Smartwatch

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INTRODUCTION

A smartwatch is a wearable computer that provides auxiliary functionality to a smart phone. This functionality can range anywhere from simple telecommunication tools to dedicated, untethered cellular connectivity and biometric tracking. There are a variety of smartwatch devices already on the market each with different features, designs and functionality.
Smartwatch design is focused around three main areas; the physical form of the watch (including the development platform of choice and enclosure design around said platform), the connectivity options of the watch (tethered to a phone, dedicated cellular modem), and the primary software functionality of the watch. The latter two areas follow the first – connectivity and software functionality is contingent on the variety of sensors, effectors and processors used within the watch.
The idea for our smartwatch is primarily a health-focused device and our choices of sensors reflect that. The ADXL345 accelerometer allows for user movement tracking. The ADS1015 Analog to digital converter and a pulse sensor will let the device monitor the user's pulse to help gauge active calories burned during exercise. The TMP006 temperature sensor allows the device to monitor the user's body temperature and send alerts based on body temperature data. All data will be processed with a dedicated app on a connected Android device, and displayed in-depth within the app. The display of the watch itself will show the user quick tidbits of information over time, and allow for quick changes and modifications to watch's functionality.

AIM

Baltej
Heart Rate Sensor …………………..($25.00x2) $50.00
ADS 1015 Analog to Digital Convertor……$9.95
Pyboard Color LCD………………………..$39.95

Thomas
USB Hub…………………………………..…$30.00
Power Supply…………………………..……$30.00
AXDL345 accelerometer……………….($15.00x2) $30.00

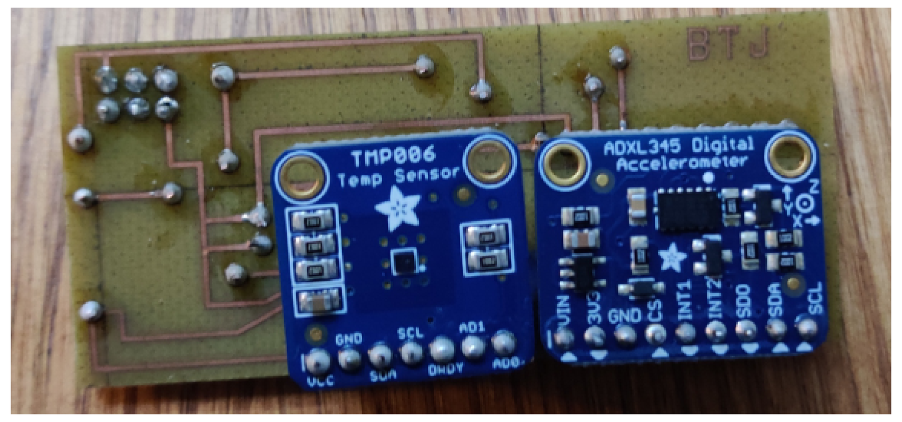
Jerreh
TMP006 IR Temperature sensor……...($10.00x2) $20.00
Raspberry Pi Zero W……………………......$70

Total Budget: $279.90

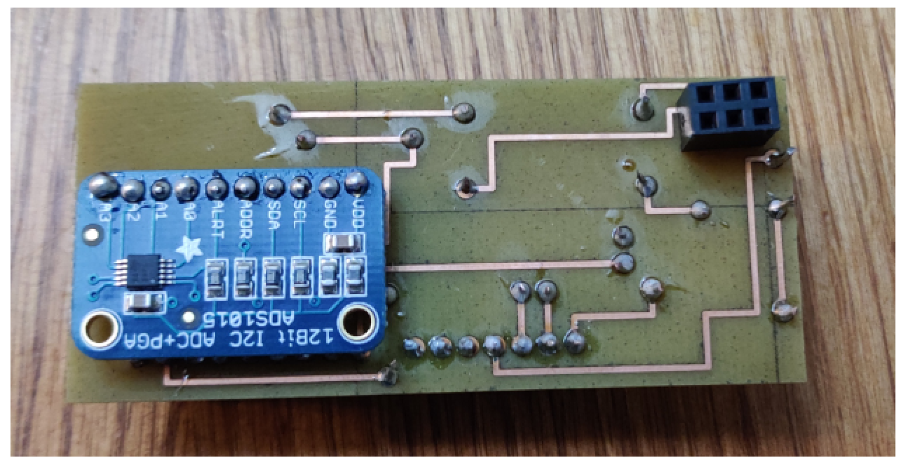
All budgeting was done assuming access to Humber facilities for PCB printing, laser cutting and 3D printing.

METHOD

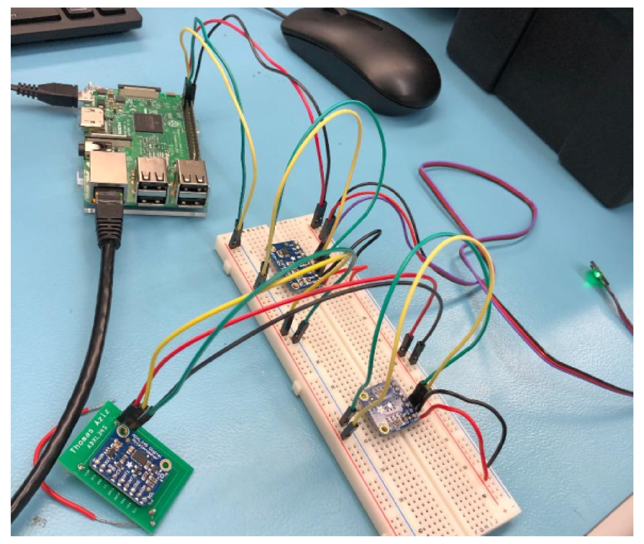
Using the Fritzing software we planned how we wanted our design to look like. Fritzing is an open-source initiative to develop amateur or hobby CAD software for the design of electronics hardware, to support designers and artists ready to move from experimenting with a prototype to building a more permanent circuit. That way we can have a good idea of what we want our hardware to look like when we create it. The PCB is the hardware we are currently using for our project. PCB stands for printed circuit board mechanically supports and electrically connects electrical or electronic components using conductive tracks, pads and other features etched from one or more sheet layers of copper laminated onto and/or between sheet layers of a non-conductive substrate. Below is a picture of our wiring of the breadboard and the PCB.
The firmware is a software program that receives a set of instructions for the hardware device communication, which will then perform an expected operation. The 64 GB SD card of the Raspberry Pi has been formatted. The RPI zero w has a CPU which uses the NOOBS operating system installer containing specifically Raspbian operating system to carry the code and connections of the hardware. All of the files for Noobs have been copied and pasted into the SD card for the setup. We then inserted the SD card into the Pi after the image has been put on it. For this project, the firmware is the part of the RPI zero W that is responsible for reading the information from the Firebase to the CPU.



Top View Of The PCB



Bottom View Of The PCB



Picture of the Breadboard wiring

RESULTS

Using android studio, we made our Mobile application, along with login activity, data visualization activity and the action control activity. We will also talk about what software we used to plan how we wanted our Mobile app to look and what language we used to make the actual Android application.
We created the app in a way that the user should be able to successfully using the firebase database service register an account and login. In the Mobile application the user has access to several different pages such as a timer, the pages to see the sensor data of each sensor and also the history of all the readings from the past. The user should have access to all the sensor readings when they are connected on a WIFI network with access to the internet.
The mobile application uses the data fed to it by either of the aforementioned sensors, being the TMP006-Temperature sensor, ADXL345 - Accelerometer and the ADS1015 with the Sen-11574 Heartrate sensor. The first thing the user will see is the login screen which allows the user to create a new account and validates attempts to sign in with their credentials by checking whether the user entered the correct username and password as well as provide a password of sufficient length, in our case at least 6 characters after authentication the user will be brought to the main menu where the user can select what data measured they want to see and retrieve it in a history tab as well as have access to settings, an about us page and also the user has access to a stopwatch and timer for all exercise functionalities we provide with the app. The Mobile application will also be able to terminate by pressing a quit in a drop-down menu to the right of the screen. Each activity will display a different reading and will complete different tasks to achieve what we want the Mobile application to do, each case is presented below:
Temperature tracking
· Tracks the Body temperature
Steps Taken
· Tracks the steps walked in the day
Heart-rate
· Tracks the bodies heart-rate

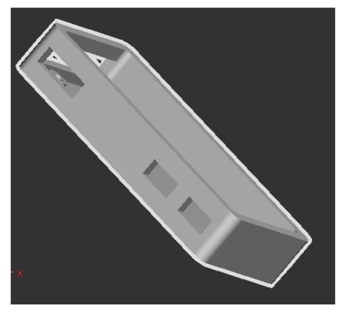
Database design will be based primarily around each sensor's data and values they record it will also record the date the data was logged via a timestamp.

Picture of the LOGIN SCREEN AND THE HOME SCREEN. ALSO A WORKING DATABASE

PRINTING

The enclosure for our project was made using various software as it had to be done using two different materials that meant one portion had to be laser cut and another 3d printed.
The laser cut portion of the prototype case was made using the CorelDraw software. In this software we were able to increase the measurements of the Raspberry Pi zero w so the case could help keep the RPI and the soldered PCB stable as our project was a smartwatch which was designed to be worn on the wrist.
The 3D portion of the case was made using the 3D sprint program. This was the first time any of our group members used this program so it was tricky getting the hang of it. Overall we ended up getting this portion of the case created on the software.
*Although we as a group got all the work done for designing the enclosure, we were unable to print the final case at the prototype lab. Due to COVID-19 Humber was forced to shut down the campus and move to online remote delivery of classes thus not allowing us to make a completely housed case with PCB and RPI altogether.

3D Cut



Laser Cut

CONCLUSIONS

The Smartwatch capstone project team would like to thank Humber College Institute of Learning and Technology and all its services for aiding in the completion of this endeavour. The Smartwatch encompasses a broad array of sensors and features demanded by those seeking an enhanced quality of life or those who want an easier way to track and maintain their routines. We hope to further our investment in this project by designing the necessary components in accordance with OACEETT safety guidelines for certification.

ACKNOWLEDGEMENTS

During the duration of this project we had help and guidance from our professor, Kristian Medri, and the Humber Media Studies department as they were our collaborators.

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