M.A.R.S Inc Solar Panel Monitoring System

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Declaration of Joint Authorship

We, Ahmad, Ramin, and Matthew, 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. Student A provided Ahmad El-Hajj. Student B provided Ramin Kurkeice. Student C provided Matthew Phillip. In the integration effort Student A is the lead for further development of our mobile application, Student B is the lead for the Hardware, and Student C is the lead for connecting the two via the Database.

Proposal

We have created a mobile application, web 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. The project has been split into three parts: hardware, software and back end(database). Software consists the mobile application to display readings and the web application which will display the readings and display them in a graph and will show previous readings. Hardware will consist the following sensors shown below, and the raspberry pi three. Backend will use MySQL to store the database.

Intended project key component descriptions and part numbers

Development platform:

Sensor/Effector 1: ACS 712 Current

Sensor/Effector 2: ZMPT101B Voltage

Sensor/Effector 3: LM35 Temperature

We will continue to develop skills to configure operating systems, networks, and embedded systems using these key components to measure the voltage, current and temperature. Once we receive the following values, they will be uploaded to the database to be displayed on a mobile application and web application.

Our project description/specifications will be reviewed by, Dragos Paraschiv, 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. Devices and components will always be tested before assembled and connected together. Safety training has been provided by Humber to help ourselves safe and others safe by our actions. Safety glasses are worn at all times when working on the projects and in the workshop. Safety precautions are taken when using the following sensors, following the manufactures guidelines. Safety soldering tips and training have been provided as well to ensure our PCB’s are functional and remain safe at all times.

Executive Summary

We have created a solar panel monitoring device to measure live readings of the solar panel. This product will help determine how efficient solar panels are and see results throughout the day. Data is currently being uploaded through a mobile application and a website showing the results of voltage, current and temperature. This product will also guide any user who needs to monitor their solar panel. Having the required knowledge and experience will help the employer produce a successful and well-functioning solar panel monitoring system with a clean and simple mobile application and web server.

Contents

List of Figures

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.

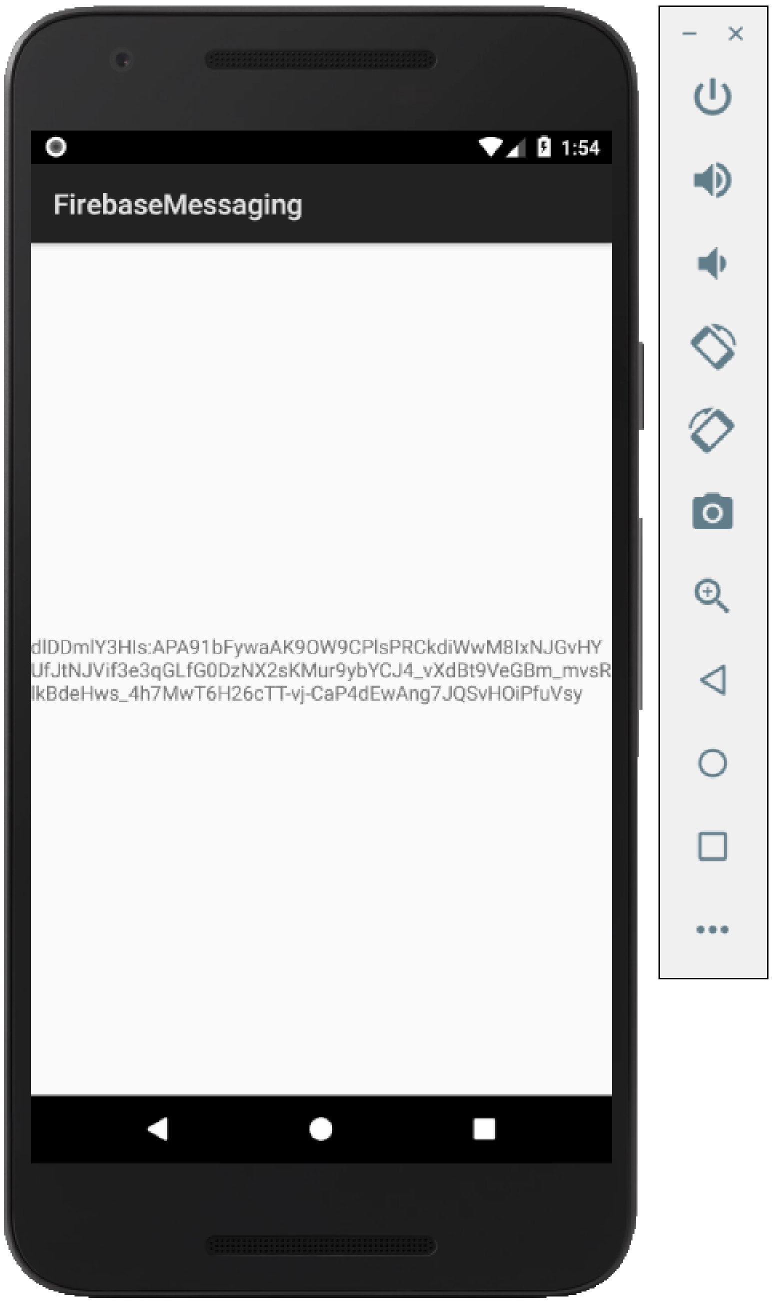

Figure 1. By Android Studio - https://developer.android.com/studio/, CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=74094999

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.

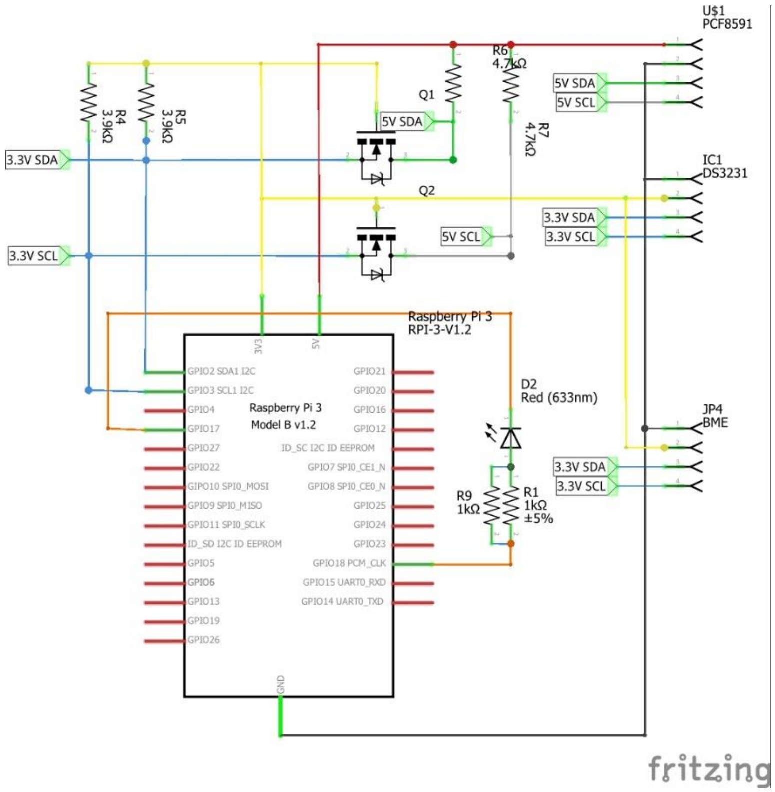

Figure 2. Initial schematic. This work is a derivative of "http://fritzing.org/parts/" by Fritzing, used under CC:BY-SA 3.0.

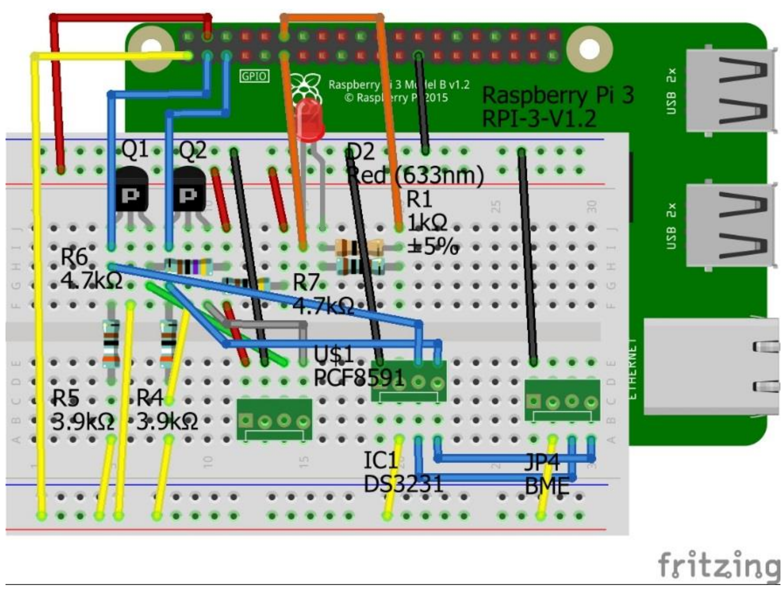

Figure 3. This work is a derivative of "http://fritzing.org/parts/" by Fritzing, used under CC:BY-SA 3.0.

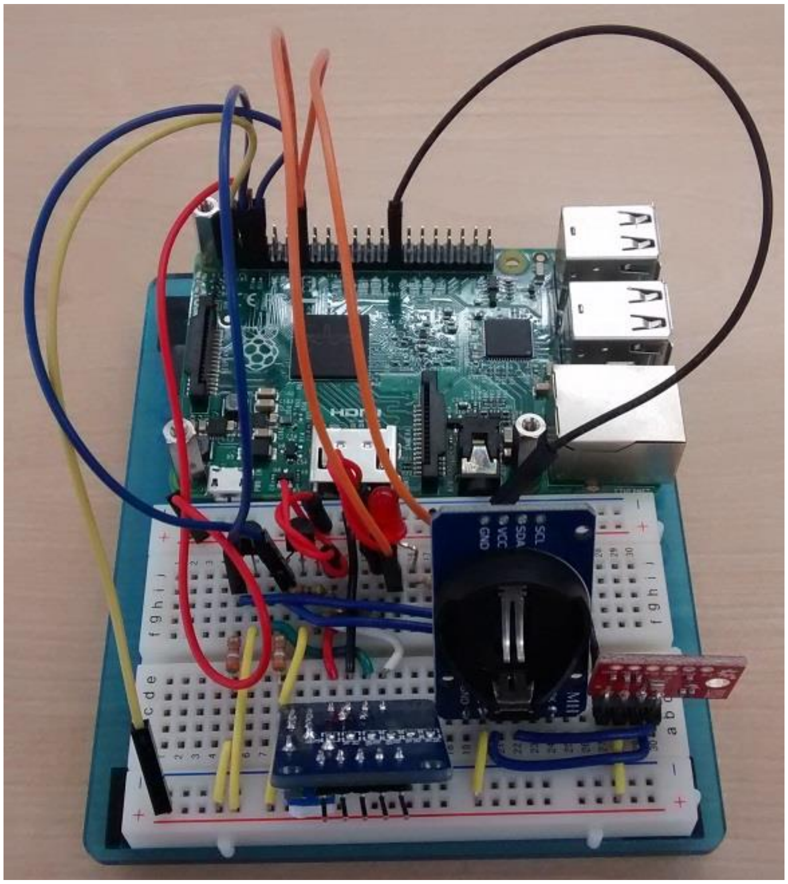

Figure 4. Breadboard prototype.

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?

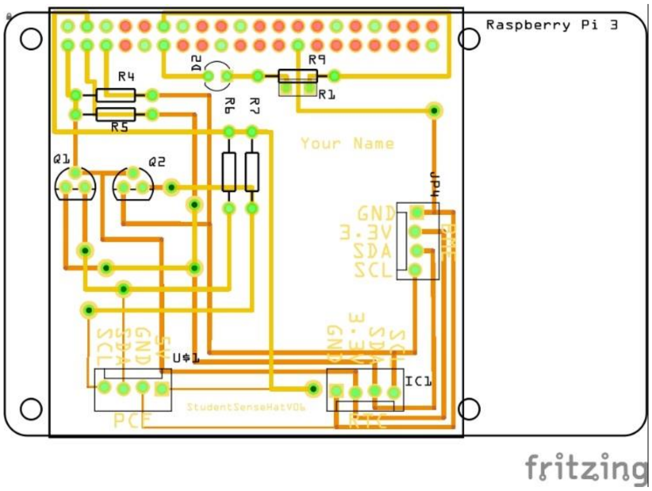

Figure 5. PCB design This work is a derivative of "http://fritzing.org/parts/" by Fritzing, used under CC:BY-SA 3.0.

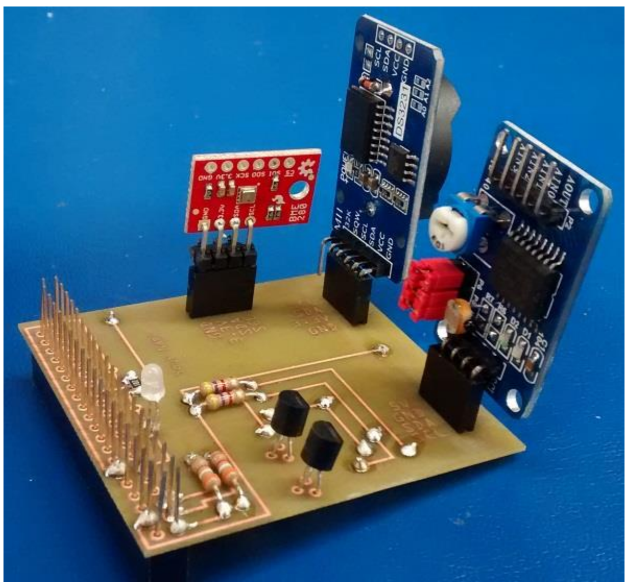

Figure 6. Humber Sense Hat Prototype PCB.

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?

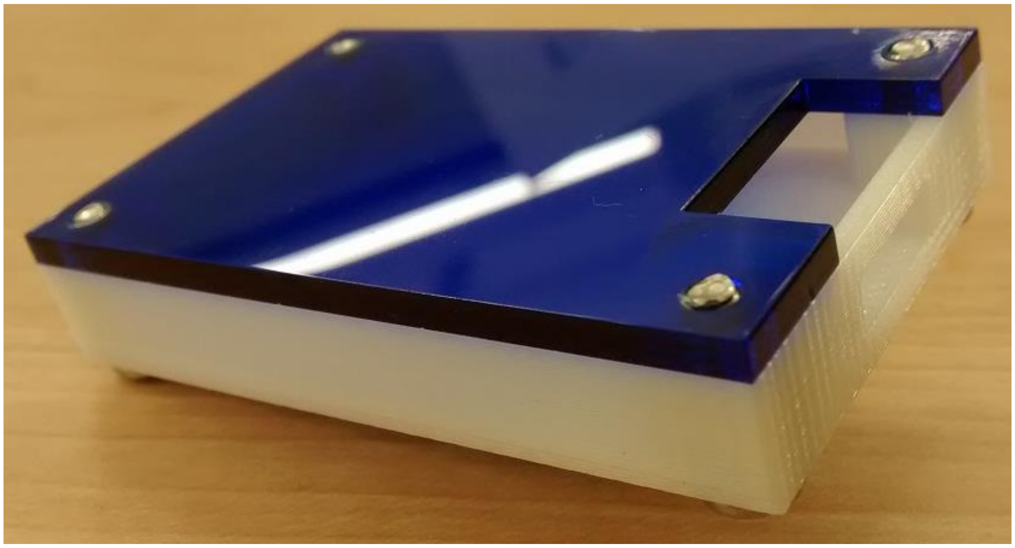

Figure 7. Example enclosure.

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