# Behavioral Sensing App Development

Team members: Jiaxiang Ding, Haosheng Ge, Vincent Perkins, Patrick Quion and Aditya Shrivastava
Clients: Dr. Nan Kong, BME, Purdue University; Dr. Prieto-Welch, CAPS, Purdue University; and Dr. Denny Yu, , IE, Purdue University

## Introduction

- Incidence of mental illness is rising on college campuses-***⅔ of students*** entering university worldwide have a mental illness (WHO, 2018)
- Purdue students demand expanded mental health resources-WellTrack, an interactive self-help therapy app, has logged ***3,000 sign-ups and 25,000 logins*** among Purdue students since November 2018 (Prieto-Welch, 2019)

## Problem Statement

As of now, there is no application that can track smartphone use patterns that have been linked to depressive symptoms and is capable of behavioral sensing

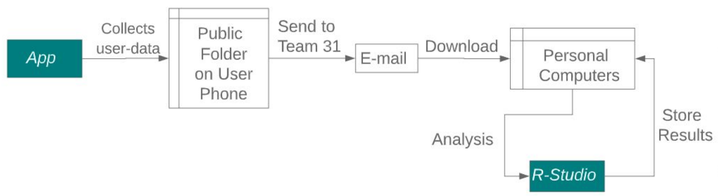
## System Model

To explore the detection of daily-life behavioral markers using mobile phone global positioning systems (**GPS**) and usage sensors, and their use in identifying depressive symptom severity. (Mohr-David, 2015)

## Methodology

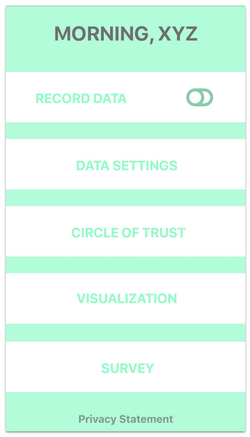
- Researched current literature on mobile sensing
- Developed android based application
- Implemented GPS and App Usage data collection
- Data visualization and Data analytics using R
- Created a UI design with Adobe XD with **MUT**

## Data Flow Diagram

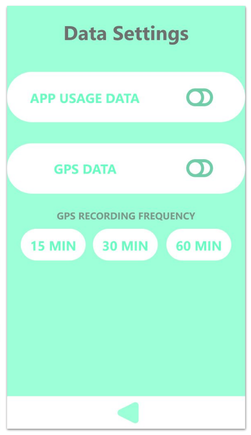



rethink

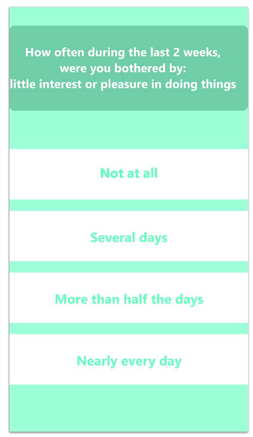
## Results




UI Homepage

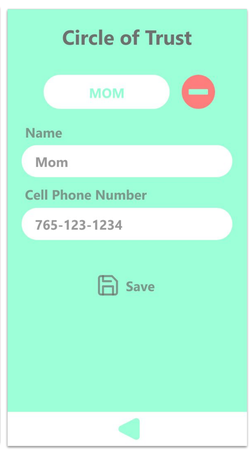



Data Setting

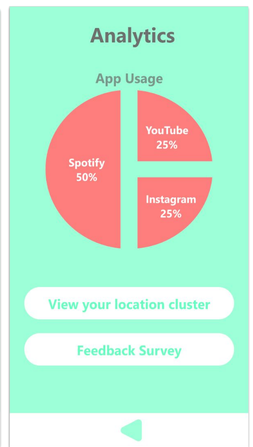



Survey


COT Feature



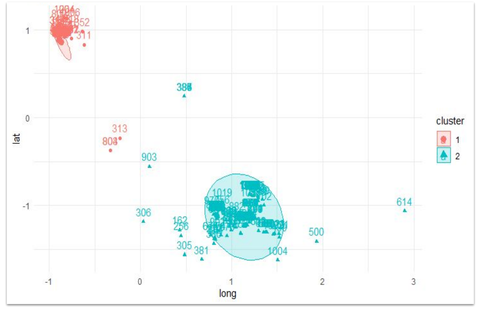

Updating Contact



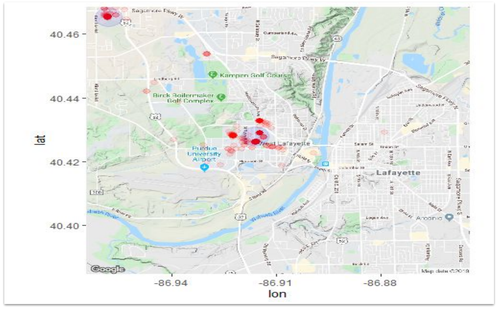

Data Analytics

A single user's GPS data was collected over 2 weeks. Their data was analyzed following a methodology outlined in Saeb et al (2015) to produce five metrics shown to be significant in predicting mental health outcomes. The optimal number of clusters is determined by the silhouette width and K-means cluster method is implemented into R scripts. The clustering of one test subject's mobile pattern, as well as their five metrics is shown.

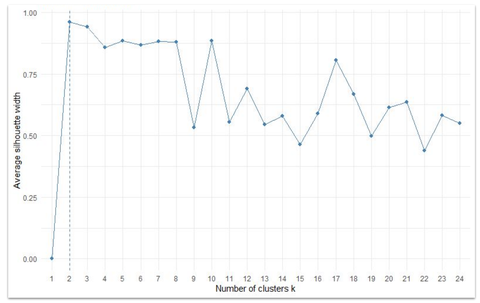
## Results Cont.



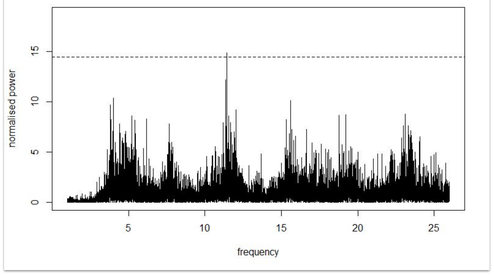

Cluster Plot



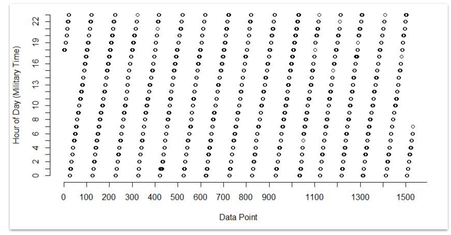

Cluster Plot on Google Maps




Silhouette Plot




Lomb-Scargle Periodogram




Hour of Day vs. Data Point Plot

| Metric | Value | Unit |
|---|---|---|
| **Location Variance** | 5.297 | N/A |
| **Number of Clusters** | 2 | clusters |
| **Entropy** | 0.525 | bits |
| **Homestay Percentage** | 57.805 | % |
| **Circadian Movement** | 2.938 | N/A |

GPS Data Metrics

## Discussion

There are more potential indicators for early detection of depressive symptoms discussed such as surrounding decibel level and social media usage. Our client decided to focus on the correlation with GPS data. With the proper IRB approval, future work on this project, could pilot a study that analyzes the metrics described here, as well as any further sensing data to find correlations with depressive symptoms

SCAN ME

150 1869 2019 YEARS OF GIANT LEAPS