ÇANKAYA UNIVERSITY
FACULTY OF ENGINEERING
COMPUTER ENGINEERING DEPARTMENT

Project Report

Version 1

CENG 407

Innovative System Design and Development I

P2018-17
Scavenger Hunt Game Using BLE Beacon

Ümmügülsüm Kaşıkçı
201311028
Aslıhan Asena Şahin
201311054
Nuri Akseli
201611653

Advisor: *Dr. Instructor Murat Saran*

Table of Contents

Abstract

In this project, we will develop a mobile “Scavenger Hunt Game” which will be a service-based web application built on top of this application for BLE Beacons, that makes it possible to do all your configurations of the application on the web. This game will be a fun game where several teams earn points by doing the jobs in the task list which is given to them and try to get the highest points by doing the jobs that specified in the city, campus or a certain area. The fundamental idea of this scavenger hunt game type is that you can see the locations on the map by following specific rules. Players can make appear the locations as game creator wants and questions pop up when a player is at the right position. The main purpose of this project is to make easier to perform the missions which is expected from people with an entertaining way [1].

Key words:

Bluetooth Low Energy (BLE), BLE Beacon, Android Studio, Firebase, Scavenger Hunt Game, Mobile Application, Web Services.

Özet

Bu projede, BLE Beacons için bu uygulamanın üzerine inşa edilmiş, web üzerinde uygulamanın tüm yapılandırmalarını yapmanıza olanak sağlayan hizmet tabanlı bir web uygulaması olacak mobil bir “Scavenger Hunt Oyunu” geliştireceğiz. Bu oyun, çeşitli ekiplerin kendilerine verilen görev listesindeki işleri yaparak puan kazandığı ve şehir, kampüs veya belirli bir alanda belirtilen işleri yaparak en yüksek puanları almaya çalıştığı eğlenceli bir oyun olacak. Bu Scavenger Hunt oyun tipinin temel fikri, belirli kuralları izleyerek haritadaki konumları görebilmenizdir. Oyuncular, oyun yaratıcısının istediği yerleri görebilir ve bir oyuncu doğru pozisyonda olduğunda sorular ortaya çıkar. Bu projenin temel amacı, insanlardan beklenen görevleri eğlenceli bir yolla yerine getirmeyi sağlamaktır [1].

Anahtar Kelimeler:

Bluetooth Düşük Enerji (BLE), BLE Beacon, Android Stüdyosu, Firebase, Scavenger Hunt Oyunu, Mobil Uygulama, Web Servisleri.

1. Introduction

1.1 Motivation

As a group of computer engineer candidates, we are designing a game which will make daily responsibilities less boring. In this project, we are aiming to use Beacon, Game and Android technologies together. We decided that Firebase is the most suitable database for our project. In order to reach our aim, we made researches about usage areas of beacons, web servers and games.

1.2 Problem Statement

In developing world, people have daily responsibilities and they can feel bored with the realisation of these responsibilities and sometimes they can make a little cheat on their work lives. For example, they can make someone else to do their jobs. Therefore, their responsibilities cannot be done as one hundred percent. If we think that these responsibilities are important and must be done correctly, we should change the old way. If they have a competitive game about their daily responsibilities, their potential to do their works increases.

In daily life, people do not have same characteristic abilities. Some people cannot communicate with strangers or some need to handle their works as being a group. But, people cannot be close with other group members all the time and they cannot help their group members to do their project. Hence, we need something to get people close with each others.

1.3 Solution Statement

In our project, we will use BLE Beacons and mobile technologies. BLE Beacons provides Bluetooth signals to detect people's mobile devices' location. So, we are developing a program which managers can add people's responsibilities as missions. And, managers are able to follow missions' status. Also, this program is a competitive game. People are going to be in race with others. Therefore, they definitely want to get higher scores and they do not get bored easily.

2. Literature Search

2.1 Gamification

Gamification can be defined as the use of game design elements in non-game applications. It is the process of integrating game mechanics and game dynamics into a website, service, online platform or content portal to ensure participation and engagement [2].

2.1.1 What is Gamification?

Gamification means applying gaming philosophy and game-based thinking to non-game activities in order to change the tendencies and behaviours of people. The main goal of this method is combining work with fun to encourage people and increase their participation and motivation [3]. For example, gamification can be used to increase the participation in a business activity, to increase the frequency of use of a service or a website, to encourage people to share more on their platforms where they are registered, or identify active users in a platform.

2.1.2 Game Mechanics and Game Dynamics

Game mechanics are the fundamental actions, behaviours, processes and control mechanisms that are used to gamify an activity. They are the rules and techniques that taken together to create a compelling and engaging user experience. They make the activity challenging, fun, satisfying, or any other emotion that designers of game want to remind users [4]. Using them individually or together generates highly motivational users. These game mechanics are:

- Points
- Levels
- Challenges, Trophies, Badges, Achievements
- Leader boards [5]

On the other hand, game dynamics are the reasons why people are motivated by game dynamics. The emotions that are reminded to users by game mechanics are called as dame dynamics. Game dynamics are people's desires, motivations and needs of the game experience. Some of the game dynamics are:

- Reward
- Status
- Achievement

- Self-expression
- Competition
- Altruism [5]

2.1.3 History of Gamification

Using play and fun to motivate people and make work life more entertaining is in our lives for a long time. According to known, the use of gamification started in 1912 but the term gamification is added to our vocabulary recently. Even before this term entered into our lives, many researchers were already exploring the role of fun and play in computer-based applications. In 1980s, publications that are related to Gamification were released by Thomas W. Malone which are "What Make Things Fun to Learn" and "Heuristics for Designing Enjoyable User Interfaces: Lessons from Computer Games". In 1990s, Stephen W. Draper published Analyzing Fun as a Candidate Software Requirement [6].

In the early 2000s, the role of fun and play in user experience is became a more considered tool by people. The idea behind this use of playfulness in software was that instead of just making simply usable interfaces, they could be fun to use as well. Therefore, to enhance the experience that the user had with the software, designers chose to consider how positive emotions and good feelings could be ensured through things such as sounds, graphics and challenges [7]. After this, applications that directly used elements from games have appeared. In 2007, Chore Wars which is a task management application with a role playing game with experience points and monster battles has released [6]. Then, Bunchball which is a gamification tool for enterprises was introduced. Bunchball launched the Nitro platform which allows organizations to integrate game mechanics into social networks, mobile applications and websites [7]. In 2009, Foursquare which is a highly successful and popular application was released. It is a location sharing social network application that gives points and badges to users for using its "check-in" service to indicate their locations. In 2010, gamification became more popular and the term adopted by companies such as Bunchball and Badgeville to represent the platforms they had created to integrate game elements into websites [6]. In 2011, the first Gamification Summit held in San Francisco [7].

Since 2011, gamification gained much more attention in both industry and academic world and growing rapidly. Conferences are organizing, books and articles are publishing about

gamification. In time, more and more organizations started to use gamification in many different areas.

2.1.4 Examples of Gamification

2.1.4.1 Amazon.com

Reviews in online websites are very significant for customers because other customer's opinions have a big influence on the decision of buying the products. Both the quality and the quantity of reviews are important. Writing a comprehensive review can be difficult. That is why some comments are so much more beneficial and useful than others [8].

In order to improve both the quality and the quantity of reviews Amazon.com started the Amazon's Top Reviewers program which rewards customers for their helpful reviews. Customers vote the reviews of other customers to indicate if that review was helpful for them or not by choosing yes or no. The number of helpful reviews of a customer turns into points. To increase the competition, there is a leader board which shows the rank of reviewers [8].

2.1.4.2 Prezi

Prezi is a popular presentation software like Microsoft PowerPoint. It is a web-based tool for creating innovative and original presentations. This service works in the online platform and it offers a totally new and different way of presenting such as zooming to pictures and using one big picture instead of regular slides. Its unique features are the reasons why people choose Prezi against Microsoft PowerPoint which its big competitor [8].

Prezi targeted students which are the professionals of tomorrow to get the general public to use Prezi instead of Microsoft PowerPoint. Because, if they are using Prezi now, they might continue to use it in the future. To reach students, Prezi has started the Prezi Ambassador Program [8]. The Prezi Ambassador Program is an exclusive opportunity for fully matriculated university students around the world to gain valuable start up experience of their own [9]. Students from all over the world can apply for the Prezi Ambassador position of their university. There can be only one Ambassador in each university. The mission of the Ambassador is to prepare a plan to make Prezi popular in their university. To arrange activities like making presentations for other students will earn points, status and Prezi merchandise to Ambassador. Ambassadors from all over the world compete against each other for big prizes such as a trip to Prezi offices in Budapest or San Francisco. Prezi uses

some of the key game elements in this program such as points, status and leader boards. In this way, Prezi uses gamification in its Ambassador Program to get new users from all over the world [8].

2.2 Android

2.2.1 What is Android?

Android is an operating system which is designed for mobile devices and it is working on UNIX kernel. It is an open source and free to use. It was developed by the Open Handset Alliance, led by Google, and other companies. It has a quite comprehensive software architecture [10].

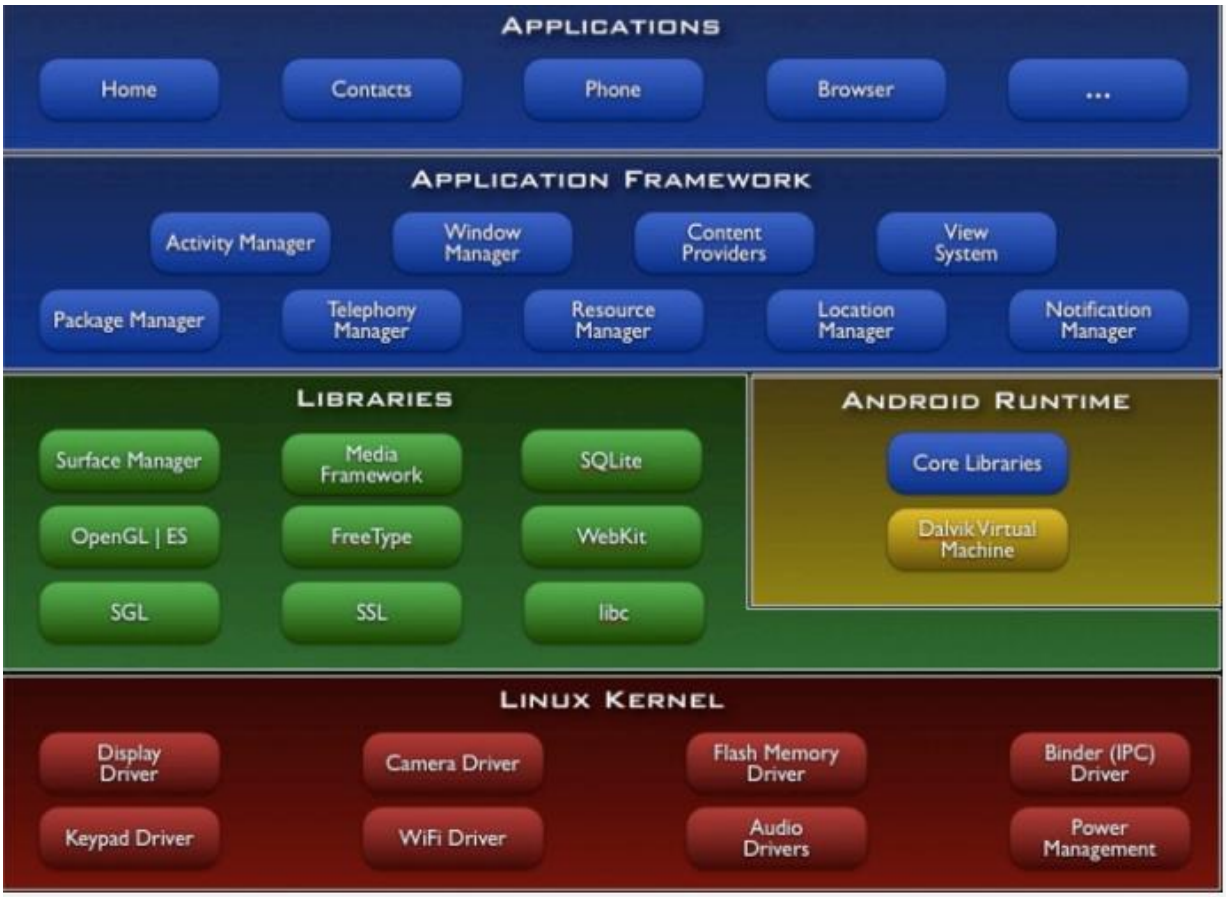

Figure 1 The architecture of android operating system [11]

Android has all necessary substructures and a large library for software developers. Previously, for the development of an application for mobile devices, developers handled the complex C and C++ codes which can change according to the device's processor, but thanks to evolution of mobile operating systems hardware access provided successfully by the developers. In this way, information of the hardware that works on a mobile device is not a

necessity to access and control the hardware's component with Software Development Kit (SDK) [12].

2.2.2 Common Applications which Comes with Android

When you buy an Android cell phone, you will have some applications like web browser, music player, camera application, and mail manager. These are just a few of these applications. In addition, mobile device manufacturers provide their own applications. For example, for HTC phones, there is an interface library that coding on Android OS and its name is HTC sense. This is the special part of an Android OS. It does not depend on one shape of usage way. Different manufacturers are free to produce their own usage way. This is the purpose of establishing the Open Handset Alliance (OHA) [12].

With Android SDK, developers can do location-based operations, database operations with SQLite database, graphic operations like 2D or 3D game development, sensor and camera operations or background operations like automatic answer system to SMS.

2.2.3 Android Development Environments

There are several environments to develop android applications such as eclipse, Intellij IDEA and Android Studio. They help us to develop Android applications. Generally, we can represent the differences between Android Studio and others as shown in below:

- With Android Studio, we can develop applications for all Android devices and environments (phone, TV ...),
- Advanced compilation method with Grandle,
- Android application templates,
- With assistant tool, direct access to Firebase in editor,
- Android Emulator support,
- Advanced interface develop editor,
- With Expresso Test Recorder, Advanced test management [10].

And there is more features like these. That is why we decided to develop our project on the Android Studio.

2.3 Web Services

Web Services are the devices that communicate over the World Wide Web. When you use a mobile application, search engine or an enterprise system, application's interface resides on your device, but the data, and potentially the business rules resides on some other server on the network [13]. The communication between interface and application's server is the role of Web services. There are several platforms to do this communication such as PHP servers, WCF and Firebase.

2.3.1 PHP

PHP is a web-based, object oriented programming language. PHP is used to develop static websites, dynamic websites or web applications also it is an HTML-embedded web scripting language. This means PHP code can be inserted into the HTML of a web page. The goal of this language is to allow web developers to write dynamically generated pages quickly and easily. PHP is also great for creating database-driven websites [14].

2.3.2 WCF

Windows Communication Foundation (WCF) is a technology for developing applications based on service-oriented architecture. WCF is Microsoft's programming model for using managed code to build unified Web services and other distributed systems that can talk to each other. WCF is designed to communicate with other non-WCF applications in addition to the various successors and predecessors of Microsoft technology [15].

2.3.3 Firebase

Firebase is a Backend as a Service. It can be called as a real-time database. With using the API which is given by firebase, the developers can develop applications quicker and Firebase is developed with mobile development in mind, but it is absolutely not limited to mobile apps. Also, Firebase includes an easy to use hosting service for all of static files [16].

If you have a project that is developed on multiple platforms and if there is user entries and data storage in this project, Firebase is very useful. The general structure of Firebase is shown in Figure 2.

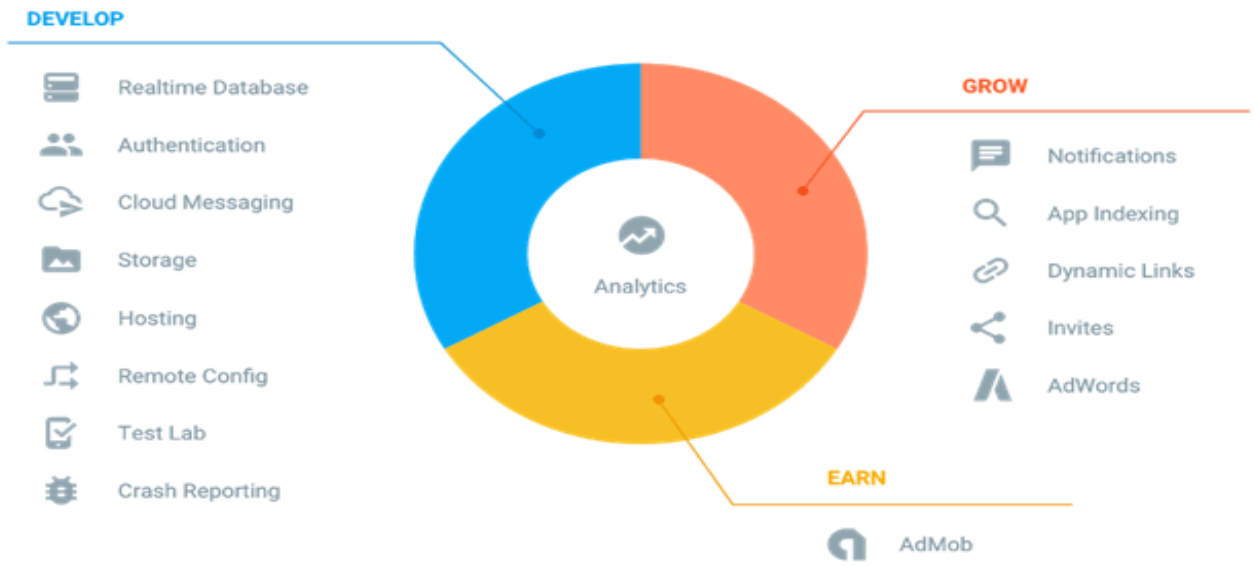

Figure 2 Firebase's general structure [17]

2.3.3.1 Database

Firebase provides a real-time NoSQL database service to users with this service. Normally, you have to set up a database in the web environment or on the mobile to perform database operations. According to the application, you have created services to reach the database, but thanks to Firebase's database service you can include a database in a program and use it easily.

2.3.3.2 Storage

With this service, you can store files such as pictures and text on your computers or servers. Users can download these files at any time.

2.3.3.3 Notification

If you want to communicate with users instantly in mobile applications that you created, you can send push notifications to users instantly with the notification service.

2.3.3.4 Firebase Analytics

With this structure, you can instantly see a lot of information, including the number of active users, the daily interaction of users, the models of users of your devices, the operating systems of the users. It is one of the most used services of Firebase [18].

2.3.3.5 Main Features of Google Firebase

- Real-time database
- User login authorization
- Storage
- Machine Learning Kits
- Performance and error testing environments
- Inter-platform common application analysis
- Common function
- Bulk notification
- Advertising tools [19]

Many of these features need to be handled individually on each platform, while developers can easily find a solution with Google's Firebase.

In our project, we decided to use Firebase, because it has more advantages compare to others and we think Firebase is fit in to our project.

2.4 BLE Beacon

2.4.1 What is BLE Beacon?

First, if you need to define this technology, Beacon is a technology that provides location information using low energy Bluetooth (BLE) technology. In other words, products or devices with Beacon technology can emit passive signals to interact with smart phones near them. Depending on the distance, this technology reaches people and then transmits the information they want to interact with [20].

2.4.2 How does BLE Beacon Work?

Beacons transmit small amounts of data through Bluetooth Low Energy (BLE) up to 50-70 meters. They are often used as indoor location technology and can also be used outside. Beacons are usually used with small batteries, but can be plugged into a wall outlet or USB port to provide consistent power. In addition to independent beacon devices, mobile phones, tablets and computers with BLE support can both emit and receive Beacon signals and function as Beacons [21].

2.4.3 What does BLE Beacon Look Like?

Beacons are small and simple devices. If you turn someone on, you cannot see multiple motherboard or cable clutter; you will probably find CPU, radio transmitter and battery. Beacons often use CR2477-derived lithium-ion chip batteries. Beacons may be in different colors or shapes; they may have an accelerometer, temperature sensor or special additional components. Still, the common feature of all Beacons is to broadcast signals [22].

2.4.4 How does BLE Beacon Communicate?

The Beacon emits an identification number ten times per second. A nearby Bluetooth enabled device receives this signal. When an application recognizes its signal, it connects it to an action or content track stored in the cloud and allows the user to view it. By editing the application on your phone, you can set how it reacts to signals [23].

2.4.5 When did BLE Beacon Appear?

Today's Beacons appeared with Apple's announcement of iBeacon in 2013, and in 2015 Google entered the market with Eddy Stone. Since then, these two product groups have been leading the market [22].

2.4.6 BLE Beacon Usage Areas

2.4.6.1 Monitoring

Manufacturing and transport are practical areas of Beacon. Managers want to know exactly where the products are in the factory and when they are delivered. With the help of the Beacon network, they can obtain exactly what they want and access the archive of this information [23].

2.4.6.2 Navigation

Google Maps and other map providers serve for external areas. Clear instructions can be taken with Beacon in the closed areas. For example, the Louvre Museum covers an area of 60,600 m^2. It is very difficult to reach the artwork that is desired to be seen in such great museums without getting lost [23].

2.4.6.3 Interaction

Beacons can automate responses and trigger events. When you enter the room, the projection device starts to operate. Every time you go to the café, you pay nine and when you go to the vault for the tenth time, the app lets you know you have won a free latte [23].

2.4.6.4 Security

Beacon can automatically send a safety issue notice (to app users or property owners) when patients enter the wrong wings or make factory workers dangerous changes [23].

2.4.6.5 Analysis

Data is one of the largest tools in the hands of a company. Beacons can collect information about where the customers are going or where there are problems in the production line. This information can be stored and accessed on how users interact with the Beacon via the online platform [23].

2.5 Related Applications with BLE Beacon

2.5.1 "Beacon Me" Mobile Application Help the Travelers as Tour Guide with Using Emojis

Modern cities are home to many attractions that may interest people. But travelers need robust mobile applications with user-friendly interfaces to help them find their way easily to discover every corner of the modern city where there are dozens of points to visit.

The Beacon Me mobile app is a mobile application designed to answer exactly this need. But it does this in an interesting way: using emojis to better help travelers discover new cities! It displays the activities, places to visit, restaurants, places and more on a map full of emojis. It is possible to find an emoji for almost all events and venues as the new emojis are used by phone and Internet users every day. The Beacon Me mobile app, which makes it easy for travelers to find points of interest, also gives travelers the opportunity to experience unique experiences that they will never enjoy in any other way.

In app or tasks users are available to users as an idea based on tasks that make them feel like a native of their city as they explore and complement attractions. The Beacon Me mobile app is now available for download from the App Store for the iOS operating system. Although the

practice is currently only available for Philadelphia, the creators of the application say they plan to launch the application in more cities soon [24].

2.5.2 Beacon and the Internet of Things are Changing the Banking Sector

When you enter the bank branch, the mobile banking application on your smart device and the sensors will tell you that you are there and will notify you of the sequence number. So, you do not have to dial the kiosks and get a number on paper. Or you will be able to receive special campaigns from your phone instantly within the context of your permission and needs within and around the bank branch. For transactions, starting from the mobile application, you will be able to receive notifications at the branch and save time by making your transaction on the phone. The sensors installed at ATMs will understand that you are approaching, and it will be able to communicate with you when you are at the ATM, and you will be able to withdraw money quickly in seconds without having to deal with the minutes in the ATM [25].

2.5.3 Chrome Android App Comes with Beacon Support

According to the Google Chromium blog, Android users will be able to interact with the Beacons soon via the Chrome browser. The new feature will be implemented in the 49th test version of Chrome for Android. With Bluetooth-based Beacons at any point, users will be able to exchange data between their phones. Emphasizing the importance of this new interaction platform called Physical Web (Google). Google first handled this work in July last year. Google has begun testing the Beacon interaction in Chrome for iOS and unveiling its work in CES 2016. With the increase of Beacon manufacturers and developers, it is finally the expected step for Android.

It is of course long to sort out what can be done with the Beacon interaction. However, details such as interoperability and user privacy are not fully resolved. We do not yet know what cyber attackers can do in this area, but the work in this area will progress continuously.

Google is organizing a competition in objects, and it is clear that the future will expand its work under the physical web tag. If you are interested in these issues, you should follow the Chrome updates for Android closely [26].

2.5.4 iBeacon Scavenger Hunt Application for iOS

With the iBeacon Scavenger Hunt you can set your own exclusive scavenger hunt game for iOS and Android devices. You can create a game by placing iBeacons in target locations and configuring their descriptors with the app. You can create a custom application based on the open source examples for Android and iOS, or use the developer's own apps in app stores. Scavenger hunts are great team building activities. They are perfect for encouraging people to visit long distance areas in trade fairs, meetings and conferences. The application is based on the developer's Proximity Kit for iBeacons cloud service, which allows you to make the iBeacon configuration in the cloud. This configurability is what makes it possible to create different Beacon Scavenger Hunts with the same application [27].

3. Software Requirements Specification

3.1 Introduction

3.1.1 Purpose

The purpose of this document is to define the application that is called the Scavenger Hunt Game Using BLE Beacon. The system is formed with a BLE Beacon device and a mobile application. This application aims to be a mobile game which is using fun and creative game dynamics in it. Collecting points by doing the specified jobs in the given task list to get the highest point is the goal of this game. This document describes the application. Requirements of the project are given in this document.

3.1.2 Scope

Nowadays, people's jobs are becoming monotonous and they want to have fun in their daily lives. In work life, people are may not adapt themselves to their works or workplaces. Else, their lives became boring or they just wanted to interest in other stuffs. Therefore, their work efficiency will decrease. This is same for students. Once a student is feeling bored, they do not want to do anything willingly. This mobile application will be a Scavenger Hunt Game's mobile version so this application will make people's jobs funnier. Schools and universities can use it to create teams to get done the given tasks. Or, kids can use it just for fun. This application's main goal is to make everyday life funnier and adapt people to their living space more easily.

3.1.3 Definitions

Term	Definition
Software Requirements Specification (SRS)	The description of a software system to be developed.
BLE Beacon	The device which sends low energy Bluetooth signals.
Android	Android is an operating system for mobile devices.
Database	A database is a collection of information that is organized so that it can be easily accessed, managed and updated.
Firebase	Firebase is Google's mobile application development platform that helps you build, improve, and grow your app.

3.1.4 References

IEEE. IEEE Std. 830 - 1998 IEEE Recommended Practice for Software Requirements Specifications. IEEE Computer Society, 1998.

3.1.5 Overview of Document

In this document, we indicated the main parts of Scavenger Hunt Game. We explained the goals of our mobile application and described how the mobile application should work. We mentioned about the functionalities of the system. Both functional and non-functional requirements are mentioned in different sections.

3.2 Overall Description

3.2.1 Product Perspective

As mentioned earlier, this application is mobile version of the Scavenger Hunt Game. So, it has similar rules in this application. Users have some roles like becoming players or game creators. Game creators create areas and give some missions to their players. Then, players try to do the given missions in specific locations tagged with Bluetooth Low Energy Beacons and try to earn points to get the highest score. BLE Beacons just provide the necessary signals and with this signal the system confirms that the task has been completed. In this way, people interact with each other and they strengthen the relationships between them.

3.2.2 Product Functions

The main purpose of the Scavenger Hunt Game Using BLE Beacon project is to maximize work efficiency and make people happy. In this way, people's life quality can increase and people can build stronger relationships with each other. With this application people can have:

- Skill of work sharing
- Time management
- Easily adapt to group work
- Competitive spirit.

For doing all of these, the application should be dynamic, it cannot be static. Also, it will have security functions to secure users' information and it will have easy to use interface to be playable by every age user.

3.2.3 User Characteristics

3.2.3.1 Players

Players must have register to the mobile application as players.
Players must know how to use the mobile application.

3.2.3.2 Game Creators

Game creators must have register to the mobile application as game creators.
Game creators must know how to use the mobile application.

3.2.3.3 Admin

Admin must have knowledge about software development life cycle.
Admin must have knowledge about Android platform.

3.3 Requirements Specification

3.3.1 External Interface Requirements

3.3.1.1 User interfaces

The user interface will be worked on mobile devices which has Android operating system version 7.0 or above.

3.3.1.2 Hardware interfaces

The application will be required mobile devices with Bluetooth hardware on it because BLE Beacon is a Bluetooth technology device.

3.3.1.3 Software interfaces

There are not any external software interface requirements.

3.3.1.4 Communications interfaces

There are not any external communications interface requirements.

3.3.2 System Features

3.3.2.1 Login and Register Features

a. Introduction of Feature

This feature is about how to access to the system. All users need to register first to use the system. They also have their own authority. This authority used to perform access control in the system; and, if they use their own information correctly, they can get into the system. Admin has the ability to manage the users and their authority.

b. Stimulus/Response Sequence

Stimulus: A user attempts to get into the system.

Response: The system authenticates the user.

Stimulus: A user attempts to register in the system.

Response: The system checks the user whether already registered or not.

Stimulus: Admin attempts to change a user's authority as admin.

Response: The user is admin now.

c. Associated Functional Requirements

3.3.2.1.c.1 Login System

Description: In login system, all actors are able to log in to the system; and, if they gave wrong information to the system, there will be a login exception to protect system's safety. And also, all actors are able to change their passwords and logout from the system. The flowchart diagram of login system is shown in Figure 3.

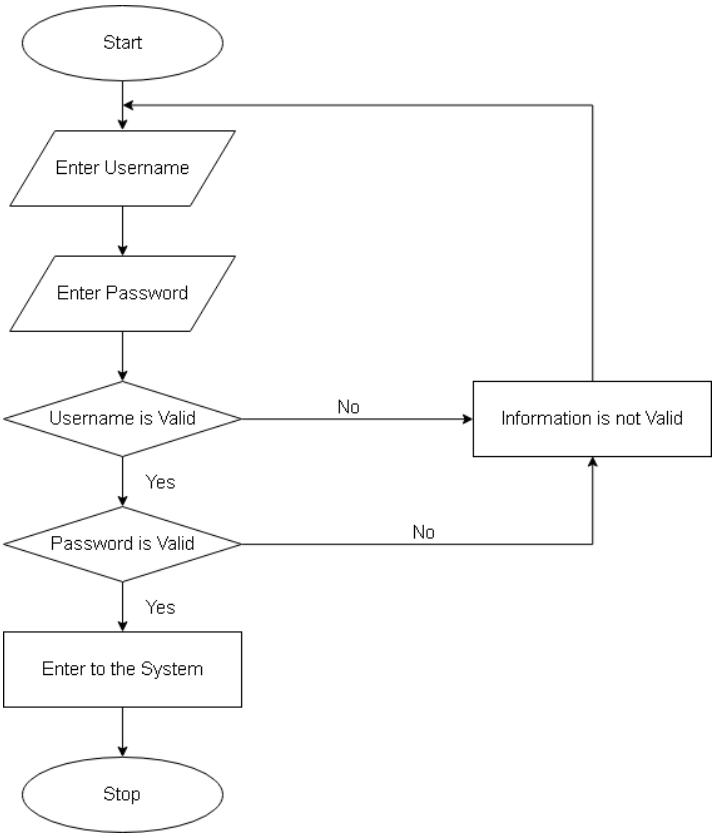

Figure 3 The flowchart diagram of login system

3.3.2.1.c.2 Registration System

Description: In registration system, players can register as a player or game creator; but no supervisor can register, because supervisors need to take this authority form another supervisor. The use case of registration system is shown in Figure 4.

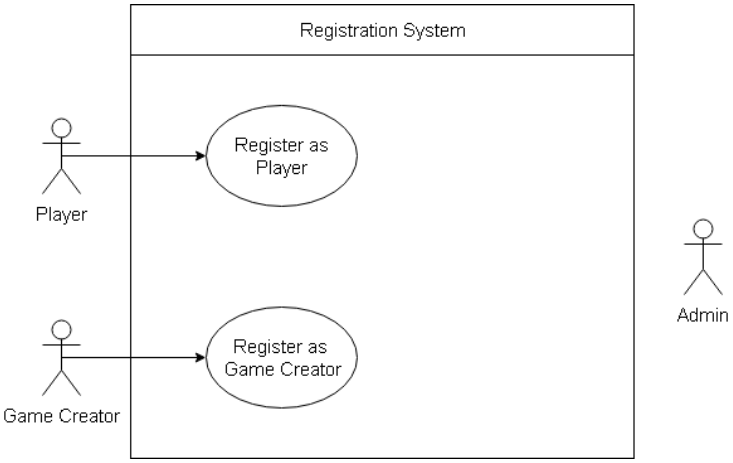

Figure 4 The use case diagram of registration system

3.3.2.2 Defining Games Features

a. Introduction of Feature

This feature can be count as basic element of the system. In this feature, game creators decide which missions will be in the game areas; and the players who are registered to a specific area will try to do the missions. If the mission is about taking a photo, game creators will control the photos and give points to players; but if game creators just want players to spend some time in somewhere, the system will determine players' time and give their points automatically.

b. Stimulus/Response Sequence

Stimulus: A game creator attempts to add a mission to the system.

Response: The mission is added for his/her players.

Stimulus: A player attempts to upload a photo for mission.

Response: The photo is uploaded to the system.

Stimulus: A game creator attempts to change a mission.

Response: The mission is changed.

c. Associated Functional Requirements

3.3.2.2.c.1 Game System

Description: In mission system, game creators can add a mission, change its points or change all of it, remove a mission, and players can do missions and they can earn points. The use case diagram of game system is shown in Figure 5.

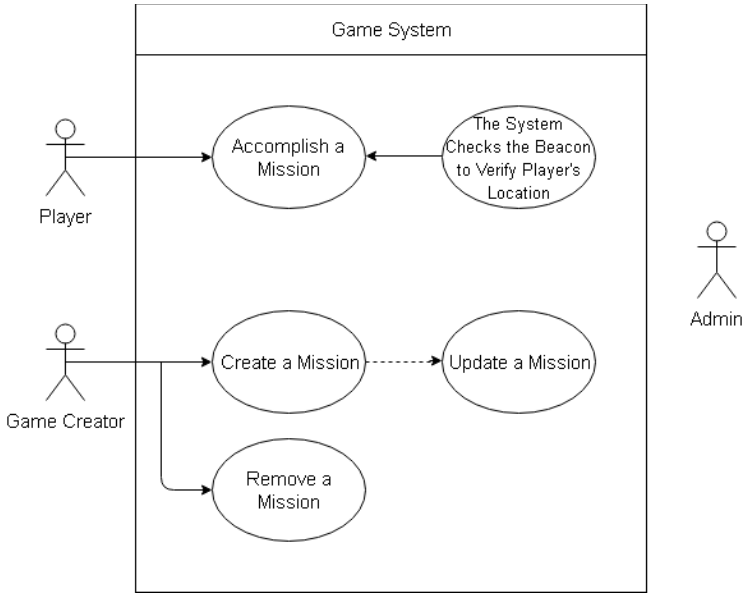

Figure 5 The use case diagram of game system

3.3.2.3 Scoreboard Features

a. Introduction of Feature

This feature can be count as the goal of the system. When players do their missions correctly, they gain mission points. This game can count as a competitive game with the scoreboard, because if a player completes all of the missions correctly, he/she gains the highest score and see himself/herself at the top of his game's scoreboard.

b. Stimulus/Response Sequence

Stimulus: A game creator attempts to see the scoreboard.

Response: The system shows the scoreboard that belongs to his areas to the game creator.

Stimulus: A player attempts to see the scoreboard.

Response: The system shows the scoreboard to the player.

c. Associated Functional Requirements

3.3.2.3.c.1 Scoreboard System

Description: In this feature, players can track their score and they can compare their scores with others. Also, game creators can see the scoreboard that belongs to their areas and they can see who their champion is. The use case diagram of scoreboard system is shown in Figure 6.

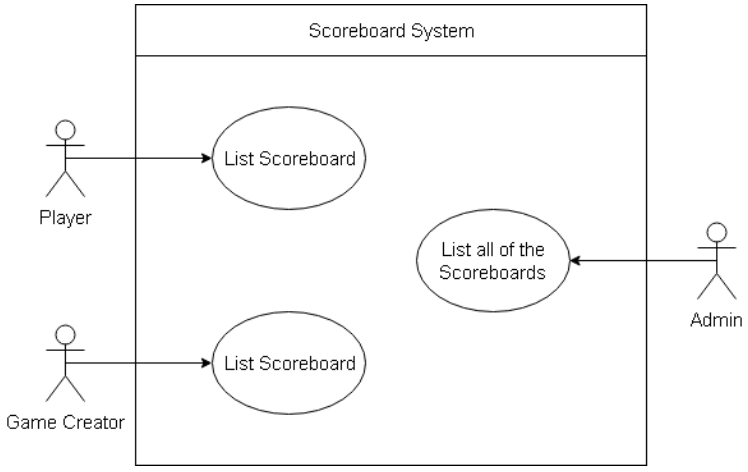

Figure 6 The use case diagram of scoreboard system

3.3.2.4 Beacon Operations Features

a. Introduction of Feature

This feature can be used to identify areas and it is used to understand the players which are in these areas during the missions. In this way, the system verifies the players' locations and it determines when players begin to their missions.

b. Stimulus/Response Sequence

Stimulus: A game creator attempts to add a beacon.

Response: Beacon added in to the system.

Stimulus: A player attempts to end his/her mission.

Response: The system verifies his/her location and ends his/her mission.

c. Associated Functional Requirements

3.3.2.4.c.1 Beacon Operations

Description: In the beacon system, game creators can add beacons to symbolize the areas or eject a beacon. And, players can connect them with their device's Bluetooth module. After that, when a player starts to do a mission, the system will check the player's location. The use case diagram of beacon operations is shown in Figure 7.

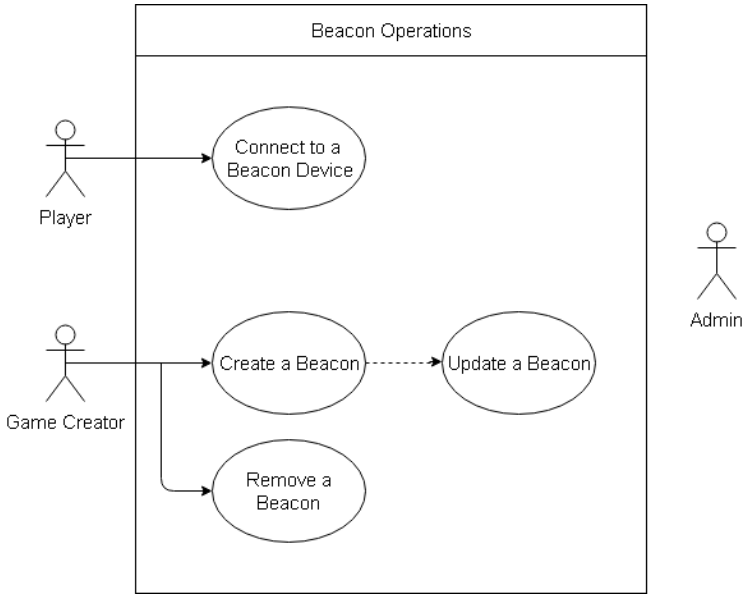

Figure 7 The use case diagram of beacon operations

3.3.3 Performance Requirements

For the Scavenger Hunt Game to work properly, user's device must not be on battery safe mode; because in this mode, Bluetooth module cannot work stable and Bluetooth must be

always on. Also, players must be in the range of beacon device to end his/her missions. If beacon's signal is low, system may not approve the missions.

3.3.4 Design constraints

3.3.4.1 Main Example: Scavenger Hunt Game

This game will be a mobile application of scavenger hunt game, so the rules should be similar with it.

3.3.4.2 Software Language

All coding parts will be done in standards of Android programming.

3.3.4.3 Data Management System

For database, Google's Firebase system will be used.

3.3.4.4 Determining Location

BLE Beacon devices used for determining location.

3.3.5 Software system requirements

3.3.5.1 Usability

The mobile application will have easy interfaces and it will be used easily by any new user.

3.3.5.2 Portability

Scavenger Hunt game must work in every current Android device. It is designed for the devices with Android version 7.0 and above, so it must work properly with current version of Android platform.

3.3.5.3 Performance

The mobile application must open in maximum three seconds, work without freezing and respond as fast as it can.

3.3.5.4 Scalability

The mobile application will not need so powerful hardware, so it will work properly on standard Android devices.

3.3.5.5 Security

In this mobile application, users must log in to get into the system and user's information will store safely in the system. Therefore, other users cannot access it. BLE Beacon devices work in one direction, so it will not give location information to other users.

4. Software Design Descriptions

4.1 Overview

4.1.1 Scope

Scavenger Hunt Game Using BLE Beacon is an Android application project. It is a game which is based on the locations and missions. In this game, there are game creators and players. To begin playing, game creators should create a game in a specific location and add missions for players. Players can earn points by completing the given missions and find a place for themselves in the scoreboard of the game. This application is in Android platform that means the users need a mobile device with Android operating system version 7.0 or above.

4.1.2 Purpose

The purpose of this Software Design Descriptions (SDD) document is describing the details of the project called "Scavenger Hunt Game Using BLE Beacon". We prepared this document according to "IEEE Standard for Information Technology - Systems Design - Software Design Descriptions - IEEE Std 1016 - 2009". In this document, we indicated how our application's software should be developed. We represented the details of design of the application by using graphical notations such as class diagrams, use case diagrams, deployment diagrams, and other supporting design information.

4.1.3 Definitions

Term	Definition
IEEE	Institute of Electrical and Electronics Engineers
Software Design Description (SDD)	The complete description of the design of the system.
UML Diagram	A UML diagram is a diagram based on the UML (Unified Modeling Language) with the purpose of visually representing a system along with its main actors, roles, actions, artifacts or classes, in order to better understand, alter, maintain, or document information about the system.
Stakeholder	A person, group or organization that has interest or concern in an organization.

4.1.4 References

IEEE. IEEE Std. 1016-2009 IEEE Standard for Information Technology - Systems Design - Software Design Descriptions. IEEE Computer Society, 2009.

4.2 Conceptual Model for Software Design Descriptions

In this part, conceptual model for the SDD is introduced. This conceptual model mainly explains the context and stakeholders in which SDD is prepared.

4.2.1 Software Design in Context

In Scavenger Hunt Game Application, Incremental Software Development Methodology is used as a development method. The idea of this methodology is to divide the project into modules. After that, project is developed module by module. Hence, potential defects are spotted early, and changes to project scope are less costly and easier to implement. At the end of the project, the application has fewer bugs, and it works correctly.

4.2.2 Software Design Descriptions within the Life Cycle

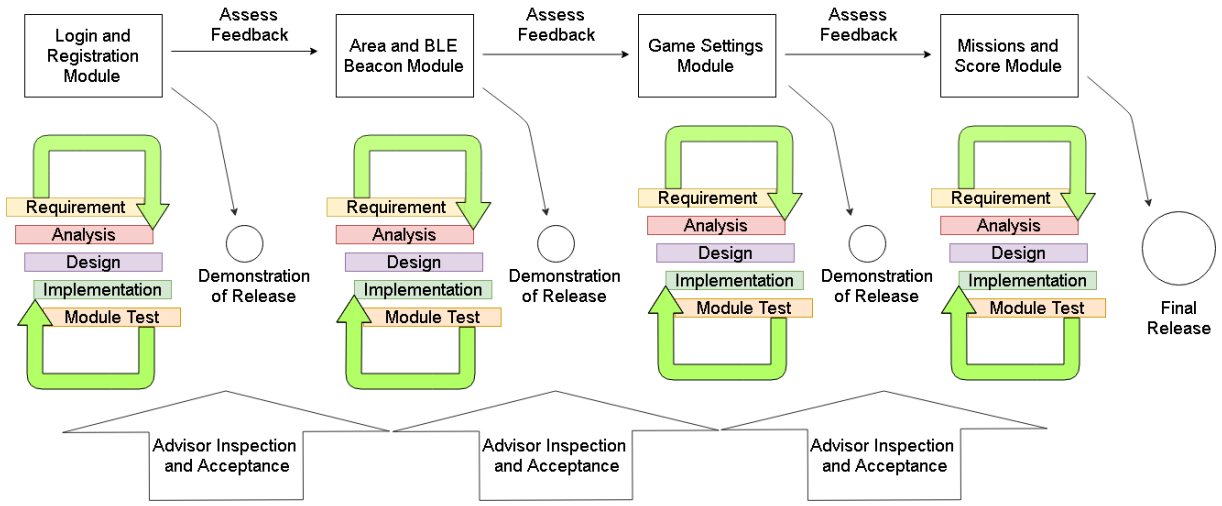

Figure 8 The development life cycle of the project

4.2.2.1 Influences on SDD Preparation

The critical software life cycle product that drives this software design is the software requirement specifications (SRS) of the project. All the details and requirements are taken from the SRS document to prepare this document.

4.2.2.2 Influences on Software Life Cycle Products

This SDD document influences the content of SRS of this project. It also has influences on the whole implementation phase of the Scavenger Hunt Game Application. Also, the test plans and documentation of the system are also be influenced by the SDD.

4.2.2.3 Design Verification and Design Role in Validation

Test cases are prepared after the SDD document phase. With these test cases, the software is tested, and all modules are evaluated. After the results, the success rate of this software is observed and documented.

4.3 Design Description Information Content

4.3.1 Introduction

In this part, SDD of this project that gives information about design and implementation are presented. In this part, also, the topics explained includes SDD identification, design views, design elements, design overlays, design rationale, and design languages.

4.3.2 SDD Identification

This SDD report is prepared concerning the IEEE 1016 - 2009 standards, and this is the first version of SDD for this project. UML notation is selected for diagrams and Draw.io website is used for drawing these diagrams.

This SDD contains development life cycle, class diagram, use case diagrams, deployment diagram, class diagram, ER diagram and flowchart diagram of this project.

4.3.3 Design Stakeholders and Their Concerns

Design stakeholders are the developer team and their advisor in the Scavenger Hunt Game project. Our developer team members are computer engineer candidates, and they know and understand software development. The concerns of this project's stakeholders are shown in below:

- The interface should be easy to use.
- The application must open in maximum three seconds.
- The application should work with every current Android device.
- The application should not need high-end hardware requirements.
- The application should be safe and secure.

4.3.4 Design Views

To represent the diagrams, UML is used in this project. This SDD document contains the design views which are governed by design viewpoitns that are explained in part 4.

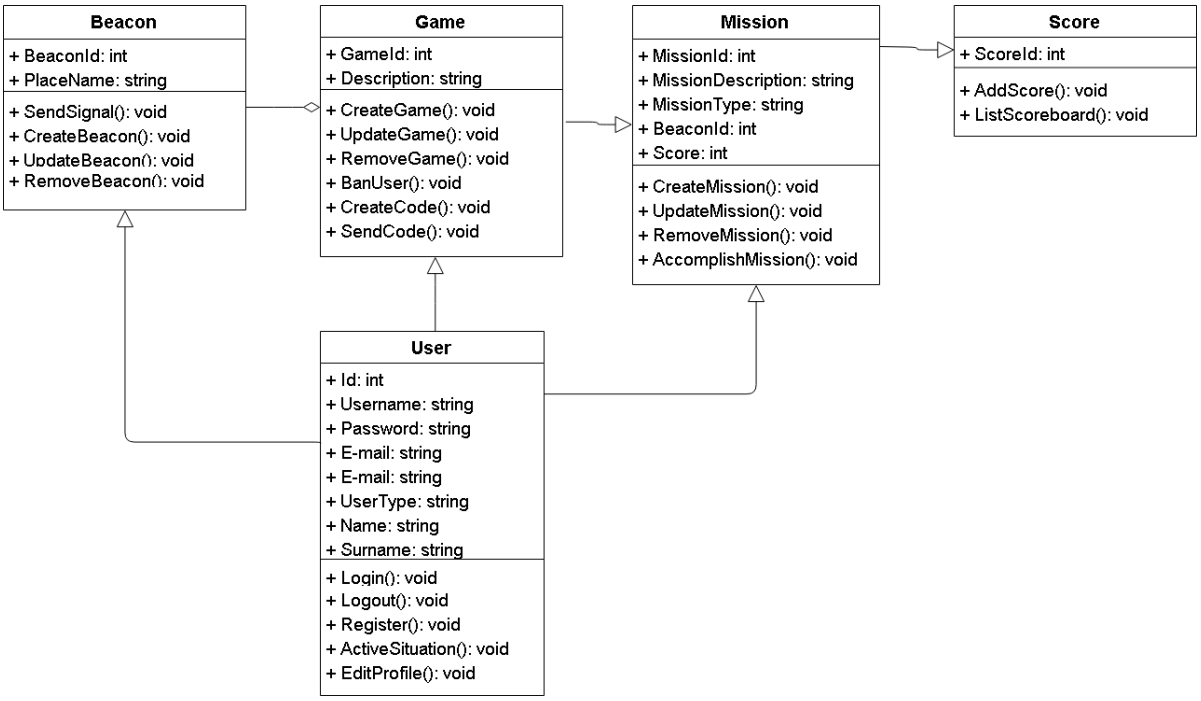

Figure 9 The class diagram of the project

As an example, Figure 9 shows the UML class diagram of Scavenger Hunt Game project. It shows the connection between all classes.

4.3.5 Design Viewpoints

This part is used to give a short explanation on the main design viewpoints which are used in part 4. It is defined in the IEEE 1016 - 2009 standards.

4.3.5.1 Context Viewpoint

The context viewpoint is about the relationships and interactions between the system and its environment.

4.3.5.2 Composition Viewpoint

The composition viewpoint shows the main work components of the project.

4.3.5.3 Logical Viewpoint

The logical viewpoint identifies all of the classes and the relations between those classes.

4.3.5.4 Information Viewpoint

The information viewpoint describes the storing, managing and distributing of information.

4.3.5.5 Interface Viewpoint

The interface viewpoint gives the necessary information about how the design project looks like and be used by anyone who is interested.

4.3.5.6 State Dynamics Viewpoint

The state dynamics viewpoint shows the behaviour of the system when there are some specific events.

4.3.6 Design Elements

This part is about main design elements like entities, design relationship, constraints.

4.3.6.1 Design Entities

a. Database Management System

In the Scavenger Hunt Game, Google's Firebase system is used for database management. It has many advantages for mobile devices and easy to integrate into the project. It is used to store users' information, beacons' information and games' information.

b. User System

Users can connect to Scavenger Hunt Game with their mobile devices. Users must use mobile devices which has Android Operating System on it, and its Android version must be 7.0 or above.

c. Location System

When system determines users' location, it uses BLE Beacon devices. So, Bluetooth modules of users' mobile devices must work properly.

d. Programming Language

The application is an Android application. Therefore, we use the Android Software Development Kit (SDK) in the software development process.

4.3.6.2 Design Relationships

This project’s main parts are Google’s Firebase as database, Android programming, BLE Beacon and Android mobile devices.

4.3.6.3 Design Constraints

- Google’s Firebase System should be used for database management system.
- Software must be programmed with according to Android programming.
- The rules of this game should be similar to board game of Scavenger Hunt Game.
- BLE Beacon devices should be used for determining location.

4.3.7 Design Overlays

Scavenger Hunt Game's main factors are simplicity and optimized design. So, it does not require a powerful hardware, and everyone can play this game easily.

4.3.8 Design Rationale

In this project, design choices are made according to simplicity and performance concerns, but stakeholders may have request further requirements. Therefore, the system must consist of modular parts and developers of the system have to use comments in their code. In this way, other developers can understand the existing code and the system.

4.3.9 Design Languages

In this project, UML is chosen as a part of design viewpoint. It will be used for explaining design viewpoints.

4.4 Design Viewpoints

4.4.1 Introduction

In this part, Scavenger Hunt Game's design viewpoints are explained in detail. In this part, UML diagrams are used to enhance intelligibility. In this part, we explain the main design viewpoints in detail.

4.4.2 Context Viewpoint

4.4.2.1 Design Concerns

There are two main concerns in our system. There are user and game. User is divided into two as player and game creator in this project. Users are the people who play and manage this game respectively.

4.4.2.2 Design Elements

Design Entities: Design entities are user and its functions in the application. The use case diagram of user functions is shown in Figure 10.

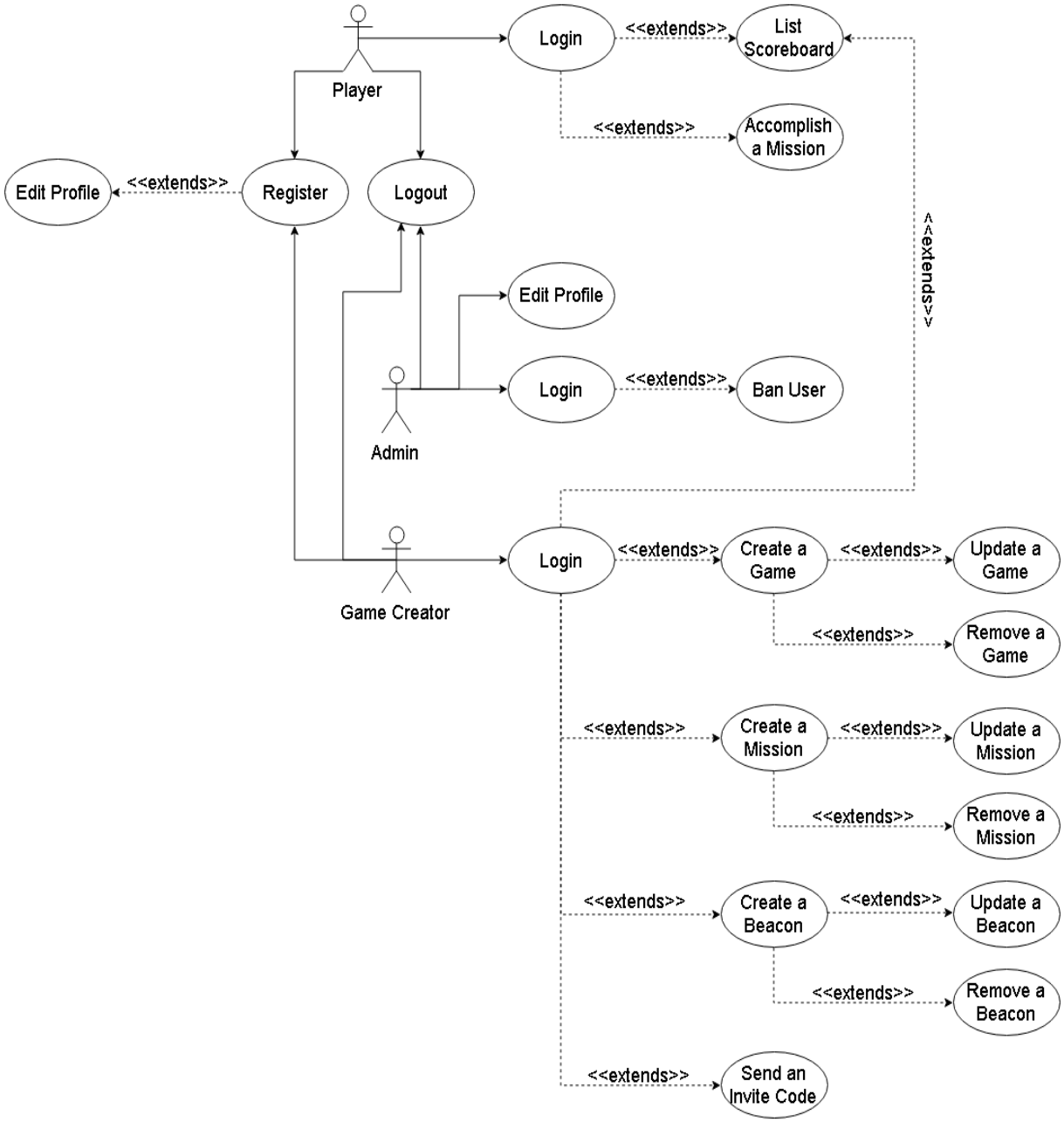

Figure 10 The use case diagram of all functions

a. Login

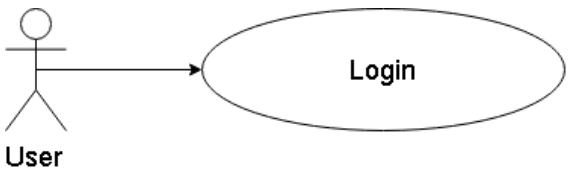

Figure 11 The use case diagram of login

Use Case Number	1
Use Case	Login
Summary	User can log in to the system with his/her username and password.
Actor	Player, Game Creator, Admin
Trigger	Login Button
Primary Scenario	To log in to the system, firstly, User must be registered to the system. After that, he/she can login with writing his/her username and password and clicking to login button.
Exceptional Scenario	• Not registered. • Incorrect information to log in.
Pre-Conditions	User must register to system.
Post-Conditions	User can enter the system.
Assumptions	User must be connected to the Internet.

b. Register

Figure 12 The use case diagram of register

Use Case Number	2
Use Case	Register
Summary	User can register the system to log in and use the application.
Actor	Player, Game Creator
Trigger	Register Button
Primary Scenario	After User get the application, User can register in registration page with required information.
Exceptional Scenario	Username is being used error.
Pre-Conditions	• User must have the application. • User must have an e-mail address.
Post-Conditions	After registration, user can enter the system.
Assumptions	User must be connected to the Internet.

c. Logout

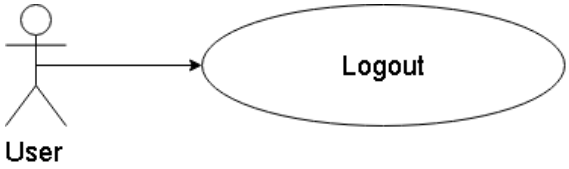

Figure 13 The use case diagram of logout

Use case number	3
Use case	Logout
Summary	User can logout from the system.
Actor	Player, Game Creator, Admin
Trigger	Logout Button
Primary Scenario	After user login the system, user can logout from the system anytime.
Exceptional Scenario	None
Pre-Conditions	User must log in to the system.
Post-Conditions	User can see login page.
Assumptions	User has already log in to the system.

d. Accomplish a Mission

Figure 14 The use case diagram of accomplish a mission

Use case number	4
Use case	Accomplish a Mission
Summary	Player can accomplish missions to earn points.
Actor	Player
Trigger	Accomplish a Mission Button
Primary Scenario	After player accomplishes a mission, player can earn points with connecting to a beacon device.
Exceptional Scenario	• Mission is not over yet. • Beacon connection is failed.

Pre-Conditions	Player must open Bluetooth module of his mobile device.
Post-Conditions	After completing a mission, player earns points and improves his/her score.
Assumptions	• Player must be connected to the Internet. • Player's mobile device's Bluetooth module must stand on.

e. List Scoreboard

Figure 15 The use case diagram of list scoreboard

Use case number	5
Use case	List Scoreboard
Summary	User can list a scoreboard.
Actor	Player, Game Creator
Trigger	List Scoreboard Button
Primary Scenario	After user begins to play or create a game, user can list the scoreboard which belongs to the game.
Exceptional Scenario	None.
Pre-Conditions	User must join a game or create a game.
Post-Conditions	User can list the scoreboard of the game.
Assumptions	User must be connected to the Internet.

f. Create a Game

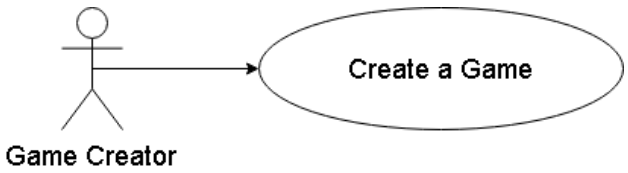

Figure 16 The use case diagram of create a game

Use case number	6
Use case	Create a Game

Summary	Game Creator can create a game.
Actor	Game Creator
Trigger	Create a Game Button
Primary Scenario	None.
Exceptional Scenario	None.
Pre-Conditions	None.
Post-Conditions	Game Creator can create a game for players and players can join a game.
Assumptions	Game Creator must be connected to the Internet.

g. Update a Game

Figure 17 The use case diagram of update a game

Use case number	7
Use case	Update a Game
Summary	Game Creator can update a game.
Actor	Game Creator
Trigger	Update a Game Button
Primary Scenario	Game Creator need to have at least one game.
Exceptional Scenario	If Game Creator does not have a game, he/she cannot change anything.
Pre-Conditions	Game Creator needs to have at least one game.
Post-Conditions	Game Creator can update a game.
Assumptions	Game Creator must be connected to the Internet.

h. Remove a Game

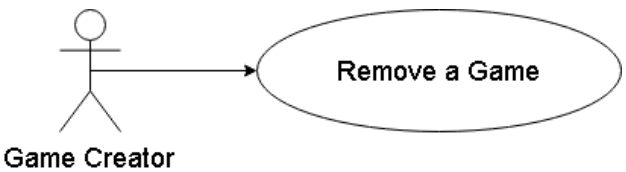

Figure 18 The use case diagram of remove a game

Use case number	8
Use case	Remove a Game
Summary	Game Creator can remove a game.
Actor	Game Creator
Trigger	Remove a Game Button
Primary Scenario	Game creator needs to have at least one game.
Exceptional Scenario	If Game creator does not have a game, he/she cannot remove anything.
Pre-Conditions	Game creator needs to have at least one game.
Post-Conditions	Game Creator can remove a game.
Assumptions	Game Creator must be connected to the Internet.

i. Create a Beacon

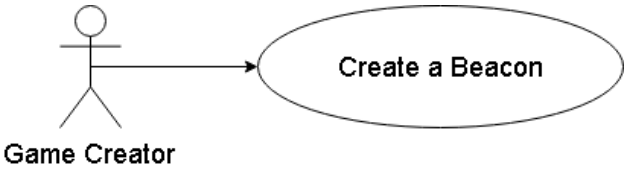

Figure 19 The use case diagram of create a beacon

Use case number	9
Use case	Create a Beacon
Summary	Game Creator can create beacons to expand his area.
Actor	Game Creator
Trigger	Create a Beacon Button
Primary Scenario	None.
Exceptional Scenario	None.
Pre-Conditions	None.
Post-Conditions	Game Creator can expand his/her area, and he/she can add missions on it.
Assumptions	Game Creator must be connected to the Internet.

j. Update a Beacon

Figure 20 The use case diagram of update a beacon

Use case number	10
Use case	Update a Beacon
Summary	Game Creator can update a beacon.
Actor	Game Creator
Trigger	Update a Beacon Button
Primary Scenario	Game Creator has to have at least one beacon in the system.
Exceptional Scenario	Game Creator has no beacon.
Pre-Conditions	Game Creator needs to have at least one beacon in the system. After that, he/she can update its condition.
Post-Conditions	Game Creator can update a beacon.
Assumptions	Game Creator must be connected to the Internet.

k. Remove a Beacon

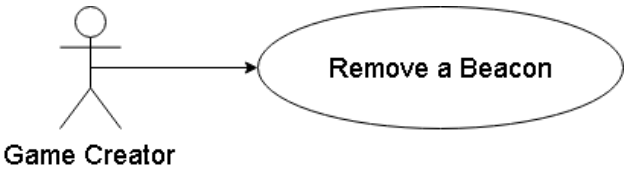

Figure 21 The use case diagram of remove a beacon

Use case number	11
Use case	Remove a Beacon
Summary	Game Creator can remove a beacon.
Actor	Game Creator
Trigger	Remove a Beacon Button
Primary Scenario	Game Creator has to have at least one beacon in the system.
Exceptional Scenario	Game Creator has no beacon.
Pre-Conditions	Game Creator needs to have at least one beacon in the system. After

	that, he/she can remove it.
Post-Conditions	Game Creator can remove a beacon.
Assumptions	Game Creator must be connected to the Internet.

l. Create a Mission

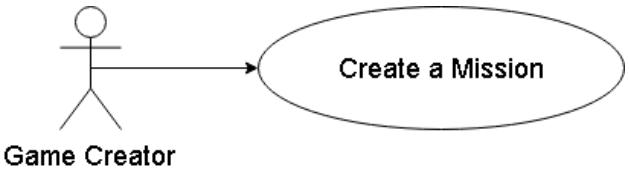

Figure 22 The use case diagram of create a mission

Use case number	12
Use case	Create a Mission
Summary	Game Creator can create a mission for players to do.
Actor	Game Creator
Trigger	Create a Mission Button
Primary Scenario	If Game Creator does not have a beacon, he/she need to add a beacon. After that, he/she can create a mission.
Exceptional Scenario	None.
Pre-Conditions	If Game Creator does not have a beacon, he/she need to add a beacon first.
Post-Conditions	Player can see the missions.
Assumptions	• Game Creator must be connected to the Internet. • Game Creator must have at least one beacon in the system.

m. Update a Mission

Figure 23 The use case diagram of update a mission

Use case number	13
Use case	Update a Mission

Summary	Game Creator can update mission.
Actor	Game Creator
Trigger	Update a Mission Button
Primary Scenario	If Game Creator created a mission before, he/she can update that mission.
Exceptional Scenario	• The mission's date is over. • Game creator has no mission.
Pre-Conditions	Game Creator needs to create a mission first.
Post-Conditions	Player can see the updated mission.
Assumptions	• Game Creator must be connected to the Internet. • Game Creator must have at least one mission.

n. Remove a Mission

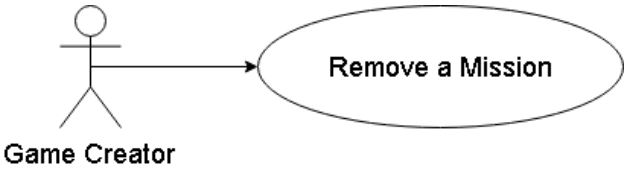

Figure 24 The use case diagram of remove a mission

Use case number	14
Use case	Remove a Mission
Summary	Game Creator can remove a mission.
Actor	Game Creator
Trigger	Remove a Mission Button
Primary Scenario	Game Creator needs to have at least one mission.
Exceptional Scenario	If Game Creator does not have a mission, he/she cannot remove anything.
Pre-Conditions	Game Creator needs to have at least one mission.
Post-Conditions	Game Creator can remove a mission.
Assumptions	Game Creator must be connected to the Internet.

o. Edit Profile

Figure 25 The use case diagram of edit profile

Use case number	15
Use case	Edit Profile
Summary	User can update his/her personal information.
Actor	Player, Game Creator
Trigger	Edit Profile Button
Primary Scenario	User needs to be registered to the system first. After that, he/she can change his/her information.
Exceptional Scenario	User is not registered.
Pre-Conditions	User needs to be registered to the system first. After that, he/she can change his/her information.
Post-Conditions	User can update his/her information.
Assumptions	User must be connected to the Internet.

p. Send an Invite Code

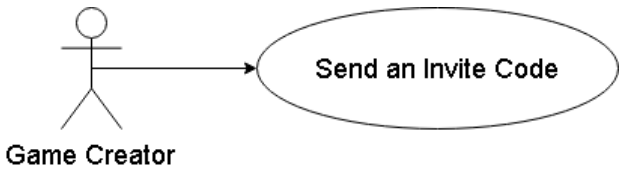

Figure 26 The use case diagram of send an invite code

Use case number	16
Use case	Send an Invite Code
Summary	Game Creator can invite players to his/her game.
Actor	Game Creator
Trigger	Send an Invite Code Button
Primary Scenario	After a game is created, Game Creator can invite players.
Exceptional Scenario	Game is not created.

Pre-Conditions	Game Creator need to create his/her game first.
Post-Conditions	Game Creator can invite players.
Assumptions	Game Creator must be connected to the Internet.

q. Ban User

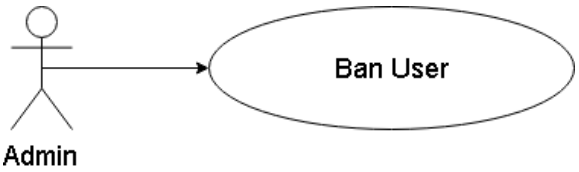

Figure 27 The use case diagram of ban user

Use case number	17
Use case	Ban User
Summary	Admin can ban users.
Actor	Admin
Trigger	Ban User Button
Primary Scenario	None.
Exceptional Scenario	User is not registered.
Pre-Conditions	None.
Post-Conditions	Admin can ban users.
Assumptions	Admin must be connected to the Internet.

4.4.3 Composition Viewpoint

4.4.3.1 Design Concerns

With the help of composition viewpoint software process will be understood. In this part, main work components and their inside components will be explained. There are four main work components in this software. Namely: Database, web server, client, and BLE Beacon.

4.4.3.2 Design Elements

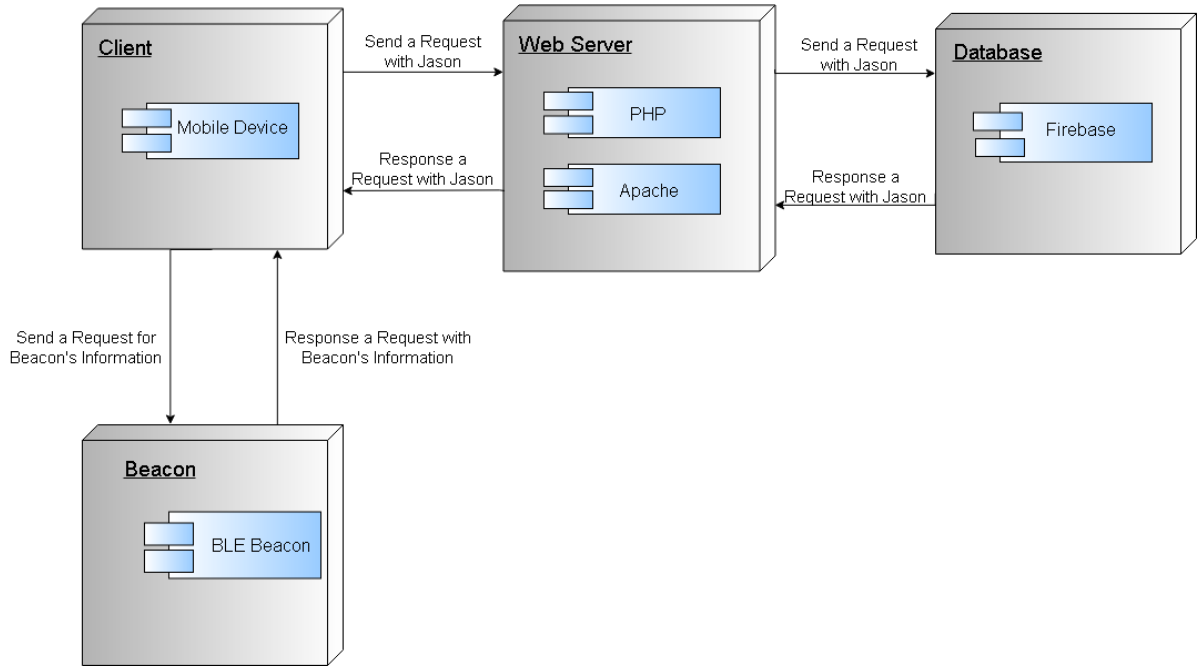

Figure 28 The deployment diagram of the project

Design Entities: There are four main design components in our project which are database, web server, client, and BLE Beacon. With web server, the client and the database has a connection.

Design Attributes: Design attributes are discussed in the following two parts.

a. Function Attribute

Database, BLE Beacon, web server, and client are the main components of our project. Web server is responsible for providing an interaction between the client and the database. The database stores information and BLE Beacon is responsible for detecting location.

b. Subordinates Attribute

All of the components mentioned above are composed together to build this project.

4.4.4 Logical Viewpoint

4.4.4.1 Design Concerns

The logical viewpoint identifies all classes and relations between classes. The goal of this viewpoint is to define and simplify the system design.

4.4.4.2 Design Elements

a. Class Relations

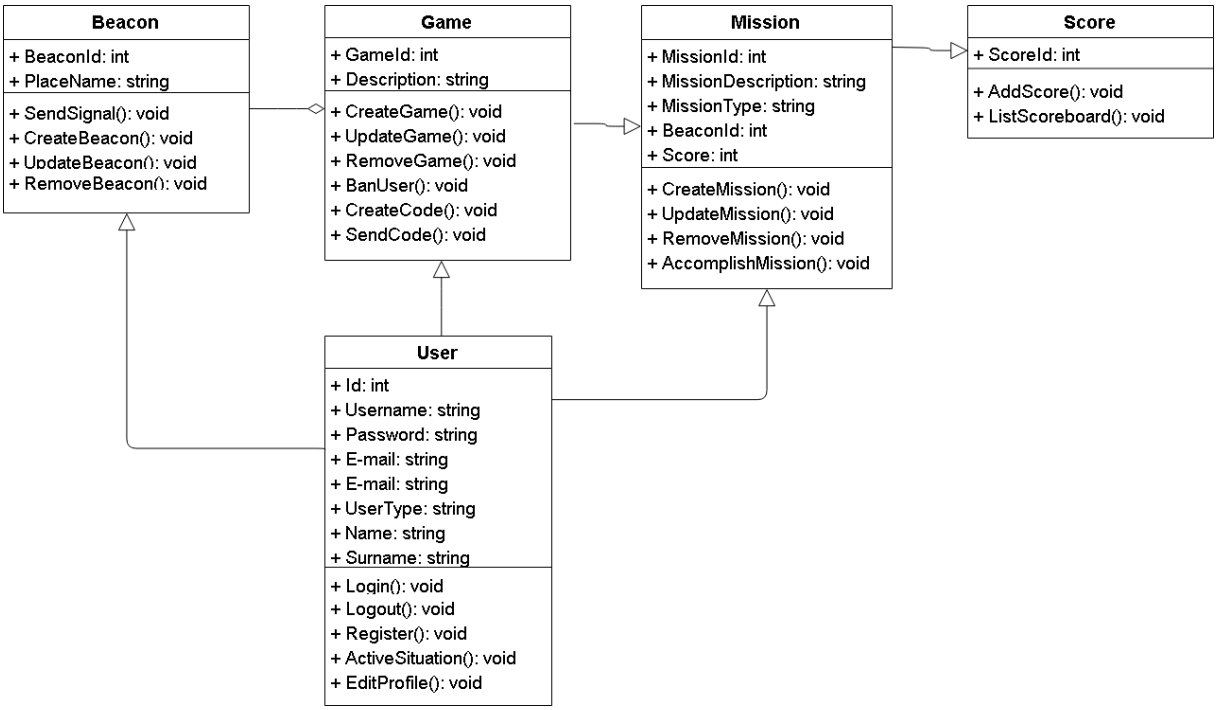

Figure 29 The class diagram of the project

b. User Class

Method/Field	Definition
Int Id	Unique id of user.
String Username	The username of user.
String Password	The password of user.
String E-mail	User's email address.
String UserType	The authority of user.
String Name	User's name.
String Surname	User's surname.
Void Login()	The way of enter to the system.
Void Logout()	The way of logout from the system.
Void Register()	The way of register to the system.
Void ActiveSituation()	User's active or deactive situation.
Void EditProfile()	The way of edit user's profile information.

c. Game Class

Method/Field	Definition
Int GameId	The unique id of game.
String Description	The description of game.
Void CreateGame()	The way of create a game in the system.
Void UpdateGame()	The way of change a game in the system.
Void RemoveGame()	The way of remove a game from the system.
Void BanUser()	The way of ban a player in a game.
Void CreateCode()	The system creates an invite code for invitation.
Void SendCode()	The way of send an invitation code to players.

d. Mission Class

Method/Field	Definition
Int MissionId	The unique id of mission.
String MissionDescription	The description of the mission.
String MissionType	The type of mission.
Int BeaconId	The beacon id that work for the mission.
Int Score	The score that belongs to the mission.
Void CreateMission()	The way of create a mission.
Void UpdateMission()	The way of change a mission.
Void RemoveMission()	The way of remove a mission.
Void AccomplishMission()	The way of end a mission.

e. Score Class

Method/Field	Definition
Int ScoreId	The unique id of score.
Void AddScore()	The way of add score to user’s total score.
Void ListScoreboard()	The way of see the scoreboard of the game.

f. Beacon Class

Method/Field	Definition
Int BeaconId	The unique id of beacon.
String PlaceName	The location of beacon.
Void SendSignal()	The signal that beacon sends.

Void CreateBeacon()	The way of add a beacon.
Void UpdateBeacon()	The way of change a beacon's information.
Void RemoveBeacon()	The way of remove a beacon.

4.4.5 Information Viewpoint

The information viewpoint describes the relationships between the classes. The class diagram explained differently with ER diagram. We can easily understand the relationships between classes with this diagram.

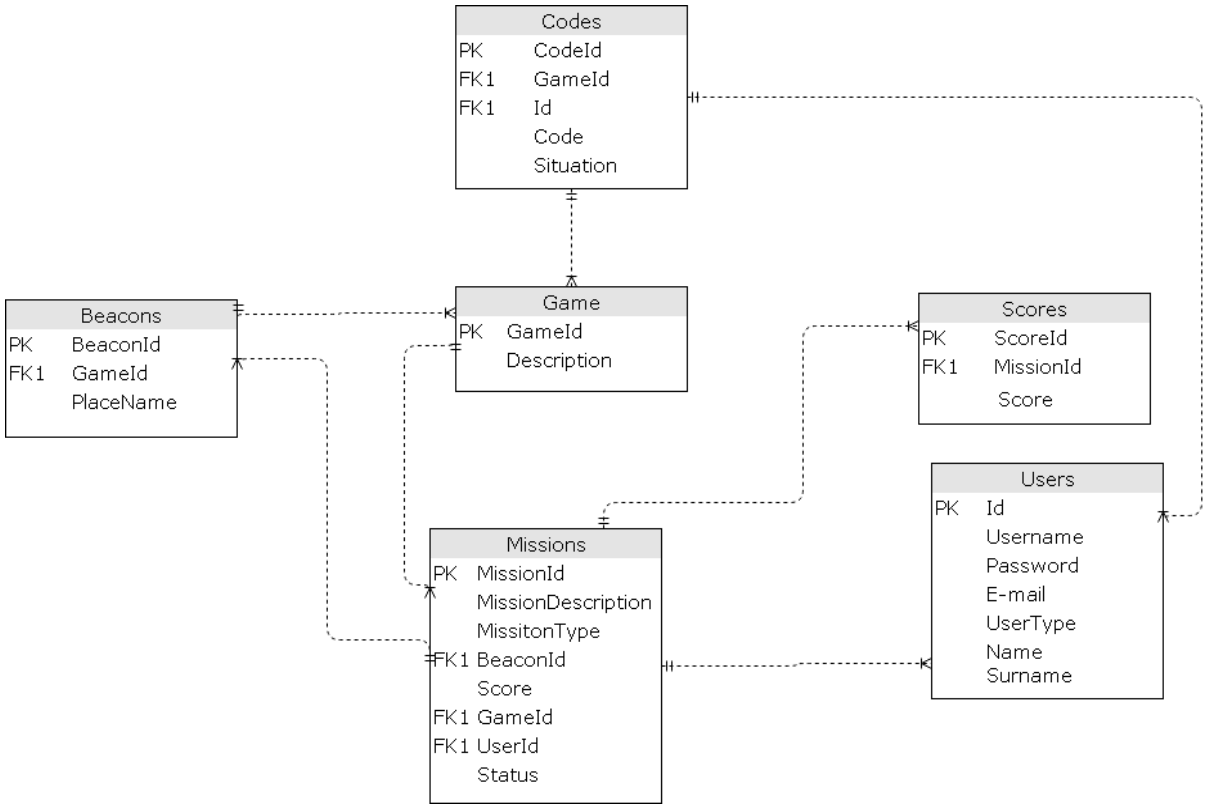

Figure 30 The ER diagram of the project

4.4.6 Interface Viewpoint

4.4.6.1 Design Concerns

The interface viewpoint provides all the information for anyone who is interested in our application. In the parts below, we created drafts of our application.

4.4.6.2 Design Elements

a. Welcome Page

After downloading and opening the Scavenger Hunt Game application, Welcome page is displayed. The user is directed to the login page with clicking to Start button.

Figure 31 Welcome page

b. Login Page

After clicking the Start button, Login page is displayed. After user fills the username and password fields, he/she should click the Login button. If the user does not have an account, he/she can register by using Register button.

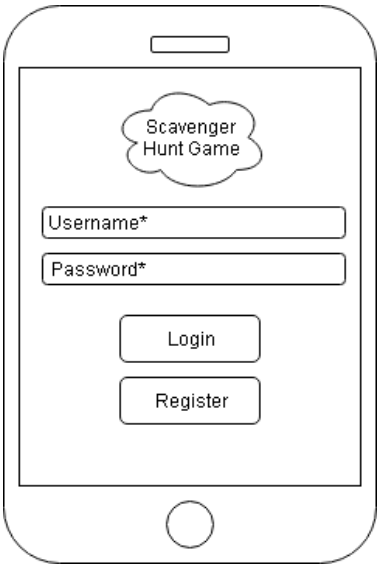

Figure 32 Login page

c. Register Page

Users who want to register to Scavenger Hunt Game can register to application after filling the required fields. After clicking the Register button, the user should be registered to the system.

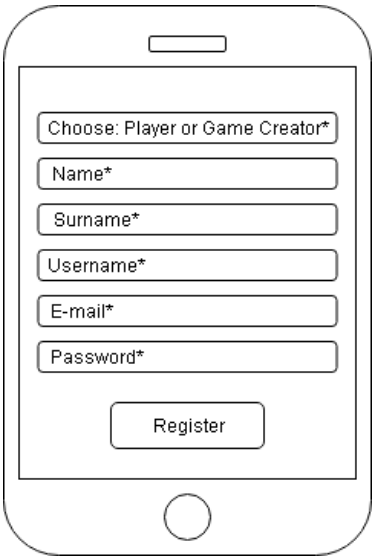

Figure 33 Register page

d. Player's Home Page

This page is the home page of player. Player can edit his/her personal information by clicking to Edit Profile button. He/she can logout from the system with the Logout button. With clicking to Join a Game button, the list of games will display and player can choose any game he/she wants to join.

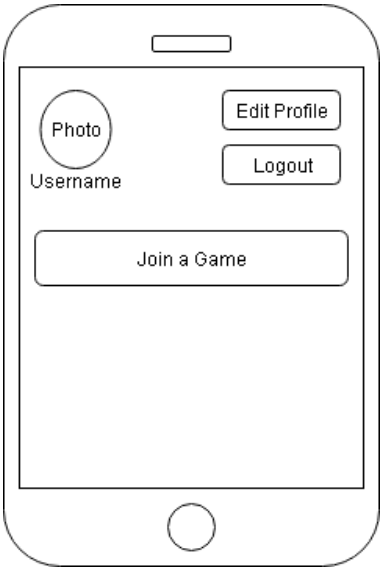

Figure 34 Player's home page

e. List of Games Page

When user clicked the Join a Game button, this page is opened. This page includes all the games in the system. And, there is a Home button to return the home page.

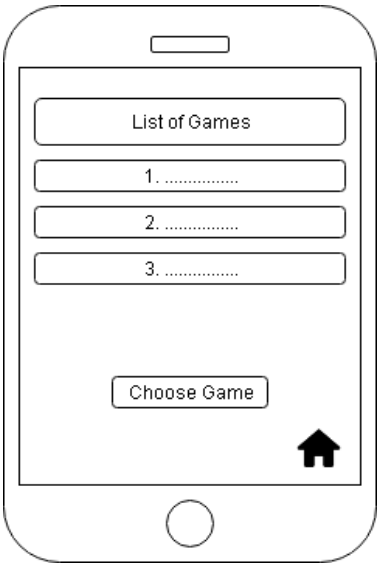

Figure 35 List of games page

f. Chosen Game Page

This page includes the operations of a player can do in the game. There is a Do a Mission button which redirects player to a mission and a List Scoreboard button which shows all of the player's scores in it. And, there is a Home button to return the home page.

Figure 36 Chosen game page

g. Mission Page

After clicking the Do a Mission button, a mission is displayed in the mission page. If player does a mission, he/she should connect to a Beacon device to complete the mission by clicking Accomplish a Mission Button. And, there is a Home button to return the home page.

Figure 37 Mission page

h. Game Creator's Home Page

This page is the home page of game creator. Game creator can edit his/her personal information by clicking to Edit Profile button. He/she can logout from the system with the Logout button. Game creator can create a game by clicking to Create a Game button, remove a game by clicking to Remove a Game button and change a game by clicking to Update a Game button.

Figure 38 Game creator's home page

i. Active Game Page

In this page, game creator can add a mission by clicking to Create a Mission button, change a mission by clicking to Update a Mission button, remove a mission by clicking to Remove a

Mission button. He/she also can add a Beacon by clicking to Create a Beacon button to expand his/her area, change a Beacon's information by clicking to Update a Beacon button and remove a Beacon by clicking to Remove a Beacon button. There is also a List Scoreboard button to see scores of game's players. And, there is a Home button to return the home page.

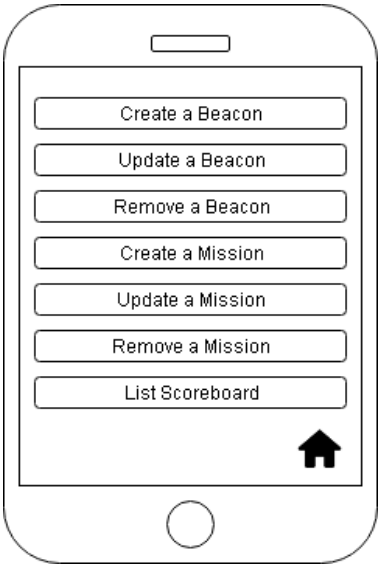

Figure 39 Active game page

j. Scoreboard Page

This page shows the scoreboard of the existing game. This page exists for both player and game creator but the contents can be different from each others. And, there is a Home button to return the home page.

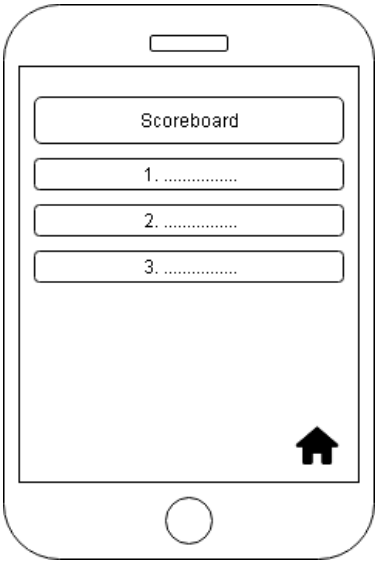

Figure 40 Scoreboard page

k. Edit Profile Page

In this page, users can change their personal information. If user updates any of the fields, in order to save the changes, he/she should click to Update button. If he/she does not want to change anything, he/she should use the Cancel button. Both Cancel and Update buttons will redirect user to his/her home page.

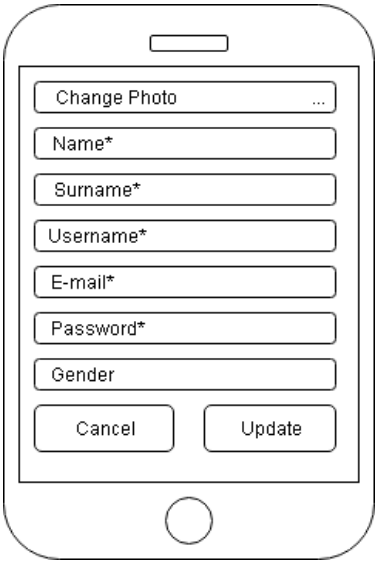

Figure 41 Edit profile page

l. Admin's Home Page

This page is the home page of admin. Admin can edit his/her personal information by clicking to Edit Profile button. He/she can logout from the system with the Logout button. With clicking to Ban User button, he/she can ban a player or game creator.

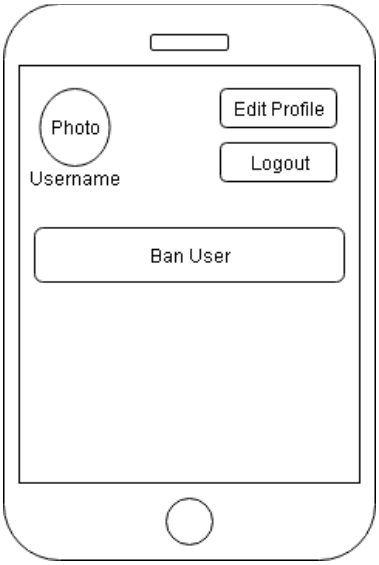

Figure 42 Admin's home page

4.4.7 State Dynamics Viewpoint

4.4.7.1 Design Concerns

The state dynamics viewpoint shows the behaviour of the system when there are some specific events. This viewpoint also related to the logical view. When a user enters the application, a user is redirected to the login page. A user must register to Scavenger Hunt Game to log in to the system. If the login is successful, a user is redirected to user's home page according to their authority. There are three home pages. There are one for players, one for game creators, and one for admins. From player's home page, a player can join a game and do a mission which game creator created for players. Also, when a player comes to the end of the mission, system check the mission's Beacon, and after the confirmation, the system gives the player a score. From game creator's home page, a user can create a game, update a game or remove a game. Also, a game creator can create a mission for his player to do or update and remove that mission. From admin's home page, admin can ban users from the games. To log out, there is a logout button for all of the users, and if users trigger that button, they can logout from the system.

4.4.7.2 Design Elements

In the state diagram, design elements begin with a start state, and it is divided into two different states; one is for a game creator, and another one is for a player. State diagram continuous with login states, display menu states, create a mission state, update a mission state, remove a mission state, create a beacon state, remove a beacon state, update a beacon state, accomplish a mission state, list scoreboard state, logout state, and end with end state. Design entities can be observed with using the state transition diagram in Figure 36 below.

Figure 43 The flowchart diagram of the project

5. Conclusions

In this project, we aimed to create an enjoyable game that contains people's responsibilities as missions. Users get points when they complete their missions. Then, they can see their place in the scoreboard. In our world, people are transforming their jobs into their habits and their performances are decreasing. In this project, our goal is to create a competitive game to increase people's performances and get people closer to their environment. To be able to do that we plan to use BLE Beacons to determine missions' location and people's location. BLE Beacon devices provide low energy Bluetooth signals and they cannot take any data from user, so it is safe and secure for usage. That is one of the reasons that we chose to use BLE Beacons in this project. The other reason is that Beacons are very beneficial at indoor location determining.

We researched about gamification, BLE Beacons and other similar projects. According to our researches, we reshaped our project. As a result of this reshaping, we prepared our SRS document. Then, we decided a developing plan for our project and we have documented this in SDD report. In this period, we explored our project's details and we decided a way of developing our project.

References

1. CENG 407 – 408 Project Proposal Form of Scavenger Hunt Game Using BLE Beacon by MuratSaran. Retrieved Retrieved November 5, 2018 from https://drive.google.com/file/d/1yY1N1bPedmuVGTtqSsUjW-8as2U1p8_u/view
2. Bunchball, I. (2010). Gamification 101: An introduction to the use of game dynamics to influence behavior. White paper, 9. Retrieved October 22, 2018 from http://jndglobal.com/wp-content/uploads/2011/05/gamification1011.pdf
3. Bozkurt, A., & Kumtepe, E. G. (2014). Oyunlaştırma, Oyun Felsefesi ve Eğitim: Gamification. Retrieved October 25, 2018 from https://ab.org.tr/ab14/bildiri/233.pdf
4. Bunchball, I. (2016). Gamification 101: An introduction to game dynamics. Retrieved October 25, 2018 from https://www.healthstream.com/docs/default-source/default-document-library/white-paper--bunchball-gamification.pdf?sfvrsn=2
5. Beza, O. (2011). Gamification - How games can level up our everyday life?. VU University, Amsterdam. Retrieved October 22, 2018 from https://www.cs.vu.nl/~eliens/ct/local/material/gamification.pdf

6. Fitz-Walter, Z. (2018). Introduction to Gamification. Retrieved October 25, 2018 from https://static1.squarespace.com/static/5993a36d6b8f5b8a32da7319/t/5b3a9fc6758d46456032f101/1530568702188/Introduction+to+gamification+1.02.pdf
7. Fitz-Walter, Z. (2013). A brief history of gamification. Retrieved November 2, 2018 from https://zacfitzwalter.com/articles/2017/10/7/a-brief-history-of-gamification
8. Van Den Boer, P. (2011). Introduction to gamification. Retrieved October 22, 2018 from https://cdu.edu.au/olt/ltresources/downloads/whitepaper-introductiontogamification-130726103056-phpapp02.pdf
9. Prezi. (2018). Prezi Student Ambassador Program. Retrieved November 5, 2018 from https://prezi.com/ambassadors/
10. Uslu, B. (2017). Android Tabanlı Mobil Uygulama Geliştirme, 5th edition. İstanbul: Kodlab.
11. Turkcell (2016, May 5). Android mimarisi ve özellikleri. Retrieved October 26, 2018 fromhttps://gelecegiyazanlar.turkcell.com.tr/konu/android/egitim/android-201/android-mimarisi-ve-sistem-ozellikleri
12. Narman, A. E. (2017). Android Studio ile Programlama, 14th edition. İstanbul: Kodlab.
13. Demircan, M. (2017). WEB SERVİSLERİ, SOAP, UDDI, WSDL Nedir?. Retrieved October 26, 2018 fromhttp://www.dmyazilim.com/bloglar/9/web-servisleri-soap-uddi-wsdl-nedir
14. Duymaz, G. (2017). PHP nedir?. Retrieved October 28, 2018 from https://www.mediaclick.com.tr/blog/php-nedir
15. Cesur, K. (2013). WCF nedir?. Retrieved October 28, 2018 from http://www.kazimcesur.com/wcf/
16. Neslihan. (2017). FireBase nedir, ne işe yarar, neden kullanmalıyız?**.** Retrieved October 28, 2018 from http://univera-ng.blogspot.com/2017/04/firebase-nedir-ne-ise-yarar-neden.html
17. Hackernoon. (2017). Introduction to Firebase. Retrieved October 28, 2018 from https://hackernoon.com/introduction-to-firebase-218a23186cd7
18. Uçarsu, O. (2017). Web ve Mobil uygulamalar için Firebase. Retrieved October 28, 2018 from http://devnot.com/2017/web-ve-mobil-uygulamalar-icin-firebase/
19. Google. (2018). Firebase helps mobile app teams succeed. Retrieved October 28, 2018 from https://firebase.google.com/products/
20. Avcı, O. (2015). Dosya konusu: Beacon teknolojisi nedir? Nerelerde kullanılır?. Retrieved November 6, 2018 from https://www.donanimhaber.com/Dosya-konusu-Beacon-teknolojisi-nedir-Nerelerde-kullanilir--77683
21. DOKO. (2017). BEACON NEDİR?. Retrieved November 6, 2018 from http://www.dokotech.com/tr/beacon-nedir/
22. Kara, A. (2018). Beacon|Bluetooth Tabanlı Etkileşim Teknolojisi. Retrieved November 6, 2018 from https://www.endustri40.com/beaconbluetooth-tabanli-etkilesim-teknolojisi/

23. FSSoftware. (2018). Beacon | Bluetooth Tabanlı EtkileşimTeknolojisi. Retrieved November 6, 2018 from http://www.fsmobility.com.tr/genel/beacon-bluetooth-tabanli-etkilesim-teknolojisi/
24. Vara, G. (2017). “Beacon Me” Mobil Uygulaması, Emojileri Kullanarak Gezginlere Rehber Oluyor. Retrieved November 6, 2018 from https://www.uzakrota.com/beacon-me-mobil-uygulamasi-emojileri-kullanarak-gezginlere-rehber-oluyor/
25. Indigo. (2017). Beacon ve nesnelerin interneti bankacılık sektörünü değiştiriyor. Retrieved November 6, 2018 from https://indigodergisi.com/2016/07/beacon-ve-nesnelerin-interneti-bankacilik-sektorunu-degistiriyor/
26. Demirel, F. (2016, Sep 11). Chrome Android uygulamasına beacon desteği geliyor. Retrieved November 6, 2018 from https://webrazzi.com/2016/02/11/chrome-android-uygulamasina-beacon-destegi-geliyor/
27. Radius Networks.(2014, Nov 20). iBeacon Scavenger Hunt Application for iOS. Retrieved November 6, 2018 from https://github.com/RadiusNetworks/scavenger-hunt-ios-os