UNIVERSITI TEKNOLOGI MARA CAWANGAN PULAU PINANG

AUTOMATIC WASHING MACHINE CONTROL USING SYSTEM VERILOG HDL

NURUL NAFISHAH BINTI SAFERE

BACHELOR OF ENGINEERING (HONS) ELECTRICAL AND ELECTRONIC ENGINEERING

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations, Universiti Teknologi MARA, regulating the conduct of my study and research.

Name of Student	:	Nurul Nafishah Binti Safere
Student I.D. No.	:	202112
Programme	:	Bachelor Of Engineering (Hons.) Electrical and Electronic Engineering (CEEE200)
Faculty	:	Faculty of Electrical Engineering
Thesis	:	Automatic Washing Machine Control Using System Verilog HDL
Signature of Student	:	....
Date	:	February 2025

ABSTRACT

This research presents the design and implementation of an advanced automatic washing machine control system utilizing FPGA technology, specifically the Altera DE2-115 development board, programmed with SystemVerilog HDL. Traditional washing machine control systems rely on microcontrollers or microprocessors, which often face challenges related to processing speed, power consumption, and reconfigurability. To overcome these limitations, this study employs a Finite State Machine (FSM) architecture to efficiently manage the key operational stages, including load selection, door verification, water filling, washing, rinsing, spinning, and completion. The FSM was designed, simulated, and verified using ModelSim Edition 10.5b and Quartus Prime 20.1 Lite Edition to ensure precise state transitions and optimized process control. The system was successfully implemented on the Altera DE2-115 FPGA platform, demonstrating high-speed performance, real-time adaptability, and improved resource efficiency compared to traditional control methods. The experimental results confirm that FPGA-based designs provide superior flexibility, reduced execution time, and enhanced reliability, making them a promising alternative for embedded control applications in household appliances. Additionally, the modular nature of the design allows for future enhancements, such as IoT integration, machine learning-based cycle optimization, and improved fault detection mechanisms. This research contributes to the advancement of digital system design by showcasing how FPGA technology can revolutionize home automation and smart appliance control.

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