

Abstract

University brings many changes and challenges inducing a great amount of emotion fluctuation[1]. In these times of emotion fluctuation, effective emotion regulation has demonstrated to be a valuable tool correlated with better academic performance and lower stress[2]. Music and light/color have been shown to be effective aspects of smart environment for emotion regulation[3]. Our goal is to develop a low-cost accessible tool for university students that enhances student performance, emotional self understanding, and positive emotion regulation habits.

Objectives

- Provide in-depth emotional analysis for users
- Provide comprehensive health data for easy interpretation, analysis, and conclusions for user
- Allow for program to grow with user for individualization
- Offer seamless environment interaction

Materials and Methods

- Raspberry Pi 4
- PulseSensor.com Pulse Sensor
- Seed Studio GSR Sensor
- HD 1080P Camera
- Live Data readings preprocessed accordingly to the database the respective ML model was built on
- Python was fundamental due to its extensive libraries like CustomTkinter and Pandas

Diagrams/Figures/Experiments

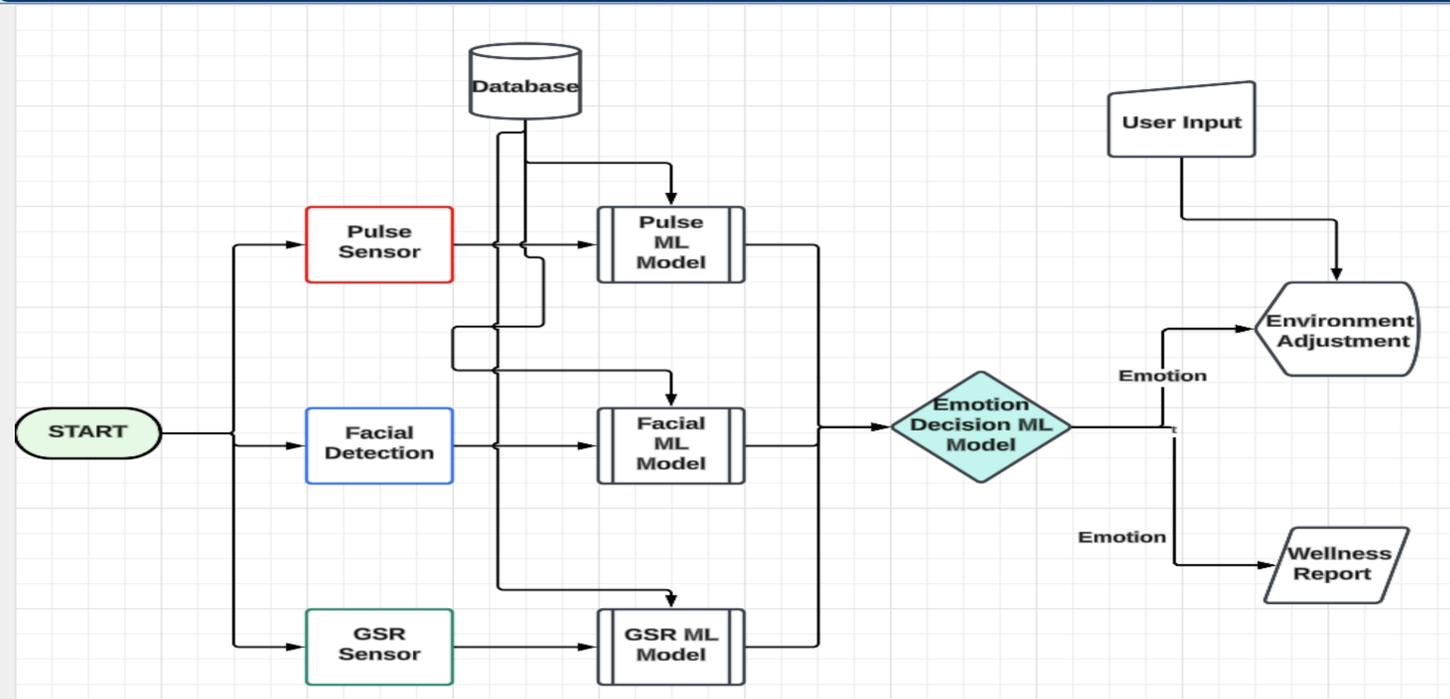


Figure 1: Flowchart of Emotion Decision Making and Environment Adjustment (above)

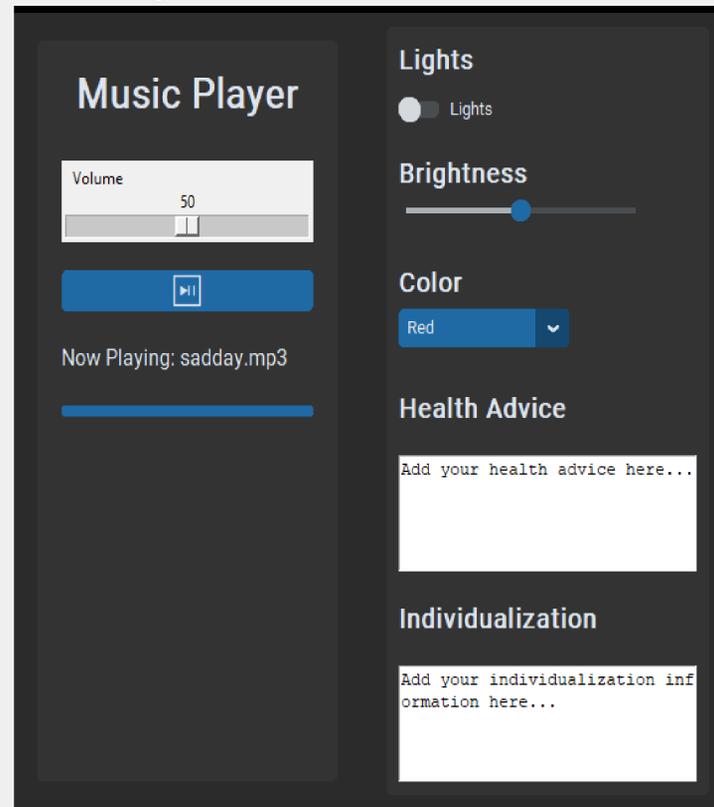


Figure 2: Environment Control GUI Interface(above)



Figure 3: Facial Detection GUI Screen (above)

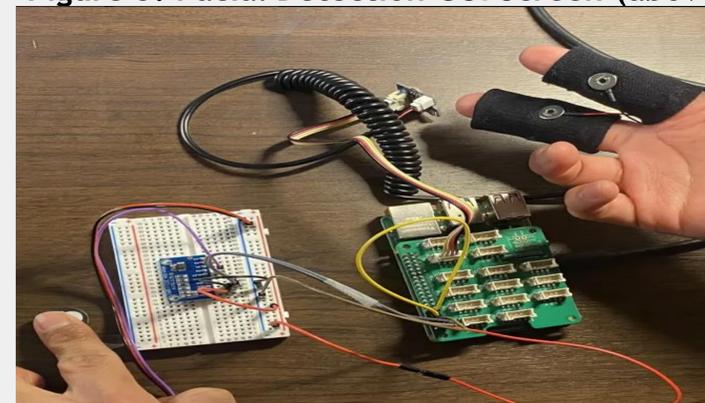


Figure 4: Sensor Usage(above)

Results

Emotion Decision Module:

- GSR Emotion Prediction Accuracy: 86%
- Heart Rate Emotion Prediction Accuracy: 81%
- Emotion Decision ML Model combines information of each sensor and facial detection for one final emotion

Environment Module:

- Integrated music player and environment lights set automatically by decided emotion, can be adjusted manually

Wellness Report:

- Comprehensive summary/regulation advice of emotional data

Additional Information

- DeepFace python library is the core of the facial detection module
- Sensor emotion detection is determined by respective machine learning models
- Machine learning models are built upon public datasets based off research dealing with the correlation between physiological signals and emotions.
- Music player, a vital part to the environment module, integrates seamlessly with the main GUI, leveraging access to a built in catalogue of music tracks and genres

References

- [1] Hagenauer, Gerda, et al. "University Students' Emotions, Life-Satisfaction and Study Commitment: A Self-Determination Theoretical Perspective." *Journal of Further and Higher Education*, vol. 42, no. 6, 2018, pp. 808-26, <https://doi.org/10.1080/0309877X.2017.1323189>.
- [2] Chacón-Cuberos, Ramón, et al. "Basic Psychological Needs, Emotional Regulation and Academic Stress in University Students: A Structural Model According to Branch of Knowledge." *Studies in Higher Education (Dorchester-on-Thames)*, vol. 46, no. 7, 2021, pp. 1421-35, <https://doi.org/10.1080/03075079.2019.1686610>.
- [3] Fernández-Caballero, Antonio, et al. "Smart Environment Architecture for Emotion Detection and Regulation." *Journal of Biomedical Informatics*, vol. 64, 2016, pp. 55-73, <https://doi.org/10.1016/j.jbi.2016.09.015>.