

# RainCheck Project: Documentation

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Follow these steps to install the Isaac's custom kernel onto a Google Nexus 5 phone. Then, install the Capacitive Data App to view capacitance values on the phone.

## **Materials/Hardware:**

You will need the following materials:

1. Google Nexus 5 Phone
2. Ubuntu Linux Machine (Note: this guide is specifically for a MacBook Pro running Linux using a Virtual Machine through VirtualBox).
3. USB cable
4. Programs: Android Debugger (adb), Fastboot. Download the latest version of Android Studio (adb and fastboot come with these programs).
5. RainCheck Git Repository
6. RainCheck Google Drive Folder

Here's an overview of the steps we'll be taking to record and view capacitance data.

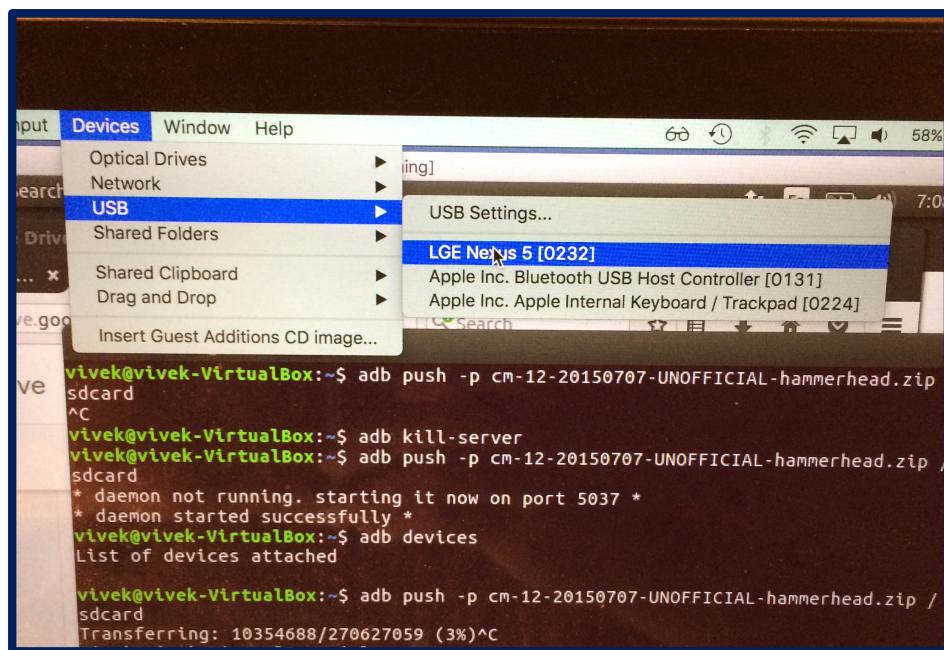
## **Steps:**

1. Unlock Android Bootloader
2. Install CyanogenMod OS
3. Install Custom Kernel
4. Install Capacitive Data App
5. Capacitance Data Recording/Collection
6. Viewing Capacitance Data

Let's begin!

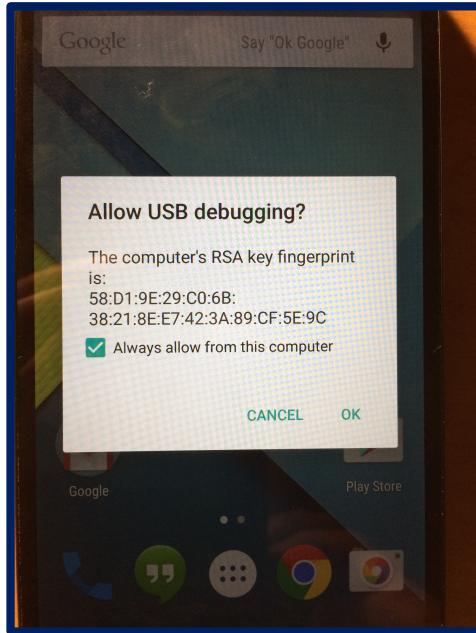
## Step 1: Unlock Android Bootloader

1. Enable USB Debugging on Android Device:
  - a. Go to “Settings” Application on the phone.
  - b. Go to “Developer Options”
  - c. Check “Enable USB Debugging.”
2. Plug the phone into the laptop using a USB cable.
3. On Laptop:
  - a. Go to “Devices” on the top bar.
  - b. Go to “USB” on the drop down menu.
  - c. Check “LGE Nexus 5.” Now, the phone should be visible on the laptop.



Screenshot 1

4. On Android Device: A popup should now appear: “Allow USB debugging?” Check “always allow from this computer.”



Screenshot 2

5. On Laptop: Open the Terminal. Now, commands: “adb devices,” “adb reboot” should work without an “unauthorized” error. If you’re still getting an “unauthorized error,” be sure that you have enabled USB debugging on your phone and you’ve given permissions for your specific computer, as seen in the above picture.

```
vivek@vivek-VirtualBox: ~/RainCheck
boot.img                               licenses
cm-12-20150707-UNOFFICIAL-hammerhead.zip META-INF
Desktop                                Music
Documents                               Pictures
Downloads                               platforms
examples.desktop                         Public
vivek@vivek-VirtualBox:~$ ls
Android                                 file_context
android-studio                          install
boot.img                                licenses
cm-12-20150707-UNOFFICIAL-hammerhead.zip META-INF
Desktop                                Music
Documents                               Pictures
Downloads                               platforms
examples.desktop                         Public
vivek@vivek-VirtualBox:~/RainCheck$ cd RainCheck/
vivek@vivek-VirtualBox:~/RainCheck$ ls
Android  docs      Kernel  README.md    shell
Data    Documentation  Python  RemoteControl
vivek@vivek-VirtualBox:~/RainCheck$ adb devices
List of devices attached
06232935005dcf6d          device

vivek@vivek-VirtualBox:~/RainCheck$
```

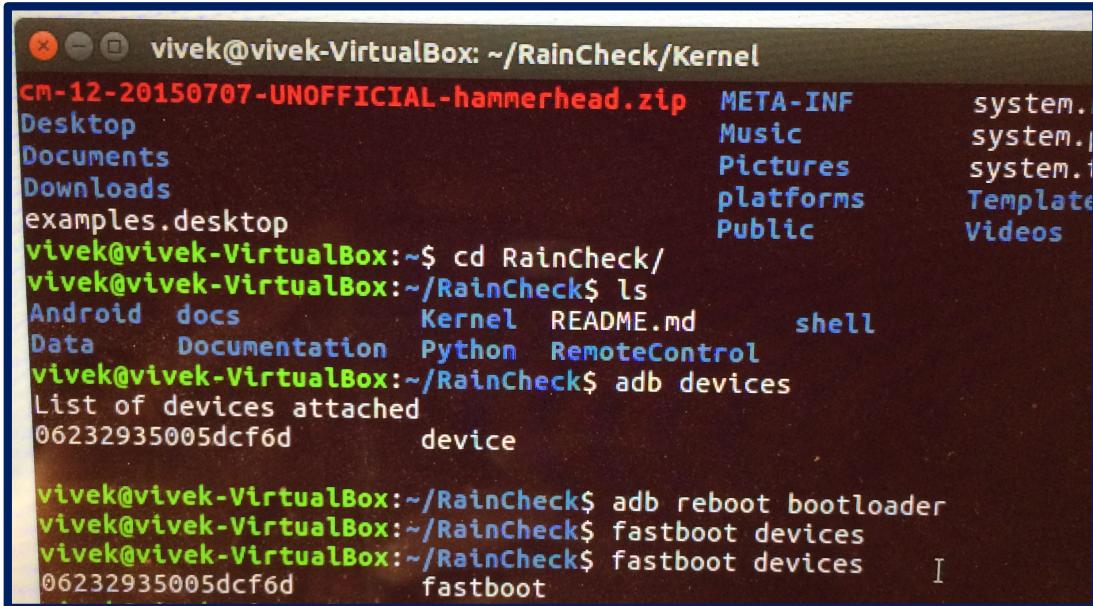
Screenshot 3

6. On Laptop: enter: “adb reboot bootloader” to boot the Android device into the Android bootloader. See the picture below for what the Android bootloader looks like on a Nexus 5 phone.



Screenshot 4

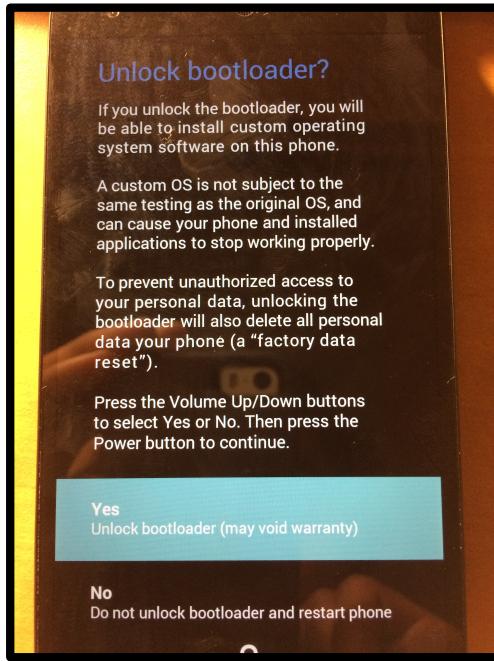
7. On the Android Device, it will say: “LOCK STATE - locked.” (In the picture above, the phone has already been unlocked).
8. On Laptop:
  - Go to “Devices” on the top bar.
  - Go to “USB” on the dropdown menu.
  - Check “Google Android.”
9. On Terminal: enter the command: “fastboot devices.” You should see a response similar to the one in the screenshot below.



```
vivek@vivek-VirtualBox: ~/RainCheck/Kernel  
cm-12-20150707-UNOFFICIAL-hammerhead.zip META-INF system.  
Desktop Music system.l  
Documents Pictures system.1  
Downloads platforms Template  
examples.desktop Public Videos  
vivek@vivek-VirtualBox:~$ cd RainCheck/  
vivek@vivek-VirtualBox:~/RainCheck$ ls  
Android docs Kernel README.md shell  
Data Documentation Python RemoteControl  
vivek@vivek-VirtualBox:~/RainCheck$ adb devices  
List of devices attached  
06232935005dcf6d device  
  
vivek@vivek-VirtualBox:~/RainCheck$ adb reboot bootloader  
vivek@vivek-VirtualBox:~/RainCheck$ fastboot devices  
vivek@vivek-VirtualBox:~/RainCheck$ fastboot devices I  
06232935005dcf6d fastboot
```

Screenshot 5

10. On Terminal: enter: “fastboot oem unlock” (to unlock the bootloader): Press Volume Up to select Yes. Press Power button to continue.



Screenshot 6

11. Now, the bootloader should say “Lock State – unlocked.”

## Step 2: Install CyanogenMod Operating System

12. On Laptop: download the CyanogenMod recovery.img file, located in the RainCheck Google Drive folder.
13. Enter: “fastboot flash recovery.img.”
14. On Laptop: download “cm-12-20150707-UNOFFICIAL-hammerhead.zip,” located in the RainCheck Google Drive folder.
15. On Android Device: Boot into Cyanogenmod recovery mode: Hold down “power button” and “volume down” buttons simultaneously to boot into recovery mode. Move “up” and “down” with volume keys, and “select” with power button.
16. On Android Device: Choose “Apply update.”



Screenshot 7

17. On Android Device: Choose: “Apply from adb.”
18. Now, in the terminal, type: “adb sideload cm-12-20150707-UNOFFICIAL-hammerhead.zip”
19. Next, choose “Reboot system now” in the Cyanogenmod recovery mode.

### **Step 3: Install Custom Kernel (Flash boot.img file in RainCheck Git Repository)**

20. On Laptop:

- a. Go to “Devices” on the top bar.
- b. Go to “USB” on the drop down menu.
- c. Check “LGE Nexus 5.” Now, the phone should be visible on the laptop.

21. On Terminal: Enter: “adb reboot bootloader”

22. On Laptop:

- a. Go to “Devices” on the top bar.
- b. Go to “USB” on the dropdown menu.
- c. Check “Google Android.”

23. On Terminal: Enter: “fastboot boot boot.img”

24. Now, the “touch screen” should **NOT** work on the phone (This is the “acid test” to make sure you have installed Isaac’s custom kernel on the phone). Great! You’ve successfully flashed Isaac’s custom kernel for reading capacitance values on your Google Nexus 5 phone!

## **Step 4: Install Capacitive Data App**

25. Build the Capacitive Data App:
  - a. The Capacitive Data app is located in: RainCheck/Android/CapacitiveDataApp
  - b. ./gradlew build (If “lint” gives you an error, try step b).
  - c. ./gradlew build –x lint (to build without lint)
26. Install the app onto the phone:
  - a. The app’s .apk is located in:  
RainCheck/Android/CapacitiveDataApp/app/build/outputs/apk/app-debug.apk
  - b. Run: adb –d install app-debug.apk to install the app onto the phone.

Great, now follow the instructions on the README page of the RainCheck Git Repository to start collecting and recording data!

## **Step 5: Capacitance Data Recording/Collection**

27. Prerequisites:
  - a. Wifi
  - b. Root the phone: go to Settings -> Developer Options -> Root Access
28. Boot the phone with “boot.img”:
  - a. Run “adb reboot bootloader”
  - b. Run “fastboot boot boot.img”
29. Run Shell Scripts located in RainCheck/shell
  - a. Run “./open\_screen.sh” to unlock the phone screen
  - b. Run “./run\_dataApp.sh” to start the Capacitive Data App
30. Go to the “Remote Control for RainCheck” website: Link:  
<https://ubicomplab.github.io/RainCheck/RemoteControl/>
31. Type in the name of the file you want to save the recording to. Note that the file must have extension “.txt.” For example, “test.txt” is a valid filename.
32. Press “play” on the website to start recording:
  - a. You should see a “start recording” message displayed on the app.
33. Press “stop” on the website to stop recording:
  - a. You should see a “stop recording” message displayed on the app.
34. Run “./pulldata.sh test” (name of file without “.txt” extension.)
35. Now, a file called “test.json” should be located in the RainCheck/Data folder containing the capacitance values you just read!

## **Step 6: Viewing Capacitance Data**

36. Open “index.html” webpage located in: RainCheck/Data folder
37. Type in the name of the “.json” file you wish to view as the “file name.”  
Note: the “.json” file must be located in the RainCheck/Data folder.
38. Enter in the frames per second (FPS) at which you wish to view the capacitance values. (e.g.: FPS: 20)
39. Click “Run” to view the capacitance data you collected!