Smart Trolley and Billing System

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Abstract :

The goal of this project is to improve and enhance the present supermarket cart-based sell and purchase procedure such that it is faster and more effective for both the seller and the customer. Customers now have to wait in lengthy lines at the payment counter during peak hours at their neighborhood grocery store, standing and waiting for extended periods of time. Customers have found this to be quite problematic, particularly the elderly, people with health concerns, people in a haste, and people who are carrying little children. An RFID scanning system device was mounted to a grocery cart in order to address this issue. This solution is entirely made to speed up the purchasing and checkout processes for customers, saving them time at the payment counter. This study includes a feasibility study, which aims to be an initial assessment of the data to see whether it merits moving further to the analysis stage. Furthermore, Arduino IDE were used to design the system programming. Next, Autodesk Inventor Professional 2019 software was used to create the gadget housing. Regarding its system, it is divided into two sections: one for customers and the other for retailers. The experiment's findings demonstrated how RFID grocery carts shorten customers' shopping and payment processes.

Key Words: **Customer, Development, Grocery Cart, Recommendation, RFID.**

I. INTRODUCTION

A grocery trolley, also known as a shopping cart, is a wheeled vehicle provided by a store, particularly a supermarket, for customers to use inside the establishment to move goods as they shop and make their way to the checkout counter or cashiers. Depending on the area, the term "wagon," "buggies," or "chariot" may also be used to describe this type of vehicle. They are widely utilized in practically all department stores, superstores that sell bulk goods, and grocery stores. The use of shopping carts is becoming increasingly important since they relieve customers of the stress of carrying large loads of items while navigating the store and enable them to make several, larger-sized, and heavier purchases at once. RFID grocery carts can be utilized in any type of store or supermarket, but they work best in crowded supermarkets at peak hours, on weekends, and during the holiday season when there are a lot of people shopping. It is compatible because RFID grocery carts, which use radio frequency identification (RFID) technology, can cut down on the amount of time customers spend making purchases (especially when paying and checking out), eliminate lengthy lines at checkout counters, and improve the overall shopping experience.

RFID grocery carts are made with the same precise design to function as the modern, traditional shopping carts—that is, to be as strong, practical, and adaptable. To improve the control and mobility of the grocery cart, only minor adjustments are made. Furthermore, as society moves into the Industrial Revolution 4.0 (IR4.0) age, a shopping cart equipped with an RFID technology and system satisfies the requirements for an IR 4.0 component, as it consists of two of the four primary components of IR4.0: cloud computing and the Internet of Things (IoT).

II. RELATED WORK

The literature survey phase is crucial to the system development life cycle because it gathers and gathers the data needed to manage or build a project during this stage. A description of the literature that is pertinent to a given field or topic is called a literature review. It provides a summary of the main points made, the identities of the important authors, the theories and hypotheses that are now in circulation, and the methods and approaches that are acceptable and beneficial. Research is done in this portion before beginning the project and

comprehending the many approaches that have been employed in the past. A thorough examination of the current systems was carried out. The advantages and disadvantages of the current systems were identified with the aid of this investigation.

Given that the project is an application of RFID technology, a review of the literature has been conducted on a few articles pertaining to various components and procedures or techniques. Data has been gathered from these papers in accordance with the project requirements.

People visit supermarkets to make payments and buy the goods they need on a regular basis. Therefore, the total products and total amount must be calculated. Here, self-service is used using RFID tags to cut down on labor costs and wait times. Utilizing Zigbee technology lowers low power consumption, low cost, and low data rate [1].

The goal of this study is to design a system that uses RFID reader antennas to scan both static and dynamic objects in a retail environment. Aisle-level scanning is used in place of performing RFID observations at the level of individual carts [2].

Instead of a barcode scanner, every product in this paper had an RFID tag. An LCD monitor, a Zigbee transmitter, and an RFID reader will be included in the smart trolley. When a goods is placed in the trolley, a scanner scans it and displays the product's pricing on the LCD. Radio frequency identification, or RFID, recognizes and tracks tags affixed to items automatically [3].

Problem Statement: Create a solution that will be economical and shorten the supermarket's billing process. A novel product that improves everyday comfort, ease, and efficiency is one that the public finds acceptable. In large cities, shopping and making purchases at malls has become a daily routine. Individuals buy various goods and load them into the cart. Once purchases are made, payments must be made at the billing counter. There is a lengthy line at the billing counter because the cashier prepares the bill using a bar code reader, which takes a lot of time. Time spent standing and waiting for individual turns can be better spent doing something useful. Finding the goods they need is another issue that the majority of people have. The majority of people are also having trouble learning about the current promotions that are offered for a given product. Shop owners are also quite concerned about potential theft or product take-out, which would result in additional losses.

III. RESEARCH METHODOLOGY

This chapter will provide a more thorough explanation of the steps involved in creating an RFID system for a grocery cart. Software the Arduino IDE were used to design the system's programming. The project's component and all necessary materials will also be briefly outlined.

A) Assumptions &Dependencies

The objectives of the grocery cart RFID system are:

i. Will address long lines at the counter
ii. To ensure ease of use and safety
iii. The consumer's convenience
iv. To include RFID technology into the purchasing process.

B) User Interface

Application Based Smart shopping cart system.

C) Hardware Interfaces:

A thorough analysis of each component and material utilized is necessary to guarantee the production of high-quality products. This is to prevent other types of product errors that could result in new problems and to help design the best solution to the primary issue. The goal of the study in this section is to learn more about the fundamental part of the apparatus that will enable the RFID System Device to function as intended. The following are the parts of the RFID System Device for Grocery Cart:

i. RFID RC522 Module for Arduino
ii. Node MCU Microcontroller
iii. Breadboard 800 Holes
iv. Dupont Jumper Wires M/M
v. RFID Passive Tags
vi. Rechargeable Battery

D) Software Interfaces:

1) Arduino IDE Software,

IV. ARCHITECTURE

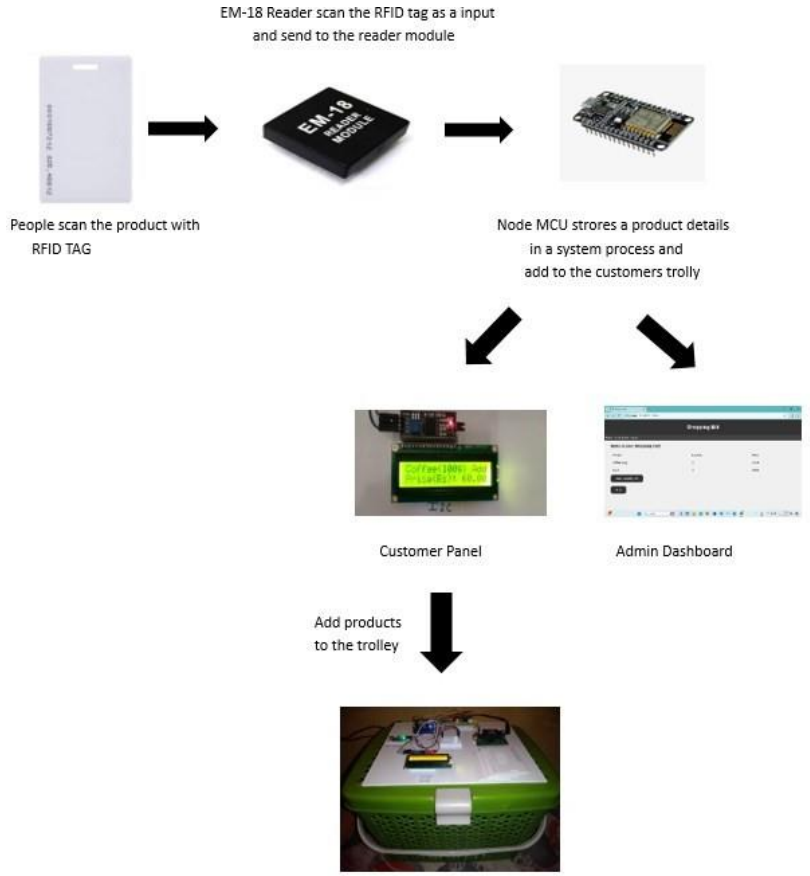

Figure 1. System Architecture

Operational Procedure of RFID System Device for Grocery Cart

1. Customer enter premises with RFID tags (can also be provide by store retailer).
2. While taking grocery cart before begin with shopping activity, customer scan their RFID tag through RFID scanner that is attached to the grocery cart.
3. RFID Reader scan information embedded in the tags and send this information to NodeMcu Microcontroller.
4. NodeMcu Microcontroller translate the information and send this information to Node.Js Database Management System Software.
5. This set up an item purchased database site which is set up exclusively for that particular customer only.

6. While moving around premises during shopping activity, customer can scan the item they wish to purchase (that have been attached with RFID adhesive tags) through the same RFID reader attached at the grocery cart.
7. Data of customers purchased item will be collected in the items purchased database and is organize and also sum up with a total price.
8. As customer are done with their shopping activity, customer can head to the cashier counter directly.

Retailer Section :

1. Customer reaches cashier counter and hand-over their RFID tags to the cashier.
2. Cashier will scan the RFID tags through a RFID reader located at the cashier counter.
3. This will command the supermarket central billing system to receive input of database from the customer's Item purchased Database.
4. Sum up of collective data with a total price that the customer need to pay will pop out at the counter screen.
5. Customer pay total amount of purchased item through cash or online services.

IV. RESULT AND DISCUSSION :

The main basic working operation of this system consist of three main part which is a purchase database management system software, a microcontroller and a RFID Reader Module, interfacing with each other.

A microcontroller is a computer present in a single integrated circuit which is dedicated to perform one task and execute one specific application. It contains memory, programmable input/output peripherals as well a processor. They run one specific program and are dedicated to a single task. They are low power devices with dedicated input devices and small LED or LCD display outputs. Microcontrollers can take inputs from the device they controlling and retain control by sending the device signals to different parts of the device. A good example is a TV's microcontroller. It takes input from a remote control and delivers its output on the TV screen.

Next, a RFID reader is Radio Frequency module and an antenna which generates high frequency electromagnetic field. It read code which is embedded in a passive generates an electromagnetic field which causes electrons to move through the tag's antenna and subsequently power the chip. The powered chip inside the tag then responds by sending its stored information back to the reader in the form of another radio signal. This is called backscatter. The backscatter, or change in the electromagnetic/RF wave, is detected and interpreted by the reader which then sends the data out to a computer or microcontroller. In this project, the module that will be used is RFID RC522 Module.

Finally, a database management system software. A database is an organized collection of data, generally stored and accessed electronically from a computer system. This collection data will be managed by a management system software that interacts with end users, applications, and the database itself to capture and analyse the data. The DBMS software additionally encompasses the core facilities provided to administer the database. The sum total of the database, the DBMS and the associated applications can be referred to as a "database system". Often the term "database" is also used to loosely refer to any of the DBMS, the database system or an application associated with the database. In this project, the database management system that will be used are Node.JS Software as it is an open-source, cross-platform, JavaScript runtime environment that executes JavaScript code outside of a browser and is easier to use.

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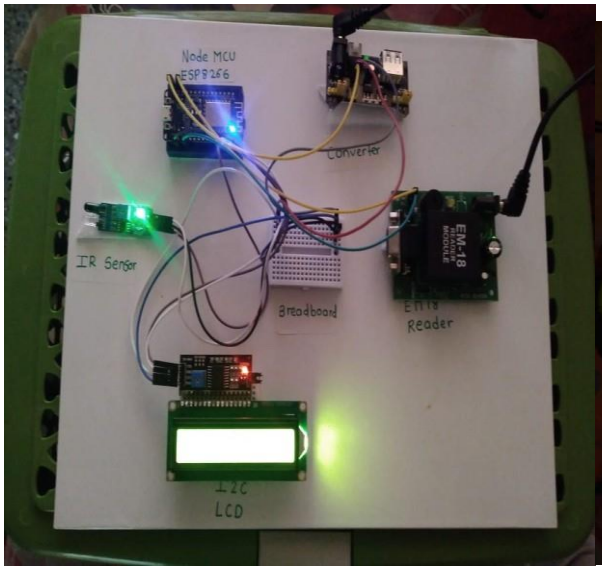

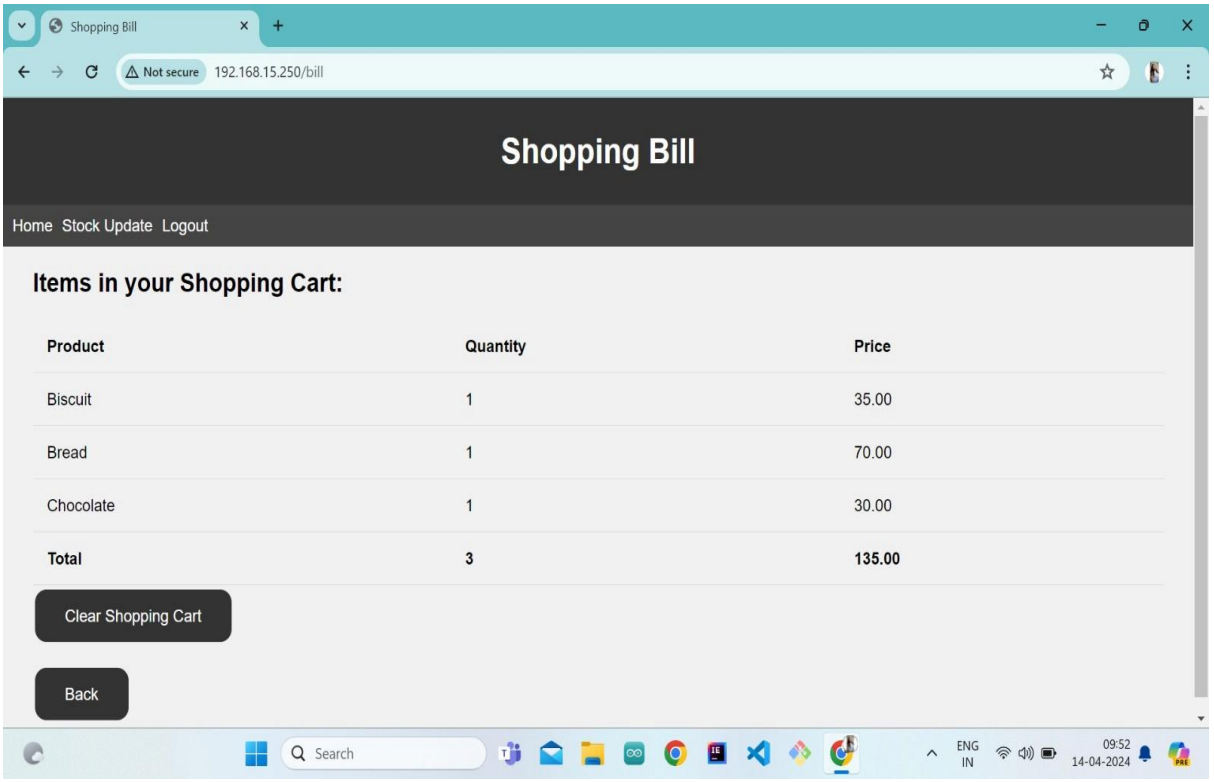

To make things short, to make the whole system work it require all three components to interface with each other by;

1. RFID reader read information embedded in passive RFID tags then send signal of information to NodeMCU Microcontroller.
2. NodeMCU Microcontoller receive input of information, translate this information and send them to Database Management System Software.
3. System collect these inputs and organize these data and sum up the total of these database wirelessly.

V. CONCLUSION

In conclusion, the main idea behind this project is to help the society by cutting short the time spent on queuing when making grocery shopping. The usual grocery cart at other related supermarkets/ hypermarkets is mainly used to store goods in the cert after shopping. By having RFID technology applied on the grocery cart, it can help both the customer and cashier when making payment, thus making the checkout process faster.

VI. REFERENCE

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