SmartWatch IOT - Computer Engineering Technology Capstone Project –

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# 1.0 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.

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 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 functionality.

### Scope and Requirements

Our objective is to implement all 3 sensors into one enclosure with a touch screen display. To meet this objective we will be required to use the knowledge and experience in PCB design, Android programming and software development gained in other courses and extracurricular work. Guidance from our industry partner and professor will help us to meet the requirements for the design and implementation of this project.

Software requirements:

* users will be able to login using a unique ID and password
* app will record and store all biometric data from the watch
* app will display trends and information based off stored data to user

Hardware requirements:

* custom PCB will connect all sensors to the development platform
* appropriate layer design for all components of the watch
* the enclosure will follow traditional watch design

Additional requirements:

* capstone presentation
* a complete project report meeting OACETT standards

# 2.0 Background

To begin we’d like to thank the Humber College Institute of Technology & Advanced Learning Computer Engineering Technology Capstones for their guidance in our progress. Their experience in hardware and software design is immeasurably helpful as we continue to further our project.

Wearables have become immensely popular devices that utilize Bluetooth connections and serve as integral IoT devices in the daily lives of a large population. The release of the Samsung Galaxy Gear in 2013 – a smart watch with an integrated heartbeat sensor and pedometer - created a whole new market for smart wearable devices. The Apple Watch currently dominates the market, with over 45% market share (Liu, 2019). The Apple Watch provides a swath of very advanced functionality, including tethered messaging, fitness tracking, biometric monitoring and cellular connectivity.

We intend to create a watch that focuses primarily on fitness tracking – an area that the current market leader is not completely focused on. We hope that our watch and accompanying software will allow users to get a more in-depth look into their daily fitness levels by providing them easy-to-read data on movement, heart rate and body temperature.

Our sensor choices will allow us to collect all the data we require, and the application will allows for us to represent the data to the user in a meaningful way.

Each sensor functions as follows:

TMP006 - The TMP006 IR Temperature sensor will allow a contactless analysis of the wearer's ambient body temperature. When integrated into the smartwatch it will let the wearer know his/her temperature and provide a suggestion. These suggestions will be dependent on the recorded temperature between the ranges of -40°C ~ 125°C. (Texus Instruments Inc., 2012)

ADXL345 – The AXDL345 accelerometer is a triple-axis accelerometer that measures the static acceleration of gravity. When integrated into the smartwatch it will allow for the device to record the user’s movement during exercise. When coupled with a pulse sensor it will allow us to measure the user’s exercise intensity and display suggestions on trends, overall intensity, and calories burned during exercise. (Analog Devices, 2015)

ADS1015 - The pulse/heart-rate sensor amped is a plug-and-play heart-rate sensor for Arduino. The pulse/heart rate sensor can be used to incorporate live heart-rate data and send it to the device's software which will use the pulse/heart-rate sensor to measure the pulses and will alert the user for any drastic changes in the user’s vital signs. (Texus Instruments Inc., 2018)

Humber College intends to present a viewing of capstone projects of various designs with the intent of showing in further detail how their capstones work. The smartwatch wearable will be present to demo to potential industry investors.