SMART SHOPPING CART: ENHANCING RETAIL EXPERIENCE WITH IOT AND AUTOMATED BILLING

Mr. Mohammed Abdul Aziz [1]

1. Assistant Professor at Dhanekula Institute of Engineering and Technology ,Vijayawada, India

M.Sowmika[2] M.Venkata Subhash[2] A.S.N.M.Vasanth[2] P.Yaswanth[2]

2.Students at Dhanekula Institute of Engineering and Technology, Vijayawada , India

Abstract:

The extravagant standard of civilization has increased, as in more and more people are crowding shopping malls. The increase in shoppers amid urban areas, especially during festive seasons and promotional sales, has become one big inconvenience with long queueing at supermarket checkout counters. Under traditional shopping methods, the customers spontaneously gather items, carry a basket or cart, and spend time standing in long bills waiting for payments; this translates into inefficiencies as far as time-wasting is concerned. To overcome some of those impediments, the study proposes the establishment of a smart shopping basket with barcode scanning and real-time billing. Although nothing new in the name, this smart shopping basket is enhancing ease of use by cutting down shopping time and completing the billing process through integration of real-time price calculation, automated billing, and IoT data transfer. By striving to revolutionize the supermarket shopping experience, this technology offers a seamless, efficient, and user-friendly alternative to traditional checkout systems.

Keywords: Smart Shopping Basket, Barcode Scanning, Automated Checkout, Supermarket Efficiency, Queue Reduction, Shopping Automation, Retail Technology, Customer Convenience.

I. Introduction:

The current shopping system struggles with the time consuming billing process and the need for trolleys with children. A project aims to reduce by putting in place an RFID-based automated billing system. The system also allows trolleys to move based on WIFI signal strength, allowing customers to shop conveniently while their children are present. This innovative solution improves the shopping experience. A network of devices having sensors, computing power, and software that communicate and share information online is known as the Internet of Things (IoT). It involves electronics, communication, and computer science engineering. With wireless networks, advanced sensors, and computational power, IoT applications provide substantial value to our lives. With billions of everyday objects equipped, IoT applications could become the next frontier. IoT home automation enables the control of domestic appliances through internet-connected systems, including heating, lighting, alarms, and security controls. This technology is primarily driven by the networked nature of deployed electronics, with devices like TVs, AV receivers, and mobile devices becoming part of the home IP network. Companies are now exploring building platforms that integrate automation with entertainment, healthcare, energy, and wireless sensor monitoring. IoT applications and cloud hosted analytics software can help facility managers manage buildings more efficiently. However, issues of building ownership, such as initial system cost and benefits collection, challenge integration. The absence of collaboration among building industry subsectors can impede the adoption of new technologies and hinder the achievement of energy, economic, and environmental performance targets.

II. Literature Survey:

The literature on automated shopping trolleys for supermarkets has limited coverage of RFID technology. Some studies have used barcodes for billing, where customers scan products using RFID technology, and the bill is forwarded to a central billing system. However, these methods have limitations such as line of sight requirements and need to be fixed within the trolley's boundary. Budic (2014) developed a cash register lines optimization system using RFID technology, which uses RFID for scanning products and stores information in a database for online or central bill payments. However, this system requires maintenance of the web application server and does not take necessary steps for products accidentally dropped into the trolley by the customer. Dhavale Shraddha (2016) applied RFID technology for billing during purchases in shopping malls, using an ESP module for wireless communication. However, there are drawbacks such as distance and interference, as well as the need for stable internet connectivity.

III. Proposed Methodologies

RFID (Radio Frequency Identification System) is a technology that uses tags to identify objects without requiring light of sight. It enhances supply chain visibility for suppliers and retailers, and improves consumer shopping experiences by increasing product availability. RFID technology is being implemented in the industry as new fields emerge with scientific advancements.

A. Barcode History

The barcode, introduced in 1932, was developed by Harvard University students. It initially used Morse code to identify products, which evolved into a bar-coding system in 1948. The technology was made public in 1967, with the first barcode being introduced on Wrigley's Gum. Today, bar code technology has expanded its applications to include various products and services.

B. RFID System

A RFID tag is a silicon microchip attached to an antenna mounted on a substrate, encapsulated in materials like plastic or glass veil. adhesively attached to objects. It communicates with the tag through a scanner with antennas, and can be reacted to by a reader or A host computer with a microprocessor or microcontroller is responsible for processing the reader's input RFIDRC522 Module.

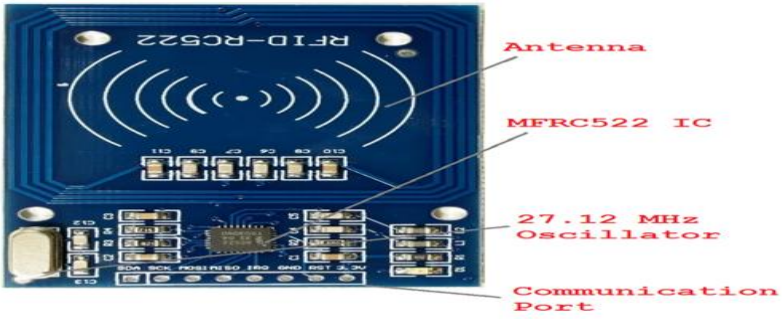

Fig 1:RFID Reader

C. Proposed Block Diagram

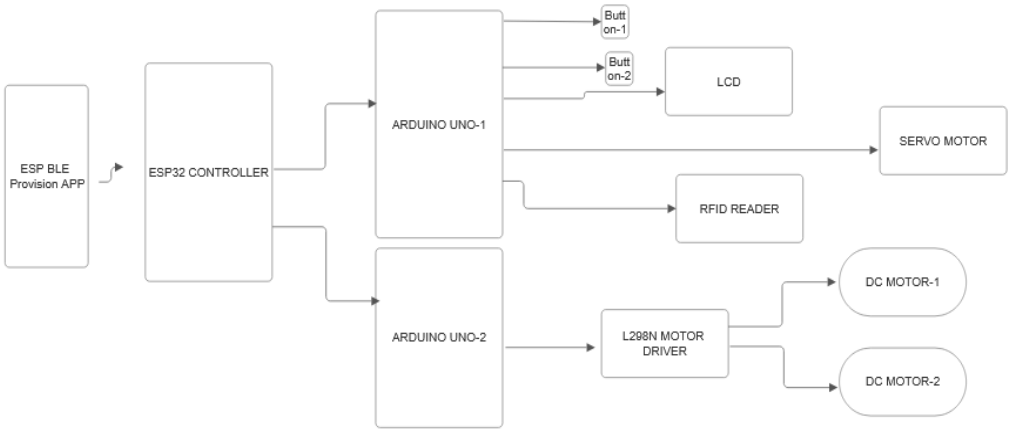

Fig.2: Block Diagram of Proposed Model

Algorithm:

Step-1: First before giving power supply check your device properly, so that to prevent power glitches which may damage your device.
Step-2: Charge the batteries fully as DC motors are drawing much current.
Step-3: Power up ESP32 controller and two arduino boards.
Step-4: Install ESP BLE Provision app on your mobile.
Step-5: Install ESP32 board manager libraries for ESP32 from ESPressif systems.
Step-6: Connect the ESP32 first, next off all the wifi connections, turn on your bluetooth and pair with prov_123.
Step-7: Dump the given first code on ESP32 and check the serial monitor to check the wifi signal values.
Step-8: Dump the other two codes on two arduino's.
Step-9: Now check it once, that when you make mobile far away from the trolley, the motors should start running or else motors should stop.
Step-10: If your mobile device is near to your trolley and wants to add things in the trollery, press the add button.
Step-11: It will ask for scanning, scan a tag at RFID reader.
Step-12: It will show item added and display the product name and price.
Step-13: Press another button to remove the product.
Step-14: Later scan the product to remove, and check the display.

D. Hardware Implementation:

Arduino is an open-source electronics prototyping platform for creating interactive objects or environments. It uses an external reference voltage to set analog input pin limits and can sense the environment through sensors. Arduino projects can be standalone or communicate with computer software like Flash, Processing, or MaxMSP. The microcontroller is programmed using the Arduino programming language and development environment.

ESP32 is a powerful microcontroller SoC by ESPressif Systems, designed for IoT, automation, wearable devices, smart homes, and industrial applications. It offers Wi-Fi and Bluetooth connectivity, making it ideal for Cloud-based IoT projects. The upgraded model of the ESP8266 module, ESP32, is manufactured in China.

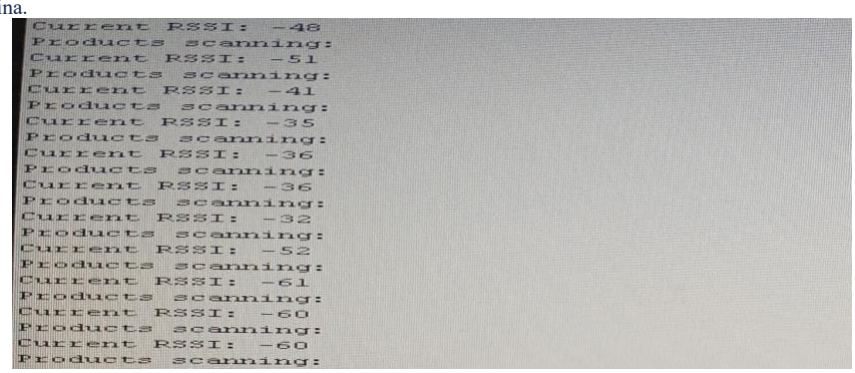

Fig.3: WIFI Signal Strength

LCD is a flat panel display that uses liquid crystals for its primary operation. LEDs, commonly found in smartphones, televisions, computer monitors, and instrument panels, have various use cases for consumers and businesses. Each pixel is made up of color or monochrome pixels arrayed in front of a light source or reflector. Each pixel has a column of liquid crystal molecules suspended between two transparent electrodes and two polarizing filters. The liquid crystals twist the polarization of light entering one filter to allow it to pass through the other.

Fig.4:LCD Connection Established

The "SMART TROLLEY - DIET" is a smart shopping trolley system. The trolley has successfully established a connection with a server, database, or user authentication system. The text formatting indicates the system is in an operational or initialization state, awaiting further input or user interaction.

The RFID tag scans an item, detecting product details. The LCD screen displays the item name, price, and total amount. As the item is added to the trolley, the total cost is automatically updated. The servo motor gently opens, allowing the product to be placed inside the trolley, ensuring a seamless shopping experience and easy tracking of purchases.

Fig.5: Product Purchase Displayed On LCD

The L298N Motor Driver Chip, featuring two standard H-bridges, is suitable for building a two authentication system. The text formatting indicates the wheeled robotic platform. It has a 5V to 35V supply system is in an operational or initialization state, range and can deliver 2A continuous current per channel, awaiting further input or user interaction. making it compatible with most DC motors.

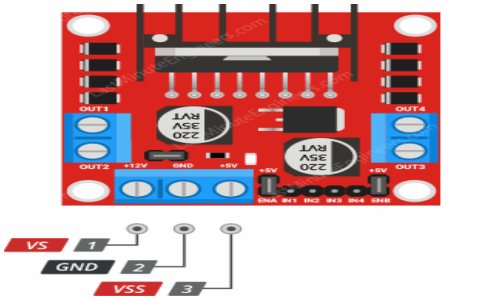

Fig.6: L298 Motor Driver Chip

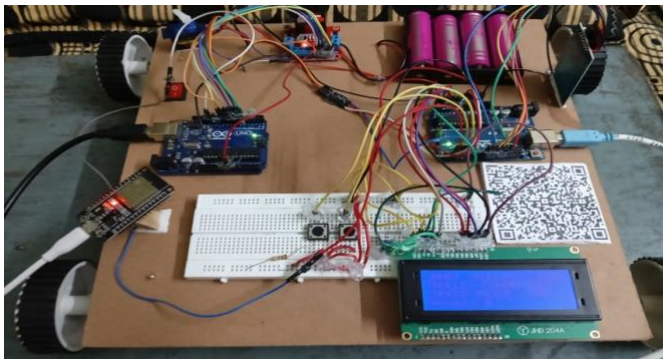
Fig.7: Results

IV.CONCLUSION AND FUTURE SCOPE

Smart trolleys are set to incorporate advanced AI, IoT, and sensor fusion techniques. They will track items using RFID and computer vision, but also integrate data from multiple sensors for higher accuracy and real-

time inventory management. This convergence will enable the cart to adapt to dynamic store environments and customer behavior more intelligently.

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