Project: IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)

Submission Title: Rolling Shutter OFDM Scheme for Optical Camera Communication ystem
Date Submitted: May 2021
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Abstract: RS-OFDM scheme for OCC system based on rolling shutter effect

Purpose: To discuss about the RS-OFDM scheme for OCC system based on rolling shutter effect.

Rolling Shutter OFDM scheme for Optical Camera Communication system

Introduction

❑ Orthogonal Frequency-Division Multiplexing (OFDM) is a digital multi-carrier modulation scheme that is employed in broadband wired and wireless communication as an effective solution with Inter-Symbol Interference (ISI) caused by a multipath channel.

❑ In Light Fidelity (Li-Fi), the OFDM waveform is well-known and frequently implemented; however, the use of OFDM technology with Optical Camera Communication (OCC) is new technology.

❑ [1] has been discussed the potential of using OFDM waveform in Optical Camera Communication system. These advantages of using OFDM waveform in OCC system can be summarized as follow.

❑ In this document, we propose the Rolling Shutter OFDM scheme for OCC system.

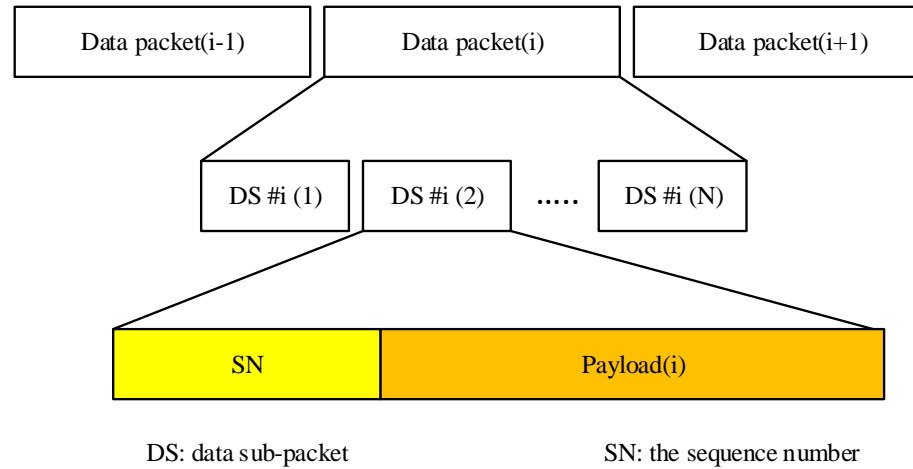Yeong Min Jang

Rolling shutter OFDM scheme
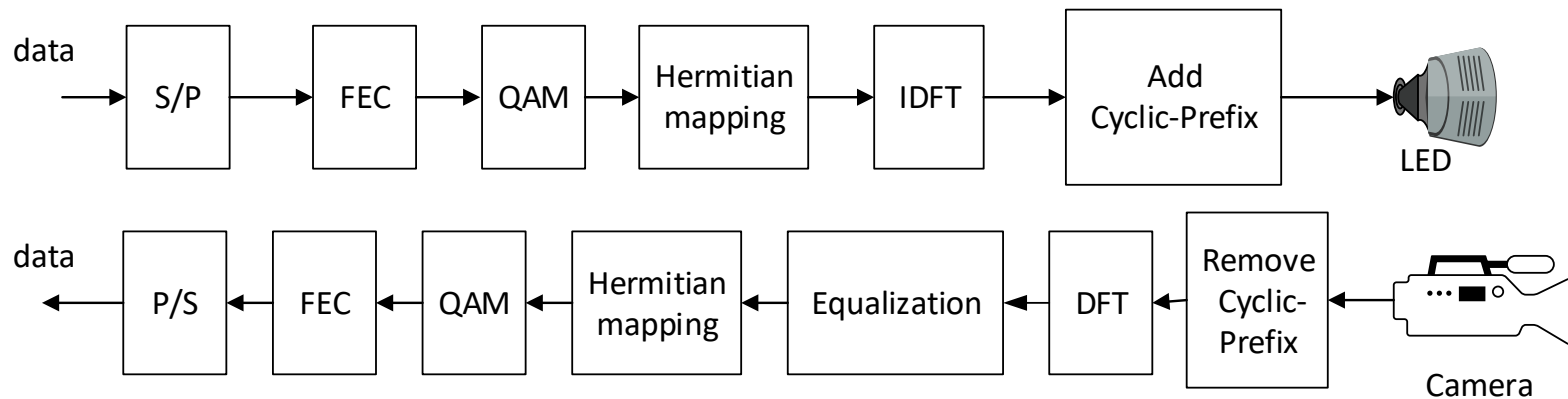
Architecture of Rolling Shutter-OFDM system

Unlike the conventional OFDM in Radio Frequency, instead of feeding the data symbol directly into the IDFT block, each symbol must pass through the Hermitian block.

$$X_m = X_{N-m}^{*} \text{ for } 0 < m < N \text{ and } X_0, X_1, X_2 \dots X_{N-1}$$

$$X = [0, X_1, X_2 \dots 0 \dots X_2^{*}, X_1^{*}]$$

Data structure of Rolling Shutter OFDM scheme

Data packet(i-1)	Data packet(i)	Data packet(i+1)

| DS #i (1) | DS #i (2) | ..... | DS #i (N) |

| SN | Payload(i) |

DS: data sub-packet   SN: the sequence number
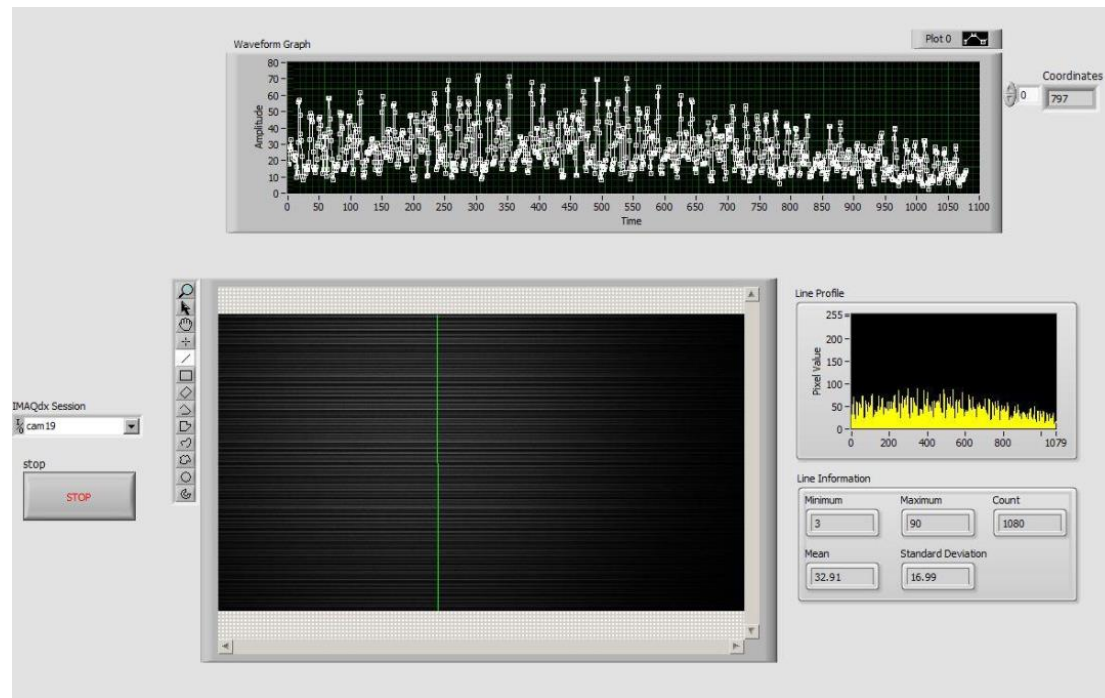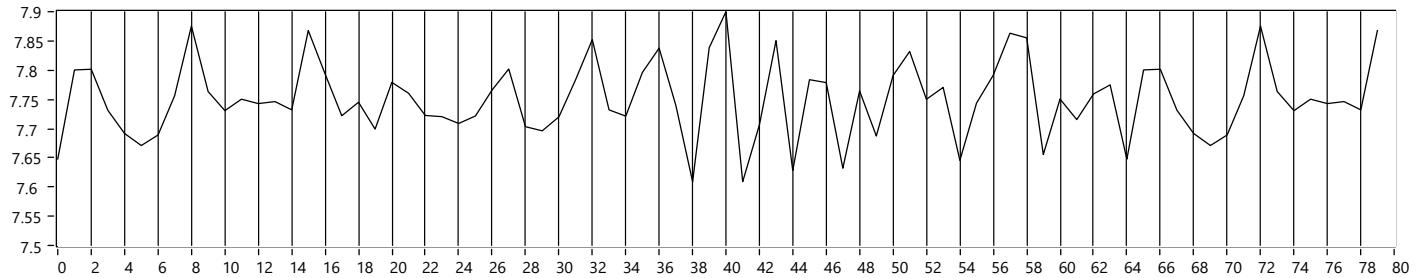
Proposed data frame structure for Rolling Shutter-OFDM system

❑ To support the compatibility of frame rate variation, every packet can contain many sub-packets, and each sub-packet in the same packet has the same data payload with a Sequence Number (SN).

❑ The SN represents the serial number of packets.

Rolling Shutter OFDM waveform

Rolling Shutter OFDM demonstration
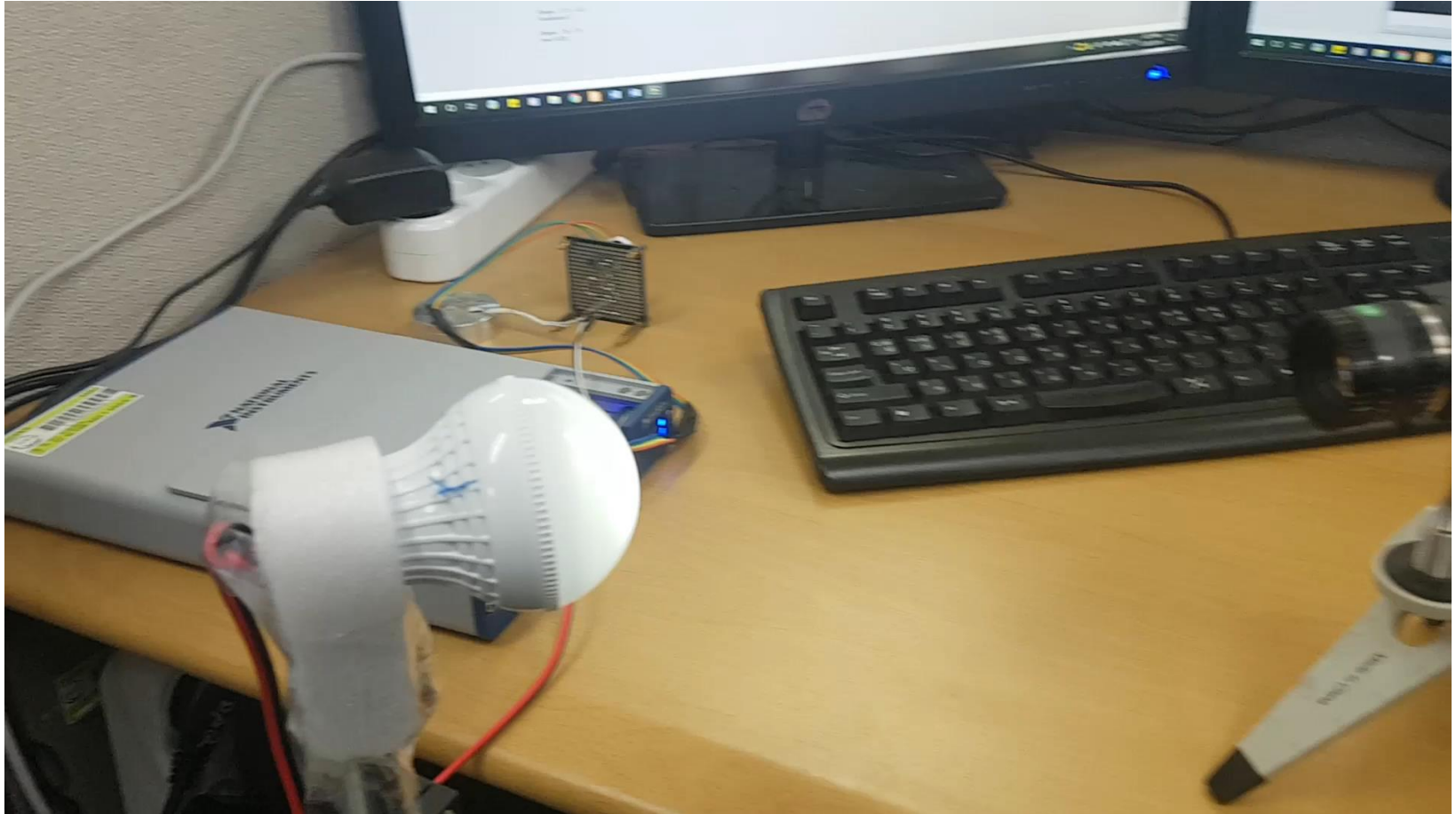
Video demo

References

[1] Huy Nguyen, Thieu Minh Duc, Trang Nguyen, and Yeong Min Jang, "Rolling OFDM for Image Sensor Based Optical Wireless Communication," IEEE Photonics Journal, Volume 11, Issue 4.