Design Thinking Approach to Projects matched with Design Sprint

Computer Engineering as a Discipline

Non-Syllabus Material

Divisions of the Process

- Design Thinking

Empathy

- Begin in anothers shoes and seeing it from their point of view
- Finding out who is affected by this issue and how

Define

- Finding out what the real Problem is from the stand point of the person affected by it.
- Finding out what the current solution fails at providing or what it ignores but is important.

Ideate

- Coming up with the simplest solutions to address a specific problem.
- Conceptualizing this solution so that it can be implemented.

Divisions of the Process

Design Sprint Tasks

Empathy

- Select a Topic among the four provided
  - Vote on it if you like

Empathy

- Divide your discussion board to three areas
  - Who gets affected by the issue?
  - Why are they affected?
  - Are they any solutions that exist to address the issue?
    - What are their strengths from a human use point of view?
    - What are their weaknesses from a human use point of view?

Empathy

- Let the members of the group place their answers to this on the board.
- This tasks asks empathy and doesn't judge the perspective nor the person. So any and all ideas about it are welcomed.

Empathy Summarization Tasks

- Come up with a summary of the following items listed:
  1. State the Topic chosen among the four.
  2. Who are the people affected by the issue?
  3. What are the current ways its addressed?
     1. What are the pain points associated with this current way to do it based on peoples perception of doing or using it?

Example

- Topic Street Lamp Lights at night
  - Who are affected:
    - Pedestrians & Cyclists at Night
    - Motorists
    - Local Governments
  - What are the issues:
    - Not Enough Lighting Fixtures (Pedestrian)
    - Too Dim (Motorist)
    - Is on even when its not used or useful at the time (LGU)
    - Costs cash to maintain (LGU)

Example Topic Street Lights

Current Solution	Pros	Cons
Mercury Lamp	Brightness Sufficient (Motorist & Pedestrian) Time Tested (LGU)	Consumes a lot of energy so cost to operate is high(LGU)
Solar Powered Lamps	No Outtage even in electrical black outs (LGU) No electric bill cost (LGU)	Limited Sun Light may cause charging issues (LGU) Battery Replacement cost every two years (LGU) Cost to purchase (LGU) Lighting may be insufficient(Motorist / Pedestrian)
LED Tube Lamps	Brightness sufficient (Pedestrian) Water Proof (LGU) Electric Bill Cost Lower(LGU)	Consumes energy to operate and requires a 220v connection (LGU)
General Lights	Reduces Nightime Crash Makes People Feel Safe	Poles are additional problems to motorists and pedestrians. Some lights are blinding to motorists

Define Stage in Design Thinking

- Purpose:
- Uncovered Issues:
- Proof that the Uncovered Issues are Real.

Design Thinking

- Define
  - Purpose: Street lighting can provide safety benefits at midblock and intersection locations and can also improve safety for pedestrians, particularly at crossing points.
  - Uncovered Issues:
    - Proof that the Uncovered Issues are Real.

Design Thinking

- Define
  - Purpose
  - Uncovered Issues:
    - Cost to maintain and operate
    - Conventional Lighting Doesn't function if it's a brownout period.
    - LED Based Solar Lamps are not that bright compared to conventional mercury ones.

Mercury Lamp Information

- Most Commonly Used: MV80 Lamps
  - 80 Watt Lamp with 2250 Lux of Output
- Operation: 12 Hours / day
- Cost of Electricity: 5.5 Pesos / kWH - https://www.globalpetrolprices.com/Philippines/electricity_prices/
  - Yearly Cost 24,090 PhP / Lamp post

Lamp Information Comparison

- Most Commonly Used: MV80 Lamps
  - 80 Watt Lamp with 2250 Lux of Output
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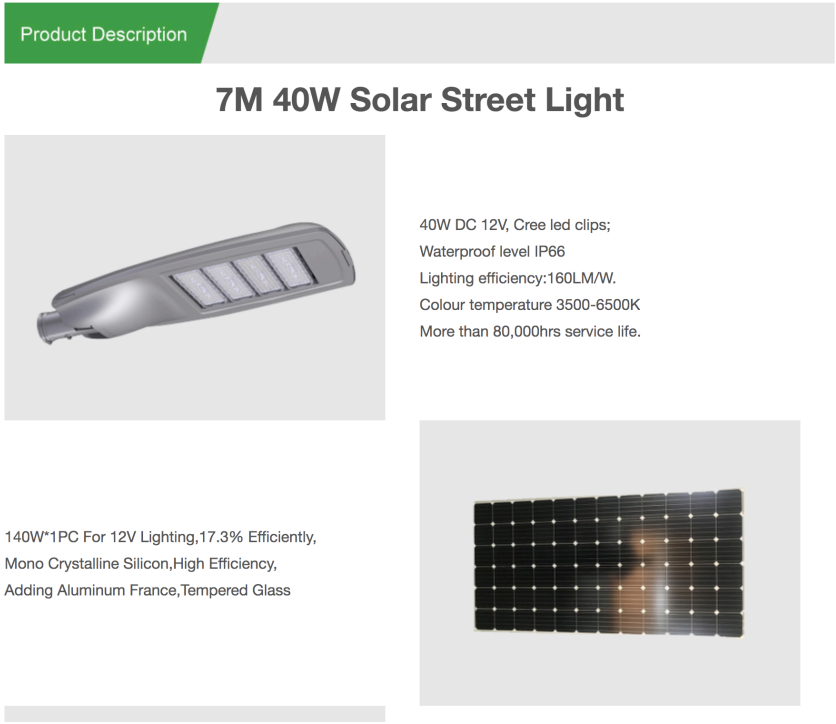
- LED Lamp



- 6400 Lumens
- Yearly Cost:12,045 PhP/yr

Solar Lights LCA Source 1

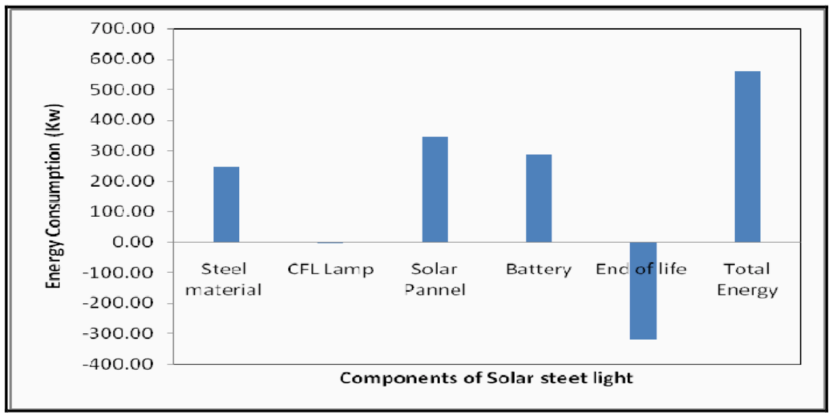


Figure 3 Energy inventory for the solar street light

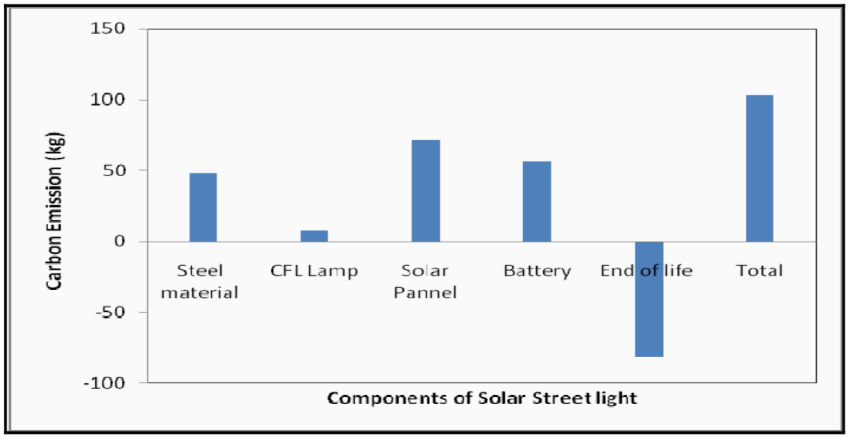


Figure 4 Carbon inventory for solar street light

- Muthu, Mari & Victor, Kirubakaran. (2015). Carbon and energy pay back period for the solar street light using life cycle assessment. International Journal of ChemTech Research. 8. 1125-1130.

Solar Lights Comparative LCA

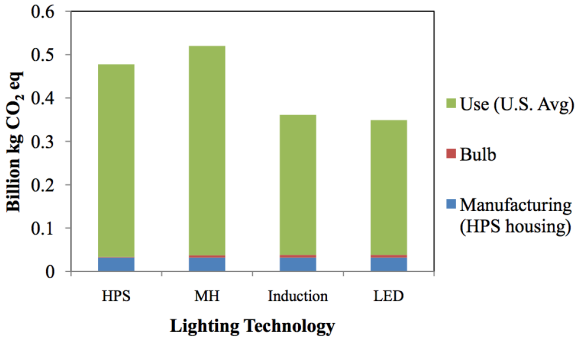


Figure 24. Global Warming 1

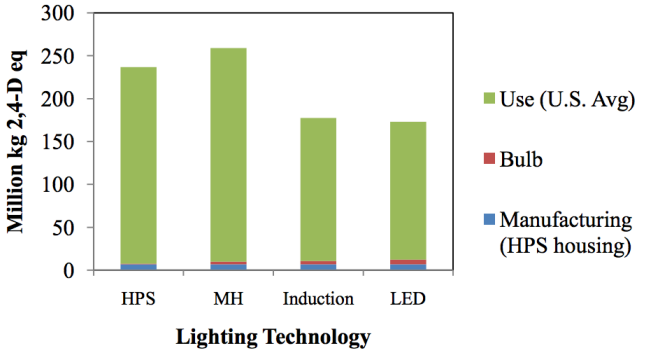


Figure 25 Ecotoxicity Emissions

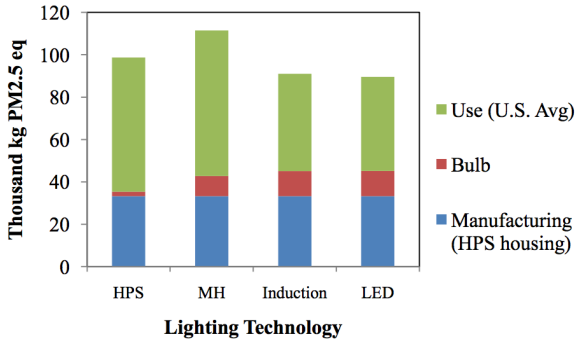


Figure 26: Respiratory Effects Emissions

- https://www.pitt.edu/news2010/Streetlight_Report.pdf

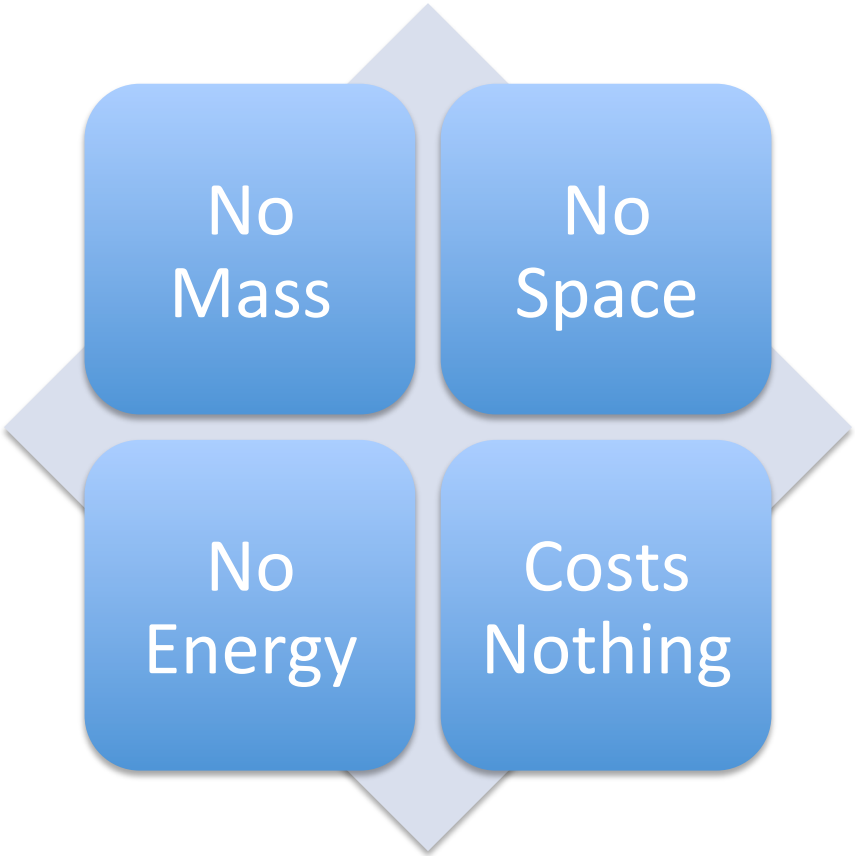
Design Thinking

- Define
  - Purpose
  - Uncovered Issues:
    - Cost to maintain and operate (Valid)
    - Conventional Lighting Doesn't function if it's a brownout period. (Valid)
    - ~~Solar Lamps are not that bright compared to conventional mercury ones.~~
    - Solar Lamps they do have a smaller environmental footprint compared to MV80 Lights Operation Side.

Design Thinking

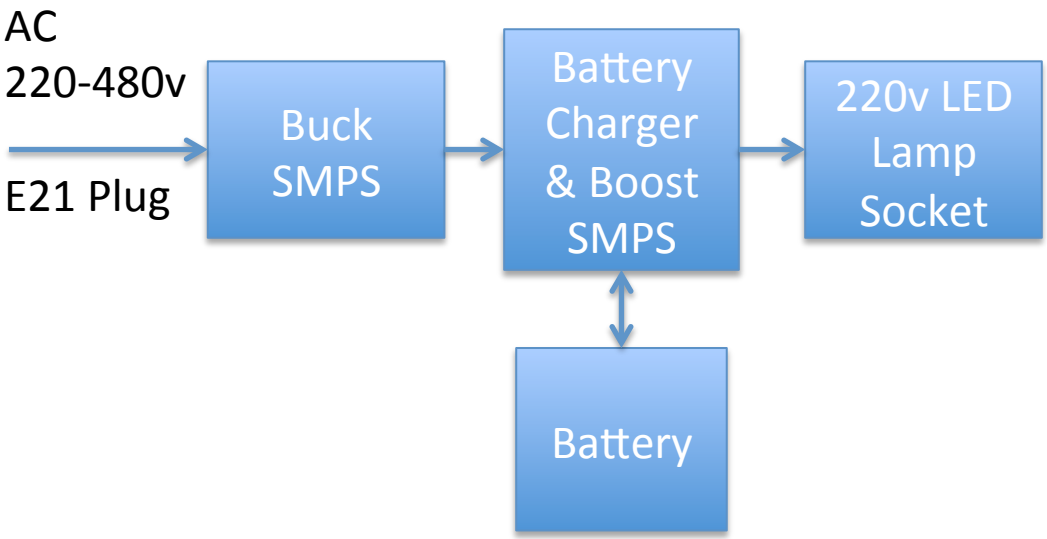
- Human Aspect to LED Lights
  - "Sense of Security" provided by Street Lights.
    - Brighter Lights versus Dim Lights is better ?
  - Maintenance Aspect: Lamp Replacement Rather than Whole Item Replacement. (Easier for Technician and Service Provider, Lower Cost)
  - You have to phone it in for the thing to get service (Post Number and Area to be provided and ticket to be issued)
  - Replacement should be as tough as existing unit. (Service Provider Aspect)
  - Replacement Lamps should be cheaper and easier to source than HPS / MV80 Lamps. (Supply Chain Aspect)

Ideate: Entry 1

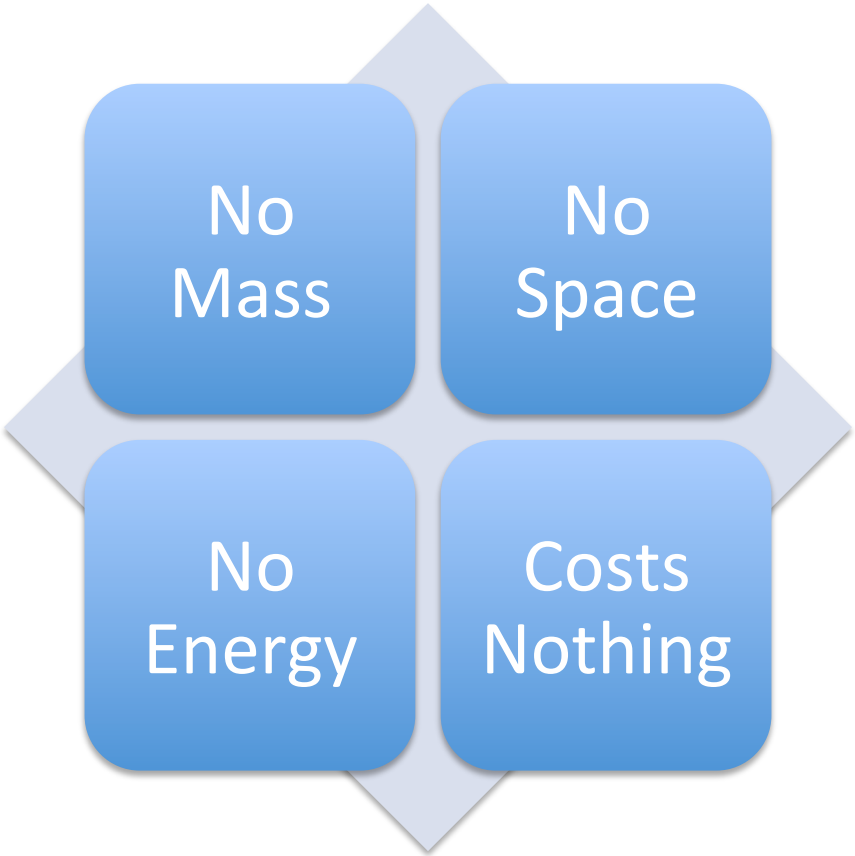


- Lamp Replacement with Battery
  - Occupies Same Space
  - Requires no Conversion Cost
  - Uses Current System
  - Works on the Same Level

Ideate Entry 1: Block Diagram

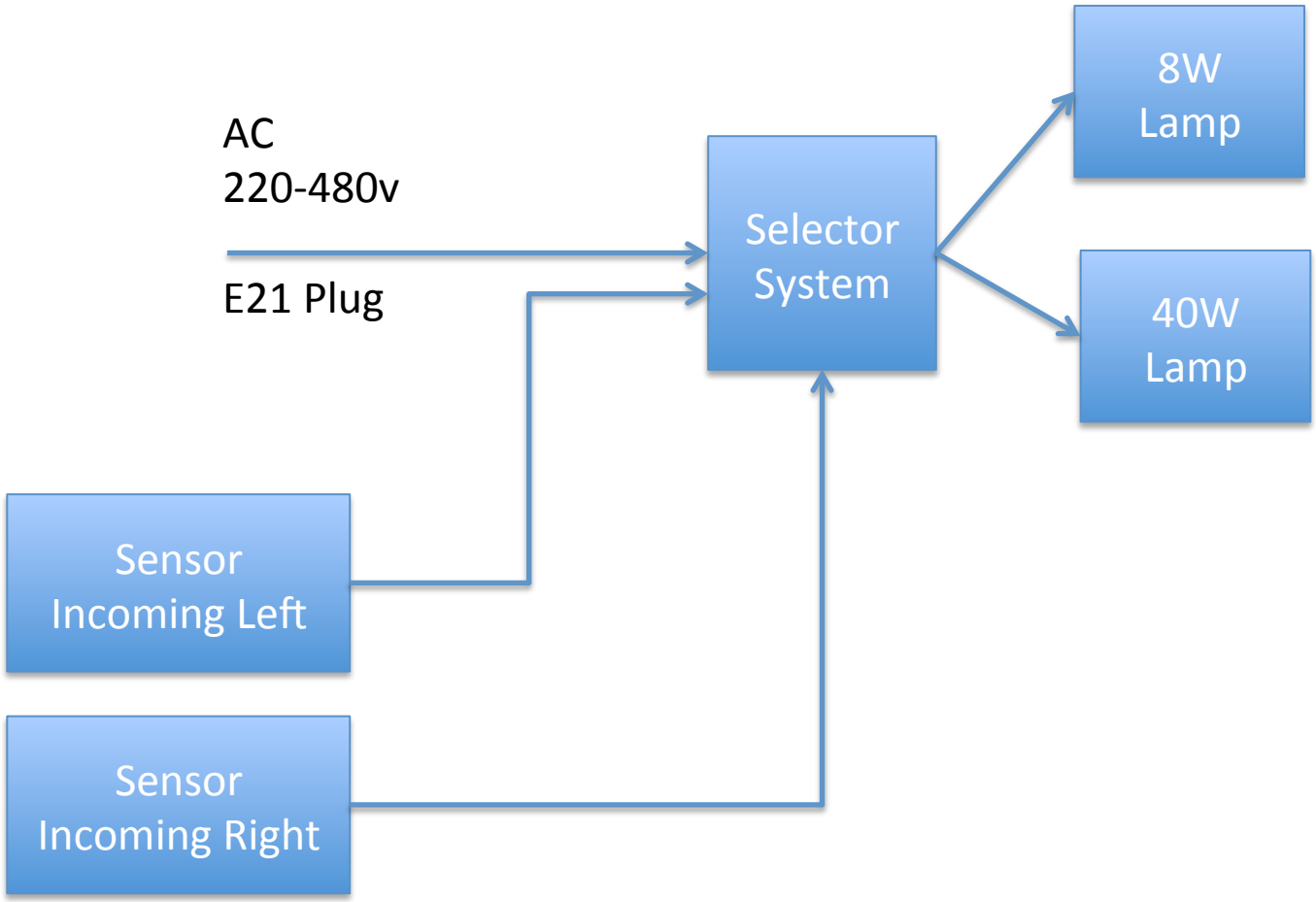


Ideate Entry 2

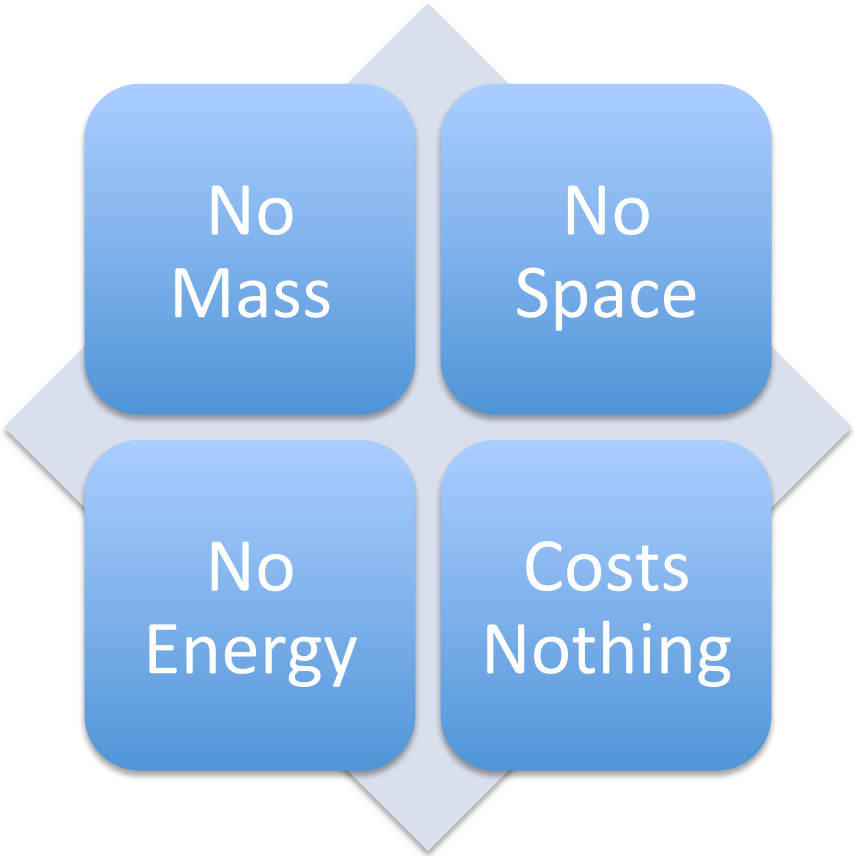


- Dual Lamp with Remote Sensing to Replace MV80 Lamp
  - Occupies Same Space
  - Requires no Conversion Cost
  - Uses Current System
  - Works on the Same Level
  - Detects Vehicle / Person shifts from lower Wattage Lamp to Higher Wattage Lamp for 4 minutes only.

Ideate Entry 2: Block Diagram

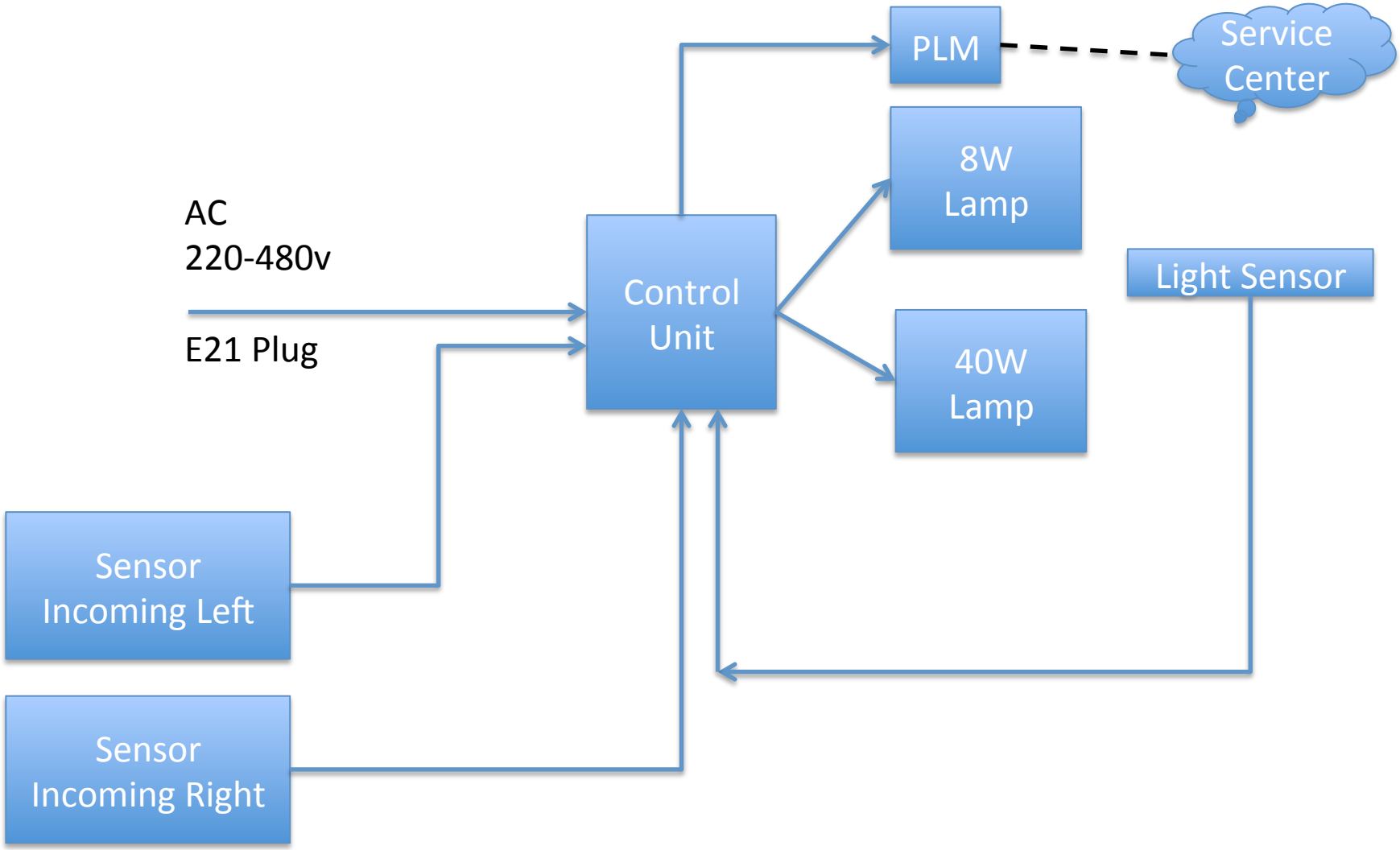


Ideate Entry 3

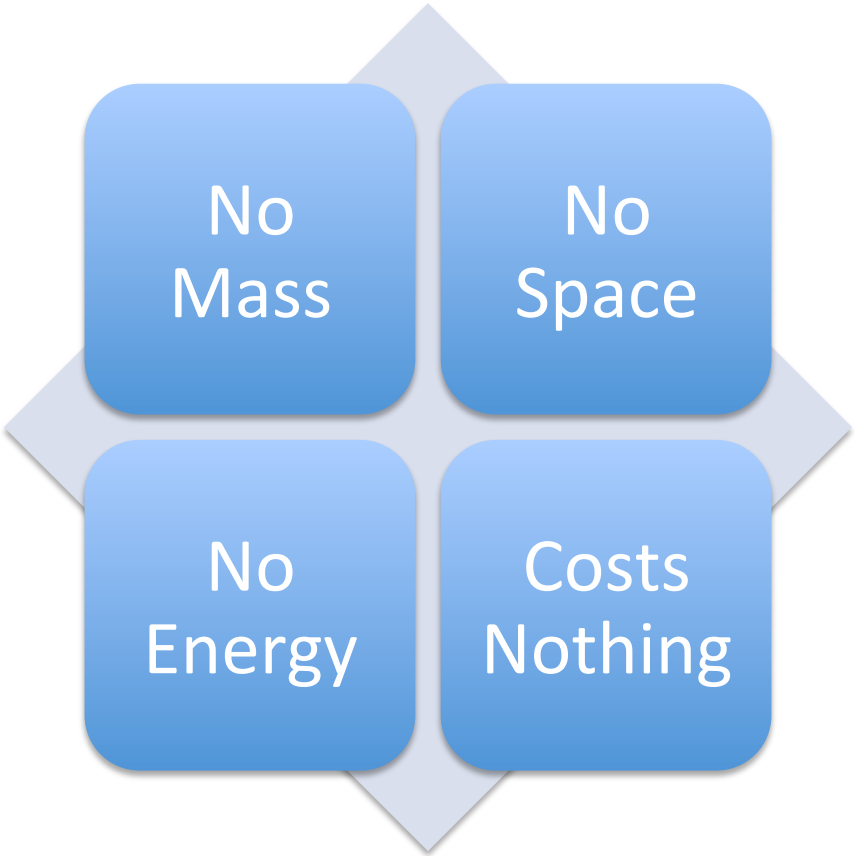


- LED Based Lamp Replacement with Sensing and Reporting.
  - Occupies Same Space
  - Requires no Conversion Cost
  - Uses Current System
  - Works on the Same Level
  - Detects Vehicle / Person shifts from lower Wattage Lamp to Higher Wattage Lamp for 3 minutes only.
  - If system is faulty or lamps don't light up it can be sensed and a signal is sent via Power Line Modem to call Service Crew.

Ideate Entry 3: Block Diagram

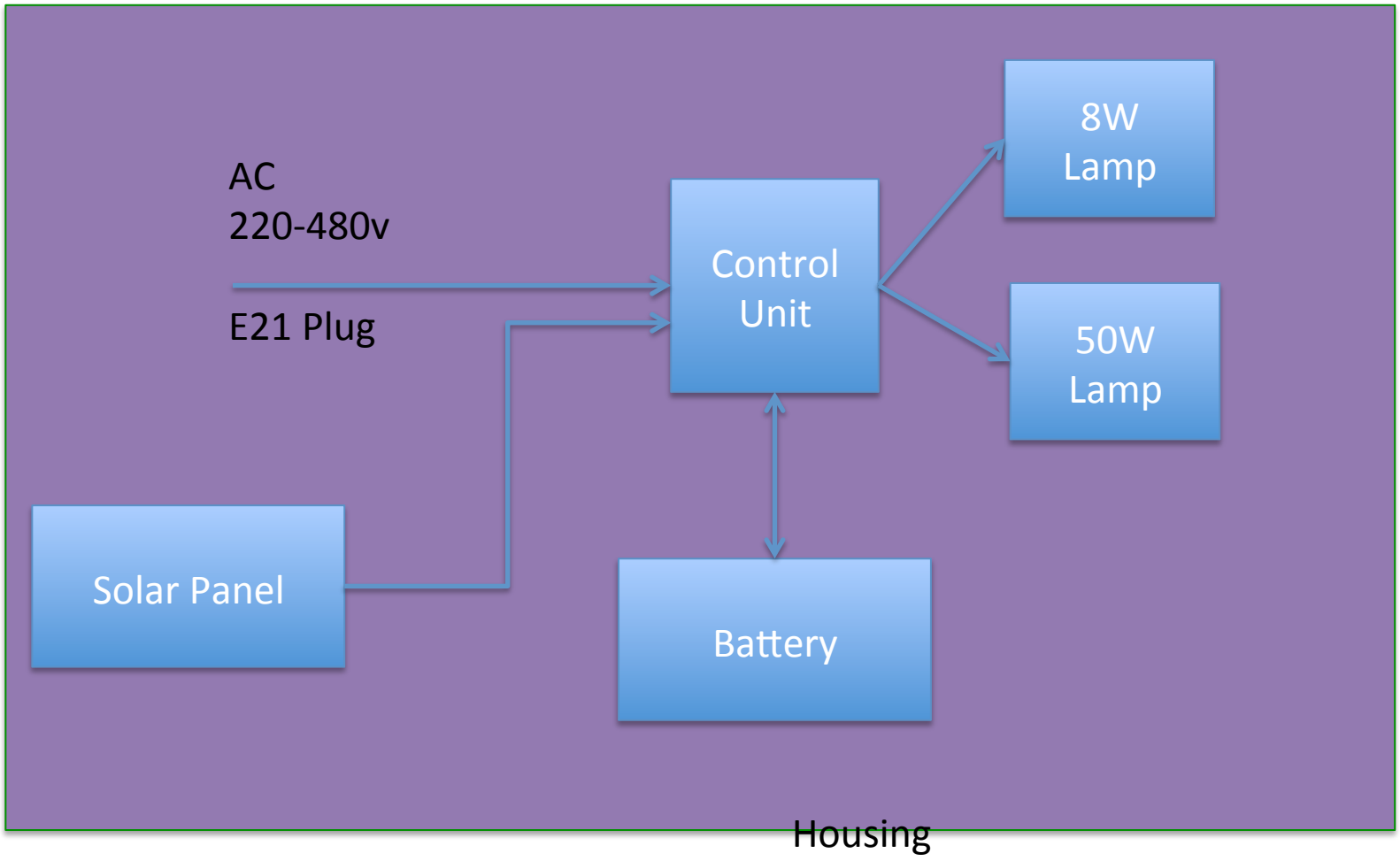


Ideate



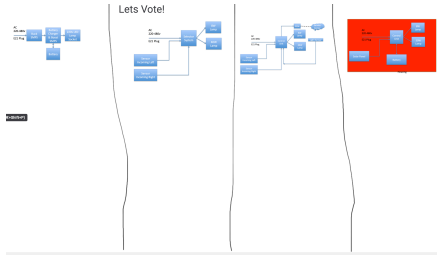
- LED Based Lamp with Solar Charging and Backup power provided by AC Line.
  - Reduced Cost to Operate: Power Consumption
  - Takes Power From AC when Solar System Fails.
  - Uses LED Lights that is custom made.

Ideate Entry 4: Block Diagram

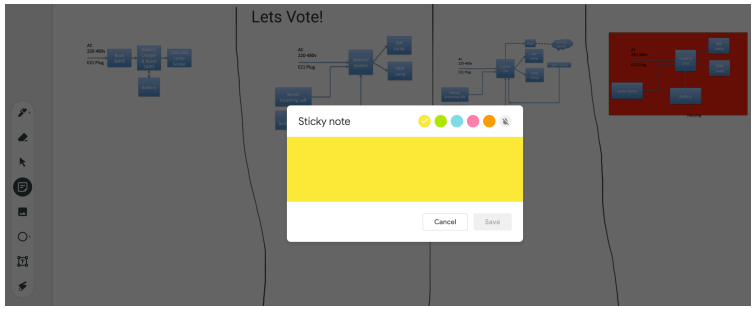


The Vote

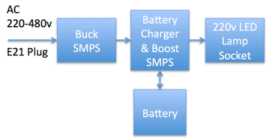
- Using Google Meet we can use the Jamboard to set a vote
  - Place the designs on the Jamboard



  - Use the Sticky Note with your names to cast your vote for a design to do.

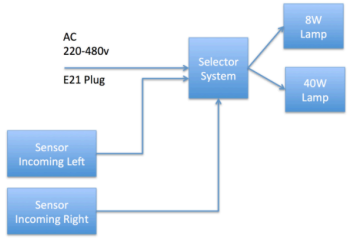


Round 1 Example Vote

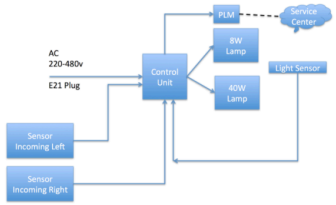


Volts

Lets Vote!

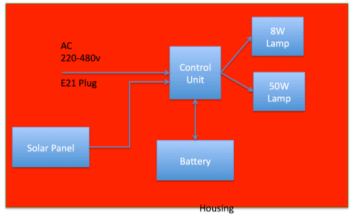


Mike



Aira

Francis

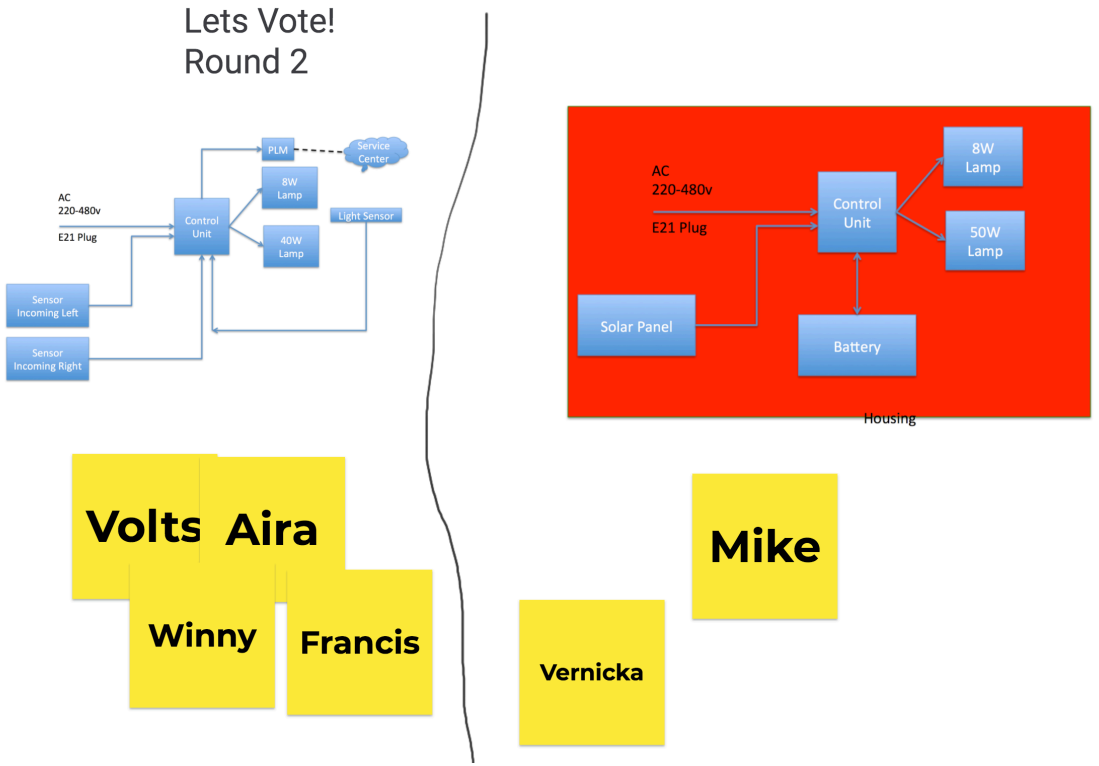


Vernicka

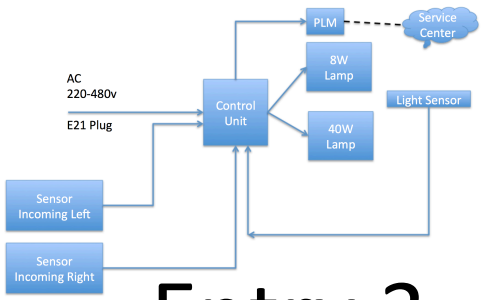
Winny

Round 2 Preparation

- Remove the lowest votes from the board.
  - The two highest votes are again to be voted on



Create & Test



Entry 3

Test

Prototype