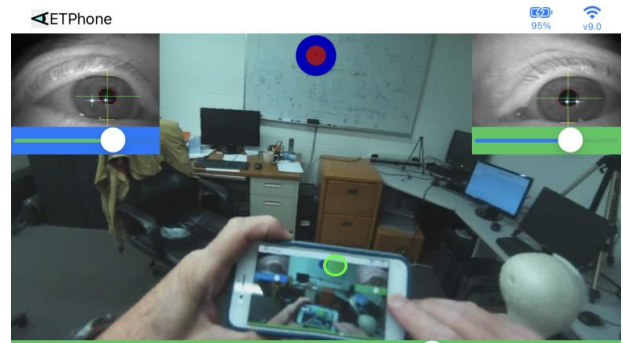


Eye Tracker Systems Manual

ETPhone for use with ETVision

MANUAL VERSION 1.1

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1 General Description

ETPhone is an iPhone app that can assist in the use of the Argus Science *ETVision* eyetracker. It can be used simply to display the AutoCalibration target used by *ETVision*, but can also be used to substitute for functions normally performed by the *ETVision* PC when it is not convenient for the PC to be in WiFi range.

In addition to simply displaying the *ETVision* AutoCalibration target, the *ETPhone* app can:

- Establish a WiFi connection to the *ETVision* Controller.
- Display eye and scene camera images with superimposed eye feature recognition overlays and a superimposed point-of-gaze cursor.
- Start and stop SD card recording by the *ETVision* Controller.
- Perform Auto Calibration and record 30 Hz digital data, as well as scene camera video files to iPhone memory.

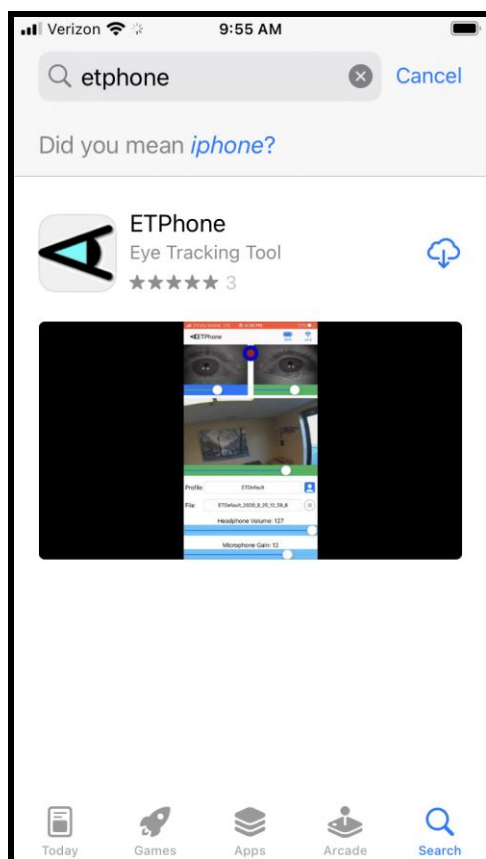
If using *ETVision* in an environment where it is not convenient to bring the *ETVision* PC, *ETPhone* can be used to verify that head mounted cameras are properly aimed, that eye features will be properly recognized, and that a subject auto calibration will be successful before starting SD card recording on the Controller. It can also be used to adjust the camera gain and compression ratio, and subject head phone and microphone volumes, if necessary. The video data recorded on the SD card can later be played back through the *ETVision* PC to produce 180 Hz eye tracking data (see *ETVision* manual, section 7.8.3).

Alternately, if only 30 Hz data is required (rather than 180 Hz data) and recording period will be reasonably short, data can be recorded directly on the iPhone by the *ETPhone* app.

The *ETPhone* app will run on iPhone 8 or above with IOS 16.0 or above.

2 Installation

Search for “ETPhone” on the iPhone App Store.

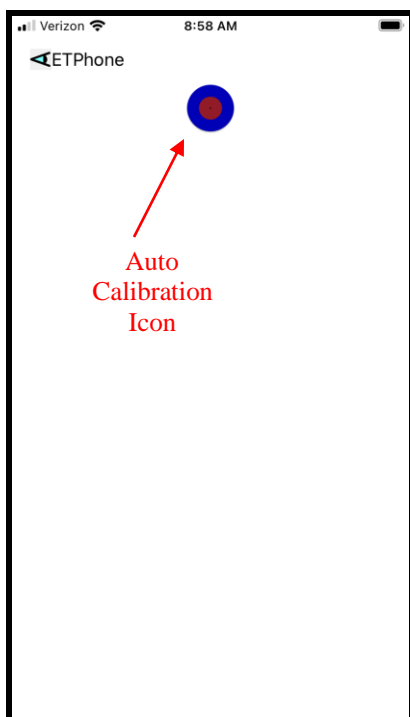


Touch the download icon to download and install the app.

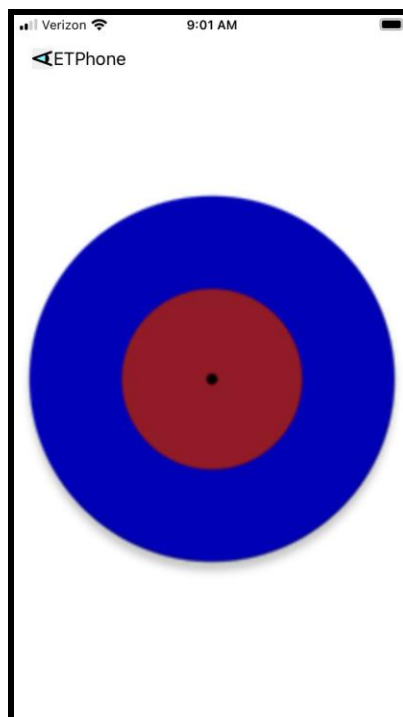
3 *ETPhone* Operation

3.1 Display Auto Calibration Target

Open the *ETPhone* App and touch the calibration target icon. A full size calibration target image will fill the iPhone screen as shown on the right image below. Touch the center of large target to return to the home screen.



ETPhone home screen (no Wi-Fi connection)

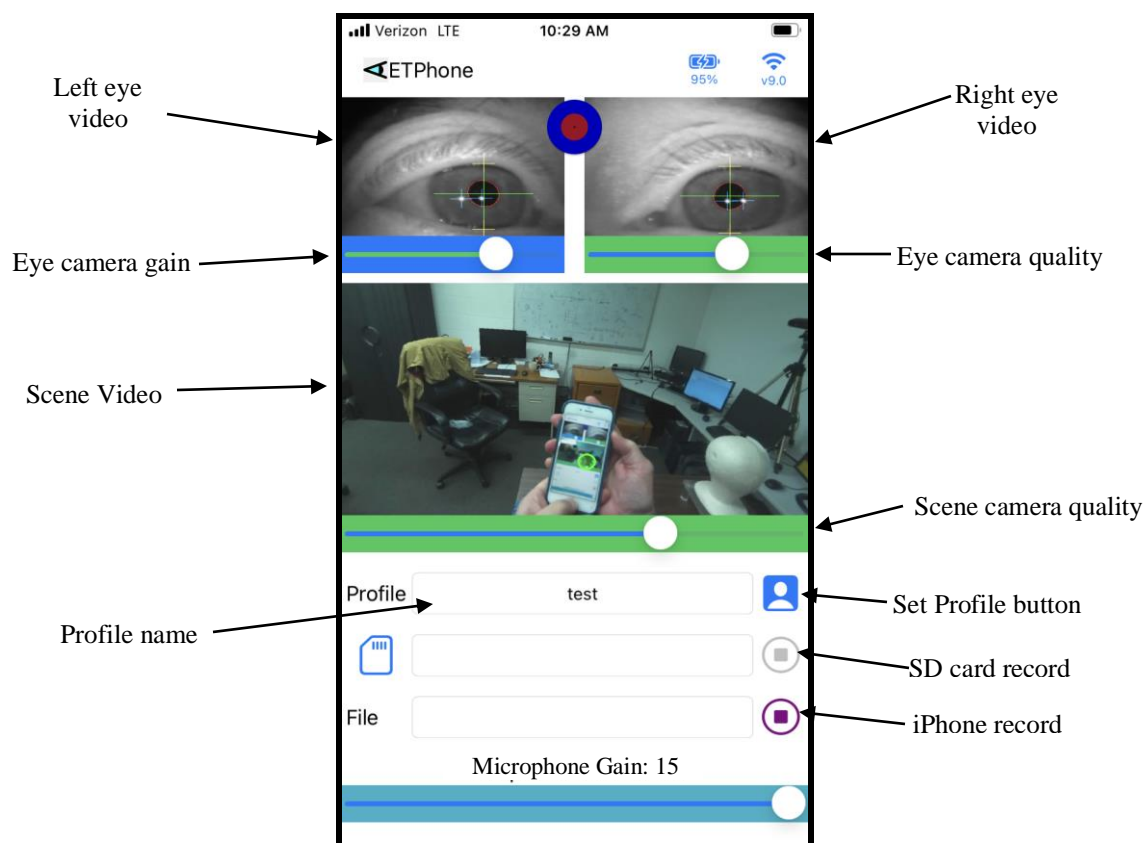


Full screen Auto Calibration target

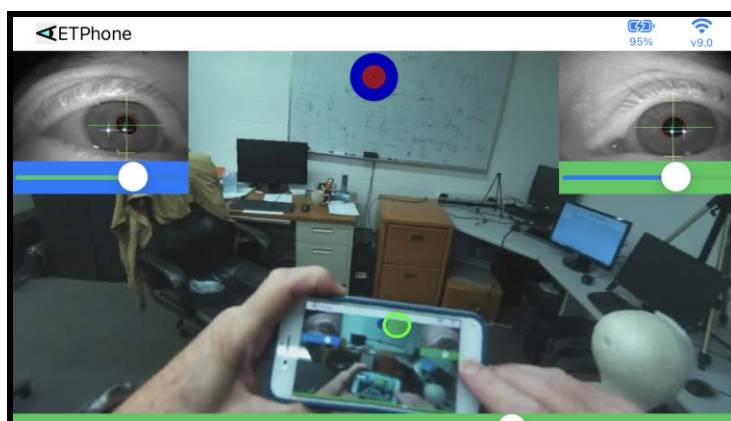
3.2 Establish WiFi communication between *ETPhone* and the *ETVision* Controller

- Close the *ETPhone* app if already opened.
- Be sure that the *ETVision* controller is connected to the head mounted optics, and that it is powered on (green power light if controller is connected to a power outlet; blue power light if running on battery power).
- Be sure no other device is connected to *ETVision* controller (the controller will only connect to one device at a time).

- Go to iPhone “Settings > Wi-Fi”. If the phone is within Wi-Fi range of the *ETVision* Controller, the Networks list should include the *ETVision* serial number listed on the Controller back panel label. Touch this item to connect. If asked for a password, use the password listed on the Controller back panel label. A check mark will appear next to the network name to indicate a successful connection.
- Close "Settings" and open the *ETPhone* app. An *ETVision* interface screen should appear showing the eye and scene images from the head mounted cameras.



Holding the Phone horizontally produces the display shown below. This display can be scrolled to expose the additional items shown at the bottom of the vertical display.



3.3 Monitor *ETVision* cameras and performance

The Eye image displays show the same feature recognition overlays for the pupil, corneal reflections, and eyelid positions as the standard *ETVision* PC display. These are explained in section 7.8 of the *ETVision* manual. The slider under the left eye image controls eye camera gain for both eyes (default = 10), and the slider under the right eye image controls the quality ratio for both eye cameras (default = 70).

The slider under the scene camera image controls image quality (default = 70). If the eye features are being successfully recognized, the scene image will show a superimposed point-of-gaze cursor. On *ETPhone*, the point of gaze cursor is always a green circle as shown on the sample images. Unlike the cursor on the *ETVision* PC application, it is not configurable.

The Microphone Gain slider can be used to adjust the volume of audio that will be picked up by the head gear microphone and recorded on either SD card recordings or phone recordings.

3.4 Auto Calibrate

To perform a subject Auto Calibration, touch the target icon at the top of the *ETPhone* screen to produce the full screen target display. Hold the target still at about an arms length in front of the subject (or have the subject hold it themselves), and ask the subject to fixate the center of the target. When *ETPhone* detects that calibration has been successful (target recognized in scene camera image, and eye position stable for about a second) the full screen target will disappear and the standard display will reappear. Touching the center of the full screen target will cause the standard screen to return even if the calibration criteria have not been met.

Calibration results will be reflected in 30 Hz recordings saved on the iPhone, but will not be saved by SD card recordings.

In the case of SD card recordings, only the raw video information is saved. The calibration must be done during the off-line process when the SD recordings are played back through the *ETVision* PC application. ***Nevertheless, if recording to an SD card, it is recommended that an ETPhone Auto Calibration be done after SD card recording begins.*** This section of video data can then be used to do an Auto Calibration (or manual single point calibration) during off- line SD card file playback.

Auto Calibration is the only subject calibration procedure available on *ETPhone*. Manual and multi point calibration procedures available on the *ETVision* PC application are not supported by *ETPhone*. Assuming appropriate video data was collected (periods where the subject was know to be fixating target points) these options will still be available during SD card file playback using the *ETVision* PC application.

3.5 Set “Profile” name

Files recorded either by the controller on an SD card or directly on the iPhone will have a file name consisting of the “Profile” name followed by a date and time code corresponding to the controller clock value when recording begins. To set the “Profile” name type the desired file name in the

“Profile” name field on the *ETPhone* app, and touch the profile symbol to the right of the name field to set the profile name.

3.6 Control SD card recording

To control SD card recording with *ETPhone*, first establish a Wi-Fi connection as previously described. If an SD card is detected by the *ETVision* Controller the SD card record button on *ETPhone* will be active. If this button is “grayed out” ensure that an SD card is correctly inserted in the *ETVision* Controller. The SD card record button should then appear active.

Start recording by touching the SD card record button. An SD card file, with a name consisting of the profile name followed by a date and time code, will start recording, and the SD card record button will change to a pause symbol. The iPhone record button will be disabled, and turn gray. It is not possible to simultaneously record both to an SD card and directly to the phone.

As mentioned in the previous section, ***it is recommended that an ETPhone Auto Calibration be done after SD card recording begins.*** This section of video data can then be used to do an Auto Calibration (or manual single point calibration) during off- line SD card file playback.

To stop recording to the SD, touch the pause symbol. The button will revert to showing the record symbol (and the phone record symbol will once again become active). To record another file to the SD card, touch the SD card record button again. A new file will begin recording. Each file recorded will be named with the current profile name and a time code corresponding to the Controller clock value when recording started. After each recording starts, it is recommended that the subject fixate the Auto Calibration target, as previously described, to provide a period of video data that can be used for Calibration during SD card file playback.

To process recorded SD card files and create eye-tracking data, follow instruction in section 7.8.3 of the *ETVision* manual.

3.7 Record eyetracking data files on the iPhone

A fixed digital data set along with the scene camera video can be recorded 30 times per second directly on an iPhone running *ETPhone*. *Note: Rather than recording directly to the iPhone, we normally recommend recording to the SD card for subsequent processing or directly to a PC since these options produce data with the most robust feature recognition and highest update rate (180 Hz).*

If the subject is not already calibrated, perform a subject Auto Calibration as previously described in section 3.4.

To start recording 30 Hz data to the iPhone, touch the phone record button. The record symbol will change to a pause symbol. Even if there is an SD card in the controller, the SD card record button will become inactive and will turn gray when recording to the phone begins (it is not possible to simultaneously record both to an SD card and directly to the phone). Stop recording by touching the pause button on *ETPhone*.

A digital data file and a scene camera video file will be recorded, both at 30Hz. Both files will have a file name consisting of the Profile name followed by a date and time code. The data file will have a “csv” extension, and the video file will have a “mov” extension. The data file format will be the csv file format described in the *ETVision* manual, but with 30 samples per second rather than 180 samples per second.

The size of the digital data file will usually be just over 8 KB/sec. The size of the video file will depend on scene camera “quality” value and video content, but will usually be about 0.8 MB/sec.

The data items recorded on the digital data file are listed below.

Time
Status
overtime_count
mark_value
CU_video_field_num
left_pupil_pos
right_pupil_pos
left_pupil_diam
right_pupil_diam
left_pupil_height
right_pupil_height
left_ellipse_angle
right_ellipse_angle
left_eyelid_upper_vert
right_eyelid_upper_vert
left_eyelid_lower_vert
right_eyelid_lower_vert
left_cr_pos
right_cr_pos
left_cr_diam
right_cr_diam
left_cr2_pos
right_cr2_pos
left_cr2_diam
right_cr2_diam
horz_gaze_coord
vert_gaze_coord
vergence_angle
verg_gaze_coord
left_eye_location
right_eye_location
left_gaze_dir
right_gaze_dir

An explanation of each data item can be found in Appendix C of the *ETVision* manual.

To view files recorded by *ETPhone*, open the “Files” app on the iPhone. Under “Browse”, select “On my iPhone”, then select the “ETPhone” folder to see the list of recorded *ETVision* files. Swipe a file name to the left and touch the “trash” icon to delete the file. Touch the file name to view the file; and then touch the “send” icon to send files to other devices via email, air drop, etc. (Note that some files might be too large to send via email). Alternately, connect the iPhone to a PC and use the PC *iTunes* app to transfer files.

Files recorded by *ETPhone* can be processed by *ETAnalysis* in the usual fashion, but of course need to be first transferred to a PC running *ETAnalysis*. Because of the low temporal resolution (30 Hz update rate), data recorded on *ETPhone* is usually not appropriate for the saccade analysis available on *ETAnalysis*.