

# Smart Energy Management Meter (SEMM)

TEAM - 81



Ali Hammad - EE  
Jaoad Benalshekh - EE  
Turki Alotaibi - ISE

Yousef Alahmed - ICS  
Jawad Aljarrash - ICS  
Ahmed Alnafea - CIE

## INTRODUCTION

**Problem Statement:**  
Addressing the escalating energy demands in buildings requires an innovative solution that offers real-time monitoring, predictive analysis, and automated energy optimization to reduce consumption, lower costs, and promote sustainability.

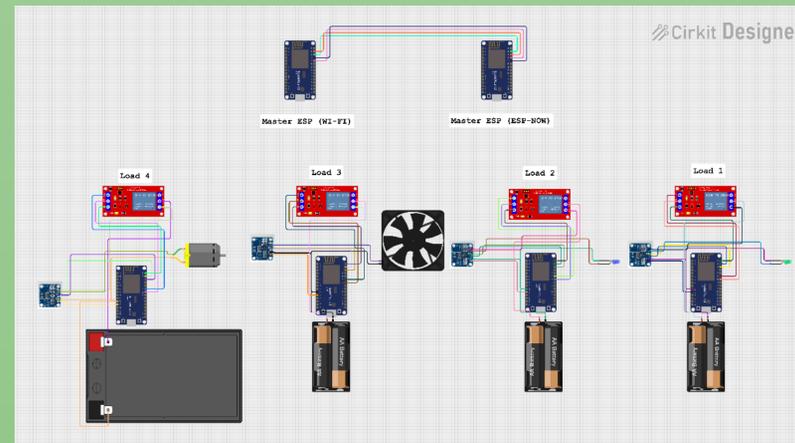
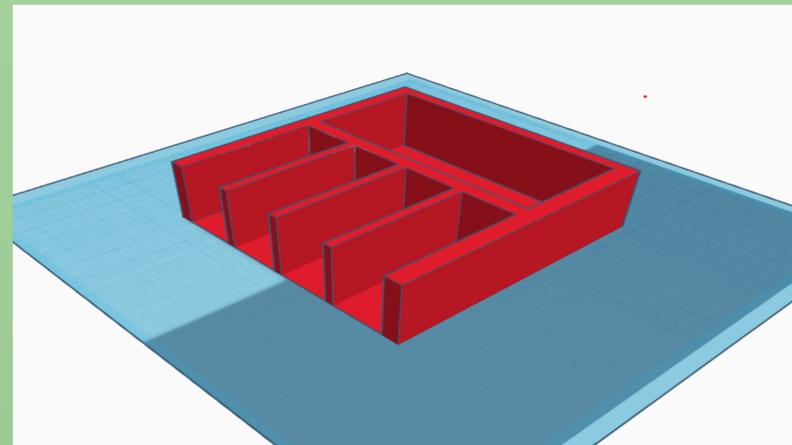
- Constraints:**
  - The Product is only compatible with 220V.
  - Connected equipment shouldn't have more than 30A.
  - The product is limited to newly constructed buildings within 3 years.
  - The product is limited to 4 loads.
  - The budget is limited to 4125 SAR.

- Target Specifications:**
  - Voltage measurement range 0-12V
  - Current measurement range 0-2V
  - Power measurement range 0-20W
  - Data storage period – 1 year
  - Communication delay < 500ms

- Project Impact:**
  - Energy Efficiency:** SEMM optimizes energy consumption, reducing electricity costs for building owners.
  - Economic Savings:** By applying mathematical model and optimization techniques which saved around a 10% of the energy consumption cost.
  - Environmental Sustainability:** Reduced energy consumption contributes to lower carbon footprints and environmental impact.
  - Social Awareness:** By promoting energy efficiency, SEMM raises awareness about sustainable practices and environmental responsibility.

## PROTOTYPE DESIGN

A box was designed to demonstrate the prototype. At the front of the box, four spaces represent individual rooms, each containing a load. The prototype circuit is situated within the larger space behind the rooms.



An application will accompany the product, granting users access to each room's electricity consumption from the start of the day and month. Real-time data will be presented through line graphs depicting today's consumption and the previous six days. The app will also issue alerts upon detecting anomalies and offer a comparison between today's and yesterday's consumption.

## VALIDATION AND TESTING

All product specifications are fulfilled, except for the communication delay. Current, voltage, and power ranges are sourced from the current sensor datasheet, facilitating easy data storage for a year in an Excel sheet. Additionally, the system adeptly manages four loads, efficiently controlling them, a capability thoroughly tested and verified.



This figure showcases the user interface for the application. Here, users can view detailed consumption data while also managing the loads.

## CONCLUSION

The smart energy management meter (SEMM) prototype integrates current sensors, relays, ESPs (both slave and master), and batteries, enabling load control and data reading, with transmission to the AI module for predictive analysis. While the estimated product cost is around 1800 SAR, we managed to stay within budget, spending approximately 3700 SAR for testing and error correction until reaching the optimal design.