Smart Shopping Using IOT

Pramila Dalavai*1, Samarth M Hathwar*2, Prajwal Kulkarni*3
Information Science Department , BMS College of Engineering,
Basavanagudi , Bull Temple Road , Bangalore-560019,India
*pramiladalavai@gmail.com
*samarth.hathwar@gmail.com
*prajwalkulkarni76@gmail.com

***Abstract*— Smart shopping system is the project which is developed for shopping markets. This system helps the customer to bill their products on their own. The customers can reduce their time consumption in supermarkets by using this system. The system helps the customer in many ways such as reducing time consumption, helps in estimating the bill and reduces the manpower for the owner. Till now we saw the conventional barcode scanner being used from now we can use RFID tags for scanning the products. Each bunch of products will have one unique RFID tag and the RFID reader is kept on the shopping cart so that the customer can take the RFID tag, tap on the reader and go. There will be a display where the customer can see the total bill of the products taken. A web-page will be developed to which the order summary and the bill can be broadcasted. The web-page does not directly make any communications with any hardware component, but queries and fetches information from the real-time.**

Keywords*— RFID , IOT , NODEMCU , SMART SHOPPING SYSTEM*

I. INTRODUCTION

Everyone wastes time while shopping, notably at the cashier counter, by standing in line, and time is the most valuable commodity in everyone's life. The crowds are frequently large, especially during festival season, and invoicing time will grow proportionately. As a result, the smart shopping system's primary goal is to shorten shopping time. Customers can create their own invoices, making it simple for them to estimate their bill. Smart shopping may eventually reduce the number of people working at the cash registers. This strategy can help you save money, and the money you save can be used to enhance the quality and experience of your customers. In addition, instead of counters, more products can be placed. This will be a complimentary service to the existing self-checkout system.

Because the concept was centered on technology, it was critical to obtain user feedback for which the concept was created. The goal was to look at the role of assumptions, perceptions, and expectations from retailers and their regular consumers when it came to the planned Smart Shopping System. The Smart Trolley concept is based on the most common automated self-checkout technology found in most UK stores. The proposal is based on a smaller version of an automated self-checkout system mounted on a shopping trolley with a user interface screen that allows customers to pay for things scanned and placed in the cart before exiting the store. This is done to relieve demand on the cash registers during peak hours. The Smart Trolley includes all the standard features, such as scanning an item for price and data.

Additionally, shoppers must stand in lengthy lines on weekends and during holiday seasons only to have their purchases scanned at the counter and paid. These issues are significantly reduced or eliminated as a result of this paper. The Smart Shopping Basket not only shows the total cost of the items in the cart, but it also offers a function that allows the customer to remove any item they so choose. The tiresome process of scanning the items at the counter is also done by the consumer while they are shopping, therefore the Smart cart eliminates this step as well. Since clients only need to pay the bill for the goods they purchased and bag them, this will significantly shorten the lines at the billing counters. The product has advantages for shopping centers as well because it aids them in maximizing their whole staff, which eventually leads to earnings.

Although there have been numerous attempts to update shopping carts, the goal of all of these initiatives is to use web servers and other tools to locate products in the market more quickly. Instead of not being able to select the goods of their choosing, customers' most frequent issues are going over budget and squandering time in billing lines. Therefore, it is necessary to address the most frequent issues before moving on to the more complicated ones.

This solution aims to accomplish the aforementioned in a way that is both affordable and practical, making real-time implementation possible.

II. RELATED WORK

Supermarkets and shopping malls currently use the standard barcode technique. The disadvantage is that such a device can only scan one product at a time. This takes a long time during the billing process. This is due to the "line of sight" architecture of barcode scanners, which means that goods (barcodes) can only be scanned when they are placed in a straight line with the barcode. We have identified a superior solution as a result of our efforts, which aids in optimal time management and bill creation at checkout.

Algorithm I: When the smart cart reads the product RFID tag, it performs validation of the HMAC present on the tag. If the verification is successful, the smart cart produces two symmetric keys, sl and s2, at random. s1 is used to encrypt data, while s2 is utilized to generate the message authentication code. The smart cart then adds its own ID I as well as a timestamp, to the tag information. The message is encrypted and sent to the server using the two session keys s2 and s3.

Algorithm 2: The server decrypts the message and confirms the signature and time stamp when it receives this request from the smart cart. If the message is genuine, the server searches the database for the desired information Info (TI), concatenates it with a new timestamp, and encrypts the message with sl acquired from the cart. The server also uses s2 to generate a message authentication code, which it delivers to the smart cart along with the encrypted message.

Algorithm 3: After getting the server's response, the smart cart uses s2 to check the MAC. If the MAC is valid, the smart cart uses sl to decrypt the message and checks the time stamp. If the verification is successful, the billing information on the LCD display will be updated by the smart cart.

III. PRODUCT DESCRIPTION

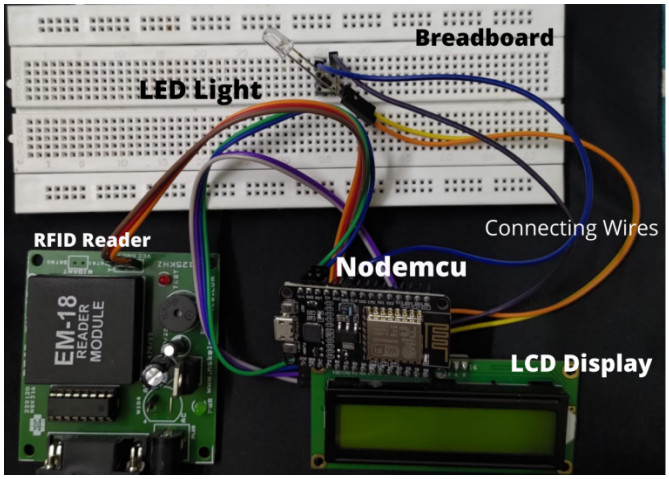

Fig: Screenshot of full module components

The aim of this project is to provide an automated billing system using RFID technology. Eliminates “line of sight” scanning, by replacing barcode scanner with RFID reader that can detect products within a certain range, and without having to scan items individually. The RFID information is processed through the microcontroller and the data is sent to the server. The server reads the request and makes necessary updates/additions to the database. The bill details are then broadcasted to the web application from the real-time and the checkout is processed.

a) RFID tag

RFID tags are microchips that hold identifying information that is broadcast wirelessly to a reader by an antenna. In essence, the chip has a serial number, similar to how barcodes function today, that uniquely identifies a certain item. RFID tags have a higher capacity than barcodes, which is a significant distinction. As a result, a greater range of data, such as information about the creator or maker, batch or lot number, weight, ownership, destination, and history, can be encoded on the tag (such as temperatures to which an item has been subjected). In fact, depending on the application, RFID tags can hold an infinite amount of other forms of data. For identifying purposes, RFID tags can be placed on individual items, cases, or 7 pallets, as well as fixed assets like trailers, containers, and totes.

b) RFID Reader

The data contained in the RFID tag is read using an RFID reader. To interrogate electronic tags via radio frequency (RF) communication, RFID readers or receivers are made up of a radio frequency module, a control unit, and an antenna. Many feature a user interface for interacting with a program. Readers can be carried or mounted in strategic areas to ensure that the tags can be read as they pass through an "interrogation zone."

c) *LCD Display*

Numbers and letters could be shown on the LCD. The name of the product, its price, the date it will expire, and the total amount will be displayed. On the LCD display, there is a complete listing of the products as well as their prices. The microcontroller is connected to up/down switches, which may be used to view all of the purchases.

d) *Buzzer*

A buzzer is a mechanical, electromechanical, or piezoelectric audio signaling device that can be mechanical, electromechanical, or piezoelectric. A buzzer is connected to the microcontroller to notify that the RFID reader has scanned the product.

e) *Wireless Card*

The Wireless Module was created to satisfy the need for a low-cost, low-power wireless device that can broadcast and receive data. The module runs at a frequency of 2. 4 GHz. The module can also function as a node in a Wireless Sensor Network (WSN).

f) *Nodemcu (esp8266 microcontroller)*

NodeMCU ESP8266 NodeMCU is an Internet of Things (IoT)-focused open-source Lua-based firmware and development board. It includes software for Espressif Systems' ESP8266 Wi-Fi SoC as well as hardware for the ESP-12 module.

IV. METHODOLOGY

A. Software Requirements

1. Arduino Software (IDE)

A text editor for writing code, a message box, a text console, a toolbar with basic function buttons, and a series of menus are all included. It connects to the Arduino hardware, allowing programmes to be uploaded and communicated with.

2. ESP8266Wifi.h Library

The ESP8266 Wi-Fi library was built using the ESP8266 SDK's naming conventions and overall functionality philosophy, as well as the Arduino WiFi library's. As the number of Wi-Fi capabilities migrated from the ESP8266 SDK to the esp8266 / Arduino grew, it became evident

that we'd have to provide separate documentation for what's new and extra.

3. *WiFiClient.h Library*

   Creates a client that can connect to the internet through the IP address and port specified in client.

4. *LiquidCrystal_I2C.h Library*

   The package includes routines for controlling I2C displays that are quite similar to those available in the Liquid Crystal library.

5. *Programming Language*

   Embedded C : An RFID receiver (installed in the trolley) and transmitter (RFID tags) use this information to map the product to the correct price based on the specified items.

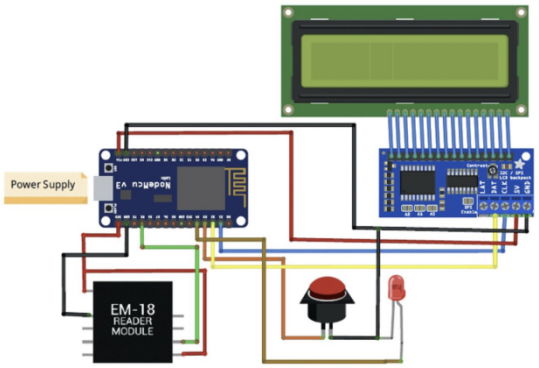

Fig: System Architecture

The above figure explains that the reader emits RF carrier pulses indefinitely and the server monitors the received RF signals for data. The existence of a tag (for the purposes of this article, only passive tags are considered) modulates the rf field, which is sensed by the reader. When enough energy is obtained from the rf field generated by the reader, the active tag collects a small fraction of the energy emitted by the reader and begins delivering modulated information. It's worth noting that data modulation (modulation for 0s and 1s) can be done via direct modulation, FSK, or Phase modulation. The reader demodulates and decodes the signals received from the tag antenna for further processing.

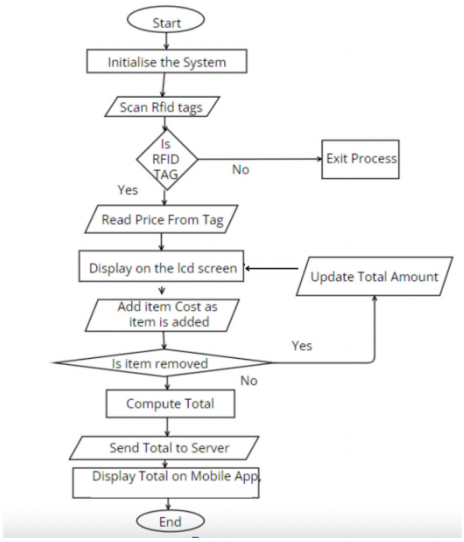

Fig: Data flow diagram

V. IMPLEMENTATION

It's time to configure NodeMCU now that the hardware configuration has been completed successfully. Include all of the necessary library files in the code, such as ESP8266WiFi. h for the ESP8266 board, LiquidCrystal I2C. h for the LCD, and Wire. h for SPI connection. Then, with the name server and default port number of 80, construct the ESP8266WebServer class object. Declare your network credentials, such as your SSID and password. The NodeMCU must be connected to the internet.

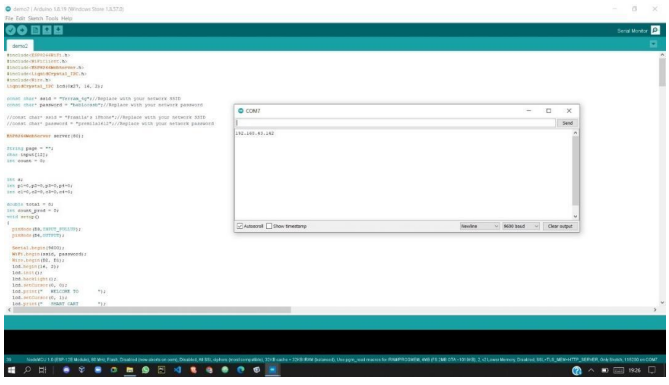

Fig: Screenshot displaying of Nodemcu connected to local server

Fig:Screenshot displaying successful ssid connection

The billing information will be presented on the LCD. The 12 digit codes on the RFID tags are decoded and stored in an array. To retrieve product information, the array's items will be matched with the memory's Stored Tag numbers. If the button is not pressed and the code is correct, the next condition is met, and the item is added to the shopping cart. The code increases the number of products in the cart and adds the price to the overall cart value. The code decreases the number of products in the cart and decrease the price to the overall cart value when item is removed.

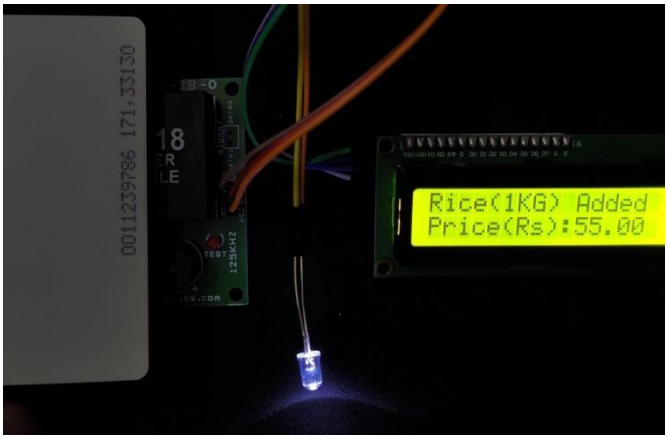

Fig:Screenshot of Item Added

VI. RESULTS

So that's how a Smart Shopping Trolley with RFID may be developed and monitored from anywhere in the globe via a web page. In the cart, an HTML table displays product details and billing information. The HTML page is saved in a string variable and returned back to the client upon request.

Fig:Screenshot of Webpage Displaying User's Bill

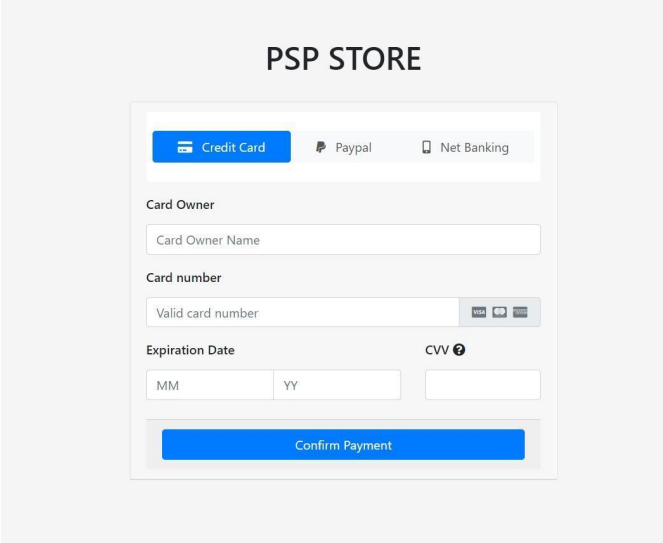

Fig:Screenshot of Payment gateway

Fig:Screenshot of QR scanner

Scan the QR code to access the webpage on mobile. The separate costs of the products are computed. Cost Values changed as per product value.

VII. CONCLUSION

The smart cart enables us to discard use of database infrastructure. Making use of NodeMCU as it was cost-effective and wireless features. In the long run, it reduces the amount of manpower required. Because the proposed system employs the over-used 2. 4 GHz spectrum, the impact of several users running at the same time, as well as any spectrum coexistence difficulties, must be investigated.

In most situations where tags are employed, a combination of the technological advantages listed justifies their use. The uses discussed range from the mundane to the bizarre. Although space constraints limit the number of cases present in this work, they have made an effort to keep them diverse. Hopefully, the variety will spark ideas and demonstrate how RFID technology may be applied to unique operational advantages.

VIII. FUTURE ENHANCEMENT

The system can successfully be demonstrated in the future where WSN may be used to create a Smart Shopping System that automates the entire invoicing process. The designed system then will be extremely robust, fair, and cost-effective. Because of the effectiveness of WSN paired with a very trustworthy Image Processing technology, it is reliant and fair. Because it uses a passive sensor and decreases communication requirements, the system is also energy constrained. The decision-making process is carried out locally within the cart, removing a communication barrier between the motes. Furthermore, no complicated routing algorithms or unicast broadcasts can be used in the application. Additionally, the current approach does not address the positioning of repeaters within a supermarket layout.

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