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NEO TANDEM TECHNOLOGIES



User Manual

V0.1

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DOCUMENT REVISIONS

Version 0.0: Initial creation of document

Version 0.1: Added basic content relating to Introduction, Processes and Appendix.

Version 0.7: Added more content for all sections including fixes to some texts.

1 Introduction

1.1 Scope and Purpose

The purpose of this eye-tracking software is to provide the user with a eye-tracking software which will allow for the tracking of the eye on 2D and 3D models and videos. The system is centred around making eye-tracking possible for all media types.

Our client wanted us to develop this software so that it could help the Geo-Informatics department with research they want to do on how people view geological locations and what stands out to them when they view it. That is why we had decided to give the option of three different types of eye-tracking. This software will thus aid them in their research and help provide the data that they needed.

1.2 Process Overview

The Eye-tribe as a system comes with the infrared camera which is used to track the eyes and it also comes with an SDK that will allow you to developed programs to be used with the camera. there is also access to a few sample programs one the Eye-Tribe website. these can be downloaded and then they can be used with the camera to see all the functionality it is capable of.

These items found when purchasing the Eye-tribe camera form only the base of what the camera is really capable of. We have taken these elements and expended them and integrated them with aspects such as 3D modeling and tracking eyes on multiple media formats.

There are a few core process that have been implemented and that will allow for more effective eye-tracking across mediums. The process are as follows:

- Eye tracking on 2D and 3D models and videos.
- Creation of heat maps from eye-tracking.
- Saving heat map on specific media.
- Creating Statistics on information gathered.

The eye tracking on the various models uses the camera to track the eyes of the user and then saves the data in a file so that it can be used later.

The data that is saved is then used to create heatmaps. The heatmaps come in two forms: normal and then overlay. Normal is just the basic points of the heatmap on a blank background. Overlay is a heatmap that has been overlaid onto the media and shows where on the media the user had looked.

The recorded data is also used to create a statistical report of the data. This report includes metadata about the media recorded and then actual data from the stored points. The data on the recorded points includes data such as time, points gathered and a map that shows which sections where most looked at. the report is in PDF format.

The following process listed are the core of this program as they carry out the basic and most important functionality of this software.

2 Configuration

2.1 System Configuration

2.1.1 Minimum Hardware requirements

- 1.6 GHz or faster processor
- 4GB of RAM
- 1GB of available hard disk space
- 5400 RPM hard drive
- DirectX 9-capable video card
- USB 3 port or better(camera requirement)

2.1.2 Recommended Hardware requirements

- 2.6 GHz or faster processor
- 8GB of RAM
- 2GB Graphics Card
- 1GB of available hard disk space
- 5400 RPM hard drive
- DirectX 9-capable video card running at 1024 x 768 or higher display resolution
- USB 3 port or better(camera requirement)

2.1.3 Required Software requirements

- Windows 7 OS or better.

2.1.4 Recommended Software requirements

- The Eye Tribe software. That comes with the Eye Tribe camera.
- Windows Media Player Version 12.
- Any PDF reading software such as Adobe Reader.

2.1.5 Recommended External Devices

- The Eye Tribe eye-tracking camera. The camera can be purchased at The Eye Tribes website (<https://theeyetribe.com/>).

2.1.6 Connecting the camera to the computer

Below is a picture of the eye tribe camera.



Figure 1: Camera

The camera uses a USB 3.0 connection to connect to the computer. This is due to large amounts of data that needs to be transported quickly. Below shows two pictures of how the eye tribe is connected to the computer.



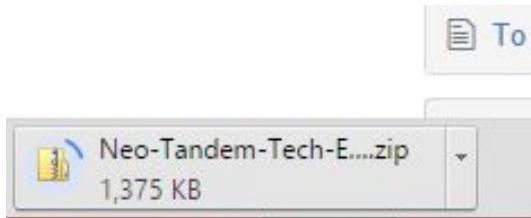
Figure 2: Camera

2.2 Installation

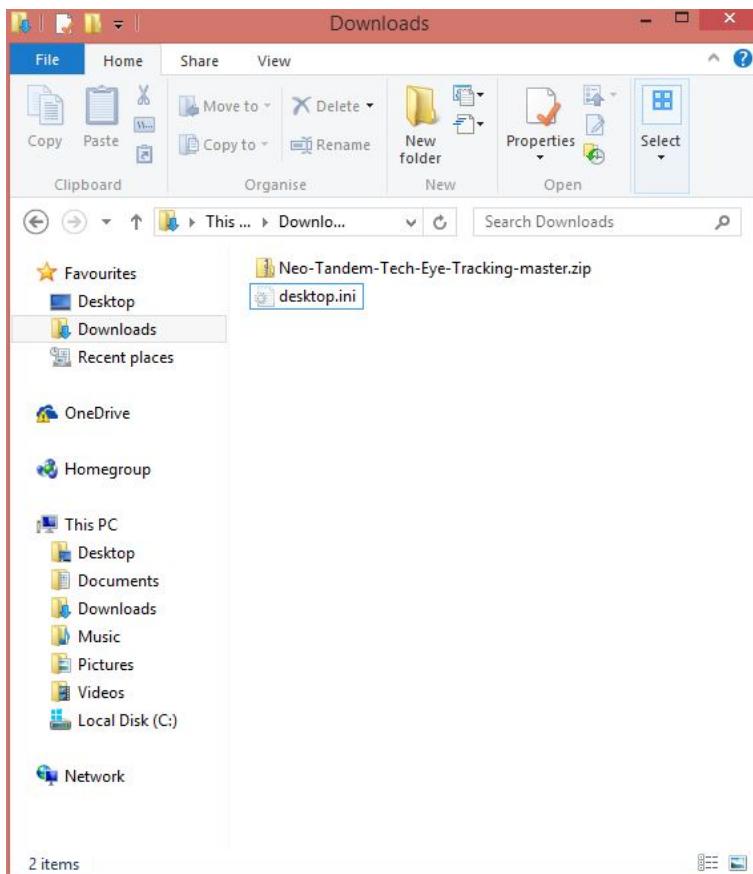
Please ensure that you meet the minimum requirements. It is recommended that you meet the recommended requirements as this will ensure that the best performance is achieved. The software can be downloaded from Github. At the moment it is only an executable file but a full installation onto your computer will be developed soon. Follow the steps below to install the eye tracking software on your computer.

1) Navigate to <https://github.com/MichaelNunes/Neo-Tandem-Tech-Eye-Tracking> and then click on the download as zip button.

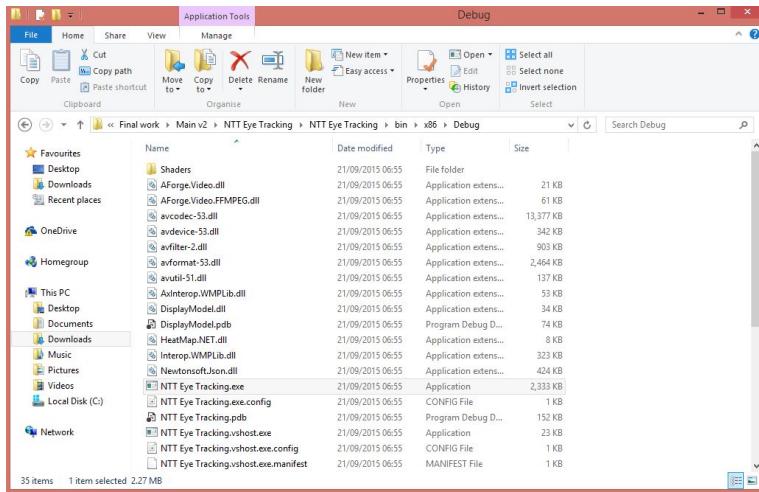
2) Unzip the archive using software of your choice to a folder of your choice



3) Navigate to the following directory: filename/Neo-Tandem-Tech-Eye-Tracking/Final work/Main v2/NTT Eye Tracking/NTT Eye Tracking/bin/Debug.



4) Here you can run the executable called NTT Eye Tracking.exe and the program is run.



3 Getting Started

The program is made to run with as little configuration as possible. There are no authentication processes that are associated with the program. The user will be able to just run the application and use it if the minimum requirements have been met.

3.1 Basic use

Once the application is run the user will be presented with a screen which will allow them to select the option to start a new recording session or use a previously created session. A new form will pop up with options to navigate to different sections of the application. The calibration button will navigate to the calibration page will allow the set-up of The Eye Tribe eye camera. This form will allow you to calibrate the camera to ensure that the data recorded is correct. The calibration process will be discussed further in a later section. The recording button on the main page will open the recording set up. This page will allow the user to select the type of recording which will then take them to the appropriate pages to do the recording. The recording the page will allow for recording on the selected media. You would select the appropriate media and then start the recording. The data will then be saved and then used to make the heat maps and all the associated files.

The application can be exited easily by just pressing the exit button(red cross) on the top right of the application. This will end the application and end all its accompanied processes. This will ensure that the application does not cause harm to the computer.

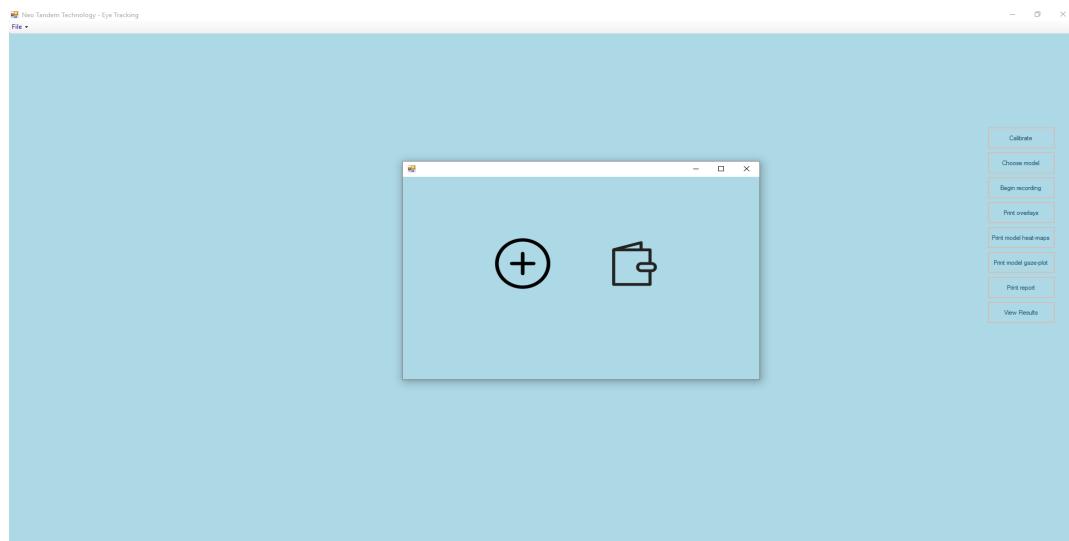
4 Using the System

The following section will go in to in depth detail about the system and how to use it. This section of the user manual will show you how to perform actions throughout the application. There will also be sections on what to expect from each action. Certain

troubleshooting sections will be referenced in this text and if you encounter any of these errors please refer to the troubleshooting section to try and solve the error.

4.1 Starting the program

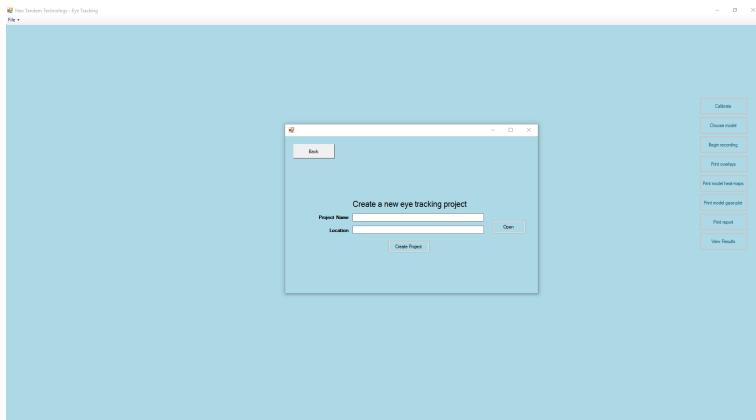
The program will allow you to perform eye-tracking on different kinds of media. Different media can be recorded and so the program will allow for multiple recordings' of the same or different media. The program allows you to create what is known as a eye-tracking recording project. This project is used to keep all the information of your recordings' for a specific session. You can always return to the session and continue recording in that project which allows you to move between recording projects.



When the user runs the Eye tracking software a form will appear. The form is split into two sections, start a new recording or to open a existing project. Below are the execution of both methods.

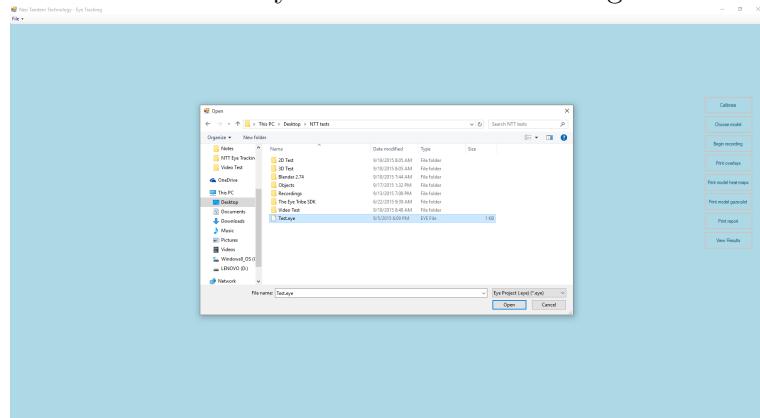
4.1.1 Start a new project

To start a new project you will need to specify a name for the project and location to store all the files. A default name will be given to the project called "project". This will create 3 files and a series of folders in the location selected. The 3 files created are the .eye file which contains all the information about the recording project. This information is all that is needed to continue recordings'. The two other files that are created are the settings files for general user settings and then settings for 3D recording. The folders that are created are just the folders for the recording data and the results. Once this all the folders are created then the program will proceed to the main menu.



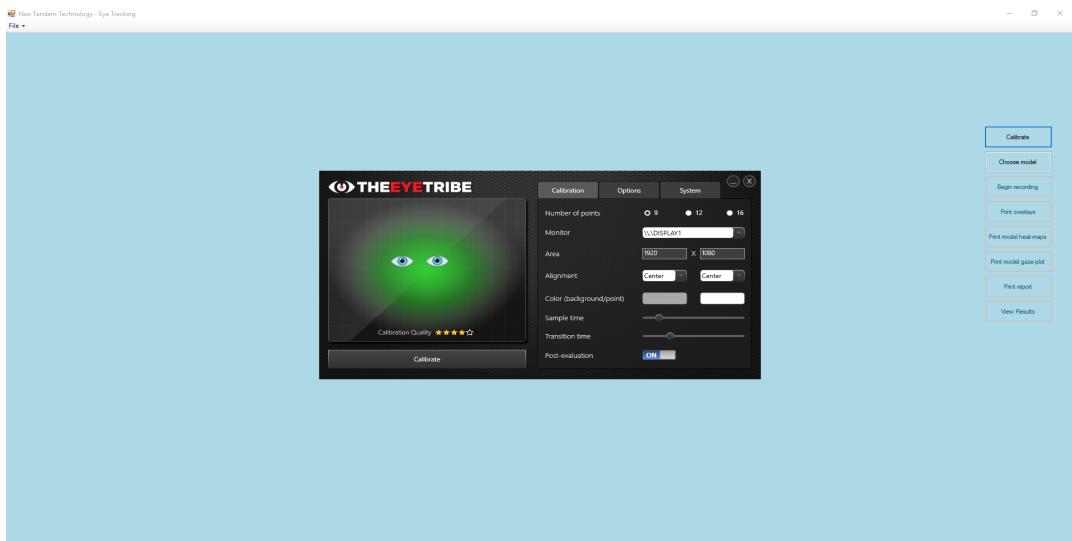
4.1.2 Open existing project

This will allow you to select an existing project and continue recording. Press the open button to select a file. The only file that will be accepted are ".eye" files. Once you select the file the settings are loaded up from the files and then the program moves to the main menu for you to continue recording.

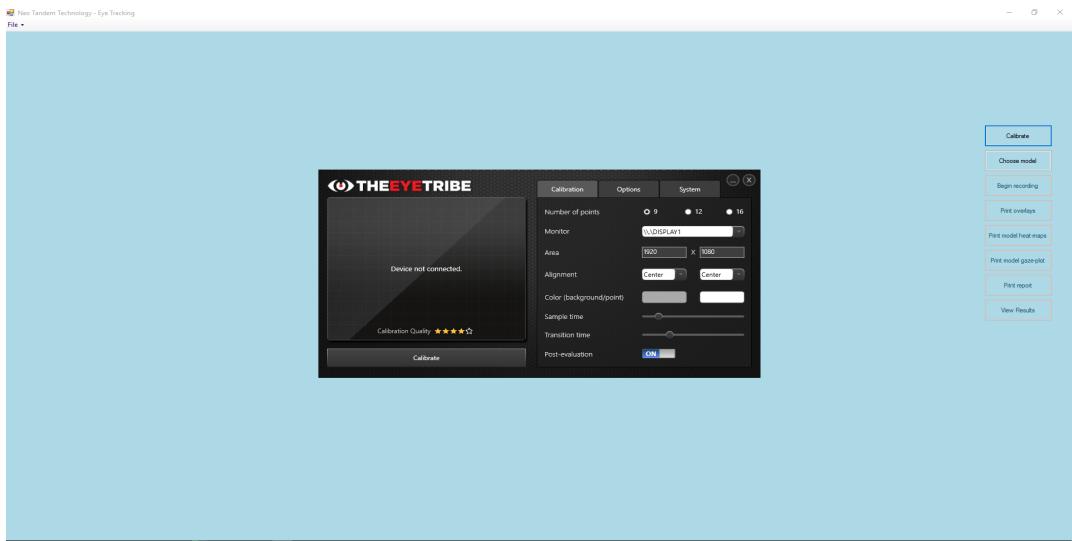


4.2 Calibration Screen

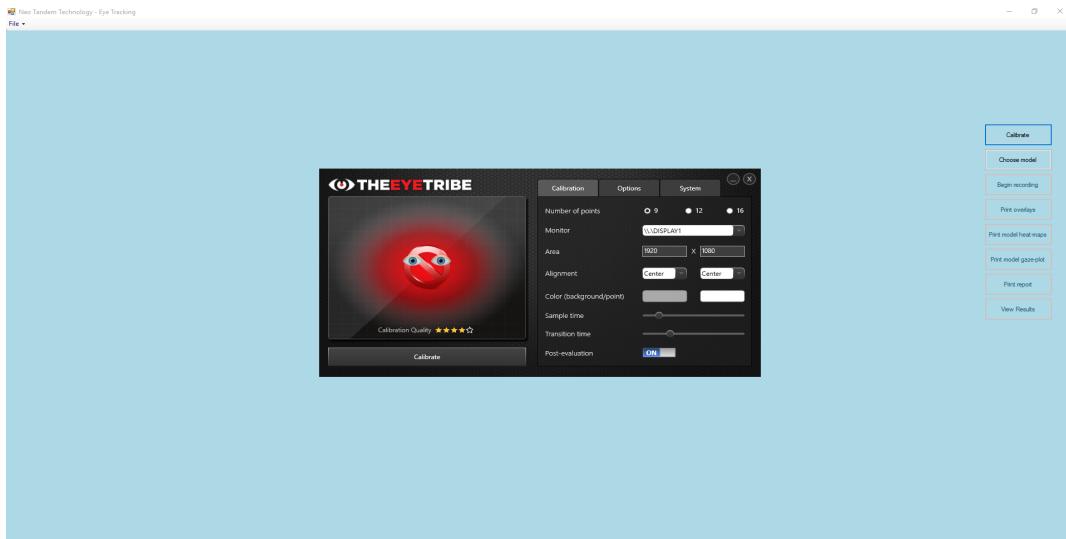
When navigating to a recording screen there will be a button to navigate to the calibration screen. The calibration of The Eye Tribe camera is vital as this will ensure that the program will accurately create the heat maps for the media that has the eye tracking performed on it. This will also allow the user to configure the settings of the recording to their needs. The pressing of the calibration button will open the EyeTribeUIWin program which initiates the server and opens up the calibration. Use the calibration to calibrate the camera. Leave the server window open as this is what will transfer the data from the camera to the program. The server is connected to the internet so also ensure that there is a stable internet connection available. Once you have calibrated you may then proceed back to the menu screen and then start recording.



The calibration will show the following if there is no camera detected

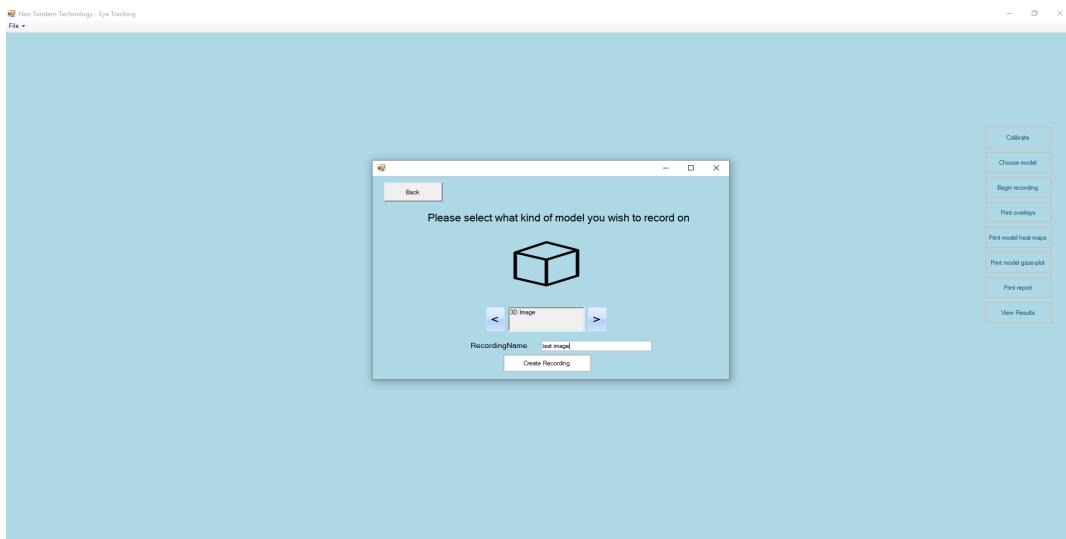


The calibration will show the following if there is no eyes detected



4.3 Recording Set-up Screen

When you are done opening an existing project or starting a new one you will be navigated to this screen. This screen is used to set-up the recordings'. This screen will allow you to do multiple recordings'. These recordings' are executed sequentially and can not be performed at the same time. The application will be navigated to either of three screens: 2D recording screen, 3D recording screen or the Video recording screen. This navigation will be dependent on the options taken in the recording set-up. You will also be allowed to name the recordings, this will create new folder in the recordings directory. The folder will be placed in the appropriate recording type sub-folder of the recordings folder. The folder will house all the information about the recordings such as eye-tracking data and also the resulting heat maps.

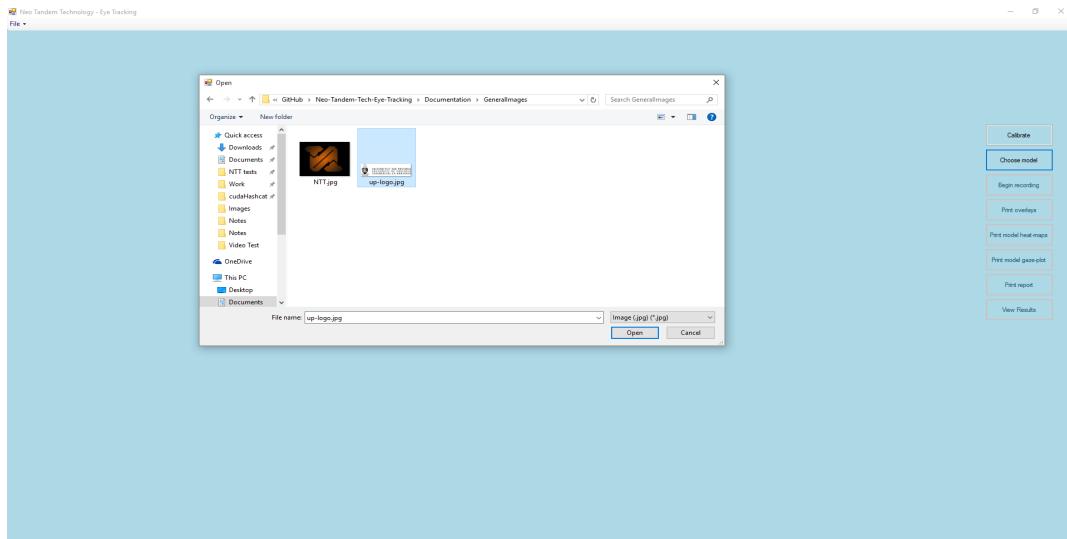


The screen has a text box for the user to enter the name of the recording. The name should contain only alpha numeric characters so that when the folder is created it will not fail. If it does not follow these rules then it will not be allowed to continue to the next section of the application. There is also a carousel that will cycle through various

options to select what type of recording is needed to be performed. Once ready then press the start recording to proceed to the recording page.

4.4 Choosing model

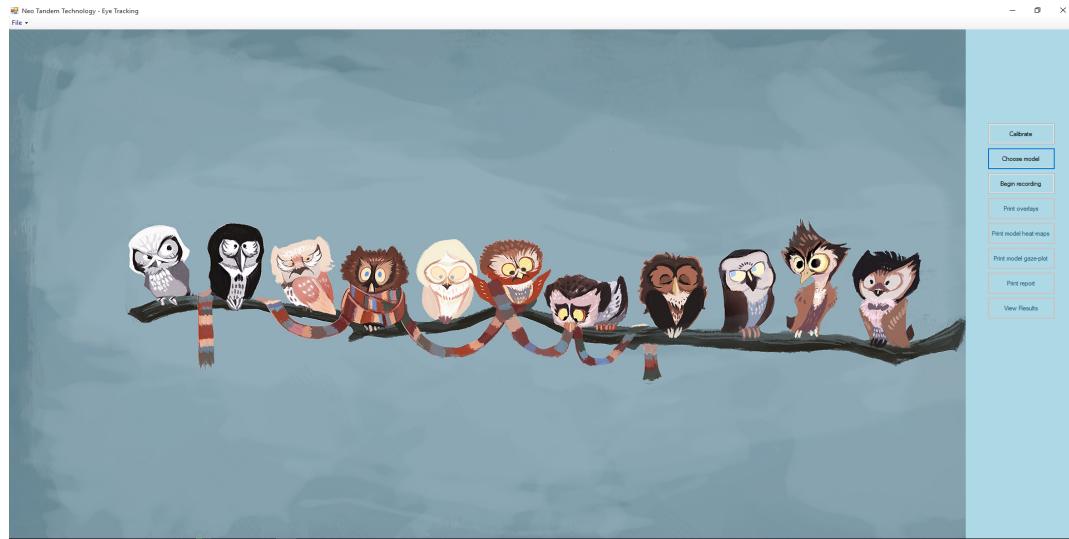
The user must select the model they wish to do recording on by pressing the choose model option. This will open up a dialogue for the user to select their model.



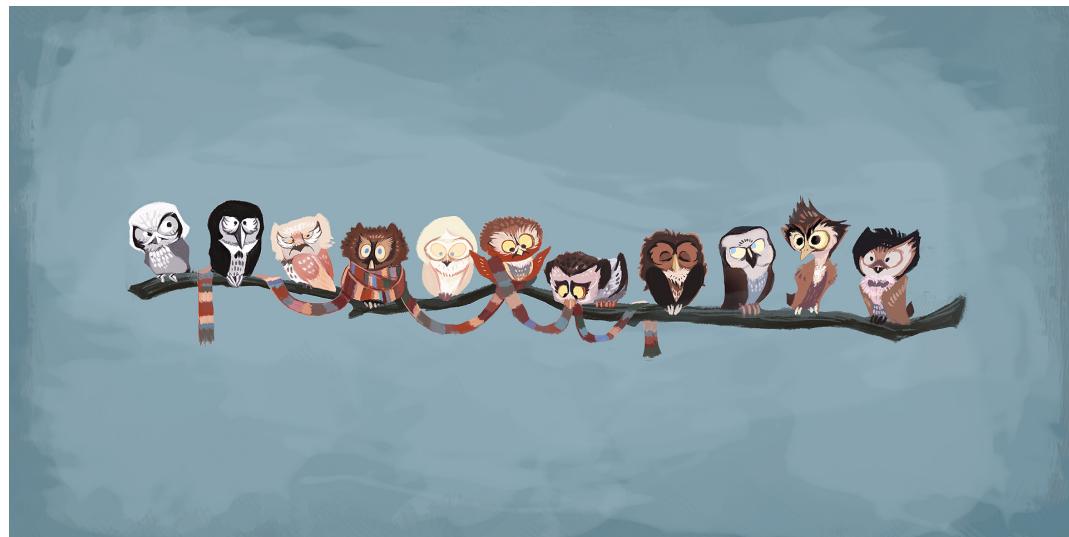
4.5 Recording 2D model

The 2D model recording form is navigated after the 2D model is selected in the recording set up. The page has a list of buttons that will perform all the tasks that need to be performed. The open model button when pressed, will allow the selection of a 2D model to be chosen. The 2D models are often just images and any image is allowed to be chosen. The quality of the image will improve the results from the eye tracking recording. The higher the image the more accurate the results will be. When an image is selected then the record button can be pressed. When the record button is pressed, the screen is filled with the image. The image is expanded to fit on the entire width and height of the image. The high image quality will provide a crisper and more clear image. The recording also starts once the image is made full screen. During this process it is recommended that you move as little as possible as the data that is recorded could be tampered with. Once you are done with the recording press the Esc key. You are then able to find the results of the recording in the project location in the recordings folder and then in the folder with the models name as a folder. The folder will contain a copy of the image, a text file which contains all the recorded data and two images that have heat maps on them. The one heat map image is just the heat map while the other image is a heat map which then has the image that the recording was performed on. When you are done recording the data you can then exit the application or restart the recording. Restarting the recording will overwrite the data that was there. The exiting of the application is done through the pressing the red X in the top right corner of the form.

model displayed in the window and recording is ready.



The recording occurring on a model,2D in this case.



4.6 Recording 3D model

The 3D model recording form is navigated after the 3D model is selected in the recording set-up. The page has a list of buttons that will perform all the tasks that need to be performed. The open model button when pressed, will allow the selection of a 3D model to be chosen. The 3D model will need to be in the format of a object file. These files have the extension ".obj". When an 3D model is selected then the record button can be pressed. When the record button is pressed. The 3D model then has snapshots taken and then a slide-show is created of the model and then is shown. The slide-show is expanded to fit on the entire width and height of the screen. The recording also starts

once the slide-show starts the is made full-screen. During this process it is recommended that you move as little as possible as the data that is recorded could be tampered with. The recording process will end when all the slide-show images have been shown. You are then able to find the results of the recording in the project location in the recordings folder and then in the folder with the models name as a folder. The folder will contain all the snapshots, a text file which contains all the recorded data and images that have heat maps for each snapshot on them. The one set of heat map images are just the heat maps for each snapshot. while the other image is a heat map which then has the models snapshot that the recording was performed on. When you are done recording the data you can then exit the application or restart the recording. Restarting the recording will overwrite the existing data that was there. The exiting of the application is done through the pressing the red X in the top right corner of the form.

4.7 Recording 3D model flythrough

The 3D model flythrough recording form is navigated after the 3D model is selected in the recording set-up. The page has a list of buttons that will perform all the tasks that need to be performed. The open model button when pressed,will allow the selection of a 3D model to be chosen. The 3D model will need to be in the format of a object file. These files have the extension ".obj". When an 3D model is selected then the record button can be pressed. When the record button is pressed. The 3D model then is rendered and then the user is placed inside of the model and is then free to roam the model using either the keyboard or a gamepad. The 3D render is expanded to fit on the entire width and height of the screen. The recording also starts once the 3D render starts the is made full-screen. During this process it is recommended that you move as little as possible as the data that is recorded could be tampered with. The recording process will end when all the slide-show images have been shown. You are then able to find the results of the recording in the project location in the recordings' folder and then in the folder with the models name as a folder. The folder will contain a video of your recording, a text file which contains all the recorded data and video that has a heatmap overlaid. When you are done recording the data you can then exit the application or restart the recording. Restarting the recording will overwrite the existing data that was there. The exiting of the application is done through the pressing the red X in the top right corner of the form.

4.8 Recording Video

The video recording form is navigated after the video is selected in the recording set-up. The page has a list of buttons that will perform all the tasks that need to be performed. The open video button when pressed, will allow the selection of a video to be chosen. The video that is chosen needs to be a ".wmv" file as it uses and extension of the Windows Media player. The length of the length of the video can be any length but the longer the video is the longer it will take to be processed. When an video is selected then the record button can be pressed. When the record button is pressed, the screen is filled with the video and the video will then start playing. The video is expanded to fit on the entire width and height of the screen. The video is recommended to be

a medium quality one as the video might show signs of pixelation during the playing. The recording also starts once the video is made full screen and begins to play. During this process it is recommended that you move as little as possible as the data that is recorded could be tampered with. The recording will end when the video has stopped playing. Once you are done with the recording process you are then able to find the results of the recording in the project location in the recordings' folder and then in the folder with the models name as a folder. The folder will contain a copy of the image, a text file which contains all the recorded data and two videos that have heat maps on them. The one heat map video is just the heat map while the other image is a heat map which then has the video that the recording was performed on. The heat map will be populated as time goes by showing the most looked at on the model. When you are done recording the data you can then exit the application or restart the recording. Restarting the recording will overwrite the data that was there. The exiting of the application is done through the pressing the red X in the top right corner of the form.

4.9 Report summary creation

Once a recording has been completed on a model a statistical report is then generated with various details on the recording. The report is in a PDF format so a PDF reader such as Adobe reader is required to be installed on the computer to view the report. The report is located in the folder specified for the model.

The statistical report contains three pages. The first page is a cover page with a generic heading, the second page will contain data on the model. This information is just the basic metadata such as the models name, the models location and various other details about the model recorded.

The third and final page contains all the data for the recording that is then summarised. This data includes the number of points used and how many points where known as "lost points". Lost points are points that have been discarded as they are not in the bounds of the screen. These points have no impact on the creation of the heat-maps. The data also tracks the time of the recording based on the amount of points that are recorded. The pdf also contains a grid of where the points are mapped on the grid. The grid is a three by three(3X3) grid and each sections represent a part of a screen. The grid is also used to determine a point of interest which is a section that has been looked at the most.

All this information is written to the PDF and then saved for later reading and quick view summary to easily and quickly see what happened in the recording.

4.10 Gaze Plot Maps

Gaze plot maps show how the eye is moving around the recorded media. This records the fixations in the eyes as the move across. This differs from the heatmap in that it shows where the eyes fixate to without a heatmap overlay. Instead circles are placed on the eyes location and will grow longer the eye is near to the same location. When the eye moves far enough away from the point it then stops growing and moves to the next point. This gaze plot can be created by pressing the create gaze plot button which then creates a

video which can then be viewed.

5 Troubleshooting

This section of the user manual is dedicated to showing the errors that can occur on the system. This will also provide possible solutions to problems that you may encounter. Please note that currently the program is not finished and the accompanying user manual is also not yet complete. This will be updated as the system is developed.

The system is split into many subsections. This section will also be split to ensure you are able to file what you need.

5.1 Starting the program

5.1.1 String is not a path

This error occurs when starting a new recording project and the path in the path text-box does not follow path structure. The program will not continue if this error occurs. This can be fixed by ensuring that the text inside is a actual path such as: C:/User/MyPath.

5.1.2 The path does not exist

The following error occurs when the path that is selected no longer exists on the computer. This can be fixed by doing one of two things:

1. Ensuring that the path specified is correct.
2. Creating the file path to match the selection.

Any one of these solutions can help fix the problem and allow the program to continue.

5.2 Calibration

5.2.1 Could not find EyeTribeWinUI.exe

The program requires that the Eye-tribe software be installed on the system. This error occurs when the software is not found on the system.

The solution is simply to install the software which can be found on The Eye-Tribe website when you have purchased the camera.

5.3 Naming

5.3.1 Name has invalid characters or too many

This error occurs when the name for the recording contains invalid characters. These characters need to be alphanumeric and can not contain any symbols.

The solution is to simply use only alphanumeric numbers and not symbols. Use names with 40 characters.

5.4 General recording errors

5.4.1 Could not find [insert path and name].txt

When a recording has been completed and this error is shown it means that the file that stores the data was never created so it can not create heat maps for the specific media type. This error can occur due to multiple factors.

- The eye tracking camera was not connected or was not calibrated correctly.
- The eye tracking camera was connected to a USB 2 port.

The solution would simply be to check that The Eye-tribe is connected to the computer properly and also that it is connected to a USB 3 port.

5.5 Heatmap

5.5.1 Heatmap could not be created

The heat map is created using a text file created by the program. This text file is then used in the heatmap making process. This error occurs when the text file is no longer available.

The solution for this is to restart the recording process and ensure that the text file appears in the directory. If the file does not appear in the directory then it is recommended that you restart the computer.

5.5.2 Video could not be created

When the video is created an error can occur due to the following factors:

- A image for recording is in use.
- A image for recording has been deleted.

The solution is to re run the creation of the video and avoid doing the above so that the video can be processed and created properly.

5.6 Statistics

5.6.1 Could not create statistical report

The statistical report is created using a text file created by the program. This text file is then used in the statistics making process. This error occurs when the text file is no longer available.

The solution for this is to restart the recording process and ensure that the text file appears in the directory. If the file does not appear in the directory then it is recommended that you restart the computer.

5.6.2 Report could not be saved

The report will be saved to the directory of the video model. If you recreate the report an error can arise as it needs to save the report. The reason for this error is that the report is either opened already or the directory was deleted.

This can be resolved by closing the report and then creating the report once more and ensuring that the directory still exists.

6 Appendices

6.1 EyeTribe

The Eye Tribe is a low cost development kit which can be used by various languages such as C# projects to track the movement of the eye. The Eye Tribe eye tracker includes a SDK (Software Development Kit) that allows the integration of eye tracking on multiple applications on multiple platforms. More information on the Eye Tribe and its various components can be found at <http://www.theeyetribe.com>.