



PROJECT EASY HI-FI

Engineering and Project Management

ACDA 5025

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Table of Contents

List of Figures	ii
List of Tables	ii
1.Introduction	1
2.Background	1
3.Objectives	2
4.Scope.....	2
Within the Scope	2
Out of Scope.....	3
5.Constraints.....	3
6.Assumptions.....	5
7.Risks	5
8.Deliverables.....	5
9.Ethical Considerations.....	5
10.Planning	6
11.Conclusion.....	8
12.References	8
13. Certificates	9

List of Figures

Figure 1 - Critical Path Analysis	1
Figure 2 – Gantt Chart	

List of Tables

Table 1 - Dali Kupid Specifications (Smart Home Sounds, 2026)	1
Table 2 - Cost Benefit Analysis	2
Table 3 - Speaker Specifications.....	3

1.Introduction

This Project is the design of a pair of bookshelf Hi-Fi (High Fidelity) speakers. The method used within this essay is called BOSCARD and is a tool used within project management for scoping out a project and looking at all relevant aspects (Robinson, 2019). The BOSCARD method is an abbreviation for the following Background, Objective, Scope, Constraints, Assumptions, Risks, Deliverables. By looking at all these aspects in turn all relevant topics will be looked at within this project.

2.Background

With multiple speakers of varying designs (Bookcase, Tower, Portable, etc) and with differing functionality (smart, passive, voice controlled, etc) it is easy to get lost trying to find the right speaker. With all the current hype surrounding Artificial Intelligence and its integration into everyday life it's easy to focus on the added extras involved with a speaker as opposed to the speaker hardware itself. Privacy concerns have come hand in hand with speakers such as the Echo or Google home which use AI to take instructions from users and perform actions associated with these and t's been projected that the annual growth rate will reach 26.5% in the next 4 years (Maccario & Naldi, 2023).

There seems to be no middle ground currently for speakers, you either have cheap Bluetooth speakers or high-end Hi-Fi with separate amplifiers and passive speakers which require installation. The rise of the MP3 also played its role as the file itself relies on shrinking a song down to a smaller file size to use less memory and fit on early MP3 players and iPods. This file doesn't have the capability to produce high quality sound and streaming services such as Spotify and Apple Music have started offering lossless audio which is capable of Hi-Fi quality with the right equipment (Fresh Kit, 2025).

From market research the price of the best tested bookshelf speaker from Acoustic Energy is £649 and the best budget are from Dali Kupid coming in at £299 (Kabir & McKerrell, 2026). The Dali Kupid are also mentioned on a different review website as the best budget Hi-Fi speaker (Haslam, 2025).

The Dali Kupid are passive speakers with the following specifications.

Table 1 - Dali Kupid Specifications (Smart Home Sounds, 2026)

Specifications of the DALI KUPID (Pair)

The DALI KUPID combines vibrant design with detailed, room-filling sound, perfect for smaller rooms.

Weight (Kg)	2.900000	Maximum SPL	103 [dB]
Brand	DALI	Frequency Range	63 - 25,000 [+/- 3 dB] [Hz]
Product Type	Bookshelf Speaker	Recommended Amplifier Requirements	40 - 120 [watts]
Width	140mm	Drive Unit Complement	1 x 4½ Inch Low Frequency/Midrange Driver - 1 x 26mm Soft Dome High Frequency Driver
Height	237mm	NOMINAL IMPEDANCE	4 [ohms]
Depth	195mm	Crossover Frequency	2,100 [Hz] - Crossover Principle: 2-way
Sensitivity	83 [2.83V/1m] [dB]		

With a space in the market for budget active Hi-Fi speakers focussed on sound quality over app integration and AI this project will look at the design and production of a pair of active Hi-Fi speakers which will retail at around £250 providing budget entry into the Hi-Fi space without the need for amplifiers and other expensive equipment associated with Hi-Fi. A projected profit of £207,500 over a course of 4 years has been calculated with a Benefit Cost Ratio Calculated at 1.77 suggesting a good return on investment from this project.

Table 4 - Cost Benefit Analysis

Cost Benefit Analysis				
	Year 0	Year 1	Year 2	Year 3
Cost				
Speaker Development	£30,000.00	£4,000.00	£0.00	£0.00
Components Acquisition	£5,000.00	£35,000.00	£60,000.00	£75,000.00
Acoustic Testing	£8,000.00	£3,000.00	£0.00	£0.00
Marketing	£2,500.00	£13,000.00	£15,000.00	£20,000.00
Total Cost	£45,500.00	£55,000.00	£75,000.00	£95,000.00
Accumulative Cost	£45,500.00	£100,500.00	£175,500.00	£270,500.00
Income				
Projected Sales	£0.00	£90,000.00	£140,000.00	£200,000.00
Savings from no cloud integration	£0.00	£8,000.00	£16,000.00	£24,000.00
Total Income	£0.00	£98,000.00	£156,000.00	£224,000.00
Accumulative Income	£0.00	£98,000.00	£254,000.00	£478,000.00
Yearly Profit / Loss	-£45,500.00	£43,000.00	£81,000.00	£129,000.00
Total Profit / Loss	-£45,500.00	-£2,500.00	£78,500.00	£207,500.00
BCR	1.77			

3.Objectives

This project's main objective is to design a pair of Hi-Fi quality active speakers focusing on sound quality over smart features. Success of this project will be measured against the following requirements:

- Deliver a frequency of 65Hz-26kHz with a minimum signal to noise ratio of 85dB
- A minimum sound pressure level of 85dB at 1m with no discernible distortion
- Manufacturing costs to be kept to £50 or below

4.Scope

To ensure that the project does not stray from the intended objectives listed above the items within the scope of this project and outside the scope will be identified below.

Within the Scope

- Desing an active speaker consisting of a 2 way crossover to control the frequencies between the tweeter and mid / bass driver
- Build a case that is a maximum 14cmx22cmx18cm (WxHxD) and no more than 5Kg
- Ensure it is compatible with UK mains current (50Hz / 230V)

- Maintain a budget of £50 for components used
- Ensure connectivity includes AUX, USB-C and Bluetooth
- Test speaker and ensure 85 dB SNR and SPL are achieved.

Out of Scope

- No smart integration with devices such as Alexa and Google home.
- No standalone crossover and amplifier as these speakers are active speakers and therefore don't require them
- The use of wood and other quality materials to create the speaker housing as costs would increase too much.
- The addition of other connectivity ports such as RCA or Coaxial

5.Constraints

The speaker design must conform to the following specifications stated below.

Table 5 - Speaker Specifications

Inputs	Bluetooth Input 3.5mm AUX USB C
Drivers	1x Tweeter 1x Mid / Low Range Driver
Performance (Minimum)	Bluetooth range = 5m 85dB SPL (Sound Pressure Level) 85 dB signal to noise ratio Frequency Range 70 – 25000 (Hz)
Component costs	Max £50
Power	Mains Power - 230V 50Hz
Physical Weight and Size	No more than 14cmx22cmx18cm (WxHxD) No more than 5kg

These constraints are important as they play a key role in satisfying the project objectives. Ensuring that the inputs are Bluetooth, Aux and USB C lean toward compatibility with new and existing music devices giving the option of connecting to a PC or to a TV if required providing greater flexibility. The use of a tweeter and a Mid / Low range driver allows greater sound quality as opposed to a simple full range driver, having dedicated drivers for different frequencies improves the quality produced and ensuring the crossover is designed with the specific drivers chosen is also very important for sound quality and achieving the required level of 85dB signal to noise ratio.

The limit of £50 is also critical for this project, if the component costs were to spill over then the projected benefit cost ratio would no longer be accurate and the projected profit would decrease. If this were to happen either the target price would need adjusting to maintain the profit margins or a smaller profit accepted. If the price were to be adjusted, then the speaker would not fall into the target category of budget Hi-Fi and would potentially not perform as well as competitors in the new price range which in turn could decrease sales and thus the profitability of the speaker.

Time constraints are also important to consider and with many supply issues currently surrounding electrical equipment there could be a delay in the receipt of ordered components which must be

considered during the creation of the critical path which identifies the stages of the project with no float. For this project the below Critical path analysis was created.

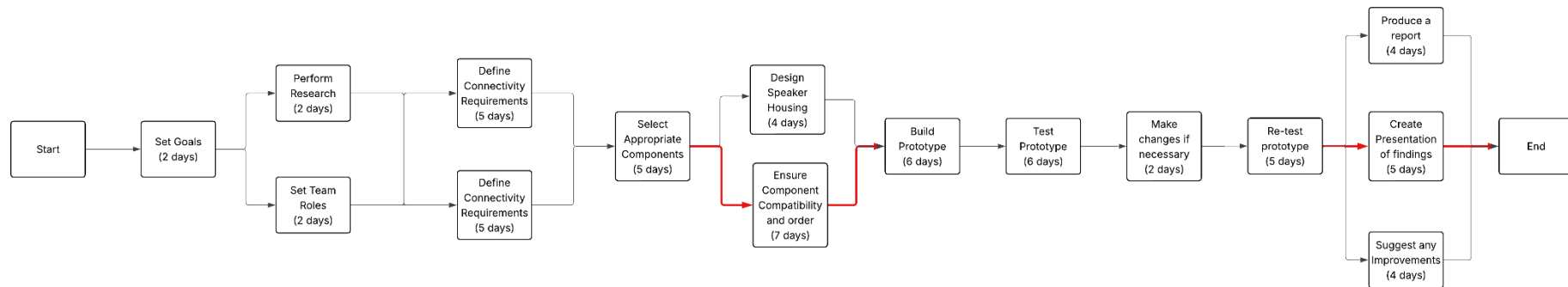


Figure 1 - Critical Path Analysis

Where there is a critical path, the arrow has been highlighted red, with 2 potential areas where a delay could impact project completion. The first being ensuring component compatibility and ordering them, with potential for shipping delays once ordered it is important to attempt to order the components as soon as possible to reduce the chance of project delays. The other potential area is when creating the presentation of findings at the end.

6.Assumptions

Assumptions made for this project are that there are sufficient budget components which can produce the required quality speaker to meet the above objectives and constraints. It is also assumed that the budget does not cause too much constraint as to make the project fail as the build cannot be achieved. It is also assumed all components will arrive swiftly without delay and consequently delay of the project. It is also assumed that no staff illnesses will occur during the project as losing a member will increase the workload on the rest of the time and thus delay aspects of the project and the project.

7.Risks

Delays are one of the risks involved with this project and as such a week of buffer has been added in to try and mitigate any potential delays and not affect the project deadline. Factors such as component delivery could affect the deadline with current supply chains disrupted by the war in Iran and the disruption in the Hormuz straight. To mitigate this risk a 7 day buffer has been added to the plan to allow for such delays.

Component quality within budget not being of the required standard is a risk as this would then either cause the project to fail or a shifting outside of the scope to allow for greater spend on components to reach the other constraints set. To mitigate this risk the budget was increased from the initial £35 to £50 to allow room for better components and thus sound quality.

Staff illness is a risk with such a small team one long term illness could cause the project to delay a few weeks as the increased workload on the rest of the team would slow progress down. To mitigate this, it is proposed to have one extra member of staff available who can cover for illnesses if one should arise.

8.Deliverables

The deliverable in this project is a pair of Hi-Fi bookshelf speakers that is produced within all constraints set above. This will be accompanied by a presentation and a report containing all the relevant findings and recommendations.

9.Ethical Considerations

When designing and creating this speaker sourcing components ethically must be a consideration. With neodymium drivers using a rare earth metal (neodymium) in its manufacture a lot of ethical issues are raised with regards to its extraction and processing for use. This is particularly the case in China (Martin & Iles, 2021). The process of extraction often produces hazardous by products such as toxic wastewater and uses harsh chemicals such as Hydrochloric acid during the process (Zapp, Chreiber, Marx, & Kuckshinrichs, 2022) . When procuring components ensuring they originate from a company where they have been ethically sourced is important.

When keeping manufacturing costs to a minimum it is likely that medium-density fibreboard (MDF) will be used as the housing material as it is cheaper than wood. A consideration when purchasing this is the manufacturing process and the use of formaldehyde glue. Where possible the MDF should be either made using an alternative to formaldehyde glue or that the MDF has been manufactured responsibly. Once produced it is possible to wrap the MDF to look like wood and give a more premium finish.

It is also important to consider the environmental impact from shipping all these components from all over the world with most electrical components originating in Asia and MDF also being available from China (largest producer of MDF). Where possible the MDF should be sourced locally with many factories producing in the UK. With electronic components however there are very few manufacturers in the UK and with the strict budget ensuring it sourced ethically from abroad will be the most appropriate option for this project.

10.Planning

This project has been split into 4 specific phases each with a specific milestone. During each of these phases it is proposed that a brief daily catchup meeting be held at 8am just to raise any issues and if there are no issues then the day continues immediately. Every Friday this meeting will go into further detail of the proposed plan to ensure all members of the team are on track and to discuss the project and any findings they have.

Phase 1 is the initial steps which include the following tasks each assigned to a specific person for completion.

- Set goals
- Perform research
- Set defined roles within team
- Define connectivity requirements
- Define size and noise output requirements

Phase 2 is the design and planning aspect of the project and has the following tasks

- Create budget
- Select appropriate components
- Ensure chosen components are compatible and order
- Design speaker housing

Phase 3 is the execution of the prototype and has the following tasks

- Build prototype
- Test prototype
- Make changes if necessary
- Re-test prototype

Phase 4 is the review and involves the following

- Produce a report of findings
- Suggest any improvements
- Create a presentation of findings

These tasks were then given a timeframe to complete ranging from 2 days to a week and plotted on a Gantt chart providing a timeline of tasks and a completion date for the project. The completion date is inclusive of the 7 days float that will account for any delays.

Each section has a specific milestone that needs to be complete prior to moving on to the next section, for Phase 1 it is ensuring that the requirements are set and no changes will be made to them as changes will impact actions further down the line such as selecting components.

For the prototype to be built these components and design must be finalised. For Phase 3 the milestone prior to moving on to Phase 4 is having a complete and working prototype that has passed all requirements thus allowing the report to be finalised and presentation written.

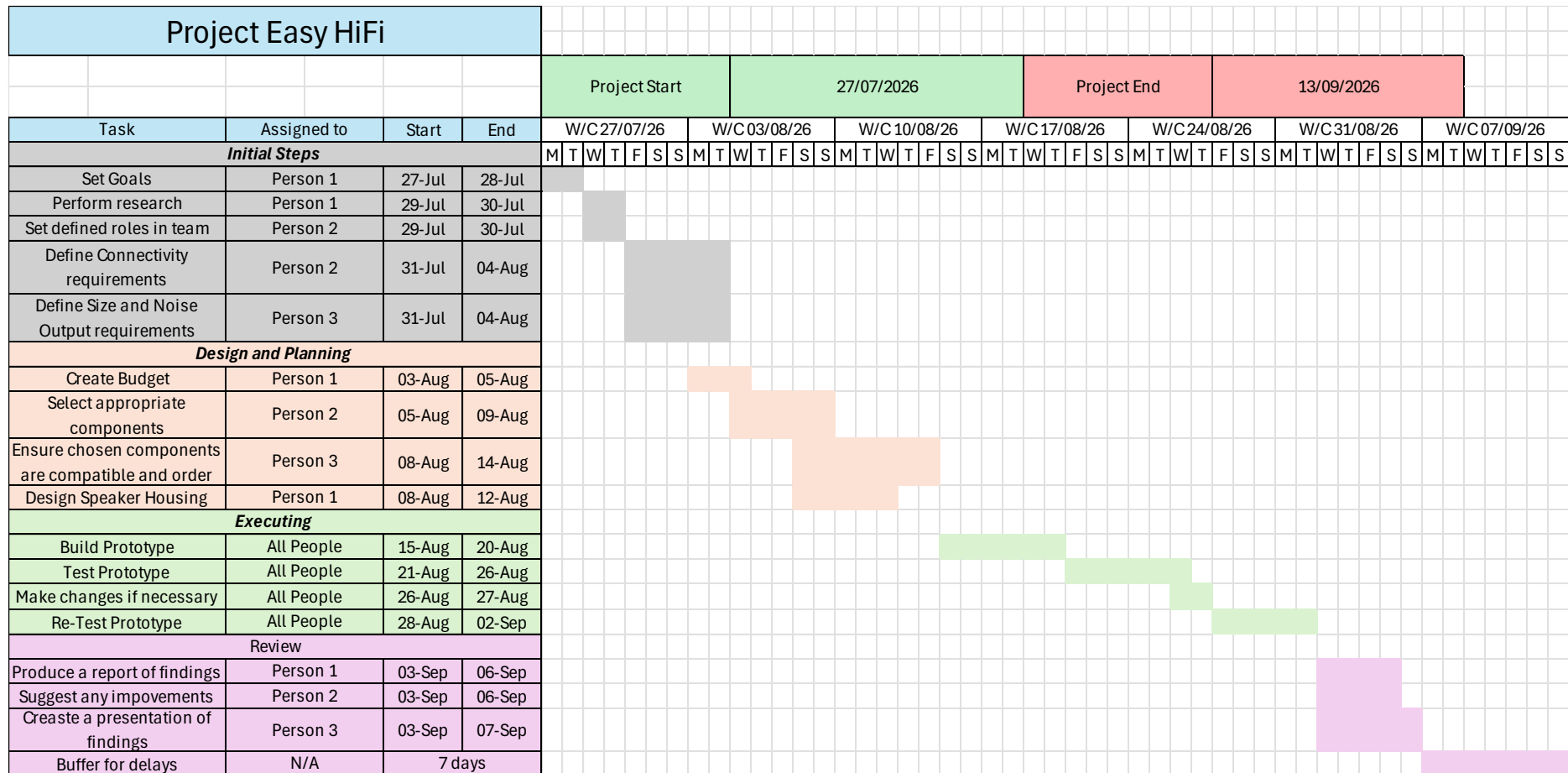


Figure 2 - Gantt Chart

11. Conclusion

To summarise this project has the potential to be a successful and lucrative by addressing the gap in the market for budget Hi-Fi bookshelf speakers. With a BCR of 1.77 there is some room for adjustment in pricing and cost but this is to be avoided if possible, to maximise profit. With a lenient approach to project timing and the addition of a buffer week it is very probable that this will be complete on time and provide the profits mentioned above.

12. References

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13. Certificates



The certificate features a green and white design with a black border. A green circular logo in the top left corner contains the text "PREVENT TRAINING MATERIALS FOR HIGHER EDUCATION". The main title is "AN INTRODUCTION TO THE PREVENT DUTY AS IT AFFECTS HIGHER EDUCATION". Below this is the heading "CERTIFICATE OF COMPLETION". The text "THIS ACKNOWLEDGES THAT" is followed by a light blue input field for the name, which contains "Dafydd Adams". Below this is the text "HAS SUCCESSFULLY COMPLETED THE INTRODUCTION TO PREVENT E-LEARNING". This is followed by another light blue input field for the date, which contains "08/06/26".

PREVENT TRAINING MATERIALS FOR HIGHER EDUCATION

AN INTRODUCTION TO THE PREVENT DUTY AS IT AFFECTS HIGHER EDUCATION

CERTIFICATE OF COMPLETION

THIS ACKNOWLEDGES THAT

Name: Dafydd Adams

HAS SUCCESSFULLY COMPLETED THE INTRODUCTION TO PREVENT E-LEARNING

Date: 08/06/26



Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

This is to certify that
Dafydd Adams
successfully completed the
Equality & Diversity Briefing
course with a score of
100%
on
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