CHAPTER V
CONCLUSION AND SUGGESTIONS

5.1 Conclusion

Based on the design, implementation, and testing results of the temperature and humidity control system using the Interval Type-2 Fuzzy Logic method, several conclusions can be drawn as follows:

1. The Interval Type-2 Fuzzy Logic-based control system was successfully implemented to regulate temperature and humidity in the mini greenhouse according to the predetermined setpoints, namely 26°C for temperature and 85% RH for humidity.
2. Based on the cold start testing results, the system was able to reach stable conditions within an average time of approximately 4–5 minutes during morning and nighttime conditions, and around 7–8 minutes during daytime conditions due to higher initial environmental temperatures.
3. The system was able to operate properly under WiFi Off, PLN Off, and simultaneous WiFi & PLN Off disturbance conditions. The use of a backup battery power supply successfully maintained the operation of both the system and actuators without significant performance degradation.
4. The Mean Absolute Error (MAE) and Integral Absolute Error (IAE) results indicate that the system has a relatively low error rate. From the data logging test, the temperature MAE was 0.0638°C and the humidity MAE was 0.1433%, indicating that the system was capable of maintaining environmental conditions close to the desired setpoints in a stable manner.
5. Overall, the Interval Type-2 Fuzzy Logic method demonstrated good, stable, and adaptive control performance in handling environmental changes and external disturbances throughout the testing process.

5.2 Suggestions

Based on the results of this study, several suggestions can be proposed for future research and development:

1. The system can be improved by using sensors with higher accuracy to obtain more precise temperature and humidity measurements.
2. Future studies may compare this control method with other control approaches, such as PID, Sugeno Fuzzy, or Adaptive Fuzzy Control, to evaluate and identify more optimal control performance..
3. The system can be further developed by integrating cloud-based or mobile application monitoring features to enable real-time remote monitoring.
4. Future testing can be conducted on a larger greenhouse scale to evaluate the performance of the Interval Type-2 Fuzzy Logic method under more complex environmental conditions.
5. Future research may also improve the backup power system by using batteries with larger capacity to enhance system reliability during prolonged power outages.