

The Vending Machine designed by us has **3 states** which are as follows:

1. IDLE
2. BUTTON
3. PRODUCT

IDLE STATE:

- In this state the **SUPPLIER** loads the items in the machine and assigns the cost and count to that corresponding item when the **valid_s** bit is HIGH.
- **valid_s check:**
 - SUPPLIER Control/USER transaction:
 - Whenever in the IDLE state the SUPPLIER makes the valid_s high the USER only buys the product with the values assigned to cost and count of the corresponding ITEMS in a newer transaction.
 - If the valid_s is LOW then the USER buys the ITEMS with the already assigned previous values.

NOTE [Transaction cost and count values]: If the USER does a transition to another state the SUPPLIER values won't take effect until the USER doesn't complete the current transaction. To aid this process flags are set in the design which are made zero once USER presses the button and makes transition.

- **Multiple button checks:** The multiple buttons pressed by the USER is checked and **IF, YES**, the machine remains in the IDLE state.

IDLE TO BUTTON TRANSITION

- The IDLE TO BUTTON transition takes place only when the following conditions are true
 - *If single button is pressed.*
 - *If the SUPPLIER has not pressed valid.*
 - *If the RESET is not applied.*
 - *If the enter key is made high.*

BUTTON STATE:

- In this state the following conditions are checked
 - **COUNT NOT ZERO:** The count of the ITEMS in the vending machine is checked whether it is not reduced to zero.
 - **MONEY NOT ENOUGH TO BUY A PRODUCT:** If the coins inserted by the USER are not enough to buy the product.
- **BUTTON TO PRODUCT TRANSITION:**
 - *Whenever the USER inserts COINS EQUAL TO or MORE than the cost of an ITEM then only then transition occurs.*

PRODUCT STATE:

- In this state the PRODUCT is available to the USER for which the USER has pressed the BUTTON.
- **PRODUCT TO IDLE TRANSITION:**
 - *Once the USER gets the product the machine is transitioned to the IDLE state.*

OUTPUTS:

The info display has values displayed in the following state:

IDLE: the info display is visible only when the button is pressed by the USER

BUTTON: The info display is visible in the state which informs the USER that the money he has inserted is less or more and the USER can know that they must insert more coins if the ITEM costs more.

ITEM-BUTTON-PRODUCT MAPPING

Every row in the following table corresponds to the bit pattern of the bit variables in the corresponding column in that same row:

For example:

If the **item_s** is 3'b001 which is the supplied pattern for an ITEM. When the USER presses the button[0]=6'b100000, for that respective button[0] pressed a product=3'b000 will come out from the Vending machine as an output.

| bit [5:0] button | bit [2:0] item_s | bit [2:0] product |
|---------------------|------------------|-------------------|
| button[0]=6'b000001 | item_s=3'b000 | product=3'b001 |
| button[1]=6'b000010 | item_s=3'b001 | product=3'b010 |
| button[0]=6'b000100 | item_s=3'b010 | product=3'b011 |
| button[0]=6'b001000 | item_s=3'b011 | product=3'b100 |
| button[0]=6'b010000 | item_s=3'b100 | product=3'b101 |
| button[0]=6'b100000 | item_s=3'b101 | product=3'b110 |

NOTE: THE PRODUCT value is considered zzz when there is no transaction operation going on.

STATUS CONFIGURATIONS:

| | | |
|----|------------------------|--|
| zz | NO PRODUCT | No operation is going on |
| 00 | INTERNAL ERROR | When there is no product in the machine even though a button is pressed |
| 01 | NO PRODUCT AVAILABLE | Whenever the PRODUCT is not provided by the vending machine whenever the money provided by the USER is not enough to buy a product |
| 10 | TRANSACTION PROCESSING | If the transactions happen properly whenever the transitions going on from IDLE TO BUTTON AND BUTTON TO PRODUCT STATES |
| 11 | PRODUCT AVAILABLE | In the PRODUCT STATE whenever the product comes out then this is the status |

COINS ENCODING:

- Whenever a user buys a product, he inserts COINS:
 - The COINS used are QUARTER, NICKEL AND DIME

| COINS | BIT PATTERN | TO ADD to BAL intermediate variable in the operation |
|----------|-------------|--|
| NO MONEY | 00 | NOTHING TO ADD meaning zero to ADD |
| NICKEL | 01 | 101 |
| DIME | 10 | 1010 |
| QUARTER | 11 | 11001 |

enter_key

- 0- enter_key is not pressed by the USER but they have checked the price for the product and
- 1-enter_key is pressed by the USER and they will get the PRODUCT for the corresponding BUTTON pressed.