A project on

Dhaka Metro Rail Automatic Ticketing System Using Verilog HDL

Project For Fulfilment

Fourth Year Project Work

Submitted by

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CERTIFICATION

I am pleased to certify that the project work entitled **"Dhaka Metro Rail Automatic Ticketing System Using Verilog HDL"** submitted by **Md. Forhad Hossain**, Roll no: 1515032, Reg. no: 1166, Session: 2015-2016 has performed the project under my supervision for the fulfilment of the Fourth Year Project Work of department of Electrical & Electronic Engineering. Islamic University, Kushtia-7003.

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ABSTRACT

This project introduced a ticketing system that allows a seamless ticketing experience for the passenger. Passengers will be able to choose their desired destination by selecting the ticket. The module has been designed and synthesized with Cadence Genus using Verilog Hardware Description Language (HDL). The ticket to price selection, Money calculation, Money comparison and change processing section uses Moore finite state machine (FSM), which allows simplicity in the designing process. The wave after the simulation process of the functional system has shown in this paper.

INTRODUCTION

Bangladesh is now a developing country. Government takes many steps to reduce the traffic difficulty in the urban areas like the capital city Dhaka. As now they are developing a metro rail to overcome this problem. Booking the tickets through ticket counters is time consuming process. we usually face many problems at ticketing counter of exact currency to be paid while booking the reservation or unreserved tickets.

To overcome this problem, firstly, we have studied the development of Metro rail ticketing system at home and abroad, and then studies the basic needs of this ticketing system then we designed an electronic ticketing machine by using Verilog HDL. This machine is flexible and reliable compare to Microcontroller based design machines. The project contains the FSM (Finite State Machine) especially Moore state machine. The different states in the FSM define each operation of the electronic ticket machine.

1.0 DESIGN PRINCIPLE

1.1 Verilog HDL Language

Verilog is a HARDWARE DESCRIPTION LANGUAGE (HDL). Early in 1984, Gateway Design Automation created Verilog, roughly three years after the US Department of Defense started developing VHDL. In 1987, VHDL was accepted as an IEEE standard with backing from the DoD. Not until 1995 did Verilog enter the scene. Today, both VHDL and Verilog are popular HDLs and FPGA design tools usually support both languages.

It is a language used to describe digital systems such as flip-flops, microprocessors, memory, and network switches. It is most frequently utilized in the register-transfer level of abstraction for digital circuit design and verification. In Verilog HDL is a machine- and human-readable formal notation designed to be used throughout the entire electronic system development process. This implies that any digital hardware at any level can be described using HDL.

Designs, which are described in HDL are independent of technology, very easy for designing and debugging, and are normally more useful than schematics, particularly for large circuits. At the same time, we can see that Verilog language has the following advantages: it can accurately, simply and clearly describe various levels of systems. To sum up, we can see that Verilog language is a complete and excellent description language. Its ability is enough to help us complete very complex chip design or complete electronic system design.

1.2 Cadence Tools

Cadence Design Systems is a company that develops software, hardware, and silicon intellectual property (IP) for designing integrated circuits (ICs), printed circuit boards (PCBs), and electronic systems. They offer a range of tools and solutions to aid in various aspects of electronic design automation (EDA).

Genus: Genus is a leading RTL synthesis solution offered by Cadence. RTL synthesis is the process of converting a Register Transfer Level (RTL) description of a digital circuit into a gate-level representation that can be implemented in silicon.

Encounter: The Encounter platform from Cadence focuses on physical design and implementation of digital integrated circuits. It covers various stages of the design flow, from initial placement and routing to final sign off.

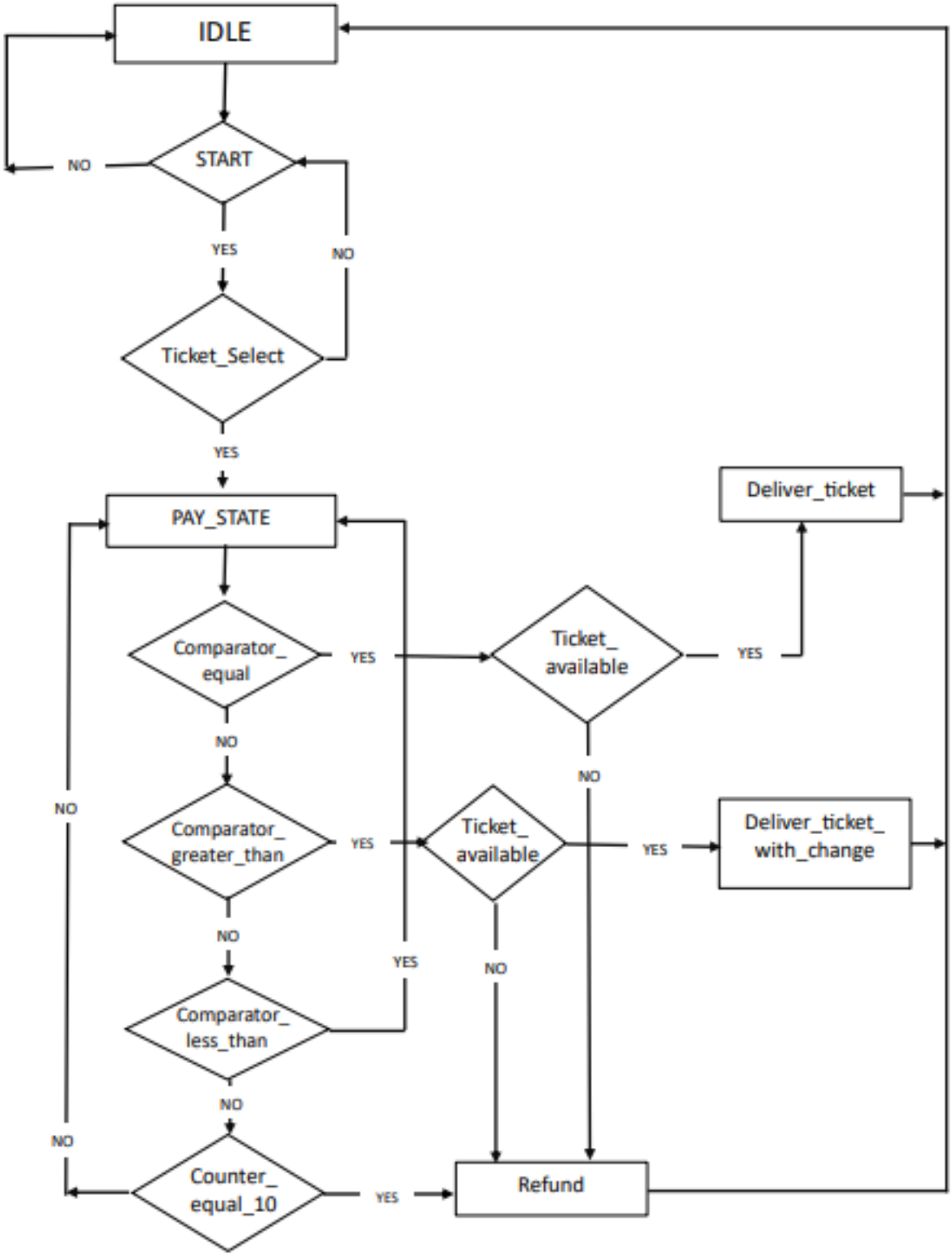
2.0 DESIGN METHODOLOGY

2.1 Overall Operation

This project is designed for the proposed machine which can vend tickets for the two destinations but in case it's possible to make it work for more destinations. Firstly, the machine will be in IDLE mode, After Starting the machine & select the desired ticket, it will convert automatically into precise price and go to the next state as Pay State. Then passenger will provide the required amount of currency for the selecting ticket. This design only accepts 10 Taka & 20 Taka notes. In this section the machine will compare the selecting ticket precise price and the given money (Taka). If the inserts currency is equal to desired currency, then the passenger will receive the ticket for his journey. If the inserts currency is greater than desired currency, then the passenger will receive the ticket with the change. If the inserts currency is less than desired currency, passenger will have to pay the rest of the currency for receiving ticket, otherwise it will automatically go to the IDLE section and the amount of currency that was inserted by the passenger will be refunded back to the passenger. Before receiving the ticket, at any point of transaction if he wants to cancel the transaction the inserted amount will be refunded back to passenger.

2.2 Flow Chart

The flow chart of the proposed design if given below:



3.0 DESIGN CONTENT & SIMULATION

3.1 Ticket to Price selection Module

The input of this module is ticket_sel (ticket select), cash1 & cash2. Cash1 & cash2 input is selected previously, as it is not changeable by the passenger. Because the price of each ticket is fixed. When the passenger select the ticket for desired destination this module convert into selected price rate in output as price_out. When passenger select the No. 1 ticket then the output 'price_out' will be cash1 signal. On the other hand, if the passenger select No. 2 ticket then the output 'price_out' will be cash2 signal.

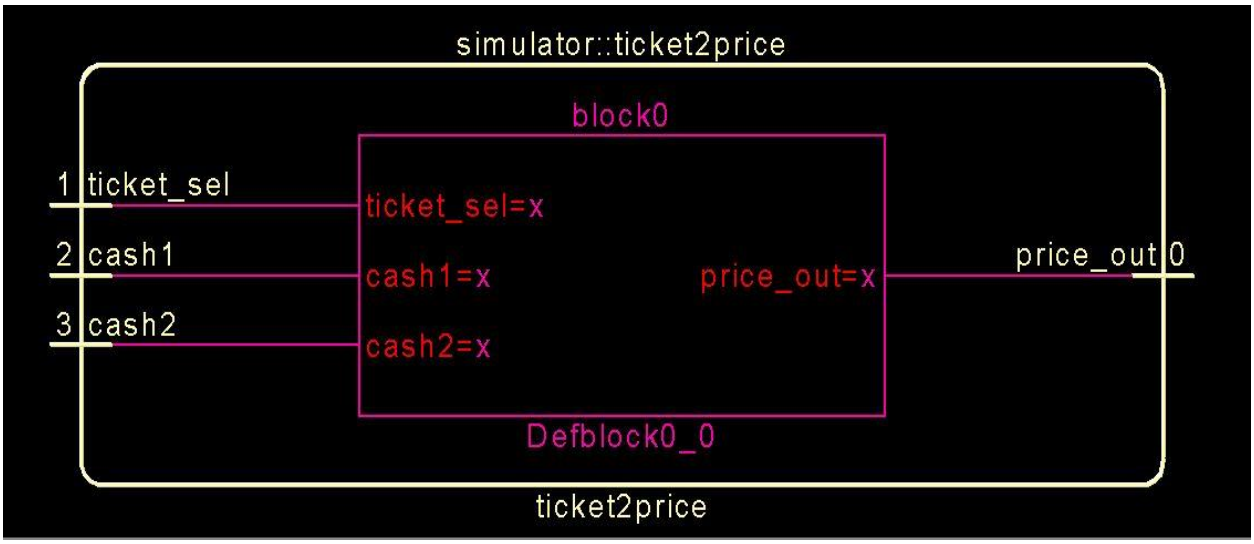


Fig 1: Ticket to Price selection Module

Simulation Result:

The simulation diagram of the ticket to price selection module is as follows. Through the simulation diagram we can see that, when we select the ticket1 (ticket_sel) the output (price_out) is same as cash1, similarly the output will be same as cash2 when select the no 2 ticket.

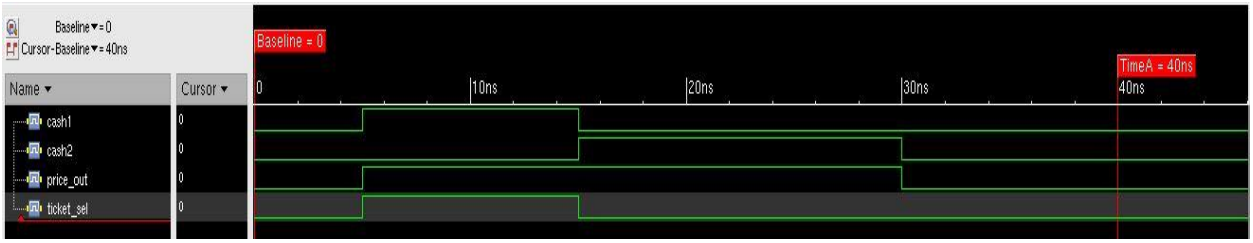


Fig 2: Simulation waveform of Ticket to Price selection Module

3.2 Money Calculation Module

Module input: clr_tk (clear money), reset, clk (clock), TK10 & TK20 means the signal of input is 10 taka and 20 taka. It's like the pay sate in this design. Passenger must pay for the tickets & this module actually use for inserting the money into the machine. This module works as an Adder. This module will calculate how much money the passenger inserts in the machine at a certain clock period of time. The output will be the total amount of money that inserts by the passenger.

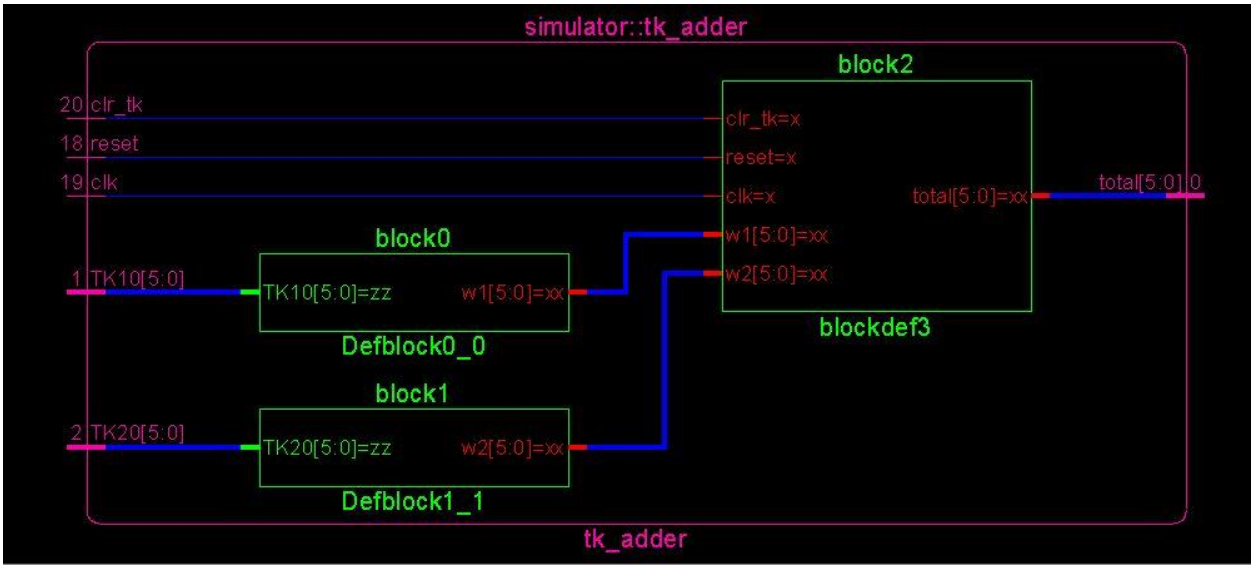
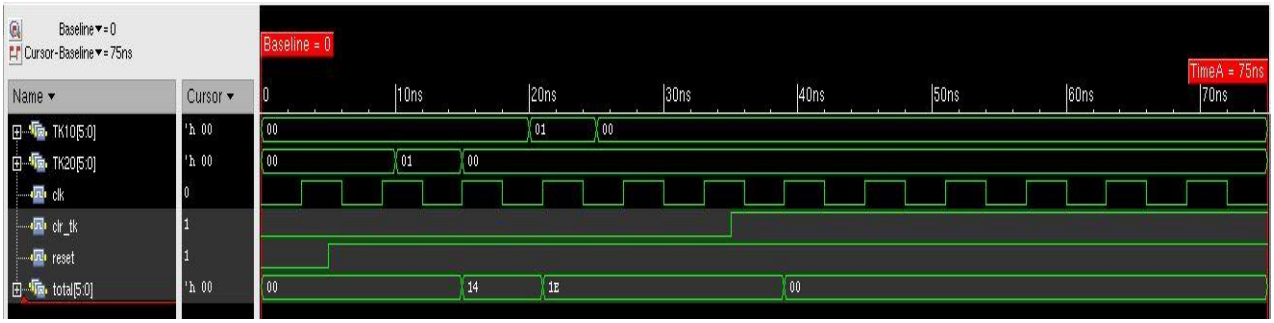


Fig 3: Money Calculation Module

Simulation Result:

According to the money calculation module, when TK10 signals is high consecutively two times the output total signal is high. So, the total amount of investing money is TK20. The simulation of money calculation module is given below:



3.3 Money Comparison Module

Module input: Two inputs of this module is the output of the “Money Calculation Module” and “Ticket to Price Selection Module”. In this section the machine will compare the selecting ticket precise price and the inserts money (Taka). If the inserts money is equal to desired currency, then the output will be “comp_eq”. If the inserts currency is greater than desired currency, then the output will be “comp_gt”. If the inserts currency is less than desired currency, the output will be “comp_lt”. otherwise it will automatically go to the IDLE section and the amount of currency that was inserted by the passenger will be refunded back to the passenger.

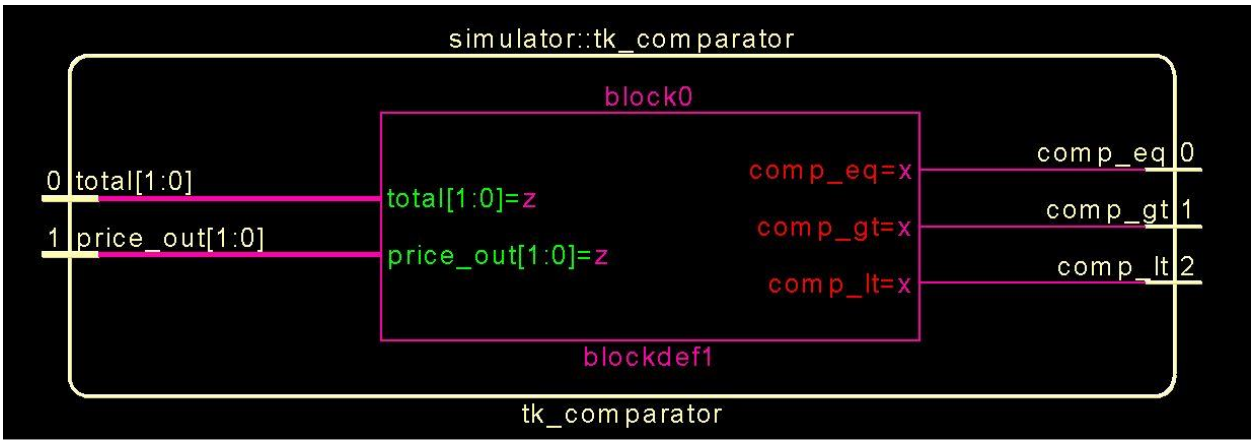


Fig 4: Money Comparison Module

Simulation Result:

According to the money comparison module, we can see that when two inputs price_out Tk10 and total Tk10 signal is high, the output com_eq signal is high. Also, when price_out Tk20 signal is high but total Tk10 signal is high, the output com_lt signal is high and finally when price_out Tk10 signal is high but total Tk20 signal is high, the output com_gt signal is high.

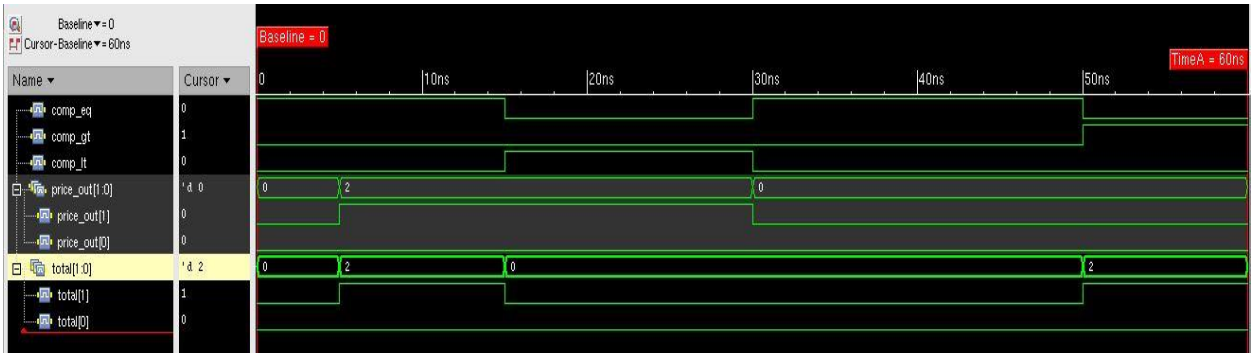
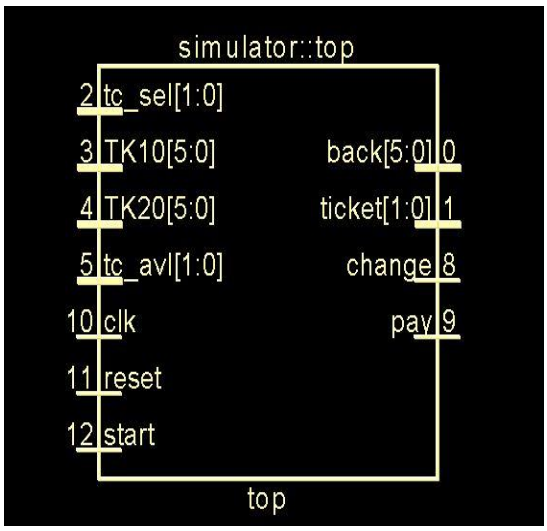


Fig 5: Simulation waveform of Money Comparison Module

3.4 Top Level Module

This Top level module is composed of ticket to price selection module, Money calculation module & Money comparison module. These modules are connected each other with FSM (Finite state machine) module.



Passenger only can control the Top level inputs, the output of the machine will depend upon the passenger inputs. That's the controlling unit/port for passenger. The top module port block diagram is shown in paper's right side and the connection of all the modules as we can say the top 1 level is shown in below:

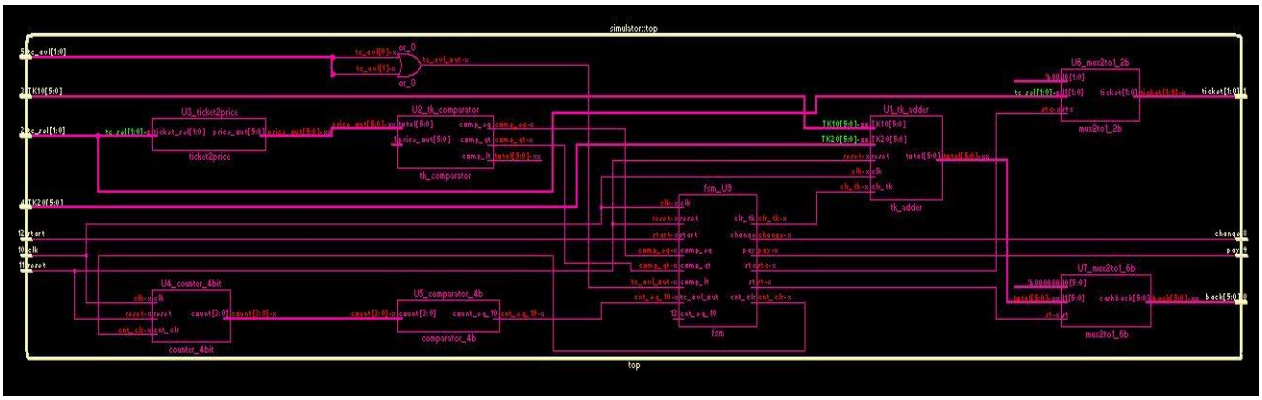


Fig 6: Top Level Module

Simulation Result:

From the simulation diagram of top level module, we can see that firstly when ticket selecting signal for No. 1 ticket is high & inserts TK20 then it delivers the No. 1 ticket with changes. secondly, when ticket selecting signal for No. 1 ticket is high & inserts TK10 then it delivers the No. 1 ticket. Thirdly when ticket selecting signal for No. 2 ticket is high & inserts TK10 then it goes through the pay option for further receiving money when it gets the signal of inserting another input then it delivers the No. 2 ticket. The simulation waveform of the top level module is given below:

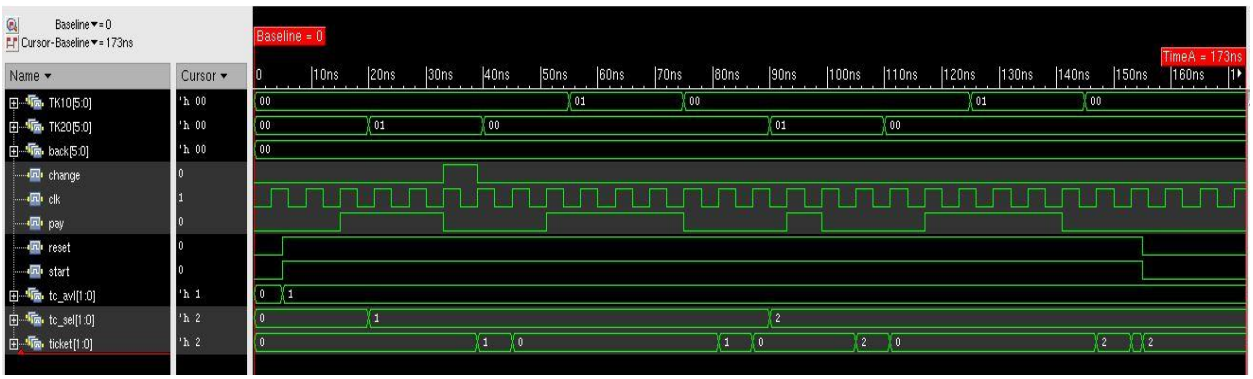


Fig 7: Simulation waveform of top level module

CONCLUSION

The system avoids queues, saves time and speeds up the ticket sales process. It has much better features like cancellation of tickets between event and the machine refunds if no tickets are available. Its design is very flexible and reliable.

In future, we can easily improve the algorithm for more destinations and add some of the following features - the ability to pay by card and the ability to queue and process orders according to FIFO.

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