UNITE

Smart, Connected, and Coordinated Maternal Care for Underserved Communities

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NSF REU IoT-SITY

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OBJECTIVE

To build an app to ubiquitously monitor health parameters of underserved expecting pregnant mothers to prevent preterm births.

BACKGROUND

- We are collaborating with the University of Turku in Finland, where they are currently running clinical trials using the wearable devices to continuously track health parameters of 15 pregnant women. As of now, two of the mothers have given birth, and they are monitoring the mothers 1-3 months postpartum.
- We are working to help prevent preterm births, which is the most common cause of neonatal deaths.
- Underserved communities with low socioeconomic status may not receive satisfactory maternal care or delayed and infrequent care, resulting in poor birth outcomes and a decline in overall health.
- This project will bring together a diverse case of community members, including mothers, families, care providers, and outreach resources.
- We are working with the School of Nursing at UCI, OC MOMS, and University of Turku.
- The UCI Sue and Bill Gross Nursing School gave the watches to the caretakers of the moms to test possibly feasibility in the OC region.

METHODOLOGY

1. Check WiFi connection
2. Compress and send data
3. Free up the storage

App Order

1. HRV Collection
2. Recording
3. Sleep Sensor Service
4. Alarm Service
5. WiFi App

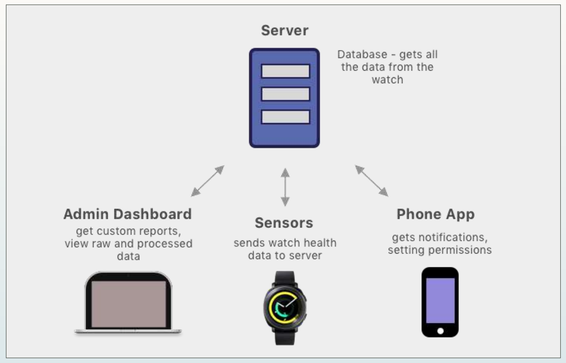
The moms would send the data to the cloud server using the watch app once a day. The data will be deleted from the watch storage after sending.

PROJECT OVERVIEW

The UNITE project is a community engagement model for maternal care that is smart, connected, and coordinated.

The model is designed to be scalable, portable across diverse communities, and brings together a multi-disciplinary partnership of researches together with non-profit agencies.

- The project has multiple interfaces: a admin dashboard, a phone, and wearable devices, with the Oura Ring and the Samsung Gear Sport Watch.
- The Samsung Gear Sport Watch was utilized for this project considering several factors such as the built-in sensors, flexible strap, long battery life, and waterproofness



Architecture of the system

Interface of the watch app

FINDINGS

Troubleshooting the watch

Since I worked on the watch app, I used the Tizen Studio IDE to continue working on developing the app. Installing the packages and the external software to run the app on my watch was my first hurdle. I created a list of instructions to help facilitate the process for future workers on the project.

Headers for files

There are currently no headers for the Monitor and Detector files, so I wrote some C code to print to log the contents of different functions what are available in Tizen Studio.

```
void
example_sensor_callback(sensor_h sensor, sensor_event_s *event, void *data)
{
    FILE * fp;
    sensor_type_e type = SENSOR_ALL;
    if ((sensor_get_type(sensor, &type) == SENSOR_ERROR_NONE) && type == SENSOR_HUMAN_SLEEP_DETECTOR) {
        updateFileName();
#ifdef DEBUG
    FILE * fp = fopen(logFileName,"a");
    fprintf(fp , "\");

    int printnum = sensor_get_type(sensor, type);
    fprintf(fp, printnum);

    int printnum2 = sensor_get_default_sensor(type, sensor);
    fprintf(fp, printnum2);

    fclose(fp);
#endif
```

```
    if ((sensor_get_type(sensor, &type) == SENSOR_ERROR_NONE) && type == SENSOR_HUMAN_SLEEP_MONITOR) {
#ifdef DEBUG
    FILE * fp = fopen(logFileName,"a");
    fprintf(fp , "\");

    int printnum = sensor_get_type(sensor, type);
    fprintf(fp, printnum);

    int sensor_count;
    int* list;
    int printnum1 = sensor_get_sensor_list(type, &list, &sensor_count);
    for(int i=0; i<sensor_count; i++) {
        fprintf("%d", *list[i]);
    }

    fprintf(fp, printnum1);

    fclose(fp);
```

Showing alarm service in WiFi app

I wanted to show a notice on the watch when the battery is low and the WiFi gets automatically turned off, so the mothers can be aware that the battery is off.

LIMITATIONS

- We are assuming the users do not software update the watch app, because there are some major changes with the updates.
- Some of the main problems mostly included the connectivity of the watch. Services shut down in low battery.
- Data sent to the server is inconsistent.

FUTURE DIRECTION

- Adding a Bluetooth app feature to the watch app to be more energy conservative.
- Continue working on current small app bugs:
  1. When the watch is low on battery or shuts down, the services on the app are uninstalled from the watch.
  2. Show alarm service in WiFi App.
  3. Fixing the timestamps in the Monitor file.
- Planning on having controlled study clinical trials in Orange County for a community of underserved mothers in Fall 2019.

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