BROADBAND POWER LINE COMMUNICATION SYSTEM OPTIMIZATION FOR INTEGRATED SYSTEM OF VISIBLE FREE SPACE OPTIC AND BROADBAND POWER LINE COMMUNICATION

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"To my beloved Father, Mother "

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ABSTRACT

Recently the indoor power line has been proposed as a competitive technology for digital systems in homes. Indoor power line integrated with other systems to distributing data inside home, such as visible free space optic (VFSO). Employing visible light generated by white LEDs for indoor optical wireless have been proposed and implemented. Since white-LED is usually distributed over the ceiling for illumination, it is possible to use the ubiquitous power line cables as a communication medium between other fixed network and LED lights. Some works have been done in this area but because power line is an unpleasantly medium in case of noise and multipath distortion the existing systems do not have good quality factor. So considerations of these parameters are very important issue to model the actual system. Hence for high-speed data communication, channel equalization is necessary the optimal equalizer is based on maximum likelihood sequence estimation (MLSE). In this case, a Decision-feedback equalizer (DFE) has been proposed in to limit the effect of ISI produced by multipath propagation in power line channel.

This paper attempts to investigate the performance of decision feedback equalizer (DFE) to reducing the effects of impulsive noise and ISI for integrated between BPLC and VFSO, and comparing the result with system which use Orthogonal Frequency Division Multiplexing (OFDM) techniques with Binary Phase Shift Keying (BPSK) sub carriers. It has been observed that in the case of using DFE the multipath effects and bit error rate are reduced. The information that is presented in this thesis could be useful for a optimizing the design of the BPLC systems

ABSTRAK

Baru-baru ini saluran elektrik indoor telah dicadangkan sebagai kompetitif teknologi untuk sistem digital di rumah. Indoor saluran elektrik bersepadu dengan sistem lain untuk mengedarkan data di dalam rumah, seperti terlihat percuma optic (VFSO) ruangan. Menggaji terlihat cahaya yang dihasilkan oleh LED putih untukindoor optik wayarles telah dicadangkan dan dilaksanakan. Sejak putih LED biasanya diedarkan ke langit-langit untuk penerangan, itu adalah membolehkan anda menggunakan kabel saluran elektrik di mana-mana sebagai komunikasi menengah antara rangkaian tetap yang lain dan lampu LED. Beberapa karya telah dilakukan di daerah ini, tetapi kerana power line adalah menyenangkan menengah di kes kebisingan dan distorsi multipath sistem yang ada tidak mempunyai baik factor high. Jadi pertimbangan parameter-parameter ini sangat isu penting untuk model sistem aktual. Oleh kerana itu, untuk data kelajuan tinggi komunikasi, pemerataan saluran diperlukan equalizer optimum berdasarkan urutan estimasi maksimum likelihood (MLSE). Dalam kes ini, Keputusan-feedback equalizer (DFE) telah dicadangkan untuk menyekat ISI kesan yang dihasilkan oleh propagasi multipath pada kanal saluran elektrik.

Tulisan ini cuba untuk menyiasat prestasi maklum balas keputusan equalizer (DFE) untuk mengurangkan kesan hingar impulsif dan ISI untuk bersepadu antara BPLC dan VFSO, dan membandingkan hasilnya dengan system yang menggunakan orthogonal Frequency Division Multiplexing (OFDM) teknik dengan Tahap Binary Shift Keying (BPSK) subcarrier. Telah diamati bahawa dalam kes menggunakan DFE kesan multipath dan kesalahan bit rate dikurangkan. Maklumat yang disajikan tesis ini dapat berguna untuk mengoptimumkan rekabentuk sistem BPLC.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

BPLC	-	Broad Band Power Line Commutation
VFSO	-	Visible Free Space Optic
DFE	-	Decision Feedback Equaliser
OFDM	-	Orthogonal Frequency Division Modulator
FSK	-	Frequency Shift Keying
FFT	-	Fast Fourier Transform
VLC	-	Visible Light Communication
LED	-	Light Emitted Diode
AWGN	-	Additive White Gaussian Noise
PSD	-	Power Spectral Density
ISI	-	Interfrance Inter Symbol
DSP	-	Digital Signal Proccesing
MLSE	-	Mean Last square error
BER	-	Bit Error Rate
SNR	-	Signal To Noise Rato
QPSK	-	Quarther Phase Shift Keyeing
GBN	-	Generalized Background Noise
LV	-	Low Voltage

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Background of the study

Today, indoor wireless optical communication design great interest. infrared remote controls and devices communicate, according to the Infra-Red Data Association (IrDA) are very widespread and are the largest area of application.. Meanwhile, introducing the new type of LED (white LED) as a device lighting, which offers advantageous features such as brightness high reliability, low power consumption and long life, you expected in the near future will use white general lighting LED. Having said that, because of the rapid passage of the LEDs, modulation visible light waves for free space communications is possible, so new kind of optical wireless communication, Visible Light Communication (VLC) has been studied [1]. In this system, the LED is not only used as a lighting device, but also be used as a communication device. This Dual function of LED, lighting and communication, it is clear many new and interesting applications.

In addition to wireless optical systems for indoor applications, there is a growing interest in using ubiquitous wired system for home networks so-called power line communication (PLC). Using the power line as a means of communication could be a convenient way than other systems because it uses a existing cabling infrastructure [2].

power line communication (PLC) is a technology that uses the infrastructure of the distributed power supply system as medium. The PLC technology can provide a range of consumer services such as Internet, home entertainment, home automation, and enable the authority to supply electricity efficiently manage their own distribution networks in order competitive. [14].

PLC technology offers several advantages over other wire line and wireless communication technology that makes PLC efficient and economical to use in some applications. First place, PLC uses the existing infrastructure of networks of line electrical wiring means big savings. Second, PLC more secure than wireless and telephone communication line. The data transmitted in any home, companies etc., and can not be breached by someone outside the subnet. [14] Although PLC is well market "'last mile" solution for high data rate and data media at low voltage (LV). [9]

All power line communications systems operate by impressing a modulated carrier signal on the cable system. Different types of cables electrical use different frequency bands, depending on the transmission characteristics of the signal wiring power used. As the system power wiring was originally intended for transmission of alternating current, using conventional circuits have only a power wire limited ability to carry the higher frequencies. The problem of propagation is a limiting factor for all types of electrical cables.

PLC narrow-band (9 to 140 kHz) makes it possible to speed data transmission up to several thousand bits per second that are sufficient only for certain measurement tasks, the transmission of data with very low bit rate and the realization of some numbers transmission channels for voice connections.

But to achieve the highest data rate, PLC transmission systems must operate in a wider range of frequency (1 MHz to 30 MHz), which offers broadband PLC (BPLC) for make telecommunications services more sophisticated. Recently, the

internal power line was proposed as a competitive technology for digital home entertainment systems. Earlier research focused on the determination of parameters different channels that affect the performance of indoor communication Broadband power-line (BPLC) systems with up to 30 MHz frequency. [19]

There has been a growing interest in using the infrastructure of power- line for broadband communication services. However, there is that a number of challenges that exist with regard to the transfer of data through this type of network is concerned. Power-line topology varies from region to region and from country to country [6].

Thus, two systems (PLC and VLC) are introduced in each separately are now improved, but the next generation of communication usually referred to as fourth generation (4G) systems will not be based on a single system, but will include a series of different complementary access technologies, the integration of communication across the network (PLC) with visible light communication (VLC) might be one of the 4G systems. To understand this system, proposed a revision of the system integrated data and the transfer function of multipath channel PLC and noise associated with that channel are simulated. There are some challenges for communication over power lines, as the change in impedance, attenuation, transfer function of the channel varies considerably from time to time and different types of interference and noise in the system. In general, the frequency band from 1MHz to 30MHz is considered suitable for high data transmission. Frequency of 30MHz overcome is difficult to use for high data transmission due to the high attenuation of signals. Main influences of the band in BPLC from 1MHz to 30MHz are signal attenuation, noise and multipath. [4]

The noise in networks BPLC is varied and is described as the superposition five types of additive noise of M. Zimmermann [2], which is divided into two groups: the color of background noise and impulse noise. The first types noise usually remain stationary over time intervals and are summarized as background noise. The last type is the time variant and is classified as impulsive noise. The impulsive noise has a short random duration in the presence and high spectral power density. This results in impulsive noise burst error which may be run overcome the limitation of being detected and corrected by use error correcting

codes. power line channel is very hard, noisy and non-linear transmission medium [4]. The power cables were never designed to carry data signals. One of the main problemsPLC should be considered involves the interference between symbols (ISI), that is generated by the effects of multipath propagation and its spread consequent delay.

1.2 Statement of the Problem

Multipath and impulsive noise effect is serious problem for PLC because the distribution of power lines is complicated. They effects are the main reason to cause the bit errors in power line communications.

1.3 Objectives of the Study

To reduce the effects of none Gaussian noise and inter symbol interference (ISI) of broad band power line channel (BPLC) in integrated system of PLC and visible free space (VFSO) system.

1.4 Research Questions

How to minimize ISI and none Gaussian noise effects?

1.5 Scope of the Study

In order to achieve the objective of this research, the following scope of work will be done which comprises:

i. A literature review on related topics which are broadband powerline communications (BPLC), adaptive equalizer (AE), visible free space optic (VFSO).
ii. Modeling and simulation of power line channel which is used in integrated system of BPLC and VFSO with considering its noises and multipath distortions, transmitter and receiver filters and adaptive equalizer at receiver.
iii. Selecting an appropriate modulation scheme which is suitable for the harsh environment of power line channel.
iv. Design the decision feedback equalizer based on defining suitable training signal.
v. The optimal design of DFE will be selected and used in system.
vi. Measurement and characterization of the optimized system
vii. Thesis development