

# ***USER MANUAL***

## Overview:

*EDA Arousal* application is designed to view and visualize EDA value in real time using [Empatica E4](#) wristband that measures the changes in the sweating level at the skin surface besides other features. The first phase of the application defines the baseline of the EDA values of the user for a specific period of time while the user is at rest condition with the absence of any external stimuli. In other words, it finds the range of the EDA values (min and max) to be used as a threshold in the next phase of the application for detecting emotional arousal based on real time EDA values. Besides showing the values, the application provides a visualization (emoji face) which reflects the changes in the EDA values, it gets bigger when the EDA increases and smaller when it decreases. If the value ever goes above the maximum value that was previously defined, there will be a color change in the background indicating arousal.

This user manual is designed to guide users to take the full advantage of using the application by providing a complete description of how it works.

## Configuration and Setup:

*EDA Arousal* application is an Android application that is compatible with any Android device running 4.4 KitKat (API level 19) or higher. It was developed using Empatica SDK and API. To run this application you need two things: an Android mobile phone or tablet, and Empatica E4 wristband to measure EDA (as shown below).



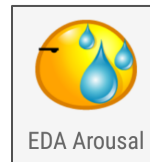
[1]

Before using the application please:

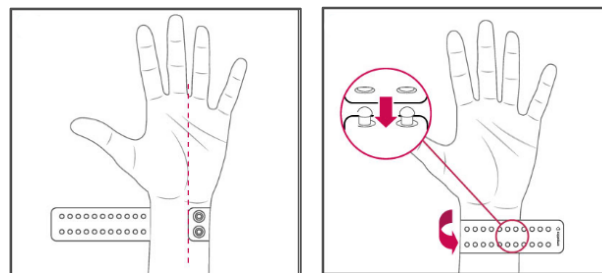
- Make sure your Android device software version is 4.4 KitKat (API level 19) or higher.
- Turn on the Wi-Fi in your device.
- Turn on the Bluetooth in your device.
- Make sure the wristband is fully charged to avoid disconnection problem. For more information on how to charge it please refer to Empatica website [1].

## Running and Step-by-Step Process:

- 1- Install the application *EDA Arousal* on your device (Android mobile phone or tablet) and again, make sure both Bluetooth and Wi-Fi are on.

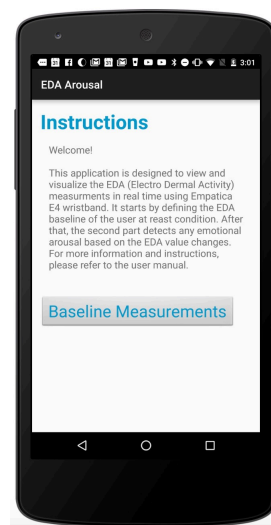


- 2- Wear the Empatica E4 wristband on your hand with the case on the top of the wrist just as you wear a watch and wrap the band around your wrist and tighten. For more information about the wristband, please refer to their website [1].

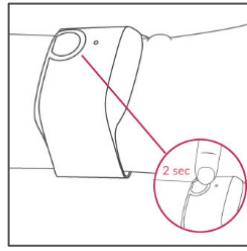


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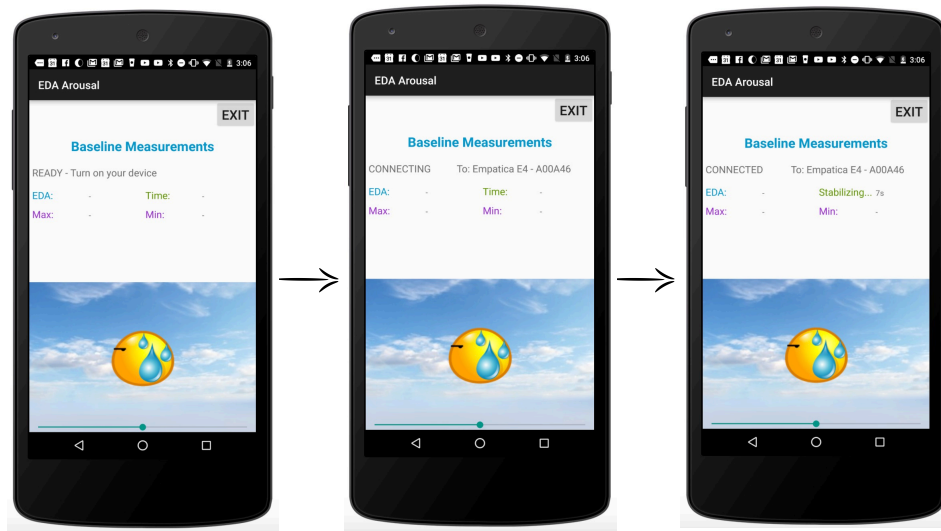
- 3- Open the application. The home page will display a brief introduction about it. You can start by clicking on the “*Baseline Measurements*” button.



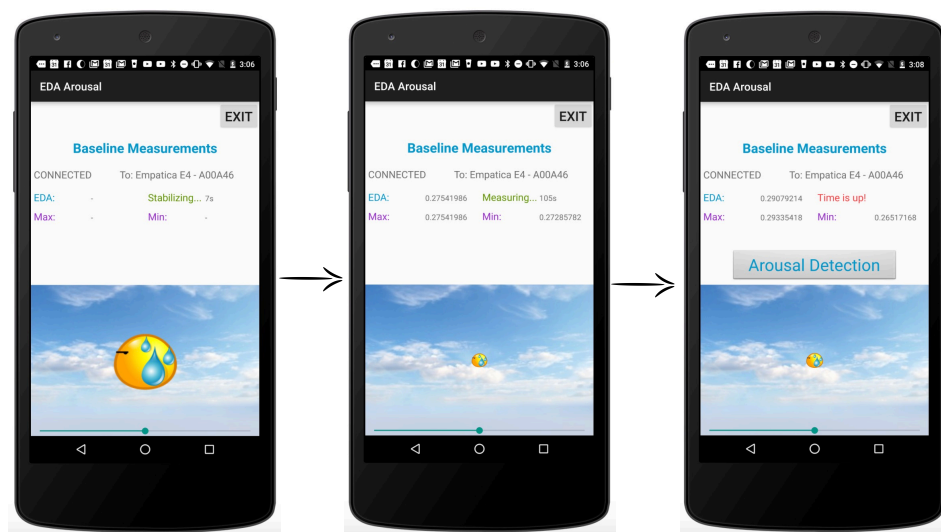
- 4- The first part of the application is for finding the baseline of the EDA values while in rest. Start by turning on Empatica E4 wristband to connect it to your device, press the circle button on top of the wristband for 2 seconds until you see a blinking green light. The device then will change mode from ‘Ready-turn on your device’ to ‘Connecting’. When your phone shows the word ‘connected’ that means the wristband is now connected to your device and will start measuring the EDA soon.



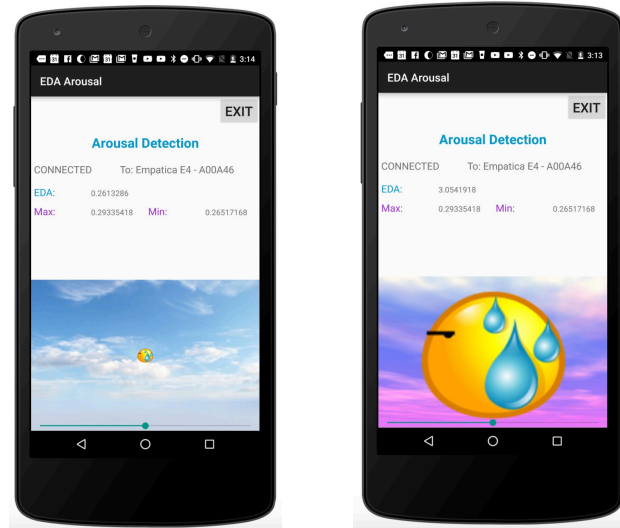
[1]



- 5- After connecting, the baseline measurements process starts and lasts for 2 minutes (10 seconds stabilizing and 110 seconds measuring). Notice the size of the visualization (the emoji face) changes based on your EDA value. When the time is up, the Min and Max values will stop changing and you are ready to move to the next part of the application by clicking on the “Arousal Detection” button.



- 6- In this part, the wristband will still be connected to your device and measuring your EDA. The minimum and maximum values defined in the previous step will be used as a threshold to detect emotional arousal. So, whenever the EDA value goes above that max then there will be an arousal and will be represented as a change in the background color of the visualization from blue to purple.



- 7- Remember, you can always exit to the home page by clicking on the “Exit” button at the top right corner of the screen.

## Tips for Developers:

### Empatica Programming

Empatica supports three platforms: Android, iOS and Windows based Bluetooth Low Energy Server. *EDA Arousal* is based on Android platform. Developers can build real-time connections to the Empatica E4 through the provided API. There are two ways to build applications that use Empatica E4:

1. Build from Android sample code:

Empatica provides an android sample project at <https://github.com/empatica/empalink-sample-project-android>. This sample project gives you the boilerplate code to connect to Empatica E4 and start streaming data. Developers can start with this sample project and add fancy features to make new applications. For this way, you do not need to take care of details about how to connect your phone to Empatica.

Steps:

- Create an Empatica Connect account at <https://www.empatica.com/connect/login.php>
- After login to your account, click “Developer Area” at the right corner.
- You can find your API Key at this page.
- Clone or download the sample code.
- Open the sample project in Android Studio.
- Assign your API key to the `EMPATICA_API_KEY` constant in `MainActivity.java`.
- Download the Android SDK from Developer Area.
- Unzip the archive you've downloaded and copy the `.aar` file inside into the `empalink-2.0` folder contained in the sample project.
- Revise the code to add more features. For example, add new activities, add new layouts.
- Build and run you application.

## 2. Build from Android SDK:

If you need more advanced features from Empatica API, you can build your own application from scratch using Android SDK, which can be downloaded from the Empatica Developer Area. <https://www.empatica.com/connect/developer.php>

For more information about installation and usage, please read the README.md file of SDK.

## Common Errors

### 1. The device keeps trying to CONNECT to Empatica E4 or might end up DISCONNECTING.

- Make sure the device is in range.
- Make sure your phone is connected to wifi.
- Make sure your phone's Bluetooth is on.
- Check your USB cable.
- Turn off any other device, which may cause Bluetooth interference.
- Make sure the API key that you are using is correct.
- Make sure the wristband is fully charged.

### 2. The EDA value is unreasonably small. For Example, 0.0 or $1.0 * e-9$ .

- Make sure the band is fastened correctly and tightly. and the sensor contacts the skin.
- Once Empatica E4 is connected to the phone, the values during the first several seconds is usually not very accurate. So make sure your program has a short “stabilizing” period before reading to discard these inaccurate data.

### 3. Get a error message that “Error:A problem was found with the configuration of task ':app:prepareEmotion\_arousalEmpalink20UnspecifiedLibrary'. File '.../empalink-

2.0/empalink-2.0.aar' specified for property 'bundle' does not exist.” when run your project in Android studio.

- This usually happens when push code to the github then clone again. To solve this, copy the ‘empalink-2.0.aar’ file you will find in Empatica Android SDK into the ‘empalink-2.0’ folder contained in your project.

4. When measuring with Empatica, the EDA value keeps increasing slightly, not stable.

- That probably happens when the user just wears the Empatica whisband and the temperature of the sensor is different from the skin temperature. Let the user wear the whisband for more than 10 minutes before testing.

## **References:**

[1] Empatica Website, <https://www.empatica.com/get-started-e4#get-started-main>