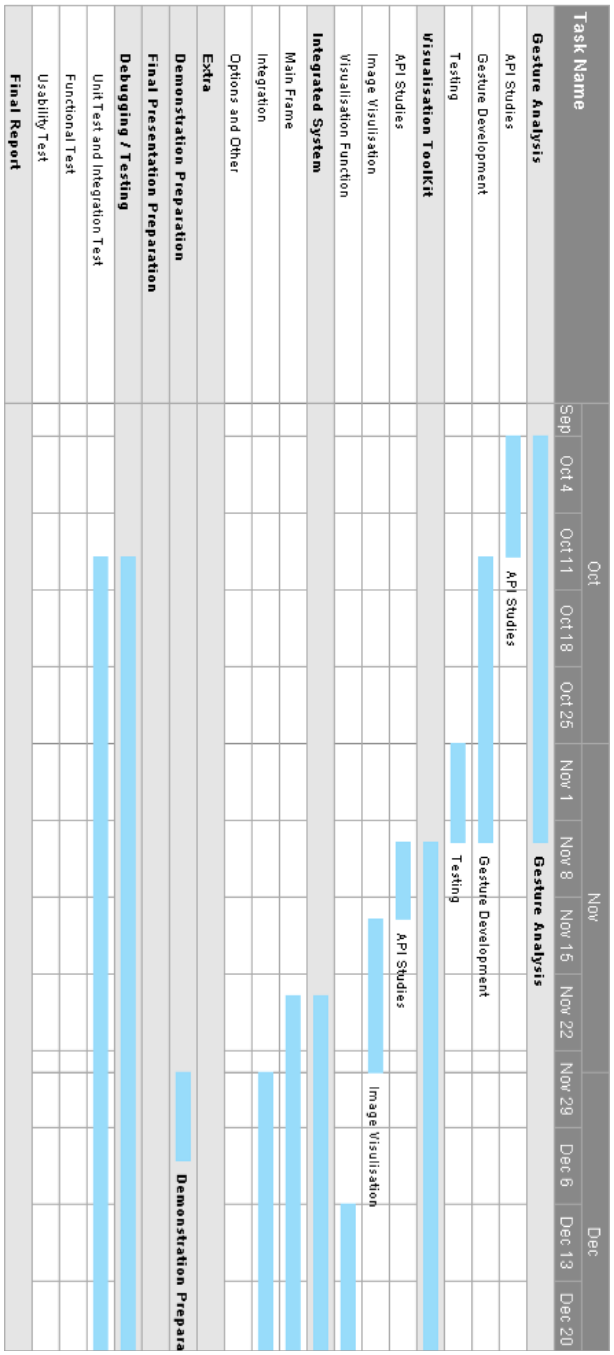
LeapMotion Visualisation System (LVS)
Leap Motion Controlled Data Manipulation
Using Visualisation Toolkit
Additional Materials

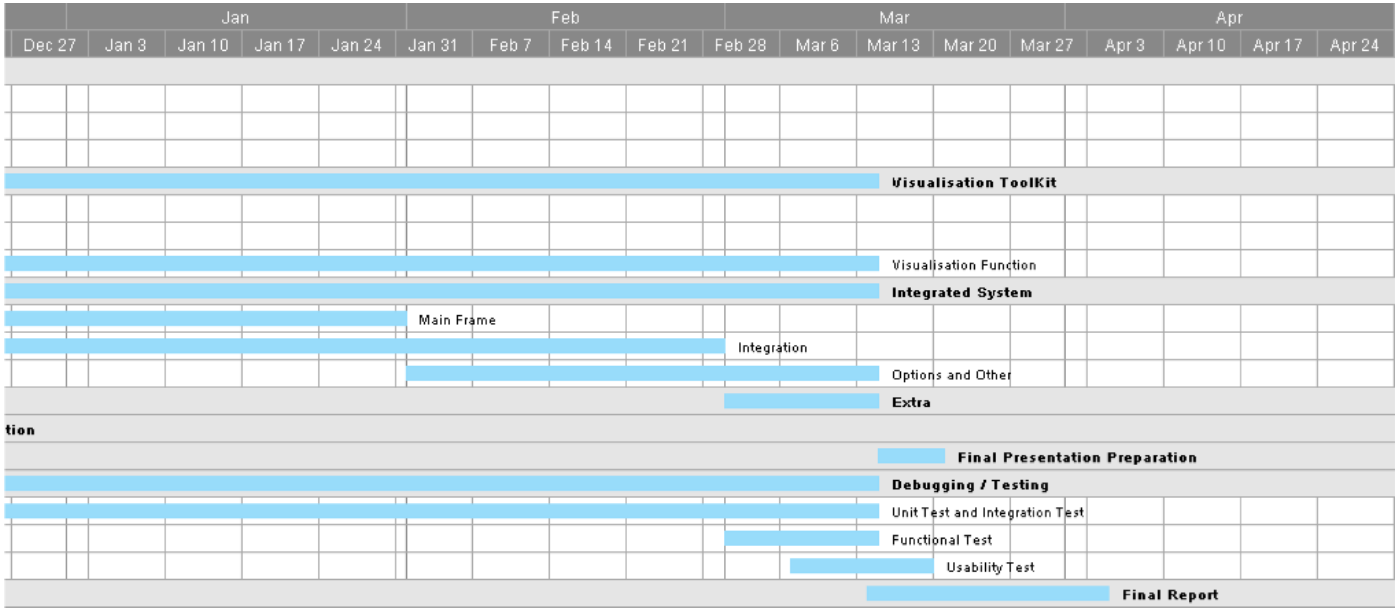
Chun Yin, Tsang
Student ID: 1467193
Supervisor: Dr. Hamid Dehghani

Submitted in conformity with the requirements
for the degree of BSc. Computer Science
School of Computer Science
University of Birmingham

Contents

1 Gantt Chart




Jan
Feb
Mar
Apr
Dec 27
Jan 3
Jan 10
Jan 17
Jan 24
Jan 31
Feb 7
Feb 14
Feb 21
Feb 28
Mar 6
Mar 13
Mar 20
Mar 27
Apr 3
Apr 10
Apr 17
Apr 24
Visualisation ToolKit
Visualisation Function
Integrated System
Main Frame
Integration
Options and Other
Extra
tion
Final Presentation Preparation
Debugging / Testing
Unit Test and Integration Test
Functional Test
Usability Test
Final Report

2 Testing

2.1 Functional Test

1.1 ToolBar

Test Case ID	Scenario	Expected Output	Actual Output	Result
TC#1101	After the application is launched, click "New File Button" to open new LVSFile.	A new LVSFile with name "untitled.lvs" should be created.	Same as expected	Pass
TC#1102	After the application is launched, click "Open Button" to open any LVSFile.	The target LVSFile should be opened, if there is any imported item it should be shown in the tree panel. The title of the frame should display the opened file name.	Same as expected	Pass
TC#1103	After the application is launched, click "Save Button" / "Save As Button".	The system status panel should show the message to notify user there is nothing to save.	Same as expected	Pass
TC#1104	After the application is launched, click "Import Data Model Button".	The system should have imported the data file, showing in the tree panel. A new LVSFile should be also automatically created.	Same as expected	Pass
TC#1105	After the application is launched, use the "Actor Switching" Buttons.	The system should have no response and not break. Since there is no file being imported.	Same as expected	Pass
TC#1106	After the application is launched, click the "Movement Tracking Button".	The menu option and the button in ToolBar should be active or deactive relatively. When the button is enable, user's hand show be shown by dot on the screen, else no dot should be shown.	Same as expected	Pass
TC#1107	After the application is launched, click the "Gesture Tracking Button".	The menu option and the button in ToolBar should be active or deactive relatively. When the button is enable and user performing a gesture, the gesture type and relative operation name should have shown on the screen.	Same as expected	Pass
TC#1108	After the application is launched, change "Opacity", "ColorMap", "Representation" Combo Box.	The value could be change but nothing response and the system should not break.	Same as expected	Pass
TC#1109	After the application is launched, connect and disconnect the Leap Motion Controller.	The Connection status label should change its color to reflect the connection status, red for disconnected and green for connected.	Same as expected	Pass
TC#1110	After the application is launched, click the "Presentation Mode Button".	All other panel should be hidden, only showing the VTKPanel.	Same as expected	Pass
TC#1111	After a new LVSFile is created, press again the "New File Button".	The System should show a dialog request user to save changes before opening a new one.	Same as expected	Pass
TC#1112	After a new LVSFile is created, press "Save Button" or "Save As Button" and then "New File Button".	The System should be able to save the file in target directory and a new LVSFile "untitled.lvs" should be created.	Same as expected	Pass

TC#1113	After import several Data Model File, use the "Actor Switching" to change between actors.	The actor displayed in VTKPanel and the "Actor Switching" is synchronised. And the index will not be < 0 or > range.	Same as expected	Pass
TC#1114	After import any Data Model, change the combo box "Opacity", " ColorMap" or "WireFrame"	The actor displayed should reflect as the change chosen, for instance, changing opacity will affect the transparency.	Same as expected	Pass
TC#1115	After any changes, click "Save" or "Save As Button".	The LVSFile should be saved with chosen name and path.	Same as expected	Pass
TC#1116	After clicking the "Open LVSFile Button", click cancel.	The system should not be crashed with NullPointerException.	Same as expected	Pass
TC#1117	After creating a new LVSFile click the "Save Button", click cancel.	The system should not be crashed with NullPointerException.	Same as expected	Pass
TC#1118	After clicking the "Save As LVSFile Button", click cancel.	The system should not be crashed with NullPointerException.	Same as expected	Pass
TC#1119	After the application is launched, click "Import Data Model Button", then "Cancel".	The system should not be crashed with NullPointerException and a new LVSFile should be created.	Same as expected	Pass

1.2 MenuBar

Test Case ID	Scenario	Expected Output	Actual Output	Result
TC#1201	After the application is launched, click "New File" or Ctrl+N in menu to open new LVSFile.	A new LVSFile with name "untitled.lvs" should be created.	Same as expected	Pass
TC#1202	After the application is launched, click "Open File" or Ctrl+O in menu to open any LVSFile.	The target LVSFile should be opened, if there is any imported item it should be shown in the tree panel. The title of the frame should display the opened file name.	Same as expected	Pass
TC#1203	After the application is launched, click "Save Button" / "Save As Button".	These two buttons should be disabled.	Same as expected	Pass
TC#1204	After the application is launched, click "Edit Preference" in menu.	A edit preference dialog should be shown.	Same as expected	Pass
TC#1205	After the application is launched, click "Import Data Model Button" or Ctrl+I.	The system should have imported the data file, showing in the tree panel. A new LVSFile should be also automatically created.	Same as expected	Pass
TC#1206	After the application is launched, click "Edit Object".	A edit file dialog should be shown.	Same as expected	Pass
TC#1207	After the application is launched, click "Presentation" or Ctrl+P.	All other panel should be hidden, only showing the VTKPanel.	Same as expected	Pass
TC#1208	After the application is launched, click the "Tracking" or Ctrl+T.	The menu option and the button in ToolBar should be active or deactive relatively. When the button is enable, user's hand show be shown by dot on the screen, else no dot should be shown.	Same as expected	Pass

TC#1209	After the application is launched, click the "Gesture Status" or Ctrl+G.	The menu option and the button in ToolBar should be active or deactive relatively. When the button is enable and user performing a gesture, the gesture type and relative operation name should have shown on the screen.	Same as expected	Pass
TC#1210	After the application is launched, click the "Edit Tracking Info".	A edit tracking info dialog should be shown.	Same as expected	Pass
TC#1211	After the application is launched, click the "About LVS".	A about info dialog should be shown.	Same as expected	Pass
TC#1212	After the application is launched, click the "Tutorial".	A tutorial dialog should be shown.	Same as expected	Pass
TC#1213	After the application is launched, click "Import Data Model" or Ctrl+I, then "Cancel".	The system should not be crashed with NullPointerException and a new LVSFile should be created.	Same as expected	Pass
TC#1214	After importing a Data Model or Create a new LVSFile.	Save, Save As and Edit Object Option should be enabled in menu.	Same as expected	Pass

1.3 Tree Panel

Test Case ID	Scenario	Expected Output	Actual Output	Result
TC#1301	A LVSFile with imported Data Model is opened by the system.	All imported Data Model should be listed in the Tree Panel, with format : [index][fileName]. Each FileItem should have 4 implemented filter option, slice, contour, threshold, scalar bar.	Same as expected	Pass
TC#1302	A Data Model is imported to the system.	The imported Data Model should be listed in the Tree Panel, with format : [index][fileName]. Each FileItem should have 4 implemented filter option, slice, contour, threshold, scalar bar.	Same as expected	Pass
TC#1303	A Data Model is being removed in the file edit dialog.	The tree panel should reflect the changes immediately by removing the object. The index of the object should automatically shift to fill the removed one.	Same as expected	Pass
TC#1304	Double Click on the FileItem.	The node should be expanded showing filter options in form of checkbox.	Same as expected	Pass
TC#1305	Click on the Filter Option.	The checkbox should be tick or unticked opposite to previous status. The VTKPanel should also be updated automatically to display the applied filter actor.	Same as expected	Pass
TC#1306	Resize Tree Panel	The panel should be freely resized which will not be affected by the VTKPanel - a AWT Component.	Same as expected	Pass

1.4 Status Panel

Test Case ID	Scenario	Expected Output	Actual Output	Result

TC#1401	Save file, Open file Operations	The status panel should show a short message reflecting the result of the operation.	Same as expected	Pass

1.5 OverLayer Panel

Test Case ID	Scenario	Expected Output	Actual Output	Result
TC#1501	Drag the overlayer component.	The overlayer will be able reposition itself referring to the main frame.	Same as expected	Pass
TC#1502	Drag the main frame.	The overlayer will be able reposition itself referring to the main frame.	Same as expected	Pass
TC#1503	Activate Slice Translate Function with Leap Motion Connected.	OverLayer Button - sliceTransButton will appear.	Same as expected	Pass
TC#1504	User's hand move on top of the Leap Motion Controller.	Dot will appear indicating the position of users hand on the screen.	Same as expected	Pass
TC#1505	User performing gesture on top of the Leap Motion Controller.	Gesture type and operation name will be shown.	Same as expected	Pass

1.6 Dialogs

Test Case ID	Scenario	Expected Output	Actual Output	Result
TC#1601	Open Preference Edit Dialog.	The preference edit dialog should show the correct configuration from lvs.properties.	Same as expected	Pass
TC#1602	Open Preference Edit Dialog, click "Cancel".	Changes should not be saved.	Same as expected	Pass
TC#1603	Open Preference Edit Dialog, change some config and then click "Apply".	Changes should be saved.	Same as expected	Pass
TC#1604	Open File Edit Dialog.	Showing all the imported FileItem with its ID, Name, Path correctly.	Same as expected	Pass
TC#1605	Open File Edit Dialog, press "Edit".	Item Edit Dialog will be shown.	Same as expected	Pass
TC#1606	Open File Edit Dialog, check some checkbox and click "Delete".	The selected FileItem will be removed from current LVSFile. The index of the rest of the FilteItem will be automatically rearranged.	Same as expected	Pass
TC#1607	Open File Edit Dialog, click "Delete".	The system should not be crashed with NullPointerException.	Same as expected	Pass
TC#1608	Open File Edit Dialog click "Cancel" or "Apply".	The File Edit dialog will be closed. "Apply" should have the same result atm, since it was designed for further development.	Same as expected	Pass
TC#1609	Open Item Edit Dialog, click "Threshold", "Contour", "Slice" respectively.	The dialog's layout will be change respectively. Only the clicked tab will be expanded, others wil be in hidden status.	Same as expected	Pass
TC#1610	Open Item Edit Dialog click "Back".	The dialog will return to File Edit Dialog.	Same as expected	Pass
TC#1611	Open Item Edit Dialog change threshold range.	The changes on threshold will be shown when threshold option is activated.	Same as expected	Pass

TC#1612	Open Item Edit Dialog change contour custom range and step.	The changes on contour will be shown when contour option is activated. At the mean time, the calculated values should be shown in the Add Value Field.	Same as expected	Pass
TC#1613	Open Item Edit Dialog change contour by add value.	The changes on contour will be shown when contour option is activated.	Same as expected	Pass
TC#1614	Open Item Edit Dialog change custom range after apply an Add Value Operation.	The add value operation has higher priority which will override the custom range and the custom range textfield should be cleared.	Same as expected	Pass
TC#1615	Open Item Edit Dialog change slice normal.	The changes on slice will be shown when slice option is activated. It should be represent in form of change cutter slice orientation.	Same as expected	Pass
TC#1615	Open Item Edit Dialog input out of default range or non-digit data.	Appropriate Error Message willl be shown to notify user.	Same as expected	Pass
TC#1616	Open Item Edit Dialog do any changes and click "Apply".	Message will be shown to notify changes have been saved.	Same as expected	Pass
TC#1617	Open Edit Tracking Dialog, click "All".	All fingers and palm should be turned on.	Same as expected	Pass
TC#1618	Open Edit Tracking Dialog, click "All Fingers".	All fingers should be turned on.	Same as expected	Pass
TC#1619	Open Edit Tracking Dialog, click "Palm".	All palms should be turned on.	Same as expected	Pass
TC#1620	Open Edit Tracking Dialog, click "Left Fingers".	All Left Fingers should be turn on.	Same as expected	Pass
TC#1621	Open Edit Tracking Dialog, click "Right Fingers".	All Right Fingers should be turn on.	Same as expected	Pass
TC#1622	Open Edit Tracking Dialog, click "None".	All fingers and palm should be turn off.	Same as expected	Pass
TC#1623	Open Edit Tracking Dialog, change "Finger" color.	The color of the dot should reflect to the change immediately.	Same as expected	Pass
TC#1624	Open Edit Tracking Dialog, change "Palm" color.	The color of the dot should reflect to the change immediately.	Same as expected	Pass
TC#1625	Open Edit Tracking Dialog, click any dot button.	If the dot is off it will light up, otherwise.	Same as expected	Pass
TC#1626	Open Tutorial Dialog.	Showing all loaded helper images.	Same as expected	Pass
TC#1627	Open Tutorial Dialog, click on arrow buttons.	Switch betweens images. If it reaches the end or front, it can automatically goes to the other end.	Same as expected	Pass
TC#1628	Open Tutorial Dialog, click on any dot button.	Directly show the image in that index.	Same as expected	Pass

2.1 Gesture

Test Case ID	Scenario	Expected Output	Actual Output	Result
TC#2101	Perform Pointing Gesture and move around.	The cursor will follow the movement of hand.	Same as expected	Pass

TC#2102	Perform Pointing Gesture and then do Click Command on any component.	The component will be clicked with a left click operation.	Same as expected	Pass
TC#2103	Perform Pointing Gesture and click on slice trans overlayer button.	The slice translate mode will be activated or deactivated opposite to its current status.	Same as expected	Pass
TC#2104	Perform Pointing Finger Gesture and swipe left or right.	If there are more than one actor, the displayed actor will switch referring to the swiping direction, which swipe to left to decrement and to right to increment the current index.	Same as expected	Pass
TC#2105	Perform Two Finger Gesture and move front or backward.	If there is an actor, the actor will zoom in if user's hand move forward. Otherwise, zoom out if user's hand move backward.	Same as expected	Pass
TC#2106	Perform Three Finger Gesture and move around within Neutral Area.	If slice translate function is activated, the slice should still not be moved.	Same as expected	Pass
TC#2107	Perform Three Finger Gesture and move around out of Neutral Area toward edges.	If slice translate function is activated, the slice should be translated following the direction of movement.	Same as expected	Pass
TC#2108	Perform Four Finger Gesture.	Gesture should be recognised and display by gesture status. However, no function should be mapped.	Same as expected	Pass
TC#2109	Perform Flow Gesture and move around within Neutral Area.	If the is an actor, it should still not be rotated.	Same as expected	Pass
TC#2110	Perform Flow Gesture and move around out of Neutral Area toward edges.	If the is an actor, it should be rotated following the direction of movement. The closer to the edge the faster the rotation.	Same as expected	Pass
TC#2111	Perform Stpp Gesture.	Gesture Cheat Sheet should appear.	Same as expected	Pass
TC#2112	Perform Fist Gesture.	Gesture should be recognised and display by gesture status. Since this gesture is for repositioning, therefore, no function should be performed.	Same as expected	Pass
TC#2113	Perform Hold Gesture.	Gesture should be recognised and display by gesture status. However, no function should be mapped.	Same as expected	Pass
TC#2114	Perform Clap Gesture.	The application should be terminated, however, changes in system preference should still be saved.	Same as expected	Pass

3.1 VTK

Test Case ID	Scenario	Expected Output	Actual Output	Result
TC#3101	Import Data Model File of Extension VTK	The file should be imported and the actor should be able to display on VTKPanel.	Same as expected	Pass

TC#3102	Import Data Model File of Extension STL	The file should be imported and the actor should be able to display on VTKPanel.	Only one of the testing file cannot be shown, maybe there is problems with the file. More detial investigation is required to solve it.	Pass
TC#3103	After saving current file, create a new LVSFile.	The VTKPanel should be clear. Previous file's model should not be still showing in VTKPanel.	Same as expected	Pass
TC#3104	After application is launched, immediately open a LVSFile or import a Data Model.	The imported item should immediately display on VTKPanel.	Same as expected	Pass
TC#3105	Choose contour option.	The VTKPanel will display the contour actor within applied data range.	Same as expected	Pass
TC#3106	Choose threhold option.	The VTKPanel will display the threshold actor within applied data range.	Same as expected	Pass
TC#3107	Choose slice option.	The VTKPanel will display the slice actor with initial position at the center of the actor.	Same as expected	Pass
TC#3108	Choose scalar bar option.	The VTKPanel will show the scalarbar widget with correct data range.	Same as expected	Pass
TC#3109	After the application is lauched.	The orientation widget should be functioning even there is not actor.	Same as expected	Pass
TC#3110	After choosing slice option, activate the slice transform function.	The camera will reset to initial position.	Same as expected	Pass
TC#3111	Choose multiple options, for instance, contour and slice.	Both actor should be able to show in the panel at the same time.	Same as expected	Pass
TC#3112	Open a LVSFile, Import a new Data Model or switch actor.	The camera should automatically reset to a position which user can see the whole actor.	Same as expected	Pass
TC#3113	Activate the slice transform function, move the slice and deactivate it.	The slice actor shown should reflect to the change of slice.	Same as expected	Pass
TC#3114	Enable scalar bar and change the color map.	The scalar bar should response to the change immediately.	Same as expected	Pass

2.2 Usability Test

2.2.1 Questionnaires

User's Background

This part is about the user's background, for instance knowledge on relevant software or algorithms.

*Required

Have you ever use a gesture controller (e.g. Kinect) or related experience? *

- ○ Yes
- ○ No

Have you ever use any visualisation software(s)? *

- ○ Yes
- ○ No

If yes for previous question, which software(s) have you been using?

Your answer

Test Review

Did you manage to break the program during your testing?

- ○ Yes
- ○ No

How user-friendly is the GUI design?

	1	2	3	4	5	
Lowest	○	○	○	○	○	Higest

How will you rate the "look and feel" of the GUI?

	1	2	3	4	5	
Lowest	○	○	○	○	○	Higest

How will you rate the performance of the GUI?

	1	2	3	4	5	
Lowest	○	○	○	○	○	Higest

Is the gesture easy to be memorise?

	1	2	3	4	5	
Hard	○	○	○	○	○	Easy

Is the software easy to learn?

	1	2	3	4	5	
Hard	○	○	○	○	○	Easy

How will you rate the accuracy of the gesture being recognised?

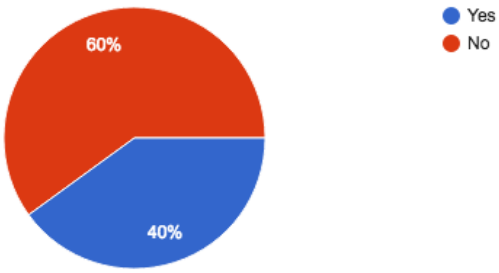
	1	2	3	4	5	
Never	○	○	○	○	○	Always

Is there any other opinion?

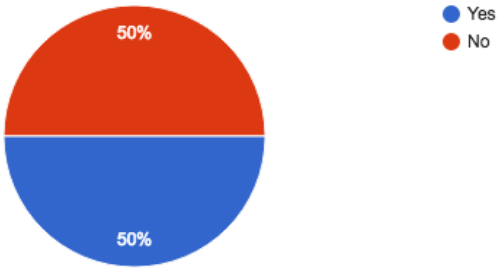
Your answer

2.2.2 Test Result

Have you ever use a gesture controller (e.g. Kinect) or related experience?
(10 responses)



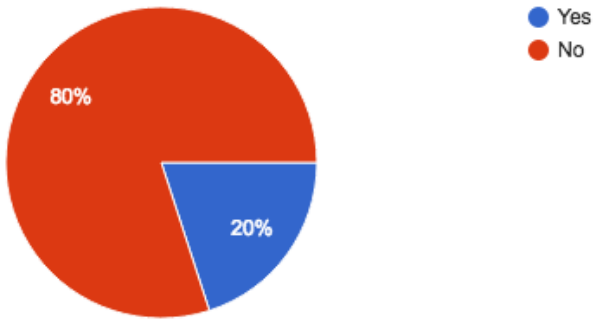
Have you ever use any visualisation software(s)? (10 responses)



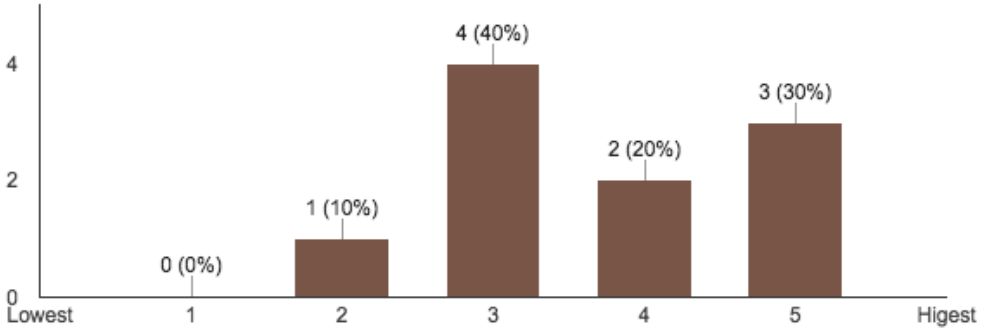
If yes for previous question, which software(s) have you been using?
(5 responses)

RViz, PCL
NirView, NirFast Slicer
paraview, nirview, meshlab
Paraview
Libgdx

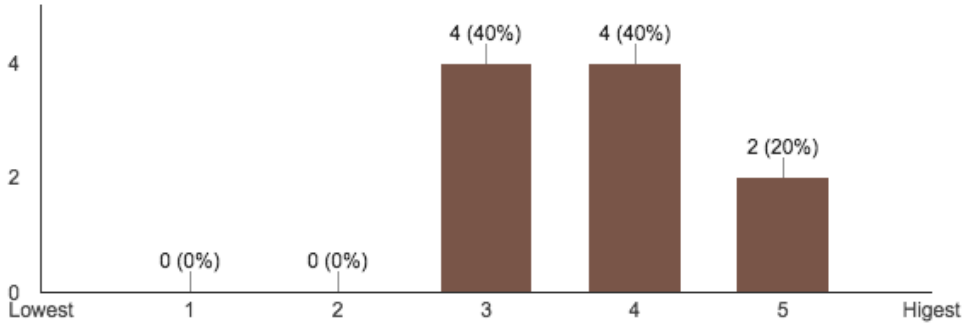
Did you manage to break the program during your testing? (10 responses)



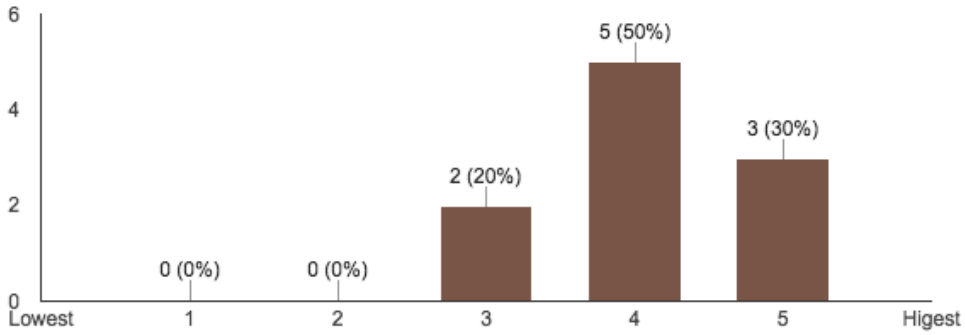
How user-friendly is the GUI design? (10 responses)



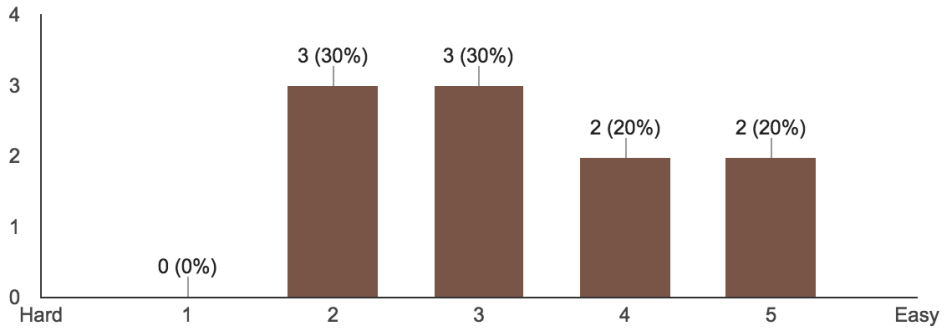
How will you rate the "look and feel" of the GUI? (10 responses)



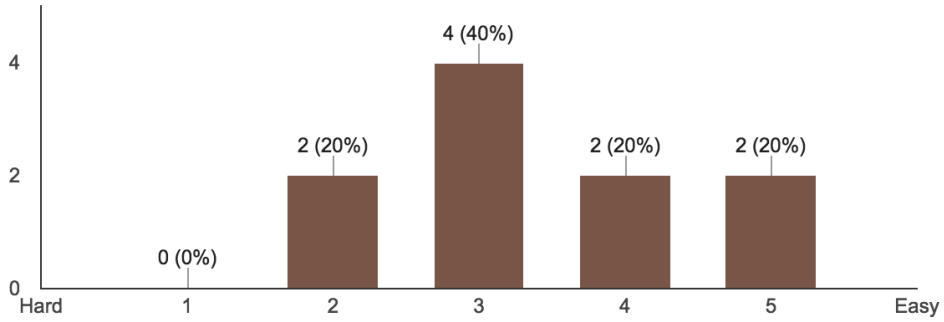
How will you rate the performance of the GUI? (10 responses)



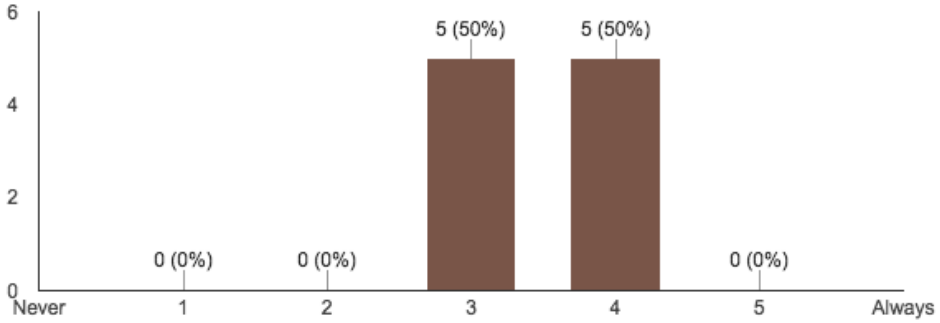
Is the gesture easy to be memorise? (10 responses)



Is the software easy to learn? (10 responses)



How will you rate the accuracy of the gesture being recognised? (10 responses)

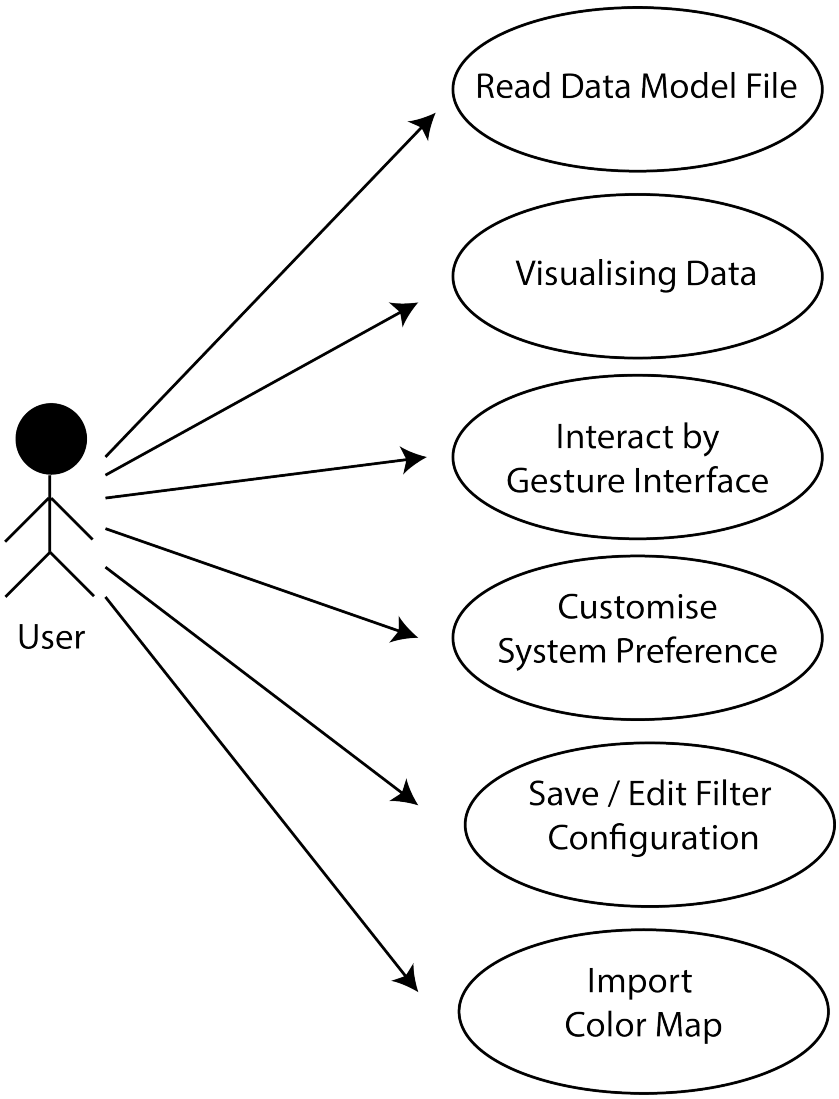


Is there any other opinion? (6 responses)

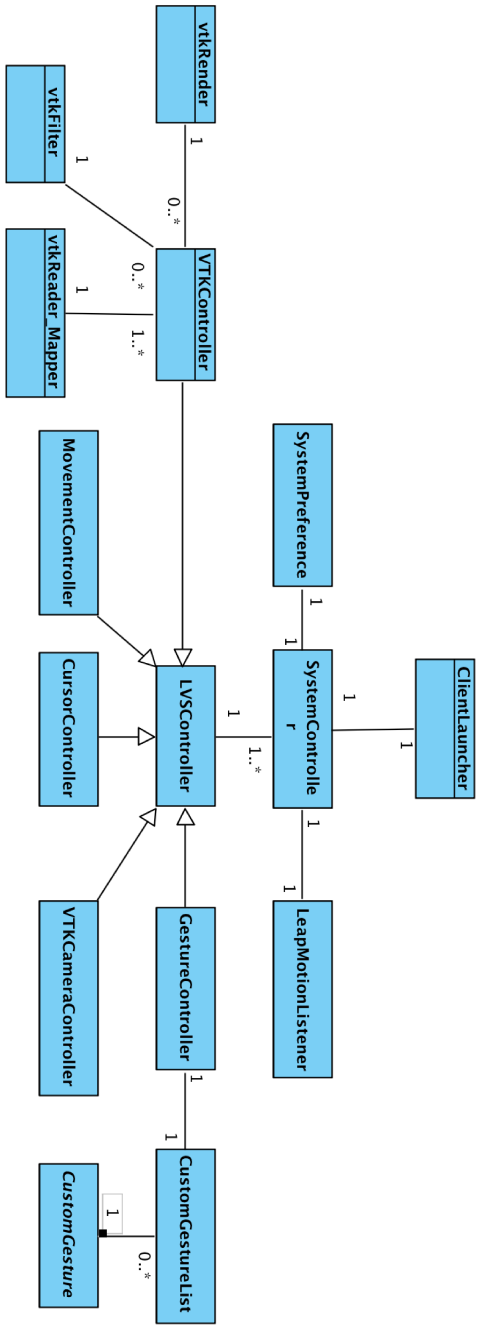
It can be difficult to remember all of the gestures so an easy way to view them again could be useful.
It can be difficult to remember all of the gestures so an easy way to view them again could be useful. The hand display should provide the function of the gesture and not the gesture name.
The GUI was quite plain, from a design perspective.
Please extend the project to the level of Iron Man ;)
gesture could be more humanized
Need time to remember those gesture, some of them are not accurate.

3 UML Diagrams

3.1 Use Cases Diagram



3.2 High-Level Class Diagram



4 User Manuals

4.1 Controls

4.1.1 Buttons & Hot-Keys

All controls are accessible from toolbar and menu-bar, some of them have mapped Hot-Keys.

Figure 2 - Toolbar

1) New File (Ctrl+N) Creates a new LVSFile

2) Open File (Ctrl+O) Open a existing LVSFile

3) Save File (Ctrl+S) Save current LVSFile

4) Save As File (N/A) Save current LVSFile as another or a new file.

5) Import Data File (Ctrl+I) Import a Data Model File into the system (i.e. VTK, STL)

6) Actor Switching Panel Change the current displaying actor

7) Movement Tracking Enable/Disable movement tracking function

8) Gesture Tracking Enable/Disable gesture tracking function

9) Opacity Change the transparency of displaying actor

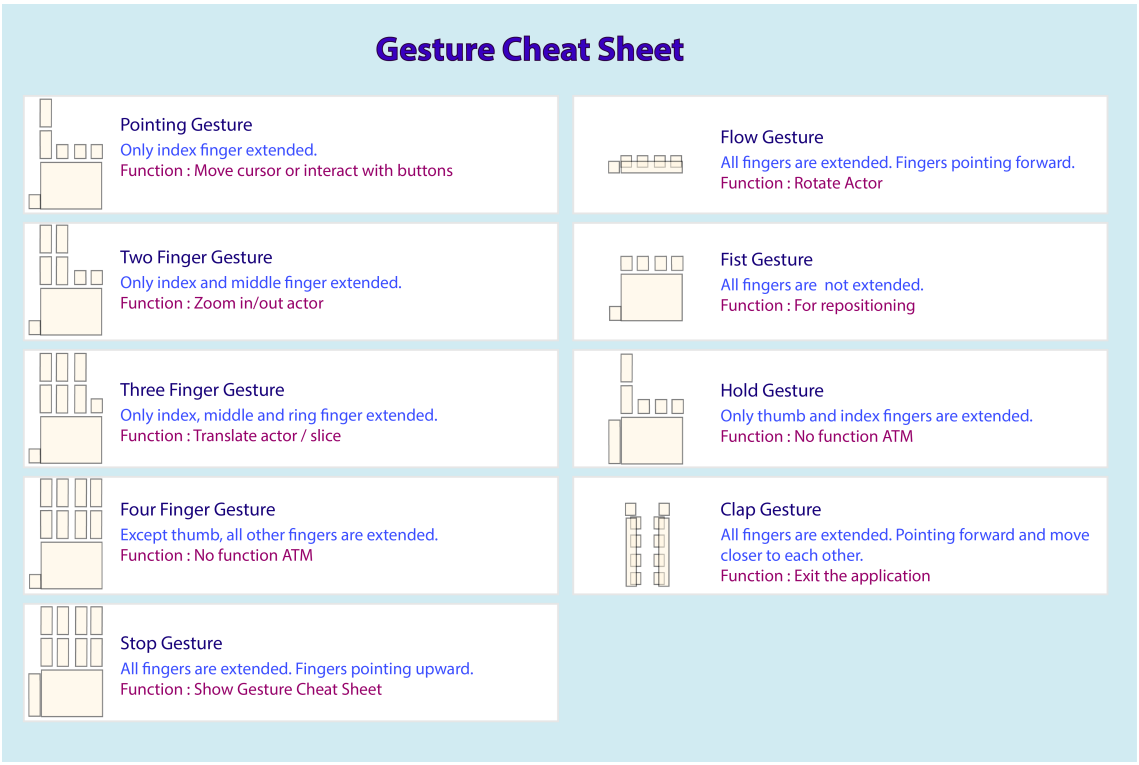
10) Color Map Change color representation of displaying actor

11) Data Representation Change data representation format of displaying actor

12) Leap Motion Status Leap Motion connection status

13) Presentation Mode Enable presentation mode

4.1.2 Gesture


Gesture Cheat Sheet
Pointing Gesture
Only index finger extended.
Function : Move cursor or interact with buttons
Flow Gesture
All fingers are extended. Fingers pointing forward.
Function : Rotate Actor
Two Finger Gesture
Only index and middle finger extended.
Function : Zoom in/out actor
Fist Gesture
All fingers are not extended.
Function : For repositioning
Three Finger Gesture
Only index, middle and ring finger extended.
Function : Translate actor / slice
Hold Gesture
Only thumb and index fingers are extended.
Function : No function ATM
Four Finger Gesture
Except thumb, all other fingers are extended.
Function : No function ATM
Clap Gesture
All fingers are extended. Pointing forward and move closer to each other.
Function : Exit the application
Stop Gesture
All fingers are extended. Fingers pointing upward.
Function : Show Gesture Cheat Sheet

4.2 Filters/Algorithm

The following list the simple description and available parameters for each filters/algorithm

Contour Showing specific values of data
Available Parameters:

- Custom Range - Maximum and Minimum
- Step - Number of Exact Values generated from custom range
- Exact Values - Any numbers within the default range

Threshold Showing the data within the range
Available Parameters:

- Custom Range - Maximum and Minimum

Slice Showing the cross-section of data on particular point
Available Parameters:

- Normal of slice - Normal in Vector form (X,Y,Z)