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IoT Based Smart Shopping Cart Using RFID

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Abstract: *In today's technological age, most customers must stand in line at the supermarket to shop becauseit is a time-consuming process. Because of a barcode-based billing method, a large population in the supermarket during discount offers or weekends causes problems with long lines. In this regard, a Smart Shopping Cart based on the Internet of Things (IoT) is presented, which includes an RFID sensor, an Arduino microcontroller, a wireless communication module, and a software device are all used in this project. RFID sensors require a wireless connection. One element is the RFID tag attached to each product, while the other is the RFID reader that efficiently reads the product information. Following so, the information for each product appears in the Phone app. On the mobile application, the user can quickly change their shopping list based on preferences. The shopping information is then digitally taken as input, which generates bills automatically. This prototype is intended to speed up the buying process while also addressing difficulties with service quality. In the future, the proposed technique might be simply applied and tested in mass manufacturing in a real-world setting.*

Keywords *- IoT, RFID sensors, microcontroller, Phone App, Subsequently, digitally.*

I.Introduction

The age of sensing technologies has here. We are using smart technology in our daily lives (for example, smartphones, smartwatches, smart automobiles, and smart clothing), and we can't picture life without the internet or being online every day. The rapid advancement of technology creates new applications for sensing technologies [1]. In the sphere of IoT, the term intelligent has only recently emerged. The term "Internet of Things" is used to describe how we plan to develop our project. Kevin Ashon coined the term "internet of things" in 1999. Simply put, the internet connects a range of physical appliances, sensors, and actuators to send and receive data (internet + number of physical devices) [2]. In the internet age of Things, interactions between physical objects are a reality (IoT). Everyday objects can now be given communication and computation capabilities, allowing them to communicate with one another from any location. This has helped usher in terms of economics, finance, and the environment, while also posing enormous issues in terms of data collecting, wireless communications, and major decision. Home automation, e-health systems, wearable devices, and other Internet of Things (IoT) applications have all earned a lot of press. [3] The number of major and small shops has increased around the world as a result of expanding customer demand and spending. Customers frequently complain about insufficient product information and wasted time at the billing counters [4]. People increasingly shop at shopping malls for their daily needs, such as consumer goods and food. During special deals and festivals, the shopping mall attracts a considerable population. They used to use a calculator to calculate the price of the product and make the bill for purchase in the malls or supermarkets. It takes a long time, clients must be waiting for billing, and human error is a possibility (Fig.1). They've adopted barcode billing to combat this. In comparison to the old method, this removes both human error and long lineups for estimating product costs. It does, however, need the use of a sigh line [5].

Fig.1. A problem faced by customers in shopping malls [6]

When buyers know precisely how much they're paying, they're more ready to scrimp on brand names, and despitepaying at least 22% more, they were happy when they left the store than others who didn't. Consumers who aren't on a budget, on the other hand, are becoming more economical as a result of this actual purchase feedback. Theyspend 19 percent less on average and buy fewer name brands and less inexpensive retail brands. Aside from a distinctive feature and a scanning near the shopper, the smart grocery cart seems like any other. When a consumer tries to steal his store card, his purchase record is available on a wide range of purposes, including generating a suggested shopping list, alerting him to discounts, and reminding him about vulnerable items purchased recently.[7]

II. Radio Frequency Identification [Rfid]

Radio frequency identification (RFID) is becoming more common as a substitute for barcode systems. RFID tags or transponders are used in RFID systems to remotely store and retrieve data, enabling for automatic identification. A radio-frequency identification tag is a system that can be attached to or integrated into a good or service, animal, or human being. RFID tags with silicon chips and antennae are known as chip-based RFID tags. We've built a great shopping cart system in this paper that allows clients to maintain track of their checklist and pay at the checkout while out shopping. RFID is one of the most revolutionary technologies that will determine the omnipresent retail sales of the future. This technology provides a significant set of opportunities for customers visiting self-service stores to improve their shopping experience. Indeed, new low-cost RFID tag production techniques have evolved, making this technology increasingly viable as a potential alternative for the barcode system [7].

A. Types and Working Process of RFID

The RFID is classified into 2 types. They are, passive and active. Active tags have a battery life, but passive tagsdo not. Because of the RFID utilization of mobile devices and automatic recognition, software for smart carts hasbecome easier. RFID uses wireless networks to make the traditional retail process more efficient, transparent, andrapid [6].

B. Working Process of RFID

The information stored on a tag that can be read from up to several feet away that is affixed to an object is capturedand read by an RFID System. The tag is a microprocessor with an antenna that can be affixed to an object to allowit to be identified. The RFID reader communicates with the RFID tag using radio waves. As a result, this label need not be in the reader's direct line of sight to be scanned. Tags that act as transceivers and scanners that act astransceivers make up an RFID system as shown in Fig.2 [8].

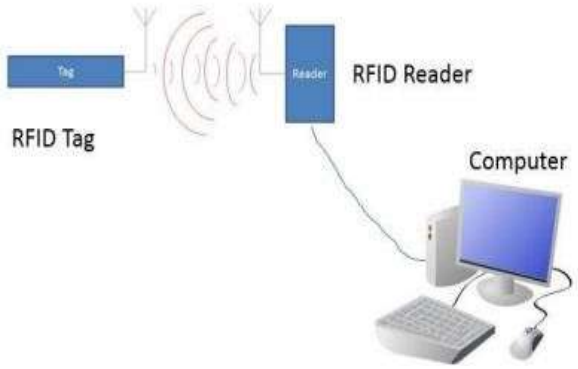

Fig. 2. Working Process of RFID [9]

III. Working Flow Of Internet Of Thinks-Based Smart Shopping Cart Using Rfid

The customer's login process into the smart shopping carts Android mobile application is depicted in the diagram below Fig.3.

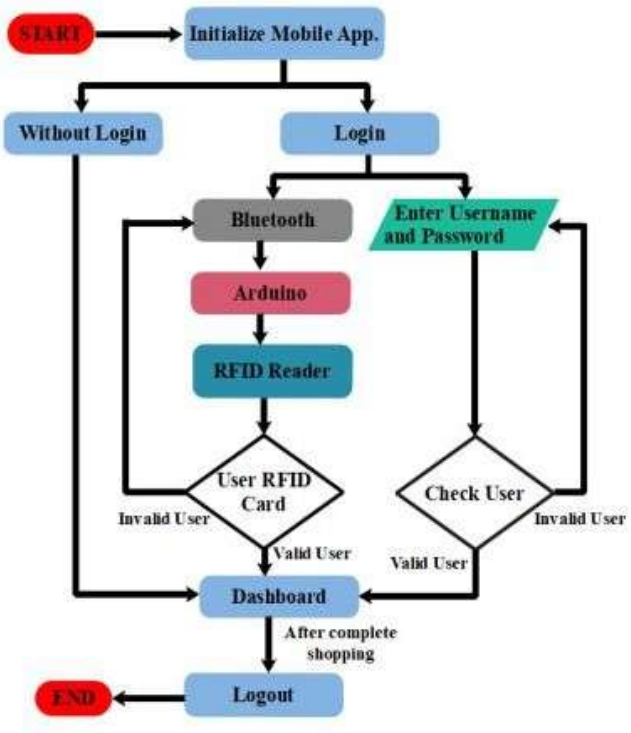

Fig. 3. Working process of RFID in shopping malls using Smart cards [10]

Users can easily deal with the system's UI user interface and utilize its many features. Customers can utilize the suggested services to find the most cost-effective item and add it to the shopping basket, with the amount includedto their final settlement. The data will be sent to the centralized server once the customer has finished their transaction. The recommended system's map would help find the goods in the mall with segmental specifications for the consumer's convenience. Using this technique, customers can purchase a more number of items in a limitedperiod of time with minimum effort. The four main components of a Smart Shopping Cart are hardware integration, graphical user, WIFI device, and network database. [10].

A. Hardware integration/ Hardware component

To finish, need the following electronic components:

1. RFID Readers

A number of online shops sell RFID devices that can read and comprehend Mifare tags. SPI is used to communicate between the microcontroller and the card reader. A 13.56MHz magnetic flux is used to communicate between the card machine and the tags.

The RFID Reader works on the basis of electromagnetic wave induction. RFID Reader emits electromagneticwaves using its built-in antenna to read RFID tags in specified limits between 0-60mm.When RFID tags are present on products that are within the RFID reader's range. It reads information from RFID tags [10].

It's utilized for inventory control and sports event timing. RFID is a complement for detecting codes from a distance, not an alternative for bar-coding. The technique is used to automatically recognize a user, a package, or an object. [11].

2. RFID Tag

RFID tags serve as data storing devices. The passive RFID tags, is don't require any battery energy and are thus significantly more efficient than active tags. When Passive RFID tags are put in a spectrum of Energies waves emitted by an RFID reader, flux is created. The chip generates power as a result of the flux in coil power.

B. SOFTWARE COMPONENT

The material and data transfer from the connection to the Phone app is governed by software applications. The Android operating system was used to create the prototype's basic mobile application.

Following payment at the checkout counter, the list of things kept in the shopping cart number can be viewed, as well as all of the items thathave been paid for. The Order ID and QR code are then sent as confirmation [11].

C. WIRELESS COMMUNICATION

The Bluetooth module makes serial wireless data transmission simple. It uses the 2.4GHz ISM frequency band, which is among the most widely used. Bluetooth 2.0+EDR is the specification that is used. The signal broadcast time of various devices is set at a 0.5-second interval in Bluetooth 2.0, which reduces Bluetooth chip stress and allows Bluetooth to sleep for extended periods of time. This module's serial interface is simple to use and speeds up the design/development process. The HC-06 is a Bluetooth class 2 slave system that contains a transparent global serial connection.

Once it is connected to a master Bluetooth device, such as a PC, smartphone, or tablet, its function becomes transparent. All received data through the serial input is immediately transferred over the air. The module receiveswireless data and sends it out via the serial interface in the same format as it was received. The HC-06 can operatefrom 3.6 to 6 volts, although the RXD pin's logic level is 3.3 volts and is not 5 volts tolerant. A Logic Level Converter is recommended to protect the sensor if it is linked to a 5V device like the Arduino Uno or Arduino Mega. [10].

D. NETWORK DATABASE

A diagram of the Central Automated Billing System is shown. Because each cart has a product identificationdevice (PID), the PID sends its data through ZigBee to a central automated billing system, which calculates the net price of the items purchased. Customers can acquire their billing information based on their Cart IdentificationNumber in the packaging section. If a customer pays their bill using a debit or credit card, there is no need for a cash collector. A product database is part of the automated central billing system. Visual basic will be used tocreate the automatic billing system. Visual Basic was created with novice programmers in mind [11].

Fig. 4. Central automated billing system [11]

The Supermarket System Is a web application that handles data processing at the cashier or administrative level. [10].

IV. Conclusion

In this article is to use RFID technology to simplify the billing process, make it faster, and boost security. The whole shopping experience will be elevated as a result of this. Various parameters, such as smart trolley system parameters such as product name, product cost, product weight, and so on, are continuously shown. As a result of the conclusion, we can conclude that,

1. Automatic product billing using RFID technology will be a more practical choice in the future.
2. The RFID-based system is efficient, compact, and has a promising performance.

3. Customers can use the technology to find and purchase the highest-quality product. As an example, the proposed technology can be easily implemented in everyday situations to aid in the purchasing process via shopping cart automation.
4. An Android application can interface with the server wirelessly to collect information from the system based on the customer RFID card for the registration and login verification or to get the information about the purchase based on product RFID tags. Customers can freely wander around the store and engage with product information thanks to its wireless information extraction feature.

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