**UNDERGRADUATE THESIS**

# SUBMERSIBLE PUMP CONTROL SYSTEM USING FUZZY TYPE-2 BASED ON IOT AND ANDROID FOR RICE IRRIGATION

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## STATEMENT OF ORIGINALITY

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Hereby declares that this undergraduate thesis contains no part of any other scientific work that has been submitted to obtain an academic degree at any higher education institution. Furthermore, it does not contain any work or opinions previously written or published by others, except for those which are explicitly cited in this thesis and listed completely in references.

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# ABSTRACT


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| Student Name / NPM: | Nafis Pratama Putra/22081010230 |
| Thesis Title: | Submersible Pump Control System Using Fuzzy Type-2 Based On IoT And Android For Rice Irrigation |
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An Internet of Things (IoT) based automatic submersible pump irrigation system with type-2 fuzzy logic control (Interval Type-2 Fuzzy Logic System) has been designed and implemented to address water and energy inefficiencies in rice paddy irrigation. This system uses an ESP32 microcontroller as the main control unit integrated with two soil moisture sensors, a tipping bucket rain sensor, and a PZEM-004T sensor for monitoring electrical power consumption. Sensor data is sent in real-time to a web server that runs a type-2 fuzzy algorithm with 36 rule bases, a type-2 membership function, and a Karnik-Mendel type reduction method, resulting in pump ON/OFF decisions that are more robust to sensor data uncertainty. The results of data processing can be monitored and controlled via an android based mobile application. Tests on rice paddies show that the system functions well and is able to detect variations in soil moisture conditions and rainfall accurately. Compared to manual methods, this system successfully saves electricity consumption by 40% and water use by 41% in a 24-hour test. The results of this study prove that the integration of IoT, type-2 fuzzy logic, and mobile applications can be an effective solution in supporting the implementation of efficient and resource-saving smart farming.



**Keywords**: Type-2 fuzzy logic, submersible pumps, Internet of Things (IoT), water and energy efficiency, smart agriculture

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The author realizes that in the preparation of the following thesis there are many shortcomings. For this reason, constructive criticism and suggestions from all parties are highly expected for the perfection of writing the following thesis. Finally, with all the limitations that the author has, hopefully the following report can be useful for all parties in general and the author in particular.

Surabaya, July 6th 2026

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