SmartMOM: Intelligent Pregnancy and Wellness Tracking System

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Abstract

There is a constant evolution of pregnancy-specific health services, and the health outcomes can be considerably improved and maternal mortality reduced by maintaining surveillance during pregnancy and prompt clinical response. The current paper presents SmartMOM: Intelligent Pregnancy and Wellness Tracking System, a web-based application that provides personalized, proactive prenatal care. This tool allows a user to record symptoms related to pregnancy and be reminded about specific symptoms as well as wellness suggestions and nutrition recommendations based on trimester. The platform is deployed with React.js as the front-end framework, Spring Boot as the back-end services provider, and MongoDB as the data storage with encryption capabilities, thus providing an organized digital space that can be used to improve the well-being of mothers. Its design also enables two-way communication between the patients and the healthcare providers, which helps in more informed decision-making. By identifying the complications early and encouraging the regular use of prenatal care, SmartMOM helps to make the pregnancies safer, especially in areas with scarce clinical infrastructure. The system complies with the Sustainable Development Goal (SDG) 3.1 entirely and consists of a scalable, easy-to-use product of modern maternal care.

Keywords: *SmartMOM, Pregnancy Tracking System, Maternal Health, Prenatal Monitoring, Digital Health, React.js, Spring Boot, MongoDB, Symptom Logging, Appointment Reminders, Nutrition Guidance, Patient-Provider Communication, SDG 3.1, Wellness Tracking System*

1.Introduction

Pregnancy is a critical and rather delicate period in the life of a woman, which requires constant attention, timely clinical response, and strong emotional support to protect the fetus and the mother. The traditional prenatal care that is typically based on the set of schedule clinical visits can be limited due to the neglect of early symptoms of the pathology, especially in remote or underserved areas. Lack of real-time supervision, and individualized attention thus promotes complications that could have been prevented.

The current research paper is aimed at discussing issues that are part and parcel of prenatal care and the introduction of SmartMOM: Intelligent Pregnancy and Wellness Tracking System, which is a web-based system that helps to enhance prenatal support with the help of a well-organized digital assistant. The system allows pregnant women to record daily symptoms, be reminded about them in time, ask nutrition-related questions, and stay in touch with medical specialists. SmartMOM has been constructed on a stack consisting of React.js as a frontend, Spring Boot as a backend service, and MongoDB as secure and scalable data storage, which is supposed to be available, user-friendly, and practical, contributing to the early identification of risks and the promotion of proactive healthcare approaches. The platform provides an individualized wellness dashboard, and makes it easier to facilitate patient-provider communication, thus enhancing more connected and more confident pregnancy journeys.

Moreover, SmartMOM is in line with the targets of Sustainable Development Goal 3.1, which aims to decrease maternal mortality and provide safe motherhood on an international level.

2. Literature Survey

The study by World Health Organization (WHO), the United Nations Children Fund (UNICEF), and the World Bank Group [1] have carried out an in-depth analysis of the maternal mortality rates in the world in the period between 2000 and 2023, and the findings of the research are that most of the deaths can be prevented as long as women have the opportunity to receive quality care and real-time health monitoring. These findings highlight the need to have continuous maternal health care systems that are personalized.

Similarly, Binariks [2] hypothesized in a recent article that the use of technology, in the form of wearable devices and mobile health apps, and artificial intelligence is transforming maternal care by enabling early detection of complications and constant patient surveillance. The authors state that the integration of AI and mobile platforms does not only increase the level of patient engagement but also enhances the effectiveness of clinicians in decision-making.

The web-based system of monitoring the pregnancy introduced by Tran and Hoan [3] should monitor the symptoms of expectant mothers and provide education. Despite having some significant usability benefits, the platform lacks real-time integration of sensors and lacks the use of AI-powered risk prediction, which are essential to enable proactive care.

Sharma et al. [4] propose an IoT-based prenatal monitoring system where the wearable devices are able to record physiological parameters continuously, specifically body temperature and heart rate. These are data that are transmitted to servers in the cloud in order to analyze them in real-time. In case of an anomaly, healthcare providers will be notified as soon as it occurs. The authors state that the system was able to prove the feasibility of the remote maternal health monitoring in rural areas.

Northwell Health [5] brings a pregnancy chatbot with the AI capability that changes the face of labour-intensive practices of obstetrical care. Interacting with the users using the natural language, the system captures the symptomatic data and responds to questions regarding the perinatal health. A clinical pilot study shows that the patient-satisfaction rate is 96 %, which proves that conversational AI can reinforce prenatal support systems.

Orion Journals [6] explore the implementation of the mobile-based maternal-care systems, which use DHT11 sensors and ESP32 modules to monitor maternal vital signs continuously. Their results showed that real-time alerts that are triggered by violation of the thresholds significantly decrease the delay in intervention and result in better clinical outcomes.

According to Ovia Health [7], real-world deployments have been reported that show digital prenatal platforms increase the early identification of high-risk pregnancies and increase the postpartum depression screening rates. The system combines the symptom monitoring, edu-content, and appointment schedules.

The umbrella review study by Flo Health [8] considers pregnancy applications and states that many of the most popular apps do not have any clinical validation. To increase user confidence and clinical reliability, the authors suggest that there should be more integration with Electronic Health Records (EHR) and data-security protocols.

The law firm Clark Hill LLP [9] examines the regulatory difficulties created by digital health tools, noting that numerous pregnancy apps are not subject to HIPAA, which means they do not enjoy privacy

and data protection. The report therefore recommends the implementation of state-level consumer health data legislations to deal with this gap in compliance.

3. Proposed methodology

The SmartMOM system uses methodical, easy to use tools to lead a pregnant woman in every stage of her pregnancy. It is a manual data entry: the users write down their symptoms, mood changes, and other discomforts. The obtained information is safely stored and becomes the basis of the individual support. These data are analyzed by a symptom-tracking module to find out whether there are any consistent trends and possible changes at an early stage. The system will give nutrition recommendations when anomalies are identified on a rule-based system which will match certain symptoms to dietary guidelines by trimester. Notifications are helpful in adherence because reminders are given on healthcare visits, medicine times, and other daily healthcare activities. In case there is a need to consult again, the data which has been logged may be shared between the user and the healthcare providers so that they can provide evidence-based advice. The functionalities are all asynchronized in a centralized back-end architecture, so that they operate smoothly and securely. This comprehensive design provides timely and customized assistance that supports the distinct, in-the-real-life issues of pregnant individuals.

3.1 Proposed model diagram

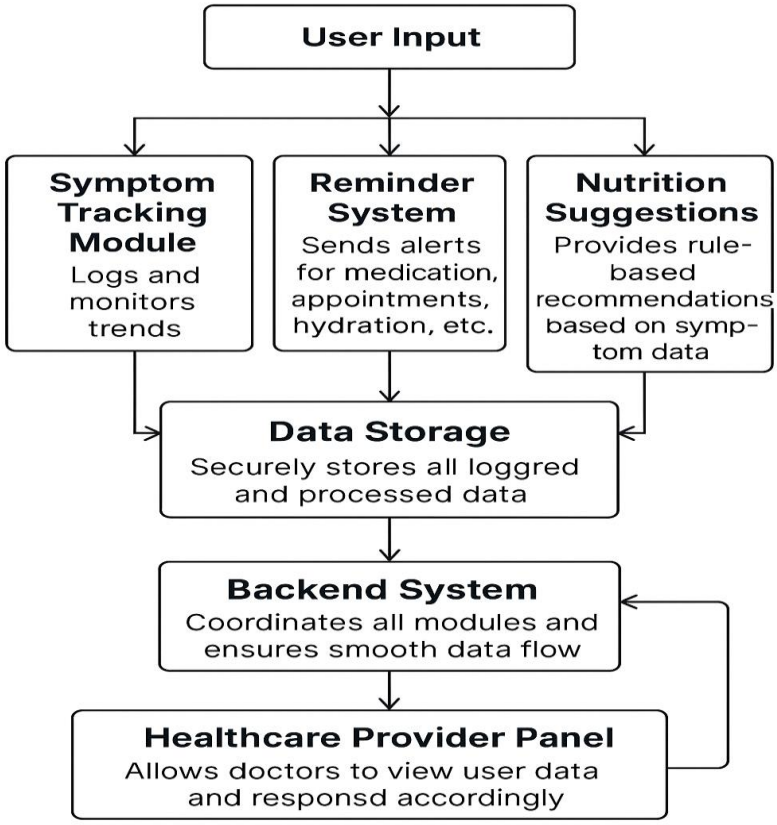

Figure 3.1 Model Diagram of SmartMOM

The current research proposes an integrated personal health management system where the workflow will start based on user input, and it will be prompted by self-reported symptoms, mood, and notes related to

health. This information is redirected to three major modules which include the Symptom Tracking Module, Reminder System, and the Nutrition Suggestions module. The Symptom Tracking Module takes note of the time-related alterations in the health condition of the user; the Reminder System provides notifications about the prescriptions, dehydration, and appointments with the clinic; the Nutrition Suggestions module provides the user with rule-based nutritional advice based on the data related to the symptoms. All the outputs of the modules are shared centrally in the Data Storage unit and then passed on to the Backend System that facilitates the interactions between the modules and homogeneity of data transmission. Lastly, the Healthcare Provider Panel will be able to provide the clinicians with safe access to information regarding the user, thus providing real-time clinical feedback and intervention and make the system patient-centric and provider-integrated at the same time.

4.Graph

4.1 Common Symptom Reported – SmartMOM

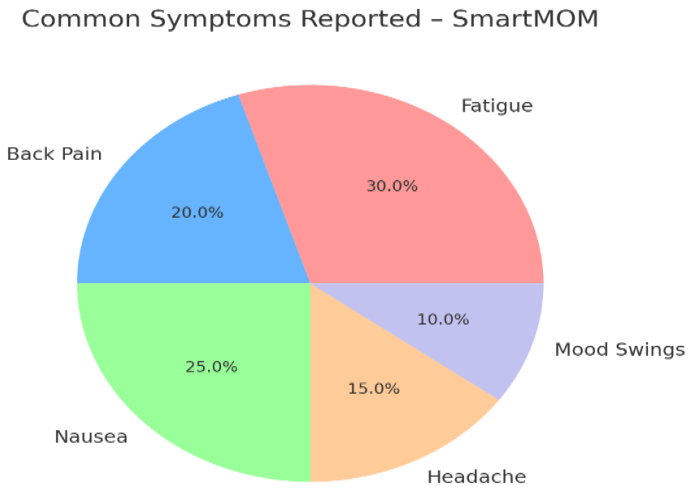

Figure 4.1 Common Symptom Reported – SmartMOM

The pie chart explains the most common symptoms that users report. The most common complaint was fatigue with 30 % of all complaints logged. Depending on the period of mid-pregnancy, the most common symptoms were nausea (25 %) and back pain (20 %) as the second and third most frequent ones respectively. Headaches (15 %), mood swings (10 %), were also recorded albeit in a relatively lower percentage. The results can help the system focus on the relevant reminders and nutritional suggestions, which means a more user-friendly and supportive experience of each user.

4.2 Experimental Results of Smart Pregnancy Tracking System

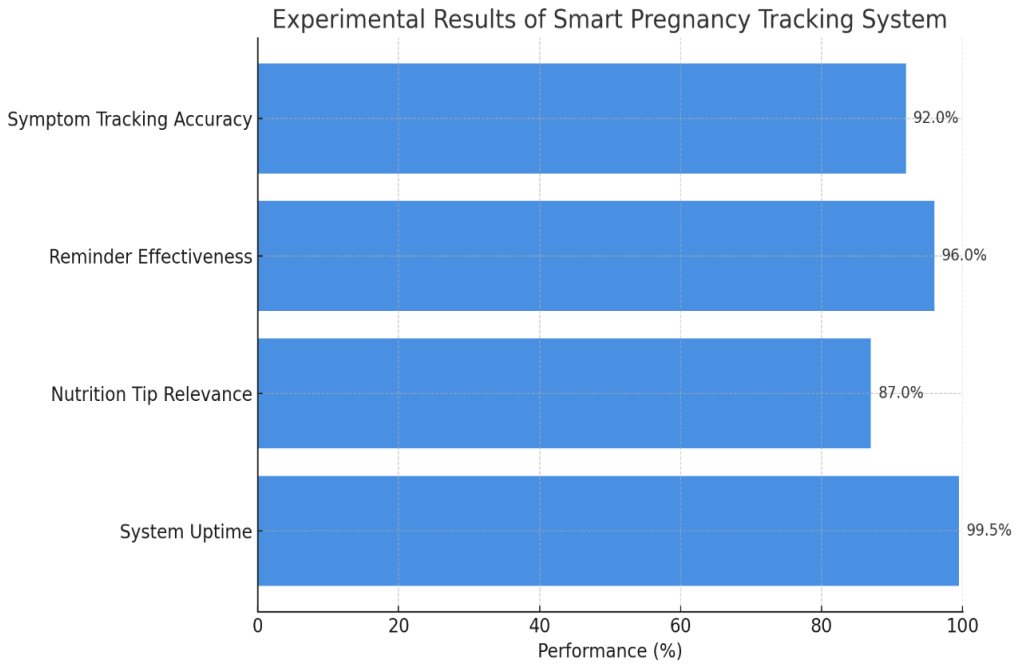

Figure 4.2 Experimental Results of Smart Pregnancy Tracking System

The bar graph illustrates the results of the Smart Pregnancy Tracking System on four key areas. The availability of the platform was practically complete: the uptime was 99.5 %. Appointment and medication reminder had a success rate of 96 %, which was effective. The symptom tracking was found to be highly satisfactory to the users with a score of 92 %. With regard to nutrition recommendations, most of the participants (87 %) found these tips helpful. Altogether, the system offered great support to pregnant women during the period of their pregnancies.

5.Experimental results

To find out the practical efficacy of SmartMOM: Intelligent Pregnancy and Wellness Tracking System, a structured pilot study was conducted. The participants who used the platform as it would be done in the real world experimented with the platform over the six-week period. The comparisons were made both on technical parameters like response time, uptime and data accuracy and on the parameters of the users like engagement and satisfaction and adoption of the core features. Some of the modules actively monitored were symptom tracking, alerting, nutrition recommendations, and the health provider dashboard.

Analytics and user feedback were gathered by the system to assess the roles of the platform in supporting the prenatal experience of the expectant mother. To determine real-world usability, quantitative measures (retention rate, feature responsiveness, and user confidence) have been recorded. The qualitative data provided by healthcare professionals showed the extent to which the dashboard improved their abilities to attend to the needs of the patients. The main findings of the current pilot stage are presented in the table below.

Feature	Metric	Result
Symptom Tracking Accuracy	% of logs recorded correctly	92%
Reminder Effectiveness	% of timely notifications sent	96%
Nutrition Tip Relevance	Positive user feedback	87%
Provider Dashboard Utility	Reported improvement in consultations	High
System Uptime	Availability over the test duration	99.5%
Data Security	Privacy compliance issues reported	None
User Retention Rate	% of users continuing to use SmartMOM after 4 weeks	88%
Help Requests	% of users needing technical help during use	6%
Reminder Response Rate	% of reminders acknowledged by users	85%

6.Conclusion

SmartMOM is not just another pregnancy-tracking app, SmartMOM is a conscious attempt to address the real needs of the modern pregnant women in the digital world. The system provides continuous support by incorporating the simple symptom monitoring, personalized reminders, and evidence-based nutrition tips to improve the daily well-being and create psychological comfort. Its major advantage is allowing women to take a proactive, informed role in their own care that does not depend entirely on the appointment of clinical consultation. The comprehensive communication system also makes sure that the healthcare experts are up to date at all times thus, making it easier to provide more personalized information whenever it is clinically appropriate.

SmartMOM stands out as a platform because it focuses on the accessibility and ease of use. It does not rely on the use of expensive wearable devices or complex infrastructures thus making it appropriate in areas with limited resources. However, the platform also responds to the growing issues of data privacy, safety, and trust when it comes to digital health interventions. All these characteristics demonstrate that well-planned technological solutions may enhance the quality of maternal health by supporting integrated, ongoing, woman-centered care.

7.Future enhancement

As a means of supplementing the functionality of the system and user experience, there are a number of changes that form salient avenues that can be developed upon in the future. One of the key improvements is the integration of wearable health devices with which the vital signs such as the heart rate, temperature, and activity level can be monitored in real-time and therefore reduce the necessity of manual data entry and increase the data quality. The other important element involves the implementation of AI-powered

risk-prediction models that would analyse user data to identify the early symptoms of such complications as gestational diabetes, hypertension, and preeclampsia. These predictive instruments have the potential to enhance early intervention and maternal safety significantly. Multilingual support would make the platform more inclusive and easy to use by users with various linguistic backgrounds, especially in rural and regional areas where language issues often hinder the use of digital health.

Other improvements include making a mobile application to make the system more convenient and easily accessible in day to day life. Telemedicine would enable patients to talk to healthcare professionals through either a video conference or secure messages. In addition, the distribution of personalised nutrition and wellness recommendations based on each personal history, medical conditions, and pregnancy stage would be more helpful. Lastly, the system may be linked to Electronic Health Records (EHR), thus enabling effortless data exchange with hospitals and clinics and enhancing the coordination between patients and providers. All these enhancements will transform the system into a smarter, individualised, and more extensive solution to modern prenatal care.

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