ABSTRAK

PREDIKSI KEBUTUHAN AIR MENGGUNAKAN MODEL LSTM DENGAN PEMBANDING MODEL GRU UNTUK SISTEM *SMART FARMING* BERBASIS IOT DI KABUPATEN BANYUASIN

(2025 : 52 Halaman + 42 Gambar + 5 Tabel + Daftar Pustaka + Lampiran)

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Pertanian modern menuntut sistem irigasi yang presisi dan efisien untuk meningkatkan produktivitas sekaligus menghemat sumber daya air. Penelitian ini mengusulkan sistem prediksi kebutuhan air tanaman cabai berbasis Internet of Things (IoT) menggunakan model *Long Short-Term Memory* (LSTM) dengan pembanding *Gated Recurrent Unit* (GRU). Data dikumpulkan secara real-time dari lahan cabai di Kabupaten Banyuasin menggunakan sensor suhu udara, kelembaban udara, kelembaban tanah, dan curah hujan yang terintegrasi dengan mikrokontroler ESP32, Node-RED, dan protokol MQTT. Dataset lebih dari 10.700 entri diproses melalui pembersihan, normalisasi dengan *MinMaxScaler*, dan pembentukan urutan data menggunakan metode sliding window (7 timestep). Model LSTM dan GRU dilatih dengan batch size 16, epoch 100, dan variasi *learning rate* (0,00060–0,00080). Evaluasi menggunakan MAE, RMSE, MSE, dan SMAPE. Hasil menunjukkan LSTM dengan *learning rate* 0,00075 memiliki performa terbaik (MAE 0,58%; RMSE 1,09%; SMAPE 1,00%) dan prediksi konsisten pada tiga skenario lingkungan: lembab (93,67 mL), normal (167,47 mL), dan panas (309,57 mL). GRU juga menunjukkan hasil baik dengan efisiensi komputasi, cocok untuk *edge computing*.

Kata kunci : *Smart Farming*, *Internet of Things*, *Long Short-Term Memory, Gated Recurrent Unit*

ABSTRACT

PREDICTING WATER REQUIREMENTS USING AN LSTM MODEL COMPARED TO A GRU MODEL FOR AN IOT-BASED SMART FARMING SYSTEM IN BANYUASIN REGENCY

(2025 : 52 *Page* + 42 *Picture* + 5 *Table*+ *Reference* + *Attachment*)

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Modern agriculture requires precise and efficient irrigation systems to increase productivity while conserving water resources. This study proposes an Internet of Things (IoT)-based water demand prediction system for chili plants using a Long Short-Term Memory (LSTM) model with a Gated Recurrent Unit (GRU) comparison. Data was collected in real-time from chili fields in Banyuasin Regency using sensors for air temperature, air humidity, soil moisture, and rainfall, integrated with an ESP32 microcontroller, Node-RED, and the MQTT protocol. The dataset of over 10,700 entries was processed through cleaning, normalization with MinMaxScaler, and data sequence formation using the sliding window method (7 timesteps). The LSTM and GRU models were trained with a batch size of 16, 100 epochs, and varying learning rates (0.00060–0.00080). Evaluation was conducted using MAE, RMSE, MSE, and SMAPE. The results show that LSTM with a learning rate of 0.00075 has the best performance (MAE 0.58%; RMSE 1.09%; SMAPE 1.00%) and consistent predictions in three environmental scenarios: humid (93.67 mL), normal (167.47 mL), and hot (309.57 mL). GRU also showed good results with computational efficiency, making it suitable for edge computing.

Keyword : *Smart Farming*, *Internet of Things*, *Long Short-Term Memory, Gated Recurrent Unit*