

# **IMPLEMENTATION OF FUZZY MAMDANI FOR CONTROLLING PLANT NUTRITION DAN WATER PH IN HYDROPONIC SYSTEM**

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## **ABSTRACT**

*The reduction in agricultural land has triggered the emergence of urban farming such as hydroponics in urban areas. The hydroponic system has parameters such as plant nutrient levels and water pH that determine the growth of hydroponic plants. Monitoring and controlling these parameters is done manually every day, this requires tenacity and patience from the users of the hydroponic farming system. Therefore, it is necessary to have a control system that makes it easier for users of the hydroponic system. This research implements Fuzzy Mamdani for controlling plant nutrition and water pH in a hydroponic system. The case study used lettuce plants with pH levels in the range of 6 – 7 and plant nutrient levels between 560 – 840 ppm. The hydroponic system was made using the NFT (Nutrient Film Technique) method. The prototype uses an ESP-32 microcontroller with TDS, pH, and ultrasonic sensors. The actuator is a peristaltic motor for liquid nutrition and pH. Through 30 test scenarios on each sensor, the accuracy and precision of the TDS sensor were 99.23% and 99.82%, the accuracy and precision of the pH sensor were 99.22% and 99.07% and the ultrasonic sensor accuracy and precision was 99, 41% and 99.60%. The implementation of Fuzzy Mamdani as a control system algorithm is able to control plant nutrition in the range of 560 – 840 with a 100% success rate and is able to control water pH in the range of 6 – 7 with a success rate of 90% in 10 test scenarios.*

**Keywords:** *Hydroponics, Fuzzy Mamdani, Nutrition, pH, TDS, ESP-32*