DROGBA INC.

# Software Requirement Specification

## *v.1.1.*

*Members*

| | |
|---|---|
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# 1 – Introduction

This software requirement specification (SRS) report includes description of COW-3D project, senior graduate project of Computer Engineering Department in Middle East Technical University, mentored by Ahmet Oğuz Akyüz. All the functionalities and specifications about the project will be explained in detailed.

There are some other products like our Cow-3D project for example a graduate student is already done our department like we want in theory but our project has some additional features and older products do not reflect our department's needs. For example in old product user can not select destination and starting point and cannot go shortest path. Moreover, according to our department experience, people who do not know computer engineering building very well can lose their way easily. Therefore a better and more user-friendly product is necessary to achieve some features we will explain later in this document. These are the reasons why we selected this project and why we have to achieve.

## 1.1 – Problem Definition

The target problem that this project aims to solve is make controbution to

Computer Engineering Department's publicization and path finding in the department building. We will design an application that includes the 3D model of the department building. In the application, the user will be able to walk in and around the model and check inside the rooms that are represented by panoramic pictures. The aim of this functionality is help the people who are interested about the department to explore the building. The application also includes a path finding functionality. With the help of this functionality, the user will also be able to see the shortest path beetween the initial point and the point which user desires to arrive. The main goal here is to help the newcomers and the visitors of the department to find their way in the department.

## 1.2– Purpose

This document aims to explain the requirements of the our system which consists of modeling a building and creating an application that uses this 3D model to implement its functionalities.

The intended audience of this document is the members of the project group and developers who are willing to implement the application explained in this document. The document will guide the developers through the implementation phase. In addition to this, the document also help the developers to see early misunderstandings, inconsistencies and possible defects of the system.

## 1.3– Scope

The project name is COW-3D. “COW” is the abbreviation of Ceng On Web which is used as the name of the website of department’s courses and assignments platform. “3D” represent s the 3D model of the department which will be used.

The software will make the user to be able to explore the building . While exploring the building the user can walk thorugh coridors, see the rooms of staffs and lecture halls. The rooms and lecture hallswill be displayed as panaromic pictures of themselves. The end-product will run on web browsers for the people who wants to access the product through desktop and laptop computers. In addition to this, there will be an Android application of the end-product which can be used by the users who wants to access the product through their Android smart-phones.

The software will include two basic oparations. These operations are exploration and path finding. With the first one, the user will be able to explore the 3D model of the building by the arrow and direction keys. On the other hand, in the second one, user can enter his/her current location and the destination location he/she wants to reach. After getting these inputs from user, the software will compute the shortest path between the selected points and guide the user with arrows which will be displayed on model of building.

## 1.4– Definitions, Acronyms and Abbreviations

SRS : Software Requirement Specification

Android : Android is the operating system that powers smart phones and tablets[1].

3Ds Max: 3ds Max® software provides a comprehensive 3D modeling, animation, rendering, and compositing solution for games, film, and motion graphics artists. 3ds Max 2014 has new tools for crowd generation, particle animation, and perspective matching, as well as support for Microsoft DirectX 11 shaders[2].

Unity 3D: Unity is a game development ecosystem: a powerful rendering engine fully integrated with a complete set of intuitive tools and rapid workflows to create interactive 3D content[3].

## 1.5– Definitions, Acronyms and Abbreviations

[1] Retrieved October 28, 2013, from http://www.android.com/kitkat/index.html

[2] Retrieved October 28, 2013, from

http://www.autodesk.com/products/autodesk-3ds-max/overview

[3] Retrieved October 28, 2013, from

http://unity3d.com/unity

## 1.6– Overview

This SRS document includes 7 more parts from this point.

Section 2 is about overall description of the project. This section includes 4 subsections.

Section 3 is about modules and interfaces. This section includes 3 subsections.

Section 4 is about data models and descriptions. This section includes 1 subsection.

Section 5 is about behavioral designs which are mentioned in 2 subsections.

Section 6 is about planning the project with specifying team structure, basic schedule of project and process model.

Section 7 is the conclusion part of SRS.

Section 8 includes table of contents, index and appendixes.

# 2 – Overall Description

This section will give information about product perspective, product functions, constraints, assumptions and dependencies.

## 2.1– Product Perspective

COW-3D application is totally independent system that is not related to any other system and not a component of a larger system. This program has only one type user, so there is no functionality differences between users which means there exists only one type user interface. At the beginning of the program, the user will be stand in front of the entrance. There will be two options for the user. Firstly, the user can explore the all of the department. The user can move any direction he/she wants.

The user can visit any room including professors' room. Secondly, the user can use the path finding feature of the application. With this feature, the user who does not know which direction he/she goes can easily find his/her path. To use this feature, the user must choose starting and destination points. After these choices, the program will show the shortest path visually. Thanks to this feature, visitors can easily find his/her desired path.

In terms of hardware, COW-3D will be compatible with mobile devices (android devices only) using having touch-operated control, i.e. smart phones. It will be controlled with finger movement of the users. Hence, it will ease showing details of map.

In terms of software, COW-3D will run on Android operating system. There exist mainly two different operating systems for mobile devices, Android and iOS. However, iOS is only compatible with Apple devices while Android is usable with any other tools, so we choose it. Moreover, it will be implemented making use of Unity3D for visualizing its features.

This brief information of interfaces is explained in more detailed below.

## 2.1.1– User Interface

There will be one type of user. Therefore there are no differences between users in terms of functionality, visualization and interface.

There will be two options at the beginning for the user. Firstly, the user can explore the building. In the web application, for this choice, the user will be standing at the entrance of the department. When she/he wants to move, the user will use the arrow keys;

1. When "up arrow key" button is activated, the camera move the viewpoint upward.
2. When "down arrow key" button is activated, the camera move the viewpoint downward.
3. When "rightward key" button is activated, the camera move the viewpoint rightward.
4. When "leftward key" button is activated, the camera move the viewpoint leftward.

For the camera angles, WASD keys will be used;

1. When "forward key" button is activated, the user will move forward.
2. When "backward key" button is activated, the user will move backward.
3. When "rightward key" button is activated, the user will move right.
4. When "leftward key" button is activated, the user will move left.

For the android application, the user will be standing at the entrance of the department. There will be buttons for arrow and 'WASD' keys.

By using this feature, users can see the any part of the department. Users can walk all around the building.

Secondly, the user can use the path finding option. There will be searching option for the users. When a user select this, all possible destinations will be listed. Also, the user can write the name of the destination he/she wants to go. After the selection of the destination, application will show the shortest path from stating point to destination point.

### 2.1.2– Hardware Interface

Only mobile devices which have touch-operated properties will be suitable for the application. They can be tablet or mobile phones. These devices should have some limit requirements to make the application run effectively. We expect 1GHz, 1MB for processor & 1GB RAM for tablets as well as the same limitation necessity for smart phones.

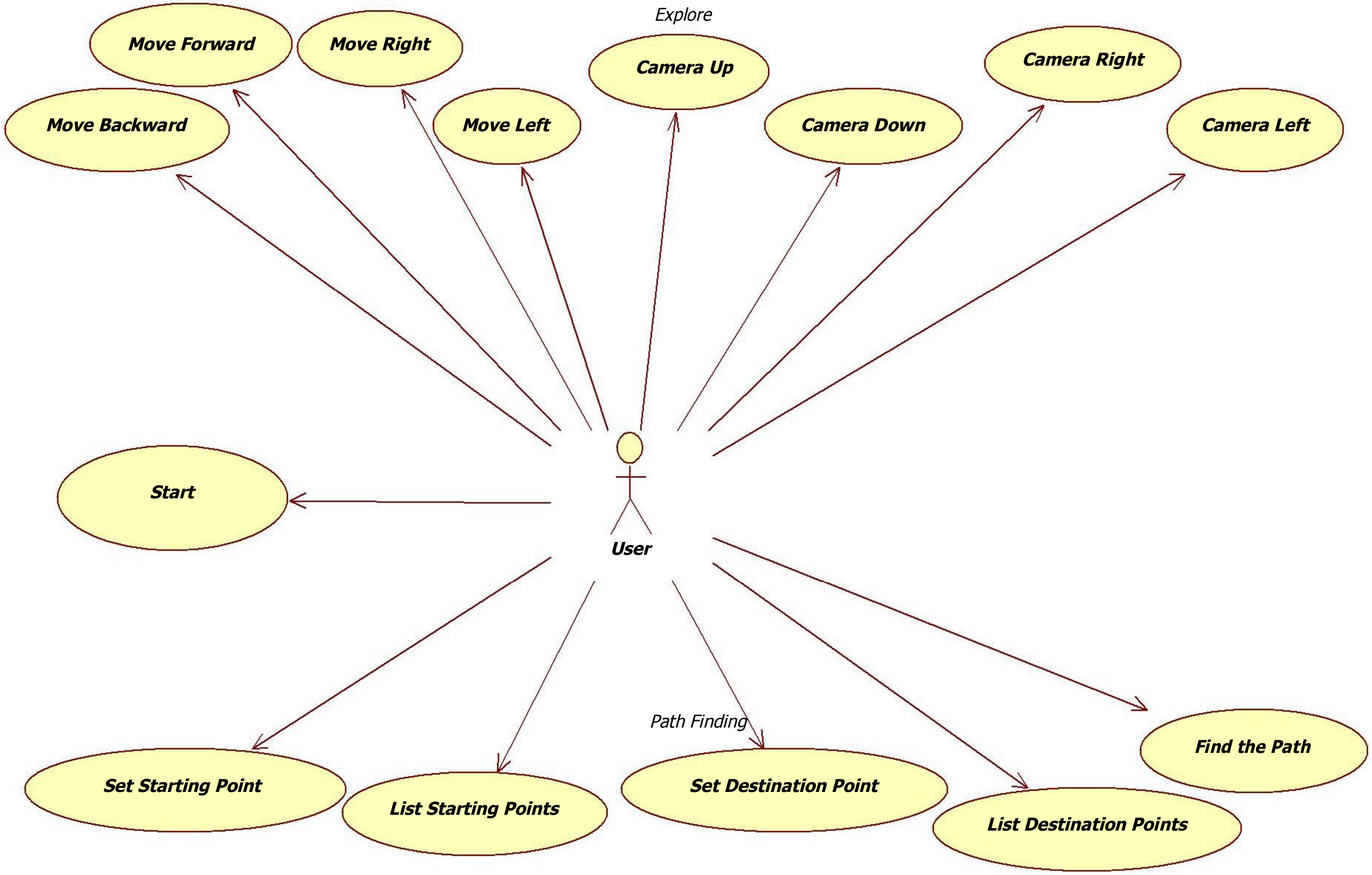
### 2.1.3– Software Interface

Mobile devices will be used for the application and they must have android to run the application. Moreover, application will be coded by Java. Therefore Java must be setup to the mobile devices. For java there must be a compiler. It can be android SDK. To make the map visual Unity3D will be used.

For the web, application will be run by JavaScript. Also, for the web application, Unity3D will be used as visual tool.

## 2.2– Product Perspective

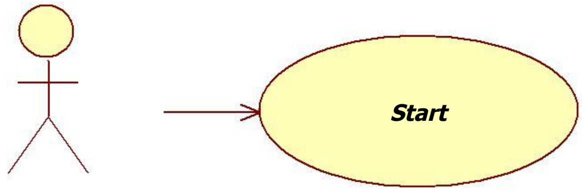
Use case diagram of the COW-3D system is revealed in Figure 1. Steps are gathered in distinct entities, the functions of which are stated in further subsections.



Use Case diagram

## 2.2.1– Start

*Diagram*:



*Brief Description:*

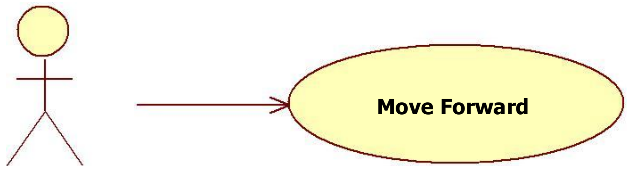
This function becomes active just after touching COW-3D application icon from menu of the mobile device or when the user enter the web application. After starting user will be asked to select one of the available modes from either Explore Mode or Path Finding Mode. This functionality will provide to enter necessity fields.

## 2.2.2– Explore

This interface involves all necessary functionalities as a purpose of getting all relevant information about exploring from the user.

### 2.2.2.1– Move Forward

*Diagram*:

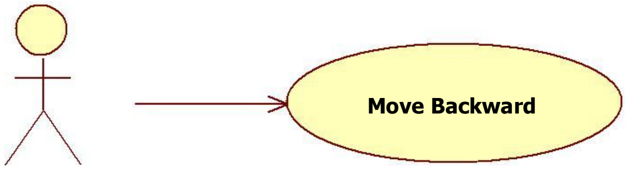


*Brief Description:*

This function becomes activate when the user press “forward key” button on the keyboard. This function makes the user move forward.

### 2.2.2.2– Move Backward

*Diagram*:

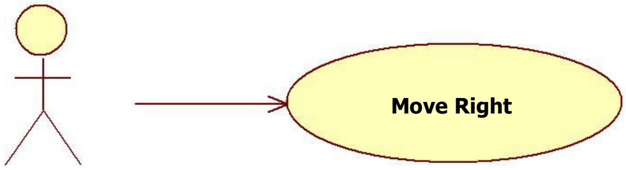


*Brief Description:*

This function becomes activate when the user press “backward key” button on the keyboard. This function makes the user move backward.

### 2.2.2.3– Move Right

*Diagram*:

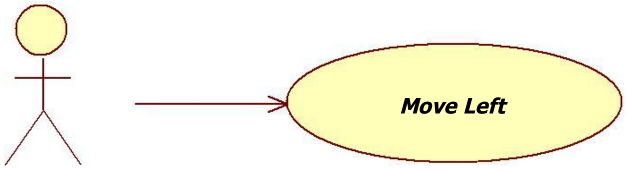


*Brief Description:*

This function becomes activate when the user press ‘rightward key’ button on the keyboard. This function makes the user move right.

## 2.2.2.4– Move Left

*Diagram*:

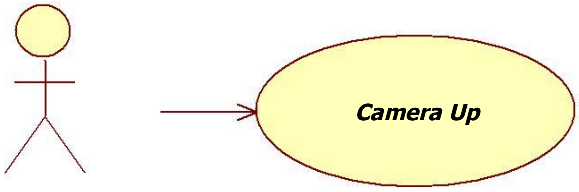


*Brief Description:*

This function becomes activate when the user press “leftward key” button on the keyboard. This function makes the user move left.

## 2.2.2.5– Camera Up

*Diagram*:

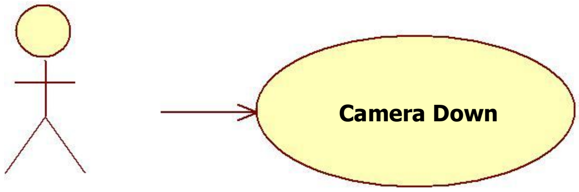


*Brief Description:*

This function becomes activate when the user press ‘Up Arrow Key’ button on the keyboard. This function makes the view point move up.

## 2.2.2.6– Camera Down

*Diagram*:

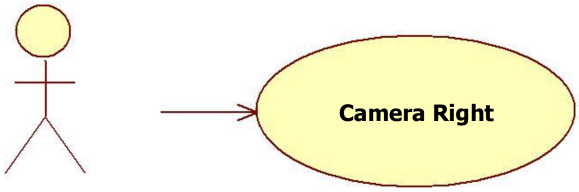


*Brief Description:*

This function becomes activate when the user press ‘Down Arrow Key’ button on the keyboard. This function makes the view point move down.

## 2.2.2.7– Camera Right

*Diagram*:

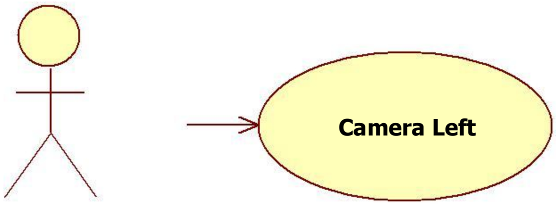


*Brief Description:*

This function becomes activate when the user press ‘Right Arrow Key’ button on the keyboard. This function makes the view point move right.

### 2.2.2.8– Camera Left

*Diagram*:



*Brief Description:*

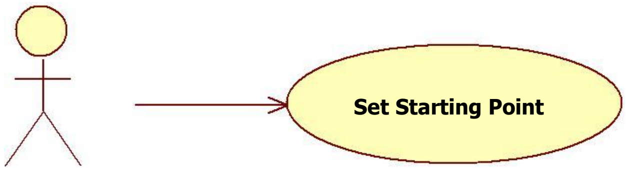
This function becomes activate when the user press 'Left Arrow Key' button on the keyboard. This function makes the view point move left.

## 2.2.3– Path Finding

This interface involves all necessary functionalities as a purpose of getting all relevant information about shortest path finding from the user.

## 2.2.3.1– Set Starting Point

*Diagram*:

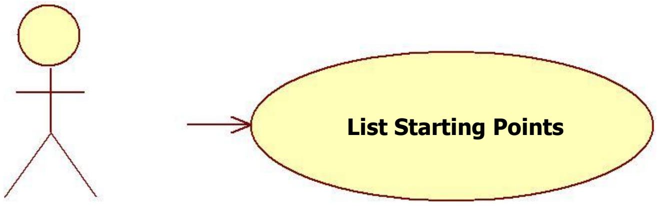


*Brief Description:*

This function becomes activate when the user press ‘Set Start Point’ field on the screen. User can set the start point directly from here.

## 2.2.3.2– List Starting Points

*Diagram*:

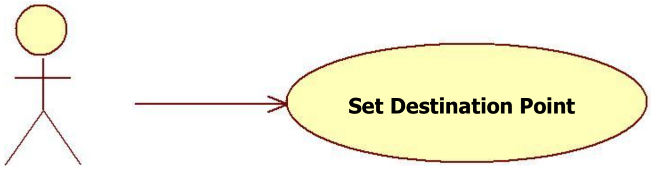


*Brief Description:*

This function becomes activate when the user press ‘Select From Starting Point” field on the screen. User can see the all starting points.

## 2.2.3.3– Set Destination Point

*Diagram*:

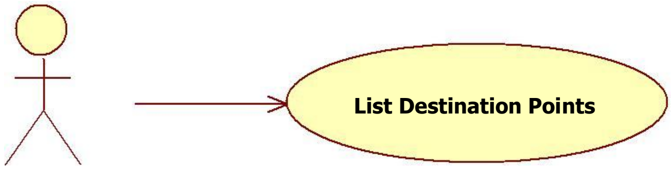


*Brief Description:*

This function becomes activate when the user press ‘Set Destination Point’ field on the screen. User can set the destination point directly from here.

## 2.2.3.4– List Destination Poins

*Diagram*:

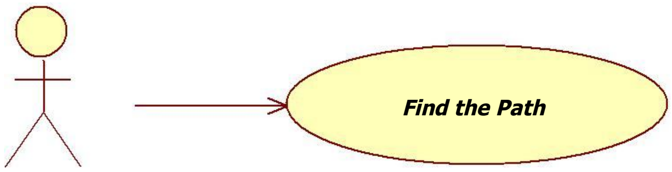


*Brief Description:*

This function becomes activate when the user press ‘Select From Destination Points” field on the screen. User can see the all destination points.

### 2.2.3.5 Find the Path

*Diagram*:



*Brief Description:*

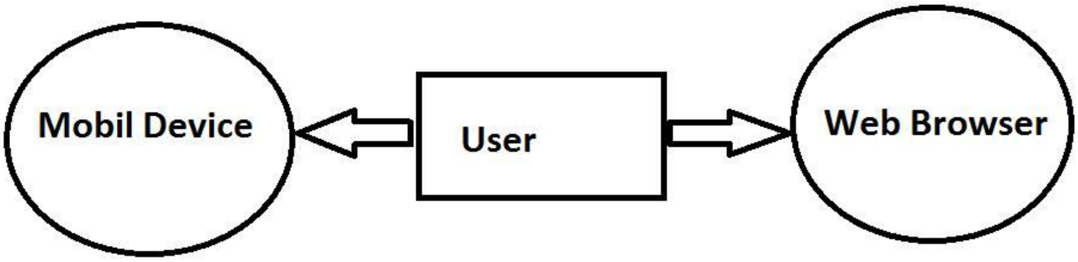
This function becomes activate when the user press ‘Find the Path’ button on the screen. User can see the shortest path from starting point to destination point.

# 3 – Specific Requirements

This section describes the details of software requirement in 3 subsection: Interface Requirements, Functional Requirements and non-Functional requirements.

## 3.1– Interface Requirements

There is only one user and the user interface is shown in the figure which indicates that user can reach the product either from web browser or Android mobile application of product.



## 3.2– Functional Requirements

### 3.2.1-Start

| | |
|---|---|
| Use Case Name | UseCase No:1 – Start |
| Xref | Section 2.2.1 |
| Actor | User |
| Trigger | The user presses "start" button |
| Precondition | None |
| Basic Path | 1) User presses "start" button<br>2) User select the mode from 2 available modes<br>3) The system becomes active |

### 3.2.2-Move Forward

| | |
|---|---|
| Use Case Name | UseCase No:2 – Move Forward |
| Xref | Section 2.2.2.1 |
| Actor | User |
| Trigger | User presses "forward key" |

| | |
|---|---|
| Precondition | None |
| Basic Path | 1) User presses “forward key”<br>2) System moves the viewing point to forward |

### 3.2.3-Move Backward

| | |
|---|---|
| Use Case Name | UseCase No:3 – Move Backward |
| Xref | Section 2.2.2.2 |
| Actor | User |
| Trigger | User presses “backward key” |
| Precondition | None |
| Basic Path | 1) User presses “backward key”<br>2) System moves the viewing point to backward |

### 3.2.4-Move Right

| | |
|---|---|
| Use Case Name | UseCase No:4 – Move Right |
| Xref | Section 2.2.2.3 |
| Actor | User |
| Trigger | User presses “right key” |
| Precondition | None |
| Basic Path | 1) User presses “right key”<br>2) System moves the viewing point to right |

### 3.2.5-Move Left

| | |
|---|---|
| Use Case Name | UseCase No:5 – Move Left |
| Xref | Section 2.2.2.4 |
| Actor | User |
| Trigger | User presses “left key” |
| Precondition | None |
| Basic Path | 1) User presses “left key”<br>2) System moves the viewing point to left |

### 3.2.6-Camera Up

| | |
|---|---|
| Use Case Name | UseCase No:6 – Camera Up |
| Xref | Section 2.2.2.5 |
| Actor | User |
| Trigger | User presses “up arrow key” |
| Precondition | None |
| Basic Path | 1) User presses “up arrow key”<br>2) System changes the viewing direction to upward |

### 3.2.7-Camera Down

| | |
|---|---|
| Use Case Name | UseCase No:7 – Camera Down |
| Xref | Section 2.2.2.6 |
| Actor | User |
| Trigger | User presses “down arrow key” |
| Precondition | None |
| Basic Path | 1) User presses “down arrow key”<br>2) System changes the viewing direction to downward |

### 3.2.8-Camera Right

| | |
|---|---|
| Use Case Name | UseCase No:8 – Camera Right |
| Xref | Section 2.2.2.7 |
| Actor | User |
| Trigger | User presses “right arrow key” |
| Precondition | None |

| | |
|---|---|
| Basic Path | 1) User presses “right arrow key”<br>2) System changes the viewing direction to rightward |

### 3.2.9-Camera Left

| | |
|---|---|
| Use Case Name | UseCase No:9 – Camera Left |
| Xref | Section 2.2.2.8 |
| Actor | User |
| Trigger | User presses “left arrow key” |
| Precondition | None |
| Basic Path | 1) User presses “left arrow key”<br>2) System changes the viewing direction to leftward |

### 3.2.10-Set Starting Point

| | |
|---|---|
| Use Case Name | UseCase No:10 – Set Starting Point |
| Xref | Section 2.2.3.1 |
| Actor | User |
| Trigger | User selects “Set Start Point” in input form |
| Precondition | “Path Finding Mode” must be selected |

| | |
|---|---|
| Basic Path | 1) User selects “Set Start Point” in input form<br>2) System sets the selected point to start point |

### 3.2.11-List Starting Points

| | |
|---|---|
| Use Case Name | UseCase No:11 – List Starting Points |
| Xref | Section 2.2.3.2 |
| Actor | User |
| Trigger | User selects “Select From Starting Points” in input form |
| Precondition | “Path Finding Mode” must be selected |
| Basic Path | 1) User selects “Select From Starting Points” in input form<br>2) User selects one of the points from list<br>3) System sets the selected point to start point |

### 3.2.12-Set Destination Point

| | |
|---|---|
| Use Case Name | UseCase No:12 – Set Destionation Point |
| Xref | Section 2.2.3.3 |
| Actor | User |
| Trigger | User selects “Set Destination Point” in input form |
| Precondition | “Path Finding Mode” must be selected |

| | |
|---|---|
| Basic Path | 1) User selects "Set Destination Point" in input form<br>2) System sets the selected point to destination point |

### 3.2.13-List Destination Points

| | |
|---|---|
| Use Case Name | UseCase No:13 – List Destination Points |
| Xref | Section 2.2.3.4 |
| Actor | User |
| Trigger | User selects "Select From Destination Points" in input form |
| Precondition | "Path Finding Mode" must be selected |
| Basic Path | 1) User selects "Select From Destination Points" in input form<br>2) User selects one of the points from list<br>3) System sets the selected point to destination point |

### 3.2.14-Find the Path

| | |
|---|---|
| Use Case Name | UseCase No:14 – Find the Path |
| Xref | Section 2.2.3.4 |
| Actor | User |
| Trigger | User selects "Find the Path" in input form |
| Precondition | "Path Finding Mode" must be selected and start point and destination point must be entered |

| | |
|---|---|
| Basic Path | 1) User selects “Find the Path” in input form<br>2) System shows the path to the user |

# 3.3– Non-functional Requirements

## 3.3.1– Performance Requirements

- Since there will be only one user using the application in his/her local environment, the system does not need to handle multiple user case.
- The program can be run at any computer which has browser and internet connection.
- Users can also use the application with their Android smartphones.
- System does not require high performance.

## 3.3.2– Design Constraints

### 3.3.2.1-Language

Android smartphone application will be implemented in Java programming language. Our aim is to use this language to port the application to smartphones.

JavaScript language will be used to make the application run on webbrowser.

### 3.3.2.2-Hardware Constaints

There is no specific hardware constraints.

### 3.3.2.3-Software System Attributes

- Portability
  - The application must run on every web browser regardless of the operating syste environment and shall be independent of specific features of browsers.
- Security
  - Since the system does not have any critical data, no security level need to be introduced.

# 4 – Data Model and Description

This section describes the basic data models of the system. Each model will be described with their major attributes.

## 4.1– Data Description

The data models which are used in this project are:

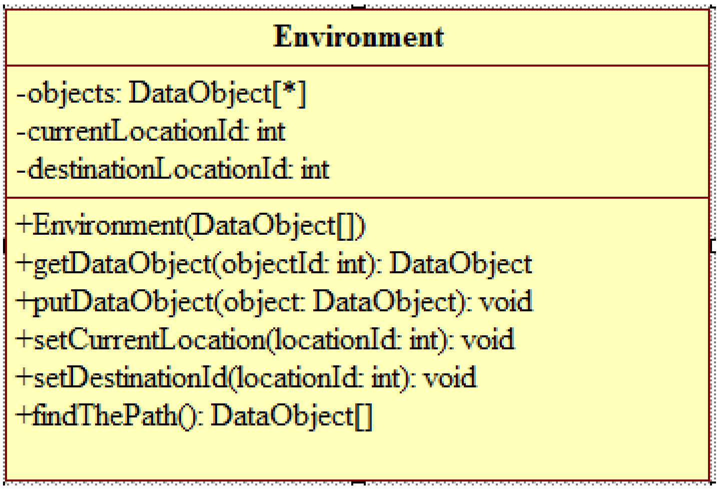
* Environment

* DataObject

* FirstPersonShooter

## 4.1.1– Data Objects

### 4.1.1.1-Environment



```
Environment
-objects: DataObject[*]
-currentLocationId: int
-destinationLocationId: int
+Environment(DataObject[])
+getDataObject(objectId: int): DataObject
+putDataObject(object: DataObject): void
+setCurrentLocation(locationId: int): void
+setDestinationId(locationId: int): void
+findThePath(): DataObject[]
```

Attributes:

- Object:
  The list of objects in the scene.
- currentLocationId:
  The id of the object on the start point
- destinationLocationId:
  The id of the object on the destination point

Operations:

- getDataObject:
  Return the object with the given id.
- putDataObject: Put the given object to the scene.

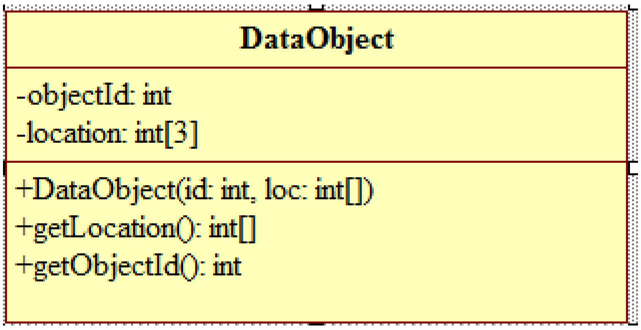
- setCurrentLocation:

  Set the current location as the location of the object which has the given id.
- setDestinationLocation:

  Set the destionation location as the location of the object which has the given id.
- findThePath:

  Find a shortest path between the current and destination points and returns the objects on the calculated path.

### 4.1.1.2-DataObject



Attributes:

- objectId:

  A unique id for every object.
- Location:

  Coordinates of the object.

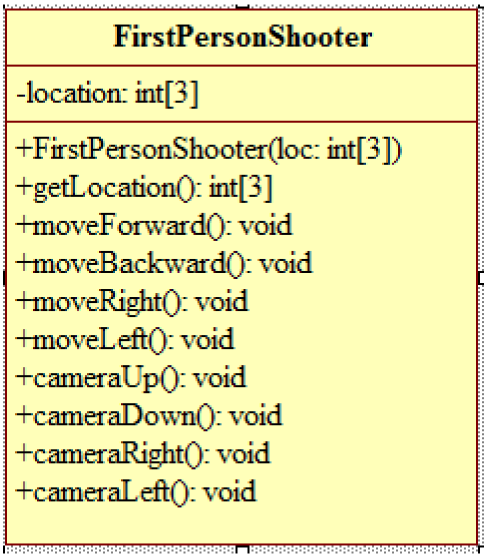
Operations:

- getLocation:

  Returns the location of the object.
- getObjectId:

  Returns the id of the object .

### 4.1.1.3-FirstPersonShooter



**FirstPersonShooter**

-location: int[3]

+FirstPersonShooter(loc: int[3])
+getLocation(): int[3]
+moveForward(): void
+moveBackward(): void
+moveRight(): void
+moveLeft(): void
+cameraUp(): void
+cameraDown(): void
+cameraRight(): void
+cameraLeft(): void

Attributes:

- location:
  Location of the user

Operations:

- getLocation:
  Return the location of the user.
- moveForward:
  Moves the viewing point to forward.
- moveBackward:
  Moves the viewing point to backward.
- moveRight:
  Moves the viewing point to rightward.
- moveLeft:
  Moves the viewing point to leftward.
- cameraUp:
  Moves the viewing direction to upward.
- cameraDown:
  Moves the viewing direction to downward.
- cameraLeft:
  Moves the viewing direction to leftward.
- cameraRight:
  Moves the viewing direction to rightward.

## 4.1.2– Data Dictionary

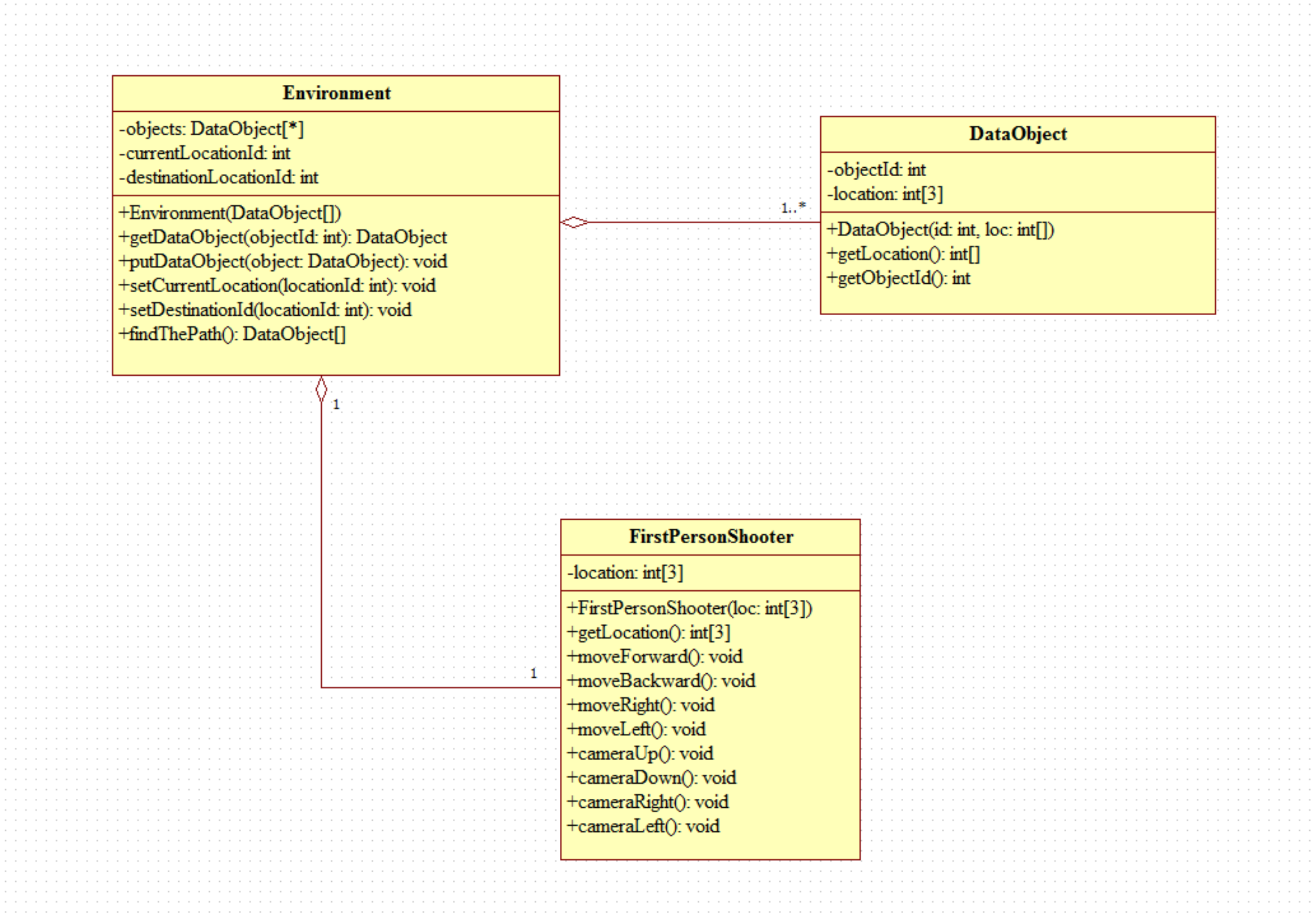
The data objects have been explained in detail in section 4.1.1.

## 4.1.3- Data Relations

The relationships between classes are:

- The environment class has one or more than one DataObject class.

All these relationships are shown on Class Diagram in the below figure.



Data Class Relations Diagram

# 5 – Behavioral Model and Decription

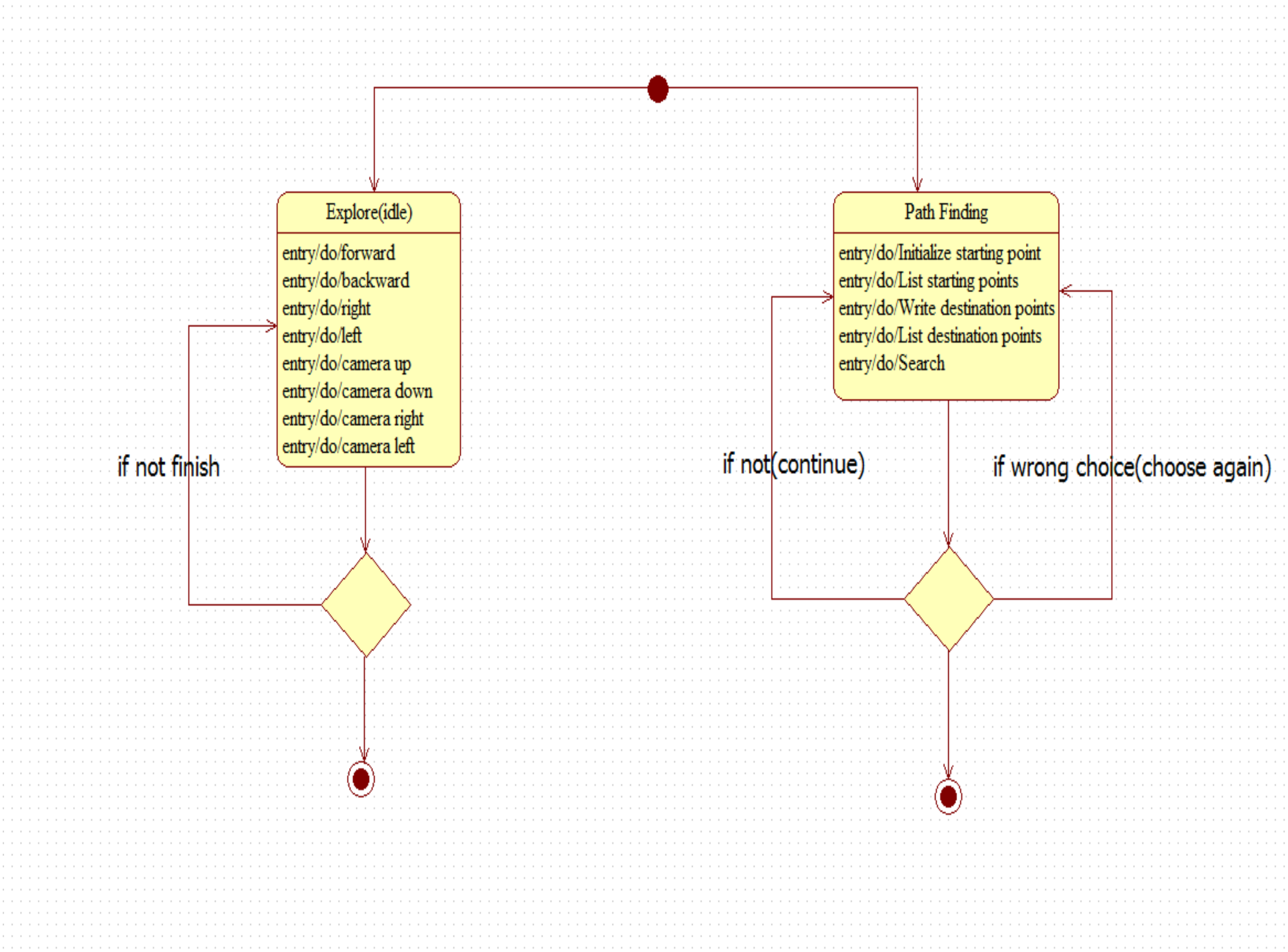
This section presents a description of the behavior of the software.

## 5.1– Description for Software Behavior

When the application starts with a single touch to COW-3D icon or entering the website of the product, the user will see two options. These are exploring and path finding options. In the first option, there are some keys which the user use to move and change camera angle. By using arrow keys, the user can change his/her view point and thanks to that, the user can explore all his/her around. The user can use W-S-A-D keys to move forward, backward, right and left respectively.

In the second option, the user can use path finding feature of the product. In this feature, the user can select starting and destination points or search for destination point. When the user select start and destination point, application will show the shortest path according to points. When the user search for destination, then all possible destination points will be showed and the user will select one of them. After that application will show the shortest path to the user.

## 5.2– State Transition Diagram



# 6 – Planning

In this part of the document, the structure of the team responsible from the project, the basic schedule, and the process model will be presented.

## 6.1– Team Structure

The project team is group of 4 people, and each group member has the same responsibility on the project. Fatih Hafızoğlu is the coordinator and the contact person for the group, who synchronizes the meetings, work plan and have the basic contact relation with the advisor who is Assistant Professor Ahmet Oğuz Akyüz. Since the team is a small group of people and the members know each other, all the decisions are given after meetings and discussions. The labor division is made evenly and decided in weekly meetings. Beside this meetings the members are in contact with each other all the time which will ease the project development and handling faced problems. Moreover, group has contact with the advisor assistant, by having meetings every week.

All the members of the group has the same level of knowledge about the project. Therefore, to get the necessary knowledge sooner, the research areas about the project are divided into 4 different parts and assigned to each member, and the useful information is shared with the other members. Similar to research, software development part will be divided into 4 different parts and everyone will develop COW-3D his own part according to the common decision taken in the meetings. Therefore, it is not going to be a problem to merge these 4 parts to each other.

During the development period, according to the needs of the project, members will have some specific tasks decided by the group, but for now mainly our members and the roles are:

Ali Hopyar – Researcher, Software Developer, Designer, Tester

Fatih Hafızoğlu - Researcher, Software Developer, Coordinator

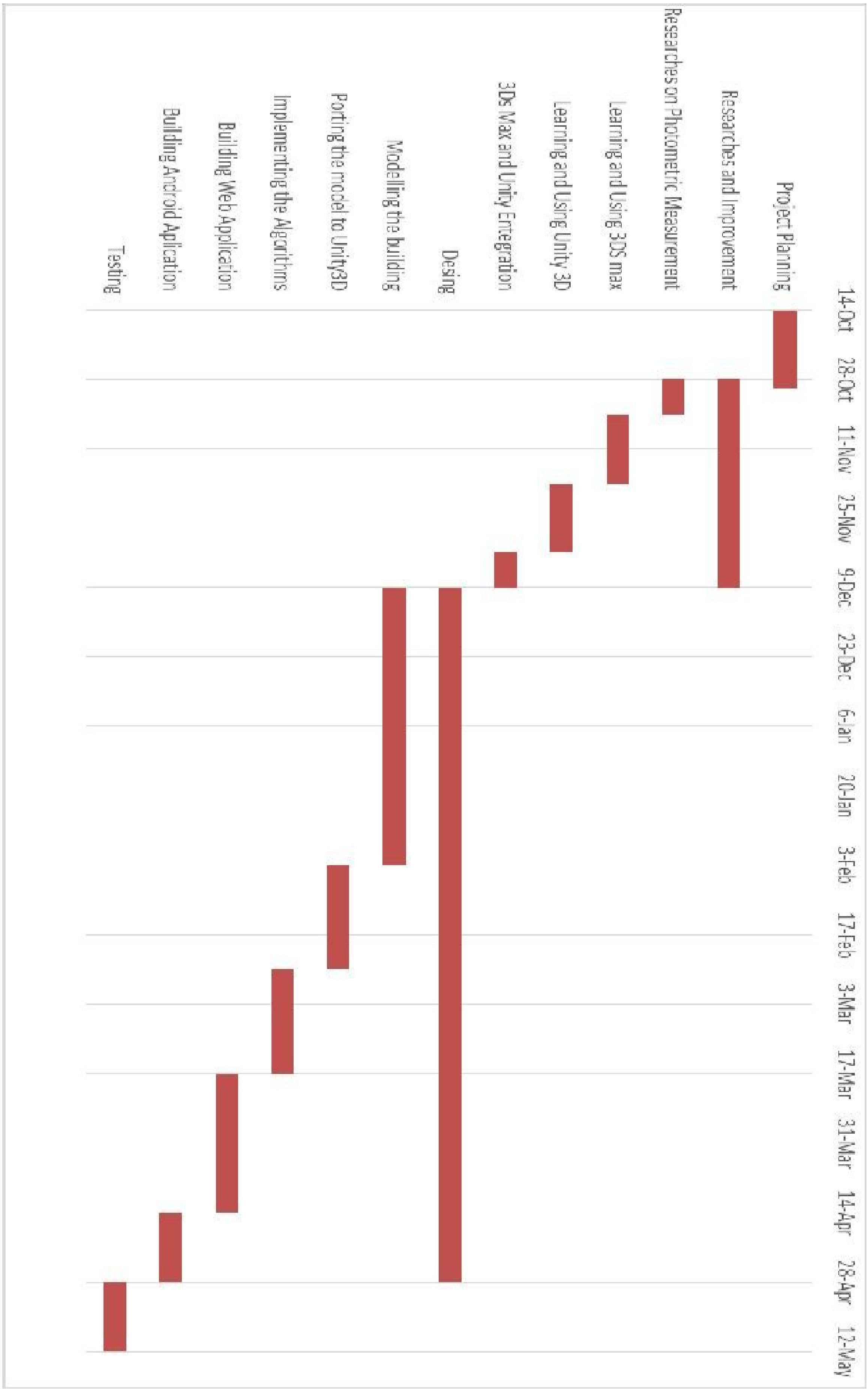
Volkan Gümüş - Researcher, Software Developer, Designer

Yaşar Halim Kaya - Researcher, Software Developer, Tester

## 6.2– Estimation

Our aim is to start implementation as soon as possible after finishing documentation and researches. To start implementation, we decided to start from begin modelling basic things in 3DS Max and after that port the models we made to Unity environment. While doing this, each member will also do researches about making a web and andoid application. The plan is before finishing documentaion, each member to have enough knowladge to complete entire project.

The basic schedule we decided in our meetings is given below:


Project Planning
Researches and Improvement
Researches on Photometric Measurement
Learning and Using 3DS max
Learning and Using Unity 3D
3Ds Max and Unity Entegration
Desing
Modelling the building
Porting the model to Unity3D
Implementing the Algorithms
Building Web Application
Building Android Aplication
Testing
14-Oct
28-Oct
11-Nov
25-Nov
9-Dec
23-Dec
6-Jan
20-Jan
3-Feb
17-Feb
3-Mar
17-Mar
31-Mar
14-Apr
28-Apr
12-May

## 6.3– Process Model

We are going to use the incremental process model in the development phase of the project. The incremental model begins with determining the requirements and then continues with the development. Depending on the test results, either the requirements are updated and the process cycle starts from the beginning to satisfy the new requirements or the system is decided to be deployed.

This model allows us to change the requirements during the process so that we are able to converge the system into the best state it can be. Although each team member have been assigned to different tasks, they are expected to contribute the development of each one.

# 7 – Conclusion

This report is prepared to show COW-3D project requirement details. Firstly, the problem intended to be solved is defined, and the details of the solution is explained. After the basic information about the product, the detailed description of the requirements are introduced. This includes the user interfaces, product functions, non-functional requirements, attributes, and design constraints. User and function relations, data to be processed, and user roles are modeled. After these detailed explanation about the product, team structure, estimated time schedule, and process model is stated.

# 8 – Supporting Information

Document change history and Table of contents is given below.

## 8.1 – Document Change History

| Date | Revision | Comment |
|---|---|---|
| **29.10.2013** | 1.0. | created |
| **29.12.2013** | 1.1. | 1. Introduction is updated<br>4.1.3. Data Relations is added<br>5.2. State Transition Diagram is updated<br>8.1. Document Change History is added<br>8.2.Table of contents is moved to 8.2. |

# 8.2– Table of Contents