National Parks VR Experience

The Document Detailing the Functions and Design of the Game

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I Project Description

1 Project Overview

The focus of this project is to provide a unique virtual experience for users to go and experience national parks and resources without the hassle of leaving the comfort of their home.

Players using any type of compatible virtual reality technology would be able to go to any national resource and learn about it through a narrator. The narrator would explain to the user what the current national resource is and give facts and details about it.

2 The Purpose of the Project

2a The User Business or Background of the Project Effort

The VR business would be able to help distribute the VR gear to numerous people that can't make the trip to experience national parks in reality.

With so many people going to national resources every year, the demand for visiting these national areas is high. Money, weather, and work hinder people's ability to go out and visit all these amazing areas. This project would allow people to enjoy the outdoors from their home at any hour. Not only could you spend hours visiting any national resource you want, but you can also have the narrator explain to you countless trivia and information about each place you visit.

2b Goals of the Project

We want to provide everyone the experience of national resource exploration and entertainment while also maintaining the comfortability of being in your own home.

2c Measurement

The increase in revenue from returning customers will increase and there will be more happy customers using the product that will continue to come back for more.

3 The Scope of the Work

The primary environment of this product will be in the homes of the user and used every day as a form of entertainment.

3a The Current Situation

There are currently a wide variety of National Resources that can be found around the world. However, every time someone goes to one of these outdoor areas to experience the physical reality of the landmark, not only do they have a chance to get hurt either by nature itself or by someone else, but they also have to travel a fair bit to the destination and that ends up using money and time that we don't all have. Bringing this

product into the world will allow the user to experience it all and more at home without the hassle of wasting the users time and energy.

3b The Context of the Work

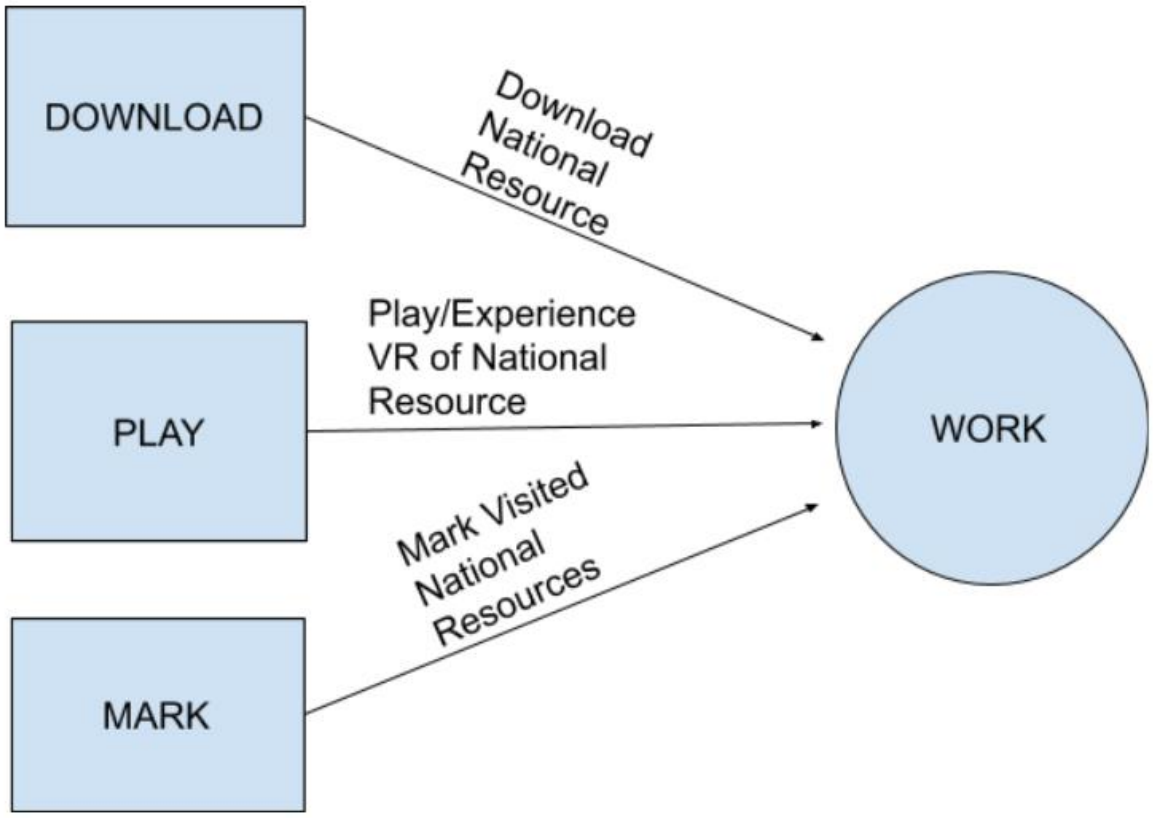

Figure 1 – Overview of the Work Being Done

3c Work Partitioning

Table 1 - Overview of the Commands

Event Name	Input and Output	Summary
Download	Download National Resource (in)	Download a National Resource for the user to visit

QuickPlay	Quickplay (in)	Randomly play a downloaded National Resource
Play	Play selected National Resource (in)	Select a downloaded National Resource to Play
Toggle Narration	Toggle User Narration (in)	Toggle the Narrator Voice

3d Competing Products

As previously stated, going to all these National Resources around the world will make you spend countless time just to travel, not including the money that has to be spent and the chances of danger that can happen throughout the trip. This project would not only get rid of all those problems with a one-time purchase, but would also be available anytime for you to use and immerse yourself inside your own home. Currently, there are a few competing products such as Hidden Worlds and Virtual Travel, but they are only minor in the sense that they only have the ability of a 360 degree turn around system, where our product will actually have the ability to do just that and much more.

4 The Scope of the Product

The product would include sixty-two different National Parks in the country, and there are options that the user can choose from if they want to view other national parks, or they can have a narrator speak and explain different facts and trivia about the certain spot they're viewing in the National Park. There's an explore option where the user can view different parts of the National Park. There's also a history option if they also just want to read about what they're viewing. Using VR allows us to get really close to reality and experience these tourist attractions, however, it doesn't have the feel of touching visuals experienced in reality since there are no VR handsets that support 3D rendering/processing. The user won't be able to experience feeling certain objects in the VR than they would in reality.

4a Scenario Diagram(s)

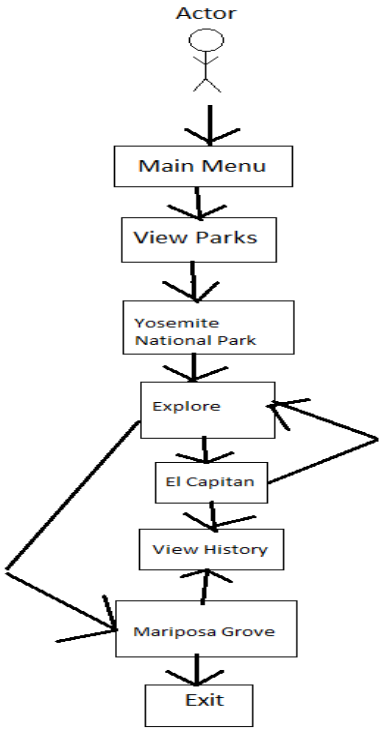

Figure 2 – Overview of scenarios for using product

4b Product Scenario List

1. Enable/disable narrator while exploring parts of national park
2. View history of parts of national park or full description of entire park
3. View fun facts or trivia after looking at the history of national park
4. Explore multiple spots of a national park

4c Individual Product Scenarios

1. **Enable/disable narrator while exploring parts of national park:** The player is currently exploring El *Capitan* at Yosemite National Park, and they want to listen to the tour guide talk about the history of the place instead of just reading the history. They click on the option that says "Narrator" and clicks on "Enable", which makes the tour guide talk.

2. **View history of parts of the national park or full description of the entire park:** The player listened to the tour guide talking about the history of the *El Capitan* at Yosemite National Park, but they want to also read what the tour guide was talking about to get a better understanding of the history. They click on the "History" option to view the full details of the history of *El* Capitan.

3. **View fun facts or trivia after looking at history of national parks:** The player is done looking at the history and wants to test their knowledge by looking at fun facts and trivia of the *El Capitan* at the Yosemite National Park. They click on the "History" option and there are two more options, "Fun Facts" and "Trivia", so the player decides to view them both.

4. **Explore multiple spots of a national park:** The user is done looking at the *El Capitan* at the Yosemite National Park, and now wants to look at a different spot of the park. They click on the "Explore" option and view the different choices to choose from. The player decides to look at the *Mariposa Grove* at Yosemite National Park, so they click on that to view the location.

5a The Client

Virtual reality companies would be our main client as this product is to be used with a VR headset. Those types of companies would want this software to be developed to use with their virtual reality equipment and for it to be compatible with gaming consoles.

5b The Customer

The client would distribute the product out to the customers, who in this case would primarily be gamers and schools. Gamers would have it for entertainment and schools could use the product for educational purposes.

5c Hands-On Users of the Product

User #1: Students
Role: Use the product for an educational purpose in school. They would learn about the national parks using this.

Subject Matter Experience: The students will know how to use the product and will listen to the narrator talk about each park (Novice).

Technological Experience: They would learn how to use the product if they have experience with VR technology (Journeyman).

Other user characteristics: The users would be in a higher age group, preferably high school or later.

User #2: Casual gamers with an interest in virtual reality
Role: Use the product as a form of entertainment.

Subject Matter Experience: They know how to use the product (Master).

Technological Experience: They know how to use VR technology (Master).

5d Maintenance Users and Service Technicians

We will need maintenance users to update the historical information regarding every national park, making sure that the information is accurate and current knowledge, meaning how tour guides currently explain parts of a national park. A developer to update visuals frequently and keep everything current to how the national parks are in reality right now. A developer to fix any bug issues throughout the product, and another developer for promotional content like exploring other national parks.

5e Other Stakeholders

1. **Testers –** needed to see what the bug and glitches issues in the program are. See if the historical information in each national park is provided correctly and information is current and accurate.

2. **Business Analysts –** needed to suggest solutions for business problems that may come up during development of this program.

3. **Marketing Experts –** needed to help market and promote the product, decides when it is a good time to release the product, provide information to better increase sales.

Developers – needed to fix the bugs and glitches that testers find from the program. They are also in charge of developing the visuals of the national parks and adding information for every park.

5f User Participation

We expect users to see that the information for each national park is accurate, making sure the visual 3D effects are realistic and working properly for each national park, test out the different options the user can make and interface prototyping.

5g Priorities Assigned to Users

Key users of this product would be casual gamers who are interested in virtual reality. These users would probably already have the necessary equipment. People who would like to visit national parks in the comfort of their home would also enjoy this product.

Secondary users would be people who enjoy national parks but do not always have access to get to one. Users who are interested in buying one of the required systems or the VR headset itself would also be a secondary user.

Unimportant users would be people who do not have much of an interest in virtual reality or video games at all. They would also be people who do not really care for national parks.

6 Mandated Constraints

6a Solution Constraints

Description: The product must work with current VR systems such as Playstation VR, Oculus Rift, and HTC Vive.

Rationale: The product is a virtual reality experience. Customers will be able to use the VR systems that they already own.

Fit criterion: No extra peripherals or devices will be needed in order to use the software besides the ones previously stated.

Description: The product will be available to download online for all compatible systems previously mentioned.

Rational: The product will be available online so the customer can easily obtain it.

Fit criterion: The product will be distributed online in a timely manner.

6b Implementation Environment of the Current System

The product can be used offline, but the internet is required to download the interactive maps of the national parks.

As described in the Partner or Collaborative Applications section, the product will work with existing game systems such as PlayStation 4 and gaming PC's, along with the VR devices compatible with these systems.

The product must be used in an appropriate space that allows the user to move and look around safely while wearing the VR headset.

6c Partner or Collaborative Applications

The product must use the PlayStation Plus application if it is being used on a PlayStation 4. If the user has a computer, a file sharing application will be needed. Both applications will allow the user to download the interactive maps and rate their experience in each.

6d Off-the-Shelf Software

The product must work with the PlayStation 4 and gaming PC's. Any existing PlayStation 4 will be able to run the software, but will need to be accompanied by the PlayStation VR headset in order to use it. If the user has a gaming PC then an Oculus Rift, HTC Vive, or any other VR headset for PC's will be needed to use the product. If

any user already has one of the products mentioned, the software should be compatible and work seamlessly. Any future VR systems should work with the software as well.

6e Anticipated Workplace Environment

The product will be used indoors, presumably in a living room or another spacious room in a house. The product requires a large area to be used efficiently. It would be preferred if there is minimal background noise so the user can hear the narrator.

Similar to a gaming PC or console, the product will have to be connected to a TV or a monitor.

The product will also be connected to the internet to download the maps of the national parks.

6f Schedule Constraints

One schedule constraint would be scheduling updates. Most successful applications release updates one to four times a month. Every update should not let previous features that worked well fail, and must fix any bugs and add improvements. The product's updates should also still work with all compatible devices. If the updates are not released in a timely manner, this could interfere with the reliability of the product.

Another constraint would be the initial release date. The best time to release the software would be six months prior to late spring/early summer since people primarily plan their trips to national parks in advance. If the product is released around Christmas buying season, this would give the customers enough time to plan a trip after their virtual reality experience. The development of the game would take about three to six months, so if planned accordingly the product could be released by then. If we do not release it by that point, it could impact the business aspect of it.

6g Budget Constraints

The main budget constraint would be the cost of hiring a team of developers. The average pay of a virtual reality developer is about $45/hour. The limitation of our funds and how long this project would take (estimate: three to six months) will determine how many people we could bring on to this project.

Another budget constraint could be the cost of certain hardware and systems that our product would need.

7 Naming Conventions and Definitions

7a Definitions of Key Terms

- Virtual Reality (VR) Technology - a computer-generated simulation that can be interacted with in a pseudo-physical way used by a person via electronic equipment that include goggles and controllers

- Puzzle - a game, toy, or problem designed to test ingenuity or knowledge

- Oculus Rift - a lineup of virtual reality headsets developed by Oculus VR and Facebook Inc.

7b UML and Other Notation Used in This Document

This document uses the Unified Modeling Language (UML) for its diagrams. The different types of arrows show the different types of relations between different entities in the program.

7c Data Dictionary for Any Included Models

No models used

8 Relevant Facts and Assumptions

8a Facts

- The rendering engine is Unity
- The product must work with the hardware the VR is running

8b Assumptions

It is assumed that the user has access to some virtual reality device in order to use this product as intended. It is also assumed that any interactions with this product will be used indoors.

II Requirements

9 Product Use Cases

9a Use Case Diagrams

The diagram below shows a use case diagram for the menu options the user can choose from. It's expected that the player will need a VR system in order to view the menu options. The player is able to view all the national parks in the country, and they can choose which one they would like to visit. After selecting the national park, they are given more options whether they would like to explore a certain part of the

national park, if they would like to review the history of the national park, or if they would like to have a narrator/tour guide to make it feel more realistic.

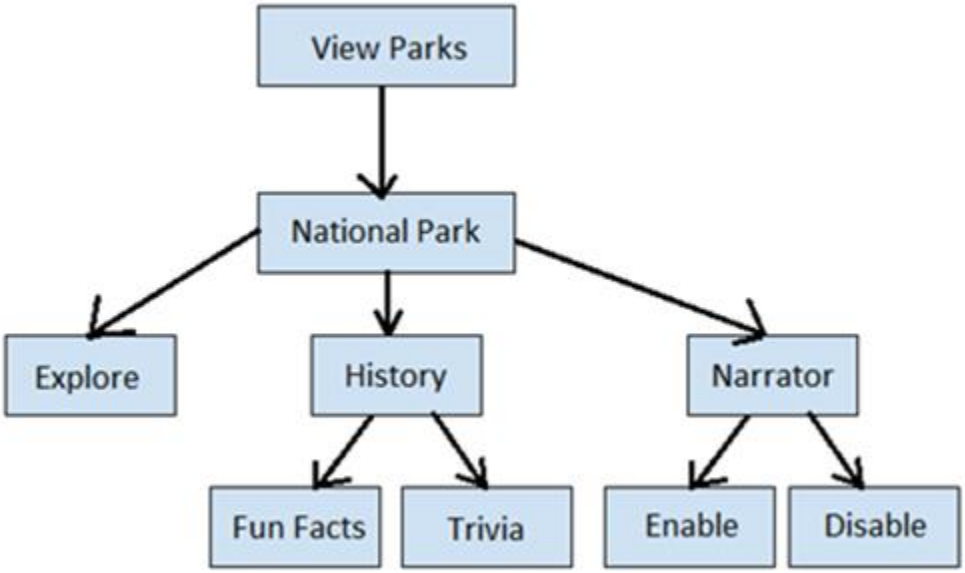

Figure 3 – Use Case Diagram

9b Product Use Case List

The following diagram depicts a use case diagram that shows how the player is going to interact with the main menu in the VR product, and the various components associated with it. Having this use case diagram is the best way to graphically summarize the product use cases relevant to the product.

A list of product use cases is:

- Main menu is displayed on the main screen.
- A menu item is selected.
- Exploring different parts of a national park.
- Viewing the history of a national park.
- Review fun facts or trivia.
- Narrator is added to the system.

9c Individual Product Use Cases

Use case ID: 1 Name: Main menu is displayed on the main screen.

pre-conditions: Player has to wear a VR headset.

post-conditions: Players will be able to see the main menu on the main screen.

Initiated by: System

Triggering Event: When the product is started up, main menu will be the first thing to display

Additional Actors: NA

Sequence of Events:

1. The product is turned on or started.
2. The player wears a headset on their head.
3. The main menu is displayed on the main screen.

Alternatives: NA

Exceptions: NA

Use case ID: 2 Name: A menu item is selected.

pre-conditions: The player should already have the main menu displayed in the main screen.

post-conditions: The menu item that is selected will be displayed in the main screen to the player.

Initiated by: System

Triggering Event: When the player selects a menu option

Additional Actors: NA

Sequence of Events:

1. System displays the main menu to the user.
2. Users can click on the menu option they want to select.
3. Users click on the menu option they selected and go into another sub-menu if there is any.
4. System will display the menu option that was chosen by the user.

Alternatives: If the user wanted to go back and choose a different menu option, there is a back button as a menu option in order for them to select a different option.

Exceptions: NA

Use case ID: 3 Name: Exploring different parts of a national park.

pre-conditions: Player has to already be in a national park they selected and select what part of the national park they would like to visit.

post-conditions: The part of the national park that the player selected will be shown on the main screen.

Initiated by: System

Triggering Event: When player clicks on the explore option

Additional Actors: NA

Sequence of Events:

1. Player is shown the national park that they selected.
2. Player clicks on the explore option.
3. Player selects what part of the national park they want to see after clicking explore.
4. System will display the part of the national park that the player selected they wanted to see.

Alternatives: Players can select the explore option again after they are done viewing the part of the national park they wanted to see.

Exceptions: NA

Use case ID: 4 Name: Viewing the history of a national park.

pre-conditions: Player has to already be in a national park they selected and selected a part of the national park they're viewing.

post-conditions: The history of the national park will be displayed on the main screen along with the view of the national park.

Initiated by: System

Triggering Event: When the player selects the history option

Additional Actors: NA

Sequence of Events:

1. Player is shown the national park they selected.
2. Player clicks on the explore option and selects a part of the national park they want to view.
3. System displays the part of the national park that the player selected.
4. Player clicks on the history option.
5. System will display facts and history about the part of the park the player is viewing.

Alternatives: NA

Exceptions: NA

Use case ID: 5 Name: View fun facts or trivia.

pre-conditions: Player has to click on the history option.

post-conditions: Fun facts or trivia will be displayed on the screen.

Initiated by: System

Triggering Event: When the player selects the trivia or fun facts options

Additional Actors: NA

Sequence of Events:

1. Player clicks on the history option.
2. System displays facts and history about the part of the park the player is viewing.
3. Player selects either fun facts or trivia options.
4. System will display some fun facts or trivia on the main screen about the part of the park the player is viewing.

Alternatives: NA

Exceptions: NA

Use case ID: 6 Name: Narrator is added into the system.

pre-conditions: Player has to already be in a national park they selected.

post-conditions: Player will be able to hear a speaker talk about the national park they are viewing.

Initiated by: System

Triggering Event: When the player selects the narrator option and selects Enable.

Additional Actors: Disable option if player wants to turn off the speaker.

Sequence of Events:

1. Player clicks on the national park they want to view.
2. System displays the national park to the main screen.
3. Player clicks on the Narrator option.
4. System displays two more options, Enable or Disable Narrator.
5. Player clicks on the Enable Narrator option.
6. Player will be able to hear the speaker start talking about the national park.

Alternatives: NA

Exceptions: NA

10 Functional Requirements

ID#1 – VR Headset

Description: The player must wear a VR headset while playing the product.

Rationale: To be able to get the 2D and 3D effects of the game and visualize the product in a better way. It should make the product feel more real like you're actually there.

Fit Criterion: The headset should help the player make the game feel more realistic like the player is actually there.

Acceptance Tests: ID#1 – VR Headset

ID#2 – Explore

Description: The system needs to have the explore option to view multiple locations in the national park.

Rationale: This will help the player view a specific part of the national park they want to see since there are many national parks that are very huge and there's too much to explore.

Fit Criterion: The explore option will make it so the player can find what they want to view easier, easier to see, and it's a lot quicker to explore multiple locations.

Acceptance Tests: ID#2 – Explore, ID#1 – VR Headset

ID#3 – History

Description: The system needs to have the history option for multiple locations and selected parts of national parks.

Rationale: This will keep players interested and wanting to learn about the national parks, or it may be for educational purposes like having a school project about certain national parks or areas.

Fit Criterion: Useful for educational purposes and brings in interest in viewing other national parks.

Acceptance Tests: ID#3 – History, ID#2 – Explore, ID#1 – VR Headset

11 Data Requirements

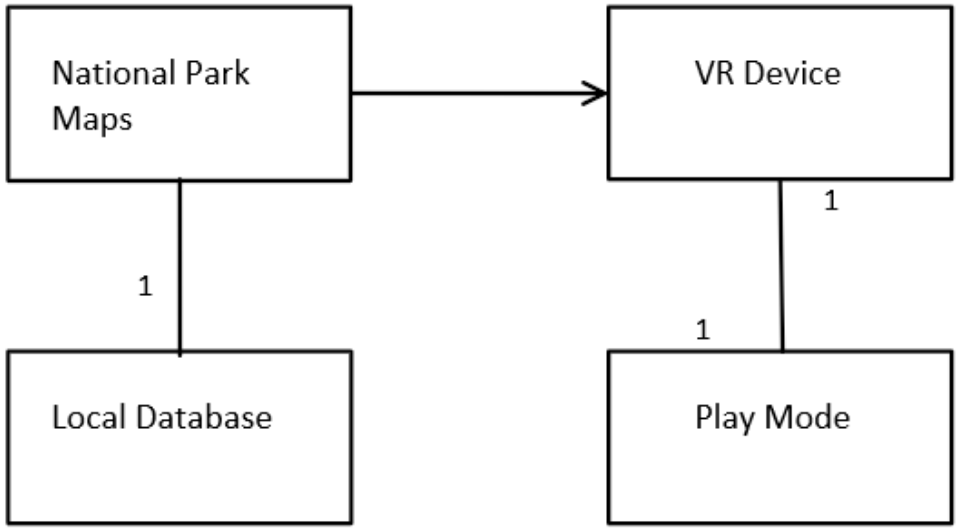

Figure 4 -- Data Class Diagram

In the figure above, we can see that the VR device has one subclass. The class shows that there will be a play mode. The national park maps class communicates with the VR device class. Within the national park map class there is an object that is labeled as local database. There is a one-to-one relationship between the maps and database.

12 Performance Requirements

12a Speed and Latency Requirements

ID# 4 -- Speed

Description: Any interface between a user and the automated system shall have a maximum response time of 2 seconds.

Rationale: the interaction between the user and system should be seamless.

Acceptance Tests: #4 -- Speed

12b Precision or Accuracy Requirements

ID# 5 -- Precision/Accuracy

Description: All numeric data about the national parks given by the product shall be accurate to the hundreds.

Rationale: The data in the system could change based on what is recorded about the parks.

Fit Criterion: Compare multiple sources to the data in the system.

Acceptance Tests: ID# 5 -- Precision/Accuracy

12c Capacity Requirements

ID# 6- Offline Play

Description: The product shall cater to a single user.

Rationale: The product will primarily be played offline, with only one user since it is single player.

Fit Criterion: Once the interactive maps are downloaded, the product can be played offline.

Acceptance Test: ID# 6-- Offline Play

13 Dependability Requirements

13a Reliability Requirements

ID# 7- Reliability

Description: Any data configured by the user should be saved within the internal storage of the application. This only includes any settings that were changed as all national parks should be available at the start.

Rationale: It makes it easier for the user to change settings and keep them. It should also make it easier to access all national parks.

Fit Criterion: If any new national parks are created, then the user should be able to connect to the internet and update the app. The system should not crash under any circumstances either. If it does, then the application should quit anyway and go back to the desktop.

Acceptance Test: ID# 7—Reliability

13b Availability Requirements

ID# 8- Availability

Description: The product is assumed to be used at home where they have the desktop computer and VR device available to use. If there is an update available (bug fixes, new national parks, new information, etc.), then the product should be able to connect to the internet successfully and make changes.

Rationale: It should be available to use at any time the user wants to use the app.

Fit Criterion: It has to connect to the internet in order to update.

Acceptance Test: ID# 8—Availability

13c Robustness or Fault-Tolerance Requirements

ID# 9- Fault-Tolerance

Description: Since the only time the product needs to connect to the internet is during updates, all data should be stored locally. Therefore, there are no complications with accessing the app offline.

Rationale: The user can access all of the different national parks at fast speeds and have all information available immediately.

Fit Criterion: If online connection fails, it would simply not update the app.

Acceptance Test: ID# 9-- Fault-Tolerance

13d Safety-Critical Requirements

ID# 10- Safety Critical Requirements

Description: Since virtual reality devices are known to cause motion sickness, the app should have settings available to prevent anyone from getting sick. There also should be a calibration button so that the user can reorient their view. Since the user will ideally be sitting down to use this app, there is no worry about breaking personal items by walking into them.

Rationale: The user shouldn't get sick or be bumping into objects using the app.

Fit Criterion: The user can specify what settings they want changed to make sure they aren't hurting themselves.

Acceptance Test: ID# 10-- Safety Critical Requirements

14 Maintainability and Supportability Requirements

14a Maintenance Requirements

ID# 11- Maintenance

Description: After the first release on any device, any fixing of bugs should be done on a weekly basis so that more time can be spent on adding content if need be. The feedback of users should constantly be looked at so the developers know what to fix and implement in the app at a later time. The developers should also make sure that the app works with the various devices it is compatible for.

Rationale: The app can continue to update, fixing bugs and adding new content.

Fit Criterion: If there are new VR devices, the developers can port it and maintain the app with that device as well.

Acceptance Test: ID# 11—Maintenance

14b Supportability Requirements

ID# 12- Supportability

Description: The testing phase of the product and its corresponding software should run parallel and continuous with any new code production.

Rationale: They can keep track of bugs during development. If there are bugs that appear in release, then the users should be able to provide feedback so that the developers can focus on it in future updates.

Fit Criterion: After any version release, users can provide feedback to the developer's website or online stores where the app is offered.

Acceptance Test: ID# 12—Supportability

14c Adaptability Requirements

ID# 13- Adaptability

Description: The product should run smoothly on any available VR device.

Rationale: Since different VR devices have different controller types and control schemes, the app should be able to use any controller type.

Fit Criterion: It should support different languages and settings depending on the location of the user and where they downloaded the app from.

Acceptance Test: ID# 13—Adaptability

14d Scalability or Extensibility Requirements

ID# 14- Scalability

Description: If new information about the parks is revealed or new parks are made, the product should reflect these changes and update as soon as the developers are ready to distribute a new version.

Rationale: All data, including new parks added to the app, would be available immediately to go to.

Fit Criterion: The new data would take up more space and users should have enough space to handle the app and future updates.

Acceptance Test: ID# 14—Scalability

14e Longevity Requirements

ID# 15- Longevity

Description: The product and its associated system parts should be maintained occasionally for a long period of time as it is an education tool and a form of entertainment.

Rationale: As long as there is new information regarding the national parks, then the app is going to update constantly and therefore maintenance is required to make sure the app is working properly.

Fit Criterion: If any new VR devices are made available to the public, the developers can port the app to the new device and keep extending the amount of time of maintenance.

Acceptance Test: ID# 15—Longevity

15 Security Requirements

15a Access Requirements

ID# 16- Access

Description: The developers should only be available to access feedback from the user through a website like Steam or the actual game website through reviews.

Rationale: The data installed should include every piece of data (every park, every fact, etc.) and that this is only an educational simulator.

Fit Criterion: The developers do not need to access any other information from the user.

Acceptance Test: ID# 16—Access

15b Integrity Requirements

ID# 17- Integrity

Description: The app should be secure enough to protect itself from intentional abuse from any download, especially after any update since it has to connect to the internet to update.

Rationale: The app should protect the user from any form of corruption, loss, or theft.

Fit Criterion: The app has to protect the user's information.

Acceptance Test: ID# 17—Integrity

15c Privacy Requirements

ID# 18- Privacy

Description: The product would have a user's terms and conditions agreements that the user can read at any time.

Rationale: The app should protect the identity of its users and keep them confidential.

Fit Criterion: In the case that the product's information policy has changed, it will notify the customers that the app made updates to it.

Acceptance Test: ID# 18—Privacy

15d Audit Requirements

ID# 19- Audit

Description: Audits have to account for paying for the product through an online store.

Rationale: They have to make sure the company is paid the correct amount.

Fit Criterion: It must provide the user with security regarding their purchase and make sure that they get what they paid for.

Acceptance Test: ID# 19—Audit

15e Immunity Requirements

ID# 20- Immunity

Description: The product would be checked before any release if it could cause problems to users and their systems. The product would also be released on official online stores so there is no risk of viruses, worms, Trojan horses, etc.

Rationale: Since the product has to connect to the internet occasionally to update, there has to be no risk of malicious interference when downloading the product from online.

Fit Criterion: Most of the immunity will be through the game engine since all of the code will be used for the game and not the actual installation. Despite this, the code should not have any problems that cause anything malicious to the user's system as well.

Acceptance Test: ID# 20—Immunity

16 Usability and Humanity Requirements

16a Ease of Use Requirements

ID# 21- Ease of Use

Description:

- **Efficiency of use:** Users will be able to use the product after connecting their system to VR. VR systems like HTC Vive may take some time to set up if you're not sure how to connect to VR.
- **Ease of remembering:** The user would get pretty familiar with the product if they played with it once since there aren't many settings and options to choose from. If the user has used the product before and wants to use it again later to view a new park, they should be able to remember methods to get there.
- **Error rates:** For some huge national parks that have multiple locations, graphics may take a while to load or possibly crash because there's heavy amounts of assets being loaded in. Fixing the graphics to use less memory can be a possible fix to have the product load faster, and less likely to crash.
- **Overall satisfaction in using the product:** Users would feel like they learned something new or feel happy like they've just experienced a trip to the national parks they selected.
- **Feedback:** Getting feedback from websites like Metacritic would help and help us improve on what we can do to make the product better and focus on areas that need some improvements.

Rationale: The product shall be easy for 11-year-old children and up to use, as they would be our potential target market since they would be the most interested in learning and visiting new places, and they love to play games.

The product shall help the user to avoid making mistakes.

The Product shall make the users want to use it.

Fit Criterion:

- **Efficiency of use:** 80% of the population should be able to understand and use the product accurately if they follow the instructions.
- **Error rates:** If the user already has a good graphics card on their PC, about 90% of the population should be able to use the product without running into any errors.

Acceptance Test: ID# 21-- Ease of Use

16b Personalization and Internationalization Requirements

ID# 22- Personalization

Description:

- **Languages, spelling preferences, and language idioms:** Users will be able to change to a few languages that are most common in the country, and if there are a large number of non-english users using the product, we may add in more languages for the user.
- **Currencies, including the symbols and decimal conventions:** Our market sellers will handle the currency exchanges if the user buys the game outside the United States.
- **Personal configuration options:** There will be a settings option for users to add their own personal preferences and cover most of configuration cases.

Rationale: The product shall retain the buyer's buying preferences.

The product shall allow the user to select a chosen language.

Fit Criterion:

- Users should be able to change the language in the settings provided in the main menu.
- The user should be able to customize their settings accordingly, so the user feels more comfortable with using the product.

Acceptance Test: ID# 22—Personalization

16c Learning Requirements

ID# 23- Learning

Description:

- If the user is using the game for the first time, they should be able to use the game and follow the walkthrough on how the product works when they first start the product. Setting up the VR system with the product may be a little complicated because there may be some computer settings the user may have that conflict with the VR system possibly, and it could cause problems.
- If the user forgets how the product works, they can look through the instructions option that will explain how the product works and can view the walkthrough again if they want to.

Rationale: Users using the product again should remember how to use the product since there aren't really any game mechanics besides multiple options of what national parks to visit.

Fit Criterion:

- Users should be able to learn how to use the product with ease once they get the hang of using the explore option.
- Developers should be able to easily understand how the product works but creating the graphics may take some time to learn and updating the maps as frequently as possible to make it feel more realistic.

Acceptance Test: ID# 23—Learning

16d Understandability and Politeness Requirements

ID# 24- Understandability

Description: The user isn't expected to know much on how to use the product, but basic knowledge on what national parks or parts of the national park they would like to visit would be useful to make it easier for them to navigate through the product.

Rationale: Some parts would be made sure that it's relevant to the current events.

Fit Criterion: Users shouldn't have to understand where some of these national parks are in the world because the product provides the information for them.

Acceptance Test: ID# 24—Understandability

16e Accessibility Requirements

ID# 25- Accessibility

Description: The product may be difficult to use for people that are blind as it defeats the purpose of using VR to make it feel more realistic and the product mainly requires visual attention in order to use it.

Rationale: The product can still be used by people who are hearing impaired; however, they wouldn't be able to use the Narrator option if they wanted a speaker.

Fit Criterion: People with impaired hearing shouldn't have much difficulty in using the product since all information in the game like history, fun facts, trivia, menu options, are all written and readable in the game.

Acceptance Test: ID# 25—Accessibility

16f User Documentation Requirements

ID# 26- User Documentation

Description: A user manual for learning how to use VR systems is provided to better understand VR, but most information about the game and how to use the product is given in the game.

Rationale: Videos on YouTube on how to use VR is usually provided. There aren't really any user manuals for installations or service for just the product.

Fit Criterion: The product already provides a walkthrough on how to navigate the product. Videos would be provided from YouTube on how to use the VR system and connect it with the product.

Acceptance Test: ID# 26-- User Documentation

16g Training Requirements

ID# 27- Training

Description: The users are given a walkthrough of the product of how it works. There is an instructions option also on how the product works and they can review the walkthrough again if they want.

Rationale: Users may look up videos to learn how to use VR if they are new to it.

Fit Criterion: Users should be familiar on how to use the product after going through the walkthrough. Users should know the main purpose of the product.

Acceptance Test: ID# 27—Training

17 Look and Feel Requirements

17a Appearance Requirements .

ID#28 -- Appearance

Description: The product shall be attractive to all ages.

Rationale: Although the key group is casual gamers, they vary in age. So, the game must appeal to people of all ages.

Fit Criterion: A sampling group of people who vary in age shall, without prompting or enticement, start using the product within four minutes of their first encounter with it.

Acceptance Tests: ID# 28—Appearance

17b Style Requirements

ID#29 -- Authoritative Style

Description: The product shall appear authoritative.

Rationale: The product needs to prove that it is reliable so the customer will want to purchase it

Fit Criterion: After their first encounter with the product, at least 70 percent of representative potential customers shall agree they feel they can trust the product.

Acceptance Tests: ID# 29-- Authoritative Style

18 Operational and Environmental Requirements

18a Expected Physical Environment

ID#30 -- Open Space Environment

Description: The product shall be used in a quiet room with a big enough space for the user to move.

Rationale: The product has sound and visuals, so the user will need to be able to hear in-game audio and be able to see through the headset by moving around.

Fit Criterion: While using the product, the user will be able to play without obstacles in their environment

Acceptance Tests: ID# 30-- Open Space Environment

18b Requirements for Interfacing with Adjacent Systems

ID# 31-- Compatible VR headsets

Description: The product shall work with all current VR headsets.

Rationale: The product should be able to work with any VR Compatible headset so the user does not have to purchase a separate one.

Fit Criterion: The product will be able to work on HTC Vive, PlayStation 4, Oculus Rift, etc.

Acceptance Tests: ID# 31- Compatible VR headsets

18c Productization Requirements

ID# 32-- Distribution

Description: The product shall be distributed as a ZIP file.

Rationale: A ZIP file is the easiest way for the user to obtain the product over the internet.

Fit Criterion: When the user downloads the product, it will be compressed into a ZIP file so it can be installed with ease.

Acceptance Tests: ID# 32-- Distribution

ID# 33-- Installation

Description: The product shall be able to be installed by an untrained user without recourse to separately printed instructions

Rationale: The product is for all ages so the installation should be easy.

Fit Criterion: The product will be installed with ease by the user.

Acceptance Tests: ID# 33-- Distribution, ID# Installation

18d Release Requirements

ID# 34-- Release

Description: Each release shall not cause previous features to fail.

Rationale: Each release of the product should fix bugs along with adding improvements without causing other features to fail.

Fit Criterion: Description of the previous features to check for, making sure none have failed.

Acceptance Tests: ID# 34—Release

19 Cultural and Political Requirements

19a Cultural Requirements

ID# 35 - Culture

Description: The product shall not be offensive to any religious or ethnic group. None will be discriminated against while using this product.

Rationale: No one should feel discouraged to use this product, and therefore the most logical way to do that is to make everyone feel like they can use this product without being discriminated against in any way.

Fit Criterion: More people will be not only pleased with the product but will continue to come back and remember how happy it made them.

Acceptance Tests: ID#35 – Culture

19b Political Requirements

ID# 36 - Politics

Description: The product will not be associated with any political beliefs, and will solely run for the purpose of entertainment.

Rationale: Regardless of the users political standing and/or views, any politics associated with the user shall not interfere with how the product is used. The product will be built using the components it was designed to use and will therefore be able to be distributed and used anywhere.

Fit Criterion: Users should not have to go to a specific place to get a version of the product that was not made in their region.

Acceptance Tests: ID#36 – Politics

20 Legal Requirements

20a Compliance Requirements

ID#37 - Compliance

Description: All personal information while using this product will be kept safe. Under no circumstance will personal information fall into the hands of others by the Terms and Service/Privacy Statement. You will never be prompted to input your personal info to use this product.

Rationale: Every user who uses this product should have their information stored privately so no other user can claim it. This provides the user with safekeeping and allows them to feel safe while using the product.

Fit Criterion: Users should not have to worry as to whether their information might get leaked and released to others and should be more focused on playing with the product and having a good time.

Acceptance Tests: ID#37 – Compliance

20b Standards Requirements

ID#38 - Standards

Description: The product shall follow and adhere to any and all company standards that use it, specifically software development standards.

Rationale: Software Development of this product will follow the rules and guidelines to the letter while using/developing it. All instances of the product must meet the specified criteria before it is released to the public.

Fit Criterion: Users should not have to have any problems if they receive a product that did not follow the software development criteria to the letter. Receiving a broken product will make the user unsure if they want another one and will lower the general approval of the product through the users eyes.

Acceptance Tests: ID#38 -- Standards

21 Requirements Acceptance Tests

21a Requirements – Test Correspondence Summary

Test	Requirements																			
	Req 1	Req 2	Req 3	Req 4	Req 5	Req 6	Req 7	Req 8	Req 9	Req 10	Req 11	Req 12	Req 13	Req 14	Req 15	Req 16	Req 17	Req 18	Req 19	Req 20
Test 1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Test 2		X	X																	
Test 3			X																	
Test 4																				
Test 5																				
Test 6																				
Test 7																				
Test 8																				
Test 9																				
Test 10																				
Test 11																				
Test 12																				
Test 13																				
Test 14																				
Test 15																				

Test	Requirements																			
	Req 21	Req 22	Req 23	Req 24	Req 25	Req 26	Req 27	Req 28	Req 29	Req 30	Req 31	Req 32	Req 33	Req 34	Req 35	Req 36	Req 37	Req 38	Req 39	Req 40
Test 1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Test 2																				
Test 3																				
Test 4																				
Test 5																				
Test 6																				
Test 7																				
Test 8																				
Test 9																				
Test 10																				
Test 11																				
Test 12																				
Test 13																				
Test 14																				
Test 15																				

Table 2 -- Acceptance Tests

21b Acceptance Test Descriptions

ID#1 – VR Headset

Description: The player must wear a VR headset while playing the product.

ID#2 – Explore

Description: The system needs to have the explore option to view multiple locations in the national park.

ID#3 – History

Description: The system needs to have the history option for multiple locations and selected parts of national parks.

ID# 4 -- Speed

Description: Any interface between a user and the automated system shall have a maximum response time of 2 seconds.

ID# 5 -- Precision/Accuracy

Description: All numeric data about the national parks given by the product shall be accurate to the hundreds.

ID# 6- Offline Play

Description: The product shall cater to a single user.

ID# 7- Reliability

Description: Any data configured by the user should be saved within the internal storage of the application. This only includes any settings that were changed as all national parks should be available at the start.

ID# 8- Availability

Description: The product is assumed to be used at home where they have the desktop computer and VR device available to use. If there is an update available (bug fixes, new national parks, new information, etc.), then the product should be able to connect to the internet successfully and make changes.

ID# 9- Fault-Tolerance

Description: Since the only time the product needs to connect to the internet is during updates, all data should be stored locally. Therefore, there are no complications with accessing the app offline.

ID# 10- Safety Critical Requirements

Description: Since virtual reality devices are known to cause motion sickness, the app should have settings available to prevent anyone from getting sick. There also should be a calibration button so that the user can reorient their view. Since the user will ideally be sitting down to use this app, there is no worry about breaking personal items by walking into them.

ID# 11- Maintenance

Description: After the first release on any device, any fixing of bugs should be done on a weekly basis so that more time can be spent on adding content if need be. The feedback of users should constantly be looked at so the developers know what to fix and implement in the app at a later time. The developers should also make sure that the app works with the various devices it is compatible for.

ID# 12- Supportability

Description: The testing phase of the product and its corresponding software should run parallel and continuous with any new code production.

ID# 13- Adaptability

Description: The product should run smoothly on any available VR device.

ID# 14- Scalability

Description: If new information about the parks is revealed or new parks are made, the product should reflect these changes and update as soon as the developers are ready to distribute a new version.

ID# 15- Longevity

Description: The product and its associated system parts should be maintained occasionally for a long period of time as it is an education tool and a form of entertainment.

ID# 16- Access

Description: The developers should only be available to access feedback from the user through a website like Steam or the actual game website through reviews.

ID# 17- Integrity

Description: The app should be secure enough to protect itself from intentional abuse from any download, especially after any update since it has to connect to the internet to update.

ID# 18- Privacy

Description: The product would have a user's terms and conditions agreements that the user can read at any time.

ID# 19- Audit

Description: Audits have to account for paying for the product through an online store.

ID# 20- Immunity

Description: The product would be checked before any release if it could cause problems to users and their systems. The product would also be released on official online stores so there is no risk of viruses, worms, Trojan horses, etc.

ID# 21- Ease of Use

Description:

- **Efficiency of use:** Users will be able to use the product after connecting their system to VR. VR systems like HTC Vive may take some time to set up if you're not sure how to connect to VR.
- **Ease of remembering:** The user would get pretty familiar with the product if they played with it once since there aren't many settings and options to choose from. If the user has used the product before and wants to use it again later to view a new park, they should be able to remember methods to get there.
- **Error rates:** For some huge national parks that have multiple locations, graphics may take a while to load or possibly crash because there's heavy amounts of assets being loaded in. Fixing the graphics to use less memory can be a possible fix to have the product load faster, and less likely to crash.
- **Overall satisfaction in using the product:** Users would feel like they learned something new or feel happy like they've just experienced a trip to the national parks they selected.
- **Feedback:** Getting feedback from websites like Metacritic would help and help us improve on what we can do to make the product better and focus on areas that need some improvements.

ID# 22- Personalization

Description:

- **Languages, spelling preferences, and language idioms:** Users will be able to change to a few languages that are most common in the country, and if there are a large number of non-english users using the product, we may add in more languages for the user.
- **Currencies, including the symbols and decimal conventions:** Our market sellers will handle the currency exchanges if the user buys the game outside the United States.
- **Personal configuration options:** There will be a settings option for users to add their own personal preferences and cover most of configuration cases.

ID# 23- Learning

Description:

- If the user is using the game for the first time, they should be able to use the game and follow the walkthrough on how the product works when they first start the product. Setting up the VR system with the product may be a little complicated because there may be some computer settings the user may have that conflict with the VR system possibly, and it could cause problems.
- If the user forgets how the product works, they can look through the instructions option that will explain how the product works and can view the walkthrough again if they want to.

ID# 24- Understandability

Description: The user isn't expected to know much on how to use the product, but basic knowledge on what national parks or parts of the national park they would like to visit would be useful to make it easier for them to navigate through the product.

ID# 25- Accessibility

Description: The product may be difficult to use for people that are blind as it defeats the purpose of using VR to make it feel more realistic and the product mainly requires visual attention in order to use it.

ID# 26- User Documentation

Description: A user manual for learning how to use VR systems is provided to better understand VR, but most information about the game and how to use the product is given in the game.

ID# 27- Training

Description: The users are given a walkthrough of the product of how it works. There is an instructions option also on how the product works and they can review the walkthrough again if they want.

ID#28 -- Appearance

Description: The product shall be attractive to all ages.

ID#29 -- Authoritative Style

Description: The product shall appear authoritative.

ID#30 -- Open Space Environment

Description: The product shall be used in a quiet room with a big enough space for the user to move.

ID# 31-- Compatible VR headsets

Description: The product shall work with all current VR headsets.

ID#32-- Distribution

Description: The product shall be distributed as a ZIP file.

ID#33-- Installation

Description: The product shall be able to be installed by an untrained user without recourse to separately printed instructions

ID#34-- Release

Description: Each release shall not cause previous features to fail.

ID#35 - Culture

Description: The product shall not be offensive to any religious or ethnic group. None will be discriminated against while using this product.

ID#36 - Politics

Description: The product will not be associated with any political beliefs, and will solely run for the purpose of entertainment.

ID#37 - Compliance

Description: All personal information while using this product will be kept safe. Under no circumstance will personal information fall into the hands of others by the Terms and Service/Privacy Statement. You will never be prompted to input your personal info to use this product.

ID#38 - Standards

Description: The product shall follow and adhere to any and all company standards that use it, specifically software development standards.

III Design

22 Design Goals

The main goal for this project is to make the interactive maps as accurate as possible. The user should feel like they are actually at the national park they have chosen to experience virtually.

The system should have a place for the user to choose what they would like to do in the interactive park. The system should also have a friendly user interface, making it easy for the user to navigate throughout the application.

23 Current System Design

There is no pre-existing system.

24 Proposed System Design

24a Initial System Analysis and Class Identification

The needed classes for this system would be Interactive Maps, Play, and Database. The diagram for this can be seen in Figure 9.

24b Dynamic Modelling of Use-Cases

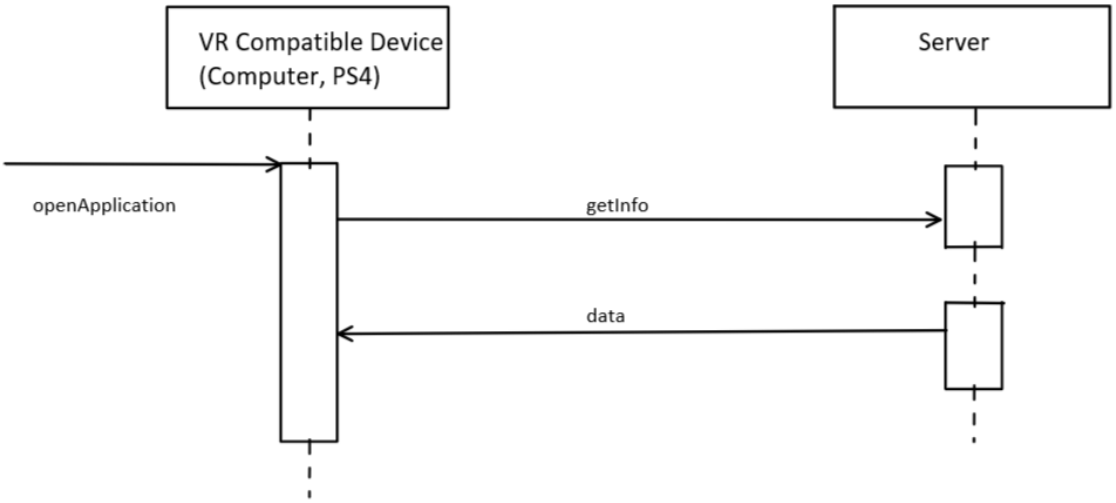

Figure 5 – Sequence Diagram of Use Case

24c Proposed System Architecture

The Software Architecture to be applied to this project is Client-Server. The server hosts, delivers and manages most of the resources and services to be consumed by the client. In this particular project, the system will have the database for all the interactive maps, while the client can see the interactive maps on their end but have to play to learn all the information.

24d Initial Subsystem Decomposition

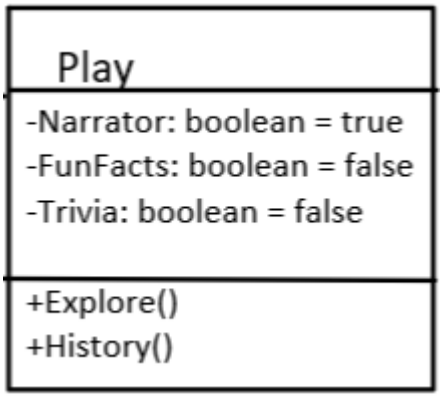

Figure 6 – Subsystem Diagram

25 Additional Design Considerations

25a Hardware / Software Mapping

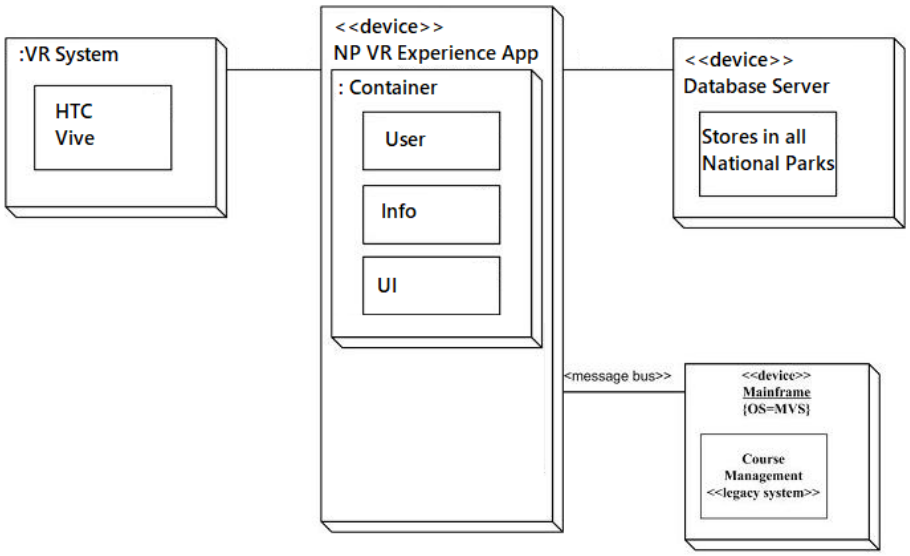

Figure 7 – Deployment diagram to show what's mapped into the hardware

Software and hardware mapping will be handled by the gaming system and VR devices.

25b Persistent Data Management

When the system shuts down, the user will be able to have their data restored whenever they start the system back up. Some of the data that will be restored:

- User Preferences
- Search history
- Previous national park and location of the park the player visited

25c Access Control and Security

Actor/Objects	User	System
User	getUserSettings()	user FirstName user LastName user Settings username/password
HTC Vive	isDisplay() isSounds()	Display Sounds

Display	isDisplay() getMenu() updateAll()	National Park maps
Sensors	retrieveData() getLocation() sendData()	Location of national parks

Table 3 – Access Control and Security

25d Global Software Control

Not Applicable.

25e Boundary Conditions

Some of the boundary condition concerns for this system are the startup, shutdown, creation of databases, and error behaviors. Some of these boundary conditions such as startup and shutdown are taken care of in the requirements section. There needs to be a database for every national park's information stored, and error behaviors to monitor the system.

25f User Interface

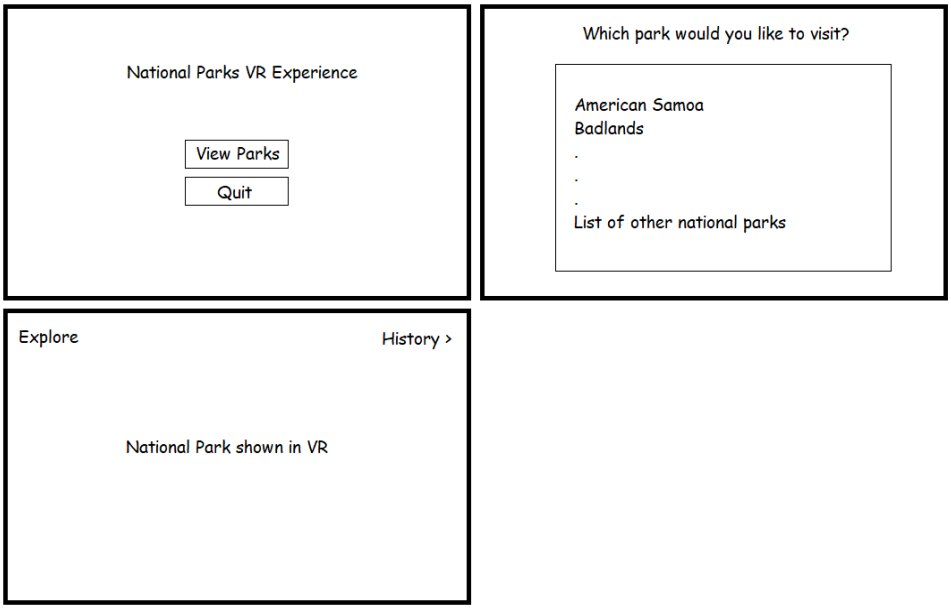

Figure 8 – Main menu, menu after clicking View Parks, and national park UI shown in VR

25g Application of Design Patterns

Some of the design patterns we used may be MVC and Composite. MVC is used for the VR mechanics and menus. while Composite is used for our other functions such as displaying history, explore option, and narrator.

26 Final System Design

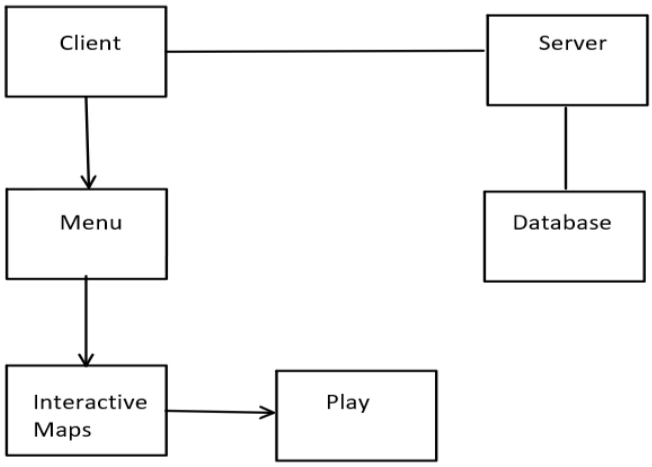

Figure 9 – Overall System Design

27 Object Design

27a Packages

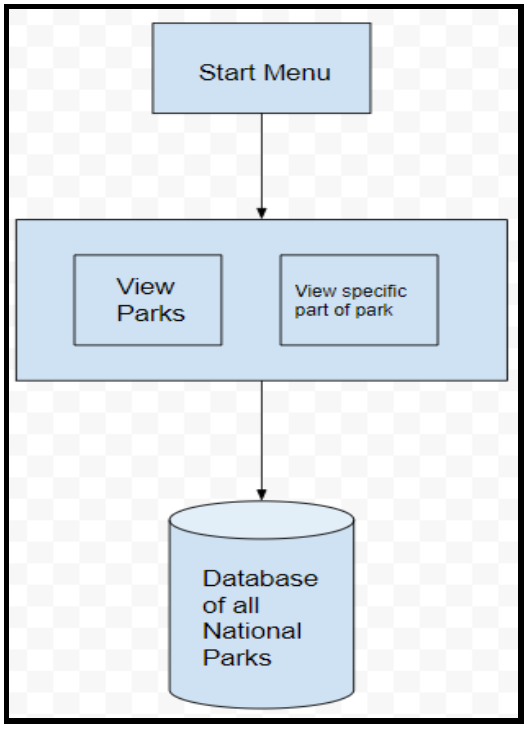

Figure 10 – What the package overview will look like for our application

27b Subsystem I

Not applicable.

27c Subsystem II

Not applicable.

27d etc.

Not applicable.

IV Project Issues

28 Open Issues

Updated hardware and software, whether it be operating systems or virtual reality systems, could possibly lead to problems with the game running.

New virtual reality devices are being made and it is possible that our current resources for making the game would make it difficult to port to other devices.

29 Off-the-Shelf Solutions

29a Ready-Made Products

Unless the technology of virtual reality changes completely overnight, we can use any available headset as a starting point for possible ports. Our current resources allow compatibility for most virtual devices and are open source (specifically, the Virtual Reality Toolkit). If there are any new devices on the market, then we can just develop the VRTK code to allow usage.

29b Reusable Components

The Virtual Reality Toolkit is already a good starting point for developing with virtual reality within Unity. It's convenient that the VRTK is open source. If there are new devices available on the market, we can buy them and develop the code to work with them.

29c Products That Can Be Copied

The VRTK is open source, so we can use the code from it and develop it to improve features.

30 New Problems

30a Effects on the Current Environment

Users must be aware of their surroundings as using VR could lead to unintentional accidents. We don't want any destruction of property issues, so we want to make sure users should have a clear playing area so they do not bump into things.

30b Effects on the Installed Systems

We have to make sure any assets that we use in the game do not take up a lot of space within the user's computer system. If they do take up a lot of space, then we must routinely clean out assets that are not in use.

30c Potential User Problems

With virtual reality, users will sometimes experience motion sickness due to wearing the headset. We would recommend that users understand that the VR environments can be disorienting to some and that they should respond appropriately if they get nauseous or sick.

30d Limitations in the Anticipated Implementation Environment That May Inhibit the New Product

The game must run on the minimum requirements for the virtual reality devices. For example, the Oculus Rift requires the OS be 64-bit Windows 10, an Intel Core i3-6100 or greater, 8GB of RAM, and the GPU be NVIDIA GeForce GTX 1050Ti.

30e Follow-Up Problems

Not applicable.

31 Migration to the New Product

Not applicable.

32 Risks

Any glitches or bugs in any part of the game can ruin game experience for the user as well as ruin other parts of the game along with those afflicted with the bug or glitch. Problems in users' game systems or VR devices can render the entire game useless and unable to be played. Any faults in the users devices that can make the game unbearable to play such as sound crashes or overheating of the VR device must be kept to a minimum.

33 Costs

$500,000 for total game cost including development, testing, advertising, servers, and then updates and such and maintenance of the game. We would calculate the total amount of dollars as well as time that people must put forth to get the product up and running. Creating and shipping everything out would take a chunk of the budget and hiring game testers and creators would take a decent amount of time as well.

34 Waiting Room

- More interactive maps -- all national resources rather than just parks.
- More options on how to play for the user.
- Different types of weather scenarios in the interactive maps.

35 Ideas for Solutions

Game systems or VR device issues won't be able to be solved by us since we aren't the creators for those devices. However, we can provide troubleshoot instructions in case there are problems with those devices.

There should be periodic updates to the application itself to fix any bug issues or glitches within the application. Visuals for the national parks will also get updated frequently to keep up how these places look currently in real time.

36 Project Retrospective

Things that worked out - The group worked very well with each other, planned things accordingly, split sections off and everyone did their fair share of work. The communication was astonishing even with the outbreak of the Covid-19. Although some work was hindered like meeting up to discuss the next plan of action, transferring discussions through online applications worked very well.

Things that could be improved on in the future -The entire document was completed to the best of the group's ability, and some sections could have been altered or done differently to better improve on the final documentation. Some sections didn't cover the full detail and effectiveness of this project, but overall, the group did as well as they could with what they had. Your text goes here . . .

V Glossary

VR - Virtual Reality

VRTK - Virtual Reality Toolkit

Application - the program/game we are making

Unity - the game engine used for this game

VI References / Bibliography

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[2] A. Silberschatz, P. B. Galvin and G. Gagne, Operating System Concepts, Ninth ed., Wiley, 2013.

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