PENGEMBANGAN SISTEM KENDALI NUTRISI PADA BUDIDAYA HIDROPONIK DI *MICRO PLANT FACTORY* BERBASIS *INTERNET OF THINGS (*IoT*)*

INTISARI

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Pertanian presisi dapat menjadi solusi untuk mengatasi tantangan ketahanan pangan. Salah satu aplikasinya adalah budidaya tanaman hidroponik dalam ruang terkendali, seperti *Plant Factory*. *Plant Factory* memiliki keunggulan dalam pengendalian suhu lingkungan dan nutrisi, tetapi biaya awal yang tinggi mendorong munculnya *micro plant factory*. Pemberian nutrisi merupakan aspek penting dalam budidaya tanaman hidroponik di *micro plant factory*. Oleh karena itu, diperlukan pengembangan berupa perancangan dan evaluasi sistem kendali nutrisi pada *micro plant factory*. Prinsip kerja dari alat ini yaitu sistem pengendalian dapat mengontrol pH dalam rentang 5,5-6,5 dan nilai EC dalam rentang 1300-2100 µS/cm sesuai dengan kondisi ideal tanaman selada. Adapun alat pengendalian terdapat pada pompa peristaltik akan menambahkan pH *up*, pH *down*, air maupun AB mix berdasarkan algoritma sistem. Data hasil pengamatan berupa nilai sensor pH, EC dan suhu nutrisi akan tersimpan pada *cloud server* setiap sepuluh menit sekali dilanjutkan analisis oleh pengguna. Hasil uji kinerja sensor pH dan sensor EC dengan tiga metode pengujian, yaitu uji regresi linear untuk sensor pH dan sensor EC sebesar 0,9931; 0,9836, *Root Mean Square Error* (RMSE) sebesar 0,37; 86,81 µS/cm dan *Mean Absolute Percentage Error* (MAPE) sebesar 0,99; 0,07. Dalam hal performa berupa *online data logging*, sistem kendali nutrisi tergolong sangat baik dengan data terkirim 100%. Rak atas dan rak bawah memiliki tingkat keseragaman parameter tanaman berupa jumlah daun dan tinggi tanaman yang sama. Hal ini dibuktikan dengan uji *T-test* 0,01 yang menunjukkan bahwa tingkat keseragaman antar tanaman tidak memiliki perbedaan yang signifikan. Oleh karena itu, nutrisi yang diperoleh antar rak juga seragam.

Kata kunci: sistem kendali, nutrisi, pH, EC, parameter tanaman

DEVELOPMENT OF NUTRITION CONTROL SYSTEM FOR HYDROPONIC CULTIVATION IN MICRO PLANT FACTORY BASED ON *INTERNET OF THINGS* (IoT)

ABSTRACT

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Precision agriculture can be a solution to the challenge of food security. One application is hydroponic plant cultivation in a controlled space, such as a plant factory. Plant factories have the advantage of controlling the ambient temperature and nutrients, but the high initial cost has led to the emergence of micro plant factories. Nutrient provision is an important aspect in hydroponic plant cultivation in micro plant factories. Therefore, development is needed in the form of designing and evaluating a nutrition control system in a micro plant factory. The working principle of this system is that the control system can control pH in the range of 5.5-6.5 and EC value in the range of 1300-2100 µS/cm in accordance with the ideal conditions of lettuce plants. The control device contained in the peristaltic pump will add pH up, pH down, water or AB mix based on the system algorithm. Observation data in the form of pH, EC and nutrient temperature sensor values will be stored on the cloud server every ten minutes followed by analysis by the user. The performance test results of the pH sensor and EC sensor with three test methods, namely linear regression tests for pH sensors and EC sensors of 0.9931; 0.9836, Root Mean Square Error (RMSE) of 0.37; 86.81 µS/cm and Mean Absolute Percentage Error (MAPE) of 0.99; 0.07. In terms of performance in the form of online data logging, the nutrient control system is classified as very good with 100% data sent. The upper shelf and lower shelf have the same level of uniformity of plant parameters in the form of the number of leaves and plant height. This is proven by the T-test 0.01 which shows that the level of uniformity between plants has no significant difference. Therefore, the nutrients obtained between shelves are also uniform.

Keywords: control system, nutrient, pH, EC, plant parameters