Department of Electronic & Telecommunication Engineering

University of Moratuwa

EN2160 Electronic Design Realization

Report - Preliminary Design Part

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1. The Implemented Initial Preliminary Design

A remarkable digital meter has emerged, bringing a new level of convenience and functionality to our daily lives. With its integration of advanced technology, this device surpasses traditional meters by seamlessly displaying time, date, temperature, and humidity information. In addition to its accurate timekeeping capabilities, it serves as a versatile instrument for monitoring environmental conditions. This digital marvel allows users to effortlessly measure and view temperature and humidity levels in real-time. Whether you're seeking to create the perfect indoor climate or simply stay informed about the surrounding conditions, this digital meter provides invaluable insights at your fingertips. Experience the convenience and precision of this all-in-one solution, revolutionizing the way we interact with our surroundings.

Product Specifications

- Temperature range: 5 ^{0}C – 85 ^{0}C
- Supply voltage: 5V DC
- Operating voltage: 5V DC
- 0.96" OLED display.
- RTC real-time clock

1.1 Design Implementation

1.1.1 Block Diagrams

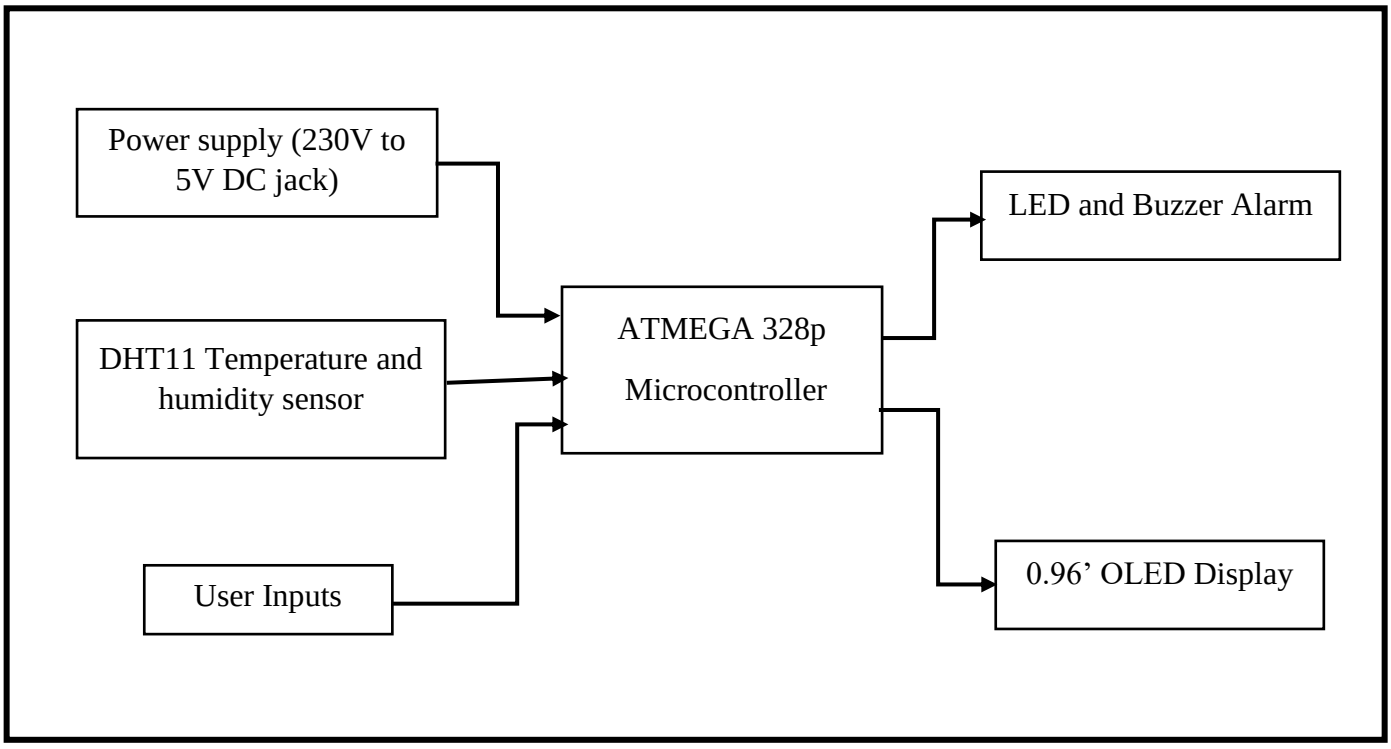
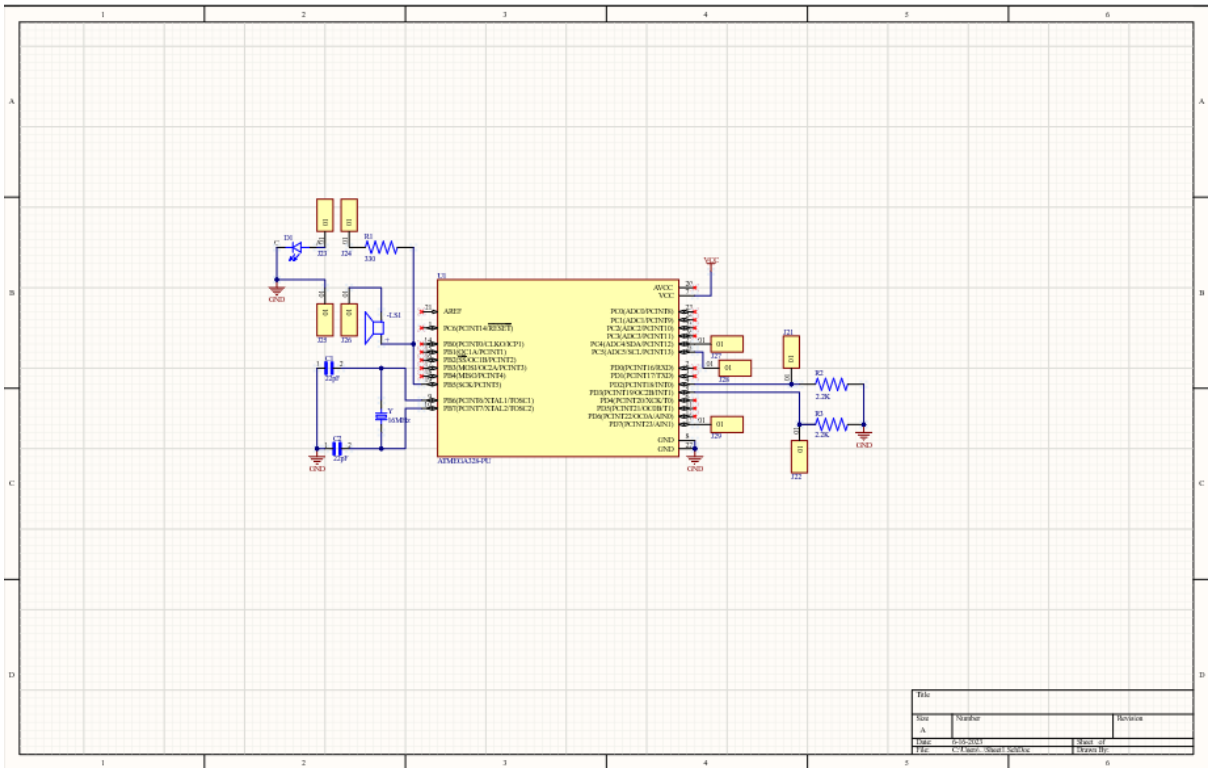
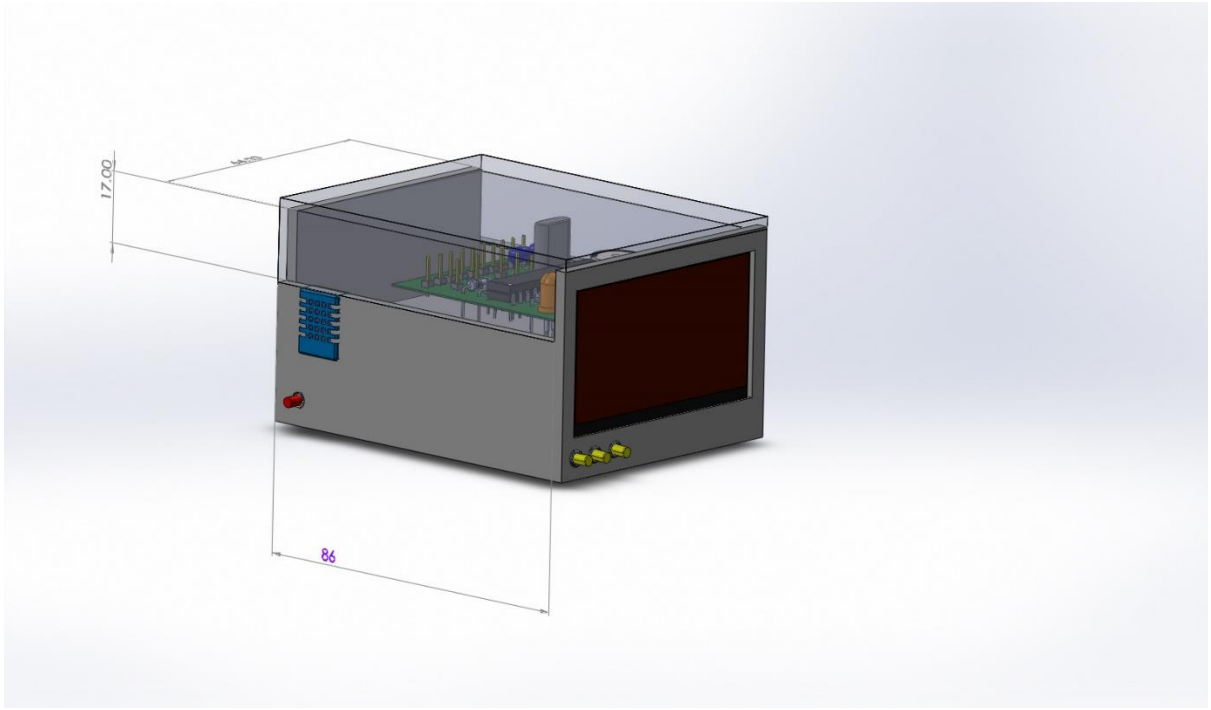


Figure: Initial Block Diagram

1.1.2 Schematic Design



1.1.3 Enclosure Design



2. Problems identified considering the course content delivered by Prof. Jayasinghe

After validating the above schematic diagram and the SOLIDWORKS design according to the lectures delivered about professional product design techniques and go through the process of proper design guidelines, the following issues in those designs are identified and taken into consideration for further designs.

2.1 Schematic Design.

- Components are numbered without an order.
- Input and Output blocks are not placed in correct positions.
- Direction of current flowing is not considered when designing the schematic design.
- Standard sheet sizes were not used.
- Correct wire connecting methods are not used.

2.2 Solidworks Design

- Moldability is not taken into consideration when designing. So draft analysis is not done, and draft angles are not applied to the design.
- Design is not professional and attractive only basic features are used when designing.
- Correct designing procedures are not followed. (Ex: - Initial sketching).
- Adding features like lips and groos and mounting bosses.

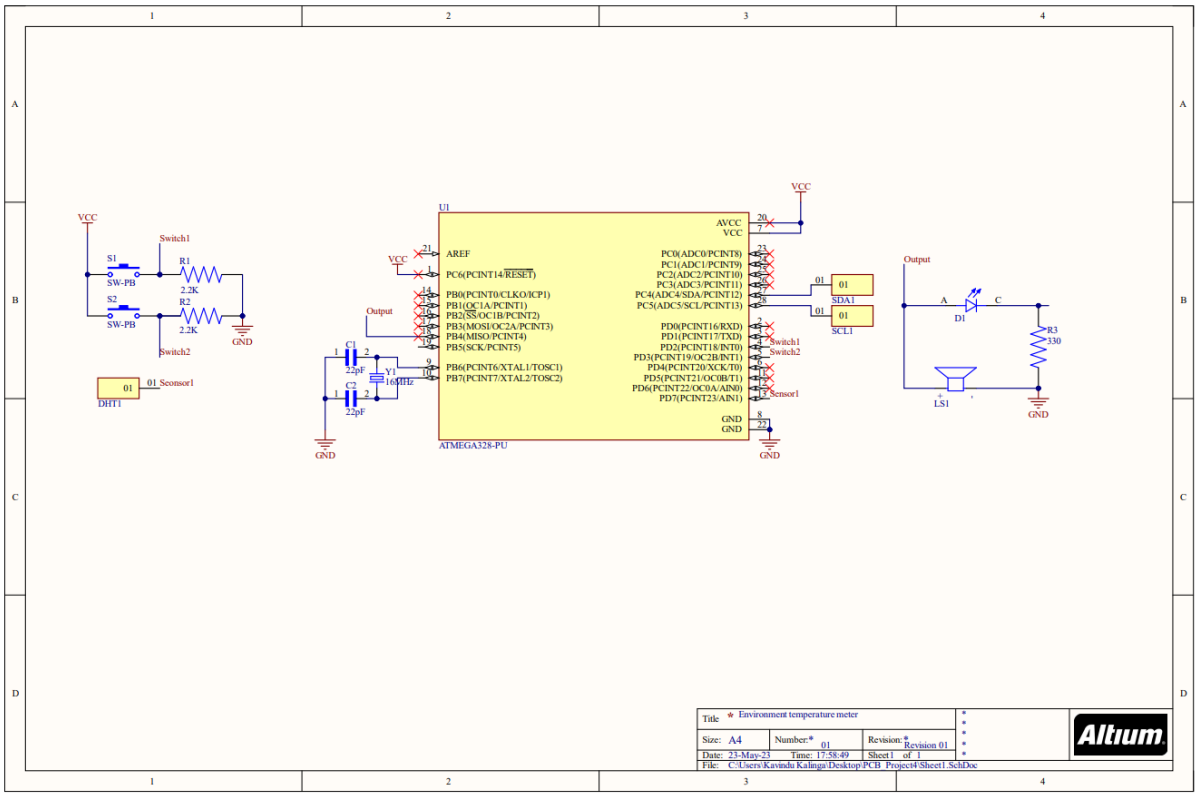
In addition to that,

- Design driven innovation concept.
- User centered design concept.
- Maintaining proper Documents.

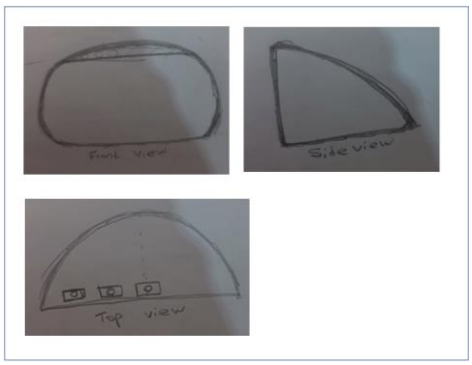
are the important concepts that we were learnt.

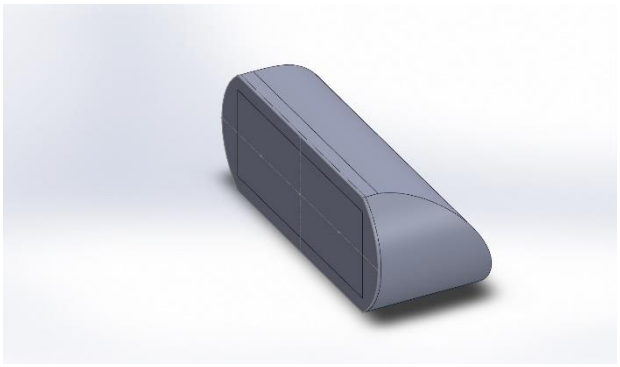
2.3 Corrections done after the course.

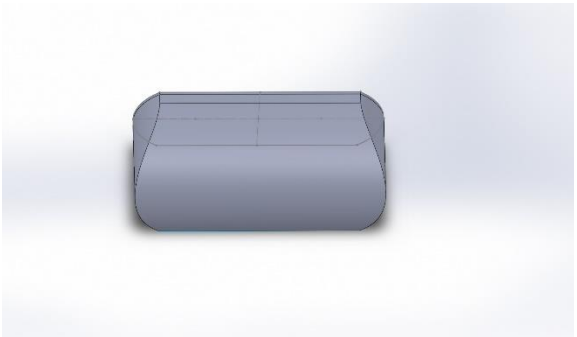
2.3.1 Schematic Design

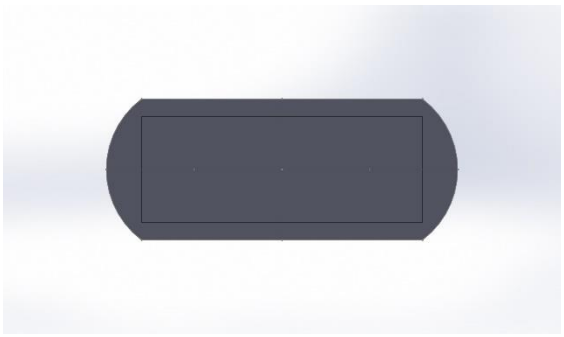


2.3.2 Enclosure Design









3. Problems/Improvements identified/proposed by members of your group.

Following the approach of design driven innovation students in our group performed some brainstorming sessions and through which we were able to come up with new ideas as well as identify some issues which I could not identified in my design. Coming to a conclusion, 3 alternative design ideas were taken into consideration for a better design.

The following are the 3 block diagrams proposed by the members of our group.

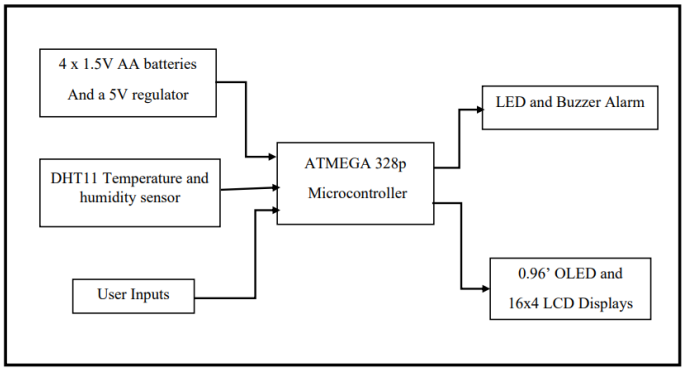


Figure: Block Diagram 1

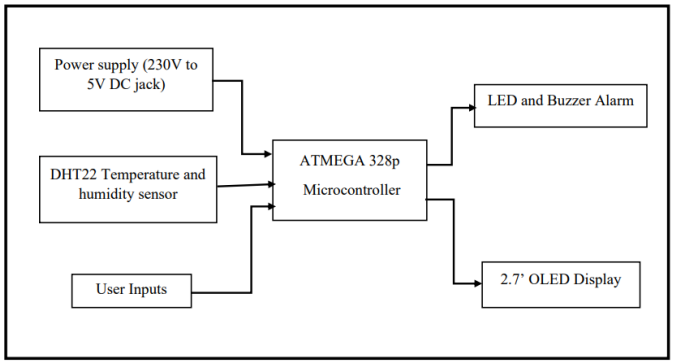


Figure: Block Diagram 2

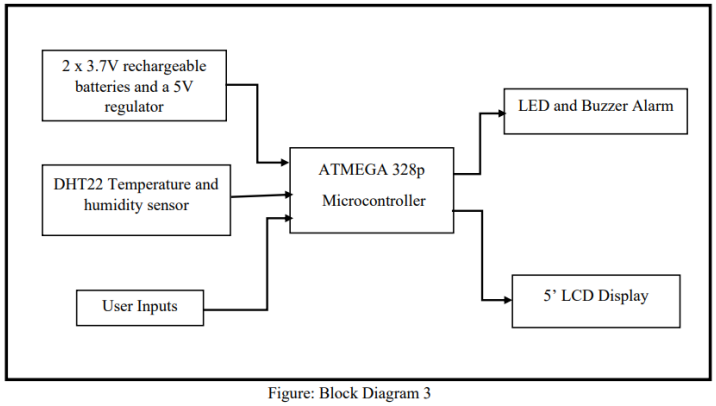


Figure: Block Diagram 3

And the following 3 enclosures were proposed by the members of the group.

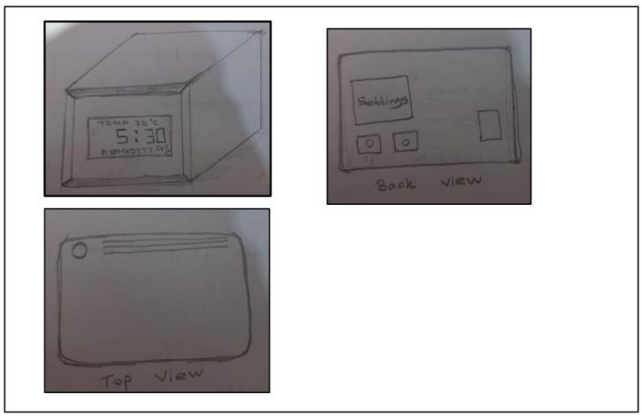


Figure: Enclosure 1

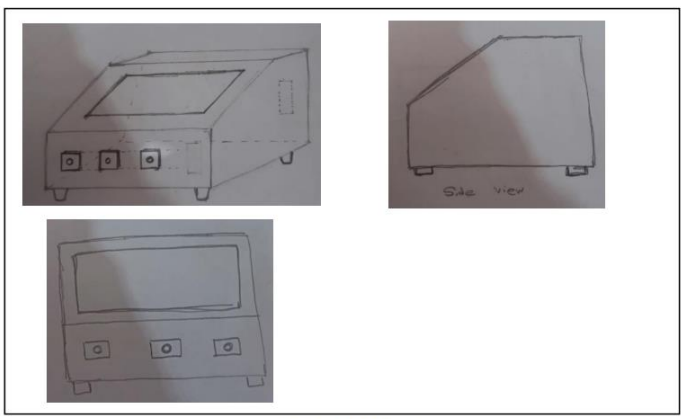


Figure: Enclosure 2

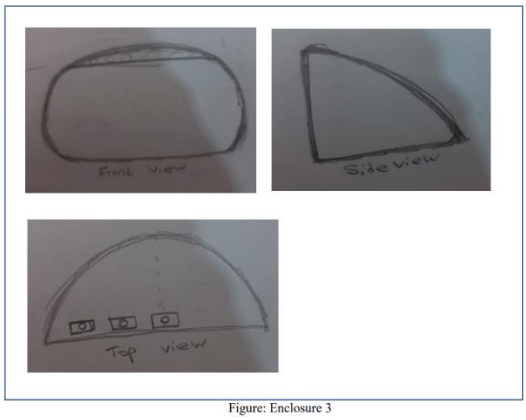


Figure: Enclosure 3

4. Problems/Improvements identified/proposed by users.

In designing with a user-centered approach, we prioritize incorporating user feedback to enhance our design. This involves presenting our initial design to users and gathering their preferences and suggestions. If they express approval for our concept, we proceed to implement their suggestions. However, if users do not demonstrate a genuine need for the product we have designed, we explore alternative options. Below are the suggestions we received from the public survey for the "Smart Energy Meter" and the corresponding improvements:

User Survey Recommendations:

- Adding feature of displaying air quality
- Connecting the device to mobile phone via Wi-Fi or Bluetooth then users can see the measurements using an app remotely.
- Predicting the temperature and humidity in the future by analyzing previous data
- Adding more than one threshold value to temperature to ensure that temperature is in a safe value.

There is no considerable change in the enclosure.

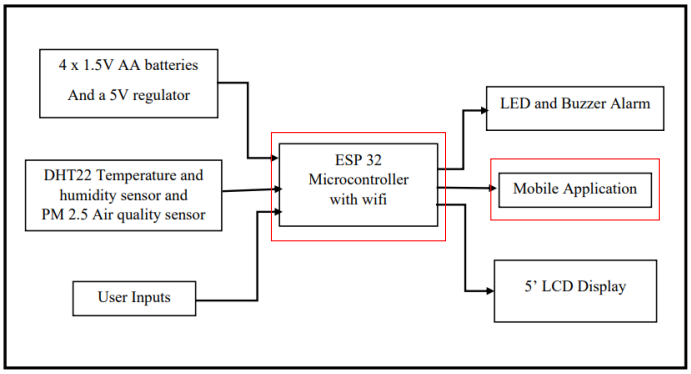


Figure: Block Diagram 4

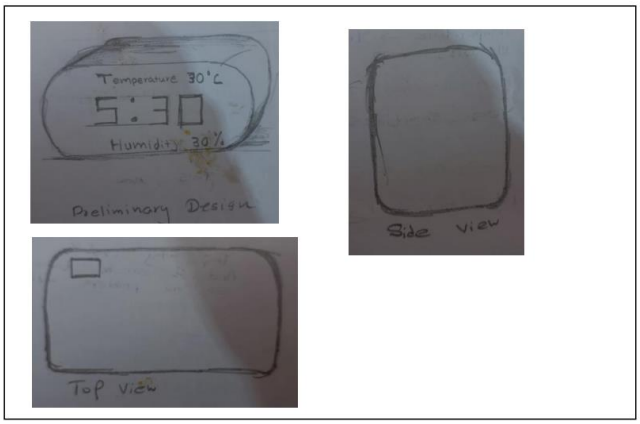


Figure: Enclosure 4

Then as a group of designers we evaluated those 4 designs according to 7 criteria.

(For Block diagram: Functionality, Accuracy, User Friendliness, Cost, Power Consumption, Reliability, Compatibility).

	Block Diagram 1	Block Diagram 2	Block Diagram 3	Block Diagram 4
Functionality	8	8	8	10
Accuracy	8	10	10	10
User Friendliness	6	7	9	10
Cost Effectiveness	9	8	8	6
Power Efficiency	7	9	8	7
Reliability	10	10	10	10
Compatibility	9	9	8	9
Total	57	61	61	62

(For SOLIDWORKS design: Durability, Attractiveness, Cost Effectiveness, User Safety, Compatibility, Repairability, Weight and Hardness)

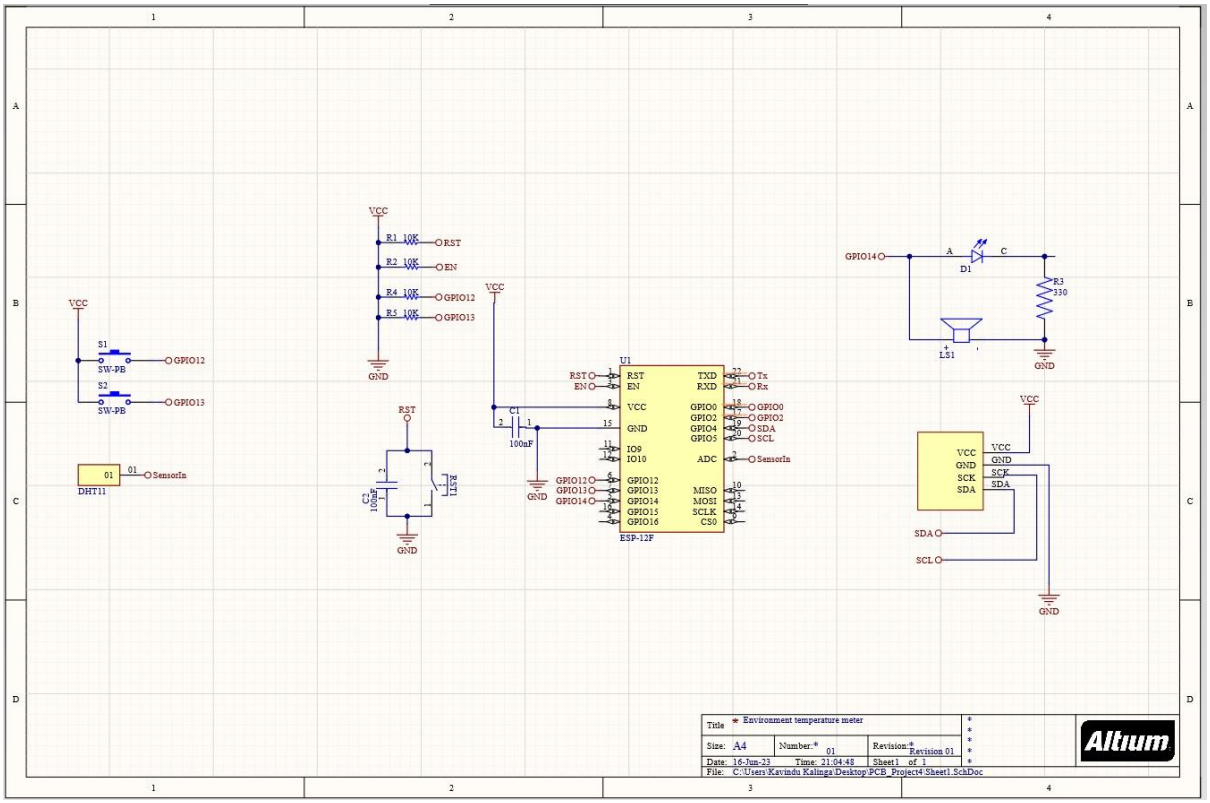
	Enclosure 1	Enclosure 2	Enclosure 3	Enclosure 4
Durability	10	8	9	9
Attractiveness	4	6	8	8
Cost Effectiveness	10	8	7	6
User Safety	8	8	8	8
Compatibility	8	8	9	9
Repairability	10	8	10	10
Weight and Hardness	7	8	9	9
Total	57	54	60	59

Then according to the evaluated results, Block diagram 4 and the enclosure 3 are the most productive designs which align with evaluation criteria.

5. Schematic and Solid work design of the improved design

5.1 Improved Schematic Design

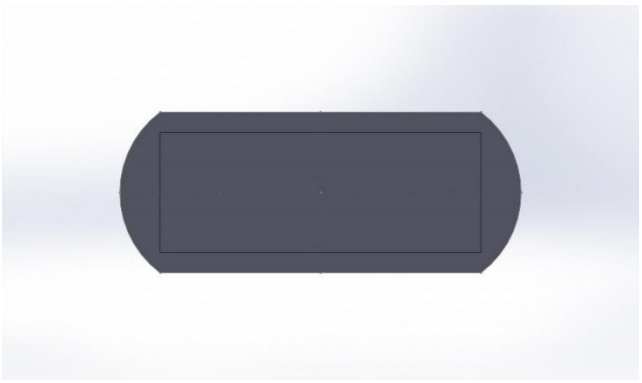
Block diagram 4 is selected.



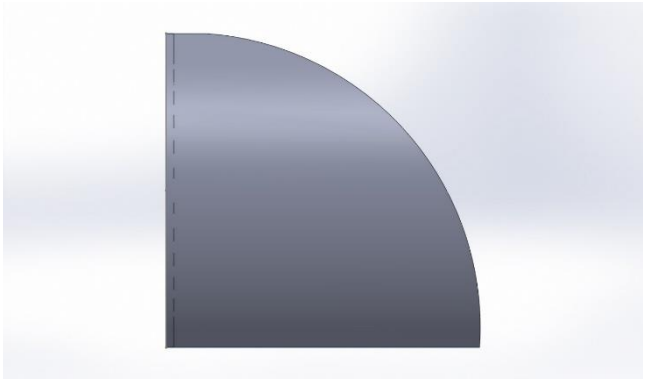
5.2 Improved Enclosure Design

The enclosure design 3 is selected.

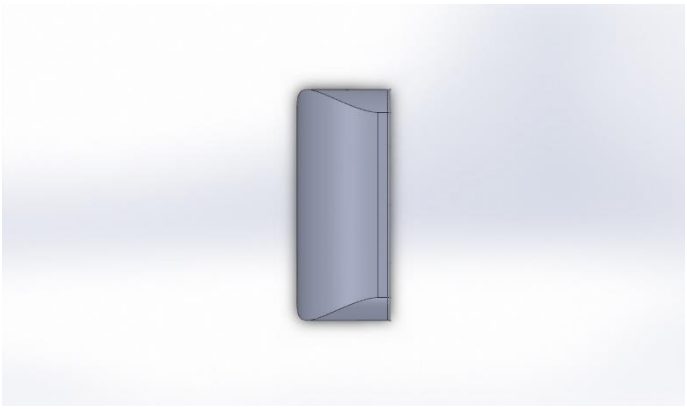
Front View

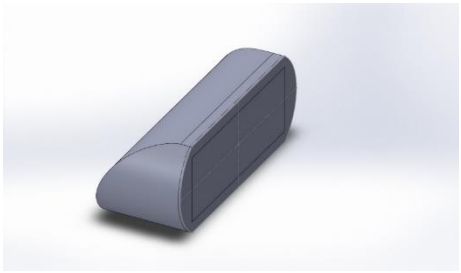


Side View



Top View





Design Tree