ACKNOWLEDGEMENTS

This research could not have been accomplished without the generous guidance, steadfast encouragement, and kind support of many individuals. Foremost, I wish to express my profound appreciation to my supervisors, Dr.-Ing. Fiky Y. Suratman and Istiqomah, S.T., M.Sc., for their expert supervision, thoughtful critiques, and patient mentorship, which were essential to the successful completion of this work.

I would also like to extend my gratitude to Muhammad Azhar Ismail, S.T., M.Sc., for his teachings and expertise in electrical engineering, particularly in robotics. His foundational lessons broadened my perspective on problem-solving and creative thinking as an engineer.

Furthermore, I would like to thank and appreciate my colleagues, Evander Ricardo Manuel, and Nyimas Anggun Barokatillah, for their unwavering support and dedication. Through every challenge and obstacle, they stood by my side, proving themselves not only as exceptional team players but also as true friends. Their resilience and determination never wavered, even in the toughest of times, and their positive attitude kept the team motivated. Beyond their professionalism, their kindness and camaraderie made every struggle easier to bear. I am truly grateful for their friendship and the invaluable role they played in our shared journey.

I am also deeply grateful to Razak and the colleagues at SAS Laboratory for sharing their knowledge of underwater robotics and guiding my team in developing our own underwater vehicle.

Moreover, I am incredibly grateful to the Vaslo group for making my four-year university journey not just bearable, but truly memorable. Their brotherhood, endless support, and shared laughter turned challenges into adventures and ordinary days into cherished moments. They were my second family, and for that, I will always be thankful.

Finally, I must acknowledge the unwavering support, prayers, and encouragement from my parents, sisters, and Farah. Their love and belief in me were my greatest motivation, giving me the strength to persevere. Without their help, this achievement would not have been possible.