

# New Design Concept for Residential Electric Meter Adapter Sdmay20-28

<https://sdmay20-28.sd.ece.iastate.edu/>



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Client: Alliant Energy

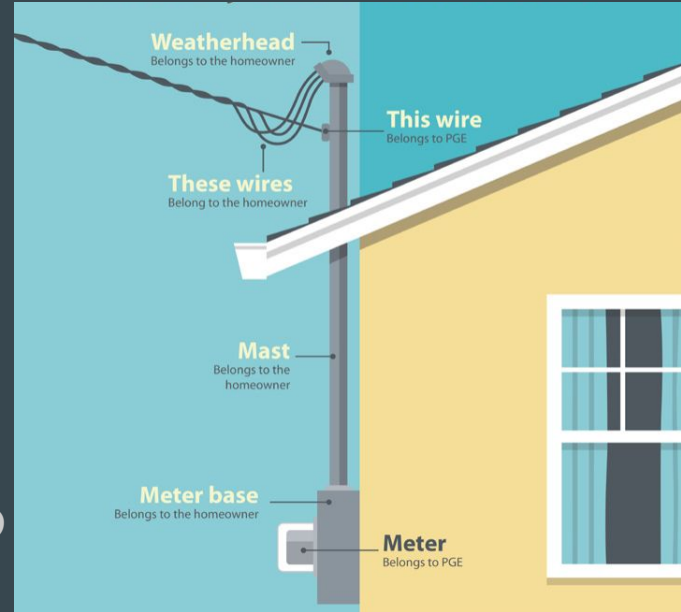
Faculty Advisor: Dr. Zhaoyu Wang

# Project Plan



# Project Overview

- Alliant Energy, an energy provider, is converting from overhead distribution lines to underground.
- We were tasked with designing an adapter for residential electric meter sockets, that converts from existing overhead feeds to a new underground connection.
- The scope of our project was to create a design, 3D model, and prototype by the end of the year.



<https://www.portlandgeneral.com/outages/power-out/pge-certified-electrical-contractors>

# Problem Statement

- Alliant Energy's current solutions to this problem
  - Unsightly
  - Bulky
  - Expensive
- Possible code violations/cause for inspection.
- Contractor involvement

## Meter Base Adapters



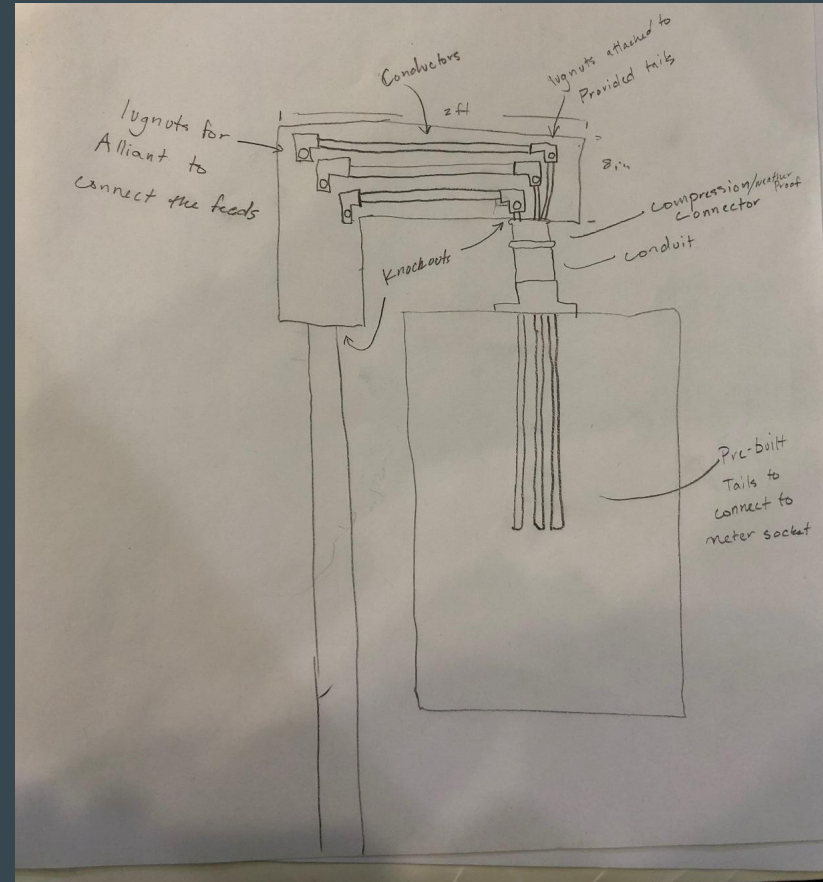
Junction Box



EII Adapter

# Conceptual Sketch

- Will mount onto home and convert older overhead connections to underground feeds
- Prebuilt raceways across the top of our adaptor to connect old meter socket wires to new underground feeds
- Eliminates wire bend issue with the current solution



# Requirements (Technical/Functional)

- Cannot result in a reinspection of the socket
  - This causes entire home to be required to be up to code
  - Will be on the homeowner's responsibility to pay for this
- Must be able to match appropriate current ratings
- Terminal connections must be able to fit 1/0, 4/0, and 350 MCM wire to be universal for Alliant Energy
- Terminal connections must meet minimum distance of 1.5" from edge of enclosure
- Bus bar must be code compliant
- 1.5", 2", and 2.5" knockouts for conduit connectors

# Constraints and Considerations

- Reduce cost
  - Manufacturing
  - Installation
- Aesthetically unobtrusive on house
- Biggest available wire is 350 MCM, so our project is designed to handle the maximum ampacity of a 350 MCM wire
- Enclosure modification
  - Sized to contain all internal components
  - Knockouts to bring in conduit
  - Locking door

# Potential Risks and Mitigation Plan

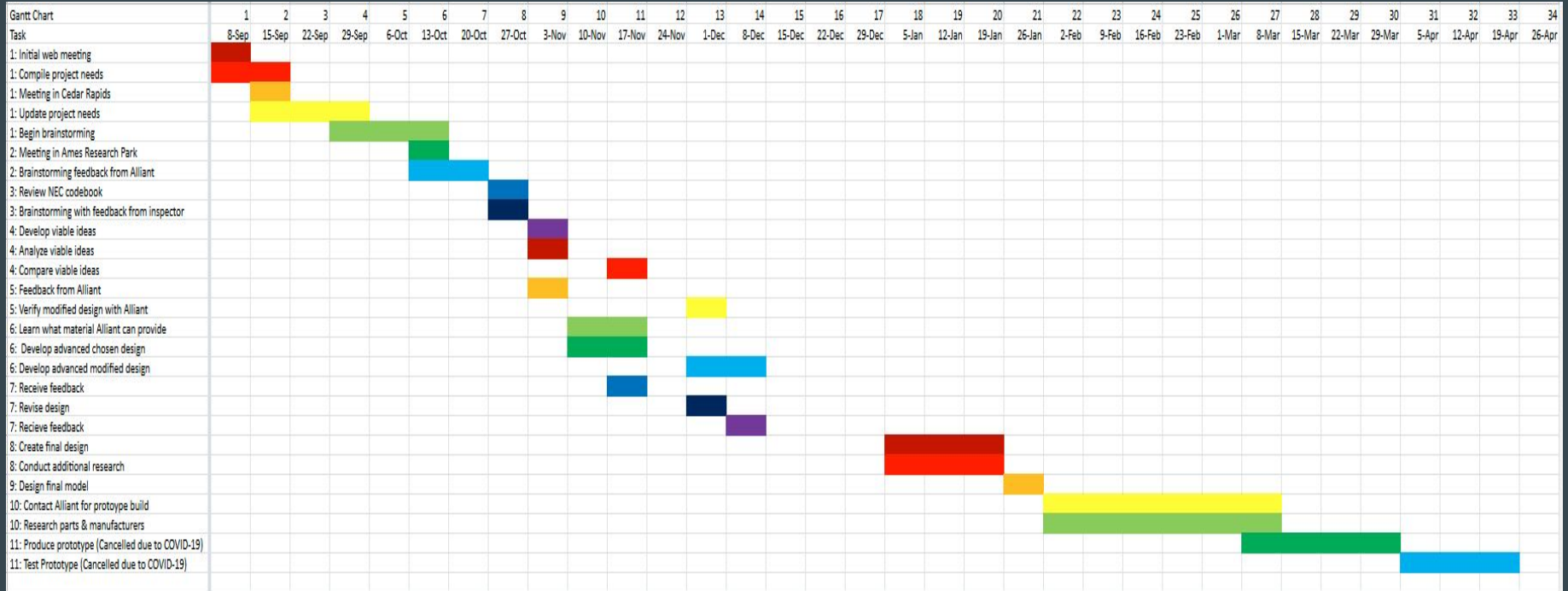
- Frequent feedback from Alliant Energy to fulfill the client's criteria
- Contacted two separate state inspectors on potential code violations and discussed potential solutions
- Had electrical contractors review different designs to foresee future installation issues
- Reviewed model and prototype design with turnkey panel manufacturing company to ensure proper and effective design



# Resource/Cost Estimate

- Initial design concept cost estimated ~\$2,500 per unit
  - \$2,000 for manufacturing parts and labor
  - \$500 for installation
  - Up to \$2,000 extra for code updates
  
- Final design concept cost estimated ~\$1,000 per unit
  - Buying in bulk will bring this price down
  - Labor cost will also be reduced by removing contractor labor

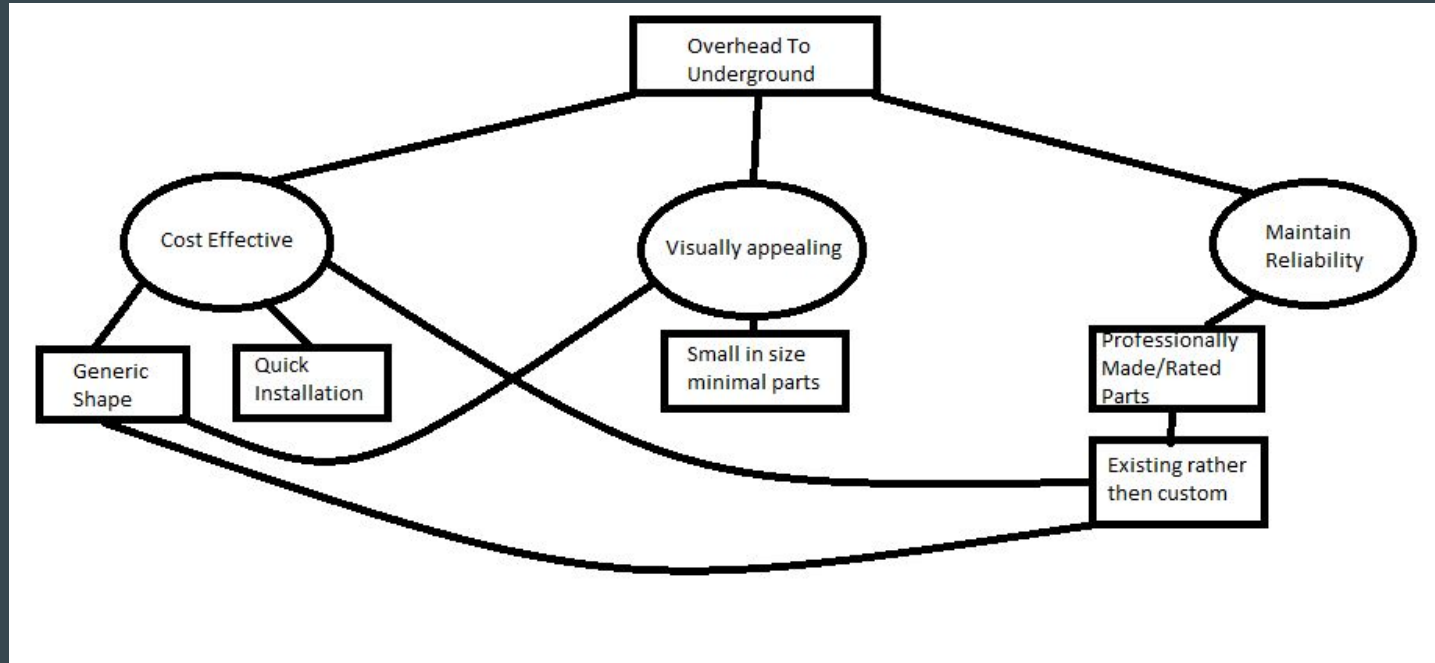
# Project Milestones & Schedule



# System Design



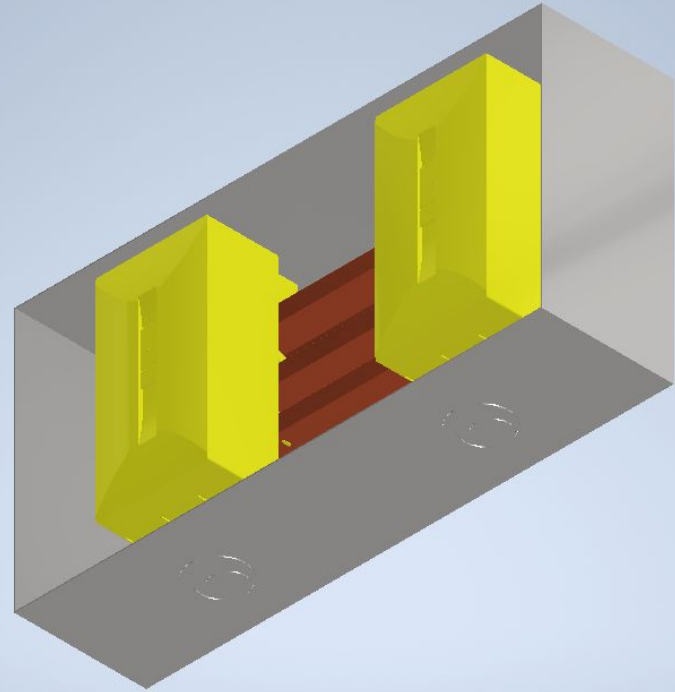
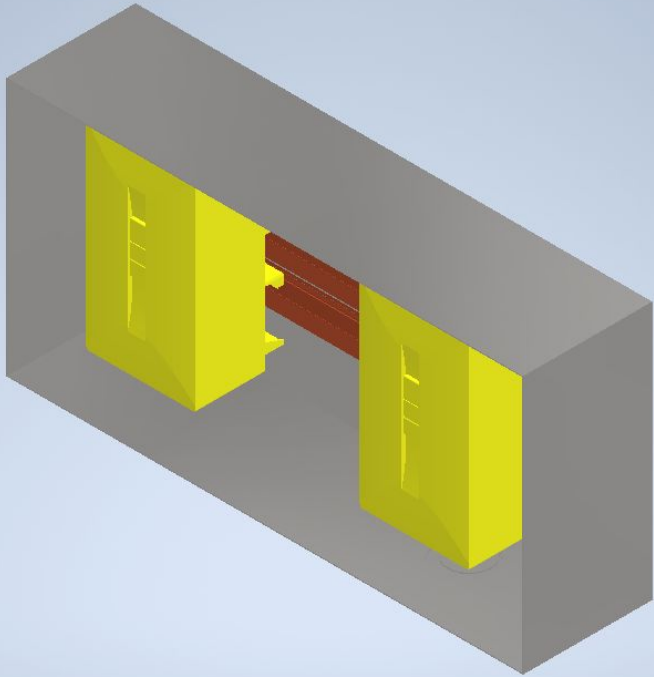
# Functional Decomposition



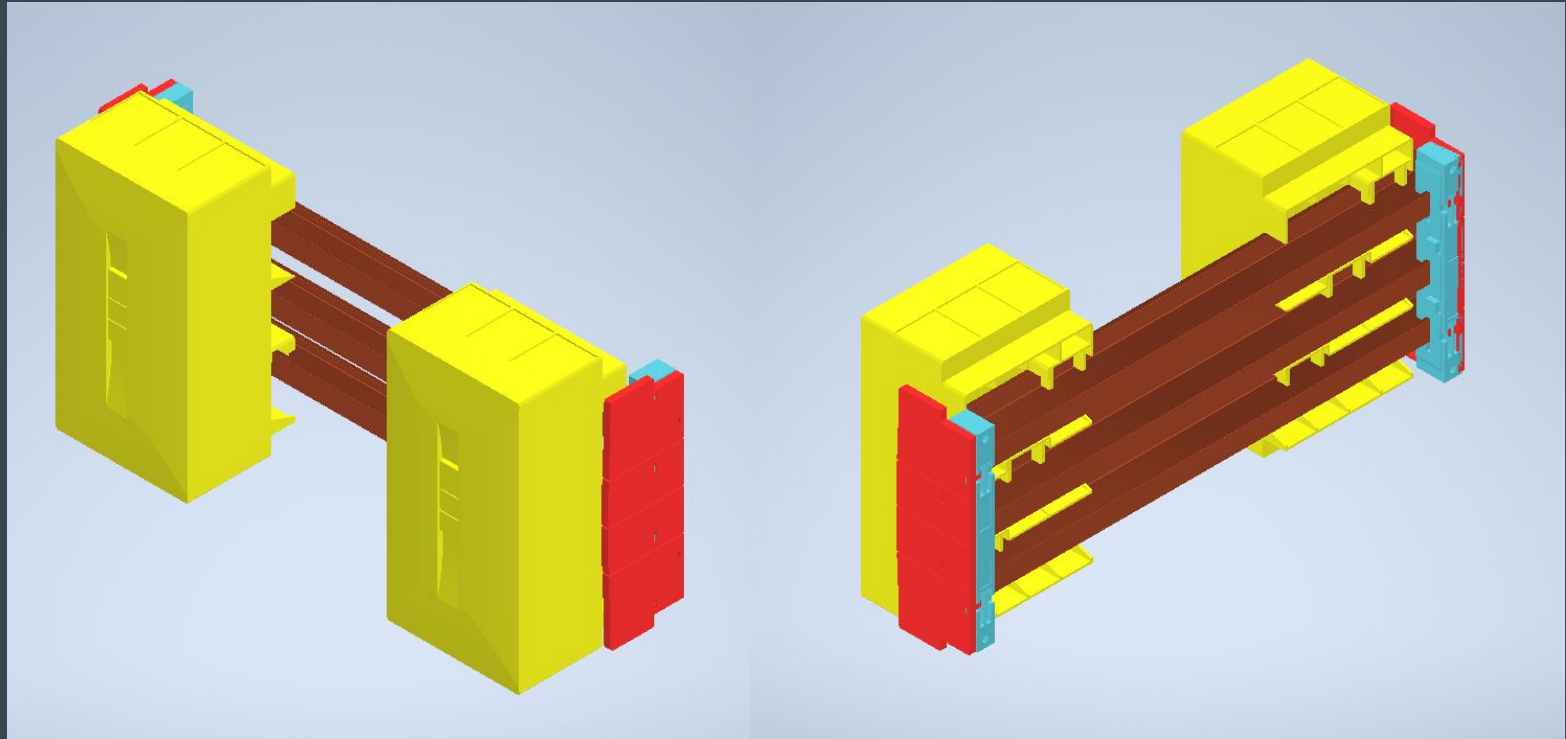
# Detailed Design : Bill of Materials

Part #	Manufacturer	Description	Qty
A122406LP	Hoffman	Enclosure 24 l x12 h x6 d	1
9342.300'	Rittal	Adapter	2
3524.000'	Rittal	Busbar	3
9341.070'	Rittal	End Cap	2
9341.000'	Rittal	Support	2

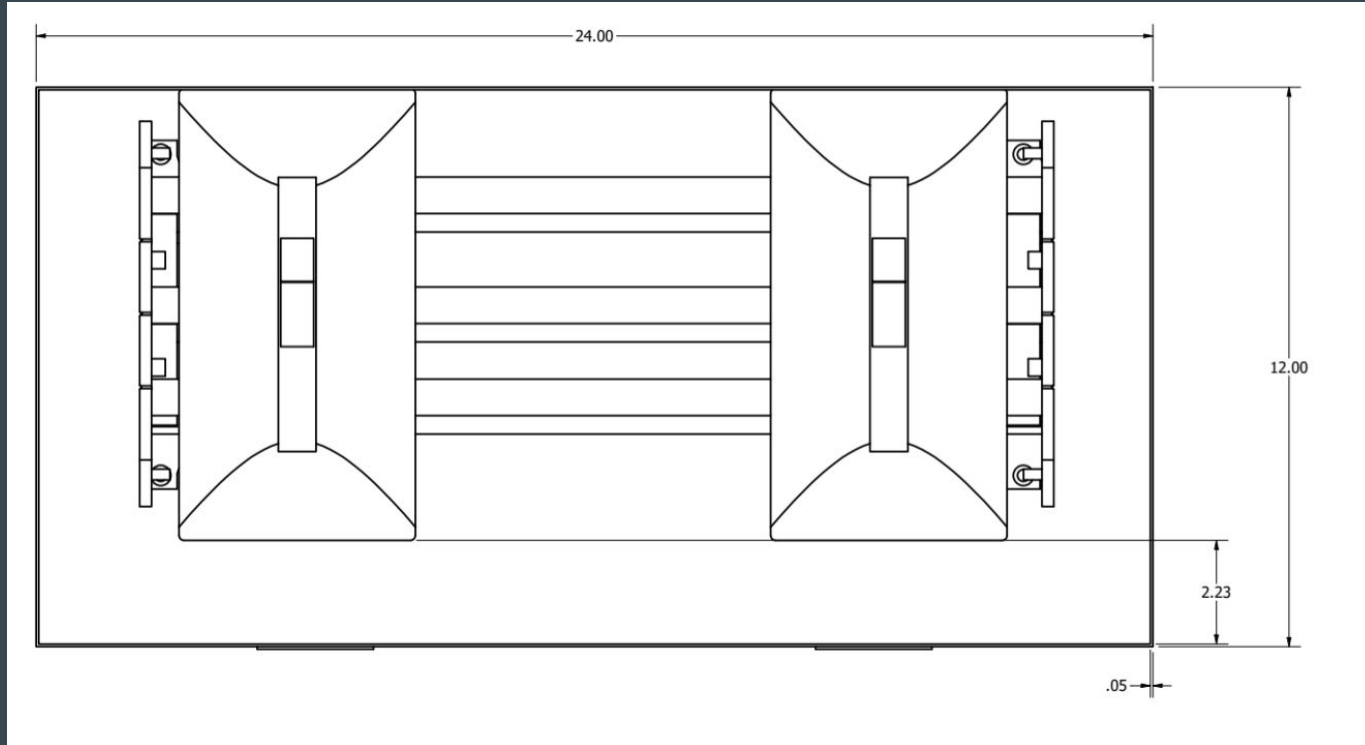
# Detailed Design : 3D Model



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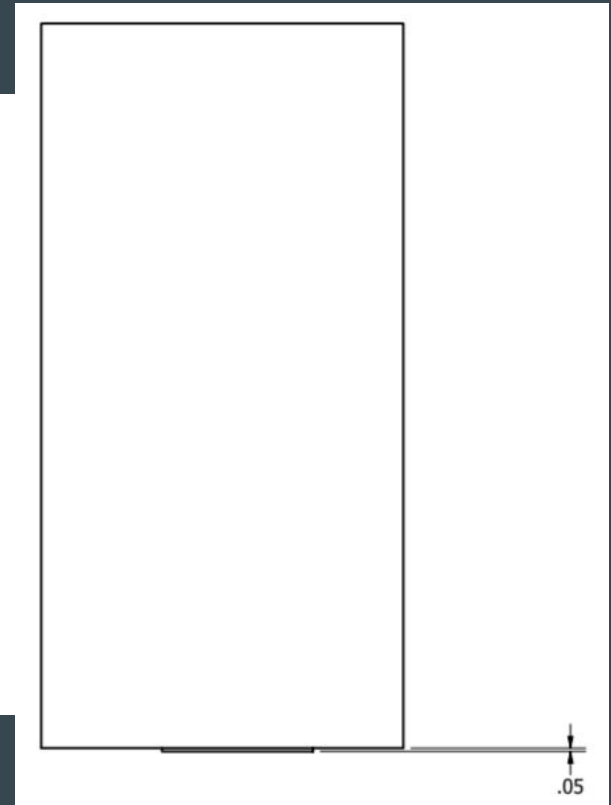
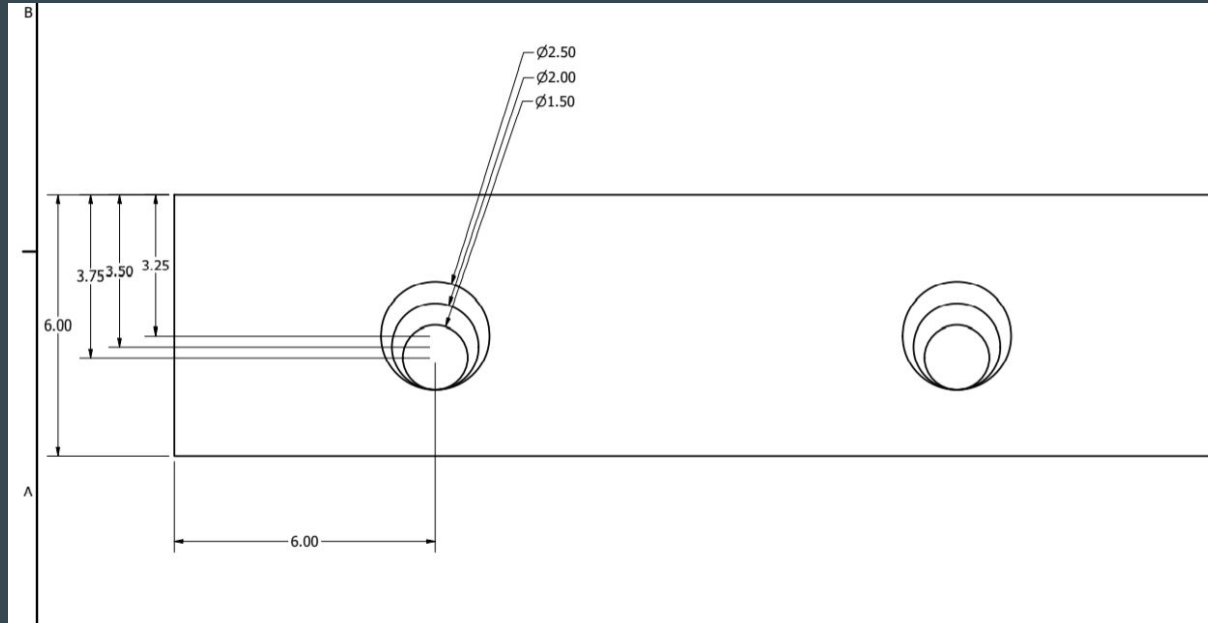


# Detailed Design : Layout

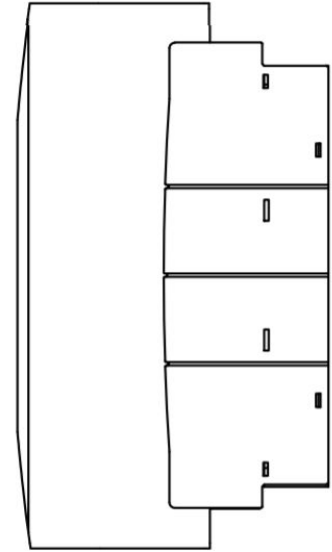
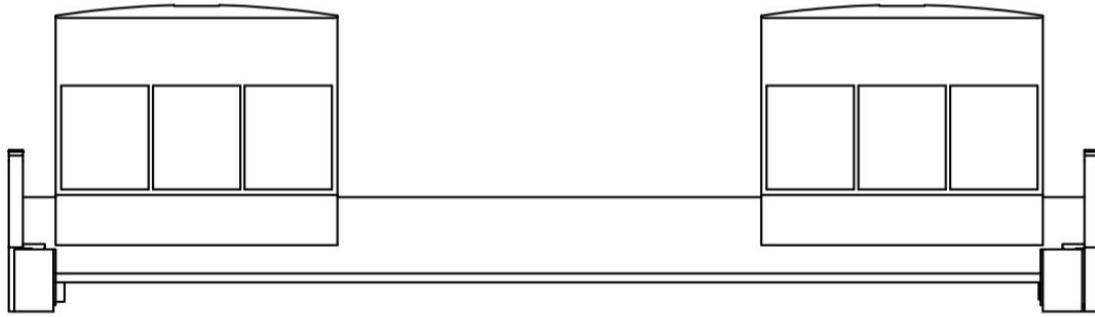




# Detailed Design : Layout



# Detailed Design : Layout



# HW/SW/Technology Platforms Used

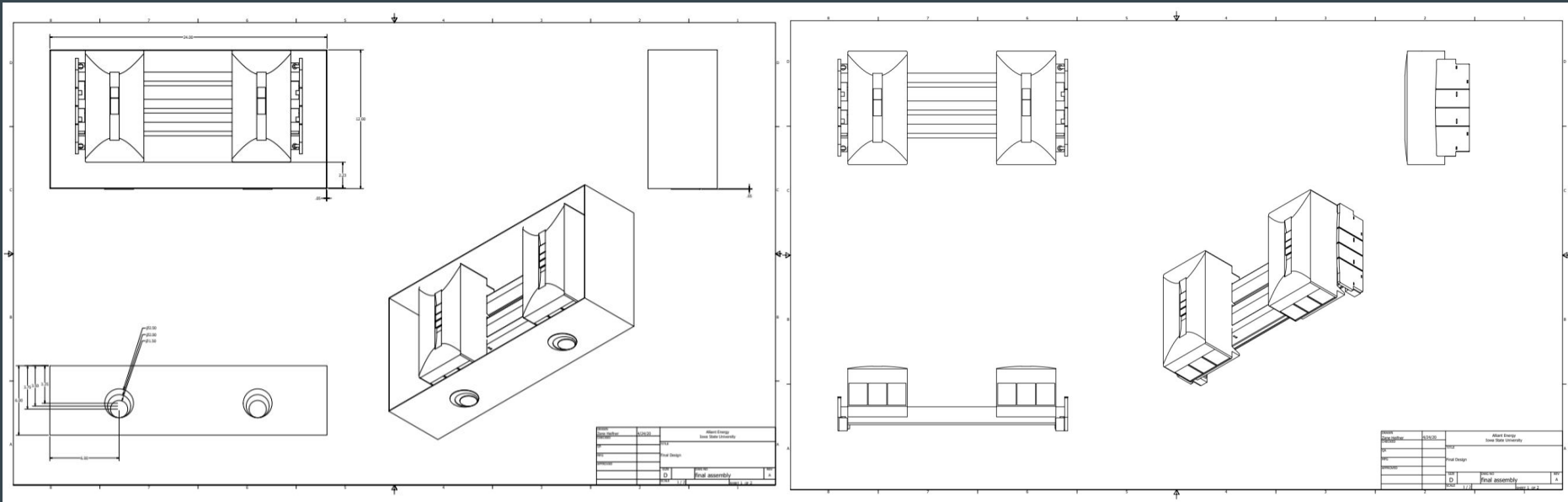
- Software
  - AutoCAD Electrical - 2D layout
  - AutoDesk Inventor - 3D model
  
- Hardware
  - Busbar rittal 3524.000
  - Adapter rittal 9342.000
  - Endcap rittal 9341.070
  - Support rittal 9341.000
  - Hoffman enclosure 24l x 12h x 6d

# Test Plan

- **\*\*Testing cancelled due to COVID-19\*\***
- Consistent feedback from Alliant Energy throughout design process.
- Designed using readily available code compliant parts.
- Prototype planned to be developed by a professional panel manufacturer.
- Installation timing comparison through industry professionals.

# Prototype Implementations

- **\*\*Prototype manufacturing cancelled due to COVID-19\*\***
- Initial model of our prototype has been approved for manufacturing.
- We have researched different part types to ensure code compliance.



# Engineering Standards and Design Practices

- National Electric Code 2017: section 110.28
- NFPA (National Fire Protection Association)
- Spoke with state inspectors
- Used stock parts from reputable source to ensure code compliance
- Feedback from industry professionals

# Conclusion



# Task Responsibility/Contributions of Each Project Member

- Derek Drees (Research)
  - Research, communication with professionals/experts, brainstorming, verification.
- Zane Heifner (Communication)
  - Communication/coordination between team, advisor, industry professionals, and client, drafting of 3D and 2D models
- Brenden Koenighain (Documentation)
  - Made schedule and division of tasks, compiles and manages all documents, brainstorming, creating an economic analysis of mass production of our design to evaluate cost effectiveness.
- Austin Meyer (Website and Testing)
  - Management of team website, producing weekly updates, brainstorming, verification, creating a testing plan to evaluate the ease of installation and therefore cost effectiveness of labor.



# Future Prospect of the Project

- Next step is to manufacture a prototype
- First article build will provide more accurate mass production cost
- Design should be updated again after prototype build
- Future code updates could affect what specific parts were selected

# Thank You

