Department of Electronic & Telecommunication Engineering
Faculty of Engineering
University of Moratuwa

Electronic Design Realization - MP3 Player

Conceptual Design

Bandara D.M.D.V.
Undergraduate (Biomedical engineering)
Department Electronic and Telecommunications
Faculty of Engineering
University of Moratuwa

June 1, 2023

Contents

Proposed Design - Original Interpretation

The following design is my very own interpretation of a MP3 player with the additional charging functionality.

Initial - Block Diagram

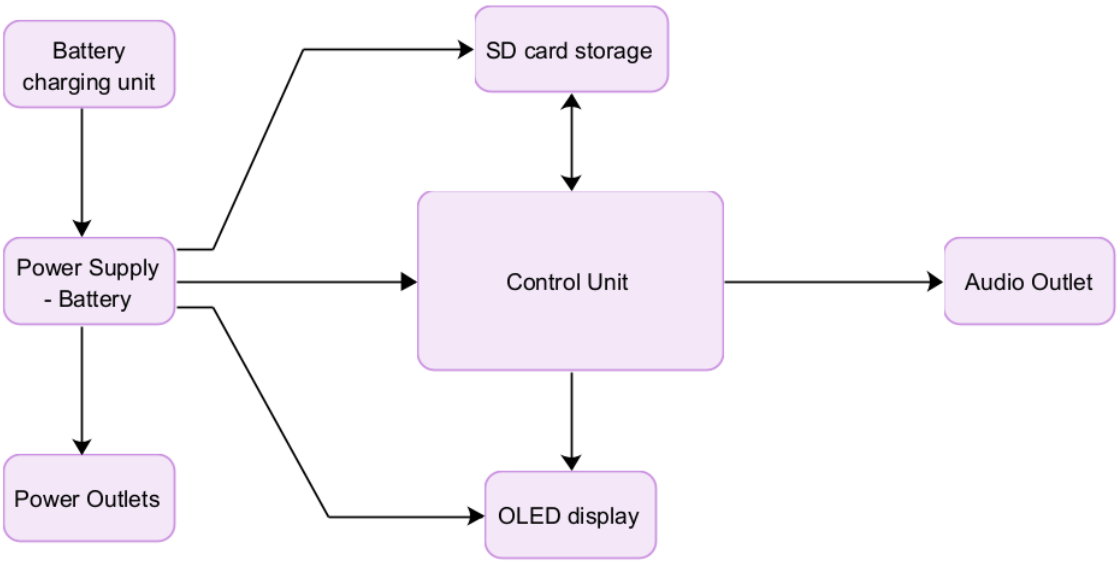


Figure 1: Initial - Block Diagram

Initial - Sketch

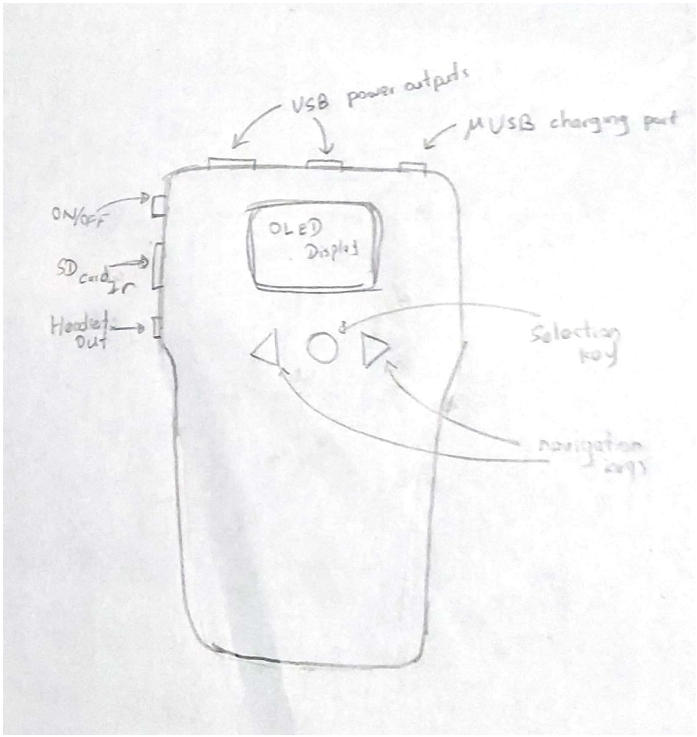


Figure 2: Initial - Sketch

Proposed Specifications

- 9600mAh battery can ensure a longer period of non-interrupted music.
- Songs are stored in a SD card storage.
- 3.5mm Headset Outlet is used to give Sound output.
- USB outlet to charge two devices at the same time.
- 3 Buttons to navigate through songs and control Volume
- OLED display to show the soundtrack number, Volume.
- Micro_USB Inlet to recharge the device

Then this design was subjected to 3 iterations of design-driven innovation cycles which lead to 3 new designs which are included in this report. The group members who actively contributed to the design cycle are,

1. Bandara H.M.S.D. - 200064C
2. Chandira R.M. - 200082E
3. Hewavitharana M.I. - 200220D
4. Marasinghe M.M.H.N.B. - 200381U
5. Pramuditha A.A.H. - 200476P
6. Samarasekera A.M.P.S. - 200558U
7. Wijetunga W.L.N.K - 200733D

And together, we came up with the following three designs.

Design-Driven Innovation

Design 1

The first suggestion that everyone agreed upon was to change the traditional design of the enclosure. Disk shape was the one most agreed upon which allowed the design to be very thin and easy to carry(thin like a book). Also, there is a slit to easily wind the earpiece wires and in the back a dent for the ends to be clipped in. I have to change to a thin LIPO battery to achieve these specifications.

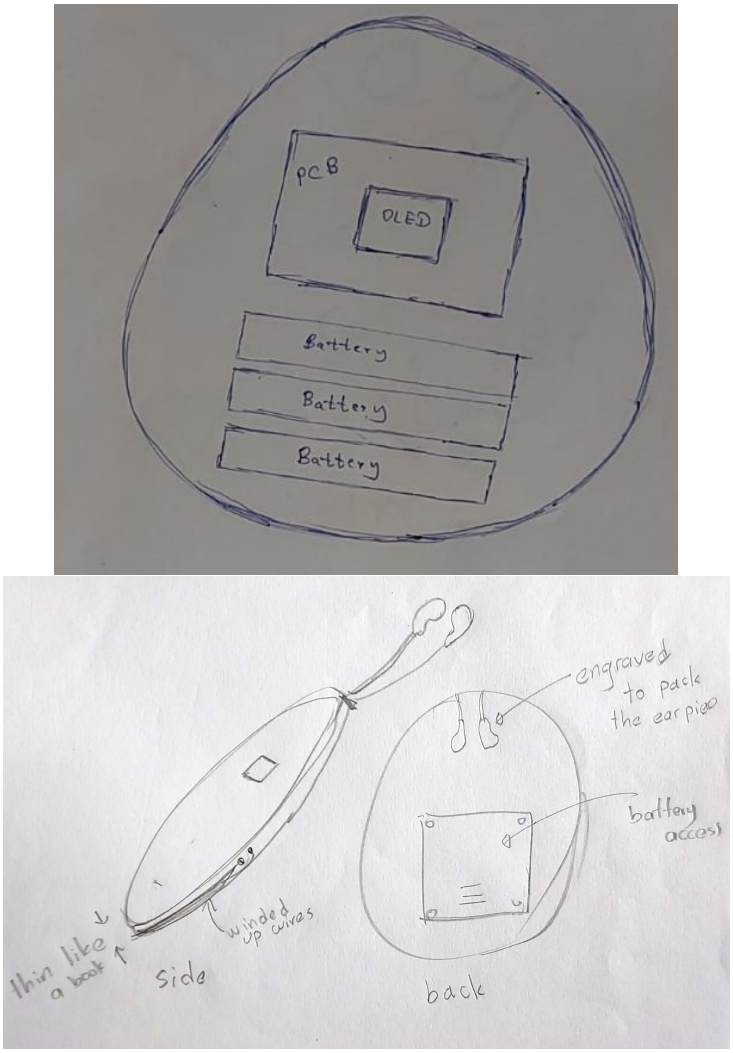


Figure 3: Design 02 - sketches

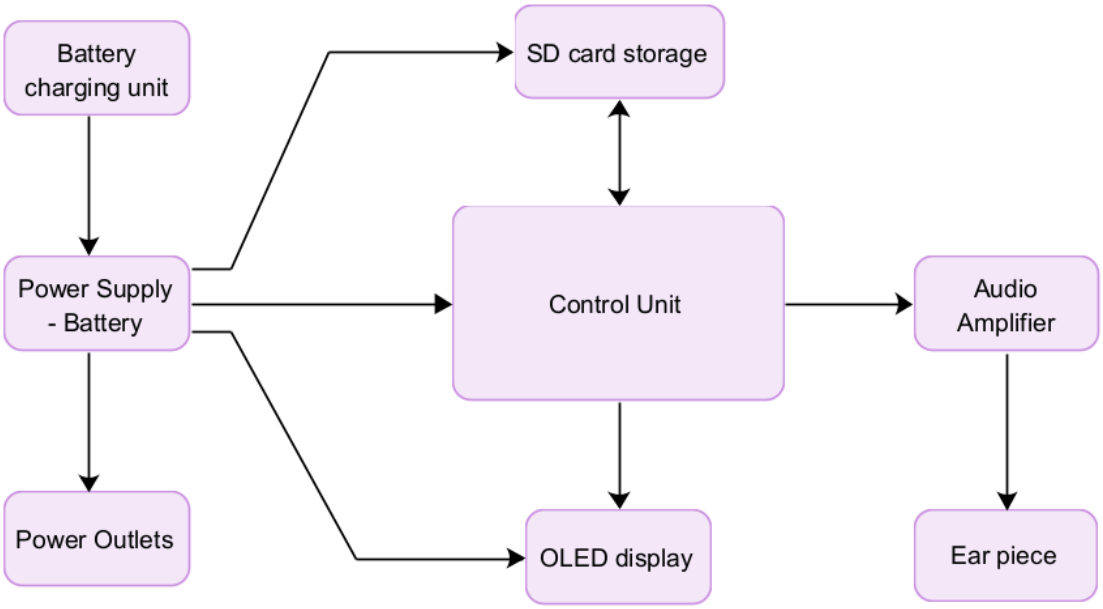
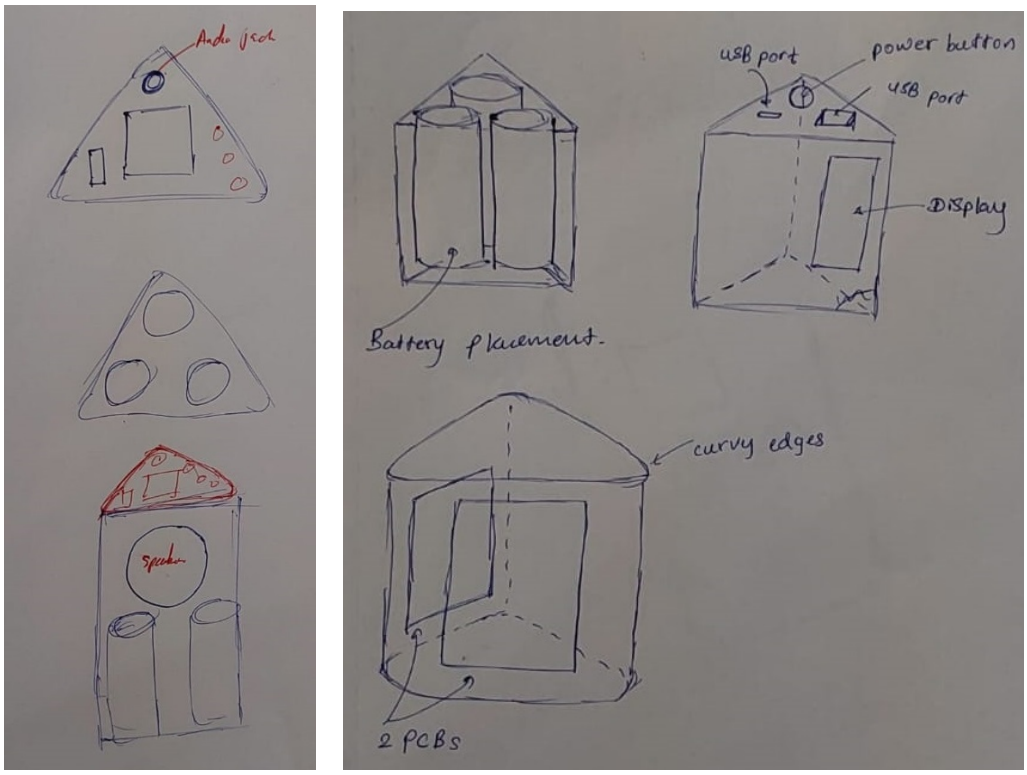


Figure 4: Design 01 - Block Diagram

Design 2

In addition to the earpiece outlet, adding a speaker and making it in the shape of traingular prism. Two versions of designs were proposed one with side display and the other with the display on top.



(a) Version 1.0 **(b)** version 2.0

Figure 5: Design 02 - sketches

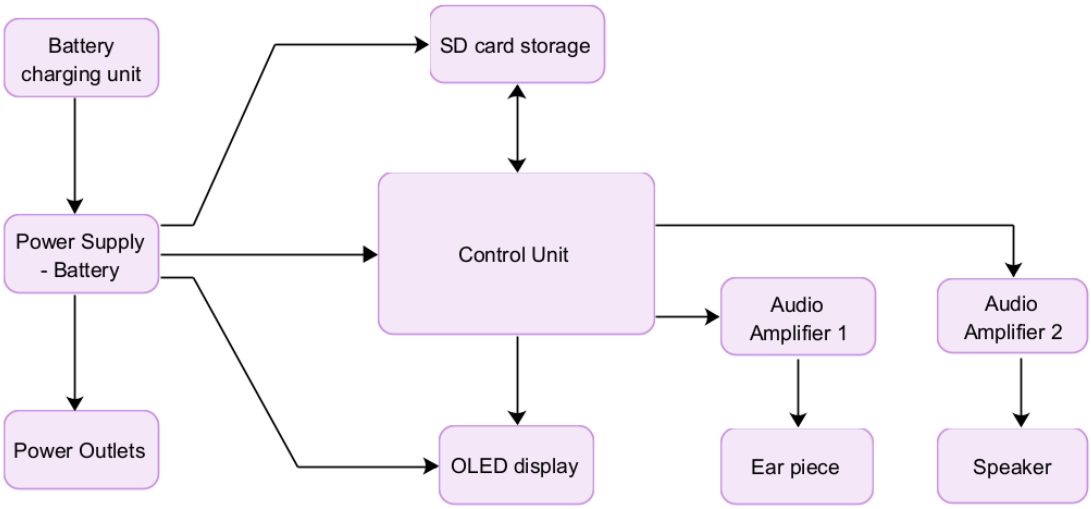


Figure 6: Design 02 - Block Diagram

Design 3

Similar in design to the original but with an inbuilt speaker, Bluetooth functionality, and velcro/clip-on method to easily attach it to the flaps of common bags. This design should be designed to play high-quality music through its in-built speakers.

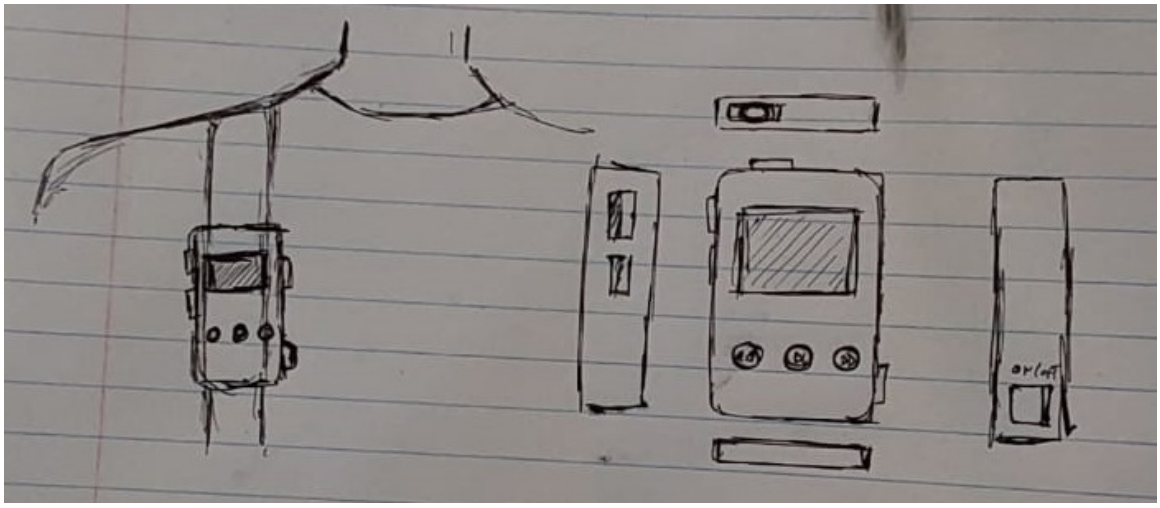


Figure 7: Design 03 - sketch

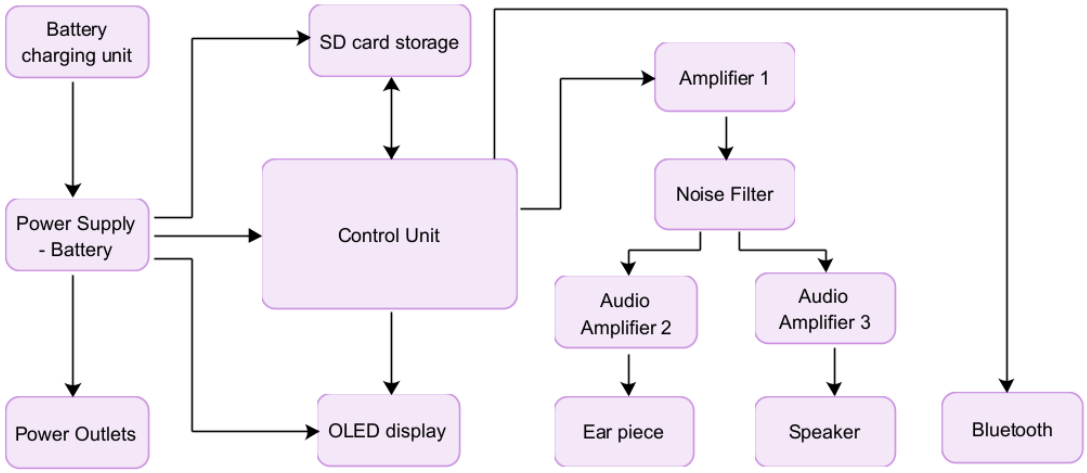


Figure 8: Design 03 - Block Diagram

User-centered design

User survey

With the initial design, we surveyed some of the other university undergraduates and outside personnel to get diverse user feedback and identify flows, and improvements they might expect. For this, we have created a questionnaire including the following questions.

Questionnaire

1. Your current profession?
2. Will you use or need something like this?
3. At what price point would you like to buy such an item?
4. On a scale of 1-5, how would you rate our product considering other similar products in the market as the midline (Rating 3)
5. What other specifications would you like to add to this design? How can we make this to your likeness?
6. Any other comments on the Product?

We received seven such completed question sets within the allocated period of two hours and the results per each question are summarized below.

User Feedback

1. Our sample of users included a businessman, a School student, a Construction worker, a factory worker, and three undergraduates and one of which was a part-time musician.
2. Most did say that their mobile can play music but since this has an extended battery life and also can charge your mobile phone we received sufficient constructive feedback about the idea.
3. The average scaled rating we got was 4.143 Which is satisfactory.
4. Improvement wise there are a few suggestions which we have used below to improve our device as shown below.
5. Few said that the Mp3 players are a bit outdated and not using them anymore. Hence the market will be low.

With the suggestion of our sample users, we have short-listed the specifications as follows.

Selected specifications

- Bluetooth compatibility to transfer music and connect to wireless earbuds/ headphones
- Battery size can be reduced using a lipo battery and overlaying it with the circuit, hence the whole device size can be reduced.
- Build an inbuilt speaker with quality sounds
- Touch-screen to navigate the system menu.

Rejected specifications

We had to reject a few of the user specifications as those are not necessary and are used by anyone in this kind of device.

- Using a portable USB stick to store songs in addition to the SD card storage.
- Radio functionality

Design 4

Following the design cycle specified in the reference, we were able to come up with the following design with the additional features we mentioned above.

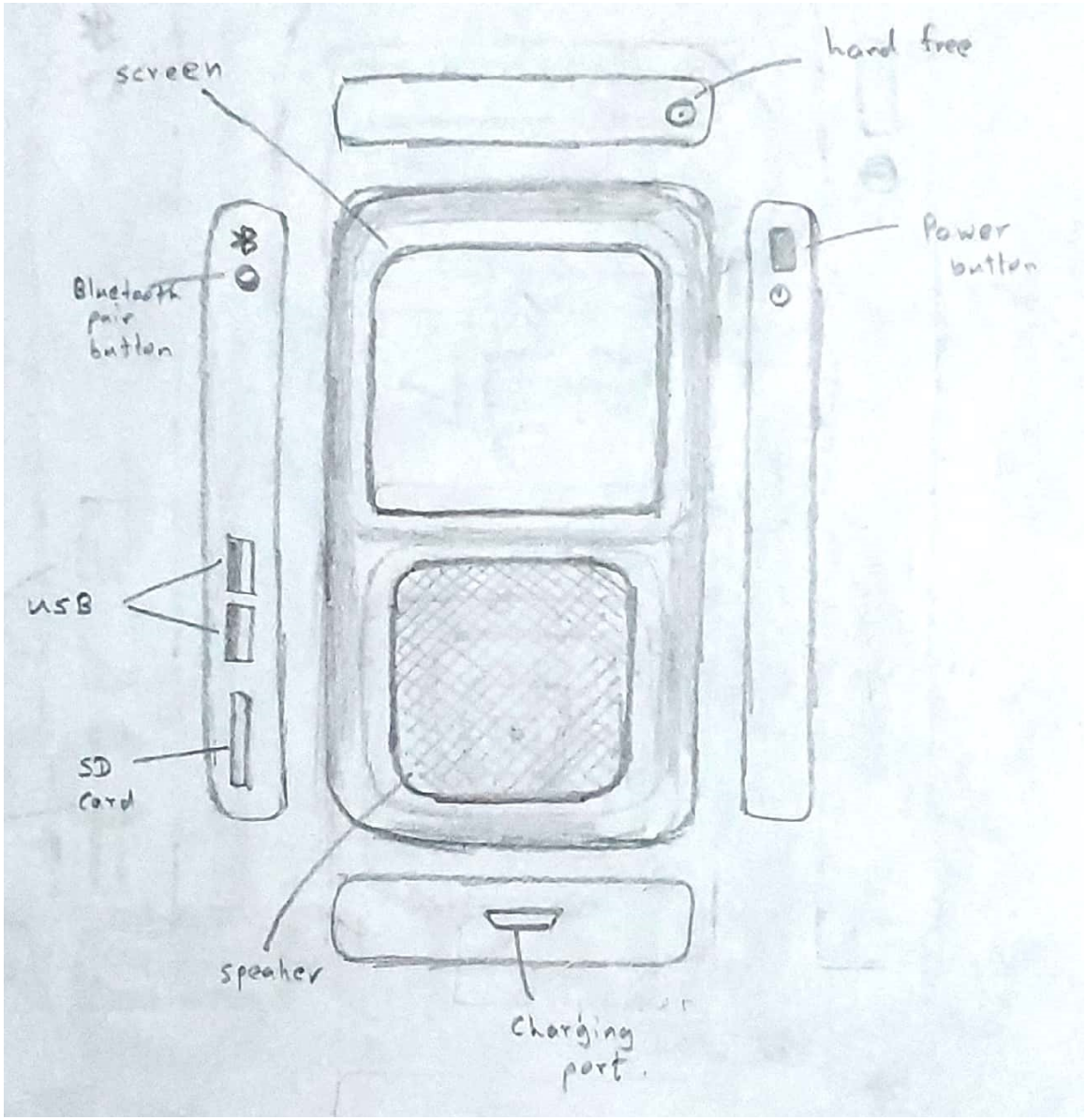


Figure 9: Design 04 - sketch

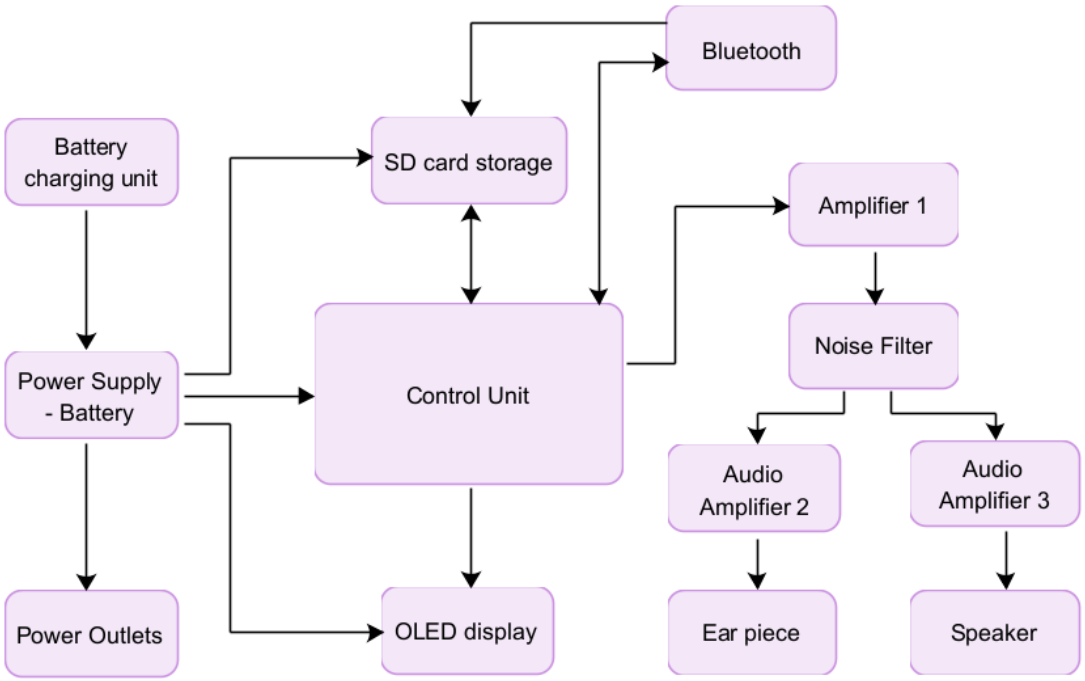


Figure 10: Design 04 - Block Diagram

Selection Matrix

Taking the Initial Sketch as the Baseline (0 marks), the following matrix is used to select the best design.

For Sketches

The criteria used for the selection of the best design sketch are,

1. Ergonomics - How well does the device fit in the user's hand?
2. User Safety - Is it safe to use?
3. Durability - Is the design going to last a long time or will it break?
4. Accessibility - Is the design easy to use, and easy to control?
5. Weight and portability - Is the design easy to carry around?
6. Manufacturing cost - Will the design be cheap?
7. Overall look - IS the finishing look appealing to the majority of users?

Objectives	Weight	Design 01	Design 02	Design 03	Design 04
Ergonomics	5	-1	+1	0	0
User Safety	10	0	0	+1	+1
Durability	10	-1	+1	-1	-1
Accessibility	7	+1	-1	0	+1
Weight and portability	10	+1	0	+1	0
Manufacturing Cost	5	-1	-1	0	-1
Overall look	3	-1	+1	+1	+1
Final score - sketch		-6	6	13	5

Table 1: Screening sketches

For block diagrams

The criteria used for the selection of the best block diagram are,

1. Quality - Is the music quality better?
2. User-friendly interface - Is the user interface easy to use?
3. Functionality - Are the functions of the devices improved?
4. Accessories - Whether the supported amount of accessories such as headphones, and ear pieces have increased or not?
5. Manufacturing cost - Will the schematic design/parts be cheap?
6. Power efficiency - Will the battery last longer?
7. Scalability/Modularity - Will the design allow future improvements? Is it easy to replace certain parts separately?

Objectives	Weight	Design 01	Design 02	Design 03	Design 04
Quality	10	0	0	+1	+1
User-friendly interface	5	0	0	0	+1
Functionality	10	+0.25	+0.5	+0.5	+1
Accessories	5	0	0	+1	+1
Manufacturing cost	4	-1	-1	0	-1
Power efficiency	8	-1	0	0	-1
Scalability/Modularity	3	0	0	0	-1
Final score - Block Diagram		-9.5	1	20	15

Table 2: Screening block diagrams

Objectives	Design 01	Design 02	Design 03	Design 04
Sketch	-6	6	13	5
Block diagrams	-9.5	1	20	15
Total score	-15.5	7	33	20

Table 3: Results

Conclusion

In conclusion the best design from the design cycles is the design 03 given in Figure 7 And 8.

Reference

- Article : Inclusive Design Toolkit ,Concept design process, University of Cambridge