CHARACTERISATION OF PULSE POSITION MODULATION TECHNIQUE FOR INDOOR VISIBLE LIGHT COMMUNICATION (VLC) SYSTEM

ENG CHOON XIAN

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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CHARACTERISATION OF PULSE POSITION MODULATION TECHNIQUE FOR INDOOR VISIBLE LIGHT COMMUNICATION (VLC) SYSTEM

ENG CHOON XIAN

This report is submitted in partial fulfillment of the requirements for the degree of Bachelor of Electronic Engineering with Honours

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APPROVAL

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DEDICATION

Special thanks to my supervisor, family, and all lecturers who willing to guide me and support me throughout this final year project.

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ABSTRACT

This project proposes characterisation of pulse position modulation technique for indoor visible light communication (VLC) system. The project fundamentally involves the light-emitting diode, LED as a light transmitter and the photodiode as a part of the receiver to capture the optical signal. The signal will be transferred from one to another at a certain distance. Later, On/Off keying is added to the circuit as to compare the distance in the previous circuit. Pulse position modulation technique is then added accompanied by the transmitter and receiver, which compared the distance with the On/Off keying circuit. Three different conditions and its performance will be analysed in terms of distance and capacity.

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ABSTRAK

Projek ini mencadangkan pencirian teknik modulasi kedudukan nadi untuk sistem komunikasi cahaya yang boleh dilihat tertutup (VLC). Projek ini pada asasnya melibatkan diod pemancar cahaya, LED sebagai pemancar cahaya dan fotodiod sebagai sebahagian daripada penerima, isyarat akan kemudian memindahkan dari satu kepada yang lain dalam jarak tertentu. Kemudian, buka / tutup menaip ditambah ke litar untuk membuat perbandingan jarak dalam litar sebelumnya. Pulse teknik kedudukan modulasi kemudiannya ditambah disertakan dengan pemancar dan penerima, yang berbanding jarak dengan hidup / mati litar menaip. Tiga keadaan yang berbeza dan prestasinya akan dianalisis dari segi jarak dan kapasiti.

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LIST OF SYMBOLS AND ABBREVIATIONS

VLC	:	Visible light communication
LED	:	Light emitting diode
PPM	:	Pulse Position Modulation
OWC	:	Optical Wireless Communication
OOK	:	On/Off keying
HAP	:	High altitude platform
RF	:	Radio Frequency
Mbps	:	Megabits per second
THz	:	Tera hertz
RGB	:	Red, Green, Blue
MHz	:	Mega hertz
nm	:	Nanometres
mm	:	Millimetres
SMD	:	Surface-mount device
PCB	:	Printed circuit board
E	:	Energy
h	:	Planck’s constant
f	:	Frequency
m^2	:	Metres squared

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kg	:	Kilogram
s	:	Seconds
DC	:	Direct current
SNR	:	Signal to noise ratio
TIA	:	Transimpedance amplifier
R_1	:	Resistor 1
R_2	:	Resistor 2
C	:	Capacitor
PWM	:	Pulse width Modulation
CSK	:	Colour Shift Keying
OFDM	:	Orthogonal Frequency-Division Multiplexing
DPPM	:	Differential Pulse-Position Modulation
VPPM	:	Variable Pulse Position Modulation
IPPM	:	Inverse Pulse Position Modulation
UART	:	Universal Asynchronous Receiver-Transmitter
CCS	:	Code Compose Studio

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CHAPTER 1

INTRODUCTION

The introduction of this project is explained in this chapter following the background studies/research and the problem statement. The objectives, scopes and expected results are also discussed in this chapter. For the project background, an explanation about the lighting has been depicted.

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1.1 Project Background

Visible light communication (VLC) is one of a promising communication technology, which is intensively being developed recently. It is asserted as an advanced free-space optical wireless communication method. The basic idea for this communication is to employ conventional light source, which is nowadays light emitting diode (LED), for simultaneously transmitting information and illuminating by modulating data into its light intensity. Human eyes will not notice the light flickering or blinking due to a relatively high modulation speed. On the receiver side, the photodiodes can be utilized at the receiver side to detect the modulated light signal and demodulate the data. Furthermore, this technology can be used to heighten the performance characterisation without using any additional communication bandwidth.

This project proposes characterisation of pulse position modulation technique for indoor visible light communication (VLC) system. The project fundamentally involves the light-emitting diode, LED as a light transmitter and the photodiode as a part of the receiver. The optical signal will be then transferred from one to another at a certain distance. Later, On/Off keying is added to the circuit as to compare the distance in the previous circuit. Pulse position modulation technique is then added accompanied by the transmitter and receiver, which compared the distance with the On/Off keying circuit. In fact, the modulation technique may enhance the transmitted frequency resulting in extending the distance transmission between the transceiver circuit. It means that higher frequency leads to larger energy in transmitter to send the optical signal to a longer distance. From that point of view, the photoelectric effect comes with the equation as such:

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