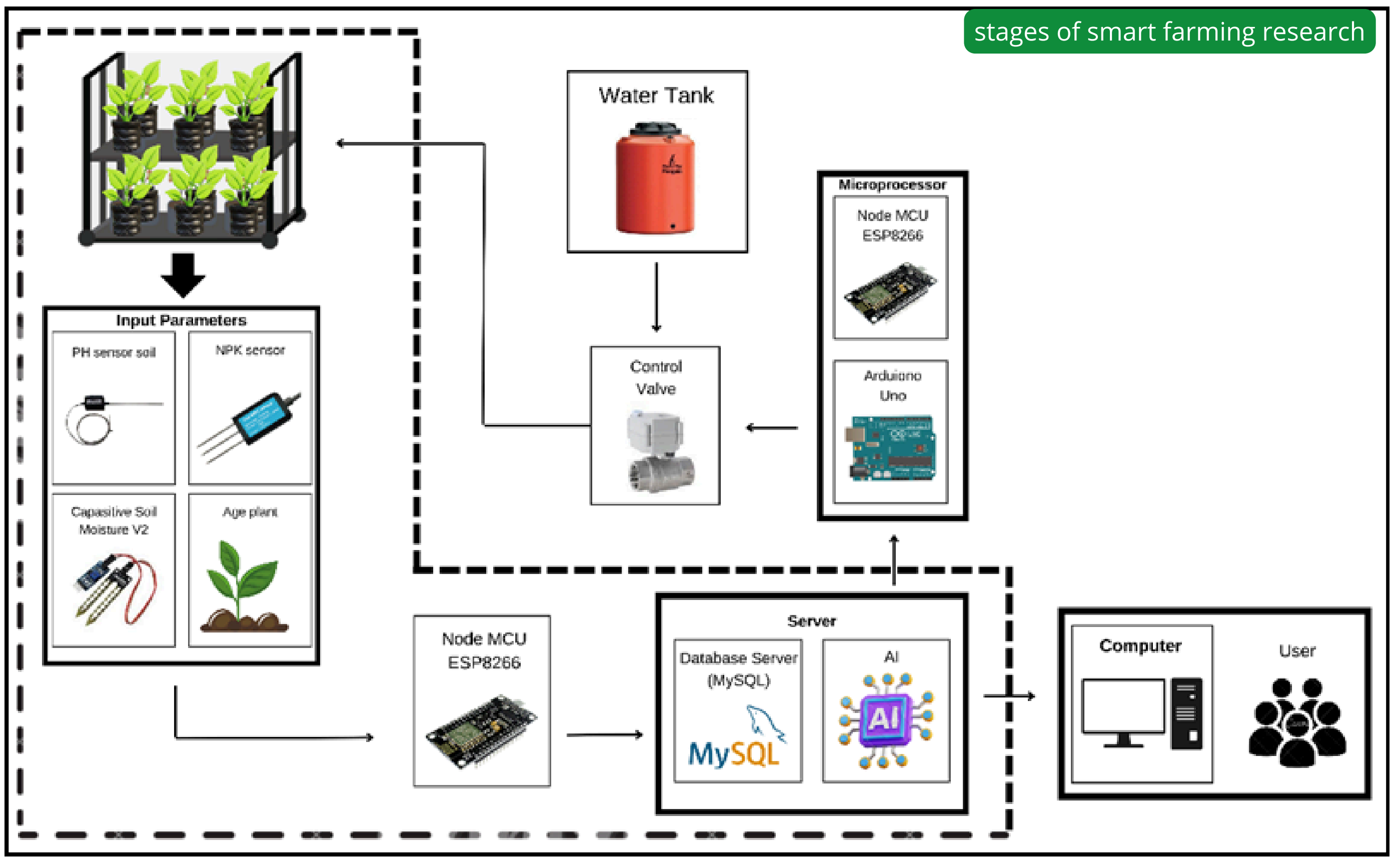
NUTRITION LEVEL ESTIMATION FOR SMART FARMING USING LONG-SHORT TERM MEMORY METHOD

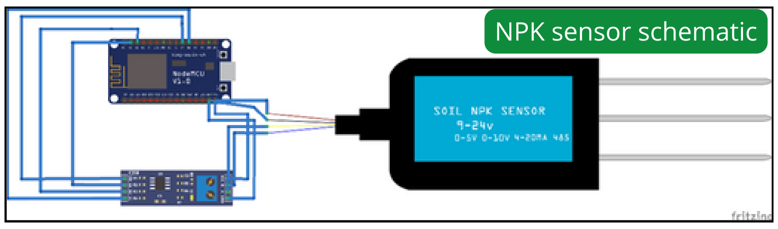
Iryna Vira Aulia Budiman 140910200001

Advisor: Arjon Turnip, Ph.D.

stages of smart farming research



NPK sensor schematic



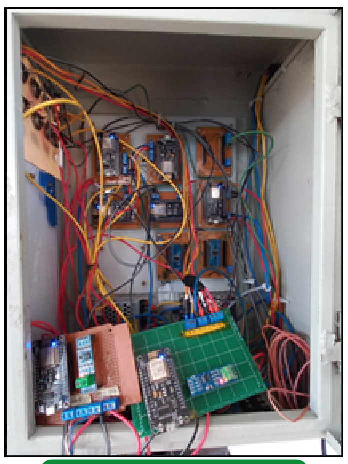
Introduction

Indonesia is known as an agricultural country, with the majority of the population working as farmers. By 2023, 88.89% of the informal workforce will be in the agricultural sector, making it the backbone of the economy. However, conventional farming methods used, such as land monitoring and manual nutrient application, are less efficient, especially on large tracts of land. Nutrients such as NPK are usually applied once a month without regard to the specific needs of the plants, leading to suboptimal growth. Plants are also susceptible to diseases, nutrient deficiencies, and other adverse conditions during growth. To solve this problem, automation technology using the Long Short Term Memory (LSTM) method is applied to estimate plant nutrient requirements more precisely. This research considers parameters such as NPK, soil pH, planting age, and soil moisture. The system sends data in real-time without human intervention, allowing farmers to monitor crop conditions remotely. This AI-based technology is expected to increase crop productivity by providing more precise nutrition, resulting in optimized plant growth compared to manual methods.

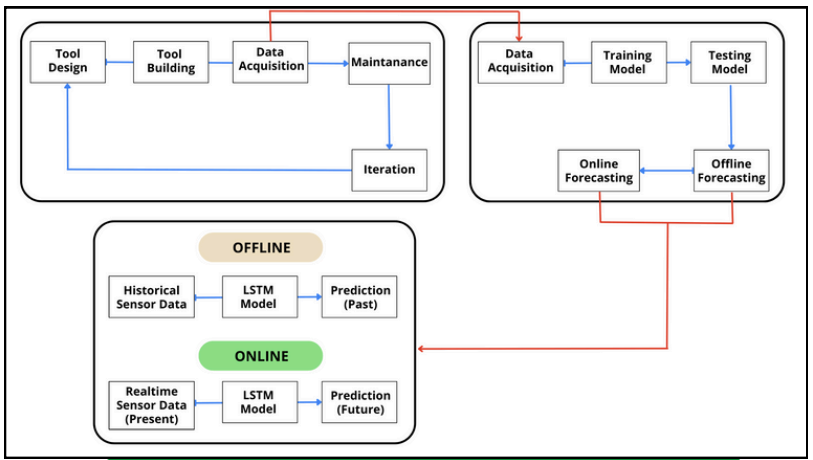
Conclusion

Based on research utilizing the Long Short Term Memory (LSTM) model to predict the nutrient requirements of eggplant plants, several significant conclusions emerged. Firstly, the LSTM model demonstrated the ability to predict nutrient needs with an accuracy of 86.6% in dry conditions and 81% in rainy conditions, indicating relatively accurate predictions. Secondly, the model's performance evaluation for dry conditions yielded a Root Mean Square Error (RMSE) of 14.5 and a Mean Absolute Error (MAE) of 11.1. In contrast, during rainy conditions, the model recorded an RMSE of 7.4 and an MAE of 6.7, showcasing good performance under both scenarios. Thirdly, the application of the LSTM method yielded more optimal plant growth outcomes compared to traditional manual methods, evidenced by increases in plant height, leaf count, and flower production. Lastly, LSTM facilitates more precise nutrient delivery tailored to plant needs, with nutrients administered in the range of 15 ppm to 53 ppm for rainy conditions and 24 ppm to 188 ppm for dry conditions, enhancing overall agricultural efficiency.

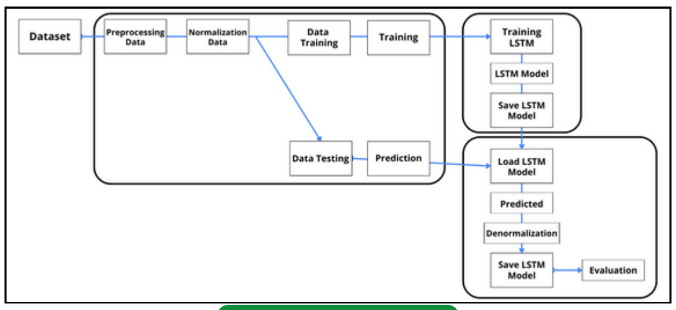
Method



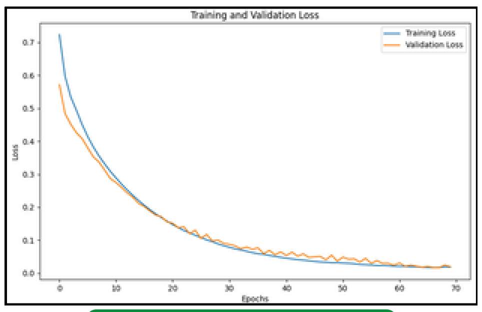
system control panel



Long-Short Term Memory (LSTM) modeling flowchart

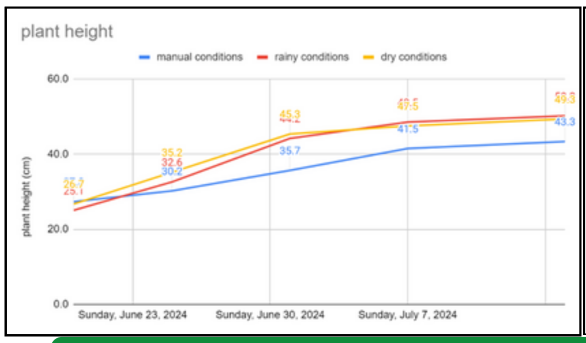


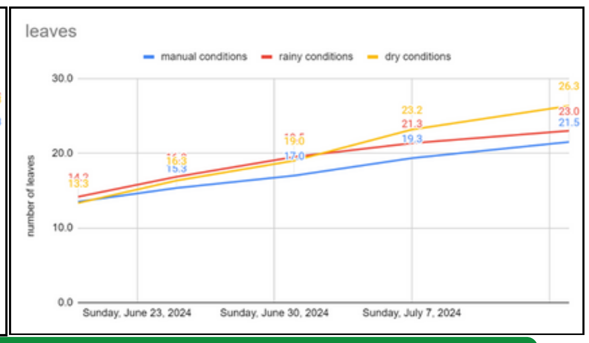
research flowchart



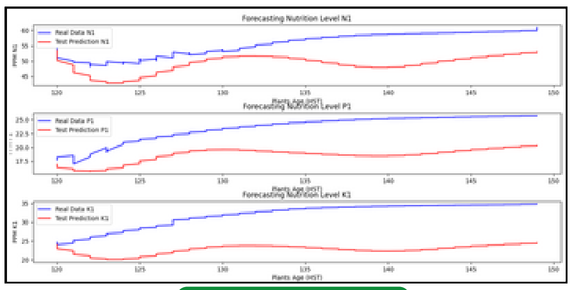
training & loss validation

Result

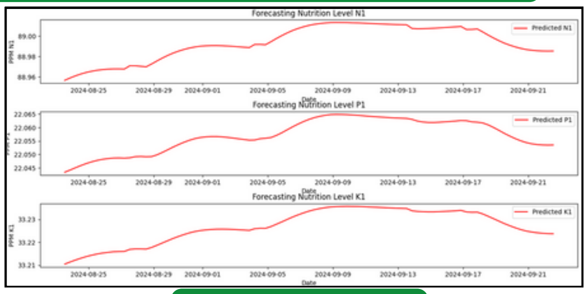




Comparison Chart of the three growth conditions of Number of Leaves and Plant Height



offline forecasting



realtime forecasting