**ActiveHouse**

Project website <https://irwintr.github.io>

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**Proposal**

The ActiveHouse Project would be a complete home monitoring system consisting of multiple Arduino based sensor hubs in each room of your home wirelessly connecting to a Raspberry Pi based base station which sends the data to the server where it can be read by the app. Each sensor hub would be capable of reading temperature, humidity, luminosity, carbon monoxide and other gas levels, water consumption, power consumption, and it would have the ability to toggle the built-in light. The power and water consumption sensors are detachable as they would not necessarily be used in each room, thus creating a more modular design. The app would allow users to view the current settings in each room and over the complete house, toggle the lighting, and set a lighting schedule.

**Executive Summary**

As a Computer Engineering student, I’ll be using all of the skills I have learned in the last 2 years in this program to complete this 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 sensor hub hardware will include a custom PCB with sensors and XBee wireless adapters and an Arduino inside a custom printed box. The Base station hardware will include an XBee wireless adapter connected to a Raspberry Pi. The database will store the sensor data from each room. The mobile device functionality will allow users to view the current settings in each room and over the complete house, toggle the lighting, and set a lighting schedule. I may end up collaborating with the greater Active House team later in the semester but I will not be working with any companies. 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.

**Background**

The problem solved by this project is that it provides a home monitoring solution so that users homes can be controlled and monitored remotely through an intuitive app. It will help people monitor their resource consumption as well which may help drive down consumption.

There are several other home monitoring solutions on the market now, but they are usually integrated into either the thermostat or home security system. This is one of the first projects I’ve seen where water and power consumption are also monitored on a residential scale.

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

* Electronic Devices and Circuits – Soldering experience
* Database with Java – Setting up database
* Electronic Circuits – Voltage Divider calculations
* Technical Workplace Writing – Creating write-ups and technical drawings
* Software Engineering – Creating project schedules

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 winter term.

*Phase 3 Demonstration to future employers*

This project will showcase the knowledge and skills that we 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. | 9 | Tech identification quiz. |
| Creating project schedule. Initial project team meeting. | 9 | Proposal due. |
| Creating budget. Status Meeting. | 9 | Project Schedule due. |
| Acquiring components and writing progress report. | 9 | 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. | 9 | Placard due. |
| Writing progress report and demonstrating project. | 9 | Progress Report due (Demonstrations at Open House Saturday, November 7, 2015 from 10 a.m. - 2 p.m.). |
| Editing build video. | 9 | Peer grading of demonstrations due. |
| Incorporation of feedback from demonstration and writing progress report. Status Meeting. | 9 | 30 second build video due. |
| Practice presentations | 9 | Progress Report due. |
| 1st round of Presentations, Collaborators present. | 9 | Presentation PowerPoint file due. |
| 2nd round of Presentations | 9 | Build instructions up due. |
| Project videos, Status Meeting. | 9 | 30 second script due. |
| **Phase 1 Total** | **135** |  |
| **Phase 2** |  |  |
| Meet with collaborators | 9 | Status Meeting |
| Initial integration. | 9 | Progress Report |
| Meet with collaborators | 9 | Status Meeting |
| Testing. | 9 | Progress Report |
| Meet with collaborators | 9 | Status Meeting |
| Meet with collaborators | 9 | Status Meeting |
| Incorporation of feedback. | 9 | Progress Report |
| Meet with collaborators | 9 | Status Meeting |
| Testing. | 9 | Progress Report |
| Meet with collaborators | 9 | Status Meeting |
| Prepare for demonstration. | 9 | Progress Report |
| Complete presentation. | 9 | Demonstration at Open House Saturday, April 9, 2016 10 a.m. to 2 p.m. |
| Complete final report. 1st round of Presentations. | 9 | Presentation PowerPoint file due. |
| Write video script. 2nd round of Presentations, delivery of project. | 9 | Final written report including final budget and record of expenditures, covering both this semester and the previous semester. |
| Project videos. | 9 | Video script due |
| **Phase 2 Total** | **135** |  |
| **Phase 3** |  |  |
| Interviews | TBD |  |
| **Phase 3 Total** | **TBD** |  |

|  |  |  |
| --- | --- | --- |
| **Material Estimates** | **Cost** | **Supplier** |
| **Phase 1** |  |  |
| Cannakit Raspberry Pi v3 | $99.99 | Amazon.ca |
| Arduino Uno SMD Rev3 | $31.08 | Digi-key |
| Xbee S1 Trace Antenna (x2) | $53.68 | Digi-key |
| Xbee Shield for Arduino | $22.77 | Digi-key |
| 3.5mm audio jack | $2.09 | Canada Robotix |
| Non-Invasive Current Sensor | $13.19 | Canada Robotix |
| Adafruit Gas Sensor | $21.12 | Digi-key |
| Adafruit Light Sensor | $8.40 | Digi-key |
| Water Flow Sensor | $11.89 | Canada Robotix |
| 3 Pin Molex header | $0.39 | Canada Robotix |
| 12mm Buzzer | $1.99 | Canada Robotix |
| Adafruit Temperature and Humidity Sensor | $19.70 | Digi-key |
| *Shipping* | *$6.95* |  |
| *Tax* | *$37.22* |  |
| **Phase 1 Total** | **$330.46** |  |
| **Phase 2** |  |  |
| Materials to improve functionality, fit, and finish of project. | N/A |  |
| **Phase 2 Total** | **TBD** |  |
| **Phase 3** |  |  |
| **Phase 3 Total** | **TBD** |  |

**Concluding remarks**

This proposal presents a plan for providing an IoT solution for a home monitoring system. This is an opportunity to integrate the knowledge and skills developed in the Computer Engineering program to create a collaborative IoT capstone project demonstrating my ability to learn how to support projects. I request approval of this project.