TROLLEY WITH AUTOMATIC BILLING SYSTEM

A MINI PROJECT REPORT

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To

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Of

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In
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DECLARATION

I undersigned hereby declare that the project report "Trolley with automatic billing system ", submitted for partial fulfilment of the requirements for the award of degree of Master of Technology of the APJ Abdul Kalam Technological University, Kerala is a bonafide work done by me under supervision of **Mr. ROSHITH K**. This submission represents my ideas in my own words and where ideas or words of others have been included, I have adequately and accurately cited and referenced the original sources. I also declare that I have adhered to ethics of academic honesty and integrity and have not misrepresented or fabricated any data or idea or fact or source in my submission. I understand that any violation of the above will be a cause for disciplinary action by the institute and/or the University and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been obtained. This report has not been previously formed the basis for the award of any degree, diploma or similar title of any other University.

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CERTIFICATE

This is to certify that the report entitled **"TROLLEY WITH AUTOMATIC BILLING SYSTEM"** submitted by **Adin Jishnu , Sanjana C S, Uday Kumar E, Vidhusha Anilkumar** to the APJ Abdul Kalam Technological University in partial fulfilment of the requirements for the award of the Degree of Bachelor of Technology in Electronics and Communication Engineering is a bonafide record of the project work carried out by him/her under my/our guidance and supervision. This report in any form has not been submitted to any other University or Institute for any purpose.

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CONTENTS

Certificate

Declaration

Acknowledgement

Abstract

Chapter 1: Introduction

1.1 Project objective. 08

1.2 Project outline. 08

Chapter 2: Development and Implementation Of RFID Technology

2.1 Defining RFID Technology. 09

2.2 RFID implementation. 09

2.3 RFID Technology & Architecture. 11

2.4 RFID Applications. 12

2.5 A basic RFID system 13

2.5.1 Types of RFID Tags. 13

2.6 RFID communication. 14

Chapter 3: Hardware Components

3.1 Circuit. 15

3.2 Block Diagram. 16

3.3 Hardware components. 17

3.3.1 Arduino Uno. 17

3.3.2 LCD (Liquid Crystal Display) 19

3.3.3 RFID RC522. 21

Chapter 4: Software tools

4.1 Arduino IDE. 25

4.2 Software Serial Library. 25

Chapter 5: Methodology of Project

5.1 Algorithm. 29

5.2 Flowchart. 30

5.3 Program. 31

Chapter 6: Conclusion

References

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ABSTRACT

Shopping is simple but waiting on a bill counter makes shopping too boring and a tedious task. Huge amount of rush plus cashier preparing the bill with barcode scanner is too time consuming and results in long ques. This innovative project consists of an automated billing system which can be placed within the shopping trolley. The trolley with an automatic billing system leverages RFID (Radio Frequency Identification) technology to track and identify items placed in the trolley. Each item is affixed with an RFID tag that contains unique product information. The Arduino Uno, a microcontroller board, acts as the brain of the system. It communicates with the RFID reader to detect and read the RFID tags of the items in the trolley. The Arduino processes the collected data and interacts with the LCD (Liquid Crystal Display) to provide a visual interface for the user. Once the customer completes their shopping, they can proceed to the payment section. The trolley's automatic billing system supports various payment methods, such as cash, card, or mobile payment options. The Arduino Uno securely processes the payment transaction, deducting the appropriate amount from the customer's chosen payment account. The trolley with an automatic billing system utilizing Arduino Uno, RFID, and an LCD display provides an efficient, user-friendly, and technologically advanced solution for both customers and retailers.

Chapter 1: Introduction

1.1 Project objective: In the present-day shopping system one of the difficulties is to follow queue through the billing process which is me consuming. Hence this project aims to reduce the average me spent by the customer at the shopping mall by implementing automatic billing system using RFID technology.

1.2 Project outline: The main aim of the project is to satisfy the customer and to reduce the spent on the billing process which is to complete the billing process in the trolley rather than waiting in a queue even for one or two products. The customers must add the products a er a short scan in trolley and when the shopping is done the finalized amount will be displayed in the trolley. Customer could either pay their bill by their pre-recharged customer card provided by the shop. Finally, the whole information will be sent to central Pc of the shopping mall

Chapter 2: Development and Implementation of RFID Technology

2.1 Defining RFID: RFID or Radio Frequency Identification System is a technology-based identification system which helps identifying objects just through the tags a ached to them, without requiring any light of sight between the tags and the tag reader. All that is needed is radio communication between the tag and the reader. Radio Frequency Identification (RFID) technology has been attracting considerable attention with the expectation of improved supply chain visibility for both suppliers and retailers. It will also improve the consumer shopping experience by making it more likely that the products they want to purchase are available. As the technology keeps on changing day to day with the advancement of science new field of technology is being implemented in industry. Previously before the introduction of RFID technology, barcodes have been implemented.

2.2 RFID implementation: The RFID chip has come a long way since its invention, see the journey below: 1940's - Radar technology was used to identify enemy and friendly aircrafts in WWII. Technically this was the first use of RFID 1948 - Scientist and inventor Harry Stockman creates RFID and is credited with the invention. 1963 - Inventor RF Harrington formulates new RFID ideas which include scattering data and information. 1977 - The first RFID transmitting license plate is created. 2000 - By this me over 1000 patents have been submitted using the RFID technology. Experts believe that RFID will be ubiquitous in 20 years, this may be hard to believe if you are not one of the businesses on the cu ng edge of RFID technology but may have adopted this technology to reduce the cost and streamline opera on. 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 me 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 me. Shelf will signal the inventory when it needs more stuff and inventory will pull supplies from the manufacturer based on its level of stock. Simple concept, not-so-difficult implementation and revolutionary results in the pipeline. That’s RFID, in short.

2.3 RFID Technology & 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 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 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.

2.4 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 what's 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 successes 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 postproduction 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 we eliminate the intermediary. A perfect supply chain would require no distribution canter. Products would be delivered directly from the factory to the retail centre. 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

2.5 A basic RFID system: 3 Main Components of a RFID System

- A RFID tag: It consists of a silicon microchip attached to a small antenna and mounted on a substrate and encapsulated in different materials like plastic or glass veil and with an adhesive on the back side to be attached to objects.
- A reader: It consists of a scanner with antennas to transmit and receive signals and is responsible for communication with the tag and receives the information from the tag.
- A Processor or a Controller: It can be a host computer with a Microprocessor or a microcontroller which receives the reader input and process the data.

2.5.1 Types of RFID Tags:

Passive Tags – It is the cheaper version using no battery. The Tag uses radio energy transmitting from the reader. So, the Reader must be close to the tag to transfer energy to power the Tag. Since the tags

have unique serial number, the reader can recognize them individually.

Active Tags– These have an on-board battery and periodically transmits ID signals to the reader. Battery Assisted Passive or BAP– These Tags have small battery on board and will be activated in the presence of signals from the reader.

Read only Tags – These have a unique factory assigned serial number used as the key for the data base.

Read/ Write Tags – These can write object specific data give by the system user.

Field programmable Tags– These can write once but read many times. Black tags can be written with an electronic product code by the user.

2.6 RFID communication:

1. Host manages Reader(s) and issues Commands

2. Reader and tag communicate via RF signal

3. Carrier signal generated by the reader

4. Carrier signal sent out through the antennas

5. Carrier signal hits tag(s) Tag receives and modifies carrier signal – sends back modulated signal (Passive Backscatter – also referred to as ―field disturbance device).

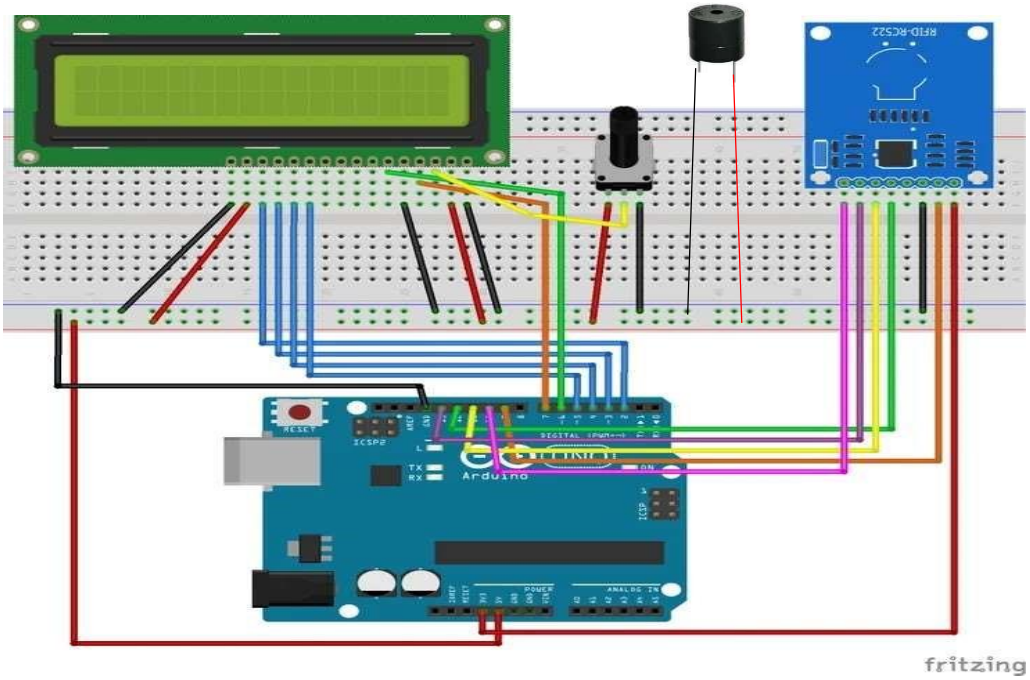
6. Antennas receive the modulated signal and send them to the Reader.

7. Reader decodes the data.

8. Results returned to the host application.

Chapter 3: Hardware Components

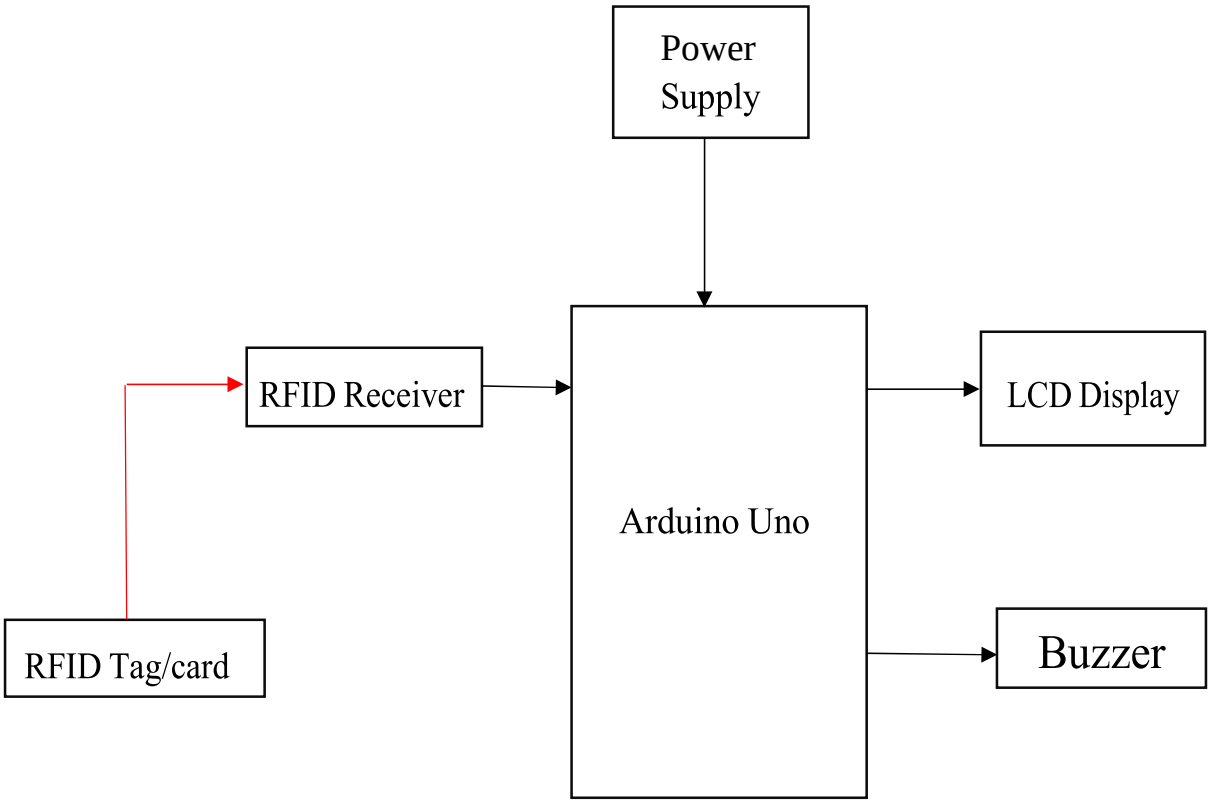
3.1 Circuit:



Components Required:

Arduino Uno board, RFID RC522 reader Module, 16 x2 LCD Display, Breadboard, Buzzer, jumper wires, Potentiometer.

3.2 Block Diagram:



3.3 Hardware Components:

3.3.1 Arduino Uno

Arduino is an open-sourAREF stands for Analog Reference. It is sometimes, used to set an external reference voltage (between 0 and 5 Volts) as the upper limit for the analog input pins. Electronics prototyping platform based on flexible, easy-to-use hardware and software. It's intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments. Arduino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lights, motors, and other actuators. The microcontroller on the board is programmed using the Arduino programming language (based on Wiring) and the Arduino development environment (based on Processing). Arduino projects can be stand-alone or they can communicate with so ware on running on a computer (e.g. Flash, Processing, Max MSP). Arduino received an Honorary Mention in the Digital Communities section of the 2006 Ars Electronica Prix.

Specifications:

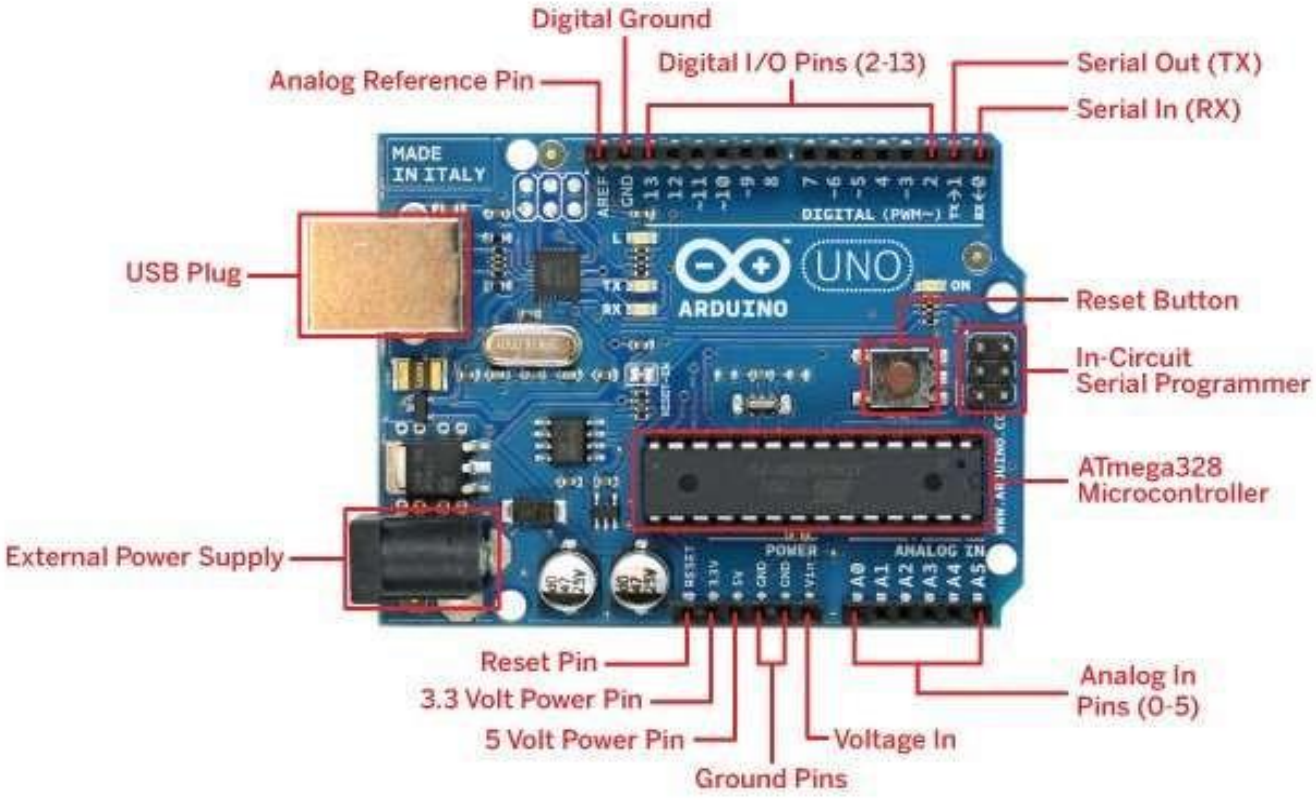
Microcontroller	Atmel ATmega328
Opera ng Voltage (logic level)	5 V
Input Voltage (recommended)	7-12 V
Input Voltage (limits)	6-20 V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	8
DC Current per I/O Pin	40 mA
Flash Memory	32 KB (of which 2KB used by bootloader)

SRAM	2 KB
EEPROM	1 KB
Clock Speed	16 MHz
Dimensions	0.70 x 1.70

Features:

- Automatic reset during program download
- Power OK blue LED
- Green (TX), red (RX) and orange (L) LED
- Auto sensing/switching power input
- Small mini-B USB for programming and serial monitor
- ICSP header for direct program download
- Standard 0.1‖ spacing DIP (breadboard friendly)
- Manual reset switch

Arduino Board Description:



3.3.2 LCD (LIQUID CRYSTAL DISPLAY):

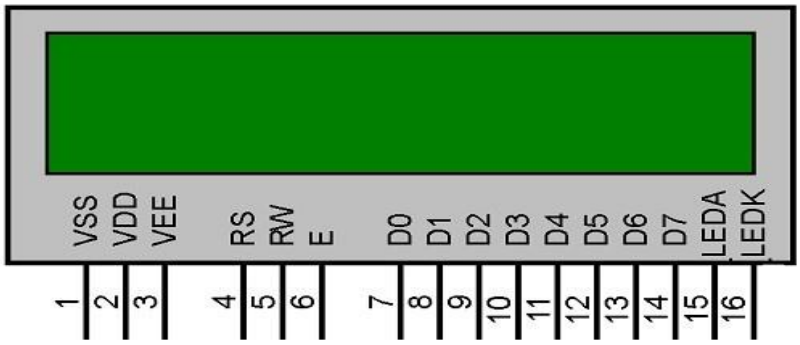
LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation. LEDs have a large and varying set of use cases for consumers and businesses, as they can be commonly found in smartphones, televisions, computer monitors and instrument panels. It is a thin, flat display device made up of any number of colour or monochrome pixels arrayed in front of a light source or reflector. Each pixel consists of a column of liquid crystal molecules suspended between two transparent electrodes, and two polarizing filters, the axes of polarity of which are perpendicular to each other. Without the liquid crystals between them, light passing through one would be blocked by the other. The liquid crystal twists the polarization of light entering one filter to allow it to pass through the other.

Types of LCDs:

Types of LCDs include:

- Twisted Nematic (TN)- which are inexpensive while having high response time. However, TN displays have low contrast ratio, viewing angles and colour contrasts.
- In Panel Switching displays (IPS Panels)- which boast much better contrast ratios, viewing angles and colour contrast when compared to TN LCDs. Digital I/O The Arduino UNO board has 14 digital I/O pins (15) (of which 6 provide PWM (Pulse Width Modula on) output. These pins can be configured to work as input digital pins to read logic values (0 or 1) or as digital output pins to drive different modules like LEDs, relays, etc. The pins labelled can be used to generate PWM. AREF stands for Analog Reference. It is sometimes, used to set an external reference voltage (between 0 and 5 Volts) as the upper limit for the analog input pins.
- Vertical Alignment Panels (VA Panels)- which are seen as a medium quality between TN and IPS displays.
- Advanced Fringe Field Switching (AFFS)- which is a top performer compared IPS displays in colour reproduction range.

LCD Pin Description:

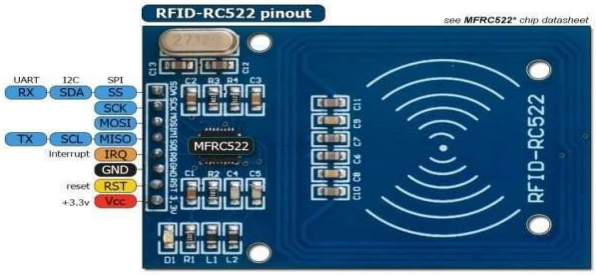


No.	Pin	Func on
1	VSS	Ground
2	VCC	+5v
3	VEE	Contrast Control 0 volt: high contrast
4	RS	Register Select 0: Command reg. 1: Data reg.
5	RW	Read/Write 0: Write 1: Read
6	E	Enable H-L Pulse
7-14	D0-D7	Data Pins D7: Busy Flag Pin
15	LED+	+5 volt
16	LED-	Ground

3.3.3 RFID RC522 :

EM-18 RFID reader is one of the commonly used RFID readers to read 125 KHz tags. It features low cost, low power consumption, small form factor and easy to use. It provides both UART and Wiegand26 output formats. It can be directly interfaced with microcontrollers using UART and with PC using an RS232 converter.

RFID Module and Pin Configuration:



Pin 1 : VCC
Pin 2 : RST
Pin 3 : GND
Pin 4 : IRQ
Pin 5 : MISO/SCL/TX
Pin 6 : MOSI
Pin 7 : SCK
Pin 8 : SS/SDA/RX

WORKING OF RFID RC522 READER MODULE:

The RFID RC522 reader module is a popular RFID (Radio Frequency Identification) module that uses the RC522 integrated circuit to communicate with RFID tags. It operates at 13.56 MHz frequency and is commonly used in various applications such as access control systems, attendance systems, and inventory management.

1. Powering the module: The RC522 module requires a power supply of 3.3V. It can be powered using the Arduino's 3.3V pin or an external 3.3V power supply. The module also needs a separate 5V power supply for communication with the Arduino.
2. Communication interface: The RC522 module communicates with the Arduino or any microcontroller using a serial communication interface. It uses the Serial Peripheral Interface (SPI) protocol, which requires four pins: SDA (Serial Data), SCK (Serial Clock), MOSI (Master out Slave In), and MISO (Master in Slave Out).

3. Initialization: To start using the RC522 module, you need to initialize it by setting up the appropriate registers and configurations. This includes setting the SPI communication parameters, enabling certain functionalities, and configuring the module for reading or writing data.
4. Antenna: The RC522 module has an on board antenna that is used to emit an electromagnetic field and receive signals from RFID tags. The antenna generates an electromagnetic field when powered, and when an RFID tag comes within range, it induces a current in the tag's antenna, allowing data exchange.
5. Tag detection: The RC522 module continuously scans for RFID tags in its proximity. When an RFID tag enters the range of the module's electromagnetic field, it receives the tag's unique identification data. The module can detect multiple tags simultaneously.
6. Data exchange: Once the RC522 module detects an RFID tag, it initiates a data exchange with the tag. It sends commands to the tag and receives responses from the tag. This communication involves transmitting and receiving data frames that contain information such as the tag's ID, memory blocks, or authentication data.
7. Reading and writing data: With the RC522 module, you can read data from RFID tags and write data to them. The module provides functions to read and write data blocks on the tags, allowing you to store and retrieve information as needed.
8. Processing data: After receiving the data from the RFID tag, the RC522 module processes it and provides the necessary information to the microcontroller. The microcontroller can then perform actions based on the received data, such as displaying it on an LCD, storing it in a database, or triggering certain events.

Overall, the RFID RC522 reader module operates by generating an electromagnetic field, detecting RFID tags within range, and exchanging data with the tags using the SPI protocol.

RFID tag includes microchip with radio antenna mounted on substrate which carries 12 Byte unique Identification number.

Chapter 4: Software Tools

4.1 Arduino IDE:

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them.

Figure 4.2: Arduino

4.2 Software Serial library:

This library enables so ware-based serial communication, allowing you to establish communication with the RFID reader module and LCD display module.

1. Install Libraries:
    - Software Serial Library: This library is typically already included with the Arduino IDE.

- MFRC522 Library: Download it from the Arduino Library Manager by going to Sketch -> Include Library -> Manage Libraries and searching for "MFRC522" by "germaniumlabs".
- LiquidCrystal Library: This library is also included with the Arduino IDE.

2. Hardware Setup:

   Connect the MFRC522 RFID module to the Arduino Uno as follows:

   - VCC -> 3.3V
   - RST -> D9
   - GND -> GND
   - MISO -> D12
   - MOSI -> D11
   - SCK -> D13
   - SDA -> D10

   Connect the LCD display to the Arduino Uno according to the wiring diagram of your specific LCD module.

3. Arduino Code:

```
#include <SoftwareSerial.h>

#include <MFRC522.h>

#include <LiquidCrystal.h>


#define SS_PIN 10

#define RST_PIN 9


SoftwareSerial mySerial(2, 3);  // RX, TX pins for SoftwareSerial
```

```
MFRC522 mfrc522(SS_PIN, RST_PIN);  // Create an instance of the MFRC522 class
LiquidCrystal lcd(12, 11, 5, 4, 3, 2);  // Create an instance of the LiquidCrystal class

void setup() {
Serial.begin(9600);
mySerial.begin(9600);
  mfrc522.PCD_Init();  // Initialize the RFID module
lcd.begin(16, 2);  // Initialize the LCD module

  lcd.setCursor(0, 0);
lcd.print("Ready to scan:");
}

void loop() {
  // Check for new RFID cards  if (mfrc522.PICC_IsNewCardPresent() && mfrc522.PICC_ReadCardSerial()) {
    String uid = "";
    for (byte i = 0; i < mfrc522.uid.size; i++)  {  uid  += String(mfrc522.uid.uidByte[i], HEX);
    }
```

```
    lcd.clear();
lcd.setCursor(0,        0);
lcd.print("Card  UID:");
lcd.setCursor(0,        1);
lcd.print(uid);

    // Send UID to Serial for further processing or billing
calculations    mySerial.println(uid);

    delay(2000);  // Wait for 2 seconds before scanning the next
card        mfrc522.PICC_HaltA();  // Halt the current card to
prepare for the next one
    mfrc522.PCD_StopCrypto1();  // Stop encryption
on the PCD        lcd.clear();        lcd.setCursor(0, 0);
lcd.print("Ready to scan:");
  }
}
```

This code initializes the necessary libraries and the RFID reader (MFRC522) and sets up the LCD display. In the' loop()' function, it checks if a new RFID card is present, reads its UID, and displays it on the LCD. The UID is also sent to the Serial port (pins 2 and 3) for further processing or billing calculations.

Chapter 5: Methodology of Project

5.1 ALGORITHM:

Step 1: Initially the cart is reset.

Step2: Then the RFID TAG is read by the reader. If the tag is read at odd number of times, then the item is added into the cart.

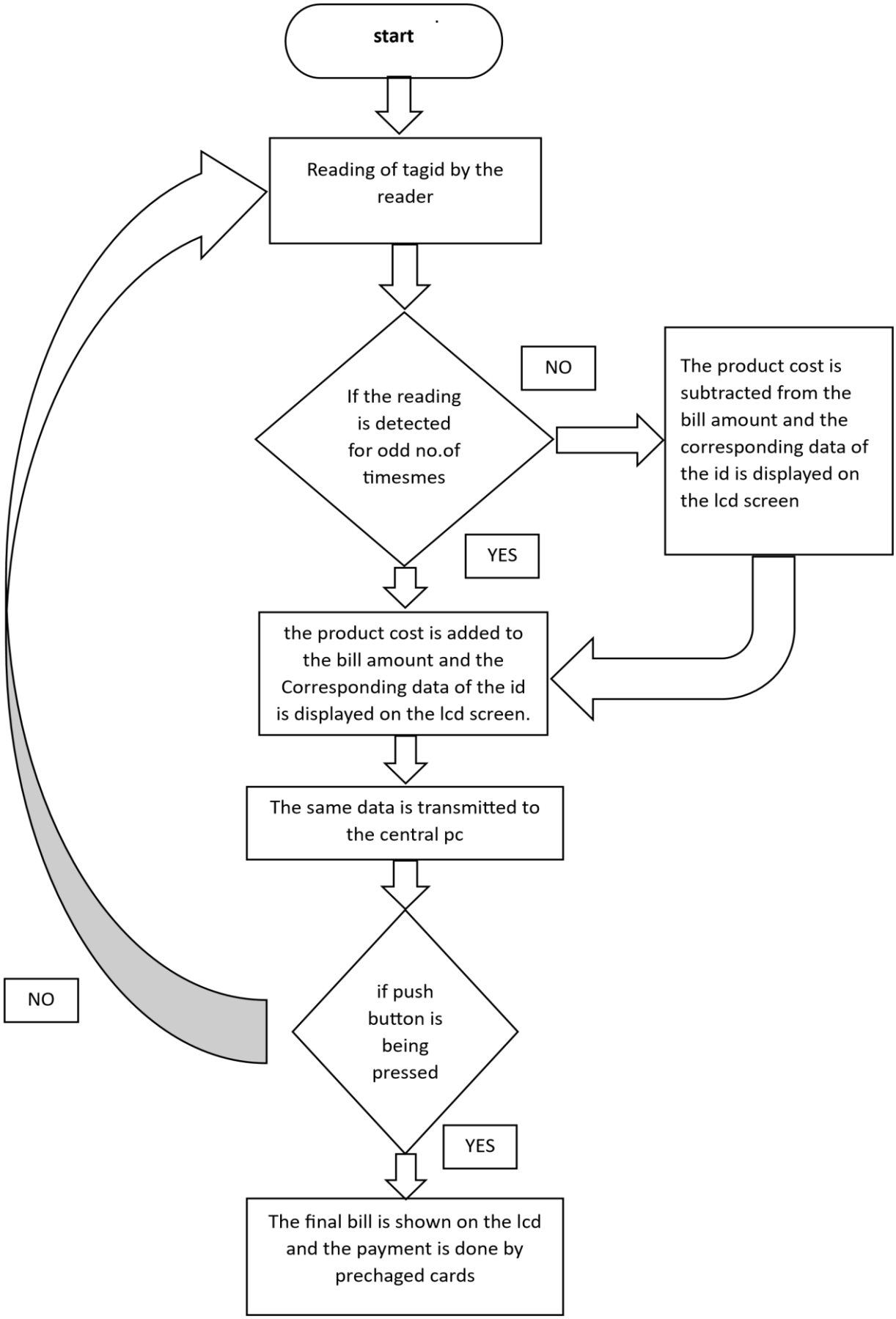
Step3: If the RFID TAG is read at an even number of times, it gets subtracted from the cart.

Step4: Again, after pressing the reset button the total billing amount is displayed on the LCD screen.

Step5: Then using the pre-charged cart the amount is debited form the cart.

Step6: After the final billing is done it is transmitted via HC-12 transmitter and it is observed at the billing section by the respective person.

5.2 FLOW CHART:



5.3 PROGRAM

```
#include <SPI.h>
#include <MFRC522.h>
#include <LiquidCrystal.h>

#define SS_PIN 10
#define RST_PIN 9
#define BUZZER_PIN 8

MFRC522 mfrc522(SS_PIN, RST_PIN);   // Create MFRC522
instance.

// Initialize the library with the numbers of the interface pins
LiquidCrystal lcd(7, 6, 5, 4, 3, 2);

int totalAmount = 0;

void setup() {
  Serial.begin(9600);         //   Initiate   a   serial
communication
 SPI.begin();                 //   Initiate   SPI   bus
mfrc522.PCD_Init();   // Initiate MFRC522
  Serial.println("Approximate your card to the reader...");
```

```
  Serial.println();

  // Set up the LCD's number of columns and rows:
  lcd.begin(16, 2);
  lcd.print("smart trolley");
pinMode(BUZZER_PIN, OUTPUT);
}

void loop() {
//Turn off the
display
lcd.noDisplay();
delay(500);
// Turn on the
display:
  lcd.display();
delay(500);

  // Look for new cards   if
(!mfrc522.PICC_IsNewCardPrese
nt)) {
  return;
  }
```

```
  // Select one of the cards   if
(!mfrc522.PICC_ReadCardSeri
al()) {
return;
  }
  //  Show  UID  on  serial
monitor
 lcd.setCursor(0,0);
Serial.print("UID  tag:  ");
lcd.print("UID: ");
 String content = "";
 byte let er;
  for (byte i = 0; i < mfrc522.uid.size; i++) {
       Serial.print(mfrc522.uid.uidByte[i] < 0x10 ? " 0" : " ");
       Serial.print(mfrc522.uid.uidByte[i], HEX);
       lcd.print(mfrc522.uid.uidByte[i] < 0x10 ? " 0" : " ");
       lcd.print(mfrc522.uid.uidByte[i], HEX);
      content.concat(String(mfrc522.uid.uidByte[i] < 0x10 ? " 0" : "
"));
      content.concat(String(mfrc522.uid.uidByte[i], HEX));
  }
  Serial.println();
Serial.print("Message: ");
```

```
lcd.print("Message: ");
content.toUpperCase();

  if (content.substring(1) == "ED 1E D1 FC") {
     lcd.setCursor(0, 1);

     Serial.println("Authorizedaccess");
     lcd.print("SNICKERS ");
     totalAmount += 30;
     digitalWrite(BUZZER_PIN,
HIGH);
    delay(1000);
    digitalWrite(BUZZER_PIN, LOW);
     delay(2000);
  }
else if (content.substring(1) == "AC A1 FE 37") {
     lcd.setCursor(0, 1);
     Serial.println("Authorized access");
     lcd.print("DAIRY MILK  ");
     totalAmount += 40;
    digitalWrite(BUZZER_PIN, HIGH);
   delay(1000);     digitalWrite(BUZZER_PIN,
LOW);
```

```
  delay(2000);
  }
 else if (content.substring(1) == "12 4B 4C 1B") {
       lcd.setCursor(0, 1);
       Serial.println("Authorized
access");
       lcd.print("KITKAT ");
       totalAmount+=10;
digitalWrite(BUZZER_PIN,
HIGH);
       delay(1000);
digitalWrite(BUZZER_PIN,
LOW);
       delay(2000);
 }
else
{
   lcd.setCursor(1);
   Serial.println("Access
denied");
    lcd.print("Access denied  ");
    digitalWrite(BUZZER_PIN,
HIGH);
```

```
   delay(1000);
digitalWrite(BUZZER_PIN,
LOW);
   delay(2000);
  }

  Serial.print("Total amount: Rs ");
  Serial.println(totalAmount);
  lcd.setCursor(0, 1);
  lcd.print("Total: Rs ");
 lcd.print(totalAmount);
}
```

CHAPTER 6: CONCLUSION

The integration of an Arduino Uno, RFID technology, and an LCD display in a trolley with an automatic billing system offers numerous benefits and enhances the overall shopping experience. This system streamlines the checkout process, improves accuracy, and provides convenience for both customers and store owners.

By incorporating an RFID reader into the trolley, customers can easily scan their items and have them automatically added to their virtual shopping cart. This eliminates the need for manual item scanning, reducing human errors and saving me at the checkout counter. The Arduino Uno acts as the central processing unit, efficiently managing the data from the RFID reader and facilitating seamless communication between the trolley and the store's billing system.

The LCD display serves as an interface, providing real- me information about scanned items, their prices, and the total bill.

The trolley with an automatic billing system using Arduino Uno, RFID technology, and an LCD display offers a modern, efficient, and user-friendly solution for shopping. It enhances the checkout process, improves accuracy,
and provides convenience for both customers and store owners, ultimately enhancing the overall shopping experience.

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