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| --- |
| Oculus RC Buggy |
| Submitted By: Jack Sanchez |
| Submitted To: Calvin Caldwell |
| E-mail: jack.sanchez@oit.edu |
| Date: Tuesday, Oct 21st 2014 |
| Version: 1.0 |
| Responsible Analyst: Jack Sanchez |
|  |
|  |

# 1.0 Signatory Page\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Submitted By: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_

Company: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Job Title: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Approved By: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_

Company: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Job Title: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# 2.0 Revision History\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Author** | **Company** | **Version** | **Date** | **File Name** | **Comments** |
| J. Sanchez | OculusRC | <0.1> | Oct 22, 2014 | UseCaseModel.docx | Initial Use Case Model |
| J. Sanchez | OculusRC | <0.5> | Oct 27, 2014 | UseCaseModel.docx | Use Case Model Update |
| J. Sanchez | OculusRC | <0.7> | Oct 28, 2014 | UseCaseModel.docx | Use Case Model Update |

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[8.7 Use Case 007 – Connect Oculus Rift\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 26](#_Toc402255112)

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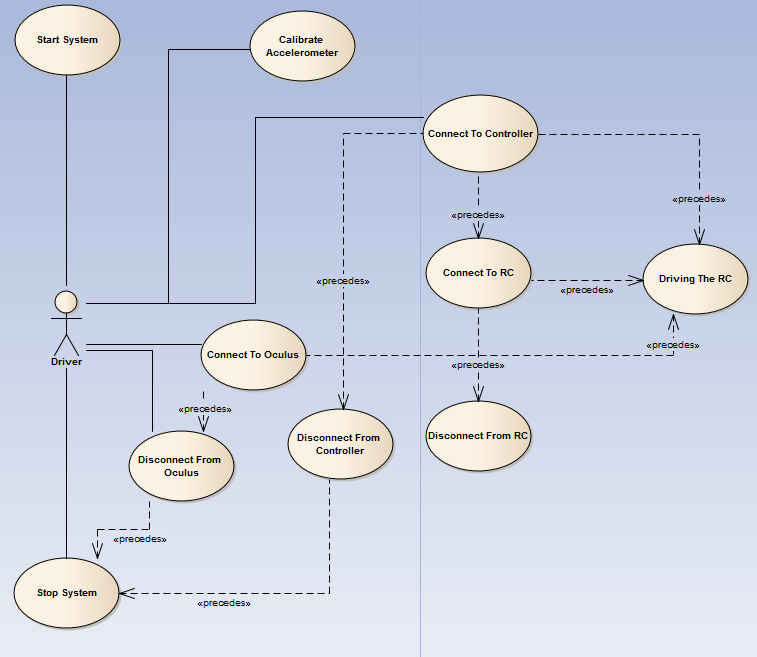
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# 4.0 Context Diagram\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



# 5.0 Use Case Catalog\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| --- | --- | --- |
| **ID** | **Name** | **Description** |
| 001 | Driving the RC | User is actively driving the RC car |
| 002 | Calibrate Accelerometer | User zeros out the sensor reading |
| 003 | System Start | User starts the system |
| 004 | System Stop | User turns off the system |
| 005 | Connect Xbox Steering Wheel | User connects the steering wheel controller |
| 006 | Disconnect Xbox Steering Wheel | User disconnects the steering wheel controller |
| 007 | Connect Oculus Rift | User connects the Oculus Rift head mounted display |
| 008 | Disconnect Oculus Rift | User disconnects the Oculus Rift |
| 009 | Connect to RC | User connects client system to the server system on the RC car |
| 010 | Disconnect from RC | User disconnects the client system from the server system |

# 6.0 Actor Catalog\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |
| --- | --- | --- |
| **Name** | **Type** | **Description** |
| Driver | Person | This is the sole user of the system and their main function is to operate the RC car remote system using a steering wheel and an Oculus Rift |

# 7.0 Features Verification Matrix\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| --- | --- | --- |
| **Feature #’s** | **Use Case ID** | **Use Case Name** |
| **1, 2, 3, 4** | 001 | Driving the RC |
| **1.3,1.4,1.8,4.4** | 002 | Calibrate Accelerometer |
| **1, 3, 4** | 003 | System Start |
| **1, 2, 3, 4** | 004 | System Stop |
| **2.4, 2.5** | 005 | Connect Xbox Steering Wheel |
| **2.4, 2.5** | 006 | Disconnect Xbox Steering Wheel |
| **3.8** | 007 | Connect Oculus Rift |
| **3.8** | 008 | Disconnect Oculus Rift |
| **1, 2, 3, 4** | 009 | Connect to RC |
| **1, 2, 3, 4** | 010 | Disconnect from RC |

# 8.0 Use Case Specifications\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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# 8.1 Use Case 001 – Driving the RC\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| General Information | |
| Use Case Name\Number : 001  Subject Area : RC Car Driving  Description : User wants to drive the RC Car | Responsible Analyst : Sanchez |

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| --- | --- |
| **Requirements/Feature Trace** | |
| **REQ#** | **Requirements Name and / or Short Description** |
| 1 | This use case traces to the full Network section, driving the RC utilizes all networking components |
| 2 | This use case traces to each controller requirement |
| 3 | This use case traces to each video requirement |
| 4 | This use case traces to each sensor requirement |

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| --- | --- | --- |
| **Revision History** | | |
| **Author** | **Date** | **Comments** |
| Sanchez | 10/15/14 | Initial draft of first use case |
| Sanchez | 10/27/14 | Revising draft of use case |
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| **Insertion Points in other Use Cases** | | |
| **Use Case Name** | **Use Case Number** | **Step Inserted After** |
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| **Actors** | | |
| **Actor Name** | **Person/System** | **Brief Description** |
| Driver | Person | The driver is the user who controls the RC car |
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| **Pre-Conditions** | |
| # | Description |
| 1 | RC Car server system is properly connected |
| 2 | Oculus Rift is connected to the client PC system |
| 3 | Xbox controller is properly connected to the client PC system |
| 4 | A wireless connection exists within the vicinity |
| 5 | The system has been started |

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| **Start Stimulus** |
| The user initiates all systems and begins the connection to the RC from the client station |

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| **Use Case Main Course Steps** | | | | | |
| **Number** | **Description** | | **Adds/Alt Name/Number** | **Bus Rule#** | |
| 1 | System displays ready screen | |  |  | |
| 2 | User presses the Start Driving button | |  |  | |
| 3 | System begins wireless connections | |  |  | |
| 4 | System begins camera stream | |  |  | |
| 5 | System begins controller stream | |  |  | |
| 6 | System begins sensor stream | |  |  | |
| 7 | System prompts user to put on Oculus Rift headset | |  |  | |
| 8 | User puts on Oculus Rift headset | |  |  | |
| 9 | System prompts user ready to drive | |  |  | |
| 10 | User begins driving RC | |  |  | |
|  |  | |  |  | |
| **Exception Conditions** | | | | | |
| **Exception Situations** | | **Action(s) on Exception** | | | **Adds\Alt UC #** |
| RC unexpectedly disconnects | | Attempt an auto-reconnect with a 60 second timeout, suggest options to user if timeout occurs | | |  |
| Steering wheel unexpectedly disconnects | | Prompt the user to check batteries and controller wires, offer Retry and Cancel options to user for reconnection test | | |  |
| Oculus has no image | | Prompt user to check all connections, check Oculus display mode, and system monitor configurations, offer Show Demo Scene button | | |  |
| All connections good, but no RC response from controls | | Server checks if controller daemon is running on client and server, if running prompt user to check wire connections | | |  |

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| **Post-Conditions** | |
| **#** | **Description** |
| 1 | User is driving the RC car |
| 2 | User sees the live feed through the Oculus Rift head mounted display |

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| **Candidate Objects** | | |
| **Class/Object Name** | **Descriptions** | **Possible**  **attributes** |
| RCCar | Client interface to the control of the RC car | Speed, steering angle |
| ConnectionManager | Handles the high-level aspects of client/server networking | ClientSocket, VideoStream, ControlStream |
| OculusManager | Controls, manipulates, and displays the video feed to the Rift | LeftEyeStream, RightEyeStream |
| ApplicationManager | Maintains the lifecycle of the business managers through the application | OculusManager, ConnectionManager, RCCar |

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| **Assumptions** | | | | | |
| **#** | **Assumption** | **Date**  **Raised** | **Raised**  **By** | **Date**  **Verified** | **Verified By** |
| 1 | User can operate a standard motor vehicle | 10/27/14 | Sanchez | 10/27/14 | Sanchez |
| 2 | User is over the recommended age for Virtual Reality viewing | 10/27/14 | Sanchez | 10/27/14 | Sanchez |
| 3 | Server system is in good working condition | 10/27/14 | Sanchez | 10/27/14 | Sanchez |
| 4 | RC Car is in good working condition | 10/27/14 | Sanchez | 10/27/14 | Sanchez |

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| **Issues** | | | | | |
| **#** | **Issue** | **Date**  **Raised** | **Raised**  **By** | **Date**  **Verified** | **Verified By** |
| 1 | Video stream may have high latency/delay | 10/27/14 | Sanchez |  |  |
| 2 | Video and control streams may not be synchronized | 10/27/14 | Sanchez |  |  |
| 3 | User may be adversely affected by the Oculus Rift | 10/27/14 | Sanchez |  |  |
| 4 | Network video stream will be affected by packet loss, causing video hiccup | 10/27/14 | Sanchez |  |  |
| 5 | Camera feeds may desync | 10/27/14 | Sanchez |  |  |

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| **Other Comments** | | |
| **Author** | **Comment** | **Date** |
| Sanchez | Project has multiple research issues remaining | 10/27/14 |
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| **Frequency of Execution** |
| **Frequency:**  2 Minimum: 1 Maximum: 3 Average: 2 (OR)Fixed:  **Per:** Hour:Day:  Week:  Month:  Other: |

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| **Timing Information** | | | | | | | |
| **#** | **At/**  **Between** | **Step(s)** | **Timing**  **Unit** | **Minimum** | **Average** | **Maximum** | **Comments** |
| 1 | At | 3 | ms | 250 | 250 | 500 | Initial connection sync |
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| **Volume Information** | | | | | | |
| **#** | **Step #** | **Unit of**  **Measure** | **Minimum** | **Average** | **Maximum** | **Comments** |
| 1 | 3 | Bytes | 100 | 500 | 1000 | Handshake communication |
| 2 | 4 | Kilobytes | 800 | 1200 | 2000 | Video frame data stream(x2) |
| 3 | 5 | Bytes | 50 | 100 | 250 | RC Car control data stream |
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# 8.2 Use Case 002 – Calibrate Accelerometer\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| **General Information** | |
| Use Case Name\Number : 002  Subject Area : RC Car Sensors  Description : User calibrates the accelerometer sensor | Responsible Analyst :Sanchez |

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| **Requirements/Feature Trace** | |
| **REQ#** | **Requirements Name and / or Short Description** |
| 1.3, 1.4 | System shall reset the sensor via wireless network |
| 4.1 | System shall gather the sensor readings to verify it has been calibrated |
| 4.4 | The actual requirement related to zeroing the accelerometer |
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| **Revision History** | | |
| **Author** | **Date** | **Comments** |
| Sanchez | 10/28/14 | Initial draft of use case |
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| **Insertion Points in other Use Cases** | | |
| **Use Case Name** | **Use Case Number** | **Step Inserted After** |
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| **Actors** | | |
| **Actor Name** | **Person/System** | **Brief Description** |
| Driver | Person | The driver should reset the accelerometer before driving |
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| **Pre-Conditions** | |
| # | Description |
| 1 | Client system has network access to the RC server system |
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| **Start Stimulus** |
| User runs the client application and wants to calibrate the accelerometer before driving the RC |

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| **Use Case Main Course Steps** | | | |
| **Number** | **Description** | **Adds/Alt Name/Number** | **Bus Rule#** |
| 1 | User selects Calibrate Sensors option |  |  |
| 2 | System presents calibration menu |  |  |
| 3 | User selects accelerometer |  |  |
| 4 | System presents accelerometer calibration menu, containing an inertial graph |  |  |
| 5 | User sets zero position once the RC car has been positionally stabilized |  |  |
| 6 | System sends zero signal to accelerometer |  |  |
| 7 | System displays success dialog and shows inertial graph with a “zeroed” position |  |  |

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| **Exception Conditions** | | |
| **Exception Situations** | **Action(s) on Exception** | **Adds\Alt UC #** |
| Accelerometer reset failure | System prompts user of failure and retries command, if secondary failure occurs, system prompts user to check connections |  |

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| **Post-Conditions** | |
| **#** | **Description** |
| 1 | Accelerometer has been calibrated |
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| **Candidate Objects** | | |
| **Class/Object Name** | **Descriptions** | **Possible**  **attributes** |
| InertialSensor | Sensor object interface | Value, Offset, Pin |
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| **Assumptions** | | | | | |
| **#** | **Assumption** | **Date**  **Raised** | **Raised**  **By** | **Date**  **Verified** | **Verified By** |
| 1 | System has proper connection to sensor | 10/28/14 | Sanchez | 10/28/14 | Sanchez |
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| **Issues** | | | | | |
| **#** | **Issue** | **Date**  **Raised** | **Raised**  **By** | **Date**  **Verified** | **Verified By** |
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| **Other Comments** | | |
| **Author** | **Comment** | **Date** |
| Sanchez | This use case scenario should be trivial | 10/28/14 |
|  |  |  |

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| **Frequency of Execution** |
| **Frequency:**  1 Minimum: 1 Maximum: 1 Average: 1 (OR)Fixed:  **Per:** Hour:Day:  Week:  Month:  Other: System Use |

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| **Timing Information** | | | | | | | |
| **#** | **At/**  **Between** | **Step(s)** | **Timing**  **Unit** | **Minimum** | **Average** | **Maximum** | **Comments** |
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| **Volume Information** | | | | | | |
| **#** | **Step #** | **Unit of**  **Measure** | **Minimum** | **Average** | **Maximum** | **Comments** |
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# 8.3 Use Case 003 – System Start\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| **General Information** | |
| Use Case Name\Number : 003  Subject Area : System Startup  Description : User starts system | Responsible Analyst : Sanchez |

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| **Requirements/Feature Trace** | |
| **REQ#** | **Requirements Name and / or Short Description** |
| 1 | The system checks and initializes all wireless networking components |
| 3 | The system begins the wireless video stream and synchronizes the client/server connection |
| 4 | The system initializes the sensor system |
|  |  |

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| **Revision History** | | |
| **Author** | **Date** | **Comments** |
| Sanchez | 10/28/14 | Initial use case draft |
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| **Insertion Points in other Use Cases** | | |
| **Use Case Name** | **Use Case Number** | **Step Inserted After** |
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| **Actors** | | |
| **Actor Name** | **Person/System** | **Brief Description** |
| Driver | Person | The sole actor of the system |
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| **Pre-Conditions** | |
| # | Description |
| 1 | The system is not already running |

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| **Start Stimulus** |
| User wants to begin using the system |

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| **Use Case Main Course Steps** | | | |
| **Number** | **Description** | **Adds/Alt Name/Number** | **Bus Rule#** |
| 1 | User starts client system application |  |  |
| 2 | System prepares network systems |  |  |
| 3 | System initializes video systems |  |  |
| 4 | System initializes controller systems |  |  |
| 5 | System displays ready screen |  |  |

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| **Exception Conditions** | | |
| **Exception Situations** | **Action(s) on Exception** | **Adds\Alt UC #** |
| Initialization Exception | System shall alert user if any initializing step returns a failure, system presents component failure prompt |  |

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| **Post-Conditions** | |
| **#** | **Description** |
| 1 | System has started |
| 2 | System has initialized |
| 3 | System is waiting on user interaction |

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| **Candidate Objects** | | |
| **Class/Object Name** | **Descriptions** | **Possible**  **attributes** |
| ApplicationManager | Maintains lifecycle of entire application | OculusManager, ConnectionManager, RCCar, ControllerManager |
| ConnectionManager | Provides the interface for the ApplicationManager to handle all network communications | ClientSocket, VideoStream, ControlStream |
| OculusManager | Controls, manipulates, and displays the video feed to the Rift | LeftEyeStream, RightEyeStream |
| RCCar | Client interface to the control of the RC car | Speed, steering angle |
| InertialSensor | Accelerometer sensor interface | Value, Offset, Pin |

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| **Assumptions** | | | | | |
| **#** | **Assumption** | **Date**  **Raised** | **Raised**  **By** | **Date**  **Verified** | **Verified By** |
| 1 | System is assembled | 10/28/14 | Sanchez | 10/28/14 | Sanchez |
| 2 | System is offline | 10/28/14 | Sanchez | 10/28/14 | Sanchez |
| 3 | User wants to use the system | 10/28/14 | Sanchez | 10/28/14 | Sanchez |

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| **Issues** | | | | | |
| **#** | **Issue** | **Date**  **Raised** | **Raised**  **By** | **Date**  **Verified** | **Verified By** |
| 1 | Starting this system requires a fair amount of technical skill | 10/28/14 | Sanchez |  |  |
| 2 | Starting the system requires the proper, specific configuration | 10/28/14 | Sanchez |  |  |

|  |  |  |
| --- | --- | --- |
| **Other Comments** | | |
| **Author** | **Comment** | **Date** |
| Sanchez | The system should be synchronized on startup | 10/28/14 |
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| **Frequency of Execution** |
| **Frequency:**  2 Minimum: 1 Maximum: 3 Average: 2 (OR)Fixed:  **Per:** Hour:Day:  Week:  Month:  Other: |

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| **Timing Information** | | | | | | | |
| **#** | **At/**  **Between** | **Step(s)** | **Timing**  **Unit** | **Minimum** | **Average** | **Maximum** | **Comments** |
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| **Volume Information** | | | | | | |
| **#** | **Step #** | **Unit of**  **Measure** | **Minimum** | **Average** | **Maximum** | **Comments** |
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# 8.4 Use Case 004 – System Stop\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| **General Information** | |
| Use Case Name\Number : 004  Subject Area : System Stop  Description : User stops system | Responsible Analyst : Sanchez |

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| --- | --- |
| **Requirements/Feature Trace** | |
| **REQ#** | **Requirements Name and / or Short Description** |
| 1 | The system closes and cleans up all wireless networking components |
| 2 | The system closes and cleans up all controller systems |
| 3 | The system closes and cleans up all video and Oculus components |
| 4 | The system closes and cleans up all sensor system components |

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| --- | --- | --- |
| **Revision History** | | |
| **Author** | **Date** | **Comments** |
| Sanchez | 10/28/14 | Initial draft of system stop use case |
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| **Insertion Points in other Use Cases** | | |
| **Use Case Name** | **Use Case Number** | **Step Inserted After** |
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| **Actors** | | |
| **Actor Name** | **Person/System** | **Brief Description** |
| Driver | Person | User wishes to stop using the system |
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| **Pre-Conditions** | |
| # | Description |
| 1 | The system was running |
| 2 | The user wishes to stop using the system |

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| --- |
| **Start Stimulus** |
| The user selects the System Stop function |

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| **Use Case Main Course Steps** | | | |
| **Number** | **Description** | **Adds/Alt Name/Number** | **Bus Rule#** |
| 1 | User initiates stop procedure |  |  |
| 2 | System closes sensor stream |  |  |
| 3 | System closes video stream |  |  |
| 4 | System closes controller stream |  |  |
| 5 | System closes network sockets |  |  |
| 6 | System cleans up Oculus Rift handles |  |  |
| 7 | System cleans up server resources |  |  |
| 8 | System cleans up client resources |  |  |
| 9 | System prompts user on success |  |  |
| 10 | User acknowledges success dialog |  |  |
| 11 | User closes application |  |  |

|  |  |  |
| --- | --- | --- |
| **Exception Conditions** | | |
| **Exception Situations** | **Action(s) on Exception** | **Adds\Alt UC #** |
| Resource fails to release | System attempts to clean up connections in correct dependency order, if it fails, prompt user that resource handles are locked |  |

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| **Post-Conditions** | |
| **#** | **Description** |
| 1 | Network connections have been closed |
| 2 | All resources have been freed |
| 3 | System is off |

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| **Candidate Objects** | | |
| **Class/Object Name** | **Descriptions** | **Possible**  **attributes** |
| ApplicationManager | Encapsulates the application cleanup code for client and server | OculusManager, ConnectionManager, RCCar, ControllerManager |
| ConnectionManager | Encapsulates the network cleanup code for client and server | ClientSocket, VideoStream, ControlStream, ServerSocket |
| OculusManager | Encapsulates Oculus Rift resource handles and cleanup code | LeftEyeStream, RightEyeStream, OculusHandle |
| RCCar | Encapsulates RC Car resources | Speed, steering angle, RCHandle |
| InertialSensor | Accelerometer sensor interface | Value, Offset, Pin |

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| **Assumptions** | | | | | |
| **#** | **Assumption** | **Date**  **Raised** | **Raised**  **By** | **Date**  **Verified** | **Verified By** |
| 1 | Cleanup occurs without incident | 10/28/14 | Sanchez | 10/28/14 | Sanchez |
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| **Issues** | | | | | |
| **#** | **Issue** | **Date**  **Raised** | **Raised**  **By** | **Date**  **Verified** | **Verified By** |
| 1 | Operating system could have runtime malfunction causing an invalid memory exception | 10/28/14 | Sanchez |  |  |
|  |  |  |  |  |  |

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| --- | --- | --- |
| **Other Comments** | | |
| **Author** | **Comment** | **Date** |
| Sanchez | 99% of the time, there won’t be any shutdown memory violations | 10/28/14 |
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| **Frequency of Execution** |
| **Frequency:**  Minimum: Maximum: Average: (OR)Fixed:  **Per:** Hour:Day:  Week:  Month:  Other: Paired to System Start use case |

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| **Timing Information** | | | | | | | |
| **#** | **At/**  **Between** | **Step(s)** | **Timing**  **Unit** | **Minimum** | **Average** | **Maximum** | **Comments** |
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| **Volume Information** | | | | | | |
| **#** | **Step #** | **Unit of**  **Measure** | **Minimum** | **Average** | **Maximum** | **Comments** |
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# 8.5 Use Case 005 – Connect Xbox Steering Wheel\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| --- | --- |
| **General Information** | |
| Use Case Name\Number : 005  Subject Area : Controller Connection  Description : User is connecting the controller | Responsible Analyst : Sanchez |

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| **Requirements/Feature Trace** | |
| **REQ#** | **Requirements Name and / or Short Description** |
| 2.4 | System interface for converting controller signals to servo and motor signals from server system |
| 2.5 | System interface for collecting controller signals from the client system |
|  |  |
|  |  |

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| --- | --- | --- |
| **Revision History** | | |
| **Author** | **Date** | **Comments** |
| Sanchez | 10/28/14 | Initial draft of use case |
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| **Insertion Points in other Use Cases** | | |
| **Use Case Name** | **Use Case Number** | **Step Inserted After** |
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| **Actors** | | |
| **Actor Name** | **Person/System** | **Brief Description** |
| Driver | Person | The driver needs to connect the controller to use it |
|  |  |  |
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| --- | --- |
| **Pre-Conditions** | |
| # | Description |
| 1 | Controller is not previously connected |
| 2 | User has the required Microsoft Wireless Adapter and correct Windows drivers |

|  |
| --- |
| **Start Stimulus** |
| User wants to use the controller |

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| **Use Case Main Course Steps** | | | |
| **Number** | **Description** | **Adds/Alt Name/Number** | **Bus Rule#** |
| 1 | User plugs in Microsoft Wireless Adapter |  |  |
| 2 | User powers on the Xbox Steering Wheel |  |  |
| 3 | System notifies user the controller is connected |  |  |

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| --- | --- | --- |
| **Exception Conditions** | | |
| **Exception Situations** | **Action(s) on Exception** | **Adds\Alt UC #** |
| Adapter and Controller pairing issue | Prompt user to unplug the Microsoft Wireless Adapter and plug it back in, then to power on the controller again |  |

|  |  |
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| **Post-Conditions** | |
| **#** | **Description** |
| 1 | System recognizes Xbox Steering Wheel controller |
| 2 | Controller is hooked up and ready to go |

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| **Candidate Objects** | | |
| **Class/Object Name** | **Descriptions** | **Possible**  **attributes** |
| XInputManager | Manages the driver level communication to the controller | ControllerHandle, Controller |
| Controller | Data object which reflects the current controller state | ButtonA, ButtonX, ButtonY, ButtonB, LeftBumper, LeftTrigger, RightBumper, RightTrigger, LeftJoystick |

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| **Assumptions** | | | | | |
| **#** | **Assumption** | **Date**  **Raised** | **Raised**  **By** | **Date**  **Verified** | **Verified By** |
| 1 | User understands how to connect the steering wheel controller | 10/28/14 | Sanchez | 10/28/14 | Sanchez |
| 2 | User has pre-installed the Microsoft Wireless Adapter drivers | 10/28/14 | Sanchez | 10/28/14 | Sanchez |

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| **Issues** | | | | | |
| **#** | **Issue** | **Date**  **Raised** | **Raised**  **By** | **Date**  **Verified** | **Verified By** |
| 1 | Occasionally the controller does not pair to the adapter immediately | 10/28/14 | Sanchez |  |  |
|  |  |  |  |  |  |

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| --- | --- | --- |
| **Other Comments** | | |
| **Author** | **Comment** | **Date** |
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| **Frequency of Execution** |
| **Frequency:**  Minimum: Maximum: Average: (OR)Fixed:  **Per:** Hour:Day:  Week:  Month:  Other: Tied to Use Case 003 |

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| **Timing Information** | | | | | | | |
| **#** | **At/**  **Between** | **Step(s)** | **Timing**  **Unit** | **Minimum** | **Average** | **Maximum** | **Comments** |
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| **Volume Information** | | | | | | |
| **#** | **Step #** | **Unit of**  **Measure** | **Minimum** | **Average** | **Maximum** | **Comments** |
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# 8.6 Use Case 006 – Disconnect Xbox Steering Wheel\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| **General Information** | |
| Use Case Name\Number : 006  Subject Area : Controller Connection  Description : User is disconnecting the controller | Responsible Analyst : Sanchez |

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| **Requirements/Feature Trace** | |
| **REQ#** | **Requirements Name and / or Short Description** |
| 2.4 | The server application will set the RC signals to zero when the controller is disconnected |
| 2.5 | The client application will register controller disconnection through the XInput API |
|  |  |
|  |  |

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| --- | --- | --- |
| **Revision History** | | |
| **Author** | **Date** | **Comments** |
| Sanchez | 10/28/14 | Initial draft of use case |
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| **Insertion Points in other Use Cases** | | |
| **Use Case Name** | **Use Case Number** | **Step Inserted After** |
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| --- | --- | --- |
| **Actors** | | |
| **Actor Name** | **Person/System** | **Brief Description** |
| Driver | Person | Driver will disconnect controller when done with system |
|  |  |  |
|  |  |  |

|  |  |
| --- | --- |
| **Pre-Conditions** | |
| # | Description |
| 1 | The controller had previously been connected |

|  |
| --- |
| **Start Stimulus** |
| The driver has elected to disconnect the controller |

|  |  |  |  |
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| **Use Case Main Course Steps** | | | |
| **Number** | **Description** | **Adds/Alt Name/Number** | **Bus Rule#** |
| 1 | User disconnects the controller |  |  |
| 2 | System cleans up controller resources |  |  |
| 3 | User turns off and unplugs the controller |  |  |

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| **Exception Conditions** | | |
| **Exception Situations** | **Action(s) on Exception** | **Adds\Alt UC #** |
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| **Post-Conditions** | |
| **#** | **Description** |
| 1 | The system is offline |
| 2 | The controller is disconnected |

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| **Candidate Objects** | | |
| **Class/Object Name** | **Descriptions** | **Possible**  **attributes** |
| XInput | The interface to communicate with the controller |  |
| Controller | The program model of the controller |  |

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| **Assumptions** | | | | | |
| **#** | **Assumption** | **Date**  **Raised** | **Raised**  **By** | **Date**  **Verified** | **Verified By** |
| 1 | The controller is functioning properly | 10/28/14 | Sanchez | 10/28/14 | Sanchez |
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| **Issues** | | | | | |
| **#** | **Issue** | **Date**  **Raised** | **Raised**  **By** | **Date**  **Verified** | **Verified By** |
| 1 | Unplugging before system shutdown, application must handle this case | 10/28/14 | Sanchez |  |  |
|  |  |  |  |  |  |

|  |  |  |
| --- | --- | --- |
| **Other Comments** | | |
| **Author** | **Comment** | **Date** |
| Sanchez | Controller disconnection should be trivial | 10/28/14 |
|  |  |  |

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| --- |
| **Frequency of Execution** |
| **Frequency:**  Minimum: Maximum: Average: (OR)Fixed:  **Per:** Hour:Day:  Week:  Month:  Other: Tied to system shutdown |

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| **Timing Information** | | | | | | | |
| **#** | **At/**  **Between** | **Step(s)** | **Timing**  **Unit** | **Minimum** | **Average** | **Maximum** | **Comments** |
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| **Volume Information** | | | | | | |
| **#** | **Step #** | **Unit of**  **Measure** | **Minimum** | **Average** | **Maximum** | **Comments** |
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# 8.7 Use Case 007 – Connect Oculus Rift\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| **General Information** | |
| Use Case Name\Number : 007  Subject Area : Oculus Rift Connection  Description : User connects the Oculus Rift device | Responsible Analyst : Sanchez |

|  |  |
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| **Requirements/Feature Trace** | |
| **REQ#** | **Requirements Name and / or Short Description** |
| 3.8 | Once connected, video will be displayed on Oculus Rift device |
|  |  |
|  |  |
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| --- | --- | --- |
| **Revision History** | | |
| **Author** | **Date** | **Comments** |
| Sanchez | 10/28/14 | Initial draft of use case |
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| **Insertion Points in other Use Cases** | | |
| **Use Case Name** | **Use Case Number** | **Step Inserted After** |
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| --- | --- | --- |
| **Actors** | | |
| **Actor Name** | **Person/System** | **Brief Description** |
| Driver | Person | Driver is connecting the Oculus head mounted display |
|  |  |  |
|  |  |  |

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| --- | --- |
| **Pre-Conditions** | |
| # | Description |
| 1 | The Oculus Rift is not already connected |

|  |
| --- |
| **Start Stimulus** |
| User is setting up the system and needs to connect the Oculus device |

|  |  |  |  |
| --- | --- | --- | --- |
| **Use Case Main Course Steps** | | | |
| **Number** | **Description** | **Adds/Alt Name/Number** | **Bus Rule#** |
| 1 | User plugs in the Oculus Rift device |  |  |
| 2 | User toggles the Oculus connection button |  |  |
| 3 | System notifies user the Oculus Rift is connected |  |  |

|  |  |  |
| --- | --- | --- |
| **Exception Conditions** | | |
| **Exception Situations** | **Action(s) on Exception** | **Adds\Alt UC #** |
| Oculus Runtime is not running | Attempt to restart the Oculus Runtime program, prompt user on failure to reboot computer |  |

|  |  |
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| **Post-Conditions** | |
| **#** | **Description** |
| 1 | Oculus Rift is connected and ready to use |
| 2 | System recognizes the Oculus Rift |

|  |  |  |
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| **Candidate Objects** | | |
| **Class/Object Name** | **Descriptions** | **Possible**  **attributes** |
| OculusManager | The object that maintains the lifecycle of the Oculus Rift device | OculusHandle, QuanternionOreientation |
|  |  |  |

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| **Assumptions** | | | | | |
| **#** | **Assumption** | **Date**  **Raised** | **Raised**  **By** | **Date**  **Verified** | **Verified By** |
| 1 | User has already installed the proper drivers for the Oculus Rift DK2 Runtime environment | 10/28/14 | Sanchez | 10/28/14 | Sanchez |
|  |  |  |  |  |  |

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| **Issues** | | | | | |
| **#** | **Issue** | **Date**  **Raised** | **Raised**  **By** | **Date**  **Verified** | **Verified By** |
| 1 | Oculus Rift DK2 is still a developer device, it may have some unexpected, unexplainable hiccups | 10/28/14 | Sanchez |  |  |
|  |  |  |  |  |  |

|  |  |  |
| --- | --- | --- |
| **Other Comments** | | |
| **Author** | **Comment** | **Date** |
| Sanchez | The Oculus Rift currently takes a fair amount of time to properly configure for each user | 10/28/14 |
|  |  |  |

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| **Frequency of Execution** |
| **Frequency:**  Minimum: Maximum: Average: (OR)Fixed:  **Per:** Hour:Day:  Week:  Month:  Other: Tied to System Start use case |

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| **Timing Information** | | | | | | | |
| **#** | **At/**  **Between** | **Step(s)** | **Timing**  **Unit** | **Minimum** | **Average** | **Maximum** | **Comments** |
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| **Volume Information** | | | | | | |
| **#** | **Step #** | **Unit of**  **Measure** | **Minimum** | **Average** | **Maximum** | **Comments** |
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# 8.8 Use Case 008 – Disconnect Oculus Rift\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| **General Information** | |
| Use Case Name\Number : 008  Subject Area : Oculus Rift Connection  Description : User is disconnecting the Oculus Rift device | Responsible Analyst : Sanchez |

|  |  |
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| **Requirements/Feature Trace** | |
| **REQ#** | **Requirements Name and / or Short Description** |
| 3.8 | Once disconnected, video will no longer be displayed on Oculus Rift device |
|  |  |
|  |  |
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| **Revision History** | | |
| **Author** | **Date** | **Comments** |
| Sanchez | 10/28/14 | Initial draft of use case |
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| **Insertion Points in other Use Cases** | | |
| **Use Case Name** | **Use Case Number** | **Step Inserted After** |
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| **Actors** | | |
| **Actor Name** | **Person/System** | **Brief Description** |
| Driver | Person | Driver is disconnecting the Oculus head mounted display |
|  |  |  |
|  |  |  |

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| --- | --- |
| **Pre-Conditions** | |
| # | Description |
| 1 | Oculus Rift device was already connected |

|  |
| --- |
| **Start Stimulus** |
| User is shutting down the system and is ready to disconnect the Oculus Rift |

|  |  |  |  |
| --- | --- | --- | --- |
| **Use Case Main Course Steps** | | | |
| **Number** | **Description** | **Adds/Alt Name/Number** | **Bus Rule#** |
| 1 | User toggles the Oculus connection button |  |  |
| 2 | System safely frees the Oculus from use |  |  |
| 3 | System notifies user of Oculus disconnection |  |  |
| 4 | User turns off and unplugs Oculus Rift device |  |  |

|  |  |  |
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| **Exception Conditions** | | |
| **Exception Situations** | **Action(s) on Exception** | **Adds\Alt UC #** |
|  |  |  |

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| **Post-Conditions** | |
| **#** | **Description** |
| 1 | System is offline |
| 2 | Oculus Rift is disconnected |

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| **Candidate Objects** | | |
| **Class/Object Name** | **Descriptions** | **Possible**  **attributes** |
| OculusManager | Object used when communicating with the Oculus Rift | OculusHandle |
| ApplicationManager | Object which will run the shutdown procedure | OculusManager |

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| **Assumptions** | | | | | |
| **#** | **Assumption** | **Date**  **Raised** | **Raised**  **By** | **Date**  **Verified** | **Verified By** |
| 1 | System is functioning properly | 10/28/14 | Sanchez | 10/28/14 | Sanchez |
| 2 | Oculus Rift is functioning properly | 10/28/14 | Sanchez | 10/28/14 | Sanchez |

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| **Issues** | | | | | |
| **#** | **Issue** | **Date**  **Raised** | **Raised**  **By** | **Date**  **Verified** | **Verified By** |
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| **Other Comments** | | |
| **Author** | **Comment** | **Date** |
| Sanchez | Oculus Rift runtime handles driver level operations, any errors in shutdown or disconnection will be handled by the runtime environment | 10/28/14 |
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| **Frequency of Execution** |
| **Frequency:**  Minimum: Maximum: Average: (OR)Fixed:  **Per:** Hour:Day:  Week:  Month:  Other: Tied to System Stop |

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| **Timing Information** | | | | | | | |
| **#** | **At/**  **Between** | **Step(s)** | **Timing**  **Unit** | **Minimum** | **Average** | **Maximum** | **Comments** |
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| **Volume Information** | | | | | | |
| **#** | **Step #** | **Unit of**  **Measure** | **Minimum** | **Average** | **Maximum** | **Comments** |
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# 8.9 Use Case 009 – Connect to RC\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| **General Information** | |
| Use Case Name\Number : 009  Subject Area : RC Connection  Description : Client system is connecting to server system | Responsible Analyst : Sanchez |

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| **Requirements/Feature Trace** | |
| **REQ#** | **Requirements Name and / or Short Description** |
| 1 | Network components are initialized and connected |
| 2 | System must initialize all controller components |
| 3 | System must initialize all video components |
| 4 | System must initialize sensor systems |

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| --- | --- | --- |
| **Revision History** | | |
| **Author** | **Date** | **Comments** |
| Sanchez | 10/28/14 | Initial draft of use case |
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| **Insertion Points in other Use Cases** | | |
| **Use Case Name** | **Use Case Number** | **Step Inserted After** |
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| **Actors** | | |
| **Actor Name** | **Person/System** | **Brief Description** |
| Driver | Person | Driver is connecting the client to the server |
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| **Pre-Conditions** | |
| # | Description |
| 1 | Client is disconnected from the server |
| 2 | Client components are connected and initialized |

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| **Start Stimulus** |
| User selects the connect to RC (server) operation |

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| **Use Case Main Course Steps** | | | |
| **Number** | **Description** | **Adds/Alt Name/Number** | **Bus Rule#** |
| 1 | User initiates RC (server) connection |  |  |
| 2 | Client begins network handshake to server |  |  |
| 3 | Server acknowledges handshake |  |  |
| 4 | Client application notifies user of connection to server |  |  |
| 5 | Server application begins camera stream daemon |  |  |
| 6 | Client begins to receive video data, does not display |  |  |
| 7 | Server begins RC control daemon |  |  |
| 8 | Client sends signal ping to each motor to verify connection |  |  |
| 9 | Client begins XInput controller daemon |  |  |
| 10 | Server begins sensor daemon |  |  |
| 11 | Client begins receiving sensor data, does not display |  |  |
| 12 | Server zeroes accelerometer sensor |  |  |
| 13 | Client notifies user of successful connection and Ready-To-Run status |  |  |

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| **Exception Conditions** | | |
| **Exception Situations** | **Action(s) on Exception** | **Adds\Alt UC #** |
| Camera failure | Camera stream does not initiate, retry once, then prompt user for manual inspection if secondary failure occurs |  |
| RC Control failure | User observes the motor ping does not occur, must manually check connections |  |
| XInput Control failure | Client retries XInput initialization, prompts user for manual inspection upon failure |  |
| Oculus Rift failure | Client system will notify user of failure, user must manually check Oculus runtime and all Oculus connections |  |
| Sensor system failure | Server does not receive data from sensor, prompts user to test sensor manually |  |

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| **Post-Conditions** | |
| **#** | **Description** |
| 1 | Client system has connected to RC (server) system |
| 2 | RC system is ready to run |

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| **Candidate Objects** | | |
| **Class/Object Name** | **Descriptions** | **Possible**  **attributes** |
| NetworkManager | Handles the network handshakes during initialization | ClientSocket, ClientStream, ServerStream |
| ApplicationManager | Contains all manager objects crucial to system operation | NetworkManager, OculusManager |
| SensorManager | Processes and initializes sensor data | SensorHandle |
| OculusManager | Handles all Oculus Rift software interactions | OculusHandle |
| XInputManager | Manages the driver access of the controller data | ControllerHandle |
| RCCar | Manages the transfer of RC control data to the server | RCPacket |
| ControllerDaemon | Manages the translation and flow of RC control data, out to the servo and the motor | SteeringServo, DriveMotor |

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| **Assumptions** | | | | | |
| **#** | **Assumption** | **Date**  **Raised** | **Raised**  **By** | **Date**  **Verified** | **Verified By** |
| 1 | Minimal network latency and traffic | 10/28/14 | Sanchez | 10/28/14 | Sanchez |
| 2 | All peripherals are connected properly | 10/28/14 | Sanchez | 10/28/14 | Sanchez |

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| **Issues** | | | | | |
| **#** | **Issue** | **Date**  **Raised** | **Raised**  **By** | **Date**  **Verified** | **Verified By** |
| 1 | This use case contains a lot of moving parts | 10/28/14 | Sanchez |  |  |
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| **Other Comments** | | |
| **Author** | **Comment** | **Date** |
| Sanchez | Due to the developer and experimental nature of the project, many failures are not able to be handled automatically and require knowledgeable user attention | 10/28/14 |
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| **Frequency of Execution** |
| **Frequency:**  3 Minimum: 1 Maximum: 4 Average: 2 (OR)Fixed:  **Per:** Hour:Day:  Week:  Month:  Other: |

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| **Timing Information** | | | | | | | |
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| **Volume Information** | | | | | | |
| **#** | **Step #** | **Unit of**  **Measure** | **Minimum** | **Average** | **Maximum** | **Comments** |
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# 8.10 Use Case 010 – Disconnect from RC\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| **General Information** | |
| Use Case Name\Number : 010  Subject Area : RC Car connection  Description : User is disconnecting the RC system | Responsible Analyst : Sanchez |

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| **Requirements/Feature Trace** | |
| **REQ#** | **Requirements Name and / or Short Description** |
| 1 | Network components are cleaned up and destroyed |
| 2 | Controller components are cleaned up and destroyed |
| 3 | Video components are cleaned up and destroyed |
| 4 | Sensor systems are shut down and cleaned up |

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| **Revision History** | | |
| **Author** | **Date** | **Comments** |
| Sanchez | 10/28/14 | Initial draft of use case |

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| **Insertion Points in other Use Cases** | | |
| **Use Case Name** | **Use Case Number** | **Step Inserted After** |
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| **Actors** | | |
| **Actor Name** | **Person/System** | **Brief Description** |
| Driver | Person | Driver is disconnecting the server system from the client |

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| **Pre-Conditions** | |
| # | Description |
| 1 | Client and server systems were connected and functioning |

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| **Start Stimulus** |
| User is done using the OculusRC device |

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| **Use Case Main Course Steps** | | | |
| **Number** | **Description** | **Adds/Alt Name/Number** | **Bus Rule#** |
| 1 | User selects the disconnect from server operation |  |  |
| 2 | Client sends disconnect notice to server |  |  |
| 3 | Server shuts down sensor systems and stream |  |  |
| 4 | Server shuts down controller daemon |  |  |
| 5 | Server shuts down camera feed |  |  |
| 6 | Server cleans up resources |  |  |
| 7 | Server sends good-bye message to client and shuts down |  |  |
| 8 | Client receives good-bye message and cleans up all network sockets and streams |  |  |
| 9 | Client notifies user of disconnected status |  |  |

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| **Exception Conditions** | | |
| **Exception Situations** | **Action(s) on Exception** | **Adds\Alt UC #** |
| Invalid Memory Operation | In some rare circumstances, the server system can run into memory corruption during cleanup and shut down procedures, system retires shutdown and forces system kill if second failure occurs |  |
| Client queries server | Client sends mistimed request to server, server is off so client receives nothing, system begins timeout, cancels request after 60 seconds and notifies the user that the server is offline |  |

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| **Post-Conditions** | |
| **#** | **Description** |
| 1 | Server is offline |
| 2 |  |

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| **Candidate Objects** | | |
| **Class/Object Name** | **Descriptions** | **Possible**  **attributes** |
| NetworkManager | Handles all socket and stream cleanup | ClientSocket, ClientStream, ServerStream |
| ApplicationManager | Contains all manager objects crucial to system operation | NetworkManager, OculusManager |
| SensorManager | Handles sensor system shutdown | SensorHandle |
| OculusManager | Handles all Oculus Rift software interaction | OculusHandle |
| XInputManager | Manages the driver access of the controller data | ControllerHandle |
| RCCar | Manages the transfer of RC control data to the server | RCPacket |
| ControllerDaemon | Manages the shutdown procedure of server control systems | SteeringServo, DriveMotor |

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| **Assumptions** | | | | | |
| **#** | **Assumption** | **Date**  **Raised** | **Raised**  **By** | **Date**  **Verified** | **Verified By** |
| 1 | No adverse system events have occurred | 10/28/14 | Sanchez | 10/28/14 | Sanchez |
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| **Issues** | | | | | |
| **#** | **Issue** | **Date**  **Raised** | **Raised**  **By** | **Date**  **Verified** | **Verified By** |
| 1 | Client/Server communications can break down and fail | 10/28/14 | Sanchez |  |  |
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| **Other Comments** | | |
| **Author** | **Comment** | **Date** |
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| **Frequency of Execution** |
| **Frequency:**  Minimum: Maximum: Average: (OR)Fixed:  **Per:** Hour:Day:  Week:  Month:  Other: Tied to System Stop use case |

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| **Timing Information** | | | | | | | |
| **#** | **At/**  **Between** | **Step(s)** | **Timing**  **Unit** | **Minimum** | **Average** | **Maximum** | **Comments** |
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| **Volume Information** | | | | | | |
| **#** | **Step #** | **Unit of**  **Measure** | **Minimum** | **Average** | **Maximum** | **Comments** |
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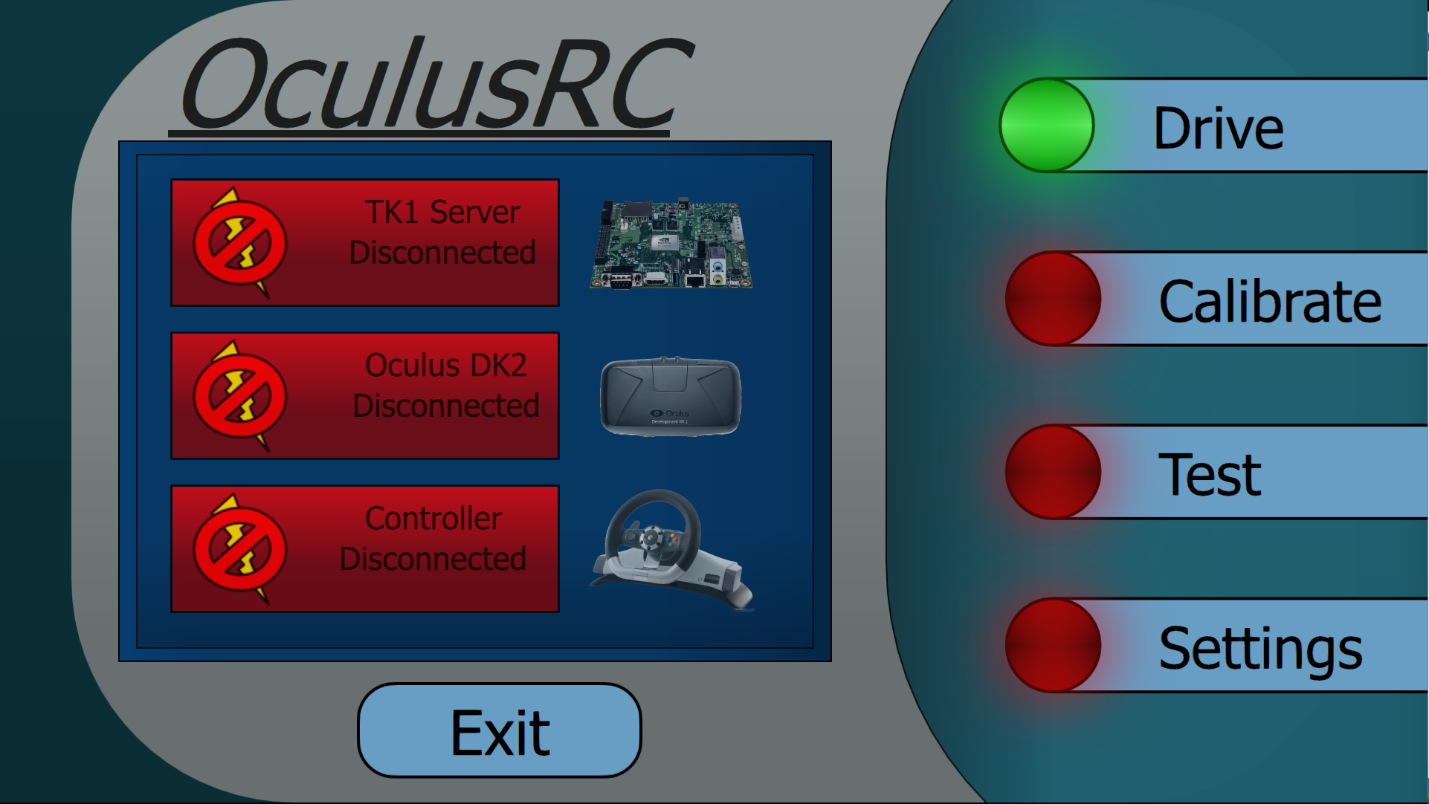
# 9.0 CRUD Matrix\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| Use Case ID:  Class Name: | 001 | 002 | 003 | 004 | 005 | 006 | 007 | 008 | 009 | 010 |
| ClientManager | CRU | RU | CR | RD | RU | RU | RU | RU | RU | RU |
| NetworkManager | CRU |  | CR | RD |  |  |  |  | RU | RU |
| OculusManager | RU |  | CR | RD |  |  | RU | RU | RU | RU |
| RCManager | RU |  |  | RD |  |  |  |  | CRU | RUD |
| SensorState | RU | RU | CR | RD |  |  |  |  | CRU | RUD |
| ControllerManager | RU |  | CR | RD | RU | RUD |  |  | RU | RU |
| SteeringWheelController | RU |  | CR | RD | RU | RD |  |  | CRU | RUD |
| ControllerStreamManager | CRU |  |  | RD |  |  |  |  | CRU | RUD |
| VideoManager | CRU |  | CR | RD |  |  | CRU | RUD | RU | RU |
| VideoStreamManager | CRU |  |  | RD |  |  |  |  | CRU | RUD |
| SensorStreamManager | CRU | RU |  | RD |  |  |  |  | CRU | RUD |
| ServerControlManager | CRU |  | C | RD |  |  |  |  | RU | RU |
| VideoFeed | CRU |  |  | RD |  |  | CRU | RUD | CRU | RU |
| RTSPClient | CRU |  |  | RD |  |  |  |  | CRU | RUD |
| OculusState | CRU |  | CR | RD |  |  | RU | RUD | RU | RU |
| StreamClientState | CRU |  |  | RD |  |  |  |  | CRU | RUD |
| RTPPacket | CRU |  |  | RD |  |  |  |  | CRU | RUD |
| Frame | CRU |  |  | RD |  |  |  |  | CRU | RUD |
| Vector3f | CRU | RU |  | RD |  |  |  |  | CRU | RUD |
| XInputControlState | CRU |  | CRU | RD | RU | RUD |  |  | CRU | RU |
| SensorBase | CRU |  |  | RD |  |  |  |  |  |  |
| Accelerometer | CRU | RU |  | RD |  |  |  |  | CRU | RUD |
| ServoController | CRU |  |  | RD |  |  |  |  | CRU | RUD |
| MotorController | CRU |  |  | RD |  |  |  |  | CRU | RUD |
| ServerNetworkManager | CRU |  |  | RD |  |  |  |  | CRU | RUD |
| RTSPManager | CRU |  |  | RD |  |  |  |  | CRU | RUD |
| SensorMonitor | CRU | RU |  | RD |  |  |  |  | CRU | RUD |
| CaptureController | CRU |  |  | RD |  |  |  |  | CRU | RUD |
| CameraManager | CRU |  |  | RD |  |  |  |  | CRU | RUD |
| ServerManager | CRU | RU |  | RD |  |  |  |  | CRU | RUD |

Note: Use cases 005 through 010 are related to connecting/disconnecting hardware devices and have no effect upon the program objects during application runtime.

# 10.0 High Fidelity UI\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

This is the latest mockup of the client side application user interface.



# 11.0 Glossary\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* Oculus Rift – a virtual reality, head-mounted display designed to be worn by a user
* HMD – acronym meaning, Head-Mounted Display
* OculusRC – the name of the proposed system
* RC – remote control, generally referring to a remote control vehicle
* NVIDIA Jetson TK1 – a developer board custom built from the ground up by NVIDIA
* Client – the system which interfaces to the controller and head mounted display
* Server – the system which connects directly to the RC vehicle
* XInput – the interface which communicates to the controller
* Controller – abbreviation for the Microsoft Xbox 360 Steering Wheel
* Barrel Distortion – a special algorithm designed to process video for viewing on the Oculus Rift device
* Pincushion Distortion – an effect applied to the Oculus Rift screen by the devices’ lenses
* Depth Mode – the term used to describe a video feed which employs the Parallax Distortion used by the human eyes to perceive depth
* FPV Mode – the term used to describe a video feed which is displayed in a “traditional sense” which offers no distortion nor depth of field
* Real-Time Streaming Protocol – this networking protocol (RTSP) is designed to reduce the video networking delay to be as close to real time as possible, it is built on UDP

Appendix A: Business Rules\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. The RC Server system will provide a video feed to display on the Client system.
2. The video feed has the option to be displayed on the Oculus Rift.
   1. The video feed will be piped through a barrel distortion algorithm, this compensates for the pincushion distortion applied by the lenses of the Oculus Rift device.
   2. The video feed will have the option of being displayed in “Depth Mode”.
   3. The video feed will have the option of being displayed in “FPV Mode”.
3. The video feed has the option to be displayed on the standard Client monitor.
4. The video feed will be transmitted using the Real-Time Streaming Protocol (RTSP).
5. The RC car has the option to be controlled by the Microsoft Xbox 360 Steering Wheel.
6. The RC car has the option to be controlled by a standard keyboard.
7. The system requires an accessible Wi-Fi connection.