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# Medicine and Femmecare Sanitary Napkins Vending Machine

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***Abstract***

*Access to affordable sanitary napkins and essential medicines in rural areas of India remains a significant challenge. This study presents an innovative vending machine designed for rural areas to provide essential sanitary napkins and medicines, aiming to enhance public health and welfare. The vending machine addresses menstrual hygiene by offering free sanitary napkins to registered women via a unique QR code system, leveraging Raspberry Pi technology and a Pi camera. For those without QR codes, sanitary napkins can be accessed through convenient payment methods. The machine also dispenses medicines for common ailments, available to all users through coin or online payments. It features a 7" LCD touch display for intuitive operation and integrates both coin mechanisms and digital payment options. Furthermore, it includes a specialized disposal compartment for used sanitary napkins, equipped with a Peltier device and electromagnetic lock. This disposal system is restricted to authorized personnel, ensuring safe and controlled disposal. This study details the setup and functionality of the machine, including the integration of hardware and software components such as the Raspberry Pi, Pi camera, and payment systems. The potential of this vending machine to improve healthcare access in rural areas is discussed, with a focus on promoting hygiene and health awareness, particularly among women. The socio-economic impact, challenges faced, and outcomes achieved are explored, highlighting the transformative potential of this innovation in promoting health equity in rural regions. The findings underscore the feasibility and effectiveness of using Raspberry Pi-based technology and QR codes to enhance healthcare accessibility.*

**Keywords:** Menstrual hygiene, sanitary napkins, disposal Raspberry Pi, QR Code, vending machine, LCD touch display

## INTRODUCTION

In remote and underserved rural regions, accessing essential healthcare products like sanitary napkins and medicines remains a continuous challenge. The limited availability and restricted accessibility to these critical items can disproportionately impact the health and well-being of individuals, particularly women facing menstrual health issues and communities with limited access to medical facilities. Recognizing this gap in healthcare accessibility, the integration of advanced technology into vending machines presents a promising solution to address this pressing concern. This report explores the development and implementation of an innovative vending machine system designed specifically for rural areas. The primary aim is to bridge the gap in access to sanitary napkins and essential medicines by introducing a vending machine equipped with a QR scanner, simplifying the process of product selection. The

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integration of QR scanner technology into the vending machine serves as a groundbreaking approach to enhancing user interaction and accessibility. Throughout this report, the technical complexities of integrating QR scanners into the vending machine system will be examined. Additionally, the report will explore the potential socioeconomic impact of deploying such a technological solution in rural communities. The overarching goal is to highlight the feasibility and benefits of employing QR scanner-enabled vending machines to address critical healthcare needs, particularly in areas where access to these essential items is limited. This vending machine stands out due to its strategic utilization of Raspberry Pi technology to generate and employ personalized QR codes. Women can effortlessly obtain sanitary napkins by simply scanning their unique QR codes using the integrated Pi camera system. For those without QR codes, the vending machine offers alternative user-friendly payment methods, ensuring accessibility for all individuals. Additionally, the machine dispenses medicines through both coin-operated mechanisms and online payment options, enhancing convenience and flexibility for users. This vending machine is equipped with a 7" LCD touch display, users can seamlessly interact with the vending machine to select their desired products. The comprehensive setup of the machine includes a dedicated disposal compartment for burning used sanitary napkins, promoting proper hygiene practices and environmental sustainability. This disposal compartment is designed with restricted access, where only authorized personnel can manually activate the burning process. Once the disposal compartment is filled, a notification is sent to the authorized person, who then comes and turns on the disposal mechanism, ensuring the safe and controlled disposal of the used napkins. The report delves into the intricate workings of the machine, detailing the integration of Raspberry Pi, Pi camera, touch display, QR codes, and payment systems to facilitate a smooth and efficient user experience. Beyond its technical prowess, this vending machine holds significant socio-economic implications for rural communities. By improving healthcare access, especially for women and underprivileged populations, it empowers communities by fostering health awareness and hygiene practices. The report underscores the transformative potential of this project in enhancing healthcare accessibility and promoting health equity in rural regions, ultimately contributing to the overall well-being and development of these underserved communities. Through a comprehensive exploration of the development process, challenges encountered, and outcomes achieved, this report aims to showcase the effectiveness of Raspberry Pi-based technology and QR codes in vending machines. By emphasizing the positive impact on healthcare accessibility and community empowerment, this vending machine represents a promising innovation with far-reaching benefits for rural areas, addressing the critical need for improved healthcare services and promoting sustainable development in these underserved regions.

## LITERATURE REVIEW

Gawande *et al.* proposed a finite state machine (FSM) based automatic dispense machine that incorporates an expiry date feature [1]. Their research, published in the International Conference on E-mobility, Power Control and Smart Systems (ICEMPS), explores the utilization of VHDL for the design and implementation of this automated system. Patil *et al.* presented a touch screen-based automated medical vending machine, aiming to improve the accessibility and efficiency of medical supplies distribution [2]. The touch screen interface represents a significant advancement in user-friendly design for automated vending machines. Kara provides foundational knowledge on microprocessor systems and their applications [3]. Hay *et al.* conceptualized the “Any Time Medicine Vending Machine”, focusing on the availability of medicines round the clock [4]. By proposing an automated system that operates 24/7, this concept aims to address the limitations of traditional pharmacy hours and improve healthcare accessibility. Vijendra *et al.* proposed “The Complete Vending Machine”, which provides a comprehensive guide to the design, implementation, and operation of vending machines [5]. It covers a broad spectrum of topics, including mechanical design, electronic control, and user interface considerations. Shreeshayana and Simrah introduced the concept of an ATM-based automated medical machine (AMM) in the Int Res J Eng Technol [6]. This research explores the adaptation of ATM technology for dispensing medical supplies, combining the security features of ATMs with the functionality of medical vending machines. Samba *et al.* conducted a community-based study on menstrual hygiene among adolescent girls, published in the Int J Res Appl Sci Eng Technol

[7]. This study highlights the importance of accessible menstrual hygiene products and the role of vending machines in addressing this need. The findings emphasize the necessity of providing sanitary products in a convenient and discreet manner to promote menstrual hygiene management. The Sandip Institute of Technology & Research Centre published a report on the implementation of sanitary napkin vending machines and incinerators [8]. This initiative aims to improve menstrual hygiene by providing easy access to sanitary napkins and environmentally friendly disposal options. The report underscores the importance of integrating vending machines and incinerators to address both availability and waste management issues. Babu *et al.* proposed a solar powered IoT-based intelligent sanitary napkin dispenser, emphasizing sustainable and smart solutions for menstrual hygiene [9]. Their research highlights the use of renewable energy sources and IoT technology to enhance the efficiency and accessibility of sanitary napkin dispensers. Yunita and Pangaribuan developed an IoT-based intelligent sanitary napkin disposer, focusing on the proper disposal of used sanitary products [10]. This research addresses the environmental impact of sanitary waste and proposes a smart solution for its management. The integration of IoT technology enables real-time monitoring and efficient operation of the disposal system. The author designed a sanitary napkin vending machine with an integrated incinerator to promote menstrual hygiene. Published in the In IOP Conf Ser: Mater Sci Eng, their work focuses on providing a comprehensive solution for the availability and disposal of sanitary products.

## METHODOLOGY

This methodology outlines the sequential steps involved in setting up, testing, and evaluating the vending machine system equipped with various components to provide sanitary napkins and medicines in rural areas. The first step involves gathering and assembling the necessary components such as the Raspberry Pi, digital display, DC motor, motor drive, power supply module, IR sensor, and Pi camera. The Raspberry Pi is configured to ensure compatibility and connectivity with the other hardware components. Next, a program is developed on the Raspberry Pi to generate unique QR codes for each sanitary napkin and medicine item intended for vending.

Following this, the Pi camera functionality is established to scan and interpret the generated QR codes accurately. Code is developed to trigger the camera for QR code scanning upon user interaction. The DC motor and motor drive system are then set up to control the dispensing of products based on QR code scanning. The system is programmed to activate the motor for product retrieval upon successful QR code validation. A user interface is designed and created for display on the digital screen, facilitating QR code scanning, product selection, and transaction completion. User-friendly prompts and instructions are integrated to guide users through the vending process. Accurate testing of the entire system is performed to ensure proper functionality and synchronization among the hardware components. The IR sensor, motor drive, and camera system are calibrated to optimize accuracy and reliability. Finally, continuous feedback from users, stakeholders, and technical experts is gathered to iterate on the design, functionality, and deployment strategy of the vending machine. Learnings and best practices are incorporated to enhance impact and scalability over time.

## TECHNICAL SETUP

The technical setup of the vending machine system involves integrating various hardware and software components to provide sanitary napkins and medicines in rural areas efficiently. The primary components include a Raspberry Pi, a digital display, a DC motor, a motor drive, a power supply module, an IR sensor, and a Pi camera as shown in Figure 1.

### Raspberry Pi and Peripheral Assembly

The Raspberry Pi serves as the central processing unit. It is configured to ensure seamless connectivity with all peripheral devices. The Touch Screen Display (7"), DC Gear Motor (12 V, 45 rpm), Power supply module (Consists 5 V, 3.3 V–2.5 A), IR sensor (3.3 V), and Pi Camera (rev 1.3) are all interfaced with the Raspberry Pi.

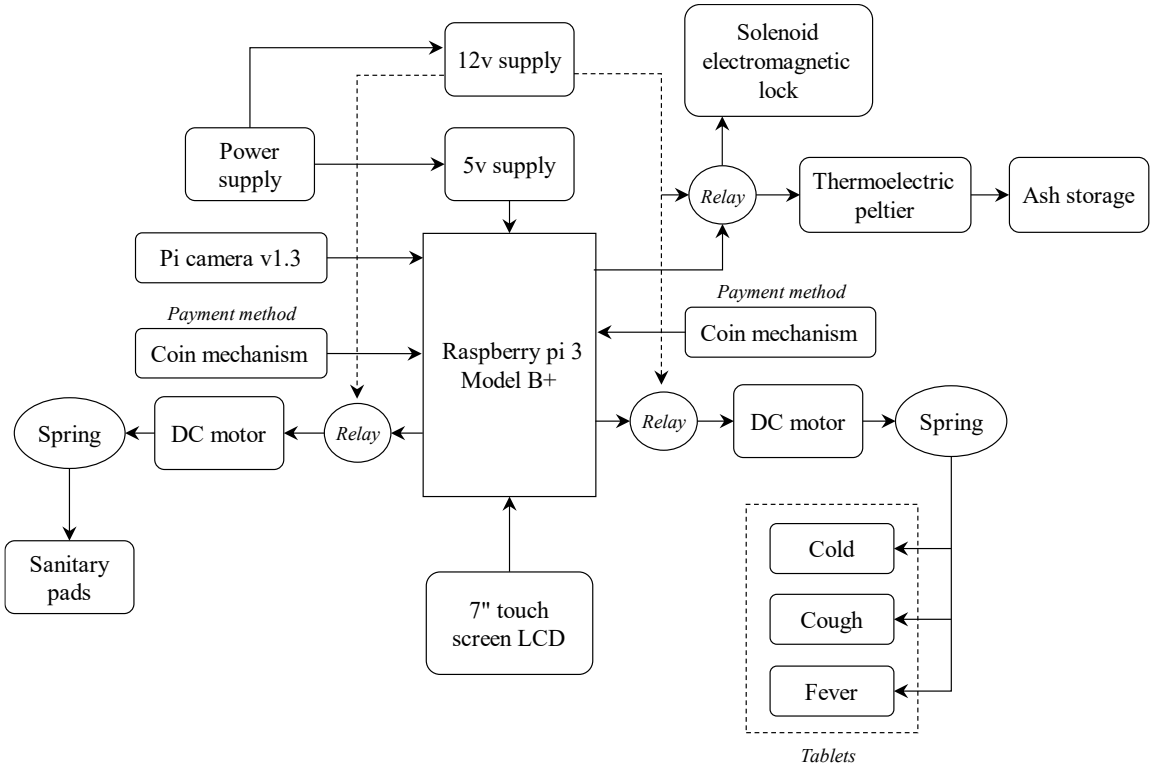



**Figure 1.** Block diagram of medicine and Femmecare sanitary napkins vending machine.


**Figure 2.** Femmecode Access Card.

### QR Code Generation

Custom software is developed on the Raspberry Pi to generate unique QR codes. These codes are used to identify each sanitary napkin and medicine item. This program ensures that each item is tagged with a distinct QR code for tracking and dispensing purposes as shown in Figure 2.

### Camera Integration

The Pi camera is set up to scan and interpret the QR codes. Software is developed to trigger the camera upon user interaction, enabling it to capture and process the QR code images accurately. The camera's positioning and lighting conditions are optimized to enhance scanning reliability.

### Dispensing Mechanism

The DC motor and motor drive are configured to control the dispensing mechanism. The system is programmed such that the motor activates and dispenses the selected product upon successful QR code validation. This setup ensures precise and reliable product retrieval.

**User Interface Development**

A user-friendly interface is designed and deployed on the digital display. This interface guides users through the vending process, including QR code scanning, product selection, and payment processing. The interface includes clear instructions and prompts to facilitate smooth user interactions.

**Payment Integration**

The vending machine supports both coin-based and UPI payment methods. The coin mechanism is connected to the Raspberry Pi, enabling it to detect and validate coin insertions. For UPI payments, the system integrates with digital payment platforms to process transactions securely.

**Disposal System**

A dedicated disposal compartment is included for used sanitary napkins. The system uses an electromagnetic lock and a Peltier device for controlled access and disposal. Authorized personnel can unlock and activate the disposal mechanism when needed, ensuring safe and hygienic disposal.

**Continuous Improvement**

Feedback from users and technical experts is continuously gathered to refine the system. Iterative improvements are made to enhance the design, functionality, and user experience. This process ensures the vending machine remains effective and scalable over time.

**WORKING**

The sanitary napkin and medicine vending machine features a user-friendly 7" LCD touch display that allows users to choose between the options of purchasing medicines or accessing free sanitary napkins. The technical setup is shown in Figure 3. The database of registered woman is shown in Figure 4.

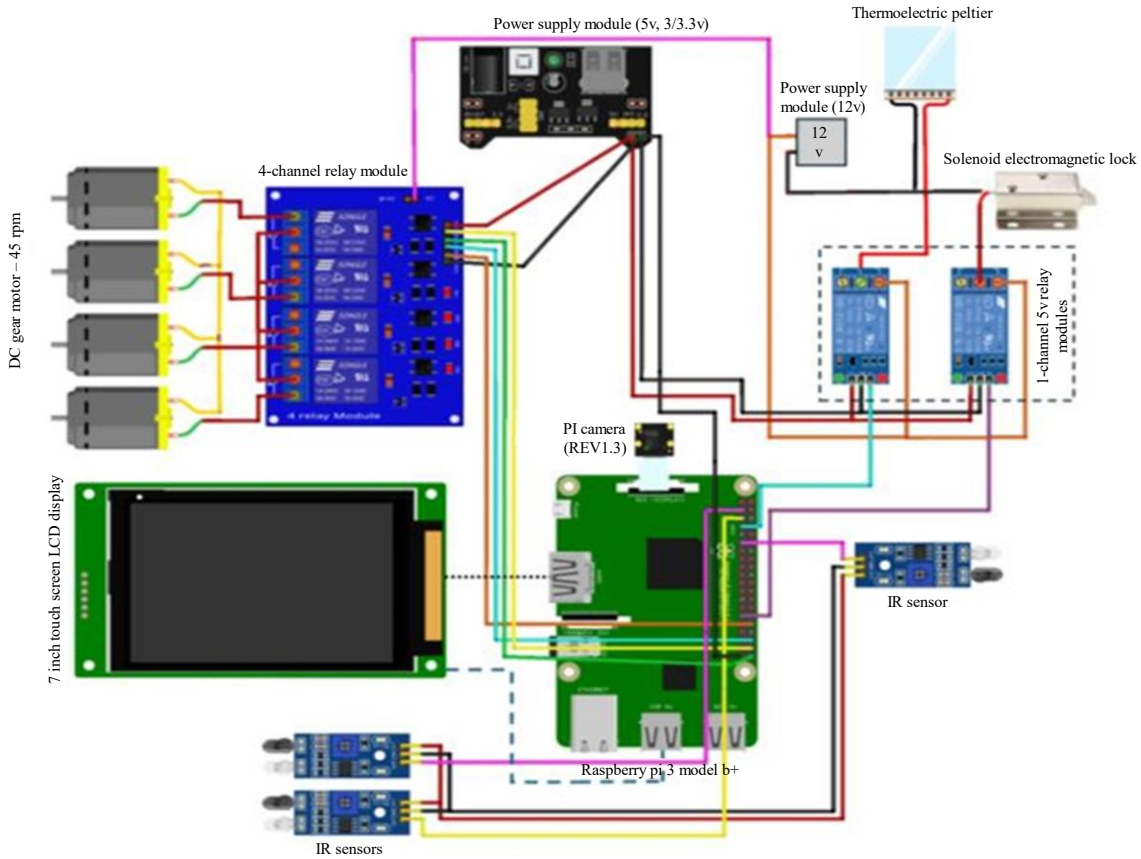
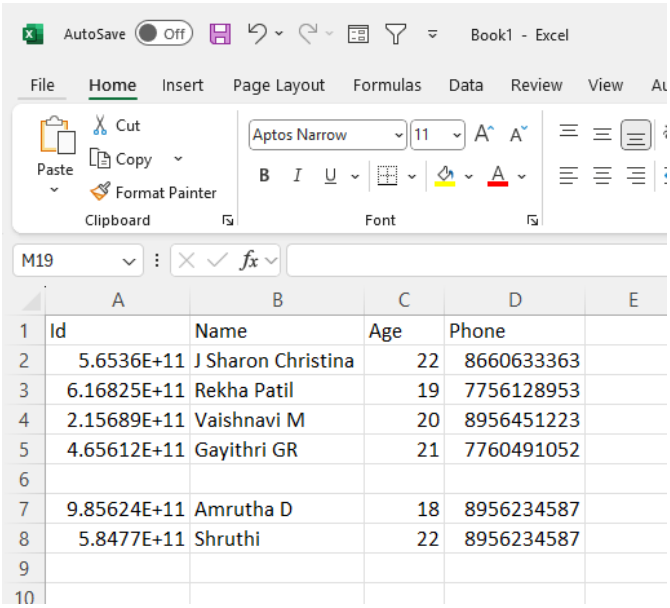



**Figure 3.** Technical Setup.



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| 8 | 5.8477E+11 | Shruthi | 22 | 8956234587 | |
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**Figure 4.** Database of registered women.

**Figure 5.** Working model.

 

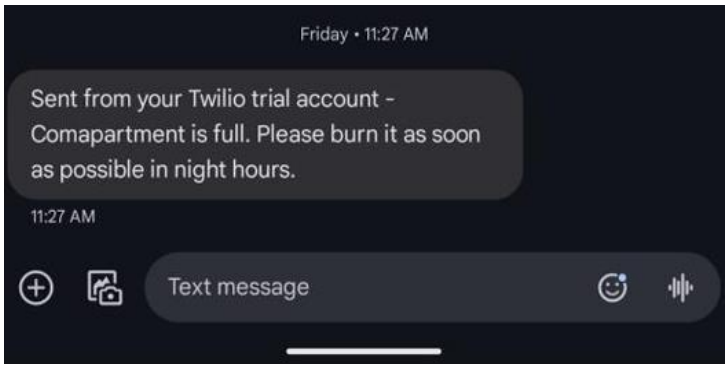


**Figure 6.** Message to authorized person.

For the medicine dispensing functionality, users can select from three options: cold, cough, and fever. They can then choose to pay either through a coin mechanism or digital payment at a cost of Rs. 2 per medicine, making it an affordable option for people in rural areas.

The machine's innovative sanitary napkin dispensing system utilizes Raspberry Pi technology. Women can access free sanitary napkins by scanning their unique QR code using the Raspberry Pi-based camera system. These QR codes are provided upon registration, and each woman can access a maximum of two packs of free napkins at a time and then will be locked for 20 days to prevent misuse of the facility. For those without a QR code, the machine offers the option to purchase sanitary napkins for Rs. 5 through the coin mechanism or digital payment, ensuring accessibility for all. The vending machine also features a dedicated disposal compartment for used sanitary napkins. Working model is presented in Figure 5. When the user selects the “Disposal” option on the touch display, the disposal door opens, allowing them to deposit the used napkins. Upon the compartment filling up, the system sends an alert to the authorized personnel. The authorized person can then unlock the disposal compartment by scanning a unique QR code in front of the Raspberry Pi camera, enabling them to safely burn the used napkins. The security and accessibility features of the machine are designed to address the needs of the rural population. The QR code based access for free sanitary napkins and the unique QR code required the authorized personnel to access the disposal compartment to ensure secure and controlled distribution. Additionally, the coin mechanism and digital payment options provide affordable and accessible alternatives for those without QR codes, promoting inclusivity and addressing the diverse needs of the community. The messaging system includes text messages or SMS to the authorized person as shown in Figure 6.

Overall, this comprehensive vending machine integrates technology, user convenience, affordability, and hygienic disposal to address the challenges of menstrual hygiene management and access to essential medicines in rural areas, contributing to the well-being and empowerment of women and the community as a whole.

## CONCLUSION

The vending machine in this project provides a convenient and hygienic solution for dispensing sanitary napkins and medicines at reasonable prices. By integrating a Raspberry Pi with a camera, relay, touch screen display, DC motors, and other components, the machine enables both coin-based and UPI payment options for users. The key features of this vending machine include free distribution of sanitary napkins through QR code access, ensuring accessibility and affordability. Coin-based and UPI payment options for purchasing napkins and medicines at reasonable prices. Automated disposal system using a Peltier device and electromagnetic lock, with controlled access for burning used napkins. Leveraging technology like Raspberry Pi, camera, and touch screen to create a user-friendly and efficient vending experience, this project demonstrates a comprehensive approach to addressing the need for accessible and hygienic sanitary products and medicines, while also incorporating safety and security measures.

 

The integration of digital payment options and disposal systems enhances the overall functionality and convenience of the vending machine, making it a valuable asset for the community it serves.

**Future Scope**

The vending machine system for dispensing sanitary napkins and medicines holds significant potential for future expansion and impact, particularly in the context of rural India. Here are some key areas of future scope:

- *Integration with government programs:* Collaborate with government health initiatives to subsidize costs and promote widespread use.
- *Enhanced product variety:* Include a broader range of medicines and hygiene products to cater to diverse health needs.
- *Mobile app integration:* Develop a mobile app for easier access to vending machine locations, product availability, and digital payments.
- *Data collection for health insights:* Use data analytics to monitor usage patterns, helping to inform public health strategies and resource allocation.
- *Solar power utilization:* Implement solar-powered vending machines to ensure operation in areas with limited electricity.

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