
CTIS411 SENIOR PROJECT- 1

SOFTWARE REQUIREMENTS

SPECIFICATION

VR-based Firefighting Aircraft Simulation

Team 17:

Emre Bener

Ömer Faruk Eş

Engin Kaan Görgün

Mustafa Oğulcan Tekiner

Project Supervisor:

Okyay Say

Table of Contents

1. REQUIREMENTS	2
1.1. FUNCTIONAL REQUIREMENTS	2
1.1.1 Use-Case Diagrams	2
1.1.2. Narratives of the Use-Cases	4
1.2. NON-FUNCTIONAL REQUIREMENTS:	15
2. CONSTRAINTS:	16
2.1 User Constraints.....	16
2.2 Development Constraints	16
2.2.1 Development Constraints for Unreal Engine.....	16
2.2.2 Development Constraints for Visual Studio	17
3. REQUIREMENTS PROTOTYPES	18
4. SYSTEM MODELS	18
4.1. Activity Diagrams	19
4.2. Analysis Class Diagram.....	21

Table of Figures

Figure 1: Menu System Use-Case Diagram	2
Figure 2: Options Subsystem Use-Case Diagram	3
Figure 3: Simulation System Use-Case Diagram	3
Figure 4: Menu System Demo.....	18
Figure 5: Simulation Landscape.....	18
Figure 6: Menu System Activity Diagram	19
Figure 7: Crash Plane Activity Diagram.....	20
Figure 8: Menu System Activity Diagram	21

1. REQUIREMENTS

1.1. FUNCTIONAL REQUIREMENTS

1.1.1 Use-Case Diagrams

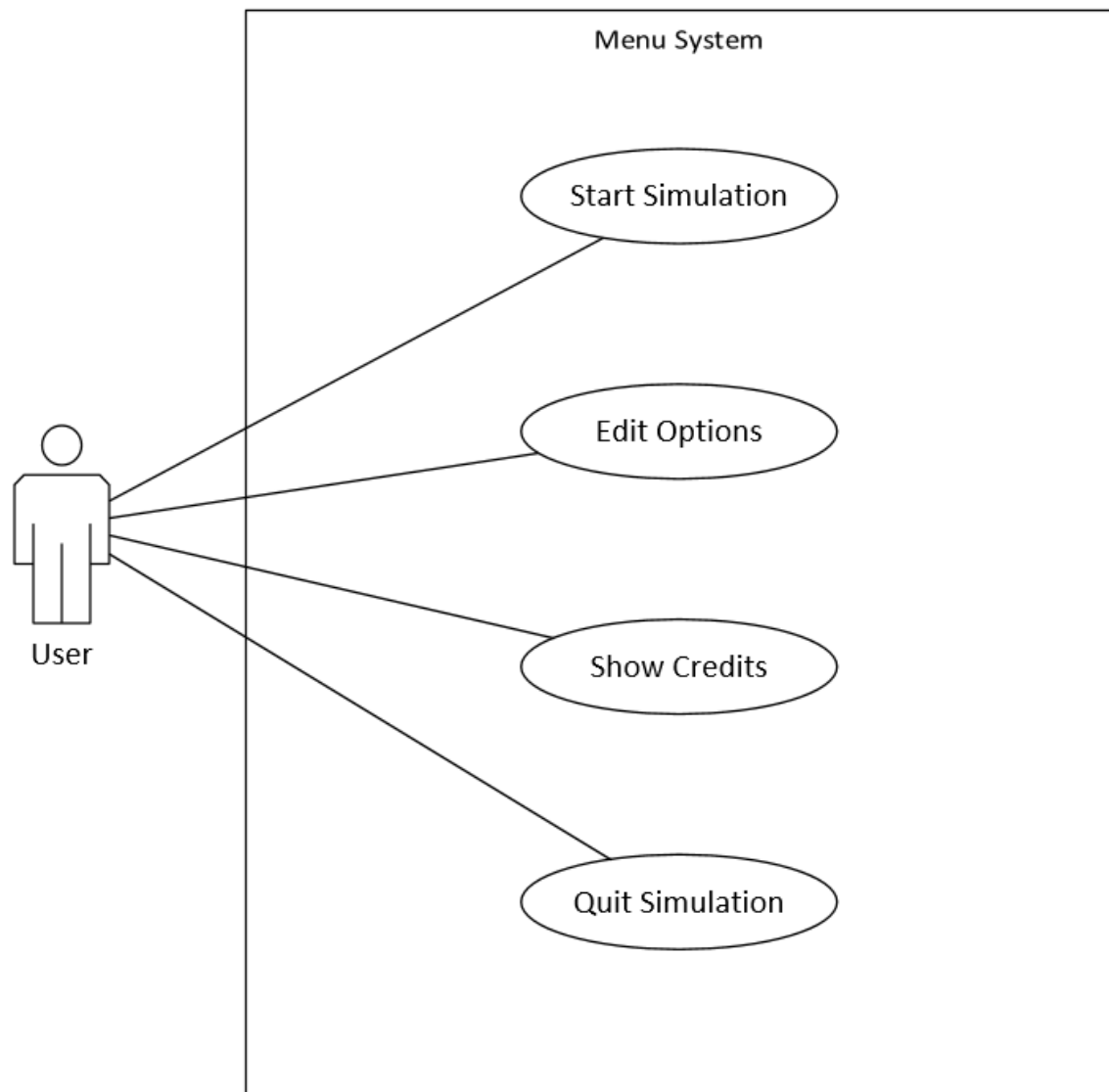


Figure 1: Menu System Use-Case Diagram

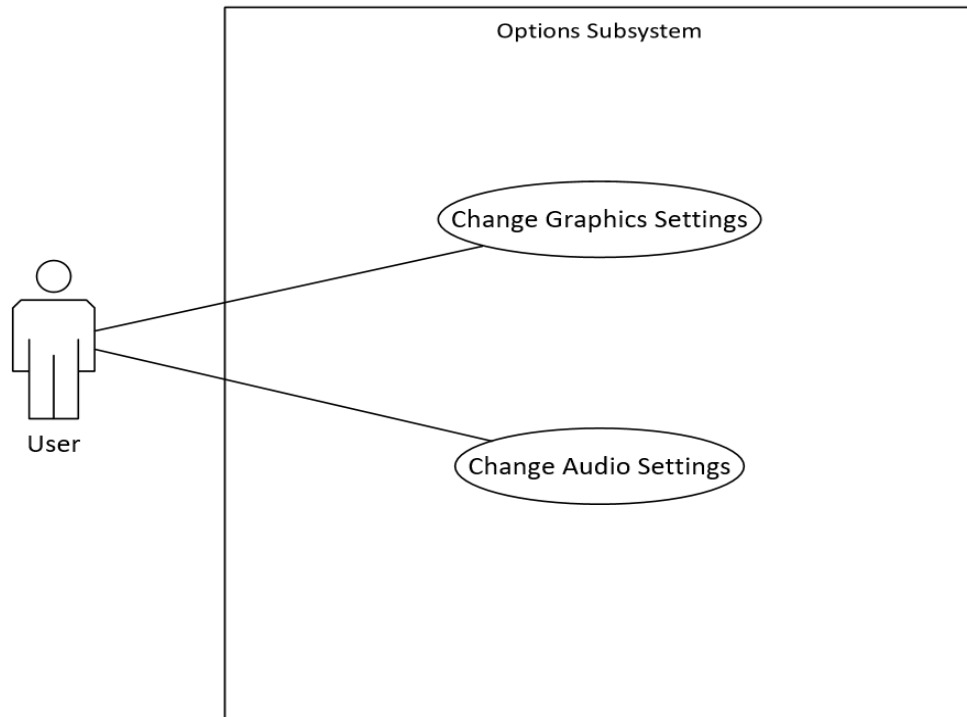


Figure 2: Options Subsystem Use-Case Diagram

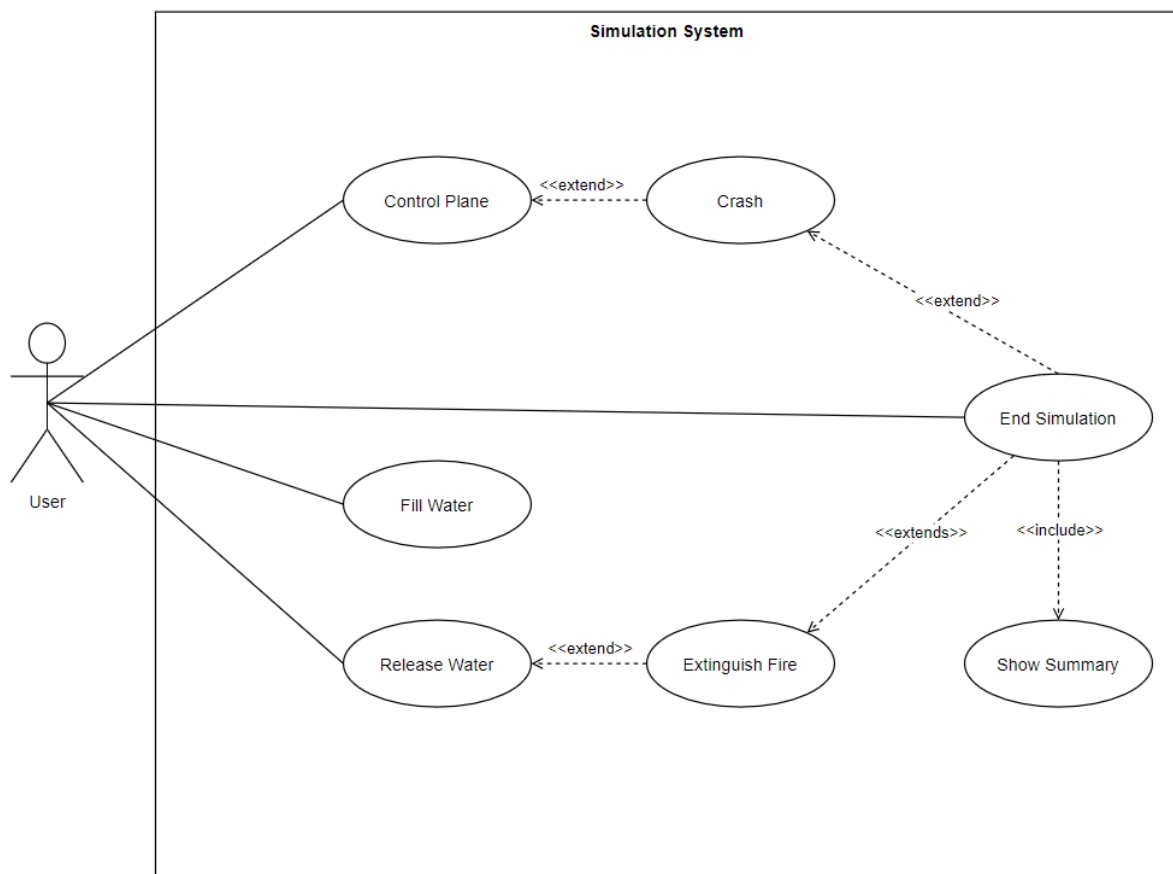


Figure 3: Simulation System Use-Case Diagram

1.1.2. Narratives of the Use-Cases

Use Case ID:	UC-MS-001	
Use Case Name:	Start Simulation	
Priority:	High	
Primary Actor:	User	
Other Actor:	None	
Description:	Starting a simulation session	
Preconditions:	Application must be opened. VR gear must be powered and connected.	
Trigger:	Initialization shall start after the user selects it.	
Main Scenario:	Actor Action:	System Response
	Step 1: User taps Start Simulation button.	Step 2: System shows renders the simulation's assets.
Alternate Scenario:	None	
Exceptions:	VR gear must be connected.	
Conclusions:	User starts the simulation by selecting the start button.	

Use Case ID:	UC-MS-002	
Use Case Name:	Options	
Priority:	Low	
Primary Actor:	User	
Other Actor:	None	
Description:	Before simulations start, users can look and edit settings.	
Preconditions:	Application must be opened.	
Trigger:	Initialization shall start after the user selects it.	
Main Scenario:	Actor Action:	System Response
	Step 1: User selects Options Simulation button. Step 3: User selects Change Graphic Settings Step 5: User selects Change Sound Settings	Step 2: System shows settings screen. Step 4: System shows changeable graphical options Step 6: System shows sound on/off and volume options
Alternate Scenario:	None	
Exceptions:	None	
Conclusions:	User updates graphic and audio quality settings.	

Use Case ID:	UC-MS-003	
Use Case Name:	Show Credits	
Priority:	Low	
Primary Actor:	User	
Other Actor:	None	
Description:	Before simulations start, users can see information about developers.	
Preconditions:	Application must be opened.	
Trigger:	It shall be initiated when the user selects it.	
Main Scenario:	Actor Action:	System Response
	Step 1: User select Credits button.	Step 2: System shows credits screen.
Alternate Scenario:	None	
Exceptions:	None	
Conclusions:	Credits screen shall be shown	

Use Case ID:	UC-MS-004	
Use Case Name:	Quit Game	
Priority:	Low	
Primary Actor:	User	
Other Actor:	None	
Description:	User terminates the execution of the simulation.	
Preconditions:	Application must be opened before.	
Trigger:	It shall be triggered when the user selects it.	
Main Scenario:	Actor Action:	System Response
	Step 1: User select Quit Button.	Step 2: System closes application
Alternate Scenario:	None	
Exceptions:	None	
Conclusions:	Simulation shall be closed.	

Use Case ID:	UC-SS-001	
Use Case Name:	Control Plane	
Priority:	High	
Primary Actor:	User	
Other Actor:	None	
Description:	Plane's activities such as thrust, direction, movement, will be controlled.	
Preconditions:	Application must be opened. Simulation should be started.	
Trigger:	Initialization shall start after the user uses the plane's controls.	
Main Scenario:	Actor Action:	System Response
	Step 1: User increases thrust of the plane by pushing the Throttle Lever.	Step 2: Plane shall pick up speed.
Alternate Scenario:	<p>Alt-Step 1: User tilts Control Wheel to the right.</p> <p>Alt-Step 1:User tilts Control Wheel to the left.</p> <p>Alt-Step 1:User pulls Control Wheel to himself/herself.</p> <p>Alt-Step 1:User pushes Control Wheel from himself/herself.</p> <p>Alt-Step 1:User decreases thrust of the plane by pulling the Throttle Lever.</p>	<p>Alt-Step 2: Plane shall turn to right depending on Control Wheel's angle and plane's speed.</p> <p>Alt-Step 2: Plane shall turn to the left depending on Control Wheel's angle and plane's speed.</p> <p>Alt-Step 2: Plane will lose altitude depending on the Control Wheel's angle and plane's speed.</p> <p>Alt-Step 2: Plane will gain altitude depending on Control Wheel's angle and plane's speed.</p> <p>Alt-Step 2: Plane shall lose speed.</p>
Exceptions:	None	
Conclusions:	Plane's movement shall be controlled by the User. Plane can land on water or land. Plane can take off from water or land.	

Use Case ID:	UC-SS-002	
Use Case Name:	Fill Water	
Priority:	Medium	
Primary Actor:	User	
Other Actor:	None	
Description:	User fill release the water by button press	
Preconditions:	Plane should be on water. Water tank should be empty.	
Trigger:	User presses button	
Main Scenario:	Actor Action:	System Response
	Step 1: User presses fill button.	Step 2: Plane will take water, water gauge fill we increased.
Alternate Scenario:	None	None
Exceptions:	None	
Conclusions:	User shall press the fill button on water and the water tank will be filled with water.	

Use Case ID:	UC-SS-003	
Use Case Name:	Release Water	
Priority:	Medium	
Primary Actor:	User	
Other Actor:	None	
Description:	User shall release the water by button press	
Preconditions:	Fill Water must be initiated before.	
Trigger:	User presses button	
Main Scenario:	Actor Action:	System Response
	Step 1: User presses release water button	Step 2: Water shall be released. Water tank shall be emptied. Water gauge shall be decreased.
Alternate Scenario:		Alt-Step 2: If there is no water in the water tank, water gauge will be highlighted. There won't be any water release.
Exceptions:	None	
Conclusions:	User will control the release water, on button press.	

Use Case ID:	UC-SS-004	
Use Case Name:	Extinguish Fire	
Priority:	High	
Primary Actor:	User	
Other Actor:	None	
Description:	User shall extinguish fire via releasing water to the fire zone.	
Preconditions:	Plane's water tanks should have water. After releasing water, water should hit the fire zone.	
Trigger:	User presses the release fire button and the plane is located at the right time and location.	
Main Scenario:	Actor Action:	System Response
	Step 1: User presses the release water button at the right time and location.	Step 2: Plane shall release water. Step 3: Fire shall be extinguished. Display message.
Alternate Scenario:	Alt-Step 1: User presses the release water button at the wrong time or location.	Alt-Step 3: Fire shall not be extinguished.
Exceptions:	This case only happens if there is a fire.	
Conclusions:	User will extinguish fire.	

Use Case ID:	UC-SS-005	
Use Case Name:	Crash Plane	
Priority:	Medium	
Primary Actor:	User	
Other Actor:	None	
Description:	User crashes the plane into another object or surface.	
Preconditions:	The plane collides with any surface or object in the environment. The plane's speed must be greater than suitable landing speed.	
Trigger:	The plane's body static mesh collides with any object.	
Main Scenario:	Actor Action:	System Response
	Step 1: User crashes the plane into an object or surface.	Step 2: Game engine's event system detects the collision/crash. Step 3: Simulation stops, user is taken to the simulation summary screen.
Alternate Scenario:	None	
Exceptions:	None	
Conclusions:	While controlling the plane, if the user crashes the plane, simulation will end.	

Use Case ID:	UC-SS-006	
Use Case Name:	End Simulation	
Priority:	Medium	
Primary Actor:	User	
Other Actor:	None	
Description:	Simulation shall be stopped.	
Preconditions:	Extinguish Fire must be fulfilled. or Crash Plane initiated. or User presses the exit button.	
Trigger:	User should extinguish the fire or crash plane.	
Main Scenario:	Actor Action:	System Response
	Step 1: User presses End Simulation Button.	Step 2: Simulation will end and the System will show Simulation Summary.
Alternate Scenario:	Alt-Step 1: User crashes plane.	Alt-Step 2: Simulation will end and the System will show Simulation Summary.
	Alt-Step 1: Extinguish Fire must be fulfilled.	Alt-Step 2: Simulation will end and the System will show Simulation Summary.
Exceptions:	None	
Conclusions:	Simulation shall end and Show Simulation Summary will be initiated.	

Use Case ID:	UC-SS-007	
Use Case Name:	Show Simulation Summary	
Priority:	Low	
Primary Actor:	User	
Other Actor:	None	
Description:	Simulation shall show a brief information about the performance of the user at the end of the simulation.	
Preconditions:	End Simulation must be fulfilled.	
Trigger:	When simulation ends.	
Main Scenario:	Actor Action:	System Response
	Step 1: User successfully completes the simulation.	Step 2: System shall prepare a group of data that explains how well the simulation is completed.
Alternate Scenario:	Alt-Step 1: User cannot complete the simulation. Alt-Step 1: User presses End Simulation Button.	Alt-Step 2: System shall give a Simulation failed screen to the user. Alt-Step 2: System shall give a Simulation failed screen to the user.
Exceptions:	None	
Conclusions:	System will show brief information about simulation at the end.	

1.2. NON-FUNCTIONAL REQUIREMENTS:

Property	Requirement
Performance	REQ-NF-001 Each frame shall take no longer than 16 ms(milliseconds) to render REQ-NF-002 Simulation shall take no longer than 1 minute to start REQ-NF-003 Simulation shall perform at 60 frames per second.
Reliability	REQ-NF-00x The simulation shall run continuously at least 12 hours before experiencing a failure. REQ-NF-00x The simulation shall run continuously for at least 4 hours before experiencing a glitch.

2. CONSTRAINTS:

Constraints	
Programming Language	C++
Operating system	Windows
Frameworks	Unreal Engine
Services	NONE
Databases	NONE

2.1 User Constraints

Minimum System Requirements	
Video Card	NVIDIA GTX 1060 / AMD Radeon RX 480 or greater
CPU	Intel i5-4590 / AMD Ryzen 5 1500X or greater
Memory	8GB RAM or greater
Video Output	Compatible HDMI 1.3 video output
OS	Windows 10

2.2 Development Constraints

2.2.1 Development Constraints for Unreal Engine

Minimum System Requirements for Windows	
Operating System	7 SP1+, 8, 10, 64-bit versions only
CPU	SSE2 instruction set support.
GPU	Graphics card with DX10 (shader model 4.0) capabilities.

2.2.2 Development Constraints for Visual Studio

Supported Operating System	Visual Studio 2019 will install and run on the following operating systems (64 bit recommended; ARM is not supported): <ul style="list-style-type: none">• Windows 10 version 1703 or higher: Home, Professional, Education, and Enterprise (LTSC and S are not supported)
Hardware	<ul style="list-style-type: none">• 1.8 GHz or faster processor. Quad-core or better recommended• 2 GB of RAM; 8 GB of RAM recommended (2.5 GB minimum if running on a virtual machine)• Hard disk space: Minimum of 800MB up to 210 GB of available space, depending on features installed; typical installations require 20-50 GB of free space.• Hard disk speed: to improve performance, install Windows and Visual Studio on a solid state drive (SSD).• Video card that supports a minimum display resolution of 720p (1280 by 720); Visual Studio will work best at a resolution of WXGA (1366 by 768) or higher.

3. REQUIREMENTS PROTOTYPES

Demo video is included to the SRS documents.



Figure 4: Menu System Demo



Figure 5: Simulation Landscape

4. SYSTEM MODELS

4.1. Activity Diagrams

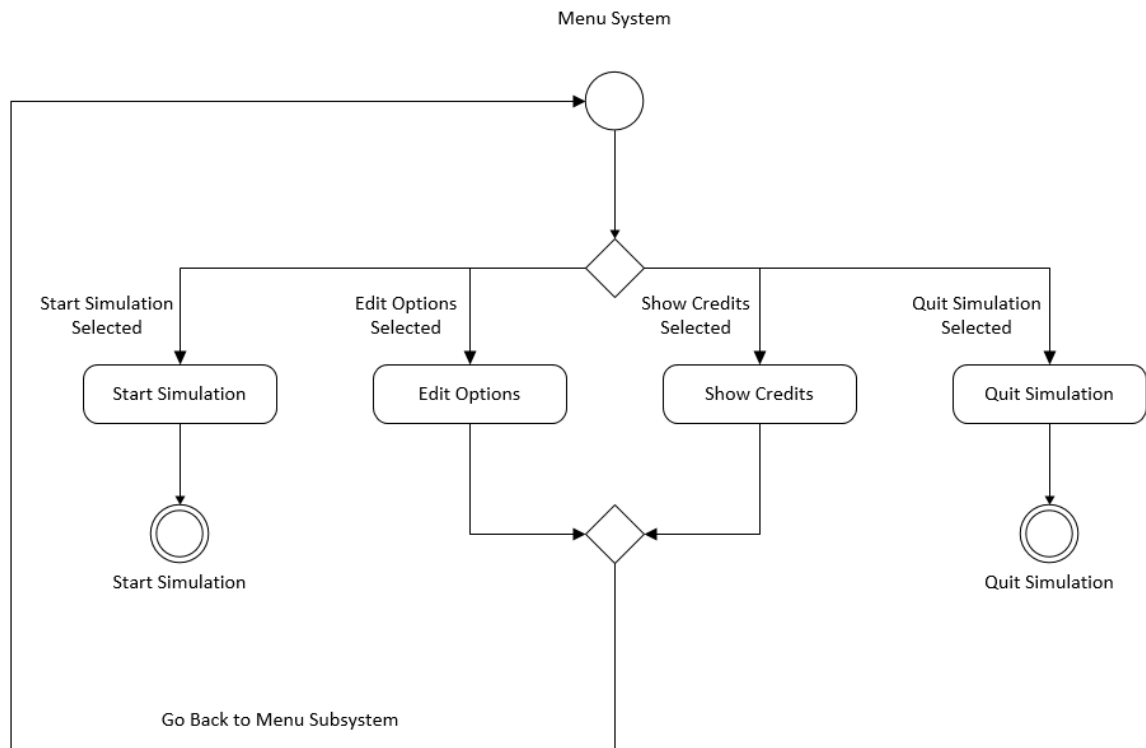


Figure 6: Menu System Activity Diagram

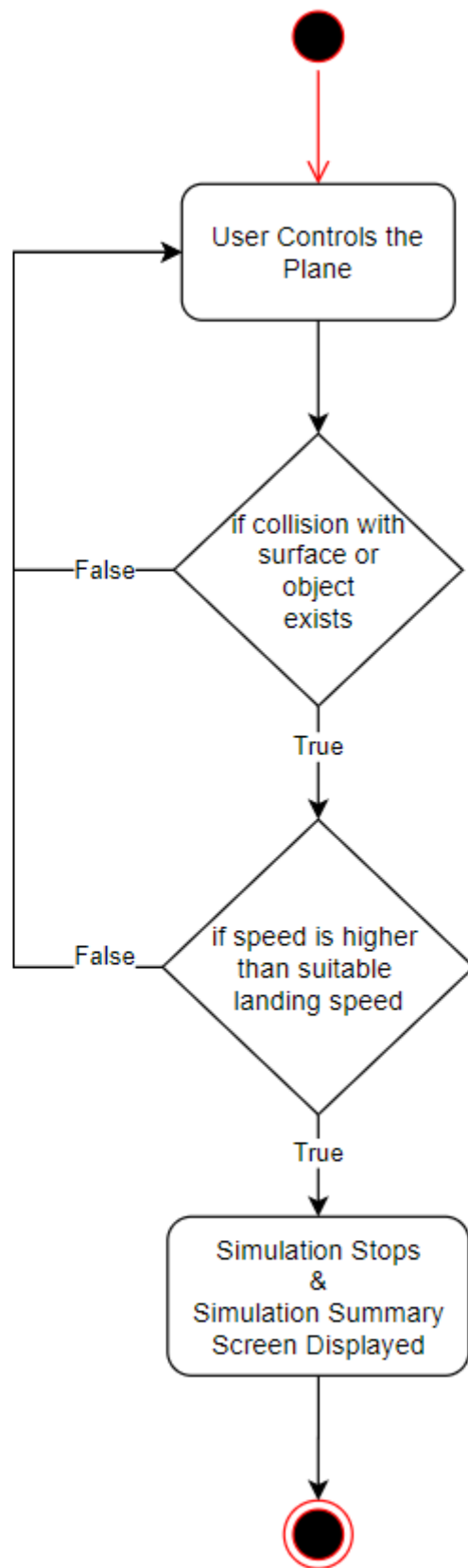


Figure 7: UC-SS-005 Activity Diagram

4.2. Analysis Class Diagram

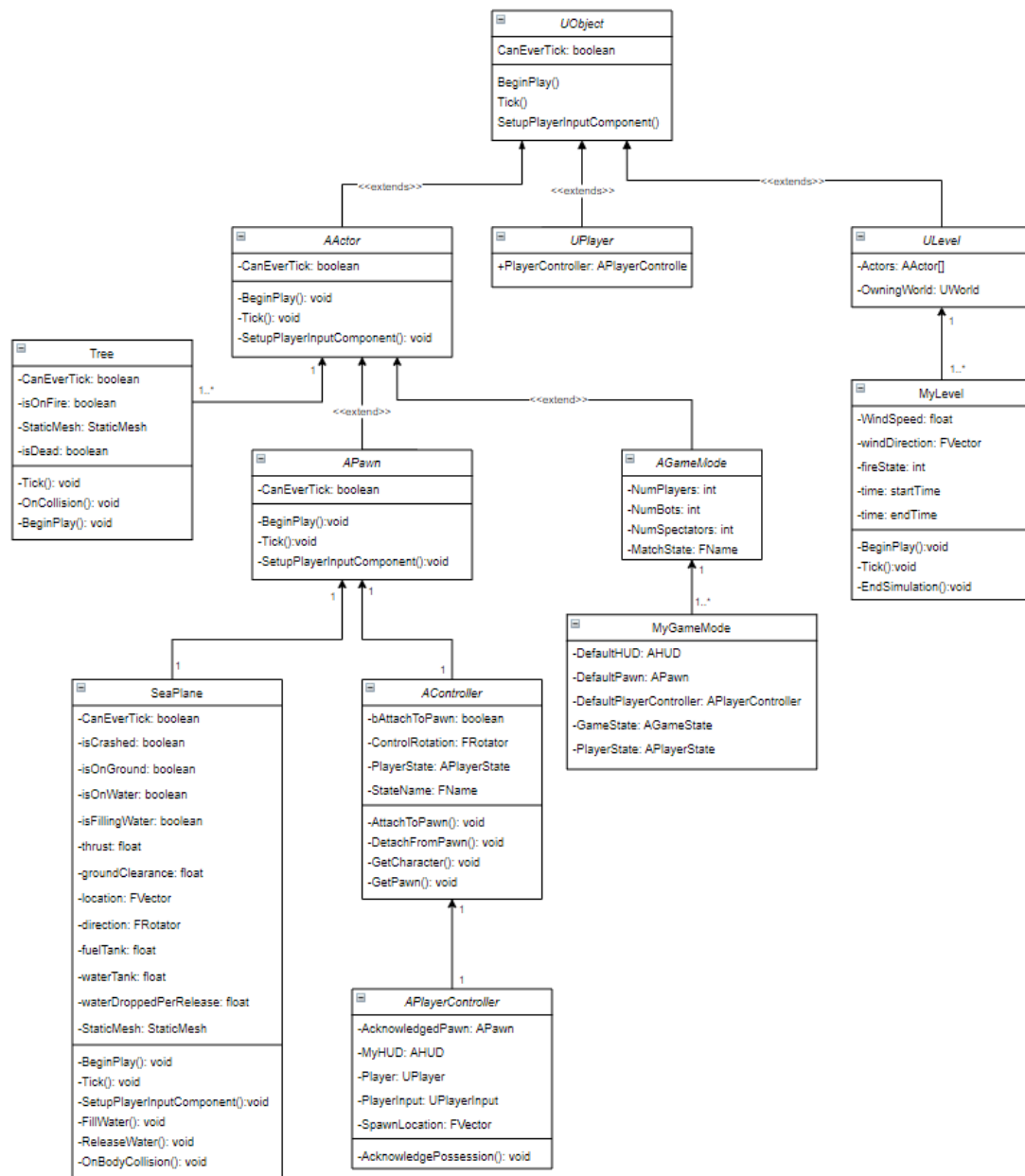


Figure 8: Analysis Class Diagram