IMPLEMENTATION OF SMART STORE

Harishwar Sangem
Dept. of Electronics and Communication engineering
National Institute of Technology
Warangal, India
sh21ecb0b52@student.nitw.ac.in

Sarvepalli Mahathi
Dept. of Electronics and Communication engineering
National Institute of Technology
Warangal, India
ss21ecb0b53@student.nitw.ac.in

Saurabh
Dept. of Electronics and Communication engineering
National Institute of Technology
Warangal, India
ss21ecb0b54@student.nitw.ac.in

***Abstract*—: The contemporary electronic technology is based on embedded system which deals with integrating numerous transistors on a single silicon chip. The main goal of growing technology is to make lifestyles turn out to be simpler and more comfortable. Nowadays, with the rise in technology, a wide variety of objects are being made and sold for low costs. Leading to a significant increase in both the number of shops and the customers. While purchasing an item, the consumers have to make calculations regarding those items & need to compare them with their budgets. And after the shopping is done, the customer must wait for the billing. So to avoid the boredom of waiting in the billing queue our research proposal has been carried out on a novel concept that is "Smart Shopping Using Smart Trolley". In this proposed project we assign a barcode to each of the product and the customers can bill their goods by themselves by scanning the product with the scanner attached to the trolley. Apart from this the project includes features which make the shopping experience comfortable and eco-friendly. These features are - Automated door and lights, fire alarm and counters which display the number of customers in the store and even the number of customers present at the billing counters.**

Key Words: Automated door and lights, Barcode, Barcode scanner, sensors, smart trolley.

I. Introduction

People go to the supermarket to buy everyday necessities and provisions for their livelihood. A supermarket is a hotspot for the necessities and provisions and it is always filled with a crowd of people buying their needs. As people keep buying the needs, they also face few problems, such as having chaotic time while moving through a door, spending a very long time standing in the queue in the counter for bill payment, etc. People suffer from these problems and end up wasting a lot of time even . As a solution to these problems, the proposed project prototype can be made into a mainstream product to help the people to shop better. The proposed project intends to provide a hassle-free and eco-friendly experience to the user in the supermarket.

The smart trolley uses an embedded chip with a barcode scanner and a battery to allow users to self-egress at the supermarkets. The main theme of the paper is to decrease the time consumption the billing counters at the supermarkets. When a customer picks up a product and scans its barcode using the scanner attached to the trolley, the door of the trolley opens and when the object gets placed in the trolley, the door closes back. The price of the object then gets added back into the bill, and the quantity of that item in the database gets reduced by 1, thereby helping the management of the store to keep track of the number of products of each type.

The automated door and lights work with the input received from pressure sensors and passive infrared sensors respectively. These sensors act as motion detectors, and based on the input of these sensors the door opens/closes and the lights turn on/off. The automatic door is especially useful when a customer is carrying a lot of loads and isn't in a position to open/ close the door. And the automatic lights save electricity by turning on only when a customer comes in their vicinity.

The fire alarm is similar to the automated door and lights, but it gets activated when a high input is received from the smoke sensors. This is an essential safety feature, it helps in putting off the fire quickly by turning on the extinguishers as soon as it detects any smoke.

The counters too rely on the passive infrared sensors for getting inputs about the movement of the customers. With the help of two sensors, one placed at the entry point and one placed at the exit point, the counters keep a track of the number of people present. By displaying the number of people present at each of the billing counters, we can help the customer complete his billing quickly by directing them to the line with least number of customers.

II. Methodology

i. Smart trolley

The smart trolley performs the following operations: generates item details, assists in self-billing by the customer and updates the quantity of products in the database.

A. Block diagram

The Fig. 1 represents the block diagram of the smart trolley. It consists of a register to store the barcode (simulated here as 16-bit digital signal), two pir (passive infrared) sensors, 16-bit comparator, adder and LCD display.

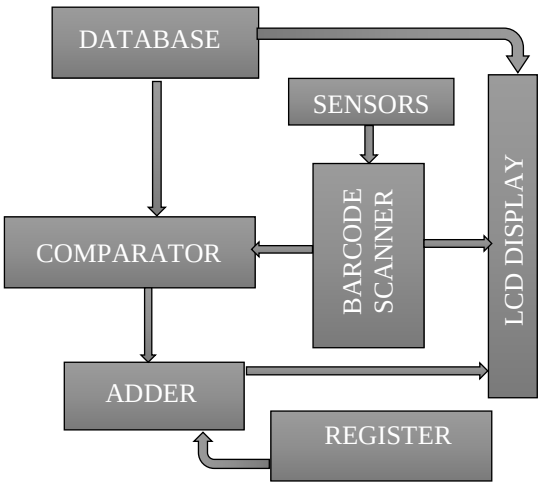


Fig. 1

B. Algorithm

Step 1: Initialize the database.

The database has three arrays containing information of the barcodes of various products, quantity of the products and the cost of each product. The information of a product in all the arrays is linked through the index values.

Step 2: If object_in changes from low to high:

If yes: Open the trolley door. Assign door status as high

Is the barcode scanned:

If yes: compare the barcode with the barcodes in the database.

When the barcode is found:

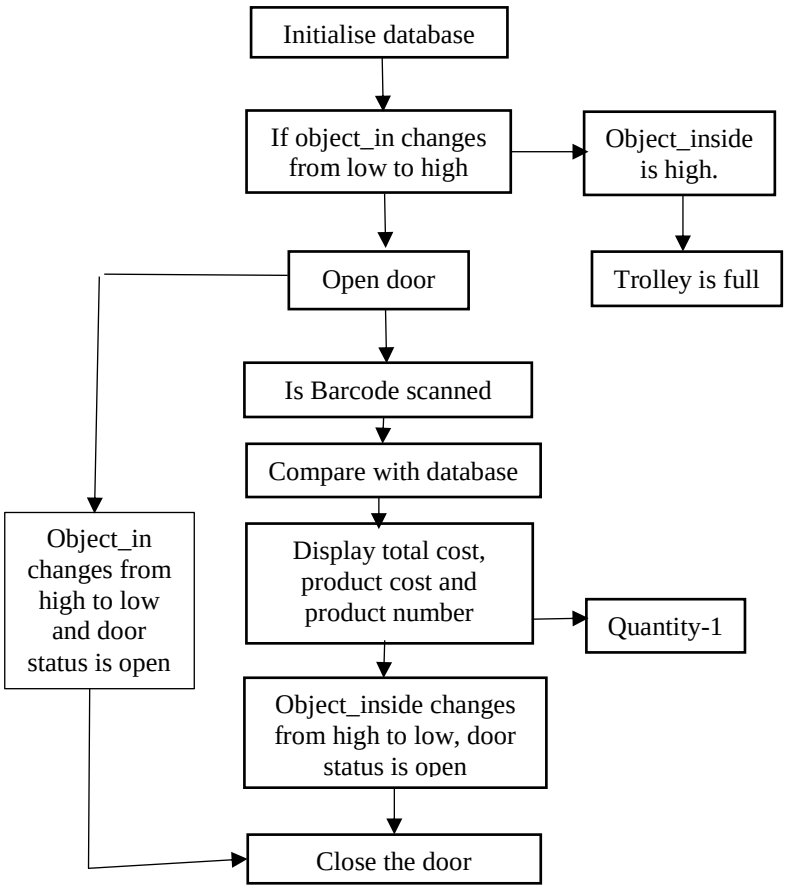
Display object number, object cost, add cost to previous cost and display cost, and reduce quantity by 1.

Step 3: If object_inside turns from low to high, object_in is low and door statues is high, close the door. Give door state as low.

Step 4: If object_inside is high and object_in turns from low to high, the trolley is full. Door remains closed.

Step_5: If object_in turns from high to low and door state is open, close the door. Give door state is low.

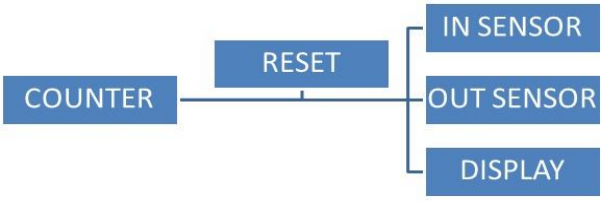
C. Flowchart



ii. Customer counter

The customer counter tracks the number of people who entered and the number of people who left and displays the number of customers present. The counter can count from 0 to 31 (5 bit counter).

A. Block diagram



B. Algorithm

Step 1: If reset is high, value of counter is zero.

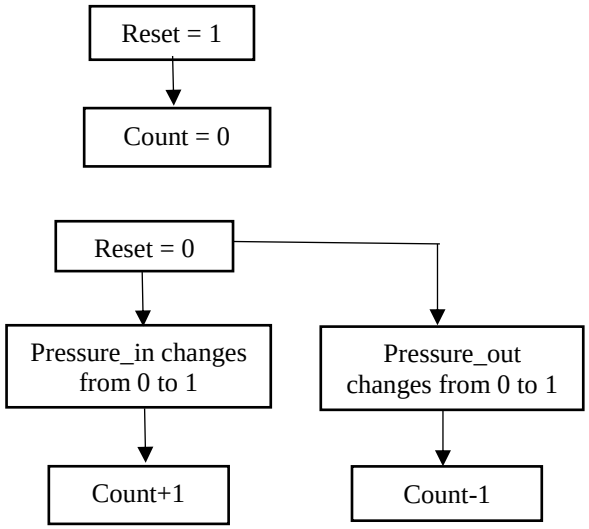
Step 2: If pressure_in changes from low to high and reset is 0,

count=count+1

Step 3: If pressure_out changes from low to high and reset is 0,

count=count-1

C. Flowchart



iii. Automated door

The automated door opens when a person comes in its vicinity (pressure sensor turns on), and when the person moves away from the sensor i.e, they are either passing through the door or are moving away from the door, the door waits for some time (delay of 2ns for simulation) and gets closed automatically.

A. Block diagram

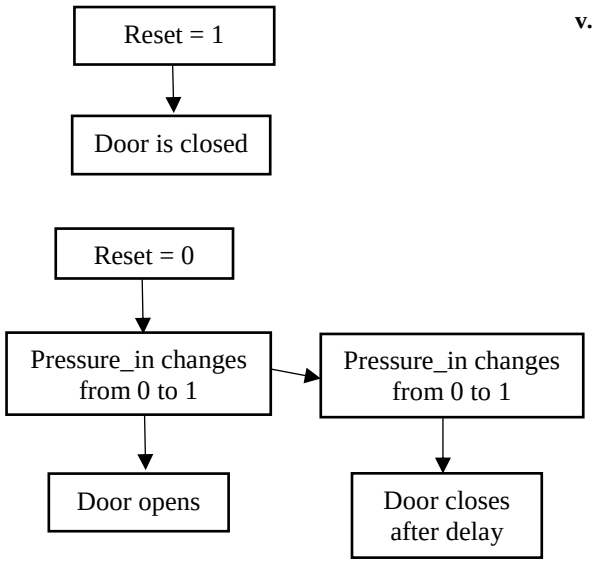
B. Algorithm

Step 1: If reset is 1, door is closed.

Step 2: If pressure_in turn high from low, the door opens.

Step 3: If pressure_in turn low from high, the door waits for some time and gets closed.

C. Flowchart



iv. Automated lights

The automated lights turn on opens when a person comes in their vicinity (pir sensor gives a high input), and when the person moves away from the sensor i.e the lights, they turn off automatically.

A. Block diagram

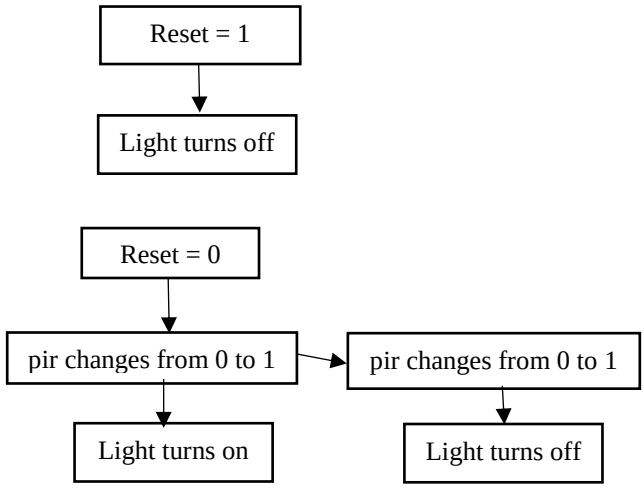
B. Algorithm

Step 1: If reset is 1, lights are off.

Step 2: If pir turns high from low, the lights turn on.

Step 3: If pir turns low from high, the lights turn off.

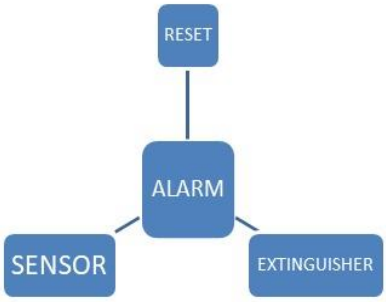
C. Flowchart



v. Fire alarm

The fire alarm has a smoke sensor, when the input from smoke sensor is high, the extinguisher turns on. Additionally, if there is smoke but the extinguisher must not turn on (due to various reasons), the reset of the alarm can be set to high.

A. Block diagram



B. Algorithm

Step 1: If reset is high, extinguisher is off.

Step 2: If sensor input changes from low to high and reset is 0,

Extinguisher is on.

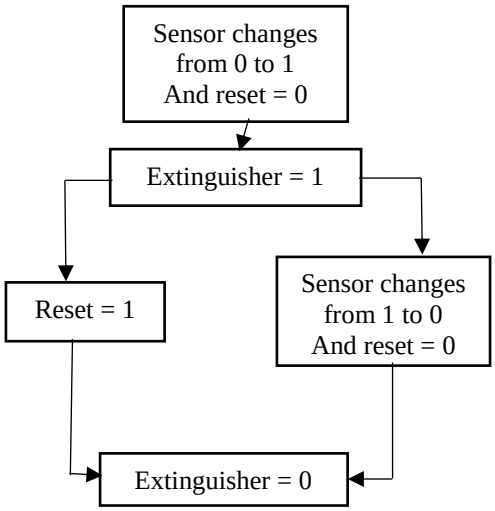
Step 3: If sensor input changes from high to low and reset is 0,

Extinguisher is off.

Step 4: If sensor input is high and reset turns high

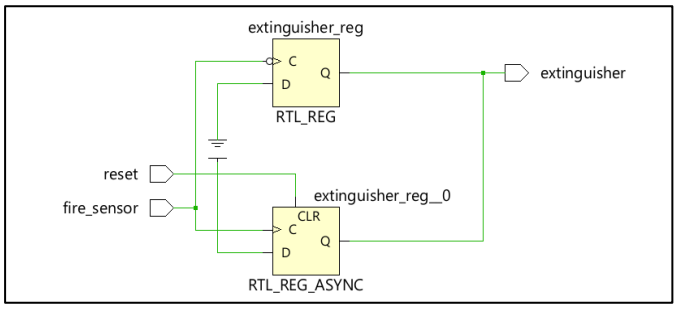
Extinguisher is off.

C. Flowchart

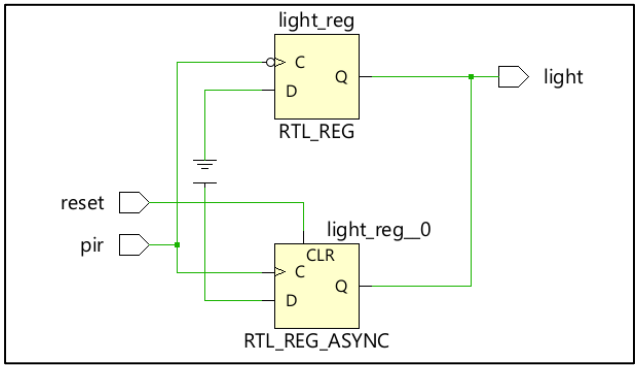


III. RESULTS

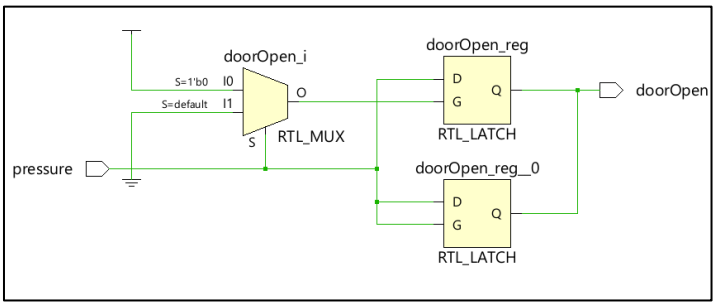
This is the complete prototype of smart store, including the features of smart trolley, fire alarm, counter, automated lights and door.
Currently the prototype of smart trolley can add into the bill the items bought by the customer but the customer cannot remove any object from the trolley. Also the trolley can only bill the packed items. To solve these issues, we plan to add a weight monitor to the trolley in the future.
The following show the RTL diagrams of all the features and the simulation outputs of the smart trolley and the customer counter.



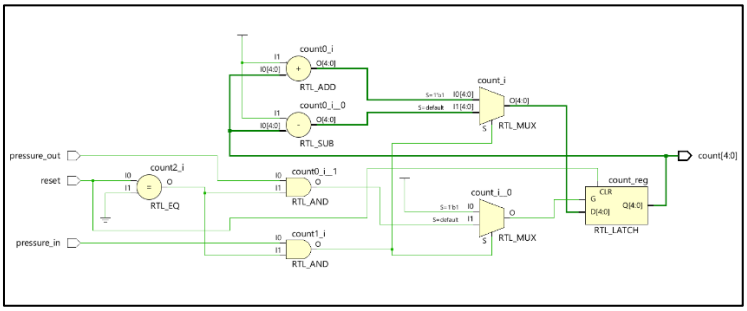
RTL diagram of fire alarm



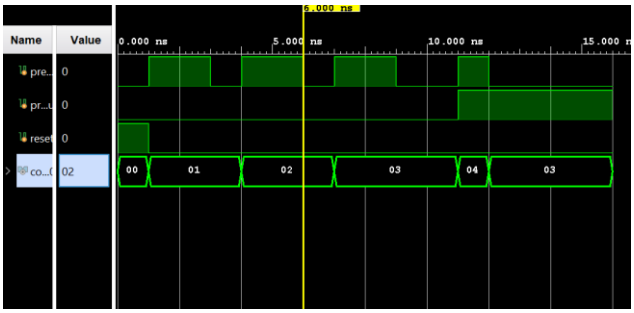
RTL diagram of Automated lights



RTL diagram of Automated door

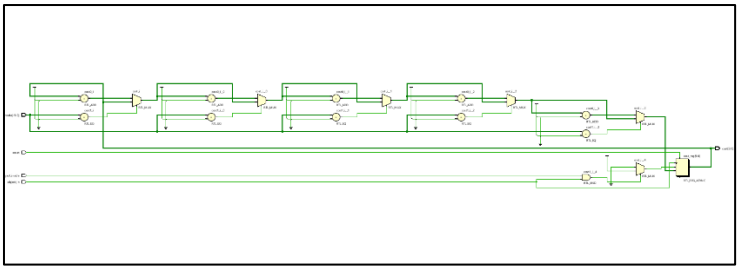


RTL diagram of counter



Simulation output of counter

The above shown figure corresponds to the simulation output of the customer counter. The value of the count changes based on the input received from the in and out sensors. In the given simulation the count of customers first increases to 4 and then decreases by 1.



RTL diagram of smart trolley

```
# run 1000ns
                    door is open
product          1
   item's cost  10
  (quantity left)  15
total cost  10
                    door is closed
                    door is open
product          3
   item's cost  39
  (quantity left)   4
total cost  49
                    door is closed
                    door is open
product          5
   item's cost  81
  (quantity left)   8
total cost 130
                    door is closed
                    door is open
                    door is closed
                    door is open
product          4
   item's cost  24
  (quantity left)  59
total cost 154
                    door is closed
                     trolley is full, door is closed
```

Simulation output of smart trolley

The above shown is the simulation output of the LCD attached to the trolley. Here it has been simulated in the TCL console of Verilog HDL. The simulation shows that three objects were added first, then an object was brought close for scanning but was replaced again, and finally the trolley is full.

IV. CONCLUSION

The smart store project enables a hassle free and faster shopping, caters to the safety of the customers and even contributes in reducing the carbon foot print. It aims at providing a more comfortable and enjoyable shopping experience. This is mainly beneficial to the customers who procure less commodities and are in a hurry to leave.

REFERENCES

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