UNDERGRADUATE THESIS

IMPLEMENTATION OF INTERNET OF THINGS AND TYPE-2 FUZZY LOGIC FOR AUTOMATED TEMPERATURE AND HUMIDITY CONTROL IN OYSTER MUSHROOM CULTIVATION HOUSES

RIZKY FATKHUR ROHMAN
NPM 21081010051

THESIS ADVISOR
Dr. Ir. Mohammad Idhom, SP, S. Kom., MT
Henni Endah Wahanani, ST. M. Kom.

MINISTRY OF HIGHER EDUCATION, SCIENCE, AND TECHNOLOGY
UNIVERSITAS PEMBANGUNAN NASIONAL VETERAN JAWA TIMUR
FACULTY OF COMPUTER SCIENCE
INFORMATICS STUDY PROGRAM
SURABAYA
2026

APPROVAL SHEET

IMPLEMENTATION OF INTERNET OF THINGS AND TYPE-2 FUZZY LOGIC FOR AUTOMATED TEMPERATURE AND HUMIDITY CONTROL IN OYSTER MUSHROOM CULTIVATION HOUSES

By:
Rizky Fatkhur Rohman
NPM. 21081010051

Has been defended before and accepted by the Thesis Examination Committee of the Informatics Study Program, Faculty of Computer Science, Universitas Pembangunan Nasional "Veteran" Jawa Timur on April 1, 2026.

Approved by,

Dr. Ir. Mohammad Idhom, SP, S. Kom., MT ..... **(Advisor I)**
NIP. 19830310 202121 1 006

Henni Endah Wahanani, ST. M. Kom. ..... **(Advisor II)**
NIP. 19780922 202121 2 005

Dr. Rizky Parlika, S.Kom, M.Kom. ..... **(Head Assessor)**
NIP. 19840518 202121 1 003

Achmad Junaidi, S.Kom, M.Kom. ..... **(Assessor I)**
NIP. 19781110 202521 1 048

Acknowledged by,
Dean of the Faculty of Computer Science

Prof. Dr. Ir. Novirina Hendrasarie, MT
NIP. 19681126 199403 2 001

APPROVAL SHEET

IMPLEMENTATION OF INTERNET OF THINGS AND TYPE-2 FUZZY LOGIC FOR AUTOMATED TEMPERATURE AND HUMIDITY CONTROL IN OYSTER MUSHROOM CULTIVATION HOUSES

By:
Rizky Fatkhur Rohman
NPM. 21081010051

Approved to proceed to the Thesis Examination

Approved by,

Coordinator of the Informatics Study Program

Faculty of Computer Science

Dr. Intan Yuniar Purbasari, S.Kom. MSc.
NIP. 19800602 202521 2 029

STATEMENT OF ORIGINALITY

I am the undersigned:

Name	:	Rizky Fatkhur Rohman
Student ID Number	:	21081010051
Program	:	Bachelor (S1)
Study Program	:	Informatics
Faculty	:	Faculty of Computer Science

Hereby declares that this Thesis contains no part of any scientific work that has previously been submitted to obtain an academic degree at any higher education institution, nor does it contain any work or opinion that has been written or published by any other person or institution, except those properly cited in this document and fully listed in the references.

I also declare that this scientific document is free from any form of plagiarism. Should any indication of plagiarism be found in the future, I am willing to accept sanctions in accordance with the applicable laws and regulations. Thus, this statement is made truthfully and without coercion from any party whatsoever, and to be used as appropriate.

Surabaya, May 6, 2026
Declarant,

Rizky Fatkhur Rohman
NPM. 21081010051

ABSTRACT

Student Name / NPM	:	Rizky Fatkhur Rohman / 21081010051
Thesis Title	:	Implementation of Internet of Things and Type-2 Fuzzy Logic in Automated Temperature and Humidity Control for an Oyster Mushroom Cultivation Chamber
Advisor	:	1. Dr. Ir. Mohammad Idhom, SP, S. Kom., MT 2. Henni Endah Wahanani, ST. M. Kom.

Oyster mushroom cultivation requires stable temperature and humidity conditions, while environmental control is still commonly performed manually. This research aims to implement an Internet of Things (IoT) system and Interval Type-2 Fuzzy Logic for automated temperature and humidity control in a mini oyster mushroom cultivation chamber.

The system was developed using an ESP32 microcontroller, SHT31 sensor, intake fan, exhaust fan, peltier module, and PTC heater. Monitoring was conducted through the Blynk mobile application, while experimental data were automatically stored using spreadsheets for data logging.

Testing was carried out using the cold start method under morning, afternoon, and night conditions, as well as disturbance conditions such as WiFi Off, PLN Off, and WiFi & PLN Off. The results showed that the system was able to achieve the temperature set point of 26ºC and humidity set point of 85% within approximately 4–5 minutes during morning and night tests, and 7–8 minutes during afternoon tests. The system also obtained a Mean Absolute Error (MAE) of 0.0638°C for temperature and 0.1433% for humidity.

Based on the test results, the designed system was able to control temperature and humidity automatically and stably according to the defined set point values.

Keywords: Internet of Things, Interval Type-2 Fuzzy Logic, ESP32, Oyster Mushroom Chamber, Temperature and Humidity Control.

ACKNOWLEDGEMENTS

All praise and gratitude be to Allah SWT for His blessings, grace, and mercy, which have enabled the author to complete this thesis entitled "Implementation of Internet of Things and Type-2 Fuzzy Logic for Automated Temperature and Humidity Control in Oyster Mushroom Cultivation Houses" successfully.

This thesis was prepared as one of the requirements to obtain a Bachelor's Degree in the Informatics Study Program, Faculty of Computer Science, Universitas Pembangunan Nasional "Veteran" Jawa Timur. The author would like to express sincere appreciation to all parties who have provided support and contributions throughout the research process, including their time, energy, thoughts, guidance, and motivation in completing this thesis.

The author realizes that the completion of this thesis would not have been possible without the assistance, guidance, encouragement, and support, both morally, spiritually, and materially, from various parties. Therefore, the author would like to express gratitude to:

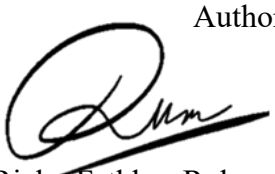
1. Prof. Dr. Ir. Novirina Hendrasarie, MT., as the Dean of the Faculty of Computer Science, Universitas Pembangunan Nasional "Veteran" Jawa Timur.
2. Dr. Intan Yuniar Purbasari, S.Kom. MSc., as the Head of the Informatics Study Program, Faculty of Computer Science, Universitas Pembangunan Nasional "Veteran" Jawa Timur.
3. Dr. Ir. Mohammad Idhom, SP, S.Kom., MT., as Thesis Advisor I, for the guidance and support provided throughout this research.
4. Henni Endah Wahanani, ST., M.Kom., as Thesis Advisor II, for the guidance and support provided throughout this research.
5. Dr. Rizky Parlika, S.Kom., M.Kom., as Examiner I, for the valuable insights and perspectives given to improve this research.
6. Achmad Junaidi, S.Kom., M.Kom., as Examiner II, for the valuable insights and perspectives given to improve this research.

7. Fetty Tri Anggraeny, S.Kom., M.Kom., as Academic Advisor, for the guidance provided during the author's academic journey and research process.
8. Lecturers and staff members of the Informatics Study Program, Faculty of Computer Science, Universitas Pembangunan Nasional "Veteran" Jawa Timur, for all assistance and support during the completion of this research.
9. The author's father, mother, and siblings, for their endless prayers, encouragement, love, and material support throughout the author's studies.
10. My sincere gratitude goes to my close friends, Rafif Ilafi, Raihan Fawwas, and Delfia Amanda, who have provided support, motivation, encouragement, and companionship throughout the process of completing this thesis. The author would also like to express appreciation to Ahmad Magfur Ali for the guidance, knowledge, and support given throughout the author's academic journey from the early semesters until the completion of the study. In addition, gratitude is extended to all colleagues and co-workers who continuously provided encouragement and support, contributing to the successful completion and publication of this thesis.
11. Special thanks to Rafif Ilafi for the continuous support, encouragement, companionship, and assistance given to the author throughout the process of completing this thesis.

The author realizes that this thesis still contains shortcomings and limitations. Therefore, constructive criticism and suggestions from all parties are highly appreciated for the improvement of this thesis. Finally, despite all limitations, the author hopes that this thesis will be beneficial to readers in general and to the author in particular.

Surabaya, 06 May 2026

Author,



Rizky Fatkhur Rohman

NPM. 21081010051

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES