CHAPTER I
INTRODUCTION

1.1. Background

Currently, the advance of telecommunications technology has increased more rapidly. This is due to the increasing need for communication from year to year are always changing. One of the communication technology that have high demand is the wireless communication technology. This technology is able to facilitate communication that can support voice communication, images, and data. However, this technology is limited by the frequency of government regulation, as to avoid interference (Barney, 2014).

Radio frequency or microwave technology are now widely used in meeting the communication needs because due to several things including the availability of a receiver or receiver with high sensitivity levels and having coverage. However, it should be realized that the use of radio frequency transmission has several weakness, such as limited bandwidth due to the limited availability of frequency spectrum. Hence the need for other wireless technologies that can solve this problem.

Visible Light Communication (VLC) is a wireless technology that uses Light Emiting Diode (LED) as a transmission medium. Information will be converted into bits through several coding schemes by the microcontroller and will be sent using the LED light. Photodiode in the receiver will detect fluctuations in the LED of the transmitter and sends a signal to the microcontroller integrated with the computer to determine the information that has been sent (Barney, 2014).

Visible Light Communication (VLC) should be considered as a medium for wireless transmission because it has several advantages over other wireless transmission. The first reason to consider is the bandwidth of the frequency spectrum of the light radiated by the LED, which range from 428 THz to 750 THz (Keiser, 2013). Bandwidth is certainly much greater than the bandwidth of radio frequencies, which range from 3 kHz to 300 GHz (Ziskin, 2005). With the greater bandwidth, will allow it to accommodate more users and potentially achieve higher transfer speeds for each user can be given a larger portion for transferring information.

Transmission using wireless technology is generally used to transmit several types of information such as voice, image, and data. Such as transmitting information in the form of voice, for example, it is necessary that sufficient bandwidth and speed. Therefore

in this thesis we successfully demonstrated an audio transmission using Visible Light Communication (VLC) system. The performance have been tested on the variation of distance between transmitter and receiver on the VLC system. Besides that the current, optical power loss have been calculated to characterize the performance of the VLC system.

1.2. Formulation of Problem

Wireless communication suffers from many restrictions due to the inherent limitations of the wireless media and existing wireless communication protocols. Limited radio frequency spectrum (or bandwidth) is one of the major issues in wireless communication (Lim, 1999). Visible Light communication is a wireless communication technology that uses light that is visible to humans.

Visible light communication (VLC) should be considered as the medium for wireless transmission because it has a few advantages over other standard wireless transmissions. The first reason to consider is VLC frequency spectrum bandwidth, because the visible light spectrum is 10,000 times larger than the entire radio frequency spectrum which ranges from 428 THz to 750 THz. This spectrum range is the vast potential of unused and unregulated (Haas, 2013). So it can improves channel utilization in wireless communication systems.

In VLC system, the distance between transmitter and receiver should be close, so the communication process in visible light communication have a good performance. In this project the performance of visible light communication have been tested at various of distance between transmitter and receiver of the VLC system. Based on the problems associated with the performance of a VLC system, then formulation of problem can be made as follows:

1. How to design the VLC system for audio transmission?
2. How the influence of distance between transmiiter and receiver to the VLC system performance?

1.3. Scope of Problems

Scope of problem based on the formulation of the problem above is focused on:

1. Transmission medium used is free space optic.
2. The modulation format used are intensity modulation that use On Off Keying (OOK) modulation.

3. The simulation research used superbright 5 mm white LED as the transmitter which has power consumption of 70 mW.
4. The receiver used is silicon pin photodiode which has wavelength of peak sensitivity up to 950 nm and dark current up to 30 nA.
5. The amplifier used is LM386 low voltage audio amplifier which has voltage gain of 20 to 200.
6. The variation of distance between VLC transmiiter and receiver that has been used in this experiment is 5 cm, 10 cm, 15 cm, and 20 cm.
7. The data used in this thesis based on simulation by direct experimental.

1.4. Objectives

Based on the problem statement, the objectives of this research are to design the visible light communication system for audio transmission and to analyze the performance of visible light communicaion system based on the variation of distance between transmitter and receiver of the VLC system.

1.5. Systematic of Writing

Chapter 1 will explain about introduction of this project, consist project background, problem statement, objectives, scope of project, and thesis outline. Chapter 2 will explain about the review of the concept of visible light communication system which includes transmitter and receiver system. Chapter 3 will discuss the method used to implement the visible light communication for audio transmission in this project. Chapter 4 provides the result and analysis of the proposed system which based on the parameters which have been designed. Chapter 5 will conclude based on the proposed system, and the future work that is suggested for improving the proposed system in the future.