**DESIGN AN IMPLEMENTATION OF IRS FOR SMALL MIMO WIRELESS NETWORK**

**A PROJECT REPORT**

***Submitted* by**

**D. MAHESWARAN 821121106025**

**M. MOHAMED YASEEN 821121106030**

**M. MUKILVANNAN 821121106032**

**P. SUDHARSAN 821121106055**

***in partial fulfillment for the award of the degree***

***of***

**BACHELOR OF ENGINEERING**

**IN**

**ELECTRONICS AND COMMUNICATION ENGINEERING**

**KINGS COLLEGE OF ENGINEERING, PUNALKULAM**

**ANNA UNIVERSITY: CHENNAI 600 025**

**MAY 2025**

**ANNA UNIVERSITY: CHENNAI – 600 025**

**BONAFIDE CERTIFICATE**

Certified that this report titled **“DESIGN AN IMPLEMENTATION OF IRS FOR SMALL MIMO WIRELESS NETWORK” is** the Bonafide work of “**D. MAHESWARAN (821121106025), M. MOHAMED YASEEN (821121106030), M. MUKILVANNAN (821121106032), P. SUDHARSAN (821121106055)”** who carried out the project work under my supervision.

**SIGNATURE**

Mrs. N. MANGAIYARKARASI, M.E.,

**HEAD OF THE DEPARTMENT,**

Department of ECE,

Kings College of Engineering,

Punalkulam,

Pudukkottai – 613 303.

**SIGNATURE**

Mr. K. SUDARSANAN, M.E.,

**SUPERVISOR,**

Assistant Professor,

Department of ECE,

Kings College of Engineering,

Punalkulam,

Pudukkottai – 613 303.

Submitted for the university viva voce held on ………………

**INTERNAL EXAMINER EXTERNAL EXAMINER**

**ACKNOWLEDGEMENT**

We owe great thanks to the Almighty for His shoers of blessings and his divine help which enables us to complete the Project successfully.

We would like to express out thanks to **Dr. R. Rajendran, Secretary,** for his support and encouragement.

We wish to express our deep sense of gratitude and respect **to Dr. J. Arputha Vijaya Selvi, Principal,** Kings College of Engineering, Punalkulam, for giving permission to do the project work successfully.

A special thanks to **Shri. T. R. S. Muthukumar, CEO,** Kings College of Engineering, Punalkulam, for offering the means of attaining our most cherished goal and for their incessant support.

We express our sincere thanks to **Mrs. N. Mangaiyarkarasi, Head of the Department,** Electronics and Communication Engineering, and **Mr. W. Newton Davod Raj, Project Coordinator,** who endorsed us with constant encouragement, and for extending full support.

With immense pleasure, we extend our sincere and heartfelt thanks to **Mr. K. Sudarsanan, Project Guide.** We also extend our sincere thanks to all the staff members of ECE department.

We extend our sincere and heartfelt thanks to non-teaching staff members of ECE department. Our deepest thanks to our parents for updating us by providing professional Education and for their prayerful support that make me to complete the project.

(D. MAHESWARAN)

(M. MOHAMED YESEEN)

(M. MUKILVANNAN)

(P. SUDHARSAN)

**ABSTRACT**

The exponential growth of wireless data demand and the limitations of conventional communication infrastructure have necessitated the development of innovative technologies to improve signal quality and energy efficiency. Intelligent Reflecting Surfaces (IRS) have emerged as a promising solution in next-generation wireless networks.

This project explores the design and implementation of an IRS-assisted wireless communication system, where a programmable meta surface is used to dynamically control the reflection of incident signals toward the receiver, thereby enhancing the overall communication performance.

The IRS is modelled using discrete phase shifts and is integrated into a simulation environment to analyse its impact on system parameters such as signal-to-noise ratio (SNR), bit error rate (BER), and achievable data rate. Optimization algorithms are employed to configure the IRS elements in real-time, maximizing signal strength at the receiver while minimizing interference.

The project demonstrates that IRS can significantly improve wireless coverage, reliability, and spectral efficiency, especially in non-line-of-sight (NLoS) scenarios.

This work contributes toward the practical realization of IRS in 6G networks, highlighting its potential in future smart radio environments.

**TABLE OF CONTENTS**

|  |  |  |
| --- | --- | --- |
| **CHAPTER NO.** | **TITLE** | **PAGE NO.** |
|  | **ABSTRACT** |  |
|  | **LIST OF TABLES** |  |
|  | **LIST OF ABBREVIATIONS** |  |
| **1** | **INTRODUCTION** |  |
|  | 1.1 OVERVIEW OF THE PROJECT |  |
|  | 1.2 WIRELESS COMMUNICATION |  |
|  | 1.3 WIRELESS TECHNOLOGY |  |
|  | 1.4 WIRELESS COMMUNICATION STANDARD |  |
|  | 1.5 5G / 6G GENERATION |  |
|  | 1.6 MIMO AND TYPES |  |
|  | 1.7 IRS DETAILS |  |
|  | 1.8 COMSOL MULTIPHYSICS 6.3 |  |
|  | * 1. SCOPE OF THE PROJECT |  |
|  | 1.10 OBJECTIVE |  |
| **2** | **LITERATURE SURVEY** |  |
| **3** | **EXISTING AND PROPOSED SYSTEM** |  |
|  | 3.1 EXISTING SYSTEM |  |
|  | 3.1.1 DISADVANTAGES |  |
|  | 3.2 PROPOSED SYSTEM |  |
|  | 3.2.1 ADVANTAGES |  |
| **4** | **SYSTEM DESIGN** |  |
|  | 4.1 BLOCK DIAGRAM |  |
|  | 4.2 DESCRIPTION |  |
| **5** | **HARDWARE REQUIREMENTS** |  |
|  | 5.1 POWER SUPPLY |  |
|  | 5.2 ARDUINO UNO MICROCONTROLLER |  |
|  | 5.2.1 PIN DIAGRAM |  |
|  | 5.2.2 PIN CONFIGURATION OF ARDUINO |  |
|  | 5.2.3 FEATURES OF ARDUINO UNO |  |
|  | 5.2.4 PERIPHERAL FEATURES |  |
|  | 5.2.5 SPECIAL FEATURES |  |
|  | 5.2.6 DETAILED FEATURES OF ARDUINO UNO |  |
|  | 5.2.7 SPECIAL FUNCTION REGISTERS |  |
|  | 5.2.8 PROGRAMMING IN ARDUINO UNO |  |
|  |  |  |
|  |  |  |
| **6** | **SOFTWARE REQUIREMENTS** |  |
|  | 6.1 COMSOL MULTIPHYSICS 6.3 |  |
|  | 6.2 INTRODUCTION OF THE SOFTWARE |  |
|  | 6.3 SOFTWARE FEATURES |  |
|  | 6.4 FUNCTIONS |  |
| **7** | **SYSTEM IMPLEMENTATION** |  |
|  | 7.1 |  |
|  | 7.2 |  |
|  | 7.3 |  |
|  | 7.4 |  |
| **8** | **EXPERIMENTAL RESULT AND ANALYSIS** |  |
| **9** | **CONCLUSION** |  |
| **10** | **FUTURE SCOPE** |  |
|  | **APPENDEX** |  |
|  | **REFERENCES** |  |

**LIST OF TABLES**

|  |  |  |
| --- | --- | --- |
| **TABLE NO.** | **TITLE** | **PAGE NO.** |
|  |  |  |

**LIST OF FIGURES**

|  |  |  |
| --- | --- | --- |
| **FIGURE NO.** | **TITLE** | **PAGE NO.** |
|  |  |  |

**ABBREVIATIONS**

|  |  |  |
| --- | --- | --- |
| **S. NO.** | **ABBREVIATION** | **EXPANSION** |
|  |  |  |