Drogba Inc.

Software Design Description

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1 Overview

1.1 Scope

This document is the Software Design Description(SDD) of the project COW-3D. It explains what the project is and gives the design views that should conform the design concerns and requirements outlined in the Software Requirement Specification(SRS) and in this document. It is written in a way that a developer(s) who wishes to implement the project will get all the information he needs.

1.2 Purpose

The purpose of this document is to outline the desing views of the project. The design concerns and requirements that are mentioned in the Software Requirement Specification are matched with design views and design viewpoints are matched with design viewpoints. The document describes the development phase, thus it is the primary source for the developer.

1.3 Intended Audience

The intended audience of this document is the members of the project group, developers of the system and the users. The project group is meant to use this document in the development and the test phase of the project. The users may check this document to see the design choices and how the system is developed. The main intended audience, on the other hand, is the developers who wish to implement the system.

2 Definitions

SRS : Software Requirement Specification

SDD : Software Design Description

COW : Ceng On the Web

UML : Unified Modelling Language

3 Conceptual Model

This section describes the concepts of the document. It gives information about the project for which this document is prepared.

3.1 Software Design in Context

3.1.1 Application Overview

The project for which this document is prepared for is one of the senior graduate projects of Computer Engineering Department in Middle East Technical University. It is called COW-3D where COW refers to Ceng On the Web the online communication platform of the Computer Engineering Department. The 3D, on the other hand, refers to the three dimensional virtual model of the department's building. The project was proposed by one the lecturers of the department, Ahmet Oguz Akyüz and it is mentored by the proposer during the process.

The project's main goal is to help the department to be publicized by drawing more attention from prospective students of the department. It also aims to help the users to be familiar with the department building and to find their way in the building with the functionalities provided by the system.

There is a similar application in which the building is modeled in 3D. It was a project conducted by a graduate student. Although, this application has a 3D model of the building and lets the user to walk in it, it does not serve as a solution for the problem that we are aiming to solve. First of all, it lacks the functionality to guide the user through a pre-defined path. It also does not have a realistic view. Our project adds solutions for these problems. For guiding a user, our system will provide what we call a 'Guide' functionality in which the user is able to set the current and destination point and the system calculates the shortest path between the defined points and guides the user through the way. To add a realistic view to the model, our system will have 'texture mapping' which is a process of adding real textures(extractred from real images) of an object onto the 3D model of it.

3.1.2 Technologies Used

The 3D model that will be used in the application will be generated in Autodesk's 3ds Max. The models will then be ported into Unity 3D where the proposed functionalities will be implemented.

3.2 Software Design Descriptions within the Life Cycle

3.2.1 Influences on SDD Preparation

The Software Requirement Specification is the main source that drives the design choices, constraints and design process. This document may also be influenced by additional requirements or design choices that are realized during the design process.

3.2.2 Influences on Software Cycle Products

The Software Design Description mainly influences the test phase and the test documentation of the project. It may also influence the SRS document by adding or changing some requirements.

3.2.3 Design Verification and Design Role in Validation

The design shall be verified to ensure that it fulfills the requirements specified in the SRS. The design shall also be validated to ensure that it functions as intended.

4 Design Description Information Content

4.1 Introduction

The design description information content includes the SDD identification, the design stakeholders and their concerns, design views and design viewpoints. Each one is explained in the following subsections.

4.2 SDD Identification

The scope of the SDD is given in the "1. Overview" section.

There is no issuing or sponsored organization for the project. It is, however, proposed by one of the lecturers.

The project group is responsible for the project implementation and the project is not owned by anyone.

The context is described in "3.1 Software design in context" section.

The Unified Modelling Language (UML) is used throughout the document for the design views and design viewpoints.

4.3 Design Stakeholders and Their Concerns

The stakeholders are the members of the project group, the proposer of the project and the users.

The "2. Overall Description" section of the SRS document gives detailed information about the design concerns and requirements.

4.4 Design Views

Each design viewpoint mentioned in the following section corresponds to a design view.

4.5 Design Viewpoints

The design viewpoints used in this document are Context Viewpoint, Interface Viewpoint, Interaction Viewpoint, State Dynamics Viewpoint and Composition Viewpoint.

4.6 Design Languages

Unified Modelling Language (UML) is used to represent the design viewpoints listed in (4.5).

5 Viewpoints

5.1 Introduction

In this part , five main design viewpoints will be explained.

- Context Viewpoint
- Interface Viewpoint
- Interaction ViewPoint
- State Dynamics Viewpoint
- Composition Viewpoint

During the explanation of these viewpoints , UML diagrams will be used to increase understandability.

5.2 Context Viewpoint

Cow-3D product context viewpoint shows the functions provided by a design.There are two major functionalities which are PathFinding and Explore functions in the system.Each function has sub-functions too.The context is defined by the elements that interacts with the software like users.

5.2.1 The User Use Case

Use case diagram of the user who manage the COW-3D system is revealed in Figure 5.2.1.

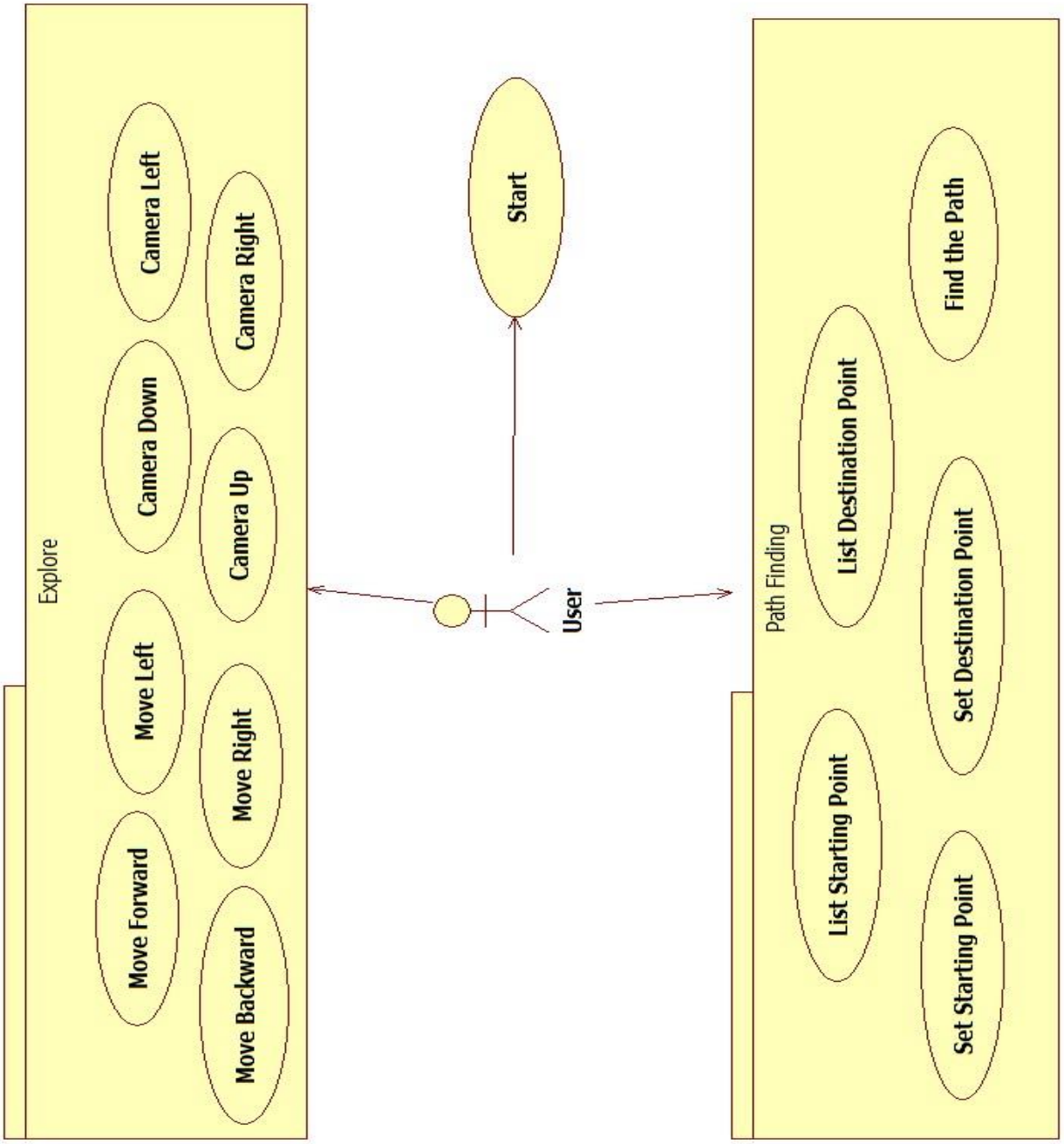

Figure 5.2.1: Use Case Diagram

Since these use cases were explained in SRS document with details, they are omitted in this document.One can see part 2.2 of COW-3D SRS Document for detailed information about use cases.

5.3 - Interface Viewpoint

Interface Viewpoint for COW-3D project is provided below with component diagram and some user interfaces.

5.3.1 – Service Definition and Access

For COW-3D project, there will be a database to store the building's parts and object inside it. Everybody who wants to use can use this COW-3D system.

Users can explore Computer Engineering Department or find a path which starts a starting point and ends a destination point. While doing these, users access the database via a user interface to see paths and objects visually but not directly. Also, users cannot do any changes on database.

Admins can access the database directly and can do changes on database. An admin can add new objects to database, correct mistakes or update the whole system.

Component diagram for COW-3D system is provided below;

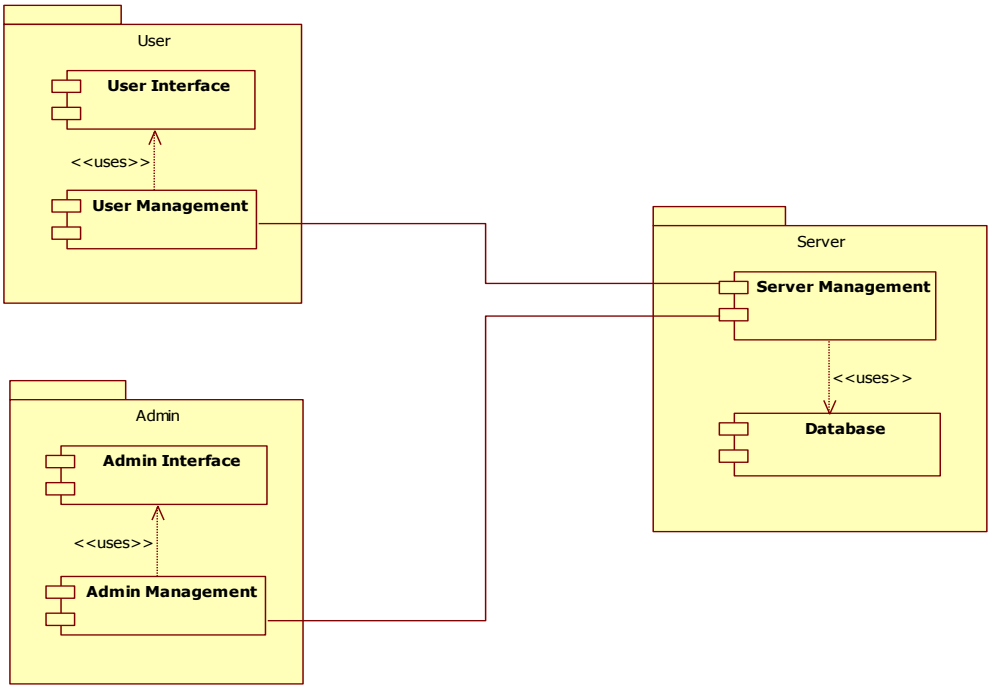

Diagram 5.3.1 Component Diagram

5.3.2 User Interfaces

In this section, some user interfaces are shown.

5.3.2.1 Mode Selection Screen

Image 5.3.2.1 – Mode Selection Screen

In this screen, users will select a mode to use the system, which are "Explore" and "Path Finding". If the user select "Explore", system will go to "Explore Mode Screen" or if the user select "Path Finding", system will go to "Path Finding Mode Screen".

5.3.2.2 Explore Mode Screen

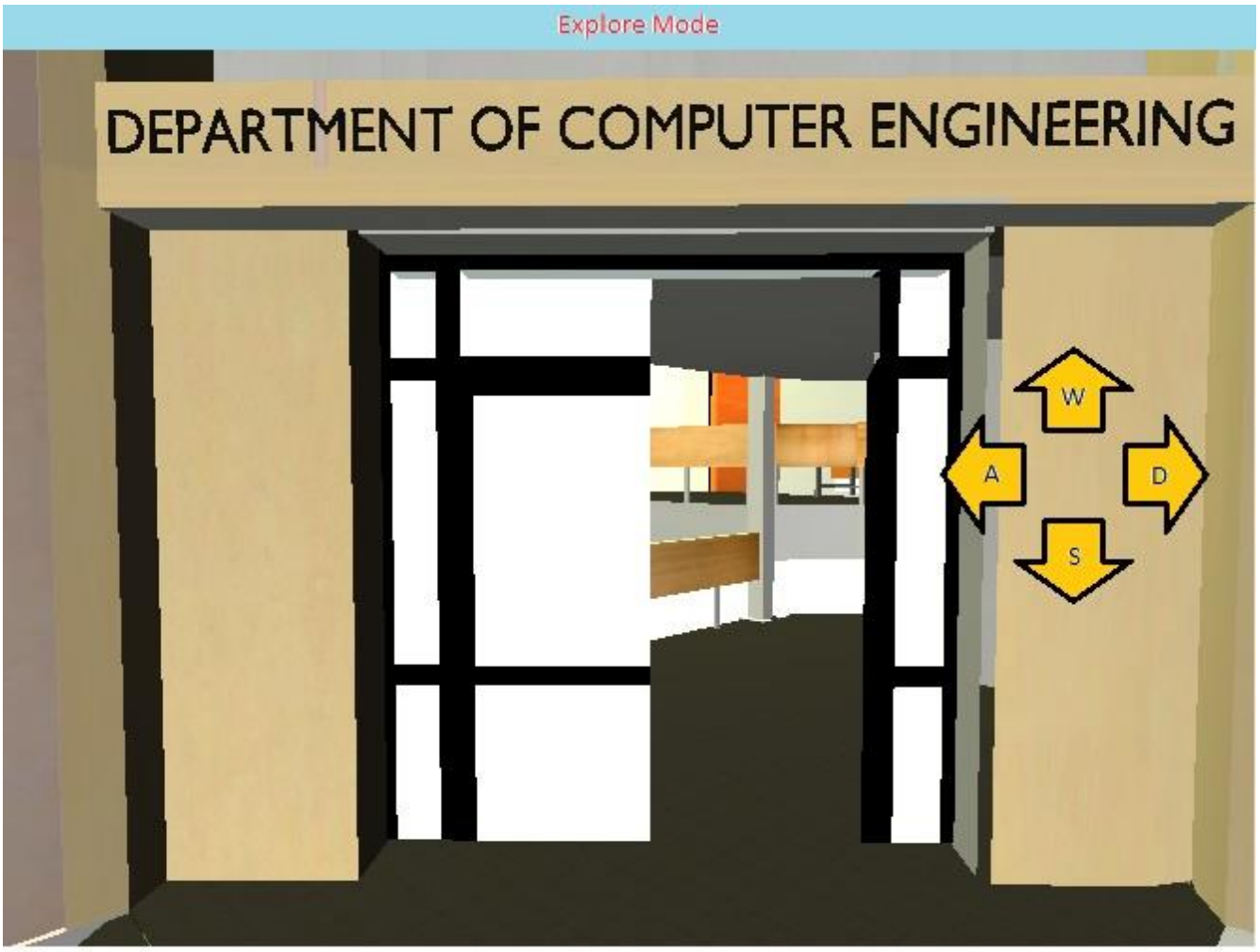

Image 5.3.2.2 – Explore Mode Screen

In this screen, users can move any direction he/she wants. Also, can look at any point by changing view point. In this mode users can see lecture halls and any parts of the building by moving the character there.

5.3.2.3 Path Finding Mode Screens

5.3.2.3.1 Starting Point Selection Screen

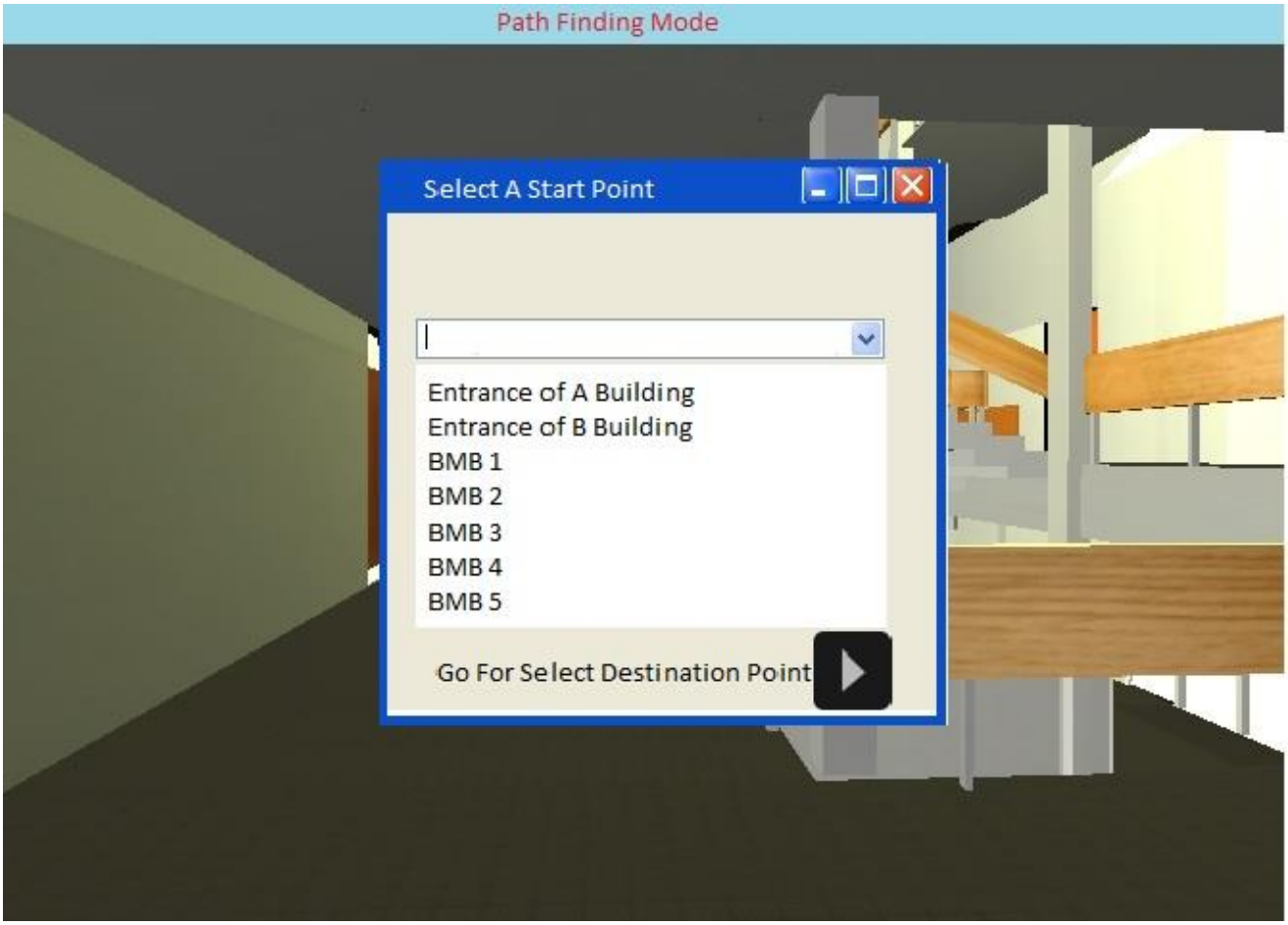

Image 5.3.2.3.1 – Starting Point Selection Screen

When a user selects "Path Finding Mode", the user will be directed to "Starting Point Selection Screen". In this screen the user will be asked to select the point he/she wants to start.

After selected "Starting Point", when user click "Go For Select Destination Point", the user will be directed to "Destination Point Selection Screen".

5.3.2.3.2 Destination Point Selection Screen

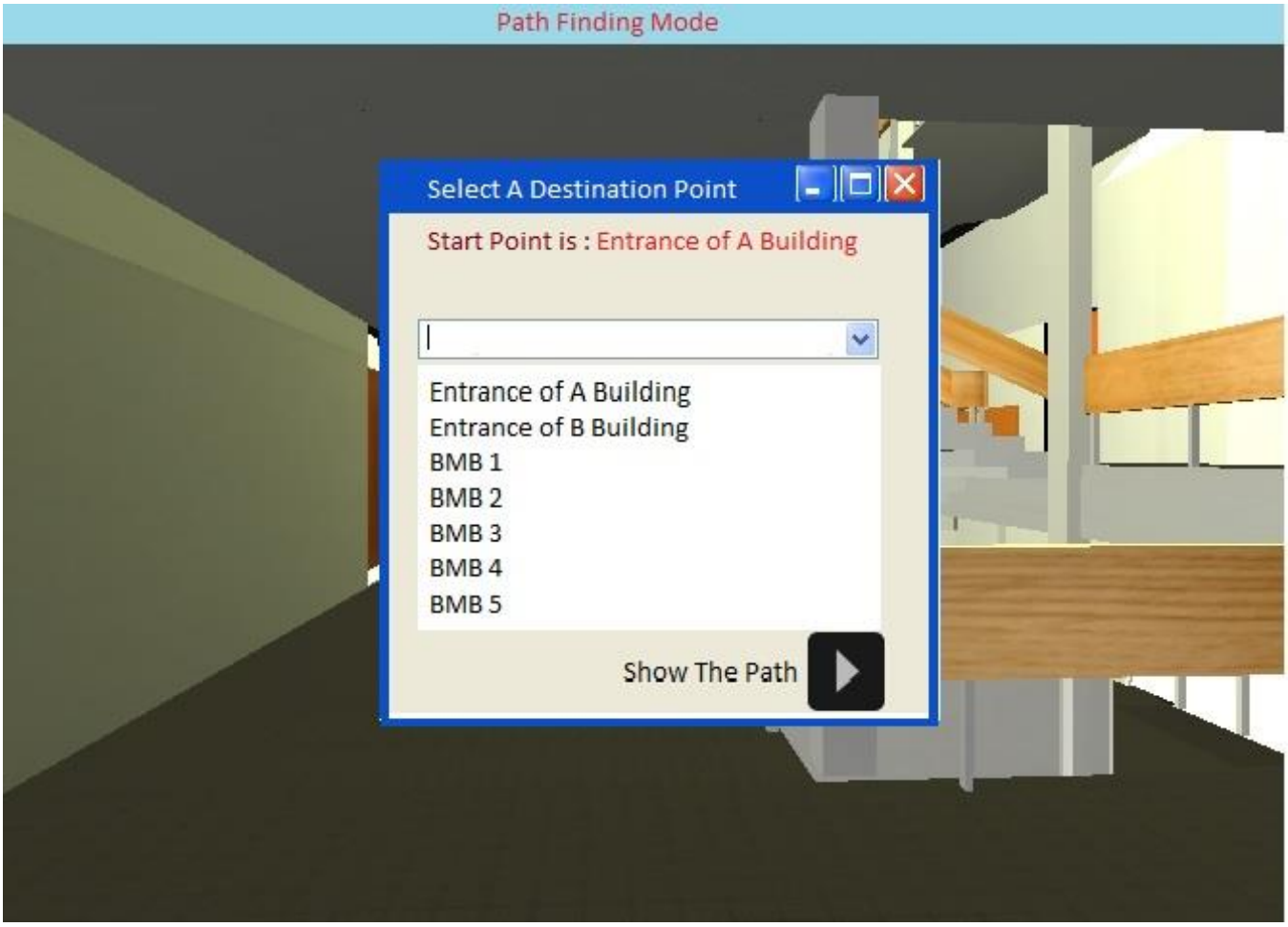

Image 5.3.2.3.2 Starting Point Selection Screen

After selected "Starting Point", the user will be directed to "Destination Point Selection Screen". In this screen the user will be asked to select the point he/she wants to go to.

After selected "Destination Point", when user click "Show the path", the user will be directed to "The Path Screen".

5.3.2.3.3 The Path Screen

Image 5.3.2.3.3 – The Path Screen

After selection of "Starting Point" and "Destination Point", the user will be directed to "The Path Screen".

In this screen, user can go to "Destination Point" starting from "Starting Point". During this period, an arrow will guide the user to show which direction the user should go.

Also, in this screen the user can see the "Starting Point" and "Destination Point".

5.4 Interaction Viewpoint

Interaction viewpoint for COW-3D project is provided below with sequence diagram to clarify the functionalities of the system.

5.4.1 Mode Selection Sequence Diagram

This section will explain the the initial functionality of the system for web application, asking user to choose from two available modes. The section will refer to "2.2.1-Start" and "3.2.1-Start" from the SRS document.

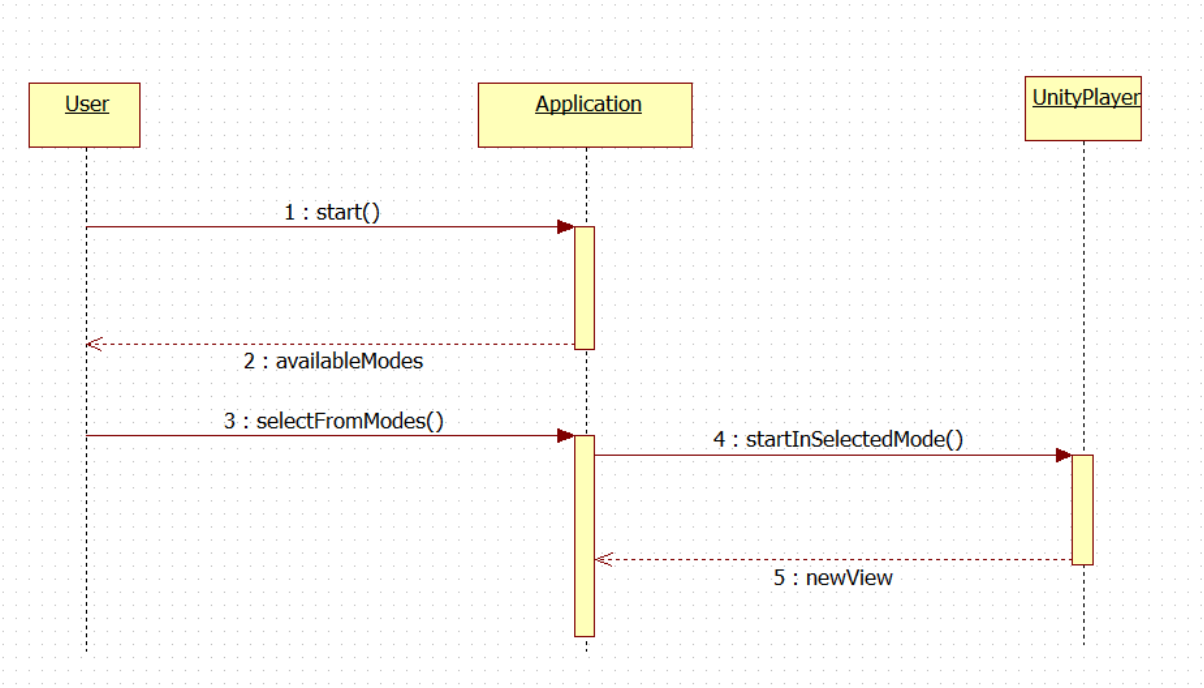

Diagram 5.4.1.1 Mode Selection Sequence Diagram

* Unity Player is a plugin that allows to display 3D worlds created using Unity

5.4.2 Move Forward Sequence Diagram

This section will explain the first person shooter go forward functionality of the system for web application which provide user to change position with moving forward. The section will refer to "2.2.2.1-Move Forward" and "3.2.2- Move Forward" from the SRS document.

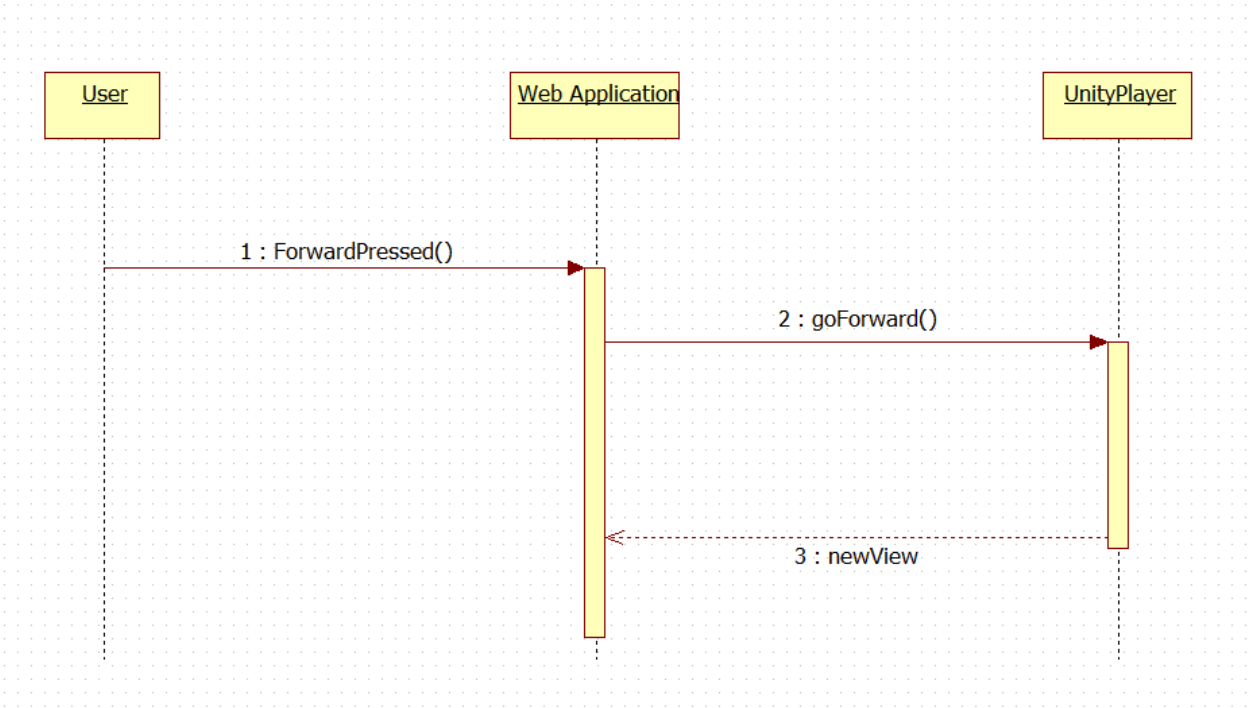

Diagram 5.4.1.2 Move Forward Sequence Diagram

* Unity Player is a plugin that allows to display 3D worlds created using Unity

5.4.3 Move Backward Sequence Diagram

This section will explain the first person shooter go backward functionality of the system for web application which provide user to change position with moving backward. The section will refer to “2.2.2.2-Move Backward” and “3.2.3- Move Backward” from the SRS document.

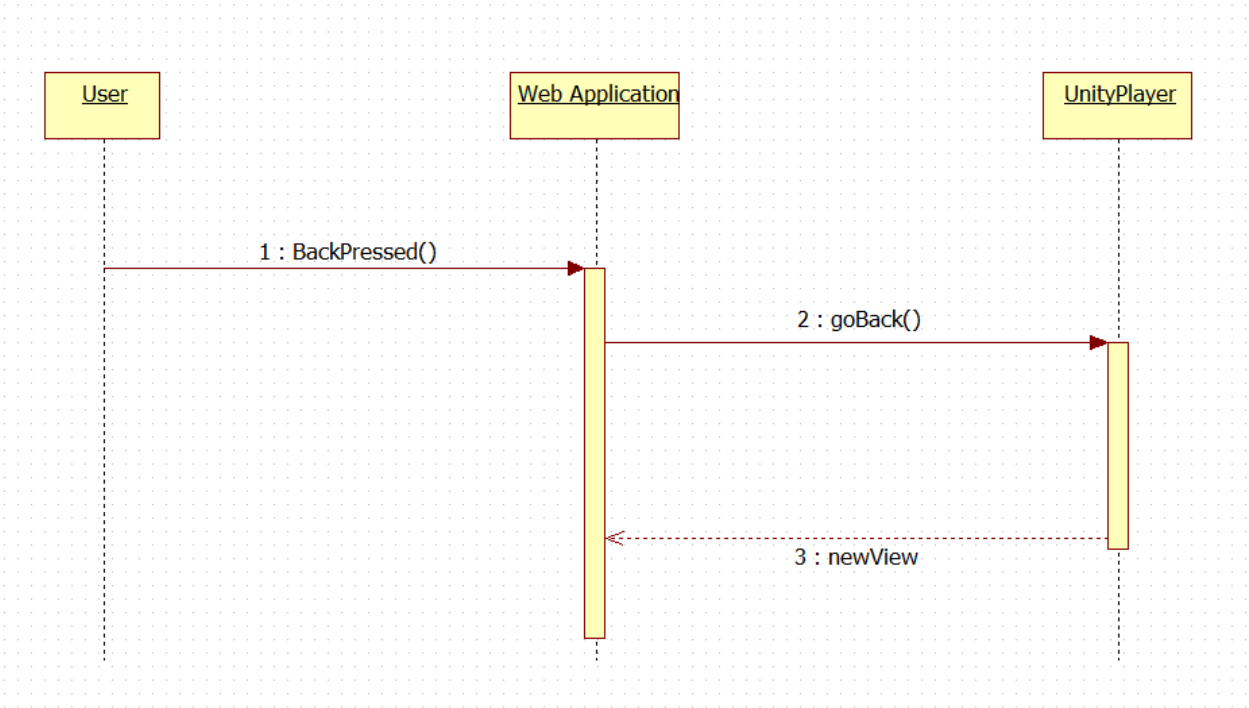

Diagram 5.4.1.3 Move Backward Sequence Diagram

* Unity Player is a plugin that allows to display 3D worlds created using Unity

5.4.4 Move Right Sequence Diagram

This section will explain the first person shooter go right functionality of the system for web application which provide user to change position with moving rightward. The section will refer to “2.2.2.3-Move Right” and “3.2.4-Move Right” from the SRS document.

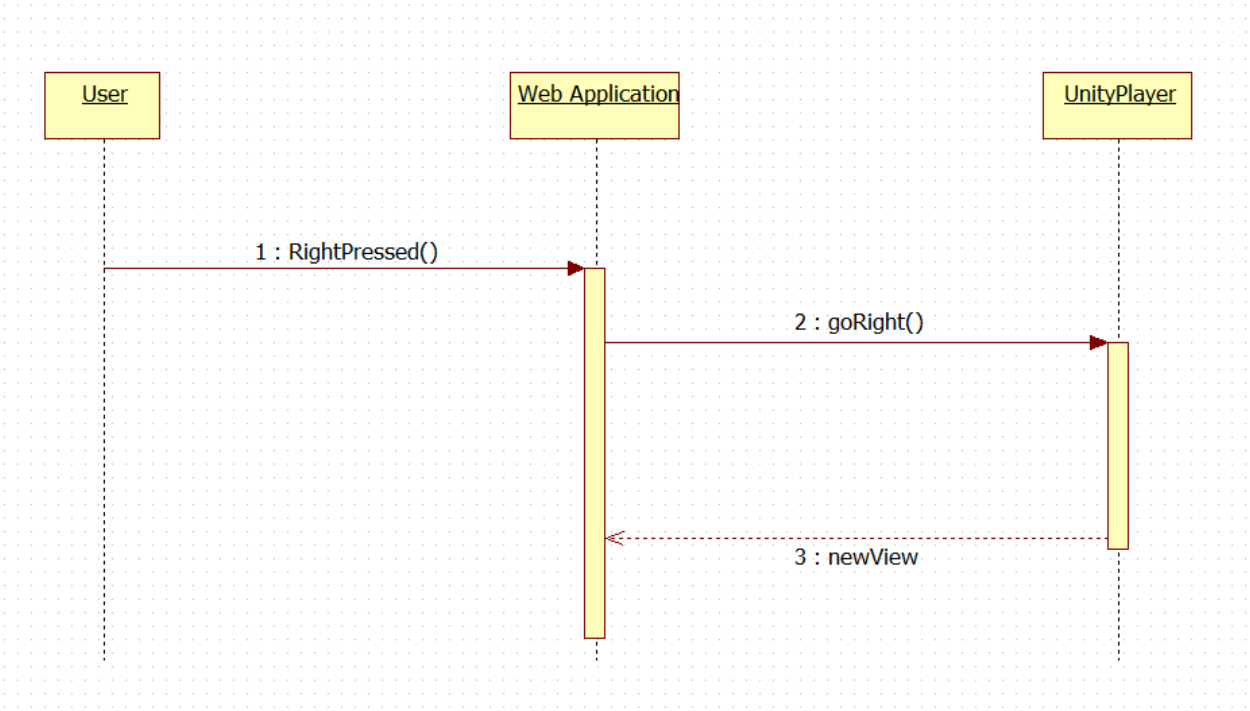

Diagram 5.4.1.4 Move Right Sequence Diagram

* Unity Player is a plugin that allows to display 3D worlds created using Unity

5.4.5 Move Left Sequence Diagram

This section will explain the first person shooter go left functionality of the system for web application which provide user to change position with moving leftward. The section will refer to “2.2.2.4-Move Left” and “3.2.5-Move Left” from the SRS document.

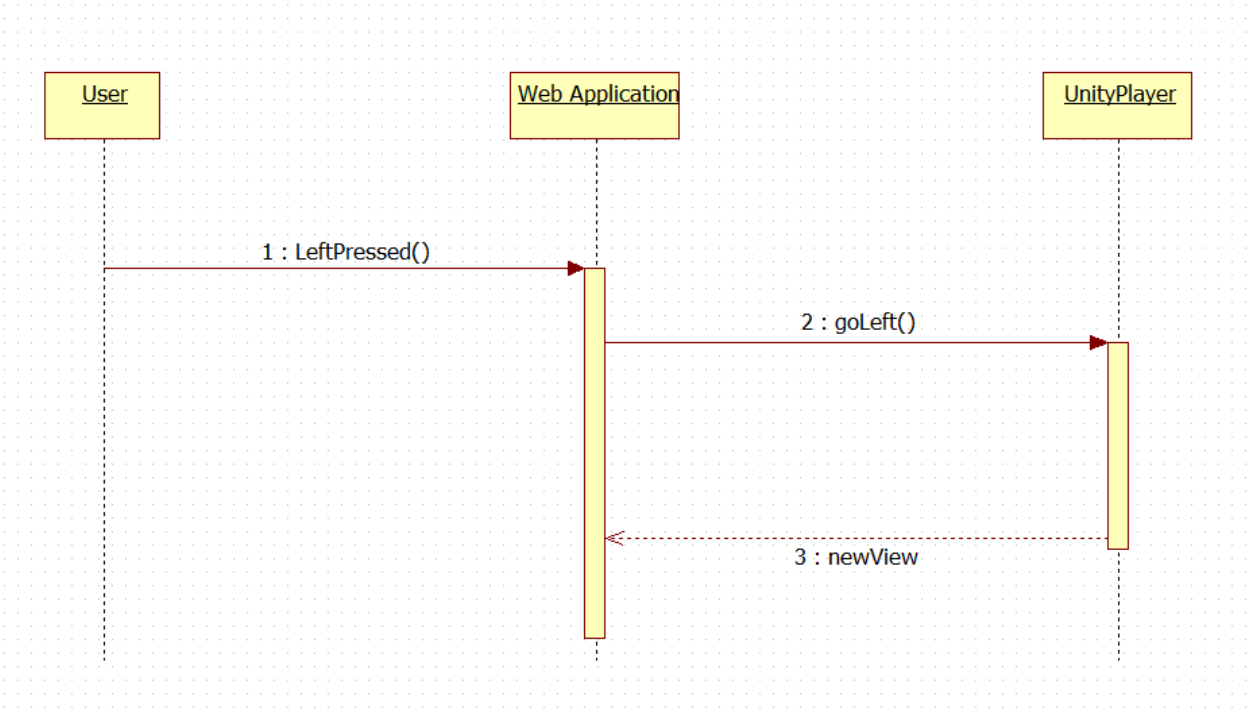

Diagram 5.4.1.5 Move Left Sequence Diagram

* Unity Player is a plugin that allows to display 3D worlds created using Unity

5.4.6 Camera up Sequence Diagram

This section will explain the first person shooter change view direction upward functionality of the system for web application which provide user to change view direction. The section will refer to “2.2.2.5-Camera Up” and “3.2.6- Camera Up” from the SRS document.

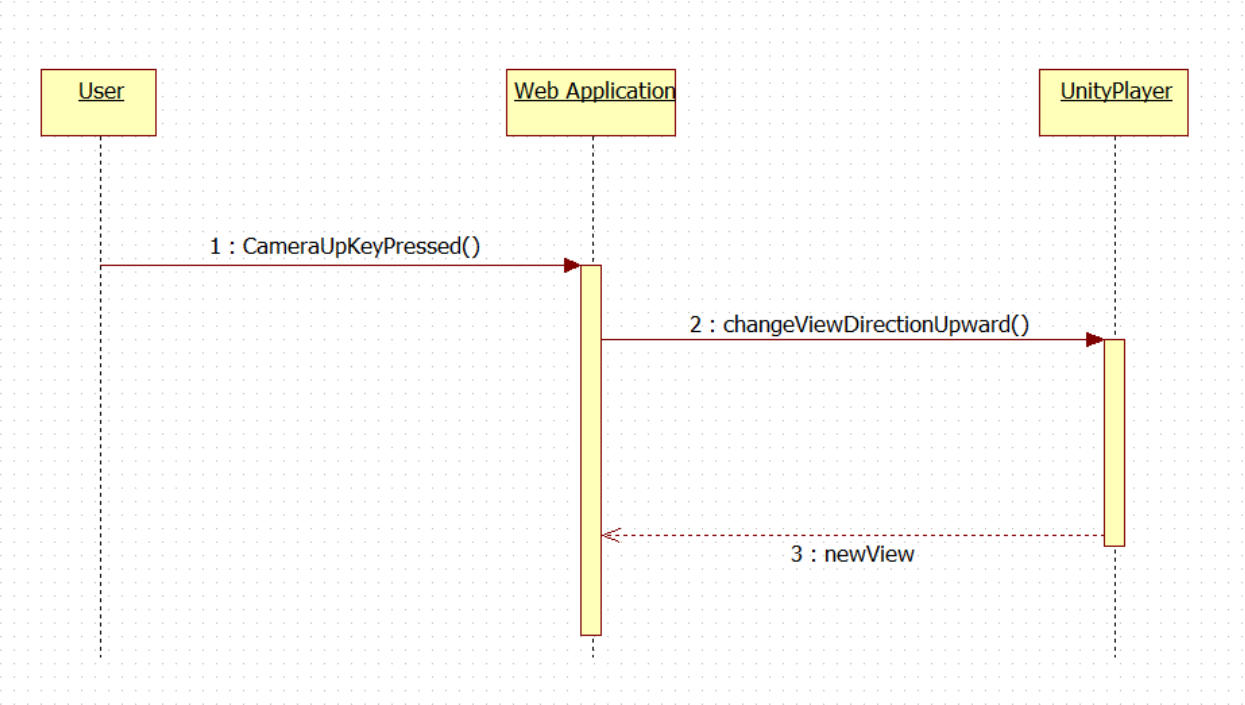

Diagram 5.4.1.6 Camera Up Sequence Diagram

* Unity Player is a plugin that allows to display 3D worlds created using Unity

5.4.7 Camera Down Sequence Diagram

This section will explain the first person shooter change view direction downward functionality of the system for web application which provide user to change view direction. The section will refer to “2.2.2.6-Camera Down” and “3.2.7- Camera Down” from the SRS document.

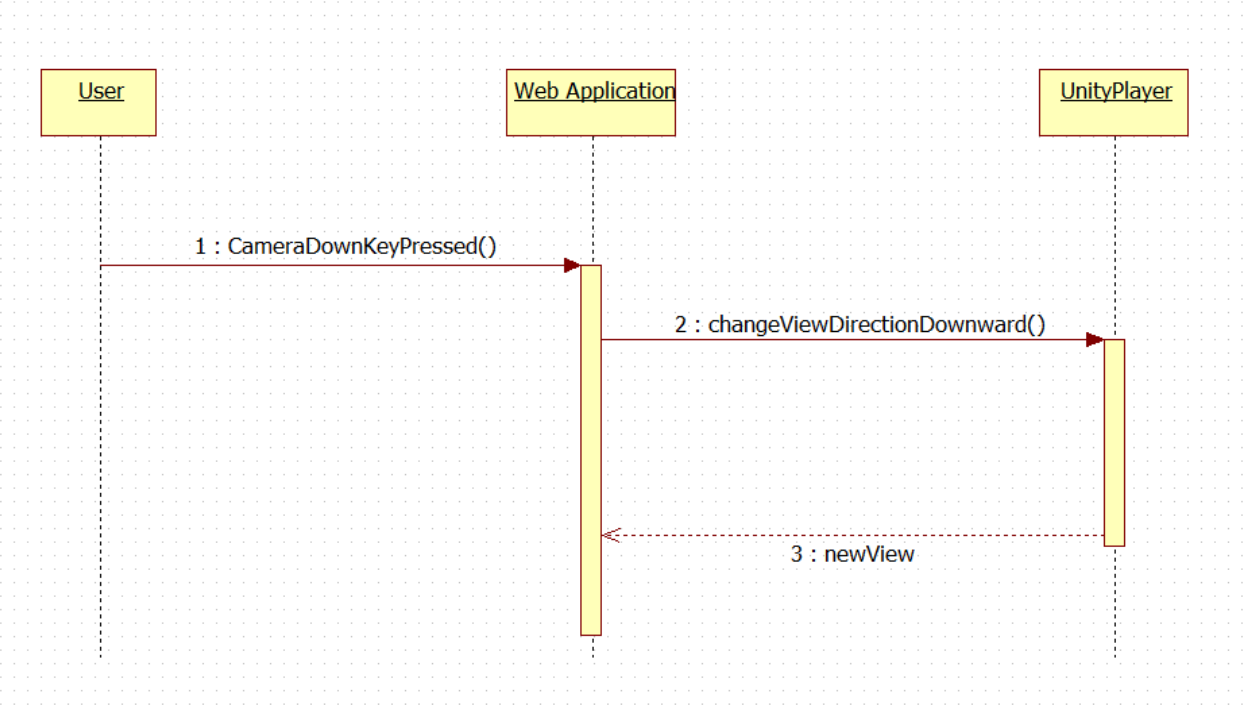

Diagram 5.4.1.7 Camera Down Sequence Diagram

* Unity Player is a plugin that allows to display 3D worlds created using Unity

5.4.8 – Camera Right Sequence Diagram

This section will explain the first person shooter change view direction rightward functionality of the system for web application which provide user to change view direction. The section will refer to “2.2.2.7-Camera Right” and “3.2.8- Camera Right” from the SRS document.

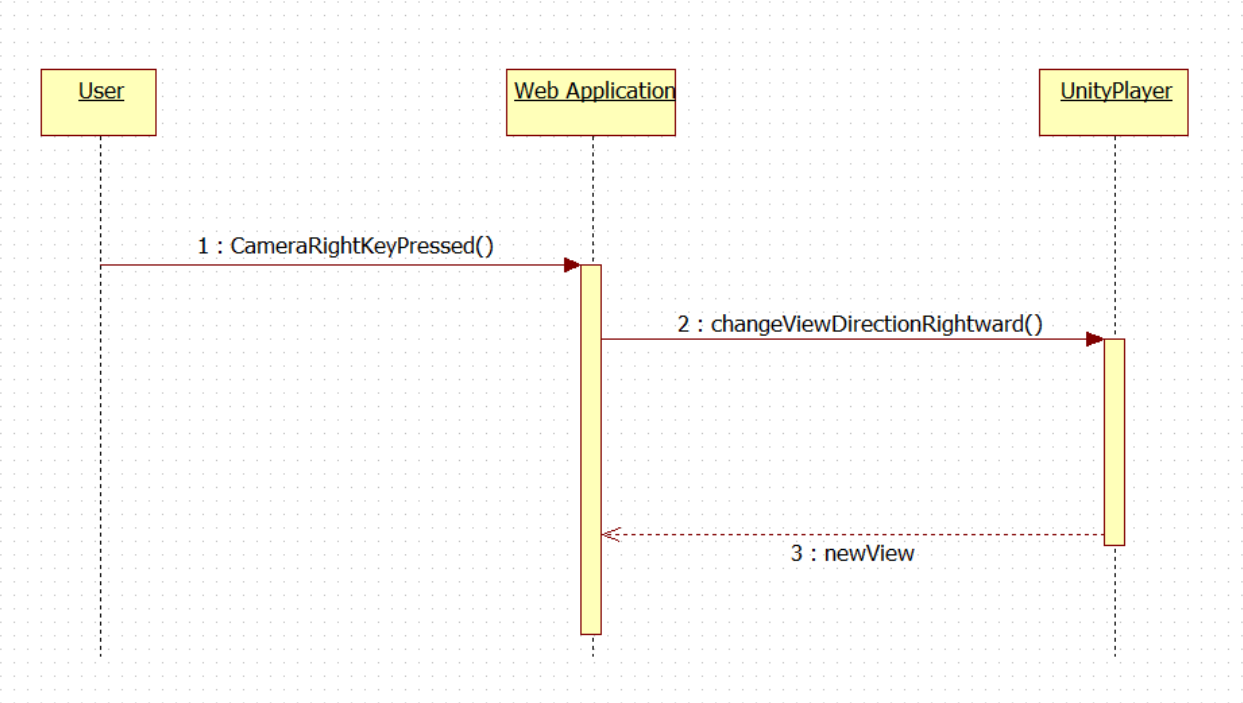

Diagram 5.4.1.8 Camera Right Sequence Diagram

* Unity Player is a plugin that allows to display 3D worlds created using Unity

5.4.9 Camera Left Sequence Diagram

This section will explain the first person shooter change view direction leftward functionality of the system for web application which provide user to change view direction. The section will refer to “2.2.2.8-Camera Left” and “3.2.8- Camera Left” from the SRS document.

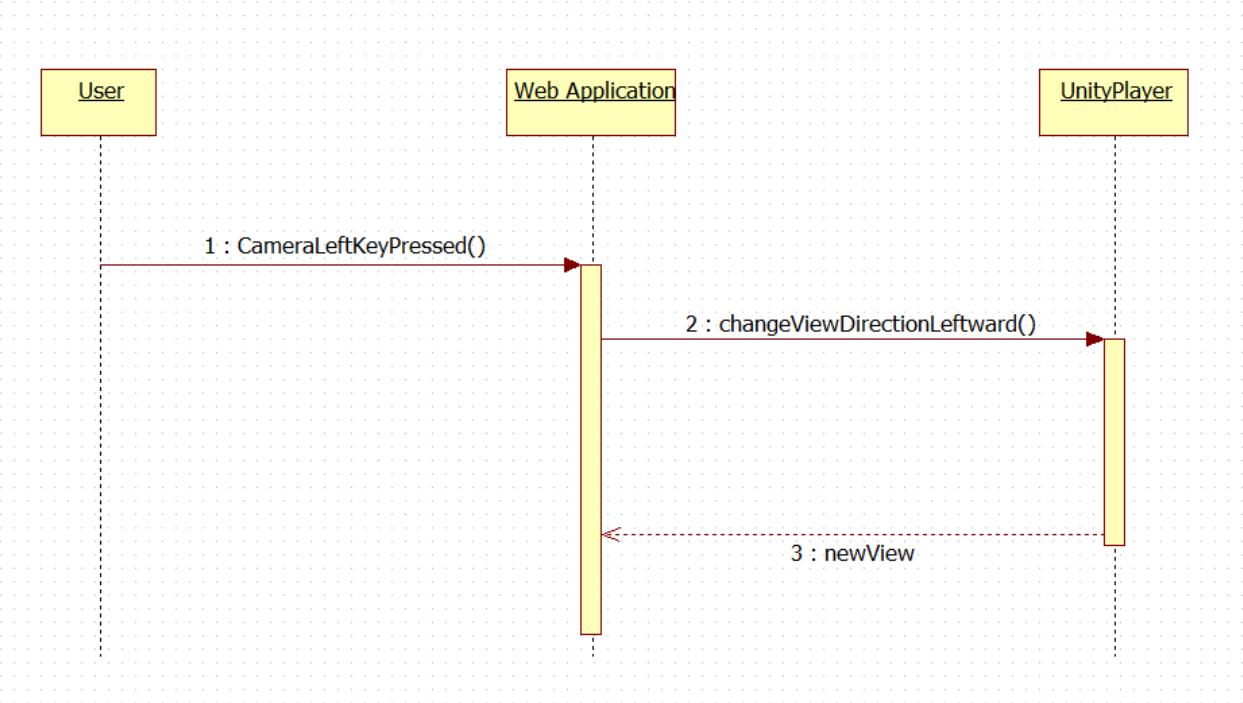

Diagram 5.4.1.9 Camera Left Sequence Diagram

* Unity Player is a plugin that allows to display 3D worlds created using Unity

5.4.10 Set Starting Point Sequence Diagram

This section will explain the start point selection functionality of the system. The section will refer to “2.2.3.1-Set Starting Point” and “3.2.10- Set Starting Point” from the SRS document.

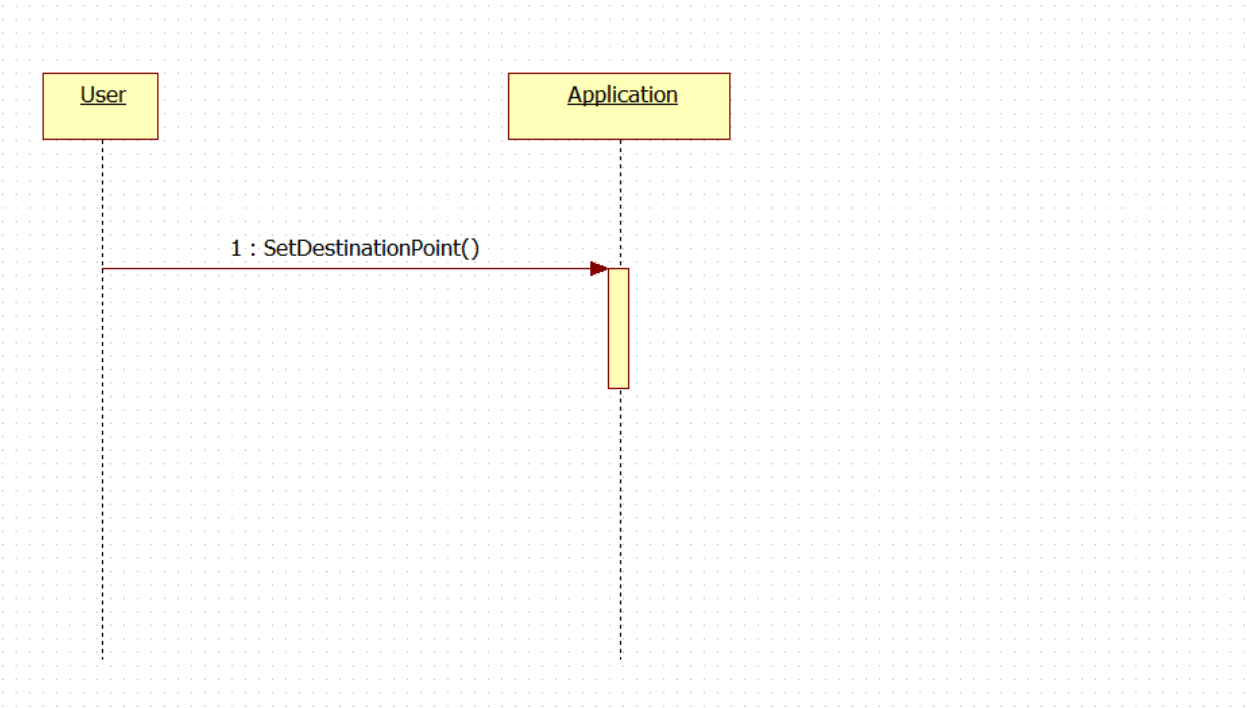

Diagram 5.4.1.10 Set Starting Point Sequence Diagram

* Since this functionality does not contain any unity player operation, it does not drawn in this sequence diagram

5.4.11 List Starting Points Sequence Diagram

This section will explain the start point selection from the list provided by system functionality of the system. The section will refer to “2.2.3.2-List Starting Points” and “3.2.11- List Starting Points” from the SRS document.

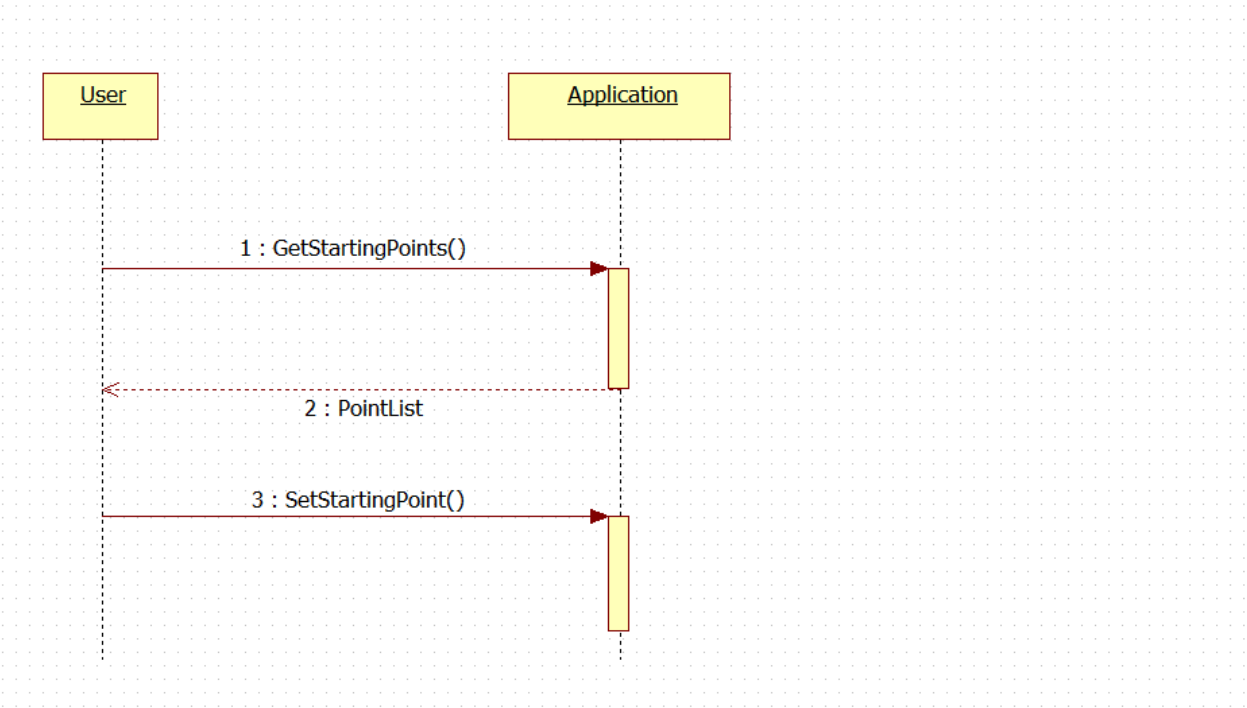

Diagram 5.4.1.11 List Starting Points Sequence Diagram

* Since this functionality does not contain any unity player operation, it does not drawn in this sequence diagram

5.4.12 Set Destination Point Sequence Diagram

This section will explain the destination point selection functionality of the system. The section will refer to “2.2.3.3-Set Destination Point” and “3.2.12- Set Destination Point” from the SRS document.

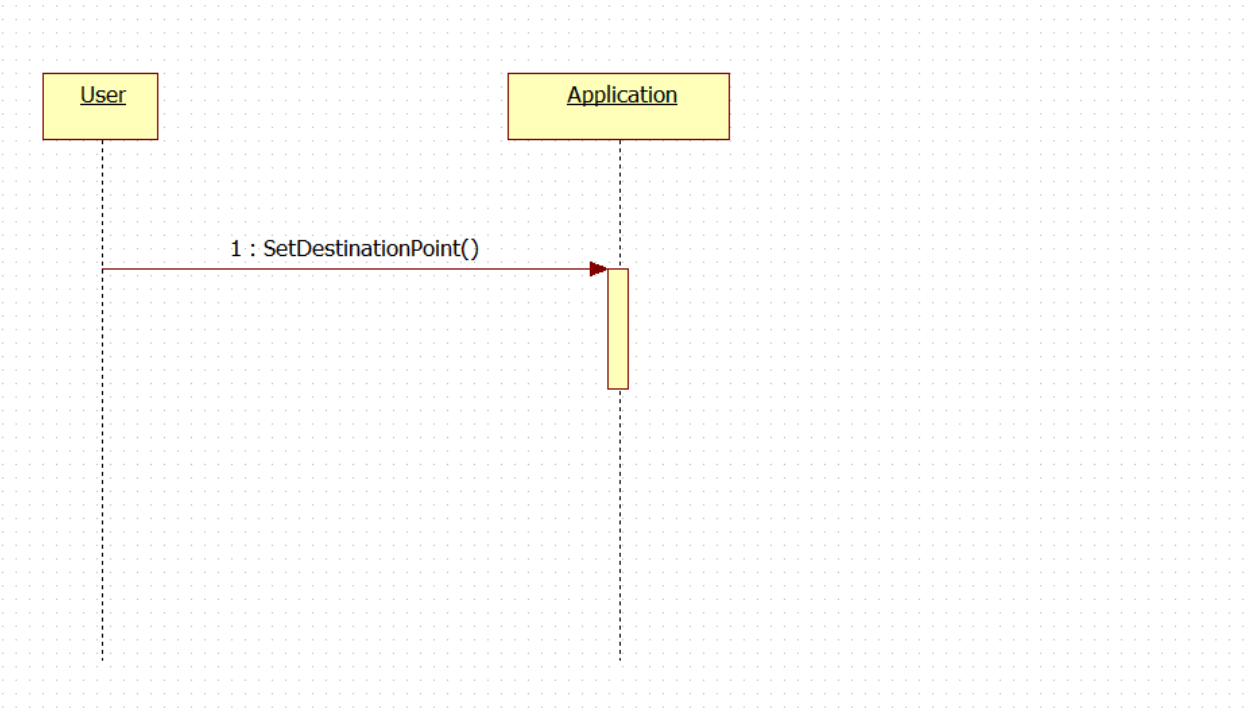

Diagram 5.4.1.12 Set Destination Point Sequence Diagram

* Since this functionality does not contain any unity player operation, it does not drawn in this sequence diagram

5.4.13 List Destination Points Sequence Diagram

This section will explain the destination point selection from the list provided by system functionality of the system. The section will refer to "2.2.3.4-List Destination Points" and "3.2.13- List Destination Points" from the SRS document.

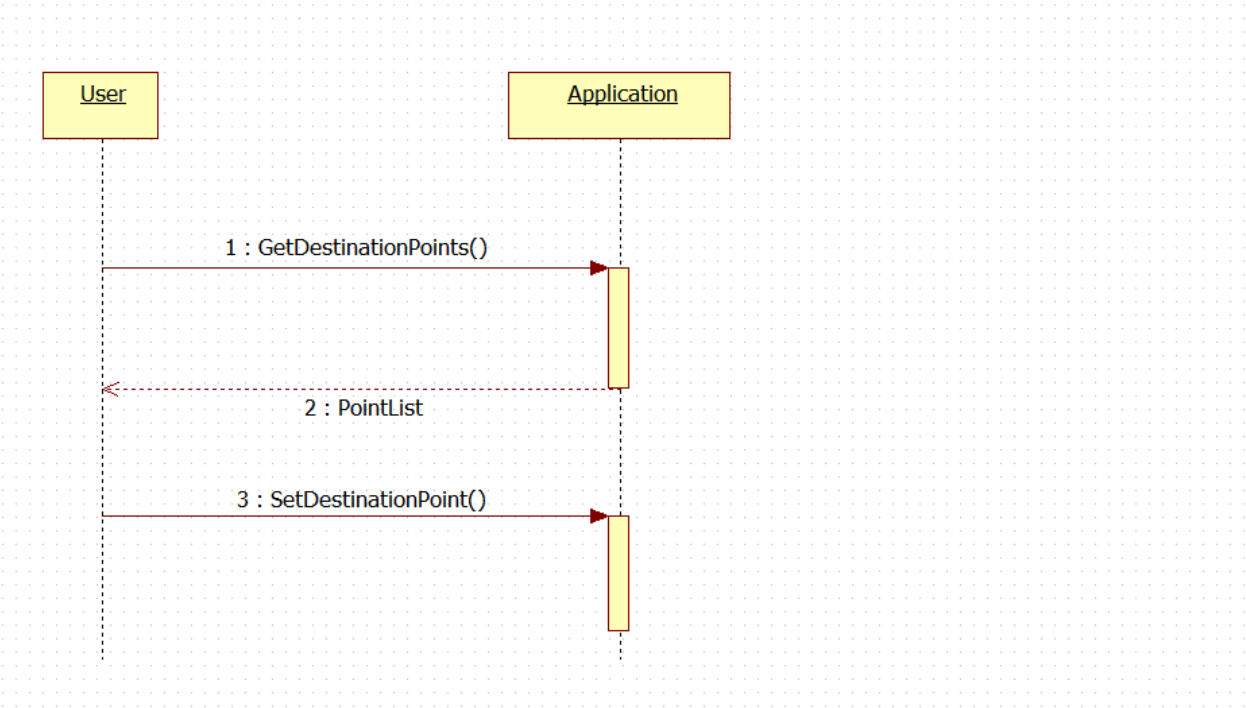

Diagram 5.4.1.13 List Destination Points Sequence Diagram

* Since this functionality does not contain any unity player operation, it does not drawn in this sequence diagram

5.4.14 Find the Path Sequence Diagram

This section will explain the computing the path with respect to desirec start and destination points functionality of the system. The section will refer to “2.2.3.5-Find the Path” and “3.2.14- Find the Path” from the SRS document.

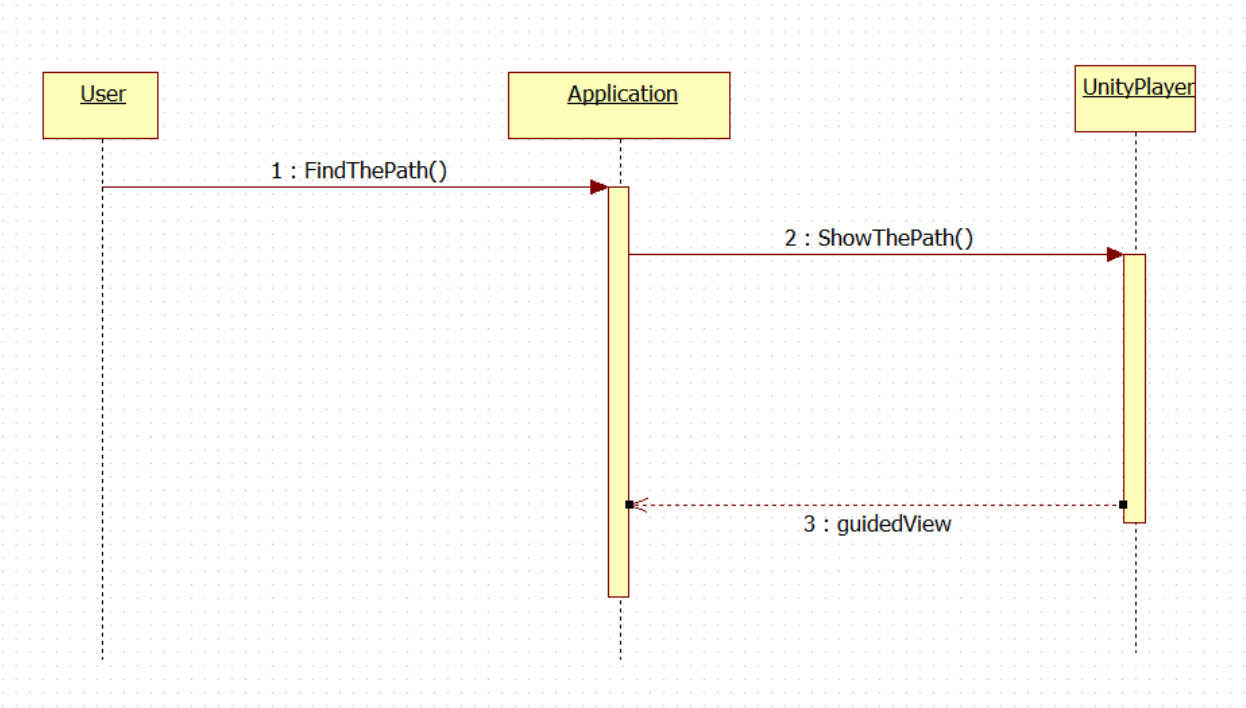

Diagram 5.4.1.14 Find The Path Sequence Diagram

* Unity Player is a plugin that allows to display 3D worlds created using Unity

5.4.15 Overall System Sequence Diagram

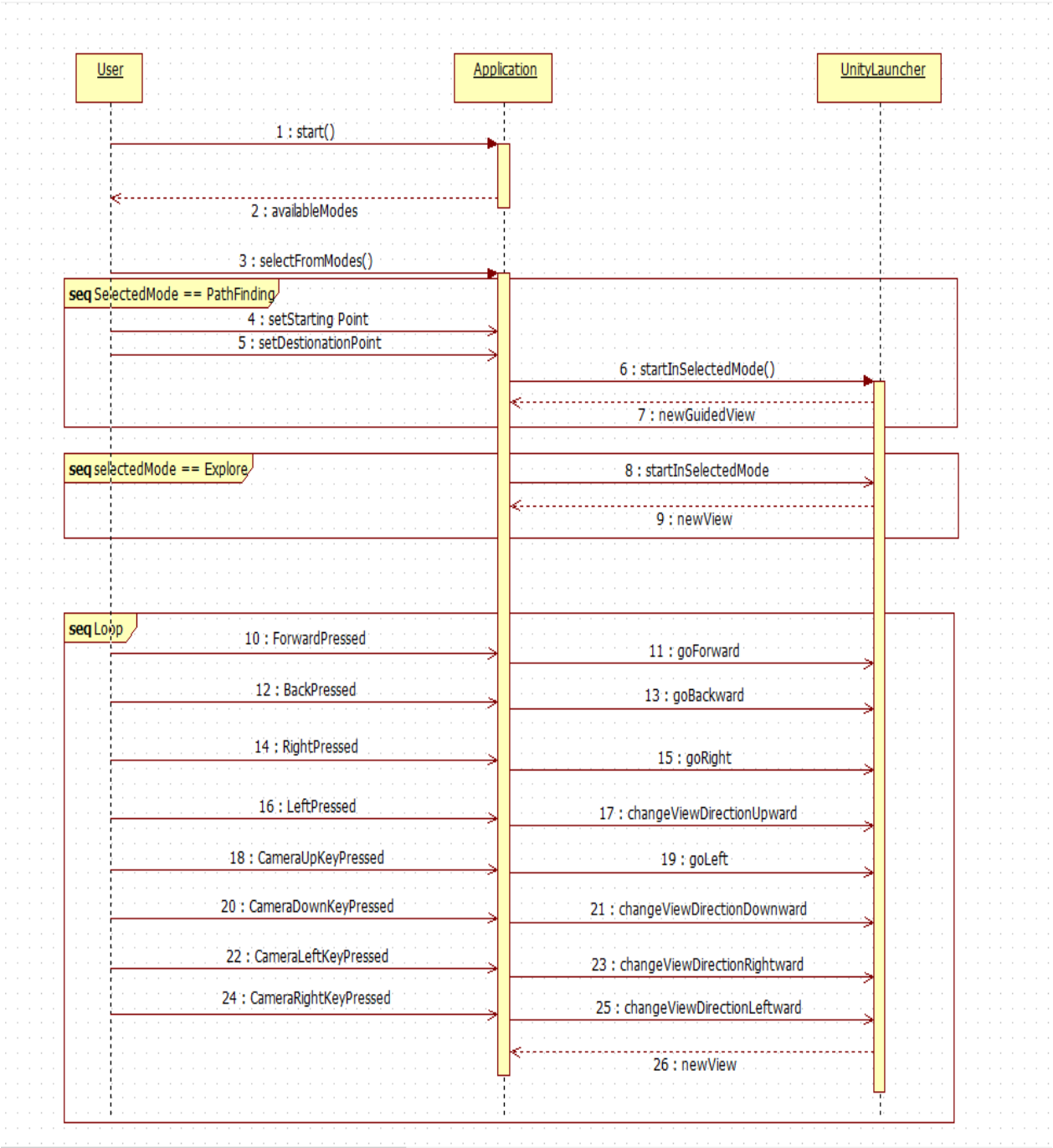

Diagram 5.4.1.15 Overall System Sequence Diagram

* Unity Player is a plugin that allows to display 3D worlds created using Unity

5.5 State Dynamic Viewpoint

Since our system is a reactive system we will introduce this viewpoint. State dynamics viewpoint shows the behavior of the system when some specific events occur. This viewpoint also related to the logical view. Since it explains in which state which condition occurs and how is it handled. Basic design concerns we take care in this viewpoint are the modes, states, transitions among events and reactions given to the events. Our aim in this viewpoint is to explain dynamic state transformation of the system.

Initial state of COW-3D system is Main Menu state.From this menu state , user can select Explorer or Path Finding states.Below state diagram shows Explorer state part of system.After selecting Explore state , user can select one of the functions(Move Right,Move Left,Move Forward,Move Backward , Camera Up,Camera Down,Camera Right,Camera Left) and smoothly can change his/her selecting function with other .So showing these connections with arrows will cause very complicated and incomprehensible.Therefore we showed these changings like below.

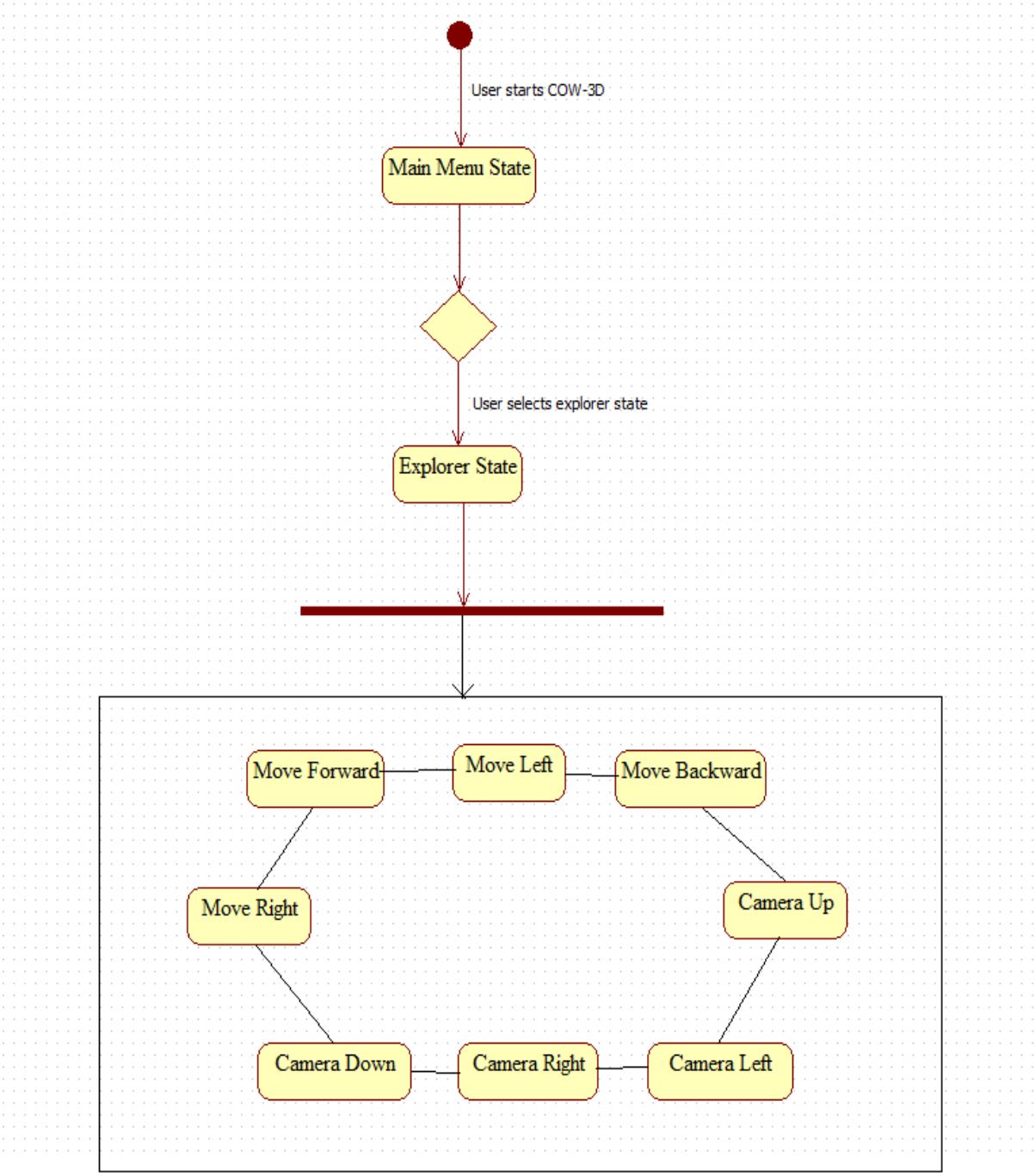

Diagram 5.5.1: State Diagram of Explorer State

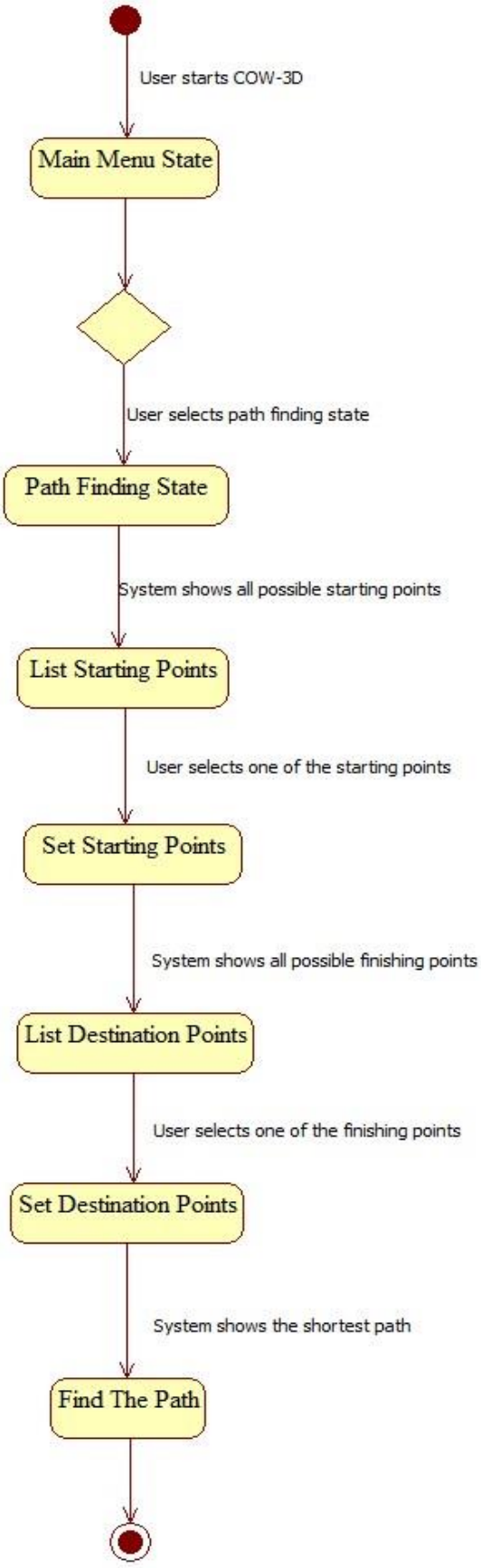

Diagram 5.5.2: State Diagram of Path Finding State

5.6 Composition Viewpoint

To be more clear general structure of COW-3D product , composition diagram is necessary.So before explain what's going on at the system, deployment diagram should be shown.

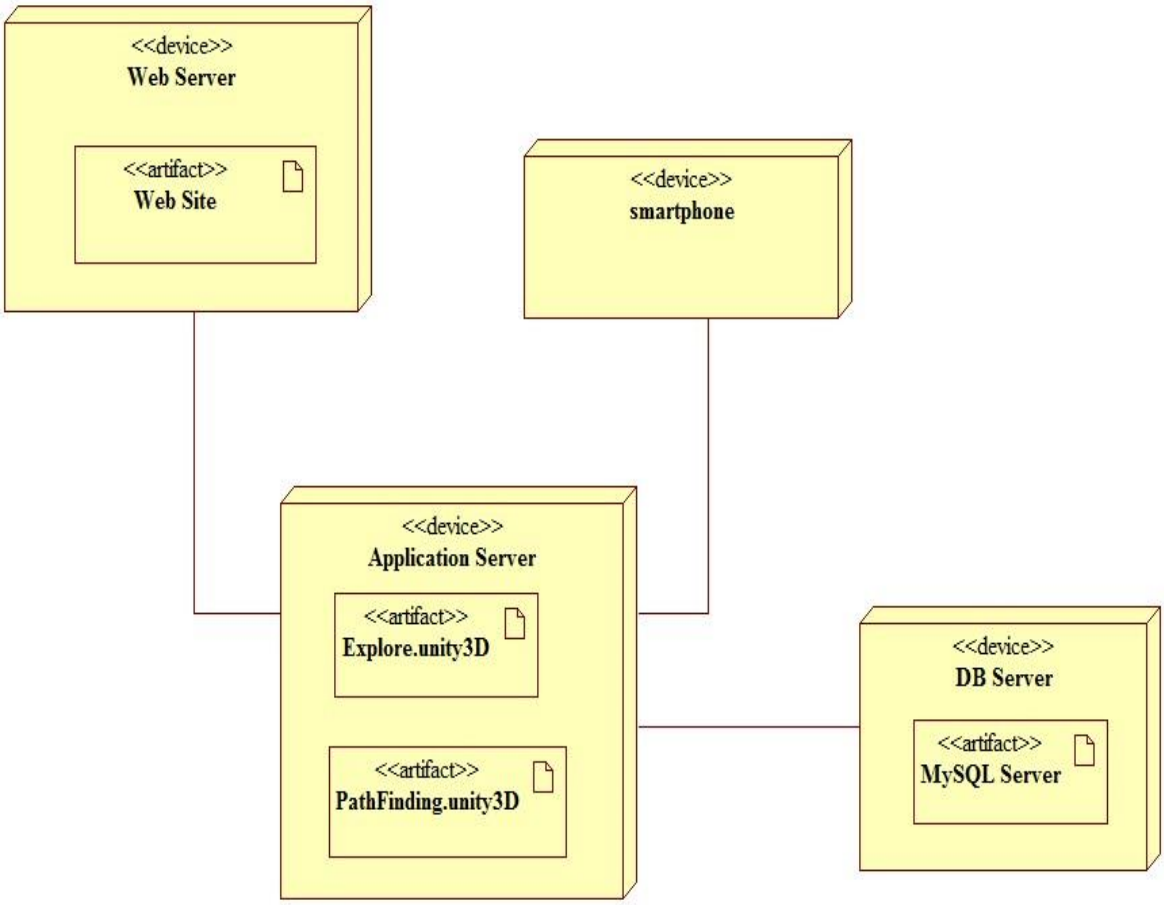

Diagram 5.6: Deployment diagram of COW-3D

This general picture shows that COW-3D can be used on websites and smartphones(android).Both of them are connection with of course our main unity3D files and this is called ApplicationServer. Moreover system has DB server to store some of the informations like some distances, informations which is about rooms etc.