Department of Electronic and Telecommunication Engineering

University of Moratuwa

EN-2160 Electronic Design Realization

Report on Preliminary Design Part

Name	Index No:
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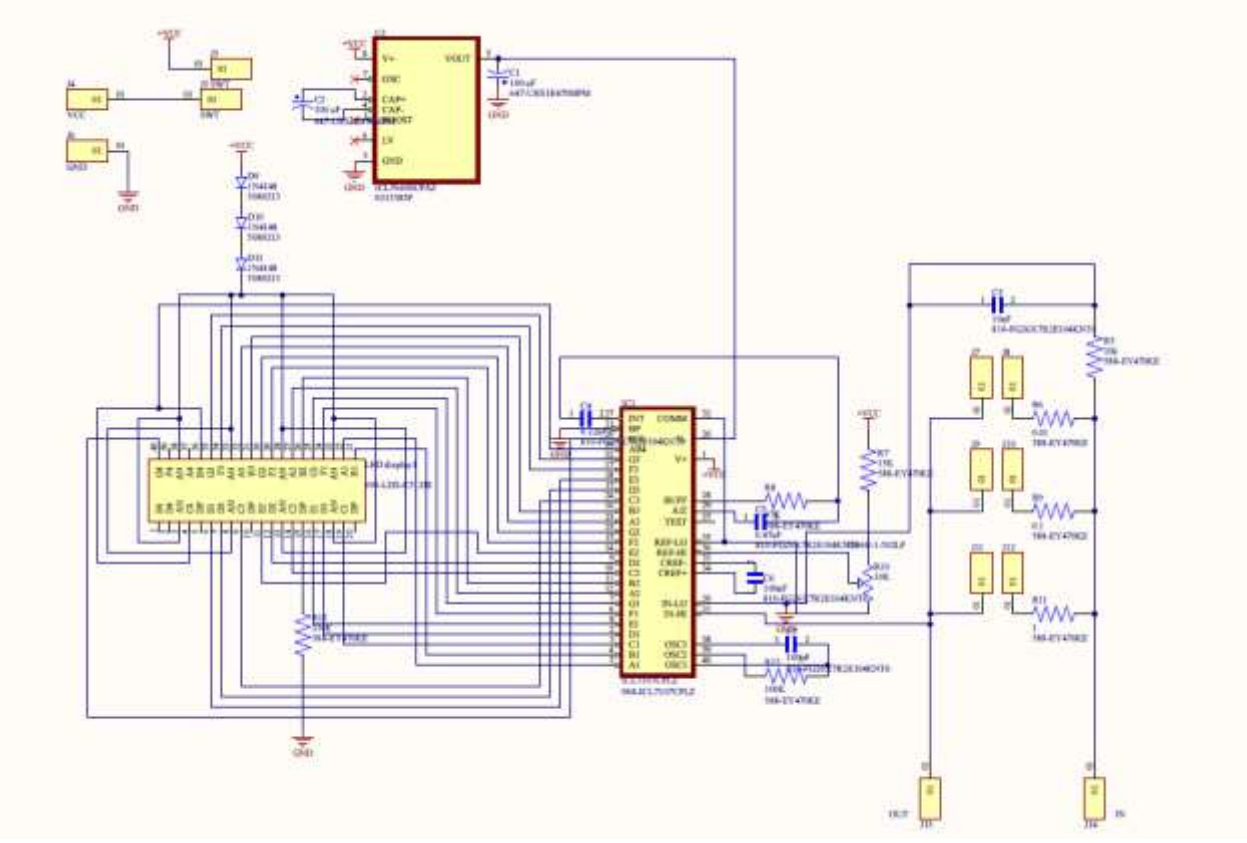
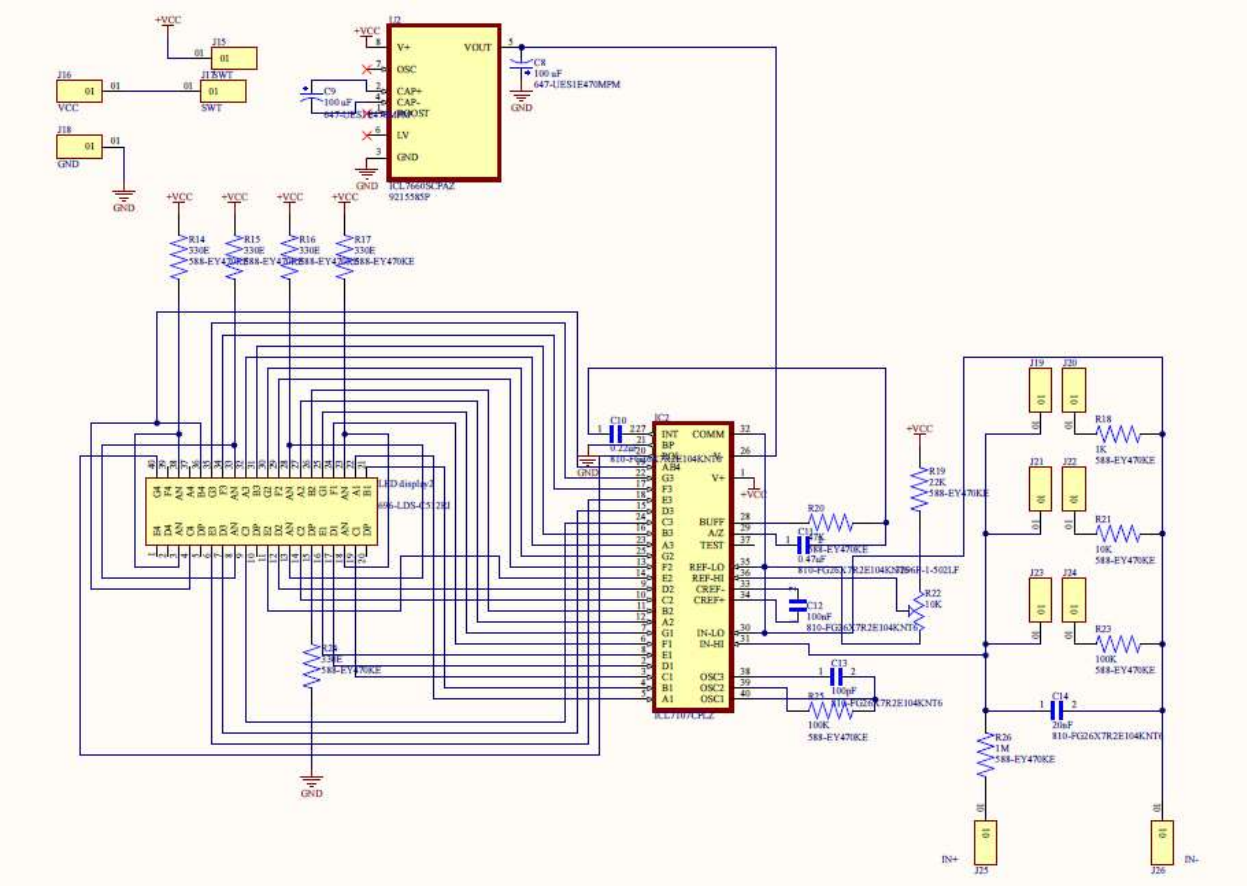
Initial Design

Schematic of in initial design

1.Digital Ammeter

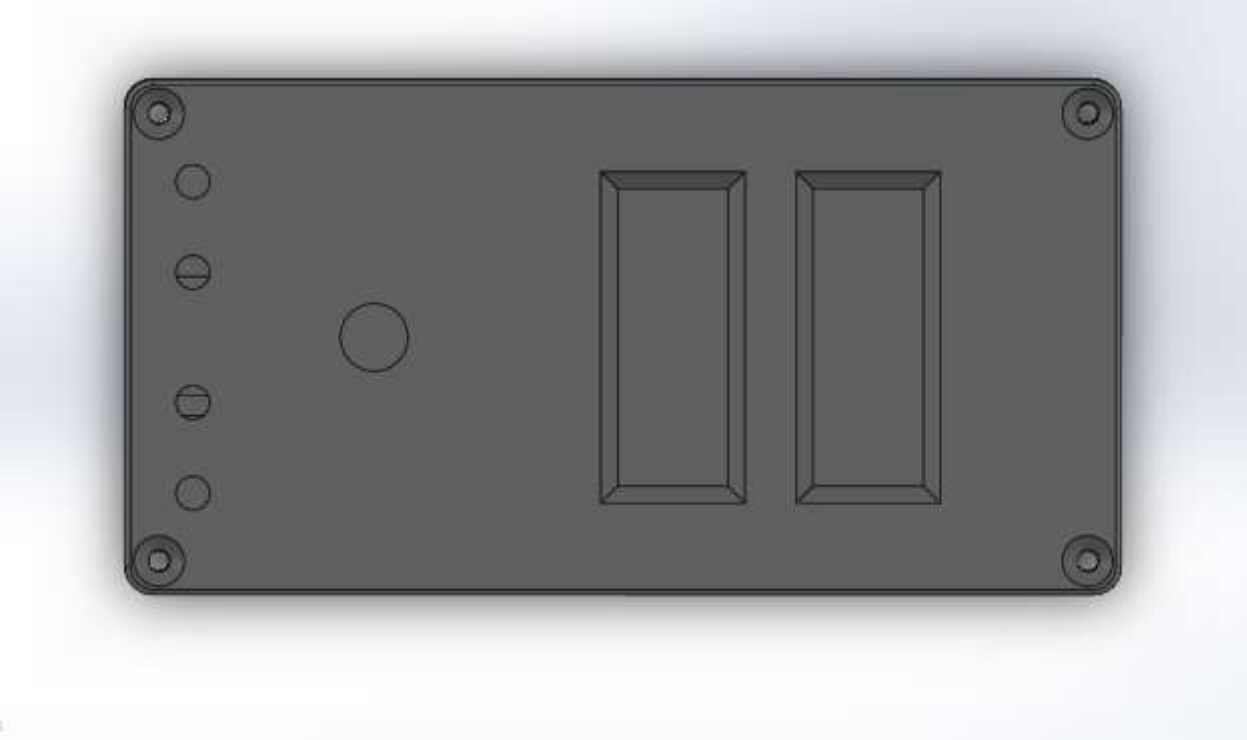


2.Digital Voltmeter



Solidwork designs

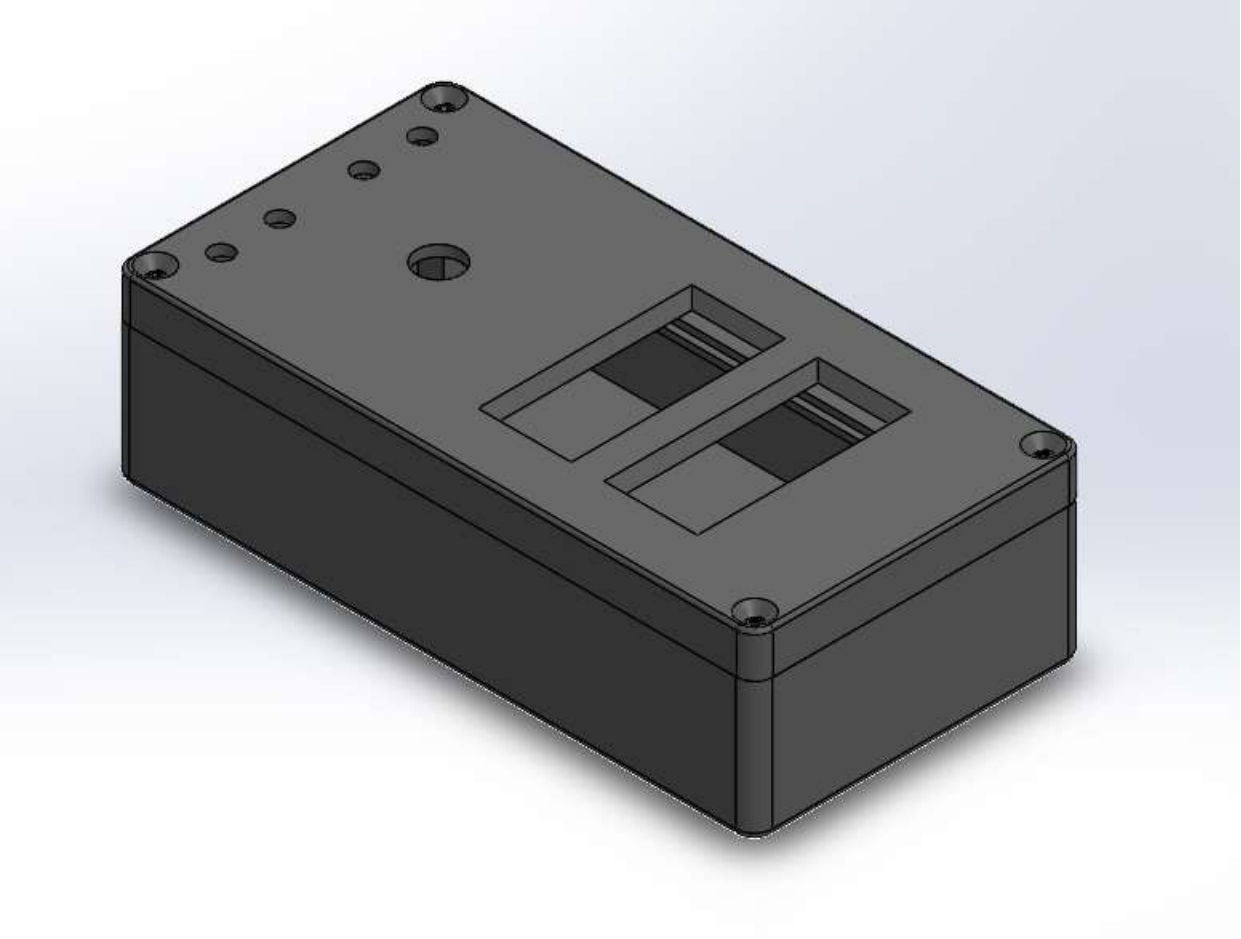
Top view



Front view

Left view.

Isometric view



Problems identified by you considering the course contend delivered by Prof. Jayasinghe

Schematic design

1. When we use logic symbols for components, we should use well defined standards for logic symbols.
2. We should pay attention when putting Reference Designators for the components (consider the order of these Designators as left to right and top to bottom).
3. Draw our schematics so that signals flow from left to right and top to bottom.
4. Use Net Names to identify nets that require critical routing and minimize the complexity of schematic drawings.
5. Add test to a schematic to delineate circuit functions.
6. To make the drawing look we should pay attention on Title Block which consists of Name of circuit, our Name, Sheet number etc.

Solidwork design

1. Before designing product, we have to estimate how much space(dimensions) required to assembly the PCBs, sensors, wiring and other required components in the design.
2. First build the design using three hand sketches with proper dimensions. And then import those hand sketches to Solidwork and use them to build the design.
3. As this is a marketable product, we always should pay attention on users' requirements. So, we have to design the solidwork design according to fulfilling the users' requirements. A major requirement is the product should be attractive enough. So, we have to use solidwork features such as curves, fillets, chambers etc. to achieve this requirement.
4. When designing the product keep concern on how to build parts in accordance to fit each other.
5. Since this is a marketable product, we have to consider high manufacturability (a high-quality process that is simple and efficient, long lasting, easy to operate and maintain, and that meets all customer specifications at the lowest possible cost). To achieve this, we have to consider mold design and tooling. To this process we have to pay attention on features like draft angles, etc.

User centered design

1. As designers we have to focus on users and their needs.
2. For that we have to involve users through a design process.
3. And do iterative design process to improve the product. The iterative design process consists of the following key items.
    i. Explore
    ii. Create
    iii. Evaluate
    iv. Manage

Problems/Improvements identified/proposed by members of our group.

To identify/propose the problems/improvements by members of our group, we used a selection matrix. We prepared three block diagrams on the product that fulfill the requirements. And did the selection matrix on following criteria.

1. Accuracy
2. Power source and battery life
3. Cost
4. Performance and features
5. Complexity
6. Measurement range
7. Power consumption

Using the above selection matrix, I chose the best selection and developed three sketches to fulfill the above selected block diagrams and did the selection matrix on the three-designs based on following criteria.

1. Appearance
2. Portability
3. Cost
4. User experience
5. Easy to handle.
6. strength
7. Durability

According to the result of the selection matrix I chose the best selection of the design.

Improvements proposed by members of our group.

- Add a rechargeable power supply to power the device.
- Build the device to be portable.
- Add more extra features to the design such as a continuity tester.

Problems/Improvements identified/proposed by users.

Our main task is to produce a marketable product. To achieve this purpose, we have to produce a user-friendly device. For this we have to focus on users and their needs. So, we have to involve users. For this I conducted a survey to get user feedback on my product. The following factors are included in the survey.

1. How frequently do you use digital volt-amp meters?
2. What are the most critical features or functionalities you expect in a digital volt-amp meter? (Check all that apply)
    - Accurate voltage measurement
    - Accurate current measurement
    - Multimeter functionality (resistance, capacitance, continuity, etc.)

- Data logging and storage
- Graphical display or waveform visualization
- PC connectivity for data transfer and analysis
- Built-in safety features (overload protection, fuse indicators, etc.)
- Customizable settings and presets

3. Which form factor do you prefer for a digital volt-amp meter?
   - Handheld portable device
   - Benchtop instrument
   - Rack-mounted unit

4. What is the maximum voltage range you would typically need to measure with the meter?
5. What is the maximum voltage range you would typically need to measure with the meter?
6. Are there any specific design considerations or constraints we should be aware of while building the digital volt-amp meter? (e.g., size limitations, power source requirements, environmental conditions)
7. How important is the ease of use and user interface design for the digital volt-amp meter?
8. Please provide any additional comments, suggestions, or specific requirements that would help us build an ideal digital volt-amp meter.

User feedbacks for the above survey

1.) Improve the physical design of the device to ensure comfortable handling and operation. Consider factors such as the shape, size, weight distribution, and grip texture to minimize user fatigue during prolonged use.
2.) Design a user interface that is intuitive and easy to navigate. Use clear labeling, symbols, and color-coded controls to make it easy to understand and operate the device's functions.
3.) Optimize the display size to provide a clear and easily readable representation of measurements.
4.) Integrate graphical representations, such as bar graphs or waveforms, to provide users with a visual depiction of the measured values.
5.) Include a battery status indicator on the display or as a separate LED to provide users with clear information about the remaining battery life. This helps users plan for battery replacements or recharging.
6.) Improve the accuracy of the measurements taken by the device.

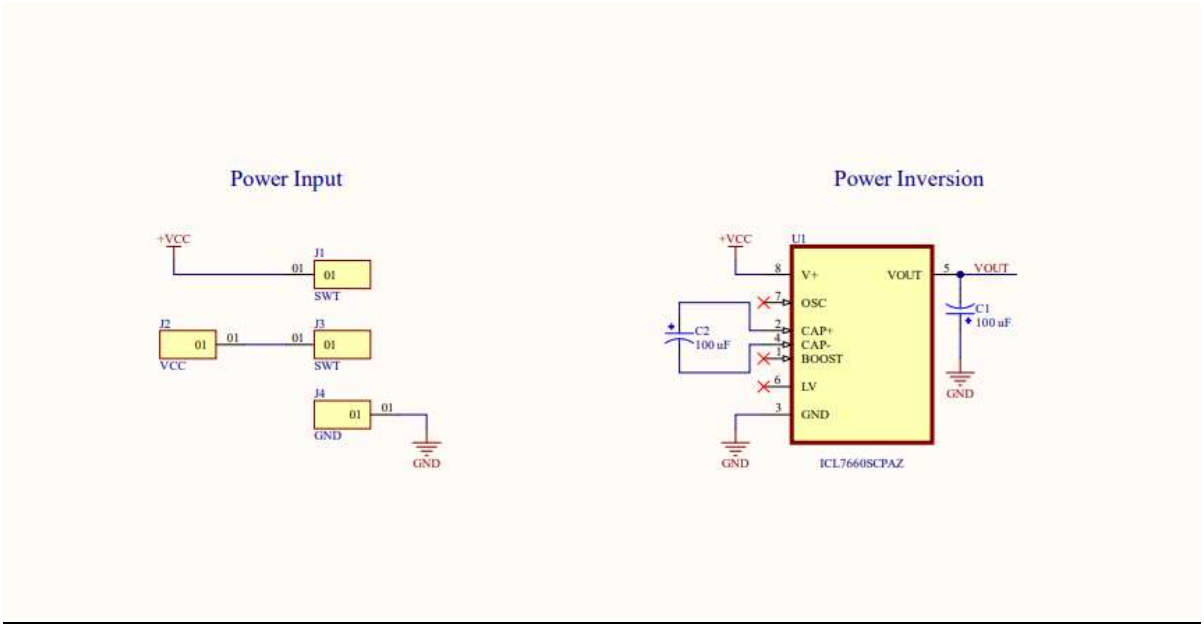
Things added to the product based on the user feedback.

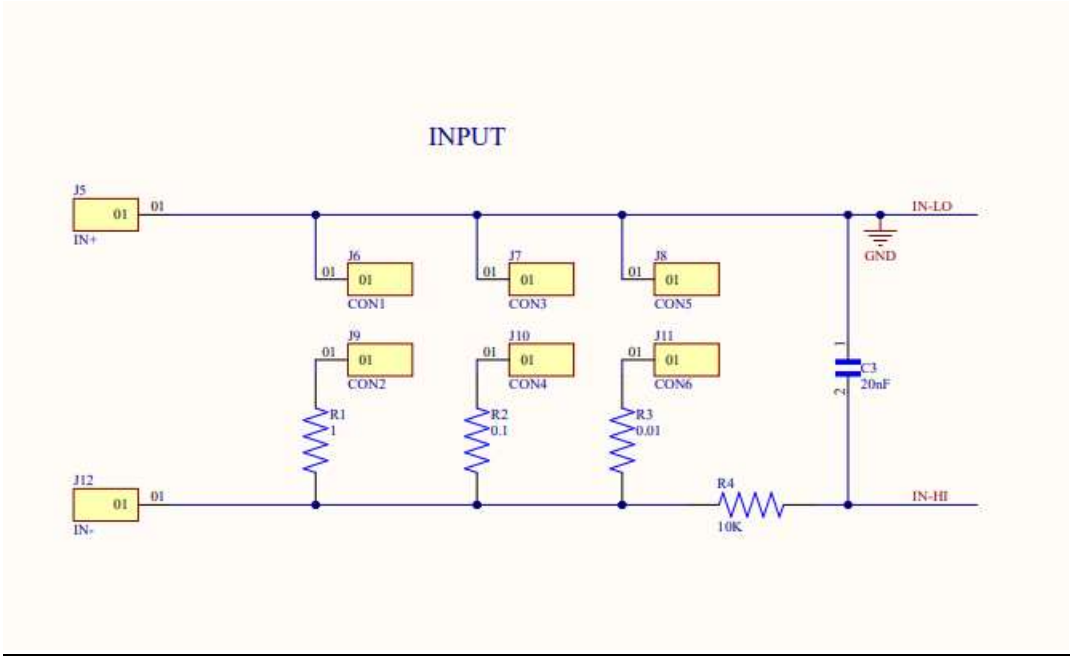
1. Added a battery level indicator circuit to indicate the remaining battery charging level.
2. Since this is a portable device minimized the size and weight of the product by changing the type of the battery.
3. Increase the accuracy of the measurements of the device and add more features to design.
4. Designed the interface in a user-friendly manner.

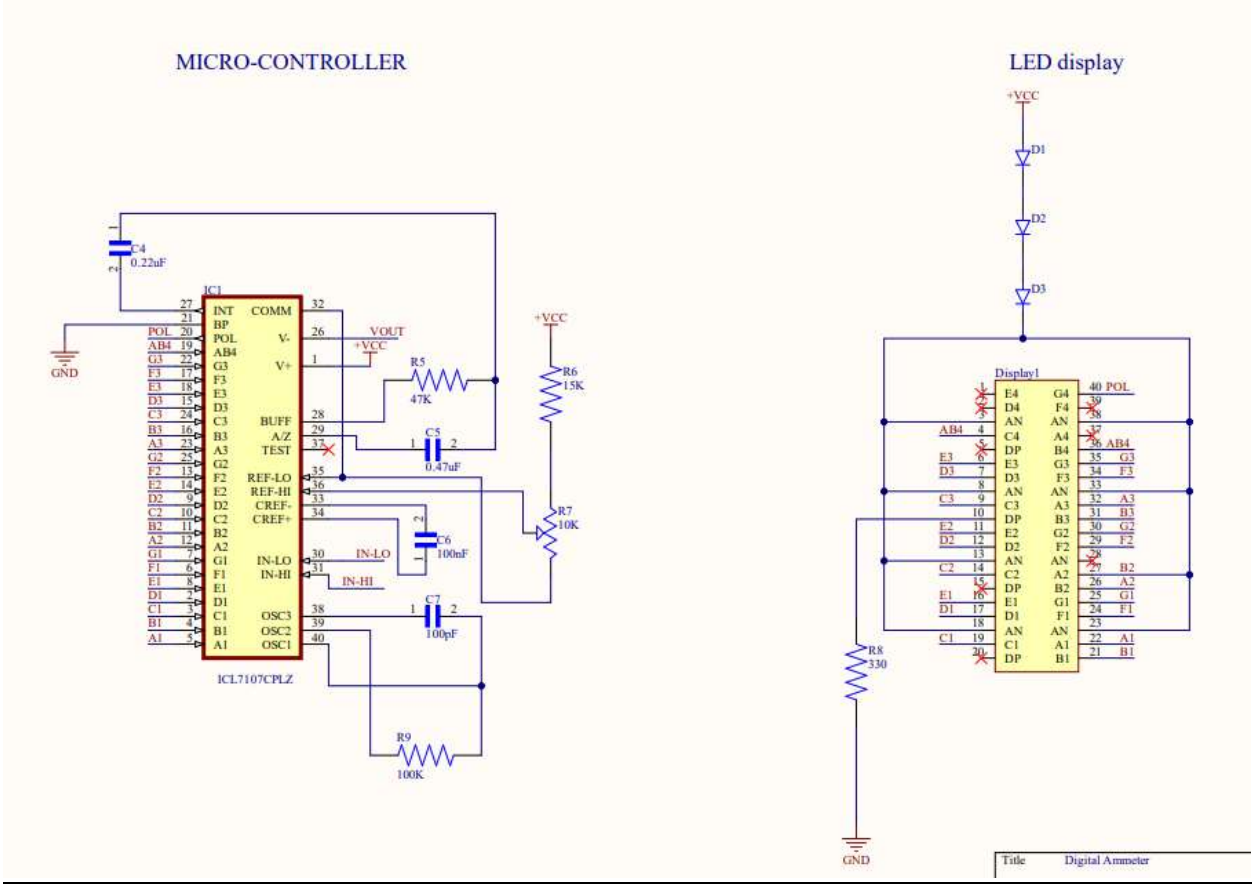
According to the above feedback I designed the schematic and solidwork design as follows.

Final Product

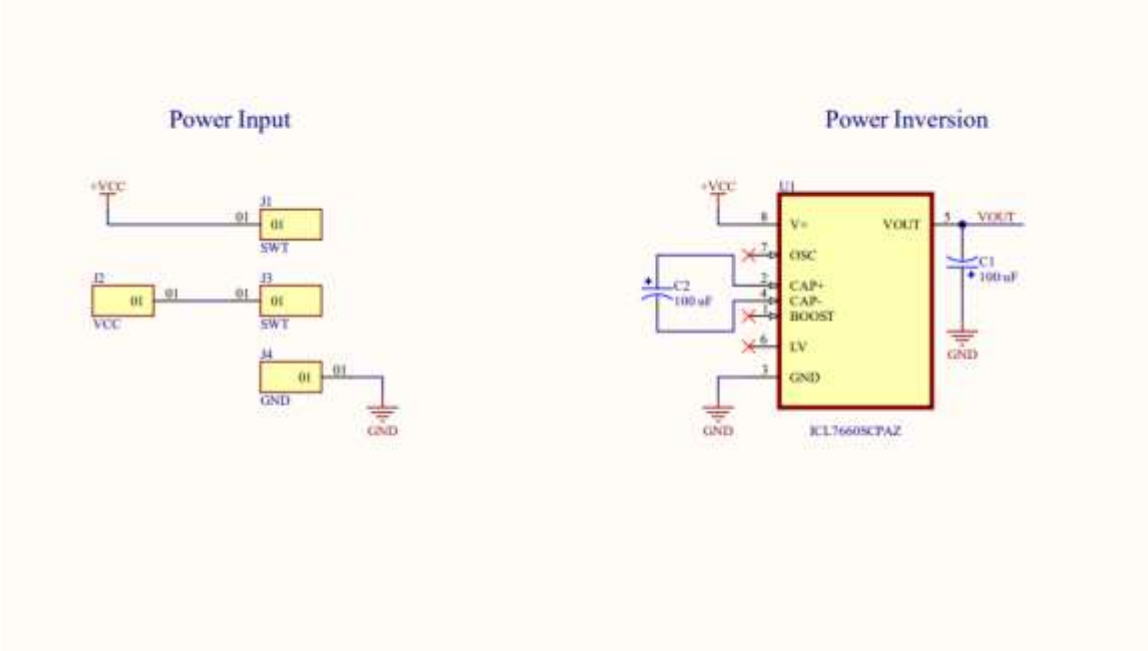
1.Digital Ammeter

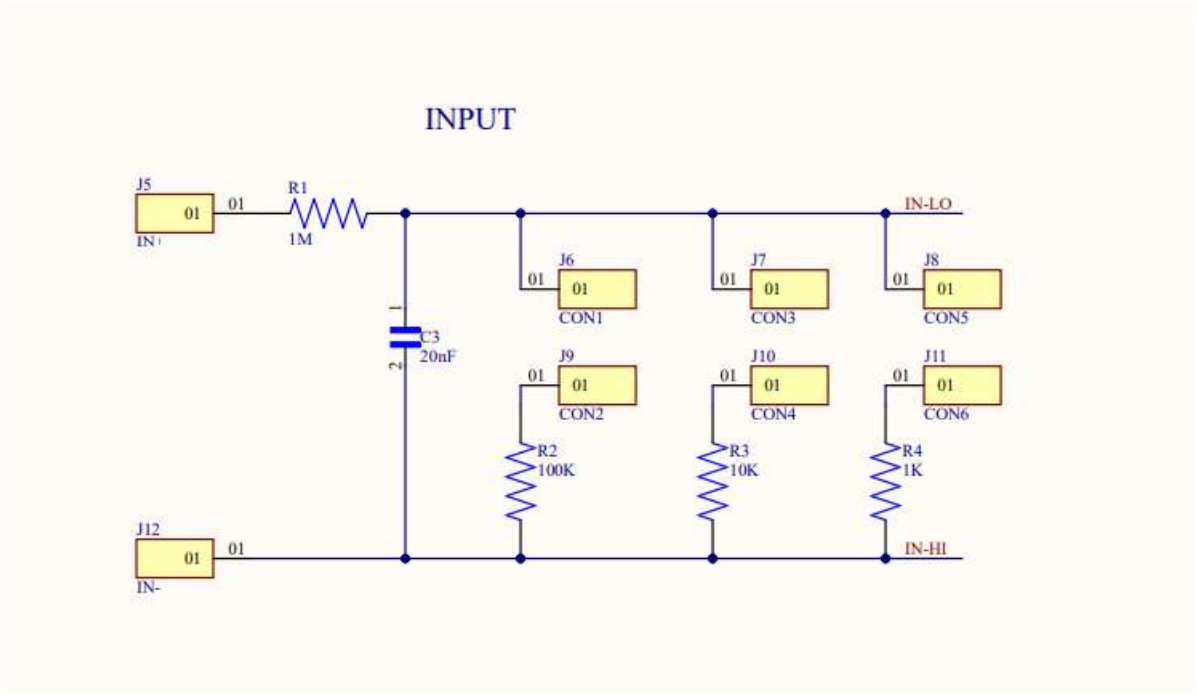


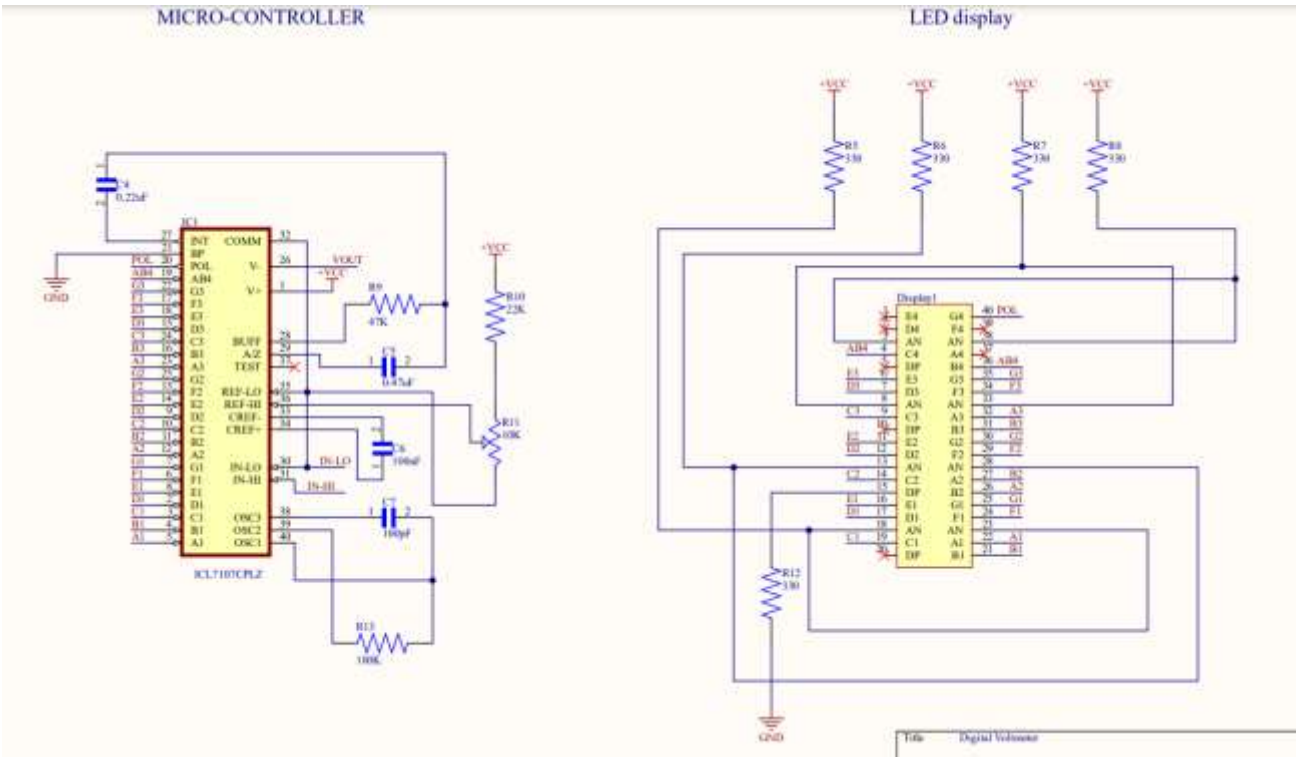




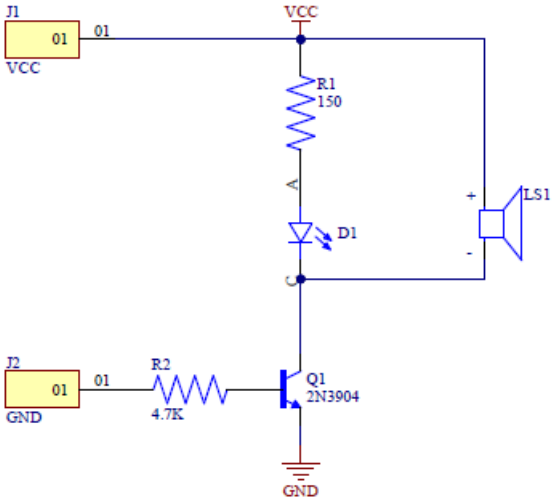
2.Digital Voltmeter




INPUT
J5
01
IN+
R1
1M
C3
20nF
J6
CON1
J7
CON3
J8
CON5
J9
CON2
J10
CON4
J11
CON6
R2
100K
R3
10K
R4
1K
IN-LO
IN-HI
J12
IN-


MICRO-CONTROLLER
LED display
ICL7107CPLZ
GND
+VCC
Display1

6. Continuity tester



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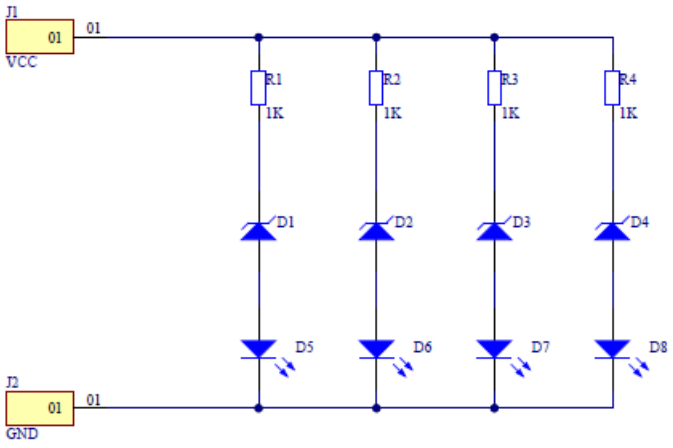
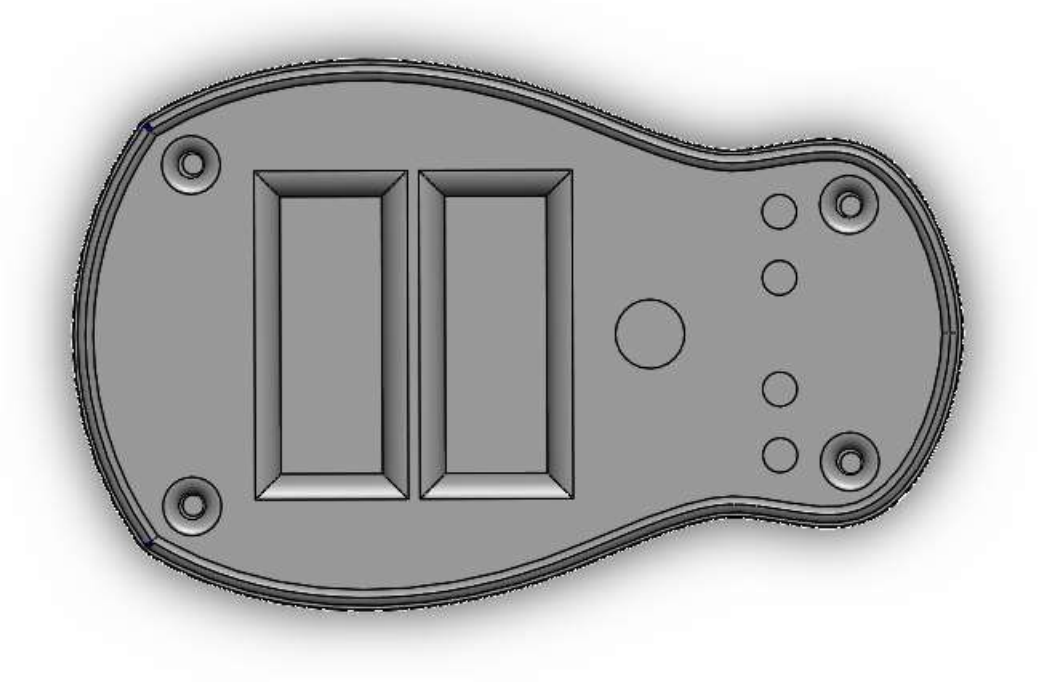
7. Battery level indicator



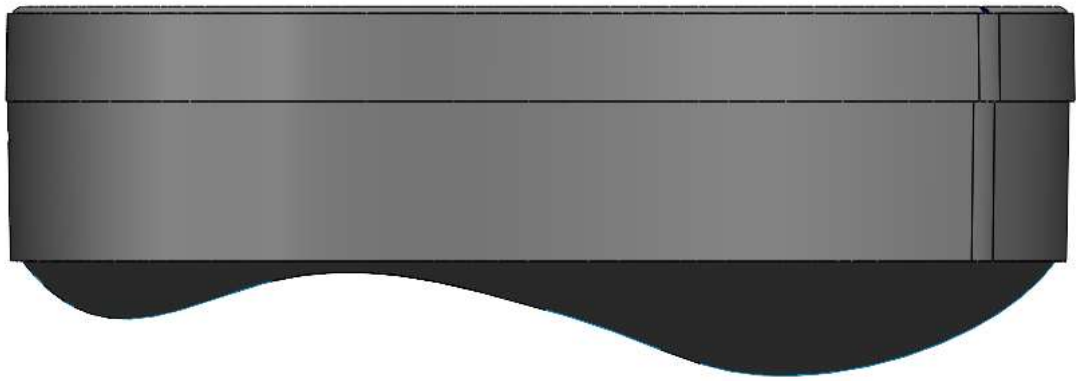
Final Solidwork design

Top view

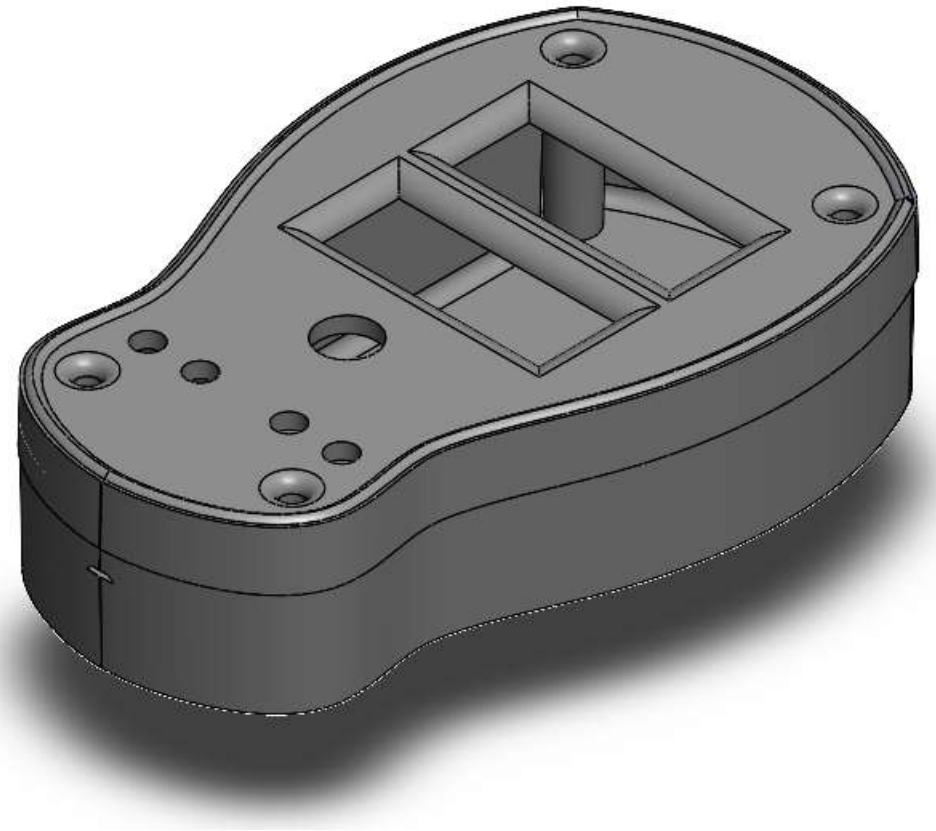


Front view

Side view



Isometric view



Final design with mold and cavity