

ABSTRACT

This Final Project aims to design and implement a mobile drive system for a waste-collecting robot based on a Field Programmable Gate Array (FPGA). The robot is controlled using Visible Light Communication (VLC), where directional commands from the Ground Control Station (GCS) are transmitted in the form of digital characters, then processed by the FPGA to generate logic signals that control the rotation of DC motors through motor drivers. The devices used include the FPGA DE0-Nano, DC motors, and the MX1508 motor driver, with the control logic programmed in Verilog. The test results show that the FPGA logic output operates at a voltage level of 3.3 V for the HIGH condition and 0 V for the LOW condition. A 4-bit control logic pattern was successfully formed according to the direction commands, such as forward = 1010, backward = 0101, right = 0110, left = 1001, and stop = 0000. Reliability testing of commands with 25 and 50 trials produced a relatively low error rate, with only 1 to 3 failures for each type of command. On flat surfaces, the average directional deviation was 1° at a distance of 80–90 cm and 2°–3° at 120–130 cm, while on contoured surfaces, the deviation was greater, namely 2°–3° at 40–50 cm and 3°–6° at 120–130 cm, with a tendency to deviate to the right.

Keywords : *FPGA, Garbage Collection Robot, Drive System, Visible Light Communication*