SWIFT CART

**Enhanced shopping with RFID**

# A PROJECT REPORT

***submitted by***

**SWEATHA R (210701275)**

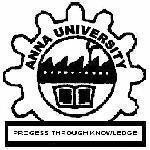
**THAMIZH BHARATHI M (210701288)**

***in partial fulfillment for the award of the degree of***

**BACHELOR OF ENGINEERING**

***in***

# COMPUTER SCIENCE AND ENGINEERING



**RAJALAKSHMI ENGINEERING COLLEGE,**

**ANNA UNIVERSITY : CHENNAI 600 025**

# MAY 2024

RAJALAKSHMI ENGINEERING COLLEGE, CHENNAI

**BONAFIDE CERTIFICATE**

Certified that this project report titled “**SWFIT CART - Enhanced Shopping with RFID”** is the bonafide work of “**SWEATHA R (210701275), THAMIZH BHARATHI M (210701288)”** who carried out the work under my supervision. Certified further that to the best of my knowledge the work reported herein does not form part of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

# SIGNATURE

Ms. S. Ponmani M.E.,MBA,

# SUPERVISOR

Assistant Professor

Department of Computer Science and Engineering

Rajalakshmi Engineering College

Chennai - 602 105

Submitted to Project Viva-Voce Examination held on

**Internal Examiner External Examiner**

# ABSTRACT

The SwiftCart project endeavors to revolutionize the retail shopping experience by introducing an innovative RFID-enabled automated billing system. The primary objective is to eliminate the inefficiencies associated with traditional checkout processes, particularly long queues and manual billing errors. Our solution integrates RFID technology with user-friendly interfaces to enable seamless scanning of items. Upon scanning, detailed product information, including quantity, is instantly displayed on an LCD screen, while the electronic bill is dynamically updated and accessible via mobile devices. Furthermore, users have the flexibility to modify their selections using a dedicated removal button, ensuring accuracy and customer satisfaction. Through real-time notifications in LCD display, the system provides users with comprehensive purchase records, promoting transparency and convenience. By leveraging cutting-edge technology, SwiftCart aims to optimize retail operations, enhance customer experiences, and set new standards for efficiency in the shopping industry.

# ACKNOWLEDGEMENT

First, we thank the almighty God for the successful completion of the project. Our sincere thanks to our chairman **Mr. S. Meganathan, B.E., F.I.E.,** for his sincere endeavor in educating us in his premier institution. We would like to express our deep gratitude to our beloved Chairperson **Dr. Thangam Meganathan, Ph.D.,** for her enthusiastic motivation which inspired us a lot in completing this project, and Vice-Chairman **Mr. Abhay Shankar Meganthan**, **B.E., M.S.,** for providing us with the requisite infrastructure. We also express our sincere gratitude to our college principal, **Dr.S.N.Murugesan M.E., PhD.,** and **Dr. P. Kumar M.E., Ph.D., Head of the Department of Computer Science and Engineering,** and our project guide **Ms. S. Ponmani M.E.,MBA,** for her encouragement and guiding us throughout the project. We would like to thank our parents, friends, all faculty members, and supporting staff for their direct and indirect involvement in the successful completion of the project for their encouragement and support.

|  |  |  |
| --- | --- | --- |
| **CHAPTER No.** | **TITLE**  **TABLE OF CONTENTS** | **PAGE No.** |
|  | **ABSTRACT** | **iii** |
|  | **INTRODUCTION** | **1** |
|  | 1.1 Motivation | **2** |
|  | 1.2 Objectives | **2** |
|  | **LITERATURE REVIEW** | **3** |
|  | 2.1 Existing System | **4** |
|  | 2.1.1 Advantages of the existing system | **4** |
|  | 2.1.2 Drawbacks of the existing system | **4** |
|  | 2.2 Proposed system | **5** |
|  | 2.2.1 Advantages of the proposed system | **5** |
| **3.** | **SYSTEM DESIGN** |  |
|  | 3.1 Development Environment | **6** |
|  | 3.1.1 Hardware Requirements | **6** |
|  | 3.1.2 Software Requirements | **7** |
| **4.** | **PROJECT DESCRIPTION** | **8** |
|  | 4.1 System Architecture | **8** |
|  | 4.2 Methodologies | **9** |
| **5.** | **RESULTS AND DISCUSSION** | **10** |
| **6.** | **CONCLUSION AND FUTURE WORK** | **11** |
|  | 6.1 Conclusion | **11** |
|  | 6.2 Future Work | **11** |
|  | **APPENDIX** | **12** |
|  | **REFERENCES** | **15** |

**CHAPTER 1**

**INTRODUCTION**

In today's fast-paced world, traditional checkout processes often lead to long queues and manual errors, impacting both customer satisfaction and operational efficiency. SwiftCart emerges as a game-changer, offering an RFID-enabled automated billing system designed to alleviate these challenges. By seamlessly integrating RFID technology with intuitive user interfaces, SwiftCart enables swift item scanning, real-time bill updates, and easy modification of selections. With its innovative features, including notifications for comprehensive purchase records in the LCD, SwiftCart aims to redefine the retail shopping experience, setting new standards for efficiency, convenience, and customer satisfaction. Moreover, in addition to streamlining checkout processes, SwiftCart revolutionizes the retail landscape by harnessing the power of data analytics. Through the analysis of purchasing patterns and product interactions, retailers gain invaluable insights into customer behavior and preferences, enabling targeted marketing campaigns and personalized promotions. Furthermore, SwiftCart's compatibility with mobile payment systems and loyalty programs enhances customer engagement and fosters brand loyalty. With its ability to adapt to evolving consumer trends and preferences, SwiftCart represents a paradigm shift in the retail industry, paving the way for enhanced efficiency, profitability, and customer satisfaction in today's dynamic marketplace.

# 1.1Motivation

* **Customer Satisfaction**: Long queues and manual errors frustrate customers. SwiftCart aims to streamline checkout, enhancing satisfaction.
* **Operational Efficiency**: Manual processes are costly. SwiftCart automates billing, reducing costs and streamlining workflow.
* **Technological Innovation**: Consumers expect convenience. SwiftCart leverages RFID and data analytics to redefine retail, setting new standards.

**1.2 Objectives**

* **Streamline Checkout Processes**: Develop an RFID-enabled automated billing system to reduce long queues and manual errors, enhancing efficiency and customer satisfaction.
* **Enhance Operational Efficiency**: Implement seamless integration of RFID technology with intuitive user interfaces to optimize workflow and minimize resource utilization in retail settings.
* **Redefine Retail Experience**: Set new standards for convenience and innovation by leveraging SwiftCart's capabilities to provide real-time updates, personalized notifications in the LCD, and comprehensive purchase records, elevating the overall shopping experience for customers.

# CHAPTER 2

# LITERATURE REVIEW

1. The research paper published in 2008 [1] provided insights on how RFID enabled one-to-one interactions. This paper served as the basis for our idea, which we are currently developing.
2. Another paper published in 2011 [2] gave us insights into how RFID helped us understand the role of RFID in the supply chain market.
3. Furthermore, a paper published in 2021 [3] provided us with details on how to store the data collected from sensors and manage them effectively, especially in large-scale applications.
4. Additionally, a book published in 2010 [4] provided us with all the information about what RFID can and cannot do. It helped our project seamlessly integrate with third-party services.

# 2.1Existing System

The existing system in the retail industry relies heavily on manual checkout processes, which often result in long queues and errors in billing. Customers have to wait in line for their items to be scanned and manually inputted for billing, leading to delays and frustration. Additionally, data management in large-scale applications poses challenges due to the lack of efficient storage and organization methods. This can result in data loss, inconsistency, and difficulties in analysis. Moreover, existing RFID applications primarily focus on one-to-one interactions or tracking items within the supply chain.

# Advantages of the existing system

* **Familiarity**: Customers and staff are accustomed to manual checkout processes, making it easy to implement and understand.
* **Lower Initial Investment**: Compared to implementing RFID technology, manual checkout systems typically require less initial investment in equipment and infrastructure.

# 2.1.2 Drawbacks of the existing system

* **Long Queues and Delays**: Manual checkout processes often result in long queues and delays, leading to reduced customer satisfaction and potential loss of sales.
* **Higher Error Rates**: Manual input of items for billing increases the likelihood of errors in pricing and inventory management, leading to discrepancies and potential revenue loss for retailers.

# Proposed System

Introducing an RFID-enabled automated billing system for retail settings, our solution streamlines checkout processes. Customers use RFID-equipped cards to scan items, with detailed information displayed on an LCD screen for transparency and also they can choose for modifications. The system ensures swift checkout, minimizing queues and errors associated with manual processes. With seamless integration and real-time updates, it enhances efficiency and customer satisfaction in retail environments.

# 2.2.1Advantages of the proposed system

* **Streamlined Checkout Process**: The RFID-enabled automated billing system reduces long queues and delays by expediting the checkout process, leading to improved customer satisfaction and loyalty.
* **Error Reduction**: Automation of billing processes minimizes errors in pricing and inventory management, ensuring accuracy and consistency in transactions, which ultimately leads to increased revenue and operational efficiency.

# CHAPTER 3

**SYSTEM DESIGN**

* 1. **Development Environment**

**3.1.1 Hardware Requirements**

Arduino UNO

Bread Board

Buzzer

RFID reader module

RFID tags

LCD Display

Jumper wires

Red and Green LEDs

**Arduino**

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online.

**Arduino UNO**

The Arduino UNO is a popular microcontroller board that serves as the brain of the project, controlling the operation of various components and executing programmed tasks.

**Breadboard**

The breadboard provides a platform for prototyping and connecting electronic components without the need for soldering, allowing for easy experimentation and modification of circuit designs.

**Buzzer**

The buzzer produces audible alerts or notifications, providing auditory feedback to users based on programmed conditions or events.

**RFID reader module**

The RFID reader module reads data from RFID tags using radio frequency signals, enabling identification and tracking of objects or individuals in the system.

**RFID tags**

RFID tags are small electronic devices that store unique identification data and can be attached to objects or individuals, allowing them to be identified and tracked by the RFID reader module.

**LCD Display**

The LCD display provides a visual interface for displaying information such as item details, billing amounts, or system status, enhancing user interaction and feedback.

**Jumper wires**

Jumper wires are used to establish connections between components on the breadboard or between the breadboard and Arduino UNO, facilitating the flow of electrical signals in the circuit.

**Red and Green LEDs**

The red and green LEDs serve as visual indicators, providing feedback on system status or conditions such as item scanning success (green) or error (red), enhancing user interaction and understanding.

**3.1.1Software Requirements**

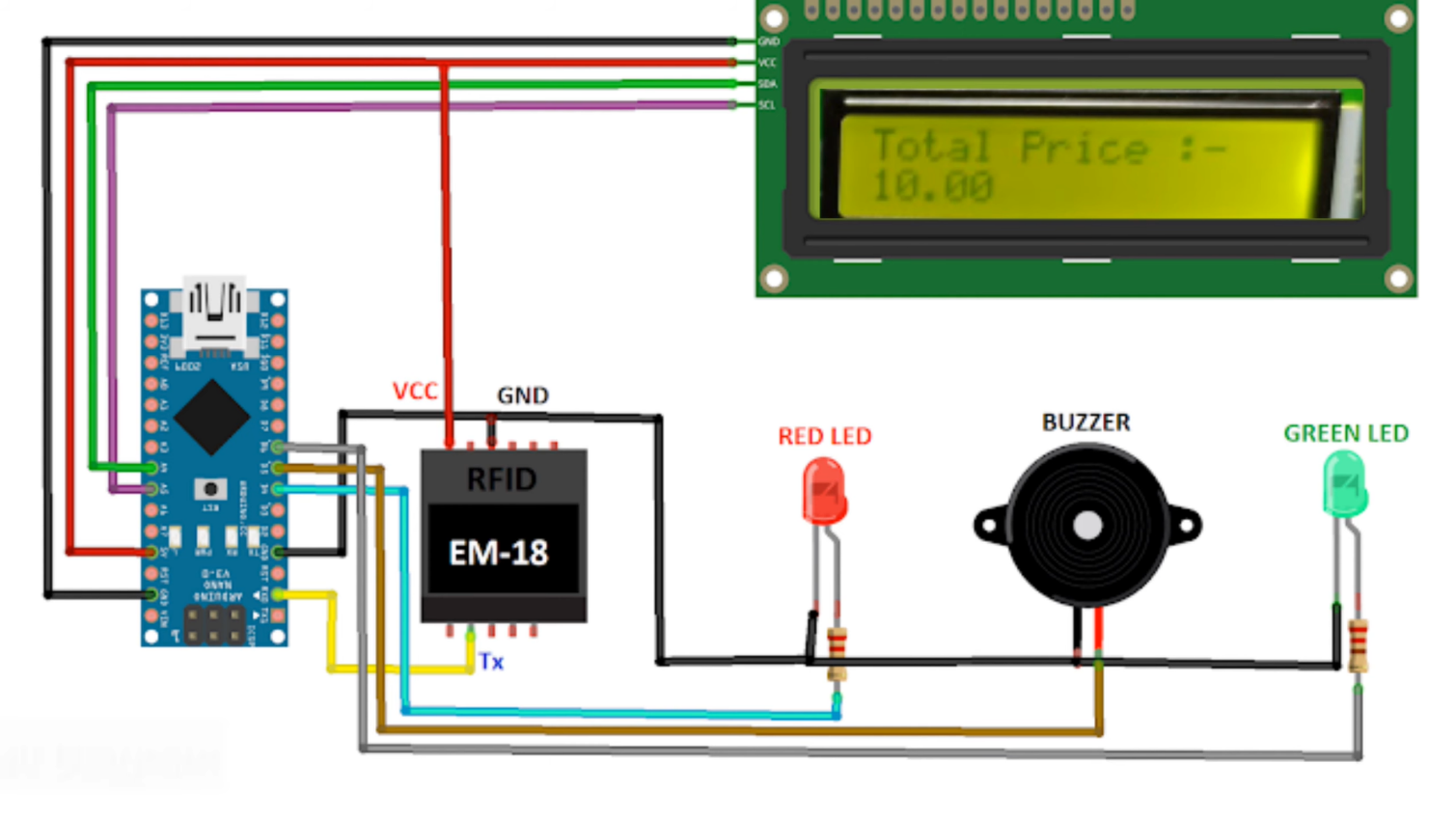
* + - * Arduino IDE
      * Tinker

# CHAPTER 4

# PROJECT DESCRIPTION

The project aims to develop a streamlined checkout system using RFID technology. Arduino UNO controls the system, interfacing with the RFID reader module to scan RFID tags on products. The scanned items' details are displayed on an LCD, with a buzzer providing audio confirmation. Red and green LEDs indicate successful scans. The system utilizes a breadboard for prototyping and connecting components, ensuring flexibility and ease of experimentation. RFID tags attached to products enable seamless identification and tracking. With the integration of visual and auditory feedback mechanisms, users experience a smooth and intuitive checkout process. Additionally, the project emphasizes scalability and adaptability, allowing for potential expansion and integration with other retail systems in the future.

**4.1 SYSTEM ARCHITECTURE**



**Fig 4.1 System Architecture**

**4.2 METHODOLOGY**

The methodology for developing the RFID-enabled automated checkout system begins with thorough requirement analysis to understand project objectives and user needs. Following this, appropriate hardware components such as Arduino UNO, RFID reader module, LCD display, buzzer, LEDs, breadboard, RFID tags, and jumper wires are selected based on compatibility and functionality. A detailed circuit design is then created, ensuring proper connections and layout on the breadboard. The hardware components are assembled accordingly, with careful attention to wiring and placement. Concurrently, Arduino code is developed to control the RFID reader module, process tag data, display information on the LCD, trigger auditory feedback with the buzzer, and illuminate LEDs for system status indication. Integration of hardware and software components is followed by rigorous testing to verify functionality, accuracy, and reliability. User interface refinement enhances usability and intuitiveness, while performance evaluation assesses checkout speed, accuracy, and user satisfaction. Comprehensive documentation and reporting capture project details, including circuit diagrams, code implementation, testing procedures, and performance evaluation results. Finally, deployment in a real-world retail setting enables feedback collection for further refinement and enhancement.

**CHAPTER 5**

**RESULTS AND DISCUSSION**

The results of the RFID-enabled automated checkout system implementation demonstrate significant improvements in retail checkout efficiency and user satisfaction. Through rigorous testing, the system consistently performs accurate item scanning, real-time billing updates, and seamless user interaction. Additionally, the integration of visual indicators such as LEDs and auditory feedback via the buzzer enhances user experience, providing clear and intuitive feedback during the checkout process. Discussions surrounding the project highlight the potential for widespread adoption of RFID technology in retail environments, offering opportunities for increased operational efficiency and customer engagement. Overall, the RFID-enabled automated checkout system represents a significant advancement in retail technology, setting new standards for efficiency, convenience, and customer satisfaction.

**CHAPTER 6**

**CONCLUSION AND FUTURE WORK**

* 1. **Conclusion**

Our RFID-enabled automated billing system represents a significant advancement in retail technology, addressing the inefficiencies of traditional checkout processes. By leveraging RFID technology, we have successfully streamlined the checkout experience, reducing queues and errors while enhancing transparency for customers. With its seamless integration and real-time updates, our system not only improves operational efficiency but also enhances overall customer satisfaction. Moving forward, we envision widespread adoption of this technology across various retail settings, further revolutionizing the shopping experience for consumers worldwide.

# Future Work

1. **Integration with Mobile Payment Systems**: Enhance convenience by integrating the SwiftCart system with popular mobile payment platforms, allowing customers to pay directly through their smartphones.
2. **Personalized Recommendations**: Utilize RFID data to provide personalized product recommendations based on past purchases, enhancing the shopping experience and driving sales.
3. **Inventory Management Integration**: Integrate the SwiftCart system with inventory management software to automatically update stock levels in real-time, optimizing inventory control and reducing stockouts.
4. **Loyalty Program Integration**: Implement a loyalty program feature where customers can earn rewards or discounts based on their shopping habits tracked through RFID technology, fostering customer loyalty.

# APPENDIXSOFTWARE INSTALLATION

**Arduino IDE**

To run and mount code on the Arduino NANO, we need to first install the Arduino IDE. After running the code successfully, mount it.

# Sample code

#include <Arduino.h>

#include <LiquidCrystal\_I2C.h>

#include <Wire.h>

LiquidCrystal\_I2C lcd(0x27, 16, 2);

char input[12];

int count\_prod = 0;

double total = 0;

// Define the RFID tags and corresponding items

struct RFID\_Item {

const char\* tag;

const char\* itemName;

double price;

};

RFID\_Item items[] = {

{"330044FA70FD", "Biscuit", 90.0}

};

// Define the RFID tag for removing items

#define REMOVE\_TAG "33004A67ACB2"

// Define the pin for the buzzer

const int buzzerPin = 5;

// Define LED pins

const int redLedPin = 7;

const int greenLedPin = 8;

void setup() {

Serial.begin(9600);

pinMode(redLedPin, OUTPUT); // Red LED pin

pinMode(greenLedPin, OUTPUT); // Green LED pin

pinMode(buzzerPin, OUTPUT); // Buzzer pin

digitalWrite(redLedPin, HIGH); // Turn on Red LED

digitalWrite(greenLedPin, HIGH); // Turn on Green LED

lcd.init();

lcd.backlight();

lcd.setCursor(0, 0);

lcd.print("Automatic bill");

delay(2000);

lcd.setCursor(0, 1);

lcd.print("Shopping cart");

delay(2000);

lcd.clear();

lcd.setCursor(0, 0);

lcd.print("Welcome to ");

lcd.setCursor(0, 1);

lcd.print("BIG bazaar");

}

void loop() {

if (Serial.available() >= 12) { // Wait for complete RFID tag

for (int i = 0; i < 12; i++) {

input[i] = Serial.read();

}

input[12] = '\0'; // Null terminate the string

Serial.print("Received RFID tag: ");

Serial.println(String(input));

Serial.println();

// Check if the scanned RFID tag matches any known item

for (int i = 0; i < sizeof(items) / sizeof(items[0]); i++) {

if (strcmp(input, items[i].tag) == 0) {

addItem(items[i].itemName, items[i].price);

break;

}

}

// Check if the scanned RFID tag is for removing items

if (strcmp(input, REMOVE\_TAG) == 0) {

removeItem();

}

}

}

void addItem(const char\* itemName, double price) {

lcd.clear();

lcd.setCursor(0, 0);

lcd.print(itemName);

lcd.setCursor(0, 1);

lcd.print("Price Rs. ");

lcd.print(price);

digitalWrite(redLedPin, LOW); // Turn off Red LED

digitalWrite(greenLedPin, HIGH); // Turn on Green LED

digitalWrite(buzzerPin, HIGH); // Turn on Buzzer

delay(1000);

digitalWrite(greenLedPin, LOW); // Turn off Green LED

digitalWrite(buzzerPin, LOW); // Turn off Buzzer

total += price;

count\_prod++;

delay(500); // Delay for stability

displayTotal();

}

void removeItem() {

if (count\_prod > 0) { // Check if there are items to remove

// Get the price of the last added item

double lastItemPrice = items[count\_prod - 1].price;

total -= lastItemPrice; // Subtract the price of the last item from the total

count\_prod--; // Decrement the count of total items

digitalWrite(greenLedPin, LOW); // Turn off Green LED

digitalWrite(redLedPin, HIGH); // Turn on Red LED

digitalWrite(buzzerPin, HIGH); // Turn on Buzzer

delay(1000);

digitalWrite(redLedPin, LOW); // Turn off Red LED

digitalWrite(buzzerPin, LOW); // Turn off Buzzer

displayTotal();

}

}

void displayTotal() {

lcd.clear();

lcd.setCursor(0, 0);

lcd.print("Total items: ");

lcd.print(count\_prod);

lcd.setCursor(0, 1);}

# REFERENCES

[1] [L. B. Ayre, *RFID in Libraries: A Step Toward Interoperability*. American Library Association, 2012.](http://paperpile.com/b/iX5mGJ/MnUP)

[2] [P. Reyes, *RFID in the Supply Chain*. McGraw Hill Professional, 2011.](http://paperpile.com/b/iX5mGJ/0kAQ)

[3] [K. B. Prakash, J. Nayak, B. tp Madhhav, S. Padmanaban, and V. E. Balas, *Big Data Analytics and Intelligent Techniques for Smart Cities*. CRC Press, 2021.](http://paperpile.com/b/iX5mGJ/AbvQ)

[4] [K. Finkenzeller, *RFID Handbook: Fundamentals and Applications in Contactless Smart Cards, Radio Frequency Identification and Near-Field Communication*. John Wiley & Sons, 2010.](http://paperpile.com/b/iX5mGJ/N0Zw)