Recycling Paper Vending Machine

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Abstract: — A "recycling paper vending machine" is an innovative device designed to promote sustainability by efficiently recycling used paper into reusable sheets. The machine collects discarded paper, processes it through shredding, pulping, and drying mechanisms, and outputs fresh sheets or paper rolls. Equipped with user-friendly controls, it incentivizes recycling by offering rewards, such as coupons or tokens, for paper deposits. Its compact design makes it suitable for public spaces like schools, offices, and malls, encouraging environmental awareness and reducing waste. This vending machine is a practical solution for minimizing deforestation and contributing to a circular economy.

Index Terms **– Recycling Paper Vending Machine (RVPM)**

I. INTRODUCTION:

Recycling paper vending machines are innovative solutions designed to promote environmental sustainability and efficient waste management. These machines encourage individuals and communities to recycle used paper by providing an easy and rewarding process. They operate by allowing users to deposit waste paper, which is then processed for recycling. The vending machine identifies, sorts, and compacts paper, ensuring it is ready for recycling centers. In return, users can receive rewards such as discounts, coupons, or even cash incentives, fostering motivation for continued participation.By integrating advanced technologies like sensors and AI, these machines ensure accurate sorting and reduce contamination. They help minimize landfill waste, conserve natural resources, and reduce carbon footprints associated with paper production. Recycling paper vending machines are not just eco-friendly but also raise public awareness about responsible waste disposal. They can be installed in schools, offices, public spaces, and commercial areas to maximize their impact. As a step toward a circular economy, these machines demonstrate how technology and innovation can support a greener future.

II. LITERATURE SURVEY

[1] **Mariya et al. (2020)** – Proposes a Plastic Eco-Redeemer Vending Machine for recycling plastic bottles, aiming to enhance waste management efficiency.

[2] **Sambhi & Dahiya (2020)** – Discusses the role of vending machines in managing plastic waste and their potential impact on environmental sustainability.

[3] **Soni et al. (2020)** – Describes an Arduino-based vending machine for plastic recycling, improving automation and ease of use.

[4] **Kosior & Mitchell (2020)** – Examines industry perspectives on plastic production and recycling, emphasizing challenges and advancements.

[5] **Lun (2011)** – Analyzes beverage container recycling processes in Japan and the potential market for RVMs.

[6] **Krystallidis (2013)** – Highlights a successful recycling reward system in Kardjali, Bulgaria, encouraging public participation.

[7] **Zamani (2015)** – Reports on Malaysia's low recycling rates and the need for improved waste management strategies.

[8] **Krystallidis (2013)** (Duplicate of #6) – Discusses the impact of incentive-based recycling programs in Bulgaria.

[9] **Geller (1989)** – Integrates applied behavior analysis and social marketing to promote environmental preservation.

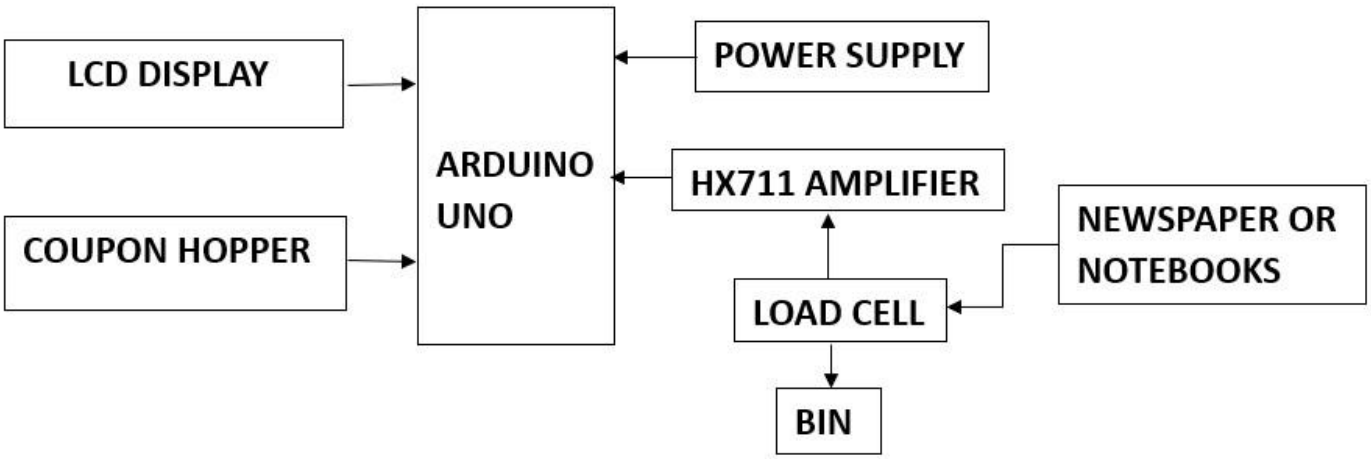
A. Overview:

A recycling paper vending machine is a smart device designed to simplify and incentivize paper recycling. Users can deposit waste paper into the machine, which processes it for recycling by sorting and compacting it efficiently. These machines are equipped with advanced technologies like sensors to ensure proper identification and minimize contamination. In return, users receive rewards such as coupons, discounts, or other incentives, encouraging active participation. By promoting recycling habits, these machines reduce paper waste in landfills, conserve natural resources, and lower carbon emissions tied to paper production. They are ideal for public spaces, schools, offices, and commercial areas, raising awareness about sustainable waste management. Recycling paper vending machines play a vital role in fostering environmental responsibility and advancing the shift toward a circular economy.

III. Objective

1. Encouraging Recycling and Waste Reduction
2. Improving Waste Management Efficiency

IV. Block Diagram



Fig(4.1) :Block Diagram

The paper may be put into the chamber once the user deems the paper to be useless. If the paper is accepted, it is taken inside the chamber and the message "PAPER ACCEPTED" is shown. The word "THANK YOU" is displayed to show how much are appreciated for their contribution to the recycling process. Then, reward is distributed as per previously set.

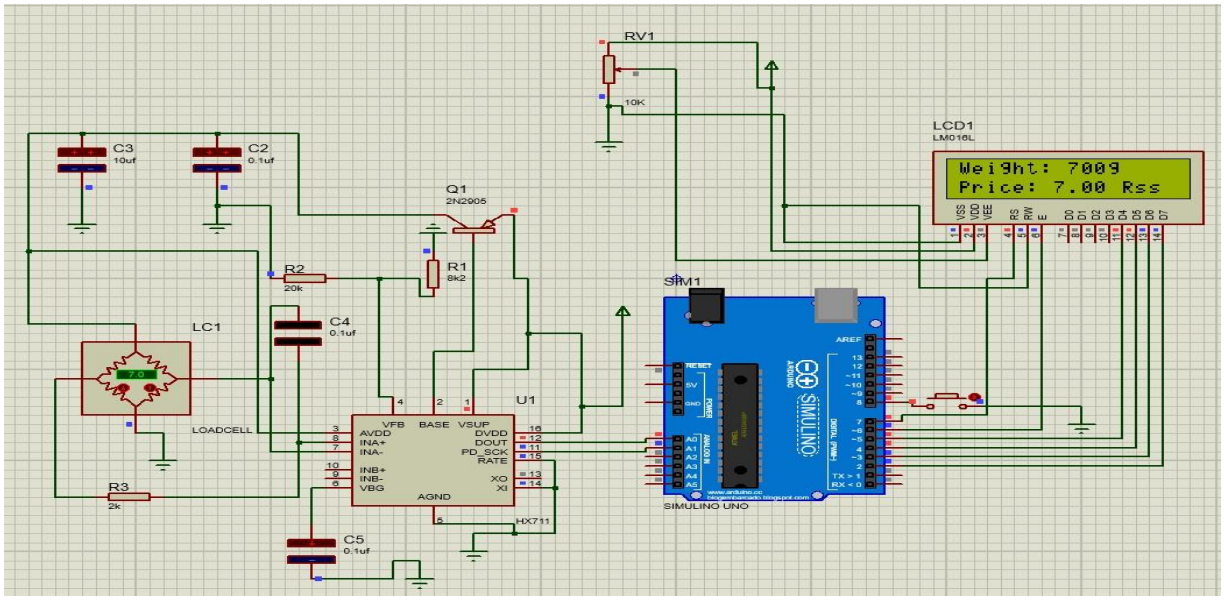
WORKING PRINCIPLE

The working principle of a Reverse Recycling paper meachine revolves around encouraging and facilitating the recycling of beverage containers, such as papers, cardboard. Here's a step-bystep explanation of how RVMs typically operate:

1. **Initialization:** The machine powers up and enters standby mode, ready to accept paper waste**.**
2. **Paper Insertion:** Users deposit paper waste through an input slot.
3. **Detection:** Sensors (e.g., optical or weight-based) identify the material type to ensure it is paper.
4. **Verification:** The system checks for contaminants like plastic or metal staples. Non-paper materials are rejected.
5. **Measurement:** The machine calculates the weight or volume of the paper for processing**.**
6. **Sorting (Optional):** If equipped, the machine classifies paper types (e.g., newspaper, cardboard) for recycling requirements.
7. **Compression (Optional):** A compacting mechanism compresses paper for efficient storage**.**
8. **Storage:** The verified and processed paper is moved to an internal storage bin for collection**.**
9. **Output:** The output will be shown in the lcd display and the coupon will be received**.**

The working principle of Paper Vending Meachines is designed to make recycling convenient and rewarding for users while automating the process of sorting and collecting recyclable containers. These machines encourage responsible recycling behaviour, reduce litter, and support environmental conservation efforts.

V.CIRCUITDIAGRAM :



Fig(5.1) :Circuit Diagram

A Recycling Paper Vending Machine circuit diagram represents the electrical and electronic components that make up the (RPVM) and how they are interconnected. It's important to note that the specific components and

their interconnections in an RPVM circuit diagram can vary depending on the manufacturer, design, and features of the machine. The purpose of the circuit diagram is to provide a detailed representation of how the electrical and electronic components work together to facilitate the recycling process and user interaction within the RPVM.

Load Cell (LC1): A load cell is connected to measure weight and generate an analog signal proportional to the applied load.

1. **Signal Amplification:** The small analog signal from the load cell is sent to an HX711 IC(U1), a 24-bit ADC (Analog-to-Digital Converter) designed for weight measurement.
2. **Power Supply to HX711:** The HX711 is powered through the AVDD (pin 16) and DVDD (pin 15) pins. Capacitors C4 and C5 (0.1 µF) stabilize the power supply.
3. **Input to HX711:** The differential analog signals from the load cell are connected to INA+ and INA-(pins 10 and 11).
4. **Data Pins:** The DOUT (pin 12) and PD_SCK (pin 11) pins on HX711 communicate weight data to the Arduino UNO.
5. **Arduino Power and Ground:** The Arduino UNO is powered via the 5V supply and GND, ensuring all components share the same ground.
6. **LCD Module:** An LCD (LM016L) is used to display the weight and price of the object. It connects to the Arduino via its data pins D4-D7 and control pins RS, E.
7. **LCD Initialization:** The LCD module requires 4-bit communication mode controlled by Arduino pins.
8. **Potentiometer (RV1):** A 10k ohm potentiometer adjusts the contrast of the LCD.
9. **Weight and Price Calculation:** The Arduino reads weight data from the HX711 and calculates the weight and price based on a defined cost per unit weight.
10. **Price Display:** The price per unit weight is hardcoded into the Arduino, and the total cost is displayed alongside the weight.
11. **Q1 Transistor (2N2905):** A PNP transistor controls an additional circuit component, likely to switch signals from the load cell.

15. **Calibration of Load Cell:** The Arduino code calibrates the load cell using the HX711 library to ensure accurate weight readings.

16. **Analog to Digital Conversion:** HX711 converts the analog signal into digital form and transmits it serially to the Arduino.

17. **Programming:** The Arduino is programmed to read the HX711 output and display the corresponding weight and price on the LCD.

19. **LCD Display Example:** As shown, the display outputs “Weight: 700g” and “Price: 7.00 Rs”.

20. **Output:** This circuit integrates a load cell, HX711, Arduino, and LCD to display real-time weight and price, functioning as a weighing scale with cost calculation.

APPLICATIONS

1. Reduces paper waste by providing a simple recycling solution.

2. Promotes environmental conservation through efficient paper reuse.

3. Encourages eco-friendly habits by offering rewards for recycling.

4. Supports waste management in schools, offices, and public spaces.

5. Decreases landfill use by diverting paper waste to recycling streams.

6. Contributes to reducing deforestation by increasing paper recovery.

7. Raises public awareness about the importance of recycling.

TABLE 1 : COMPREHENSIVE REVIEW ON RPVM

FEATURE	DESCRIPTION
Name	**Reverse Paper Vending Machine**
Location	**Supermarkets, schools, parks, public spaces, etc.**
User Interaction	**Screen interface, deposit area for containers**
Accepted Containers	**Note Books, newspapers, etc.**
Recognition Technology	**Embedded**
Central Processing Unit	**Manages sensors, data processing, and user rewards**
Payment Option	**Coupon dispenser**
Integration	**May be part of recycling programs and sustainability efforts**

VII. CONCLUSIONS AND FUTURE SCOPE

In conclusion, a paper recycling vending machine offers a sustainable and practical solution to reduce paper waste, conserve natural resources, and promote eco-friendly behaviors. By encouraging recycling through rewards and raising awareness about environmental issues, it contributes to reducing landfill waste and deforestation. Its presence in public spaces helps build a more sustainable future, fostering community involvement and supporting the circular economy. Ultimately, it plays a crucial role in enhancing waste management practices and protecting the environment.

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