**Smart-glass based**

**Remote Guidance System**

**TEST PLAN**

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**Document Sign Off**

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# **1.)** **Introduction**

## 1.1) Purpose of the test plan

The test plan is a document designed to outline the scope, resources, approach, strategy and criteria for all testing activities carried out during and after the development of the system. The plan will clearly identify the features that are to be tested and the features which will not be and the stages at which tests are to be carried out.

## 1.2) Scope

Testing will be carried out at several stages of the life cycle as the system is developed. Testing will ensure system defects, bugs to be caught early on in the development and also helps the team reevaluate their approach to developing a particular aspect of the project. The test plan is currently limited to high-level test cases and assumptions as the system architecture and features have still not reached a low-level design. As many aspects of the system are still unknown the test plan shall act as a high level guide for testing at the moment and will be further updated as the system is developed over time. The system to be tested is the Smart Glass Remote Guidance System. The system will be tested using unit tests and usability tests.

**Constraints/Assumptions**

* The team is restrained to testing the system on the Vuzix M100 smart glasses.
* The system must remain portable during testing.
* The system will be tested under the assumption that the users have full access to wifi
* Both users have the system already setup on the devices at both ends of the transmission.

The team will be following a four level testing strategy. This will allow the project to be tested at different development stages at maximum efficiency.

* Unit Testing
* System Testing
* Integration Testing
* Acceptance Testing

## 1.3) References Material

The following document has been created according to the details specified in the documents below. The documents below will provide further information on the project.

* Project Plan
* Software Quality Assurance Plan
* Software Requirements Specification
* IEEE 829 Standard template (Test Plan)

## 1.4) Objective

Carry out appropriate tests at appropriate stages of development.

The test plan shall act as a guideline for performing these different types of tests required for maintaining the quality and efficiency of the system.

## 1.5) Resources Required

* 2 Smart Glasses
* May require Smart mobiles (for higher processing power)
* 2 users acting as Operator and Instructor
* A ruler (for point of reference)
* Piece of meat (for the usability test)
* Hotspot or Wifi
* Glove (to identify the users hand)
* IDE (to create and run unit tests)

## 1.6) Environment Requirements

* 2 smart glasses (updated with current system software)
* May require smart phones (for higher processing power)
* Hotspot or wifi
* Single coloured background (to aid Hand gesture recognition)
* Gloves (to aid Hand gesture recognition)
* A ruler (for point of reference)
* Piece of meat (for the usability test)

# **2.)** **Test Items**

· The product to be tested is the Smart Glass Based Remote Guidance System

## 2.1) Features to be Tested

* Both users must be able to begin transmission.
* Both users must be able to end transmission.
* The operator must be able to take a picture during the live video streaming between the operator and instructor.
* The operator must be capable of annotating the image during the live video stream.
* The operator must also be able to share the pictures taken.
* The instructor must be able to send his hand gestures to the operator’s glasses in real time.
* The system must be able to identify dimensions of piece of meat and assess its quality via colour and dimension.

## 2.2) Test Cases

### 2.2.1) Functional Test Cases

|  |  |  |
| --- | --- | --- |
| Test Case(s) | Steps | Expected Results |
| **Test case:** | **Select Role** |  |
| 1) Check if users can open the applications without issues  **Preconditions:** User must have application installed. | Open the application | The application should run and not freeze or crash |
| 2a) Check if the device can be set as an instructor device  **Preconditions:** User must have instructor privileges | Select the option “Instructor” | The glasses should have instructor features.  The glasses should then be ready to request connection or accept a request |
| 2b) Check if device can be set as the operator device  **Preconditions:** User must have operator privileges | Select the option “Operator” | The glasses should have operator features. The glasses should then be ready to request connection or accept a request |
|  | **Connect with user** |  |
| 1a) Check if instructor can view the other user(operator) in instructor mode  **Preconditions:** Operator devices must be visible and open for connections. | Instructor Select “connect with user” as an Instructor | The program should open up a window with a list of users that are operators. |
| 1b) Check if operator can view the other user(instructor) in operator mode  **Preconditions:** Instructor devices must be visible and open for connections | Operator Select “connect with user”as an operator | The program should open up a window with a list of users that are instructors. |
| 2a)Check if instructor can connect with an operator in instructor mode  **Preconditions:** Instructor and operator devices must be open for connections | Instructor Select 1 device from list of users(operators) | There should only be one listed operator in the list, as one device has been set up as an operator |
| 2b)Check if operator can connect with an instructor in operator mode  **Preconditions:** Operator and instructor devices must be open for connections | Operator Select 1 device from list of users (instructors) | There should only be one listed instructor in the list, as one device has been set up as an instructor |
|  | **Send video feed** |  |
| 1)Check if Operator can send video feed to Instructor  **Preconditions:** Connection with instructor has to be established | Glasses automatically send operator video feed when application is opened and the connection is established | Receiving user is prompted to receive video streaming |
| 2) Check if Instructor can receive video stream  **Preconditions:** Connection with operator has to be established |  | Video stream connection is successfully setup and video feed would stream from the operator’s device to the instructor’s device |
| 2b)Check if Instructor can refuse video streaming  **Preconditions:** Operator has to send video request |  | Video stream setup is dropped and sending user is notified of video stream request being denied. |
|  | **View video feed** |  |
| 1)Check if Instructor can view received video feed  **Preconditions:** Instructor has to receive video feed | Glasses automatically show video feed, when video feed is received by instructor’s glasses | Sending user begins to send video feed to the system. The system is meant to process the feed and send it to the receiving user. The receiving user should be able to view the feed of the sending user. |
|  | **Send hand gestures** |  |
| 1) Check if Instructor can send hand gestures to Operator  **Preconditions:** The system has to have the video feed of the operator | Glasses automatically send instructor’s hand gestures when application starts up | The system should start obtaining the video feed of the operator and also the video feed of the instructor. The video feed of the instructor is then processed to obtain footage only of the instructor's hand and not the background surroundings. The image of the hands should then be superimposed on the operators video feed and then sent back to the operator. |
|  | **Make sketch** |  |
| 1) Check if instructor can capture image  **Preconditions:** Instructor must have video feed to capture image from | Select “Capture Image” button | System captures image of operator’s video feed |
| 1b) Check if instructor can edit image with a sketch | Select “Make sketch” button | The image is opened up in an editable format |
| 1c) Check if instructor can draw sketch on image | Draw sketch on image by using their fingers | System registers finger movements and traces it onto image |
| 1d) Check if instructor can undo sketch | Select “undo” button | System reverts image back to original condition |
| 1e) Check if instructor can save edited image | Save edited image | System saves edited image and prompts user to send it to paired device |
| 1f) Check if instructor can delete edited image | Delete edited image | System deletes edited image and goes back to video feed |
|  | **Send sketch** |  |
| 1) Check if instructor can send sketched image to instructor  **Preconditions:** Operator must have stable connection with instructor device | Select “Send” option to send to device it is paired with | System prepares image and sends image to the connected operator |
|  | **View sketch** |  |
| 1) Check if operator can view image  **Preconditions:** Operator device must receive image | Select “View image” button when image is received | System displays image sent by the operator. |
|  | **Dismiss sketch** |  |
| 1) Check if operator can dismiss image after viewing  **Preconditions:** Operator must view image | Select “Dismiss image” button after image is viewed | System dismisses image, and view goes back to operator video feed |
|  | **Object measuring** |  |
| 1) Check if an object can be measured  **Preconditions:** Glasses needs video feed from the camera | Select “Object measuring” button or a highlighted object | System shows object statistics like colour and dimensions |

### 

### 2.2.1) Non-functional Testing

**Testing Goal:** The purpose of the following test cases is to make sure that the application we develop has would not only be functional but be user friendly with a small learning curve allowing the average user to quickly adapt to the user interface.

**Testing Procedure:** The test would be performed on a set of participants, who will be asked to perform basic tasks using the applications. Upon completing the task, the user would be expected to be able to give feedback on the difficulty of the task and what their suggestion to improve the user interface would be.

**Pass/Fail Criteria:** The tasks given are very simple, and would have constant pass criteria. Each task should be completed before 30 seconds and would have a difficulty goal of being less than 5(1 being very easy, and 10 being very hard)

**Testing Constants**: All of the tests will be carried out on the application on the Smart Glasses, using sample data provided to them.

**Testing Assumptions:** The tests will be carried out in pairs of participants where on of the participants will play the role of the “operator” while the other acts as the “instructor”.

|  |  |  |
| --- | --- | --- |
| **Test Case(s)** | **Steps** | **Expected Results** |
| 1a) Check if user can select role.  **User Task:** Select role as “operator” | 1. Open the application 2. Select the option “Operator” | User successfully selects “operator role. |
| 1b) Check if user can select role.  **User Task:** Select role as “instructor” | 1. Open the application 2. Select the option “instructor” | User successfully selects instructor role. |
| 2a) Check if user can connect with the other user as an instructor  **Use Task:** Pair up your pair of glasses with another pair of glasses | 1. Select “connect with user” as an Instructor 2. Select 1 device from list of users(operators) | User successfully connects with other operator as an instructor |
| 2b) Check if user can connect with the other user as an operator  **Use Task:** Pair up your pair of glasses with another pair of glasses | 1. Select “connect with user”as an operator 2. Select 1 device from list of users (instructors) | User successfully connects with other instructor as an operator |
| 3a) Check if user can make a sketch.  **User Task:** Capture and edit an image | 1. Select “Capture Image” button 2. Select “Edit” button 3. Draw sketch on image by using their fingers 4. Save edited image | User successfully edits and saves image into gallery |
| 3b) Check if user can send sketch  **User Task:** Send edited image to instructor | 1. Select “send to operator” | User successfully sends edited image |
| 3c) Check if user can view sketch  **User Task:** View image instructor has sent you | 1. Select “view image” | User is able to view image sent by instructor |
| 3d)Check if user can dismiss sketch  **User Task:**  Dismiss the image you are viewing | 1. Select “Dismiss” | User is able to dismiss image |
| 4) Check if user can measure objects  **User Task:** Find the statistics of the highlighted object | 1. Select “Object measuring” | User is able to view object statistics |

## 

## 2.3) Features not to be Tested

Since all the features are being implemented for the first time and are all capable of being tested. There are currently no features that will not be tested.

# 3) Strategy

As stated the project will be tested following a four level testing strategy

* **Unit Testing –** This stage of testing will be carried out during the initial coding stage when there are multiple modules of code being developed by different members of the team. This will be carried out by generating multiple unit tests in order to test pieces of code. Will help detect errors early on.
* **Integration Testing –** This stage of testing will be carried out when the system reaches a low level design and all prior unit tests have been passed. Multiple modules of the system will be tested together using appropriate test cases. This will confirm if various modules function effectively altogether.
* **System Testing –** This stage will be carried out when the system reaches a functional level performing the core functions it was developed for.This will ensure if specified requirements are reached and product works as a whole. The system will undergo usability testing according to the non-functional test cases.
* **Acceptance Testing –** The last stage of testing to make sure the client is happy with the product and all requirements have been achieved successfully.

## 3.1) Roles and Responsibilities

* **Unit Testing –** Must be carried out by individual developers on a continuous basis by creating unit tests throughout the development of the system.
* **Integration Testing –** May be carried out by the developers as well the team leader/testing managers by using appropriate test cases.
* **System Testing –** Must be carried out by a separate testing team under supervision of the team leader. Users testing the system are preferred to be candidates who have experience with testing systems and interfaces.
* **Acceptance Testing –** Must be carried out by separate testing team as well the team leader under supervision of the client. Requires the users to be non - developers.

## 3.2) Test Deliverables

* Test Plan
* Test Cases
* Defect/Enhancement logs
* Test Reports
* Usability Test Guide

## 3.3) Schedule

### 3.3.1) Semester 1

|  |  |
| --- | --- |
| **Features to test** | **Estimated Testing** |
| Video Streaming | Week 9-10 |
| Both user can begin and end stream | Week 9-10 |

### 3.3.2) Semester 2

### 

|  |  |
| --- | --- |
| **Features to test** | **Estimated Testing** |
| Annotation/Sketching | - |
| Ability to take and send picture during transmission | - |
| Hand gesture recognition and transmission | - |
| Object Recognition (piece of meat) | - |

## 

## 3.4) Risk and Contingency

|  |  |
| --- | --- |
| **Risks** | **Contingency** |
| May be shortage of time which may result in less time for testing. | Carry out tests frequently as the system is developed instead of assigning a particular date. |
| Requirements may change during the course of development. | Keep updating requirements from client as frequent as possible to avoid last minute chaos. |
| Team member leaves | Have each module worked on and tested by 2 members. |
| Design lack flexibility to make changes | When designing allow room for accommodating changes. |

## 3.5) Testing Tasks

* Testing scenarios shall be taken from the client and documented. The test scenarios will be required before creating the test cases.
* Test cases shall be created for individual features of the system.
* Required resources shall be accounted for before carrying out the tests.
* Bugs will be logged and reported

# 

# **4.)** **Pass/Fail Criteria**

## 4.1) Product Level

Instructor and operator can switch roles upon accepting the connected user’s request.

|  |  |  |
| --- | --- | --- |
| **Testing Criteria** | **Pass Criteria** | **Fail Criteria** |
| Pairing the glasses over a wireless connection/ Bluetooth connection | Glasses are paired up with a stable wireless connection with a third device acting as a server. | Glasses don’t pair up successfully or connection isn’t stable enough. |
| Instructor can see hand gestures on operator’s video feed. | Request sent from operator glasses and accepted by instructor glasses. | Request isn’t sent or doesn’t prompt instructor with video request. |
| Receiving and viewing operator video feed from operator glasses on instructor glasses | Video is sent with a delay of less than 1000ms and a minimum frame rate of 20. | Video sent, has loss of frames. |
| Sending hand gestures from instructor glasses | Instructor can see hand gestures on operator’s video feed. | Instructor’s video feed does not show hand gestures. |
| Receiving only hand gestures(without video) from instructor glasses and viewing them on operator video feed. | Operator can see instructor’s hand gestures on operator video feed. | Instructor’s hand gestures are not shown at all/ or not shown clearly on operator’s video stream. |
| Make sketch | Instructor can capture a still image of video feed and draw a sketch on it using his/her finger. | Instructor can capture a still image of video feed and draw a sketch on it using his/her finger. |
| Send sketch | Instructor is able to send a saved image of a sketch to the operator | Unable to save sketched image/ send it to operator |
| View sketch | Operator can download and view sketched image. | Operator is unable to view image. |
| Dismiss sketch | Operator is able to dismiss image after viewing | Operator is unable to dismiss image after viewing |
| Object Measuring | Can pull up statistics and information about highlighted object | Unable to get information and statistics about the highlighted object |

## 4.2) Testing Stages

During each development stage test will be conducted and judged according to the following criteria

|  |  |  |
| --- | --- | --- |
| **Testing Level** | **Pass criteria** | **Fail criteria** |
| Unit Testing | * All unit tests have been passed successfully * At least 70% of all code written has been covered during testing. * All bugs and errors found have been logged and been accounted for. | * Not all unit tests have been passed * Not enough code written has been included in testing. |
| Integration Testing | * 90% of all modules developed have been tested. * Modules perform their assigned function successfully when tested together. * All issues have been logged and corrected | * Modules fail to carry out their function when put together. * Too many critical issues found. |
| System Testing | * Entire System has been tested as a whole. * 100% of all specified requirements have been successfully achieved. * Minor Issues found have been logged and fixed. * 100% of all system features functioning appropriately. | * Not all specified requirements have been achieved. * Critical issues and defects found during the test. * System features are not functioning accurately. |
| Acceptance  Testing | * When client is satisfied with the product. | * Does not achieve the requirements specified. * Critical issues found by client. * Does not satisfy the client. |

## 4.3) Suspension criteria and resumption requirements

### 4.3.1) Suspension Criteria

* The design of the system is found to be defective.
* The client has changed his mind about the specified requirements.
* The module tested is found to have critical issues which have to be fixed before proceeding further.

### 4.3.2) Resumption Requirements

* All critical issues found have been fixed.
* Modified or fixed modules have passed testing successfully.
* The new changes have gained the approval of the testing manager as well as the Team Leader.

## 4.4) Approvals

* Both the Team leader and the Testing manager must agree to the completion of a testing level before moving on to the next level.
* Any changes or addition to the system features would have to be approved by the client.