TRANSMISSION OF VOICE SIGNAL USING SQUARE WAVE FREQUENCY MODULATION

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This project and research work is dedicated to my beloved parents for their loving caring throughout my life undertaking and personal growth, my loving sisters and to all of my friends for their encouragement and love.

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ABSTRAK

Projek ini bertujuan untuk menghantar isyarat suara menggunakan gelombang segiempat, melalui kaedah isyarat modulasi. Projek ini terdiri daripada 3 blok utama iaitu litar penukar isyarat suara kepada gelombang segiempat, digital modulasi dan litar pemancar isyarat. Terlebih dahulu isyarat suara dalam 300 hingga 4 KHz yang terdiri daripada isyarat sinus akan ditukar bentuk kepada isyarat digital, kemudian isyarat ini akan dimodulasikan mengunakan teknik FSK modulasi dan isyarat yang termodulasi ini akan dipancarkan melalui gentian fiber optik menerusi litar pemancar isyarat. Isyarat ini seterusnya akan diterima dalam litar penerima dan ditukarkan semula kepada bentuk asal. Pada peringkat awalan projek ini pelbagai perisian digunakan seperti Multisim dan Proteus dalam merekabentuk, pengujian kebolehan litar serta dalam merekaan bentuk litar tercetak. Pada peringkat akhir, pemasangan serta pengujian litar sebenar dilakukan.

ABSTRACT

This project is about transmitting voice signal using square wave modulation technique. This project consists of 3 major blocks that is Analog to Digital Converter circuit modulation circuit and transmitter circuit. First of all, voice signal in a range of 300 to 4 KHz which in a sinusoidal form will be converted into digital signal before been modulated by using FSK modulation technique and this modulated signal will be transmitted through plastic fiber optic cable by the transmitter circuit. At the other end this transmitted signal will be converted to its original form. At the early stage of this project several software like Multisim and Proteus are been used to design, simulate, and for designing the PCB. At later stage, construction and testing on the actual circuit is commenced.

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UTeM	-	University Technical Malaysia Melaka
ADC	-	Analog to Digital Converter
PCB	-	Printed Circuit Board
AM	-	Amplitude Modulation
FM	-	Frequency Modulation
QAM	-	Quadrature Amplitude Modulation
OOK	-	On Off Keying
ASK	-	Amplitude Shift Keying
PSK	-	Phase Shift Keying
FSK	-	Frequency Shift Keying
PAM	-	Pulse Amplitude Modulation
MSK	-	Minimum Shift Keying
GMSK	-	Gaussian Minimum Shift Keying
DPSK	-	Differential Phase Shift Keying
TV	-	Television
A/D	-	Analog to Digital
D/A	-	Digital to Analog
LED	-	Light-Emitting Diode
LD	-	Laser Diode
ILDs	-	Infrared Laser Diodes
ST	-	Straight Tip
FC	-	Ferrule Connector
MT	-	Mechanical Transfer

NA	-	Numerical Aperture
OLTS	-	Optical Loss Test Set
OTDR	-	Optical Time Domain Reflectometer
MIC	-	Microphone
PSM	-	Projek Sarjana Muda
HFC		Hybrid Fiber Coax

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CHAPTER 1

INTRODUCTION

1.1 Project Introduction

The use and demand of optical fiber has grown tremendously. When compared to present the uses of optical fiber has grown rapidly, since its invention in the early 1970s. The most common used are in telecommunications, medicine, military, automotive, and industrial. Fiber offers many well-known advantages over twisted pair and coaxial cable, including immunity to electrical interference and superior bandwidth. For these and many other reasons, fiber optic transmission systems have been increasingly integrated into a wide range of applications across many industries.

The basic transmitting and receiving of fiber optic transmission system consists of few basic elements that are the source, optical transmitter, the fiber optic cable and the optical receiver as shown in Figure 1.1 below

Figure 1.1: Model of simple fiber link

The figure (1.1) above indicates the Source, Transmitter and Receiver. It also clearly shows the fiber optic cable constituting the Transmission Medium where it can be plastic or glass type as well as connectors that provide the interface of the Transmitter to the Transmission Medium and from Transmission Medium to the Receiver.

The transmitter converts an electrical analog or digital signal into a corresponding optical signal. The source of the optical signal can be either a light emitting diode, or a solid state laser diode. The most popular wavelengths of operation for optical transmitters are 850, 1300 or 1550 nanometers. Where in this project it uses wavelength of 660nm for transmission purposes.

The cable can consists of one or more glass or plastic fibers (single core or multiple core), which act as waveguides for the optical signal. Fiber optic cable is similar to electrical cable in its construction, but provides special protection for the optical fiber from within thus adding its advantage. For systems requiring transmission over distances of many kilometers, or where two or more fiber optic cables must be joined together, an optical splice is commonly used.

Finally, the receiver converts the optical signal back into a replica of the original electrical signal. The detector of the optical signal is either a PIN type photodiode or avalanche-type photodiode. Thus the signal will be feed to the speaker after going through several other circuits which will further improve the signal.

2   **Objectives.**

There are 3 objectives for this project that is as follows.

1. To transmit voice signal using square wave modulation technique.

This project is about transmitting voice signal using square wave modulation technique, where in order for it to be transmitted there are 3 block diagrams that has been identify and been executed. That is input of voice signal in a from of sinusoidal will firstly be converted to square wave by Schmitt Trigger circuit then feed to FSK modulation circuit and finally been transmitted through suitable transitions medium.

| Input voice signal | Schmitt Trigger | FSK Modulation | Transmit |
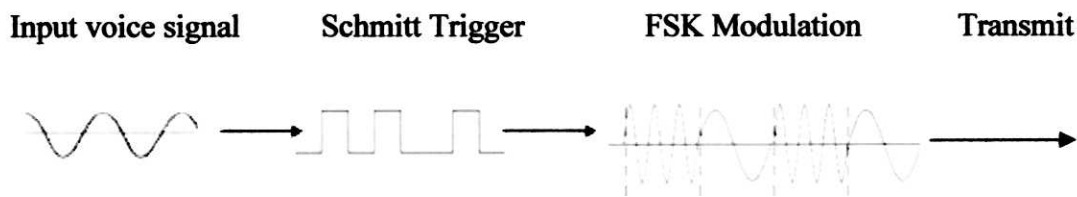
Figure 1.2: Showing transformation of the signal

2. Using fiber optic cable as its channel.

After taking into account of various transmissions medium for instate using copper wires, infrared and laser diode. It will be an added bonus if this voice signal can be transmitted by using optical fiber.

3. Constructing suitable circuit to transmit voice signal.

Suitable circuit need to be constructed in order for this project to work accordingly and that meets the basic requirement of this project

1.3   Problem Statement.

Signals for transmission can either be analogue or digital. In an analogue signal, the signal is varied continuously with respect to the information. In a digital signal, the information is encoded as a set of discrete values (e.g. 1's and 0's). Since it's in digital signal its much easier for digital transmission to regenerate back corrupted digital signal to get nearly clean and nearly perfect square-wave digital signal. Accumulated noise on the corrupted signal stops at the regenerator. Not so for an analog system where it's easy been influence by noise.

Plus for a voice signal to be transmitted over a long distance we need to modulate it and there are two modulation methods that commonly used in the analog modulation to transmit the signal, that is Amplitude Modulation (AM) and Frequency Modulation (FM) and it's depend of what kind of application that is been used. For digital modulation there are many technique that can also be used FSK, OOK, ASK, PSK, QAM, APSK and many more. But in this project Frequency-shift keying (FSK) is been used where not only FSK is a method of transmitting digital signals but it's also cheap to construct and somewhat similar to continuous-wave keying in AM transmissions. The two binary states, logic 0 (low) and 1 (high), are each represented by an analog waveform. Logic 0 is represented by a wave at a specific frequency, and logic 1 is represented by a wave at a different frequency.

Sinusoidal waveform is difficult to analyze because it have a value along the time travel where as signal transmission using square wave is much more easy to analyze compare with sinusoidal waveform, square wave is a periodic signal.

1.4   Scope of Work

i. Further understanding on how to transmit voice signal using square wave modulation need to be investigate.

This part is important because it helps to identity the type of modulation techniques and what type of system that is needed in this project. After getting a much clearer picture, then further development of this project can be done.

ii. Use Multisim 8 for design and simulation purposes.

Before any fabrication is been build, simulation need to take place this is to identify the capability of design, weakness, improvement and to reduce wastage. The result need to be taken and compare to the actual result.

iii. Prototype on strip board is been build and tested.

Bread board is used to build the prototypes, where further testing and improvements are needed. Comparison of results to the software is needed.

iv. Use Proteus Software to design the circuit and then fabrication of PCB.

This software enables PCB circuits to be built. From there the components are soldered.

v. Further testing and measurement is been taken.

Finally the combine circuits for the system is been tested and troubleshoot. The circuit is then measured to get the required readings.

1.5 Project Methodology.

Below shows 4 main phase of this project:

Phase 1: Project Planning
- Identify project and discussion with supervisor
- Prepare Gantt Chart for guidelines and progress of project

Phase 2: Literature Review
- Background reading and reference
- Searching for suitable modulation techniques.
- Designing and simulation

Phase 3: Building the Hardware
- Components and parts identification/specifications/procurement
- Designing circuit boards and assembling
- Testing, analyzing and diagnose circuits

Phase 4: Finishing
- Testing of prototype in operation, application and results.
- Presentation on outcome of project.