SmartDen

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Computer Engineering Technology

Tuesday, January 14, 2020

Status

/1 Hardware present?

# **Declaration of Joint Authorship**

We, Boswell Orendain, Hoang Phuc, and Sam Fatuga 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. Boswell Orendain provided Humidity and Temperature Sensor (DHT-11),Ultrasonic Distance Sensor (HC-SR04) and Arduino Uno R3. Hoang Phuc provided Stepper Motor (ULN2003APG) and Arduino Uno R3 microcontroller. Sam Fatuga provided RGB LED (YSL-R596CR3G4B5C-C10) and the Stm32 microcontroller. In the integration effort Hoang Phuc is the lead for further development of our mobile application, Sam Fatuga is the lead for the Hardware, and Boswell Orendain is the lead for connecting the two via the Database.

**Proposal**

We have created a mobile application that interact with the sensors and effectors that the kids at MakerKids(a kids coding boot camp) already is familiar with and is using. This application allows the students to be able to view sensors data in real-time and control the effectors with an android mobile device.We have prototyped a small embedded system with a PCB (Printed Circuit Board) to be controlled by the mobile application. Our IoT capstone project will take place in a model of their classroom and we aspire that this will inspire the kids to keep pursuing their passion for Technology.

The mobile application that we have built is an android application that we named SmartDen and is programmed with Java and is available for download on the Google Play Store.We built this application in Software Project, a semester 5 course where we learned android application programming with Android Studio.We have built a seamless user interaction experience by following the Android Design Guidelines. The data that will be stored comes the following: firstname,lastname,email,password,sensor codes to register their sensor to their account, and sensor data. All of these data are all stored in our database hosted by Hostinger.com, a database hosting service. The users will be able to register an account to the application to be able to log in and is able to register their sensors and effectors via QR-Code.This application is intended to interact with the sensors and effectors of our prototyped small embedded system with a custom PCB board that is enclosed in a custom PCB Case (laser cut) that we have built in the Hardware Production Technology, semester 5 course.

Intended project key component descriptions and part numbers

Development platform:

Sensor/Effector 1: Humidity and Temperature Sensor (DHT-11)

Sensor/Effector 2: Ultrasonic Distance Sensor (HC-SR04)

Sensor/Effector 3: Stepper Motor (ULN2003APG)

Sensor/Effector 4: RGB LED (YSL-R596CR3G4B5C-C10)

Our project description/specifications will be reviewed by, Jennifer Turliuk, 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**

Our Internet of Things (IoT) capstone project consist of a smart phone application (Android) will allow its users to be able to lock door(s), change the color of a light bulb(s),detect when someone is nearby (security purposes),notify when someone has entered a room(s),view the temperature of a room(s). Every sensor will be provided with a corresponding code that they can scan with their phone through the application to be able to register to their accounts.

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# **1.0 Introduction**

SmartDen Application is an Android App to manage and monitor home appliances. It allows user to protect, automate and control their home in real-time anywhere in the world from any current mobile device. The Smart Den application offers solution for:

* Security and safety alerts
* Energy efficiency management
* Home automation
* Children education

You can optimize your home whenever you are with no setbacks, as our app provides simple icons and user-friendly interface. With Smart Den, you can:

* Program the light to change color
* Remotely unlock/lock doors
* Remotely turn lights on/off
* Read Temperature
* Remotely control garage door
* Get notification if someone tries to break in the house

We implement Java, PHP, SQL and Android Studio to build the software. For the hardware side, we use Arduino Uno to control the sensors like Temperature and Humidity Sensor (DHT 11), Ultrasonic Distance Sensor (HC-SR04), Stepper Motor (ULN2003APG), RGB LED (YSL-R596CR3G4B5C-C10), just to name a few. The bridge between the hardware and software is Bluetooth module (for testing unit only).

For this project, we partnered with Maker Kids, a company which offers fun and educational programs on Coding, Robotics and Minecraft for children. So our goal is not only making a practical and functional application but it also has to be educative and entertaining.

## **1.1 Scope and Requirements**

Our Internet of Things (IoT) capstone project uses a distributed computing model of an android application, database accessible by making json object requests to a web server that communicates to a database server interchangeably, reads a hardware module’s serial output as well as being able to control it *via* Bluetooth and is documented via an OACETT certification acceptable technical report.First time users that uses our application *Smartden* will first need to register an account through the application in able to access the functionalities of our application. Once a user had made an account, they can now register the sensors via *QR-Code* to their accountthat comes with the sensor(s)/effector(s) that they have bought. Users can identify through our application where these modules are placed in their household to identify where they are located. Our application’s functionalities we plan to accomplish based on the hardware modules are listed as the following:

Temperature and Humidity Sensor (DHT 11)

* Display temperature and humidity reading of the module’s location in the application in real time.
* Notify user with a meaningful message of the day based on the current temperature, for instance, when a room is cold,give a message saying, “It’s cold in your room, make sure to be bundled up If you already are not ”.

Ultrasonic Distance Sensor (HC-SR04)

* Notify user when someone is getting close to an area for example: “Someone is getting near your front door”, “Someone entered the room”, “There is an unusual movement in your backyard”.

Stepper Motor (ULN2003APG)

* User would be able to lock a door with our application.

RGB LED (YSL-R596CR3G4B5C-C10)

* User would be able to change an led color with our application.

In terms of limitations, here is a list of our project’s limits:

* The connection between the android smartphone and the microcontroller is shorter due to our microcontroller using bluetooth technology.
* Our project is currently only available to smartphone devices that are running android os. Our application *SmartDen* is only available and downloadable in the Google Play Store, an android application market place distributing only applications that run on android os. In terms of android OS, our application was coded and developed in API version 23, which means that android devices below this OS version (2.13 aka *Marshmallow*) will not be able to download our application.

In terms of what will not be done, here is a list of what our project will not do:

* Make a visual representation of a house or room.
* User transfers the registered sensor/effector to another account.

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# Report

# /1 Hardware present?

# /1 Introduction (500 words)

# /1 Scope and Requirements

# /1 Background (500 words)

# /1 References

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# **2.0 Background**

We would like to thank mentor Jenifer Turliuk from MakerKids for supporting this project. The company introduces kids, aged 5-13, to STEM topics in the fields of: programming, robotics and Minecraft. The object of the company is to introduce these kids to Information technology so that they are familiar and can adapt to a growing field. The importance of introducing children technology has been discussed at length by Shelley Pasnik who explains: “Children, especially young children, need caring and knowledgeable adults to help them navigate and learn about the world, and this includes the world of technology.”(Pasnik, 2016). Pasnik’s article deals with the importance of STEM and best steps to take in introducing it to young children. Makerkids, although not mentioned in the article, is an example of the recommended ways that children should be introduced to technology.

Our task was to create a project that implements sensors that the kids are familiar with in order to further their technology education. The idea is to have the kid’s hack into the project and manipulate and interact with it as they seem fit. This is to help teach them that in addition to being fun, technology can help solve problems or simplify tasks. In her article titled, “Prioritizing STEM and coding won’t fill one of the biggest gaps in education”**,** Tara Chklovski discusses the need to expand the technology topics kids are introduced to. Chklovski explains,” Real-world problem-solving is critical because it rewards kids’ desire for meaning”(Chklovski, 2019), our smarthome solves the problem of making everyday tasks at home even easier. Our project aims to show these children that technology can go further than writing lines of code, it is going to show them that technology can also be used to make life a little easier.

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# **6.0 References**

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