ABSTRACT

Light-based communication system is one of the alternative solutions for short-range wireless data transmission that is energy efficient and resistant to electromagnetic interference. This Final Project aims to design and implement an infrared light-based one-way data communication system using DE0-Nano FPGA board as a transmitter and ESP8266 microcontroller as a receiver. This system sends data in the form of text from one computer to another through light media, with infrared LEDs as transmitters and photodiodes as receivers. The received light signal is amplified using LM358 op-amp circuit before being converted into digital data by ESP8266, then displayed in real-time via serial communication to the computer. The system design includes programming the UART module on the FPGA using Verilog HDL language, as well as signal processing and amplification on the receiver side. Tests were conducted by varying the distance and angle between the LED and photodiode. The test results show that the system can transmit data intact up to 15 cm and can still function properly at a maximum angle of ±5° to the upright position. Beyond this distance, the quality of data reception degrades significantly as the received light intensity decreases.

Keywords: *communication system, LED, FPGA, visible light communication (VLC), UART*