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

Submission Title: MIMO C-OOK scheme in Optical Camera Communication System

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Abstract: MIMO C-OOK scheme in Optical Camera Communication System based on the rolling shutter effect of camera.

Purpose: To introduce the feasibility of MIMO C-OOK for Optical Camera Communication

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MIMO C-OOK scheme in Optical Camera Communication System

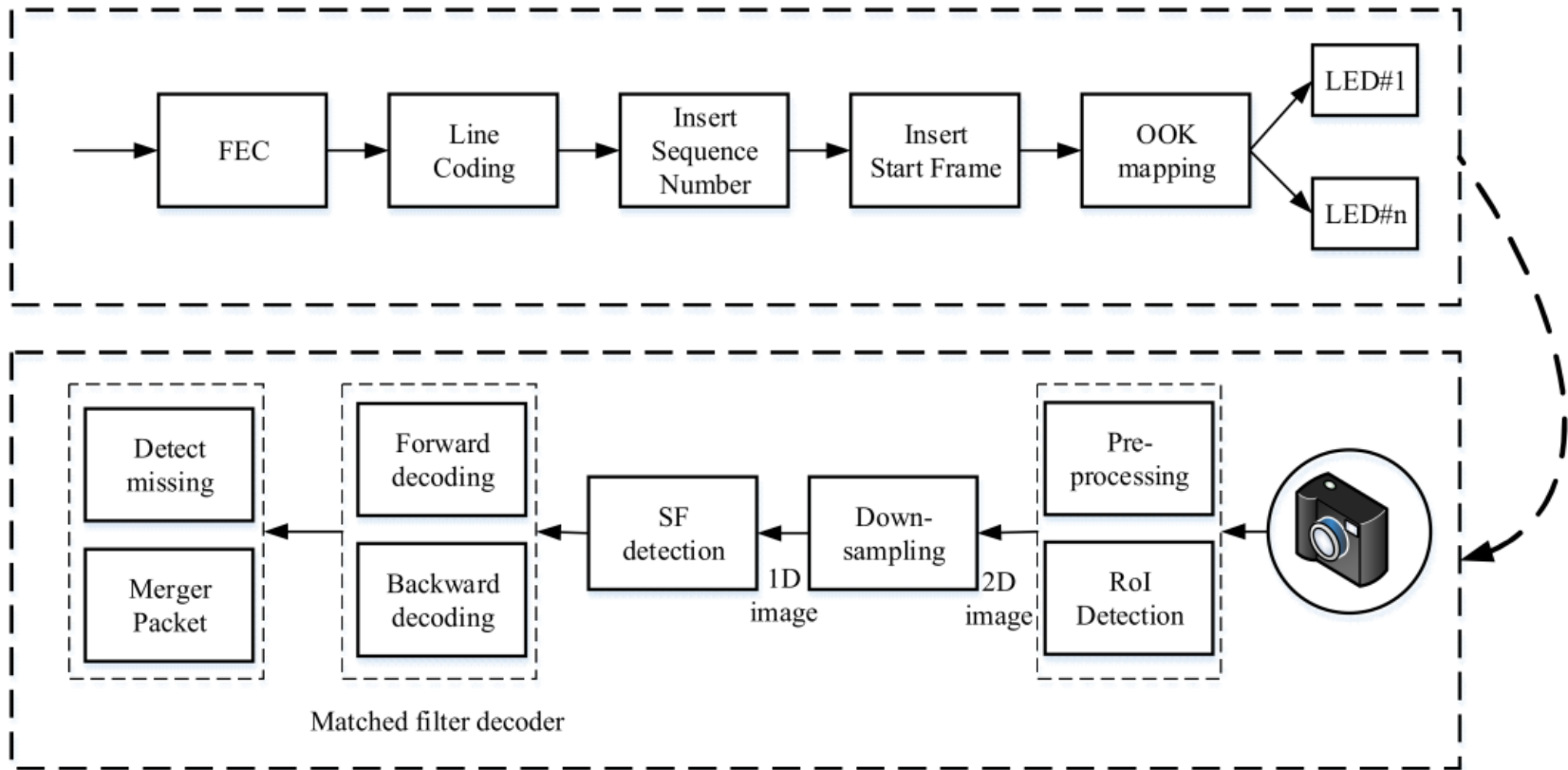
Introduction

- ❑ On-Off keying (OOK) scheme is known as the simplest form of amplitude-shift keying modulation by using two statuses: ON/OFF to transmit data

- ❑ C-OOK stands for Camera- On Off Keying, a communication mode within the IEEE 802.15.7-2018 Optical Wireless Communication standard. Particularly, C-OOK is within the PHY V layer of IEEE 802.15.7-2018 standard.

- ❑ MIMO C-OOK scheme, which updated the conventional C-OOK scheme, used MIMO, region of interest, and match filter techniques.

Architecture of MIMO C-OOK scheme



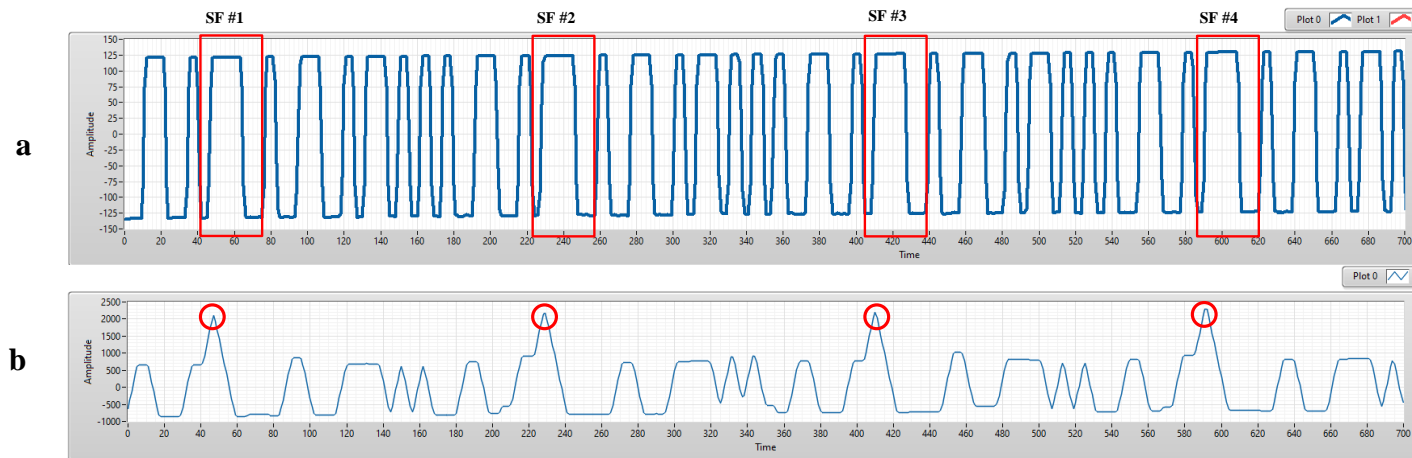
Reference architecture of MIMO C-OOK

Matched filter for MIMO C-OOK scheme

- Find the start of frame

With the preamble detection based on matched filter, the received signals and the template of preamble signal will be multiplied by the convolution algorithm (1). The positions of preamble part are the maximum value of the convolution results

$$(f * g)(t) \triangleq \int_{-\infty}^{+\infty} f(\tau)g(t - \tau)d\tau$$

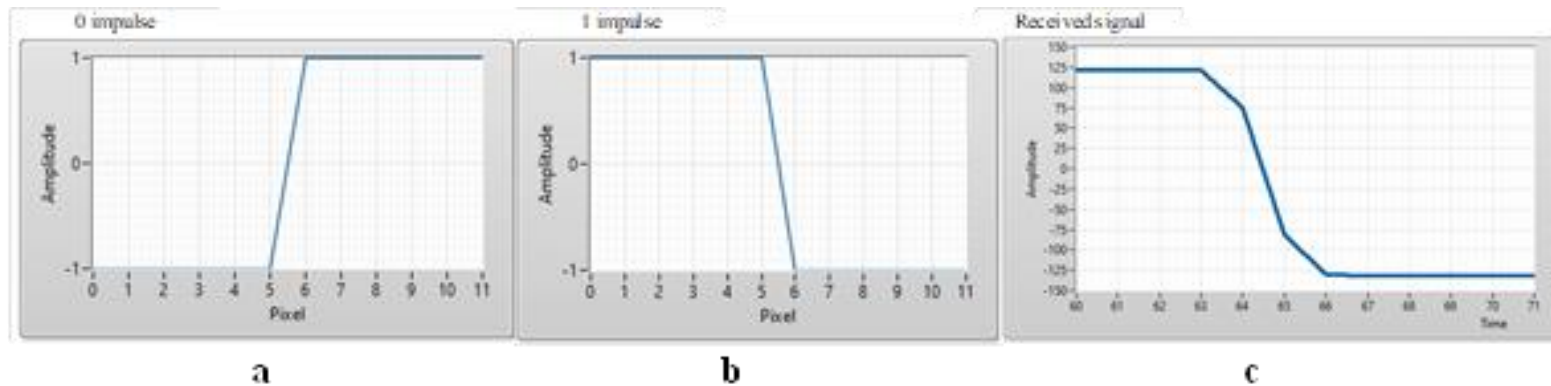


An experimental result of COOK within a rolling image. (b) The results of preamble position detection based on matched filter.

Matched filter for MIMO C-OOK scheme

- Decoding based on the matched filter

With data decoding, we also multiplied the received signal and the template signal of line coding (Manchester code, 4B6B, 8B10B, etc.). Then, we can define the value of signals (0 or 1).



Manchester code signal patterns and COOK received signal. (a) 0 impulse, (b) 1 impulse, (c) COOK received signal.

References

- [1] V.H. Nguyen, M.D. Thieu, H. Nguyen, and Y. M. Jang, “Design and Implementation of the MIMO–COOK Scheme Using an Image Sensor for Long-Range Communication,” MDPI Sensors Journal, 2020.