PENGEMBANGAN *SOIL MOISTURE CONTENT* (SMC) *MONITORING SYSTEM* TERINTEGRASI *CLOUD* UNTUK PENGAMATAN LENGAS TANAH DENGAN VARIASI KEDALAMAN PADA PERKEBUNAN KELAPA SAWIT

INTISARI

Oleh:

NADA BERLIANA KUSUMAWATI
19/446811/TP/12614

Produktivitas kelapa sawit yang masih belum optimal disebabkan oleh beberapa faktor yang dapat dilihat dari kondisi tanah dan lingkungannya. Upaya yang dapat dilakukan untuk mengoptimalkan produktivitas kelapa sawit, salah satunya dengan *monitoring* lahan. Lahan kelapa sawit yang sangat luas, sulit untuk dilakukan pemantauan secara berkala sehingga perlu dilakukan *monitoring* secara intensif melalui teknologi IoT agar ketersediaan air di lahan kelapa sawit tetap terjaga kualitasnya sehingga produktivitasnya tidak akan menurun. Oleh karena itu, diperlukan perancangan *Soil Moisture Content* (SMC) *monitoring system* yang sesuai untuk mengamati kadar lengas tanah, suhu tanah, dan lingkungannya. Prinsip kerja dari SMC, yaitu solar panel mengonversi cahaya matahari menjadi energi listrik, kemudian *solar charge controller* (SCC) meneruskan dan membagi energi listrik ke perangkat. Selain itu, SCC digunakan untuk mengisi daya baterai. Tegangan yang masuk ke *board* berasal dari baterai. Implementasi SMC akan dipasang di tiga variasi kedalaman pada lahan perkebunan kelapa sawit. Data yang telah didapatkan, kemudian akan dikirim dan disimpan pada *cloud server*. Setelah itu, data dapat diakses oleh *user* untuk selanjutnya dapat dilakukan antisipasi awal terkait *water deficit.* Data kalibrasi SMC dianalisis dengan menggunakan tiga metode, yaitu uji regresi linier, *RMSE*, dan *MAPE*. Hasil uji regresi linier didapatkan bahwa sistem memiliki nilai *R square* tertinggi, yaitu sebesar 0,9782, nilai *RMSE* terkecil, yaitu 1,2%, dan nilai *MAPE* terkecil, yaitu 2,6%. Implementasi alat SMC *site* A dipasang pada Tanah *Ultisols*, sedangkan alat SMC *site* B dan *site* C dipasang pada Tanah *Spodosols*. Tanah *Spodosols* memiliki lapisan *hardpan*, dimana kedalaman lapisan tersebut berkisar antara 30 cm sampai lebih dari 75 cm. Nilai perubahan laju lengas tanah yang paling tinggi dari ketiga *site*, yaitu pada SMC 1 *site* B dengan nilai 0,635 %/jam.

Kata kunci: sistem *monitoring*, lengas tanah, kelapa sawit, *hardpan*

DEVELOPMENT OF CLOUD-INTEGRATED SOIL MOISTURE CONTENT (SMC) *MONITORING SYSTEM* FOR SOIL MOISTURE OBSERVATION WITH DEPTH VARIATION IN PALM OIL PLANTATIONS

ABSTRACT

By:

NADA BERLIANA KUSUMAWATI
19/446811/TP/12614

The productivity of oil palm, which is still not optimal, is caused by several factors, which can be seen from the soil and environmental conditions. Some efforts can be made to optimize oil palm productivity, one of which is by *monitoring* the land. Oil palm land is very large and challenging to monitor regularly, so it needs to be monitored intensively through IoT technology so that the quality of water availability in oil palm land is maintained and productivity will not decrease. Therefore, it is necessary to design a suitable Soil Moisture Content (SMC) *monitoring system* to observe soil moisture content, soil temperature, and the environment. The working principle of SMC is that solar panels convert sunlight into electrical energy, and then the solar charge controller (SCC) forwards and divides that electrical energy into devices. In addition, SCC is used to charge the battery. The voltage that goes to the board comes from the battery. The SMC implementation will be installed at three variation depths on oil palm plantations. The data that has been obtained will then be sent to and stored on the cloud server. After that, the user can access the data so that further anticipation can be carried out regarding the water deficit. SMC calibration data were analyzed using three methods, namely the linear regression test, the RMSE, and the MAPE. The results of the linear regression test showed that the system had the highest R squared value, which was 0.9782, the smallest RMSE value, which was 1.2%, and the smallest MAPE value, which was 2.6%. The implementation of the SMC site A tool is installed on Ultisols soil, while the SMC site B and site C tools are installed on Spodosols soil. Spodosols have a hardpan layer, where the layer's depth of the layer ranges from 30 cm to more than 75 cm. The value of the change in soil moisture rate is the highest of the three sites, namely at SMC 1 site B with a value of 0.635%/hour.

Keywords: *monitoring system*, soil moisture, oil palm, hardpan