Smart-glass based
Remote Guidance System

TEST PLAN

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Table 1. Document Change Control

Version	Date	Authors	Summary of Changes
1.0	04/10/2018	Dineth Gunawardena	Updated Test Cases due to changes in requirements
1.2	14/10/2018	Ayub Khan	Updated Test Cases due to change in prototype working

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 and bugs are 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 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
·   IEE 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
·   Hotspot or Wifi
·   Glove (to identify the users finger required for tracing)
·   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 finger recognition)
  ·

  ·Good lighting to aid hand and finger recognition

2.) Test Items

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

2.1) Features to be Tested

- Users must be able to establish a connection between the two devices.
- Users must be able to stream and view video feed between the two devices.
- Instructor must be able to send hand gestures which overlays on the operator video feed.
- Instructor must be able to make a sketch on a screenshot and send it to the operator.

2.2) Test Cases

2.2.1) Functional Test Cases

Test Case(s)	Steps	Expected Results
Test case:	Establish Communication	
1) Check if connection is established between devices	1) User turns on the device 2) System automatically tries to establish a connection with the other device	Connection is established between the two devices when the device is switched on
	Send video feed	
1)Check if instructor can send video feed **Preconditions:** Connection between users has to be established	1) Function is automatically triggered after the precondition of establishing communication is satisfied	Video stream connection is successfully setup and video feed would stream between both users
	View video feed	
1)Check if user can view operator's video feed **Preconditions:** Connection between	System automatically broadcasts video stream to both users.	Both users can view the operator's video feed on their displays

users has to be established		
	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	System 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. Both users should see video feed of both the operator's feed and the instructor's hand gestures to both users
	Make sketch	
1) Check if instructor can capture image **Preconditions:** Instructor must have video feed to capture image from	1) Instructor clicks button on the glasses	System captures image of video stream
2)Check if instructor can draw sketch on image	2)Draw sketch on image by using their fingers	System registers finger movements and overlays it onto image
	Send sketch	
1) Check if instructor can send sketched image to operator **Preconditions:** Instructor has created sketch using "Make a sketch" function	1) Instructor uses same button to make sketch to send sketch	System sends image to the operator
	View sketch	
1) Check if operator can	System automatically	Operator can view

view image **Preconditions:** Operator device must receive image	replaces operator's video feed with sketched image	sketched image
	Dismiss sketch	
1) Check if operator can dismiss image after viewing **Preconditions:** Operator device must receive image	1) Operator uses any button to dismiss sketch	System dismisses image, and view goes back to operator video feed

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
1) Check if user can make a sketch	1. User clicks a button on the glasses	User must see image with draw path of his/her finger
2) Check if user can send	1. User clicks the same	Operator must

sketch	button used to make the sketch	acknowledge that a sketch was received
3) Check if user can dismiss the sketch	1. User clicks any button on the glasses	User must see the sketch being removed from the operator's display
4) Check if user can send video	1. Function is automatically triggered when connection is established	User must see video feed

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

Features to test	Estimated Testing
Establish communication	Semester 2
Sending and viewing video feed	Semester 2

Sending hand gestures	Semester 2
Making,sending,viewing and dismissing sketches	Semester 2

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	Instructor can capture a still image of video feed and draw

	a sketch on it using his/her finger.	a sketch on it using his/her finger.
Send sketch	Instructor is able to send a saved image of a sketch to the instructor.	Unable to save sketched image/ send it to instructor
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

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

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.

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.