RFID Based Shop Billing Machine using Raspberry Pi

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Abstract - *Today's world is inventing more and more technical solutions to make human life easier than it already is with every passing moment. By creating a smart billing machine that takes care of comfort while shopping is another step taken in the same direction. As we go for shopping in any mart or malls, we observe the long and long line waiting to pay the bill. For such type of systems, usually, the barcodes are being used for so long time. It consumes very much of time as we have to scan every item. Also for the scanning purpose, line of sight communication has to happen, whereas the RFID can be read without a line of sight. An RFID reader can access the information of the tag from a distance of around 300 feet, whereas barcode technology cannot be read from a distance of more than 15 feet.*

Barcodes and RFID are similar in that they are both data collection technologies, if compared, RFID technology is found to be more comprehensive than barcode technology.

Key Words: *RFID,* **Raspberry Pi,** *Python.*

1. INTRODUCTION

Electronic Commerce has become extremely popular with the rise in wireless technologies and other communication techniques. Purchasing and shopping in big malls are becoming a daily activity in metro cities. There is a huge rush in such places during weekends and holidays. People purchase different items and put them in trolley. After completion of purchases, one needs to go to the billing counter for payments. At the billing counter, the cashier prepares the bill using bar code reader which is a very time-consuming process and results in the long queue at the billing counter. A smart product is the one that aids comfort, convenience, and efficiency in everyday life. In this paper, we discuss an innovative concept of Intelligent Smart Shopping and Billing. The key idea here is to assist a person in everyday shopping in terms of reduced time spent while purchasing a product. The main goal is to provide a technology oriented, economical, easily scalable, and rugged system for ease of his activity. The barcode technology needs the direct line of sight to read; sometimes it is unable to scan as well. So this problem will be overcome by using RFID technology. The aim of the project is to create a convenient and user friendly environment for the customers. It also aims to intelligently coordinate all appliances communicating together, thereby ensuring greater comfort of purchasing things. In our approach, the RFID tags will be given to the customers. And the material they require will be written to the card. And once they done with shopping, they will go to the billing system where the reader will generate appropriate bill. The results of this project will be the Bill will be generated by just putting the RFID card on the reader which is interfaced with Raspberry Pi.

Table 1.1.1 Specifications of System

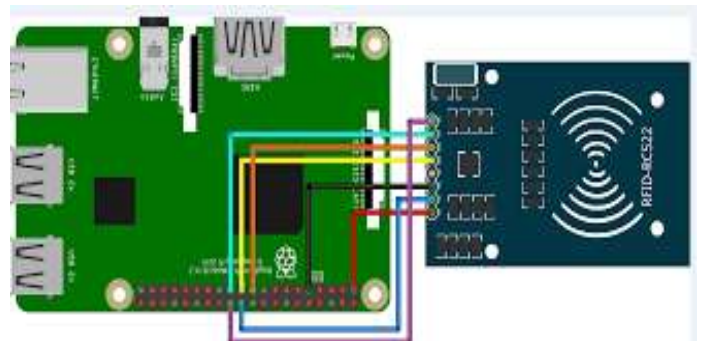| Sr.No.	Description	Specification
1	Raspberry Pi	3B+
2	MFRC522	Reader & Writer
3	RFID Tag	Passive
4	Display	7" or Monitor
5	Software	Python 3.7

2.1 Interfacing

FIGURE 2.1 INTERFACING OF SYSTEM

2.1 DETAILS OF ARCHITECTURE

2.1.1 Raspberry Pi

FIGURE 2.1 Raspberry Pi

Raspberry Pi is a compact board which has no. of ports to interface other peripherals like USB, HDMI mouse, and keyboard. Just by connecting the peripherals we can replace the whole CPU by this tiny board. It works on the ARM11 processor. The procedure for setting up the Raspberry Pi is as follows:

1. First of all format the microSD card by using the software SD formatter.

2. Download the Raspberry Pi's operating system image file.

3. Burn it on the MicroSD card using Win32Disk Imager.

4. After burning, remove the SD card from the laptop and insert it in Raspberry Pi.

5. By powering on, it will start boot and will display the options.

6. In this, we have to enable the SPI and I2C mode.

7. We have to enable Wi-Fi connection for accessing the internet for updating and downloading the libraries.

By using these steps, we can set up the raspberry Pi.

Also we can go for another settings.

2.1.2 RFID Module RC522

FIGURE 2.2 RC522 Module

Table 2.1.1 Pin connections of RC522 to Raspberry Pi

RC522 Header	Pi Header	Notes
3.3V	1	3.3V
RST	22	GPIO25
GND	6	Ground
IRQ	–	Not connected
MISO	21	GPIO9
MOSI	19	GPIO10
SCK	23	GPIO11
SDA	24	GPIO8

- Voltage: DC 3.3V

- Operating Current :13-26mA

- Idle Current :10-13mA

- Operating Frequency: 13.56MHz

- Supported card types: mifare1 S50, mifare1 S70.

- Dimensions: 40mm × 60mm

- Module Interface SPI Data Transfer Rate: Max. 10Mbit/s

- Card reading distance ：0～30mm.

For communication of two devices i.e. RFID card and Raspberry Pi, the Reader and Writer interface is MFRC card. NFC stands for Near Field Communications. These are mainly used for contactless payments, RFID based attendance systems, etc. NFC is a peer to peer technology which works on short-range wireless systems which operate at 13.56 MHz and the approximate baud rate is 106 kbit /s to 424 Kbit/s. By fetching the data written on the RFID card, we can generate the bill by using some software interfaces.

2.1.3 RFID Tags

RFID is nothing but Radio Frequency Identification. RFID uses electromagnetic fields to identify and track tags attached to objects. The tags contain electronically saved information. There are two types of RFID cards. The first is passive and second is the active card. The passive tags do not need any power supply for its operation; whereas active tags need the power supply for reading and write operations.

2.1.4 Display

The Display performs the intimidator role with this system. We have designed the program in python to provide the GUI (graphical user interface). We can connect the touch screen display or a monitor. It supports both the hardware. To add and remove the purchased items, it will be easier to use display. If the touchscreen is being used, we have to take care that the drivers of the display must be available, unless the display will not work properly.

2.1.5 Software

Any embedded system needs some program to operate in the required manner. For the raspberry pi, Raspberry, NOOBS, Ubuntu is the operating systems. From these, Raspbean is used in our system. As well as for programming of raspberry pi, Python 3.7 is used. Python is a high-level general-purpose programming language. Created by Guido van Rossum and first released in 1991, Python has a design philosophy that emphasizes code readability, notably using significant whitespace. It provides constructs that enable clear programming on both small and large scales. Van Rossum led the language community until stepping down as leader in July 2018.

3.1 Key Steps of the system
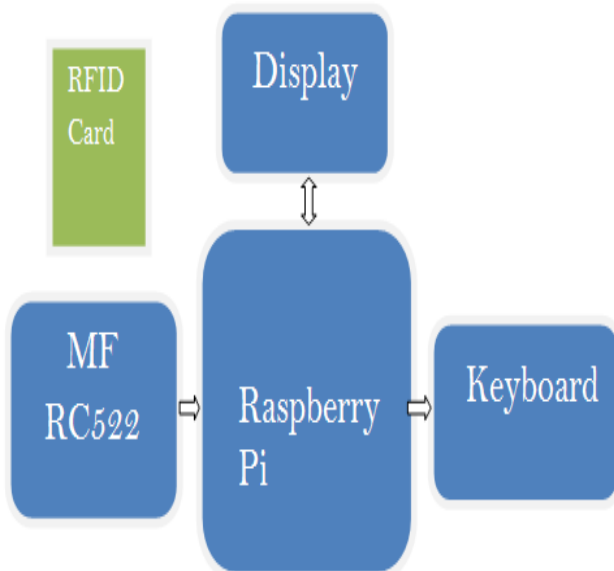
1. **Writing and reading of the Card:**

FIGURE 3.1 Key Steps of the System

The system is designed in such a way that, the person who wants to buy the product will be given an RFID card. The shopkeeper will insert one by one item on the card just by putting the tag on the RFID Module. The customer will keep this card with him till he leaves the shop. At the time of billing, that card will be again put on the reader and the final bill will be generated.

For this particular operation, we will access a web page which will be available on one web page.

By using network connections, we will be able to determine the sale of the shop. Also the requirement of particular goods in the shop. Thus because of this, we will be able to calculate the sale and purchase ratio.

3. Conclusion

This paper gives detailed design RFID based shop billing machine using Raspberry Pi. By using RFID and Raspberry Pi, we can implement this system successfully.

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