SMART LED NETWORK SYSTEM

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Goal

- ❖ Goals
- ➢ Design lighting mechanism to increase energy efficiency in data centers by varying and controlling brightness of LEDs
- ➢ Implement control system driven by written algorithms to facilitate the communication between LEDs and Passive Infrared Sensors (PIR).
- ➢ Create a network of effectively working nodes that will be demonstrated as a prototype for future

Motivations

While the United States electricity use has flattened in recent years, data center electricity use overall and as a portion of U.S. consumption – has nearly tripled since 2000. In the modern era of technological advancement cloud computing has definitely replaced personal computing and with that being said it is vital to manage and bring about increased energy efficiency in data centers. This study primarily focuses on conserving energy in regards to lighting in data centers through a development of a smart lighting mechanism. The mechanism will be designed in a way in which the brightness of particular LEDs will be controlled by the detection of passive infrared sensors (PIR). The presence of human activity in relation to the sensors will thereby determine how bright the particular LED will be lit. Through a wireless communication the remainder of LEDs will simultaneously dim thus conserving energy.

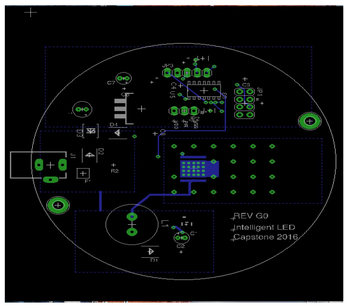
Determining more specific metrics such as the brightness of a particular LED will be developed through certain code that is inputted through a microcontroller that will then communicate with the sensors. Additionally, an LED driver will be necessary to connect with the LEDs to maintain constant current, as without this device, current will vary as will the brightness. This study is a part of a growing body of research on energy smart data centers. With data centers now representing more than 2% of the US electricity consumption, this project will contribute to further research on implementing this new design.

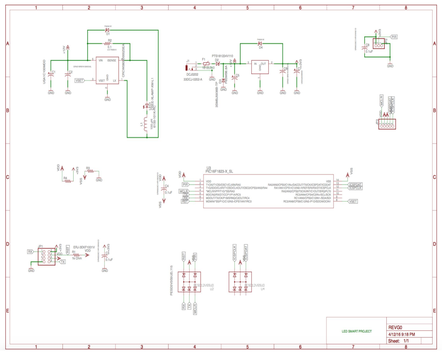
Challenges

- ❖ Controlling the operating temperature of LEDs by lowering the regulation current while sacrificing brightness.
- ❖ Figuring out a way to combat manufacturing defect on PCB
- ❖ Developing specific algorithm for PIC microcontroller to accurately communicate with sensors.

Methodology

- ❖ Step 1
- ➢Hardware Design
- ■ Research Power Electronics DC-DC converter concepts to understand potential system to build
- ■ Utilize EAGLE PCB Design software to formulate high level schematic layout that was later approved by advisor
- ■ Build and Debug PCB

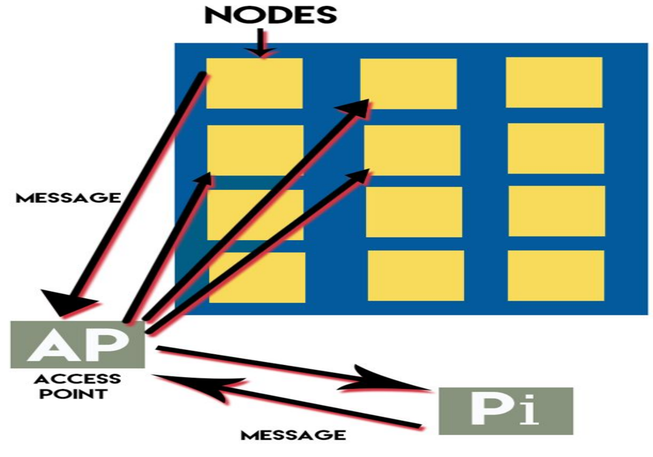




- ❖ Step 2
- ➢ Software Design
- ■ Write algorithm for PIC microcontroller to effectively communicate with sensors
- ■ Implement code that will facilitate a clear communication between the Raspberry Pi and matrix of nodes
- ❖ Step 3
- ➢ Testing
- ■ Ensure fluid communication between hardware components and software algorithms
- ■ Create test scenarios for a variety of circumstances.
- ■ Account for unexpected variable change in system

Results

- ❖ Result 1
- ➢ A matrix of nodes with LEDs that systematically dim and brighten through wireless communication with the Raspberry Pi
- ❖ Result 2
- ➢ Lower Energy Usage = Higher Cost Savings
- ❖ Result 3
- ➢ Reduction in lighting expenses by 40%



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