A Smart Trolley for Smart Shopping

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Abstract: *Shopping is really attractive and attractive; At the same time, standing in long queues for bills and payment processes is boring. Therefore, it is proposed to design smart trolleys that take care of shopping and billing. Through this, the customer can go directly to the shop, buy products using smart trolleys and leave the shop. He gets an e-bill through mail and can use the shop's website to check his purchase details. To realize this, We need an Arduino board, radio-frequency identification (RFID) reader, RFID tag, LCD display, ESP8266 Wi-Fi module, database manager and website to store product and customer details, which can be accessed anywhere in the world through admin. It is an IoT-based system where the trolley can communicate with the network spread across the world.*

Keywords: Shopping Trolley, RFID Reader, RFID Tag, IOT, Smart Cart, e-Billing

I. INTRODUCTION

Shopping includes going to the store, checking the products, taking products, going through the billing department, standing in a long queue, scanning the products, calculating the total amount, paying the bill by cash or credit or debit card. However, sometimes people do not enjoy it. According to the analysis, people have to struggle a lot while shopping and this makes them irritable. People want to make shopping easier and more fun. This will attract more and more customers to the shop . There is a technology called RFID (Radio Frequency Identification) that helps make your purchases easier. Although the bar code system is widely prevalent, RFID has not much advantage over the bar code system. This is shown in the Table . It Arduino uno to communicate with the Arduino UNO board, RFID readers, and send data to online databases via the Wi-Fi module. In fact, shopping is something that people love to do. He always wanted to buy new things to meet his needs and the needs of others . However, some people despise it mainly because of the crowd, long queues in the shop, billing, etc. Apart from this, they will have a tough time finding products. Sometimes, they lose the bill, because it is a physical existence. A solution has to be found. The project has been developed keeping in mind the people's struggle while buying and the shop owner should adopt emerging technology to attract more and more customers. The system has the provision of sending the billing details to the customer by mail, which lessen the worries about losing the bill.

	RFID	Bar Code
Rate of reading	More than one tag simultaneously	Single tag at a time
Read/write ability	Can read, write And modify	Only read
Line of sight	Not needed	Essential
Durability	High	Low-cannot be Read if soiled
Security	High- hard to reproduce	Low-easier to counterfeit

TABLE NO.1 RFID VS BARCODE

This is mainly to facilitate shopping, invite more customers, make shopping fun and mainly save time. Moreover, customers manage their purchase details online and stay connected with shop owners for any questions or suggestions and also do billing completely online. The main objective of this project is to facilitate the purchase of customers and reduce the number of workers in the shop to save the shopkeeper's money. Instead of barcode stickers, all products in the store must be pasted with RFID labels.The comparison of RFID with barcode is shown in Table 1. Thus, RFID

readers are being appointed to scan products for billing, send data online, store transactions in the database for future reference for the shop owner and provide e-bills to customers. The summary of this approach includes the use of RFID system to keep details of each product. Each label in the product is stored with its name, ID and price. So when the reader comes in contact with the RFID reader, he reads all the information and adds it to the cart. Once the product is selected, the customer can go to the billing area. Each customer is given their smart card, which contains their ID and their balance in the card.

II. REQUIRMENT

2.1 Hardware Requirement
RFID READER AND TAG

FIG.1 RFID READER

An RFID system generally comprises of three units; they are- an antenna, a receiver and a transponder-RF tag. The function of RFID tag antenna is shown in Figure 1. The tag is activated by receiving the radio signal emitted by the antenna. The tag communicates with the transceiver through the antenna, while the antenna has transceivers and decoders. Radio waves of different wavelengths emitted by the RFID reader. When the RFID tag appears in an electromagnetic wave, it detects the signal and decodes the data further.

ARDINO UNO

FIG.2 ARDINO

Ardino uno board is a micro controller kit that is used to get data from peripheral devices like IR sensor, RFID reader etc. The Ardino uno microcontroller board is based on the ATmega328P IC. This detect & scan RFID tag object in its path and information from the RFID reader is also processed through it.Ardino uno board consists of sets of Digital and Analogue pins that may acts as an interface to various expandsion board and other circuit. The operating voltage of Ardino uno is 5v and it can also be operated in between 6v-20v.

DC MOTOR

DC motor with appropriate torque and speed specification to ensure smooth and controlled lid movement. The motor should also be compact and lightweight to fit within the trolley's design constraints. Determine the power supply requirements of the DC motor to ensure compatibility with the trolley's electrical system. Consider factors such as voltage, current, and the integration of any necessary motor control circuit.
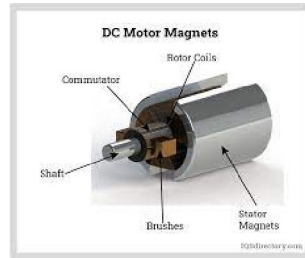
FIG.3 DC MOTOR

LCD DISPLAY

FIG.4 LCD DISPLAY

LCD displays in shopping trolleys provide valuable information to shoppers, including product details, pricing promotios, and store navigation. They enhance the shopping experience by offering features like barcode scanning, multilingual support, and real-time inventory updates. This technology improves engagement, helps shoppers make informed decisions, and allows retailers to communicate effectively with customers

2.2 Software requirement

Arduino Compile In C Programming Language

Arduino programming can be written in C or C++ programming language for the compiler which converts the programming language to binary machine code for the target processor. Minimal Arduino C/ C++ programs consist of two functions: setup function which is used to initialize variables and other libraries needed in the program. We can also initialize the input and output pin modes. After setup function, we have loop function in which function loop is executed in the main program in the repeatedly manner.
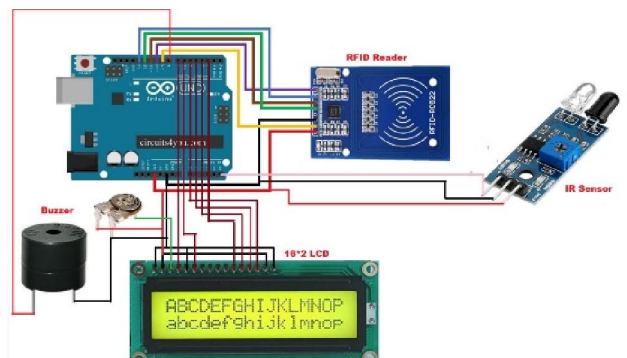
III. ARCHITECTURE

FIG.5 ARCHITECTURE OF SMART TROLLEY

IV. COMPONTENTS CONNECTIONS

- LCD Display connected to pin7 (rs), 6 (en), 2 (d4), 3 (d5), 4 (d6), & 5 (d7) which is used for displaying information to the user.

- RFID Module(MFRC522) Connected to pins 10 (SS_PIN) and 9 (RST_PIN). Used for reading RFID card information.
- BUZZER connected to pin 8. Used for providing audio feedback to the user.
- Input Pin (A5) used to trigger the scanning process.
- LiquidCrystal : Used for controlling the LCD display.
- SPI : Used for serial peripheral Interface communication with the RFID module.
- MFRC522: Used for interacting with the RFID module and reading RFID card information.

V. SYSTEM OVERVIEW

When scanning products, the intended system must be reliable and consistent in providing appropriate responses to operations and all details must be properly sent to the online database. We propose a smart trolley system that includes scanning products for customers and completing the billing process in the trolley itself. The customer has to take the trolley, then scan his card and continue to scan the products. If you want to remove a product from the cart, then he re-scan. Once all the products are scanned, they can go to the checkout. He will then have to scan his customer card to deduct the amount from his card. The card also has a balance check. Customers can also view the billing details in the shop's online website.

The admin or shop owner can use this system with the help of the MasterCard given to him. The authority gives the right to recharge the customer card through MasterCard. Only the master customer can recharge the card, write the product details in the product's RFID sticker, add a customer to the system, issue customer cards and maintain an online database

The proposed system is an attempt to automate the billing process in shopping malls and will be beneficial for costumers as well as shoppers in many ways. The detailed flowchart of the billing process of the system is shown in figure 2.
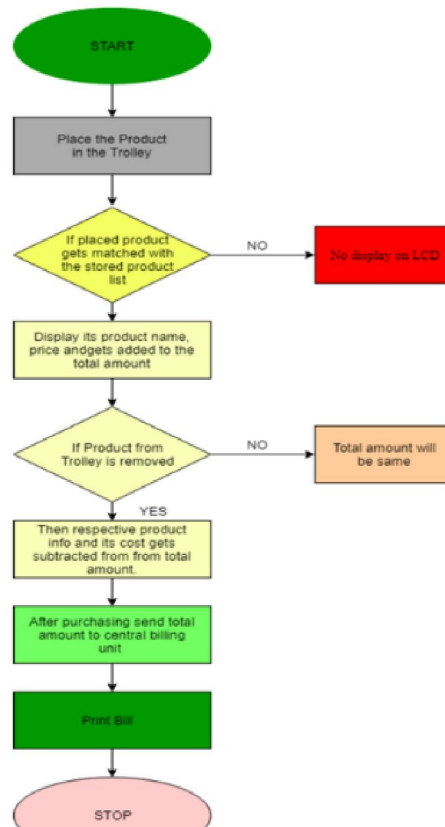

Figure 6. Flow chat of the Billing Process

VI. MODULES DEVELOPED

A. DETAILED MODULES

The development of system is carried out in following seven modules. They are as follows:

• Database management - To store product and customer details.
• Setting up Arduino with RFID reader, Wi-Fi module and keypad.
• Reading products using RFID - Scanning the products.
• Billing - To calculate total amount.

B. MODULES DESCRIPTION

Database Management:

The information about the customers as well as the master details are stored in the database. It receives information from the Arduino and saves it to the database. Additionally, the master can add customer details to the database as well.

Arduino, RFID reader and Wi-Fi integration:

The connections can be made as shown in the architecture diagram. Arduino IDE can be used to do the programming and dump it to the Arduino board. For the Wi-Fi module, the latest AT firmware has to be updated and library has to be installed. For RC522 RFID module the RC522 library has to be installed in Arduino IDE

Scanning the products using RFID:

The customer has to scan once to add products to the cart and then if he wants to remove he has to double scan the products. Once the product is scanned, ESP8266 send the product details online to add it to cart. Once double scanned, again it sends data to remove it from the cart.

VII. RESULT

The designed system has a provision to log in through the customer login page and admin login page. Once the sign-in is successful, the customer can easily keep track of the online purchase details. It also makes it easier for the seller to work using an online database. This result shows how strong the system is in the face of any problem. This is an innovative solution that benefits both the customer and the shop owner. Scan the Master's MasterCard and snapshot the functionality available to it; This includes checking the balance of a particular customer and recharging the customer card, while Figure 5 shows the customer card functionality available to the customer; They are looking at balance and buying.
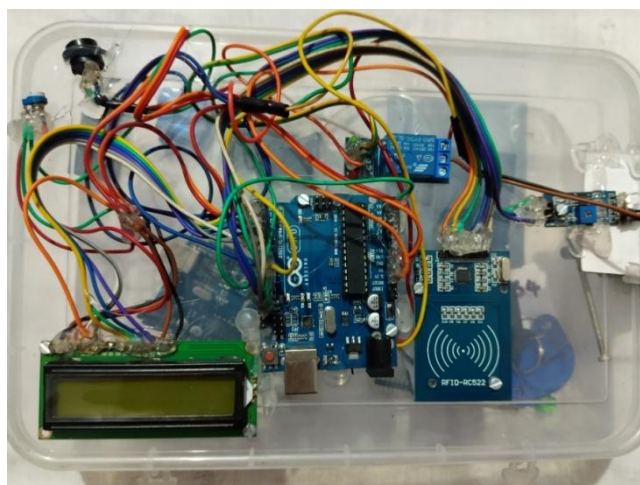
VIII. CONCLUSION

Each product in the shop have an RFID tag and each trolley is equipped with a RFID reader. Payment is made by the customer card. The smart trolley system is very efficient for both customers as well as the shop owners. This system is

robust and consistent since it can work both online and offline. People always wanted to buy new stuffs to satisfy their needs; however, some people hate it mainly because of the crowd, long queues in the shop, billing, etc. In a big shopping mall, it is very difficult to search for a particular product. In light of these, the smart trolley seems to be a better alternative for all these woos. In future, this system can be improved further by providing face recognition instead of smart cards. By this, all details are stored online with the customer's face as identity. This makes the customer come to the shop and take a trolley and do all purchasing and can walk out of the door. There is no need of customer's smart card. The bill will be sent to his mail id, and money can be deducted directly from the customer's bank account. However, smart trolley can be improved in security aspect also by providing consumers privacy and it must guarantee secure online transaction

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