RFID BASED SMART SHOPPING TROLLEY WITH AUTO PAYMENT

A PROJECT REPORT

Submitted by

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in the partial fulfilment for the award of the degree

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SAVEETHA ENGINEERING COLLEGE

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SAVEETHA ENGINEERING COLLEGE (AUTONOMOUS)

BONAFIDE CERTIFICATE

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Submitted for the 'University Project Viva Voce' examination held on _____.

INTERNAL EXAMINER **EXTERNAL EXAMINER**

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CONTENTS

ABSTRACT

Shopping mall is a place where people get their daily necessities. There has been an emerging demand for quick and easy payment of bills in shopping malls. Quite often, when shopping in a supermarket-shoppers are frustrated at locating the items on the shopping list and no assistance is available.

To overcome such problems, we have designed a smart trolley with a mobile application. This paper provides an app which helps the customers in finding the location of the product. It also provides a centralized and automated billing system using RFID. Automatically a payment link will be sent to the customer's mobile, He can pay the amount through the link without waiting in queue. Each product of shopping mall, supermarkets will be provided with a RFID tag, to identify its type. Each shopping cart is implemented with a Product Identification Device (Arduino Uno) that contains microcontroller, an RFID reader. Purchasing product information will be read through a RFID reader on shopping cart and it is displayed in Receiver which is interfaced to the controller.

LIST OF ABBREVATIONS

RFID - RADIO FREQUENCY IDENTIFICATION.

ISM - INDUSTRIAL, SCIENTIFIC AND MEDICAL.

FHSS - FREQUENCY HOPPING SPREAD SPECTRUM.

AFH - ADAPTIVE FREQUENCY-HOPPING SPREAD

SPECTRUM.

DPDT - DOUBLE POLE, DOUBLE THROW.

AVR - ADVANCED VIRTUAL RISC.

RISC - REDUCE INSTRUCTION SET COMPUTING.

PANs - PERSONAL AREA NETWORKS.

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CHAPTER 1

INTRODUCTION

Objective:

To introduce a modern system which conserves the time of consumers in any store by minimising the waiting period for billing and payment through automatic billing trolley and auto-pay web link to facilitate easier and faster methods of bill payment. Also owners with multiple stores could be benefit with ease in account handling as an advantage of online payment.

Introduction:

This system makes use of Radio Frequency Identification (RFID) technology to automatically detect the products added into the cart and is controlled by Arduino Uno microcontroller which is programmed to add or subtract the price of product while those are added to or removed from the cart. The product when added into the cart, Arduino throws it's details on the output screen for customer's reference. These details are retrieved from the RFID tags attached to products. Each tag contains a unique product ID which is transmitted when triggered by the RFID reader. The bill is generated for the calculated amount and displayed once shopping is completed and a copy of it is sent to both customer and the cashier. A web link for online payment is generated and sent to the customer through the mobile app which makes the payment process simple and quick.

CHAPTER 2

LITERATURE SURVEY

TITLE: **RFID Based Automatic Billing Trolley().**

AUTHOR'S: **Galande Jayshree,**
Rutuja Gholap,
Preeti Yadav

This paper proposed a system that will be placed in all the trolleys. It will consist of a RFID reader. All the products in the mall will be equipped with RFID tags. When a person puts any products in the trolley, its code will be detected and the price of those products will be stored in memory At the billing counter the total bill data will be transferred to PC by wireless RF module

TITLE: **Design and Implementation of a Smart Shopping Cart by RFID Technology()**

AUTHOR'S: **Nemalidinne Sai Megana**

In metro cities we can see you a huge rush at shopping malls on holidays and weekends. This becomes even more when there are huge offers and discounts. Now a days, people purchase a variety of items and put them in the trolley. After total purchasing one should approach counter for billing purpose. By using barcode reader the cashier prepares the bill which is a time consuming process. This results in long queues at the billing counters. This project presents an idea to develop a system in shopping malls to overcome the above problem.

TITLE: **Robust Low-Cost Passive UHF RFID Based Smart Shopping Trolley**

AUTHOR'S: **Tharindu Athauda, Juan Carlos Lugo Marin, Jonathan Lee, and Nemai Chandra Karmakar**

Retailers are often interested in low cost mechanisms to maintain stocks as well as for tracing products across the supply chain in an efficient and effective manner. In addition, shoplifting is another concern faced because of the lack of effectiveness in product tracing technique such as "barcode" used in retail supermarkets. "AmazonGo" a smart retail layout which was introduced by Amazon, to address above issues was found to be inefficient due to the over dependency of system based on historical purchased patterns of consumers. In this paper, we propose a low-cost, robust, passive UHF RFID based shopping trolley system which allows tracing and processing shopping data in real time. The UHF antenna mounted shopping trolleys are defined "Smart Trolleys" while shopping items are tagged using UHF RFID tags with unique identification codes.

TITLE: **Smart Goods Billing Management and Payment System for Shopping Malls**

AUTHOR'S: **Jatin Arora, Gagandeep , S.J. Sugumar, Ravinder Kumar**

In the present scenario, it is essential to have an automatic billing system for shopping malls, supermarket and other wholesale & retail stores. Numerous billing systems like barcode scanning mechanism-based systems or tag-based systems are available in the market. It is important to replace such existing system with better and robust systems so hereby we proposed "Smart Goods Billing Management and Payment System for Shopping Malls". In this system, the basic fundamental is barcode scanning for products, but we replace the conventional barcode scanner for faster and better results. In our prototype, the android phone is being used as a barcode scanner for simple, better and portable barcode scanner. This scanner is connected wirelessly to MCU via Bluetooth module. MCU is also connected to PC/Laptop for creating the database of all customers, their products, and bills. This database also tracks the total sale and number of goods sold per day. In addition, RFID technology is implemented in this system for payment through card-based system. Simulation and hardware-based results are proposed in this paper.

CHAPTER 3

SYSTEM ANALYSIS

EXISTING SYSTEM:

- They using PIC micro controller in CISC mechanism.
- It used only on RFID reader .
- They transmit through the Bluetooth.
- Billing section is more difficult through each customer bill.
- They cannot find expiry data.

PROPOSED SYSTEM:

- Technological developments have opened up new opportunities for the company to conduct its business activities.
- Radio Frequency Identification (RFID) is becoming preferable technology as an alternative to barcode systems.
- Time duration will be less
- User friendly
- The advantage for the shop owners is that they would need fewer cashiers, which would result in a large cut in their costs.

3.3 REQUIREMENT SPECIFICATIONS:

Both the software and hardware are required in this system

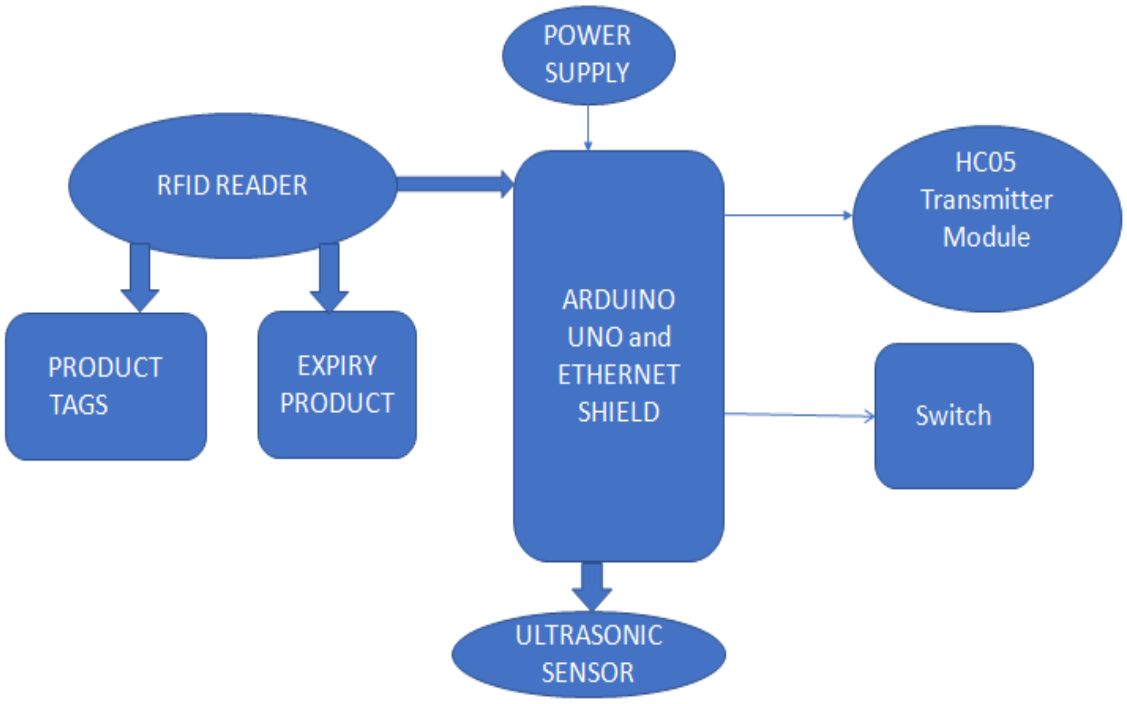
HARDWARE REQUIREMENT:

- Arduino uno
- Switch
- RFID reader
- RFID tags
- Power supply
- Hc05 module

SOFTWARE REQUIREMENT:

- Embedded C

BLOCK DIAGRAM:



3.3.a. Block Diagram

BLOCK DIAGRAM DESCRIPTION

In this block diagram “RFID READER” is used to read the tags of products such that we can know the details of the product in our mobile screen in an app. A “ARDUINO UNO” is used which is the main functional unit of the whole system. All the work of the product will be done here and a switch is used to turn ON and OFF the whole system. The power supply is used to transmit the power to the system, The HC05 transmitter module is used to transmit the data to system to cashier counter and our mobile.

CHAPTER 4

SYSTEM DESIGN

4.1 HARDWARE REQUIREMENT:

- Arduino uno.
- Switch.
- RFID reader.
- RFID tags.
- Power supply.

4.1.1 ARDUINO UNO:

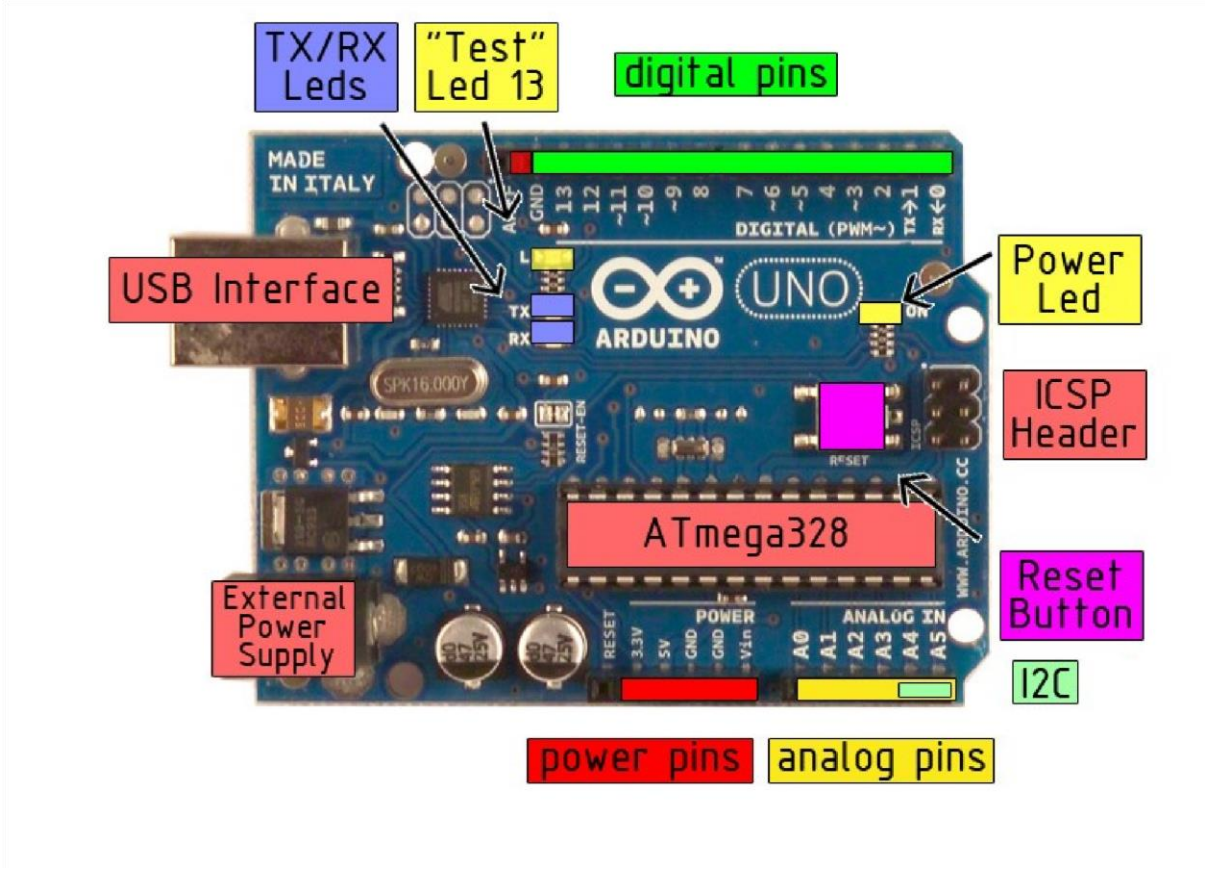
There are many other microcontrollers and microcontroller platforms available for physical computing. Parallax Basic Stamp, Net-media's BX-24, fidgets, MIT's Handy-board, and many others offer similar functionality. All of these tools take the messy details of microcontroller programming and wrap it up in an easy-to-use package. Arduino also simplifies the process of working with microcontrollers, but it offers some advantage for teachers, students, and interested amateurs over other systems:

- Inexpensive - Arduino boards are relatively inexpensive compared to other microcontroller platforms. The least expensive version of the Arduino module can be assembled by hand, and even the pre-assembled Arduino modules cost less than $50
- Cross-platform - The Arduino software runs on Windows, Macintosh OSX, and Linux operating systems. Most microcontroller systems are limited to Windows.
- Simple, clear programming environment - The Arduino programming environment is easy-to-use for beginners, yet flexible enough for

advanced users to take advantage of as well. For teachers, it's conveniently based on the Processing programming environment, so students learning to program in that environment will be familiar with the look and feel of Arduino

- Open source and extensible software- The Arduino software is published as open source tools, available for extension by experienced programmers. The language can be expanded through C++ libraries, and people wanting to understand the technical details can make the leap from Arduino to the AVR C programming language on which it's based. Similarly, you can add AVR-C code directly into your Arduino programs if you want to.
- Open source and extensible hardware - The Arduino is based on Atmel's ATMEGA8 and ATMEGA168 microcontrollers. The plans for the modules are published under a Creative Commons license, so experienced circuit designers can make their own version of the module, extending it and improving it. Even relatively inexperienced users can build the breadboard version of the module in order to understand how it works and save money.
- The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.
- "Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version.

- 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform, for a comparison with previous versions.
- Microcontroller ATmega328.
- Operating Voltage 5 V.
- Input Voltage (recommended) 7-12 V.
- Input Voltage (limits) 6-20 V.
- Digital I/O Pins 14 (of which 6 provide PWM output).
- Analog Input Pins 6.
- DC Current per I/O Pin 40 mA.
- DC Current for 3.3V Pin 50 mA.
- Flash Memory 32 KB of which 0.5 KB used by bootloader.
- SRAM 2 KB.
- EEPROM 1 KB.



4.1.1.a Arduino Uno

SOFTWARE DESCRIPTION OF ARDUINO CODE

ARDUINO IDE

Arduino Programming Basics

Command	Description
Pin-Mode(*n*, INPUT)	Set pin *n* to act as an input. One-time command at top of program.
Pin-Mode(*n*, OUTPUT)	Set pin *n* to act as an output
Digital-Write(*n*, HIGH)	Set pin *n* to 5V
Digital-Write(*n*, LOW)	Set pin *n* to 0V
delay(*x)*	Pause program for *x* millisecond, *x* = 0 to 65,535
Tone(*n, f, d*)	Play tone of frequency *f* Hz for *d* millisecond on speaker attached to pin *n*
for()	Loop. Example: for (i=0; i<3; i++){} Do the instructions enclosed by {} three times
if (*expr*) *{}*	Conditional branch. If *expr* true, do instructions enclosed by {}
while (*expr*) {}	While *expr* is true, repeat instructions in {} indefinitely

4.1.1.a ARDUINO PIN CONFIGURAYION

Instructions in the setup() function are executed once. Those in the loop() function are executed indefinitely.

4.1.2 SWITCH

The pushbutton is a component that connects two points in a circuit when you press it. The example turns on an LED when you press the button.

We connect three wires to the Arduino board. The first goes from one leg of the pushbutton through a pull-up resistor (here 2.2 K Ohms) to the 5 volt supply.

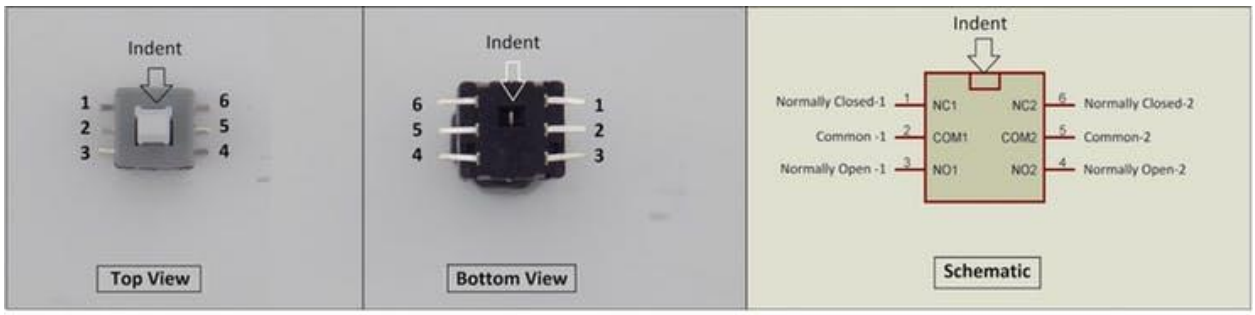
The second goes from the corresponding leg of the pushbutton to ground. The third connects to a digital i/o pin (here pin 7) which reads the button's state.

When the pushbutton is open (un-pressed) there is no connection between the two legs of the pushbutton, so the pin is connected to 5 volts (through the pull-up resistor) and we read a HIGH. When the button is closed (pressed), it makes a connection between its two legs, connecting the pin to ground, so that we read a LOW. (The pin is still connected to 5 volts, but the resistor in-between them means that the pin is "closer" to ground.)

A **6 Pin Push Switch** also known as **Mini DPDT Push Switch**, is nothing but a combination of two push switches placed together inside one package. Unlike momentary switches which connect the wires of the switch only for a second, this switch retains its ON-OFF state till pushed later on. For example, if I push it once so that it's turned on, it will remain in ON state till it's pushed again. That's why this switch is useful in controlling power connections most of the time.

Now back onto its features. It has two common ports which are independent of each other and have no connection between them at all, which means you can switch two different wires easily through it.

If you refer to this pin diagram:

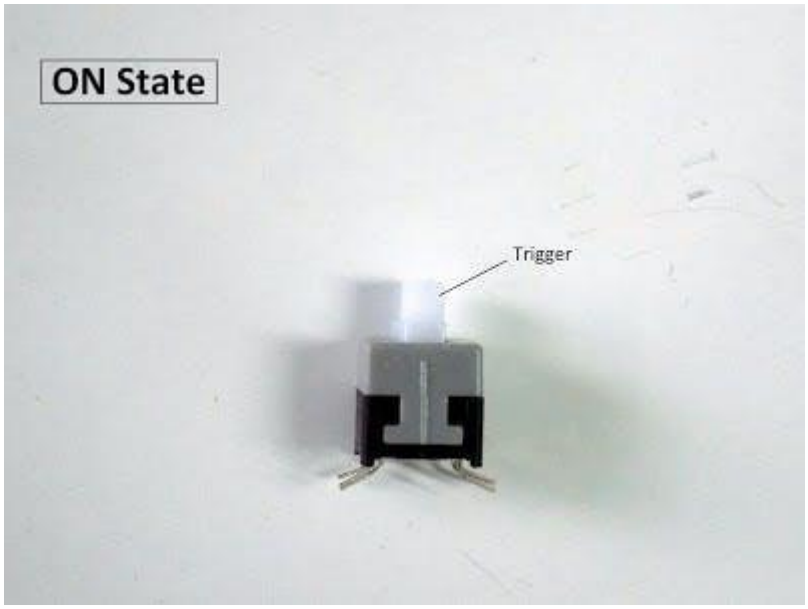


6 Pin Push Switch (Mini DPDT Push Switch) Pinout

4.1.2.a Push Switch

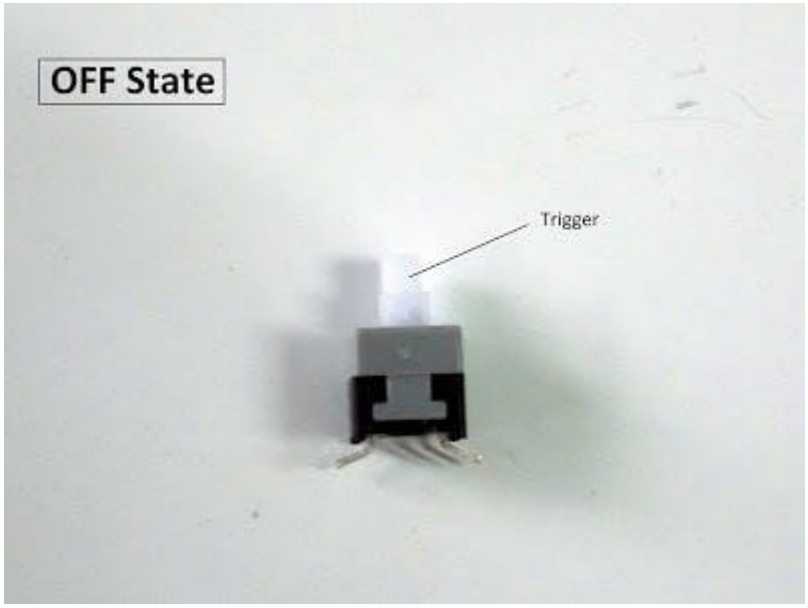
You can easily interpret that this switch has two **common** pins which are simultaneously switched ON and OFF.

When the **trigger** is pushed and moves down a notch, the connections between **Pin 1 to Pin 2** and **Pin 5 to Pin 6** are made. This is the **ON** state of the switch.



4.1.2.b On State

When the **trigger** is pushed again, it regains its previous position, the connections between **Pin 2 to Pin 3** and **Pin 5 to Pin 4** are made. This is the **OFF** state of the switch.



4.1.2.c Off State

That's all for this switch. If you're curious about its usage, you can visit these instructions where I made a project based on it:

- Convertendo - Toggles between OMTP and CTIA modes of a TRRS pins.
- Boggler - Toggles the connection between series and parallel modes of a battery.

4.1.3 RFID READER AND TAGS:

Radio frequency identification (RFID) is a general term that is used to describe a system that transmits the identity (in the form of a unique serial number) of an object wirelessly, using radio waves.

RFID technologies are grouped under the more generic Automatic Identification (Auto ID) technologies.

The barcode labels that triggered a revolution in identification systems long time ago, are inadequate in an increasing number of cases. They are cheap but the stumbling block is their low storage capacity and the fact that they cannot be reprogrammed.

A feasible solution was putting the data on silicon chips. The ideal situation is contactless transfer of data between the data carrying device and its reader. The power required to operate the electronic data carrying device would also be transferred from the reader using contactless technology. These procedures give RFID its name.

One grand commercial vision for RFID is to change the way demand-supply chain moves. In the current almost stone-age scenario, manufacturer produces goods based on forecasts and hopes all of them will be consumed before the shelf life gets them. Good, if the market is consistent. Horrible, if a sudden surge makes the supply fall short and hence everyone in the chain miss on profits. Disastrous, if demand dies suddenly and losses are passed along the chain.

In a not so distant future, RFID enabled stores will monitor the consumption in real time. Shelf will signal the inventory when it needs more stuff and inventory will pull supplies from the manufacturer based on its level of stock.

RFID Technology and Architecture

Before RFID can be understood completely, it is essential to understand how Radio Frequency communication occurs.

RF (Radio Frequency) communication occurs by the transference of data over electromagnetic waves. By generating a specific electromagnetic wave at the source, its effect can be noticed at the receiver far from the source, which then identifies it and thus the information.

In an RFID system, the RFID tag which contains the tagged data of the object generates a signal containing the respective information which is read by the RFID reader, which then may pass this information to a processor for processing the obtained information for that particular application.

Thus, an RFID System can be visualized as the sum of the following three components:

1.RFID tag or transponder
2. RFID reader or transceiver
3. Data processing subsystem

An RFID tag is composed of an antenna, a wireless transducer and an encapsulating material. These tags can be either active or passive. While the active tags have on-chip power, passive tags use the power induced by the magnetic field of the RFID reader. Thus passive tags are cheaper but with lower range (<10mts) and more sensitive to regulatory and environmental constraints, as compared to active tags.

An RFID reader consists of an antenna, transceiver and decoder, which sends periodic signals to inquire about any tag in vicinity. On receiving any signal from a tag it passes on that information to the data processor.

The data processing subsystem provides the means of processing and storing the data.

RFID systems can also be differentiated based on the frequency range it uses. The common ranges are Low-Frequency (LF: 125 - 134.2 kHz and 140 - 148.5 kHz), High-Frequency (HF: 13.56 MHz) and Ultra-High-Frequency (UHF: 868 MHz - 928 MHz).

Low-frequency systems have short reading ranges and lower system costs. They are most commonly used in security access, asset tracking, and animal identification applications. High-frequency systems, offering long read ranges (greater than 90 feet) and high reading speeds, are used for such applications as railroad car tracking and automated toll collection. However, the higher performance of high-frequency RFID systems incurs higher system costs.

RFID Applications

There are two main area of applications, defined broadly as proximity (short range) and vicinity (long range).

Long range or vicinity applications can generally be described as track and trace applications, but the technology provides additional functionality and benefits for product authentication.

RFID enables greater automation of data collection process. Most companies spend considerable effort in knowing whats in their warehouse. RFID will help

them dig deeper and much more easily, tracking to the detail of even each unit, long after it has left the factory or warehouse.

RFID allows all this data to be transferred securely. Companies use independent suppliers, data from each of them can be carried on tags and uploaded to the Company's central system.

Imagine the control that the Company will have on a product's life cycle. The creation of sucesses and defeats can be better understood. There have been numerous instances when companies had to recall the entire product due to a fault in a minor component. Imagine the costs involved in recalling a whole car for a mistake in the AC system! RFIDs can make such recalls much more focussed.

There would be better data about post production performance. A car could have individually tagged components. Data could be collected everywhere, accident sites, repair shops, even the garage.Even inside the factory, tags could enable faster and focussed fault tracing.

The Just in Time(JIT) practice followed by many companies, where components are used when they are delivered and delivered just before being needed, can lead to out of stock situations. RFID will eliminate the problem.

The eventual aim of RFID in retail and manufacturing ~W eliminate the intermediary. A perfect supply chain would require no distribution center. Products would be delivered directly from the factory to the retail center.

Some other areas where passive RFID has been applied in recent past are:

- Person Identification.
- Food Production Control.
- Vehicle Parking Monitoring.
- Toxic Waste Monitoring.
- Valuable Objects Insurance Identification.
- Asset Management.
- Access Control.
- Short range or proximity applications are typically access control applications. Some main areas are:

- Access control.
- Mass transit ticketing.

4.1.3.a RFID reader EM-18

EM-18 Pin Configuration

EM-18 is a nine pin device. Among nine pins, 2 pins are not connected, so we basically have to consider seven terminals.

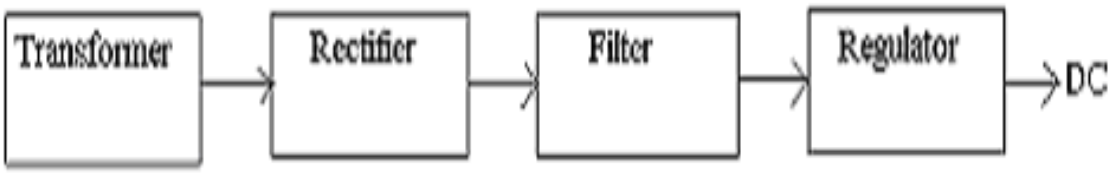
Pin Number	Description
VCC	Should be connected to positive of power source.
GND	Should be connected to ground.
BUZZ	Should be connected to BUZZER
NC	No Connection
NC	No Connection
SEL	SEL=1 then o/p =RS232 SEL=0then o/p=WEIGAND
TX	DATA is given out through TX of RS232
DATA1	WEIGAND interface DATA HIGH pin
DATA0	WEIGAND interface DATA LOW pin

TABLE 4.1.3.a

4.1.3.b RFID Tags.

4.1.4 POWER SUPPLY:

All electronic circuits work's only in low DC voltage, so we need a power supply unit to provide the appropriate voltage supply for their proper functioning. This unit consists of transformer, rectifier, filter & regulator. AC voltage of typically 230volts rms is connected to a transformer voltage down to the level to the desired ac voltage. A diode rectifier that provides the full wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation. A regulator circuit can use this dc input to provide dc voltage that not only has much less ripple voltage but also remains the same dc value even the dc voltage varies somewhat, or the load connected to the output dc voltages changes.



4.1.4.a POWER SUPPLY

TRANSFORMER:

A transformer is a static piece of which electric power in one circuit is transformed into electric power of same frequency in another circuit. It can raise or lower the voltage in the circuit, but with a corresponding decrease or increase in current. It works with the principle of mutual induction. In our project we are using a step down transformer to providing a necessary supply for the electronic circuits. Here we step down a 230volts ac into 12volts ac.

RECTIFIER:

A dc level obtained from a sinusoidal input can be improved 100% using a process called full wave rectification. Here in our project for full wave rectification we use bridge rectifier. From the basic bridge configuration, we see that two diodes (say D2 & D3) are conducting while the other two diodes (D1 & D4) are in off state during the period t = 0 to T/2.Accordingly for the negative cycle of the input the conducting diodes are D1 & D4. Thus the polarity across the load is the same.

In the bridge rectifier the diodes may be of variable types like 1N4001, 1N4003, 1N4004, 1N4005, IN4007 etc… can be used. But here we use 1N4007, because it can withstand up to 1000v.

FILTERS:

In order to obtain a dc voltage of 0 Hz, we have to use a low pass filter. So that a capacitive filter circuit is used where a capacitor is connected at the rectifier output& a dc is obtained across it. The filtered waveform is essentially a dc voltage with negligible ripples & it is ultimately fed to the load.

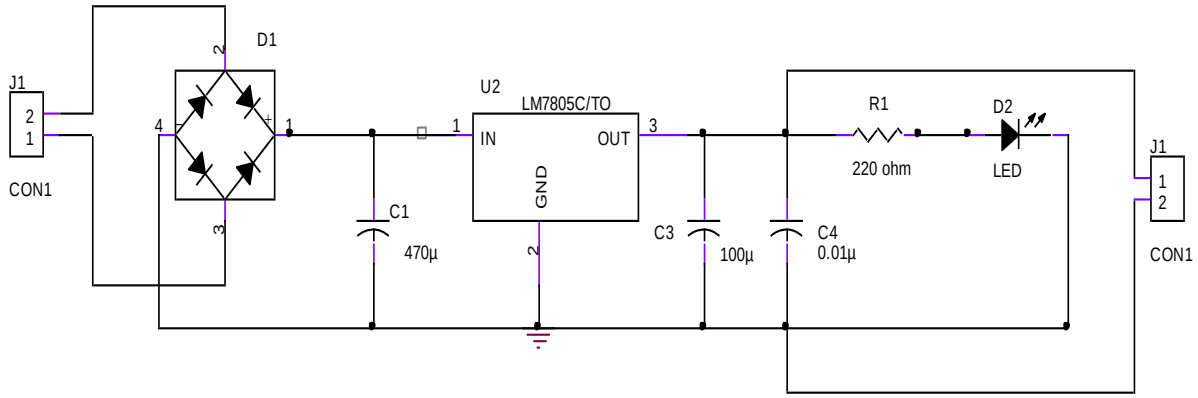
REGULATORS:

The output voltage from the capacitor is more filtered & finally regulated. The voltage regulator is a device, which maintains the output voltage constant irrespective of the change in supply variations, load variations & temperature changes. Here we use fixed voltage regulator namely LM7805.The IC LM7805 is a +5v regulator which is used for microcontroller.

FEATURES AND DESCRIPTION OF REGULATORS

- Output Current up to 1A
- Output Voltages of 5, 6, 8, 9, 10, 12, 15, 18, 24V
- Thermal Overload Protection
- Short Circuit Protection
- Output Transistor Safe Operating Area Protection

CIRCUIT DIAGRAM:

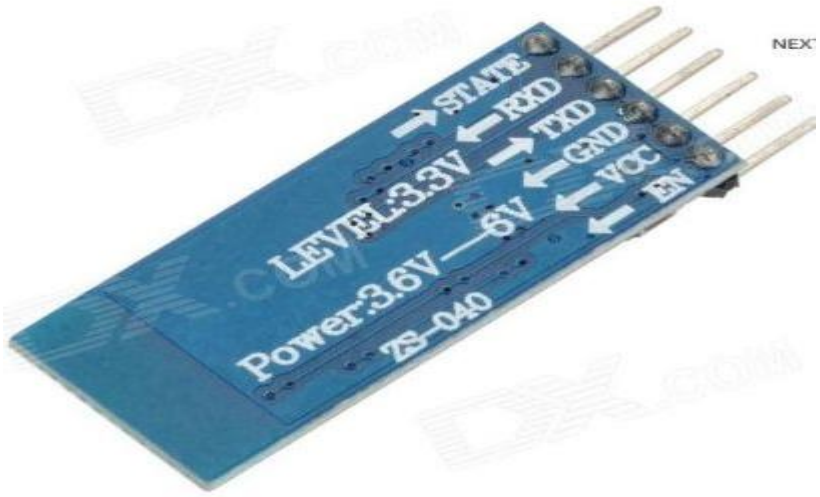


4.1.4.B CIRCUIT DIAGRAM.

4.1.5 HC05 MODULE:

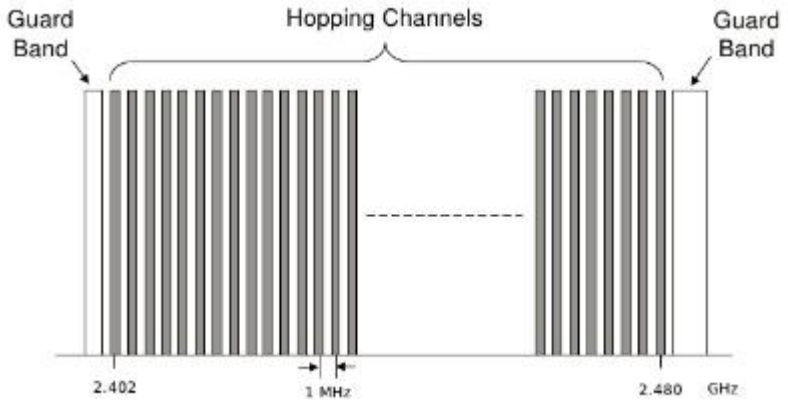
HC-05 Bluetooth module:

Bluetooth is a way of communication which makes the world wonder about it. Bluetooth is now provided in everything which is designed for some type of communication. It is available from smartphones to self-driving vehicles systems. It has interesting history and working system, which proves how versatile it is. It is managed by the Bluetooth Special Interest Group, which set the standards, advance the Bluetooth capabilities.



4.1.5.a BLUETOOTH MODULE

Bluetooth operates in the standard Industrial, Scientific and Medical (ISM) short range frequency band of 2.4 GHz. Specifically, it operated in the 2400–2483.5 MHz frequency band, which includes guard bands as well. It uses something called Frequency Hopping Spread Spectrum (FHSS), which is basically a multiple access method in which data packets are divided based on frequency over 79 designated Bluetooth channels. Each channel has a bandwidth of 1 MHz. The newer Bluetooth 4.0 standard, however, uses 2 MHz steps and thus has 40 designated channels. It uses a variation of FHSS called Adaptive Frequency-hopping spread spectrum (AFH), which theoretically skips channels with interference and results in better communication.

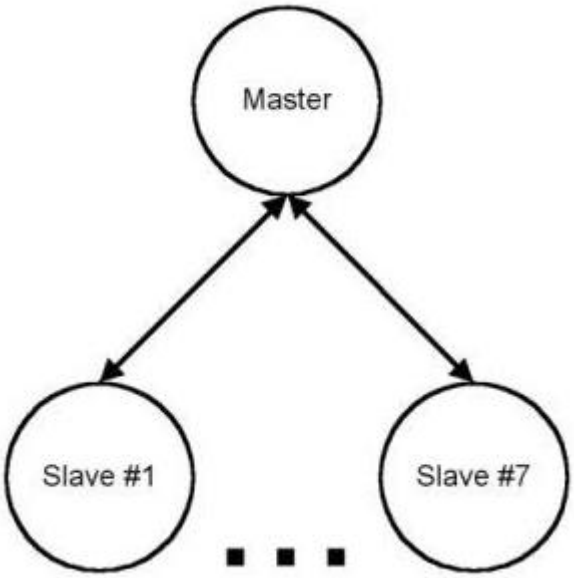


4.1.5.b Frequency Hopping Spread Spectrum

Bluetooth is essentially a protocol with a master-slave architecture, which means that one master device can communicate with up to 7 devices. This was and is a huge advantage to earlier wired communication protocols which could work only with a 1 to 1 configuration. Essentially creating a new standard called

Personal Area Networks (PANs), Bluetooth brought about far more effective ad-hoc networks and allows communication without traditional host based networking.

Pin Configuration of HC-05 Bluetooth module



4.1.5. MASTER SLAVE CONNECTIVITY

There are 6 pins available at the output of module. Facing back side, from left to right these are as follows:

1. EN Used for AT commands. In normal usage it is not required to be connected.
2. VCC Power supply +5V.
3. GND Power supply ground.
4. TxD Transmitting pin.
5. RxD Receiving Pin.
6. STATE Gives digital output shoeing status whether module is connected or not.

Pin Configuration

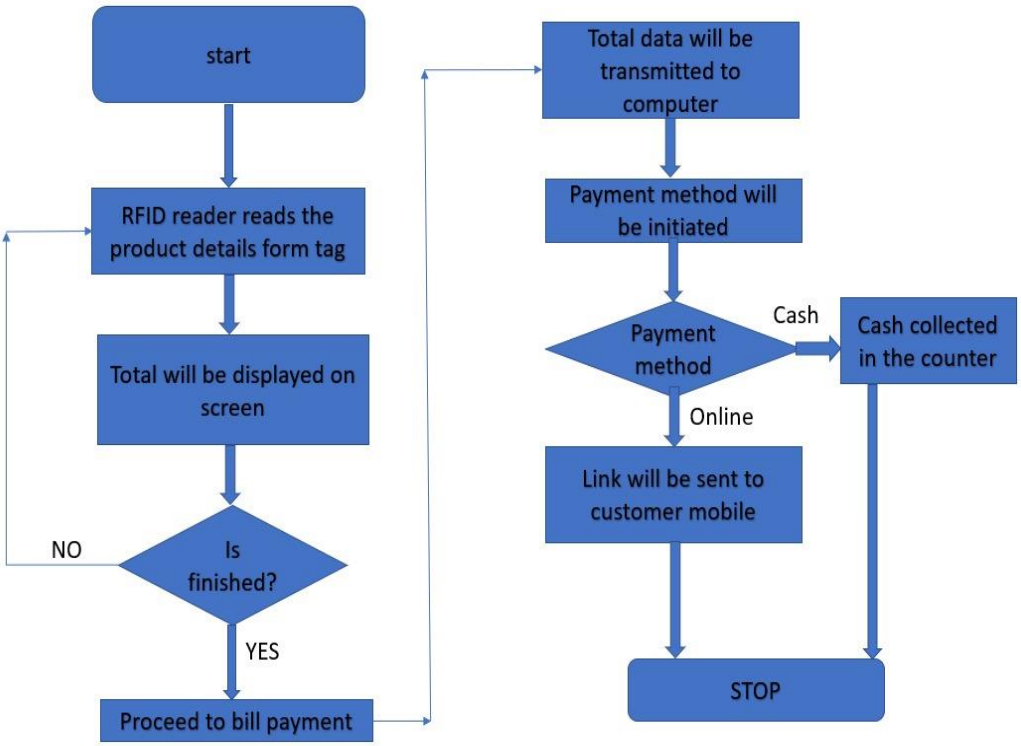
Pin Number	Pin Name	Description
1	Enable / Key	This pin is used to toggle between Data Mode (set low) and AT command mode (set high). By default it is in Data mode
2	Vcc	Powers the module. Connect to +5V Supply voltage
3	Ground	Ground pin of module, connect to system ground.
4	TX – Transmitter	Transmits Serial Data. Everything received via Bluetooth will be given out by this pin as serial data.
5	RX – Receiver	Receive Serial Data. Every serial data given to this pin will be broadcasted via Bluetooth
6	State	The state pin is connected to on board LED, it can be used as a feedback to check if Bluetooth is working properly.
7	LED	Indicates the status of Module • Blink once in 2 sec: Module has entered Command Mode • Repeated Blinking: Waiting for connection in Data Mode • Blink twice in 1 sec: Connection successful in Data Mode
8	Button	Used to control the Key/Enable pin to toggle between Data and command Mode

TABLE 4.1.5.a

4.2 SOFTWARE REQUIREMENT:

- Flowchart
- Code

4.2.1 FLOWCHART:



4.2.1.a Flowchart

4.2.2 CODE:

```
int RFIDResetPin = 13;
char tag1[13] = "5000B9A7155B"
char tag2[13] = "5000B9A7155B"
char tag3[13] = "5000B9A7155B"
char tag4[13] = "5000B9A7155B"
char tag5[13] = "5000B9A7155B"

void setup() {
   Serial.begin(9600);  // Connect to the serial port.
}
void loop () {
   byte i = 0;
   byte val = 0;
   byte code[6];
   byte checksum = 0;
   byte bytesread = 0;
   byte tempbyte = 0;

   if(Serial.available() > 0) {
      if((val = Serial.read()) == 2) {  // Check for header
         bytesread = 0;
         while (bytesread < 12) {  // Read 10 digit code + 2 digit checksum
            if( Serial.available() > 0) {
```

```
val = Serial.read();
if((val == 0x0D)||
   (val == 0x0A)||
   (val == 0x03)||
   (val == 0x02)) { // If header or stop bytes before the 10 digit reading.
    break;  // Stop reading
}
// Do ASCII/hexadecimal conversion:
if ((val >= '0') && (val <= '9')) {
    val = val - '0';
}
else
    if ((val >= 'A') && (val <= 'F')) {
        val = 10 + val - 'A';
    }

// Every two hex-digits, add byte to code:
if (bytesread & 1 == 1) {
    // Make some space for this hex-digit by
    // shifting the previous hex-digit with 4 bits to the left:
    code[bytesread >> 1] = (val | (tempbyte << 4));
    if (bytesread >> 1 != 5) {              // If we're at the checksum byte,
        checksum ^= code[bytesread >> 1];  // Calculate the checksum... (XOR)
    };
}
```

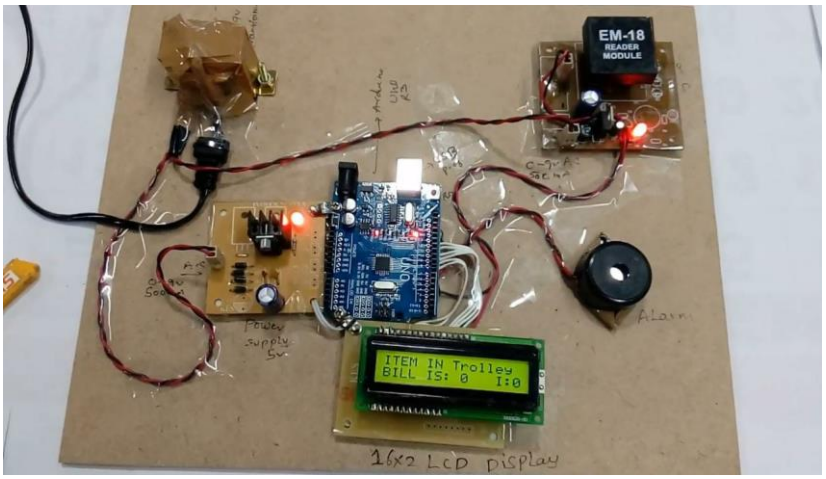
```
            else {
               tempbyte = val;                  // Store the first hex digit first...
            };
            bytesread++;                        // Ready to read next digit
          }
        }
        // Output to Serial:
        if (bytesread == 12) {                  // If 12 digit read is complete
          Serial.print("5-byte code: ");
          for (i=0; i<5; i++) {
            if (code[i] < 16)
              Serial.print("0");
            Serial.print(code[i], HEX);
            Serial.print(" ");
          }
          Serial.println();
         Serial.print("Checksum: ");
          Serial.print(code[5], HEX);
          Serial.println(code[5] == checksum ? " -- passed." : " -- error.");
          Serial.println();
        }
        bytesread = 0;
      }
    }
}
```

CHAPTER 5

OUTPUT

1. Reading the product details from RFID tag:

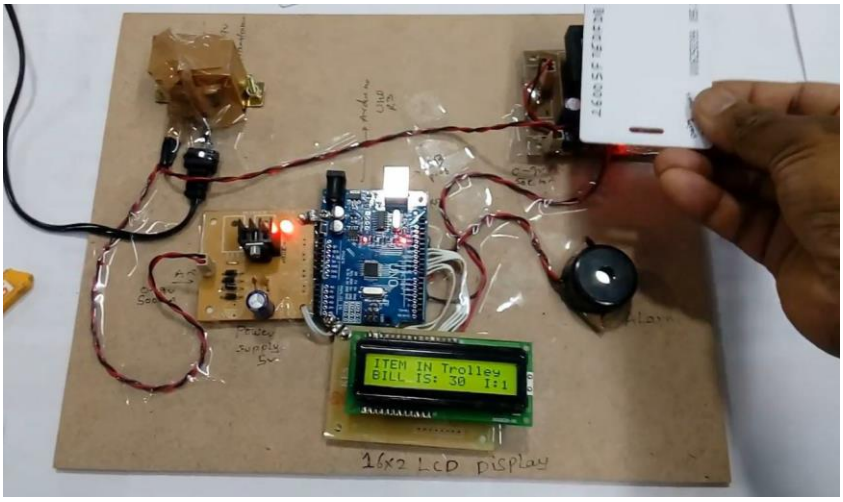
- The product details are preloaded in the RFID tags.
- The tag, when taken closer to the reader, the antenna transfers the data to the reader.
- The buzzer goes on to indicate that the product is successfully added to the cart.



5.1.a OUTPUT 1

2. Calculating total price:

- The details read from the tag include the price, productid and other necessary aspects.
- Every time a product is added, the new total is generated and updated in memory.
- Once the shopping is finished, a customer can check the total bill he/she made and proceed to checkout.
- Customers are instructed to use the finish button once they finish shopping.



5.1.b OUTPUT 2

3. Bill Generation and Transfer via Bluetooth:

- The finish button when pressed by the customer, starts the data transfer function is executed by the Arduino.
- This uses the Bluetooth (HC05) module to send the bill data to the cash counter.
- The generated bill shows the details of all the products in the cart such as product name, product ID, quantity and price.
- These details and the total amount to be paid are shown and payment is collected accordingly.

4. Payment methods:

- Customers can choose from two types of payments as per their comfort, either through cash or online payment.
- If he/she choose online payment, then the bill could be paid by scanning QR code or by requesting a payment link.
- Customers by their choice can avail Master Card, which solely is used for the payment purpose in that specific shop only. This card is also a RFID based tag in which customer can preload money and use the available balance while he/she shops.

CHAPTER 6

FUTURE WORK:

The RFID based shopping system has a great scope for advancements in the near future. This system could be a cost-efficient alternative for the Amazon-Go technology which already is implemented by Amazon corp. with very high expenditure. Using RFID, we can develop a come and go shopping system with zero waiting for bills and payments.

A master card could be used to store the bill details from the reader after the shopping is finished. This card is developed to hold the customer details along with his/her bill details.

Another RFID reader at the entrance and exit are used to read the customer details and the bill to the counter where the bill is generated and sent to the customer through e-mail or SMS along with a payment link.

Hint: This step could also be automated if required.

This makes sure that the customer waits nowhere for either billing or payment. He/she can just walk into the shop, takes the required products and add to cart by scanning tags. Once the shopping is finished, he/she uses his master card to load the bill details. Finally, the customer just walks out after scanning his master card at the exit reader.

Many more technologies like Li-Fi, IoT, etc can be integrated for making the shopping much easier and faster.

CONCLUSION:

The developed product is easy to use and does not require any specific training. It has the effective usage in supermarkets, etc as smart trollies can effectively minimize the queues in the billing counters so that customer's time can be saved. This project is made especially to save time and provide the ease in shopping for the customers which can increase efficiency in the shopping system and to attract the people towards the latest technologies in the continuously developing world.

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