IOT BASED SANITARY PAD VENDING MACHINE

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Introduction:

In today's rapidly advancing technological era, automation systems have become essential across various sectors to improve efficiency, accessibility, and user convenience. One such application is in the field of automated product dispensing systems, such as sanitary napkin vending machines, which play a crucial role in promoting menstrual hygiene, especially in public places, schools, and rural areas.

This project presents a GSM-based automated control system using a microcontroller, designed to dispense items (like sanitary pads) through remote SMS commands. The system incorporates key components such as a GSM module for wireless communication, a microcontroller for decision-making, a relay module for controlling the motor, and an LCD display for user feedback. It also includes a voltage regulator circuit to ensure stable operation of all electronic components.

This model demonstrates how basic electronics and communication technologies can be combined to build a reliable and affordable remote-operated solution. It is particularly useful in areas where manual maintenance is difficult or where access to hygiene products needs to be discreet and automatic. The IoT-based sanitary pad

vending machine has the potential to improve accessibility, hygiene, and reduce stigma around menstruation.

Objectives:

- The main objective of this project is to overcome coin-based mechanisms and provide access to sanitary napkins at working places like offices, shopping malls, etc. with digital online payment.
- To design an automatic sanitary pad vending machine that dispenses pads easily and hygienically when a payment is made.
- To send notifications to the administrator when the pad stock is low or the machine needs maintenance.
- To promote menstrual hygiene awareness and support the health and dignity of women and girls.

Methodology:

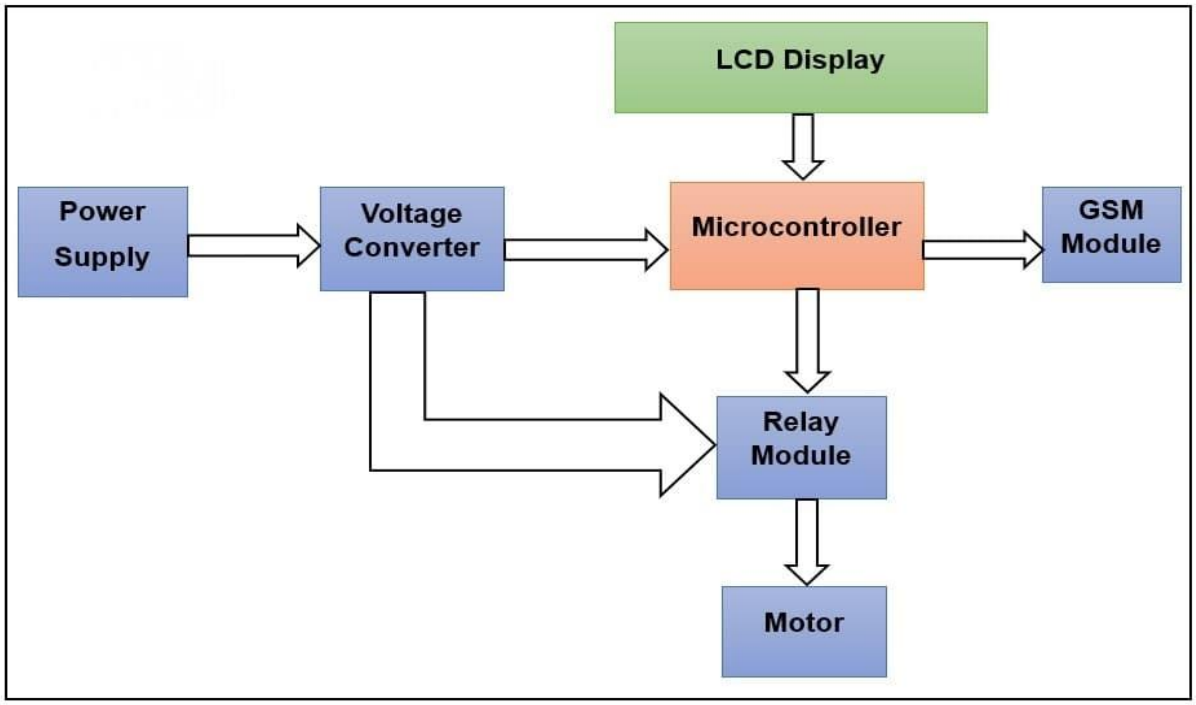


Fig.1: Block diagram of IOT based sanitary pad vending machine

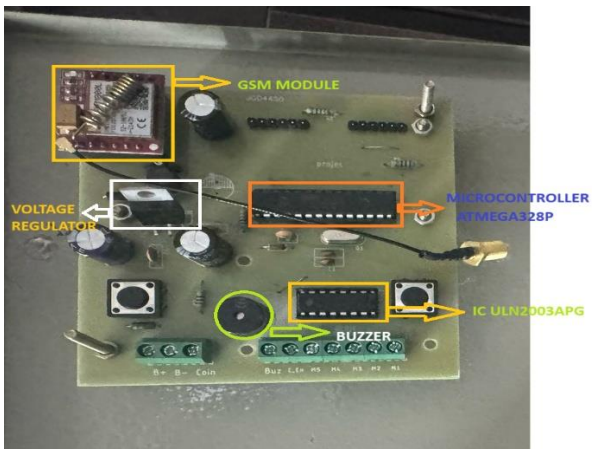
The development of this GSM-based sanitary napkin vending machine involves a combination of electronic components, communication modules, and mechanical

dispensing mechanisms. The system is powered through a regulated 12V DC power supply, which is stepped down and converted to 5V where necessary using a voltage regulator. This ensures safe and stable operation of the microcontroller and its connected components. At the core of the system is a microcontroller (such as ATmega328P), which is programmed to process SMS commands and control the motor-based dispensing unit. A GSM module is connected to the microcontroller via serial communication. This module receives SMS messages from users or administrators. Once an SMS command—such as "MESSAGE"—is received, it is passed to the microcontroller, which interprets it and initiates the vending process.

The microcontroller then activates a relay module, which in turn powers the DC motor. The motor is connected to a dispensing mechanism that pushes a single sanitary napkin out of the machine. To provide real-time system feedback, a 16x2 LCD display is integrated into the circuit. This display shows important messages. Allowing users to interact with the system effectively. The entire circuit is built using connecting wires and enclosed within a protective casing for safety and usability. The mechanical structure of the dispenser includes a motorized roller system that is precisely controlled to ensure only one pad is released at a time.

Additionally, system functionality was validated by sending multiple test SMS messages to check the response of the GSM module, the accuracy of the LCD display, and the timing of the motor control through the relay. The accompanying block diagram (as shown earlier) illustrates the interconnections between the power supply, voltage regulator, microcontroller, GSM module, LCD, relay, and motor. This visualization aids in understanding the overall data flow and control logic within the system. Through this methodology, the project successfully demonstrates how basic electronics, communication, and automation principles can be applied to create a low-cost, efficient, and remotely operable sanitary napkin vending machine.

Result and Conclusion:



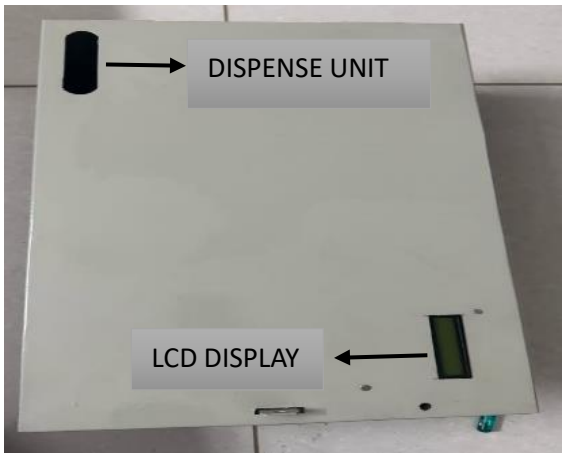


Fig. 2 (a) **Fig. 2 (b)**

Fig: 2(a) and (b) Circuit and Outer view of Vending machine

Fig. 2 (c): LCD displaying the availability of pad

Fig. 2 (d): LCD displaying Authentified message on Payment

Fig. 2 (e): LCD display to Collect the pad

The GSM-based sanitary napkin vending machine was successfully designed, assembled, and tested. The system responded accurately to SMS commands, triggering the relay and motor to dispense one sanitary napkin per valid request. Testing showed that the GSM module consistently received messages within 3–5 seconds, and the microcontroller processed them without delay.

The LCD display provided real-time updates to the user, such as system status and dispensing confirmation, enhancing the usability of the system. During multiple trials, the motor operated precisely for a set duration, ensuring a single pad was dispensed each time. The relay module reliably handled switching without overheating. Power supply stability was maintained using a voltage regulator, and no component failures were observed during continuous testing.

The project demonstrates that a low-cost, remotely operable sanitary napkin vending machine can be built using basic electronic components and GSM communication. It is particularly useful in rural or public areas where access to sanitary products is limited.

Overall, the project meets its objective of providing an automated, hygienic, and accessible solution for sanitary pad distribution. The use of SMS control makes it user-friendly, and the modular design allows for further upgrades

Project Outcome & Industry Relevance:

The successful implementation of the GSM-based sanitary napkin vending machine highlights its potential as a cost-effective and practical solution for promoting menstrual hygiene, especially in rural, educational, and public settings. The project demonstrates how basic microcontroller technology, combined with GSM communication, can automate essential services with requiring internet access.

The system ensures privacy, ease of use, and timely access to sanitary products, making it highly suitable for deployment in schools, colleges, hospitals, railway stations, and remote communities. Its modular design allows for easy upgrades such as QR-based digital payment.

From an industry perspective, the project aligns with the goals of smart public health infrastructure, women empowerment initiatives, and digital automation. It can be adopted by companies involved in hygiene product manufacturing, smart vending, and

public health services. By addressing a real-world problem through technology, this project bridges the gap between electronics, healthcare, and social welfare.

Working Model:

This project involved the development of a physical working model of an IoT-based sanitary pad vending machine. The system was built using real hardware components including a microcontroller, GSM module, relay module, DC motor, voltage regulator, and LCD display. All components were assembled and tested to demonstrate automated pad dispensing and remote alert functionalities in a real-time environment. The implementation allowed practical testing of system responses and ensured successful integration of mechanical and electronic modules, moving beyond software-based modelling.

Project Outcomes and Learnings:

The project successfully resulted in the development of a functional, real-time IoT-based sanitary pad vending machine capable of automated dispensing and remote monitoring. It enhanced awareness about menstrual hygiene solutions and demonstrated how technology can be used for social good. The system was able to perform tasks like pad dispensing using a DC motor, display user instructions via LCD, and send low-stock alerts through a GSM module.

From a learning perspective, the project team gained hands-on experience in embedded systems, including working with microcontrollers, relays, and various electronic components. Skills in power management using buck and boost converters, system integration, GSM communication, and I2C-based LCD handling were strengthened. Additionally, the team improved their knowledge of system design, troubleshooting, and teamwork — key aspects of real-world engineering and product development.

Future Scope:

1. A mobile app interface could be introduced for real-time monitoring, pad availability tracking. Solar power integration would make the system energy-efficient and suitable for remote or rural areas without stable electricity.
2. Additionally, AI-based predictive maintenance can be implemented to forecast refill schedules and component wear-out, reducing downtime.

3. Cloud-based data storage and analytics could help in monitoring usage trends and optimizing supply chains.
4. Scaling the system for dispensing multiple hygiene products like tampons or wet wipes would also make it more versatile and marketable in public and corporate spaces.