RFID Based Vending Machine

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ABSTRACT
The vending machine which provides the beverage like snacks, cold drink, it is also used for ticketing. These systems are operated on either coin or note or manually switch operated. This paper presents the system which operates not on coin or note, it operates on RFID system. This system gives the access through only RFID which avoid the misuse of machine. A small RFID reader is fitted on the machine. The identity card which contains RFID tag is given to each person. If the ID card owner wants to get some snacks, by showing the ID tag to the reader is the only way to get the desired snacks and the amount to money to pay will be deducted from the account.

KEYWORDS: – *RFID, LCD, Arduino UNO, DC motor*

I. INTRODUCTION

As the world becomes more smarter, people replaces the automatic systems instead of manpower system. The automatic machines become an important role in our life. Nowadays, the shops use the automatic system such as automatic selling system also called vending machine. A vending machine is an automated machine that provides items such as snacks, beverages, cigarettes and lottery tickets to consumers after money, a credit card, or specially designed card is inserted into the machine. The first modern vending machines were developed in England in the early 1880s and dispensed postcards.

Vending machines exist in many countries, and in more recent times, specialized vending machines that provide less common products compared to traditional vending machine items have been created and provided to consumers. The vending machines first came into the market in the 18th century, and then modern vending machines came up in the 19th century with the help of modern technologies. The word vending is a Greek word, which means selling. The first modern commercial coin based vending machine was introduced in London and England for the purpose of selling postcards. The Vending machine is simply a machine, which works automatically and can sell out canned soups, packed eatables, chocolates, candies, snacks, even hot drinks such as coffee, tea, hot chocolate and also drinks like juices, soda water, plain water, and even sometimes some sort of stationery. Therefore, it is also known as Automatic Dispense Machine. These machines are more reliable, easily accessible and much more practical than the convention method of purchase. Nowadays these machines are found almost everywhere like at schools, offices, small restaurants for selling snacks and drinks, even found at railway stations for selling tickets and thus avoiding the queue and in turn saves time. This machine has a huge market with high annual revenues for both developed and developing countries. Gradually, vending machines became a wide channel with increase in sales and even the competition between the manufacturers. It does have many benefits, first benefit is in terms of setup, it is easy to setup a vending machine because it occupies very less space and is compact in size, it is a low cost driven machine and can provide various products as the output.

II. Methodology

The main components used in the system are microcontroller, motor driver, DC motor, LCD display, RFID RC522 and power supply. Figure 1 shows the system block diagram.
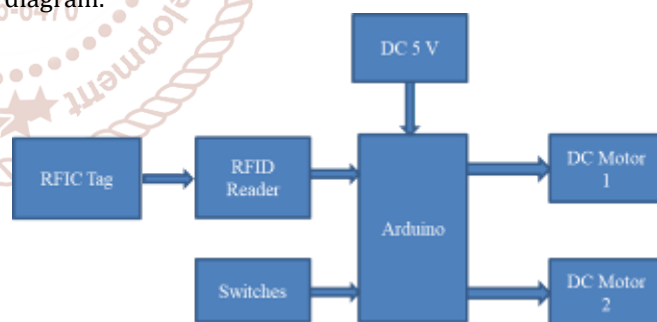

Figure1. System Block Diagram

A. RFID Technology

RFID is a secure and cost effective electronic identification wireless technology based on capacitive inductive resonant system [1]. This technology incorporates radio frequency (RF) electromagnetic fields [3]. Passive RFID battery-less package includes the RFID card and RFID reader with 13.56 MHz operational frequency. Radio tag or transponder, RFID reader, and a data base to store UIDs (unique identification numbers) of RFID card tags and further details of card holder, are the three significant components of RFID system [2]. RFID card is an identification card that stores a unique serial number, consisting of a tag or transponder made up of small spiral coil shape inductor antenna and an electronic micro-chip [1]. RFID reader radiates 13.56 MHz frequency radio signals, and in addition acts as a power source for

passive RFID using EM field. Process of RFID doesn't need line of sight, and is also contactless, RFID reader just needs to be in range of RFID card (usually <1m) in order to read UID already stored in that specific card [2].

B. Arduino

Arduino Uno is a 8-bit microcontroller board based on the ATMega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP (In Circuit Serial Programmer) header and a reset button. In this system, Arduino microcontroller circuit serves as a data processor that controls the motor connected to spiral spring.

C. Spiral Mechanism

This is one of the most important parts on vending machine, delivering mechanism. In this system, spiral mechanism is used, with aluminum wire manually shaped into spiral with the help of PVC Pipe. Vending machine has two chambers for dispensing the items. Each chamber has one DC Motor attached behind it, when someone and presses the button, then corresponding motor rotates and dispense one item. Dispensaries coil has been attached to motor to dispense the item on rotation of motor, these coils are made by cloth hanger wires.

III. System Design

In this paper, a prototype of vending machine that sells two different types of food snacks is designed and constructed. There was two buttons to choose the type of snack. After choosing the required snack type, place RFID card to the RFID reader. Then the reader detects the card ID and displays the amount of money on LCD. Microcontroller drives the motor driver to put out the chosen snack and the remaining balance is displayed on LCD.
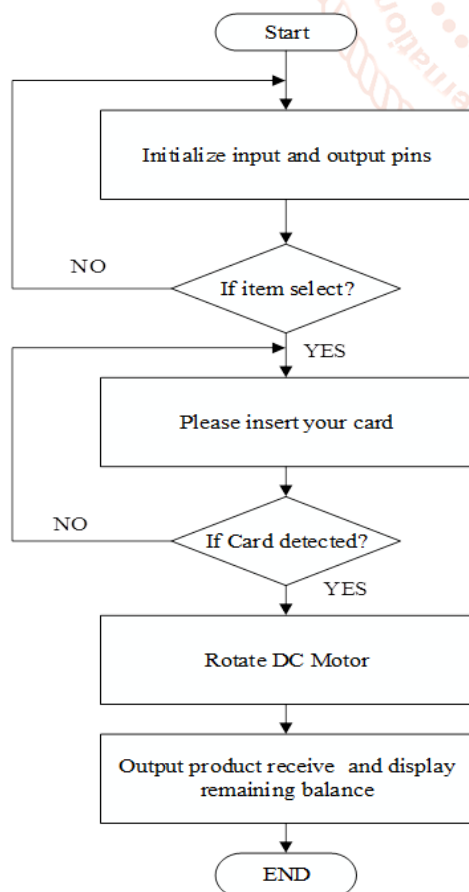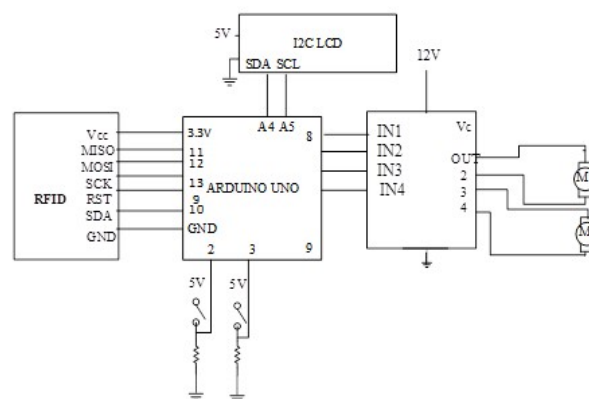

Figure2. System Flowchart

Figure3. Circuit Diagram of Vending Machine

The overall circuit diagram is shown in Figure 3.The MDRC522 RFID was chosen as the card scanner. This 3.3V board was connected to Arduino in the system through a level shifter circuit, allowing it to be operated safely by the 5V Arduino. RFID V_{cc} and ground are connected to Arduino supply and ground pins. MIS0 and MOS1pin are connected to Arduino microcontroller pin 11 and 12. SCK, RST and SDK pins are connected to Arduino microcontroller pin 13, 9 and 10 respectively.

IV. Test and Results

In the proposed vending machine, an Arduino Uno is a master controller along with RFID tag and reader. In this system there are two chambers for dispensing the items. Each chamber has one continuous rotation DC Motor attached behind it, when someone inserts a RFID card on vending machine and presses the button, then corresponding DC motor rotates and dispense one item. Dispensaries coil has been attached to DC motor to dispense the Item on rotation of DC motor, these coils are made by cloth hanger wires. If motor rotate fixed angle the products are available to user at output of vending machine. Display information on LCD display such as insertion of RFID card, selection of product and Account balance.

Figure4. Top View of Vending Machine

Every consumer holds a passive RFID card with an operational frequency of 13.56 megahertz. When consumer brings his RFID card in the range of RFID reader, already stored UID unique identification number in that particular card is read by the RFID reader. Arduino software uses that UID number to create a database against each RFID consumer, in which details like consumer identity, current balance, and after transaction balance against his card are stored. LCD displays current balance.

Figure5. Experimental Test Result for RFID Card Detection

If the user select one of the product by pressing the switch, metal spring are rotated. And then the product will be available to user at the output of vending machine and also remaining balance is displayed on the LCD screen.

Figure.6. Experimental Test Result for the Item1 Choose

In this system, the user need to insert a RFID card and press a button of user choice and the vending machine will dispense the corresponding item for user. This RFID based Vending Machine is majorly using four hardwares which are: Arduino Uno, two continuous rotation DC motors, LCD, RFID card and 12V power supply. Two buttons are for selecting the items in the two chambers. LCD displays the messages and instructions to operate the Machine. This system is portable, affordable, consumes less power and can be made easily available so that the user can use this system whenever and whatever.

Figure7. Experimental Test Result for the Item 2 Choose

V.   Conclusion

In this system, the user need to insert a RFID card and press a button of user choice and the vending machine will dispense the corresponding item for user. This RFID based Vending Machine is majorly using four hardwares which are: Arduino Uno, two continuous rotation DC motors, LCD, RFID card and 12V power supply. Two buttons are for selecting the items in the two chambers. LCD displays the messages and instructions to operate the Machine. This system is portable, affordable, consumes less power and can be made easily available so that the user can use this system whenever and whatever.

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