Fear Assessment using Wearable Sensors

Sensors and IoT project Idea
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Project Idea:

- Our Project idea is all about evaluating fear based on non-intrusive measurements obtained using multiple sensors.
- How does a particular individual get affected by watching a horror movie?
- What effect does it have physiologically and psychologically?

Sensors and Data to be Collected:

- Omron blood pressure cuff
  - Systolic and diastolic blood pressure
- Empatica E4 wristband
  - Heart rate
  - Blood volume pulse
  - Electrodermal activity
  - Skin temperature
- AliveCor Kardia Mobile 6L
  - Six Lead ECG

Data Collection Protocol:

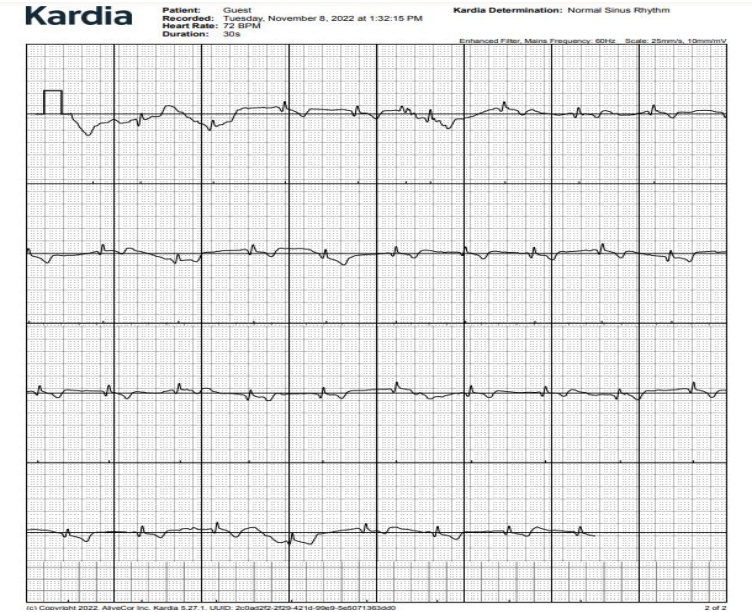
- Pre Experiment Survey.
- Participant's initial blood pressure and heart rate are recorded using **Omron**.
- Participant sits comfortably while wearing the **Empatica E4** wristband and by placing fingers on the **EKG** Sensor.
- Participant is made to watch a horror clipping while the data is being recorded.
- Participant's final blood pressure and heart rate are recorded using **Omron**.
- Post Experiment Survey.
- **Goal:** Understand how the sudden visuals effects an individual.
- **Participants:** Our classmates and friends. (>4)

Data Analysis:

Alive Cor:

- As the device is not programmable, We were not able to extract raw data and instead were only able to access the data directly from the app or by sharing it in a PDF form.

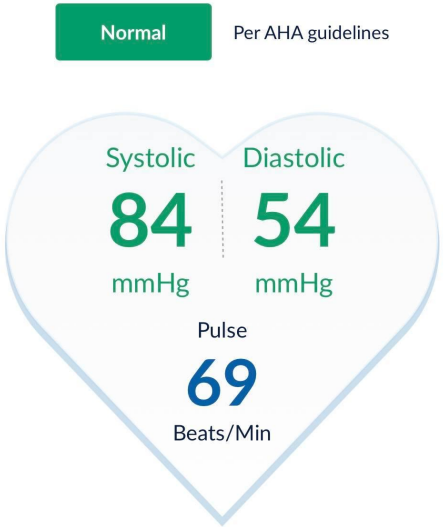
- EKG scan includes
    - Participant name
    - Participant age
    - Heart rate
    - Duration of scan
    - Instant analysis
    - The actual EKG scan



Data Analysis:

Omron:

- All that is needed to be able to collect data is to have an account on the app and have it connected to the sensor. Once that is done, just press the middle button on the right side of the sensor and the data collection is done.



Data Analysis:

EDA:

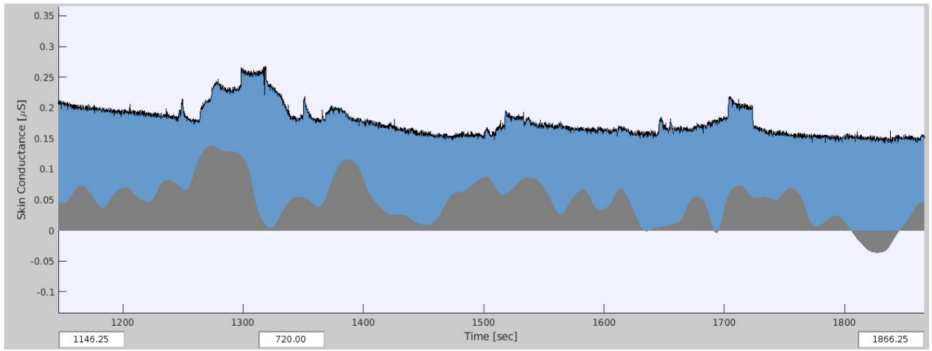
There are several MATLAB open source software's available for analysis of physiological signals. Two of them are:

- For EDA we can use the matlab software:

  http://www.ledalab.de

- We have used the Flirt library:

  https://flirt.readthedocs.io/en/latest/index.html

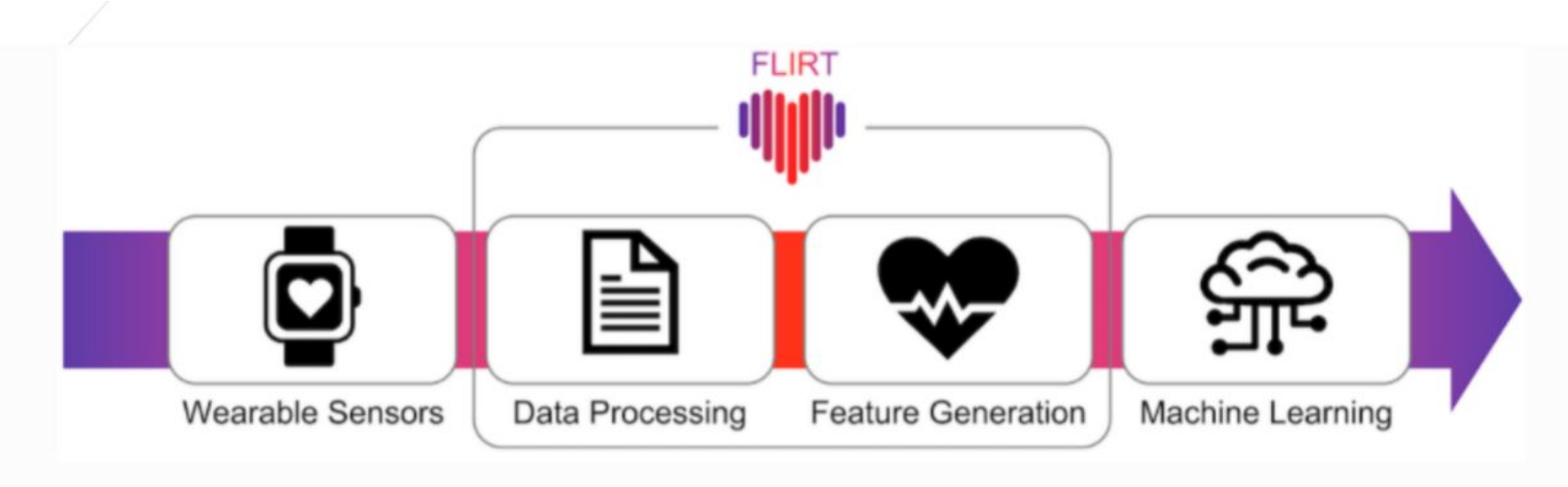


Sensor Fusion:

Sensor fusion is combining of sensory data or data derived from disparate sources such that the resulting information has less uncertainty than would be possible when these sources were used.

In this project we are going to use EKG sensor and E4 which provides some common types of data.

Feature Extraction:



Results:

- Compared the video time series with the EDA data time series.
- Observed rise in the peaks of Phasic data.

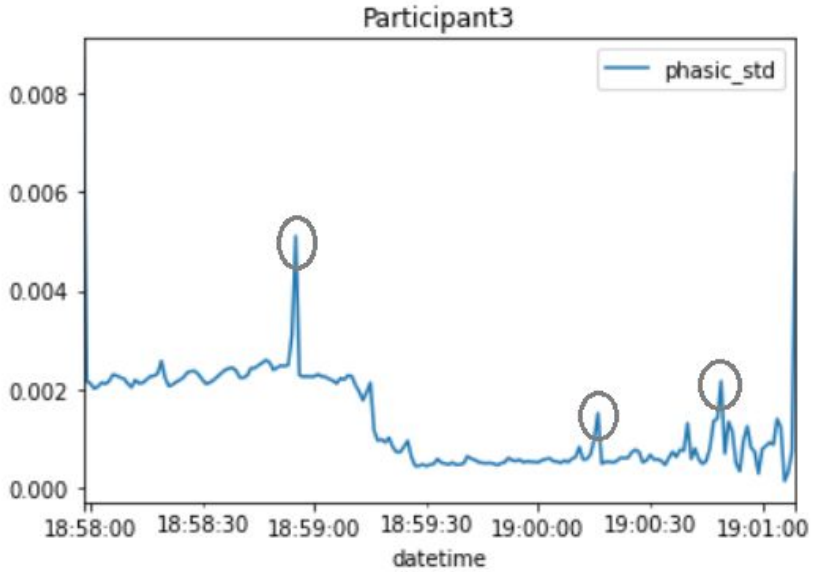


Fig: Phasic Component of EDA signal

Results:

- Rise in Blood Pressure and Heart rate for 65% of total participants.

Fig: EKG Signal Recorded for the last 30 seconds.

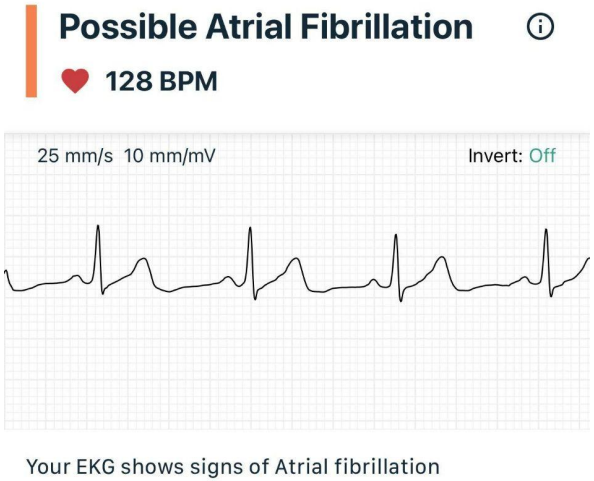


Fig: Analysis of the recorded EKG.

Research Paper:

In this paper, the authors proposed a new method for evaluating fear based on non-intrusive measurements obtained using multiple sensors. The experimental results based on the t-test, the effect size and the sum of all of the correlation values with other modalities showed that facial temperature and subjective evaluation are more reliable than electroencephalogram (EEG) and eye blinking rate for the evaluation of fear.

Choi, J.-S.; Bang, J.W.; Heo, H.; Park, K.R. Evaluation of Fear Using Nonintrusive Measurement of Multimodal Sensors. *Sensors* **2015**, *15*, 17507-17533. https://doi.org/10.3390/s150717507

Questions???