



Plastic Bottle Reverse Vending Machine

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ABSTRACT

Managing plastic waste is an IMPORTANT POINT of concern these days, RECYCLING, it is one of the novel approaches to manage the waste effectively. The AIM of the work is to present the concept of a reverse vending machine which is proposed to serve as a solution to the problem of pollution caused due to plastic items. This paper focuses on the concept of CASH-FROM-TRASH, where recycled plastic can be used to produce USEFUL PRODUCTS and help in reducing greenhouse gas emissions and pollution. Recently, due to the increase in man-made waste and the limitation of landfills for waste, recycling is one of the new approaches for efficient waste management. Current recycling practices, which force people to bring large amounts of waste to recycling centers, can be frustrating and a source of discouragement for recycling. To overcome these problems, many countries have designed and installed automatic recycling bins in subways and shopping malls. The featured bonus was developed from the concept of reverse vending machine (RVM). Currently, reverse vending machines are very popular in countries like Greece, Japan, Europe, Korea, United States, and China. Reverse Vending Machines (RVMs) reduce staff work, saves time and energy, and is cost effective. This article describes the operation of a reverse vending machine that starts working after inserting a plastic material. There are some very interesting bonuses for users of reverse vending machines and they will receive coins as a reward. The reverse vending machine handles the acceptance of plastic products and the offers coins as a reward based on the weight of the plastic products.

1. Introduction .

The amount of waste produced is rapidly increasing year on year, increasing by more than 7.3% over the past 10 years. A common method of waste disposal is open landfills. This method is hazardous to human health, animal and plant life. [5] There are different types of plastics used every day, but not all plastics are recycled. Drinks in PET bottles are mainly plastic problems. Compared to supermarket straws and plastic bags, PET bottles take up more space and are easy to fold [3]. Only one-sixth of the purchased PET bottles are recycled, five of which are eventually dumped in landfills or the sea. Plastics take nearly hundreds of years to break down and pollute the environment, wildlife and other organisms. Polyethylene terephthalate is a flexible plastic composed of two monomers, modified ethylene glycol and purified terephthalic acid. PET is mainly used for food and water packaging due to its safety, transparency, strength and flexibility. Up to 100% of PET packages can be made from recycled PET, allowing endless recycling of materials and reducing the amount of waste landfilled [4].

1.1.About :

Recycling is one of the best approaches for effective waste management by increasing the amount of waste generated and limiting landfills for waste treatment. I came up with the idea of a vending cart with a reward function called a reverse vending machine.

A reverse vending machine (RVM) is a machine capable of returning empty beverage containers such as bottles and cans for recycling. In most cases, the machine will return deposit or refund amount to the end user. The reverse folder is an important part of the container storage system in Europe and the United States, where 70% of up to, beverage containers are sorted and recycled [5]. The RVM classifies containers in three ways: by analyzing the material of the container (using an infrared spectrometer, etc.), by checking the shape of the container, and by checking the barcode.

These three basic controls prevent fraudulent collection. But at the same time, this equipment makes RVM too expensive. In this paper, detection of fraud by reverse vending machine (RVM) with strain gauge gravimeter and infrared photoelectric sensor is performed.

The goal of reverse vending machine (RVM) is to effectively manage waste and reduce pollution levels for recycling. In the recommended reverse directory, the user inserts a plastic bottle (PET) into the machine once the machine is running , coins will come out according to the weight of the bottle. Reverse vending machines can be installed at bus stops, train stations, universities, malls, public places, etc ^[1].

Other bottles:

- Polyethylene terephthalate
- High density polyethylene
- Polyvinyl chloride
- Low density polyethylene
- Polypropylene.
- Polystyrene



Figure 1 .Types Of Bottles And Their Recycling Rates

1.2 Survey details :

A survey was conducted at the college from students, based on the usage of PLASTIC BOTTLES per day per person.

This is the SURVEY DETAILS :

Table 1 - SURVEY DETAILS :

Total number of students	Types of bottles	Column B (t)
250	1 .One litre.	132
	2. Half litre.	156
	3 . Others.	78

2.Process:

There are three stages: start stage, processing stage, and end stage.

*** Input Steps:**

Disposable plastics come in many types of highly recyclable plastics, including bottles and cans. This machine is designed to accept only PET bottles RVM accepts one or two empty bottles in one liter PET of any shape. When the user brings the bottle closer to the door, the bottle is detected, the door opens and the user can place the bottle.

*** Processing step:**

After placing the bottle, the force sensor checks the weight of the PET bottle. Its length is detected by the IR sensor. The bottle is then accepted and returned to the user. Due to the low weight of the empty bottles, an HX711 amplifier is used to amplify the impact of the force sensor and the bottles fall into the bottles held inside the device. The signal is transmitted to the Arduino UNO

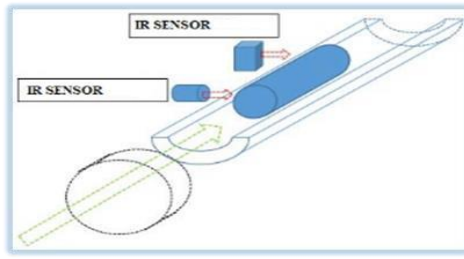


Fig. 2 Detection of bottle length by IR sensor

* Output:

The parts that come out of the box contain the part to the user based on the weight of the bottle. The table below shows the parts according to the weight of the bottle.

Table 2: Output details

Weight Required to each Coin to pop out	Resultant Weight	Coin User gets	Number of Bottles getting filled in the Bin
120gm	120gm	First	3
120gm	240gm	Second	6
120gm	360gm	Third	9
120gm	480gm	Fourth	12
120gm	600gm	Fifth	15
120gm	720gm	Sixth	18
120gm	840gm	Seventh	21
120gm	960gm	Eighth	24
120gm	1080gm	Ninth	27
120gm	1200gm	Tenth	30

Note: The 1000ml bottle weighs approximately 0g and the height of the RVM is 2 cm. So, to meet the 120g standard and dispensing unit, 3 bottles are needed, and the design model size is 1.2kg (total 30 bottles can be filled).

3. Block diagram and Flowchart of project :

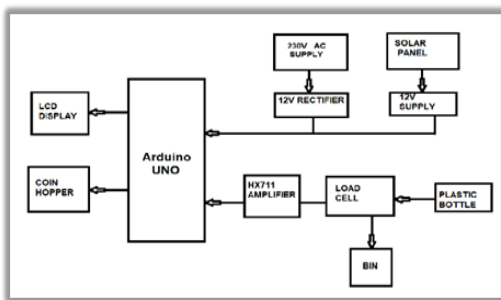


Figure 3 : Block Diagram

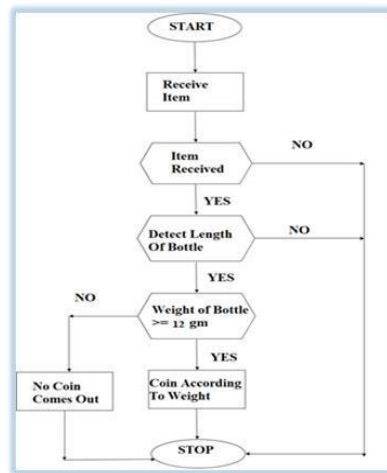


Figure 4 : Flowchart

4. Model:

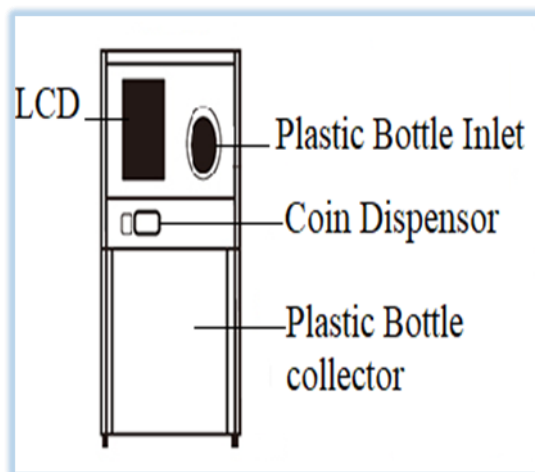


Figure 5 : Model diagram of RVM

5. Advantages :

- This machine helps in waste management.
- People who recycle waste will receive coins.
- The system can be installed in many different places, such as an ATM.
- Can be installed in locations where large amounts of plastic are released into the environment.
- Can be installed in public transport such as train and bus stations to issue tickets in exchange for PET bottles.

6. Disadvantages:

- The system requires proper maintenance and care.
- Equipment should be installed everywhere.
- High initial investment in system.
- Collected in the container.

7.. Conclusion

- This module reduces a person's physical effort to perform the required tasks (plastic collection and classification) by about 80%.
- Use renewable energy sources.
- Empty PET bottles with a capacity of 1000 liters can be easily sorted and recycled.
- The module is designed for 1.2 kg of plastic, making it compact, easy to transport and to install.
- This model can be installed in commercial complexes, railway stations, shopping centers, etc.

8. Future Scope :

Reverse vending machines have endless research and improvements. However, in many countries reverse vending machines are not common due to the high initial implemented simply because they cannot afford it. For this project, a low cost vending machine is designed.

The remaining challenges and the scope of this work are as follows:

- Improves the detection accuracy of the sensor system.
- Various classification systems for materials.
- Redeem points.
- IOT implementation.

- Reduced energy consumption.
- Install the barcode reader.
- Implement image recognition procedures in RVM.

References

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