CUSTOMIZABLE AUTOMATED SNACK VENDING MACHINE

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Abstract - The paper presentsthe design and fabrication of acustomizable automated snack vending,whichdispenses consumer products, based on the currency inserted. The dimensions of the machine are customizable so it can fit on any available space at the customer's premise. A simple and low cost Arduino controllercontrols the currency acceptance andsnack dispensing of wafer packets, chocolates and juice tetra packs placed on the acrylic spiral coil. The methodology implemented in the conceptualization of the project was customer survey, concept selection and test, system level design, detail design, testing & analysis. The final design could successfully vend four different type of materials staked on the acrylic spiral coil in 5 seconds.

Keywords - Arduino Mega, DC Stepper Motor, Dimensions Customizable Vending Machine, Abudhabi Dhiram

I. INTRODUCTION

A vending prototype is an automated prototype 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 prototype. Vending prototypes exist in many countries, and in more recent times, specialized vending prototypes that provide less common products compared to traditional vending prototype items have been created. The main objective of this project is to design a low cost, effective vending prototype to vend small products like a chocolates, candy, snacks and tetra packs of water/juice. This prototypeis Arduino based and has digital display that instructs the user to follow steps to vend his desired product. After the required payment has been tendered through the coin inserted, the display prompts the user to select a product of his choice staked in the spiral coil.Once the product selection is done, it would be released and made available at the open compartment at the bottom of the prototype.

II. LITERATURE SURVEY

The earliest known reference to a vending prototype is in the work of Hero of Alexandria, an engineer and mathematician in first-century Roman Egypt. His prototype accepted a coin and then dispensed holy water [1].When the coin was deposited, it fell upon a pan attached to a lever opened a valve which lets some water flow out. The pan continued to tilt with the weight of the coin until it fell off, at a point where a counterweight snapped the lever up and turned off the valve. Coin-operated prototypes that dispensed tobacco were being operated as early as 1615 in the taverns of England. The prototypes were portable and made of brass [2]. An English bookseller, Richard Carlile, devised a newspaper dispensing prototype for the dissemination of banned works in 1822. Simeon Denham was awarded British Patent no. 706 for his stamp dispensing prototype in 1867, the first fully automatic vending prototype [3].An automatic stamp and postcard vending prototype, early 20th century, Japan [4]. The first modern coin-operated vending prototypes were introduced in London, England in the early 1880s, dispensing postcards. The prototype was invented by Percival Everitt in 1883 and soon became a widespread feature at railway stations and post offices, dispensing envelopes, postcards, and notepaper. The Sweetmeat Automatic Delivery Company was founded in 1887 in England as the first company to deal primarily with the installation and maintenance of vending prototypes. In 1893, Stollwerck, a German chocolate manufacturer, was selling its chocolate in 15,000 vending prototypes. It set up separate companies in various territories to manufacture vending prototypes to sell not just chocolate, but cigarettes, matches, chewing gum and soap products[5].

The first vending prototype in the U.S. was built in 1888 by the Thomas Adams Gum Company,[6] selling gum on New York City train platforms. The idea of adding games to these prototypes as a further incentive to buy came in 1897 when the Pulver Manufacturing Company added small figures, which would move around whenever somebody bought some gum from their prototypes. This idea spawned a whole new type of mechanical device known as the "trade stimulators". Modern Vending Prototypes are used to dispense change, cigarettes, food, snacks, gum candies, newspapers, stamps and tickets.

III. DESIGN OBJECTIVES

The design objective in this work is to design a light weight portable prototype vending prototype. The mass of the prototype should exceed 5kg. The prototype is to accept UAE currency on 1 AED coins.

The prototype is to provide digital display of the amount of coins inserted, and instructions tothe user on the following step he has to follow in order to dispense the desired item. The prototype needs to dispense the specified item in a time span of up to 5 seconds.

The prototype was conceptualized on the Arduino Mega Platform, and is designed to have a button based user interface with a LCD digital display. The prototype is designed to have four compartments for placing different categories of snacks and a rechargeable battery for continuous power.

IV. COMPONENT SELECTION

The prototype consists of the main body, the coin dispenser, the Arduino controller, the fan, spiral coil feeders. This section will explain the selection of these components.

A. The Main Body

The body of the prototype is made of acrylic, with 42*50 inner compartment, the acrylic sheet has a thickness of 5 mm for sufficient strength. The inner compartment has a dimension of 60*60*60 cm. The display window is covered with transparent sheet of dimension 30*30 cm. The snack dispenser window is designed at the bottom and has a dimension of 20*10 cm.

B. Controller

The controller used for the design is Arduino Mega 5V. This controller is basically the heart of the prototype. The controller is supplied with a DC power source, the output of the controller is connected to the stepper motor and the LCD. The input signal to the controller comes from the coin acceptor and the button keys. A cooling Fan of 12V is also provided to dissipate the additional heat from the system.

C. Coin Acceptor & Comparator

The coin acceptor and comparator used in the design is GD 100F Electronic Advanced Front Entry CPU, which has a working voltage of DC + 12V ± 20%, working temperature range of 20℃ to +50℃ suitable for the gulf region. The system can accept coins of Thickness 1.2 - 3.2 mm and diameter 17 - 34 mm. The acceptor is programmed to accept 1 AED coins, it also has anti fake coin, anti-fishing and anti-electromagnetic interference.

D. Display

The user interactive display used in the prototype is 1604 Character module Liquid Crystal Display, having dimensions 16mm X4mm.

E. Stepper Motor System

The stepper motor system consists of four 9 V Stepper motors with an Arduino compatible stepper motor driver board. The Mosaic stepper motor used in this design is a four phase, unipolar, permanent magnet stepper motor. It is a standard size, 200-steps-per-revolution, with 5 mm shaft diameter. This motor, like most stepper motors is a permanent magnet motor. The Mosaic stepper is a high resolution motor where a full revolution of the shaft requires 200 steps, while each step turns the shaft only 1.8° for a full step, or 0.9° in half-stepping mode. The input for the stepper motor driver comes from the Arduino Mega, the driver drives the stepper motors, which are in turn coupled to the acrylic spiral coil.

F. Power System

The power system used for the design consists of a 12V AC to DC charging adapter and a rechargeable Lithium Ion battery for uninterrupted supply of power.

G. Miscellaneous Components

The prototype also has four round shaped selector buttons, power on/ off button and LED lamp for illumination.

V. CONTROLLER DESIGN

The central part of this system is developed with thehelp of Arduino Mega 5V. The display prompts for the coin input, once the coin is inserted the Arduino senses the coin input.Based on the coin insertion the Arduino sends signals to the display, the display prompts the user to enter the desired key based on the product to be vended.

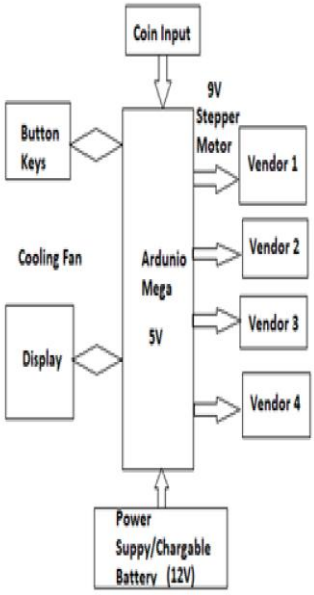


Fig. 1: Block diagram of Automatic Snack Vending Prototype

Once the desired key is pressed the Arduino sends signal to the 9V stepper motor, which in turn rotates the coupled spiral coil. The 1604 Character L.C.D display is interfaced to the Arduino. All the instructions for thevending process are displayed on the display real time. In case any extra coins are inserted in thecoin dispensing mechanism, the

dispenser automatically returns it to the user.

VI. FLOW CHART

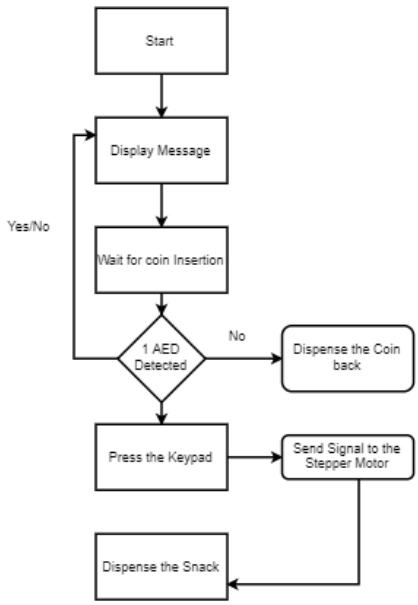


Fig. 2: Flow Chart on the working of Automatic Snack Vending Prototype

The flow chart explains the control flow of operation. At first the prototype initializes the controller and wait for the coin insertion. The CPU Based coin acceptor and comparator is used to detect coins of 1AED. If a wrong coin is inserted the coin acceptor system dissipates the wrong coin back and sends a signal to the display flashing a message to enter the right coin. If the coin is accepted the LCD display flashes a message to press the desired key. Once the key is pressed the prototypetakes input from the keypad and sends signal to the Arduino signals the stepper motor driver. The stepper motor driver drives the stepper motor the corresponding snack rack and the snack is dispensed at the dispensing tray designed at the bottom of the prototype.



Fig. 3: Model of the Automatic Snack Vending Prototype



Fig. 4: Acrylic Spiral Coil

VII.FUTURESCOPE

- Technological improvement to include a touch based interface & wireless prototype monitoringsystem.
- Cashless system including option for credit card payment.
- Increasing the speed of dispensation to 3 seconds.
- Refrigeration and heating different item racks.

CONCLUSION

The system designed is portable and has 4 racks that can store 5 items each, so maximum items stored in the system at any point of time is 20. The system fulfils all the design specifications mentioned. It dissipates every item within a time span of 5 seconds. The system was designed at a total cost of AED 1500 and a span of 3 months.

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