

Empowering Hygiene: Design and Development of an Arduino-Based Vending Machine for Sanitary Pads and Sanitizers

Pameela M

Lecturer, Department of Electrical and Electronics Engineering,
GEMS polytechnic College, Aurangabad, Bihar, India
pameela@gemspolytechnic.edu.in

Shweta Kumari, Aryan Kumar, Kumari Divya Bharti and Priyanka Kumari,
Final Year Students, Department of Electrical and Electronics Engineering,
GEMS polytechnic College, Aurangabad, Bihar, India

Abstract — This project introduces an innovative Arduino-based automatic vending machine designed to dispense sanitary pads and hand sanitizer. The primary objective is to implement cutting-edge technology to address the limitations of traditional coin-based vending machines, specifically those that only accept a fixed denomination without providing change. The vending machine consists of three key units: a Coin Acceptor, an Arduino UNO for programming and control, and a Spring Mechanism for product delivery. Additionally, an Automatic Hand Sanitizer Unit enhances the machine's functionality, contributing to better protection against Covid-19. The project aims to provide a cost-effective solution to improve hygiene practices and make essential products more accessible.

Keywords— Arduino UNO, Motor Drive, Sensor, Vending Machine, Sanitary Pad,

Hand Sanitizer, Covid-19, Hygiene, Automation.

I. Introduction

Hygiene product accessibility, particularly sanitary pads and sanitizers, is a critical concern in various communities. This research proposes a novel approach by developing an Arduino-based vending machine that not only provides sanitary pads but also dispenses sanitizer, incorporating a 5-coin affordability mechanism for enhanced accessibility.

Vending machines have evolved over the years, offering a wide array of products to consumers at the touch of a button. From snacks to beverages, these automatic dispensers have become ubiquitous in various settings. This project focuses on an Arduino-based vending machine specifically designed to dispense sanitary pads, addressing a fundamental need in public spaces. While the concept of vending machines originated in the late 19th century, this project seeks to

leverage modern technology to not only dispense essential hygiene products but also encourage interdisciplinary learning by integrating mechanical, electronic, electrical, and programming skills.

The primary motivation behind this project is to contribute to the advancement of technology applications in society, addressing prevalent issues related to hygiene product accessibility. The vending machine is equipped with three key units: a Coin Acceptor, an Arduino UNO for programming and control, and a Spring Mechanism for efficient product delivery. Additionally, an Automatic Hand Sanitizer Unit is integrated, reflecting the project's commitment to promoting health and safety, especially in the context of the ongoing Covid-19 pandemic.

II. Problem Statement

Access to essential hygiene products such as sanitary pads and hand sanitizers is crucial, especially in public places. In many instances, the availability and accessibility of these products can be limited, leading to inconvenience for users. The need for a convenient and automated solution to provide these products in a user-friendly manner is evident.

The current challenge is to develop an Arduino-based vending machine capable of dispensing sanitary pads and hand sanitizers. The machine should be designed for easy use in public spaces such as restrooms, educational institutions, and healthcare facilities. The primary goal is to create a reliable, user-friendly, and efficient system that ensures quick access to essential hygiene products.

CHALLENGES:

Challenges in Designing and Implementing Arduino-Based Vending Machine for Sanitary Pads and Hand Sanitizer:

Technological Integration:

Integrating Arduino, coin acceptors, motors, and sensors requires a seamless technological integration, posing a challenge in ensuring all components work cohesively.

Cost-Effectiveness:

Designing a vending machine that is both affordable and efficient poses a financial challenge. Balancing functionality with cost-effectiveness is crucial for widespread adoption.

User Interface and Accessibility:

Creating a user-friendly interface for a diverse user base is challenging. The design must be intuitive, ensuring easy access to sanitary pads and hand sanitizers for users of different ages and backgrounds.

Maintenance and Durability:

Vending machines in public spaces require robustness to withstand regular usage. Ensuring minimal maintenance and high durability is a challenge, especially in environments with varying conditions.

Hygiene and Safety Standards:

Meeting hygiene and safety standards is critical, especially when dispensing products related to personal health. Ensuring the cleanliness and safety of the dispensed items adds complexity to the project.

III. Working Principle

User Interaction:

The process begins when a user approaches the vending machine to purchase sanitary pads or hand sanitizer.

Coin Insertion:

The user inserts a coin into the designated coin acceptor slot. The coin acceptor, equipped with sensors, detects and verifies the inserted coin's authenticity and denomination.

Arduino Control:

The coin acceptor sends signals to the Arduino Uno microcontroller, which processes the information. The Arduino manages the user interface, processes the coin value, and initiates the product dispensing mechanism.

Product Selection:

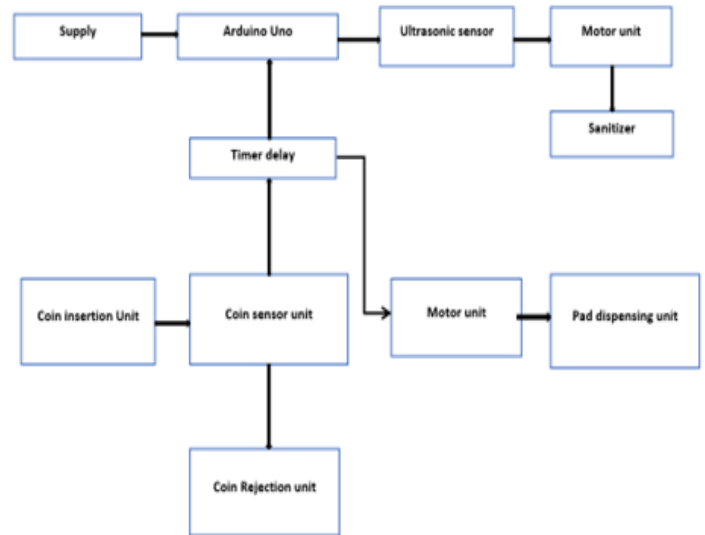
The vending machine is equipped to dispense either sanitary pads or hand sanitizer. The user selects the desired product through the user interface, typically a button or a touch screen, triggering the corresponding dispensing mechanism.

Dispensing Mechanism:

For sanitary pads, the dispensing mechanism involves a motor-driven system that releases a single sanitary pad per transaction. The mechanism ensures accurate and controlled dispensing. For hand sanitizer, a pump or similar mechanism dispenses a predetermined quantity of sanitizer into a user-accessible area.

IV. Proposed Model

The proposed model is an Arduino-based vending machine designed to dispense sanitary pads and hand sanitizer. This innovative solution aims to address the need for accessible and hygienic menstrual hygiene products in public spaces.



V. Design of Vending Machine

The key components and features of the proposed model Design include:

Arduino Uno Microcontroller:

- The central control unit is an Arduino Uno, providing a programmable and open-source platform.
- It serves as the brain of the vending machine, controlling various functions and in



Ultrasonic Sensor:

- An ultrasonic sensor is employed for user detection. This sensor initiates the interaction with the vending machine when a user approaches, ensuring a touch-free and convenient experience.



Coin Acceptor:

- The vending machine is equipped with a coin acceptor mechanism.
- Users can insert coins of different denominations to make payments for the sanitary pads and hand sanitizer.



Product Dispensing Mechanism:

- A reliable and user-friendly product dispensing mechanism is integrated. This ensures the secure and hygienic dispensing of sanitary pads and hand sanitizer when a successful transaction occurs.

12V DC Motor:

- The dispensing mechanism is powered by a 12V DC motor, providing the necessary force for smooth and controlled product dispensing. The motor ensures efficient operation and reliability.

12V/2A Adapter:

- The vending machine is powered by a 12V/2A adapter, ensuring a stable and regulated power supply. This adapter is chosen for its compatibility with the system's power requirements.

Time Delay Relay:

- Time delay relays are used to control the timing of different operations within the vending machine. This includes regulating the duration of product dispensing and ensuring a systematic process.

Jumper Wires:

- Jumper wires are used for neat and organized connections between different components. Different colors may be employed for easy identification and troubleshooting.

VI Arduino Programming

```
const int anPin = 0;

long anVolt, cm;

void setup() {
    Serial.begin(9600);
}

void read_sensor() {
    anVolt = analogRead(anPin);
    cm = anVolt / 2;
}

void print_range() {
    Serial.print("Range = ");

    Serial.print(cm);

    Serial.println(" cm");
}

void loop() {
    read_sensor();

    print_range();

    delay(100);
}
```

VII Applications

The Arduino-based vending machine for sanitary pads and hand sanitizer has several potential applications, contributing to both public health and technological innovation. Here are some key applications:

Public Restrooms and Facilities:

Installation in public restrooms to provide easy access to sanitary pads and hand sanitizers for women and men.

Suitable for schools, colleges, offices, shopping malls, and other public spaces.

Healthcare Centers:

Implementation in healthcare facilities, clinics, and hospitals to enhance hygiene practices and ensure the availability of sanitary products.

Educational Institutions:

Placement in schools and colleges to promote menstrual hygiene among female students.

The hand sanitizer unit can contribute to maintaining a clean and sanitary environment.

Corporate Offices:

Integration into corporate office spaces to support the well-being of employees and maintain a clean working environment.

Transportation Hubs:

Installation in airports, bus stations, and train stations to cater to the needs of travelers and commuters.

Commercial Spaces:

Use in shopping centers, restaurants, and entertainment venues to offer convenient access to sanitary products and hand sanitizers.

Community Centers:

Deployment in community centers and recreational facilities to address the hygiene needs of community members.

Promotion of Technological Literacy:

As a project developed using Arduino, it can be utilized in educational settings to promote technological literacy and interdisciplinary learning.

Crisis or Disaster Response:

Temporary deployment in disaster-stricken areas or during emergencies to provide essential hygiene products.

Innovation and Entrepreneurship:

Inspire innovation and entrepreneurship by serving as a prototype for similar vending machines, encouraging the development of cost-effective solutions.

These applications contribute to promoting better hygiene practices, ensuring the availability of sanitary products, and leveraging technology for social and public health benefits.

VIII Conclusion

The Arduino-based vending machine for sanitary pads and hand sanitizer is a technological advancement aimed at addressing hygiene needs in public spaces. This innovative solution combines mechanical, electronic, and programming elements to create a versatile and user-friendly system. The inclusion of a sanitary pad dispenser is particularly noteworthy as it contributes to menstrual hygiene awareness, making such products more accessible and promoting a healthier environment.

The project's interdisciplinary approach is commendable, encouraging learners to bridge the gap between various disciplines. By incorporating Arduino technology, the machine becomes a cost-effective and efficient solution for dispensing essential hygiene products. Additionally, the

integration of an incinerator for sanitary waste reflects a commitment to environmental sustainability, addressing the challenges associated with improper disposal.

With applications ranging from educational institutions to healthcare facilities, this Arduino-based vending machine showcases the potential for technology to contribute to public health and well-being. As the project successfully aligns with contemporary hygiene and environmental concerns, it sets the stage for future developments and advancements in automated hygiene dispensing systems.

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