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Review on Design Simulation of Smart Vending Machine Using FPGA

Poonam V. Bhonde¹, Asst. Prof. Shweta Thakur²

^{1, 2} Dept. Electronics & Telecommunication Engineering G.H. Rasoni Institute of Engineering & Technology. R.T.M. N. University Nagpur, India.

Abstract: Vending machine will help in distributing water pouch & snacks at public places, which could provide suitable purchasing method for people. These type of vending machines also implemented in another way such as microcontroller & FPGA board. In this paper, simulation of a vending machine depends on state machine i.e. MEALY machine model is used to check the process of different states. This paper describes the designing of vending machine using FSM model including SMS alert system with the help of GSM module. The role of GSM module is sending & receiving the message after product dispense (including information of product cost, no. of product, etc.). By using VHDL, this vending machine can be simulated easily & it required less time. The whole process simulated by using Xilinx ISE simulator tool with the help of VHDL coding. Design of VHDL code by the process such as frequency of operation, formulation and coding, source code simulation, finally synthesis, optimization and fit the design. Vending machine will be design using Finite State Machine (FSM) Model with SMS alert system.

Keywords: VHDL, FPGA board, GSM module, FSM Model.

I. INTRODUCTION

Nowadays due to modern and fast lifestyle, peoples are fully focused on saving their precious time in purchasing, which is very valuable for them. So, the vending machine is very flexible, practical & also easy to operating purchasing ways. The Vending machine is one of the best product selling techniques as per the requirement of users. In 1880, the vending machine has existed. First, post-card selling coin-operated VM was established in London & England [5]. The Tremendous increasing graph & innovation in daily routine ,humans are more tired to innovations in wireless technologies which became a part in the present period of human life. GSM modules are very cheap in the market which can be accessed throughout the state [2]. Before some years ago vending machines were mechanical now latest electronic technology occurs some modern vending machine is designing with features such as accepting debit or credit cards instead of cash. This type of machine works ,when some money drop in slot ,select required product ,select quantity of product i.e. how much product we want & then push the dropout product button. In last few years various technology propose to designing vending machine with auto-billing features, cancel features, etc [2]. The finite state automation is set of all possible states and controls transition from state to state in responses to describe process involving inputs and outputs. Mealy machine also called as synchronous FSM which is a state machine that uses only input actions, and the output depends on the input and present states [7]. he micro-controller based machine is recently used at various public places but micro-controller based machine is very difficult to enhance the design than FPGA based machine. This machine saves time and cost. The machines usually work, when some money (usual coins) is put in a machine [7].GSM module is used to send and receive SMS and it is interfaced with FPGA through RS232 serial communication. VMAS inputs give FPGA after that GSM module directly sends message parity bits. to a mobile phone which is numbers recorded in a coding using Xilinx [6]. NThe interconnection between GSM module and mobile phone is remote and afterward, that module communicates serially with the help of FPGA board through RS-232 serial communication for the control of appliances. Similarly, Universal Asynchronous Receiver Transmitter receives and transmits data in parallel to serial and serial to parallel with changing Baud Rates per second, with parity bits & start-stop. FPGA having limited I/O N-Bit operations can be performed through RS-232 protocols. The expected requirements of the vending machines are increasing day by day due to the modern and fast lifestyle. This FPGA based vending machine will be used at the remote location for fast & accurate dispense of some products for the domestic purpose at various public places. We can monitor the FPGA based vending machine with the mainframe computer. Due to it's flexible and reliable algorithm the user can easily enhance the algorithm for a huge number of products and money in low cost than the microprocessor based vending machine.

II. FSM (FINITE STATE MACHINE)

In a Finite State Machine, yield of circuit is characterized in an alternate state i.e. each yield is a state. A State Register to hold the condition of the machine and a next state rationale to disentangle the following state. A yield enlist characterizes the yield of the machine. In FSM based machines the equipment gets diminished .There are two kinds of states machines are as per the following Machine

A. Mealy Machine

The capacity of MEALY machine is the yield relies upon the present state and also on the info. The piece portrayal of MEALY machine is as appeared beneath the figure 1

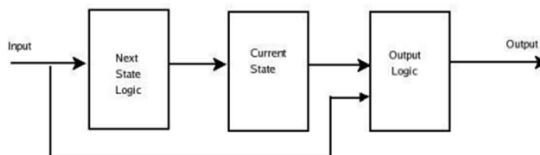


Figure 1: MEALY Machine Model

B. Moore Machine

The capacity of this machine is just yield is relies upon the present state. The diagrammatical portrayal of MOORE machine is as appeared beneath the figure 2.

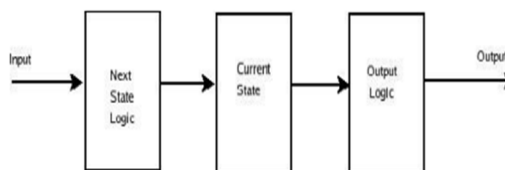


Figure 2: MOORE Machine Model.

III. FPGA (FEILD PROGRAMABLE GATE ARRAY):

A debug client function includes in FPGA function for the purpose of observe & manipulates at least one bus and one portion of the plurality of internal signals [12]. Sophisticated HDL simulation software provides through FPGA vendors, allowing cycle-accurate simulation of the designs as they would run on the target hardware FPGA platform. FPGA stands for Field Programmable Gate Array. We use here FPGA Spartan 3 development board.

IV. ARDUINO

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board. It is a microcontroller board based on the ATmega 328(datasheet).The recommended voltage for most Arduino models is between 6 and 12 Volts. It has 14 digital input/ output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button, AREF Stands for Analog Reference. It contains everything needed to support the microcontroller, simply connect it to a computer with a USB cable or power it with AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the ATmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter

V. LITERATURE REVIEW

A. The few researchers were analyzed the design of Vending Machine with different features. Similarly, Seenuvasan T, Saranya P [10] proposed a new approach to design an FSM based Vending Machine with auto-billing features. While, the FPGA based VM with features like SMS alert system, cancel feature were not detail described & analyzed in many works.

- B. According to the research paper [6], authors have an idea of a wireless electronic security system with sensor interface through GSM. FPGA board which are activated and deactivated through commands in serial communication from a cell. Status of the appliances sent via SMS through GSM module to predefined numbers programmed in the system.
- C. Regarding the efficiency of Vending Machine, many researchers have been investigated the algorithm of the VM. Anchal Katiyar [8] proposes a VM is an efficient algorithm for implementation of the vending machine of FPGA board. Because of the reaction of FPGA based machine is very quick and utilizations required less power as compared to microcontroller based distributing machine. This candy machine underpins a few items.
- D. According to the research paper, [1] authors have described an idea of MEALY Machine Model is used to model the process for state i.e. user selection, waiting for money insertion, product delivery, and servicing. The Spartan 3 development Board is used to test the proposed model.
- E. In [6] vending machine using Finite State Machine (FSM) Model is proposed using VHDL. FSM modeling is the most important part of developing proposed vending machine model as this reduces the required hardware. In this project MEALY Machine Model is used to model the process for state i.e. user selection, waiting for money insertion, product delivery, and servicing.
- F. Recently current way of life, in various nations Reverse VM is extremely well known. It requires less investment and vitality of the framework that raises the effectiveness of VM. In [5], they can be embeddings the void drink holder into it when the Reverse VM works. Without supporting the buyer's collaboration the turnaround candy machine can't helpful. The best case of discounted task is the helpful case of RVM which is one of the essential capacities in the VM.
- G. [11] they propose multi-select VM, which is the Mealy model where the outline of FSM is considered. The productivity of VM can be expanded utilizing streamlined coding written in VHDL dialect and actualized in FPGA board. This VM has four item drain, water, natural product, and sprite. It takes just coin two sorts of coin 5 rupees and 10 rupees. It has auto charging and wipes out highlights. Here, Xilinx ISE

VI. CONCLUSION

It has been seen in various situations that FPGA based machine gives quicker reaction with low power utilization and simple to use by a normal individual when contrasted with the microcontroller based machines. The outline and reenactment of a programmed machine is practically checked utilizing Xilinx ISE test system and the created bit stream record has actualized in FPGA board. The FPGA usage is assessed its streamlined parameters through Xilinx. Utilizing suitable outline, the productivity of Vending Machine can without much of a stretch be upgraded for some applications. Multifaceted nature diminishments that include in the expansion in proficiency of the general framework utilized as a part of Vending Machine. Its calculation is exceptionally adaptable and solid as the seller can undoubtedly upgrade the calculation for expansive number of items and coins.

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