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TECH ENHANCED SHOPPING TROLLEY

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ABSTRACT- *In the modern retail landscape, the integration of technology has revolutionized traditional shopping experiences. This paper explores the concept of a "Tech□Enhanced Shopping Trolley," designed to enhance convenience, efficiency, and customer satisfaction in retail environments. The proposed smart trolley incorporates various technological features, including RFID (Radio-Frequency Identification) tagging, IoT (Internet of Things) connectivity, touch-screen interfaces, and data analytics capabilities. The primary objective of the Tech-Enhanced Shopping Trolley is to streamline the shopping process for consumers while providing valuable insights to retailers. By integrating RFID tagging, the trolley automatically scans items as they are placed inside, eliminating the need for manual scanning at checkout counters. Additionally, IoT connectivity enables real-time communication between the trolley and the retailer's inventory management system, ensuring accurate stock levels and reducing instances of out-of-stock items. The inclusion of touch-screen interfaces on the trolley provides shoppers with personalized recommendations, product information, and promotional offers based on their shopping preferences and past purchases. Furthermore, data analytics capabilities enable retailers to gather valuable insights into consumer behavior, such as shopping patterns, popular products, and peak shopping hours, facilitating informed decision-making for inventory management and marketing strategies.*

***Key Words*: ARDUINO UNO, Bluetooth, EM18 Reader, App, ID'S, Motors, L293d,**

1. INTRODUCTION

Technology is always changing the way we purchase and engage with items in the quickly changing retail industry. The Tech-Enhanced Shopping Trolley is one such invention that has the potential to completely transform the conventional shopping experience. Retailers are looking for creative ways to incorporate technology into their business practices as customers want more efficiency, convenience, and tailored experiences from their shopping experiences. The Tech-Enhanced Shopping Trolley is a combination of state-of-the-art technology designed to make shopping easier for customers and give businesses useful information about. This project attempts to reinvent the function of the shopping trolley in the retail ecosystem by introducing aspects like RFID tagging, IoT connectivity, touch-screen interfaces, and data analytics capabilities. With its potential to improve convenience, productivity, and customer pleasure in retail contexts, this introduction lays the groundwork for an exploration of the Tech-Enhanced Shopping Trolley's numerous components and features. This initiative attempts to satisfy the changing requirements and expectations of modern customers while providing merchants with actionable data to promote company success using a mix of cutting-edge hardware and software solutions. In the parts that follow, we'll explore the Tech-Enhanced Shopping Trolley's design, features, and possible advantages, demonstrating how it represents a paradigm change in how we approach shopping in the digital era. This project intends to revolutionize the idea of the shopping trolley as we know it, ushering in a new era of retail innovation and consumer involvement by utilizing technology to provide a seamless and customized shopping experience.

1.1 Block diagram For Remote Control Trolley

A remote-control trolley, often referred to as an RC cart or remote-controlled cart, is a compact vehicle used for moving supplies or objects between locations. The user may move the trolley without coming into direct touch with it thanks to its wireless remote control technology. These trolleys are frequently employed to increase productivity and efficiency in a variety of industries, including industrial plants, hospitals, and warehouses.

Control signals are sent by the transmitter to the receiver circuit, which translates them into commands and forwards them to the motor driver circuit. The motors are then under the direction of the motor driver circuit, and the motors move the trolley framework in response to commands from the remote control. Keep in mind that this is a simplified block diagram and that, depending on the particular needs and design of the remote control trolley, the real implementation may contain extra components or changes.

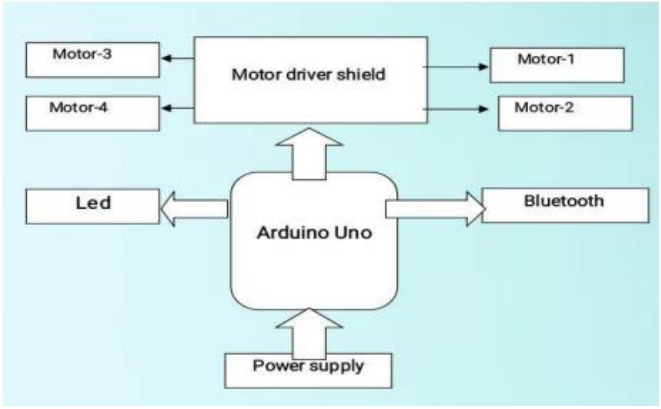

Fig-1: BLOCK DIAGRAM FOR REMOTE CONTROL TROLLEY

1.2 BLOCKDIAGRAM FOR BILLING PROCESS

Billing procedures may be automated and streamlined with the use of RFID (Radio Frequency Identification) technology, increasing their precision and efficiency. Here are some details on how billing procedures might incorporate RFID. Businesses may increase security, decrease mistakes, and improve speed in billing procedures while improving customer satisfaction by using RFID technology.

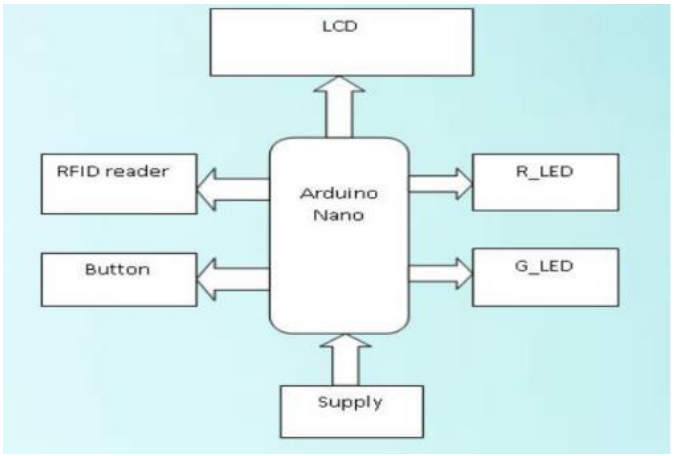

Fig-2: BLOCK DIAGRAM FOR BILLING PROCESS

2. ARDUNIO UNO

The Arduino Uno is a popular open-source microcontroller board based on the ATmega328P microcontroller chip. It's widely used by hobbyists, students, and professionals for prototyping and developing various electronic projects due to its simplicity, versatility, and affordability. Here's some information about the Arduino Uno.

1. **Microcontroller**: The ATmega328P microprocessor chip, an 8-bit AVR microcontroller clocked at 16 MHz, is the foundation of the Arduino Uno. It features two KB of SRAM for data storage, one KB of EEPROM for non-volatile storage, and thirty-two KB of flash memory for storing code.
2. **Input/Output Pins**: There are several digital and analog input/output pins on the Uno board. It features six analog inputs, a USB port for power and programming, an ICSP header, an ICSP header, a reset button, and fourteen digital input/output pins, six of which may be used as PWM outputs.
3. **Operating Voltage**: The Uno requires 5 volts to function. It may be powered by an external power source with a voltage range of 7 to 20 volts or by a USB connection.
4. **Programming:** The Arduino Integrated Development Environment (IDE), which is built on the Processing programming language, may be used to program the Arduino Uno. For both novice and expert users, the integrated development environment (IDE) offers a streamlined programming environment and an extensive library to make development simple.
5. **Open Source**: The Arduino Uno is a hardware platform that is accessible for anybody to study, alter, and distribute without restriction. This includes its design files, schematics, and source code. Because of its openness, the Arduino ecosystem has grown and it has been widely adopted.

2.1 Features

The Arduino Uno is a feature-rich, multipurpose microcontroller board that may be used for a variety of electronics applications. Here are a few of its salient attributes:

a) **Microcontroller:** The ATmega328P microcontroller chip, an 8-bit AVR microcontroller clocked at 16 MHz, is the foundation of the Arduino Uno.

b) **Pins for Input and Output**: The Uno board has 20 pins in total, 14 of which are digital. Six of these digital ports are PWM (Pulse Width Modulation) output compatible. Six analog input pins are also included.

c) **Analog-to-Digital Converter (ADC):** Because the Arduino Uno's ATmega328P microcontroller includes an integrated 10-bit ADC, it can read analog signals from sensors and other devices that are attached to the analog input ports.

d) **Memory:** The software code is stored in 32 KB of flash memory on the Uno board. Additionally, it has 1 KB of EEPROM for non-volatile data that must be kept even in the event of a power outage and 2 KB of

SRAM for variables and temporary data that are needed during program execution.

e) **USB Connection:** The Uno board has a USB Type-B connection that enables serial communication and programming when it is linked to a computer. When powered by a computer, the board is further powered via the USB connection.

3. PROBLEM STATEMENT

The retail sector is always changing, and new technology is essential to improving the shopping experience. One such invention is the RFID-enabled smart trolley, which is intended to transform the conventional billing system and expedite the checkout procedure. Long lines and disgruntled customers are frequently caused by the time-consuming manual procedures used in traditional invoicing systems in supermarkets and retail establishments. By using Radio Frequency Identification (RFID) technology to automate the invoicing process, the RFID-based smart trolley seeks to overcome these problems.

There are a number of issues with the present manual billing method, such as its inefficiency, lengthy wait times, and potential for calculation mistakes. The goal of the RFID-based smart trolley is to do away with these shortcomings and give customers a smooth and effective shopping experience.

In the traditional checkout procedure, patrons must wait in line as individual goods are scanned and the total is computed by hand. The length of this procedure, particularly during busy times, irritates and dissatisfies customers. Human mistake, such as item counting problems, price inaccuracies, or scanning omissions, can occur in manual billing systems. These mistakes may result in differences in the final charge, which will be inconvenient for consumers and store employees alike. Prolonged lines at checkout counters provide for a bad shopping experience that deters customers from returning to the store. The profitability and reputation of the store may also be impacted by this inefficiency.

4. REQUIRED COMPONENTS

- ARDUINO
- LIQUID CRYSTAL DISPLAY
- EM-18 RFID READER
- RFID TAG
- PUSH BUTTON
- MOTOR DRIVER SHEILD
- MOTORS
- BLUETOOTH MODULE
- POWER SUPPLY

4.1Arduino

The open-source Arduino UNO microcontroller board is built on the ATmega328P microcontroller from Microchip. The board, shown in Figure 2, is made up of groups of digital and analog I/O pins that may be connected to other expansion boards and other devices. There are six analog and fourteen digital pins on the board. This is the first user-friendly Arduino that is compatible with USB. The PCB had already been programmed with a boot loader. Without requiring the assistance of any related outside software developers, the boot loader enables the user to upload new code. It is programmable.

Fig-3: Arduino uno

4.2 LIQUID CRYSTAL DISPLAY

A unique form of matter known as liquid crystals (LC) combines properties of crystalline solids and liquids. These intriguing materials have organized molecular structures similar to crystalline solids and fluidity, which allows them to flow like liquids.

Liquid crystals exhibit distinct physical behavior due to their chemical configuration and ability to react to external stimuli. A key factor in the behavior of liquid crystals is their molecular makeup. These compounds, which are usually made up of rod- or disc-shaped molecules, have an intermediate structure that lies between the rigid order of crystalline solids and the unpredictability of liquids. Interesting optical and electrical features of liquid crystals are made possible by this structural configuration.

Liquid crystals come in a variety of forms, the most popular being cholesteric, smectic, and nematic. Smectic liquid crystals have a layered structure, whereas nematic liquid crystals contain molecules arranged in a certain direction but without any positional order.

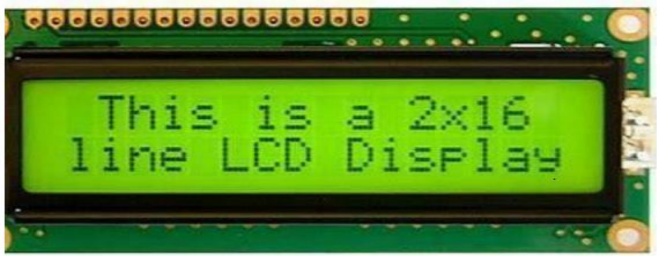

Fig-4: 16X2 LCD

4.3 SOFTWARE SERIAL LIBRARY

A vital tool for embedded systems engineers and microcontroller hobbyists alike is the Software Serial Library. It offers a software-based method for putting serial communication protocols into practice on platforms with hardware UART (Universal Asynchronous Receiver-Transmitter) capabilities that may be restricted. Understanding the fundamentals of serial communication is crucial before exploring the Software Serial Library. Serial communication in microcontroller applications refers to sending one bit of data at a time via a single wire. In order to enable information flow between devices, sensors, or modules, this is essential.

Even though many microcontrollers have hardware UART modules built in, certain projects can need more serial ports than what the hardware can provide. The Software Serial Library comes in handy in this situation since it makes software emulation of serial communication possible. Within the Arduino ecosystem, the Software Serial Library is commonly used to increase the capacity of Arduino boards with constrained hardware UART. It enables simultaneous communication with many serial devices by enabling developers to build virtual serial ports via software.

4.4 EM-18 RFID READER

For contactless identification applications, the EM-18 RFID Reader is a popular small and multipurpose Radio-Frequency Identification (RFID) module.

The EM-18 RFID Reader, which can scan RFID tags and cards and was designed with speed and simplicity in mind, is a well-liked option for many access control, attendance monitoring, and security systems.

RFID technology, a wireless communication technique that transfers data between the reader and RFID tags using electromagnetic fields, is the foundation of the EM-18 RFID Reader. RFID offers a smooth and effective way of access and authentication by enabling fast and precise identification without the need for physical touch.

The EM-18 RFID Reader is renowned for its easy-to-use characteristics, which include an integrated antenna, a small form factor, and simplicity in integration. It is appropriate for a wide range of applications since it operates in the low-frequency region and is compatible with RFID cards and tags from the EM4100 series.

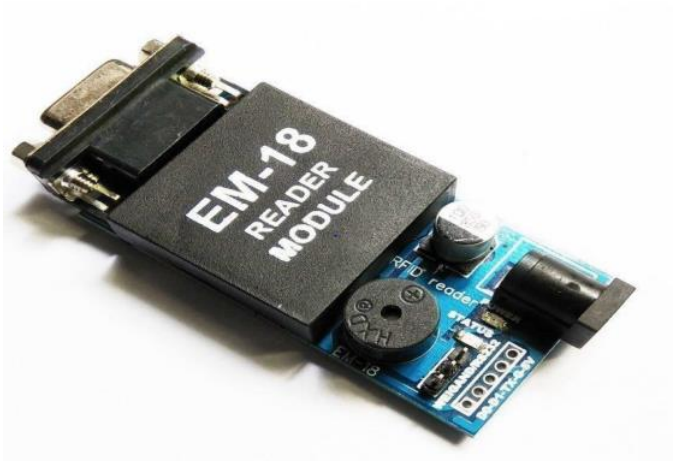

Fig-5: EM18 reader module

4.5 MOTOR DRIVER SHIELD

The electrical circuits or devices known as motor drivers regulate the direction, speed, and operation of electric motors. They are crucial parts of many different electromechanical systems, from straightforward DIY projects to intricate industrial gear. Motor drivers normally supply the power and voltage required to run the motor after receiving control signals from a microcontroller or other control circuitry.

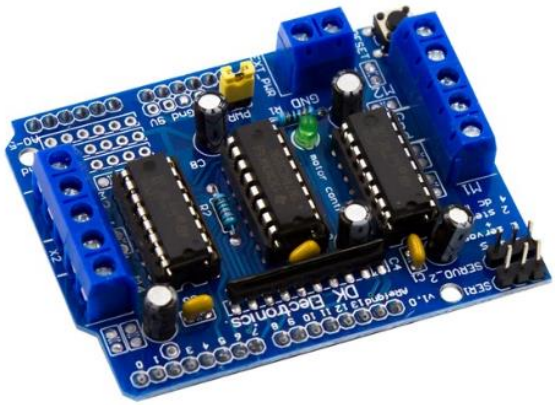

Fig-6: L293D

4.6 DC MOTOR

DC motors are electromechanical devices that use the interplay of magnetic fields to transform electrical energy into mechanical energy. They function according to the electromagnetic induction principle, which states that a motor rotates when electric current passes through a wire in a magnetic field.

Fig-7: DC Motor

4.7 BLUETOOTH MODULE:

A Bluetooth module is a standalone circuit board that uses Bluetooth protocols to allow wireless connection between devices. It incorporates necessary parts such as a baseband controller, Bluetooth radio, and communication interface for attaching to an embedded system, such as a microcontroller. Because of its low power consumption, simplicity of integration, and capacity to create wireless connections, Bluetooth modules are frequently employed in a variety of embedded system applications.

Fig -8: Bluetooth Module

5. PROPOSED SYSTEM

The suggested system introduces an RFID-Based Smart Trolley for Automatic Billing in an effort to transform This cutting-edge system, which makes use of Radio-Frequency Identification (RFID) technology, provides a smooth and effective way to automate the invoicing process in retail settings. The system's fundamental component is the incorporation of RFID technology into shopping carts. Every product has an RFID tag attached to it, making it possible to monitor and identify it in real time as things are added to the cart. This connection streamlines the entire shopping and payment process by doing away with the requirement for manual item scanning during checkout. The integrated RFID readers in the smart trolley are positioned purposefully to collect data from product RFID tags. Instantaneous information on the items in the trolley is provided by the readers through communication with a central processing unit. A convenient and inconspicuous shopping experience is guaranteed by this design. A complex automatic billing algorithm that runs on the central processing unit is part of the proposed system. The overall cost of the products in the cart is determined by this algorithm, which takes quantity, discounts, and promotions into account. As a consequence, there is no need for human input, and the billing process runs smoothly and accurately.

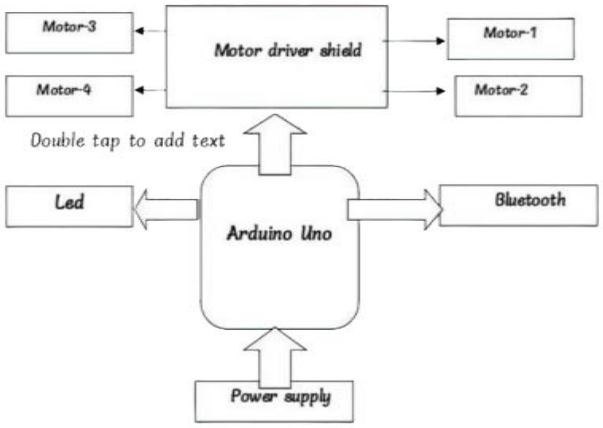

Fig -9: Block diagram

The user-friendly display unit of the smart trolley informs customers throughout their shopping experience. A list of the scanned goods, each with its own price and the running total are shown on the display in real time. This interactive interface guarantees billing process clarity while improving the entire buying experience. Customers can link their payment methods to the smart trolley through the integration of secure payment alternatives provided by the proposed system. When the shopping is done, the technology makes it easier to make a safe, cashless purchase, which increases convenience and shortens checkout lines.

6. METHODOLOGY

The methodology for implementing an RFID-based smart trolley system for automatic billing involves a systematic approach to seamlessly integrate Radio-Frequency Identification (RFID) technology into the traditional shopping experience. This innovative system aims to automate the billing process, enhance customer convenience, and improve overall efficiency in retail environments. The first step in the methodology is a thorough requirement analysis. This involves identifying and understanding the specific needs of the retail environment where the RFID-based smart trolley system will be implemented. Factors such as the average number of items per shopping trip, the desired level of automation, and integration with existing point-of-sale (POS) systems are considered.

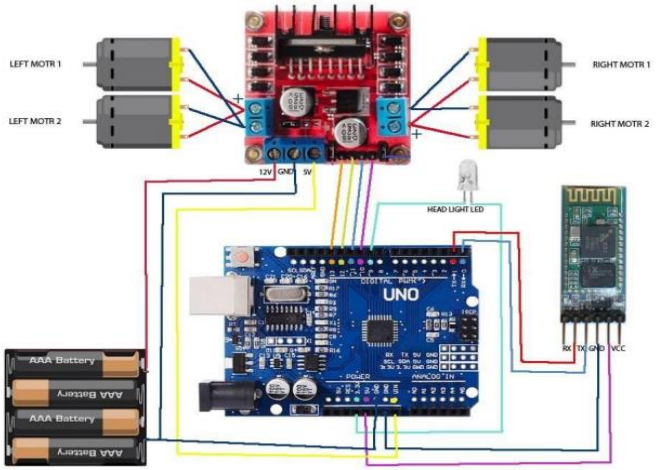

Fig -10: Methodology

7. Results

Fig:7.1

8. CONCLUSION

EM-18 reader, RFID tags, Arduino, and RFID technology are used to complete the work. Its goal is to expedite the shopping experience and shorten billing times for clients, hence benefiting them. It may be used in malls where there is a lot of traffic and a rush of people entering the stores. Within the automation industry. This technology will take the place of the currently in use barcode system. Therefore, with minimal human participation, this technology may assist individuals in making their shopping easier and time-saving. This lowers the need for labor and maintenance The RFID-based smart trolley system's capacity to raise customer satisfaction and operational efficiency is one of its main benefits.

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