THE UNIVERSITY OF DODOMA

COLLEGE OF INFORMATICS AND VIRTUAL EDUCATION

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

FINAL YEAR PROPOSAL

ACADEMIC YEAR**: 2024/2025**

TITLE: PORTABLE AMPLIFIER FOR MIN PORTABLE AUDIO DEVICES

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CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND

In today’s world, portable devices such as smartphones, tablets, and music players have become essential for everyday activities, from entertainment to communication. However, these devices often have limitations in their built-in audio output, resulting in low sound quality and volume, especially when used in outdoor or noisy environments.

To address this issue, the "Portable Amplifier for Min Portable Audio Devices" project aims to design and develop a compact, lightweight, and efficient audio amplifier. This portable amplifier will enhance the audio output of small devices, providing louder, clearer, and more enjoyable sound without compromising portability.

The project focuses on delivering a user-friendly and cost-effective solution that can be easily connected to mini portable devices. It will incorporate features such as a rechargeable battery, compact design, and compatibility with a wide range of devices. This innovation is ideal for users who require enhanced audio performance while on the go.

1.2 PROBLEM STATEMENT

In recent years, portable devices such as smartphones, tablets, and music players have become the primary sources of audio entertainment. Despite advancements in their design and functionality, these devices often suffer from low audio output and limited sound quality due to small inbuilt speakers and limited amplification capabilities. This limitation becomes evident in noisy environments or outdoor settings, where the sound is barely audible, reducing the overall user experience.

Furthermore, existing audio amplifiers tend to be bulky, expensive, or require complex connections, which undermines their portability and convenience for users on the go. There is a need for a lightweight, affordable, and easy-to-use solution that can enhance the audio output of mini portable devices without compromising portability.

This project addresses this issue by developing a Portable Amplifier for Min Portable Audio Devices that provides a simple, compact, and efficient way to amplify audio output. The amplifier aims to deliver clearer and louder sound while ensuring compatibility with various devices and maintaining user convenience.

1.3 OBJECTIVES

1.3.1 Main objective.

To design and develop portable amplifier for min portable audio devices that amplifies 1.5W to 100W.

1.3.2 Specific objective.

1. To gather the requirements
2. To design portable amplifier
3. To implements portable amplifier
4. To test and evaluate the amplifier for usability, accuracy, and reliability.

1.3.3 Project significance

1. Enhancing audio experience: The amplifier improves sound quality and volume, enabling users to enjoy louder and clearer audio in various settings, including outdoor environments, noisy areas, and gatherings.

2. Provides portability and convenience: By maintaining a compact, lightweight design, the amplifier ensures ease of use and mobility, catering to users who are frequently on the move.

3. Ensuring Cost-Effective Solution: The project provides an affordable alternative to expensive audio systems, making it accessible to a wide range of users who seek better sound quality without high costs.

4. Increasing in device utility: The amplifier extends the functionality of mini portable devices like smartphones, tablets, and music players, allowing them to perform beyond their built-in limitations.

1.4 Project scope

The project aims to design and develop a compact and efficient amplifier system that enhances the audio output of low-amplitude signals from devices like smartphones and music players. This covers design and develop a mini audio amplifier circuit to amplify signals from audio sources like cell phones, Increase the amplitude of the audio signals within the audible range to produce clearer and louder sound output, Ensure the circuit can be integrated with a speaker to convert the amplified audio signals into sound, Focus on simplicity and ease of use, with an intuitive interface for adjusting volume levels and Use affordable components to keep the project cost low and accessible for a wide range of users.

1.5 LITERATURE REVIEW

The use of audio amplifiers in consumer electronics is ubiquitous, as they are critical in enhancing the audio output of devices such as smartphones, music players, and computers. Audio amplifiers boost low-amplitude signals to a level that can be heard clearly through speakers, making them an essential component of audio systems.

Early studies and designs of audio amplifiers, such as those by **Hugh D. Young** (2000), emphasized the need for amplifiers that can handle low-level audio signals without introducing significant distortion. Modern amplifiers incorporate advanced techniques to minimize such distortion, ensuring a clean and powerful audio output.

Another study by **Boucher** (2004) examined how transistor amplifiers replaced tube amplifiers in consumer electronics, paving the way for portable audio solutions. Transistor amplifiers are now the standard in most modern mini amplifiers, offering efficient power use and compact designs that suit the needs of portable devices.

The trend towards smaller, more portable electronics has increased the demand for miniaturized audio amplifiers. Mini audio amplifiers, designed to work with devices like smartphones, laptops, and portable speakers, offer users enhanced audio performance while maintaining a lightweight, compact form. **Akshay Mehta and Rajiv Dubey** (2016) conducted a study on portable audio amplifiers, where they explored the design of small form-factor amplifiers that could deliver a high-quality sound experience while consuming minimal power. These amplifiers typically use integrated circuits (ICs) like the LM386, TDA2822, or the PAM8403, which are widely used for their low power consumption and efficiency.

While mini audio amplifiers offer convenience and portability, they also face several challenges. These include maintaining sound clarity at high volumes, minimizing power consumption, and reducing the physical size of the components. Researchers have found that Class D amplifiers, also known as switching amplifiers, are ideal for portable applications because they are highly efficient in converting power and generating less heat than traditional amplifiers. **Karl D. Frey** (2011) discussed the advantages of Class D amplifiers in portable audio systems, noting their ability to operate at high efficiency, which is crucial for extending battery life in devices like smartphones and portable speakers.

Moreover, the use of Class D amplifiers has become more prevalent in recent years due to their efficiency. These amplifiers are ideal for portable systems, offering compact designs without compromising on audio performance. The integration of battery management systems also ensures that the amplifier remains energy-efficient, which is critical for enhancing the battery life of portable devices (Jones, 2017

CHAPTER TWO

METHODOLOGY

2.1 INTRODUCTION

This chapter outlines the methodology used in designing and implementing the portable amplifier for min portable audio devices. The methodology includes design, system design, implementation, testing and evaluation.

2.2 DESIGN

2.2.1 DESIGNING PROCESS

The design of portable amplifier for min portable audio devices involves key components and considerations. These include;

1. Transistor: These transistors are used for signal amplification, where they amplify the low-amplitude input audio signal to a higher output signal suitable for driving speakers. In this project we will use 2SC5200 transistor.
2. Toroidal Coil: Toroidal inductors help filter and smooth the audio signal, reducing noise and distortion.
3. Resistor: Resistors are used to control the current flow within the circuit, ensuring stable operation of the amplifier.
4. Capacito**r**: Electrolytic capacitors are used for power filtering and coupling, ensuring that only the AC audio signal is passed to the amplifier stages while blocking unwanted DC components.
5. Potentiometer: Potentiometers allow for manual adjustment of the audio amplifier's gain (volume control), giving users the flexibility to control the output volume.
6. Speaker: The speaker are responsible for converting the amplified audio signal into sound. In this project we will use the speaker with 100W
7. Terminal Block: Terminal blocks provide secure and reliable connections for power supply, input signals, and output signals to the speakers.
8. Aux Cable: The aux cable serves as the input connection between the audio source (e.g., smartphone or MP3 player) and the amplifier.
9. Power Supply: It ensures stable and sufficient power delivery to operate the amplifier and connected components efficiently. In this project we will use A 12V, 3A DC power supply provides the required voltage and current for the amplifier circuitry.

2.2.2 PROJECT BLOCK DIAGRAM

The portable Amplifier will consist of battery, Amplifier IC, audio jack and speaker

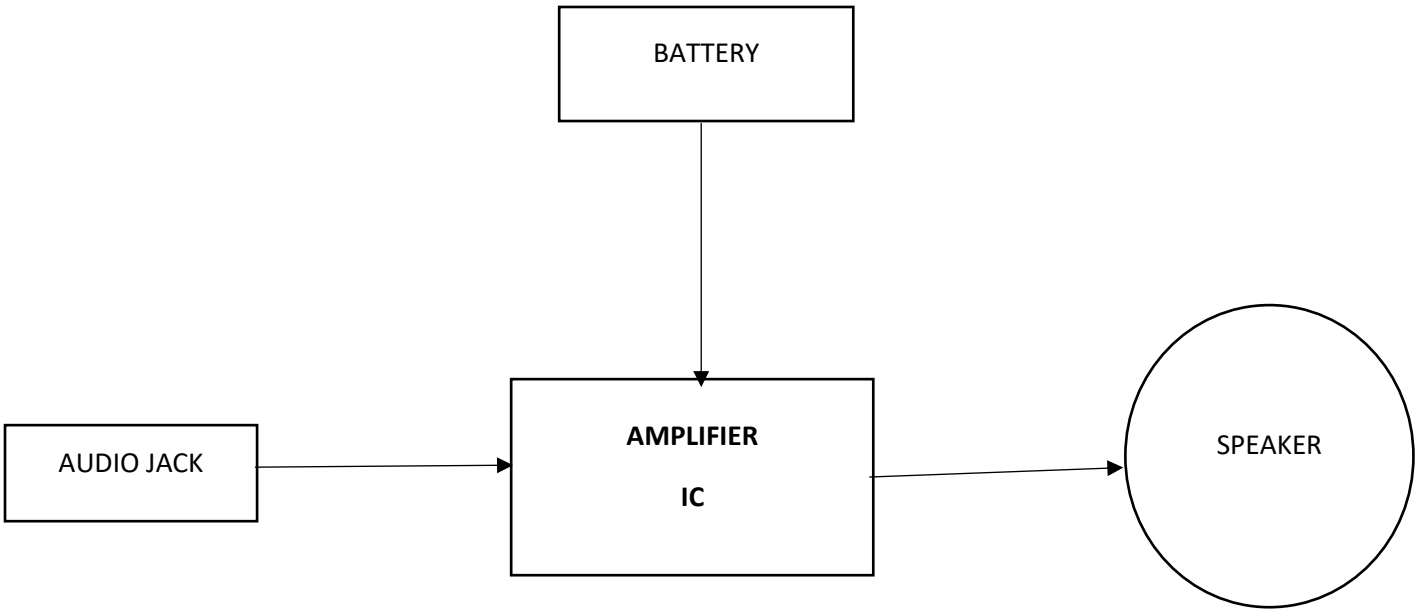

Figure 1: Project block diagram

2.2.3 PROJECT FLOW CHART

The figure 2 shows the sequence steps needed to perform audio amplification.

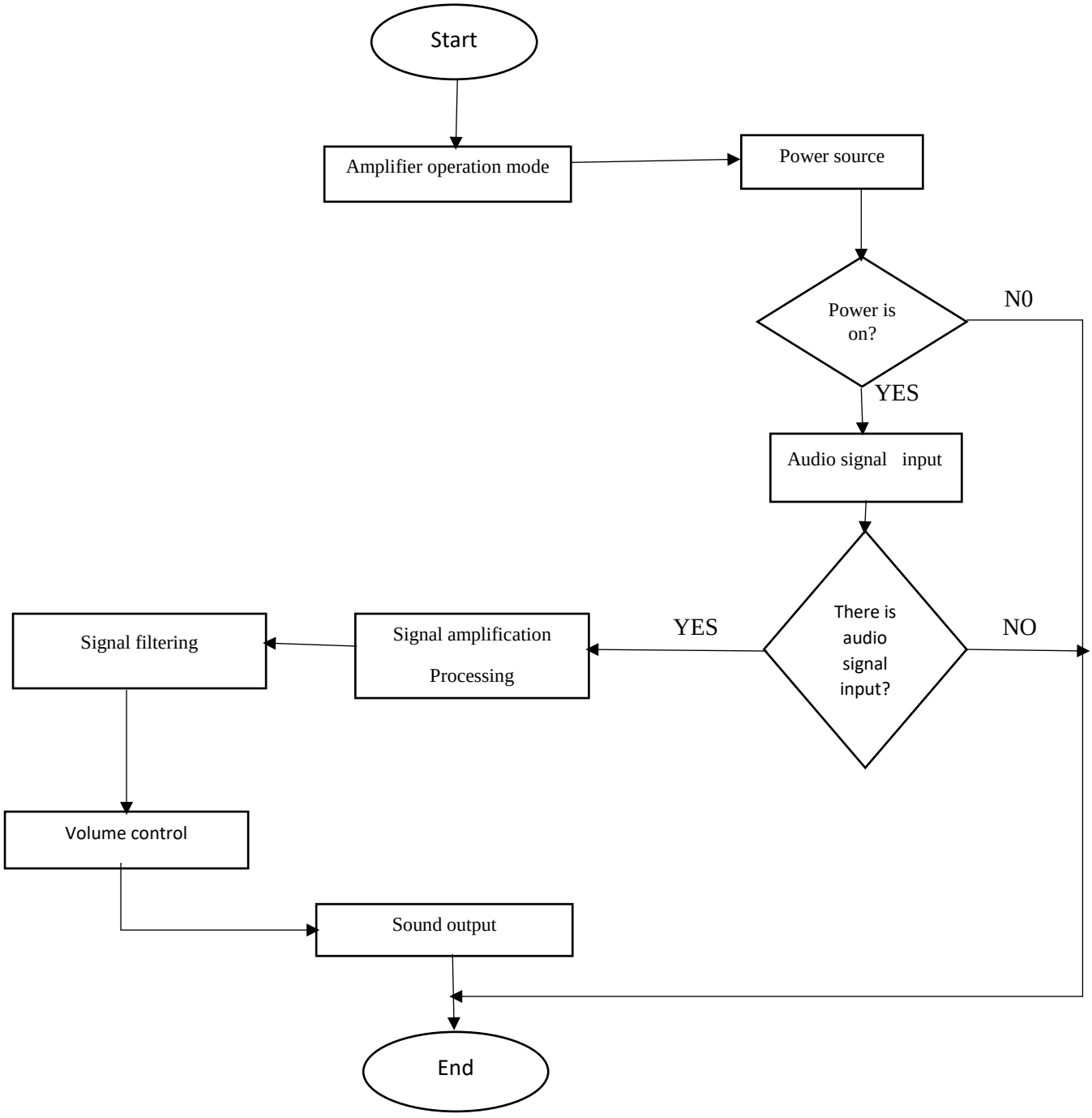

Figure 2: Project flow chart

The flow chart explanation for figure 2.

1. Start: Initialize the amplifier by power on the amplifier and audio signal input device by plug in audio jack to sound the source.
2. Amplifications process: Since amplification status mode is clear the amplifier will work as the user need by using potentiometer by choosing amount of sound level he needs.
3. Sound Output: Clear and amplified audio is produced by the woofer, delivering enhanced sound quality and volume.

2.3 IMPLEMENTATIONS

Implementations of the portable amplifier will be as follow;

Step 1: Prepare the Components

- Capacitor 470uf/25V
- 2SC5200 Transansistor
- Toroidal Coil
- Resistor
- Capacitor Potentiometer
- speaker
- Terminal Blog
- Aux Cable
- Power Supply

Step 3: Connect the Amplifier Circuit

- Connect the NPN Transistors 2SC5200 to a heatsink for heat control.
- Connect the Toroidal Coils to the power supply.
- Connect the Resistors to the base and collector pins of the transistors.
- Connect the Capacitors between the audio input source and the base of the transistors.
- Connect the Potentiometers to the input signals, with the middle terminal connected to the base of a transistor.
- Connect the Woofer to the output of the transistors
- Connect the emitter pins of the transistors together.
- Connect the collector pins of the transistors to the speaker's positive terminal.

Step 3: Connect the Power Supply

- Connect the positive terminal of the power supply to the toroidal coil.
- Connect the negative terminal of the power supply to the transistor emitter (ground).

2.4 TESTING

Various testing methods will be used to ensure the system's performance and reliability. These methods include load testing, functional testing, field testing, and user testing.

1. **Load Testing**

   The amplifier will be tested under different load conditions, such as varying power consumption levels and multiple mini audio devices (e.g., smartphones, tablets, MP3 players). Aim to ensure the amplifier performs consistently and efficiently under maximum load without overheating or distortion.

2. **Functional Testing**

   The system’s functionality will be tested to confirm all components, including transistors, capacitors, potentiometers, and speakers, work as expected. Aim to verify that the amplifier properly amplifies low-amplitude signals and outputs clear and undistorted sound.

3. **Field Testing**

   The amplifier will be tested in real-world environments such as outdoor spaces, noisy areas, and small rooms to evaluate its performance. Aim to assess the audio output quality, range, and clarity in different practical scenarios.

4. **User Testing:** End users will interact with the amplifier to provide feedback on ease of use, portability, sound quality, and overall performance. Aim to gather user insights and ensure the project meets user expectations and needs.

2.5. EVALUATION

The general evaluation of the Mini Audio Amplifier project focuses on assessing its overall design, functionality, performance, and real-world applicability. Below are the key areas of evaluation:

1. Project Objectives Achievement

- The amplifier will successfully boosts low-amplitude signals to produce louder and clearer sound output.
- It meets portability requirements with its compact and lightweight design.

2. Performance Evaluation

- Load testing confirms stable operation at varying power levels and with different input devices (smartphones, tablets, etc.).

3. Reliability and Durability

- The amplifier performs consistently under prolonged use without overheating, demonstrating good thermal management.
- Components like transistors, capacitors, and inductors operate reliably under full load conditions.

4. Usability and Portability

- The compact and lightweight design makes it portable and easy to carry.
- The use of an AUX cable allows for seamless connection with multiple devices.
- Simple controls (potentiometers for volume adjustment) make the system accessible even for non-technical users.

5. Overall Assessment

- The Mini Audio Amplifier project achieves its goals of providing an affordable, portable, and functional audio amplification system.
- It delivers clear sound quality, is easy to implement, and has practical applications in both educational and everyday use cases.

CHAPTER THREE

PROJECT TIMELINE AND IMPLEMENTATION PLAN

3.1 PROJECT TIMELINE

The timeline below for the development of portable Amplifier for min portable audio device.

ID	Task name	YEAR (2024/2025)																													
		MONTHS Activity Duration in (Weeks)																													
		Nov.				*Dec.*				*Jan.*				*Feb.*				*Mar.*				*Apr*				*May*				*June*			
		W1	W2	w3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4
1	Concept formulation																														
2	Concept Note presentation																														
3	Proposal writing																														
4	Proposal Presentation																														
5	Collecting System requirements																														
6	System Design and Architecture																														
7	System Implementation																														
8	Testing																														
9	Project progress																														
10	Submission of progress report																														
11	Writing Final Report																														
12	Final Project Presentation																														
13	Submission of Report																														

Table 1: Project Gantt chart

3.2 IMPLEMENTATION PLAN

- The system will successfully amplify low-amplitude audio signals from mini audio devices (e.g., smartphones, tablets, MP3 players) to produce louder and clearer sound.

- The amplifier will enhance the quality of audio signals by minimizing noise and distortion while maintaining audible frequency range.

- The amplifier will feature a lightweight and compact design, ensuring ease of transport and usability for users on the go.

- The project will deliver a budget-friendly alternative to expensive audio systems, making it accessible for a wide range of users.

- The use of potentiometers will allow users to control and adjust the volume (gain) easily, improving usability and flexibility.

- The amplifier will be compatible with various audio devices, including smartphones, tablets, MP3 players, and other AUX-supported devices.

- The system will operate reliably under varying load conditions without overheating or signal distortion, ensuring long-lasting performance.

CHAPTER FOUR

SYSTEM REQUIREMENTS AND BUDGET

4.1 HARDWVARE REQUIREMENTS

The following are hardware that we need in our project

1. NPN Transistor (2SC5200 x 2)
2. Toroidal Coil x 2 (3A 60-100uh)
3. Resistor (680 Ohm/2w x 2)
4. Capacitor 470uf/25V
5. Potentiometer 100k x 2
6. Speaker x 2 (50w + 50w 8 Ohm)
7. Terminal Blog x 3
8. Aux Cable (3 wire)
9. Power Supply 12v 3A DC

4.2 SOFTWARE REQUIRMENT

- Proteus

4.3 PR0JECT BUDGET

The table2 shows the approximation budget of the whole project, mostly of our requirements are hardware base. It shows the number of devices. Names of devices and amount

COMPONENT	NUMBER OF ITEMS	PRICE(Tsh)
Transistor (2SC5200)	2	40000
Toroidal Coil(3A 60-100uh)	2	20000
Resistor (680 Ohm/2w)	2	30000
Potentiometer 100k	2	20000
Speaker (50w + 50w 8 Ohm)	2	50000
Terminal Blog	3	10000
Aux Cable	3	20000
Power Supply 12v 3A DC	1	30000
Other cost		150000
TOTAL		370000

Table 2: project budge

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