

Vending Machine for cold and Hot beverages



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Abstract:

Basically, our design of vending machine will give both cold and hot beverages. To illustrate it, we have included two hot beverages and four cold beverages, it can be changed or even added more drinks accordingly to the demand.

Introduction:

This design of vending machine is intended to produce diverse range of products. The drinks which we included are coffee, tea, coke, pepsi, maaza and orange juice.

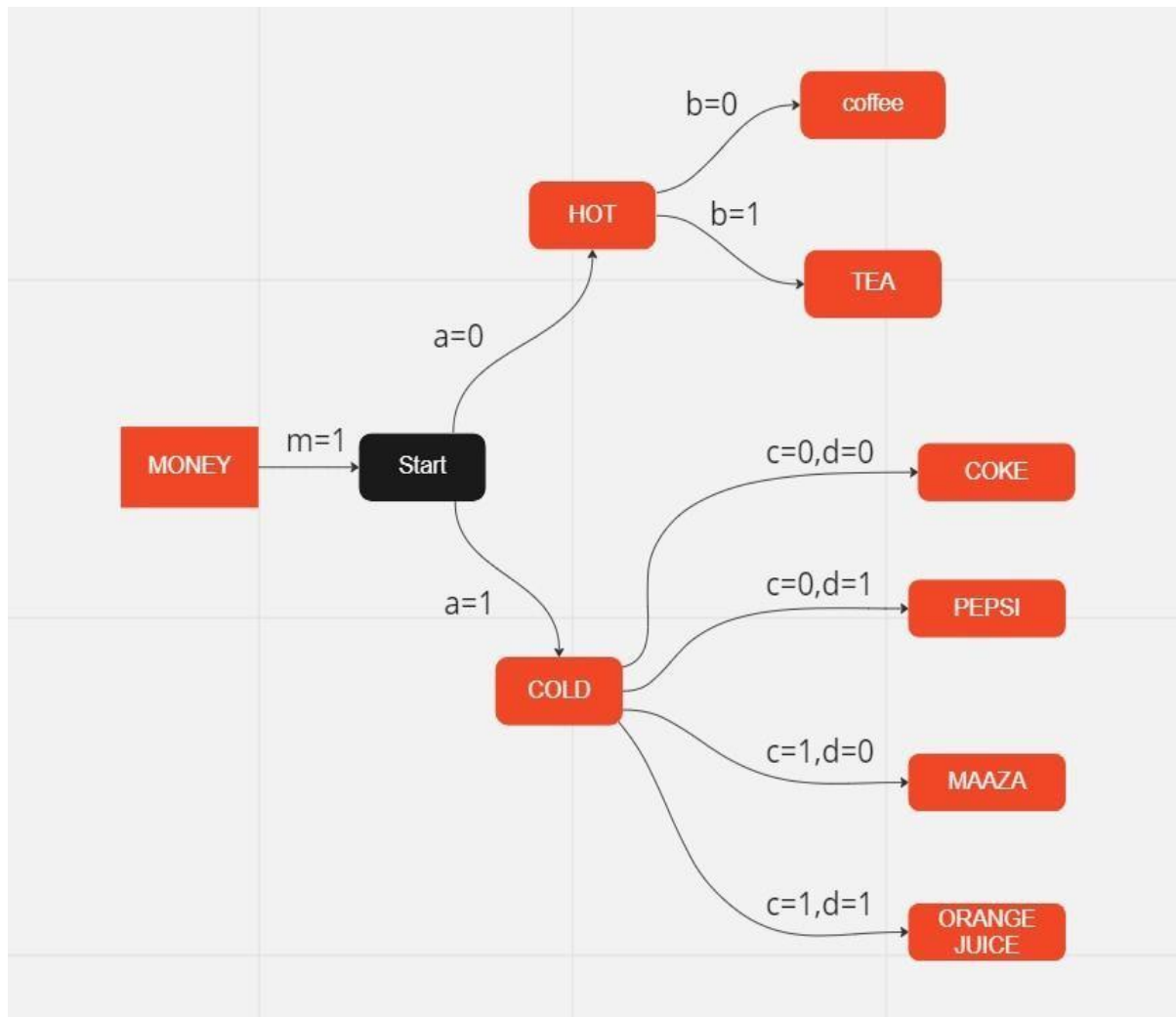
Problems with the existing machines and their solutions:

- The customer may drink the beverage and escape without paying the money if the shop owner is busy with other customers, Sometimes the customer may forget to pay the money

To overcome this issue, we have designed in such a way that, it works only if money is paid.

- We haven't yet experienced a vending machine which has both hot and cold beverages, but our design overcomes this issue too!!

Flow Chart:



The above flow chart explains our model, i.e if Money is paid, the machine starts, the user should give input to the system in terms of 0 or 1 as select line inputs, 0 represents hot beverages while 1 represents cold beverages, the same is done to obtain hot beverages. since there are four cold beverages, four different combinations are required, we have

done it using combinations of 0 and 1 as inputs to two select lines as shown in the above flow chart

Truth table:

Money	a	b	c	d	Coffee	Tea	Coke	Pepsi	Maaza	Orange Juice
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0	0	0
0	0	0	1	0	0	0	0	0	0	0
0	0	0	1	1	0	0	0	0	0	0
0	0	1	0	0	0	0	0	0	0	0
0	0	1	0	1	0	0	0	0	0	0
0	0	1	1	0	0	0	0	0	0	0
0	0	1	1	1	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0	0
0	1	0	0	1	0	0	0	0	0	0
0	1	0	1	0	0	0	0	0	0	0
0	1	0	1	1	0	0	0	0	0	0
0	1	1	0	0	0	0	0	0	0	0
0	1	1	0	1	0	0	0	0	0	0
0	1	1	1	0	0	0	0	0	0	0
0	1	1	1	1	0	0	0	0	0	0
1	0	0	0	0	1	0	0	0	0	0
1	0	0	0	1	1	0	0	0	0	0
1	0	0	1	0	1	0	0	0	0	0
1	0	0	1	1	1	0	0	0	0	0
1	0	1	0	0	0	1	0	0	0	0
1	0	1	0	1	0	1	0	0	0	0
1	0	1	1	0	0	1	0	0	0	0

1	0	1	1	1	0	1	0	0	0	0
1	1	0	0	0	0	0	1	0	0	0
1	1	0	0	1	0	0	0	1	0	0
1	1	0	1	0	0	0	0	0	1	0
1	1	0	1	1	0	0	0	0	0	1
1	1	1	0	0	0	0	1	0	0	0
1	1	1	0	1	0	0	0	1	0	0
1	1	1	1	0	0	0	0	0	1	0
1	1	1	1	1	0	0	0	0	0	1

Truth table explanation:

Variable 'a' is a select line for a 1:2 decoder.

Variable 'b' is a select line for a 1:2 decoder.

Variable 'c','d' are select lines for a 2:4 decoder.

a – 0 mean Hot a – 1 mean Cold

b – 0 mean Coffee b – 1 mean Tea

c, d – 0 0 mean Coke c, d – 0 1 mean

Pepsi c, d – 1 0 mean Maaza c, d – 1 1

mean Orange Juice.

K-MAP FOR COFFEE:

Group : 1

M,a \ b,c,d	000	001	011	010	110	111	101	100
00	0 0	0 1	0 3	0 2	0 6	0 7	0 5	0 4
01	0 8	0 9	0 11	0 10	0 14	0 15	0 13	0 12
11	0 24	0 25	0 27	0 26	0 30	0 31	0 29	0 28
10	1 16	1 17	1 19	1 18	0 22	0 23	0 21	0 20

$$\text{Coffee}(M, a, b, c, d) = Ma'b'$$

K- MAP FOR TEA:

Group : 1

M,a \ b,c,d	000	001	011	010	110	111	101	100
00	0 0	0 1	0 3	0 2	0 6	0 7	0 5	0 4
01	0 8	0 9	0 11	0 10	0 14	0 15	0 13	0 12
11	0 24	0 25	0 27	0 26	0 30	0 31	0 29	0 28
10	0 16	0 17	0 19	0 18	1 22	1 23	1 21	1 20

$$\text{Tea}(M, a, b, c, d) = Ma'b$$

K-MAP FOR COKE:

Group : 1

M,a \ b,c,d	000	001	011	010	110	111	101	100
00	0 ₀	0 ₁	0 ₃	0 ₂	0 ₆	0 ₇	0 ₅	0 ₄
01	0 ₈	0 ₉	0 ₁₁	0 ₁₀	0 ₁₄	0 ₁₅	0 ₁₃	0 ₁₂
11	1 ₂₄	0 ₂₅	0 ₂₇	0 ₂₆	0 ₃₀	0 ₃₁	0 ₂₉	1 ₂₈
10	0 ₁₆	0 ₁₇	0 ₁₉	0 ₁₈	0 ₂₂	0 ₂₃	0 ₂₁	0 ₂₀

$$\text{Coke}(M, a, b, c, d) = \text{Mac}'d'$$

K-MAP FOR PEPSI:

Group : 1

M,a \ b,c,d	000	001	011	010	110	111	101	100
00	0 ₀	0 ₁	0 ₃	0 ₂	0 ₆	0 ₇	0 ₅	0 ₄
01	0 ₈	0 ₉	0 ₁₁	0 ₁₀	0 ₁₄	0 ₁₅	0 ₁₃	0 ₁₂
11	0 ₂₄	1 ₂₅	0 ₂₇	0 ₂₆	0 ₃₀	0 ₃₁	1 ₂₉	0 ₂₈
10	0 ₁₆	0 ₁₇	0 ₁₉	0 ₁₈	0 ₂₂	0 ₂₃	0 ₂₁	0 ₂₀

$$\text{Pepsi}(M, a, b, c, d) = \text{Mac}'d$$

K-MAP FOR MAAZA:

Group : 1

$M,a \backslash b,c,d$	000	001	011	010	110	111	101	100
00	0 ₀	0 ₁	0 ₃	0 ₂	0 ₆	0 ₇	0 ₅	0 ₄
01	0 ₈	0 ₉	0 ₁₁	0 ₁₀	0 ₁₄	0 ₁₅	0 ₁₃	0 ₁₂
11	0 ₂₄	0 ₂₅	0 ₂₇	1 ₂₆	1 ₃₀	0 ₃₁	0 ₂₉	0 ₂₈
10	0 ₁₆	0 ₁₇	0 ₁₉	0 ₁₈	0 ₂₂	0 ₂₃	0 ₂₁	0 ₂₀

$$\text{Maaza}(M, a, b, c, d) = \text{Macd}'$$

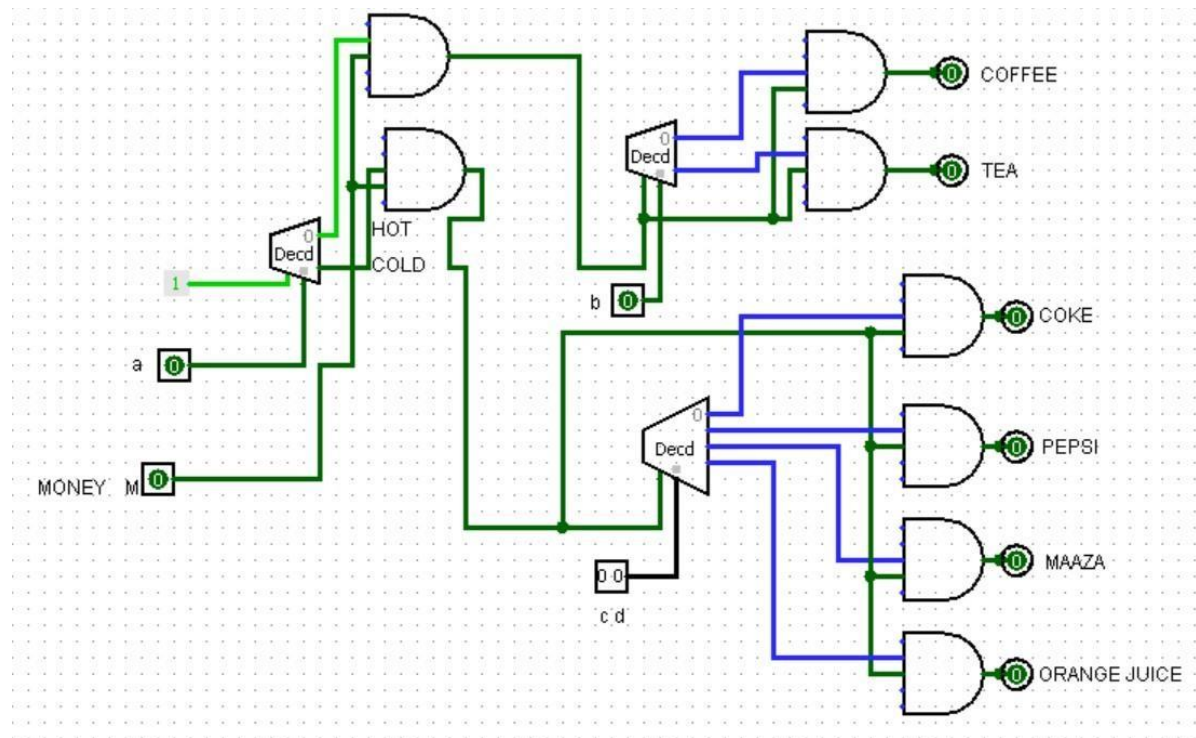
K-MAP FOR ORANGE JUICE:

Group : 1

$M,a \backslash b,c,d$	000	001	011	010	110	111	101	100
00	0 ₀	0 ₁	0 ₃	0 ₂	0 ₆	0 ₇	0 ₅	0 ₄
01	0 ₈	0 ₉	0 ₁₁	0 ₁₀	0 ₁₄	0 ₁₅	0 ₁₃	0 ₁₂
11	0 ₂₄	0 ₂₅	1 ₂₇	0 ₂₆	0 ₃₀	1 ₃₁	0 ₂₉	0 ₂₈
10	0 ₁₆	0 ₁₇	0 ₁₉	0 ₁₈	0 ₂₂	0 ₂₃	0 ₂₁	0 ₂₀

$$\text{Orange juice}(M, a, b, c, d) = \text{Macd}$$

CIRCUIT DIAGRAM:



Verilog Code :

Data flow Model:

```
module dataflow(input m,
input a,
input b,
input c,
input d,
output cof,
output tea,
output cok,
output pep,
output maz,
output oj);
assign cof=m&~a&~b;
assign tea=m&~a&b;
assign cok=m&a&~c&~d;
assign pep=m&a&~c&d;
assign maz=m&a&c&~d;
assign oj=m&a&c&d;
endmodule
```

```
module dataflow_tb;
reg m,a,b,c,d;
```

```
wire cof,tea,cok,pep,maz,oj;
dataflow df(m,a,b,c,d,cof,tea,cok,pep,maz,oj);
initial
begin
    $monitor("money=%b a=%b b=%b c=%b d=%b
coffee=%b tea=%b coke=%b pepsi=%b maaza=%b
orangejuice=%b",m,a,b,c,d,cof,tea,cok,pep,maz,oj);
    m=0;a=0;b=0;c=0;d=0;
    #100;
    m=0;a=0;b=0;c=0;d=1;
    #100;
    m=0;a=0;b=0;c=1;d=0;
    #100;
    m=0;a=0;b=0;c=1;d=1;
    #100;
    m=0;a=0;b=1;c=0;d=0;
    #100;
    m=0;a=0;b=1;c=0;d=1;
    #100;
    m=0;a=0;b=1;c=1;d=0;
    #100;
    m=0;a=0;b=1;c=1;d=1;
    #100;
    m=0;a=1;b=0;c=0;d=0;
    #100;
    m=0;a=1;b=0;c=0;d=1;
```

#100;
m=0;a=1;b=0;c=1;d=0;
#100;
m=0;a=1;b=0;c=1;d=1;
#100;
m=0;a=1;b=1;c=0;d=0;
#100;
m=0;a=1;b=1;c=0;d=1;
#100;
m=0;a=1;b=1;c=1;d=0;
#100;
m=0;a=1;b=1;c=1;d=1;
#100;
m=1;a=0;b=0;c=0;d=0;
#100;
m=1;a=0;b=0;c=0;d=1;
#100;
m=1;a=0;b=0;c=1;d=0;
#100;
m=1;a=0;b=0;c=1;d=1;
#100;
m=1;a=0;b=1;c=0;d=0;
#100;
m=1;a=0;b=1;c=0;d=1;
#100;
m=1;a=0;b=1;c=1;d=0;

```

#100;
    m=1;a=0;b=1;c=1;d=1;
#100;
    m=1;a=1;b=0;c=0;d=0;
#100;
    m=1;a=1;b=0;c=0;d=1;
#100;
    m=1;a=1;b=0;c=1;d=0;
#100;
    m=1;a=1;b=0;c=1;d=1;
#100;
    m=1;a=1;b=1;c=0;d=0;
#100;
    m=1;a=1;b=1;c=0;d=1;
#100;
    m=1;a=1;b=1;c=1;d=0;
#100;
    m=1;a=1;b=1;c=1;d=1;
end
endmodule

```

Gate level Model:

```

module gateflow(
input m,

```

```
input a,  
input b,  
input c,  
input d,  
output cof,  
output tea,  
output cok,  
output pep,  
output maz,  
output oj);  
not(na,a);  
not(nb,b);  
not(nc,c);  
not(nd,d);  
and(cof,m,na,nb);  
and(tea,m,na,b);  
and(cok,m,a,nc,nd);  
and(pep,m,nc,d);  
and(maz,m,a,c,nd);  
and(oj,m,a,c,d);  
endmodule
```

```
module gateflow_tb;
```

```

reg m,a,b,c,d;
wire cof,tea,cok,pep,maz,oj;
gateflow gf(m,a,b,c,d,cof,tea,cok,pep,maz,oj);
initial
begin
    $monitor("money=%b a=%b b=%b c=%b
d=%b coffee=%b tea=%b coke=%b pepsi=%b
maaza=%b
orangejuice=%b",m,a,b,c,d,cof,tea,cok,pep,maz,
oj);
    m=0;a=0;b=0;c=0;d=0;
    #100;
    m=0;a=0;b=0;c=0;d=1;
    #100;
    m=0;a=0;b=0;c=1;d=0;
    #100;
    m=0;a=0;b=0;c=1;d=1;
    #100;
    m=0;a=0;b=1;c=0;d=0;
    #100;
    m=0;a=0;b=1;c=0;d=1;
    #100;
    m=0;a=0;b=1;c=1;d=0;
    #100;
    m=0;a=0;b=1;c=1;d=1;
    #100;

```

```
m=0;a=1;b=0;c=0;d=0;
#100;
m=0;a=1;b=0;c=0;d=1;
#100;
m=0;a=1;b=0;c=1;d=0;
#100;
m=0;a=1;b=0;c=1;d=1;
#100;
m=0;a=1;b=1;c=0;d=0;
#100;
m=0;a=1;b=1;c=0;d=1;
#100;
m=0;a=1;b=1;c=1;d=0;
#100;
m=0;a=1;b=1;c=1;d=1;
#100;
m=1;a=0;b=0;c=0;d=0;
#100;
m=1;a=0;b=0;c=0;d=1;
#100;
m=1;a=0;b=0;c=1;d=0;
#100;
m=1;a=0;b=0;c=1;d=1;
#100;
m=1;a=0;b=1;c=0;d=0;
#100;
```



```
    m=1;a=0;b=1;c=0;d=1;
    #100;
    m=1;a=0;b=1;c=1;d=0;
    #100;
    m=1;a=0;b=1;c=1;d=1;
    #100;
    m=1;a=1;b=0;c=0;d=0;
    #100;
    m=1;a=1;b=0;c=0;d=1;
    #100;
    m=1;a=1;b=0;c=1;d=0;
    #100;
    m=1;a=1;b=0;c=1;d=1;
    #100;
    m=1;a=1;b=1;c=0;d=0;
    #100;
    m=1;a=1;b=1;c=0;d=1;
    #100;
    m=1;a=1;b=1;c=1;d=0;
    #100;
    m=1;a=1;b=1;c=1;d=1;
end
endmodule
```

Behavioral Model:

```
module
behavioral(m,a,b,c,d,cof,tea,cok,pep,maz,oj);
input m,a,b,c,d;
output reg cof,tea,cok,pep,maz,oj;
always @(*)
begin
cof=m&~a&~b;
tea=m&~a&b;
cok=m&a&~c&~d;
pep=m&a&~c&d;
maz=m&a&c&~d;
oj=m&a&c&d;
end
endmodule
```

```
module behavioral_tb;
reg m,a,b,c,d;
wire cof,tea,cok,pep,maz,oj;
```

```
behavioral test(m,a,b,c,d,cof,tea,cok,pep,maz,oj);  
initial  
begin  
    $monitor("money=%b a=%b b=%b c=%b  
d=%b coffee=%b tea=%b coke=%b pepsi=%b  
maaza=%b  
orangejuice=%b",m,a,b,c,d,cof,tea,cok,pep,maz,  
oj);  
    m=0;a=0;b=0;c=0;d=0;  
    #100;  
    m=0;a=0;b=0;c=0;d=1;  
    #100;  
    m=0;a=0;b=0;c=1;d=0;  
    #100;  
    m=0;a=0;b=0;c=1;d=1;  
    #100;  
    m=0;a=0;b=1;c=0;d=0;  
    #100;  
    m=0;a=0;b=1;c=0;d=1;  
    #100;
```

m=0;a=0;b=1;c=1;d=0;
#100;
m=0;a=0;b=1;c=1;d=1;
#100;
m=0;a=1;b=0;c=0;d=0;
#100;
m=0;a=1;b=0;c=0;d=1;
#100;
m=0;a=1;b=0;c=1;d=0;
#100;
m=0;a=1;b=0;c=1;d=1;
#100;
m=0;a=1;b=1;c=0;d=0;
#100;
m=0;a=1;b=1;c=0;d=1;
#100;
m=0;a=1;b=1;c=1;d=0;
#100;
m=0;a=1;b=1;c=1;d=1;

#100;
m=1;a=0;b=0;c=0;d=0;
#100;
m=1;a=0;b=0;c=0;d=1;
#100;
m=1;a=0;b=0;c=1;d=0;
#100;
m=1;a=0;b=0;c=1;d=1;
#100;
m=1;a=0;b=1;c=0;d=0;
#100;
m=1;a=0;b=1;c=0;d=1;
#100;
m=1;a=0;b=1;c=1;d=0;
#100;
m=1;a=0;b=1;c=1;d=1;
#100;
m=1;a=1;b=0;c=0;d=0;
#100;

```
m=1;a=1;b=0;c=0;d=1;
#100;
m=1;a=1;b=0;c=1;d=0;
#100;
m=1;a=1;b=0;c=1;d=1;
#100;
m=1;a=1;b=1;c=0;d=0;
#100;
m=1;a=1;b=1;c=0;d=1;
#100;
m=1;a=1;b=1;c=1;d=0;
#100;
m=1;a=1;b=1;c=1;d=1;
end
endmodule
```

```
money=0 a=0 b=0 c=0 d=0 coffee=0 tea=0 coke=0 pepsi=0 maaza=0
orangejuice=0
money=0 a=0 b=0 c=0 d=1 coffee=0 tea=0 coke=0 pepsi=0 maaza=0
orangejuice=0
money=0 a=0 b=0 c=1 d=0 coffee=0 tea=0 coke=0 pepsi=0 maaza=0
orangejuice=0
money=0 a=0 b=0 c=1 d=1 coffee=0 tea=0 coke=0 pepsi=0 maaza=0
orangejuice=0
money=0 a=0 b=1 c=0 d=0 coffee=0 tea=0 coke=0 pepsi=0 maaza=0
orangejuice=0
money=0 a=0 b=1 c=0 d=1 coffee=0 tea=0 coke=0 pepsi=0 maaza=0
orangejuice=0
money=0 a=0 b=1 c=1 d=0 coffee=0 tea=0 coke=0 pepsi=0 maaza=0
orangejuice=0
money=0 a=0 b=1 c=1 d=1 coffee=0 tea=0 coke=0 pepsi=0 maaza=0
orangejuice=0
money=0 a=1 b=0 c=0 d=0 coffee=0 tea=0 coke=0 pepsi=0 maaza=0
orangejuice=0
money=0 a=1 b=0 c=0 d=1 coffee=0 tea=0 coke=0 pepsi=0 maaza=0
orangejuice=0
money=0 a=1 b=0 c=1 d=0 coffee=0 tea=0 coke=0 pepsi=0 maaza=0
orangejuice=0
money=0 a=1 b=0 c=1 d=1 coffee=0 tea=0 coke=0 pepsi=0 maaza=0
orangejuice=0
money=0 a=1 b=1 c=0 d=0 coffee=0 tea=0 coke=0 pepsi=0 maaza=0
orangejuice=0
money=0 a=1 b=1 c=0 d=1 coffee=0 tea=0 coke=0 pepsi=0 maaza=0
orangejuice=0
money=0 a=1 b=1 c=1 d=0 coffee=0 tea=0 coke=0 pepsi=0 maaza=0
orangejuice=0
money=0 a=1 b=1 c=1 d=1 coffee=0 tea=0 coke=0 pepsi=0 maaza=0
orangejuice=0
money=1 a=0 b=0 c=0 d=0 coffee=1 tea=0 coke=0 pepsi=0 maaza=0
orangejuice=0
money=1 a=0 b=0 c=0 d=1 coffee=1 tea=0 coke=0 pepsi=1 maaza=0
orangejuice=0
```

```
money=1 a=0 b=0 c=1 d=0 coffee=1 tea=0 coke=0 pepsi=0 maaza=0
orangejuice=0
money=1 a=0 b=0 c=1 d=1 coffee=1 tea=0 coke=0 pepsi=0 maaza=0
orangejuice=0
money=1 a=0 b=1 c=0 d=0 coffee=0 tea=1 coke=0 pepsi=0 maaza=0
orangejuice=0
money=1 a=0 b=1 c=0 d=1 coffee=0 tea=1 coke=0 pepsi=1 maaza=0
orangejuice=0
money=1 a=0 b=1 c=1 d=0 coffee=0 tea=1 coke=0 pepsi=0 maaza=0
orangejuice=0
money=1 a=0 b=1 c=1 d=1 coffee=0 tea=1 coke=0 pepsi=0 maaza=0
orangejuice=0
money=1 a=1 b=0 c=0 d=0 coffee=0 tea=0 coke=1 pepsi=0 maaza=0
orangejuice=0
money=1 a=1 b=0 c=0 d=1 coffee=0 tea=0 coke=0 pepsi=1 maaza=0
orangejuice=0
money=1 a=1 b=0 c=1 d=0 coffee=0 tea=0 coke=0 pepsi=0 maaza=1
orangejuice=0
```

```
money=1 a=1 b=0 c=1 d=1 coffee=0 tea=0 coke=0 pepsi=0 maaza=0
orangejuice=1
money=1 a=1 b=1 c=0 d=0 coffee=0 tea=0 coke=1 pepsi=0 maaza=0
orangejuice=0
money=1 a=1 b=1 c=0 d=1 coffee=0 tea=0 coke=0 pepsi=1 maaza=0
orangejuice=0
money=1 a=1 b=1 c=1 d=0 coffee=0 tea=0 coke=0 pepsi=0 maaza=1
orangejuice=0
money=1 a=1 b=1 c=1 d=1 coffee=0 tea=0 coke=0 pepsi=0 maaza=0
orangejuice=1
```


Conclusions and Future work:

Through this design, we would like to add an additional feature in the vending machines available around us that is giving beverages only when money is paid.

The future work in this design will be adding billing system and accepting the actual money used by the user and giving them beverages based on that.