FIBER-WIRELESS AUDIO COMMUNICATION

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PROJEK SARJANA MUDA II

Tajuk Projek : **FIBER-WIRELESS AUDIO COMMUNICATION**

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"I declare that this report "Fiber-Wireless Audio Communication" is the result of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree".

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Supervisor's Name : ENGR. NURMALA IRDAWATY BTE HASSAN

Date : 18-06-2012

To my beloved family, for their genuine love, prayers and encouragement. To all lecturers who guide me and to all my friends for your help and support.

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ABSTRACT

An optical communication system is consists of a transmitter which encodes a message into an optical signal. A channel which carries the signal to its destination and a receiver reproduces the messages from the received optical signal. Nowadays, by using light as signal information transmission in optical communication system is becoming a helpful technique and has encouraged a major new technology in audio, video and data transmission. Wireless optical communication is a telecommunication technology that uses light propagating in free space to send data from one point to another point whereby for this project sound is used as the input source and has characterized by frequency, wavelength, period, amplitude, speed and direction. The purpose of this project is to design the transmitter and receiver circuit that able to detect signal in the wireless channel by using the infrared as a photo-source. The sound is generating using Function Generator, then will be amplified and going through the speaker. The sound will be generated using IC Music Generator and the output will be heard at the speaker in the receiver. After test and verification, it is concluded that the device has the ability to detect the signal in wireless channel with an acceptable accuracy. On the other hand, by using the wireless channel is quite challenging to design and analyze it because of noise.

ABSTRAK

Satu sistem komunikasi optik terdiri daripada pemancar yang mengekod mesej kepada isyarat optik. Saluran yang membawa isyarat ke destinasi dan penerima mengeluarkan mesej daripada menerima isyarat optik. Dengan menggunakan cahaya sebagai isyarat pemancaran maklumat dalam system komunikasi optik, ianya menjadi satu teknik berguna dan telah memperkembangkan satu teknologi baru terutama dalam audio, video dan penghantaran data. Komunikasi tanpa wayar ialah satu teknologi telekomunikasi yang menggunakan cahaya yang menggunakan ruang bebas dalam menghantar data dari suatu destinasi ke satu destinasi lain apabila audio atau bunyi digunakan sebagai sumber input dan sifat cahaya ini dinyatakan oleh frequensi, panjang gelombang, tempoh amplitude, kelajuan dan arah. Tujuan utama projek ini adalah untuk mencipta litar penghantar dan penerima yang dapat mengesan maklumat dengan mengunakan sistem perhubungan optik tanpa wayar sebagai saluran dan infra merah sebagai sumber cahaya. Isyarat bunyi dihasilkan dari Penjana Isyarat dan kemudiannya akan diperkuatkan oleh Penguat. Isyarat maklumat akan dijana menggunakan „IC Music Generator" dan isyarat bunyi yang dikeluarkan akan dapat didengar pada penerima atau pembesar suara. Selepas pemeriksaan dilakukan, kesimpulan yang dapat dibuat adalah peralatan tersebut dapat mengesan maklumat di saluran tanpa wayar dengan jelas dan tepat. Walaubagaimanapun, dengan menggunakan sistem tanpa wayar sebagai saluran adalah sukar untuk menganalisis dan merekabentuk disebabkan oleh hingar.

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Hz	-	Hertz
ECM	-	Electrets Condenser Microphone
LED	-	Light Emitting Diode
IR LEDs	-	Infrared Light Emitting Diode
GaAs	-	Gallium Arsenide
Ω	-	Ohm
V	-	Voltage
W	-	Watt
A	-	Ampere
mW	-	miliWatt
mA	-	miliAmpere
VoIP	-	Voice over Internet Protocol or IP Telephony
FET	-	Field Effect Transistor
PIN	-	Positive Intrinsic Negative
DC	-	Direct Current
Op-amp	-	Operational Amplifier
FSO	-	Free Space Optic
IC	-	Integrated Circuit
IR	-	Infrared
SiO_2	-	Silica Glass
NIR	-	Near Infrared
SWR	-	Short Wavelength Infrared

MWIR	-	Mid Wavelength Infrared
LWIR	-	Long Wavelength Infrared
FIR	-	Far Infrared
PCB	-	Printed Circuit Board
kHz	-	kiloHertz
AC	-	Alternating Current
CC Camera	-	Closed Circuit Camera
ADC	-	Analog to Digital Converter

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CHAPTER 1

PROJECT OVERVIEW

1.1 Introduction

The root communication system consists of a transmitter, receiver and an information channel. Communication is the transfer of message or information from one location to another. By using light as signal information transmission in optical communication system is becoming a helpful technique whereby the idea of guided optical communication along optical fiber has encouraged a major new technology in audio, video and data transmission. The objective of this project is to display the inputs which are the audio at the output.

The basic of communication system consists of a transmitter, a receiver and an information channel, arranged as in Figure 1.1.

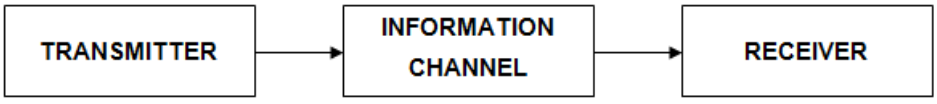

Figure 1.1: The Basic Communication System [1]

At the transmitter, the message is generated and put into a form suitable for transfer over the information channel [1]. The information travels from the transmitter to the receiver over this channel. Information channels can be divided into two categories: unguided channel and guided channel. The atmosphere is an example of an unguided channel over which waves can propagate. Systems using atmospheric channels include commercial radio and television broadcasts and microwave relay links. Guided channels include a variety of conducting transmission structures [1]. A few of these, illustrated in Figure 1.2, are the two-wire line, coaxial cable and rectangular waveguide. Guided lines cost more to manufacture, install and service than do atmospheric channels. Guided channels have the advantages of privacy, weather independence and the ability to convey message within, under and around physical structures [1]. Fiber waveguides have these advantages and others. At the receiver, the message is extracted from the information channel and put into its final form.

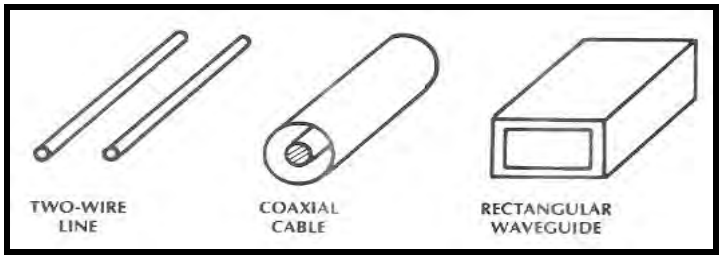

Figure 1.2: Some Conducting Transmission Lines [2]

An optical link uses light source and detector to transmit and receive information through the cable. In telecommunication, optical wireless refers to the mutual use of two technologies which are conventional radio frequency (RF) wireless fiber optic [2]. Optical communication systems are able to provide wider bandwidth and better security [2]. Furthermore, sending information by the use of light waves either in physical light guides or wirelessly is not new in nowadays technology. Definitely, light is better compared to radio waves especially when it fits to some wireless communications [2].

Moreover, optical transmissions can transmit sensor data and dissimilar with RF communications, which is it can also distribute high-resolution images but the most

important major problem is it is expensive to provide each end user with a separate fiber optic line [2].

Other than that, optical system can operate in location where RF transmission would obstruct with other equipment for example in the busy area like factories. Extensive range links are obtainable by fiber optic cables and the links that come from the long-range end-points to end users are undertake by radio frequency wireless [3]. One of the main advantage is this technology is the large amount of potential bandwidth available at optical frequencies, even though some proper features of the optical system such as practical impracticality of beam interception make them preferable in certain specific application [3]. Occasionally, laser systems supply the local range which also known as free space optic (FSO), rather than by RF wireless [3].

Lastly, an optical link is a communications link that consists of a single end-to-end optical circuit. On the other hand, the digital audio wireless transmission system is complimentary from such fluctuations as it does not use very complicated system. In short, digital audio wireless transmission is an optimum system to transmit high-quality audio signals without deterioration [3].

1.2 Project Objectives

There are four main objectives of this project. These objectives serve as guide and milestones to the project in order to have clearer view of the target results. The most important is to understand the basic principal of optical communication and get an experience to know the component involved in optical communication such as optical transmitter and receiver. The objectives of the project are as follow:

i. To develop a device that will transmit and receive sound by infrared wireless transmission.
ii. To design and fabricate the transmitter and receiver circuit of the audio communication system.

iii. To develop a system that easily operates, convenient and affordable.

iv. To design the low cost circuitry for audio communication system.

1.3 Scope of Project

Basically the scope of the project is designing transmitter and receiver and then fabricates the both circuits. The scope of this project will be based on the input signal by using the microphone at the transmitter. After that, the receiver circuit schematic and then the available component can be testified and used in this project. To design the schematic, Proteus is used as the software.

In addition, this project will focus on the sound that generated by using the Function Generator with different frequency range. The sound frequency range is between 1kHz to 10kHz. Then, sound will be amplified using High Speed Amplifier the output sound that came out was fed into the speaker and then will be detected by using the Electrets Condenser Microphone (ECM) with the receiver circuit.

Subsequently, the output from the filter was fed into speaker to analyze the signal which can be detected or not. Lastly, the complete circuit will be tested to detect the signal in wireless channel.

1.4 Problem Statement

For actual sound waves is consists of continuous in air pressure and electronic representations of these signals can be recorded in either digital or analog formats. Analog sound versus digital sound compares the two ways in which sound is recorded and stored. Moreover, this project wants to design the device which optical communication. This design is quite challenging because if the wireless is use as a channel, the important things that is taken into consideration seriously is noise when the

signal transmitted to the receiver. So, this project going to be the education purpose for student who wants to study about the wireless communication. This project also wants to design the low cost circuitry for example want to choose between infrared and laser as a photo-source, the advantages and disadvantages are both considered. Further, the application such as using analog or digital is considered, so if analog, infrared is the best choice to select.

1.5 Project Methodology

Methodology is the way of something is done and it shows like a flowchart. This methodology is done to fulfill the scope of project and finally to archive the objectives. Implementation and works of a project are summarized in a flowchart as shown in Figure 1.3.

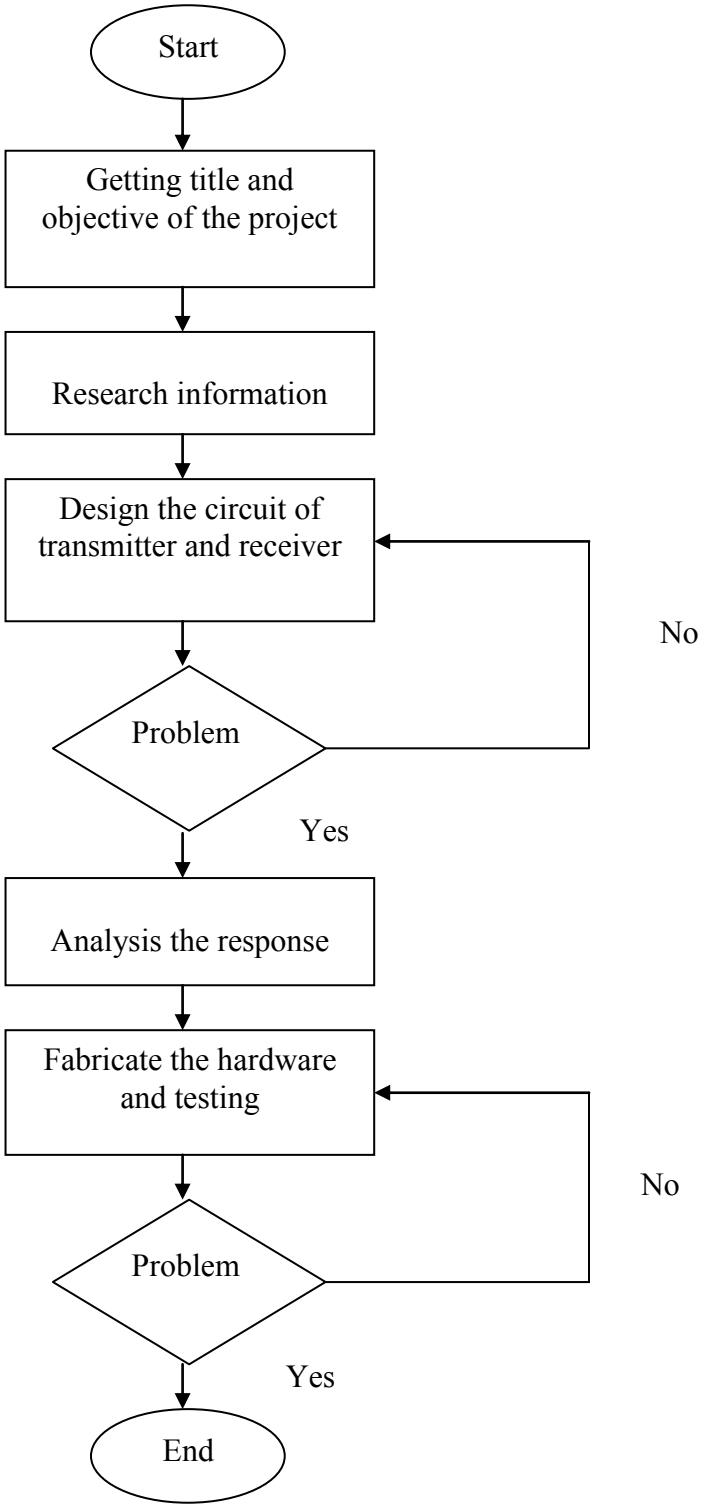

Figure 1.3: Flow Chart of Project