JnJ’s Clockwork

Software and Hardware Specification Sheet

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Declaration of Joint Authorship

We, Juan Rodriguez, Jordan Pulido, and Johnson Dinh, confirm that this work submitted for the project is the joint work of ourselves, and does not infringe upon anyone's copyright nor violate any proprietary rights. Any uses made with other authors' ideas, equations, figures, techniques, or any other material from the work of other people included in the project are in accordance with the standard referencing practices. Furthermore, to the extent that we have included copyrighted material that surpasses the bounds of fair dealing within the meaning of the Canadian Copyright Act. Johnson Dinh has handled the database connection along with the app integration for the hardware, Juan Sebastian Rodriguez created the foundation of the app, along with its features and functionality. Juan also designed the overall structure of the hardwares appearance. Jordan Dave Pulido was responsible for the assembly and functionality of the hardware.

Proposal

January 17th 2019

Proposal for the development of JnJ's Clockwork

Prepared by Johnson Dinh, Juan Rodriguez, Jordan Pulido
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https://github.com/JuanRodriguez19/JnJ-s-Clockwork

Executive Summary

As a student in the Computer Engineering Technology program, I will be integrating the knowledge and skills I have learned from our program into this Internet of Things themed capstone project. This proposal requests the approval to build the hardware portion that will connect to a database as well as to a mobile device application. The internet connected hardware will include a custom PCB with the following sensors and actuators: HTU21D-F Humidity/Temp Sensor (0x40), DRV2605 Haptic Motor Driver (0x5A), Display Screen. The database will store: Username, Password, Timestamp, Temperature Reading, Alarms Saved By Users. The mobile device functionality will include: Alarm Clock, Time Zones, Timers, Stopwatch, Temperature readings, User Information, Customization Features and will be further detailed in the mobile application proposal. I will be collaborating with the following company/department: Humber Prototype Lab. In the winter semester I plan to form a group with the following students, who are also building similar hardware this term and working on the mobile application with me. These are the following group members: Juan Rodriguez, Johnson Dinh, Jordan Pulido. The hardware will be completed in CENG 317 Hardware Production Techniques independently and the application will be completed in CENG 319 Software Project. These will be integrated together in the subsequent term in CENG 355 Computer Systems Project as a member of a 2 or 3 student group.

Background

The problem solved by this project is: As a youth, it becomes increasingly difficult to manage and maintain a proper sleeping schedule. The snooze button is used to give the user 5 more minutes to relax and properly wake up, however this is oftenly abused and the user ends up repeatedly hitting the snooze button, which often leads to time wasting. A bit of background about this topic is: This project will consist of an alarm clock application which will link up to a physical hardware element via bluetooth. The hardware being developed would contain a display where the current time, alarm settings, and local temperature readings would appear. The app is where the user would be able to customize and select what they want to appear on the display. Each sensor in the hardware portion of the project serve their own purpose in conjunction with one another. The Humidity/Temp sensor would give the current readings of the temperature and store them in the database, the Haptic sensor will vibrate the device with an alarm goes off as a time of notification. The display screen will be responsible for displaying the core information requested by the user.

Existing products on the market include Google Home. I have searched for prior art via Humber's IEEE subscription selecting Institute of Electrical and Electronics Engineers and have found and read A DIY approach to pervasive computing for the Internet of Things: a smart alarm clock which provides insight into similar efforts.

In the Computer Engineering Technology program we have learned about the following topics from the respective relevant courses:

- Java Docs from CENG 212 Programming Techniques In Java,
- Construction of circuits from CENG 215 Digital And Interfacing Systems,
- Rapid application development and Gantt charts from CENG 216 Intro to Software Engineering,
- Micro computing from CENG 252 Embedded Systems,
- SQL from CENG 254 Database With Java,
- Web access of databases from CENG 256 Internet Scripting; and,
- Wireless protocols such as 802.11 from TECH152 Telecom Networks.

This knowledge and skill set will enable me to build the subsystems and integrate them together as my capstone project.

Methodology

This proposal is assigned in the first week of class and is due at the beginning of class in the second week of the fall semester. My coursework will focus on the first two of the 3 phases of this project:

Phase 1 Hardware build.
Phase 2 System integration.
Phase 3 Demonstration to future employers.

Phase 1 Hardware build

The hardware build will be completed in the fall term. It will fit within the CENG Project maximum dimensions of 12 13/16" x 6" x 2 7/8" (32.5cm x 15.25cm x 7.25cm) which represents the space below the tray in the parts kit. The highest AC voltage that will be used is 16Vrms from a wall adaptor from which +/- 15V or as high as 45 VDC can be obtained. Maximum power consumption will be 20 Watts.

Phase 2 System integration

The system integration will be completed in the fall term.

Phase 3 Demonstration to future employers

This project will showcase the knowledge and skills that I have learned to potential employers.

The brief description below provides rough effort and non-labour estimates respectively for each phase. A Gantt chart will be added by week 3 to provide more project schedule details and a more complete budget will be added by week 4. It is important to start tasks as soon as possible to be able to meet deadlines.

Display screen for hardware element required. Materials for creation of the device. Casing for sensors and Raspberry Pi. Additional connectors to link up sensors to one another.

Concluding remarks

This proposal presents a plan for providing an IoT solution. The hardware device is a convenient option for those that want to maintain a solid time schedule all while being able to view current temperature readings of the area around them without having to open up external applications. This is an opportunity to integrate the knowledge and skills developed in our program to create a collaborative IoT capstone project demonstrating my ability to learn how to support projects such as the initiative described by [3]. I request approval of this project.

References

[1]Google Home. (2016). Retrieved from https://store.google.com/ca/product/google_home

[2]Institute of Electrical and Electronics Engineers. (2015, August 28). IEEE Xplore Digital Library [Online]. Available: https://ieeexplore.ieee.org/search/advsearch.jsp

[3]Scott, G. and Chin, J. (2013). A DIY approach to pervasive computing for the Internet of Things: A smart alarm clock - IEEE Conference Publication. [online] Ieeexplore.ieee.org. Available at: https://ieeexplore.ieee.org/document/6659445 [Accessed 15 Jan. 2019].

Abstract

The purpose of this project is to create a device which alarms the user more effectively for those wanting to be notified on time with ease. It will consist of an alarm clock application which will link up to a physical hardware element via bluetooth. This technical report will give a thorough analysis of the development process regarding every aspect of the project, ranging from app structure to hardware assembly. Explanations revolving around certain ideals and decisions will be given to provide readers insight on why certain features are present along with their purpose.

Test cases will be examined during development to acknowledge mistakes that were made along the road along with the solutions for said mistakes. Any hardships and difficulties will also be documented for prevention purposes in the future of similar circumstances. Hardware explanation and breakdowns can be located in the Requirement Specification portion of the report.

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Illustrations

Introduction

JnJ's Clockwork is an android based alarm mobile application where users are able to set and customize alarms of their choice for daily use. The user will be able to create multiple alarm profiles along with being able to set timers and stopwatches. When connected to its corresponding hardware component, the app furthers its capabilities by allowing users the ability to read local temperatures via the sensor included. The project is designed to give users ease of access to anything time related in a simple and clean formfactor.

Students can benefit greatly from this product for those that struggle waking up at certain times of day and require an external source for assistance such as the app. It can also be used to set reminders for certain time periods such as deadlines for assignments etc. The temperature readings are an added bonus as it readily displays the current temperature in real time without having the need to open other respective applications for similar purposes.

In order for the app to function as intended, it is linked up with a database known as Firebase. This allows user information such as their own personal accounts, alarm templates and temperature values to be stored in a cloud which is ultimately located in Firebase. A Unique approach we are taking for this project would be the exclusion of a snooze button on the hardware itself which must be manually turned off in the app when alarms are triggered. This would make it harder for users to simply ignore the alarm they set up initially with a simple button press and motivate them to wake up.

Project Description

Requirement Specifications

Hardware

The hardware portion of this project will be a joint effort between each member of the group as there are many responsibilities in order for everything to function as intended. In terms of the hardware design and enclosure, it will be handled by Juan. The functionality of each sensor will be tested and operational mainly from Jordan with help from Johnson when required. Connections between sensors and the Raspberry Pi will be accomplished by Johnson. The Integration of components may require additional help from every member due to problems that may occur during development.

The project utilizes many hardware components such as the Raspberry Pi 3B+, HTU21D-F Humidity/Temp Sensor (0x40), and a Display screen. These sensors will be inclosed using 3D printed materials with a maximum dimension size of: 12 13/16” x 6” x 2 7/8 ”. The Humidity and Haptic sensor are ready for integration with one another as they were already completed last semester. The new inclusion for the project is the Display Screen as it is crucial to display the time and temperature from the application. The android smartphone’s role will act as the device’s remote as it can communicate with the clockwork through bluetooth. A 8GB micro SD card will be used as storage as it can store the installation of the Raspbian OS, and reading and writing values from the Clockwork. The PCB (printed circuit board) acts as the structure and support of the system for sensor connections.

Software

The android application will be developed and maintained by Juan and Johnson. Add ons and additional functionality will be incorporated with the help from Jordan. The app is mostly complete in its current state. The only things that are left to work on is bluetooth functionality and debugging. The app needs to respond to the hardware in order to display desired information from the application.

The project utilizes a smartphone capable of running Android API 21 or higher. An up to date version of Android Studio was used to build the mobile application. A Raspberry Pi 3 was implemented with connection between the hardware and application. Updating the Raspbian OS to its newest version was used throughout the project. The mobile application will be used to work alongside the hardware components. Firebase real-time readings is going to be used for communication such as storing user and temperature readings.

Database

The database will be designed, created and upheld by Juan and Johnson. The database connection is established and connected to the mobile application. Reading and writing from the sensor to the database are also required. The database utilizes user-authentication to allow maximum security and protection for the users information. In order to read and write temperature, the user must be registered using a username and password through authentication processing. Offline mode allows access to the app, without the need to register and login. Offline mode skips user-authentication, and moves the user to the actual app. In offline mode, there will be no form of communications to the database. Therefore the user is unable to read/write temperature to the database.

Background

Problem

Solution

Conclusion

Recommendations

Bibliography