VRC HIGH SCHOOL
REVERSE ENGINEERING

CD PLAYER

Team 78116a
LONDON, ENGLAND

Daniel-Samuel, Alex, Adi, Suren, Faraz

INTRODUCTION

“What is a CD player?”

The mere notion of this question may shock some listeners. Yet, it remains frequently asked in rising generations.

Such a question was also bewilderedly framed to us from a good friend of ours. So, we sought to explain this “relic of ancient” history to them. Whilst somewhat obsolete, the fading culture surrounding the CD era is to be marvelled at, which subsequently paved the way for the new digitalised audio formats/devices we see today.

Despite originally being invented in 1982, this device synthesises complex sound from binary data on mere bumps on an aluminium coated polycarbonate disk.

Alongside, our CD player possesses USB ports, volume control, an audio jack and much more, making it a viable challenge to analyse, as a farewell to their epoch.

PARTS LIST


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
18
18
19
22
23
24
25
26
27
20
21
44
41
42
43
40
39
28
29
30
31
32
33
34
35
36
37
38

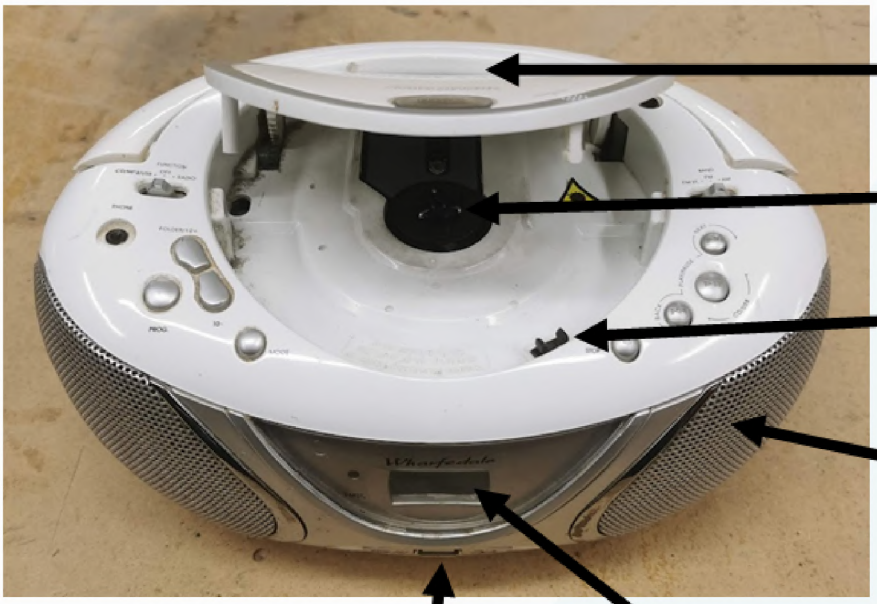
PARTS LIST

1. Speaker grates
2. Speaker modules
3. Speaker module mounting screws
4. Speaker stabilising mounts
5. Button control boards
6. Transformer
7. Transformer mounting screws
8. Connecting cable between primary motherboard and secondary board
9. Mounting brace for power port
10. Power input port mounting screw
11. Power input port
12. USB port
13. USB port mounting screws
14. Disk reading control board protective cover
15. Disk reading control board
16. LCD display
17. Motherboard stabiliser
18. Limit switch
19. Main (primary) motherboard
20. Disk Reading mechanism shock absorbent spacers
21. Limit switch mount
22. Disk Reading/spinning laser module thingy
23. Wire for disk reading thingy
24. Mounting Bracket for disk reading motherboard
25. 2nd mounting bracket for disk reading motherboard
26. Ribbon cable for lcd
27. Structural standoff
28. CD player structure assembly screws
29. Main motherboard mounting screws
30. Disk reading motherboard mounting screws
31. Laser module mounting screws
32. Limit switch mounting screws
33. Disk reading motherboard brace screws
34. Button Board mounting screws
35. LCD mounting screws
36. USB port mounting screws
37. Audio jack mounting screws
38. Speaker grille mounting screws
39. Battery cover
40. Bottom structural body piece
41. Motherboard stabiliser screw
42. 2nd motherboard stabiliser
43. Motherboard stabiliser screws
44. Spring piece for CD player opening top

OVERVIEW OF CD PLAYER

Front View

Front Isometric View



Top View

OTHER FEATURES

Power input port

Volume Control

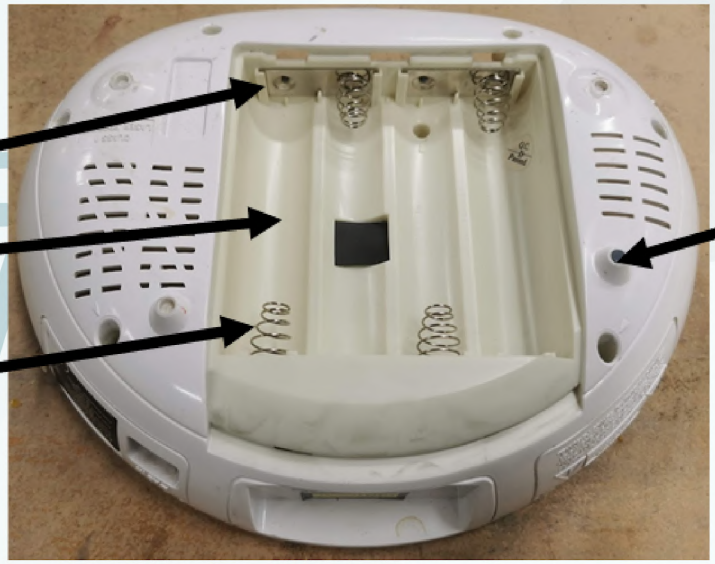
Sliding Battery Cover

Grates to allow air flow + cooling

Positive Terminal

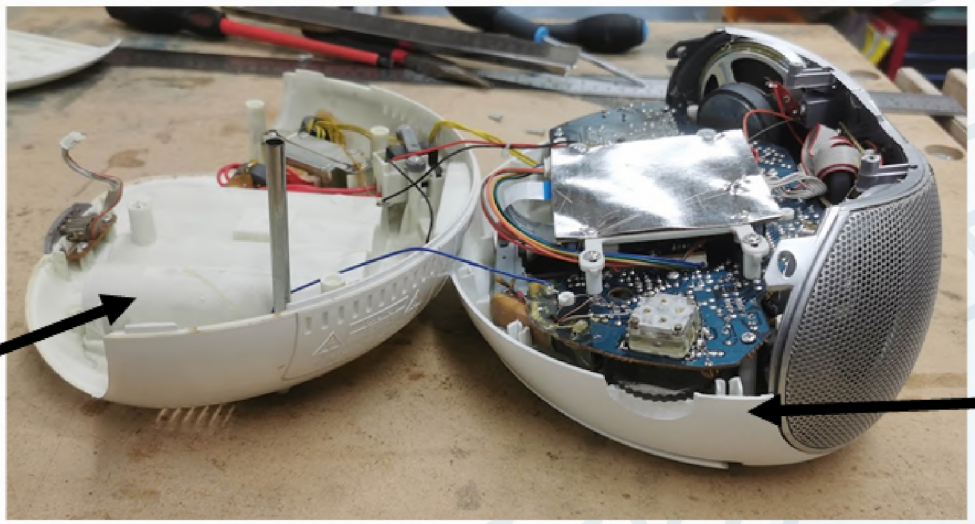
Battery slots

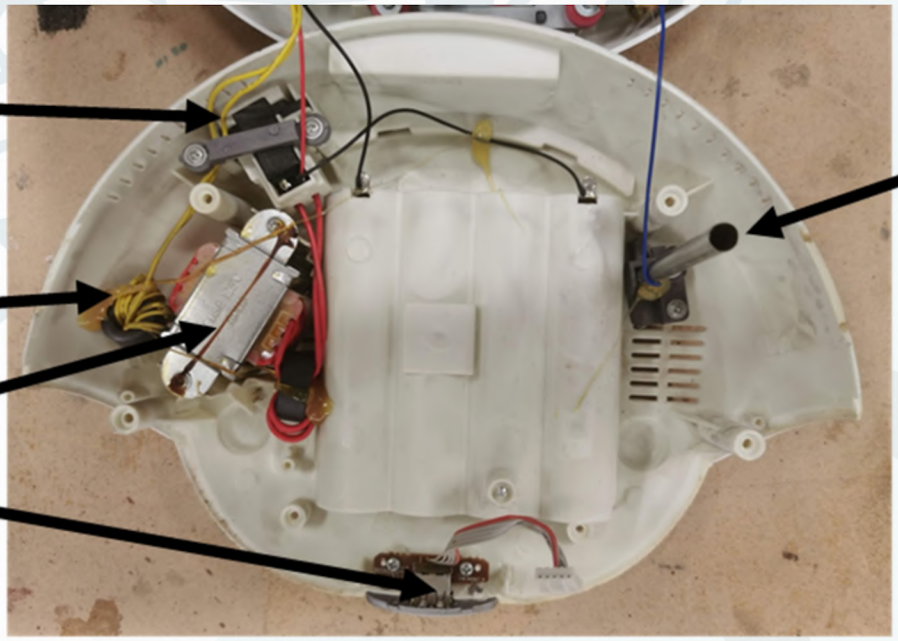
Negative Terminal

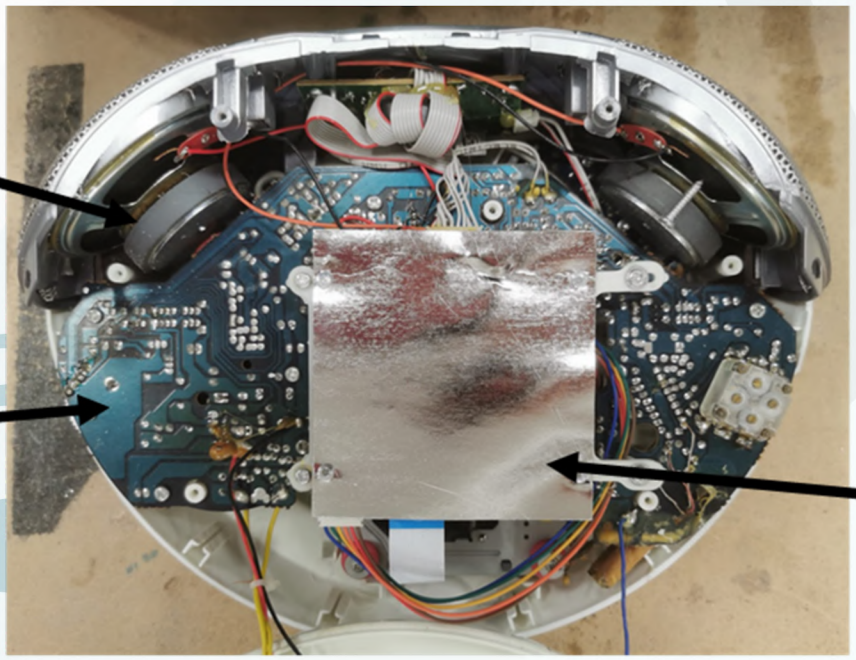


CD player feet for stability

INTERNAL FEATURES

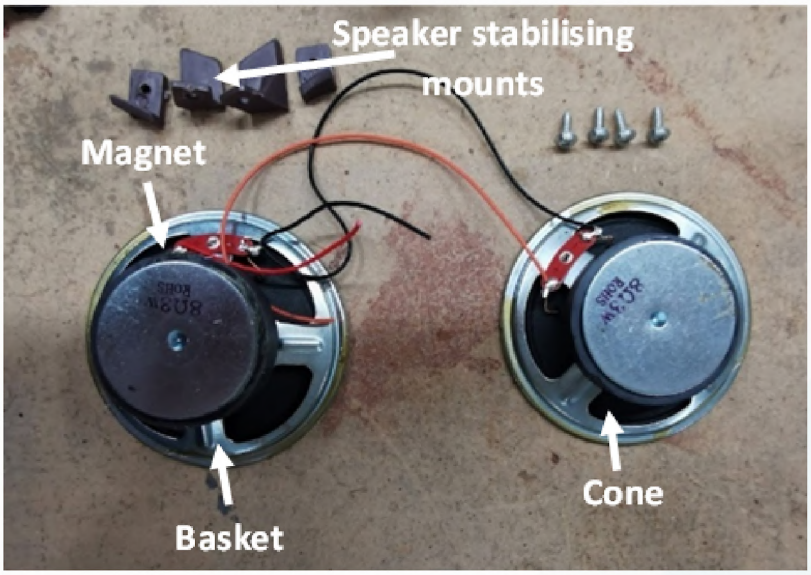


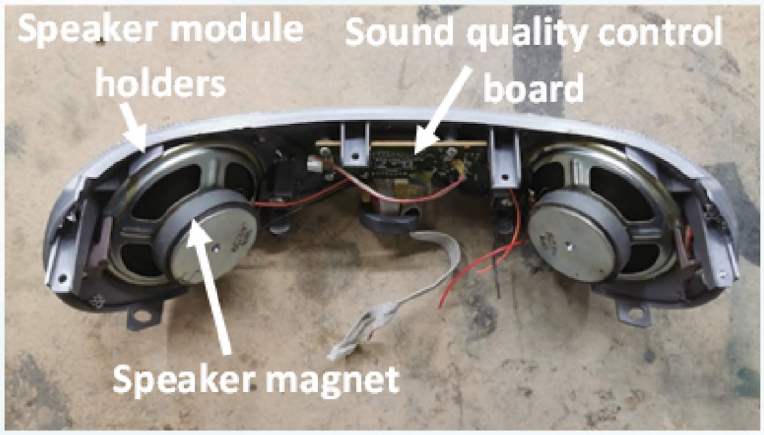


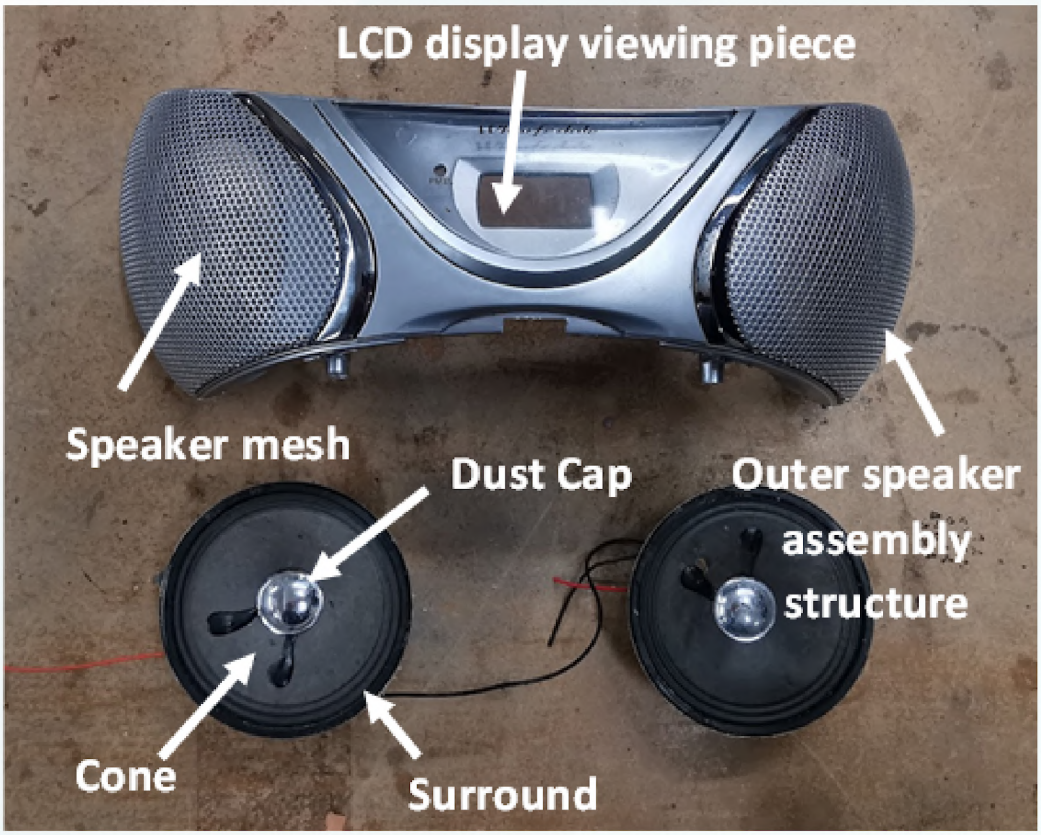


SPEAKER SYSTEM

A cone diaphragm connected to a current carrying coil moves in a permanent magnetic field provided by a magnet. This causes rapid oscillations causing compressions and rarefactions within the air producing a longitudinal sound wave. Current through the coil is controlled from a microchip, thus controlling the amplitude and frequency of sound to produce music.

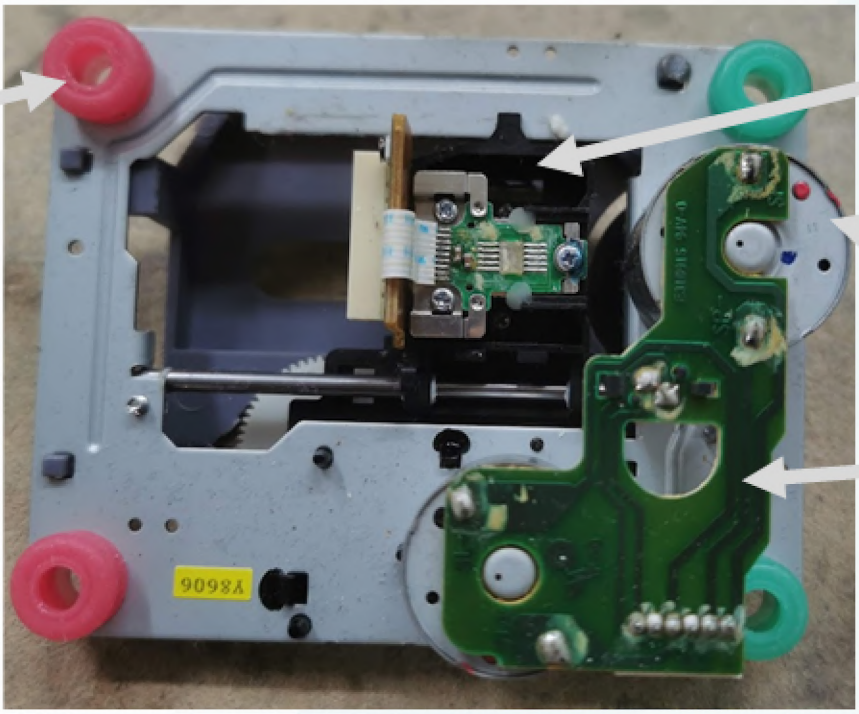


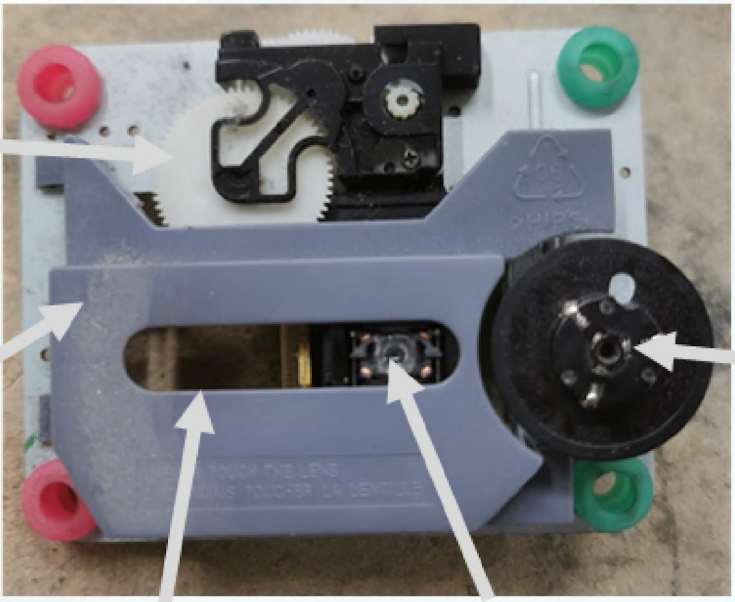




CD READER

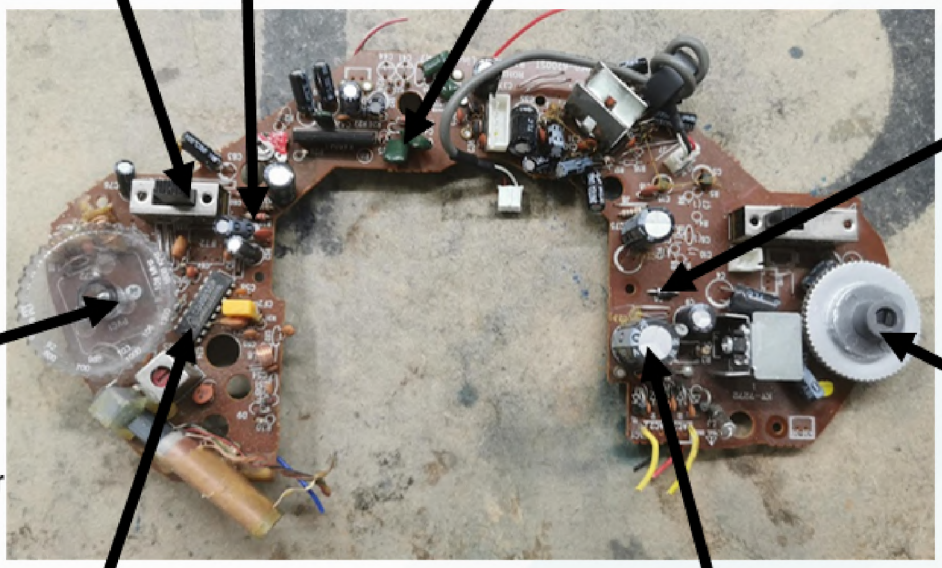
Powered by a motor, the spindle platter rapidly rotates a disk. The assembly is mobile, allowing it to sequentially move along the radius of the disk. An emitted laser focuses on pits and bumps on the disk (representing binary data) through an optical deck. A laser pickup senses the reflected laser off the aluminium coating of the CD. This then determines whether the beam has reflected off a pit or bump from the diffraction of the laser allowing data to be "read".



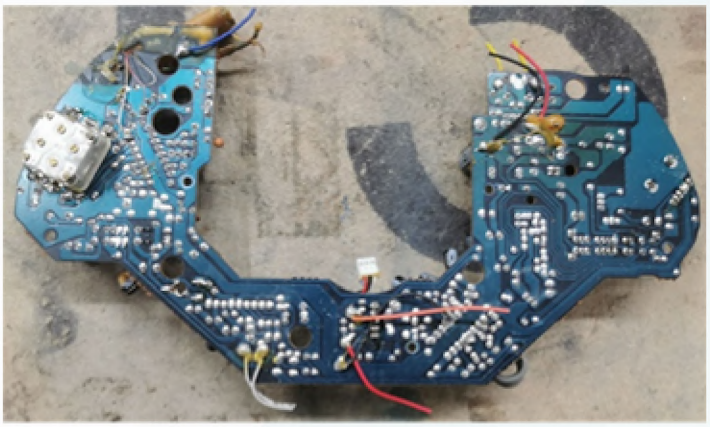


MOTHERBOARDS

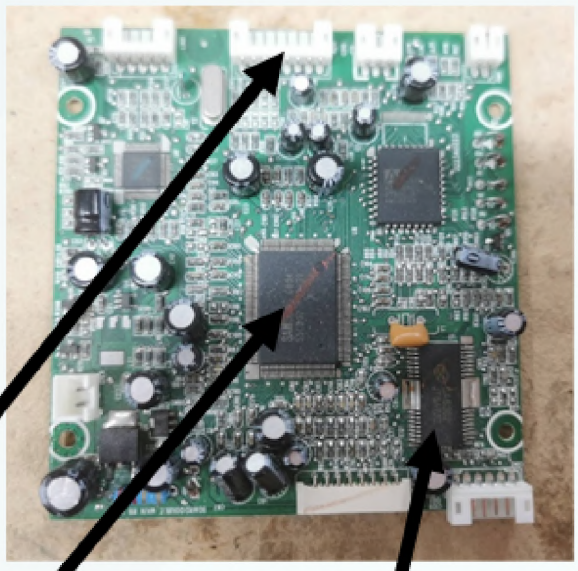
Motherboard Top View



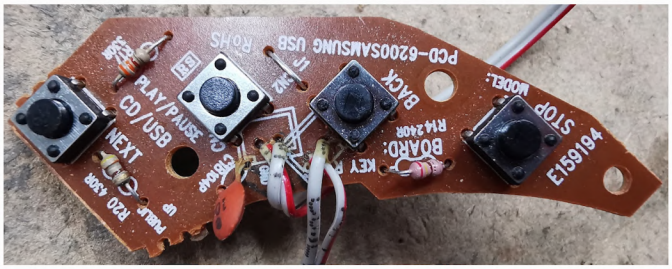
Motherboard Bottom View



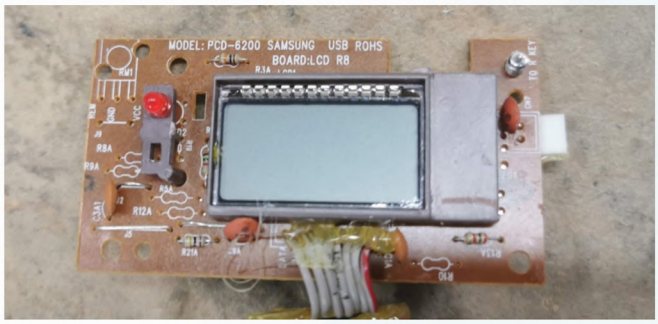
Disk reading (secondary) board



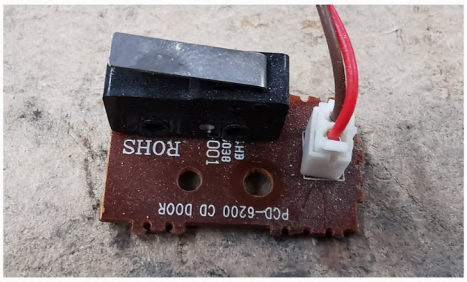
COMPONENT SUMMARY



Button board: Control button inputs e.g. stop, start, playback speed



LCD board: Controls output of LCD screen e.g. CD track number



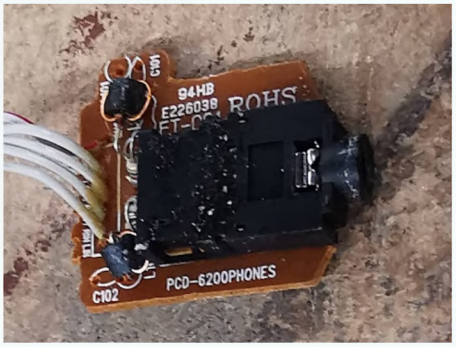
Limit Switch: Defines limit of travel for laser assembly to ensure its not damaged by the motor trying to spin it off the movement rod

Opening spring: Uses its elastic potential to open CD cover when pressed

Shock absorbent spacers: Absorb vibrations of the movement of laser assembly

Power input port: Provides power to CD player

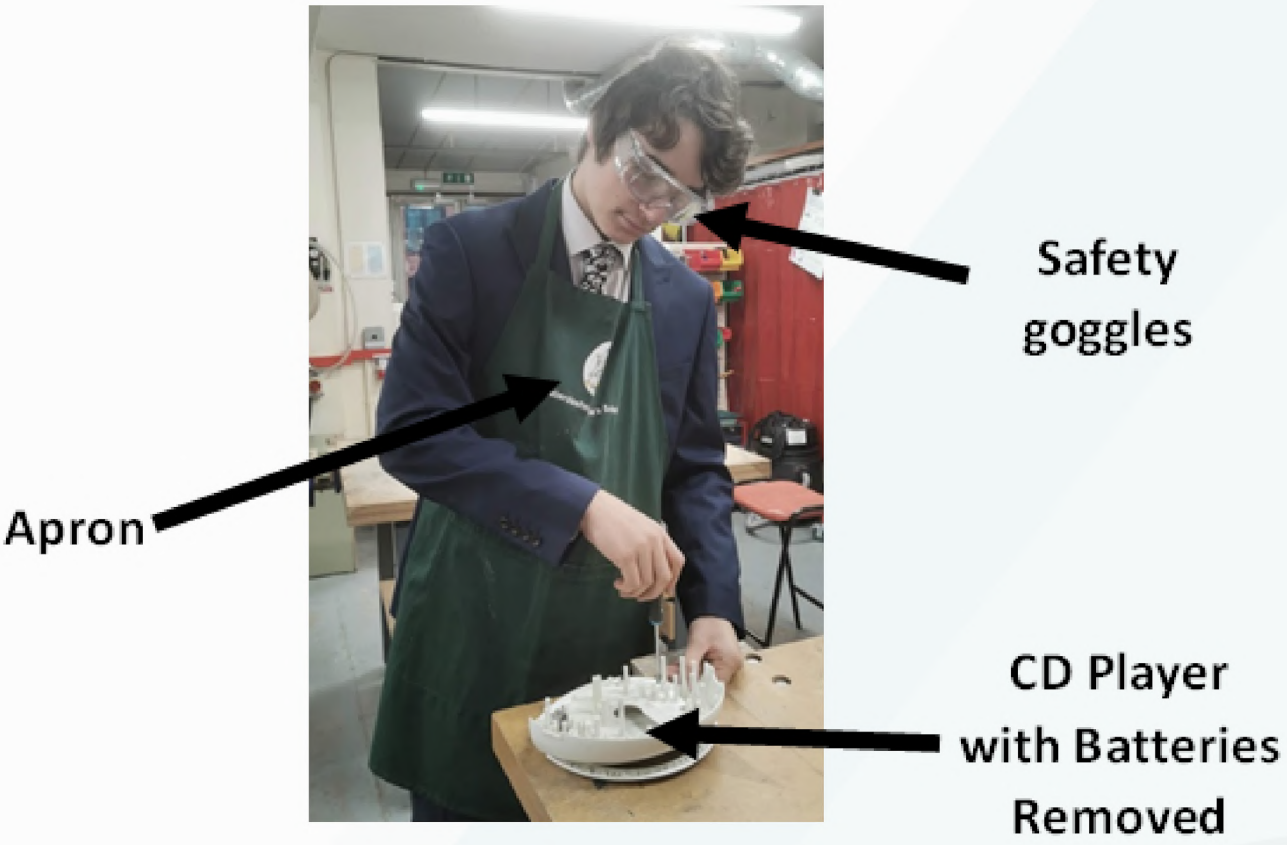
Transformer: Steps up voltage input to CD player



Audio Jack: Outputs CD player audio to external devices.

SAFETY PRECAUTIONS

To ensure safety we removed all power sources from the device. Safety goggles and aprons were worn throughout to avoid eye injury/prevent damage from equipment. We attentively minimised contact with charged capacitors throughout.



TOOLS USED

CONCLUSION

To recap, through this report we have:

- Understood how analogue to digital converters function read data and concepts behind optics.
- Learned the physics behind how speakers generate sound
- Gained familiarity with mechanical components such as the laser assembly and spindle.
- Grasped the complexity of implementing several integrated circuits with dozens of components.

Subsequently, we developed an appreciation of the importance of good design and assembly, making it possible to compact so many parts in such little space. Ultimately, the experience was rather rewarding, and analysis of the deconstruction helped us realise the complexity of seemingly simple devices.

Most importantly, we were able to comprehensively inform our friend on the great service that is a CD player.

Credit to:

Our friend, Bryan, for providing us with a great idea.