Asian Journal of Applied Science and Technology (AJAST)
Volume 1, Issue 1, Pages 131-136, February 2017

Smart Newspaper Vending Machine

K.R.Nimisha[1], K.Indumathi[2], R.Divyamani[3], R.Kavya[4], K.Gowrimanokari[5]

[1]*Assistant Professor, Department of ECE, Sri Eshwar College of Engineering, India. Email: nimisha.k.r@sece.ac.in*
[2]*UG Scholar, Department of ECE, Sri Eshwar College of Engineering, India. Email: mathiindu01@gmail.com*
[3]*UG Scholar, Department of ECE, Sri Eshwar College of Engineering, India. Email: divyamani965@gmail.com*
[4]*UG Scholar, Department of ECE, Sri Eshwar College of Engineering, India. Email: kavyagk1996@gmail.com*
[5]*UG Scholar, Department of ECE, Sri Eshwar College of Engineering, India. Email: gowri.k96@gmail.com*

Article Received: 14 February 2017 *Article Accepted: 23 February 2017* *Article Published: 27 February 2017*

ABSTRACT

The usage of newspaper is inevitable and its demand is increasing steadily particularly in the places such as educational institutions, Railway stations, etc. At the same time, time is a precious thing that one does not want to waste in any way. In small shops it is quite difficult to buy papers during rush time period and the paying of the newspaper depending on the type would cause further time delay and there is a chance for the error in the manual payment. To avoid these problems, this project titled "Smart Newspaper Vending Machine" is proposed to deliver the newspaper to the public by using the better user interface and microcontrollers based on the Mechatronics principles. It will be more cheap and economic and it will be very useful for the college and school students. Here it is designed to deliver the newspaper by scanning the respective RFID tag which was given by the agent. It will help us to save more time and manual work will be nullified.

Keywords: Newspaper, vending machine, user interface, microcontroller and RFID tag.

1. INTRODUCTION

When the world is running hastily with advancement, time is the undisputedly the most valuable resource of all. It becomes inevitable to save the time by all possible means. In places such as shopping malls, Canteens and retail outlets, automation is incorporated for the automatic delivery of the products to the customers. A Smart vending machine is the one that dispenses items such as snacks, beverages, consumer products, and even books and to customers automatically, after the customer inserts currency or credit into the machine. For instance, the vending machines are used in now a day to ease delivery. However, the technology is improved, now also we are seeing the traditional method in distribution of newspaper.

Cool drink vending machine, ice-cream vending machine, chocolate vending machine, water/tea/coffee vending machines, etc. can be increasingly found to encroach the shops now a days, which reduces the time and also reduce the human effort required to recognize, search and deliver the product.

The Automatic Teller Machine (ATM) is the best example of all, for the application of engineering principles to reduce time and human effort. The vending machines are used for its applications by determining its output width. These kinds of vending machines operate based on the application of electronics engineering, mechanical engineering and electrical engineering, which are collectively used. And to enrich the user interface the computer engineering also used. Thus, it is proposed in this project to design and fabricate a Smart newspaper vending machine, with the application of mechatronics principles, so as to reduce the time taken and the human effort taken to deliver the paper to the customer in required quantity and size, and also meet the higher demand for coins at the peak time, such as morning hours near the places like bus stands, schools, colleges and railway stations.

2. OBJECTIVES

The main objectives of this project are as follows:

1. To provide solution for the coin usages and faster delivery of paper with better improvement in payment.

2. To reduce the wastage of time and the unnecessary crowding in the shops especially during morning hours.

3. To improve the better user interface, digitized payments are used to meet the problems that are arising nowadays.

3. METHODOLOGY

The Smart Newspaper Vending Machine works under the methodology of the mechatronics system with the objective to provide automation. Generally the automation deals with the elimination of manual work using electronic processing of mechanical work control mechanism. It consists of three main units which include:

A. Input unit
B. Processing unit
C. Output unit

Input Unit: The input unit of the Smart newspaper vending machine Comprises of the components required to receive RFID tag from the customer and authenticating the card to check for valid users.

© 2017 AJAST All rights reserved.

Processing unit: The processing unit comprises of the components required to ensure the reception of the genuine RFID tag. It further, signals the output unit to deliver the newspaper to the customer and selects one among the varieties of the newspaper will be selected by the customer, on read of a genuine RFID tag given by the agent, inside the smart newspaper vending machine.

Output unit: The output unit comprises of the components required to deliver the paper to the customer. It works on the instruction from the processing unit.

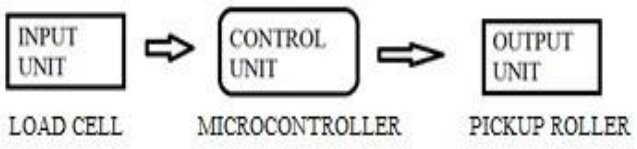

Fig.1. A simple representation of the Smart Newspaper Vending Machine

The entire system works based on the application of electronic, mechanical and electrical system.

a. Electronic system

The electronic part of the system includes the microcontroller with the integrated chips so as to perform the processing of the system. The microcontroller is used for the entire processing and is coded using the software "energia" tool. Each and every part of the entire system has been controlled by the microcontroller.

b. Mechanical system

The mechanical part of the system includes the working mechanism [1]. The mechanical components include the rods, slider, high torque motors, etc. This includes the power transmission from the motor to the delivery of the newspaper out of the smart newspaper vending machine. The fabrication of the base and structure of the entire machine has also comes under the mechanical work. The fabrication of the steel casing is done by using welding and riveting process, as required.

c. Electrical system

The electrical system in the smart newspaper vending machine includes the motors, power supply unit with the transformer. The input power supply is to be stepped down to provide the power to the MSP430 system in the required voltage. The power supply to the electrical motor is also to be taken care of. The required type of electrical motor so as to deliver the paper out of the vending machine is to be chosen.

4. DESIGN OF SMART NEWSPAPER VENDING MACHINE

The smart newspaper vending machine proposed in this paper, is made by the following list of components:

A. Microcontroller (MSP430G2553)
B. Transformer
C. DC Motors
D. Slider
E. Power supply board
F. Relay Board
G. RFID Reader
H. LCD Display
I. Ultrasonic sensor

Microcontroller

A microcontroller [5] (sometimes abbreviated µC, uC or MCU) is a small computer on a single integrated circuit containing a processor core, memory, and programmable input/output peripherals. Program memory in the form of Ferroelectric RAM, NOR flash or OTP ROM is also often included on chip, as well as a typically small amount of RAM. Microcontrollers are designed for embedded applications, in contrast to the microprocessors used in personal computers or other general purpose applications.
The microcontroller used in this machine is the MSP430 Microcontroller.MSP430 (Fig.2) is the LOWPOWER device which requires 5V to operate it. It has 20 pins out of 14 are GPIO pins.

Fig.2. MSP430G2553 Microcontroller

Transformer

A transformer is an electrical device that transfers energy between two or more circuits through electromagnetic induction. A varying current in the transformer's primary winding creates a varying magnetic flux in the core and a varying magnetic field impinging on the secondary winding.

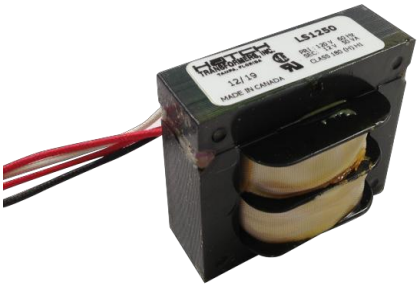

Fig.3. Step down transformer

© 2017 AJAST All rights reserved.

This varying magnetic field at the secondary induces a varying electromotive force (EMF) or voltage in the secondary winding. Making use of Faraday's Law is conjunction with high magnetic permeability core properties, transformers can thus be designed to efficiently change AC voltages from one voltage level to another within power networks In this system, two step down transformers (Fig.3) are used (one for the DC motor and another for the microcontroller) to step down the power from 230V to 12V power supply.

DC Motor

A DC motor [7] is any of a class of electrical machines that converts direct current electrical power into mechanical power. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic; to periodically change the direction of current flow in part of the motor. Most types produce rotary motion; a linear motor directly produces force and motion in a straight line. In this project, the DC Motor (Fig.4) of 12V, 5A is used.

Fig.4. DC Motor Slider

Slider (Fig.5) plays a vital role in the delivery of the paper. Here we used the rods to move the slider up and down. Two DC motors with high torque is used here. And the slider is driven by using the 1000RPM DC motor. Once the valid card is authenticated, then the slider motor turns on. Then Newspaper is pushed out from the tray. After the paper got dispensed then the motor direction gets reversed until it reaches the original position.

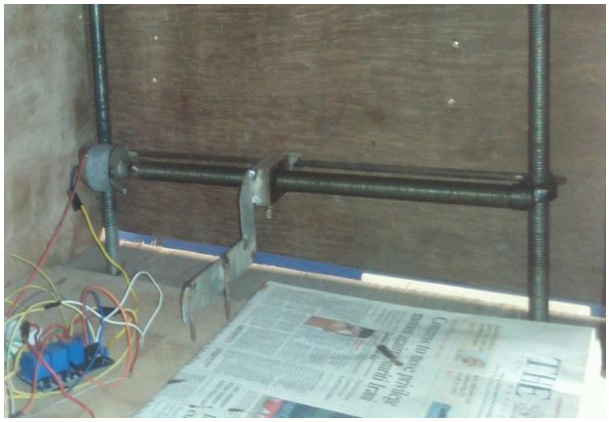

Fig.5. Slider

Power supply board

A power supply board (PSB) (Fig.6) mechanically supports and electrically connects electronic components using conductive tracks, pads and other features etched from copper sheets laminated onto a non-conductive substrate. PSBs can be single sided (one copper layer), double sided (two copper layers) or multi-layer. Conductors on different layers are connected with plated-through holes called vias. Advanced PSBs may contain components-capacitors, resistors or active devices - embedded in the substrate.

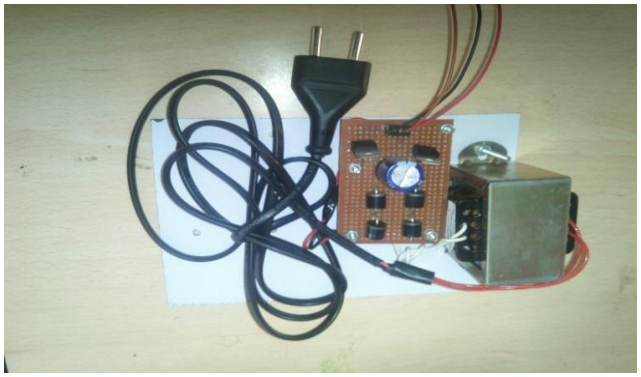

Fig.6. Power Supply

Fig.6. shows the transformer, which is used to step down 230V AC to 12V AC. And we used diodes to rectify the AC volts to DC. And the regulators are used to provide 12V (IC7812) and 5V (IC7805) Dc voltages.

Relay Board

In this project, since the high torque motors are used, to control those motors, relay boards are used. The relay board (Fig.7) used here is 5V, 10A 4-channel relay board, which can drive up to 12V DC motors. Relay will act as switch. Once the threshold value is achieved then it allows the supply voltage as output. It is also used to control the directions (Forward or Reverse) of the DC motors.

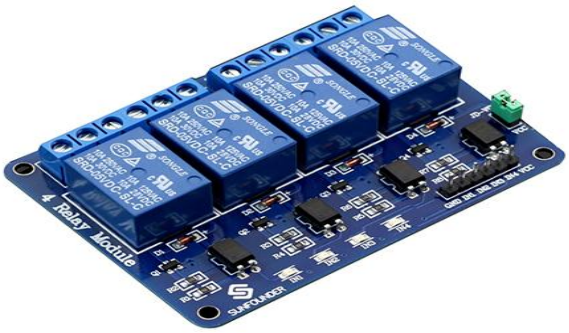

Fig.7. 4-channel relay board

RFID Reader

RFID stands for Radio Frequency Identification. RFID reader (Fig.8) used here is (EM18) which is used to provide communication between the user and controller. The user will be provided with the RFID tags by the agents. Each user will have different tags to authenticate their subscription to get the newspaper. EM18 transmits the signals through txt pin to the controller.

© 2017 AJAST All rights reserved.

Fig.8. RFID reader module

LCD Display

A liquid crystal display (LCD) is a flat panel display, electronic visual display, or video display that uses the light modulating properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock. The same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements. The LCD displays information about the steps that should be followed by the user etc.

Fig.9. LCD Display

Ultrasonic sensor

Every day the width of the newspaper will vary. While considering this factor the proposed project should meet the above problem. So we have to calculate the width of the newspaper every day and based on that value the up and down motors should be controlled. Ultrasonic transducer [3] uses the physical characteristics and various other effects of ultrasound of a specific frequency. It may transmit or receive the ultrasonic signal of a particular strength. These are available in piezoelectric or electromagnetic versions. The piezoelectric type is generally preferred due to its lower cost and simplicity to use. Here the ultrasonic sensor used is HC-SR04 shown in Fig.10.

This sensor is having the echo and receives pins to send and receive ultrasonic waves, to calculate the distance which is used to find the width of the newspaper. The width of the newspaper is calculated by using the below formula.

$$\left.\begin{matrix}Width\ of\ the\\ Newspaper\end{matrix}\right\} = \frac{(Tray\ size - distance\ given\ by\ sensor\ values)}{Quantity\ of\ newspapers}$$

Here the quantity of the newspaper is fixed.

Fig.10. Ultrasonic sensor module

5. WORKING PRINCIPLE

The working of the smart newspaper vending machine can be clearly explained in three stages:

Stage 1:

The process gets started by scanning the RFID tag using the reader. After this the controller authenticates the card and checks for the subscription. Once all the conditions are satisfied, then the controller asks the user to wait for some seconds to dispense the newspaper which was shown in Fig.11.

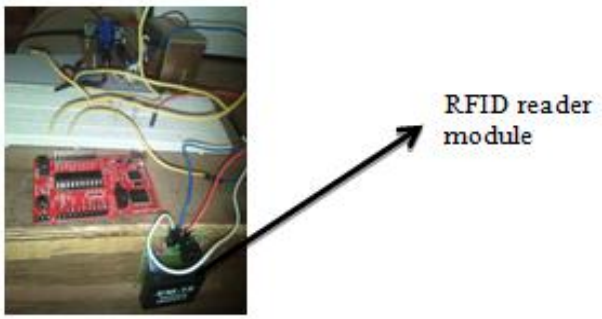

Fig.11. Stage1

Stage 2:

Once the card or tag is authenticated then the motors will turn on. The motor driver i.e. relay board runs the motor setup. Depending on the width value the UP and DOWN rods will start to rotate in forward direction. After completion the slider will turns on. And it push out the newspaper as per the program (Energia) used in controller (MSP430) shown in Fig.12.

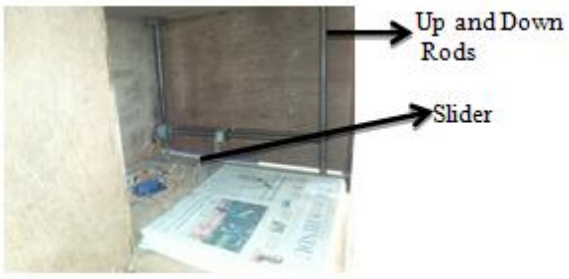

Fig.12. Stage 2

© 2017 AJAST All rights reserved.

Stage 3:
The slider pushes out the newspaper. The LCD display asks the user to collect the newspaper. After this the slider will be driven in reverse direction and the motors connected to the up and down rods will be driven in forward direction shown in Fig.13.

Fig.13. Stage 3

6. ADVANTAGES
The main advantages of this Smart newspaper vending machine include:

- To reduce the man power
- To automatize the process in newspaper distribution
- To improve the user interface
- High quality delivery
- Used to avoid queues

7. ENTIRE SETUP

Fig.14. Outer part of the Machine

Fig.15. Inner part of the Machine

8. APPLICATIONS
This smart newspaper vending machine provides applications in places such as

- Schools
- Colleges
- Railway stations
- Bus stands
- Parks
- Apartments etc.

9. CONCLUSION
Though, automatic vending machines are available to deliver various commodities, but vending machine to deliver newspapers with digital transaction does not exist, which is a much needed one. Newspaper finds applications almost everywhere to improve the knowledge and this type of smart newspaper vending machines could be used to reduce time and human effort with improved accuracy.

ACKNOWLEDGMENT

The authors thank Mrs.Nimisha.K. R, M.E., their project guide for helping and guiding them throughout the entire project.

REFERENCES
[1] R.S.Khurmi and J.K.Gupta., Machine Design, *Manufacturing Considerations-First Edition.*

[2] Kamalanathan.P, Irshath Ahmed.R, Mohamed Aamir.M & Kalaiselvan.P (2015), "Automatic paper vending machine", *International Journal of Science, Engineering and Technology Research (IJSETR),* vol.4, ISSN:2278-7798.

[3] A.k. Shrivastava, A. Verma & S.P. Singh (2010), "Distance Measurement of an Object or Obstacle by ultrasound sensors using P89C51RD2", *International Journal of Computer Theory and Engineering,* Vol. 2.

[4] William Bolton., Mechatronics, a Multi-disciplinary approach, *Micro controller & ADC control,* pp.339-465.

[5] Robert A. Sohlegel., Google Scholar, *Vending Machine.*

[6] Hajra Chawdry, Manufacturing Technology, *Fabrication techniques.*

[7] Pugazhendhiran., Electric motors and Drives Control., *EDC sixth edition.*

AUTHOR BIOGRAPHIES

Indumathi. K is a vibrant student, pursuing final year in Bachelor of Electronics and Communication Engineering at Sri Eshwar College of Engineering, Coimbatore. She had presented papers in various National level symposiums and participated in various technical and non-technical events. Her areas of interest include Embedded systems and Programming.

© 2017 AJAST All rights reserved.

	Divyamani.R is an active student, pursuing final year in Bachelor of Electronics and Communication Engineering at Sri Eshwar College of Engineering, Coimbatore. She had presented papers in various National level symposiums and participated in various technical and non-technical events. Her areas of interest include Networking and controllers.
	Kavya.R is a passionate student. She had presented papers in various National level symposiums and participated in various technical and non-technical events. Her areas of interest include Networking and programming.
	Gowrimanokari.K is an intellectual student. She had presented papers in various National level symposiums and participated in various technical and non-technical events. Her areas of interest include Networking.

© 2017 AJAST All rights reserved.