

ABSTRACT

The growing problem of waste caused by the lack of public awareness highlights the need for an automated and efficient solution in waste management. This Final Project presents a control system based on Visible Light Communication (VLC), implemented in a Ground Control Station (GCS) to direct the movement of a waste-collecting robot. The system utilizes VLC communication with RS485 as the data transmission medium between the GCS and the robot, operated through a Raspberry Pi that functions as the command transmitter. Meanwhile, a Node-RED–based user interface allows operators to intuitively control direction and speed. The development process includes designing the VLC communication circuit, programming the robot control logic, integrating the hardware components, and testing the system under real conditions. The robot is designed to respond to light signals as movement instructions such as forward, backward, turning, and stopping based on inputs from the GCS. Test results show that the system can operate stably and accurately in receiving and executing commands through light signals, with an average delay of 1–2 seconds and a command execution success rate of up to 85 percent, while the dashboard can display sensor data accurately, although the robot monitoring system remains limited to graphical representations without location visualization or a movement map.

Keywords: Visible Light Communication (VLC), Ground Control Station (GCS), Trash Collecting Robot, Raspberry Pi, Node-RED, Robot Control System