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IoT Based Smart Trolley for Modern Shopping

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ABSTRACT: Conventional billing systems used in the supermarket nowadays are a big hassle for the customers as it creates a long waiting time for payment of the products purchased. To provide a solution for the above problem, we have designed an application called Smart Shopping Cart using IoT which can eliminate queues for billing throughout the supermarket. Using the application, we scan the products and then put them inside a Smart cart which is designed using Node MCU, and LCD to display the total price of the items in the cart. To make it more feasible the bill is also made available on the web server that makes it easy for the customer to check the list of items added and so they can manage the purchase.

I. INTRODUCTION

In our day-to-day life, we see that the use of computing technology and innovative applications have increased rapidly. Many people are connected to this digital world through their smartphones and laptops because of the high-speed internet connectivity, user-friendly interface, and personalized recommendation. This has made things simpler and easier.

The new technology such as social media has given the users a better and broader perspective of many items and information about various products in their daily life and ensures that they are of the best quality. As our cities are overpopulated, the diversity of wants and needs of the people are also huge. As a result, many people prefer to go to malls and supermarkets to buy different varieties of commodities. The major drawback here is the people coming to shopping malls and supermarkets are huge in number, resulting in large queues for billing. Customers have to wait for a long time in a queue for scanning their items and paying the bill.

Smart Shopping trolley using bolt ESP8266 based on IOT. The word intelligent is recently developing in the field of IOT. The term of Internet of Things is used to develop our project in efficient. Internet of things was introduced by Kevin Ashton in 1999. In simple defining is that the variety of physical appliance or sensors or actuators interconnect to send and receive the data over a internet (internet + no. of physical devices). It securely collect and transfer the data. In the real world, Every supermarket required trolley (or) shopping basket because the consumer purchase the variety number of items. So, the supermarket provide the trolley to help the consumer stored their purchased items. This product is essentially an embedded system. In this cart system helps to the consumer in reducing their purchasing time and avoids the long queue in billing section. The many technology is play virtual role in the project.

The shopping cart system consists of trolleys that are integrated with RFID readers and in all the belongings present in the supermarket an each product have RFID tag individually attached that have unique RFID number. The RFID reader attached on the trolley when the customer drop the product they want to buy into the cart that time RFID reader identify the RFID number of the product. The RFID tag describe information is stored in the database which can easily retrieving using centralized system. The many existed system was mostly using different controllers and sensors.

An automated smart shopping system is formed by introducing the concept of IoT to connect all items in the grocery shop. In this system, an inexpensive RF-ID tag is embedded within each product. When the product is placed into a smart cart, the product detail is automatically read by the cart equipped with an RF-ID reader. Hence, billing is made from the shopping cart itself preventing customers from waiting in a long queue at checkout. If any item is not scanned due to tampered bar code, we can identify that based on weight at last. Thus, inventory management becomes easier.



This system makes both the customer and supermarket employee's work easier by reducing the time it actually takes while using the old method of billing i.e., manual billing technique.

II. LITERATURE REVIEW

S. Saravanakumar, M.Tech.,(Ph.D), Ravichandran.K, Jeshwanthraj.R. "IOT Based Smart Cart with Automatic Billing for Futuristic Shopping Experience: A Review of Existing Literature." Acquiring and shopping at enormous shopping centers is winding up day by day action in metro urban areas. We can see huge surge at these shopping centers on siestas and ends of the week. Individuals buy distinctive things and place them in trolley. After fruition of buys, one needs to go to charging counter for installments. At charging counter the clerk set up the bill utilizing standardized identification per user which is extremely tedious process and results in long line at charging counter. In this paper, we talk about a item "Smart Shopping Cart" being produced to help a man in regular shopping as far as diminished time spent while buying. The primary target of proposed framework is to give an innovation situated, minimal effort, effectively adaptable, and rough framework for helping shopping face to face. [1]

1 Dr. B. Shoban babu, 2M. Mounika3 T.R. Revanth Kumar. " Smart Shopping Cart with Automated Billing Using Arduino: A Comprehensive Review." Nowadays purchasing and shopping at big malls is becoming a daily activity in Smart cities. This project targeted to reduce the Queue at a billing counter in a shopping complex. The system does the same by displaying the total price of the product kept inside the cart. In this way the customer can directly pay the amount at the billing counter and leave with the commodities he/she has bought. Since the entire process of billing is automated it reduces the possibility of human error substantially. Also the system has a feature to delete the scanned products to further optimize the shopping experience of the customer. The hardware for the test run is based on the Arduino platform and GSM modules, as both are very popular in small-scale research and wireless automation solution. [2]

Swetha k b1, Abhishek g2, Ruthvik t3, Meghana b n4. " Survey on Smart Shopping Cart: A Literature Review." A huge crowd in the supermarket at the time of weekends or discount times makes trouble to wait in long queues because of the barcode-based billing process. In this regard, the Internet of Things (IoT) based Smart Shopping Cart is proposed which consists of Radio Frequency Identification (RFID) sensors, Arduino microcontroller, Wi-Fi module, and Mobile application. RFID sensors depend on wireless communication. One part is the RFID tag attached to each product present in the store and the other is RFID reader that reads the product information. This experimental prototype is designed to eliminate the time-consuming shopping process and quality of services issues. [3]

Anusha B.G, Dr Nagaveni V. " A Review on Smart Cart Shopping System Using IOT: Nowadays shopping at big malls is a daily activity in metro cities. One can see a huge rush at malls on holidays and on special discount days. People purchase different items and put them in trolleys and go to billing counter for payments. In that time, they have to wait in a long queue to get their products scanned using RFID reader with help of barcode scanner and get their billed. To modify that customer has to purchase in smart way in shopping malls. Each and every product is attached with a RFID tags, when placed into a smart shopping cart, can be automatically read by a cart equipped with a RFID reader, so that the billing can be conducted from the shopping cart itself.[4]

Saurabh Shrivastav1 " Internet of Things Based Smart Shopping Cart using RFID Tag: Time is most valuable in everyone's life, no one wants to waste their time. But while shopping everyone wastes most of the time at the billing counters by standing in a queue. Therefore, the main aim of the smart shopping cart is to reduce the shopping time. The main aim is to satisfy the customer and reduce the time spent on the billing process which is very hectic and time-consuming. This paper focuses on reducing the queue at a billing counter in a shopping complex. In this way the customer can directly pay the amount at the billing counter and leave with the belongings he/she has bought. The hardware for the test run is based on the Cloud platform and the RFID reads and RFID tags, as both are very popular in small-scale research and wireless automation solutions. Keywords: Smart cart, RIFD, Wi-Fi, Microcontrollers.[5]

III. OBJECTIVES

(1) To also provides the centralized and automated billing system using RFID. This model is reasonable and profitable smart shopping cart handled by the IOT innovations. The primary goal is to provide a technology oriented, time saving and commercial oriented system for enhanced shopping experience. (2) To The objective of this project is to design and



develop a prototype of an automated motorized shopping cart, capable of trailing shoppers along with the extensive ability to avoid obstacles with its built-in intelligence.

IV. BLOCK DIAGRAM

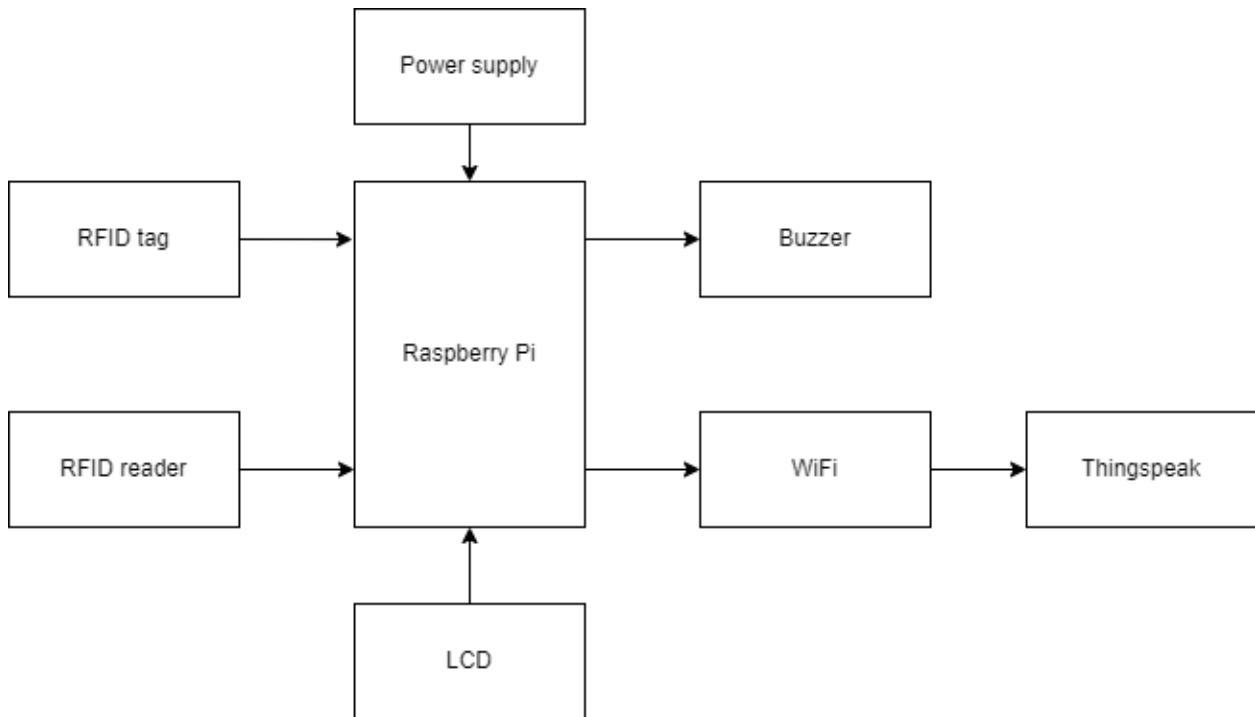


Figure: Block diagram of the project

V. HARDWARE DISCRIPTION

I) Raspberry Pi

1)Description:

Raspberry Pi 3 Model B+ is a single-board computer developed by the Raspberry Pi Foundation. It is a credit-card-sized computer that can be used for a variety of tasks, including programming, media center, and home automation. The 3B+ model features a 1.4GHz 64-bit quad-core ARM Cortex-A53 CPU, dual-band 802.11ac wireless, Bluetooth 4.2/BLE, faster Ethernet, and Power-over-Ethernet support (with separate PoE HAT).

2) Diagram:



Figure: Raspberry Pi

3) Features:

i. The Raspberry Pi 3 Model B+ has the following features:

ii. Broadcom BCM2837B0, Cortex-A53 (ARMv8) 64-bit SoC @ 1.4GHz CPU.

iii. 1GB LPDDR2 SDRAM.

iv. Dual-band 802.11ac wireless LAN and Bluetooth 4.2/BLE.

v. Gigabit Ethernet port.

vi. 4 USB 2.0 ports.

vii. 40-pin GPIO header for interfacing with other devices.

viii. 3.5mm audio jack.

ix. microSD card slot for loading the operating system and storing data.

x. 5V DC via micro-USB connector (minimum 2.5A).

xi. Supports a variety of operating systems, including Raspberry Pi OS, Ubuntu, and others.

xii. Dimensions: 88 x 58 x 19.5 mm.

xiii. Weight: 46 g.

These features make the Raspberry Pi 3 Model B+ a versatile, low-cost computer that can be used for a wide range of projects and applications, including home media centers, game consoles, retro gaming machines, Internet of Things (IoT) devices, and more.



4) Working:

The model B+ stays ahead in terms of processing speed and comes with an improved wireless capability. The dual-band Wi-Fi 802.11ac runs at 2.4GHz and 5GHz and provides a better range in wireless challenging environments and Bluetooth 4.2 is available with BLE support.

The top side is painted with metal shielding, instead of plastic in the earlier models, that acts as a heat sink and drains the excessive amount of heat if the board is subjected to the high temperature or pressure. This B+ model is three times faster than Pi 2 and 3 which is a major development in terms of speed, capable of executing different functions at a decent pace.

The ethernet port comes with 300 Mbit/s which is much faster than earlier version with 100 Mbit/s speed. It is known as gigabit ethernet based on USB 2.0 interface.

Four pin header is added on the board that resides near 40 pin header. This allows the Power over Ethernet (PoE) i.e. provides the necessary electrical current to the device using data cables instead of power cords. It is very useful and reduces the number of cables required for the installation of a device in the relevant project. PoE works only in the presence of PoE hat.

5) Applications:

Raspberry Pi comes with a wide range of applications and works as a regular computer in some cases.

- i. Tablet Computer
- ii. Home Automation
- iii. Controlling Robots
- iv. Coffee Projects
- v. Arcade Machine
- vi. Media Streamer measurements.

II) RFID Reader EM18 Board With FTDI Basic Programmer for Serial Interfacing

1) Description:

The RFID Reader EM18 Board with FTDI Basic Programmer for Serial Interfacing is a type of Radio Frequency Identification (RFID) reader that is designed for use in various applications that require the reading and decoding of RFID tags. The EM18 board is a low-cost, compact RFID reader that uses the EM18 RFID reader module, which is capable of reading RFID tags within a range of up to 10 cm.

The FTDI Basic Programmer for Serial Interfacing allows the EM18 board to be connected to a computer or other device for the purpose of sending and receiving data over a serial interface. This interface can be used to program the EM18 board or to receive data from the RFID reader in real-time.

The RFID reader EM18 board with FTDI Basic Programmer is an ideal solution for applications that require a low-cost, compact RFID reader with a serial interface. This combination of components allows the user to easily interface with the RFID reader and read RFID tags with minimal effort, making it a useful tool for applications such as access control, asset tracking, and inventory management.

2) Diagram:

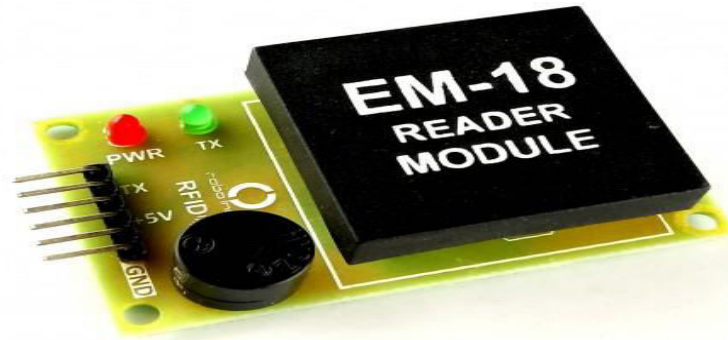


Figure: RFID Reader

3) Features:

The RFID Reader EM18 Board with FTDI Basic Programmer for Serial Interfacing typically has the following features:

- i. Compact Design: The EM18 board is compact and lightweight, making it easy to integrate into various applications and systems.
- ii. RFID Reading Range: The EM18 reader module can read RFID tags within a range of up to 10 cm, depending on the type of tag being used.
- iii. Serial Interface: The FTDI Basic Programmer allows the EM18 board to be connected to a computer or other device for the purpose of sending and receiving data over a serial interface.
- iv. Easy to Use: The RFID Reader EM18 Board with FTDI Basic Programmer is easy to use and does not require any specialized knowledge or skills.
- v. Low Cost: The combination of the EM18 board and FTDI Basic Programmer is a low-cost solution for RFID reading applications, making it an attractive option for those on a budget.
- vi. Power Supply: The EM18 board can be powered by a 5V DC power supply, making it easy to integrate into existing systems.
- vii. LED Indicator: The EM18 board is equipped with a LED indicator that provides visual feedback when a tag is being read.

4) Working:

The working of the RFID Reader EM18 Board with FTDI Basic Programmer for Serial Interfacing involves the following steps:

Powering On: The RFID reader is powered on by connecting it to a 5V DC power source and turning it on.



Reading RFID Tags: When an RFID tag comes within the range of the reader's antenna, the reader sends out an electromagnetic field that powers the tag and causes it to transmit its unique identification number to the reader.

Decoding Data: The RFID reader receives the data transmitted by the RFID tag and decodes it to obtain the tag's unique identification number.

Serial Communication: The RFID reader then communicates this information to the connected computer or device through the serial interface, using the FTDI Basic Programmer.

Processing Data: The computer or device can use the received data to perform various tasks, such as updating a database, granting or denying access, or triggering an event.

5) Applications:

Access control: The RFID reader can be used to control access to buildings, secure areas, and other environments by reading RFID tags and verifying the identity of the user.

Asset tracking: The RFID reader can be used to track the location and status of assets such as vehicles, equipment, and inventory, providing real-time information on the location and status of the assets.

Inventory management: The RFID reader can be used to automate the process of tracking inventory levels and updating stock levels, making it easier to manage inventory and reduce the risk of stock shortages.

Logistics and supply chain management: The RFID reader can be used to track the movement of goods and shipments as they move through the supply chain, providing real-time information on the location and status of shipments.

Retail: The RFID reader can be used in retail environments to track inventory levels, monitor stock movements, and automate the process of tracking sales and inventory levels.

VI. HARDWARE REQUIREMENTS

- 1) Raspberry Pi
- 2) WI-FI Module
- 3) LCD
- 4) RFID Reader
- 5) RFID Tag
- 6) HDMI Cable

VII. SOFTWARE REQUIREMENTS

- 1) Raspberry IDE
- 2) Python Programming Language

VIII. CIRCUIT DIAGRAM

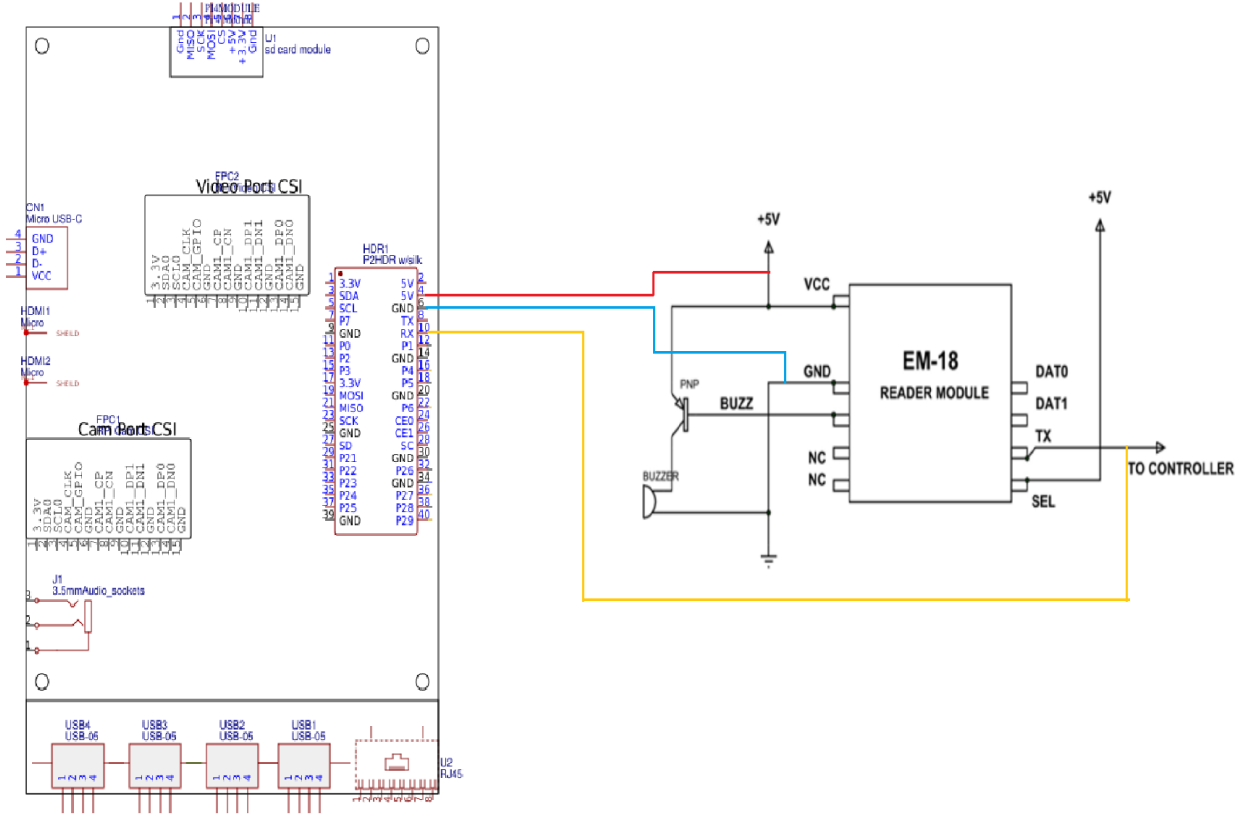


Figure: Circuit diagram

Desing steps:

Connect HDMI Cable (High-Definition Multimedia interface) of Raspberry Pi to VGA Cable (Video Graphics Array) of Desktop.

- 1) Connect Power Supply (Raspberry Pi Charger) to Raspberry Pi and AC Mains.
- 2) Connect the Keyboard to USB port.
- 3) Connect the Mouse to another USB port.
- 4) Connect VCC of Raspberry Pi to VCC of EM-18 Module Reader.
- 5) Connect GND of Raspberry Pi to GND of EM-18 Module Reader.
- 6) Connect RxD of Raspberry Pi to TxD of EM-18 Module Reader.
- 7) Switch ON the main AC Power Supply.

IX. APPLICATIONS

- 1) Shopping malls.
- 2) Vendor shops providing smart payments.



X. RESULT AND CONCLUSION

The Smart shopping trolley making new trend in supermarket. This system creates consumer shopping easier. The existed system and proposed system main motive is reduce the consumer shopping time, avoid the much time spent at the billing counter and the customer knowledge about their total bill amount during the purchasing. And also this system reduces number of salesman in billing counter. In this cart system, we can introducing bolt ESP8266 device, because it is use to monitor and controlling your system in easily compared to other IOT devices. Bolt is advanced version of IOT platform. Bolt is not use any transmitting sensor and device, because it transmitting the information to other device through the Wi-Fi network. This cart system makes the consumer shopping in efficient and increase customer satisfaction.

The basic idea is to make shopping more easy and comfortable in the overpopulated cities. This shopping cart is built with a system that enables customer to bill their products at cart itself without standing in long ques for billing. Finally, a system named smart shopping cart is designed in which the microcontroller (node MUC) and RFID technology plays a vital role in scanning the products, preparing bill and displaying it on lcd and also uploading the same into the webserver. This helps the user to view the bill on his/her device.

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