier and interesting.

1.11 Schedule of the project

Table 1.2 Schedule of the project

No	Task		Schedule			
	Task name	Description	Starting date	Finish	Duration	Advisor feedback
1	Requirement Gathering	Gathering requirement in registrar, colleges, services, training centers and office departments.	May 7	May 20	13days	

2	System requirement Specification	Specific requirements, external requirements, system requirement modeling, essential use case diagrams.	June 15	June 18	3days	
3	Requirement analysis modeling	Analysis model, system use case diagram, sequence diagram, activity diagram, conceptual class diagram	June 19	June 27	8days	
4	Design	Design goals, proposed system architecture, design control, class diagram, object model, state chart diagram, component diagram, deployment diagram, database design and others.	July 12	July 16	4days	
5	Conclusion, recommendation.	This is the final section of the document contains the proposed system conclusion, and recommendation parts.	July 17	July 18	1days	

1.12 Project Budget break-down and cost analysis

Table 1.3 The hardware budget and cost analysis

No	Items	Quantity	Total price (birr)
1	Computers and laptops	2 (for development and deployment purpose)	Free
2	Smartphone	1 (for testing and running mobile application)	Free
3	Flash	32 GB flash	300
5	For internet connection	-	100
Total			400

Table 1.4 The stationer budget and cost analysis

No	Items	Quantity	Total price (birr)
2	Paper	100	400
3	Pen	2	30
Total			430

1.13 Team composition of the project

Table 1.5 Team composition of the project

Tasks	Responsible person	Deliverables	
Chapter one			
Explanation of the existing system	Solomon	Project initiation and planning	
Major functions of existing system	Beyene		
Chapter Two			
Overall description of software requirements	Moti	Subtopics	System requirement specification
		-	
Specific requirements	All team members	Functional and non-functional requirements	
System requirement modeling	Beyene	-	
Chapter Three			
System use case diagram	Solomon, Moti	Scenario Use case description	Requirement analysis modeling
Sequence diagram, Activity diagram, class diagram	All team members	-	
Chapter Four			
Proposed system architecture	All team members	-	System design
Low level design model	All team members	Class diagram, Component diagram, deployment diagram	
Database design	Beyene, Moti	Data dictionary	

Chapter 2 System Requirement Specification

2. System Requirement Specification

The main reason for writing this system requirement specification (SRS) document is to find out the problem of the existing system and then to propose the new system. The requirements that specified below will describe the functions that the software is responsible and packages that it should include. These requirements are used by the developers and should use for validating the final delivered system. Any alternations shouldn't be taken by the developers without the real requirements gathered from the clients, so the developers are responsible and should investigate with the requirements clearly.

2.1 Background (Overview)

This chapter contains the System requirement specification of the project and that problem we are going to solve. This chapter includes the purpose of the system, scope of the chapter is discussed in section 1 of this document. Section 2 gives overall description of software requirements, the product perspective of the system, the user characteristics. Section 3 contains the general constraints: hardware and software constraints, user documentation. Section 4 describes the specific requirements: user requirements, functional and non-functional requirements. Section 4 contains the external interface requirements of the project: User interface, hardware interface, software interface and communication interface. The last section contains the System requirement modeling and essential use case diagrams.

2.1.1 Purpose

The GPS location indicator mobile application has many purpose for the institute, students, employee and others. The system has a great purpose on the issues concerned with specific area location indicator in the KIoT.

Provides information about its exact location so that it can report details on where the location of the specific object is.

The system gives different purpose for different users like students, staff and new employee. Everyone else can access the system user friendly, saving his/her time, Reduce complexity.

The purpose of this system us to understand the data modeling concepts that is used in a real time scenario and to implement a fully functional database system which interact with front end interface.

The system design provides a comprehensive architectural overview of GPS location service. It presents a number of different architectural views to depict different aspects of the system.

2.1.2 Document Convention

Table 2.1 Document convention

Indicators	Conventions
Alignment	Justified
Margin	Left=3cm, right=2.5, top=2.5, bottom,=2.5
Normal text font size	12pt
Font style	Regular
Font type	Times new roman
Page color	White
Language	English
Line between	1.5
Connection with fluid	Not allowed
Typing machine	Computer
Title font size /heading 1	16pt, bold
Sub title font size/heading 2	14pt, bold
Sub title font size/ heading 3	12pt
Crossing out words	Not allowed
Printing quality	Laser or later quality
Font color	Black

2.1.3 Intended Audience and Suggested Readings

While the proposed system software requirement specification (SRS) document is written for a more general audience, this document is intended for individuals directly involved in the development of GPS location based service application. This includes Software developers, project manager, software engineer, system owner, users and tester. This document need not be read sequentially; users are encouraged to jump to any section they find relevant.

The intended audience and suggested readings in our project, are:

- **Project manager**: - The project manager uses this document to know if the project going on correctly as required.
- **Software engineer**: - Aids with integrating budget system modeling with the rest of the product
- **Developer**: The developers uses this document to implement the system functionality and to ensure traceability.
- **System owner**: - The owner of the system would use this document to specify development tools to be used such as project cost, functional and non-functional requirement.
- **User and Clients**: - The users would use this document to verify if the requirements specified as they need.
- **Tester:** The testers will use this document to design test cases and conduct functionality and quality tests on the system functional and non-functional requirements.

Below is a brief overview of each part of the document.

- Part 1 (Introduction): This section offers a summary of the GPS location based service project, including goals and objective, project scope, general system design and some major constraints associated with the intended platform.
- Part 2 (SRS): This section contains the system requirement specification (SRS) from those including: functional and nonfunctional requirements, user documentation, general constraints, external interface requirements, system requirements modeling.
- Part 3 (Requirement Analysis Modeling): Readers interested in how GPS location based service application organizes and handles the analysis modeling the activity and sequence diagrams that are utilized by the system.
- Part 4: (System Design): This section describes the GPS location app system class by class, including interface detail, design goals, the proposed system architecture, the different low-level design models.
- Part 5: (Conclusion, recommendation, reference and appendices): the readers are intended to view the final section of the document; includes the conclusion, recommendation of the proposed system and the references we use to prepare this project and the appendices section includes any additional information which may be helpful to readers.

2.1.4 List of Acronyms, Abbreviations and Definitions

GPS – Global Positioning System

KIoT – Kombolcha Institute of Technology

SRS – System Requirement Specification

2.2 Overall Description of Software Requirements

2.2.1 Product Perspectives

The GPS location indicator is a mobile based application, the application will be able to connect with remote server and will have a firebase database server. We use products like React-native: has many libraries and frameworks to build and interactive mobile application. And the Firebase: as a Realtime Database lets us build rich, collaborative applications by allowing secure access to the database directly from client-side code. Data is persisted locally, and even while offline, realtime events continue to fire, giving the end user a responsive experience.

2.2.2 User characteristics

Security level: On this level the system we don't; have any security manner.

Educational level: The system needs high level educational level, having few understandings about computer and technology system.

Experience: The system needs some experience about how the technology interact with the environment.

- Admin
- User

And inside the institute anyone can access the application through their smartphone.

The following table describes general user's characteristics that will affect the functionality of the software product.

Table 2.2 User's characteristics

User type	User characteristics	User technical expertise	How the user characteristics and technical expertise will affect the system functionality

Admin	Have a knowledge about the operation, how the system will work, and responsible for manage the system as a whole.	Have the ability and knowledge about the programming language, the use specific tools and programs of the system.	Can easily modify, add positions and manage the functionality of the system effectively.
User	The users are one of the part that can access the system, inside the institute. Specially focused on freshman students and new employee or any new users. Because they don't know anything about the institute specific locations where exists.	The student should have knowledge about technologies and have a good understanding about how the technologies are interact with environment.	Provide system help, provide appropriate error message for invalid user inputs. User interface with less input steps.

2.3 General Constraints

Constraints means anything that challenges to do our project properly. We expect the following Constraints may encounter while doing the project:

- The users must have the ability to use the internet.
- The database should be designed with firebase.
- The unavailability of data source (such as shortage of internet connection) on time may extend the project completion time.
- Shortage of electricity power
- Constraints on having experience of programming language.

Alternative work, costs and effects

Whether there are any better alternatives than the proposed work in terms of cost and effect is always a challenge to planners. Such alternatives may include a different approach, different kinds of work, changes of time schedule, location, etc.

2.3.1 Software constraints

- Constraints programming standards: the system is not fully developed and supported in high level programming languages. So, the programming standard is low.
- Constraints on installation of different libraries and frameworks
- Constraints with running and installing with compatible devices
- Constraints with google maps for using trial version (short period of time to use Google map).

2.3.2 Hardware constraints

- Not having enough space to run the app on mobile device or computers.
- Malicious detection or corrupted with moving file from one computer to another computer.

2.3.3 Assumptions and Dependencies

- It may not be easy to use the system for fresh man student and new employee, if they don't have knowledge about the technology and how to interact with the system.
- If the changing on Requirement will happen the functional requirement is either applicable or not.
- Sometime the expected result will may not be correct, because internet connection may be weak.
- People who are not familiar with computers and smart phones can't use this software.
- Changing location may require from one place to another place, so modifying the current place to the new one could challenge us.

2.3.4 User Documentations

User documentation for our system is the documentation for a product or service we provided to the end users. The user documentation is designed to assist end users to use the product or service.

We prepare User documentation to help users to learn:

- Instruction how to use our system?
- Description of features our system
- Tips and tricks of our system
- How to resolve common problems with our mobile application.

- Contact information in case undocumented questions arise

So this user documentation describes how our system is going to distribute the documentation to users. The table below shows the evaluation of user documentations;

Table 2.3 User documentation

No	Method	Solution
1	How to start the system	you can start the system by installing the application to android device, the displayed home page will tell you the main pages how can you easily use the application.
2	How to use different features of the system	In our system there are many features how users can use them, we have features like: ▪ Position nominator: to locate the specified place where a user wants to go. ▪ Voice assistant gives information to user through voice based. ▪ Measuring distance: the distance between place of origin and destination place. ▪ View information: user can view information about the specified location and some of staff profiles. ▪ Search place: users are able to search places using search bar and navigation bar.
3	How to resolve common problems with our mobile application	▪ After the application is delivered to users, the application could have problems and users can resolve simply by applying instructions from developers.
4	Tips and tricks of our system	-
5	Contact information in case undocumented questions arise by users.	▪ User support service: contact information via Telegram, LinkedIn and Twitter.

2.4 Specific Requirements

2.4.1 Functional Requirements

Table 2.4 Functional requirements

FR ID	Requirement description	Source Use case	Priority
FR01	The system must have a specific GPS location indicator based on different type of places like: training center, service center, college of building placement.	Position nominator(current location)	High
FR02	The system must be support voice response, to give a response to users, while the users want to asks FAQs like: Ask where am I?, Which is the nearest place to me?, and other questions.	Assist voice	High
FR03	The system must measure a distance; means, how much distance is left from the current position to the destination place, how many minutes takes/left from the current location to the destination place, and in which way is better to bypass (selecting a route/ the shortcut place from the alternative places, to go to the required destination place).	Measure distance	High
FR04	The system must measure the shortest paths among different alternative paths, the users will be able to select the best route to their destination place.	Select routes (shortest path)	High
FR05	The system should be modified when placement change is required.	Modify position	Medium
FR06	The system must be add position placement	Add position	High
FR07	The system shall be able to delete position.	Delete position	Medium

FR08	The system could allow to view information about, staff profile, training center, service center and college building placements.	View information	Medium
FR09	The system shall allow to search different specific location areas.	Search place	Medium
FR010	The system must allow admin to login to modify places.	Login	High

2.4.2 Non-Functional Requirements

Table 2.5 Non-functional requirements

NFR ID	Requirement' description	Requirement Group
NFR01	▪ The users shall be able to view information about staff profile, training center, service center and college building placements in fewer milliseconds. ▪ The users shall be able to search specific places within ` seconds.	Performance
NFR02	Based the user type ,the system shall provide a user-specific interface	Integrity
NFR03	The system should be available anytime 24/7.	Availability
NFR04	The system is portable or compatible to any smartphones (Android).	Portability
NFR05	The system shall have simple user interface All pages should be supported with English language	Usability
NFR06	The system shall reliable without any interruption to the specific areas.	Reliability
NFR07	The system shall be able to save times to targeted location of the user.	Robustness
NFR08	The system is reusable, a segment of source code that can be used again to add new functionalities with slight modification.	Reusability

2.5 External Interface requirements

Specify hardware, software, or database elements with which a system or component must interface. This section provides information to ensure that the system will communicate properly with external components.

2.5.1 User Interfaces

The user interface is one of the most significant part of our system, the user interface of our mobile application is more user friendly and it is the bridge between users and our system. The user-friendly of the system helps the users to carry out their tasks with efficiency, effectiveness and satisfaction. The user interface proposed system has many icons and symbols to help users to can easily access, with these signs the users are able to input the destination places through search bar, selected location places are displayed with interactive with interfaces to help users to exploit positional information and location to system users.

2.5.2 Hardware Interfaces

One of the major tasks in system design deals with hardware and software interface which deals with which components would be part in which hardware. So our system has two main hardware components: the clients, and the database server.

The database server used Firebase database and handle all persistent data storage. Lastly the client can access the application via android device.

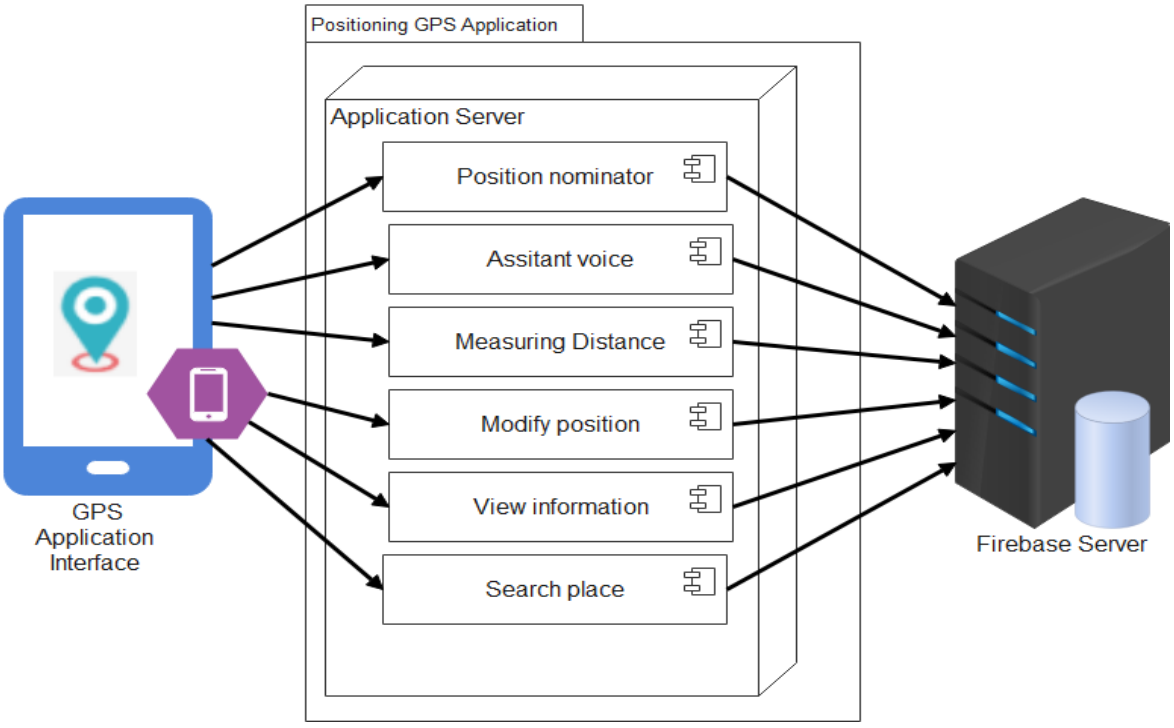


Figure 2.1 Hardware interfaces

2.5.3 Software Interfaces

The software interface of the system defines the interactions of different software interfaces how they will look alike in the software atmosphere.

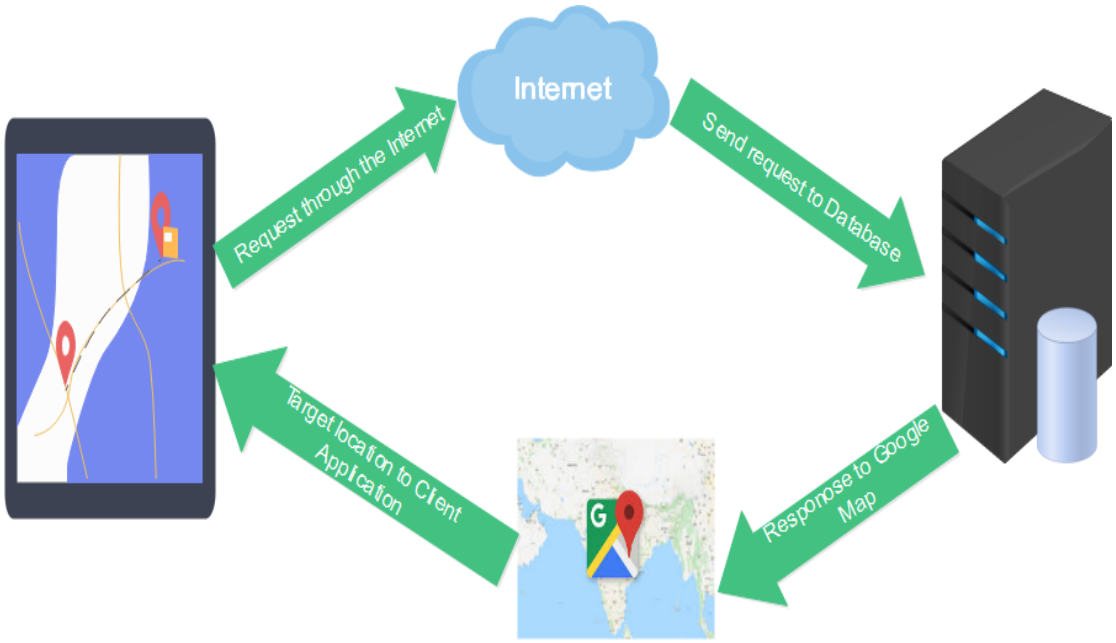


Figure 2.2 Software interfaces

2.5.4 Communication Interfaces

The system is based on mobile application and the user can interact with the system by installing the application on the device. A users need to enable an internet access to communicate with the system.

The requested input sent by user is passed through the internet to the server, if the requested input is defined in the database server, the exact location will be displayed to a user mobile application by using google map.

2.6 System requirements Modeling

The requirement of this proposed project, namely functional and non-functional requirements, deals with components, interface design how the requirements must meet the desired goals of the project (i.e – enabling a stranger to have an online access of his/her current location with the surrounding environment), and the features and behavior of the designed models of the system application are integrated with requirements of the system analysis modeling to construct architecture, component and model of the system. The process of the proposed system is largely concerned with determining, developing and agreeing to the users' requirement.

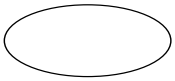
It also covers the major activities such as constructing a use case model, documenting the use case, constructing class diagrams, constructing sequence and activity diagrams, designing user interface prototyping about the proposed system.

2.7 Essential use case Diagrams

The essential use cases are directly or indirectly participate in our system.

Actor: Is a person, or external system that plays a role in one or more interaction with the system. And represented with:

Use case: describes a sequence of actions that provides something of measurable value to an actor and is drawn as a horizontal ellipse.



System boundary: indicates the scope of the system project. Anything within the box represent functionalities in side in scope.

In our project has two main actors:

1. Admin: is one the main actor that have a big influence on the system, has a role and responsibility.

Activities, role and responsibilities of admin

- Modify Place – When change is needed on requirements the admin can add, delete, edit placements with in information.

2. Users: The users are who only use the application, they don't have any activities, role and responsibilities on the system.

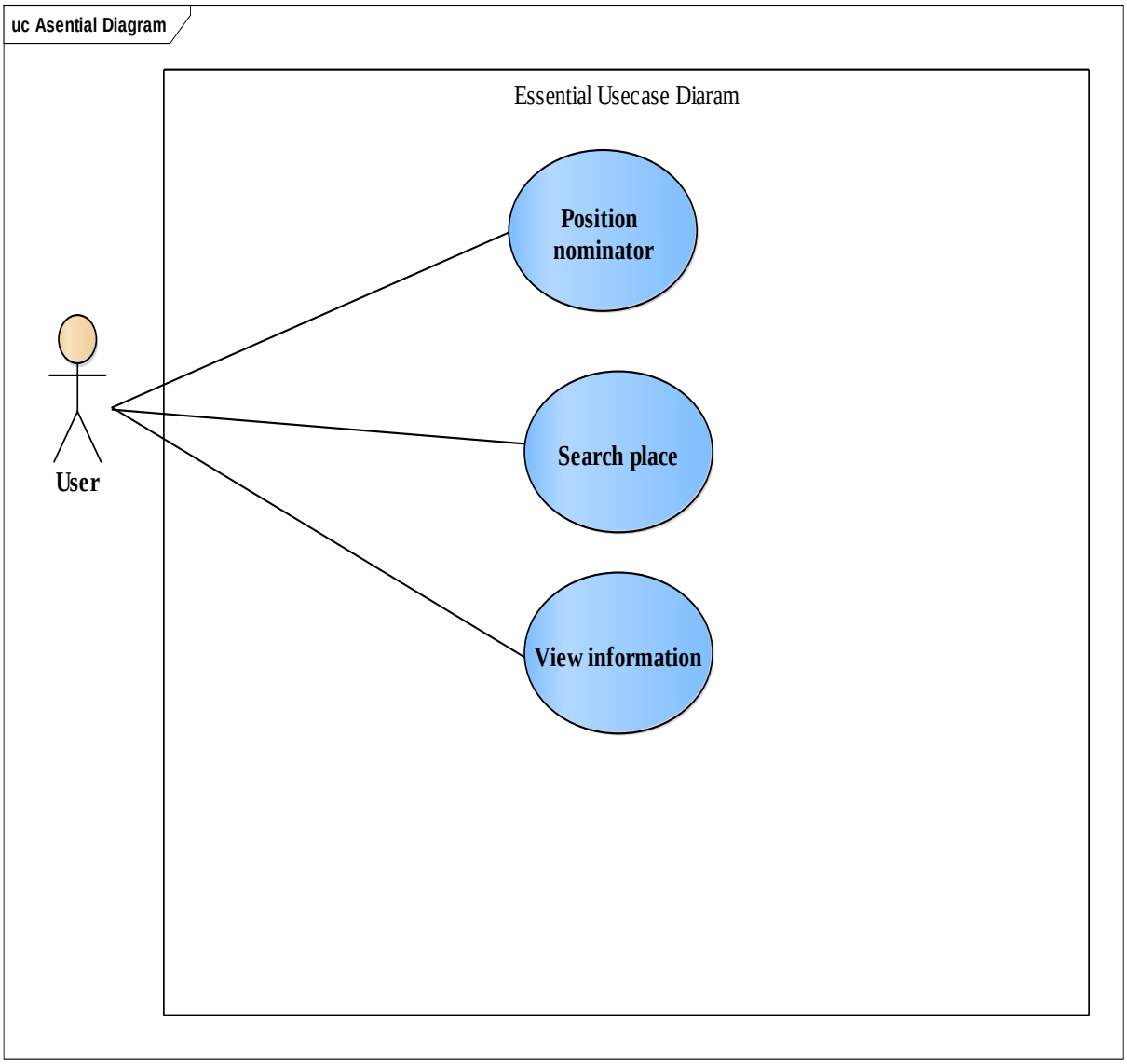


Figure 2.3 Essential use case diagrams

Chapter 3 Requirement Analysis and Modeling

3. Overview of Analysis and Modeling

The proposed system analysis and model of our project deals with an object model for use case, and which serves as an abstraction of the artifact. We use system analysis to finding out what happens in the existing system and deciding on what changes and the new features required and defining exactly what the proposed system must be. The process of system analysis is largely concerned with determining, developing and agreeing to the users' requirement. It also covers the major activities such as constructing a use case model, documenting the use case, constructing class diagrams, constructing sequence and activity diagrams, designing user interface prototyping about the proposed system.

3.1 System use case diagram

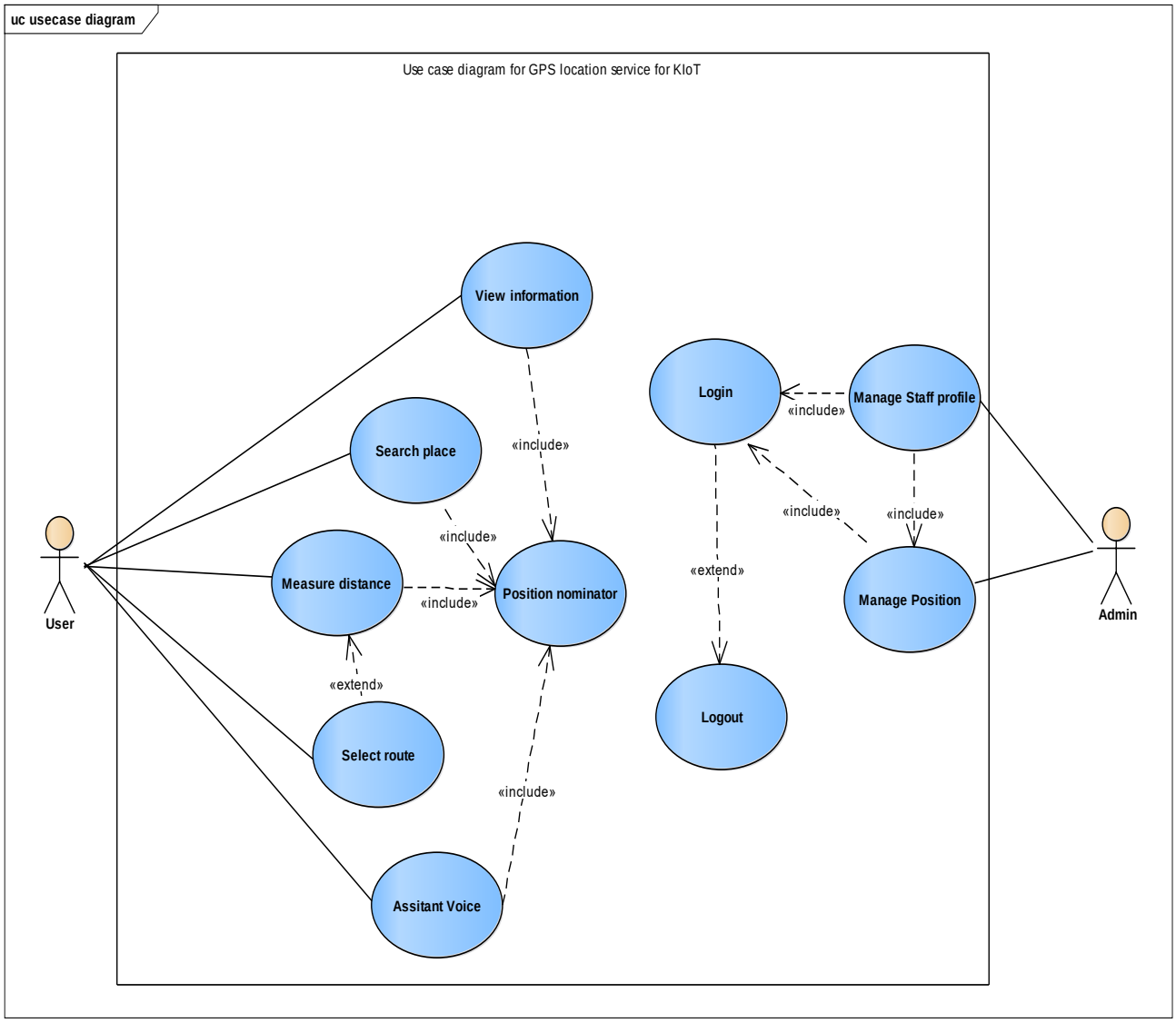


Figure 3.1 System use case diagram

3.1.1 Scenario

One of the effective way to capture user needs for a system is to taking a user-centric approach. The user-centric approach focuses on what the user do to achieve their goals instead of what the system should do. Common user centric approaches used in software requirements are use case and user stories. Scenarios may include a precondition, the steps taken in the normal flow and alternate flows and a post condition. Therefore, scenarios are usually represented in process flow models such as activity diagrams.

Requirement modelling with UML begins with the creation of scenarios in the form of use cases, activity diagrams.

- **Creating a preliminary use case**: A use case describes a specific usage scenario in straightforward language from the point of view of a defined actor. But how do you know (1) what to write about, (2) how much to write about it, (3) how detailed to make your description, and (4) how to organize the description?
- **Refining a Preliminary Use Case:** A description of alternative interactions is essential for a complete understanding of the function that is being described by a use case. Therefore, each step in the primary scenario is evaluated by asking the following questions.
    - Can the actor take some other action at this point?
    - Is it possible that the actor will encounter some error condition at this point? If so, what it be?
    - Is it possible that the actor will encounter some other behavior at this point? If so, what it be?

Answers to these questions result in the creation of a set of secondary scenarios that are part of the original use case but represent alternative behavior.

- **Writing a Formal Use Case:** The informal use cases presented are sometimes sufficient for requirements modeling. However, when a use case involves a critical activity or describes a complex set of steps with a significant number of exceptions, a more formal approach may be desirable.

3.1.2 Use case Model

In the proposed system the use case modelling is the functionality of a new system.

The GPS location indicator application its specific goal is to show how users can interact with application in order to solve a specific problems related with geolocation for KIoT institute. As such, the use case model helps us to define user's objective, the interaction between the system and the users, so the system's behaviour required to meet these objectives.

We use the use-case model because of it acts as an integrated thread in the development for our system and used like the main specification of the system functional requirements as the basis for design and analysis, as the basis for user documentation.

A use case represents discrete unit of interaction between a user and the system. This interaction is a single unit of meaningful work, such as search place, view information, and other tasks. Each use case describes the functionality to be built in the proposed system, which can include another use case functionality or extended another use case with its own behaviour. In the proposed system various model elements are contained in use-case model, such as actors, use cases, and the association between them.

Components of Basic use case model

1. **Actor**: Actors are peoples involved with the system defined on the basis of their roles.
2. **Use case**: The use case defines how actors use a system to accomplish a specific objective.
3. **Associations**: Associations are another components of the basic model, used to define the associations among actors and use cases they contribute in.

What the users can do using the system?

With a following simple steps users can do by using the application:

- First, users should be to install the application on their android device.
- Users can now able to access the system by defining their destination address with a current location.
- They can find the exact location where they want to go by searching places on search bar or by selecting places specified in navigation bars.
- The User can view their destination places with a current location in position nominator page
- Users can access the voice assistant feature for FAQs.

- Generally, the proposed system is suitable for users with its different features, they can easily interact with the system and access the application with their smartphones without any implicit.

3.1.3 Use case description

Table 3.1 Use case description for login

Use case name	Login	
Use case ID	1	
Actor	Admin	
Pre-condition	Admin logs in to the system using his/her account	
Flow of event	System	Actor
	1. The system displays home page 3. The system displays admin login form 5. The system display login successfully message.	2. The system displays admin click login button. 4. Admin fill the login form and click submit button
Alternative flow	▪ If the input field is incorrect, the system will display error message & allow him/her to try again (Go to login page: return to step 3). ▪ If the user forgot or wants to change username or password, the system allows to the user to change the username or password by asking some security questions.	
Post condition	The system saves all necessary information's of the admin activity when he/she interact with system	
Exceptions	-	
Priority	High	
Special requirements	When the admin perform this task connection should not be down	

Table 3.2 Use case description for position nominator

Use case name	Position nominator	
Use case ID	2	
Actor	User	
Pre-condition	The user must install the application on the android device	
Flow of event	System	Actor
	1. The system displays the home page 3. If the search name is occurred the system displays the specified location with a position nominator page	2.The user able to search specified location using search bar or navigation bar 4. Users will be able to select the destination place with a current location that is derived from longitude and latitude position.
Alternative flow	If search name is incorrect, the system displays a pop up error message and the system allow to try again (Go to home page: return to step 1).	
Post condition	The system will displayed the exact location entered by user input in Position nominator page, with different most known position sign and symbols.	
Exceptions	-	
Priority	High	
Special requirements	When the user search, if places is not defined, the system allow to show related places.	

Table 3.3 Use case description for voice assistant

Use case name	Assistant voice	
Use case ID	3	
Actor	User	
Pre-condition	First: the user should open a home page Second: users can search a place name or they can easily select places from the listed navigation bar.	
Flow of event	System	Actor
	2. The system will display the destination place from user input on home page (position nominator page). 4. The system allows user to access the voice assistant features by asking FAQ using their voice.	1. Users select place names from navigation bar or able to search place name on search bar 3. The users can access the voice assistant button when destination location is verified and known.
Alternative flow	If the user ask unspecified questions the voice assistant will give a response “location not found ” message to user(Go to position nominator page: return to step 2).	
Post condition	The user can access voice assistant feature by the help of FAQ to get a necessary information.	
Exceptions	-	
Priority	Medium	
Special requirements	Voice assistant feature must be turn on.	

Table 3.4 Use case description for view information

Use case name	View information	
Use case ID	4	
Actor	User	
Pre-condition	First: the user should go to position nominator page Second: using search bar or navigation bar users can view and have information about some of staff personal profile or place information.	
Flow of event	System	Actor
	2. The system display the required place searched by user with detail information on position nominator page 4. The system have to show more information about searched place or selected place and some of staff personal profile.	1. User click on search bar to search places or select places from navigation bar 3. User can click on view more information link
Alternative flow	If user want to know more information about the location or related staff profiles, for more user can make physical contact,	
Post condition	The system shall allow to view required information reliably(Go to position nominator page: return to step 2).	
Priority	Medium	
Special requirements	Staff profile information and targeted place information must be defined.	

Table 3.5 Use case description for measuring distance

Use case name	Measuring distance	
Use case ID	5	
Actor	User	
Pre-condition	First: the user should open a home page Second: users can search a place name or they can easily select places from the listed navigation bar.	
Flow of event	System	Actor
	2. If position is found, the system will display the location from origin place to destination place with its distance, (meter, kilometre), time frame it takes (minute, hours), and selecting shortest paths to the destination places, on position nominator page.	1. Users select place names from navigation bar or able to search place name on search bar 3. From the current position by clicking the destination place, users are able to know what the exact distance from their origin to their destination place measured with: the total distance left, the total time takes the distance, and selecting the shortest path from the listed alternative places.
Alternative flow	The system will return to the position nominator page again if measuring distance is not displayed correctly.	
Post condition	The user able to know the distance of exact location.	
Exceptions	-	
Priority	Medium	

Table 3.6 Use case description for search place

Use case name	Search place	
Use case ID	6	
Actor	User	
Pre-condition	The user must install the application The user should open the home page.	
Flow of event	System	Actor
	4. The system display the exact location searched by user on position nominator page (i.e. it depends on user search input name)	1. Users open home page 2. User clicks on search bar 3. Users enter place name.
Alternative flow	If search place is unknown or undefined in the database, the page will display “place is not found” message to user, else display position nominator page searched by user with their sign and symbols (Go to home page: return to step 1).	
Post condition	The system will display the destination place successfully.	
Exceptions	-	
Priority	High	

Table 3.7 Use case description for modify position

Use case name	Modify position	
Use case ID	7	
Actor	Admin	
Pre-condition	Admin must login to the system by using login button	
Flow of event	System	Actor
		1. Admin click on the login button

	3. The system will display a page with 3 main buttons 5. The system display modify position page	2. Admin fill login form and click on submit button 4. The admin is granted to select from the list one buttons and clicks on modify position button 6. Admin is granted to access the modify position page. 7. Admin clicks on the input form fields. 8. Admin can now edit values to which input field belongs to. Input forms fields are: position type (training, service, office and other centers), latitude, longitude, position name, information and others. But to modify a position, position must to be added first. 9. Admin filled, to which input field is want to modify. 10. Admin now clicks on the submit button.
Alternative flow	1. If login field is incorrect, the system will display an error message & allow to fill again (Go to login page: return to step 2).	

	2. If input fields are incorrect to be modified, the system will display an error message & allow to fill again (Go to modify position page: return to step 5). 3. If there is no any editable position the admin can add position (Go to add position page: return to step 4) in there by clicking the add position button.
Post condition	The admin modify position successfully.
Priority	High

Table 3.8 Use case description for add position

Use case name	Add position	
Use case ID	8	
Actor	Admin	
Pre-condition	Admin must login to the system by using login button	
Flow of event	System	Actor
	3. The system will display a page with 3 main buttons 5. The system display add position page	1. Admin click on the login button 2. Admin fill login form and click on submit button 4. The admin is granted to select from the list one buttons and clicks on add position button 6. Admin is granted to access the add position page. 7. Admin clicks on the input form fields. 8. Admin can now add values input fields one by one: The input fields are:

		▪ Position name ▪ Latitude ▪ Longitude ▪ Type (training, service, office and other center's) and other defined forms fields. 9. Admin filled the add position input forms. 10. Admin now clicks on the submit button.
Alternative flow	1. If login field is incorrect, the system will display an error message & allow to fill again (Go to login page: return to step 2). 4. If add position form (input field) is incorrect the system displays a popup error message to fill again correctly (Go to add position page: return to step 5).	
Post condition	The admin successfully add position	
Exceptions	Adding duplicate position name	
Priority	High	
Special requirements	When adding new position input values must be correct	

Table 3.9 Use case description for delete position

Use case name	Delete position	
Use case ID	9	
Actor	Admin	
Pre-condition	Admin must login to the system by using login button	
Flow of event	System	Actor
		1. Admin click on the login button 2. Admin fill login form and

	3. The system will display a page with 3 main buttons 5. The system display different added positions and enable delete sign. 6. System ask why admin, wants to delete the position, and explain his/her response in the text area field below.	click on submit button 4. The admin is granted to select from the list one buttons and clicks on delete position button. 7. Admin clicks on the text area fields and write why he/she wants to delete the position. 8. Admin can now delete position by using position id or unique name, but to delete a position, position must to be added first.
Alternative flow	▪ If login field is incorrect, the system will display an error message & allow to fill again (Go to login page: return to step 2). ▪ If admin is unable to delete position, the system will display a message “please check all the requested”.	
Post condition	Successfully position is deleted by admin	
Priority	Medium	
Special requirements	To delete a position, position must to be added first	

3.2 Sequence diagram

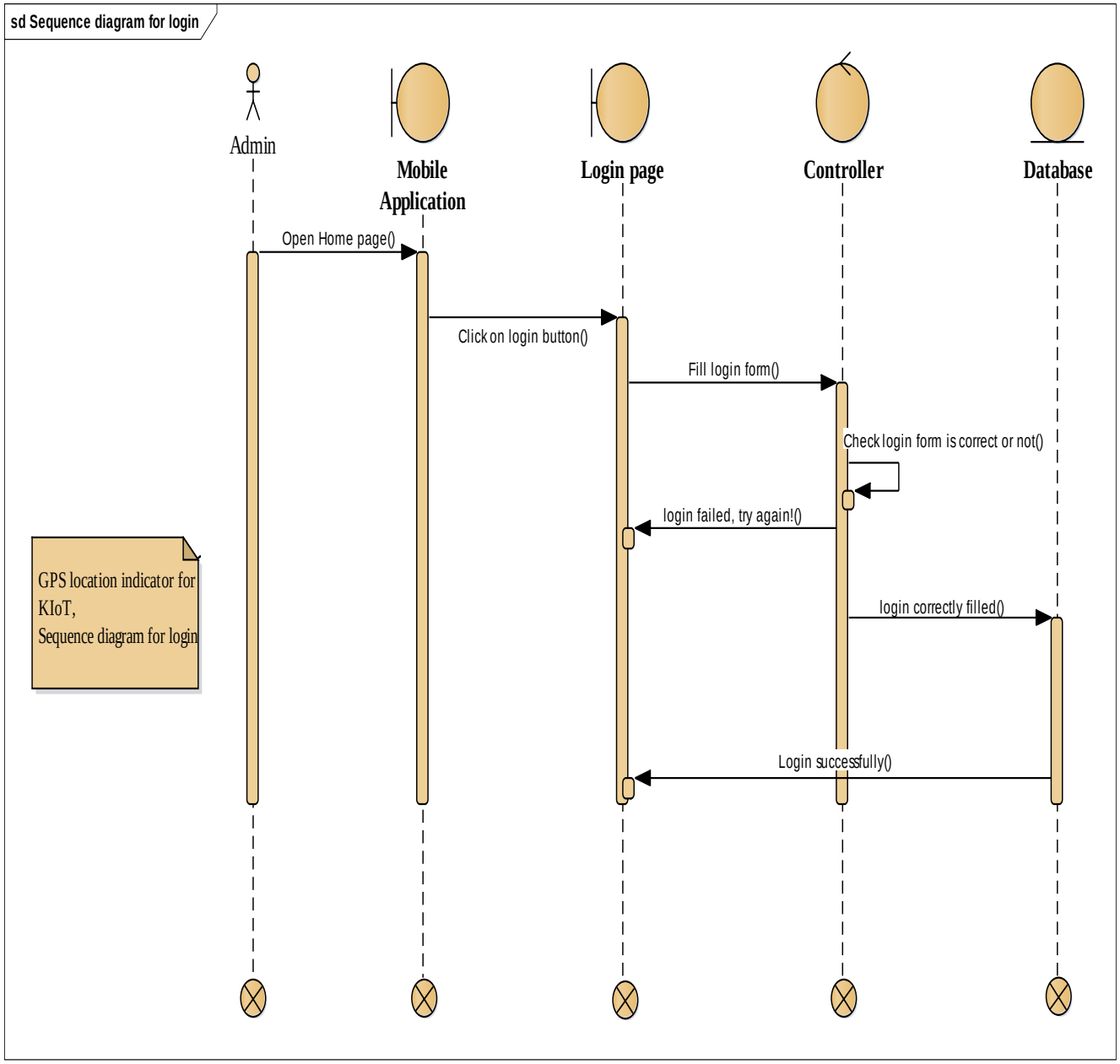


Figure 3.2 Sequence diagram for admin user login

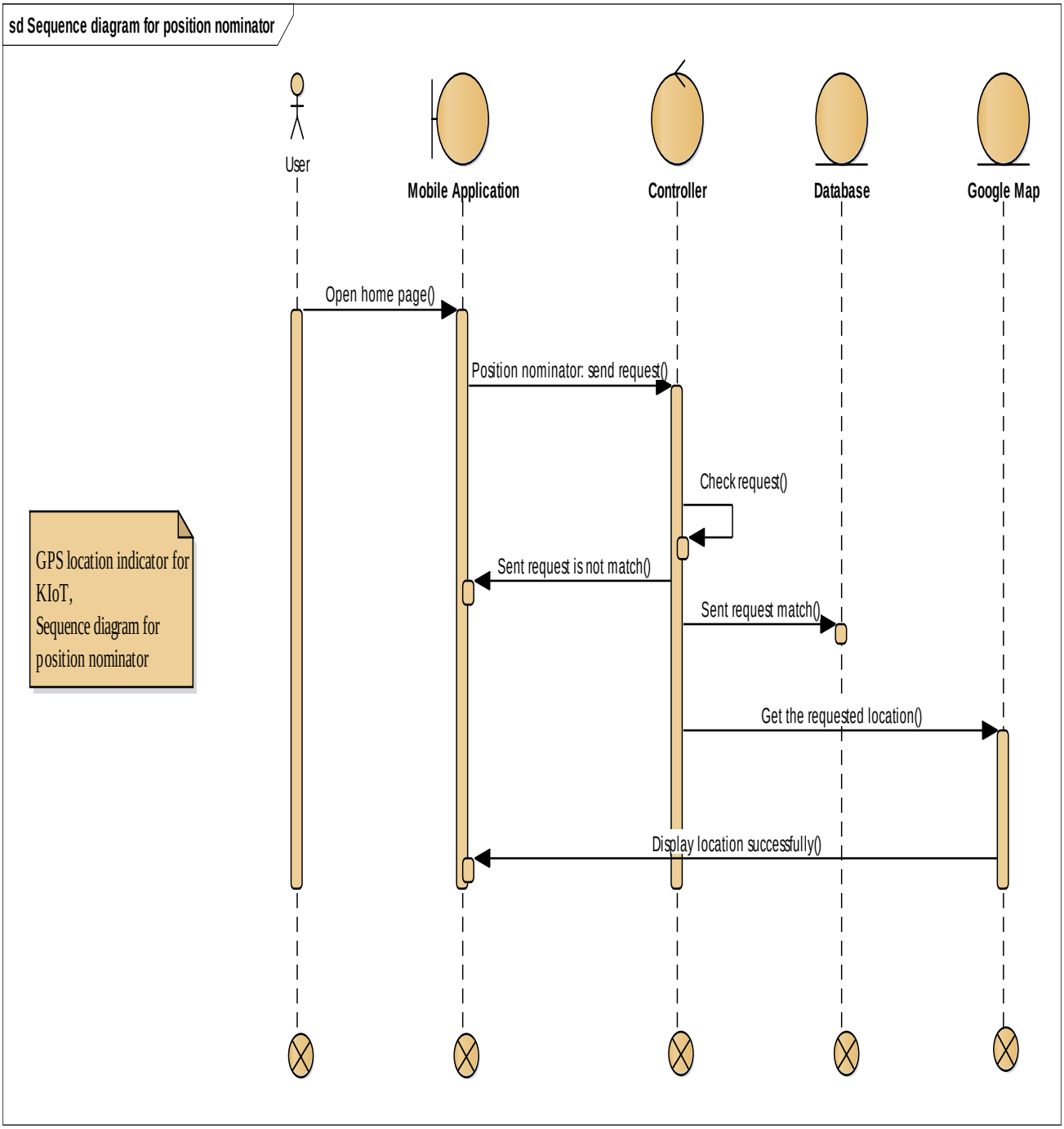


Figure 3.3 Sequence diagram for position nominator

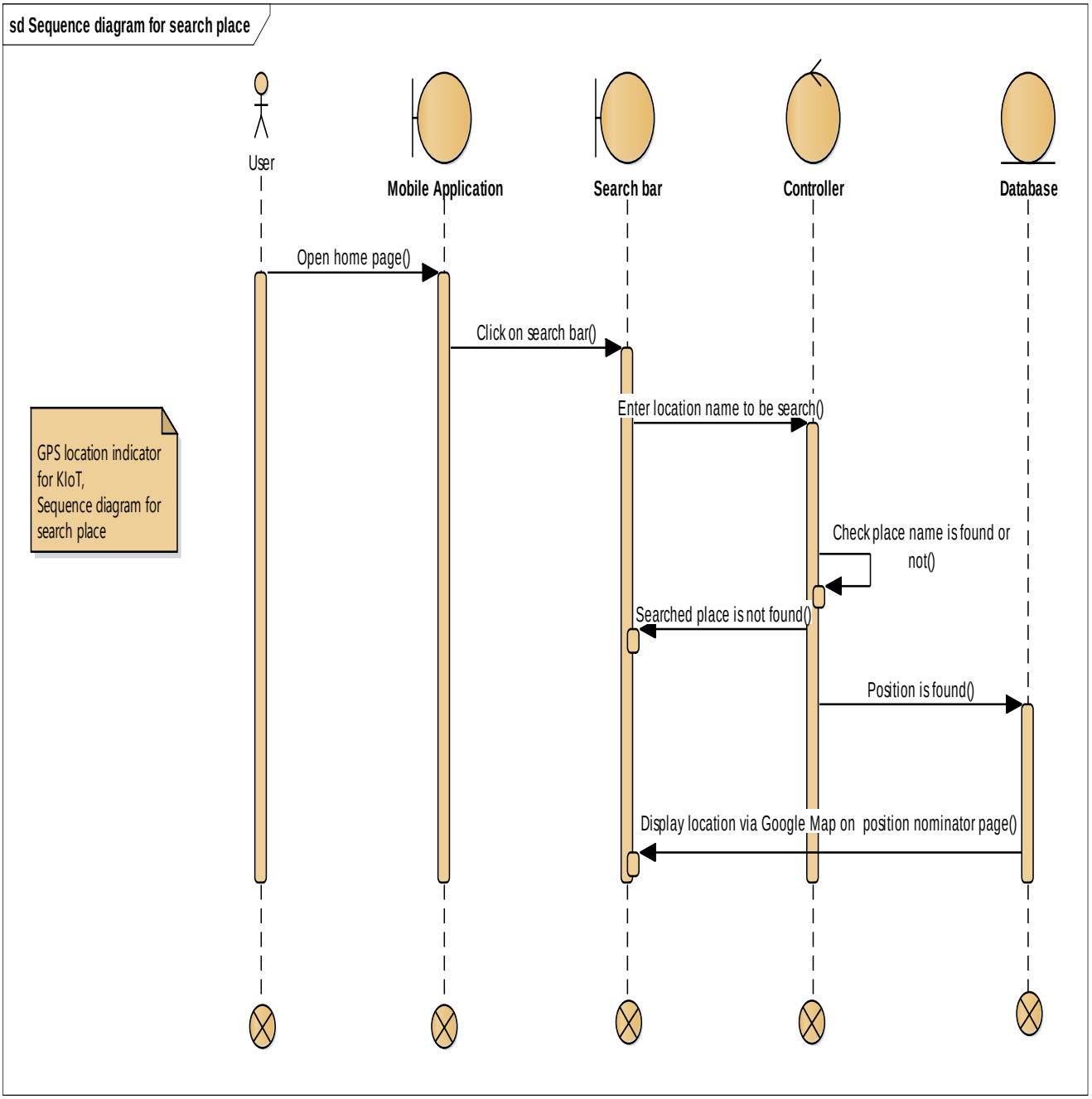


Figure 3.4 Sequence diagram for search place

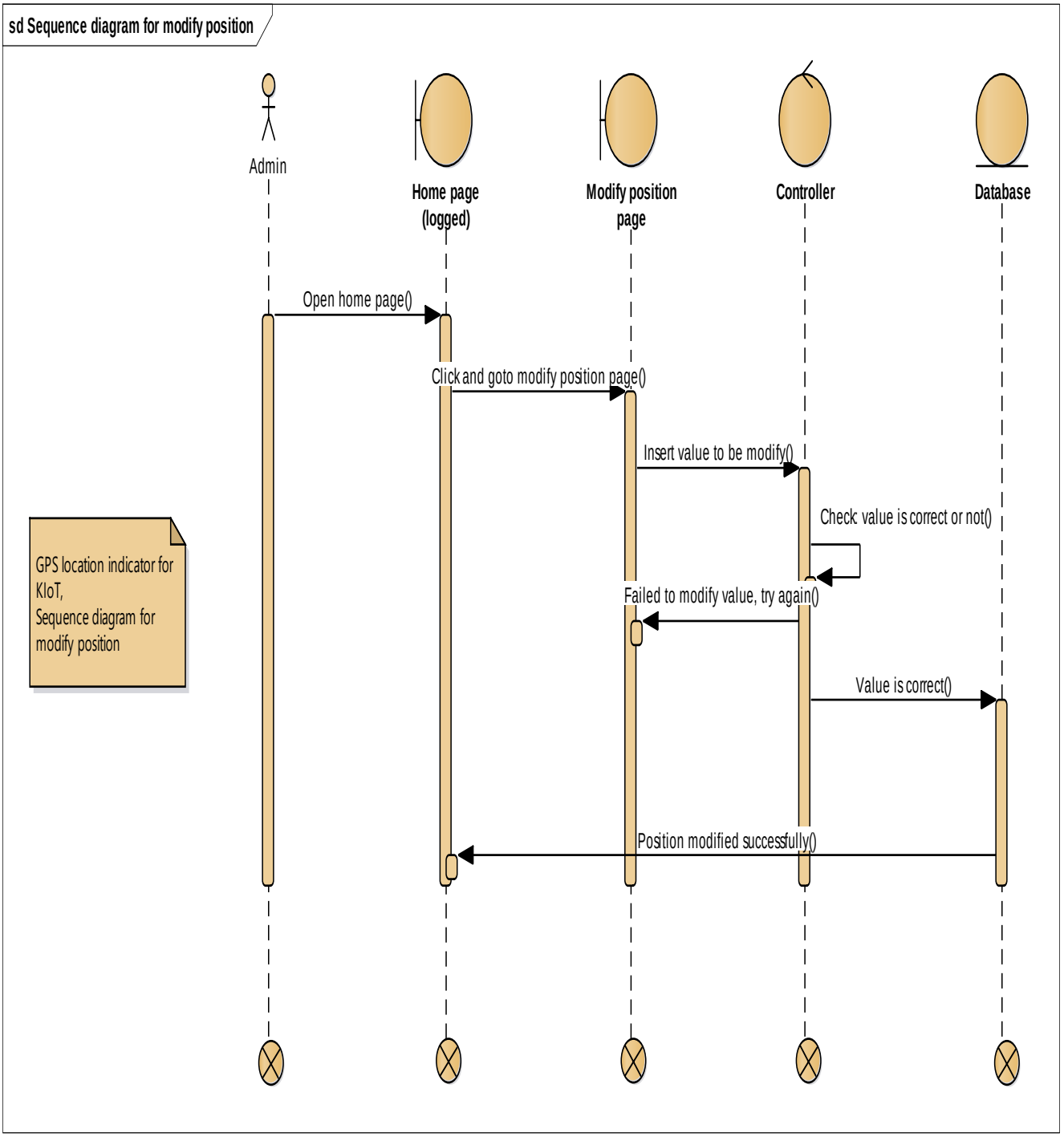


Figure 3.5 Sequence diagram for modify position

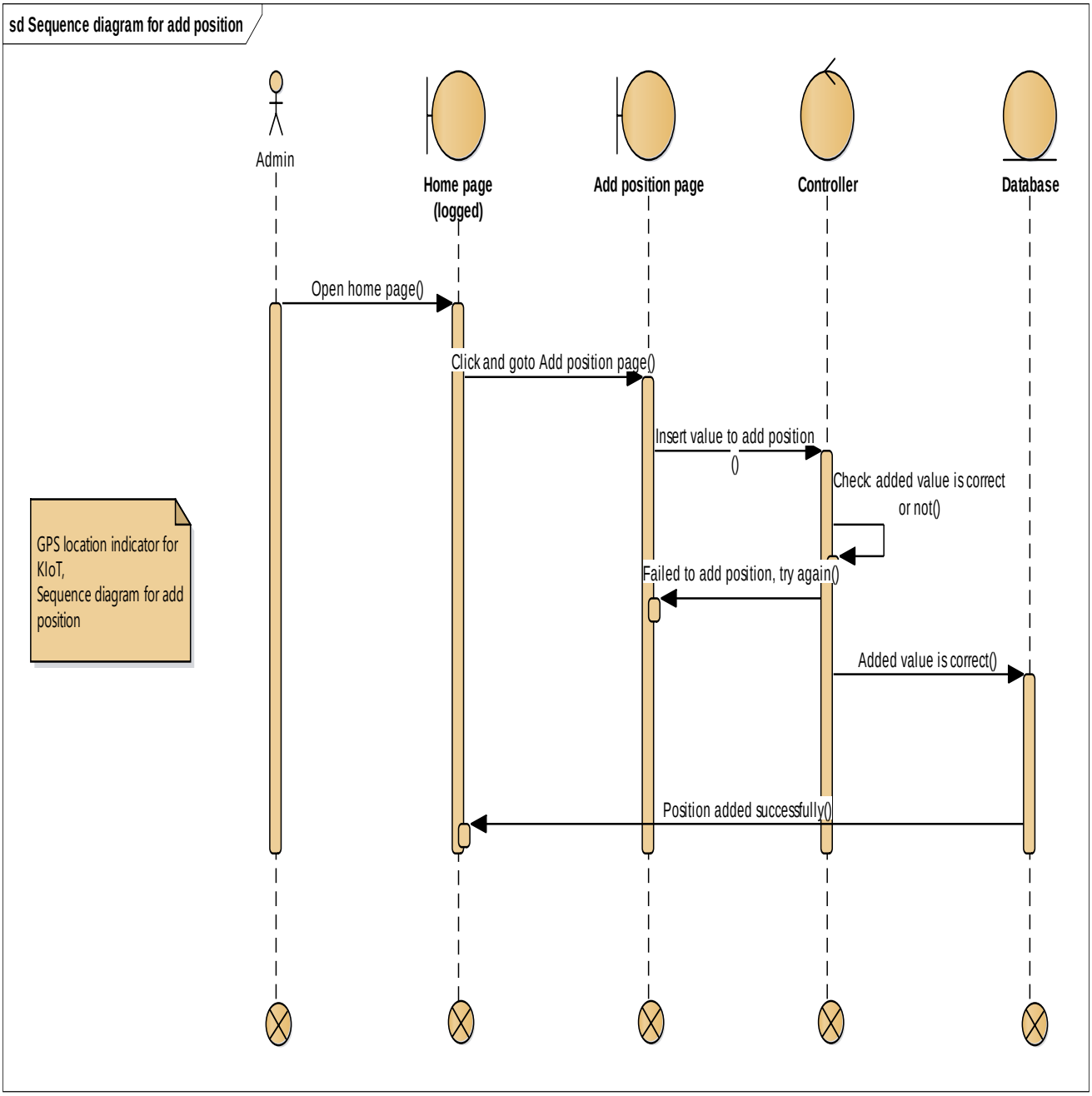


Figure 3.6 Sequence diagram for add position

3.3 Activity diagram

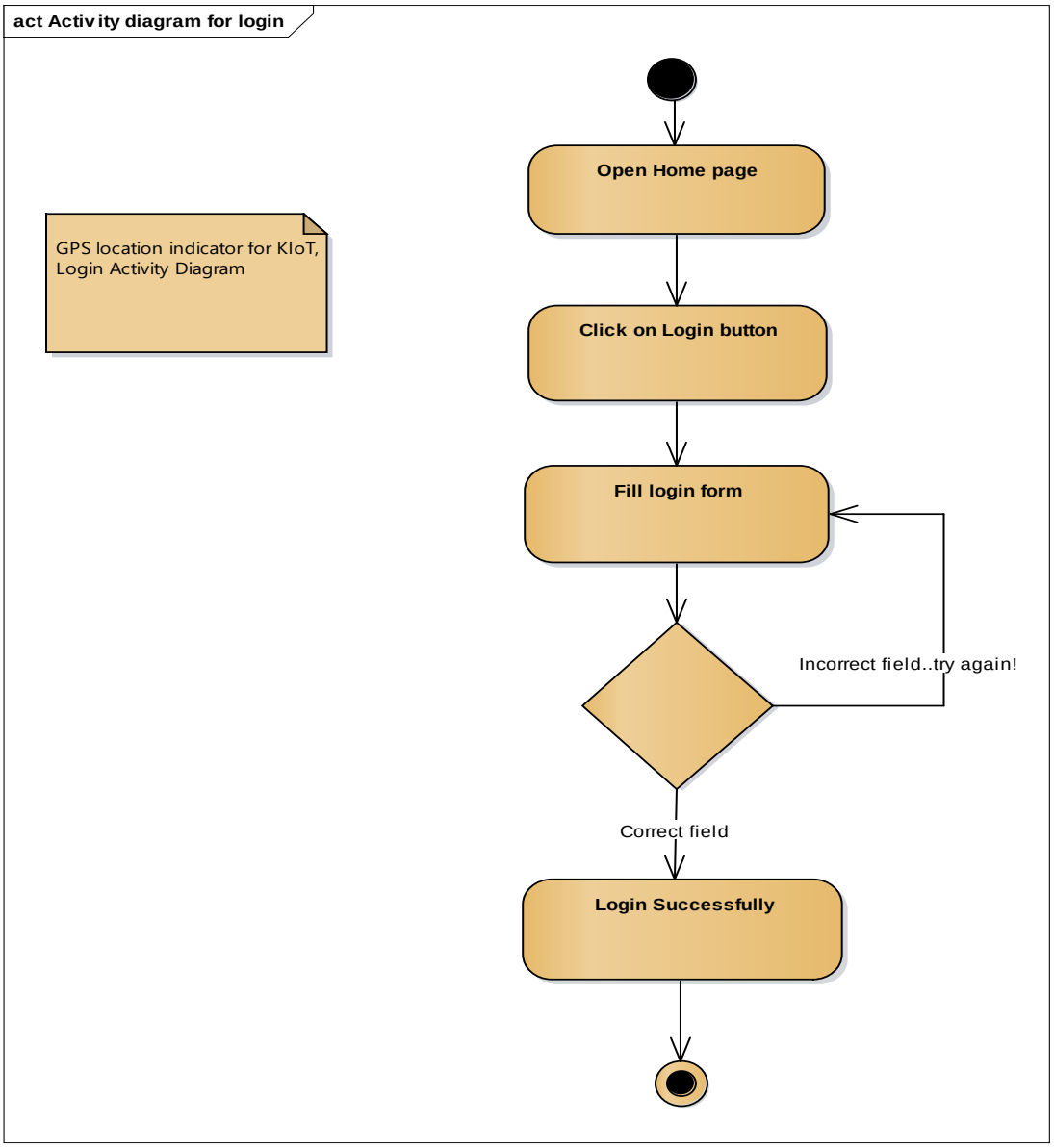


Figure 3.7 Activity diagram for login

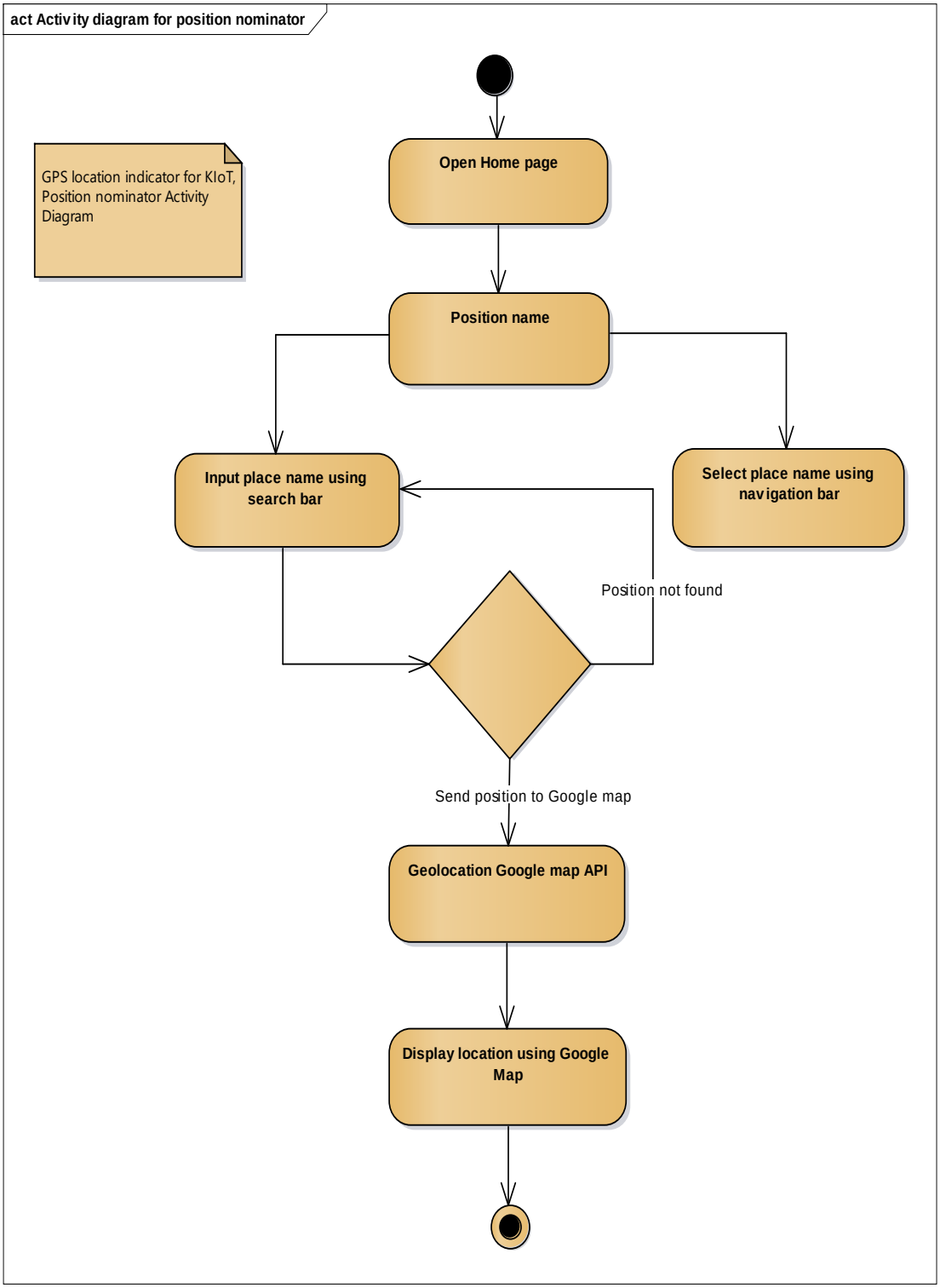


Figure 3.8 Activity diagram for position nominator

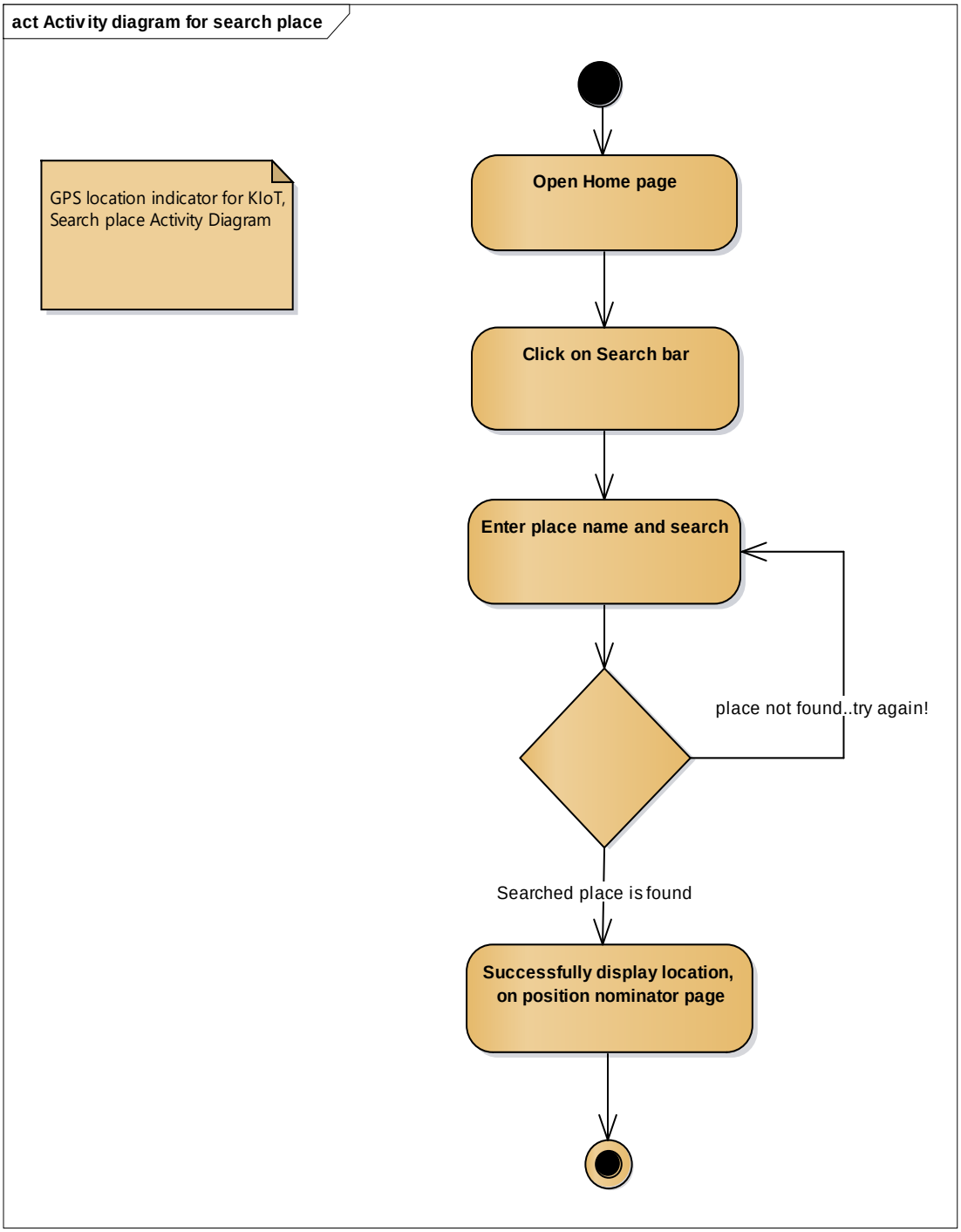


Figure 3.9 Activity diagram for search place

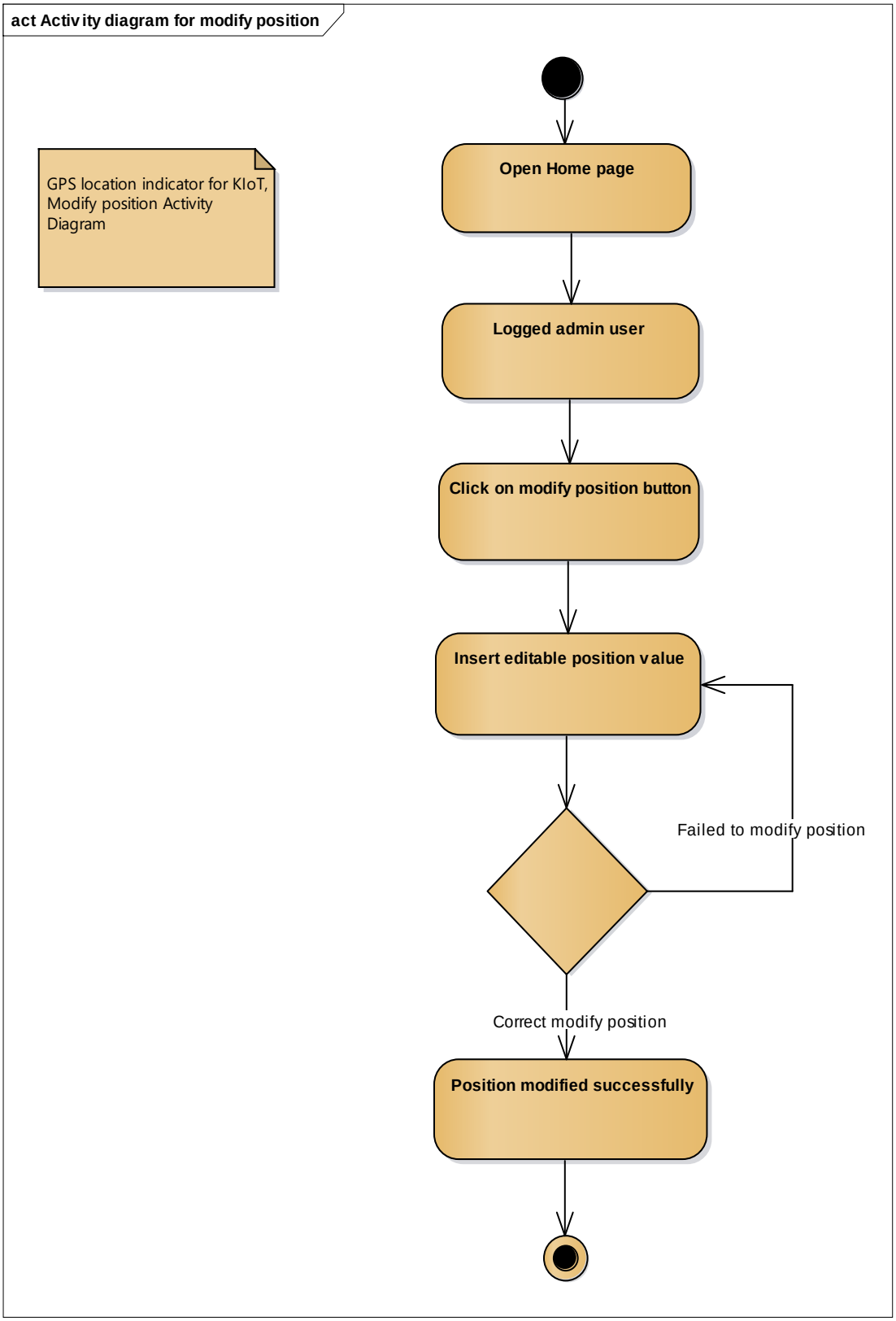


Figure 3.10 Activity diagram for modify position

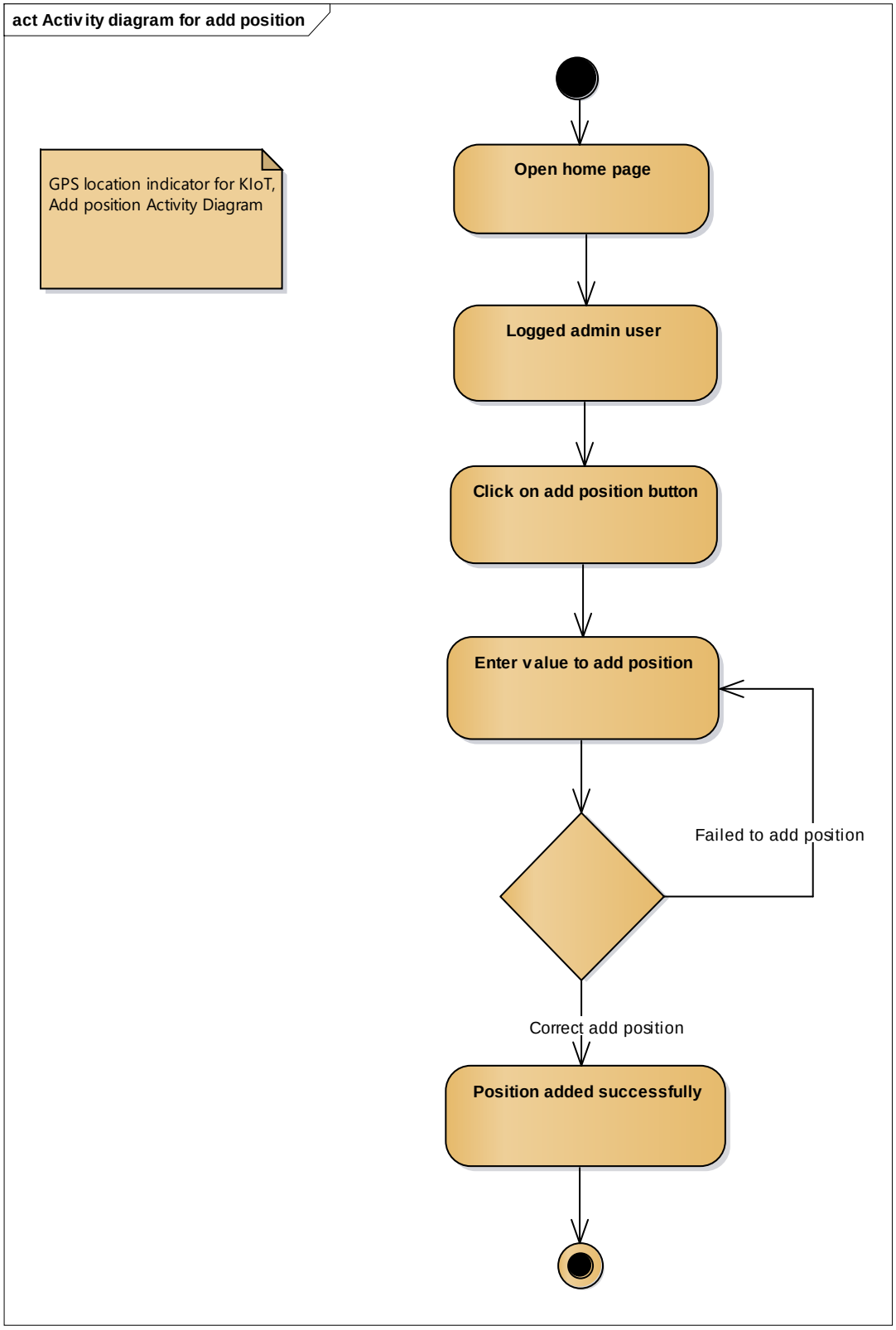


Figure 3.11 Activity diagram for add position

Chapter 4 System Design

4. Overview

The proposed system of design states a system completely from the actors' point of view and serves as the basis of communication between the client (user) and the developers. In the analysis model, however, does not contain information about the internal structure of the system, its hardware configuration, or, more generally, how the system should be realized. But the purpose of designing is to show the direction how the webpage is built and to obtain clear and enough information needed to drive the actual implementation of the webpage. It is based on understanding of the model, the webpage built on. The system design, includes purpose of the system, design goals, proposed system architecture like, system process, subsystem decomposition, hardware/software mapping, persistent data management, component diagram, deployment diagram, boundary condition, database design and access control.

4.1 Design considerations and Purposes

The system has a great purpose on the issues concerned with location based service system by providing necessary information, easing the work and working environment and others. The system gives different purpose for different users like employee, student, staff. For example, the student and employee gets different functionality from the system like knowing the exact location of different service, training, academic, college centers, and the real position structure of the university, this saves their time, reduce complexity. The purpose of this system is to understand the data modeling concept that is used in a real time scenario and to implement a fully functional database system which interacts with front end interface. The system design provides a comprehensive architectural overview of GPS location indicator. It presents a number of architectural views to depict different aspects of the system.

4.1.1 Architectural design

The proposed system architectural design contains the structure, behavior, and different views of a system. This comprises a system component, the expand systems developed, that will work together to implement the overall proposed system.

The architectural design is more described in the next section on figure 4.4 proposed system architecture.

4.1.2 High level design

The high level design in the proposed system is generally states the system design, to the overall design of the proposed system and contains the overall architecture/ description of any application that found in the system.

This the high level design includes the front end, backend, Google API, google API router and along with its database and its services, system, platforms used, and the relationship between different modules existed in the system. Basically converts the overall user requirements into a high level solution to design the application and its modules.

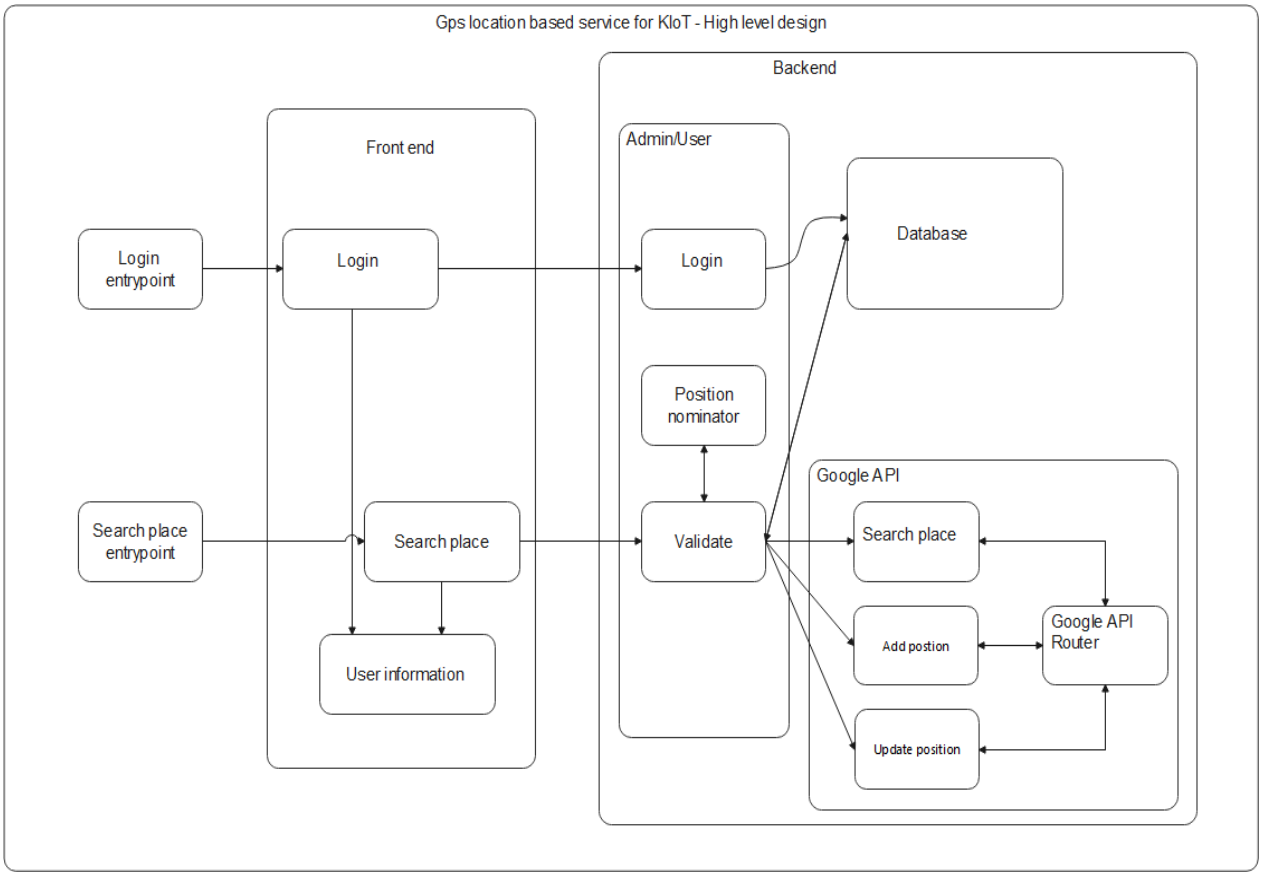


Figure 4.1 High level design

4.2 Design goals

The goal of designing is to model a system with highly quality. Implementing of high quality system depends on the nature of the design created by the designer. If one wants to make changes to the system after it has been put in to operation depends on the quality of the system design. So if the system is designed perfectly, it will be easy to make changes to it.

The goal of the system design is to manage complexity by dividing the system in to manageable pieces. Some design goal of the system is listed below.

- **Modifiability**: The system should be modifiable to modify different services depending on the need of the user.
- **Flexibility:** The system should be changeable to suit new condition or situation.
- **Usability**: is the 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.
- **Efficiency:** The system must do what it supposed to do efficiently without the problem.
- **Availability:** The system needs to be on work for 24 hours in a day and 7 days in a week as needed.
- **End user:** End user criteria's are qualities that are desirable from user's point of view like usability, maintainability and utility.
- **Accessibility** One of best feature of proposed system is its accessibility. Users can access the current information being everywhere in the country as well as on internet. To trace some of its best features related with accessibility like:
    - It is accessible without time limitation – user can share their idea every time.
    - Information or the same information accessed by multiple users at the same time.

4.3 Design guidance and Issues

Design guidelines are sets of recommendations on how to apply design principles to provide a positive user experience. We use design guidance to judge how to adopt principles as intuitiveness, learnability, efficiency and consistency so we can create compelling design and meet and exceed user needs.

Designers use such guidelines to judge how to adopt principles such as intuitiveness, learnability, efficiency and consistency so they can create compelling designs and meet and exceed user needs.

4.3.1 Performance

This is the measures of the system's operation under load. Criteria's for performance are the response-time. The system should respond fast with high through put, it should perform operation minimum time.

4.3.2 Dependability

The main target of the system is to provide a reliable and efficient place indication to users by using GPS location mapping. The proposed system is dependable on location; because the system focuses on the positioning location.

4.3.3 Maintenance

The system should be easily extensible to modify the course offering criteria, add new functionality, portable to different platforms. The code for the system should be easily readable, understandable and should be easily mapped to specific requirements.

4.4 Proposed System Architecture

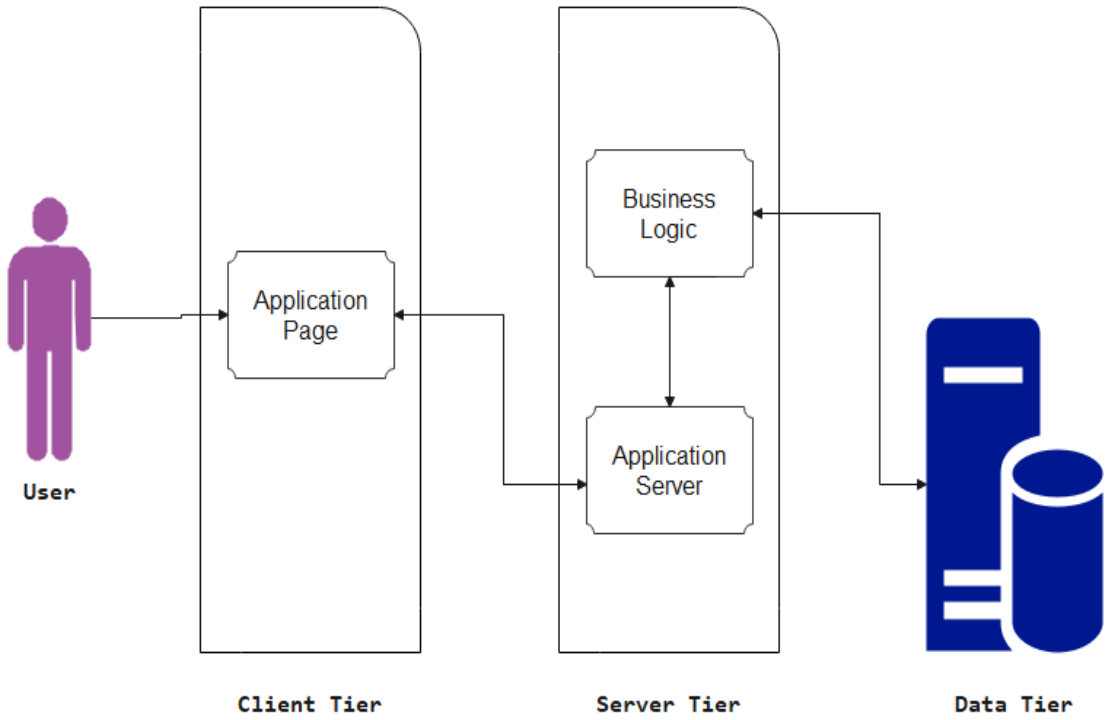


Figure 4.2 Proposed system architecture

Client Tier

The client tier describes the users who participate on the system, on our system the users could be anyone, but we mainly focused on student and employees who access the system.

Server Tier

The middle tier will contain the core parts of the gps application, i.e., the application server and business logic. The application server will handle all requests coming from the client machines. The requests are different with its type, for example; request for data insertion, request for report generation and others. It is also the web server which the responses that is forwarded to the client machines.

The **business logic** part will hold the process and core functions that will be implemented in the system. When the data is submitted from the client machines, first it will be handled by the functions of the application server and then transferred to the business logic for processing. Again, the business logic processes the data and sends it either to the database or back to the web server, this is determined by the type of service required.

Data Tier

The system uses one database; this database is the repository consisting of the application data. It is here that all the database tables will be stored.

4.4.1 System Process

The system process explains the input features, process and the final result of output.

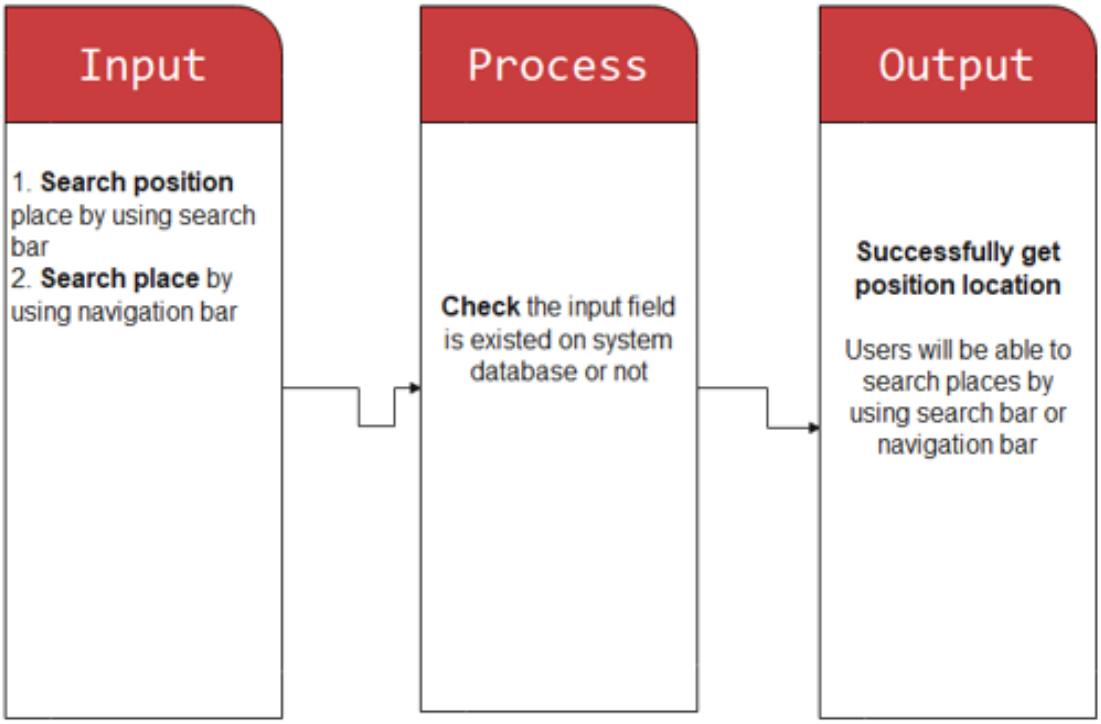


Figure 4.3 System process

4.4.2 Subsystem Decomposition

To reduce the complexity of the solution domain, we decompose our system into simpler parts, called subsystems, which are made of a number of solution domain classes. In the case of complex subsystems, we recursively apply this principle and decompose a sub-system into simpler subsystems and mainly we have only two actors: an admin ad user. We decompose our system in to two subsystems. These are:

Admin

Manage position

- Add position
- Modify position
- Delete position

User

Position nominator subsystem

- Search place using search bar
- Select place using navigation bar

View subsystem

- View detail information
- View destination place

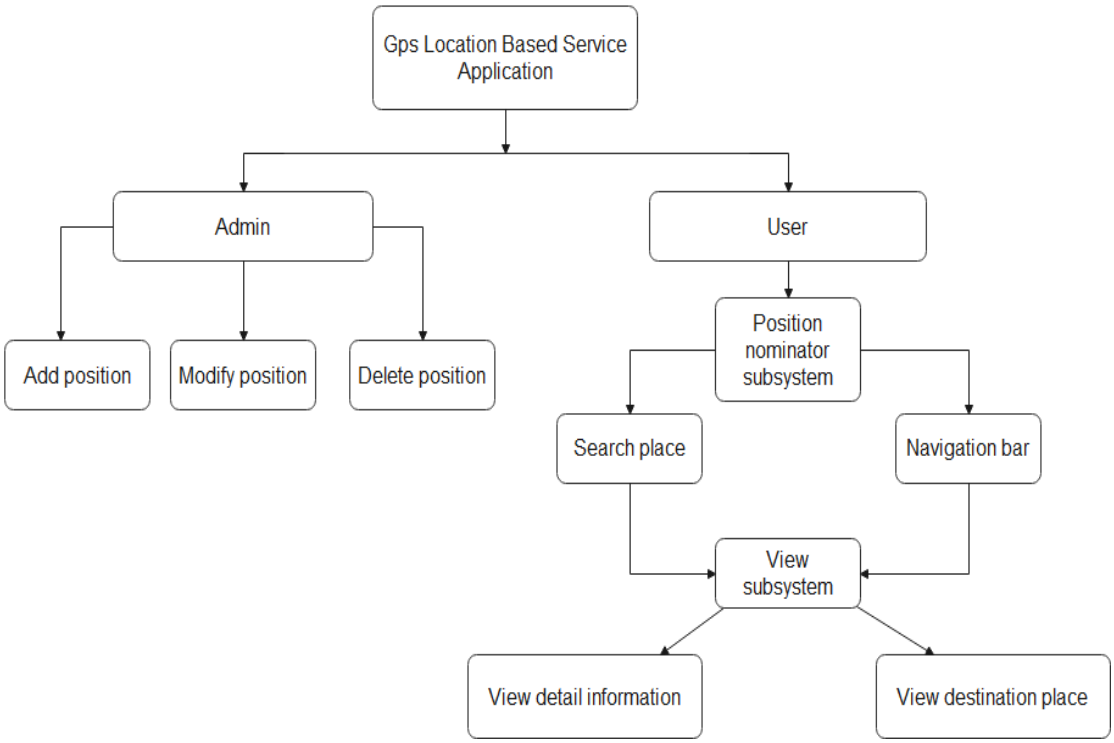


Figure 4.4 Subsystem decomposition

4.4.3 Hardware/software mapping

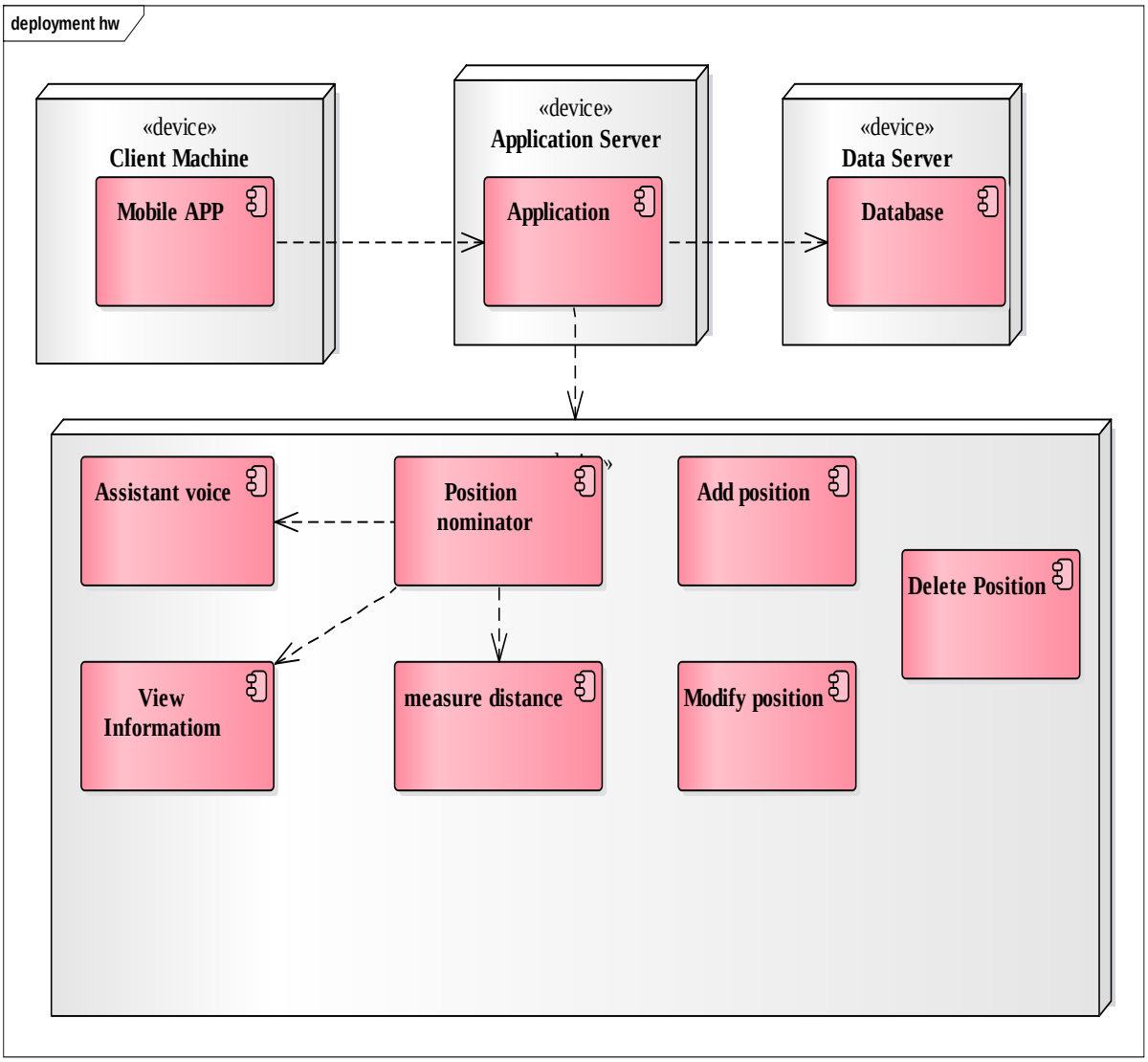


Figure 4.5 Hardware/software mapping

4.4.4 Persistent data management

Persistent data modeling deals with how the persistent data such as file, database, etc. are stored and managed and to outlive a single execution of the system. This Persistent data management describes the persistent data stored by the system and the data management infrastructure required for it. The proposed system will use firebase database for storing data. This will allow the database to be easily integrated and accessible by the rest of the system.

Data management issue raises the questions, which data need to be persistent, where should persistent data be stored, and how are they accessed. Persistent data represents a bottleneck in the system on many different fronts.

Most functionality in system is concerned with creating or manipulating persistent data. For this reason, access to the data should be fast and reliable.

4.5 Design Control

The purpose of design control is to make sure that our plan has been made to be implemented to ensure that all final requirements of the design are met during our development process. By doing this our system had a better control over development, review, and documentation. Design control includes.

1. General
2. Planning
3. Design input
4. Design output
5. Design review
6. Design verification
7. Design validation
8. Design transfer
9. Design changes
10. Design History File (DHF)

These steps can be applied using a design control process as can be depicted.

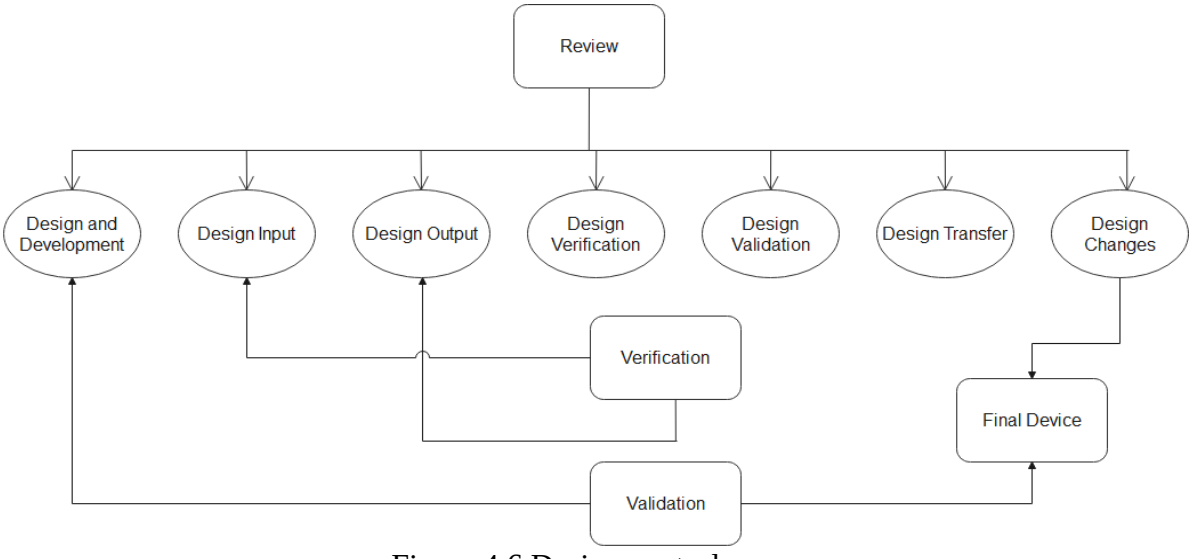


Figure 4.6 Design control

Design control must include all activities involved in designing the product and must apply responsibility to each aspect of the implementation of the design. According to the Quality System Regulation (QSR) a design controls is necessary for all type of

devices. Design control also necessary for all devices which are automated by a software, and for some type of devices. Each part of design control is integral in keeping patient and user risk low as well as to ensure that the best product in developed.

4.6 Low-Level Design Model

4.6.1 Class Diagram

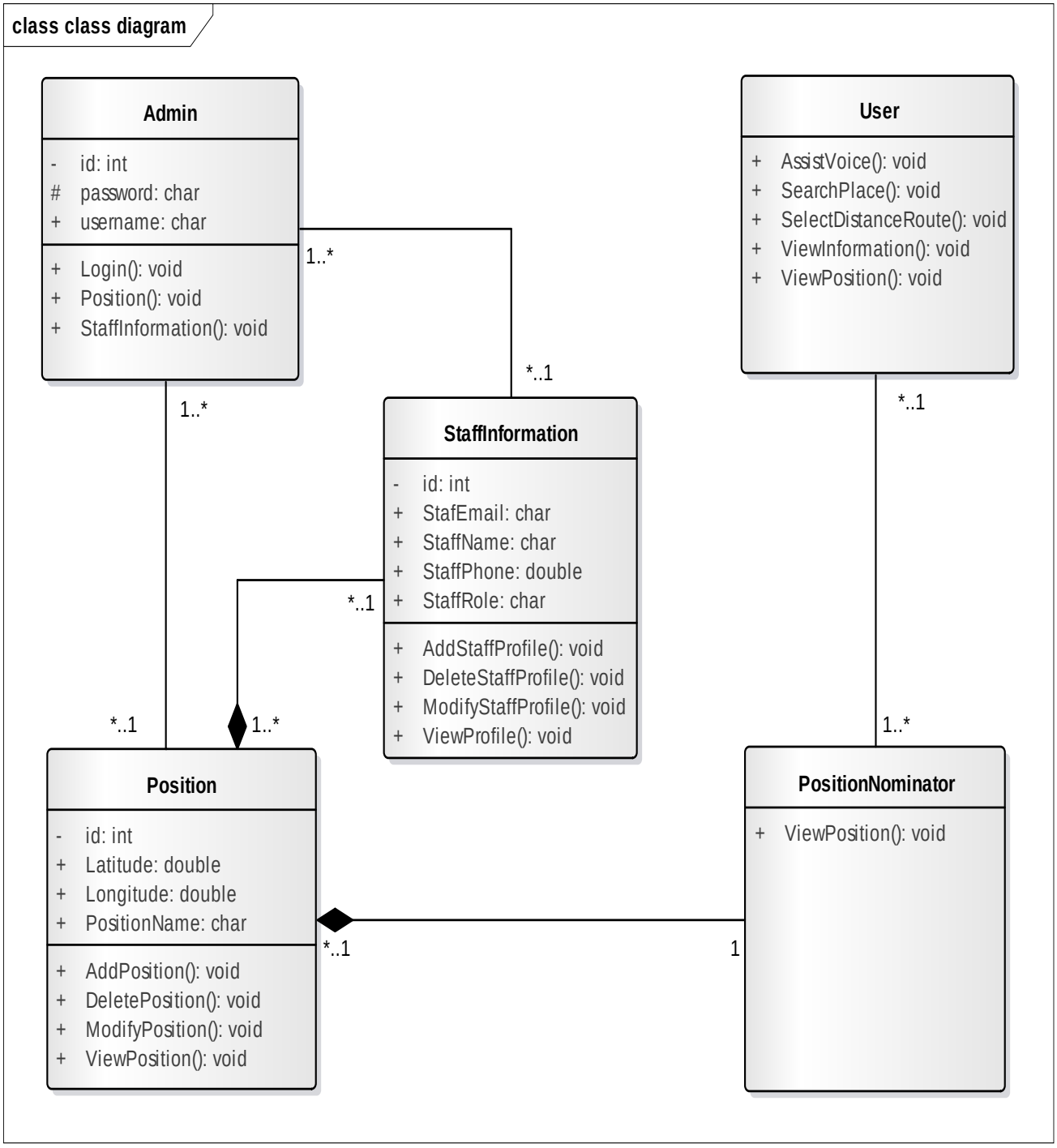


Figure 4.7 Class Diagram

4.6.2 State Chart diagram

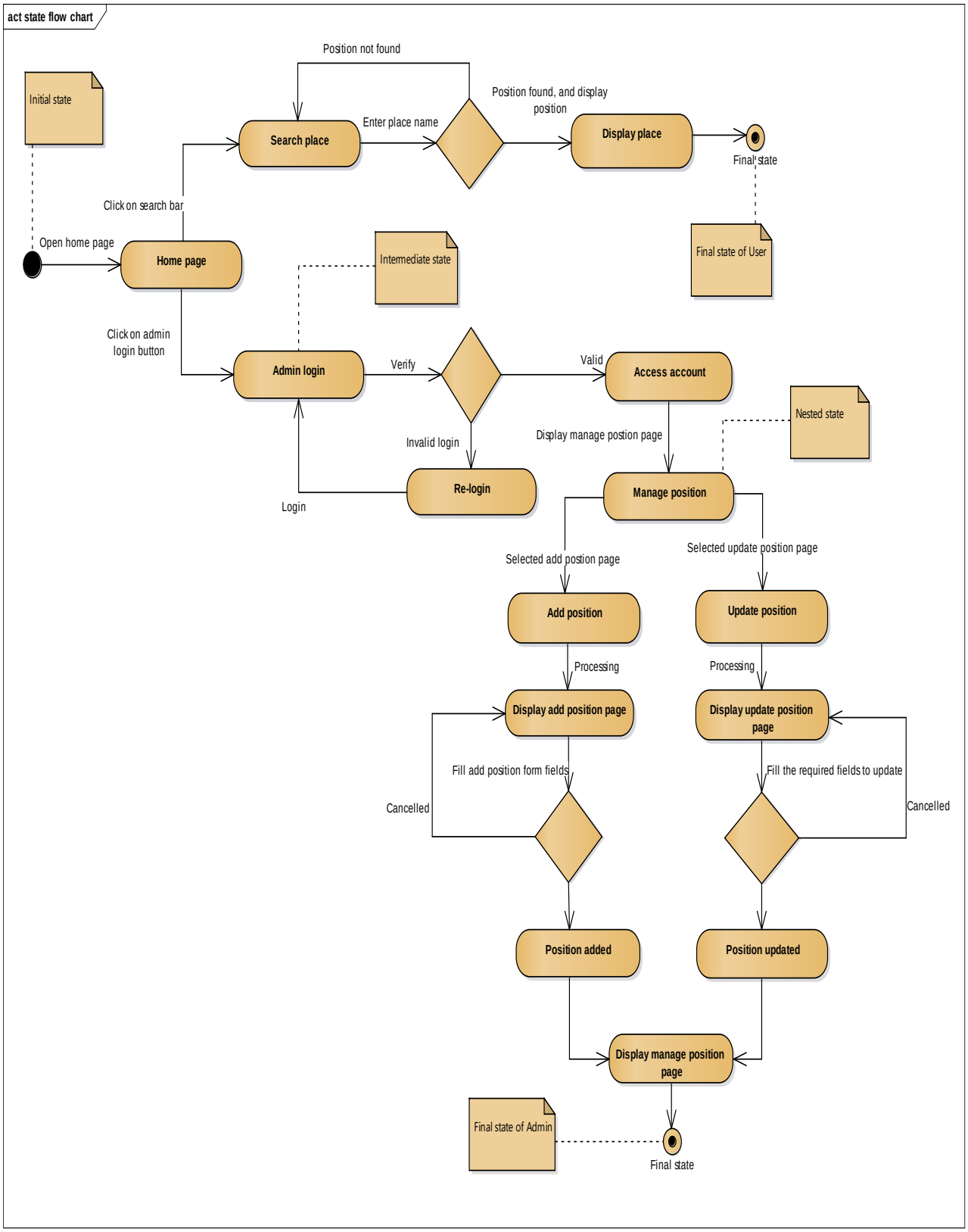


Figure 4.8 State chart diagram

4.6.3 Component's diagram

In this modeling components of the system will be wired showing that there is relation among components. As component diagram is a special kind of diagram in UML.

We use to describe the components we used to make those functionalities not to describe the functionality of the system.

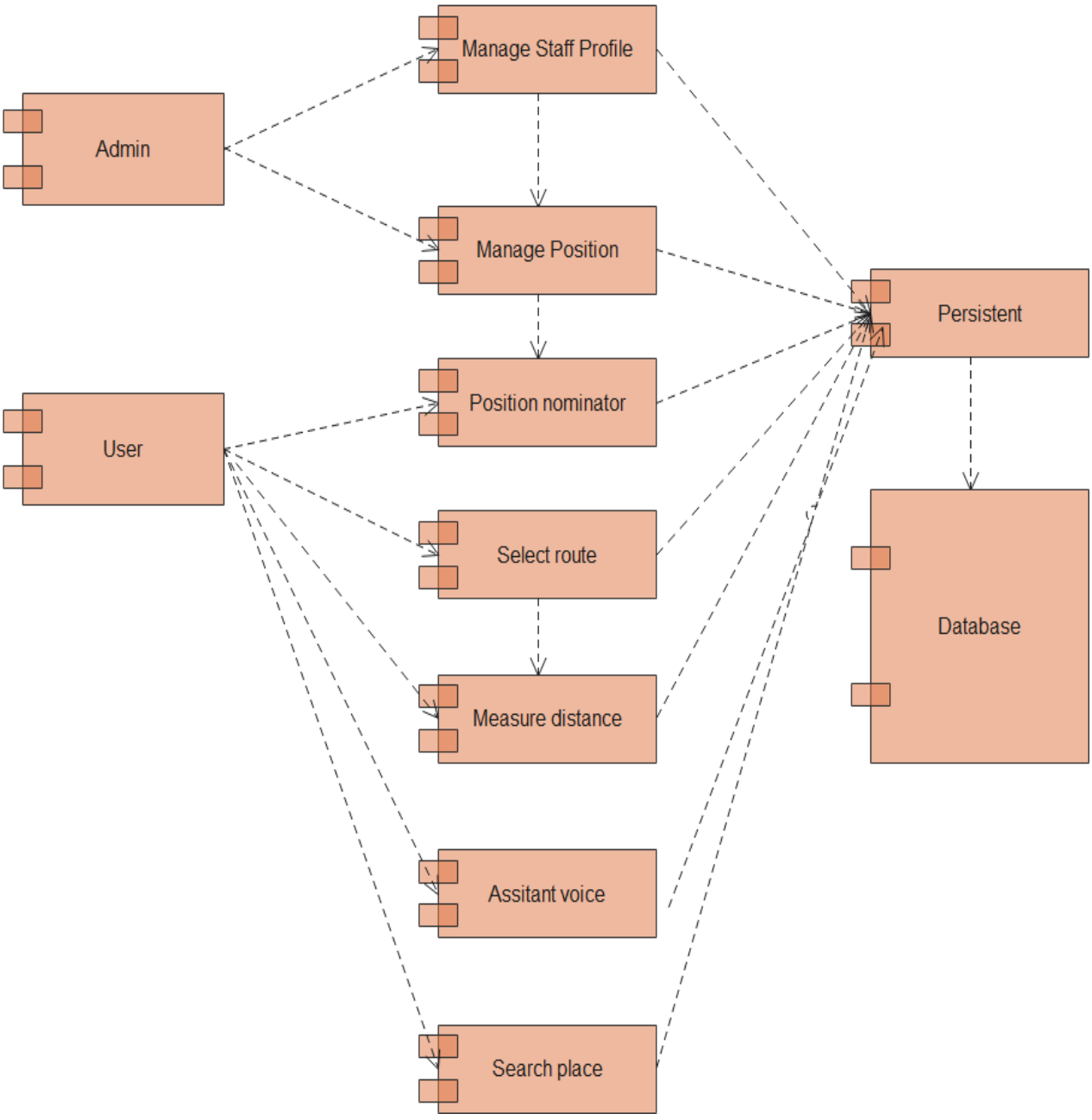


Figure 4.9 Component's diagram

4.6.4 Deployment Diagram

Deployment diagram we used in our system to show the hardware of the system, the software that we installed in the hardware and also the middleware that we used to connect the disparate machines to one from another.

We also used to show the software and hardware components of our work together. This configuration of the hardware nodes (users) and shows the components (positioning locating, voice assistant, modify place, distance measure) that run on those nodes with two machines (admin machine, user machine).

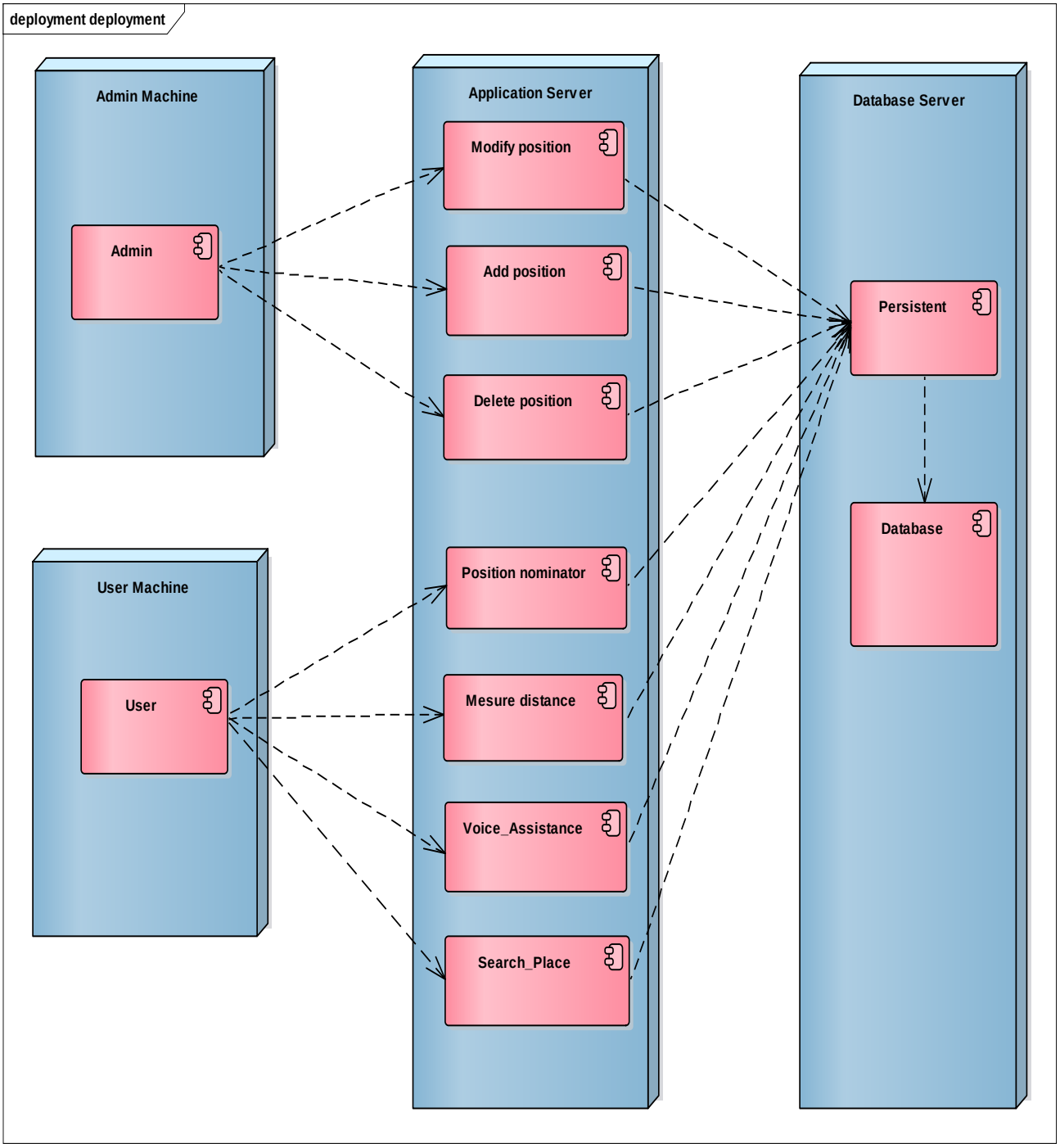


Figure 4.10 Deployment diagram

4.7 Database Design

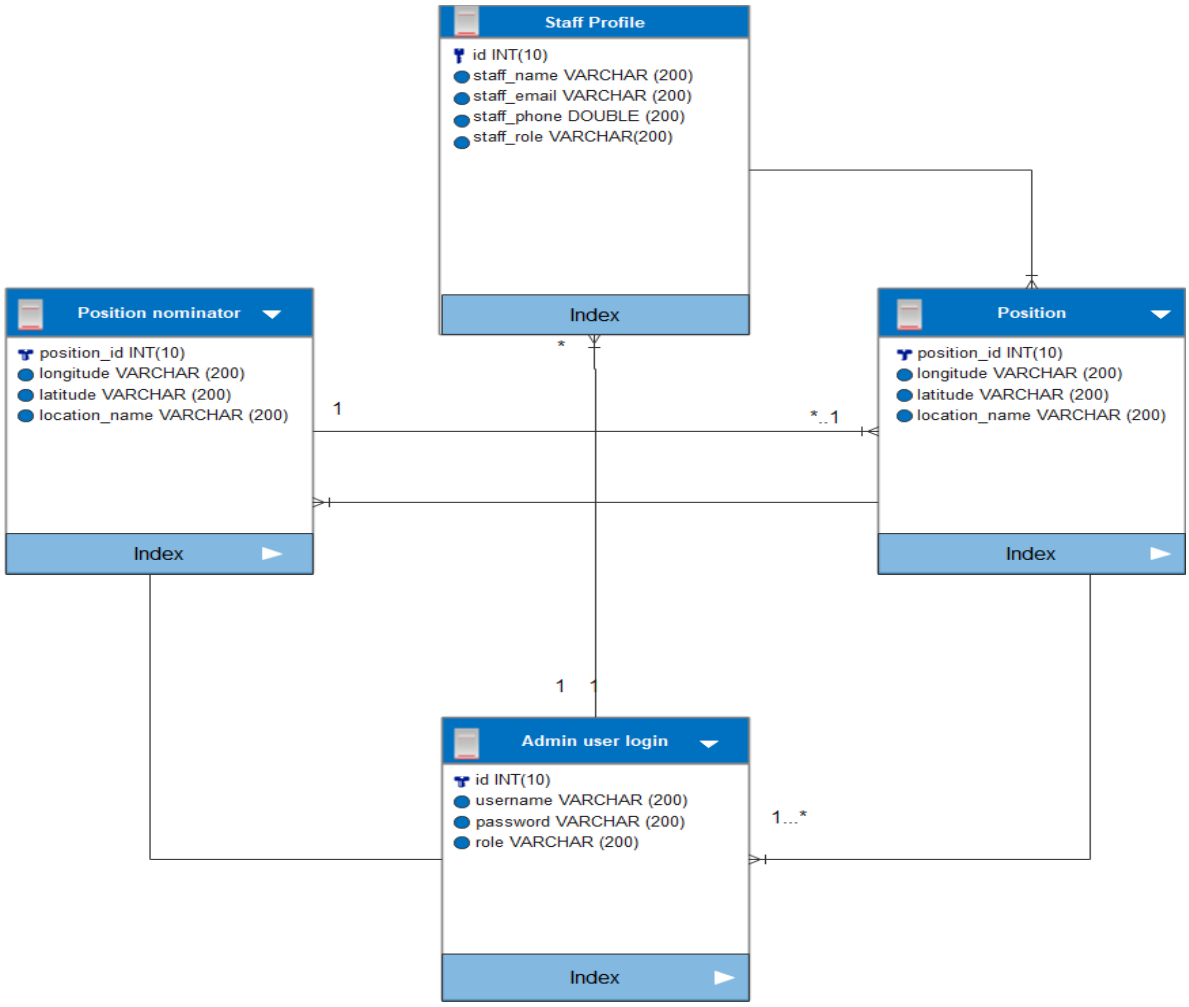


Figure 4.11 Database design

4.7.1 Data Dictionary

Table 4.1 Data dictionary for Positioning nominator

Column	Data type	Allow null	Key	Description
Position id	Int (10)	Not null	Primary	Auto Increments
Position name	Varchar (200)	Not null		Location name
longitude	Varchar(200)	Not null		Giving east-west position
latitude	Varchar(200)	Not null		Giving north-south position

Table 4.2 Data dictionary for Position

Column	Data type	Allow null	Key	Description
Position id	Int (10)	Not null	Primary	Auto Increments
Position name	Varchar (200)	Not null		Location name
longitude	Varchar(200)	Not null		Giving east-west position
latitude	Varchar(200)	Not null		Giving north-south position

Table 4.3 Data Dictionary Login for Admin user

Column	Data type	Allow null	key	Description
Id	Int (10)	Not null	Primary	Auto Increments
username	Varchar (200)	Not null		Admin username
password	Varchar(200)	Not null		Admin password
Role	Varchar(200)	Not null		Admin Role

Table 4.4 Staff Profile

Column	Data type	Allow null	Key	Description
Id	Int (10)	Not null	Primary	Auto Increments
Staff name	Varchar (200)	Not null		Staff name
Staff email	Varchar(200)	Not null		Staff email address
Staff phone	Double(200)	Not null		Staff phone number
Staff role	Varchar(200)	Not null		Staff role

4.8 Boundary condition and Access control

The access control shows who can access which class in the system and we describe it by using access control matrix.

Table 4.5 Boundary condition and Access control

	Method	**System admin**	**User**
Functionality	Login	√	X
	Position nominator	X	√
	Add position	√	X
	Modify position	√	X
	Delete position	√	X
	Add Staff profile	√	X
	Modify Staff profile	√	X
	Delete Staff profile	√	X
	View information	X	√
	Search place	X	√

4.8.1 Access Controlling

Access controls are security features that control how users and systems communicate and interact with other systems and resources. Access is the flow of information between a subject and an object. It is all about the act of ensuring that an authenticated user accesses only what they are authorized to. In our systems, different actors have access to different functionality and data. The system is divided into two modules namely:

1. Administrator module: The administrator module is a person who is responsible for managing system, add position, delete position and modify position if replacement change is required.
2. User module: The user is who has access grant to use the system to view information's about the university and different places, by identifying their destination address using the installed app, they can go to the specified places. Generally, users could be students, employee or anyone who wants to use the system in the institute.

Conclusion and Recommendations

Conclusion

In today's fast moving world people tends to reduce their work effort and also save their time. This Mobile application intelligently provides the service as per locations, thus reducing user effort. One of the best way to personalize information is to enable them to be location based. The User Interface of the system is very user friendly and can be easily used by users. Using this application in the user can focus on his/her daily activities without any worrying and users also have been increasingly pushing for better location accuracy, which is in turn supporting the GPS technological development in smartphone. This application helps users in a variety of aspects and thus has a greater scope of development in the future work.

Recommendations

The recommendation is when developing the gps location application can obtain user location from a mobile device might be complicated. The future work is

User movements

Developing this feature in the future is, when a user location is changed, to estimate user location movements every often.

Finding a facility

The GPS location indicator application can help user to find hospitals, schools, gas filling station, or any other facility of interest indicated by user within certain range. Just like a GPS device its location will also be updated as soon as user change his/her position.

Location based reminders

User can enter in to-do lists when location information is activated when the user passes by.

References

[1] http://www.neaeagovet.com/kiot/(neaeagovet, 2022)

[2] https://www.gps-coordinates.net/

[3] https://www.researchgate.net/publication/220232925_Applications_of_location-based_services_A_selected_review

[4] https://en.wikipedia.org/wiki/Location-based_service

[5] https://earth.google.com/

[6] https://www.aua.gr/tsili/e-serv_public/LAS-NPSC2006.pdf

[7] (Msc.Muktikanta Sahu, 7/06/2013)

[8] https://krazytech.com/technical-papers/location-based-services-through-gps

[9] https://gssc.esa.int/navipedia/index.php/Location_Based_Services

[10] https://link.springer.com/article/10.1007/s10291-002-0031-5

[11] Priyanka, Ruta Gadgil, Neha Tamhankar, “Location Based Service suing GPS for mobile”in ARPN journal of Science and Technology Volume: 04 Issue: 05 | May-2015.