International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 07 | July 2021 www.irjet.net p-ISSN: 2395-0072

SMART BILLING TROLLEY

M.Shyamsunder[1], Sambaraju Bhavani [2], Mohammed Mujtaba[3], Mikkili Keerthana[4]

[1]*Assistant Professor, Department of ECE, University College of engineering, Osmania University*
[2]*Student, Department of ECE, University College of engineering, Osmania University*
[3]*Student, Department of ECE, University College of engineering, Osmania University*
[4]*Student, Department of ECE, University College of engineering, Osmania University*

Abstract - *Though almost everything is available online for purchase, a large number of people still prefer to buy many things by visiting supermarkets and malls. The traditional way of shopping that is still in implementation involves picking the things of their interest and waiting in the queue at the billing counter until it's their turn. This creates inconvenience and delay especially during festive seasons and holidays when the malls are filled with crowd. To reduce this hassle, we propose a smart billing trolley which uses RFID technology to detect and bill the products when dropped in the trolley. The product details are updated on the database providing billing details to the system in the billing counter. In this way, the customer can keep track of the bill while he can still make choices to buy and pay the bill at the counter or online while leaving without waiting in the queue.*

1. INTRODUCTION

In the world of Internet of Things (IoT), interactions among physical objects have become a reality. Day to day items would now be able to be outfitted with computing power and communication functionalities, permitting objects everywhere to be associated with one another. This has brought a new revolution in industrial, financial and environmental systems and triggered great challenges in data management, wireless communications and real-time decision making. Also, numerous security and protection issue have risen and lightweight cryptographic techniques are in high demand to fit in with IoT applications. There has been a lot of IoT experimentation on various applications such as smart homes, e-health frameworks, wearable gadgets, and so on. This project centers around a smart shopping framework based on Radio Frequency Identification (RFID) technology. All things available to be purchased are joined with a RFID tag, so they can be tracked by any gadget outfitted with a RFID reader in the store.

Items put into a smart shopping trolley (with RFID perusing capacity) can be read by default and the billing information is generated. Subsequently, clients do not have to hold up in long lines at checkout. When shopping has been done by a customer, the payment can be made at the checkout point using the billing data generated on the smart trolley.

In the current system, bar codes are used for scanning the product details where the customers tend to wait in long queue for generating the bill followed by payment. At times, the bar codes would have been damaged and that particular product cannot be scanned by a barcode scanner leading to confusion. Also, each and every product has to be scanned manually.

In order to solve the problems previously identified and save consumers time, money and help the retailers to win loyal clients, in this proposed system, each product will have a RFID tag which is bearing a unique code. This code provides the information about the product i.e. its name and price. When the customer puts the product in the Smart Trolley, the RFID reader scans the tag and the code number is generated. Radio Frequency ID reader passes the code to the NodeMCU. The name and price of the product obtained by the controller gets displayed on the webpage, where client can see the item data. To store the item price and total billing data, database system is used. The action taken by the purchaser that is inserting of an item, removal of an item, item's price and total billing cost of items in the trolley is displayed on the webpage at the billing Counter. As per the test, when putting an item into the smart trolley or expelling an item from the trolley, the smart trolley is able to precisely read it. The main objective is to provide a technology oriented, low-cost, easily scalable, and rugged system for assisting shopping in person.

2. LITERATURE SURVEY

The idea of using RFID for billing purposes is inspired from an IEEE paper [1]. Although, the implementation of this project is different from that of the one proposed in the paper. This project also aims on updating the bill on a central monitoring system apart from just displaying on the User Interface. Customers can pay their respective bills at the counter without having to scan the items again. The [2] provides assistance as to how RFID technology can help in this project and it also discusses a variety of innovative options that are possible using RFID. It provides insights on how RFID technology can replace Bar code scanners.

Customer retention is important to any retailer. Especially, effective measures are to be taken to deal with the aftermath of pandemics. This project is submitted at one of the critical times in the history, where the whole world and economy came to a pause. Quarantine and lockdowns have been implemented to mitigate the effect of the coronavirus and many other hygienic measures have been made mandatory. [4] Retailers who faced the worst business ever will be planning for resilience post Covid-19. Customers would not want to wait in long queues and closer to each other after practicing Social distancing all this while. The usage of Smart trolley would reduce the billing time significantly and help giant retailers retain their customers.

The model proposed in this paper [4] helped lay the foundation of our workt in an effective way. It also provided insights on integration of various modules and features. The existing system consists of 3 key components/modules (a) Server Communication component (SCC) (b) User Interface and display component (UIDC), and (c) Automatic billing and Inventory management component (ABIMC). SCC establishes and maintains the connection of the shopping cart with the main server. UIDC provides the user interface and ABIMC handles the billing and inventory management in association with the SCC. These 3 modules are integrated into an embedded system and are tested to satisfy the functionality. The main technological objective for our presented solution is the usage of RFID technology for the automatic product identification inside the shopping cart thus eliminating consumer intervention in the process of product reading for payment.

3. WORKING PRINCIPLE

The following block diagram is used to implement the smart billing system. The fig.1 shows the placing and modes of each component used. The flow chart describes the working mechanism of the system

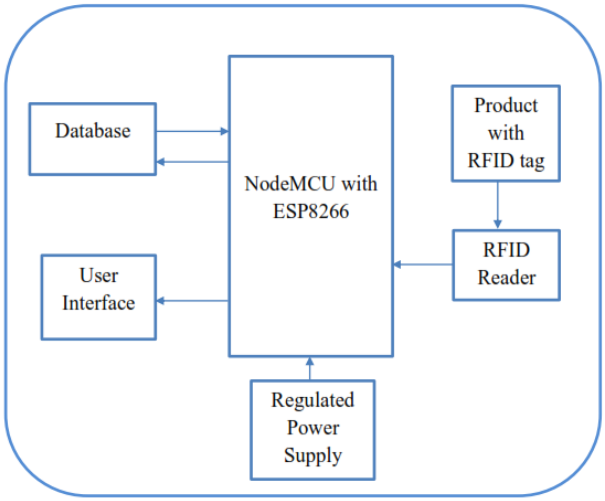

Fig.1:Block diagram of Smart billing reader

The NodeMCU acts as the main controller of the system. The remaining devices act as peripherals with input and output connections. NodeMCU is powered from a regulated power supply or through a USB cable connected to Laptop/Computer. RFID Reader can be powered from the 5V pin of NodeMCU. The ESP8266 Wi-fi module is a SoC that acts as a web server.

The RFID reader is placed on the trolley or cart into which items are dropped. The selection of reader depends on the read range/dimensions of the trolley to account for all the items dropped into the trolley and none outside the trolley. The RFID reader must be able to read all the RFID tags that are simultaneously dropped into the trolley. It reads the unique ID of the tag and transmits this data to the NodeMCU using UART communication protocol. The connection between NodeMCU and RFID reader is wired.

Every product in the mall must come with a passive RFID tag that contains a unique ID that helps retrieve the product details from the respective database. This must be taken care of, preferably during the manufacture and packaging of the item. RFID tags can be classified by the radio frequency range they use to communicate (low, high, or ultra-high), and the way the tag communicates with the reader (active or passive). Generally speaking, the lower the frequency of the RFID system, the shorter the read range and slower the data read rate.

The User Interface can be included for those customers who'd like to use their mobile phones or other electronic devices to view the bill. The URL they need to enter can be provided on the trolley in text or any electronic form. The items of a trolley are billed and displayed on that specific URL that is viewed on the trolley. This feature is easy to use ad can be extended to an application too. If they are regular customers and would like to refer to their previous orders, the order list can be stored in the database and viewed at any time. But that is out of the scope of this project. This project only provides display of the bill. Whenever an item is dropped into the trolley, its details will be displayed on the web page accessed through specified URL.

This Database block represents the storage of the details of all the products of the mall. It also represents the arithmetic unit where billing is done. A database is used to contain the details of the items brought into the mall. They are accessed with unique identification ID present o the tag of an item. This provides an efficient, swift and convenient way to display the bill. A database administrator can update the database whenever new stock is brought into the mall.

The use of a database is quite beneficial for the following reasons.

- Sharing of Data
- Data Integrity
- Data Security
- Privacy
- Backup and Recovery
- Data Consistency

Based on the ID read by the RFID reader, the NodeMCU retrieves the required product details from the respective database. This project uses MySQL to create and work on a database. The details retrieved can be displayed on the User Interface as required.

4. Methodology

The fig.2 represents the sequence of steps followed in smart billing trolley. The device is placed on the trolley with proper orientation. It is in standby mode until an item with an RFID tag is detected. Once detected, the device is triggered to run the main part of the program. The ID of the tag on the item is read by the RFID reader and the status of the Delete switch is recorded at that instant. If the switch is OFF, an item is added into the trolley by retrieving its details from the database. The item when added is displayed on the bill. For

this, a table called Bill is created and used in the same database. The details of the items added in the trolley are accessed from the stored database and are added to the table Bill. If the switch is ON, the item is scanned to be removed from the trolley and the details of that item are removed from the table Bill. Using php script file, the contents of this table (Name and price of the item) are displayed along with the total amount on the web page. This web page is refreshed for every five seconds and the contents are updated accordingly.

If by chance, a customer turns the Delete switch ON and scans an item that was not added in the trolley, this doesn't throw an error or disturb the device functionality. The customer can simply turn the switch OFF to add items into the trolley.

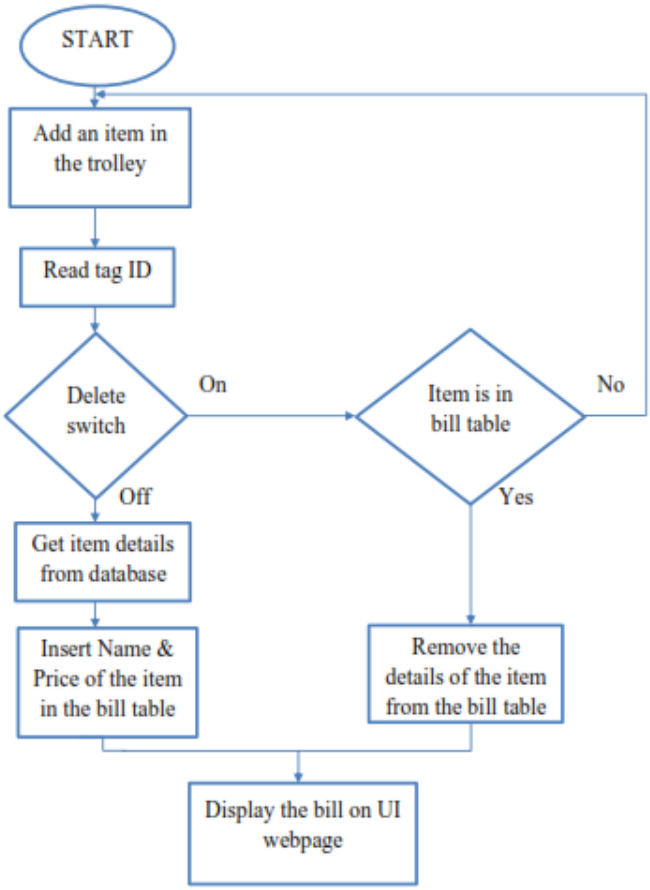

Fig.2: Flowchart of smart billing trolley

Flowchart show a clear picture of how the components are interconnected and work for the proposed system. The NodeMCU receives the tag ID from the RFID reader and uses ESP8266 to access database and webpage. The working mechanism holds advantages of being swifter and easier to operate compared to the existing mechanism followed. Also, this mechanism can be implemented in any kind of mall.

5. IMPLEMENTATION AND RESULTS

5.1 Configuration of Node MCU

The following algorithm is used to configure NodeMCU, read the RFID tag ID and post the required data onto the dedicated web page (getID). The program is written in Arduino IDE and dumped onto the NodeMCU board which executes it when supplied with power.

Step1: Import necessary libraries and define required macros.
Step2: Establish Serial connection between RFID reader and NodeMCU.
Step3: Wait until WiFi connection is established.
Step4: Wait until Serial data is available from the RFID reader.
Step5: Read the RFID tag ID and format it to send to the desired server/interface.
Step6: Make a request to the desired URL.
Step7: Based on the return code, the tag ID is successfully sent.

5.2 To fetch tag id and add data to a database

The following algorithm receives the data posted using NodeMCU and updates a table in a database dedicated for the billing of the items. In this project, we have a table named "RFID" which supposedly contains the details of all the items of a mall and another table named "Bill" which contains the details of those items that are dropped into a trolley, detected by the reader. The program/code receives the ID of the item/tag and retrieves the details of the item from the Rfid table and adds the necessary details into Bill table. It is saved as a PHP script named as "getID".
Step 1: Retrieve RFID tag ID and status and establish a database connection.
Step 2: If status is "Add", go to Step 3 else, go to Step 4.
Step 3: Retrieve the details of the item using the tag ID accessing the table named "rfid" of the database and go to Step 5.
Step 4: Delete the details with the tag ID from the table named "bill" of the database and go to Step 6.
Step 5: Insert a row of the item details into the table named "bill".
Step 6: Close the database connection.

5.3 To display the bill on a web page

The following algorithm is responsible for the actual web page that the customers interact with. It gets the data from getID web page and creates a format for the billed items to be displayed with the help of Html as well as PHP script. It is saved as "DisplayBill".
Step 1: Retrieve details of all the items from the table named "bill".
Step 2: Store the name, price, quantity of each item in arrays.
Step 3: Using html, display the elements of each array in a desired tabular format.
Step 4: Refresh the page for a desired time duration and go to Step 1 and repeat the steps.

5.4 Configuration of database

XAMPP dashboard acts as an interface between the Database Administrator and the Database.The fig.3 shows a snapshot of the XAMPP dashboard:

Fig.3: Snapshot of the XAMPP dashboard

The phpMyAdmin is a feature in the XAMPP which provides access to creating, modifying and dropping Databases. This project uses a database named "mall1" which uses two tables namely "rfid" and "bill". The table "rfid" contains a list of all the items supposed to be present in the mall. Six items are considered for demonstration and testing purposes. The table "bill" contains a list of all the items selected and dropped by the customer. The fig.4 shows a snapshot of the table named "rfid". Fig.5 showsa snapshot of the table named "bill" after entering a few items.

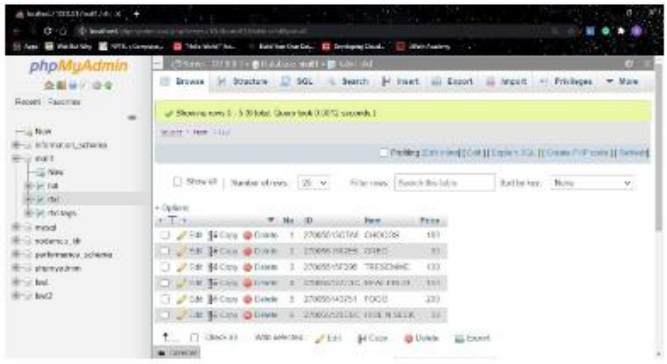

Fig.4: Snapshot of the table named "rfid".

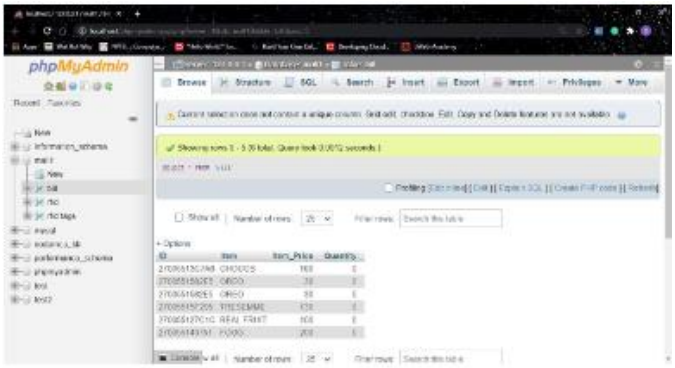

Fig.5: snapshot of the table named "bill"

The quantity column is updated during run time.

The NodeMCU is connected to the laptop and all the other connections with the components are done using jumpers. The program code is loaded in the NodeMCU and executed. The results are shown on the laptop screen along with the product's name, price and total amount.

The fig.6 shows a snapshot of how the bill looks to a customer on the UI.

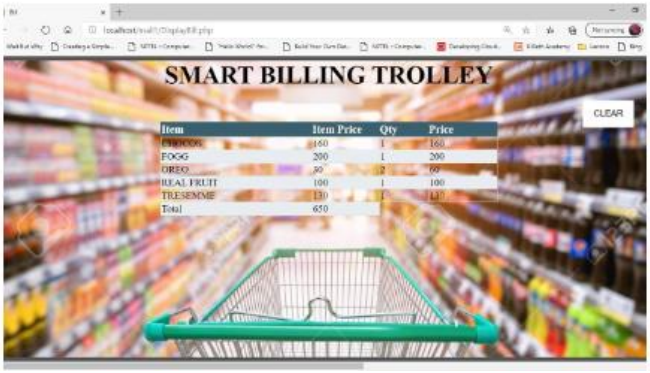

Fig.3: GUI for Bill status

6. CONCLUSIONS

Each product in the shop or a mall will have an RFID tag on it. Each Cart will have an RFID reader. There will be online payment procedure for billing. If the product is removed, it must get deleted from bill too. There must be an RFID reader at the exit door for anti-theft. Whenever the customer is done with the shopping, he/she can directly pay the amount at the counter without waiting for the manual billing as all the items are already scanned by the RFID reader placed on the cart. This proposed system does not make use of complicated routing architecture. Rather it uses simple algorithm. Model can be further extended, to prevent the loosing of the intelligence/smart shopping cart. It can be concluded that the initial cost of the model may be high but in the subsequent years the model will be beneficial as compared to the system using barcode or manual system. Further, a more advanced micro controller, larger display module and a service to pay the bill within the cart by digital payment facilities can be used, thus providing the customers better services, improving consumer experience.

REFERENCES

[1] P. Chandrasekar and T. Sangeetha, "Smart shopping cart with automatic billing system through rfid and zigbee," in Information Communication and Embedded Systems (ICICES), 2014 International Conference on. IEEE, 2014, pp. 1–4.

[2]. Santhosh Goud Sammeta; Sahith Reddy Madara, "Recent trends in RFID technologies and its impact on universities", 2018 Advances in Science and Engineering Technology International Conferences (ASET), DOI: 10.1109/ICASET.2018.8376922

[3] Raju Kumar, K. Gopalakrishna, K. Ramesha, "Intelligent Shopping Cart," International Journal of Engineering Science and Innovative Technology (IJESIT) Volume 2, Issue 4, July 2013.

Authors Profiles:

1. **Dr. Metuku Shyamsunder** has obtained his graduation from IETE and Masters in microwave from NIT Bhopal. He obtained the Ph.D degree from Osmania University (O.U), Hyderabad, India.He has 15 years of teaching and research experience. His research interests are microwave, signal processing, and embedded systems. He is currently working as assistant professor in Department of ECE, UCE (A), OU.
2. **Sambaraju Bhavani** is a Student at University College of Engineering, Osmania University Hyderabad, Telangana sate, India. She is studying in UG 4th year in Electronics and Communication Engineering. Her interesting research areas are IOT, Embedded system, Computer Networking.
3. **Mohammed Mujtaba** is a Student at University College of Engineering, Osmania University Hyderabad, Telangana state, India. She is studying in UG 4th year in Electronics and Communication Engineering. Her interesting research areas are IOT, Embedded system, signal processing.
4. **Mikkili Keerthana** is a Student at University College of Engineering, Osmania University Hyderabad, Telangana, India. She is studying in UG 4th year in Electronics and Communication Engineering. Her interesting research areas are IOT, Embedded systems and computer Networking.