



iJRASET

International Journal For Research in
Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 14 **Issue:** IX **Month of publication:** September 2026

DOI: <https://doi.org/10.22214/ijraset.2026.84837>

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Breast Cancer Awareness and Menstrual Monitoring and Tracking System

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Abstract: Breast cancer and menstrual health disorders are major concerns in women's healthcare, often worsened by limited awareness, delayed self-monitoring, and fragmented digital solutions. Existing platforms typically address menstrual tracking or breast cancer awareness independently, lacking an integrated preventive approach. This paper presents an awareness-driven digital platform, with AI-based menstrual cycle prediction that combines breast cancer risk awareness, risk calculation, and self-assessment guidance with menstrual cycle tracking and monitoring in a unified system. The platform supports structured symptom logging, guided self-examination using visual aids, healthcare facility location personalized health recommendations, and AI-based menstrual cycle prediction. A questionnaire-based risk estimation model inspired by the Tyrer-Cuzick method provides risk categorization along with medical disclaimers. Additionally, the system generates exportable health reports and includes awareness modules on nutrition, exercise, and early warning signs. The proposed solution promotes preventive healthcare, enhances user engagement, and supports early risk recognition without replacing clinical diagnosis.

Keywords: Breast Cancer Awareness, Menstrual Health Tracking, Digital Health Platform, Risk Assessment, Preventive Healthcare, Women's Health, Artificial Intelligence in Healthcare.

I. INTRODUCTION

Breast cancer is one of the most commonly diagnosed cancers among women worldwide and continues to be a leading cause of mortality, particularly in developing countries such as India. A major concern is the late detection of the disease, often resulting from low awareness, social stigma, and limited access to regular screening practices. Early identification through self-examination and awareness plays a crucial role in improving survival rates and reducing the severity of the disease. Despite the availability of medical facilities, many women lack consistent guidance and tools for performing regular self-assessment or recognizing early warning signs. Digital health platforms have attempted to address awareness; however, most of them provide only limited or fragmented support, reducing their effectiveness in promoting preventive healthcare behavior.

In addition to breast health concerns, menstrual health issues such as irregular cycles, hormonal imbalances, and conditions like Polycystic Ovarian Disease (PCOD) are increasingly prevalent. While these conditions are significant indicators of overall reproductive health, they are often inconsistently monitored. Structured tracking of menstrual patterns can help in early detection of abnormalities and improve overall health awareness. Existing applications (e.g., Know your lemons) typically treat breast cancer awareness and menstrual health tracking as separate domains, leading to a lack of comprehensive health monitoring [15]. This separation creates a gap in providing a unified platform that supports both critical aspects of women's health. This project aims to address this gap by developing an integrated and awareness-focused system that prioritizes breast cancer monitoring while also incorporating menstrual health tracking features. The proposed platform enables users to perform guided breast self-assessments, receive timely reminders, and maintain structured menstrual health records within a single interface. By promoting awareness, consistency, and early risk identification, the system encourages timely medical consultation when necessary, while clearly not replacing professional medical diagnosis.

II. LITERATURE SURVEY

Breast cancer remains one of the leading causes of mortality among women worldwide, and numerous studies have explored different approaches for early prediction, risk assessment, and awareness. Alongside this, menstrual health tracking has also gained attention as an important component of women's overall health monitoring.

[1] Regi Jose et al. (2025) proposed a development and validation model for breast cancer risk using logistic regression techniques. Their study incorporated demographic and reproductive factors to create a population-specific risk assessment tool tailored for Indian women. The model was designed to be simple and cost-effective, making it suitable for large-scale adoption. Additionally, the study focused solely on breast cancer risk and did not integrate menstrual health tracking or user engagement systems.

[2] Lukas Forer et al. (2025) introduced a multifactorial breast cancer risk assessment approach by integrating polygenic risk scores (PGS). Their model combined genetic information, lifestyle factors, and family history to deliver highly personalized risk predictions. This approach significantly improved clinical decision-making. Nevertheless, the study faced limitations such as European ancestry bias and ethical concerns related to genomic data usage. Moreover, it did not incorporate awareness-driven tools or integration with broader health monitoring platforms.

[3] Tharunya Arravalli et al. (2025) explored breast cancer detection using machine learning and explainable artificial intelligence. By employing Random Forest and ensemble models along with SHAP and LIME techniques, the study achieved high accuracy and improved interpretability of results. Despite these advantages, the model faced risks of overfitting and limited generalization. The system was also complex for non-technical users and lacked integration with preventive awareness mechanisms.

[4] A study published in JMIR (2024) evaluated menstrual tracking applications using a mixed-method approach, focusing on usability, accuracy, and privacy. The findings highlighted strengths in app design and personalization but also raised concerns regarding data privacy and lack of clinical validation. Importantly, these applications were found to operate independently without integration into broader healthcare systems such as breast cancer awareness platforms.

[5] Yao Lu et al. (2023) developed an AI-based mammography model using deep learning techniques. Their approach improved early detection of breast cancer through automated and scalable image analysis. While the model demonstrated strong performance, it required large, high-quality imaging datasets and showed limited generalizability across populations. Additionally, the system focused only on imaging and did not include menstrual data integration or awareness-based engagement.

[6] Lauren Worsfold and Lora Marriott (2021) conducted experimental testing on period tracker applications using real-cycle data. Their study revealed variability in prediction accuracy, particularly in ovulation tracking, where many apps relied on standard 28-day cycle assumptions. This highlighted the need for more personalized and clinically accurate solutions. However, the research lacked integration with long-term disease awareness systems.

[7] Sarah Earle et al. (2020) presented a comprehensive scoping review of fertility applications, analyzing menstrual tracking features and user engagement. While the study provided a broad overview of available applications, it identified inconsistencies in quality and a lack of strong clinical evidence. Furthermore, these systems lacked structured medical integration and cross-domain health monitoring capabilities.

[8] Reema A. Karasneh et al. (2020) evaluated 49 smartphone applications for period tracking using systematic review methods, MARS tools, and behavioral surveys. The study found that such applications positively influenced user awareness and behavior. However, many apps lacked evidence-based validation and required in-app purchases for full functionality. Additionally, they primarily focused on menstrual tracking without integrating disease awareness or risk prediction systems.

[9] The Collaborative Group on Hormonal Factors in Breast Cancer (2012) conducted a large-scale study analyzing the effect of reproductive factors on breast cancer risk. The research found that early menarche and late menopause significantly increase cancer risk due to prolonged hormonal exposure. However, the study focuses only on statistical analysis and lacks practical implementation in awareness or integrated health systems.

[10] Tyrer et al. (2004) developed a breast cancer risk prediction model combining genetic factors, family history, and personal health data. The model provides personalized risk estimation using probabilistic methods. Despite its accuracy, it depends heavily on clinical data and does not include real-time tracking or awareness-based features.

III.OBJECTIVES

A. Breast Cancer Module

- 1) To provide awareness modules related to breast cancer risk factors, early signs, preventive care post-care, and HRT.
- 2) To implement guided breast self-assessment tools (videos/images) with monthly reminder alerts.
- 3) To compute a personalized indicative risk score based on medical history using a Tyrer-Cuzick inspired model (non-diagnostic).
- 4) To alert users about abnormalities and encourage timely medical consultation.
- 5) To generate exportable AI-based health summary reports for professional review.
- 6) To integrate OpenStreet API driven breast healthcare facility and diagnostic centres locator.

B. Menstrual Module

- 1) To provide structured educational awareness on menstrual cycle phases, PCOS/PCOD, and menopause.
- 2) To enable tracking of period dates, flow intensity, and symptoms for identifying irregular cycle patterns.

- 3) To implement automated reminders for data entry, cycle start/end dates, and medication adherence.
- 4) To incorporate AI/ML-based prediction of the next menstrual cycle.
- 5) To provide personalized recommendations (diet, exercises, home remedies) based on user-entered data.
- 6) To generate structured, doctor-ready generalized summary reports based on tracked menstrual data.

IV. PROPOSED METHODOLOGY

A. System Overview

The proposed system follows a modular, integrated architecture designed to promote structured health awareness and preventive engagement. It consists of two primary modules: the breast cancer module and menstrual module. The system collects user inputs and processes the data using AI-based techniques, including menstrual cycle prediction based on historical user data and a questionnaire-based risk calculation inspired by the Tyrer-Cuzick model. It generates personalized insights, predictions, and structured health reports through a unified platform.

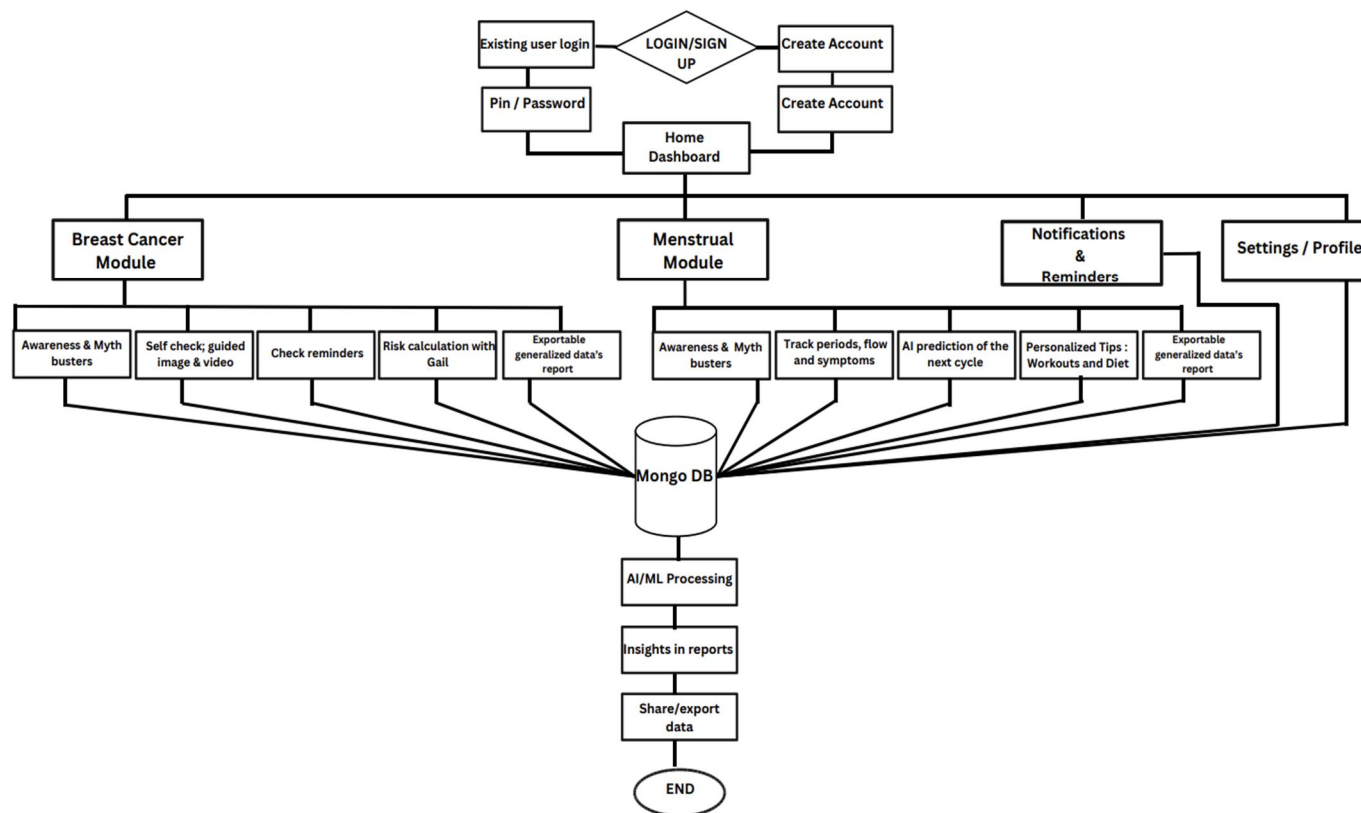


Fig. 4.1 System Architecture

B. Menstrual Health Module

The menstrual health module focuses on cycle awareness and tracking. It provides educational content related to menstrual cycle phases, PCOS/PCOD, and menopause. Users can log period dates, flow intensity, and symptoms to monitor patterns and identify irregularities.

A Random Forest Regressor is integrated into the system to estimate the next menstrual cycle based on the user's recent historical data, specifically the last three menstrual cycles. The model processes features such as previous cycle lengths, cycle variability, and user-input parameters including stress levels, sleep quality, and health conditions such as PCOS. The prediction is generated by averaging outputs from multiple decision trees, which helps reduce variance and improve accuracy. By focusing on recent three-month data, the system adapts to short-term changes in the user's cycle patterns and enhances prediction relevance.

In addition to prediction, the module provides personalized recommendations such as diet, exercise, and symptom management. It also generates structured, exportable health summaries, enabling users to better understand and monitor their menstrual health over time.

C. Breast Cancer Module

This module is designed to provide a personalized evaluation of an individual's lifetime risk of developing breast cancer. It's inspired by the Tyrer-Cuzick (IBIS) V8 model, a globally recognized clinical standard that combines multiple categories of data to generate a high-fidelity risk profile. The factors include (BMI), reproductive history (menarche age, parity), menopause, pregnancy status, BRCA1/2 status, Ashkenazi heritage, and personal clinical history (previous high-risk biopsies).

The Multiplicative Hazard Engine

The core of the assessment is a Multiplicative Hazard Ratio (HR) engine implemented in the backend. Unlike simple additive models, this system applies the proportional hazards framework established [10] by Tyrer et al. (2004). Each user input is mapped to a specific clinical coefficient, for example, a positive BRCA status triggers a 5.0x multiplier, while a previous high-risk biopsy applies a 4.0x multiplier. These factors are compounded against a 12.0% baseline (the standard lifetime risk for the average woman) to reflect how biological risks interact and multiply rather than just add up.

Incorporating variables such as Ashkenazi heritage and maternal/paternal history, the module's generated result is intended to provide an indicative risk assessment for awareness purposes and encourages users to seek professional medical advice when appropriate.

D. Technologies Used

- 1) Front-end : HTML,CSS, React.js
- 2) Back-end : Java, spring boot,Python
- 3) AI/ML layer: TensorFlow, Random Forest Regressor
- 4) API : OpenStreet API (Healthcare facility locator)
- 5) Database: MongoDB

V. RESULTS & DISCUSSIONS

The results obtained from the proposed system demonstrate the effectiveness of the integrated approach in enhancing awareness, enabling self-monitoring, and supporting preventive healthcare for women.

A. Breast Cancer Module

The breast cancer module successfully provides awareness, guided self-assessment, and risk estimation features through an interactive interface.

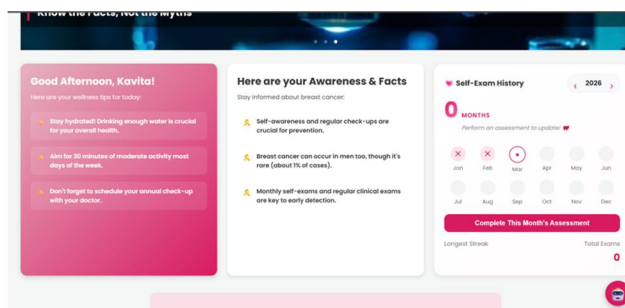


Fig. 5.1 Breast Cancer awareness and Streaks

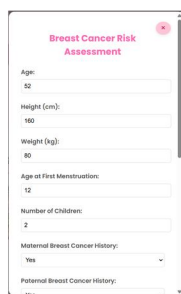


Fig. 5.2 Personalized Risk Score using Tyrer - Cuzick Model

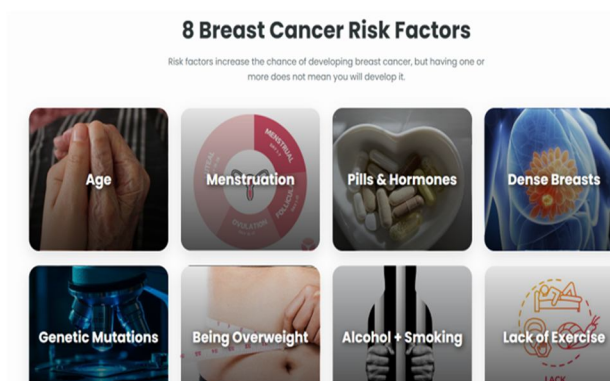


Fig. 5.3 Breast Cancer Risk Factors

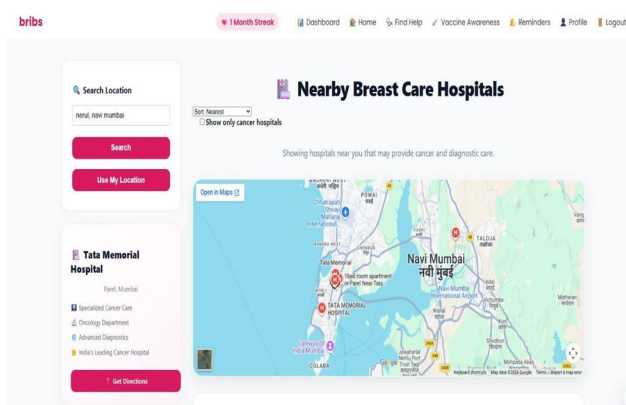


Fig. 5.4 Breast Cancer Care Hospital Locator Interface

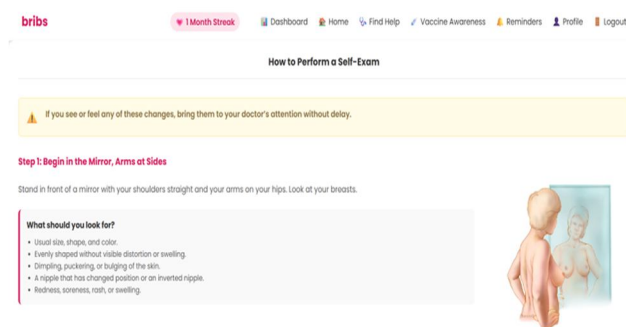


Fig. 5.5 Depiction using Images

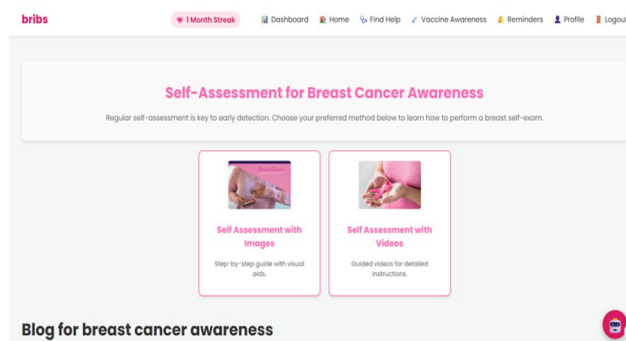


Fig. 5.6 Guided Self - Assessment tests

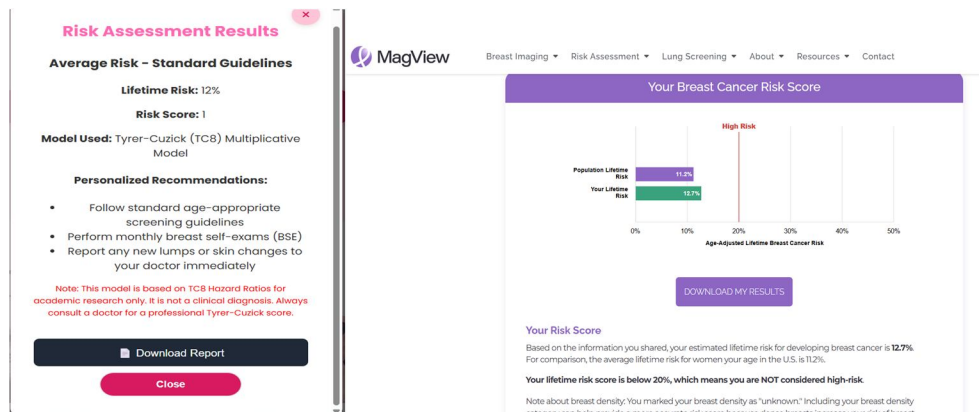


Fig. 5.7 The Proposed system was compared with MagView using the same input profile, to demonstrate indicative risk assessment capability; it does not establish clinical equivalence.

B. Period Tracking Module

The period tracking module enables structured logging of menstrual data and predicts future cycles using a Random Forest Regressor based on recent user data.

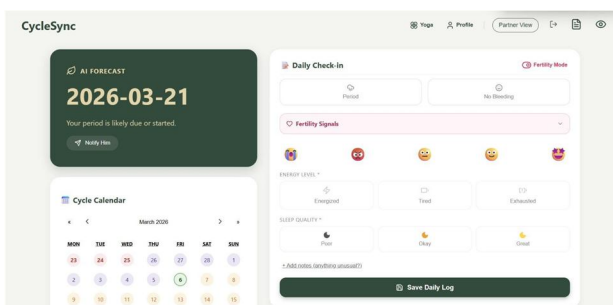


Fig. 5.8 Period Prediction and Daily Input User Interface

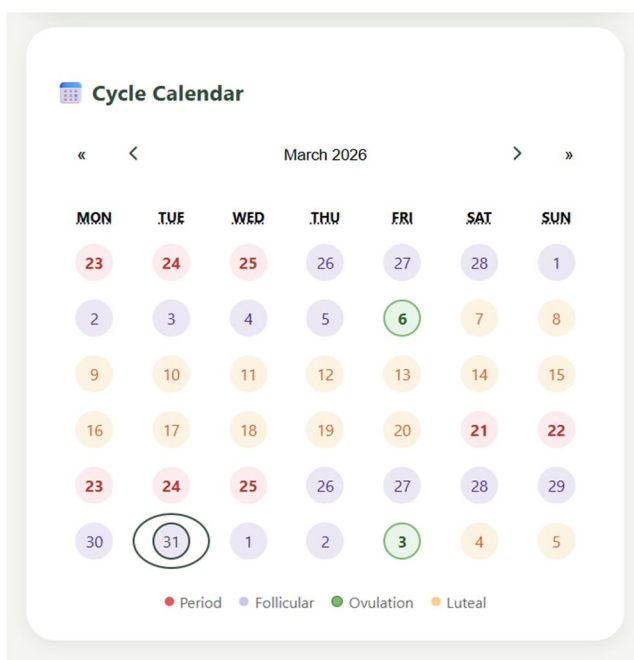


Fig. 5.9 Predicted Menstrual Cycle Phases

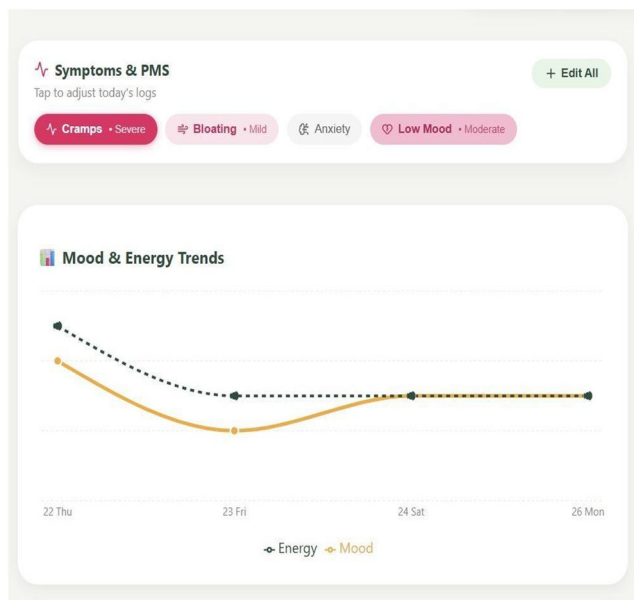


Fig. 5.10 Symptoms and Mood Energy Graph

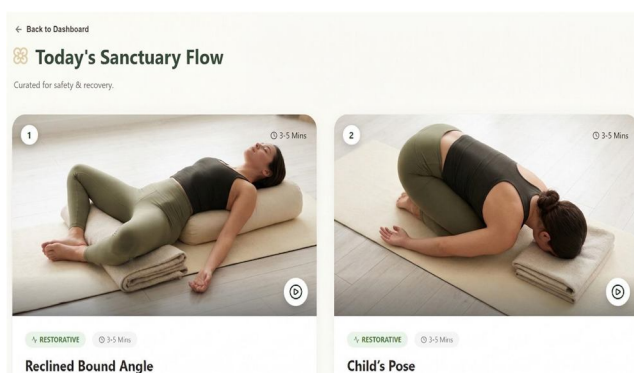


Fig. 5.11 Personalized Yoga and Exercises

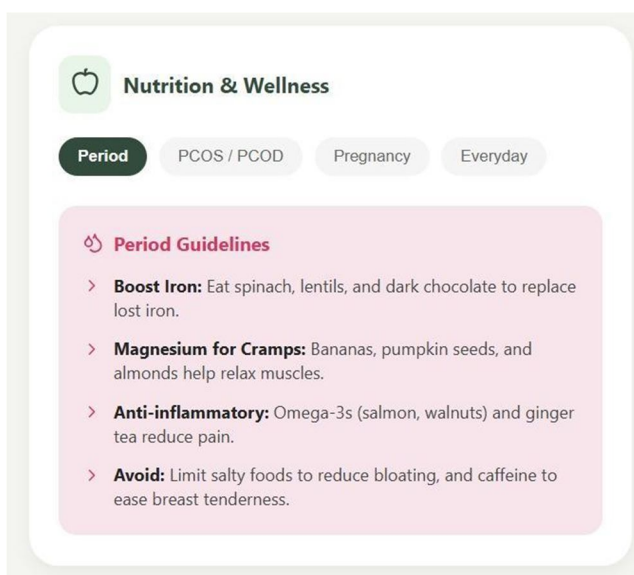


Fig. 5.12 Food and Dietary Information

WOMEN'S HEALTH SUMMARY REPORT

(Generated from self-reported data)

Date: 2026-03-31

PATIENT SNAPSHOT

Age: 21 years
Height: 157.0 cm
Weight: 54.0 kg
Known Conditions: None reported
Pregnancy Status:
Postpartum Status: Not applicable

MENSTRUAL & HORMONAL OVERVIEW

Status (Current): Menstruating
Cycle Regularity: Irregular
Avg Cycle Length: 28 Days
Current Cycle Day: Day 11
Flow Pattern: Not specified
Avg Period Duration: 5 Days

SYMPTOM SUMMARY (SELF-REPORTED)

No recent specific symptoms logged.

LIFESTYLE & ACTIVITY CONTEXT

Activity Level:
Yoga Experience:
Wellness Goals: Track Cycle

OBSERVATIONS & NOTES

Data is based solely on self-reported inputs.

Fig. 5.13 Generalized Summary Report

VI. CHALLENGES AND LIMITATIONS

The development of the proposed system involved several challenges. First, ensuring the reliability and representativeness of user data was challenging, as self-reported medical information may be inconsistent and data collection was time-consuming. Second, the limited availability of large-scale, validated medical datasets posed challenges in training and evaluating AI/ML models and may affect their generalizability across different populations. Ensuring data privacy and user trust was important due to the sensitive nature of personal data.

Additionally, research was sometimes constrained by licensing limitations, while integrating reliable information required careful selection and validation of relevant sources.

VII. CONCLUSION

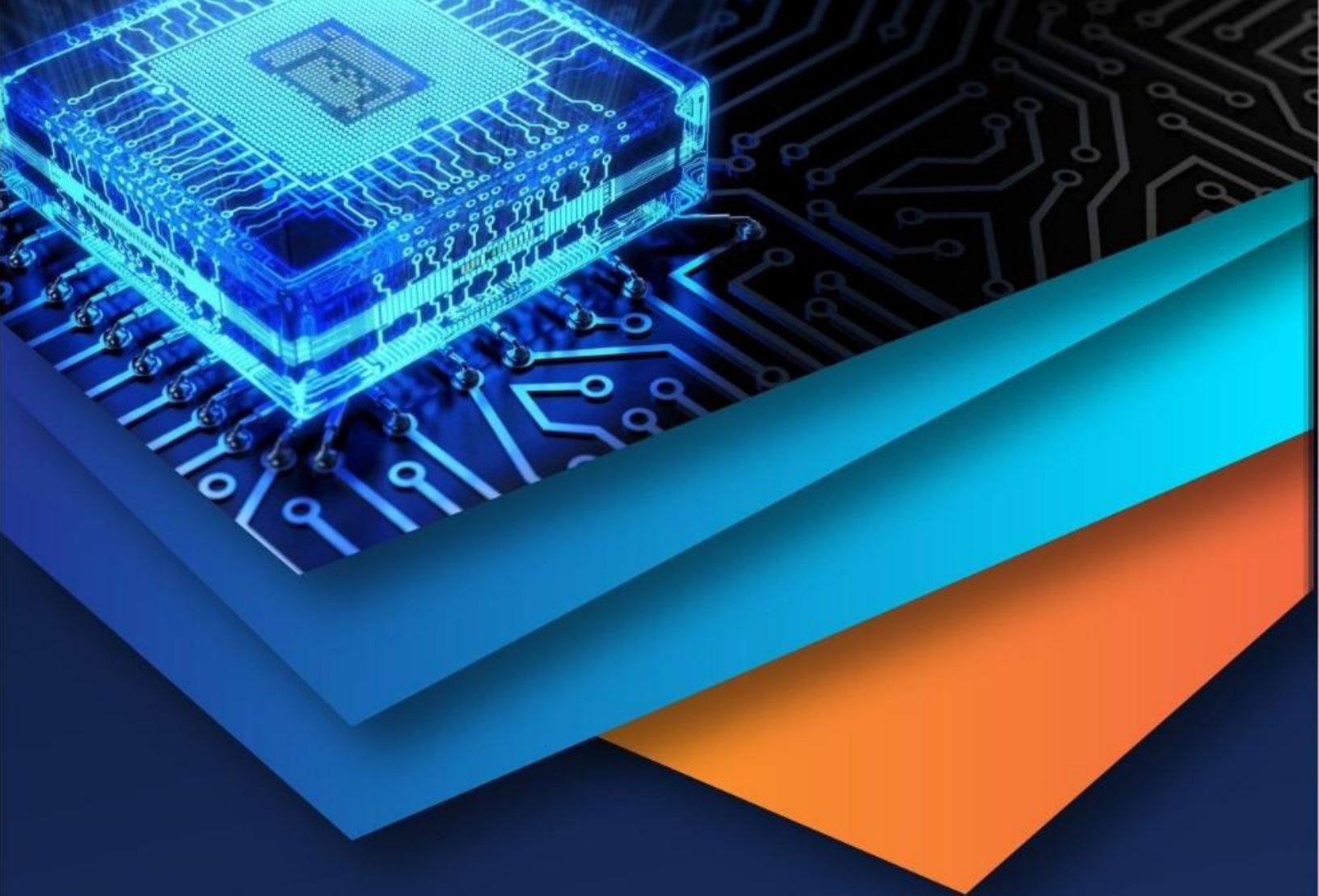
This paper presents an integrated and awareness-driven digital platform for breast cancer awareness and menstrual health monitoring. The proposed system addresses the limitations of existing solutions by combining both domains into a unified application, thereby promoting preventive healthcare and improving user engagement.

The breast cancer module is based on the self-assessment, awareness generation, and questionnaire-based risk estimation inspired by Tyrer-Cuzick, healthcare facility locator and while the menstrual health module enables tracking and utilizes a Random Forest Regressor to predict future cycle patterns based on recent user data, improving prediction accuracy and adaptability by providing personalized recommendations, reminders, and exportable health reports, the system encourages early detection, consistent monitoring, and informed decision-making. The platform is designed to assist users in understanding their health conditions while clearly not replacing professional medical diagnosis.

Future work will focus on incorporating larger and more diverse datasets, improving prediction models, and integrating real-time wearable data, strengthening privacy and security and exploring multilingual support for wider accessibility. The platform can be expanded to address overlooked aspects of men's health (including breast cancer in men and prostate health) ensuring the system evolves towards an inclusive, gender-neutral approach to preventive healthcare.

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