HUMAN TAMAGOTCHI APPLICATION

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ABSTRACT

This project is an Android application developed using Java in Android Studio. It performs SQL queries using the Android framework AWARE to cleanly bridge together Android sensors with health data evaluation techniques. The finished project is based on the Tamagotchi toy, and displays an avatar that responds to real-life inputs from the user's phone with the ultimate goal of promoting mental health.

1 Introduction

The growing impact of technology on the everyday lives of people comes with its drawbacks. Mental health issues are on the rise with the increased daily usage of smartphones, with toxic aspects such as social media and the ironic lack of connectivity it can cause people to feel. There is also a strong correlation between gamers and people with depression. Video game addiction is often associated with low mood, lack of energy, insomnia, and irritability [6]. People with depression could turn to games to escape their lives, or depression could result from too much gaming. Video game addiction can cause long hours without exercise and interaction with other people, ultimately contributing to depression. If there were a way to turn the negative effects around, games and smartphones could be used as tools to promote positive behavioral changes to combat depression, as attempted to do through this application.

1.1 Existing Work

Mental health, gaming, and smartphones have been studied relatively extensively. Some applications that currently exist to prevent mental health issues through the use of smartphones include an application for cannabis users to try to get people to use cannabis less. The application involves a survey of cannabis use followed by feedback messages, personalized text messages based on the user's goal. More than 80% of users reported that the application helped them to stop or reduce cannabis use [5]. This is one example of many similar survey based applications that smartphones can be used to encourage certain behaviors to promote mental health (such as less dependency on cannabis) [3].
Passive smartphone sensor data can be used to track behavioral features in users, potentially being more effective and convenient than monitoring patients through clinic visits. CrossCheck is a smartphone application that uses passive sensing data to monitor the mental health of schizophrenic users with the hopes of developing a relapse prevention system [7]. Some results found through the application include lower levels of physical activity being associated with lower mental health, and waking up earlier being associated with positive mental health.

1.2 Motivation

Most of the existing applications are targeting a specific group of people-either those with certain disorders or drug addictions. The purpose of the Human Tamagotchi Application is to target the general public. Anyone can use the application regardless of personal background, with the hopes of preventing any mental health issues before they arise. Gamification aspects such as an animated Tamagotchi avatar are also included to make using the application more exciting than just taking a survey, encouraging users to open the application more often than a survey-based one. The application can hopefully appeal to gamers as well, making gaming a potentially healthy hobby.

2 Application Features

2.1 AWARE Framework

AWARE is an open-source framework that allows users to access mobile context information, analyzed using their plugins. Data is recorded and stored locally on phones, then transferred throughout the day to AWARE dashboards hosted on their own server [1]. AWARE allows easy capture and inference of user data so that data mining and visualization can be used to make conclusions about an individual's social behavior [2]. For 1 million participants, the AWARE dashboard takes 0.85 seconds to be fully operational, which is scalable enough for our purposes.

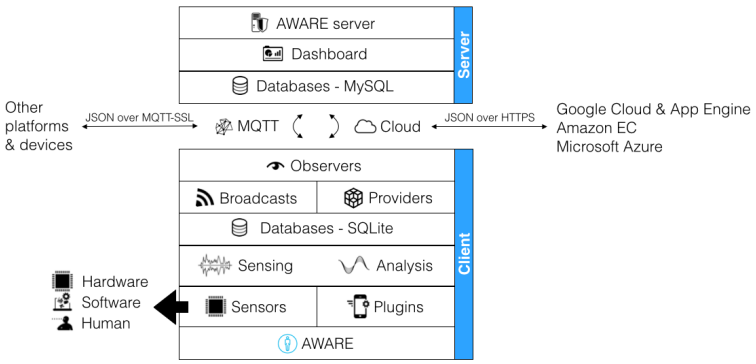


Figure 1: AWARE Architecture

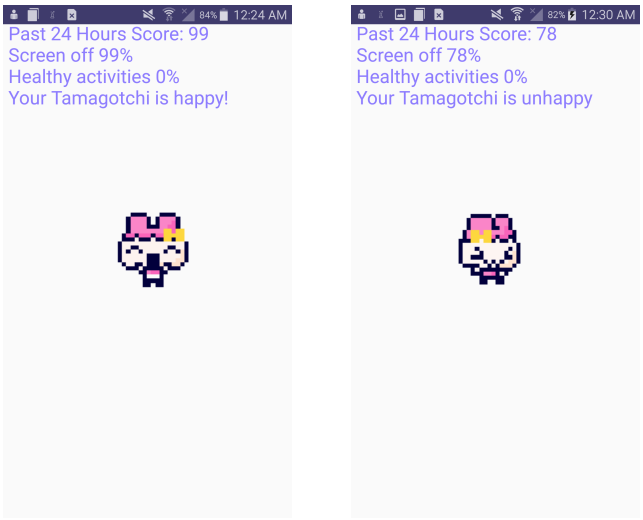
The AWARE study setup for this project collects both user activity and screen status. The first feature collected uses the Google activity recognition plugin, which detects users' activity every 60 seconds and predicts their activity to a certain confidence level using machine learning models. The various modes of activity include still, walking, running, biking, or in vehicle.
The second feature collected uses the event-based context generation function, which captures data when a change in activity is detected. The AWARE screen provider returns an integer to represent the phone's screen status, either off, on, locked, or unlocked.

2.2 Data Collection/Application Details

Screen Data		
Timestamp (millis)	Device ID	Screen Status
1551334787830	455aee5e	1
1551334797108	455aee5e	0

Table 1: Sample screen data collection

Table 1 is an example of the data collected. AWARE records screen status everytime the user's screen activity changes. For example, in the sample data, the user had screen status 1 (screen on) at timestamp 1551334787830 milliseconds since Unix epoch and changed to screen status 0 (screen off) at timestamp 1551334797108.
In order to calculate the avatar's happiness score, I would calculate the difference between timestamps and set that length of time to correspond to the earlier timestamp. In this example, the user had screen on for length of time 9278 milliseconds.
I performed similar calculations based on how long the user did a healthy activity (running, walking, or biking) and added it to how long the user's screen was off or locked. I would add up healthy activity points from the user's past 24 hours, by using SQL queries to access data from the AWARE database. This contributes to the avatar's overall happiness score, and displays an animation of the happy avatar. The threshold for happiness I set was 90, an accumulated sum of the percent of time the user's phone is off and the amount of time performing healthy activities. As long as the combined percentage is between 90 and 200, the happy avatar is shown. Otherwise, the unhappy avatar will display, as shown in Figure 2.



(a) Happy Tamagotchi (b) Unhappy Tamagotchi

Figure 2: Avatar displayed

2.3 eHealth Research Lab

This project is part of the eHealth Research Lab at UCLA. One of the projects creates a platform called eWellness, a mobile application that collects passive data from smartphones and uses statistical models and machine learning algorithms to analyze the data [4]. The analysis was done using fully supervised learning approaches. In particular, T-distributed Stochastic Neighbor Embedding was used to model a high-dimensional object by a two-dimensional point, clustering similar objects together. In Figure 3, red bullets represent healthy individuals whereas the other colors are different levels of mental distress. There is not a strong correlation, but some patterns can be determined for what people with mental distress have in common.

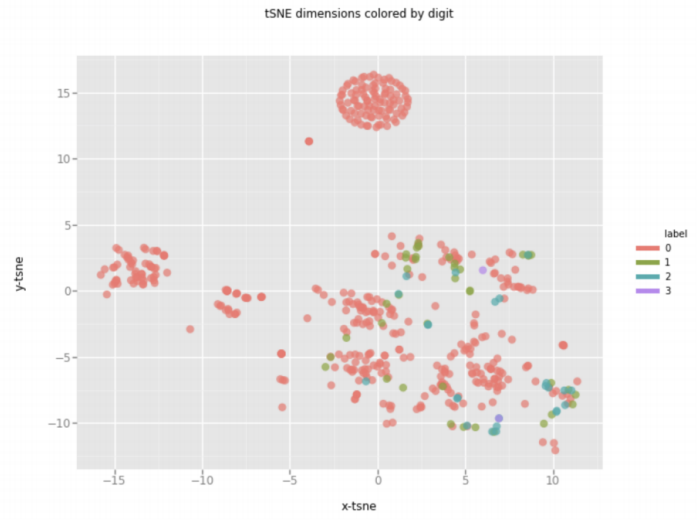


Figure 3: tSNE Mapping From eWellness Application

Given a stronger clustering or data evaluation technique, features can be determined that are linked to mental health issues and used as inputs to the Human Tamagotchi application. A binary classifier is used to determine healthy or unhealthy mental states based on the passively monitored features, resulting in an 80% success rate. The results of the study influenced the decisions on what inputs to include in my application, and hopefully through the use of the Human Tamagotchi Application users will be motivated to promote healthy habits.

3 Limitations

There are some simplified assumptions made such as using the output of the Google activity provider regardless of the confidence of the predictions made. Another option could have been using weighted probabilities of the activity predictions and updating the happiness score accordingly.
There is also no validation data of how accurate the happiness predictions are. Given more time, there could be a survey and study performed asking the user to input if they are happy or not and compare that result with the calculated happiness score.
Finally, using AWARE makes the application only compatible for Android devices. Adding support for JSON and MQTT is needed to make Human Tamagotchi a cross-platform application.

4 Future Work

This application can be extended in multiple ways. After additional work and studies are performed using the eWellness application, the results of which features are more highly linked to mental health issues can be used as inputs to Human Tamagotchi. An example could be the amount of time spent on social media applications being calculated as unhealthy. Not only is there the option of using input data from AWARE plugins, but there could also be other plugins created to extend AWARE's functionalities. As another option, the happiness score calculation can be passed into already existing and popular games, by boosting the player's score the more they participate in healthy activities. This can make gaming potentially healthier, as another application to help boost the positive aspects of gaming.

References

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