Virtual Reality---Texting While Driving

Jacob Wheeler: Major in SE
Nathan Christiansen: Major in SE
Nicholas Kapty: Major in SE

Course Instructor: Xiaocong Fan
Faculty Advisor: George Dudas

Industry Sponsor: Erie Insurance
Project Mentor: Matthew Panetta
IT Apprentice
Project Proposer: MaryJo Ingalls
Supervisor Enterprise Content Management

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Contents

1. Abstract

Erie Insurance currently works with its agents to help them display the dangers of distracted driving to their policy holders. This can often be very difficult for agents to do since the user is not able to experience the consequences of distracted driving for themselves in a safe way. In order to help solve this problem for the agents, we are creating a virtual reality experience to demonstrate how distracted driving can affect the policy holder. This virtual reality experience will utilize the Unity 3D engine and the Google Cardboard SDK to give the policy holder different scenarios in which they will have to make decisions influencing their outcome. This virtual reality experience will allow the policy holder to better understand how they can influence dangerous driving activities as well as to help stop them.

2. Report Revision History

2.1 Changes in Version 1.5

In this version, we have made the changes recommended to us by our advisor. We have added a new user requirement and functional requirement detailing more information regarding the specific tasks that the AI driver should perform. The use case mapping diagram has been updated as well. Along with that, we have changed the name of our use case “Begin Experience” to “Experience Loop” to make more sense. References have now been added and have been used in section 5 to further explain our exploratory studies.

3. Problem Statement

3.1 Business Background

Erie Insurance is a Fortune 500 insurance company employing thousands of people. Erie Insurance has been a figure in the insurance world for 90 years, and currently serves over 4 million customers in 13 states. They utilize and manage smaller agencies to deal directly with customers, selling them auto, home, life, and business insurance.

With the rise of technology, distracted driving has become more of a risk than ever before. As Erie Insurance is invested in protecting people, they are taking the initiative in informing families about the dangers of driving while distracted.

3.2 Needs

Currently, it is very difficult to display the dangers of distracted driving to a younger generation in a way that engages them. Erie Insurance is seeking an innovative solution in order to solve this problem.

3.3 Objectives

This project aims to utilize virtual reality technology to create an immersive experience that engages users of all ages. The application will easily be distributed to agents around Erie's footprint and will effectively capture the younger audience.

4. Requirements

4.1 User Requirements

4.1.1 Glossary of Relevant Domain Terminology

Virtual Reality (VR) – A simulation of a three dimensional environment

Cardboard – Google's SDK created for smartphone devices

Headset – A head mounted device that displays virtual reality devices

4.1.2 User Groups

User – Any person engaging in our experience

4.1.3 Functional Requirements

4.1.3.1 Project Scope (Use Case Diagram)

Figure 4.1 displays the system's use case diagram. This gives a layout of the main user interactions that can occur as they use the system.

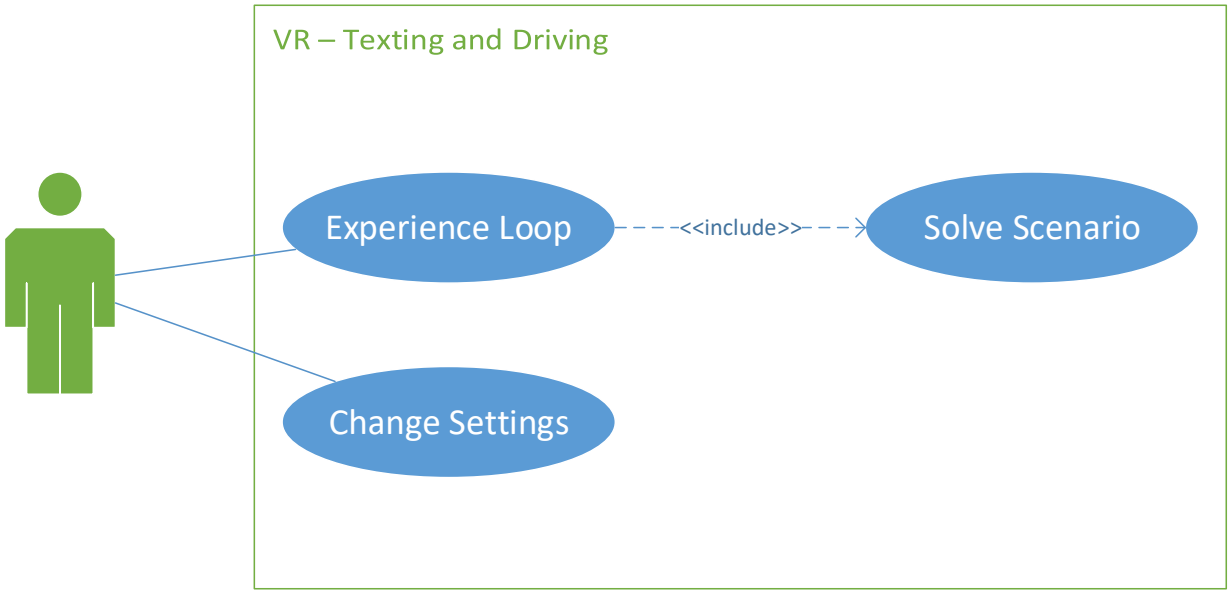

Figure 4.1 - Use Case Diagram

4.1.3.2 User Scenarios

Figure 4.2 lists the details of the use cases that occur within the system. The use cases give an overview of the sequence of the interactions that occur with the user and the system.

Project Name: Virtual Reality---Texting While Driving				
Use Case ID	**Use Case Name**	**Level**	**Author**	**Version**
UC-001	Change Settings	Primary task	Nathan Christiansen	0.4
UC-002	Experience Loop	Primary task	Nathan Christiansen	0.6
UC-003	Solve Scenario	Subfunction	Nathan Christiansen	0.3
Acknowledgment: Generated from the CapStone process management system ©2015				

Figure 4.2 - Use Case List

Project Name:	Virtual Reality--Texting While Driving
Use Case ID:	UC-001
Use Case Name:	Change Settings
User Goal:	Change Experience Settings
Scope:	VR - Texting While Driving
Level:	Primary task
Relevant User Reqs:	UF-E
Relevant System Reqs:	SF-E-01
Primary Actor:	User
Precondition:	The application is running and on the main menu
Minimal Guarantee:	Setting changes do not persist
Success Guarantee:	Settings are changed to user specifications
Trigger:	User selects settings option on main menu
Success Scenario:	Step Actions 1 The user selects settings in the main menu 2 The system brings up the settings menu 3 The user changes their desired settings 4 The user saves changes 5 The system applies changes
Extensions:	Branching Scenarios
4A	**Condition:** The user does not save changes
	Step Actions 1 The user declines to make changes 2 The system returns to the main menu
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Figure 4.3 - Change Settings

Project Name:	Virtual Reality---Texting While Driving
Use Case ID:	UC-002
Use Case Name:	Experience Loop
User Goal:	Experience the experience
Scope:	VR - Texting while Driving
Level:	Primary task
Relevant User Reqs:	UF-B,UF-C,UF-D
Relevant System Reqs:	SF-B-01,SF-B-02,SF-C-01,SF-D-01
Primary Actor:	User
Precondition:	The application is running and on the main menu
Minimal Guarantee:	The user enters the experience
Success Guarantee:	The user finishes the experience
Trigger:	User selects start experience on the main menu
Success Scenario:	**Step** **Actions** 1 The user selects start experience on the main menu 2 The system begins the experience 3 The user gains control of the passenger 4 The user SOLVES SCENARIO 5 The system continues until the next threshold 6 The system repeats step 4-5 until the user completes the experience 7 The system displays a results screen to the user
Extensions:	**Branching Scenarios**
5A	**Condition:** The user fails a scenario
	Step **Actions** 1 The system ends the experience
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Figure 4.4 – Experience Loop

Project Name:	Virtual Reality--Texting While Driving
Use Case ID:	UC-003
Use Case Name:	Solve Scenario
User Goal:	The user makes choices to solve a scenario
Scope:	VR - Texting While Driving
Level:	Subfunction
Relevant User Reqs:	UF-A
Relevant System Reqs:	SF-A-01
Primary Actor:	User
Precondition:	The user is in the experience and has not failed
Minimal Guarantee:	The default solution is chosen
Success Guarantee:	The user's solution is chosen
Trigger:	The user reaches a scenario threshold
Success Scenario:	Step Actions 1 The user reaches a scenario threshold 2 The system presents a scenario involving a dangerous situation 3 The user selects a solution presented by the scenario 4 The system enters a success state for the scenario
Extensions:	Branching Scenarios
3A	Condition: The user selects an incorrect solution or does not enter within the alloted time
	Step Actions 1 The system enters a fail state for the scenario
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Figure 4.5 - Solve Scenario

4.1.3.3 List of User Functional Requirements

User functional requirements describe functionality that the system should provide.

Project Name:	Virtual Reality--Texting While Driving				
Requirement ID:	UF-A			Type	Functional	Non-Functional
Creation:	Sep 16 2016 12:51 PM			User	☒	☐
Modification:	Sep 30 2016 03:07 PM			System	☐	☐
Description:	The application should present various scenarios that display a distracted driver, and give the user the ability to overcome the potential negative outcome.				
Priority:	✓ Highest	High	Medium	Low	Lowest
This Req. is Refined Into:	SF-A-01				
Justify why UF-A can be completely covered by SF-A-01	SF-A-01 describes how many choices the user will be able to choose from to affect their outcome.				
Traceability:	Use cases cf.	UC-003			
	Test cases cf.	Yet to be completed in test case worksheet!			
Acknowledgment	*Generated from the CapStone Process Management System ©2015*				

Figure 4.6 - Requirement UF-A

Project Name:	Virtual Reality--Texting While Driving				
Requirement ID:	UF-B			Type	Functional	Non-Functional
Creation:	Sep 16 2016 01:05 PM			User	☒	☐
Modification:	Sep 30 2016 03:06 PM			System	☐	☐
Description:	The user should control a passenger in a vehicle driven by a person engaging in dangerous activities.				
Priority:	✓ Highest	High	Medium	Low	Lowest
This Req. is Refined Into:	SF-B-01, SF-B-02				
Justify why UF-B can be completely covered by SF-B-01, SF-B-02	SF-B-01 specifies how the user will be able to control a passenger. SF-B-02 specifies how the user will be able to input commands.				
Traceability:	Use cases cf.	UC-002			
	Test cases cf.	Yet to be completed in test case worksheet!			
Acknowledgment	*Generated from the CapStone Process Management System ©2015*				

Figure 4.7 - Requirement UF-B

Project Name:	Virtual Reality---Texting While Driving				
Requirement ID:	UF-C			Type	Functional	Non-Functional
Creation:	Sep 21 2016 02:59 PM			User	☒	☐
Modification:	Oct 18 2016 08:25 AM			System	☐	☐
Description:	The system should feature multiple outcomes that can occur due to the driver being distracted.				
Priority:	✓ Highest	High	Medium	Low	Lowest
This Req. is Refined Into:	SF-C-01				
Justify why UF-C can be completely covered by SF-C-01	SF-C-01 specifies how many outcomes the system will provide and gives detail about each.				
Traceability:	Use cases cf.	UC-002			
	Test cases cf.	Yet to be completed in test case worksheet!			
Acknowledgment	*Generated from the CapStone Process Management System ©2015*				

Figure 4.8 - Requirement UF-C

Project Name:	Virtual Reality--Texting While Driving				
Requirement ID:	UF-D			Type	Functional	Non-Functional
Creation:	Sep 21 2016 03:00 PM			User	☒	☐
Modification:	Sep 30 2016 03:01 PM			System	☐	☐
Description:	The user should be able to interact with their environment between scenarios presented to them				
Priority:	✓ Highest	High	Medium	Low	Lowest
This Req. is Refined Into:	SF-D-01				
Justify why UF-D can be completely covered by SF-D-01	SF-D-01 specifies the objects that the user will be able to interact with.				
Traceability:	Use cases cf.	UC-002			
	Test cases cf.	Yet to be completed in test case worksheet!			
Acknowledgment	*Generated from the CapStone Process Management System ©2015*				

Figure 4.9 - Requirement UF-D

Project Name:	Virtual Reality--Texting While Driving				
Requirement ID:	UF-E			Type	Functional	Non-Functional
Creation:	Sep 26 2016 03:11 PM			User	☒	☐
Modification:	Sep 30 2016 03:01 PM			System	☐	☐
Description:	User should be able to modify experience settings				
Priority:	Highest	High	✓ Medium	Low	Lowest
This Req. is Refined Into:	SF-E-01				
Justify why UF-E can be completely covered by SF-E-01	SF-E-01 provides some settings that the user can modify to alter the experience.				
Traceability:	Use cases cf.	UC-001			
	Test cases cf.	Yet to be completed in test case worksheet!			
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Figure 4.10 - Requirement UF-E

Project Name:	Virtual Reality---Texting While Driving				
Requirement ID:	UF-F			Type	Functional	Non-Functional
Creation:	Oct 21 2016 12:12 PM			User	☒	☐
Modification:	Oct 21 2016 12:17 PM			System	☐	☐
Description:	The driver should be controlled by an AI and should engage in various tasks.				
Priority:	Highest	✓ High	Medium	Low	Lowest
This Req. is Refined Into:	SF-F-01				
Justify why UF-F can be completely covered by SF-F-01	Specifies what the AI will perform during the experience.				
Traceability:	Use cases cf.	Yet to be completed in use case worksheet!			
	Test cases cf.	Yet to be completed in test case worksheet!			
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Figure 4.11 - Requirement UF-F

4.1.4 Non-functional Requirements

Non-functional requirements describe the constraints and quality of the functionalities, providing testable features and specifying restrictions.

4.1.4.1 Product: Usability Requirements

Usability requirements describe how easily a user interacts with the system.

4.1.4.2 Product: Performance Requirements

Performance requirements describe how well a system performs in terms of time and resource usage.

Project Name:	Virtual Reality--Texting While Driving				
Requirement ID:	UP-01			Type	Functional	Non-Functional
Creation:	Sep 26 2016 03:06 PM			User	☐	☒
Modification:	Sep 30 2016 03:02 PM			System	☐	☐
Description:	The system should run at an acceptable frame rate suitable for virtual reality use.			Product (sub-type below)	
				Performance Requirements	
Priority:	Highest	High	✓ Medium	Low	Lowest
This Req. is Refined Into:	SP-01-01				
Justify why UP-01 can be completely covered by SP-01-01	Specifies what the acceptable frame rate the system should run at.				
Traceability:	Use cases cf.	N/A			
	Test cases cf.	Yet to be completed in test case worksheet!			
Acknowledgment	*Generated from the CapStone Process Management System ©2015*				

Figure 4.12 - Requirement UP-01

4.1.4.3 Product: Dependability/Security Requirements

Dependability/Security requirements describe the reliability and security concerns of the project.

4.1.4.4 Organizational: Development Requirements

Development requirements specify development practices and constraints.

Project Name:	Virtual Reality--Texting While Driving				
Requirement ID:	UO-01			Type / Functional / Non-Functional	
Creation:	Sep 16 2016 12:56 PM			User ☐ / ☒	
Modification:	Sep 30 2016 03:03 PM			System ☐ / ☐	
Description:	The application should be developed for modern Android devices.			Organizational (sub-type below)	
				Development Requirements	
Priority:	✓ Highest	High	Medium	Low	Lowest
This Req. is Refined Into:	SO-01-01				
Justify why UO-01 can be completely covered by SO-01-01	SO-01-01 specifies a modern Android operating system and device for eventual app deployment.				
Traceability:	Use cases cf.	N/A			
	Test cases cf.	Yet to be completed in test case worksheet!			
Acknowledgment	*Generated from the CapStone Process Management System ©2015*				

Figure 4.13 - Requirement UO-01

Project Name:	Virtual Reality--Texting While Driving				
Requirement ID:	UO-02			Type / Functional / Non-Functional	
Creation:	Sep 16 2016 12:58 PM			User ☐ / ☒	
Modification:	Sep 30 2016 03:01 PM			System ☐ / ☐	
Description:	The application should be developed for cardboard VR use.			Organizational (sub-type below)	
				Development Requirements	
Priority:	✓ Highest	High	Medium	Low	Lowest
This Req. is Refined Into:	SO-02-01				
Justify why UO-02 can be completely covered by SO-02-01	Specifies the SDK and method of displaying virtual reality applications.				
Traceability:	Use cases cf.	N/A			
	Test cases cf.	Yet to be completed in test case worksheet!			
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Figure 4.14 - Requirement UO-02

Project Name:	Virtual Reality--Texting While Driving				
Requirement ID:	UO-03			Type	Functional	Non-Functional
Creation:	Sep 16 2016 01:04 PM			User	☐	☒
Modification:	Sep 30 2016 03:01 PM			System	☐	☐
Description:	The application must feature ERIE Insurance branded paraphernalia advertising the company throughout.			Organizational (sub-type below)	
				Development Requirements	
Priority:	Highest	✓ High	Medium	Low	Lowest
This Req. is Refined Into:	SO-03-01				
Justify why UO-03 can be completely covered by SO-03-01	Specifies objects to be textured with ERIE Insurance textures.				
Traceability:	Use cases cf.	N/A			
	Test cases cf.	Yet to be completed in test case worksheet!			
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Figure 4.15 - Requirement UO-03

4.1.4.5 Organizational: Operational Requirements

Operational requirements describe conditions that a system must support.

4.1.4.6 Organizational: Environmental Requirements

Environmental requirements describe the look and feel of the system's interface.

4.1.4.7 External: Safety/Security Requirements

Safety/Security requirements detail how the system will interact with other systems, and the security concerns of these interactions.

4.1.4.8 External: Cultural and Social Requirements

Cultural and social requirements describe how the system conforms to cultural and social expectations.

4.1.4.9 External: Political Requirements

Political requirements detail how the system will influence different sections of the company.

4.2 System Requirements

User requirements tend to be vague, so they are refined into system requirements. System requirements engineer and refine the user requirements into many detailed requirements that are much more descriptive and implementable.

4.2.1 Functional Requirements

4.2.1.1 List of System Functional Requirements

Project Name:	Virtual Reality--Texting While Driving				
Requirement ID:	SF-A-01			Type: Functional / Non-Functional	
Creation:	Sep 23 2016 01:00 PM			User: ☐ / ☐	
Modification:	Sep 23 2016 01:02 PM			System: ☒ / ☐	
Description:	The system should provide three possible solutions for every decision presented.				
Priority:	Highest	High	Medium	Low	Lowest
This Req. is Engineered From:	UF-A				
Justify why meeting SF-A-01 can contribute to the fulfilment of UF-A	Specifies how the user can overcome each situation.				
Traceability:	Use cases cf.	UC-003			
	Test cases cf.	Yet to be completed in test case worksheet!			
Acknowledgment	*Generated from the CapStone Process Management System ©2015*				

Figure 4.16 - Requirement SF-A-01

Project Name:	Virtual Reality--Texting While Driving				
Requirement ID:	SF-B-01			Type: Functional / Non-Functional	
Creation:	Sep 23 2016 12:54 PM			User: ☐ / ☐	
Modification:	Sep 27 2016 10:55 AM			System: ☒ / ☐	
Description:	The user should have a first person perspective during the experience, and can use motion inputs to position the camera.				
Priority:	✓ Highest	High	Medium	Low	Lowest
This Req. is Engineered From:	UF-B				
Justify why meeting SF-B-01 can contribute to the fulfilment of UF-B	Specifies the inputs the user can use to control the passenger.				
Traceability:	Use cases cf.	UC-002			
	Test cases cf.	Yet to be completed in test case worksheet!			
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Figure 4.17 - Requirement SF-B-01

Project Name:	Virtual Reality--Texting While Driving				
Requirement ID:	SF-B-02			Type	Functional	Non-Functional
Creation:	Sep 27 2016 10:55 AM			User	☐	☐
Modification:	Sep 27 2016 10:56 AM			System	☒	☐
Description:	The user will use the button on the cardboard headset to interact with objects in the environment, and select choices during scenarios				
Priority:	✓ Highest	High	Medium	Low	Lowest
This Req. is Engineered From:	UF-B				
Justify why meeting SF-B-02 can contribute to the fulfilment of UF-B	Specifies input the user has during control				
Traceability:	Use cases cf.	UC-002			
	Test cases cf.	Yet to be completed in test case worksheet!			
Acknowledgment	*Generated from the CapStone Process Management System ©2015*				

Figure 4.18 - Requirement SF-B-02

Project Name:	Virtual Reality---Texting While Driving				
Requirement ID:	SF-C-01			Type	Functional	Non-Functional
Creation:	Sep 23 2016 12:59 PM			User	☐	☐
Modification:	Oct 18 2016 08:25 AM			System	☒	☐
Description:	The system should have four types of outcomes that can occur within the environment, including hitting an object, running off the road/lanes, speeding/slowing down, and missing traffic lights.				
Priority:	Highest	✓ High	Medium	Low	Lowest
This Req. is Engineered From:	UF-C				
Justify why meeting SF-C-01 can contribute to the fulfilment of UF-C	Specifies the different situations and outcomes that the user is presented with.				
Traceability:	Use cases cf.	UC-002			
	Test cases cf.	Yet to be completed in test case worksheet!			
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Figure 4.19 - Requirement SF-C-01

Project Name:	Virtual Reality--Texting While Driving				
Requirement ID:	SF-D-01			Type	Functional	Non-Functional
Creation:	Sep 23 2016 01:02 PM			User	☐	☐
Modification:	Sep 26 2016 02:56 PM			System	☒	☐
Description:	The user should be able to open/close glove box, interact with objects in the glove box, drink a drink in the cup holder, open/close the window, and adjust the radio.				
Priority:	Highest	✓ High	Medium	Low	Lowest
This Req. is Engineered From:	UF-D				
Justify why meeting SF-D-01 can contribute to the fulfilment of UF-D	It specifies the objects that the user can interact with				
Traceability:	Use cases cf.	UC-002			
	Test cases cf.	Yet to be completed in test case worksheet!			
Acknowledgment	*Generated from the CapStone Process Management System ©2015*				

Figure 4.20 - Requirement SF-D-01

Project Name:	Virtual Reality--Texting While Driving				
Requirement ID:	SF-E-01			Type	Functional	Non-Functional
Creation:	Sep 30 2016 01:07 PM			User	☐	☐
Modification:	Sep 30 2016 01:08 PM			System	☒	☐
Description:	The system will provide options to the user including changing weather effects and time of day.				
Priority:	Highest	✓ High	Medium	Low	Lowest
This Req. is Engineered From:	UF-E				
Justify why meeting SF-E-01 can contribute to the fulfilment of UF-E	The user will be given some control of the environment that they participate in.				
Traceability:	Use cases cf.	UC-001			
	Test cases cf.	Yet to be completed in test case worksheet!			
Acknowledgment	*Generated from the CapStone Process Management System ©2015*				

Figure 4.21 - Requirement SF-E-01

Project Name:	Virtual Reality---Texting While Driving				
Requirement ID:	SF-F-01			Type	Functional	Non-Functional
Creation:	Oct 21 2016 12:13 PM			User	☐	☐
Modification:	Oct 21 2016 12:16 PM			System	☒	☐
Description:	The driver AI should drive, text, converse with user, and look out window.				
Priority:	Highest	✓ High	Medium	Low	Lowest
This Req. is Engineered From:	UF-F				
Justify why meeting SF-F-01 can contribute to the fulfilment of UF-F	Specifies exactly what the driver's AI will do during the experience.				
Traceability:	Use cases cf.	Yet to be completed in use case worksheet!			
	Test cases cf.	Yet to be completed in test case worksheet!			
Acknowledgment	*Generated from the CapStone Process Management System ©2015*				

Figure 4.22 - Requirement SF-F-01

4.2.1.2 System Behavior

Figures 4.21 and 4.22 detail the sequence of flow between user and system, much like use cases. However, they give a more detailed look into the system, providing interaction between components in the system as well.

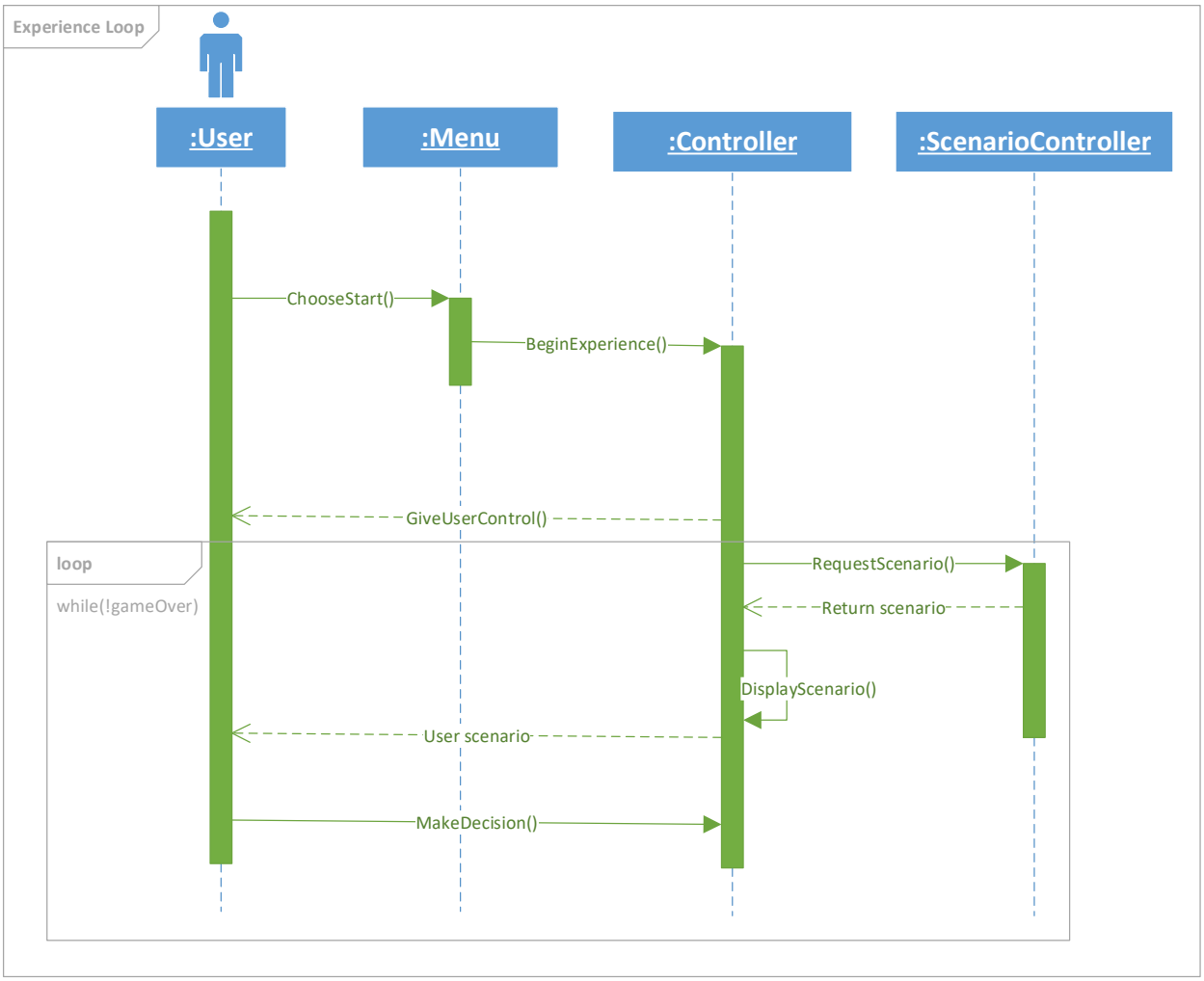

Figure 4.23 - Experience Loop Sequence

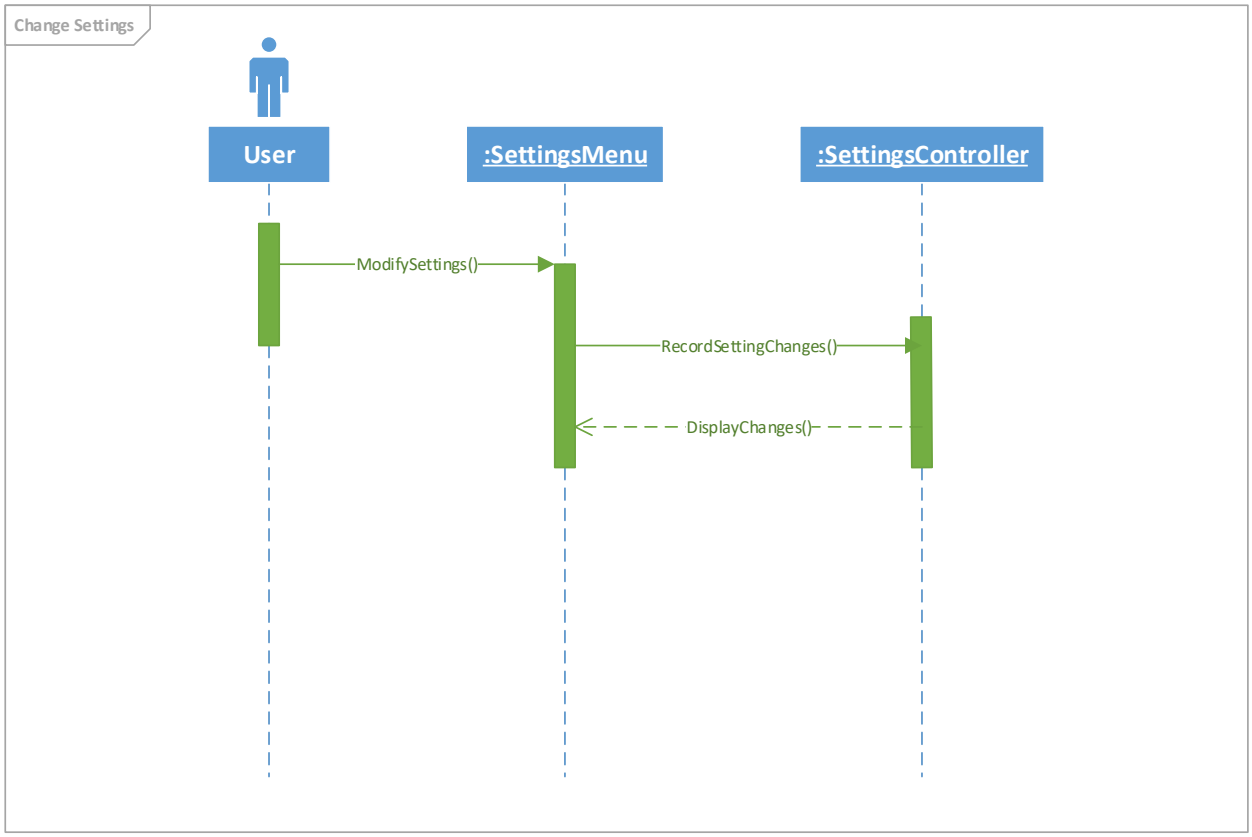

Figure 4.24 - Change Settings Sequence

4.2.1.3 Data Requirements

4.2.2 Non-functional Requirements

4.2.2.1 Product: Usability Requirements

4.2.2.2 Product: Performance Requirements

Project Name:	Virtual Reality--Texting While Driving				
Requirement ID:	SP-01-01			Type / Functional / Non-Functional	
Creation:	Sep 30 2016 02:54 PM			User ☐ / ☐	
Modification:	Sep 30 2016 02:55 PM			System ☐ / ☒	
Description:	The application should run at a minimum of 30 frames per second.			Product (sub-type below)	
				Performance Requirements	
Priority:	Highest	✓ High	Medium	Low	Lowest
This Req. is Engineered From:	UP-01				
Justify why meeting SP-01-01 can contribute to the fulfilment of UP-01	Specifies the minimum fps that the experience should perform at.				
Traceability:	Use cases cf.	N/A			
	Test cases cf.	Yet to be completed in test case worksheet!			
Acknowledgment	*Generated from the CapStone Process Management System ©2015*				

Figure 4.25 - Requirement SP-01-01

4.2.2.3 Product: Dependability/Security Requirements

4.2.2.4 Organizational: Development Requirements

Project Name:	Virtual Reality--Texting While Driving				
Requirement ID:	SO-01-01			Type / Functional / Non-Functional	
Creation:	Sep 26 2016 02:59 PM			User ☐ / ☐	
Modification:	Sep 26 2016 03:02 PM			System ☐ / ☒	
Description:	The system should be targeted for Android 5.1.1 "Lollipop" for phones with hardware specifications of the Samsung S5 and up			Organizational (sub-type below)	
				Development Requirements	
Priority:	Highest	✓ High	Medium	Low	Lowest
This Req. is Engineered From:	UO-01				
Justify why meeting SO-01-01 can contribute to the fulfilment of UO-01	Specifies the OS version and hardware requirements				
Traceability:	Use cases cf.	N/A			
	Test cases cf.	Yet to be completed in test case worksheet!			
Acknowledgment	*Generated from the CapStone Process Management System ©2015*				

Figure 4.26 - Requirement SO-01-01

Project Name:	Virtual Reality--Texting While Driving				
Requirement ID:	SO-02-01			Type	Functional	Non-Functional
Creation:	Sep 30 2016 01:03 PM			User	☐	☐
Modification:	Sep 30 2016 01:05 PM			System	☐	☒
Description:	The system will utilize the Google VR SDK to display two images through the cardboard.			Organizational (sub-type below)		
				Development Requirements		
Priority:	✓ Highest	High	Medium	Low	Lowest	
This Req. is Engineered From:	UO-02					
Justify why meeting SO-02-01 can contribute to the fulfilment of UO-02	The system will provide a VR experience that is designed around the cardboard.					
Traceability:	Use cases cf.	N/A				
	Test cases cf.	Yet to be completed in test case worksheet!				
Acknowledgment	*Generated from the CapStone Process Management System ©2015*					

Figure 4.27 - Requirement SO-02-01

Project Name:	Virtual Reality--Texting While Driving				
Requirement ID:	SO-03-01			Type	Functional	Non-Functional
Creation:	Sep 30 2016 01:00 PM			User	☐	☐
Modification:	Sep 30 2016 01:02 PM			System	☐	☒
Description:	Erie Insurance logos will be placed on buildings, billboards, bumper stickers, and air fresheners.			Organizational (sub-type below)		
				Development Requirements		
Priority:	Highest	High	✓ Medium	Low	Lowest	
This Req. is Engineered From:	UO-03					
Justify why meeting SO-03-01 can contribute to the fulfilment of UO-03	Erie Insurance will be represented within the experience.					
Traceability:	Use cases cf.	N/A				
	Test cases cf.	Yet to be completed in test case worksheet!				
Acknowledgment	*Generated from the CapStone Process Management System ©2015*					

Figure 4.28 - Requirement SO-03-01

4.2.2.5 Organizational: Operational Requirements

4.2.2.6 Organizational: Environmental Requirements

4.2.2.7 External: Safety/Security Requirements

4.2.2.8 External: Cultural and Social Requirements

4.2.2.9 External: Political Requirements

4.3 Requirements Trace Table

Figure 4.27 gives a breakdown of the system requirements that have been engineered from the user requirements.

Project Name: Virtual Reality---Texting While Driving			
User Requirements		System Requirements	
Req ID	Description	Req ID	Description
UF-A	The application should present various scenarios that display a distracted driver, and give the user the ability to overcome the potential negative outcome.	SF-A-01	The system should provide three possible solutions for every decision presented.
UF-B	The user should control a passenger in a vehicle driven by a person engaging in dangerous activities.	SF-B-01	The user should have a first person perspective during the experience, and can use motion inputs to position the camera.
		SF-B-02	The user will use the button on the cardboard headset to interact with objects in the environment, and select choices during scenarios
UF-C	The system should feature multiple outcomes that can occur due to the driver being distracted.	SF-C-01	The system should have four types of outcomes that can occur within the environment, including hitting an object, running off the road/lanes, speeding/slowing down, and missing traffic lights.
UF-D	The user should be able to interact with their environment between scenarios presented to them	SF-D-01	The user should be able to open/close glove box, interact with objects in the glove box, drink a drink in the cup holder, open/close the window, and adjust the radio.
UF-E	User should be able to modify experience settings	SF-E-01	The system will provide options to the user including changing weather effects and time of day.
UF-F	The driver should be controlled by an AI and should engage in various tasks.	SF-F-01	The driver AI should drive, text, converse with user, and look out window.
UO-01	The application should be developed for modern Android devices.	SO-01-01	The system should be targeted for Android 5.1.1 "Lollipop" for phones with hardware specifications of the Samsung S5 and up
UO-02	The application should be developed for cardboard VR use.	SO-02-01	The system will utilize the Google VR SDK to display two images through the cardboard.
UO-03	The application must feature ERIE Insurance branded paraphernalia advertising the company throughout.	SO-03-01	Erie Insurance logos will be placed on buildings, billboards, bumper stickers, and air fresheners.
UP-01	The system should run at an acceptable frame rate suitable for virtual reality use.	SP-01-01	The application should run at a minimum of 30 frames per second.
Acknowledgment: Generated from the CapStone process management system ©2015			

Figure 4.29 - Requirement Trace Table

5. Exploratory Studies

5.1 Relevant Techniques

We will be using the Unity 3D game engine to create our application. We have chosen this engine because of its C# scripting, large community, and because it allows us to create an immersive VR experience very quickly. Along with Unity 3D, we will be using the Google VR SDK for Unity to adapt our project for VR use [6]. We also plan to take advantage of the Unity Asset Store to collect models, animations, and scripts to allow us to focus on implementing the requested features and not worry about having to create all of our assets from scratch. Within the Asset Store exists an important package called Unity Test Tools [4]. Unity Test Tools allows us various ways of testing including unit tests, integration tests, and assertion component to make sure our work is as bug free as possible. All of these technologies working together will allow us to create an experience that puts the user into the middle of a seemingly dangerous situation.

5.2 Relevant Packages/Products

The main products and packages we will be using include Unity 3D, Google VR SDK, a variety of assets from the Unity Asset Store, the Android SDK to build from within the Unity engine, Unity Test Tools to complete our application testing, Visual Studio for writing C# scripts, and potentially more as we move forward.

5.3 Broader Impacts

This virtual reality experience has the potential to help minimize distracted driving. Minimizing distracted driving means that there will be less accidents, less injuries, and less deaths because of distracted driving. Since the application runs on the Android operating system, which is used by millions of people every day, this application has the potential to reach a large number of drivers and passengers.

6. System Design

6.1 Architectural Design

The system will be using the MVC architectural pattern, but will explore other options as we progress.

6.2 Structural Design

6.3 User Interface Design

6.4 Behavioral Design

6.5 Design Alternatives & Design Rationale

7. System Implementation

7.1 Programming Languages & Tools

We are implementing our project using Unity, which takes advantage of C# for creating scripts.

7.2 Coding Conventions

We will be using Microsoft C# coding conventions.

7.3 Code Version Control

We are utilizing Git and Github to keep track of all changes.

7.4 Implementation Alternatives & Decision Rationale

7.5 Analysis of Key Algorithms

8. System Testing

8.1 Test Automation Framework

8.1.1 Steps for Installing Test Framework

8.1.2 Steps for Running Test Cases

8.2 Test Case Design

8.2.1 Acceptance Test Cases

8.2.2 System Test Cases

8.2.3 Integration Test Cases

8.2.4 Unit Test Cases

8.3 Test Case Execution Report

8.3.1 Unit Testing Report

8.3.2 Integration Testing Report

8.3.3 System Testing Report

8.3.4 Acceptance Testing Report

9. Challenges & Open Issues

9.1 Challenges Faced in Requirements Engineering

We had trouble dealing with somewhat vague requirements provided by the industry sponsor, and were faced with the task of continuous meetings in order to get a clear understanding of the sponsor's needs in regard to the system.

9.2 Challenges Faced in System Development

9.3 Open Issues & Ideas for Solutions

10. System Manuals

10.1 Instructions for System Development

N/A

10.1.1 How to Set Up Development Environment

In order to develop the application, the developer must have Unity installed as well as Git in order to pull from the repository. Once pulled, opening the project in Unity will allow for additional development.

10.1.2 Notes on System Further Extensions

10.2 Instructions for System Deployment

10.2.1 Platform Requirements

10.2.2 System Installation

10.3 Instructions for System End Users

11. Conclusion

11.1 Achievement

11.2 Lessons Learned

11.3 Acknowledgment

12. References

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