

LoRa based IoT system for water quality monitoring in Shrimp Farming

Bachelor's Degree in Mechanical Engineering – Mechatronic Concentration

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Thesis Submission - June 2025

Thesis Revision - July 2025

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I hereby declare that this submission is my own work and to the best of my knowledge, it contains no material previously published or written by another person, nor material which to a substantial extent has been accepted for the award of any other degree or diploma at any educational institution, except where due acknowledgement is made in the thesis.



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Abstract

By Vasettha

This thesis presents the comprehensive design, development, and validation of a LoRa-based IoT system for enhancing water quality monitoring in shrimp farming. The primary objective is to deliver a robust, energy-autonomous sensor node capable of continuously collecting and transmitting critical water parameters, including pH, temperature, dissolved oxygen (DO), salinity, and oxidation-reduction potential (ORP). The methodology integrates a multi-sensor suite with external high-resolution ADCs for improved accuracy, a low-power ESP32 microcontroller leveraging deep-sleep states with RTC memory for power efficiency, and long-range wireless communication via the LoRaWAN protocol. A prototype was rigorously evaluated through extensive laboratory experiments and a week-long field deployment, with a specific focus on communication reliability, energy autonomy, and mechanical robustness. The findings demonstrate that the system achieves reliable real-time data transmission with over 98% packet success and confirms a communication range exceeding 1.2 km. Critically, the system proved fully energy-autonomous; its integrated solar panel generated a net daily energy surplus, sustaining continuous operation. The average current draw was empirically measured at 3.56 mA, providing a theoretical battery-only runtime of over 51 days. In conclusion, this research validates the feasibility and effectiveness of the proposed self-sustaining IoT system as a practical tool to improve decision-making and operational efficiency in modern aquaculture.

Keywords: IoT, LoRaWAN, Aquaculture, Solar energy, Renewable energy

Dedication

To the future of my beloved country, Indonesia, and to all who may find this work of benefit.



Acknowledgements

I would like to express my sincere gratitude to the many individuals who have supported me throughout this thesis journey.

First and foremost, I am profoundly indebted to my thesis advisor, **Leonard Rusli**, for their invaluable guidance, patience, and mentorship. Their insightful feedback and unwavering encouragement were instrumental in the development and completion of this research.

I wish to extend my appreciation to all the professors and staff at the **Mechatronics Engineering** at Swiss German University.

To my friends and colleagues, thank you for the stimulating discussions and the moral support that kept me going during challenging times.

Finally, I owe my deepest gratitude to my family. To my parents, and my siblings, thank you for your endless love, encouragement, and sacrifices. This accomplishment would not have been possible without your support.

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