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Proposal for the development of Roomi

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<https://github.com/roomi-develop/roomi>

Executive Summary

As students in the Computer Engineering Technology program, we will be integrating the knowledge and skills we 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: 2.4" Serial: UART/I2C/SPI 400x240 TFT with Touchscreen Module DS400240CTFT-61T, Mini Push-Pull Solenoid 5V, PN532 NFC/RFID reader . The database will store room settings and access levels of registered individuals as well as the administration's accounts that will be used to configure room settings. The mobile device functionality will allow administration to modify user and room access and display settings in a user-friendly environment. The application will be further detailed in the mobile application proposal. We will be collaborating with the following company/departments: Humber College Department of Public Safety and Humber College School of Applied Technology. In the winter semester we 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. The group members for the fall term will include: Marko Javorac, Denald Demirxhiu, and Jacob Ladan. 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 3 student group.

Background

Today, many rooms being electronically secured lack the flexibility of information display and mobile user management. The problem herein lies with the decrease in usability, and the sole focus of Roomi is to remedy this. Through the tying together of an LCD screen and existing RFID technology, users will be able to view additional important information about secured rooms, as well as allow administration to update this information easily and without the need for support from IT. The 2.4" Digole LCD Display will be used to display relevant information unique to every room. The PN532 NFC/RFID reader will allow individuals access to configured rooms, based on a predefined access level setup through the android application. The mini push-pull solenoid will be used to demonstrate how the locking mechanism will function. The mobile application will allow the administration to modify user and room access and display settings in a user-friendly environment. The hardware and application will work in unison with a cloud service hosted on Google's Firebase platform to store room's relevant information.

Existing products on the market include: METech Keyless Electronic RFID Door Lock MID300 Right Hand and Schlage NED Wireless RFID Card Lock [1]. We have searched for prior art via Humber's IEEE subscription selecting "My Subscribed Content" [2] and have found and read [3] 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-labor 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. A brief description of the planned purchases includes: 2.4" Digole LCD with Touchscreen Capabilities, Raspberry Pi 3B+, PN532 NFC/RFID Reader, and a Mini Push-Pull Solenoid 5V.

Concluding remarks

Our solution will implement an LCD touch screen at room entrances to display schedules, and information about current occupants. It will also utilize NFC/RFID readers to allow access to secured rooms through the use of keycards implementing NFC/RFID chips. 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] Schlage NDE Wireless RFID Card Lock (n.d.). Retrieved from <https://www.gokeyless.com/product/schlage-nde/Keyless Electronic RFID Door Lock MID300 Right Hand> (n.d.). Retrieved from https://www.metechs.com/store/index.php?main_page=product_info&cPath=11&products_id=90
- [2] Institute of Electrical and Electronics Engineers. (2015, August 28). IEEE Xplore Digital Library [Online]. Available: <https://ieeexplore.ieee.org/search/advsearch.jsp>
- [3] B. A. Alabdulsalam, F. A. Alsalman, Z. H. Alshakhs, H. F. Ahmad and A. Mughal, "Dynamic Video Wall Tile Creation Using Raspberry Pi3," 2017 IEEE 13th International Symposium on Autonomous Decentralized System (ISADS), Bangkok, 2017, pp. 268-271.
- K. Michael, "Novel NFC Applications to Enrich Our Connections: The NFC Forum Innovation Awards.," in IEEE Consumer Electronics Magazine, vol. 6, no. 3, pp. 118-121, July 2017. Retrieved from <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=7940251&isnumber=7931239>