

Development and Performance of a Fuzzy Logic Control System for Temperature and Carbon Dioxide for Red Chili Cultivation in an Aeroponic Greenhouse System

ABSTRACT

The use of fuzzy logic-based automatic control systems in aeroponic systems is expected to facilitate farming. This paper proposes a novel integrated fuzzy control system for an aeroponic greenhouse. The real-time method considers temperature and carbon dioxide (CO₂) effects on red chili cultivation, and the controller is based on control performance or an evaluation of the correlation of parameters. The design a fuzzy control system to control red chili plant temperature and CO₂ in an aeroponic system cultivation in a greenhouse based on control performance. The fuzzy control system was developed by using a fuzzy set, a member function, fuzzification, a set of rules, and defuzzification on a personal computer. Sensors include a DHT11 temperature sensor, a CDM4160 CO₂ sensor and 4 actuators: a 12 V pump fan, a gas valve and a lamp that is connected to the Arduino Mega 2560 microcontroller by a relay, and an L298N motor driver for control, as well as an additional Arduino 16x2 LCD screen that displays the temperature and CO₂ values read by the sensors. The performance results reported for the temperature and CO₂ fuzzy logic control parameters for red chilis cultivation in the aeroponic on greenhouse include the time delay (Td), time rise (Tr), time peak (Tp) and Error steady state (Ess) values. The red chili plants grow well using the proposed method