

Flobot: An Assistive Robot for Menstrual Health Support

1. Introduction

Managing menstrual health can be challenging, especially for women experiencing pain or maintaining busy routines. A Medical Journal study found that 20% of women face disruptions to daily activities due to menstrual pain, with those living alone feeling especially isolated.

While apps and wearables offer monitoring capabilities, they do not alleviate the physical burden of accessing care during periods of discomfort. *Flobot* addresses this gap by autonomously delivering menstrual products on request and tracking cycles, mood, and pain levels to provide a more personalised and responsive support system.

2. Objective

This project aims to develop *Flobot*, an assistive robot that delivers menstrual products on demand and supports menstrual health management through tracking of cycles, moods, and pain levels.

The system integrates real-time feedback via MQTT, a multi-channel interface (LEDs, LCD, dashboard), and multi-modal interaction design. Performance is evaluated based on response time, delivery accuracy, and usability, ensuring technical robustness and a user-centered design.

3. Methods

To accomplish this goal, we developed an integrated hardware-software system. The hardware setup includes:

- A TurtleBot3 platform equipped with a RealSense camera for navigation,
- A Raspberry Pi with GrovePi+ for sensor-based user interaction.

We used the ROS Navigation Stack to enable map creation and localization within a multi-room environment. The system was tested in realistic indoor scenarios to evaluate navigation and delivery performance.

The RealSense camera allows manual teleoperation, enabling users to remotely guide the robot when needed. Since menstrual discomfort can arise unpredictably, this ensures

Flobot can reach any requested location on demand.

For user interaction, we implemented physical buttons to record period start/end times, mood, and pain levels. Visual feedback is provided via LED strips and backlit indicators. This multi-modal interface allows users to track physical and emotional states while contributing valuable data for health monitoring.

The software architecture is built using Python, with Node-RED for flow-based logic and MQTT for real-time communication. A cycle prediction algorithm processes historical data and visualizes anticipated phases using a color-coded LED ring.

4. Results

The system successfully navigates to predefined locations such as bedrooms or bathrooms, delivering preloaded menstrual products on user request. Users can record and monitor their cycle, mood, and pain data. This allows them to identify irregularities or concerning patterns and seek medical advice if needed.

5. Conclusion

Flobot offers an innovative solution for managing menstrual health by combining product delivery with cycle tracking. This integrated approach improves accessibility and convenience, with future potential for enhancing navigation algorithms, AI-based prediction accuracy, and expanding the range of deliverable products.