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NeoCare.ai: An Intelligent Breast Cancer Detection and Patient Support Platform

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Abstract: ***As Artificial Intelligence continues to become a vital part of healthcare and digital platforms, most AI-based medical solutions are designed for urban populations or require frequent access to healthcare professionals, making them less accessible to women in rural areas. NeoCare.ai: An Intelligent Breast Cancer Detection and Patient Support Platform is developed to address this gap by providing an accessible, user-friendly, and AI-powered web solution that assists in early detection and continuous healthcare support for women, especially those with limited access to medical facilities.***

NeoCare.ai utilizes Machine Learning and Natural Language Processing (NLP) to enable efficient interaction between users and the system. The platform provides multiple healthcare services including AI-based image detection for identifying potential breast cancer symptoms, patient history tracking for managing medical records and treatments, analytics for visualizing health data, reminders for medications and appointments, community forums for sharing experiences, doctor discovery with location-based services, and an AI chatbot powered by Ollama for answering medical queries. The system is developed using Python for both frontend and backend, while Supabase is used for secure and scalable data management.

NeoCare.ai is designed to provide an integrated healthcare support system that combines early detection, patient engagement, and continuous monitoring using advanced AI technologies. The platform aims to improve awareness, accessibility, and timely medical intervention, particularly for women in underserved regions. This project demonstrates how AI can significantly enhance healthcare delivery by providing smart, accessible, and reliable digital solutions for breast cancer detection and patient care.

Keywords: AI, Breast Cancer Detection, Healthcare System, Machine Learning, NLP, Patient Monitoring, Rural Healthcare, Medical Chatbot, Python, Supabase, Ollama, Health Analytics, Digital Healthcare, Early Detection, Telehealth Support.

I. INTRODUCTION

Artificial Intelligence (AI) has significantly influenced healthcare, but most AI solutions are designed for urban populations, limiting access for women in rural areas who face challenges like lack of awareness and delayed breast cancer diagnosis.

NeoCare.ai is developed to address this gap by providing an AI-powered platform for early breast cancer detection and continuous patient support. It acts as a digital healthcare companion, offering features such as image-based detection, patient history tracking, reminders, analytics, doctor discovery, community forums, and a chatbot for medical queries.

The platform enables users to monitor their health records and receive timely alerts for medications and appointments. It also helps patients connect with nearby doctors through location-based services. The community forum allows users to share experiences and gain emotional support. The chatbot provides instant responses to common medical queries, improving accessibility. The analytics module helps visualize patient health data for better understanding. The system is designed to be simple and user-friendly for people with limited technical knowledge. It especially focuses on supporting women in rural areas with limited healthcare access.

Built using FastAPI, MongoDB, and React.js, the system ensures secure data handling and a responsive interface. NeoCare.ai aims to improve early detection, awareness, and accessibility of healthcare services, especially for women in underserved regions.

II. LITERATURE REVIEW

Automating diagnostic systems is now becoming a very common use case in healthcare applications for improving patient engagement, automating medical assistance processes for larger populations, and making healthcare services more accessible. Continuation to this, several studies are observed in this section regarding the development of AI-based healthcare systems and intelligent medical platforms. For example, Bharathee et al. (2023), developed an AI-powered healthcare assistance chatbot to assist patients through basic symptom checking and medical guidance processes.

The AI chatbot was built using Python and used Natural Language Understanding (NLU) to help identify patient intent in order to respond appropriately when answering health-related queries.

The system operated through a web-based platform so that patients could access the AI-powered chatbot easily. The results published are reported to show a high percentage of the responses provided by the AI chatbot were correctly identified as appropriate responses to the patient's request [1]. While the responses generated by the AI chatbot were relevant and appropriate for basic healthcare assistance and therefore met the accuracy, they also lacked certain features (i.e., continuous monitoring or advanced integration) that many developers look to include when designing systems like AI healthcare platforms.

Another study conducted by Gao et al. (2023) investigated the performance of AI-based models in medical decision support settings [2]. The researcher highlighted a novel architecture – a Deep Attention Matching Network (DAM) combined with advanced language models – to improve the accuracy of prediction selection compared to earlier systems. The aim of the design was not to directly interact with patients. Instead, it provided assistance to healthcare professionals through real-time analysis of patient data while suggesting possible outcomes. The use of real-world datasets validated the effectiveness of this design approach [2]. However, the system was mainly designed for clinical environments and was not easily accessible to patients, especially in rural areas. In a previous study, Easin et al. (2022) proposed an intelligent personalized digital assistant using large language models (LLMs), multi-agent systems and Chain-of-Thought techniques [3]. The goal of this study was to improve user satisfaction and increase engagement through personalized and context-aware responses. A multi-agent system was used to analyze and generate responses for users and allow access across multiple users. The model demonstrated strong capability for personalization and context management across multiple users; however, the focus of the design was on general applications and did not address challenges related to healthcare accessibility or early disease detection [3].

Existing AI-based healthcare systems are currently successful at providing accurate results and performing effectively for a given domain; however, they all have limitations. Most systems are developed for a specific application and do not generalize into a complete healthcare solution. Providing accessible healthcare services and supporting patients in rural areas are major concerns when developing such systems. The new product, "NeoCare.ai," is an AI-enabled healthcare platform that provides early breast cancer detection along with continuous patient support. It integrates features such as image detection, patient history tracking, analytics, reminders, community support, doctor discovery, and chatbot assistance, ensuring accessible and comprehensive healthcare support for women, especially in underserved regions.

III. METHODOLOGY

The AI system designed for patients utilizes a client- server framework that integrates artificial intelligence, machine learning, and real-time healthcare support technologies. Users engage with the system by using text inputs or image uploads via an interactive interface featuring a simple and user-friendly design.

Image inputs are processed through machine learning models for detection, whereas text-based interaction provides instant responses through the chatbot. Techniques in Natural Language Processing are utilized to comprehend user intent, identify language, and categorize inquiries like symptom checking, medical guidance, health information, or general queries.

According to the detected intent, the backend handles the request with established logic modules or an AI model to create responses that are accurate and relevant to healthcare needs. Language detection and translation APIs enable multilingual support for better accessibility.

IV. PROPOSED SYSTEM AND SPECIFICATION

The platform is an AI-powered online tool created to serve as a healthcare support system for patients, especially women in rural areas, constructed on a modular, multi-service framework.

1) Dual Functionality and Personalization: The system is specifically crafted to offer both Early Detection and Continuous Patient Support features within one, cohesive environment. The AI models will tailor the output according to the user's medical data and history to ensure optimal accuracy and effectiveness.

2) Essential modules & features Text Chatbot: A natural language processing (NLP) model generates conversational replies, serving as a healthcare assistant and addressing medical queries. The model implements basic filtering to ensure safe and relevant responses.

3) Image Detection: A machine learning model processes uploaded medical images to identify possible breast cancer symptoms and provide initial analysis results. Patient History Tracker: This module stores and manages user medical records, appointments, and treatment details for continuous monitoring. Analytics & Reminders: This module provides health statistics, visual reports, and sends alerts for medications and doctor appointments.

4) Architecture and Technical Stack (Conceptual) Frontend/UI: Developed using Python-based frameworks for a simple, responsive, and user friendly interface.

5) Backend/API: A server framework in Python manages the core logic and handles communication between modules through APIs. Machine Learning Model and Algorithms: Python-based models are used for image detection and chatbot functionality, including Ollama model: LLaMA 3 for handling conversational queries.

6) Data Storage: Supabase is used as a secure database to store user profiles, medical history, and system data.

V. RESULTS AND DISCUSSION

The developed NeoCare.ai system effectively showcased efficient and user-friendly interaction via text and image-based interfaces. The system could accurately process user inputs, categorize them into areas like symptom detection, health-related queries, patient history tracking, and general medical assistance, and provide appropriate outputs in real-time. Multilingual support enhanced accessibility, enabling users to interact comfortably in their preferred language.

The combination of chatbot assistance and integrated healthcare modules significantly improved user engagement, making interactions more practical and beneficial for patients. Image detection models performed well for basic analysis, while the chatbot handled common queries efficiently. The reminder and analytics modules helped users manage their health more effectively. Data handling through the system remained secure and reliable.

In general, the findings demonstrate that the proposed system serves well as a healthcare support and monitoring platform for patients. The project highlights the potential of AI-driven systems in improving healthcare accessibility, especially for women in rural areas, while also suggesting future enhancements such as improved detection accuracy, real-time consultation, and personalized healthcare recommendation.

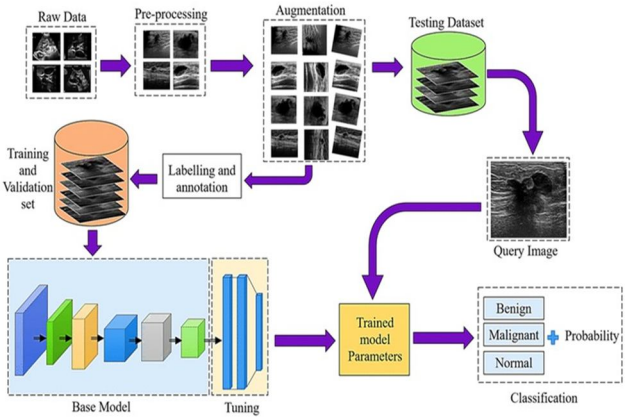

Fig. 1 Block Diagram

The block diagram of NeoCare.ai represents a multi-stage intelligent system designed for breast cancer detection using deep learning techniques. It illustrates the complete workflow starting from raw medical image input to final classification output, ensuring accurate and efficient diagnosis.

The process begins with the collection of raw medical image data, such as ultrasound or mammogram images. These images undergo a preprocessing stage where noise is reduced, contrast is enhanced, and image quality is improved to make them suitable for analysis. After preprocessing, data augmentation techniques are applied to generate multiple variations of the images, such as rotation, flipping, and scaling. This helps in increasing the size of the dataset and improves the robustness and generalization ability of the model. The augmented data is then labelled and annotated, and divided into training and validation datasets for effective learning. In the next stage, the prepared dataset is fed into a base deep learning model, typically a Convolutional Neural Network (CNN), which is responsible for extracting important features from the images. The model is trained using the training dataset, and further tuning is performed to optimize its performance and accuracy. During this phase, the system learns patterns associated with different categories such as normal, benign, and malignant cases. The trained model parameters are then stored and reused for prediction tasks. In the final stage, when a user uploads a query image, it is passed through the trained model. The system analyzes the image and classifies it into categories such as benign, malignant, or normal, along with probability scores indicating the confidence of prediction. This end-to-end workflow ensures reliable detection, efficient processing, and accurate results, making the system useful for early diagnosis and healthcare support.

VI. WORKING OF THE SYSTEM

When a user interacts with the system, the process begins with the collection or upload of a medical image, which is treated as the input query image. The image is first passed through preprocessing steps such as noise removal, resizing, and normalization to enhance quality and prepare it for analysis. The processed data is then augmented and labelled, and divided into training, validation, and testing datasets during the model development phase.

The system uses a trained deep learning model (CNN) that has already learned from the dataset through training and tuning processes. When a new image is provided by the user, it is directly passed to this trained model. The model analyzes the image features and applies learned parameters to generate predictions.

Once the analysis is completed, the system produces a classification output such as benign, malignant, or normal along with probability scores. The final result is then displayed to the user in an understandable format, completing the detection process.

This structured flow ensures accurate image processing, efficient model prediction, and reliable results, enabling effective breast cancer detection and user-friendly interaction.

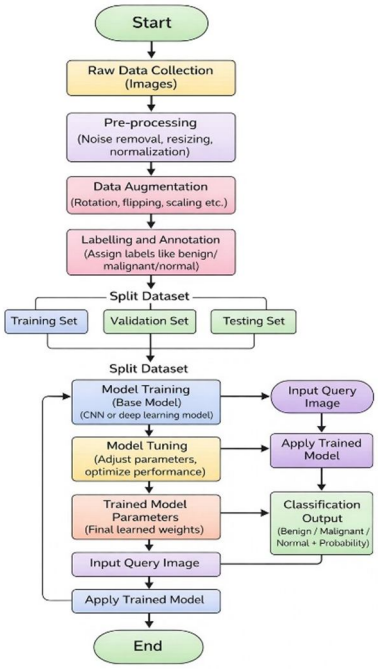

Fig. 2 Flow Diagram

VII. CONCLUSION

The NeoCare.ai initiative effectively showcases the use of Artificial Intelligence and Machine Learning to develop an efficient, accessible, and supportive healthcare platform for breast cancer detection and patient care.

The system achieves its aim of providing accurate detection and continuous healthcare support by integrating image analysis, patient management, and chatbot-based assistance in a user-friendly environment. Combining deep learning models for detection with intelligent chatbot interaction improves accessibility, while features like reminders, analytics, and patient history ensure better health monitoring and management.

The modular design allows for scalability for future improvements such as enhanced detection accuracy, real-time doctor consultation, and advanced personalization features, establishing a strong foundation for ongoing research and development in AI-based healthcare systems.

VIII. ACKNOWLEDGEMENT

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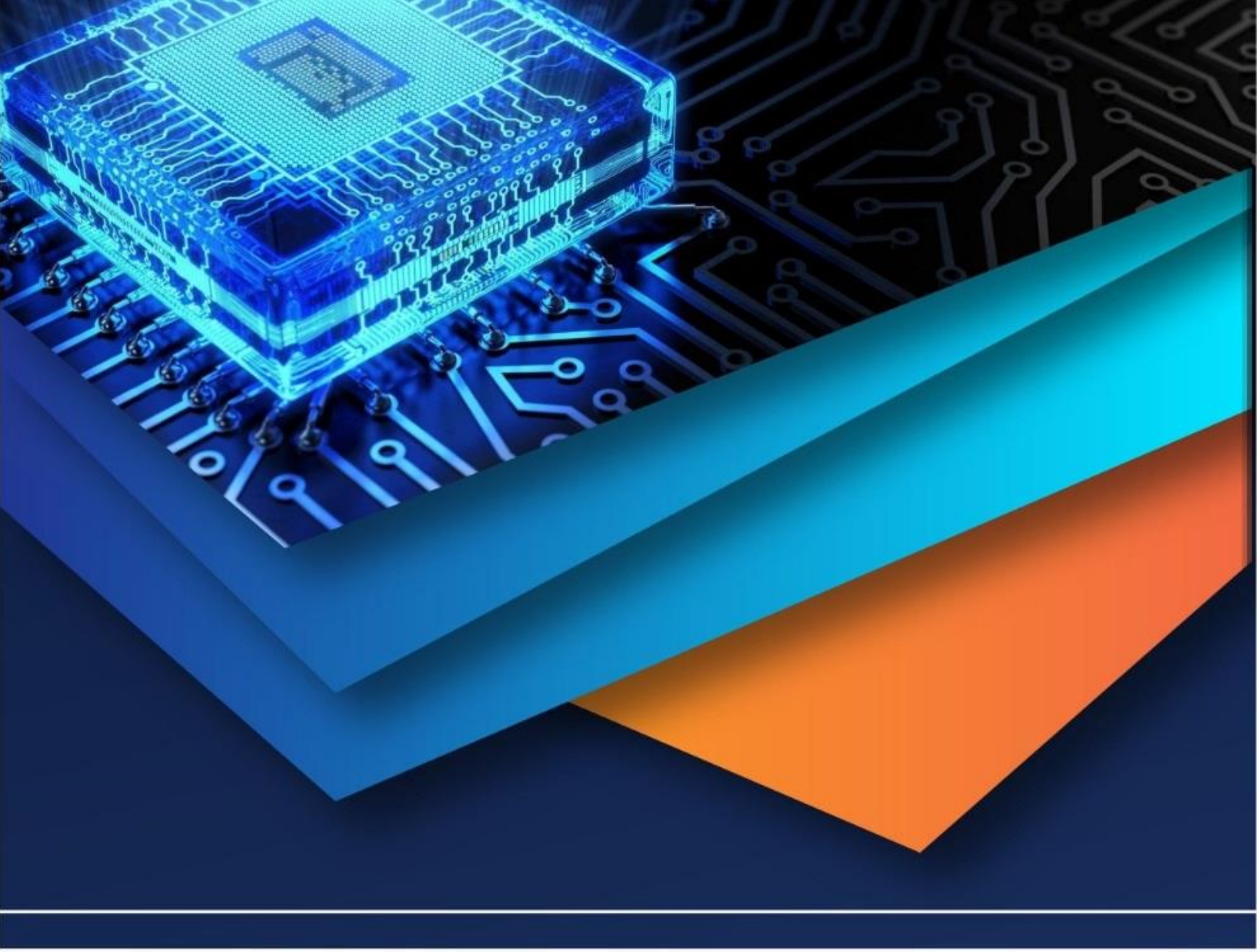

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