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LEVERAGING AI AND MOBILE HEALTH (MHEALTH) FOR MATERNAL WELL-BEING: THE MOTHER-WELL PROJECT

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ABSTRACT

Maternal mortality is still a major worldwide concern, especially in developing nations like India where timely access to treatment is short. To overcome these obstacles, MotherWell is an AI-powered maternal health monitoring app with features like individualized care, and real-time health tracking. Wearable technology is integrated into the app, that helps in tracking vital signs like temperature and pulse rate, and its AI-powered chatbot provides immediate assistance and appropriate medical advice. The chatbot's capacity to link conventional wisdom and contemporary medical science by offering scientifically supported justifications for a wide range of Indian home remedies is one of its characteristic features. MotherWell aims to empower women in underprivileged areas, enhance healthcare accessibility, and lower maternal problems by enabling smooth communication between patients and healthcare providers. The chatbot's capacity to provide scientific relevance for conventional Indian home medicines is one of its most notable features; it successfully integrates ancestral wisdom with contemporary modern medical science. MotherWell aims to empower women in underprivileged areas, gain better healthcare access, and lower maternal health risks by facilitating smooth communication between patients and healthcare professionals. MotherWell is a ground-breaking advancement in maternal health technology. It offers expectant moms a safer and more connected pregnancy experience with its extensive health dashboard and real-time data updates.

Keywords: Maternal Mortality, AI-Powered Health Monitoring, Wearable Technology, Real-Time Health Tracking, Personalized Maternal Care.

I. INTRODUCTION

Maternal health is a critical component of public healthcare, directly impacting maternal and infant mortality rates, child development, and overall family well-being. According to the World Health Organization (WHO), approximately 800 women die every day due to preventable pregnancy and childbirth-related complications, with a significant portion of these deaths occurring in low- and middle-income countries (WHO, 2023). Major maternal health challenges include limited access to healthcare, lack of early risk detection, postpartum depression, and insufficient maternal education regarding nutrition, stress management, and prenatal care.

In recent years, technology-driven solutions such as mobile health (mHealth), artificial intelligence (AI), and telemedicine have emerged as promising interventions to bridge these healthcare gaps. AI-powered maternal risk prediction models have the potential to identify high-risk pregnancies early, enabling proactive interventions, while mobile-based health solutions can facilitate remote monitoring, mental health support, and personalized health recommendations. Despite these advancements, many existing digital maternal health solutions fail to offer comprehensive, explainable, and scalable interventions, particularly in low-resource settings.

The Mother-Well Project is designed as a holistic, AI-driven maternal healthcare platform that leverages machine learning, mobile technology, to improve maternal health outcomes. This initiative aims to:

- Enhance maternal health monitoring using AI models to track pregnancy-related conditions such as gestational diabetes, hypertension, and preterm labor, ensuring timely interventions.
- Provide accessible maternal healthcare services through mHealth applications, enabling pregnant women to receive remote consultations and real-time health tracking.

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- Empower community health workers (CHWs) with digital tools to educate and assist pregnant women, particularly in rural areas where access to healthcare is limited.
- AI-Powered Chatbot Assistance to provide instant maternal health guidance, answer common pregnancy-related questions, and offer personalized health recommendations based on user input.

To address these gaps, the Mother-Well Project has been designed as a holistic, AI-driven maternal healthcare web application. This platform integrates:

- An AI-powered chatbot trained on LLaMA to provide scientifically validated maternal health guidance, including traditional Indian home remedies backed by research
- A Firebase-based backend infrastructure for real-time data management, secure user authentication, and health record storage.
- A health tracking dashboard that enables pregnant women and caretakers to monitor pregnancy progress, log symptoms, and receive AI-generated insights.

By combining AI, cloud computing, and mobile health technology, the Mother-Well Web App aims to empower pregnant women and their caretakers with instant access to reliable maternal healthcare information and monitoring tools. This approach not only enhances maternal well-being but also reduces anxiety among caretakers, ensuring a safe and well-informed pregnancy journey for all.

This paper outlines the significance, methodology, and implementation of the Mother-Well Web App, highlighting how it bridges the gap between modern healthcare, AI-driven solutions, and traditional maternal care practices.

II. LITERATURE SURVEY

1. A Mobile Health (mHealth) Technology for Maternal Depression and Stress Assessment and Intervention during Pregnancy

This study explores a mobile-based healthcare (mHealth) solution called Depression Evaluation and Educational Application (DEEA) for assessing and managing maternal depression and stress in rural Bangladesh. A pilot study involving 60 pregnant women assessed the feasibility of using a smartphone app for mental health monitoring and psycho-educational interventions. The study found high smartphone ownership (87%) and internet access (83%) among participants, suggesting that mobile interventions could be a viable strategy in low-resource settings.

Key Insights:

- High maternal depression rates (16–20%) in Bangladesh highlight the need for effective interventions.
- The DEEA application combines digital assessment with trained Community Health Workers (CHWs) to deliver psycho-educational support.

2. Explainable AI-based Maternal Health Risk Prediction using Machine Learning and Deep Learning

This research employs machine learning and deep learning techniques to predict maternal health risks based on various pregnancy-related factors. The study uses Kaggle's "Maternal Health Risk Data" to classify pregnancy risks into high, medium, and low categories. Among 14 tested algorithms, the Gradient Boosting algorithm achieved the highest accuracy (90.64%). The study also applied Explainable AI methods (LIME and SHAP) to provide interpretability for model predictions.

Key Insights:

- Machine learning significantly improves risk prediction for maternal health.
- Explainable AI (LIME, SHAP) enhances trust and transparency in model predictions.
- The most influential maternal risk factors include blood pressure, glucose levels, fetal heart rate, and age.

3. Health Recommender System for Maternal Care: Implementation Challenges from Physicians' Perspective

This qualitative study investigates the challenges of implementing a Health Recommender System (HRS) for maternal care from the perspective of Indonesian physicians. The study, based on semi-structured interviews with five physicians, identified six key challenges, including system compatibility, data quality, regulatory constraints, and usability concerns.

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Key Insights:

• Technology-related challenges: The system must be simple, user-friendly, and integrated with existing health infrastructure.

• Regulatory and policy issues: Compliance with government health policies and incentives for adoption are needed.

4. Mobile Solution to Optimize Process for Healthcare Delivery Referral in Pediatric Patients with a Presumptive Cancer Diagnosis

This study proposes a mobile solution to optimize the medical referral process for pediatric cancer patients in Peru. The solution automates appointment scheduling, diagnostic support, and communication between pediatricians, oncologists, and patients' guardians. The validation study demonstrated a significant reduction in referral processing time (95%–97.5% efficiency improvement).

Key Insights:

• Early cancer diagnosis is critical: Late-stage detection leads to higher mortality.

• Mobile technology accelerates referral processes, ensuring timely specialist intervention

III. METHODOLOGY

The design of the MotherWell system consists of three key components that improves maternal health monitoring and support since it provides a health tracking dashboard, a secure backend, and an AI-powered chatbot. The AI chatbot, created in collaboration with LLaMA, provides real-time answers to pregnancy-related questions and provides maternal health recommendations and their scientific relevance.

The backend for this project is designed using firebase providing user authentication, data storage, and real-time updates. It also ensures user privacy by preventing unauthorized access and allowing safe communication between the chatbot and the health dashboard.This seamless integration ensures a cohesive user experience across all components.

The health tracking dashboard provides a user-friendly interface where expectant mothers can check their pregnancy progress remotely. It also provides doctors and caregivers with valuable maternal health insights, ensuring proactive care and keeping a sense of assurance to track their loved one's health. Additionally, AI-driven analytics generate personalized wellness advice, helping pregnant women make informed decisions throughout their pregnancy.

By using a combination of Artificial intelligence,secure data management, and real-time health tracking, MotherWell aims to deliver a complete maternal health solution that empowers women with reliable, remotely accessible, and personalized maternity care.

IV. MODELING AND ANALYSIS

MotherWell's architecture is made up of three main parts:

Health Tracking Dashboard: This feature gathers real-time health data from wearable technology. It helps physicians and patients to efficiently track health progress, visualizes maternal health metrics, and offers trend analysis.

Chatbot Driven by AI The chatbot, which was developed with the help of the Hugging Face and LLaMA APIs, uses retrieval-augmented generation (RAG) to validate traditional Indian home remedies and respond to questions about pregnancy.

Constructed using Firebase, the backend infrastructure guarantees safe data storage, authentication, and communication between the dashboard and chatbot.

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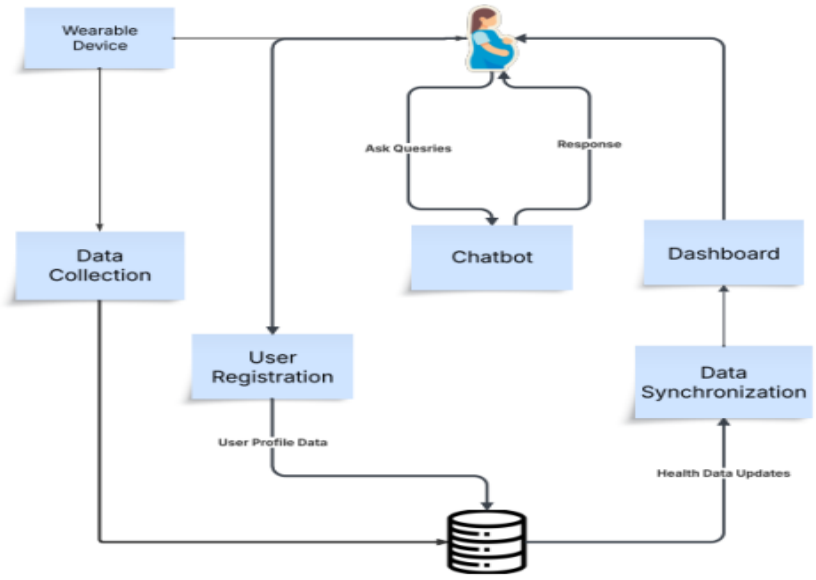
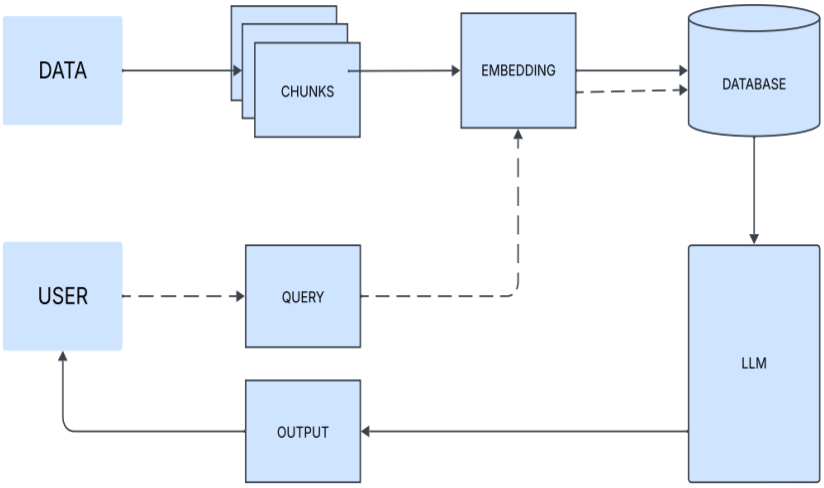


Chatbot Architecture



System Architecture

V. CONCLUSION

The MotherWell system, which uses AI-driven technology, real-time health monitoring, and secure data management to offer expectant mothers individualized and easily accessible maternity care, is a significant advancement in maternal healthcare. The system provides timely support, data-driven insights, and scientifically validated guidance for maternal well-being by combining a secure backend, an AI-powered chatbot, and a health tracking dashboard. The AI chatbot, developed with LLaMA, helps bridge the gap between contemporary medical science and traditional Indian home remedies by providing scientific validation for ancestral knowledge.

Maternal health records are secured by the Firebase-based backend architecture, which ensures seamless communication between all system components. Mothers and medical professionals can monitor critical health metrics through the Fitbit API-powered real-time health dashboard, promoting proactive and preventive care.

Despite its advantages, the system acknowledges certain limitations, such as the need for continuous improvements in AI model accuracy and reliance on compatible wearable devices. However, by integrating advanced AI technology, and real-time maternal health tracking, MotherWell establishes itself as a comprehensive, innovative, and transformative maternal healthcare solution. With further development and

enhancements, the platform has the potential to monitor maternal health, improve access to healthcare resources, and empower women with knowledge-driven maternity care.

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