Group 18
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September 22nd, 2015

EEL 4914 Senior Design Project:
S.H.A.P.E.R
(Smart Home Automated Power Expense Regulator)

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S.H.A.P.E.R is an innovative, smart and efficient way to interact with your house by controlling the lighting and the AC with automated light and occupancy sensors. It will also learn about the user energy consumption habbits and work with the user to improve them. Senior Design Group 18 consist of Juan Aleman – BSEE, Maria Alfonso – BSCpE, Gregory Pierre – BSCpE, and Francine Vassell –BSCpE. S.H.A.P.E.R will be marketed towards homeowners who are looking to live their lives in a smarter way and want to apply this concept into their houses. The sponsor that we consider is Soartech due to the interaction the user can have with the system.

We live in a technology-driven era with smart phones, smart cars, smart TVs and even smart washing machines where technology works for us and makes our lives easier. As engineers we strive to make things more efficient, which creates the motivation for us to implement processes in people's houses that are automated and more productive by saving energy. This project was chosen because not only it motivates us but also it is something users would love to have due to the good feedback received by smart-components consumers.

To begin, the automated system is innovative because it will turn on or off the bulbs in the house and achieve a preferred preset AC temperature based on the fact that someone is inside the room or not using an occupancy sensor. Then, it is smart since using a dimmable sensor the system will be able to identify if it there is light present or not in the room. In case there is light present the intensity of the bulb will adapt to a minimum preset percentage, if it is dark it will change to a maximum preset percentage. In case the user leaves the room, the AC goes back to its original temperature and the lights will turn off making this product efficient as well.

Our system will monitor the wattage per hour used for each appliance and communicate that information back to the user's device. We will be monitoring the usage of cooling/heating system, water heater, lighting system, clothes dryer, refrigerator/freezers, stove and more. Using machine learning, we will be able to predict and analyze the user's activity. This will better inform the user of what steps can be taken to lower energy consumption.

In addition, the user can choose to interact with the system directly via a smartphone/tablet application directly or through voice commands to control the lighting and the AC system in the house. There are home automation systems in the market that are similar to S.H.A.P.E.R such as Homeseer, Control4 and Creston which allow the consumer to control the lighting and the AC via an app or a computer using the internet; however, they are not voice activated. Moreover, there are systems that are currently under production such as DKC Automation which allows the user to control the lights and the TV but it doesn't have AC support which brings a great opportunity for S.H.A.P.E.R to combine all of these characteristics together to bring new features.

It is important for a good engineer to recognize any constraints he, or she, may run into when designing their project. Some of the things we feel may be a constraint are location; voice

recognition software; power supply; MCU's programmable tasks; WiFi capability and security; MCU's speed and memory space. However, our main constraints are money and time.

Some of the Specifications we want to have are MCU of 512 MB RAM, 1.2 GHz Dual-Core or better. We plan on using components with energy savings of 50% or more. Android device is what we plan to use to interact with the system. We will use a dimmable light bulb (approximately 12 - 18 Watts). Occupancy Sensors (infrared sensors preferably) with capability of at most 300 square foot room will also be used. A Wi-Fi (802.11 standard) connection will be used for device communication when needed.

Below are block diagrams showing our vision in more detail.

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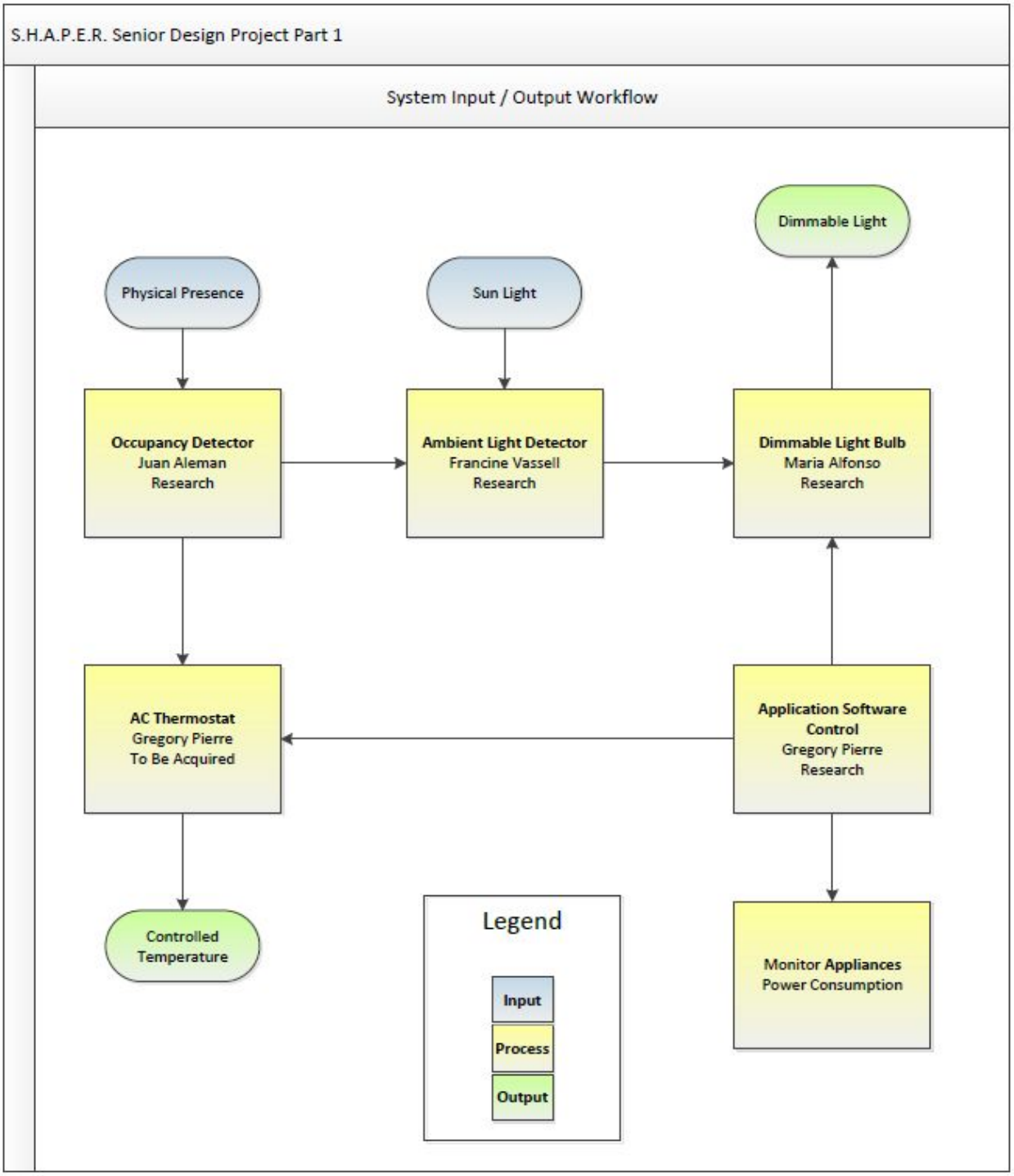

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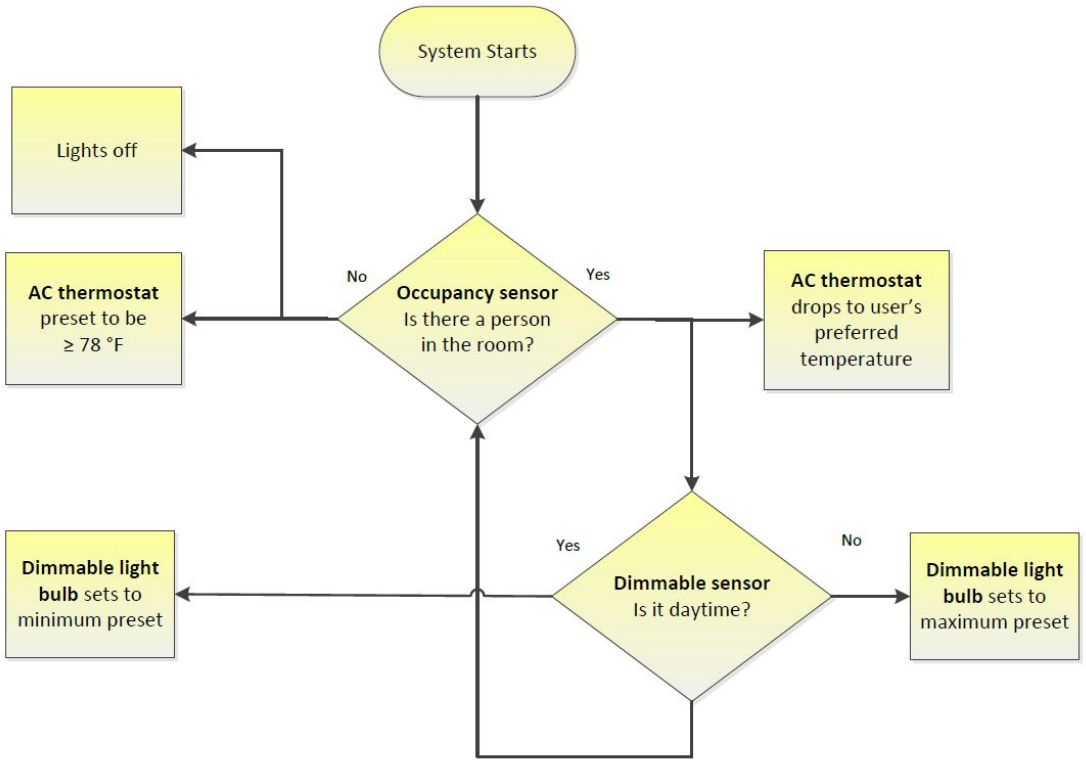
S.H.A.P.E.R. Senior Design Project Part 2

Occupancy & Dimmable Sensor Process



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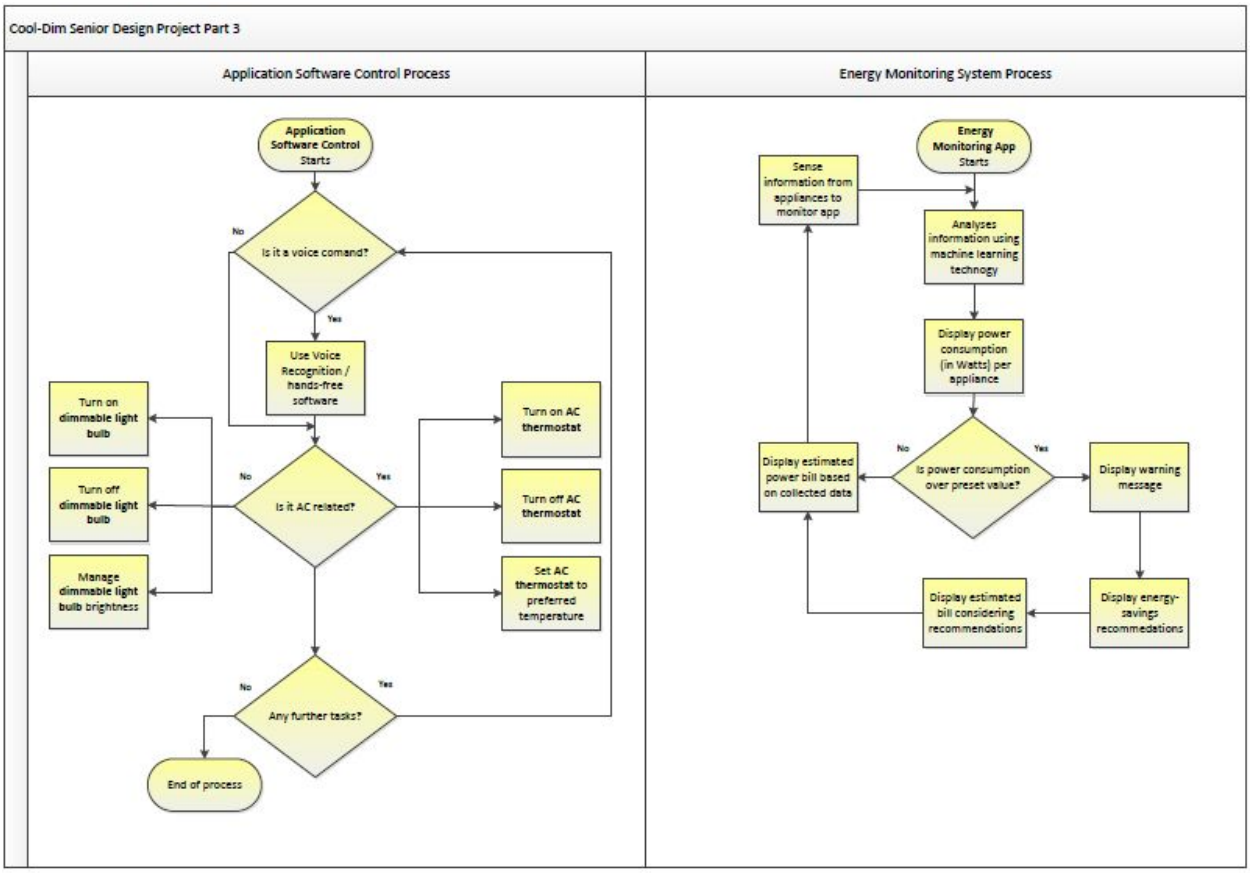

The Budget is a significant part for us to consider while researching and designing our project. Our budget will help guide us in the initial direction we plan to take our research and design. Our budget is based on the broad research on the project topics that we narrowed down into specific topics. We plan to set aside the amount of $ 560.00 to acquire the material needed to complete our project.

Our financing plan will explain how we will go about paying for the project we plan implement at the end of senior design. Our team plans to actively search for sponsorship to pay support us in the project we plan to design. If the sponsorship we acquire does not meet the full cost of the project, the remaining cost of the project will be divided among the four members of the group equally.

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Our group has decided upon an initial set of project milestone for both semesters.

Deliverable	Customer	Due Date/ Milestone	Technical Requirements	Steps to Complete
1) Broad research on project topics	Team	4 weeks by September 21st		1. Define the project description, objectives and goals. 2. Meet via Skype or in Person every week. 3. Sign Contract for accountability. 4. Discuss the specifications of the project. 5. Each team member will express his or her weakness and strength. 6. Personal Values 7. Create Agenda for Next Meeting.
2) Research on specific topics	Each team member	4 weeks by October 19th		1. Each team member will research in depth a specific component for the project according to Block Diagram. 2. Meet via Skype or in Person every week. 3. Discuss findings of the research. 4. Discuss project components: -compatibility -budget 5. Learn how to solder. 6. Create Agenda for Next Meeting.

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3) Final research and design preparations	Team	4 weeks by November 16th		1. Create real life sketch using simple materials like cardboard, duct tape, etc. 2. Create functioning application prototype. 3. Schematic diagrams and method data structures. 4. Meet via Skype or in Person every week. 5. Create Agenda for Next Meeting.
4) Finalize design and get ready for prototyping	Team	3 weeks by December 7th		1. Finish Project Final Documentation. 2. Order supplies. 3. Meet via Skype or in Person every week. 4. Create Agenda for Next Meeting.
End of First Semester				
1) Prototyping with extra features	Team	3 weeks by February 1st		1. Implement extra features separately. 2. Meet via Skype or in Person every week. 3. Get extra supplies if needed. 4. Create Agenda for Next Meeting.
2) Prepare for first presentation /Test Prototype	Each Team Member	1 week by February 8th		1. Each team member will work on their part of the project in order to deliver a good presentation. 2. Each team member will start testing his or her part of the project. 3. Create Agenda for Next Meeting.

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3) Build Final Project from Prototype	Team	3 weeks by February 29th		1. Make sure that the basic individual functions of each part of our project are met. 2. Once all of the different sections of the project have been tested, put them together to complete the project as a whole. 3. Create Agenda for Next Meeting.
4) Testing and Presenting the Final Project	Team	8 weeks by April 25th		1. Test that the project runs smoothly. 2. Prepare final presentation of the project. 3. Present the Project to the faculty. 4. Create Agenda for Next Meeting.
End of Second Semester				