



IOT BASED SMART SHOPPING CART USING NODE MCU AND RFID

¹Saksham Singh, ²Abhishek Dadhwal, ³Shashikant Tomar, ⁴Shivi Saxena, ⁵Mrs. Shweta Bhatia, ⁶Dr. Seema Malik

¹Under Graduate Student, ²Under Graduate Student, ³Under Graduate Student, ⁴Under Graduate Student, ⁵Assistant Professor (Dept. of Electronics and Communications), ⁶Head of the Department (Dept. of Electronics and Communications)

HMR Institute of Technology and Management, New Delhi, India

Abstract: We all have waited in a queue for payment in shopping malls and other places, it's very tiring and wastes a lot of time in the billing process. Today we will build a smart shopping cart with an automatic billing system that not only reduces the waiting time but also makes the process very smooth and easy. Here we use RFID cards and RFID readers with NodeMCU to build the Smart Shopping Cart. The cart information and total value will be displayed on the webpage as well as on LCD. Each RFID card is associated with a certain product and an RFID reader is installed in the cart, which reads the product details like Price and Product details and sends them to Node MCU ESP 8266. Then NodeMCU process the available items and total value in the cart and send them to ESP8266 Webserver, which can be monitored on a web browser from anywhere in the world.

Keywords – IOT based Smart Shopping Cart, RFID, NODE-MCU, ESP-8266.

I. INTRODUCTION

Over the past few years, IoT has become one of the most important technologies of the 21st century. Now that we can connect everyday objects kitchen appliances, cars, thermostats and many more to the internet via embedded devices, seamless communication is possible between people, processes, and things. By means of low-cost computing, the cloud, big data, analytics, and mobile technologies, physical things can share and collect data with minimal human intervention. In this hyperconnected world, digital systems can record, monitor, and adjust each interaction between connected things. The physical world meets the digital world and they cooperate with one another in an interconnected fashion, thus this IOT based Smart shopping cart will not only provide fast and efficient alternative for conventional shopping but can revolutionize E-commerce Domain. The sensors and actuators have a significant job in IoT that empowers us to speak with the actual world. It comprises of three terms physical, keen and availability. Which defines how adroitly the sensors, microcontrollers, chip and actual gadgets, for example, actuators which interface remotely or wired to manage information with other electronic gadgets. IoT enables people to deal with their lives, business in powerful manners and give key changes to the world that can completely change business and industry. The potentialities offered by the IoT make it conceivable to create numerous applications that have a place with the business of aviation and aviation car, telecom, clinical, healthcare, independent living, Pharmaceutical, Transportation, Manufacturing, Retail, coordination and inventory network the board.

The main goal of IoT is to monitor individual items and environment remotely. This introduces electronic labels appended to singular items. When these labels become in the scope of peruses it peruses the stored information of article remotely which is known as RFID innovation. RFID assumes a vital part in the applications of IoT. It comprises of three segments such as RFID labels connected to the item that contain personality or data about an article, RFID peruser that read the information from the tags and focal preparing framework that perform communication between RFID framework to other electronic gadgets. Item urging a progressive impact on a wide scope of applications like airplane up keep, medical care, things taking care of, and inventory network the board.

II. OVERVIEW & BACKGROUND

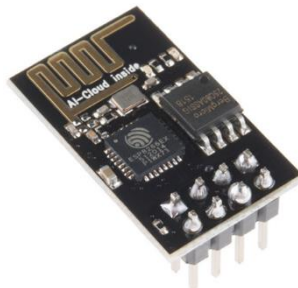
The shopping trolleys currently being used all over the world are simple carrying basket with wheels as an added facility. The trolleys do not respond in any ways to the user and just serve the person. The shopping trolley that is built in this project will enhance the shopping experience of the customer. The present shopping trolley consists of a NodeMCU and RFID reader through which the customer will be able to perform his shopping. Here each product will consist of a separate RFID tag and the tag should be swiped near the RFID reader and the product gets added to the bill. Each RFID card is associated with a certain product and an RFID reader is installed in the cart, which reads the product details like price and product details and send them to NodeMCU. Then NodeMCU process the available items and total value in the cart and send them to ESP8266 Webserver, which can be monitored on a web browser from anywhere in the world. RFID stand for Radio-frequency identification. It refers to a technology, where digital data is encoded in RFID tags and digital data is encoded in RFID tags and decoded by an RFID reader using radio waves. RFID is similar to barcoding in which data from a tag is decoded by an RFID reader device. The RFID technology is used in various applications like inventory management, door lock system, access to restricted area, etc. EM18 Reader is a very popular RFID module that can read the ID information stored in the RFID tags. The RFID tags stored a 12-digit unique number which can be decoded by an EM18 reader module, when the tag comes in a range of the reader. It gives a serial data output and has a range of 8-12 cm. the serial communication parameters are 8 bits, 1 stop bit and 9600 baud rates.

III. TECHNOLOGY KEY TERMS

In the proposed technique the customer can deal with the most efficient way of shopping. The system consists of NodeMCU, EM-18 Reader Module and RFID tags. After the purchase of each product the information is sent to the webpage through ESP8266 Wi-Fi module. The main functional unit of this system is discussed hereafter.

1. NodeMCU ESP8266

ESP8266 is Wi-Fi enabled system on chip (SoC) module developed by Espressio. It is mostly used for development of IoT (Internet of Things) embedded applications. It employs a 32-bit RISC CPU based on the TensilicaXtensa L106 running at 80MHz (or over clocked to 160 MHz). it has a 64 KB boot ROM, 64KB instruction RAM and 96 KB data RAM [2], [6]. External flash memory can be accessed through SPI. ESP8266 module is low cost standalone wireless transceiver that can be used for endpoint IoT developments. To communicate with the ESP8266 module, microcontroller needs to use set of AT commands. Microcontroller communicates with ESP8266-01 module using UART having specified Baud rate.



2. RFID Tags

Radio frequency Identification (RFID) is a wireless identification that uses radio waves to identify the presence of RFID tags. Just like Bar code reader, RFID technology is used for identification of people, we need to optically scan the barcode by keeping it in front of reader, whereas in RFID technology we just need to bring RFID tags in range of reader. Also, barcodes can get damaged or unreadable, which is not in the case for most of the RFID. RFID is used in many applications like attendance system in which every person will have their separate RFID tag which will help identify person and their attendance. RFID is used in many companies to provide access to their authorized employees. It is also helpful to keep track of goods and in automated troll collection system on highway by embedding Tag (having unique ID) on them.



3. EM18 RFID Reader

RFID Reader is used to read unique ID from RFID tags. Whenever RFID tags comes in range, RFID reader its unique ID and transmits it serially to the microcontroller or PC. RFID reader has transceiver and an antenna mounted on it. It is mostly fixed in stationary position.

Basically, RFID systems categorized as active and passive based on how they are powered and their range.



A. Active RFID System

Active RFID tags have their own transmitter and power source (mostly battery operated). They operate at 455 MHz, 2.45 GHz, or 5.8 GHz, and they typically have a read range of 60 feet to 300 feet (20 meters to 100 meters).

B. Passive RFID System

Passive RFID tags do not have a transmitter, they simply reflect energy (radio waves) back coming from the RFID reader antenna. They operate in low frequency (~125 KHz) as well as High Frequency (~13 MHz) band and have limited read range of up to ~1m.

There are two modes of coupling for communication used in RFID as,

Inductive coupling, in which RFID reader emits magnetic field and whenever RFID tags enters the magnetic field which creates energy response from RFID tags and is detected by RFID reader. As the magnetic field drops sharply with distance, it is used for short distance applications.

Capacitive coupling, where reader emits electromagnetic waves and whenever that waves encounters RFID tags, RFID tag reflects signal containing information of ID.

RFID Reader has transceiver which generates a radio signal and transmits it through antenna. This signal itself is in the form of energy which is used to activate and power the tag.

When RFID tag comes in range of signal transmitted by the reader, transponder in the tag is hit by this signal. A tag draws power from the electromagnetic field created by reader. Then, the transponder converts that radio signal into the usable power. After getting power, transponder sends all the information it has stored in it, such as unique ID to the RFID reader in the form of RF signal. Then, RFID reader puts this unique ID data in the form of byte on serial Tx (transmit) pin. This data can be used or accessed by PC or microcontroller serially using UART Communication.

4. 4 PIN TACTILE SWITCH

Push-Buttons are normally-open tactile switches. Push button allow us to power the circuit or make any particular connection only when we press the button. Simply, it makes the circuit connected when pressed and breaks when released. A push button is also used for triggering of the SCR by gate terminal. These are the most common buttons which we see in our daily life electronic equipment's.



IV. COMMUNICATION WITH THE INTERNET

The communication of the EM1-8 Reader Module is done with the help of ESP8266 module which is called as WiFi module. The ESP8266 is manufactured by expressive system which is located at Shanghai in china. ESP8266EX integrates a Tensilica L106 32-bit RISC processor, which achieves extra-low power consumption and reaches a maximum clock speed of 160 MHz. the Real-Time Operating system (RTOS) and WiFi stack to be available for user application programming and development. With antenna switches, RF balun, power amplifier, low-noise receive amplifier, filters, and power management modules in-built at the SoC level, ESP8266 modules can be easily integrated into space-constrained devices, due to their small size. ESP8266 modules can work with ESP-AT firmware to provide WiFi connectivity to external host MCUs with an RTOS- based SDK that can natively run connectivity applications. In both of these operation modes, customers can take advantage of using features like out-of-box cloud connectivity, low-power operation and WiFi security support, including WPA3. This module has

a powerful enough on-board processing and storage capabilities that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area. The ESP8266 supports APSD for VoIP applications and Bluetooth co-existence interferes, it contains a self-calibrated RF allowing it to work under all operating conditions, and requires no external RF parts.

V. TECHNOLOGY INTERVENTION

The system consists of RFID cards and EM-18 Reader Module which the web page shows the products list and their prices are set to zero before adding any product. When a RFID card of particular product is put in the range of reader module the product gets added into the bill and total price is displayed.

VI. APPLICATION AREA

Shopping in the vicinity of current days sometimes involves waiting in line to induce your things scanned for checkout. This will end in an excellent deal of wasted time for patrons. What is more, the technology presently employed in checkouts barcodes – is from another era, developed in the seventies. Nowadays barcodes square measure found on nearly each item. Barcodes square measure a universal technology therein they're the norm for retail merchandise; stores that own barcode reader will method barcodes and imprint it on the products. The foremost vital issue that's concerned in barcode scanning is that the merchandise ought to be within line of sight (LOS) of the reader so as to induce the barcode imprinted on the merchandise scanned.

Smart shopping trolley application created an automated central billing system in malls. By using the NodeMCU, the product information is directly sent to billing system. So that customers no need to wait in a long queue. It is trustworthy, highly dependable and time efficiency.

VII. ADVANTAGES

- This system helps in achieving a faster billing system.
- The innovation payment method avoids the long waiting time.
- Helps the buyer to know the bill details in advance so that he can plan an affordable purchase.
- Intimate the customers about the current offers by showing pop-up the trolley screen.
- Helps in business promotions for the supermarkets by gaining more customers providing quick service.
- Easy to use and does not need any special training.
- RFID tag and reader should not be in LOS to make the system work.
- Unlike barcodes, tags can store more information.
- Moreover, it follows commands or instructions of reader.

VIII. DISADVANTAGES

- Fraud and security concerns. Given the lack of ability to inspect merchandise before purchase, consumers are at higher risk of fraud on the part of the merchant than in a physical store.
- Privacy.
- Hands-on inspection.
- Ensuring that the retailer has an acceptable privacy policy posted. For explicitly state that it will not share private information with others without consent.

IX. CONCLUSION

As the technology is increasing rapidly day by day and the time is very precious to everyone there is a need to bring significant changes in the shopping procedure which is efficient and time saving. This project "IoT based smart shopping cart", name suggests the billing technique is improved. It is less time consuming as compared to regular billing technique. It is more reliable and provides ease for shopping. Here I conclude that the proposed system is time saving i.e. faster check out process and also generated more revenue to the shopping mall as a greater number of customers check out in less time. This system reduces require number of salesmen at counter.

X. FUTURE SCOPE

The proposed smart shopping trolley system intends to assist shopping in-person which will minimize the considerable amount of time spent in shopping as well as to time required in locating the desired product with ease. The customer just needs to type the name of the product he wants to search on the android device, and the cart will automatically guide him/her to the products locations. With the help of optical sensor, motors, and motor drivers, we will make trolley in such a way that it will follow the customer which purchasing items and it maintains the safe distance between customer and itself.

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