A Verilog HDL Based Approach for Vending Machine Design

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Abstract: **Finite State Machine (FSM) modelling is the most important component of designing the proposed model since it decreases the hardware. The Mealy Machine pretend was used to pretend a four- state process (stoner selection, staying for plutocrat insertion, product delivery, and servicing) in this work. The suggested model is estimated using the Spartan 3 development board, and its performance is compared to that of a CMOS-based machine. When a coin is inserted, vending machines distribute little quantities of various things. These machines may be created in a variety of ways utilising microcontrollers and FPGA boards. In this research, we suggested an efficient approach for implementing a vending machine on an FPGA board. Because FPGA-based vending devices respond quickly and consume less power than microcontroller-based vending machines.**

Keywords **–FSM, Mealy machine, Vending Machine, CMOS, Microcontroller, FPGA.**

I. INTRODUCTION

When money is entered into a vending machine, it dispenses a variety of things such as coffee, snacks, and cold drinks. Since the 1880s, vending machines have existed. In London and England, the first commercial coin-operated machine was created for the sale of postcards. Vending machines are more convenient and convenient than traditional purchase methods.

Nowadays, you can find them everywhere, such as at train stations selling train tickets, at schools and businesses retailing beverages and snacks, and in banks as ATM machines. Previous CMOS and SED-based machines took longer to develop than FPGA-based devices. The FPGA-powered machine is also more adaptable programmable and reprogrammable microcontroller-based machine, if they are if the design must be improved; he has to change the whole architecture again but in FPGA users can easily

increase the number of products.

In this research, a novel strategy to design an FSM-based vending machine with auto-billing capabilities is offered. The machine also has a cancel option, which allows the user to retract the request and have the money refunded to them. The user will receive a bill detailing the total quantity of goods delivered as well as the total price. This machine may be utilized in a variety of settings, including hotels, restaurants, and food markets. This saves time and money. When a product is selected and money is placed in a slot, the machines normally operate. If there is enough money, the selected item will be dumped into a tray, where the individual making the purchase may take it.

II. LITERATURE SURVEY

- In this paper, "FSM Based Design on the Replication of Hot Code Using Verilog HDL," a self-checking technique is provided to improve the SEU/MBUs immunity of FSMs' states by duplicating One-Hot code times for state encoding. This method can only repair bit-flip errors in the state register once per cycle.

- The paper "Design and Implementation of Vending Machine Using Verilog HDL on FPGA" presents the modelling of a Finite State based vending machine using the mealy machine paradigm. The Spartan3 FPGA development board was used to build the suggested machine. The whole design was functionally validated using the Xilinx 9.2i and Modalism 6.2a simulators.

- The paper, named "Finite State Machine based Vending Machine Controller with Auto-Billing Features," explains the design of multi-select machines using the Finite State Machine Model with Auto-Billing Features. The Mealy Machine simulate was used to simulate the four states (user selection, waiting for money insertion, product

delivery, and service). The suggested model is evaluated using the Spartan 3 development board, and its performance is compared to CMOS-based machines.

- The vending machine delivered a piece of tutti-frutti gum. Higher pricing was incorporated into vending machines in the late 1920s and 1930s. Soft drinks and nickel candy are examples of products sold at vending machines during the period. Coffee sellers emerged in 1946, followed by chilled sandwich vendors in 1950. Clothing, milk, postage stamps, and other products may now be purchased from vending machines.
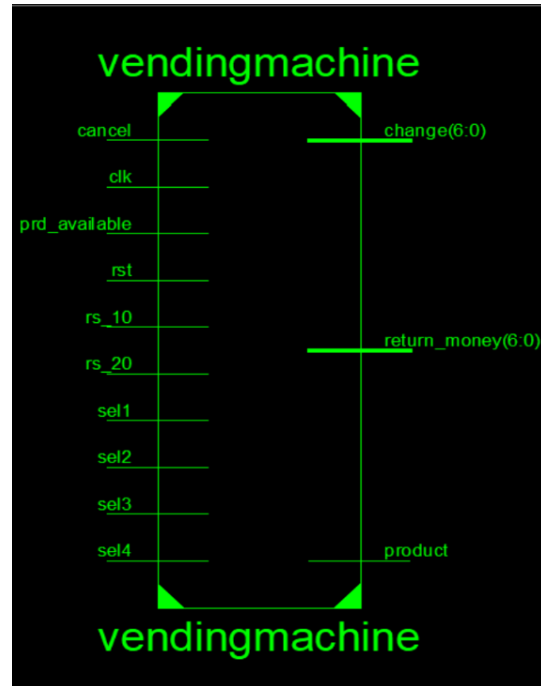
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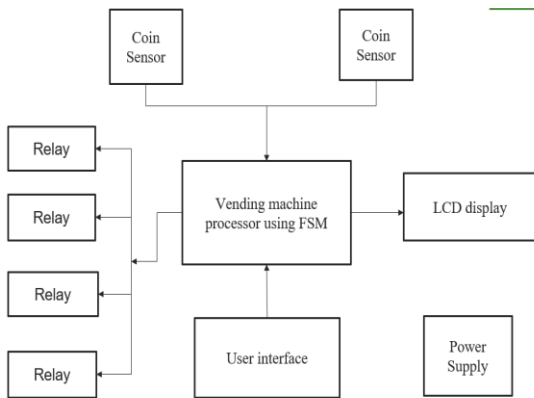

IV. FLOWCHART
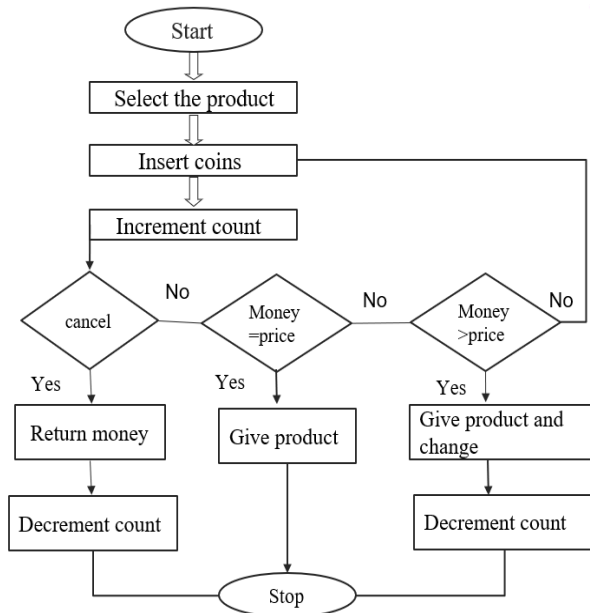
V. RESULTS

ADVANTAGES

- Verilog HDL enables modular design, allowing for the independent design and testing of the vending machine's several components (such as the display, coin mechanism, and product dispensing).
- The design may be easily expanded to accommodate future features or capabilities by adding or altering states and transitions.
- FSM-based architectures make the most use of available resources, leading to decreased power consumption and improved performance.

VI.CONCLUSION

In conclusion, utilizing Verilog HDL with FSM to construct a vending machine enables a simplified design approach with discrete states and transitions. This technique enables modular architecture and scalability, allowing for future expansions and better resource utilization. While complicated state diagrams and code verbosity are problems, the advantages of simplicity, modularity, and efficiency make Verilog HDL with FSM an excellent choice for creating vending machine systems.
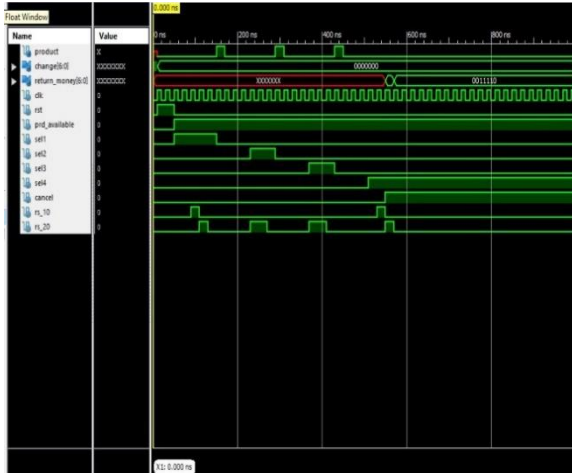
REFERENCES

[1] Abhishek Luthra, "Design and Implementation of Vending Machine using Verilog HDL on FPGA," International Journal of Innovative Research in Science, Engineering and Technology, Vol.4, Issue-11, November 2015.

[2] Samir palnitkar, "Verilog HDL", Second Edition, Prantice Hall, 2003.

[3] peter Minns, Ian Elliott, "FSM-based Digital Design using Verilog HDL", John Wiley & Sons Ltd 2008

[4] "Digital Design with RTL Design, VHDL, and Verilog" by Frank Vahid and Junho Yoon. This book offers a practical approach to digital design using both VHDL and Verilog HDL.

[5] Introduction using Digital Systems: Modeling, Synthesis, and Simulation using VHDL by "Mohammed Ferdjalla".

[6] Verilog HDL: A Practical Primer" by J. Bhasker.

[7] Ana Monga, Balwinder Singh, Academic and Consultancy-Services Division, Centre for Development of Advanced Computing (C-DAC), Mohali, India, "Finite State Machine based Vending Machine Controller with Auto-Billing Features," International Journal of VLSI design and Communication Systems (VLSICS), Vol.3, No.2, April 2012