VENDING MACHINE USING 8051 MICRO CONTROLLER

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ABSTRACT

This paper presents a project on vending machine. A vending machine is a machine that gives out different kinds of products when a person inserts a coin into it; therefore it is a coin based vending machine. These machines can be implemented using various methods but in this project it has been implemented using 8051 microcontroller. Vending machines makes it easier for making small purchases, it occupies less space and it doesn't need any continuous monitoring. These machines were first introduced in England in the early 19th century.

Keywords: 8051 microcontroller, coin sensor, dc motor, spring, vending machine

I. INTRODUCTION

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. For example, the cold drink vending machine, ice-cream vending machine, chocolate vending machine, water or tea or coffee vending machines, etc. are invading the shops in this century. ATM (Automatic Teller Machine) is the best example of technology evolution in terms of vending machine in an engineering field. ATMs reduces the time and human efforts required to search, recognize and stand in a queue for cash payments and even for cash withdrawals.

The main motive of this project is to design a low-cost effective vending machine, which can provide small chocolates or even small useful products. The most important component of vending machine is the detection of the coin that accepts and determines the value of inserted coin. This is a microcontroller-based vending machine. It mainly consists of 3 parts, the first part is coin insertion, second is coin detection that is basically programming which is implemented through microcontroller and the last stage is giving out the product according to the amount inserted. The purpose of this paper and project is to make a vending machine which can provide a chocolate or any small and less costly products at an outlet and also make it user-friendly for small products, and can be used even at places like malls as a chocolate machine for fun part. The principle is simple: the users or customers pays to the machine in form of coin and machine will return back the selected goods.

II. LITERATURE REVIEW

Kamalnathan [1] proposed microcontroller based automatic paper vending machine. It accepts coins as an input and dispenses sheets as an output. The software used is "embedded". Thus it can be helpful for college and school students.

Qureshi[2] proposed FPGA based vending machine which supports four products and two coins. It accepts coins as input in any sequence and dispenses products when required amount is deposited and returns the change if entered amount is greater than the price of product. It also supports cancel feature through which a user can withdraw the request any time and entered money will be returned back. The algorithm is implemented in Verilog HDL and design is implemented on Xilinx Sparten-3 XC3S400FPGA.

Preetilatha[3] proposed microcontroller based vending machine. It supports cashless payment as the input by scanning of RFID card and dispenses produces like A4 sheets, pencil, pen, etc. Thus it can be helpful to sale stationary items automatically.

Kumar[4] proposed real time vending machine whose design is generated for different regular customers keeping RF-ID code as the base. It describes about real time vending machine whose design is generated for different regular customers keeping RF-id code as the base. When the customer selects the required products Arduino UNO R3 microcontroller will ask to insert RF-id for further processing and then ask to choose the quantity of opted product. After completing above procedure, the required products will be dispensed through vending machine. Thus it can be helpful to purchase day to day needs in various places.

Suhail [5] proposed an FSM based automatic dispense machine which has an expiry date feature using VHDL, in this paper the author described Finite State Machine based automatic dispense machine using Xilinx ISE 14.2. This machine accepts money as an input to dispense the products and returns back the money without dispensing the product to the customer if the product is out of date. Thus it can be useful to ensure the good quality of the product along with quantity and cost.

Sharma [6] proposed a Reverse Vending machine based on FPGA and in this paper the author describes FPGA based vending machine. This machine accepts items such as empty containers, coins, snacks, chocolate, cold-drink, etc., According to the number of products the algorithm is   implemented in VHDL and simulated using Xilinx FPGA Spartan3 development board. Thus it can attract and motivate the consumer through refund and prevent the environment from pollution of waste material.

Bhuvaneshwari [7] proposed an Embedded system based automatic ticket vending machine for modern transport System, in this paper the author described RFID and Zigbee technique based ticket vending machine. In this the availability of buses along with the time is displaced and the person with the help of Zigbee selects the location. If the person wishes to go in a particular bus by using smart card, which is similar to an ATM card, ticket employing RFID technique is reversed. By showing the ticket in front of bus the door opens and then closed automatically and all safety features are provided in the bus. Thus manpower can be minimized in buses and ticket counters and safe journey is assured without any disturbance.

Singh [8] proposed a touch screen based automated medical Venting machine and in this paper the author described medicine vending machine based on IR Standard touch technology as the input to select different medical facilities like First Aid facility, ambulance facility, and direct calling facility via GSM, dynamic GPS, smart card facility and restocking medicine alert. The software used is visual basic was programmed such that when the patient selects certain facility, it will be served to that patient. Thus it can be helpful in case of illness, small or big accidents and so can be placed anywhere.
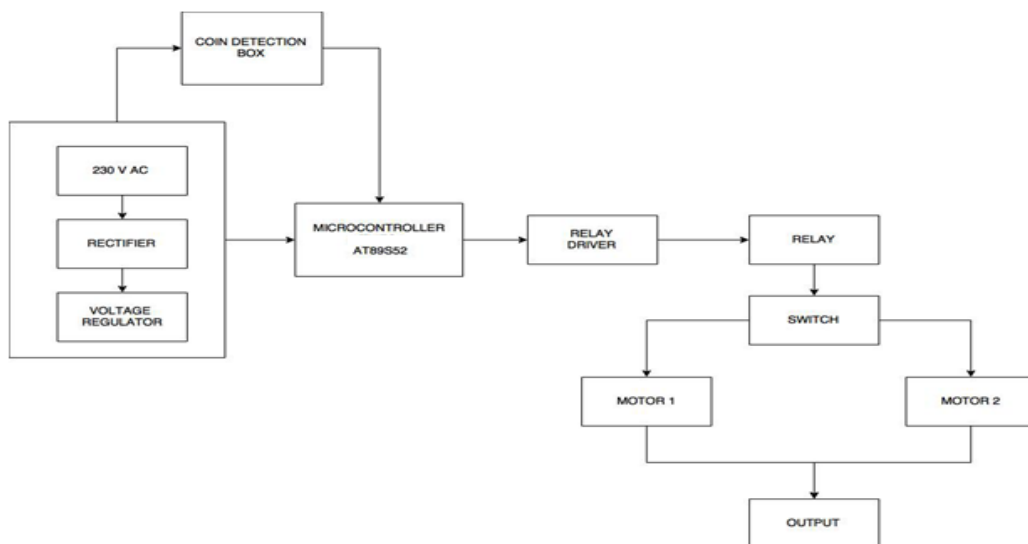
III. BLOCK DIAGRAM

Fig. 1: Block diagram of Vending Machine

The machine will accept five rupees coin. There is a slot for coin, which is connected to the microcontroller. User Interface is used for coin dispense and product dispense. Relay is used to control the dc motor of 60 RPM for product dispatch. The program is written on AT89S52 processor and downloaded using Flash Magic software for selecting product, coin checking and controlling of relay for product dispense. After supplying the AC voltage the rectifier converts it into DC voltage and the voltage regulator is used for smooth voltage of a particular value. After the coin is inserted a pulse is received at the microcontroller which is already being supplied with a fixed DC voltage, the microcontroller then drives the relay through relay driver and the relay is connected to a switch which is used to select the product, on selecting the product the relay drives the particular motor connected to that product and then the motor is driven and the product comes out.
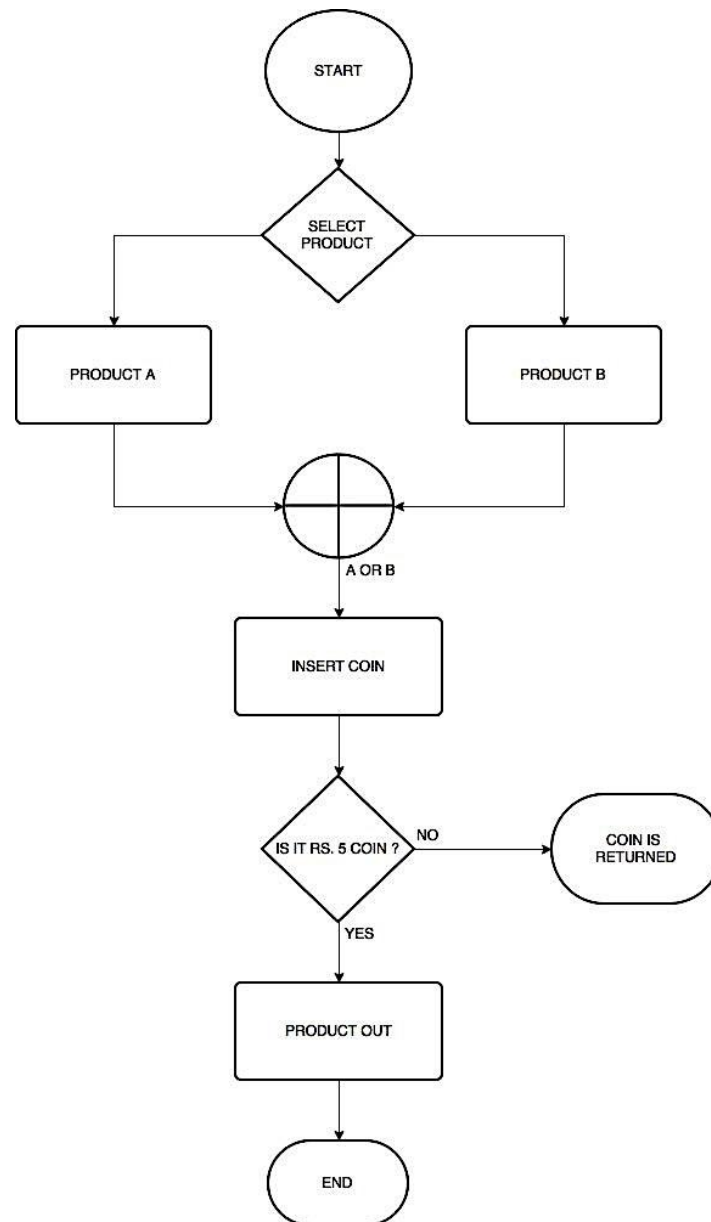
IV. FLOWCHART

Fig2: flowchart of vending machine

Initially after switching on the power supply, reset button is pressed to initiate the machine. After this the product is selected and then the coin has to be inserted in the coin slot. Then, the coin sensor JY923 checks the validity of the coin and if it is valid, according to the training given to the box, it will accept it or else if the finds the coin invalid it will return it back. The machine will check whether product is available or not. If the machine has product, then machine will go to product state and it will be delivered at the product output. If product is not available in the machine then the control unit will demand for servicing, and after service the machine will be reset. Then the desired output i.e., selected product will come out.

V. OPERATION

5.1 Coin Detection

When a 5-rupee coin is entered into the vending machine, the coin sensor will scan the coin and checks its authenticity by checking its diameter, thickness and fall-time. If the coin is authentic then the coin detector will accept the coin, but if coin is different from that which is been trained, then it will be returned back to the customer.

5.2 . Working of the machine

From the main supply the AC voltage is continuously supplied to the vending machine. There is a diode rectifier in the circuit, which converts the AC voltage into DC, and this voltage is supplied to a voltage regulator (7805 IC) through an electrolytic capacitor present at the rectifier. The capacitor stores some voltage and provides the smooth voltage to the regulator. The regulator converts the voltage supplied to a constant voltage of 5V. An LED is present in the circuit to indicate the working, with a resistor to drop the voltage because an LED needs very less voltage to operate. The 5V supply is supplied to the pin 1st pin of the controller, which is an input/output pin, is connected to the 1st pin of ULN, which is an input pin of the first channel. The 16th pin of the ULN is the output pin of the first channel is supplied with 0V because the 1st and the 16th pin are inverse of each bother. This ULN pin is connected to a relay, which is connected to two switches, which are used to select the required product. The relay switch acts as a driver and a protector. The 16th pin of the ULN is connected to the 'NO' of the relay, which therefore acts as aground. The 5V generated at the voltage regulator is then supplied to the common of the relay, which is used to drive the motor required. When the product required is selected and the coin is inserted and if accepted by the coin collector a pulse is given to the controller and the respective motor is driven which in-turn drives the spring attached to it. The spring rotates the product, which then slides out of the box.

VI. CHALLENGES FACED

Many kinds of challenges were encountered in the course of making this project in various aspects. One of the major difficulties encountered was the processing of the coin, i.e., the different types of 5-rupee coins had to be processed and identified which was a bit tedious. Another difficulty encountered was the interfacing of the mechanical parts with the electronics one. Another challenge encountered was if a fake coin of exact material and same dimensions were made, the vending machine accepted it and worked properly.

VII. RESULT

Various kinds of 5-rupee coin were trained in the coin box and following results were recorded of these different kinds of 5-rupee coins by testing them on the vending machine and this table produces information of, for how many insertions of the coin, the coin was accepted which is also showed in terms of its efficiency.

Coins	Number of Times Coin Tested	Number of Times Coin Accepted	Efficiency
	10	10	100 %
	10	10	100 %
	10	7	70 %
	10	0	0 %
	10	0	0 %

TABLE 1: Efficiency Chart of Coin Selector

VIII. ADVANTAGES

1. The whole process is automated such that one can be able to use it when the transaction is done in the correct way according to how the machine is programmed.
2. It gives the clients a free choice to purchase products at any time of the day. One can shop for his or her intended product on 24x7 hours, throughout the year.
3. Diversity in terms of the products can be handled by the vending machine.
4. Most vending machines are stationed at strategical points, which makes it convenient and time saving because of the surety of getting what the customer wants.
5. It is a one-time investment on the side of the owner who doesn't need a lot of running expenses to operate. Reduction of overhead costs by not hiring of staff only increases the profit margin for the owner making it a success bound venture.

IX. DISADVANTAGES

1. Vending machines since is used to be displayed in public areas it can suffer vandalism.

2. Logistics can also be challenging, as a coin vending machine requires someone to empty the machine each day as the coin holder can fill rather quickly.

3. In a token-based machine the logistical challenge of redistributing tokens to all clients each day and to manage lost tokens can be rather frustrating.

4. Some older coins are not easily readable by the mechanisms.

5. If product is out of stock, then also the vending machine will accept the money and the client will not get their money back.

6. If a fake coin of same thickness, metal, and weight is made then, the coin detector might accept it, but it won't have 100% efficiency.

X. FUTURE SCOPE

There are ample choices of future implementation aspects to this system. They are as follows:

1) A scanner can be added for detection of barcode and authorized signatures; this can be used when authorized medicines are given. Scanner that verifies and counts can be used.

2) The capacity of the machine can be increased by adding springs and motors.

3) The LCD can be used to display message to make it more user friendly.

4) It can be made more user-friendly by making it a touch screen based vending machine, but this has to be implemented on a large scale.

5) A scanner can be added for detection of barcode and authorized signatures; this can be used when authorized medicines are given. Scanner that verifies and counts can be used.

6) Adding springs and motors can increase the capacity of the machine.

7) Using combination of different type of sensors, the machine can check whether the product is in stock or not.

8) The LCD can be used to display message to make it more user friendly.

9) It can be made more users friendly by making it a touch screen based vending machine, but this has to be implemented on a large scale.

10) Using advance currency detector and acceptors can increase in number of detection of different types of currency notes and coins.

11) The system for returning remaining amount can be made.

12) Using touchscreen technology, it can be made more easier and user-friendly machine.

XI.CONCLUSION

When a coin is dropped in the Vending machine the coin sensor senses the coin. After the detection, if the coin entered is right then the product comes out, if a wrong coin is entered the coin comes out of the machine. The vending machine detects 5-Rupee coins only and after detecting it a product comes out. Any other 5-Rupee

worth products can also be used. Thus the desired output has been achieved. The testing for fake coins has also been done so that possibility of fraud cases gets reduced. This machine gives fast response and is easy to use by an ordinary person. The designed machine can be used for many applications and we can easily enhance the number of selections. Thus we tried our bit to modify the present day complex vending machine into a user specific vending machine.

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