Humber College Institute of Technology & Advanced Learning Smartwatch 0NB

Status

/1 Hardware present?

/1 Title Page

/1 Declaration of Joint Authorship

/1 Proposal (500 words)

|  |
| --- |
| Baltej Bal |

/1 Executive Summary

# Declaration of Joint Authorship

We, Baltej Bal, Jerreh Janneh, and Thomas Aziz, confirm that this work submitted is the joint work of our group and is expressed our own words. Any uses made within it of the works of any other author, in any form (ideas, equations, figures, texts, tables, programs), are properly acknowledged at the point of use. A list of the references used is included. The work breakdown is as follows: Each of us provided functioning, documented hardware for a sensor or effector. Baltej provided the heartrate sensor. Jerreh provided Temperature sensor. Thomas provided the accelerometer sensor. In the integration effort Baltej is the lead for further development of our mobile application, Thomas is the lead for the Hardware, and Jerreh is the lead for connecting the two via the Database.

# Proposal

We have created a mobile application, worked with databases, completed a software engineering course, and prototyped a small embedded system with a custom PCB as well as an enclosure (3D printed/laser cut). Our Internet of Things (IoT) capstone project uses a distributed computing model of a smart phone application, a database accessible via the internet, an enterprise wireless (capable of storing certificates) connected embedded system prototype with a custom PCB as well as an enclosure (3D printed/laser cut), and are documented via this technical report targeting OACETT certification guidelines.

Intended project key component descriptions and part numbers  
Development platform: Raspberry pi zero W, android.  
Sensor/Effector 1: SEN-11574 Pulse Sensor, ADS1015 to calculate the heartrate sensor.   
Sensor/Effector 2: ADXL345 is an accelerometer to count the steps for our watch.  
Sensor/Effector 3: TMP006 is a temperature sensor to calculate the body temperature.

We will continue to develop skills to configure operating systems, networks, and embedded systems using these key components to make a wearable device or also known as a smart watch that detects the pulse/heart rate, the body temperature, and the motion detection of the body. The pulse/heart rate sensor amped is a plug-and-play heart-rate sensor for the Arduino, the sensor can be used to incorporate live heart-rate data into our project. The idea of the smart watch was adapted from similar smart watch’s using similar integrated features that can already be found on the market. Apple watch, Fitbit, Galaxy Watch, are just some of the smart watch’s already on the market. Our S-watch device makes for a unique design compared to our competitors as we will use the pulse/heart rate sensor to measure the heart rate and will alert the user for any drastic changes in the user’s vital signs.

Our project description/specifications will be reviewed by, Humber Media Studies, ideally an employer in a position to potentially hire once we graduate. They will also ideally attend the ICT Capstone Expo to see the outcome and be eligible to apply for NSERC funded extension projects. This typically means that they are from a Canadian company that has been revenue generating for a minimum of two years and have a minimum of two full time employees.

The small physical prototypes that we build are to be small and safe enough to be brought to class every week as well as be worked on at home. In alignment with the space below the tray in the Humber North Campus Electronics Parts kit the overall project maximum dimensions are 12 13/16" x 6" x 2 7/8" = 32.5cm x 15.25cm x 7.25cm.

Keeping safety and Z462 in mind, the highest AC voltage that will be used is 16Vrms from a wall adapter from which +/- 15V or as high as 45 VDC can be obtained. Maximum power consumption will not exceed 20 Watts. We are working with prototypes and that prototypes are not to be left powered unattended despite the connectivity that we develop.

# Executive Summary

The accomplishments that are described by this document is that we can once we are done the project’s we can submit this report and receive a certificate or license by OACETT and that will allow us to become engineers. The idea of the S-watch was adapted from similar smart watch’s using similar integrated features that can already be found on the market. Apple watch, Fitbit, Galaxy Watch, are just some of the smart watch’s already on the market with the same technological features that we are going to have on the S-watch. These watch’s use accelerometer which counts the users' motion otherwise known as steps walked, distance travelled, and calories burned. Our S-watch device makes for a unique design compared to our competitors as we will use the pulse/heart rate sensor to measure Solution description the heart rate and will alert the user for any drastic changes in the user’s vital signs. We should be hired by an investor because we have successfully been able to get our hardware components to function correctly, we also have experience with the Raspberry Pi and the mobile web development platforms like android and working with Firebase to connect our projects together so they work as a smartwatch.

Contents

[Declaration of Joint Authorship 3](#_Toc27658517)

[Proposal 5](#_Toc27658518)

[Executive Summary 7](#_Toc27658519)

[List of Figures 11](#_Toc27658520)

[1.0 Introduction 13](#_Toc27658521)

[1.1 Scope and Requirements 13](#_Toc27658522)

[2.0 Background 15](#_Toc27658523)

[3.0 Methodology 17](#_Toc27658524)

[3.1 Required Resources 17](#_Toc27658525)

[3.1.1 Parts, Components, Materials 17](#_Toc27658526)

[3.1.2 Manufacturing 17](#_Toc27658527)

[3.1.3 Tools and Facilities 17](#_Toc27658528)

[3.1.4 Shipping, duty, taxes 17](#_Toc27658529)

[3.1.5 Time expenditure 17](#_Toc27658530)

[3.2 Development Platform 17](#_Toc27658531)

[3.2.1 Mobile Application 17](#_Toc27658532)

[3.2.2 Image/firmware 18](#_Toc27658533)

[3.2.3 Breadboard/Independent PCBs 18](#_Toc27658534)

[3.2.4 Printed Circuit Board 21](#_Toc27658535)

[3.2.5 Enclosure 21](#_Toc27658536)

[3.3 Integration 22](#_Toc27658537)

[3.3.1 Wireless Connectivity 22](#_Toc27658538)

[3.3.2 Database Configuration 22](#_Toc27658539)

[3.3.3 Security and Testing 22](#_Toc27658540)

[4.0 Results and Discussions 23](#_Toc27658541)

[5.0 Conclusions 25](#_Toc27658542)

[6.0 References 27](#_Toc27658543)

[7.0 Appendix 29](#_Toc27658544)

[7.1 Firmware code 29](#_Toc27658545)

[7.2 Application code 29](#_Toc27658546)

# List of Figures

[Figure 7. By Android Studio - https://developer.android.com/studio/, CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=74094999 18](#_Toc27658547)

[Figure 1. Initial schematic. This work is a derivative of "http://fritzing.org/parts/" by Fritzing, used under CC:BY-SA 3.0. 19](#_Toc27658548)

[Figure 2. This work is a derivative of "http://fritzing.org/parts/" by Fritzing, used under CC:BY-SA 3.0. 20](#_Toc27658549)

[Figure 3. Breadboard prototype. 20](#_Toc27658550)

[Figure 4. PCB design This work is a derivative of "http://fritzing.org/parts/" by Fritzing, used under CC:BY-SA 3.0. 21](#_Toc27658551)

[Figure 5. Humber Sense Hat Prototype PCB. 21](#_Toc27658552)

[Figure 6. Example enclosure. 22](#_Toc27658553)

# 1.0 Introduction

Idea. Self-driving cars using Machine Learning. Scope and Requirements specification. Project Schedule.

## 1.1 Scope and Requirements

Describe what will be done. It is an Internet of Things (IoT) capstone project that uses a distributed computing model of a smart phone application, a database accessible via the internet, an enterprise wireless (capable of storing certificates) connected embedded system prototype with a custom PCB as well as an enclosure (3D printed/lasercut), and is documented via an OACETT certification acceptable technical report. Also describe the limits of the project and what will not be done (CSA testing) in this project. Include the development platform specifications and any other hardware specifications possibly organized in point form, the Android device requirements, and database specifications/protocols.

Report

/1 Hardware present?

/1 Introduction (500 words)

/1 Scope and Requirements

/1 Background (500 words)

/1 References

# 2.0 Background

We would like to thank mentor Diego Magalhães from AWS for supporting this project. This section is to include at least three references, here is an example of an APA citation of a website (OACETT, 2017) followed by a sentence citing an Article in a Periodical, a Book, and a Journal Article. Humber is planning to host an internal DeepRacer event using an existing example of machine learning (Robuck, 2018), artificial intelligence (Media, O., 2019), and internet connected servers (Kinsella, 2019).

# 3.0 Methodology

## 3.1 Required Resources

Report

/1 Parts/components/materials (500 words)

/1 PCB, case (500 words)

/1 Tools, facilities (500 words)

/1 Shipping, duty, taxes (250 words)

/1 Working time versus lead time (250 words)

### 3.1.1 Parts, Components, Materials

### 3.1.2 Manufacturing

### 3.1.3 Tools and Facilities

### 3.1.4 Shipping, duty, taxes

### 3.1.5 Time expenditure

Working time versus lead time.

## 3.2 Development Platform

### 3.2.1 Mobile Application

Status

/1 Hardware present?

/1 Memo by student A + How did you make your Mobile Application? (500 words)

/1 Login activity

/1 Data visualization activity

/1 Action control activity

Include screenshots such as Figure 1. Testing. Progress.



Figure 1. By Android Studio - https://developer.android.com/studio/, CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=74094999

### 3.2.2 Image/firmware

Status

/1 Hardware present?

/1 Memo by student B + How did you make your Image/firmware? (500 words)

/1 Code can be run via serial or remote desktop

/1 Wireless connectivity

/1 Sensor/effector code on repository

### 3.2.3 Breadboard/Independent PCBs

Status

/1 Hardware present?

/1 Memo by student C + How did you make your hardware? (500 words)

/1 Sensor/effector 1 functional

/1 Sensor/effector 2 functional

/1 Sensor/effector 3 functional

The initial schematic design, Figure 2, based on datasheets (Bosch Sensortec, 2019) led to a breadboard layout Figure 3 that was realized Figure 4.

How did you build your Prototype: Breadboard?

Then a PCB was designed, Figure 5, and populated (Figure 6). Bill of Materials, Case, Time commitment. Testing. Progress.



Figure 2. Initial schematic. This work is a derivative of "http://fritzing.org/parts/" by Fritzing, used under CC:BY-SA 3.0.



Figure 3. This work is a derivative of "http://fritzing.org/parts/" by Fritzing, used under CC:BY-SA 3.0.



Figure 4. Breadboard prototype.

### 3.2.4 Printed Circuit Board

Demo

/1 Hardware present?

/1 PCB Complete and correct

/1 PCB Soldered wire visible but trim, no holes or vacancies

/1 PCB Tested with multimeter

/1 PCB Powered up

How did you build your Prototype: PCB?



Figure 5. PCB design This work is a derivative of "http://fritzing.org/parts/" by Fritzing, used under CC:BY-SA 3.0.



Figure 6. Humber Sense Hat Prototype PCB.

### 3.2.5 Enclosure

Demo

/1 Hardware present?

/1 Case encloses development platform and custom PCB.

/1 Appropriate parts securely attached.

/1 Appropriate parts accessible.

/1 Design file in repository, photo in report.

How did you build your Prototype: Case?



Figure 7. Example enclosure.

## 3.3 Integration

Demo

/1 Hardware present?

/1 Data sent by hardware

/1 Data retrieved by mobile application

/1 Action initiated by mobile application

/1 Action recieved by hardware

Report

/1 Enterprise wireless connectivity (250)

/1 Database configuration (250 words)

/1 Security considerations (500 words)

/1 Unit testing (900 words)

/1 Production testing (100 words)

### 3.3.1 Enterprise Wireless Connectivity

How did you make a Database accessible by both your Prototype and Mobile Application?

### 3.3.2 Database Configuration

### 3.3.3 Security

### 3.3.4 Testing

Unit testing and Production testing.

# 4.0 Results and Discussions

Is your prototype perfect? What did you learn?

# 5.0 Conclusions

If you were making 1000 of these.

Report

/1 Hardware present?

/1 Checklist truthful

/1 Valid Comments

/1 Results and Discussion (500 words)

/1 Conclusion

# 6.0 References

Bosch Sensortec. (2019, July). *BME680 - Datasheet.* Retrieved from Robert Bosch GmbH: https://ae-bst.resource.bosch.com/media/\_tech/media/datasheets/BST-BME680-DS001.pdf

Kinsella, J. (2019). Five trends predicted for the cloud industry in 2019. *Software World*, 50(1), 11.

Media, O. (2019). *O'Reilly artificial intelligence conference 2019 - San Jose, California.* California: O'Reilly Media, Inc.

OACETT. (2017, March). *I need to Complete a Technology Report*. Retrieved from The Ontario Association of Certified Engineering Technicians and Technologists: https://www.oacett.org/Membership/Technology-Report-and-Seminar

Robuck, M. (2018, 11). AWS goes deep and wide with machine learning services and capabilities. *Fierceinstaller*.

# 7.0 Appendix

## 7.1 Firmware code

Demo

/1 Hardware present?

/3 Code runs concurrently for all sensors/effectors

/1 Project repository contains integrated code

Status

/1 Memo including updates

/1 Financial update

/1 Progress update

/1 Modified Code Files in Appendix

/1 Link to Complete Code in Repository

## 7.2 Application code

Demo

/1 Hardware present?

/1 Memo by student A

/1 Login activity

/1 Data visualization activity

/1 Action control activity

Report

/1 Login activity

/1 Data visualization activity

/1 Action control activity

/1 Modified Code Files in Appendix

/1 Link to Complete Code in Repository