Figure 1:

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Proposal for the development of Wireless Mesh Network

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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 develop a mesh network using Digimesh protocol and a DMX transmitter and receiver. The hardware will include an XBee 900hp RF module connected with XBee Grove development board for communicating with a computer and use XCTU software to send and receive packets. I will also be working on developing a DMX transmitter and receiver using Feather 32u4 radio and Arduino UNO to generate DMX signal. I will be collaborating with Humber College Prototype Lab. In this winter semester I will be working with Kristian Medri and Vlad Porcila from the Prototype Lab.

Background

The problems solved by these projects are creating a simple mesh network using Digimesh protocol to extend the connectivity range using three different RF modules where one module will relay data between the other two RF modules. In addition to this the other project will be solving a problem which includes transmitting and receiving a DMX signal over 512 channels.

In modern communication system monitoring devices wirelessly over long distances is a challenge. Often in order to do so we require different type of network topology, mesh is one of them. Creating a mesh connection requires connected devices to be able to relay information from node to node. Doing so with a 900 MHz RF module can allow long range communication among multiple devices.

DMX signal is often used to control stage lighting and effects. Normally DMX signals are transmitted over cable connection, but to be able to do so wirelessly in a reliable way adds much more flexibility to the system.

I have searched for prior art via Humber's IEEE subscription selecting "My Subscribed Content" ("IEEE Xplore Digital Library [Advertisement]" 2012) and have found and read (Lee and Lin 2016) 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
- 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 is to 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 winter term.

Phase 3 Demonstration to future employers

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

The tables below provide 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.

Labour Estimates	**Hrs**	**Notes**
Phase 1		
Writing proposal.	4	Tech identification quiz.
Creating project schedule. Initial project team meeting.	3	Proposal due.
Creating budget. Status Meeting.	4	Project Schedule due.
Acquiring components and writing progress report.	7	Budget due.
Mechanical assembly and writing progress report. Status Meeting.	9	Progress Report due (components acquired milestone).
PCB fabrication.	9	Progress Report due (Mechanical Assembly milestone).
Interface wiring, Placard design, Status Meeting.	9	PCB Due (power up milestone).
Preparing for demonstration.	4	Placard due.
Writing progress report and demonstrating project.	6	Progress Report due (Demonstrations at Open House Saturday, November 12th, 2016 from 10 a.m. - 2 p.m.).
Editing build video.	5	Peer grading of demonstrations due.
Incorporation of feedback from demonstration and writing progress report. Status Meeting.	5	30 second build video due.
Practice presentations	3	Progress Report due.
1st round of Presentations, Collaborators present.	4	Presentation PowerPoint file due.
2nd round of Presentations	4	Build instructions up due.
Project videos, Status Meeting.	4	30 second script due.
Phase 1 Total	**80**	
Phase 2		
Meet with collaborators	4	Status Meeting
Initial integration.	4	Progress Report
Meet with collaborators	4	Status Meeting
Testing.	6	Progress Report
Meet with collaborators	4	Status Meeting
Meet with collaborators	4	Status Meeting
Incorporation of feedback.	6	Progress Report
Meet with collaborators	4	Status Meeting
Testing.	8	Progress Report
Meet with collaborators	4	Status Meeting

Prepare for demonstration.	4	Progress Report
Complete presentation.	4	Demonstration at Open House Saturday, April 8th, 2017 10 a.m. to 2 p.m.
Complete final report. 1st round of Presentations.	4	Presentation PowerPoint file due.
Write video script. 2nd round of Presentations, delivery of project.	5	Final written report including final budget and record of expenditures, covering both this semester and the previous semester.
Project videos.	5	Video script due
Phase 2 Total	**70**	
Phase 3		
Interviews	TBD	
Phase 3 Total	**TBD**	
Material Estimates	**Cost**	**Notes**
Phase 1		
RF module with development board x 3	>$143.55	Covered by Humber Prototype Lab.
RF modules with microprocessor (Feather rfm69hcw)	>$30.00	Covered by Humber Prototype Lab.
Phase 1 Total	**>$173.5.00**	
Phase 2		
Materials to improve functionality, fit, and finish of project.		
Phase 2 Total	**TBD**	
Phase 3		
Off campus colocation	<$100.00	
Shipping	*TBD*	
Tax	*TBD*	
Duty	*TBD*	
Phase 3 Total	**TBD**	

Concluding remarks

This proposal presents a plan for providing an IoT solution for developing a mesh network of 900Mhz RF modules and DMX signal transmission wirelessly. 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 (Lee and Lin 2016). I request approval of this project.

References

"IEEE Xplore Digital Library [Advertisement]." 2012. *IEEE Sensors Journal* 12 (3): 717–17. doi:10.1109/JSEN.2012.2190653.

Lee, H. C., and H. H. Lin. 2016. "Design and Evaluation of an Open-Source Wireless Mesh Networking Module for Environmental Monitoring." *IEEE Sensors Journal* 16 (7): 2162–71. doi:10.1109/JSEN.2015.2507596.