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Smart Trolley using RFID Technology

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Abstract:- Most of individuals from all walks of life will purchase their daily requirements, such as food items, clothing, toiletries, gardening equipment, electrical appliances, and others,at a shopping mall. When waiting in a queue for a long time, people may become irritated. The introduction of the smart tram addresses this issue. The primary goal of this project is to shorten the time spent waiting in lines to pay bills. The cart automatically calculates the price and bill for the items that are kept inside. Here, hardware including an Arduino Uno, an RFID reader, RFID tags, a buzzer, and an LCD display are used. The input/output pins on the Arduino development board used in the design of this system are completely accessible for use in communicating with the Reader. Each product has an RFID tag affixed to it, and a trolley with an RFID reader is attached. The RFID reader automatically reads the tags connected to the products whenever they are placed in the trolley, and the LCD then shows information about the product name, price, and quantity. The buzzer will automatically notify the user to scan ordelete the product if it is not scanned. As a result, a bill is created directly on the trolley. The likelihood of human error is decreased because the entire process is automated.

Keywords:- *Arduino uno, RFID Reader, RFID Tags, Buzzer, and LCD Display.*

I. INTRODUCTION

Numerous industries, including the retail sector, have seen a substantial transformation as a result of the advancement of technology. Radio Frequency Identification (RFID) is one such technology that has completely changed the way people shop. An innovative solution thatpromises to improve both inventory management for merchants and customer shopping experiences is the smart trolley, which uses RFID technology.

To automatically identify and track products or objects placed in a shopping trolley, RFID technology is used. RFID tags are affixed to each product in the system, and an RFID reader ismounted on the shopping cart. The technique makes it possible to automatically scan objects and make a shopping list.

The RFID-enabled smart trolley not only enhances the shopping experience for consumers, but also provides advantages for merchants like inventory optimization, accelerated checkout, and enhanced product tracking. For retailers, these advantages equate to more productivity, lower expenses, and greater profitability.

Therefore, the purpose of this paper is to examine the advantages, difficulties, and future possibilities of the smart trolley employing RFID technology. The technological details of the system, its effects on the retail sector, and its potential to influence how people purchase in the future will all be covered in this paper. The research findings will contribute to the existingliterature on RFID technology and its applications in the retail industry.

II. METHODOLOGY

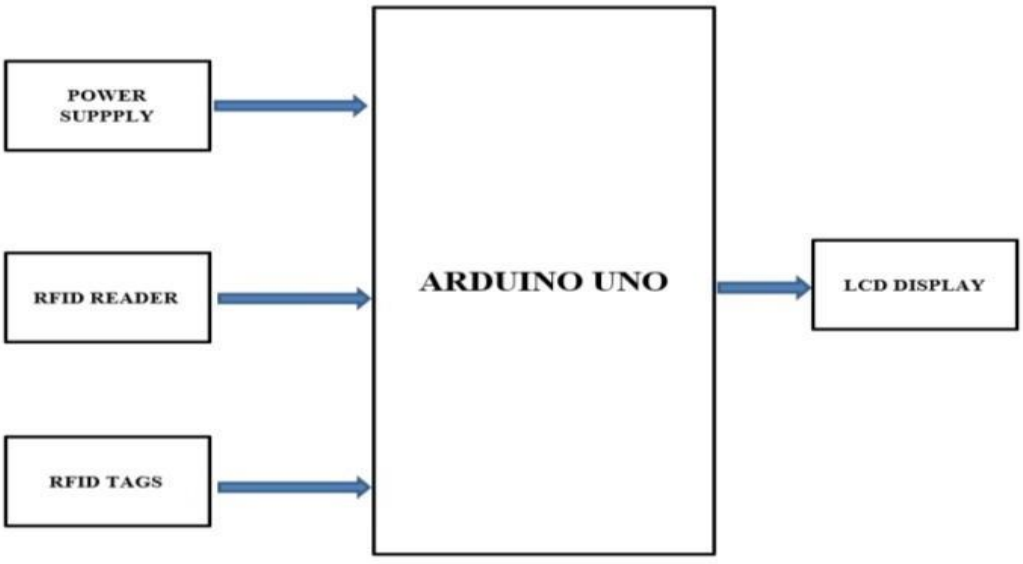

Fig. 1: Block diagram

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III. HARDWARE DESCRIPTION

A. Arduino Uno:

A microcontroller, commonly referred to as a physically programmable circuit board, is the Arduino Uno. It includes software and an integrated development environment (IDE) similar to those found in computers, which are used to create and upload Arduino programs. They often favour programs written in C or C++. They have 14 input and output pins, a USB connection, a power jerk, and a reset button included in their ATmega328pP-based architecture. The integrated development environment, or Arduino IDE, is the program used to write code for the Arduino Uno, and it is conveniently available for download on the official Arduino website. It includes six analog pins, numbered A0 to A5, and a crystal oscillator with an operating frequency of 16 MHZ. It may be powered by batteries using an ac or dc adapter in addition to a USB port.

B. RFID Reader:

RFID-based library systems go beyond just providing security and incorporate tracking capabilities, offering a combination of security and convenience. In contrast, traditional library systems like EM and RF have been used for many years. The latest technology, RFID (Radio Frequency Identification), is utilized in these systems, except for wider exit gates, to effectively monitor library objects. This enables faster and easier check-in/check-out processes, inventory management, and material handling. Unlike traditional theft detection systems, RFID technology reads the data on microchips in the markers attached to library materials regardless of their exposure or alignment, without the need for a direct line-of-sight or fixed position. The distance from the item is generally not a significant factor, except for cases involving extra- wide exit gates. The wide reading range of the markers by the exit detectors allows the structure's passages to be up to four bases wide.

RFID combines microchip and radio-frequency (RF) technologies. The RF technology reads the data on microchips in the markers attached to library materials, irrespective of the item's exposure or alignment. Unlike traditional theft detection systems, RFID does not require a line-of-sight or fixed position to read markers. The distance from the item is usually not a significant factor, except for cases involving extra-wide exit gates. This technology allows for the readingof markers from a distance of more than two bases by each of the two comparable exit detectors, enabling passages at the structure's exit to be up to four bases wide.

The use of RFID technology reduces the time required for circulation activities. This is due tothe faster retrieval of information from RFID tags compared to barcodes, as well as the ability to read multiple objects in a stack simultaneously. Initially, the anti-collision method, which allows for the check-in or check-out of an entire stack, was unreliable, but it now appears to befunctioning properly.

C. RFID Tag:

RFID (Radio Frequency Identification) tags are small devices that use radio waves to wirelessly transmit and receive data. They consist of an integrated circuit (IC) and an antenna, which work together to enable communication with RFID readers or scanners. Here is an explanation of RFID tags without plagiarism:

RFID tags are used in various industries for tracking and identification purposes. They come in different forms, including passive, active, and semi-passive tags. Passive tags operate by utilizing the energy they receive from the RFID reader since they lack an internal power source. In contrast, active tags possess their own power source, enabling them to transmit signals over extended distances. Semi-passive tags have a battery for powering the internal circuitry but rely on the RFID reader for communication.

RFID tags contain data that can be read by RFID readers using electromagnetic fields. When the tag comes within the range of a reader, the reader emits radio waves, which power the tag'sinternal circuit. The tag then modulates the radio waves with the stored data and sends it backto the reader for processing.

D. Jumper wires:

Electrical cables known as jumper wires are used to connect electronic parts on a breadboard, circuit board, or other circuitry. Depending on the application, they can be used toestablish either temporary or permanent connections.

Jumper wires' main function is to offer a way of moving electrical signals and power betweenvarious parts of an electronic circuit. They are especially helpful during the prototype and testing phases of electronic projects because they make it simple and rapid to make changes tothe circuit.

E. LCD Display:

The meaning of the phrase liquid crystal display, or LCD, is obvious. The solid and liquid states of matter are mixed together. Viewable images are produced by LCDs using liquidcrystals. Liquid crystal displays are the ultra-thin display panels used in modern televisions, cell phones, laptops, and portable video games. Displays can be substantially thinner when comparing LCD technologies to cathode ray tube (CRT) technologies.

Several layers, including electrodes and two polarised panel filters, make up a liquid crystal display. Using LCD technology, the image is shown on a laptop or other electronic devices like minicomputers. A lens projects light onto a layer of liquid crystal.

F. Power supply:

Several electrical devices can be powered by a power source that can have an output voltage of between 6 and 9 volts. The proper voltage and current rating of the power supply should be selected in accordance with the potential differences in the power requirements of these devices. The quantity of power that can be given to the device depends on the power supply's current rating, which is also significant. To guarantee that the item can operate as intended, the current rating needs to be equal to or higher than the current

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it requires.

The voltage and current needs of the item to be powered, as well as the efficiency, dependability, and safety of the power supply itself, should all be taken into account when choosing a power supply in general.

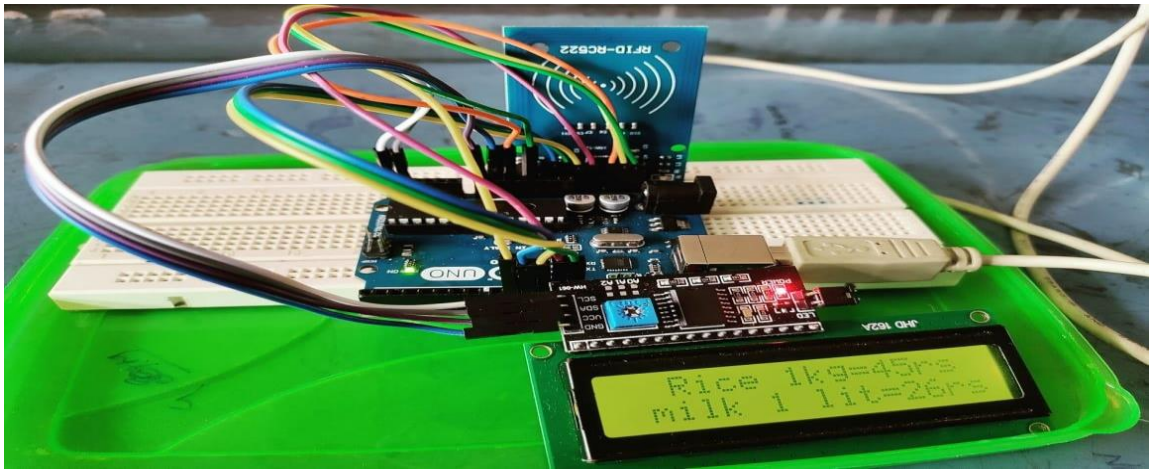

Fig. 2: Component set up

IV. SOFTWARE DESCRIPTION

A. Arduino IDE software:

The software platform known as the Arduino IDE is used to create and upload code toArduino microcontroller boards. It may be used with Windows, Mac OS X, and Linux operating systems and is free to download.

Writing, compiling, and uploading code to an Arduino board are all made simple and user- friendly by the Arduino IDE. It features a source code editor that makes it simple to write and debug code by providing syntax highlighting, automated code completion, and error highlighting.

The IDE also comes with a serial monitor that lets you see your Arduino board's output and instantly input data to it. When creating projects that communicate with sensors or other hardware, this may be extremely helpful.

The Arduino IDE may be enhanced with a number of plugins and libraries in addition to its core capabilities to increase capability and facilitate programming. It is an all-around effectiveand flexible tool for creating projects using Arduino boards.

V. RESULTS

An innovative solution that integrates RFID technology with a conventional shopping cart or trolley to increase operational effectiveness and the shopping experience is known as a"smart trolley." To offer numerous features and advantages, it combines RFID tags, readers, and LCD displays.

The RFID reader recognises the presence of RFIDtags on the products when the client loads them into the smart trolley. The Arduino Uno processes the data after receiving the unique IDs from the RFID reader. As each item is identified by the RFID reader, the name and price are shown on the LCD screen. On the LCD display, the total cost of the products is continually updated, giving the consumer access to real-time information. In addition to advertising or tailored suggestions depending on the products in the cart, the LCD display may also do so. The RFID reader may interact with the Arduino Uno to determine the total cost of the productsin the cart when the client is ready to check out.

The consumer may then examine the final amount on the LCD display and continue with the payment procedure when the Arduino Uno sends it.

VI. CONCLUSION AND FUTURE SCOPE

Through the use of RFID technology, we want to improve the billing process by making it quicker and more secure. The cast has a mechanical calculation and display feature for the total costs of all the goods it holds. This makes it simple for the customer to comprehend howmuch money is due while buying as opposed to at the register. By scanning the item once more, a product can be taken out of the cart if it is not wanted. The suggested technique is very time- effective, reliable, authentic, and trustworthy. There will be less thievery and lower salaries for workers. The method is also incredibly time-efficient. The degree of seeking skill will increaseas a result.

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