VitalSigns: Instrumentation to measure app engagement

Help us find out how our apps affect us.

Challenge Rating: 4/5

Want a project with a heart? Want some Raspberry Pi and Bluetooth action? Then this is the project for you.

We have two sensors which we're going to use to make physiological measurements on the users of our mobile apps.

The sensors measure pulse rate variation and galvanic skin response - both can be used as physiological indicators of 'arousal' or emotional response.

We want to see if we can reliably measure our user's response to our apps and if we can, to apply this to ensure that our apps are engaging without being intrusive.

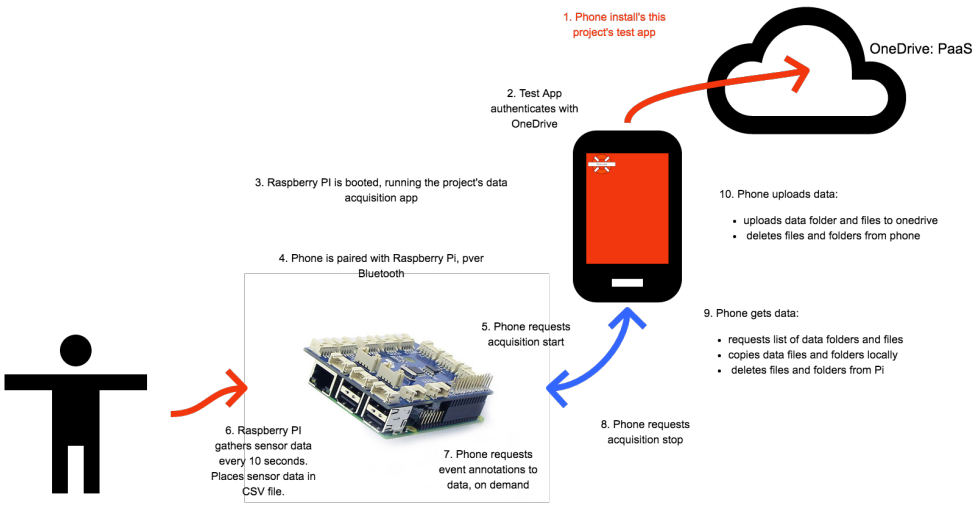
The Project

With any app we want to measure the user's emotional response indicators at any point.

That means recording a measurement from the sensors (which we have attached to the volunteer), and also adding a note to say what the user was doing at the time (which means adding a 'hook' into the application under test, which will create the note at the right point)

We need to send the data to some cloud storage, so we're going to use OneDrive.

Once we've collected the data, we can visualise it. Check out this project we did last year over the summer, with one of our Live Projects students: Time Series Data Capture. This project is available as open source, and we can modify it to our needs.



Development

Here's how we see things going - first, we'll work on prototypes to make sure you have all the skills you need:

Skillset

- Javascript
- Python
- Linux
- Ionic / Cordova

Stage 1: Base

This stage will concentrate on getting essential aspects of the device working:

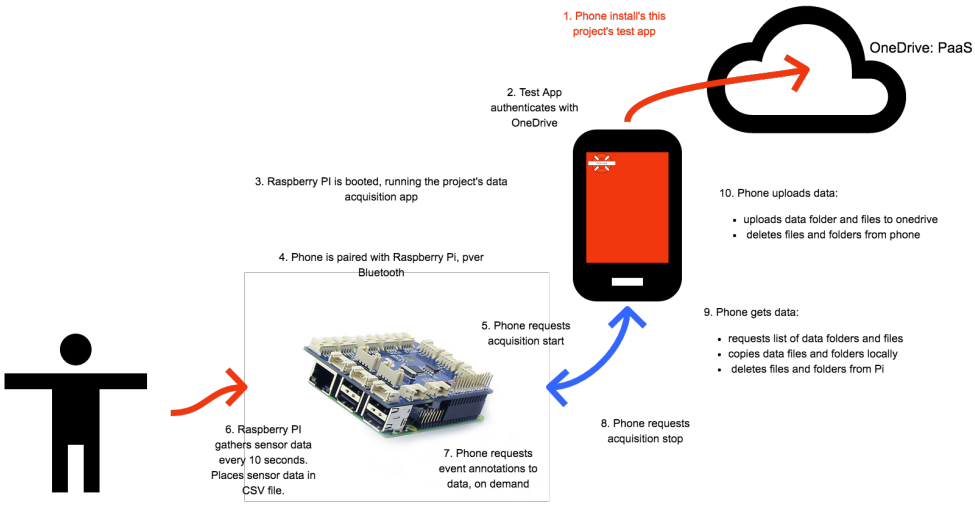
1. RPi Logging and Annotation data format defined
2. RPi Development System set-up
3. RPi Detecting and logging data from GSR sensor
4. RPi Detecting and logging pulse rate data from combined ADC and pulse sensor
5. Mobile Development system set-up
6. Mobile Test App created
7. Mobile Test App detecting and pairing with RPi
8. Mobile Test App getting a data file from Rpi
9. Mobile Test App resetting the RPi data file
10. RPi adding Annotations to Logging and Annotation file, via request from Mobile Phone, over Bluetooth
11. RPi booting automatically, beginning logging.

12. Mobile Test App connects to One Drive and uploads the data file.

Equipment

Stage 1 Equipment is enough to develop the application

1. Mobile Phone (iOS / Android)
2. Raspberry Pi 3 B+
3. Grove Sensor Board
4. Grove GSR sensor
5. Grove I2C ADC
6. World Famous Electronics' Heartbeat Sensor



Stage 2: Portable Prototype Testing

This stage will add the UPS, so that the device can be run and charged without dropping data.

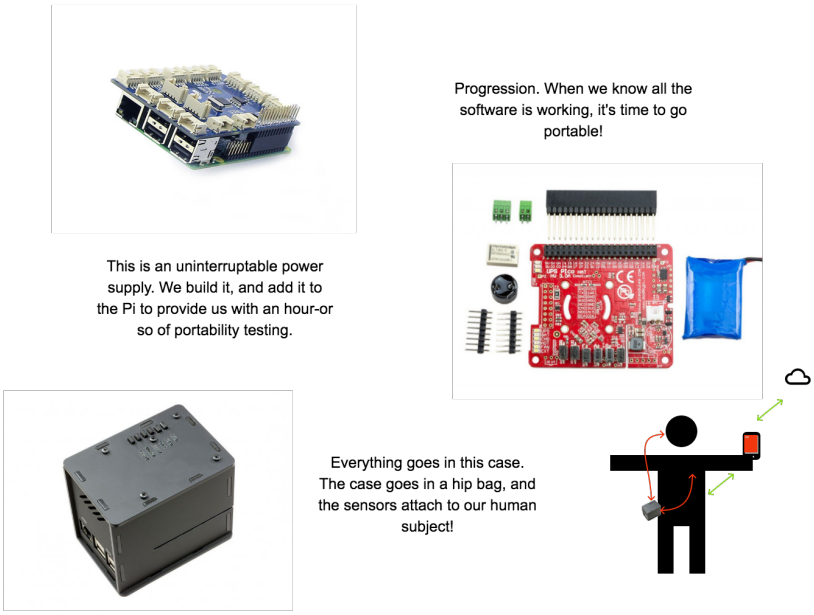
1. Add UPS to RPi
2. Check it works:
    - able to power and charge
    - resolve any I2C address clashes
3. Build case:
    - Does it fit?
    - Do cables and sensors work OK?
4. Wear Device!

Equipment

Stage 2 Equipment is enough to get some idea of possible usage

1. UPSPico Advanced Interruptable Power Supply Hat

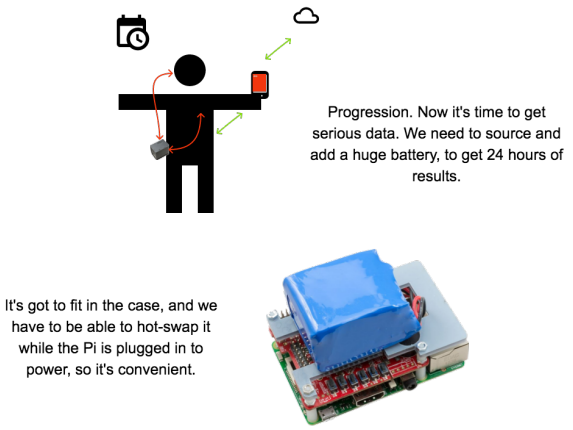
2. [UPSPico UPS Case Tall]
3. Waistband Bag



Stage 3: Deep Testing

This stage evaluates the possibility of data collection over a 24 hour period.

1. Add the high capacity battery
2. Check it works!



Equipment

1. [UPSPico LiFePO4 8000mAH Battery (or whatever will fit in the case)]

Want to Know More?

Explainer on Heart Rate Variability here

Have a look at these reports on how PRV (pulse rate variability) correlates to mood indicators (pulse rate variability and heart rate variability are simailar enough for our purposes):

Psychological stress detection with pulse rate variability

Linking Changes in Heart Rate Variability to Mood Changes in Daily Life

Heart rhythm patterns during different emotional states

Explainer on Galvanic Skin Response here

Have a look at these reports about how GSR correlates to arousal, engagement or focus:

determining useful measures of user engagement

Boredom, engagement and anxiety as indicators for adaptation to difficulty in games

exploring audience responses to performing arts

Have a look at a debunking article - which explains what we're *not* doing!