RINGKASAN

Jumlah penduduk Indonesia tiap tahun mengalami peningkatan. Pada tahun 2019 jumlah penduduk Indonesia mencapai 268,074 juta jiwa, akibatnya terjadi alih fungsi lahan pertanian menjadi pemukiman penduduk. Hal ini menyebabkan produktivitas tanaman pertanian Indonesia khususnya sayuran mengalami penurunan. Selain alih fungsi lahan, penurunan produktivitas tanaman pertanian juga dipengaruhi oleh beberapa faktor, yaitu radiasi sinar matahari, suhu udara, kelembapan udara, kelembapan tanah, curah hujan, gangguan hama dan penyakit. Salah satu solusi dari permasalahan tersebut adalah dengan menggunakan *plant factory*, *plant factory* merupakan cara menumbuhkan tanaman dalam lingkungan yang terkendali. Pada *plant factory* perlu dilakukan sistem monitoring dan kontrol iklim mikro untuk mencapai kondisi iklim mikro yang ideal bagi tanaman. Data iklim mikro dapat dimonitoring secara *online* dengan memanfaatkan *internet of things*, sehingga mendapatkan data iklim mikro terbaru dengan lebih cepat (*realtime*). Berdasarkan hal tersebut, maka dirancang sistem monitoring data dan kontrol iklim mikro dalam *plant factory* berbasis *internet of things* dengan menggunakan mikrokontroler untuk merekayasa iklim mikro di dalam *plant factory*. Penelitian ini bertujuan untuk 1) membuat sistem monitoring dan kontrol iklim mikro berbasis *internet of things* menggunakan mikrokontroler, dan 2) menganalisis kinerja sistem kontrol dalam mempertahankan kondisi iklim mikro yang optimal.

Penelitian dilakukan di Laboratorium Teknik Pengelolaan dan Pengendalian Bio-Lingkungan, Jurusan Teknologi Pertanian, Fakultas Pertanian, Universitas Jenderal Soedirman. Tahap penelitian meliputi perancangan skema sistem kontrol, perancangan perangkat lunak (*software*), perancangan perangkat keras (*hardware*), serta tahap analisis data. Data iklim mikro yang diperoleh dari sensor dianalisis dengan membandingkan data aktual dengan *set point* yang telah ditentukan.

Hasil penelitian menunjukan bahwa sistem akusisi, sistem monitoring, dan sistem kontrol iklim mikro telah berhasil dilakukan, tetapi sistem kontrol masih perlu dilakukan perbaikan sehingga bisa mencapai kondisi optimal bagi tanaman. Pada *running* 1 didapat suhu rata-rata sekitar 26,58 ^{o}C dan kelembapan rata-rata sekitar 76,22% sedangkan *set point* berada di angka 27 ^{o}C dan 75 %. Pada *running* 2 didapat suhu rata-rata sekitar 25,82 ^{o}C dan kelembapan rata-rata sekitar 61,58% sedangkan *set point* berada di 26 ^{o}C dan 60 %. Pengujian pada sistem menunjukkan osilasi data suhu udara disekitar *set point* relatif rendah, sedangkan osilasi data kelembapan udara disekitar *set point* masih tinggi. Aktuator yang digunakan sudah bekerja dengan baik namun ketika *air conditioner* yang ada dalam *plant factory* mencapai suhu batas bawah maka *air conditioner* akan berhenti bekerja, hal ini mengakibatkan naiknya kelembapan udara. Kelembapan udara dalam ruang tanam *plant factory* cenderung tinggi dikarenakan belum diterapkannya metode untuk menurunkan kelembapan udara.

SUMMARY

Every year, Indonesia's population grows. Indonesia's population reached 268.074 million in 2019, resulting in the conversion of agricultural land to residential areas. The productivity of Indonesian agricultural crops, particularly vegetables, suffers as a result. Aside from land conversion, other factors influence the loss in agricultural crop output, including solar radiation, air temperature, air humidity, soil moisture, rainfall, pest and disease disturbances, and pest and disease outbreaks. The use of a plant factory is one solution to this problem, a plant factory is a controlled environment in which plants are grown. To achieve ideal microclimate conditions for plants, a data monitoring and microclimate control system is required at the plant factory. The data can be monitored online using an internet of things platform, allowing for faster access to the most recent data. Based on this, a data monitoring and microclimate control system based on the internet of things was designed to manipulate microclimate in a plant factory using microcontrollers. The goals of this research are to 1) develop an internet of things-based microclimate and data monitoring system using a microcontroller, and 2) evaluate the control system's performance in maintaining optimal microclimate conditions.

The research was carried out at Jenderal Sudirman University's Bio-Environmental Management and Control Engineering Laboratory, Department of Agricultural Technology, Faculty of Agriculture. The research was conducted in four stages: design of the control system scheme, design of the software, design of the hardware, and data analysis. The sensor data is analyzed by comparing the actual data to a predetermined set point.

Results of the research showed that the data acquisition and monitoring system had been successfully implemented, but that the control system still needed to be developed in order to achieve optimal plant conditions. The system's tests show that the oscillations of the air temperature data around the set point are relatively low, while the oscillations of the humidity remain high.

The data acquisition and monitoring system has been successfully implemented, however the control system needs to be repaired in order to reach ideal plant conditions.. The average temperature and humidity in running 1 were around 26.58 ^oC and 76.22 %, while the set point was 27 ^oC and 75 percent. The average temperature in running 2 was about 25.82 ^oC and the average humidity was around 61.58 %, while the set point was at 26 ^oC and 60%. Tests on the system show that the oscillations of the air temperature data around the set point relatively low, while the oscillations of the humidity are still high. The actuators have worked well, but when the air conditioner in the plant factory reaches the lower temperature limit, it will stop working, resulting in increased humidity. Because the method for reducing humidity has not yet been implemented, humidity levels in the plant factory are high.