University of Moratuwa

Department of Electronic & Telecommunication Engineering

EN2160 - Electronic Design Realization

Report - Preliminary Design Part

Simple Solar Battery Charger

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THIS REPORT IS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE MODULE

EN2160 - Electronic Design Realization

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This preliminary design part report for the solar battery charger project, as per your request. This report includes the implemented design, a comparison with the design improvements based on the knowledge gained from lectures delivered by Prof. Jayasinghe, problems identified by me considering the course content, problems/improvements identified/proposed by members of my group, and problems/improvements identified/proposed by users.

1 Implemented Design:

The implemented design of the solar battery charger consists of the following components:

1. Solar panels: These photovoltaic panels convert solar energy into electrical energy.
2. Charge controller: It regulates the charging process, preventing overcharging and optimizing charging efficiency.
3. Battery bank: The energy generated by the solar panels is stored in a battery bank for later use.
4. Inverter: It converts the stored DC energy into AC power for various applications.
5. Output ports: These allow users to connect their devices for charging.

Attached to this report are the schematic diagram and SolidWorks design files showcasing the implemented design in detail.

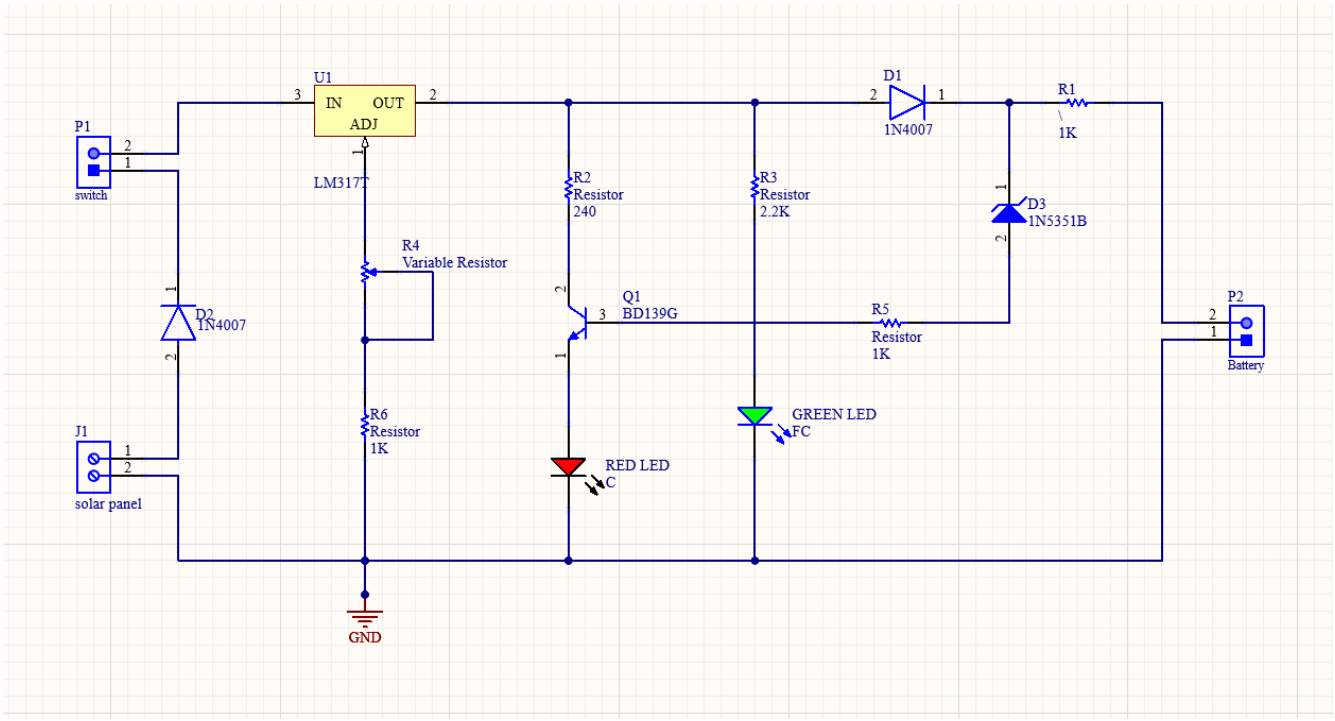

Figure 1: Implemented schematic design

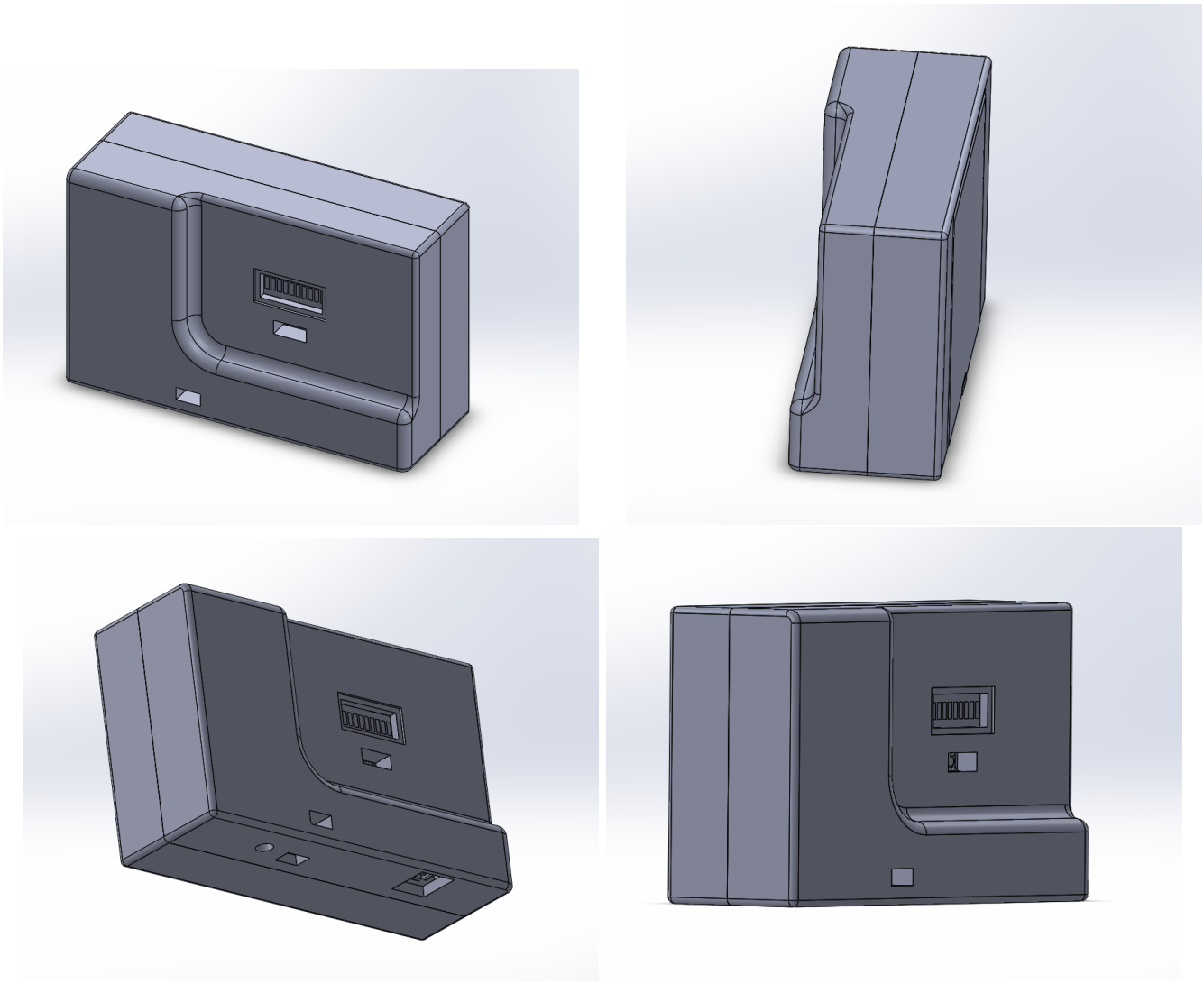

Figure 2: Implemented solidworks design

Please refer to the attached files for a detailed representation of the implemented design.

2 Problems Identified from Prof. Jayasinghe's Lectures:

After attending Prof. Jayasinghe's lectures, I have identified the following problems with the implemented design:

1. Inefficient charge controller: The current charge controller used in the design lacks advanced MPPT (Maximum Power Point Tracking) technology, leading to suboptimal charging efficiency.
2. Inadequate battery capacity: The battery bank's capacity is insufficient to meet the power requirements of users for extended periods, especially during low sunlight periods.
3. Inadequate heat dissipation: The implemented design did not adequately address the heat dissipation requirements, which could lead to potential overheating issues.
4. Suboptimal component placement: The arrangement of components in the implemented design was not optimized for efficient operation, maintenance, and accessibility.
5. Insufficient structural integrity: The design lacked robustness, and certain structural components were prone to failure under specific operating conditions.

3 Problems/Improvements Identified by Group Members:

During group discussions, the following problems/improvements were identified:

1. Lack of portability: The current design does not prioritize portability, making it inconvenient for users who require mobility.
2. Limited charging options: The design only supports AC output, restricting the charging of devices that require DC power directly.
3. Enhanced thermal management: Implementing better cooling mechanisms such as heat sinks, fans, or liquid cooling systems to ensure optimal heat dissipation and prevent overheating.
4. Improved component arrangement: Reorganizing the placement of components to optimize functionality, ease of maintenance, and accessibility.
5. Strengthened structural design: Introducing reinforcements and design modifications to enhance the structural integrity and durability of critical components.

4 Problems/Improvements Identified by Users:

User feedback highlighted the following problems/improvements:

1. Complex user interface: The current user interface of the solar battery charger is difficult to navigate and understand for non-technical users.
2. Insufficient safety features: Users expressed concerns about the lack of safety mechanisms, such as short-circuit protection and surge protection.
3. User interface complexity: Users found the interface of the implemented design to be complex and unintuitive, requiring additional training for effective operation.
4. Noise reduction: Users expressed concerns about the noise generated by certain components, indicating a need for noise reduction measures.

   c) Energy efficiency: Users emphasized the importance of optimizing the design for energy efficiency to minimize power consumption and operational costs.

5 Improved Design:

To address the identified problems, we propose the following improvements to the solar battery charger design:

1. Upgraded charge controller: We will incorporate an advanced MPPT charge controller to enhance charging efficiency and maximize energy harvesting from the solar panels.
2. Increased battery capacity: The battery bank's capacity will be increased to ensure sufficient power storage during periods of low sunlight.
3. Enhanced portability: The design will be revised to prioritize portability, incorporating lightweight materials and a compact form factor.
4. Expanded charging options: Additional DC output ports will be included to provide users with more flexibility in charging their devices.
5. User-friendly interface: The user interface will be redesigned to be intuitive, with clear indicators and easy-to-understand controls.
6. Enhanced safety features: Safety mechanisms like short-circuit protection and surge protection will be integrated to ensure user safety.
7. Upgraded cooling system: The improved design included a more efficient cooling system with enhanced heat dissipation capabilities.

8. Optimized component arrangement: The placement of components was revised to improve functionality, accessibility, and maintenance ease.
9. Reinforced structural design: Structural reinforcements were implemented to enhance the durability and integrity of critical components.
10. Streamlined user interface: The user interface was redesigned to be more intuitive and user-friendly, reducing complexity and the need for extensive training.
11. Noise reduction measures: Noise-dampening materials and improved component selection were incorporated to reduce operational noise.
12. Energy-efficient features: The design was optimized for energy efficiency, considering power consumption and operational costs.

Attached to this report, you will find the schematic diagram and SolidWorks design files showcasing the proposed improvements in detail.
This concludes the preliminary design part report for the solar battery charger project, the preliminary design was initially implemented but had several shortcomings. However, through the knowledge gained from Prof. Jayasinghe's lectures, group discussions, and user feedback, significant improvements were made to address the identified problems and enhance the overall design. The revised schematic and SolidWorks design of the improved system demonstrate the incorporation of these improvements.

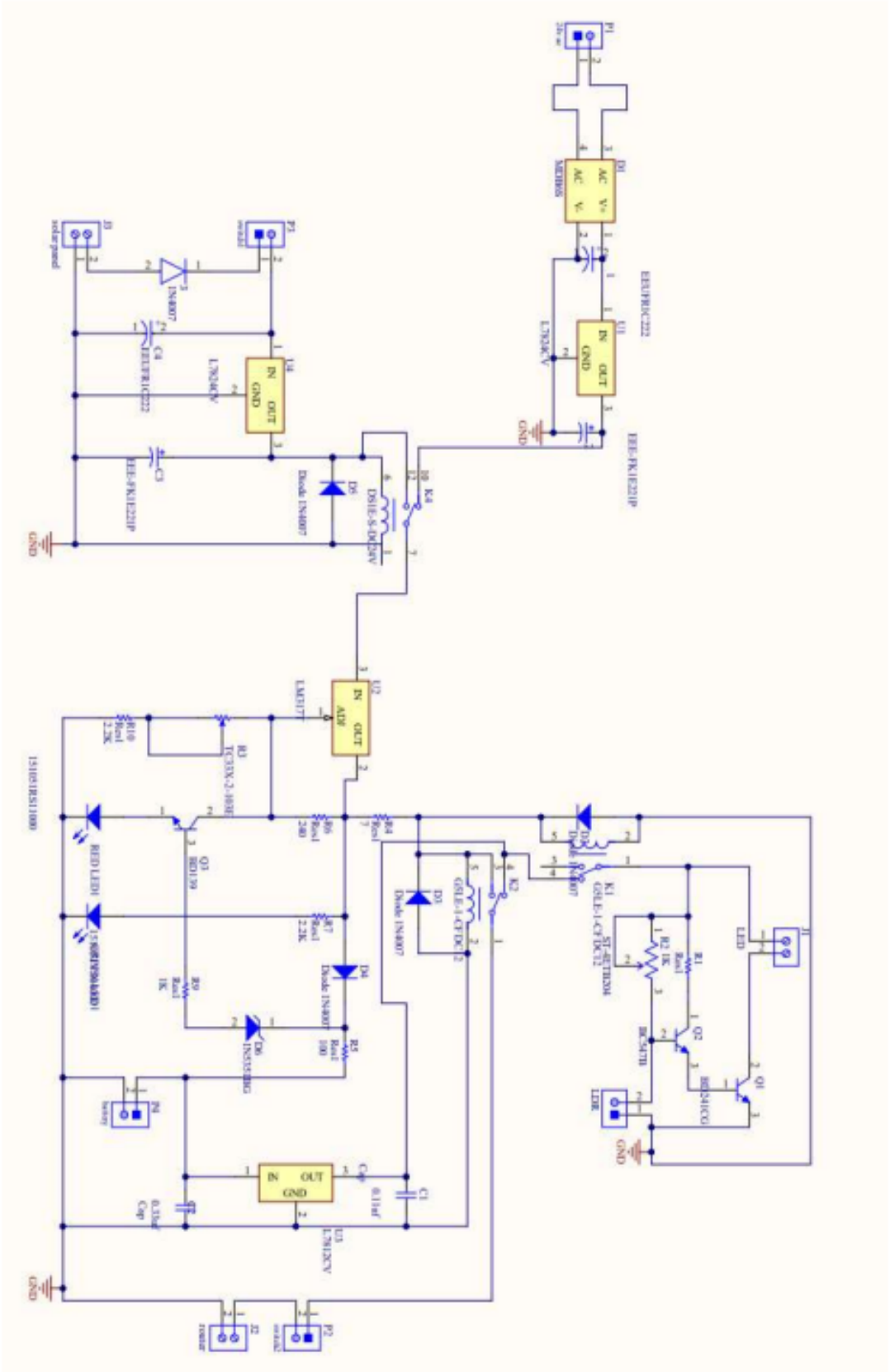

Figure 3: Improved schematic design

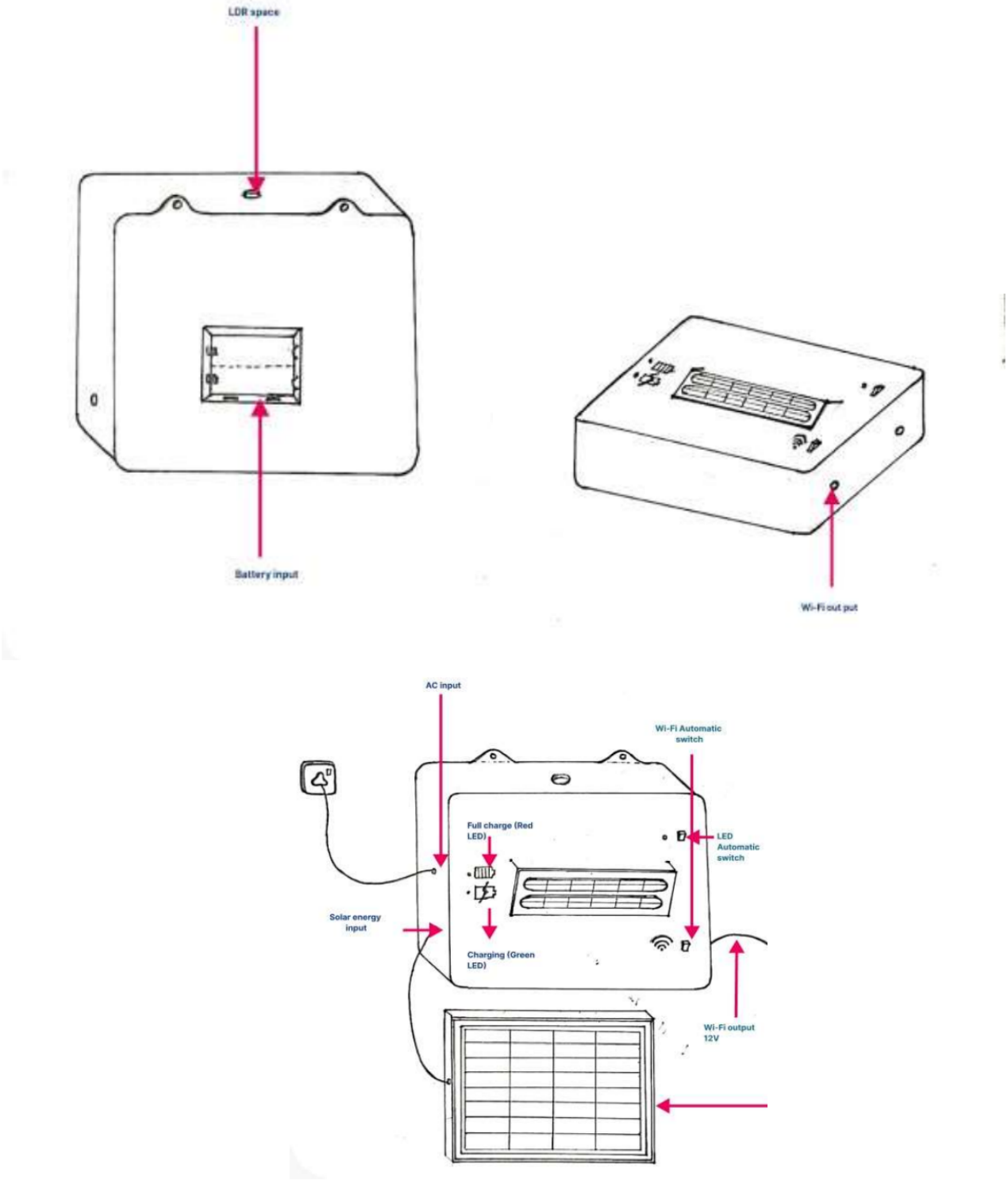

Figure 4: Hand sketches

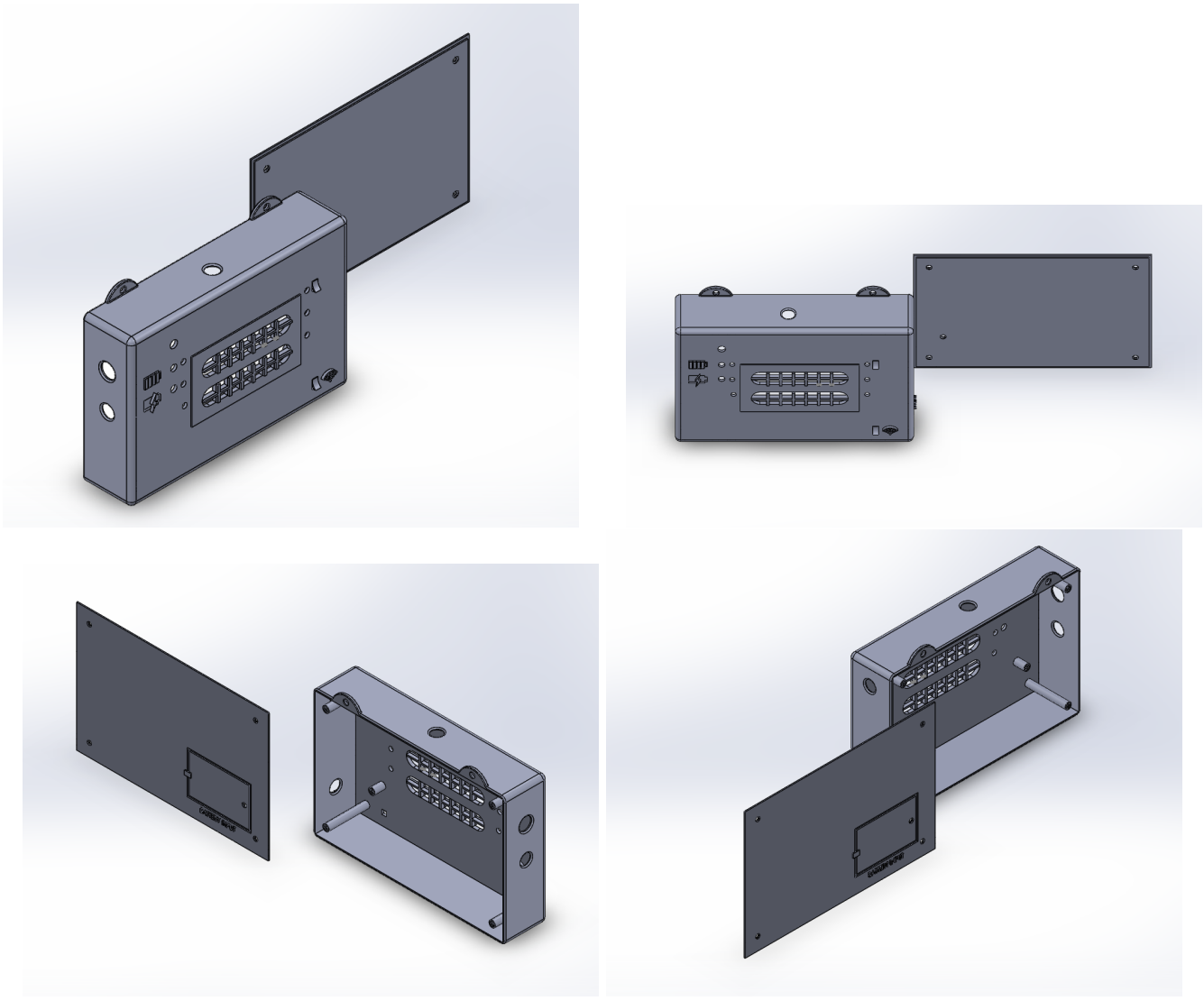

Figure 5: Improved solidworks design