Centre of Excellence (CoE), a MeitY and U.P. Government sponsored project implemented by CDAC Noida and India Cellular & Electronics Association (ICEA)

Grand Challenge Contest 2021

Design Report

General Information:

Team Name	Speaker
Registered Email ID	20je0109@pe.iitism.ac.in
Problem Statement Code	P-007
Problem Statement	To design a low cost Bluetooth Headset:

Team Details:

	Team Lead	Team member1	Team member2
Name	Aman Pandey	Aman Kanojiya	Shashvat Jain
College/Industry Name	Indian Institute of Technology (Indian School of Mines) Dhanbad	Indian Institute of Technology (Indian School of Mines) Dhanbad	Indian Institute of Technology (Indian School of Mines) Dhanbad
Address of College/Industry	Police Line Road, Main Campus IIT (ISM, near Rani Bandh, Hirapur, Sardar Patel Nagar, Dhanbad, Jharkhand 826004	Police Line Road, Main Campus IIT (ISM, near Rani Bandh, Hirapur, Sardar Patel Nagar, Dhanbad, Jharkhand 826004	Police Line Road, Main Campus IIT (ISM, near Rani Bandh, Hirapur, Sardar Patel Nagar, Dhanbad, Jharkhand 826004
State	Jharkhand	Jharkhand	Jharkhand
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Phone No.	7757897084	6354783970	9582496558

Checklist of files to be attached with the e-mail:

1) Attached Schematic file (PDF format): ☐Yes ☐No
2) Attached Layout file (PDF format): ☐Yes ☐No
3) Attached BoM list* (PDF format): ☐Yes ☐No
4) Attached Gerber files(zip format or compressed format): ☐Yes ☐No
5) Attached Centroid (Pick and Place) file*: ☐Yes ☐No
6) Attached IPR undertaking form (PDF file): ☐Yes ☐No

*According to the format mentioned in this document

a) Hardware Tools used:

1. Quad 3W Fullrange Speakers (4Ω - 35mm drivers)
2. Quad 3W High Efficiency Amplifier (AD620)(class AB)
3. Li-Po Battery 1300mAh (20hrs Playback)
4. Battery Charger
5. Boost Converter
6. Bluetooth Module
7. Driver
8. Conformal Coating
9. Speaker Crossover
10. Speaker Chassis
11. Speaker Box
12. Rubber Mounting Gasket

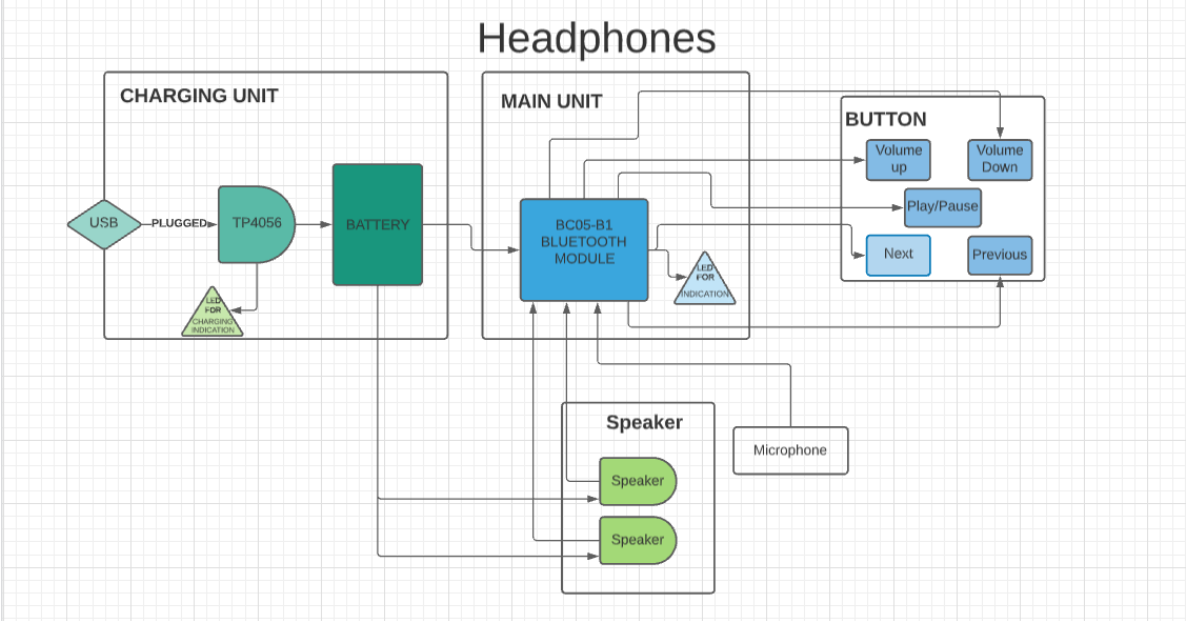
b) Software tools used:

1. Autodesk Eagle (Schematic PCB and Gerber files)
2. LucidChart (Block Diagram)

c) Technical specifications of the product:Noise control

1. High Bass
2. Easy Pairing
3. Durability
4. Long battery life
5. Waterproof upto _ m
6. Low cost
7. Bluetooth connectivity with 10m range

d) Detailed Block diagram of the product design

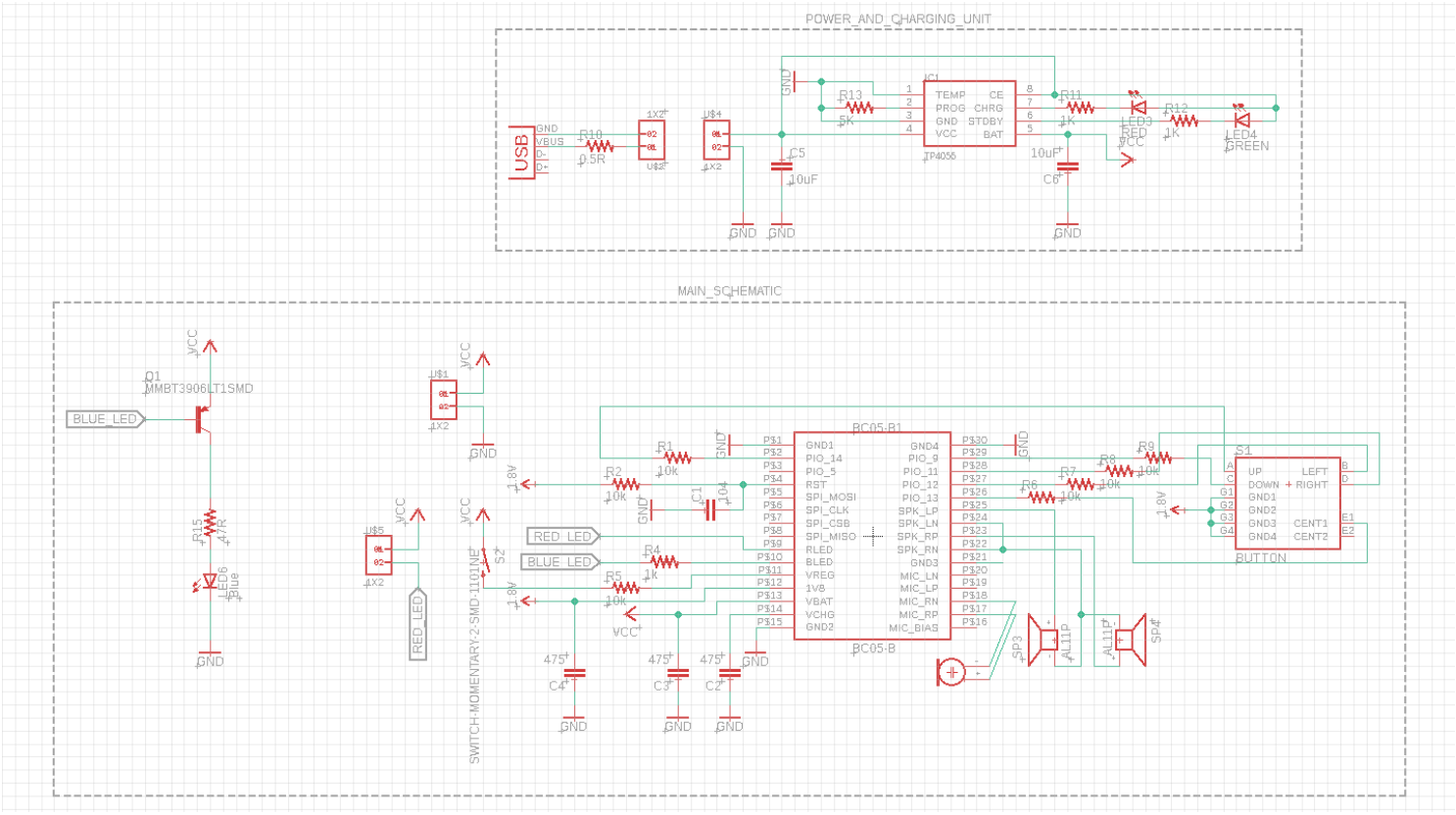


2) New/Extra features incorporated in the product design

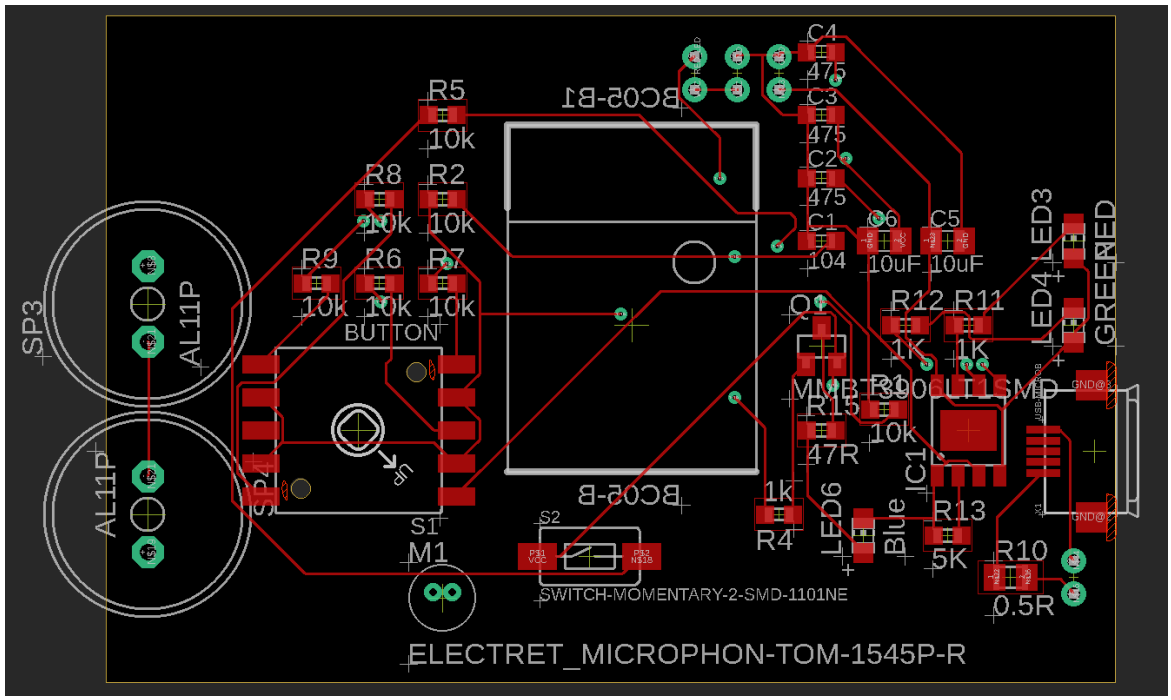
1. Noise Control
2. High Bass
3. Easy Pairing
4. Durability
5. Long battery life
6. Waterproof upto _ m
7. Low cost
8. Bluetooth connectivity with 10m range

3) Detailed explanation of circuitry (with respect to block diagram):
In this Bluetooth-based speaker, we are using the central unit as BC05, a height range Bluetooth so that the user can communicate with the speaker from large distances. It collects the Signal and converts it to analog. We can program this module using PIO pins to control the Volume, play the next song, etc., as per the buttons. We have put some LED's to specify the task it is performing. The central unit helps us to connect all parts we have built. The filters in it will filter the Signal and can provide the best result in the output. We are taking this Signal from the central unit to instrumentation amplifier AD602, which amplifies the pure Signal. This amplified Signal is taken as the output from the central output and sent to the speaker. We added the Charging unit, which has a USB B charging the battery. We are using TP4056 and a LED to indicate the charging status.

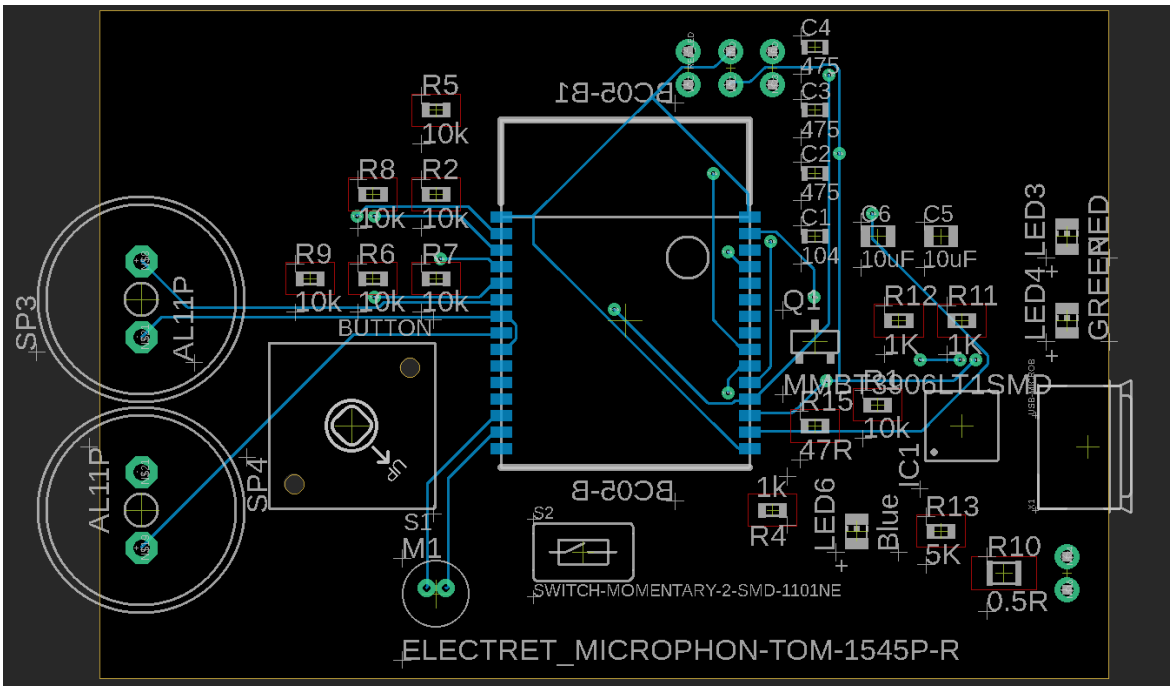
4) Screenshot of Schematic of the product design:(screenshot not exceeding 1044 x 749px)



5) PCB Layout TOP layer (screenshot not exceeding 1044 x 749px):



6) PCB layout Bottom layer (screenshot not exceeding 1044 x 749px):



8) Gerber Files description:

9) Board dimensions: Width 40.31(mm) x Height 60.94 (mm)

10) Number of layers of the PCB: 02

12) What are the factors considered to improve the efficiency in your product design?

- We can use Better Amplifier for Better Quality
- We can add small Display to view the commands on screen
- Like many upcoming speakers, we can make our speaker waterproof and make it more feasible for the users.
- A fun party addition to a Bluetooth speaker is lighting or water-dancing effects.
- We can bring the bluetooth speaker in different shapes and sizes according to our customer's lifestyles.

16)Bill of Material (BoM) Sample:

No.	Name of the component (as mentioned in the schematic)	Description	Manufacturer Part Number	Manufacturer	Quantity	Unit cost (in INR)	Total Cost (in INR)
1	R1, R2, R5, R6, R7, R8, R9	*10k ohm*	R-US_R0603	*Mouser*	*1 each*	*Rs.7.43*	*Rs. 52.01*
2	*R10*	*0.5 ohm*	R-US_M0805	*Mouser*	*1*	*Rs.7.43*	*Rs.7.43*

3	R4, R11, R12	*1k ohm*	R-US_R0603	*Mouser*	*1 each*	*Rs.7.43*	*Rs. 22.29*
4	R13	*5k ohm*	R-US_R0603	*Mouser*	*1*	*Rs.7.43*	*Rs. 7.43*
5	R14, R15, R16	*47 ohm*	R-US_R0603	*Mouser*	*1 each*	*Rs.7.43*	*Rs. 22.29*
6	C1	*104*	C-EUC0603K	*Mouser*	*1*	*Rs.18.48*	*Rs. 18.48*
7	C5, C6	*10 uF*	C-EUC0805K	*Mouser*	*1 each*	*Rs.18.48*	*Rs. 36.96*
8	C2,C3, C4	*475*	C-EUC0603K	*Mouser*	*1 each*	*Rs.18.48*	*Rs. 55.44*
9	SP1, SP2	Buerklin Speaker	AL11P	*Buerklin*	*2*	*Rs.244.11*	*Rs.488.22*
10	BC05-B1	*wireless speaker module*	BC05-B	*Shenzhen Rainbowsemi Electronics*	*1*	*Rs.7.5*	*Rs.7.5*
11	S1	*Button*	Button	*Electronics Comp*	*1*	*Rs. 6*	*Rs. 6*
12	LED5, LED6, LED7	*Blue CHIPLED 0805*	LEDCHIP-LED0805	*Kingbright*	*3*	*Rs.9.32*	*s.27.96*
13	LED4	*Green CHIPLED 0805*	LEDCHIP-LED0805	*Kingbright*	*1*	*Rs.9.32*	*Rs.9.32*
14	LED3	*Red CHIPLED 0805*	LEDCHIP-LED0805	*Kingbright*	*1*	*Rs.9.32*	*Rs.9.32*
15	X1	USB-MICROB	USB-MICROB	*KTRon*	*1*	*Rs. 4.57*	*Rs 4.57*
16	IC1	TP4056	SOP-8	*KTRon*	*1*	*Rs. 7.39*	*Rs 7.39*
17	Q1	*PNP Transistor*	MMBT3906LT1SMD	*Taitron*	*1*	*Rs. 2.25*	*Rs 2.25*
18	IC2, IC3	*Instrumentation Amplifier*	AD620	*Texas Instruments*	*2*	*Rs. 249*	*Rs. 498*

						Total	*Rs. 1282.86*

17)Centroid (Pick and Place) file format:

Designator	X-position	Y-position	Rotation	Layer
BC05-B1	135.89	19.58	0.00	Bottom

Designator	X-position	Y-position	Rotation	Layer
C1	129.54	35.56	0	Top
C2	125.73	35.56	0	Top
C3	121.92	35.56	0	Top
C4	118.11	35.56	0	Top
C5	148.59	11.43	0	Top
C6	148.59	15.24	0	Top
IC1	151.13	21.59	90	Top
IC4	107.95	15.24	0	Top
IC5	107.95	24.13	0	Top
LED3	151.13	30.48	90	Top
LED4	157.48	30.48	90	Top
LED6	100.33	33.02	0	Top
Q1	109.22	31.75	0	Top
R1	121.92	16.51	0	Top
R10	157.48	15.24	0	Top
R11	146.05	30.48	0	Top
R12	146.05	26.67	0	Top
R13	152.4	15.24	0	Top
R15	105.41	31.75	90	Top
R2	137.16	35.56	0	Top
R4	118.11	16.51	0	Top
R5	114.3	16.51	0	Top
R6	129.54	39.37	0	Top
R7	133.35	39.37	0	Top
R8	137.16	39.37	0	Top
R9	133.35	35.56	0	Top
S1	118.11	25.4	90	Top
S2	119.38	11.43	0	Top
X1	157.13	22.86	90	Top

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