

# Implementation of Smart Billing System Using Ir Sensor and Xbee Transceiver

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**Abstract**— There is an urging need to use technology in various customer based applications. To make the supermarket in a smarter way the billing system is automated. The proposed method is to prevent the illegal activities of the customers in the smart billing system implemented in the supermarket. The various components used are IR sensor, Smart card, RFID reader, Arduino UNO, LCD and XBee transceiver. The autonomous billing system uses XBee transceiver to transmit or receive the product information. A customer gets a smart card as he enters into the supermarket. For a smart card, the free unused trolley will be allotted accordingly. A person picks a product which consists of unique RFID tag and it is read by the RFID reader. The trolley consists of IR sensors to count the number of products and it is compared with the number of product sensed by the RFID reader. The adding of the product price and subtraction of the product price if it is not needed is done in the microcontroller fixed in the trolley. The total bill calculation is done in the microcontroller fixed in the reception.

**Key words:** IR sensor, XBee transceiver, Arduino UNO, RFID reader, Smart card

## I. INTRODUCTION

Now-a-days there are so many applications that involve the use of smart cards. Each smart card consists of unique 12-digit identification number. The smart card and RFID tags are read by the RFID reader. For the rapid billing purposes, the RFID tags are used in the supermarket. This proposed method prevents the illegal activities of the people. The wireless transmitter and receiver used is XBee transceiver. XBee provides wireless communication at the speed of up to 250 kbps.

## II. LITERATURE REVIEW

Most of the existing methods have implemented the smart billing system wirelessly. The main purpose of this proposed method is used to increase the security in the supermarket. So the smart billing system is incorporated to check the number of products because some of the people knowingly or unknowingly can place the product in the trolley without reading the tag by the RFID reader. The another added advantage of this method is that the particular product which is dropped in the trolley is not needed, then the unwanted product can be shown in the RFID reader again so that the product amount will be subtracted from the total amount. This calculation is done in microcontroller which is fixed in the trolley.

## III. SYSTEM DESIGN

When the person enters into the supermarket, a smart card is allotted to him. The smart card has a RF transmitter. The

transmitted signal reaches the trolley which consists of a receiver. The person also gets a unique address in which the shopping product can be added and it gets billed accordingly.

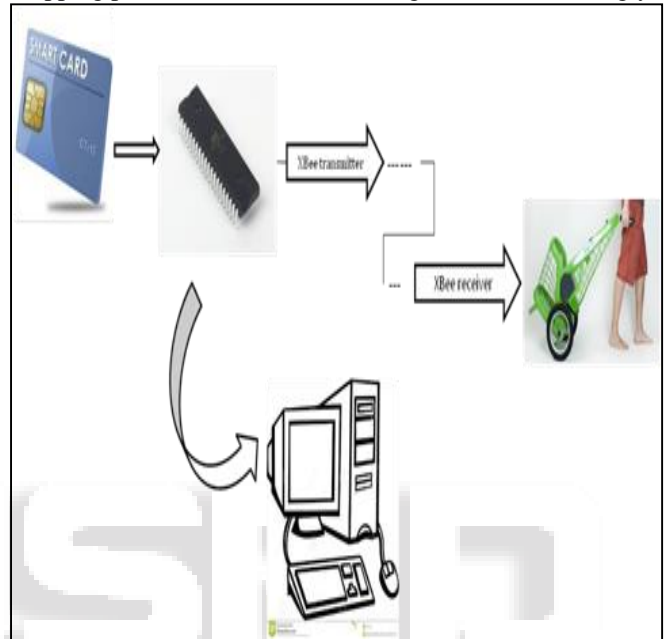


Fig. 1: Assigning the trolley

Each product in the supermarket contains RFID tag. The receiver is fixed in the trolleys. As the person puts the product into the trolleys, it gets read by the RFID reader and also sensed by the IR sensor. The number of products sensed by the IR sensor is counted and also checked which the number of products entered in the microcontroller via RFID reader. Then the information from the XBee receiver is transmitted wirelessly to the microcontroller in the reception. The bill amount is also shown in the LCD fixed in the trolley.

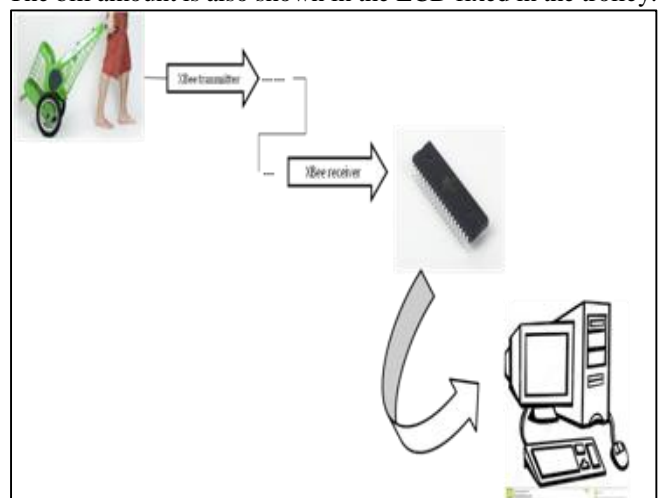


Fig. 2: Trolley to system connection

#### IV. ANALYSIS AND INTERPRETATION

##### A. Reception Module

At the reception module, as a customer shows a smart card, a reception message is displayed and a trolley is assigned to the customer. The figure below shows the reception message. This reception module is fixed near the reception area of the supermarket.

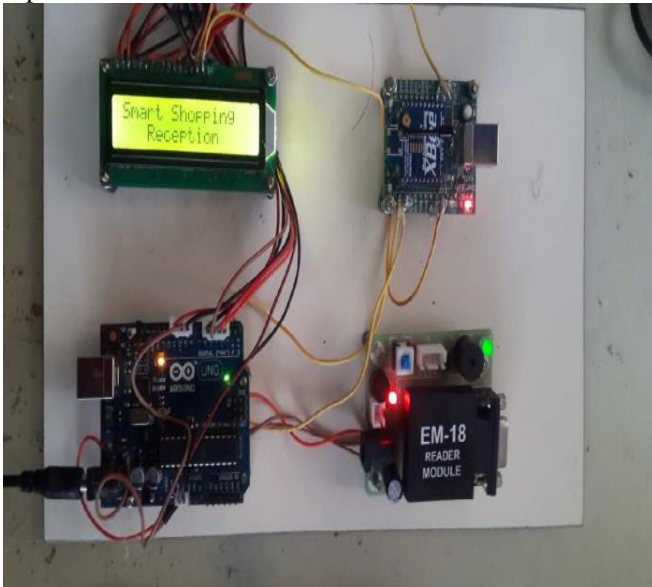


Fig. 3: Reception module

##### B. Trolley Module

The trolley module is similar to reception module but it includes IR sensor. The trolley module is activated when the reception section allots the trolley for a customer. Each module of trolley consists of LCD display, IR sensor, RFID reader, Xbee transceiver module and an Arduino. If the number of product sensed by the IR sensor is equal to the number of product sensed by the RFID reader, then the message 'items count same' are displayed in the LCD. If they are unequal, then the 'items count are different' are displayed.

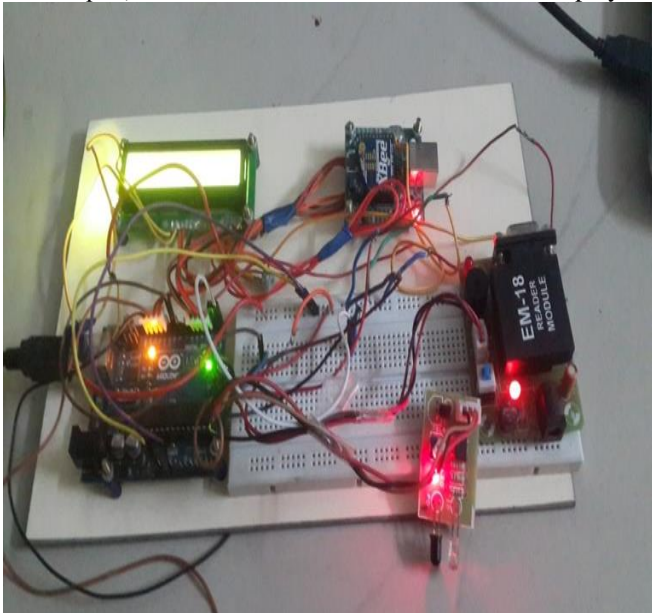


Fig. 4: Trolley module

##### C. Billing of Products

When an item is dropped in a trolley, the RFID reader identifies the product and sensed by the IR sensor. The bill value is displayed in the LCD display. If a product is added or removed from the trolley, the bill value is summed or subtracted with the existing sum and hence the total bill value is obtained and displayed in the display. The figure displays the trolley module with the sum being displayed.

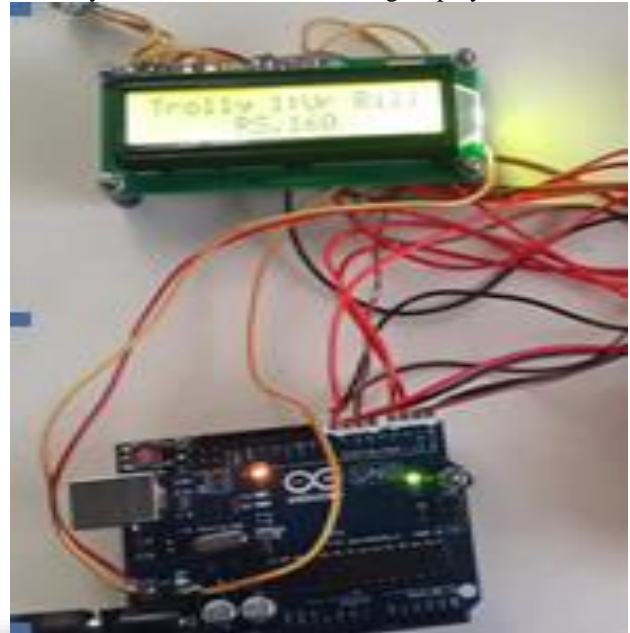


Fig. 5: Trolley module with the bill amount

##### D. Consolidation of Bills

The reception section displays the bill values of all the trolleys simultaneously thus having an overall monitoring of the process. The figure displays the bill values of two customers simultaneously. Similarly many customers billing can be done at the same time.

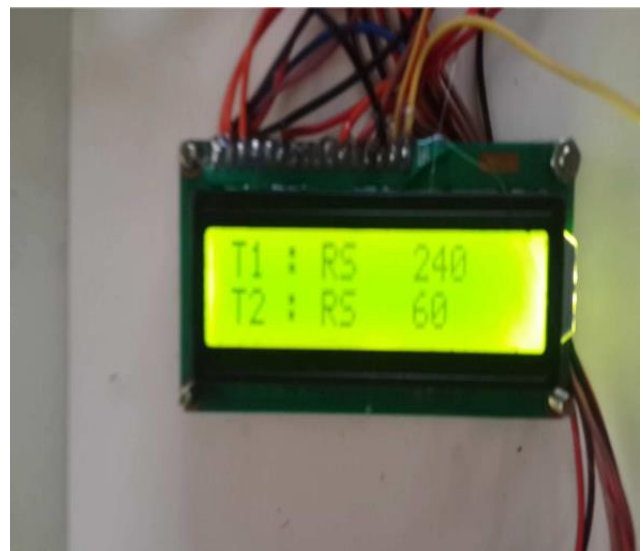


Fig. 6: Simultaneous billing

#### V. IMPLEMENTATION SOURCE CODE

The last digit of the 12-digit identification number of the smart card is used to differentiate between various items. In this report, the bill is calculated simultaneously for two

customers. Similarly, the bill can be simultaneously calculated for many customers at a time.

#### A. Coding For Reception Section Microcontroller

```
#include <LiquidCrystal.h>
#include <SoftwareSerial.h>
SoftwareSerial mySerial(9,6); // RX, TX
LiquidCrystal lcd(8,10,2,3,4,5);
int var=2015;
char CSoftSerialdata[12]={0};
char CHardWareSerialdata[5]={0};
char CHardWareSerial=0;
int trolley1SelectFlag=0;
int trolley2SelectFlag=0;
int CurrentAmt=0;
int Count=0;
int HWCCount=0;
int trolley1Total=0;
int trolley2Total=0;
void clearScreen()
{
    lcd.setCursor(0,0);
    lcd.print(" ");
    lcd.setCursor(0,1);
    lcd.print(" ");
}
void setup() {
    lcd.begin(16, 2);
    lcd.print("Smart Shopping");
    lcd.setCursor(0,1);
    lcd.print(" Reception ");
    Serial.begin(9600);
    mySerial.begin(9600);
    delay(2000);
}
void loop()
{
    if(mySerial.available()>0)
    {
        CSoftSerialdata[Count]=mySerial.read();
        if(Count==11)
        {
            if(CSoftSerialdata[Count]=='8')
            {
                Serial.println("1");
                clearScreen();
                lcd.setCursor(0,0);
                lcd.print(" Trolley 1 ");
                lcd.setCursor(0,1);
                lcd.print(" Selected" );
                trolley1SelectFlag=1;
                delay(2000);
                lcd.clear();
            }
            else if(CSoftSerialdata[Count]=='F')
            {
                Serial.println("2");
                clearScreen();
                lcd.setCursor(0,0);
                lcd.print(" Trolley 2 ");
                lcd.setCursor(0,1);
                lcd.print(" Selected" );
```

```
                trolley2SelectFlag=1;
                delay(2000);
                lcd.clear();
            }
        }
        Count=0;
    }
    else
    {
        Count++;
    }
}
if(Serial.available()>0)
{
    CHardWareSerialdata[HWCCount]=Serial.read();
    if(HWCCount==4)
    {
        if(CHardWareSerialdata[0]=='1')
        {
            CurrentAmt=(((int)CHardWareSerialdata[2])-48)*100+(((int)CHardWareSerialdata[3])-48)*10+(((int)CHardWareSerialdata[4])-48)*1;
            if(CHardWareSerialdata[1]=='1')
            {
                trolley1Total+=CurrentAmt;
            }
            else if(CHardWareSerialdata[1]=='0')
            {
                trolley1Total-=CurrentAmt;
            }
        }
        else if(CHardWareSerialdata[0]=='2')
        {
            CurrentAmt=(((int)CHardWareSerialdata[2])-48)*100+(((int)CHardWareSerialdata[3])-48)*10+(((int)CHardWareSerialdata[4])-48)*1;
            if(CHardWareSerialdata[1]=='1')
            {
                trolley2Total+=CurrentAmt;
            }
            else if(CHardWareSerialdata[1]=='0')
            {
                trolley2Total-=CurrentAmt;
            }
        }
        HWCCount=0;
    }
    else
    {
        HWCCount++;
    }
}
if(trolley1SelectFlag==1||trolley2SelectFlag==1)
{
    if(trolley1SelectFlag==1)
    {
        if(Prevtrolley1Total!=trolley1Total)
        {
            Prevtrolley1Total=trolley1Total;
            lcd.clear();
            lcd.setCursor(0,0);
            lcd.print("T1 : RS ");
            lcd.setCursor(10,0);
```

```

    lcd.print(trolley1Total    );
}
else
{
    lcd.setCursor(0,0);
    lcd.print("T1 : RS ");
    lcd.setCursor(10,0);
    lcd.print(trolley1Total    );
}
}
else
{
    lcd.setCursor(0,0);
    lcd.print("T1 Not Selected ");
}
if(trolley2SelectFlag==1)
{
    if(Prevtrolley2Total!=trolley2Total)
    {
        Prevtrolley2Total=trolley2Total;
        lcd.clear();
        lcd.setCursor(0,1);
        lcd.print("T2 : RS ");
        lcd.setCursor(10,1);
        lcd.print(trolley2Total    );
    }
    else
    {
        lcd.setCursor(0,1);
        lcd.print("T2 : RS ");
        lcd.setCursor(10,1);
        lcd.print(trolley2Total    );
    }
}
else
{
    lcd.setCursor(0,1);
    lcd.print("T2 Not Selected ");
} } }

#define x 2
void clearScreen()
{
    lcd.setCursor(0,0);
    lcd.print(" ");
    lcd.setCursor(0,1);
    lcd.print(" ");
}
void setup() {
    lcd.begin(16, 2);
    pinMode(2,INPUT); //IR sensor connected to pin 2
    lcd.print("Smart Shopping");
    lcd.setCursor(0,1);
    lcd.print(" Trolley 1 ");
    Serial.begin(9600);
    mySerial.begin(9600);
}
void loop()
{
    if(x == 1)
    {
        count1++;
    }
    if (mySerial.available(>0)
    {
        count2++;
        CSoftSerialdata[Count]=mySerial.read();
        if(Count==11)
        {
            delay(1000);
            switch(CSoftSerialdata[Count])
            {
                case 'A':
                    if(AddSubFlag1==0)
                        AddSubFlag1=1;
                    else
                        AddSubFlag1=0;
                    if(AddSubFlag1)
                    {
                        Serial.print("11010");
                        Trolley1PurAmt+=10;
                    }
                    else
                    {
                        Serial.print("10010");
                        Trolley1PurAmt-=10;
                    }
                    clearScreen();
                    lcd.setCursor(0,0);
                    lcd.print("Trolley 1:Ur Bill");
                    lcd.setCursor(0,1);
                    lcd.print(" RS. ");
                    lcd.setCursor(8,1);
                    lcd.print(Trolley1PurAmt );
                    break;
                case '2':
                    if(AddSubFlag2==0)
                        AddSubFlag2=1;
                    else
                        AddSubFlag2=0;
                    if(AddSubFlag2)
                    {

```

#### B. Coding For a Trolley Module Microcontroller

```

#include <LiquidCrystal.h>
#include <SoftwareSerial.h>
SoftwareSerial mySerial(8,9); // RX, TX
LiquidCrystal lcd(2,3,4,5,6,7);
int var=2015;
char CSoftSerialdata[12]={0};
char CHardWareSerialdata=0;
int AddSubFlag1=0;
int AddSubFlag2=0;
int AddSubFlag3=0;
int AddSubFlag4=0;
int AddSubFlag5=0;
int AddSubFlag6=0;
int AddSubFlag7=0;
int AddSubFlag8=0;
int Count=0;
int count1=0;
int count2=0;
int HWCount=0;
int Trolley1PurAmt=0;
int SelectFlag=0;

```



```

    Serial.print("11020");
    Trolley1PurAmt+=20;
}
else
{
    Serial.print("10020");
    Trolley1PurAmt-=20;
}
clearScreen();
lcd.setCursor(0,0);
lcd.print("Trolley 1:Ur Bill");
lcd.setCursor(0,1);
lcd.print("  RS. ");
lcd.setCursor(8,1);
lcd.print(Trolley1PurAmt );
break;
case '5':
    if(AddSubFlag3==0)
        AddSubFlag3=1;
    else
        AddSubFlag3=0;
    if(AddSubFlag3)
    {
        Serial.print("11030");
        Trolley1PurAmt+=30;
    }
    else
    {
        Serial.print("10030");
        Trolley1PurAmt-=30;
    }
    clearScreen();
    lcd.setCursor(0,0);
    lcd.print("Trolley 1:Ur Bill");
    lcd.setCursor(0,1);
    lcd.print("  RS. ");
    lcd.setCursor(8,1);
    lcd.print(Trolley1PurAmt );
    break;
case 'F':
    if(AddSubFlag4==0)
        AddSubFlag4=1;
    else
        AddSubFlag4=0;
    if(AddSubFlag4)
    {
        Serial.print("11040");
        Trolley1PurAmt+=40;
    }
    else
    {
        Serial.print("10040");
        Trolley1PurAmt-=40;
    }
    clearScreen();
    lcd.setCursor(0,0);
    lcd.print("Trolley 1:Ur Bill");
    lcd.setCursor(0,1);
    lcd.print("  RS. ");
    lcd.setCursor(8,1);
    lcd.print(Trolley1PurAmt );
    break;

```

```

case '6':
    if(AddSubFlag5==0)
        AddSubFlag5=1;
    else
        AddSubFlag5=0;
    if(AddSubFlag5)
    {
        Serial.print("11050");
        Trolley1PurAmt+=50;
    }
    else
    {
        Serial.print("10050");
        Trolley1PurAmt-=50;
    }
    clearScreen();
    lcd.setCursor(0,0);
    lcd.print("Trolley 1:Ur Bill");
    lcd.setCursor(0,1);
    lcd.print("  RS. ");
    lcd.setCursor(8,1);
    lcd.print(Trolley1PurAmt );
    break;
case '0':
    if(AddSubFlag6==0)
        AddSubFlag6=1;
    else
        AddSubFlag6=0;
    if(AddSubFlag6)
    {
        Serial.print("11060");
        Trolley1PurAmt+=60;
    }
    else
    {
        Serial.print("10060");
        Trolley1PurAmt-=60;
    }
    clearScreen();
    lcd.setCursor(0,0);
    lcd.print("Trolley 1:Ur Bill");
    lcd.setCursor(0,1);
    lcd.print("  RS. ");
    lcd.setCursor(8,1);
    lcd.print(Trolley1PurAmt );
    break;
case '1':
    if(AddSubFlag7==0)
        AddSubFlag7=1;
    else
        AddSubFlag7=0;
    if(AddSubFlag7)
    {
        Serial.print("11070");
        Trolley1PurAmt+=70;
    }
    else
    {
        Serial.print("10070");
        Trolley1PurAmt-=70;
    }
    clearScreen();

```

```

lcd.setCursor(0,0);
lcd.print("Trolley 1:Ur Bill");
lcd.setCursor(0,1);
lcd.print(" RS. ");
lcd.setCursor(8,1);
lcd.print(Trolley1PurAmt );

```

```
break;
```

```
case 'B':
```

```
if(AddSubFlag8==0)
```

```
    AddSubFlag8=1;
```

```
else
```

```
    AddSubFlag8=0;
```

```
if(AddSubFlag8)
```

```
{
```

```
    Serial.print("11080");
```

```
    Trolley1PurAmt+=80;
```

```
}
```

```
else
```

```
{
```

```
    Serial.print("10080");
```

```
    Trolley1PurAmt-=80;
```

```
}
```

```
clearScreen();
```

```
lcd.setCursor(0,0);
```

```
lcd.print("Trolley 1:Ur Bill");
```

```
lcd.setCursor(0,1);
```

```
lcd.print(" RS. ");
```

```
lcd.setCursor(8,1);
```

```
lcd.print(Trolley1PurAmt );
```

```
break;
```

```
}
```

```
    Count=0;
```

```
}
```

```
else
```

```
{
```

```
    Count++;
```

```
}
```

```
}
```

```
if( count1 == count2)
```

```
{
```

```
    lcd.setCursor(0,0);
```

```
    lcd.print(" items count ");
```

```
    lcd.setCursor(0,1);
```

```
    lcd.print(" same " );
```

```
}
```

```
else if( count1 != count2)
```

```
{
```

```
    lcd.setCursor(0,0);
```

```
    lcd.print(" items count ");
```

```
    lcd.setCursor(0,1);
```

```
    lcd.print(" different " );
```

```
}
```

```
if (Serial.available(>0)
```

```
{
```

```
    CHardWareSerialdata=Serial.read();
```

```
    if(CHardWareSerialdata=='1')
```

```
    {
```

```
        CHardWareSerialdata=0;
```

```
        clearScreen();
```

```
        lcd.setCursor(0,0);
```

```
        lcd.print(" Trolley 1 ");
```

```
        lcd.setCursor(0,1);
```

```
    lcd.print(" Selected" );
```

```
    SelectFlag=1;
```

```
    delay(2000);
```

```
    }}}

```

## VI. CONCLUSIONS

This method is intended to increase the security using RFID tag and IR sensor. This will take the overall shopping experience to a different and exciting level. The system parameters of smart trolley like product cost are continuously displayed and calculated. This smart billing technique checks the product count and prevents any illegal activities of the people. This proposed method is very feasible that the product can be added or removed from the list any time during shopping.

## REFERENCES

- [1] Gaurav Kapoor & Selyn Piramuthu, (2012), 'Single RFID tag Ownership Transfer Protocols', IEEE Transactions on System, Man & Cybernetics Part c: applications & reviews, Vol.42
- [2] RFID JOURNAL, 2002-2007, REFFERD 6.8.2007, available <http://www.rfidjournal.com>.
- [3] P.V.Nikitin, K.V.S. Rao, (2006) 'Theory and Measurement of Back scattering from RFID tags', IEEE Antennas & Propagation Magazine, Vol.48, pp.212-218.
- [4] Mr. P. Chandrasekar, Ms. T. Sangeetha, 'Smart Shopping Cart with Automatic Central Billing System through RFID and ZigBee', 2014.