

INTISARI

Visible Light Communication (VLC) mulai menarik perhatian seiring perlunya spektrum alternatif selain frekuensi radio. Seiring banyaknya pemakaian LED sebagai penerangan dan terjangkaunya implementasi sistem komunikasi dengan perangkat yang murah, VLC berpotensi menjadi teknologi komunikasi nirkabel yang melengkapi gelombang radio. Penelitian ini mengembangkan algoritma *frame synchronization* yang dirancang untuk sistem VLC berbiaya rendah yang efektif dan handal. Penelitian membahas metode *frame synchronization*, termasuk *hard correlation* dan *soft correlation*, serta merumuskan model probabilistik berdasarkan karakteristik modulasi intensitas cahaya melalui *On-Off Keying* (OOK) dalam saluran *Additive White Gaussian Noise* (AWGN). Selain itu, penelitian ini mengevaluasi kelebihan deret Barker dibandingkan dengan deret lainnya dalam meningkatkan akurasi sinkronisasi. Algoritma sinkronisasi dikembangkan dan dievaluasi melalui simulasi, di mana *threshold factor* dapat ditentukan menggunakan analisis *Receiver Operating Characteristic* (ROC) serta *operating region* sistem dengan melihat pengaruh *Signal-to-Noise Ratio* (SNR). Mengingat faktor biaya yang harus murah, perbandingan antara kemampuan sistem memproses sinkronisasi dengan kecepatan transmisi data perlu dipelajari. Studi ini memberikan wawasan dalam merancang protokol komunikasi yang efisien namun tetap praktis pada perangkat VLC *low-cost*.

Kata kunci : *Frame synchronization, Barker sequences, Visible light communication, Correlation, low-cost*

ABSTRACT

Visible Light Communication (VLC) is gaining prominence due the urgent need of alternative spectrum other than radio frequency (RF). The widespread adoption of Light Emitting Diode (LED) as lighting and the feasibility of implementing low-cost communication systems using minimal hardware resources makes VLC as potential complementary technology in wireless communication. This research develops a frame synchronization algorithm tailored for such low-cost VLC systems. We analyze frame synchronization methods, including hard and soft correlation, and derive a probabilistic model based on the VLC's light intensity On-Off Keying (OOK) characteristics and an additive white Gaussian noise (AWGN) channel. The significance of Barker sequences is examined in comparison to non-Barker sequences for synchronization accuracy. A synchronization algorithm is developed and evaluated through simulations, where the optimal threshold factor is determined using Receiver Operating Characteristic (ROC) analysis and the system's operating region with respect to Signal-to-Noise Ratio (SNR). Considering low-cost constraints, we investigate the trade-off between synchronization processing speed and transmission speed. This study provides insights into designing a practical and efficient communication protocol for low-cost VLC systems.

Keywords : Frame synchronization, Barker sequences, Visible light communication, Correlation, low-cost