

Indiana University - Purdue University Fort Wayne
Opus: Research & Creativity at IPFW

Computer and Electrical Engineering Technology &
Information Systems and Technology Senior Design
Projects

School of Engineering, Technology and Computer
Science Design Projects

4-28-2017

2.4 GHz Wireless Transmitter/Receiver for Audio System

Clint Thompson

Indiana University - Purdue University Fort Wayne

Follow this and additional works at: http://opus.ipfw.edu/etcs_seniorproj



Part of the [Computer Sciences Commons](#), and the [Engineering Commons](#)

Opus Citation

Clint Thompson (2017). 2.4 GHz Wireless Transmitter/Receiver for Audio System.
http://opus.ipfw.edu/etcs_seniorproj/982

This Senior Design Project is brought to you for free and open access by the School of Engineering, Technology and Computer Science Design Projects at Opus: Research & Creativity at IPFW. It has been accepted for inclusion in Computer and Electrical Engineering Technology & Information Systems and Technology Senior Design Projects by an authorized administrator of Opus: Research & Creativity at IPFW. For more information, please contact admin@lib.ipfw.edu.

2.4 GHz Wireless Transmitter/Receiver for Audio System

Final Project Report
April 28, 2017
Clint Thompson

Submitted to:
Professor Paul I. Lin, Course Instructor of ECET 491 Senior Design II



Advisor: Dr. Hadi Alasti
Department of Electrical, Computer, and Information Technology
College of Engineering, Technology, and Computer Science
Indiana University-Purdue University Fort Wayne, Indiana

ABSTRACT

This project will be demonstrating the use of Wi-Fi 2.4 GHz wireless communication integrated into an audio system. It is comprised of two Arduino UNOs with Atmel 328 Microcontroller driving both the transmitter section and the receiver section of the project. The wireless audio communication will be accomplished by two nRF24L01 transceiver modules with an antenna on both sides of the circuit. Input audio will be established through a Pioneer VSX-816 Audio/Video Multi-Channel Receiver and the output audio will be sent through a Kenwood KS-908 speaker.

With advising help from both Professor Hadi Alasti and Professor Paul I. Lin this project will cover multiple applications which can be used for and give insight to future project opportunities. This study will also include the different types of audio amplifiers that are available and the importance to the project.

TABLE OF CONTENTS

ABSTRACT.....	2
LIST OF FIGURES	6
LIST OF TABLES	7
EXECUTIVE SUMMARY	8
CHAPTER 1. SYSTEM DESIGN OVERVIEW AND RESEARCH.....	9
1.1 Deliverables	9
Prototype.....	9
Report.....	9
Presentation.....	9
1.2 Schedule.....	9
1.3 Cost.....	9
1.4 Research.....	10
1.4.1 FM Wireless Transmitter.....	12
1.4.2 FM Wireless Receiver.....	13
1.4.3 FM Problem	15
1.4.4 FM Solution	16
1.5 Types of Audio Amplifiers.....	16
1.5.1 Class A Amplifier	16
1.5.2 Class B Amplifier	17
1.5.3 Class AB Amplifier.....	19
1.5.4 Class C Amplifier	20
1.5.5 Class D Amplifier	21
Pulse Width Modulation (PWM).....	21
1.5.6 Class Summary	22

1.5.6 Most Suitable Audio Amplifier	23
CHAPTER 2. HARDWARE DESIGN.....	25
2.1 Wi-Fi 2.4 GHz Theory of Operation.....	25
2.1.1 Wi-Fi 2.4 GHz Wireless Transmitter.....	25
2.1.2 Wi-Fi 2.4 GHz Wireless Receiver	28
CHAPTER 3. SOFTWARE DESIGN	30
3.1 Wireless Transmitter Code	30
3.2 Wireless Receiver Code.....	31
3.3 System Circuit Designs.....	32
CHAPTER 4. UNIT TESTING AND SYSTEM INTEGRATION.....	33
4.1 First Week of Testing.....	33
4.2 Second Week of Testing	34
4.3 Technical Issues	41
4.3.1 Problem #1	41
4.3.2 Problem #2	42
4.4 Solutions	42
4.4.1 Solution #1	42
4.4.2 Solution #2	42
CHAPTER 5. PROJECT MANAGEMENT.....	43
5.1 System Requirements.....	43
5.2 Work Breakdown Structure (WBS).....	44
5.3 Cost	45
5.4 Schedule.....	45
5.5 Risk	47
5.5.1 Risk Register.....	47

5.5.2 Risk Matrix	48
5.5.3 Discussion	48
CHAPTER 6. CONCLUSION.....	50
6.1 Lessons Learned.....	50
6.2 Capabilities and Applications	50
CHAPTER 7 CHARTER.....	51
CHAPTER 8 ACKNOWLEDGMENT	52
REFERENCES	53
APPENDIX A – PARTS	55