

**DESIGN AND DEVELOPMENT OF ULTRA-WIDEBAND WIRELESS
TRANSMISSION**

ADZIZOL BIN ABDUL KARIM

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Signature :
Supervisor's Name : Pn Juwita Bt. Mohd Sultan
Date :

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ABSTRACT

This project is purposed to design and development of Ultra-Wideband Wireless Transmission in the communication system between multimedia devices. Ultra-Wideband is a one data transmitter system that is not using the wire system which it is a new revolution for a consumer electronic device. Ultra-Wideband become the best choice because it has a few advantages such as low power consumption in high data rated up to 480Mbps. Other that, Ultra-Wideband also do not use a high cost in develop the transmitter and receiver device besides low power transmit and low interference. Moreover, this system has a few disadvantages in their criteria such as limited range in transmit data. So this system is suitable for the Wireless Personal Area Network (WPAN) consumer electronic device. In the *Projek Sarjana Muda*, a few objectives have been proposed in order to learn and get information about the history and criteria of this system in wireless communication system, besides determine the available usage in network family such as Wireless Local Area Network (WLAN), Wireless Personal Area Network (WPAN), Wireless Metropolitan Area Network (WMAN) and Wireless Wide Area Network (WWAN). At the same time, the analysis about Ultra-Wideband will be doing in order to determine the suitable range frequency for this system. This analysis is including in understanding the theory of Ultra-Wideband which doing the simulation by using the MATLAB system. The output for this project will be present in Quadrature Phase Shift Keying (QPSK) Mapping. At the Quadrature Phase Shift Keying (QPSK) Mapping, a few output will be produces by refer to value of Signal-Noise-to-Ratio (SNR). Decreasing of Signal-Noise-to-Ratio (SNR), will increasing the magnitude of received Orthogonal Frequency Division Multiplexing.

ABSTRAK

Projek ini bertujuan mereka dan membangunkan sistem *Ultra-Wideband* tanpa wayar di dalam sistem komunikasi di antara peralatan multimedia. *Ultra-Wideband* merupakan satu sistem penghantaran data yang tidak menggunakan sistem wayar di mana ianya merupakan satu bentuk revolusi terbaru kepada pengguna peralatan elektronik. *Ultra-Wideband* ini telah menjadi pilihan terbaik kerana ianya mempunyai beberapa kelebihan kriteria seperti menggunakan kuasa yang rendah dalam kadar penghantaran data yang tinggi sehingga mencapai 480Mbps. Selain itu, *Ultra-Wideband* juga tidak memerlukan kos yang tinggi di dalam menghasilkan peralatan penghantar dan penerima selain daripada kuasa penghantaran yang rendah dan gangguan yang kecil. Namun begitu, sistem ini juga terdapat beberapa kekurangan di dalam kriterianya seperti penghantaran data pada jarak yang terhad. Oleh sebab itu, sistem ini amat sesuai untuk pengguna elektronik bagi *Wireless Personal Area Network (WPAN)*. Di dalam Projek Sarjana Muda, beberapa objektif telah di ketengahkan bertujuan mempelajari dan mengetahui sejarah dan kriteria sistem ini di dalam sistem komunikasi tanpa wayar, selain melihat kesesuaian sistem ini di dalam kumpulan rangkaian seperti *Wireless Local Area Network (WLAN)*, *Wireless Personal Area Network (WPAN)*, *Wireless Metropolitan Area Network (WMAN)* dan *Wireless Wide Area Network (WWAN)*. Di samping itu juga penganalisan mengenai jalur lebar *Ultra-Wideband* dibuat bagi mengenalpasti jarak frekuensi yang sesuai untuk melaksanakan sistem ini. Penganalisan ini termasuk di dalam memahami teori mengenai sistem komunikasi tanpa wayar *Ultra-Wideband* seperti membuat simulasi dengan menggunakan sistem Matlab. Keluaran atau hasil projek ini akan dipaparkan pada *Quadrature Phase Shift Keying (QPSK) Mapping*. Pada paparan tersebut, beberapa keluaran atau hasil akan didapati

dengan berpandukan nilai *Signal-Noise-to-Ratio (SNR)* yang digunakan. Semakin kurang nilai *Signal-Noise-to-Ratio (SNR)*, maka semakin tinggi nilai magnitud *Orthogonal Frequency Division Multiplexing* yang diterima.

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LIST OF ABBERRIATIONS

UWB	-	Ultra-Wideband
QAM	-	Quadrature Amplitude Modulator
QPSK	-	Quadrature Phase Shift Keying
OFDM	-	Orthogonal Frequency Division Multiplexing
MB-OFDM	-	Multi Band Orthogonal Frequency Division Multiplexing
FFT	-	Fast Fourier Transform
IFFT	-	Inverse Fast Fourier Transform
IDFT	-	Inverse Direct Fourier Transform
RF	-	Radio Frequency
WPAN	-	Wireless Personal Area Network
USB	-	Universal Serial Bus
FCC	-	Federal Communication Commission
IEEE	-	Institute of Electrical and Electronic Engineering
ECMA	-	European Computer Manufacture's Association

CHAPTER I

INTRODUCTION

In the chapter I, a few subtopics are listed which describe about the project as clearly. Briefly, the project is introduced in the project introduction which story about the purpose of the project and the components that involve in this project. Before the project start, the project objective must be listed in order to convenience each flow of project and get the expected result. Basically, each project that is doing will facing a few problems and these problems must have their solution as a problem statement. In the work scope, it will discuss about the flow of project which involve all of the starting project level until finishing project level. Meanwhile, the project methodology will brief about the flow project.

1.1 Project Introduction

Ultra-Wideband is a one wireless communication system that is reappears since the narrowband technology become unavailable and not precision in the Wireless Personal Area Network (WPAN). It's because the advantages of Ultra-Wideband are fulfill requirement for the consumer electronics.

This project is in research in order to achieve the objectives that show the criteria's of the Ultra-Wideband in wireless communication system such as in radio system and radar locating. As we know, the criteria's of Ultra-Wideband are more suitable in Wireless Personal Area Network (WPAN) because the coverage range is not big and it has a high speed transferring data between the electronic equipment.

As we know, the systems that involving the applications of bandwidth are need the specification value of their amplitude, frequency and noise. These three components are being important in order to ensure the system achieved the best criteria before it is implementing into the real model. It's same to the Ultra-Wideband which this project will list each components that suitable and precise. In this project, to implement the Ultra-Wideband system, one model system will be creating by using the simulation of MATLAB.

1.2 Project Objective

The objectives of this project are to learn and investigate about the Ultra-Wideband in wireless communication applications which it is suitable in Wireless Personal Area Network (WPAN). In order to achieve an investigation, this project is needed design and simulates the Ultra-Wideband system by using MATLAB/Simulink. In this case, one block diagram will be determined which has a few components that can achieve the criteria's of Ultra-Wideband. Other that, the Orthogonal Frequency Division Multiplexing (OFDM) is designed by using Matrix Concatenation. Besides, the Quadrature Phase Shift Keying (QPSK) will be analyzed and simulated in signal constellation. As a result, this project will analyze the power spectrum for both of transmitters (Tx) and receiver (Rx) parts. Lastly, the objective of this project is determined the different between Line-of Sight (LOS) channel and Non-Line-of Sight (NLOS) channel in Ultra-Wideband impulse responses.

1.3 Problem Statement

In order to achieve the expected result of this project, it will be facing a few problems which are including the information, understanding, design and simulate the project. The first problem that is listed is about the information of the Ultra-Wideband. As we know, the Ultra-Wideband is a one communication system that reappears after the narrowband technology. So, it is might be cause the information of this system is not familiar, although the research's have been done by researcher's such as Intel Corporation. Other that, the theory of this system must be understood before the design creates. In this case, each specification of elements and components are listed in order to get the result that fulfills criteria's of Ultra-Wideband. The power consumption, noise, frequency and amplitude must in the correct values. So, the mathematical theory of signal-noise-to-ratio and bandwidth are needed to understand. In design the model, it will be involve the application of MATLAB software. This might be quite tough because to simulate the model, each component must be setting first and this setting is referring to the result from the mathematical theory.

1.4 Scope of Work

The scope of this project will cover the research of project until design the model and it's including show the capability project in the wireless communication system. The project will be focused on a few criteria's which are show the imaging of the result in Quadrature Phase Shift Keying (QPSK) Mapping, application of the system over the lower power consumption and high speed transferring data. The model of this system will be created and simulated in the MATLAB. So, before the model was created, it is important to understand the requirement of the project.

1.5 Project Methodology

The methodology shows the activities that are involved from the beginning until the project successfully. Firstly, the project has been chosen and it's quite tough because each project that is choosing must have related with the studies at least. It's because it will be advantages to prepare the project. After choose the project, the research of the project such as understanding project and collect the information and knowledge are being important before create the model. In this case, it's need a few reference or literature review in order to get the best result of project. After that, the model of project will be design and simulate by referring to the information that is got. In the designing model, the result must at least approximately to the theory. If the results are not same or difference to the theory, the troubleshooting of the model will be doing. At the same time, each step that has done, it will write down through to the report as a progress report. The full report will be submit after the result was successful achieve. The figure 1.1 shows the flow chart of the project.

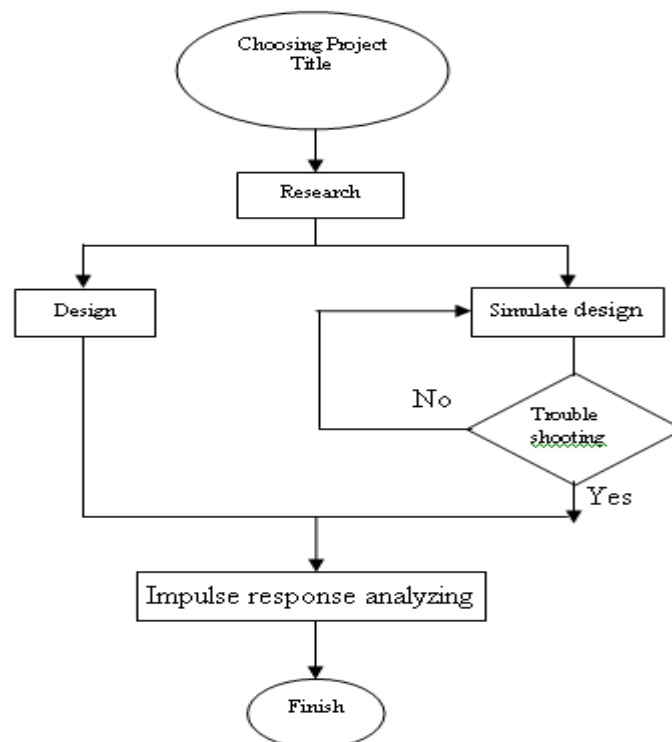


Figure 1.1: Project Methodology Flow Chart

The Table 1.1 shows the activities that involve during the *Projek Sarjana Muda* includes *Projek Sarjana Muda 1* (PSM 1) and *Projek Sarjana Muda 2* (PSM 2). By refer to the chart in table 1.1, the total week for complete this project is about 27 weeks which not including semester break and public holiday. The project must be finish among this week in order to prepare for presentation on last week project.

The activities that involve in this project are registering project, research about information or related information, understanding MATLAB, design model, simulate model and troubleshoot model. In understanding the MATLAB, it's quite tough because before design the model, the specification of block components must be understand such as the parameter in block components. Besides, the research about project should be true to the base theory because it will affect the result of project.

The final report will be submit on February which including the entire information project.

1.6 Report Structure

In the chapter I, project introduction is briefing about the project as a simple overview. This subtopic is starting with describing about the project purpose and the perspective in the each research that is done including the project objective, problem statement, scope of work and methodology.

Chapter II embracing the literature of the project which includes the concept, theory, perspective and the method of the project that is used in order to solve the problem occurs and any hypothesis that related with the research of methodology.

Chapter III is about the research methodology of the project. This chapter will discuss the method or approach that used in project development including in model structure.

Chapter IV discusses briefly on the observations, results and the analysis of the project that gain during the development of project. This chapter also consists of the recorded data analysis and the result of the project.

Chapter V covers the discussion of whole contents of the thesis and project and the suggestion for improvement process in the future research and overall conclusion of the project.

CHAPTER II

LITERATURE REVIEW

This chapter embracing the literature of the project which includes the history, concept, theory, perspective and the method of the project that is used in order to solve the problem occurs and any hypothesis that related with the research of methodology.

2.1 The History of Ultra-Wideband

Ultra-Wideband is a new wireless communication system that promises the revolution lower power consumption over the high-speed data transfer. This system also enables the personal area networking industry leading to new innovations and greater quality of services to the end user [5].

On February 14, 2002 the Federal Communication Commission (FCC) released a report that officially allocated spectral space for Ultra-Wideband technology. This allocation was strictly to define and restrict the Radio Frequency (RF) emissions of this technology and bandwidth to allow coexistence. The minimum bandwidth of Ultra-Wideband as defined by the Federal Communication Commission (FCC) must follow one of the two constraints which are the minimum bandwidth must occupy more than