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ML Based Voice Transmission Using VLC System

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ABSTRACT

We investigate the design and implementation of machine learning (ML)-based demodulation methods in the physical layer of visible light communication (VLC) systems.VLC system has the potential to add significant capacity to short range wireless access technology by piggybacking data on light from overhead luminaries. We build a exible hardware prototype of an end-to-end VLC system, from which the received signals are collected, as the real data. We are going to perform demodulation with Adaboost technique. The Adaboost method includes a strong classifier that is constructed by the weak classifiers with the *k*- nearest neighbor algorithm.

KEYWORDS : LED ,PHOTODIODE,MATLAB SOFTWARE,ADABOOST

1. INTRODUCTION

With the rapidly increasing number of mobile digital devices and the soaring high volume of wireless data traffic, the high speed wireless transmission is also highly demanded .Visible light communication (VLC), with advantages like huge unregulated spectrum, high security and immunity to electromagnetic interference, has sparked significant research attention as a promising solution . Short range wireless communications .Through massive deployment of light-emitting diodes (LEDs), VLC typically employs the intensity modulation and direct detection technique for both the illumination and data transmissions where the information is represented by the real and nonnegative light signals. Lighting is a major source of electric energy consumption.Visible light communication is a data communications medium using visible light between 400 THz-800THz. Traditional radio frequency (RF) systems are currently facing spectrum crisis, which is the bottleneck of enhancing the network capacity.VLC typically employs the intensity modulation and direct detection technique for both the illumination and data transmissions where the information is represented by the real and nonnegative light signals.Demodulation of radio), and thus the applied demodulators are optimal in terms of the AWGN channel.However,thepractical VLC channels are not easy to model since there exist toomany factors, including but not limited to: limited modulation bandwidth of LEDs, multi-path dispersion, impulse noise, spurious or continuous jamming, and low sensitivity of commercial photodetector (PD).Signals plays a fundamental role in VLC systems. In general, the traditional demodulators could be categorized into two classes: coherent and non-coherent demodulators. Moreover, the priori knowledge,such as channel state information (CSI) or channel noise,is usually required.However,in fast-fading scenarios, CSI is usually hard to estimate since the fading coefficients vary quickly within the period of one transmission block. Besides, most of existing works assume that the VLC channel suffers from additive white Gaussian noise (AWGN), and thus the applied demodulators are optimal in terms of the AWGN channel. However, the practical VLC channels are not easy to model since there exist too many factors, including but not limited to: limited modulation bandwidth of LEDs, multi-path dispersion, impulse from additive white Gaussian noise (AWGN), and thus the applied demodulators are optimal in terms of the AWGN channel. However, the practical VLC channels are not easy to model since there exist toomany factors, including but not limited to: limited modulation bandwidth of LEDs, multi-path dispersion, impulse noise, spurious or continuous jamming, and low sensitivity of commercial photodetector (PD).

2. RELETED WORK

This section discusses the most closely related, and then provide a service between the related work and our system.Using visible light communication system many LIFI based worked are carried out here we are adding the demodulation technique using the machine learning i.e using Adaboost.

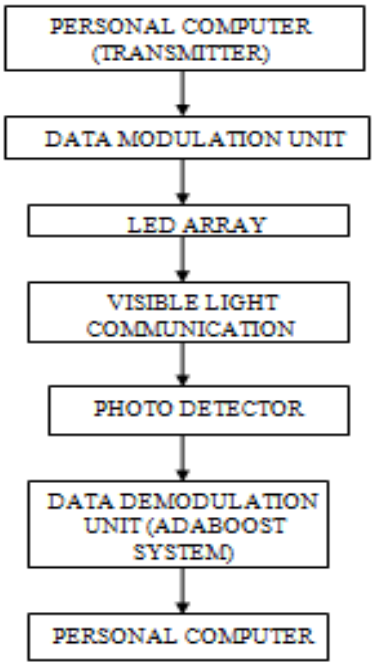
3. METHODOLOGY

We propose a exible end-to-end VLC prototype, which consists a modulation block, an arbitrary function generator, an amplier, a bias-T, a LED driver, a single LED, a single PD, a mixed domain oscilloscope, and a ML based demodulation block. According to Fig. 1, the digital signals *.n/ is modulated by the M-QAM scheme, converted* to the analog signal by the arbitrary function generator, and further amplied by the amplier. After amplication, the signal adds the direct current (DC) at the Bias-T. Finally, the signal is transformed to the visible light by LED, and sent out to the wireless channels. At the receiver, the optical signal from LED is converted to the analog signal through PD, and then the analog signal is converted to a digital signal at the mixed domain oscilloscope. Afterwards, the digital signal is demodulated by the ML based demodulator.

3.1 Benefits of Proposed System

- Transmit data by sockets of existing light fixtures.
- Alleviate a number of problems associated with the radio frequency (RF) communication systems.
- Consume far less energy.
- Security.
- Harmless for human body.
- Eye safety.

3.2 Modulesof the project:



We propose a flexible end-to-end VLC system hardware prototype to study data-driven demodulation approaches. By exploiting this prototype, we collect received signal data in real physical environmentsin modulation schemes, i.e 16-quadrature amplitude modulation(QAM).Using all the above modules we carried out the project that we will discuss in the project.

4. EXPECTED EXPERIMENTAL RESULT

THE END-TO-END VLC SYSTEM PROTOTYPE As shown in Fig above the proposed end- to-end VLC system prototype includes a source computer, an arbitrary function generator, an amplifier, a bias-T, a LED, a sliding rail, a PD, and a mixed domain oscilloscope. We use this prototype to generate the real VLC modulation dataset and verify the proposed data-driven demodulation methods. In the experiments, a serial binary bit stream is randomly generated and modulated in 8 different types of signals on computer with MATLAB. We sample *N* points in one period to generate modulated digital signals for each scheme, which is transferred to analog waveforms by the arbitrary function generator. The modulated current after amplification is super- imposed on LED. At the receiver, the sampled digital signals are monitored and shown by the mixed

domain oscilloscope. After normalization the vector is considered as the feature of transmitted symbol and processed by AdaBoost so that it can be demodulated.

5. CONCLUSION

Demodulation accuracy is decreases as a modulation order increases. We will further investigate dedicated ML based demodulators for VLC system.There are many applications that can be realized using Visible Light communication. Careful consideration will be needed to introduce it into a market. In this paper, three data driven demodulation are CNN, DBN and ADABOOST based demodulator are designed for physical layer of VLC system. A flexible end to end VLC system prototype is constructed for real data collection. By using the proposed data type, an open online real modulated dataset is created, which consists 8 types of modulated signals, i.e. OOK, QPSK, 4PPM, 16AQAM, 32QAM, 64QAM, 128QAM and 256QAM. Based on this real dataset, we investigate the demodulations performance of the proposed three demodulators. Experimental results show that for a given transmission distance

6. REFRENCES

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