DESIGN OF AN AUTOMATIC NUTRIENT CONTROL SYSTEM FOR SMART HYDROPONIC SYSTEM BASED ON IOT

Fendik Eko Purnomo, S.Pd., M.T. (*Thesis Supervisor*)

Tutut Dwi Prayogo
Study Program Of Mechatronic Engineering Technology
Majoring In Engineering

ABSTRACT

Hydroponics requires precise regulation of nutrient concentration (PPM) to support optimal plant growth. This study designs and tests an automatic hydroponic nutrient control system based on the ESP32 microcontroller, equipped with a TDS sensor, a pH sensor, and a DS18B20 temperature sensor. The system controls nutrient pumps A and B, a circulation pump, and a refill pump automatically based on sensor readings, with target PPM settings adjustable via Firebase or local buttons. The TDS sensor was calibrated using a simple linear regression method by comparing sensor readings with a reference TDS meter, resulting in a correction equation to improve measurement accuracy. The automatic control was tested in five trials with varying target PPM values. The results showed that the system was able to achieve final readings close to the target in each trial. Performance analysis using Mean Absolute Error (MAE) and Mean Absolute Percentage Error (MAPE) yielded average values of 23.75 ppm for MAE and 3.52% for MAPE, indicating that the deviation from the target remained within an acceptable range.

Keywords: Hydroponics, ESP32, Control System, TDS Sensor