



LOASCOPE OPERATING INSTRUCTIONS (RESEARCH-USE-ONLY)

Global Health Labs

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Quick Start Instructions

1. **Power on the LoaScope:** Press the power button located on the top of the device.
2. **Launch the LoaScope App:** Tap the LoaScope app icon on the touchscreen to open the main menu.
3. **Position the LoaScope:** Place the LoaScope on a flat, stable surface in a shaded area away from direct sunlight.
4. **Select the Test Option.**
5. **Scan QR Code (Optional):** A QR code prompt will appear. Place the QR code in the designated area if using one; otherwise, press **SKIP**.
6. **Enter Patient Information:** If not scanning a QR code, enter the patient identifier and, if desired, the test location. Then, press **NEXT**.
7. **Collect the Patient's Blood Sample (Ensure that the device is ready for testing before collecting a blood sample):**
 - a. Select a new capillary and inspect it for any visible cracks, scratches, or the presence of dirt. Replace it if any defects are found.
 - b. Clean the puncture site (middle or ring finger) with an alcohol prep pad.
 - c. Quickly and firmly puncture the skin with a lancet.
 - d. Allow a drop of blood to form, gently pressing around the site if needed. Position the patient's hand slightly downward to aid natural blood flow.
 - e. Position the capillary opening in contact with the blood drop and hold until the capillary is completely filled with blood.
 - f. If there are blood residues on the capillary surfaces, wipe surfaces clean using a paper towel or cotton wipe.
 - g. Apply a cotton ball to the puncture site and ask the patient to hold gentle pressure.
 - h. Safely dispose of the lancet in a proper container.
8. **Insert the Capillary and Start Test:** **Promptly** insert the filled capillary outlet-side first into the device until it clicks, and press **START TEST** to begin automated video capture. **Once the blood sample is collected, ensure that these steps are completed quickly to minimize the chances of the blood clotting, which could cause errors in the video analysis.**
9. **Capture and View Results:** The device will automatically capture seven videos of the sample along the capillary. Results will be displayed on-screen.
10. **Return to Main Menu:** Press the **Back** arrow to return to the main menu.
11. **Discard capillary:** Discard the capillary in a proper container.

For more detailed instructions, see page 4.

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Overview

The LoaScope device (Figure 1) is a research-use-only device designed to quantify the concentration of *Loa loa* worms in a patient's blood sample. It captures video sequences of a sample contained in a capillary tube (Figure 1) and detects worm movements in the recorded videos. The device automatically acquires seven fields of view (FOVs) by incrementally advancing the capillary to capture distinct sample areas. After recording, the system analyzes the videos and displays the result as the number of microfilariae per milliliter of blood.



Figure 1. LoaScope device and disposable capillary

The LoaScope includes a USB-C charging cable and a USB wall charger (Figure 2).



Figure 2. USB-C charging cable and USB wall charger.

Detailed instructions

Turning the device on and off.



Figure 3. Power button

To power on the device, press and hold the power button (Figure 3) until the home screen appears. Pressing the power button briefly will put the device to sleep. To power off the device, press and hold the power button again until a pop-up appears with options to take a screenshot, restart the device, or power it off (Figure 4).

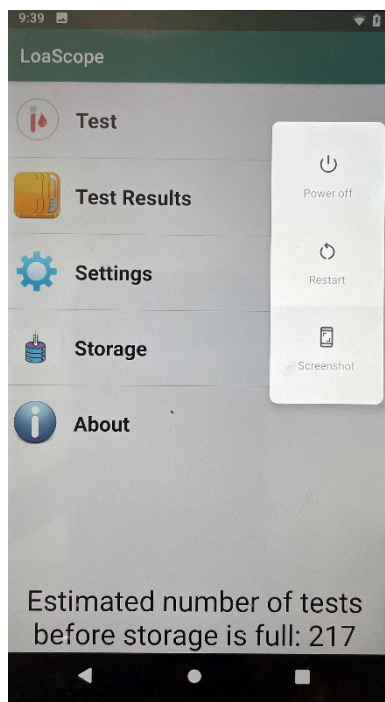


Figure 4. Power off device

Acquiring a test

1. **Choose an appropriate Location:** Select a spot to perform the scan, avoiding direct sunlight for optimal results.
2. **Position the Device:** Place the LoaScope on a flat, stable surface that won't move during video acquisition.
3. **Power On:** Press the power button (Figure 3) to turn on the device and display the device's home page. Please note that the LoaScope screen will automatically turn off after a few minutes of inactivity. To restart it, press the power button again.
4. **Open the LoaScope App:** Tap the LoaScope app icon located in the middle of the screen (Figure 5) to open the main app menu. Note that at the bottom of the main menu page, information about the device's internal storage and the number of tests that can be collected before the storage is full is indicated.

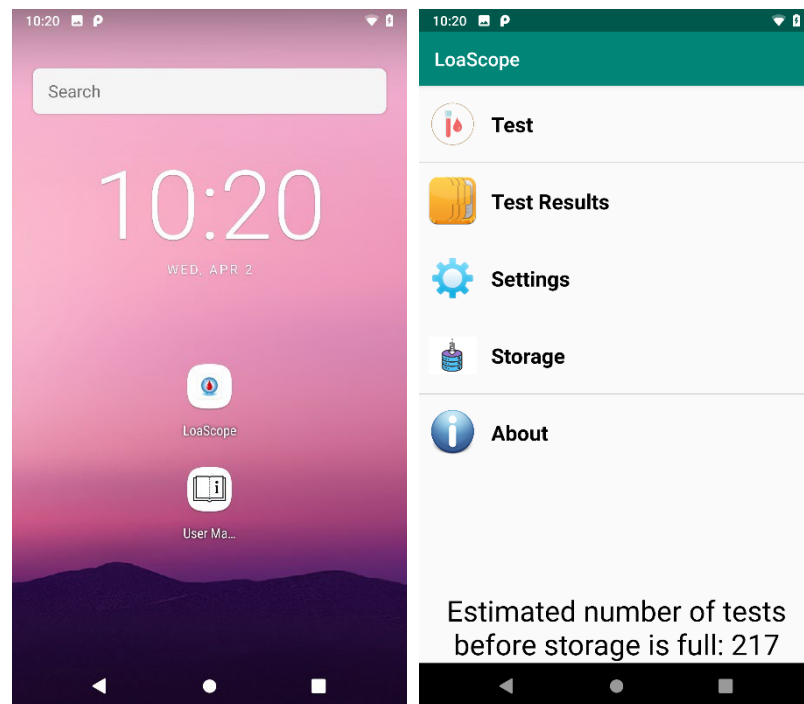


Figure 5. Device home screen and main menu page

5. **Start a Test:** Select the **Test** option from the main menu to test a sample.
6. **Scan QR Code (Optional):** If desired, scan a QR code connected to the patient ID by placing the QR code in the rectangle to scan, as shown in Figure 6. If not, press **SKIP** to enter the patient ID manually.



Figure 6. QR code scanning.

7. **Enter Patient Information:** Enter the patient ID and, optionally, enter the geographical location where the test is being conducted in the preferred format (Figure 7). Press **NEXT**. A pop-up will appear (see Figure 9 below), prompting you to collect the patient sample and insert the capillary into the device.

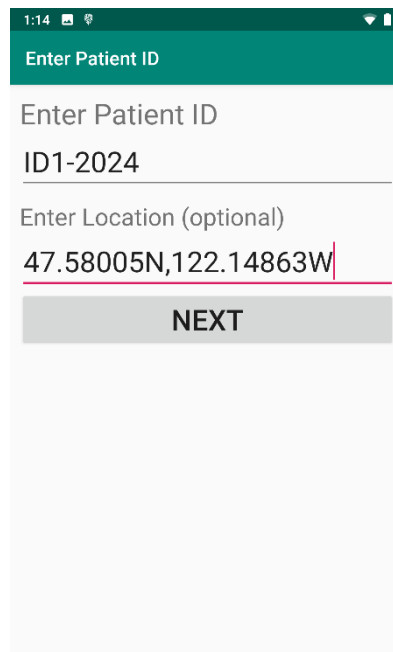
A mobile application screen for entering patient information. At the top, there is a green header with the text "Enter Patient ID". Below the header, there is a text input field with the label "Enter Patient ID" and the text "ID1-2024". Below this, there is another text input field with the label "Enter Location (optional)" and the text "47.58005N,122.14863W". At the bottom, there is a grey button labeled "NEXT".

Figure 7. Patient ID information and geographical location (optional).

8. Proceed to Sample Collection:

- a. Select a new capillary and inspect it for any visible cracks, scratches, or the presence of dirt. Replace it if any defects are found.
- b. Clean the puncture site (middle or ring finger) with an alcohol prep pad.
- c. Quickly and firmly puncture the skin with a lancet.
- d. Allow a drop of blood to form, gently pressing around the site if needed.
- e. Position the capillary opening in contact with the blood drop and hold until the capillary is completely filled with blood (Figure 8).



← Inlet

Figure 8. Capillary filled with a blood sample.

- f. If there are blood residues on the capillary surfaces, wipe surfaces clean using a paper towel or cotton wipe.
- g. Apply a cotton ball to the puncture site and ask the patient to hold gentle pressure.
- h. Safely dispose of the lancet in a proper container.

9. **Capture and View Results:** **Promptly** insert the prepared capillary and press **START SCAN**. Once the blood sample is collected, **ensure that these steps are completed quickly** to minimize the chances of blood clotting. **The blood clotting process slows down or immobilizes the worms in extreme cases, preventing their detection and causing the software to report a falsely low microfilariae count.**

The device will automatically acquire seven 5-second videos along the length of the capillary. The process will take approximately 2-3 minutes.

The LoaScope analyzes these videos for worm movements and calculates a concentration, which is displayed on-screen in microfilariae per milliliter (mf/mL). Any calculated value below 700 mf/mL will be reported as 0 mf/mL (Figure 9).

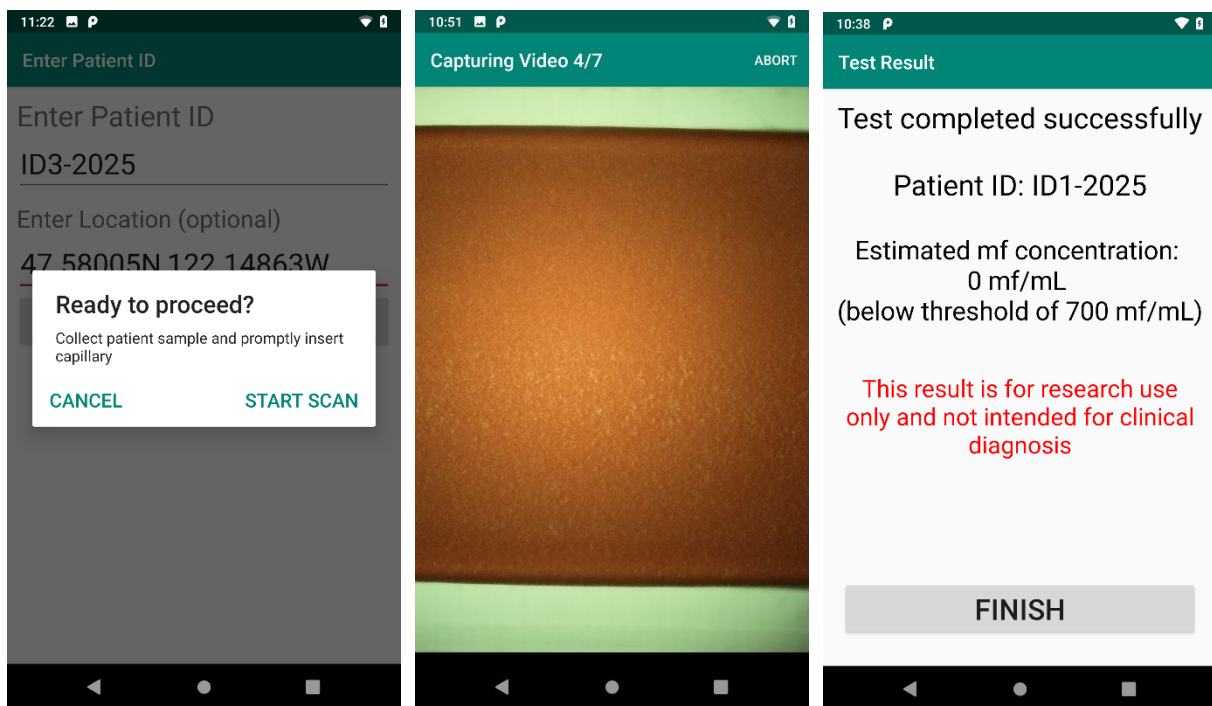


Figure 9. Video acquisition.

10. **Return to Main Menu:** After completing the scan, press **FINISH** to return to the main menu.

Aborting a test

If needed, a test can be aborted during the video acquisition by tapping the **ABORT** button in the top right corner. A pop-up window will appear, prompting the user to confirm and proceed (Figure 10). After pressing “OK,” the screen will return to the main menu. Any FOV videos already completed will still be saved and appear in the result list, but with the message “**Test aborted**” in place of a value for microfilaria count in the Test Results screen (see Figure 10 below).

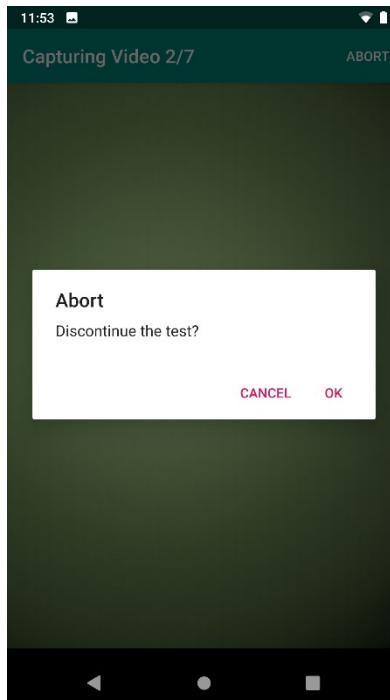


Figure 10. Abort confirmation.

Reviewing Results

Results can be accessed in the app by selecting the **Test Results** option from the main menu, which will open the **Test List** window (Figure 11). The Test List displays key details for each patient, including the Patient ID, the number of videos acquired, the microfilaria count, the test date and time, and whether the test data has been synced to the cloud.

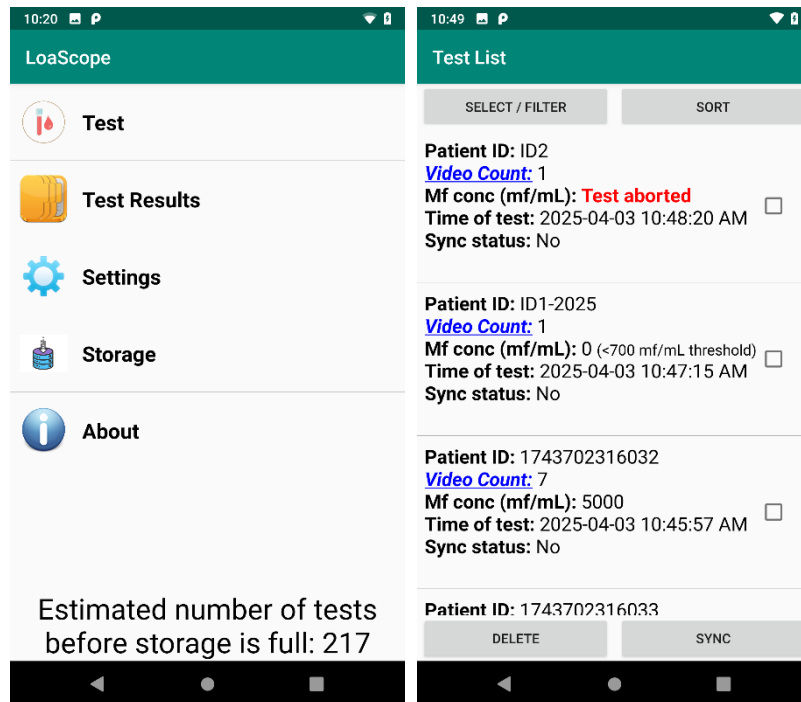


Figure 11. Results.

Each patient result can be further selected to look at the individual videos by pressing [Video Count](#). When selected, the video will automatically play. To play and pause the video, press on the video. To advance to the next video, press the arrow. The field of view (FOV) being observed is indicated by -#FOV after the patient ID (example: Patient ID: ABCD, FOV: 3, ABCD-3) (Figure 12).

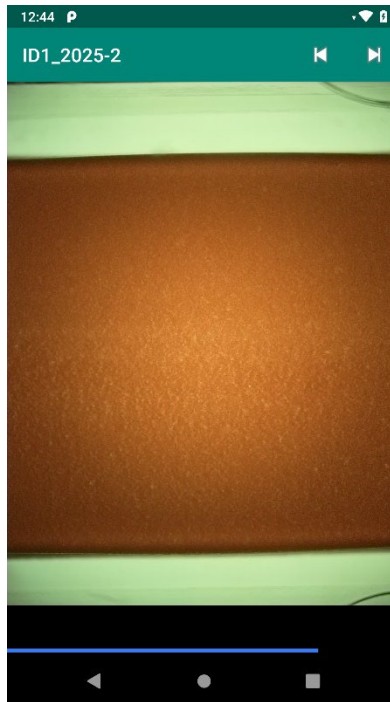


Figure 12. Viewing recorded videos.

Filtering, Sorting, Syncing, and Deleting results

The **Result List** can be sorted by Patient ID, test date, or worm count in either ascending or descending order (Figure 13).

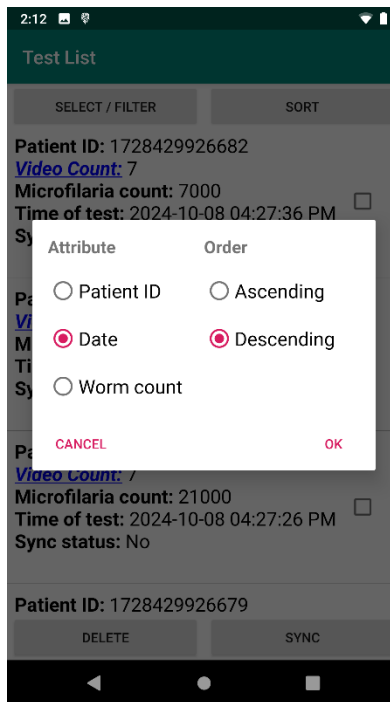


Figure 13. Filtering and sorting.

Individual results can be selected by checking the box next to each test, or multiple results can be selected in batches based on sync status or by selecting all (Figure 14).

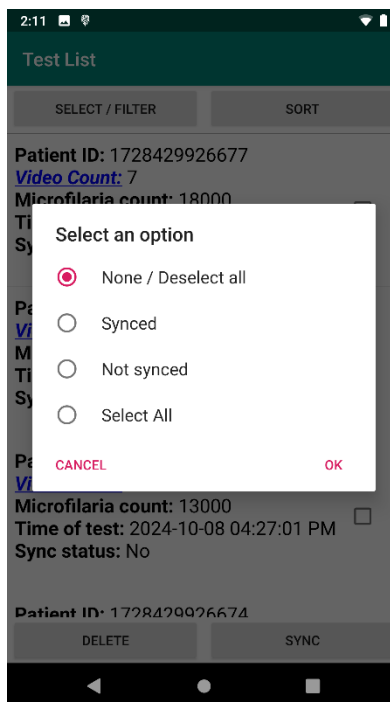


Figure 14. Selecting and syncing.

To sync results to the cloud, select the results you wish to sync, then press **SYNC** at the bottom of the page. A confirmation pop-up will appear to verify the device's internet connection. If connected, press **CONTINUE** to begin syncing. If not, follow the instructions to connect the device to the internet (see Page 15). The sync process may take varying amounts of time depending on the strength of the internet connection and the number of results being synced (Figure 15).

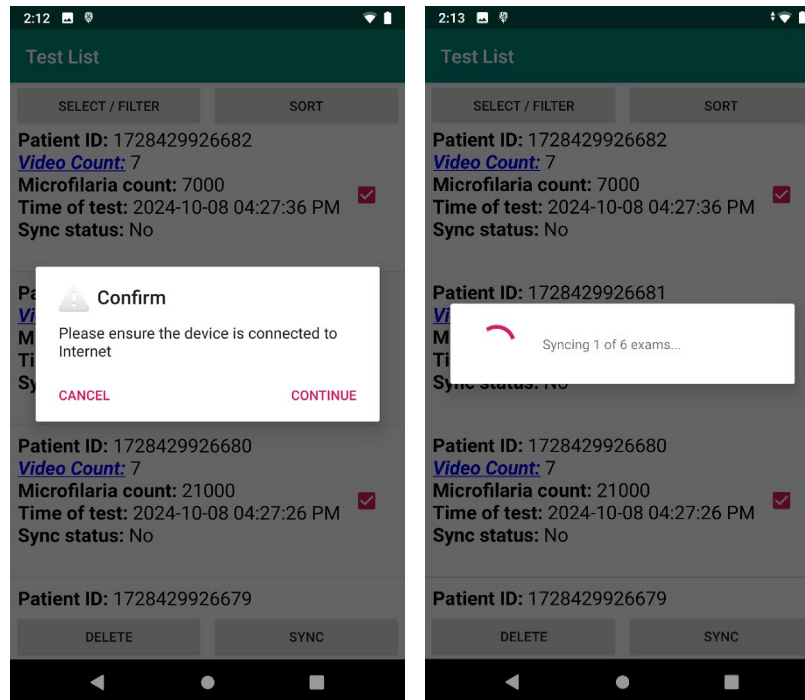


Figure 15. Syncing data

To delete data, select the results you wish to delete, then press **DELETE** at the bottom of the page. A confirmation pop-up will appear to verify the action. If you still want to proceed, press **YES**; otherwise, press **NO** (Figure 16). If the tests have not been synced to the cloud, **the results will be permanently deleted**.

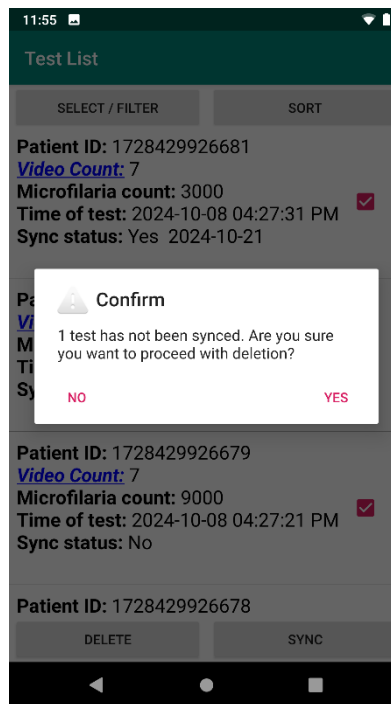


Figure 16. Deleting data

Connecting the device to the internet

1. Swipe down from the top of the screen to open the quick settings panel (Figure 17).
2. Tap the WiFi icon to turn WiFi on (if it's not already on).
3. Tap and hold the WiFi icon to open WiFi settings.
4. Select your preferred network from the list.
5. If prompted, enter the WiFi password and tap Connect.
6. When connected, the WiFi icon in the status bar will show a filled signal.

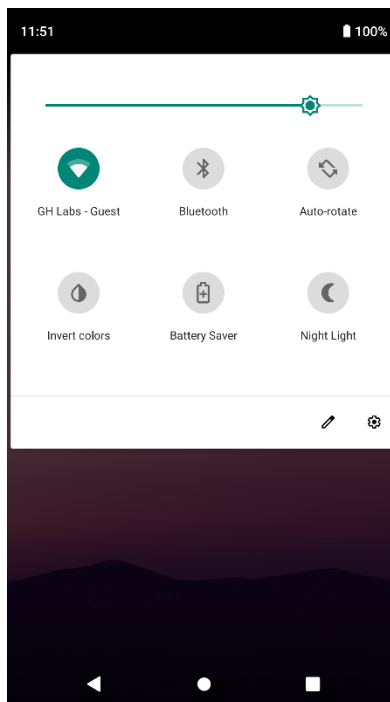


Figure 17. Connecting to internet

LoaScope app updates

New versions of the LoaScope application can be accessed from the main menu by selecting **About**. This page will show the current version of the app installed on the device. To update the app, ensure the device is connected to a WiFi network and tap on CHECK FOR UPDATE. If a new update is available, the device will automatically download the update file. The update process may take several minutes and depends on the strength of the WiFi connection (Figure 18).

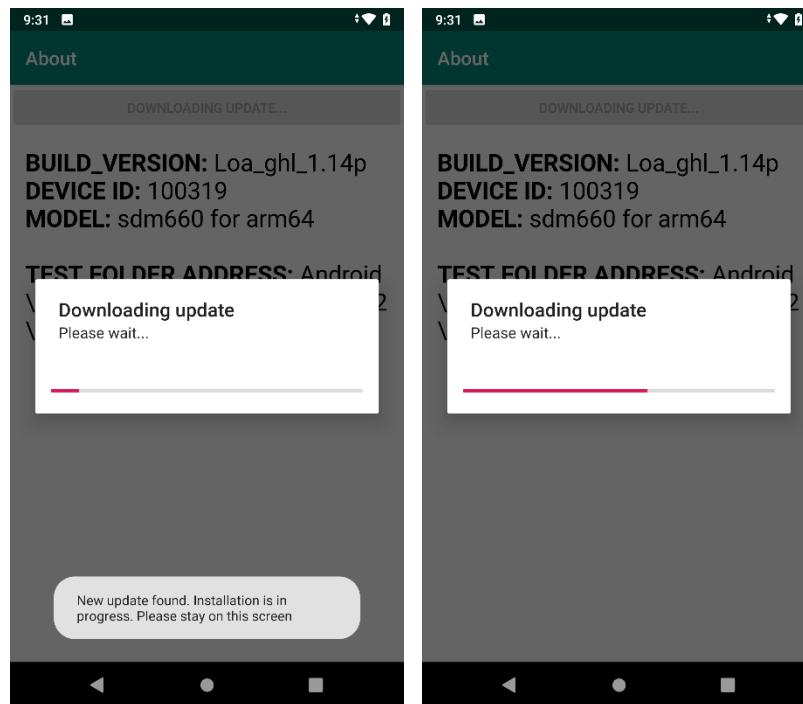


Figure 18. Updating the LoaScope.

Once downloaded, the user will be prompted to confirm the installation of the new update (Figure 19). The existing data will not be lost.

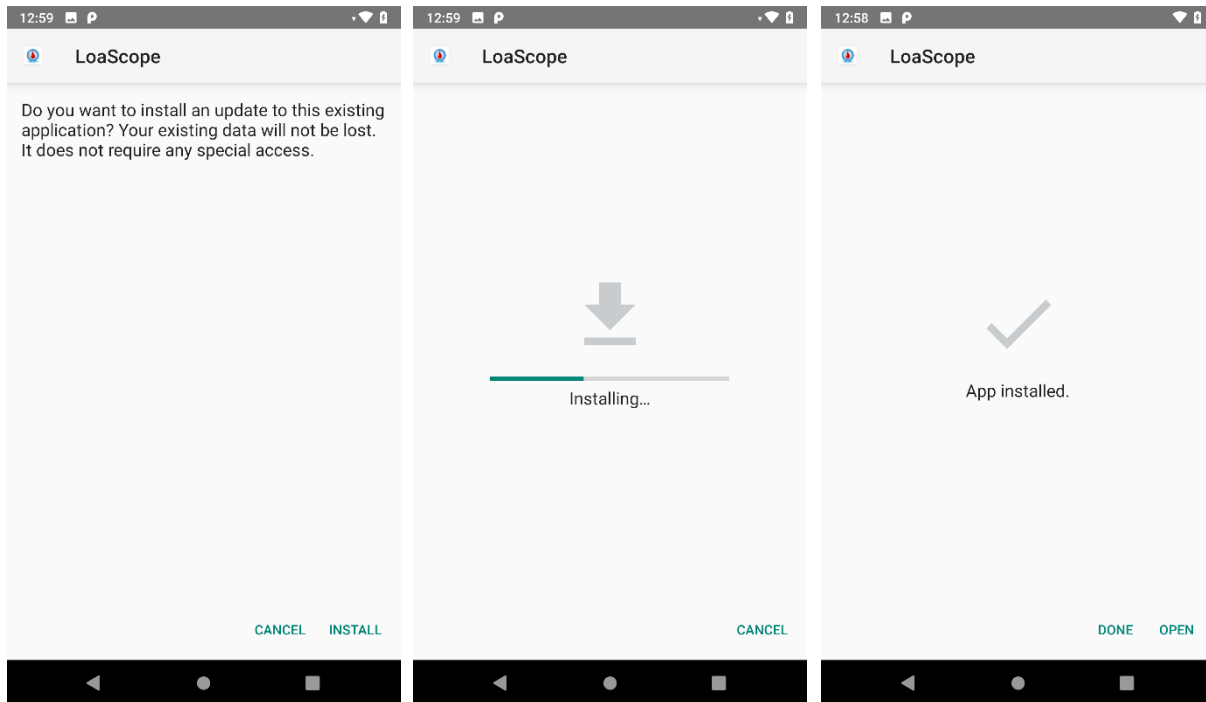


Figure 19. Installation of app update

If the application is already up to date, a message will appear at the bottom of the page indicating that the “latest version is already installed” (Figure 20).

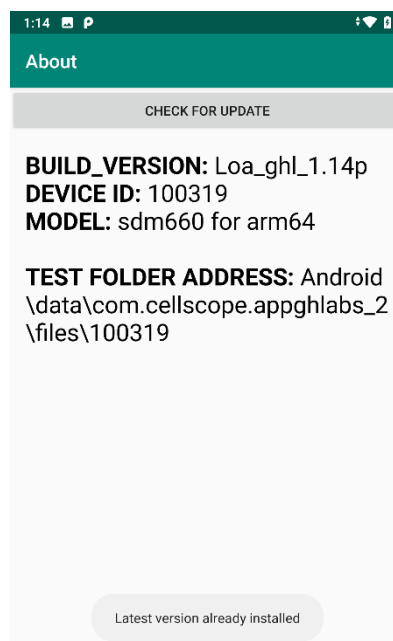


Figure 20. LoaScope application is up to date.

Charging the device

The LoaScope device needs to be fully charged for optimal operation and should last an entire day of testing on a single charge. To charge, connect the LoaScope to a USB power bank or the included power adapter using the provided USB-C charging cable (Figure 21).



Figure 21. USB charging port, USB cable, and wall plug.

Storage information

Internal device storage information can be accessed from the main menu by selecting the **Storage** option. A page will display (Figure 22):

- ❖ The number of tests currently stored
- ❖ The estimated number of tests that can be recorded before filling up the storage
- ❖ Storage free space in MB
- ❖ Storage total space in MB
- ❖ Storage space available (%)

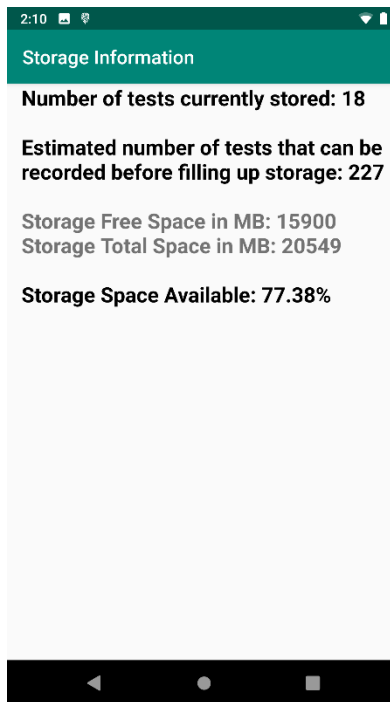


Figure 22. Storage information.

Warnings and Errors

Temperature Warning

If the device's internal temperature rises above 60 °C, a pop-up will appear with the message: **"Warning! The device is overheating ([measured temperature]C), and performance may soon be impacted. Please try to cool the device"** (Figure 23). This can occur if the device is exposed to direct sunlight or overworked. To address this, relocate the device to a shaded area, elevate it to allow better airflow, or use a small fan directed at the metal heat sink on the bottom of the device to assist in cooling. If the temperature remains high, video acquisition and processing may slow down. The pop-up message will stop appearing once the device's internal temperature drops below 60°C.

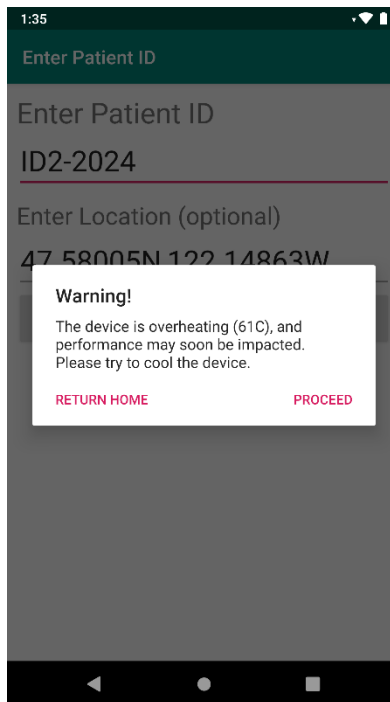


Figure 23. Overheating warning.

Device Movement Warning

If the device is moved substantially during video acquisition, a warning message will appear on the result page. “Attention: The device was moved during the test. For best results, please keep the device immobile” (Figure 24).

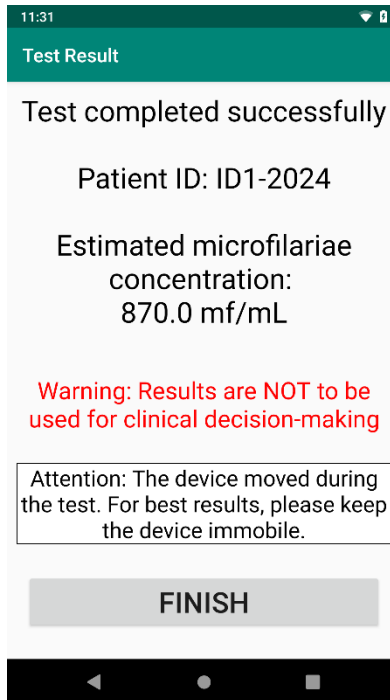


Figure 24. Movement warning.

Insufficient Blood in the Capillary

The capillary must be fully filled with blood. If a total of two fields of view are insufficiently filled, video acquisition will automatically stop, and the following message will appear: “Error: Insufficient blood in the capillary. Please use a new capillary and re-run the test” (Figure 25).

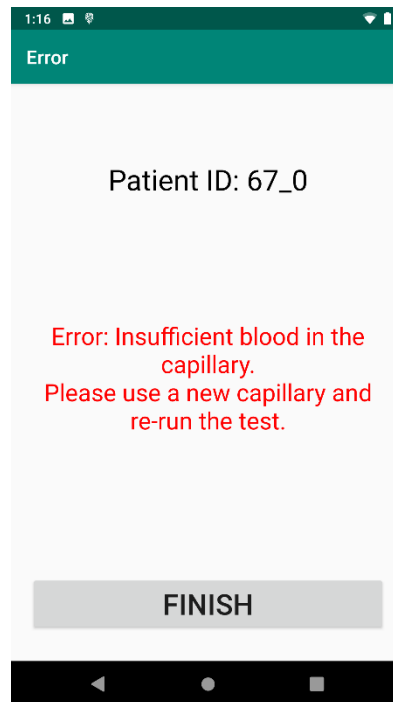


Figure 25. Insufficient blood in capillary warning.

Low/insufficient storage

If the device's internal storage is approaching its limit, a pop-up window will appear before a new video acquisition, alerting the user that storage is low: **"Warning! Storage is nearly full. Please delete data soon to free up space."** New video acquisition can still continue at this time; however, the user is advised to delete existing data to make room for additional recordings. Once the storage is completely full, a new pop-up will appear with the message: **"Alert! Device storage is full. Please delete data to allow further testing,"** and no new videos can be acquired until space is cleared (Figure 26).

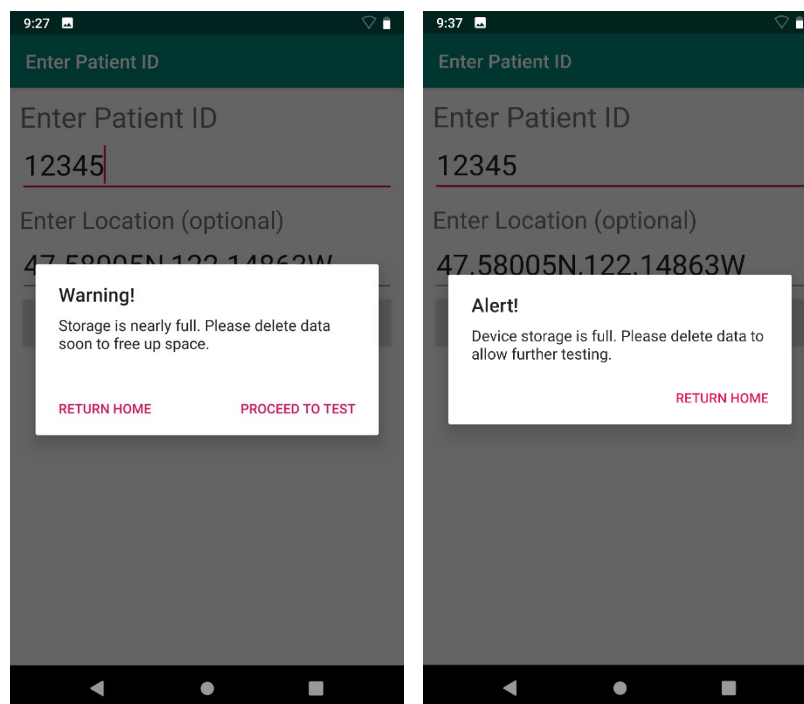


Figure 26. Storage warning.

Troubleshooting

Important Note

NEVER ATTEMPT TO OPEN THE DEVICE. Unauthorized attempts by untrained individuals to repair the LoaScope hardware can result in irreversible damage.

Cloud Sync Issues

- Verify that the device is connected to the internet by following the instructions in the manual.
- Attempt synchronization on a different network.
- **Workaround:** Connect the device to a computer and manually download the videos. The folder location where data is saved on the device is displayed in the **About** section, which can be accessed from the main menu, as shown in Figure 20. Share these videos with UC Berkeley for further processing.

Capillary Stuck in the Device

Use thin pliers carefully to attempt to extract the capillary from the device. Do not attempt to disassemble the device. If the capillary remains stuck, contact UC Berkeley for assistance.

App Installation Issues

Workaround: Install the application from a computer following the instructions below. Contact UCB

- Connect the LoaScope device via USB cable to the computer that has the LoaScope app installation file.
- Follow the computer's prompts to view the files stored on the LoaScope device, which will likely be named "sdm660 for arm64" or something similar. If the prompts do not work, open Windows Explorer and look for the device under "This PC"
 - If you are using a Mac computer, you will need to install the Android File Transfer (AFT) application on your computer (installation and download instructions here: <https://www.android.com/filetransfer/>). Once AFT is installed, you should be able to see the files saved on the LoaScope device when connecting it to the computer.
- Once you can see the device within Windows Explorer (or AFT if using a Mac) on the computer, double click on "Internal shared storage," and then again on the "Download" folder
- Copy the installation .apk file (currently named "**loa_ghl_2.0.apk**") from the computer to the Download folder noted in the previous step. Once the file has been copied, the USB cable can be disconnected if desired.
- Install the new app on the LoaScope
 - From the full apps menu, select the "Files" icon circled in the below figure

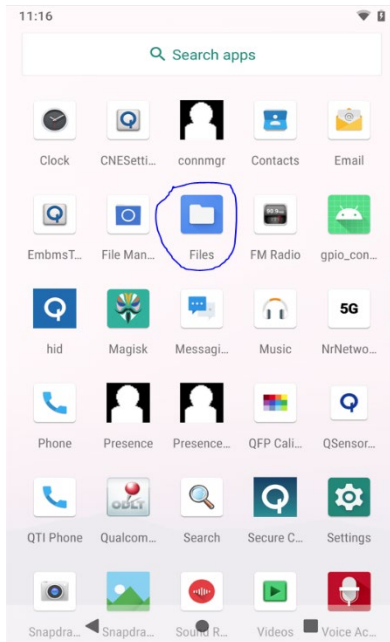


Figure 27. Access to Files app

- If the Files app does not open up to the “Downloads” folder automatically, click on the three lines in the top left corner to reveal a menu, from which you can click on “Downloads” to bring you to the folder in which the .apk file resides

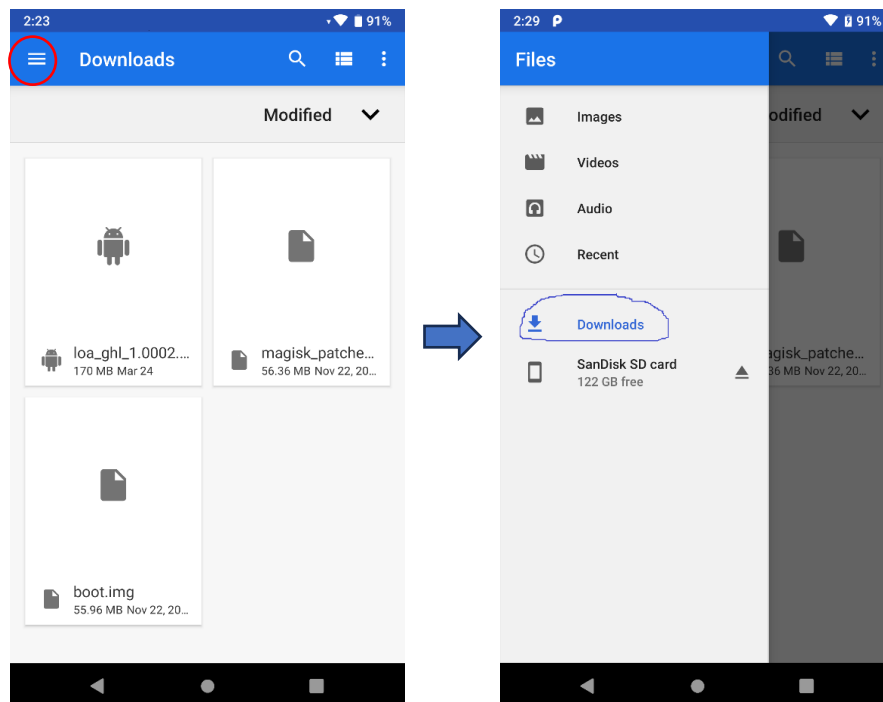


Figure 28. Access to downloaded files

- Tap on the .apk file (**loa_ghl_2.0.apk**) to begin installation. It is possible that you will have to confirm several pop-up requests for various permissions or warnings:
 - Press “Continue” for the security pop-up warning (Figure 29)
 - Click “Install” on the next screen
 - When installation is finished, click “OPEN”
 - Click “Grant” on the first pop-up from Magisk asking to confirm Superuser rights (Figure 29). Note that this pop-up may have a limited time (10 seconds) in which to respond.
 - Click “ALLOW” on the 4 system requests for permissions – (1) Location, (2) Making phone calls, (3) Accessing files, (4) Taking pictures and videos

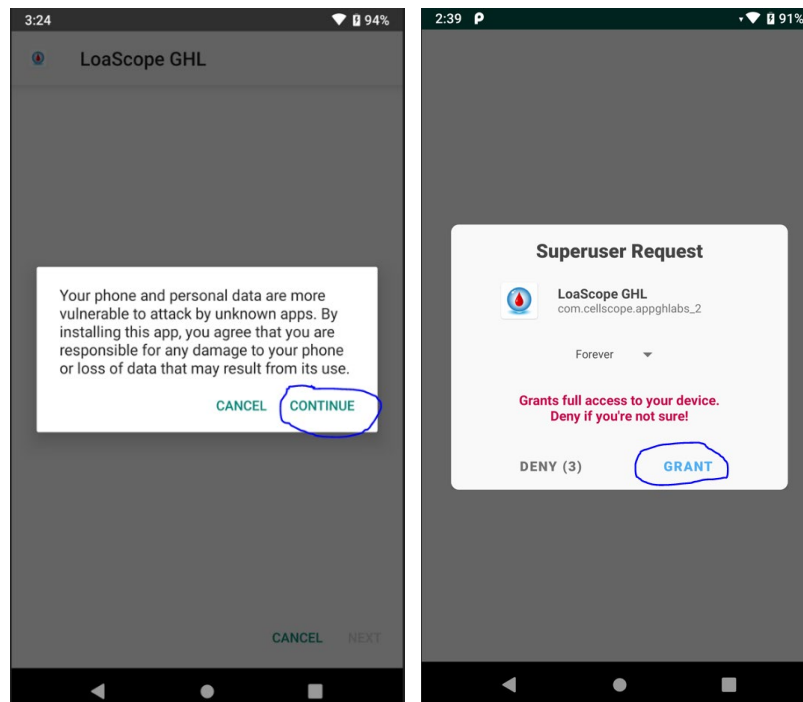


Figure 29. Installing application

- If you inadvertently denied any of the 4 system permissions, you can enable them by going to the Settings app, then:
 - Click on “Apps & notifications”
 - If “LoaScope” is not already visible, click on “See all # apps”
 - Click on “LoaScope”
 - Click on “Permissions” and be sure that all 4 options (Camera, Location, Phone, Storage) are enabled
- If you accidentally clicked the wrong options for Magisk:
 - Get to the full apps menu, and tap on Magisk. In the Magisk app, click on the “Superuser” icon circled on the bottom of the below screenshot

- If the permission is NOT set correctly, the toggle on the right-hand side (circled below, showing proper configuration) will be off (to the left). Click on that to enable and allow proper function.
- NOTE: If you wish to disable the “Superuser” pop-ups during normal operation, click on the “Notifications” as circled below to disable notifications

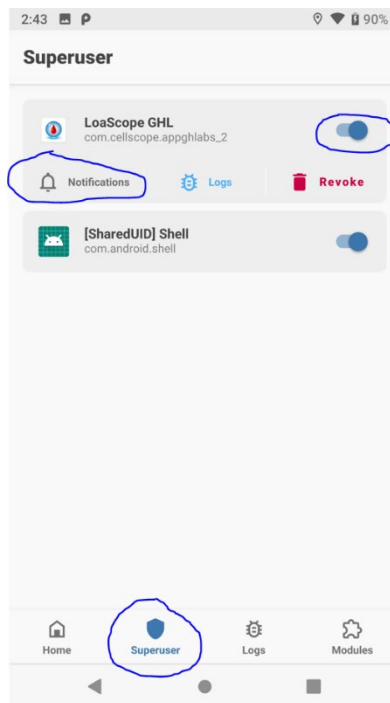


Figure 30. Granting superuser rights