EEL203 PROJECT

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VENDING MACHINE CONTROLLER

OVERVIEW

The project focuses on designing a digital vending machine controller using Verilog HDL, where the machine accepts ₹5 and ₹10 coins and dispenses a product once the total inserted amount reaches or exceeds ₹10. The entire system is implemented as a finite state machine (FSM) with four states representing the total money inserted:
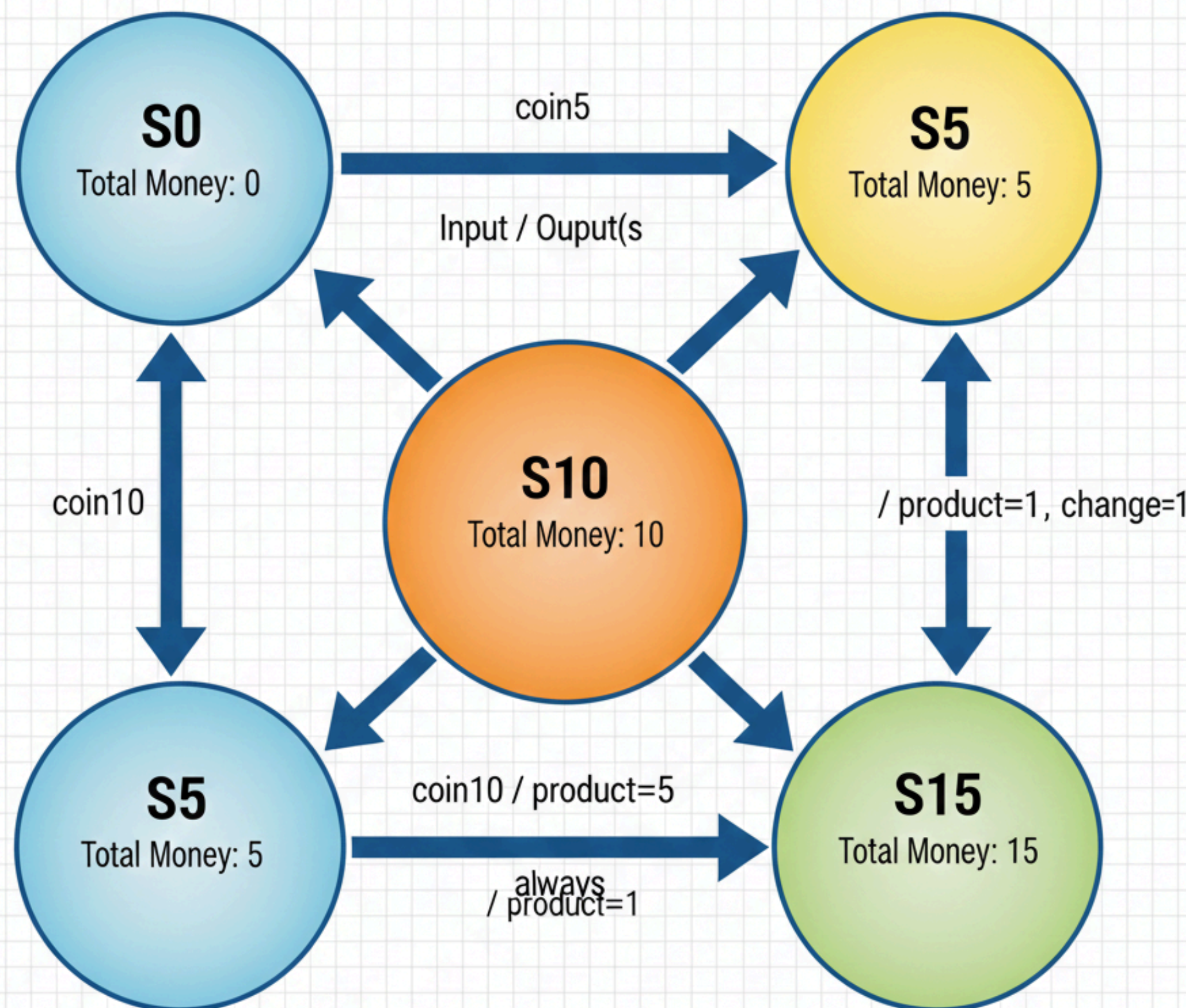
S0 for ₹0

S5 for ₹5

S10 for ₹10

S15 for ₹15

Based on the coin inserted, the machine transitions from one state to another, updating the internal total accordingly. When the accumulated value becomes sufficient to purchase the item, the controller activates the product output signal for one clock cycle, simulating the dispensing action. After dispensing, the system automatically resets to the initial state, making it ready for the next transaction, just like a real vending machine.

VERILOG VENDING MACHINE (15-UNIT PRODUCT) FSM

S0
Total Money: 0

coin5

Input / Ouput(s

S5
Total Money: 5

coin10

S10
Total Money: 10

/ product=1, change=1

S5
Total Money: 5

coin10 / product=5

always
/ product=1

S15
Total Money: 15

Inputs: clk, reset, coin110
Outputs: product, change

Note: Transitions occur on the positive clock edge.
Outputs are combinational.

This FSM tracks the accumulated money using four states (S0, S5, S10, S15), representing 0, 5, 10, and 15 units, respectively. Inputs (Coin5/Coin10) move the machine to the next state, increasing the total. The product is dispensed (output product=1) when the accumulated amount reaches 15 or more. Notably, inserting a second 10-unit coin in state S10 immediately dispenses the product and 5 units of change (output change=1), resetting the FSM to S0.

CORE ARCHITECTURE: MEALY FSM

Sequential Logic

Unlike combinational circuits, this design uses internal state memory to "remember" the accumulated value of coins inserted over time.
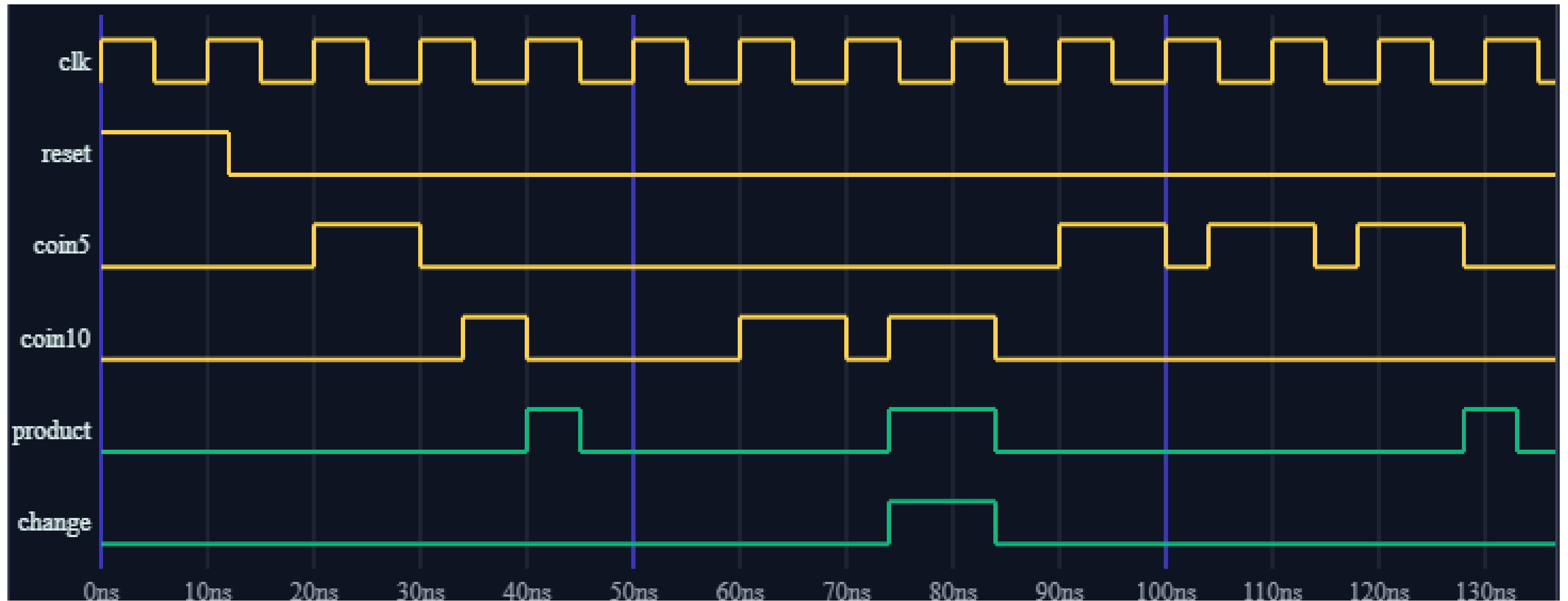
State Definitions

Four distinct states represent the current balance: S0 (0), S5 (5), S10 (10), and S15 (15).

Mealy Machine

The outputs (Product/Change) depend on both the current state AND the current input, allowing for immediate dispensing.

VENDING MACHINE FSM WAVEFORM

SIMULATION LOG DATA

```
time    reset   coin5   coin10  product change
0       1       0       0       0       0
12      0       0       0       0       0
20      0       1       0       0       0
30      0       0       0       0       0
34      0       0       1       0       0
40      0       0       0       1       0    <-- Product dispensed (5+10=15)
45      0       0       0       0       0
60      0       0       1       0       0
70      0       0       0       0       0
74      0       0       1       1       1    <-- Product + Change dispensed (10+10=20)
84      0       0       0       0       0
90      0       1       0       0       0
100     0       0       0       0       0
104     0       1       0       0       0
114     0       0       0       0       0
118     0       1       0       0       0
128     0       0       0       1       0    <-- Product dispensed (5+5+5=15)
133     0       0       0       0       0
```

FUNCTIONS

Detects coin insertion

It reads the coin input and identifies if it is ₹10, ₹5, or no coin.

Maintains running total

Each time a coin is inserted:

- Adds ₹10 if input is 01
- Adds ₹5 if input is 10

Checks if enough money is inserted

If the total amount becomes:

- ≥ ₹10 → machine dispenses the item
- Less than ₹10 → keeps waiting for more coins

Dispenses product automatically

When the target price is reached, the output dispense goes HIGH for one clock cycle.

Resets for next customer

After dispensing, the amount resets to 0, so the next transaction starts fresh.

Thank You!