CureAI: AI-Powered Platform for Disease Detection and Image Analysis

Submitted in partial fulfillment of the requirements for the degree of

Bachelor of Technology
in
Information Technology

by

PRASHANT 21BIT0524

SHASHANK MISHRA 21BIT0037

Under the guidance of Prof. SUMANGLI K

VIT, Vellore.

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DECLARATION

       I hereby declare that the project entitled *"CureAI"* submitted by me, for the award of the degree of *Bachelor of Technology in Information Technology* to VIT is a record of bonafide work carried out by me under the supervision of Prof Sumangli K.

       I further declare that the work reported in this thesis has not been submitted and will not be submitted, either in part or in full, for the award of any other degree or diploma in this institute or any other institute or university.

Place   : Vellore

Date   : 2ND September

Signature of the Candidate

<u>CERTIFICATE</u>

This is to certify that the thesis entitled "Thesis title" submitted by **Student Name & Reg. No**, **School Name**, VIT, for the award of the degree of *Bachelor of Technology in Information Technology*, is a record of bonafide work carried out by him under my supervision during the period 16. Aug. 2024 till semester end as per the VIT code of academic and research ethics.

The contents of this report have not been submitted and will not be submitted either in part or in full, for the award of any other degree or diploma in this institute or any other institute or university. The thesis fulfills the requirements and regulations of the University and in my opinion meets the necessary standards for submission.

Place   : Vellore

Date   : 2nd September 2024

Signature of the Guide

Internal Examiner   **External Examiner**

Head of the Department Information technology

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Executive Summary

CureAI is an innovative, AI-powered platform designed to enhance healthcare access and quality by providing personalized medical guidance. The platform utilizes advanced generative AI and image analysis technologies to offer comprehensive symptom-based disease detection and prescription analysis. By integrating multiple healthcare functionalities into a single, user-friendly platform, CureAI enables users to identify potential health issues early and receive tailored treatment recommendations.

Key features of CureAI include real-time symptom analysis to predict diseases, prescription scanning for detailed information on medication usage, side effects, and dosages, and image-based analysis of medical tools to provide step-by-step usage guides. The platform supports multiple languages to cater to a global audience and is accessible on all devices, ensuring inclusivity and convenience.

CureAI aims to empower individuals by offering affordable healthcare solutions, promoting early intervention, and reducing barriers to quality care. With its focus on preventive healthcare and improved patient outcomes, CureAI positions itself as a valuable tool for both health-conscious individuals and healthcare professionals. By leveraging generative AI capabilities, CureAI plans to expand its reach and impact, ultimately transforming how healthcare is delivered and accessed.

CONTENTS

1. INTRODUCTION

CureAI is an AI-driven platform designed to revolutionize healthcare accessibility by providing a comprehensive solution for disease detection and medical guidance. By leveraging advanced generative AI and image analysis, CureAI integrates various healthcare functionalities into a single, user-friendly platform, empowering individuals to make informed health decisions, while bridging the gap between medical professionals and patients.

1.1 OBJECTIVE

The primary objective of CureAI is to create a holistic healthcare platform that enhances early disease detection and provides personalized medical guidance. The platform aims to deliver accessible, affordable, and reliable healthcare information through symptom-based analysis, prescription scanning, and medical tool usage guides. By incorporating these features, CureAI seeks to enable early intervention, reduce healthcare costs, and improve patient outcomes.

1.2 Motivation

The motivation behind CureAI stems from the gaps in traditional healthcare systems, where users often face difficulties in accessing reliable medical information and affordable care. Many existing solutions lack integration of key features like medication details, side effects, dosage information, and comprehensive disease analysis. CureAI addresses these gaps by providing a cross-platform, user-friendly solution that empowers users with timely and accurate health information, thereby promoting proactive health management and reducing dependency on traditional healthcare infrastructures.

1.3 Background

The development of CureAI is grounded in the need for innovative healthcare solutions that utilize cutting-edge AI technology. By incorporating tools such as symptom-based disease detection, image-based prescription analysis, and natural language support, CureAI leverages advancements in AI to deliver a seamless and inclusive healthcare experience. The platform's design reflects a commitment to accessibility and affordability, making it a vital tool for users worldwide who seek to take control of their health and well-being.

PROJECT DESCRIPTION AND GOALS

CureAI is an AI-powered platform designed to revolutionize healthcare by offering a comprehensive, user-centric solution for disease detection and personalized medical guidance. By integrating advanced technologies such as generative AI and image analysis, CureAI provides a one-stop platform that enables users to identify potential health issues early, analyze prescriptions for detailed medication guidance, and access information on medical tool usage.

The platform's core features include real-time symptom-based disease detection, which helps users predict health conditions and seek timely interventions. Prescription analysis is achieved through image recognition, delivering insights into medication use, side effects, and dosages. CureAI also supports scanning of medical tools to offer step-by-step usage instructions, enhancing user safety and awareness.

The goals of CureAI are to democratize healthcare access by making medical information affordable, accessible, and reliable. The platform aims to empower users with personalized health insights, promote preventive care, and reduce the financial barriers associated with traditional healthcare systems. By collaborating with healthcare providers, AI technology companies, and marketing agencies, CureAI plans to expand its user base and impact. Ultimately, CureAI strives to transform healthcare delivery by fostering a proactive approach to health management and improving patient outcomes across diverse populations.

TECHNICAL SPECIFICATION

CureAI leverages state-of-the-art technologies to deliver its comprehensive healthcare solutions. The platform's architecture is designed for scalability, reliability, and ease of use, integrating multiple components to enhance its functionality.

- Frontend: The user interface is built using HTML, CSS, and Tailwind CSS to ensure a responsive and visually appealing design across all devices. It provides an intuitive and seamless user experience, allowing easy navigation and interaction with the platform's features.

- Backend: The backend is powered by JavaScript, utilizing a Node.js environment to handle server-side logic and API requests efficiently. Hugging Face models, including the BLIP (Bootstrapped Language-Image Pre-training) image captioning model, are integrated for prescription and medical tool image analysis. These models enable accurate identification and extraction of relevant data from images.

- APIs and AI Models: CureAI incorporates generative AI models from Hugging Face for natural language processing and understanding, enabling accurate disease detection and personalized medical guidance. The BLIP image captioning model is used for analyzing prescription images and medical tools, providing step-by-step instructions and detailed information.

- Data Security and Privacy: All data transmitted through CureAI is encrypted to ensure user privacy and compliance with healthcare data protection regulations (e.g., GDPR, HIPAA). The platform uses secure authentication methods to safeguard user information.

- Deployment: CureAI is deployed on a cloud-based infrastructure, ensuring high availability, scalability, and minimal downtime. The platform supports cross-platform accessibility, allowing users to access services via web and mobile devices.

This robust technical setup ensures that CureAI remains a reliable, efficient, and secure healthcare platform for users worldwide.

DESIGN APPROACH AND DETAILS

4.1 Design Approach / Materials & Methods

CureAI's design approach focuses on creating a user-friendly, responsive, and visually appealing platform, leveraging Tailwind CSS for styling. The frontend employs HTML, CSS, and Tailwind CSS to ensure cross-platform compatibility and responsive design, allowing seamless access across different devices. The JavaScript-based backend integrates with AI models from Hugging Face, such as the BLIP image captioning model, to process medical images and provide real-time insights.

The platform is structured using a modular design pattern, promoting scalability and maintainability. The use of Tailwind CSS enables rapid development with utility-first classes, resulting in a clean and minimalistic UI. The inclusion of components like headers, footers, and interactive sections follows a consistent style and design principles to enhance usability.

4.2 Codes and Standards

CureAI follows best practices and standards to ensure security, performance, and accessibility:

HTML5 and CSS3 standards for web content structure and presentation.

WCAG 2.1 standards to ensure the web content is perceivable, operable, and understandable.

Secure Coding Practices to protect against common vulnerabilities

4.3 Constraints, Alternatives, and Tradeoffs

Constraints:

Performance: Ensuring real-time processing of AI models on a web-based platform can challenge load times.

Device Compatibility: Tailwind CSS helps with responsiveness, but variations in older browsers may present compatibility issues.

Data Privacy: Handling sensitive health data necessitates strict compliance with data protection regulations.

Alternatives:

Using frameworks like React.js instead of vanilla JavaScript for better state management.

Bootstrap or Material UI as alternative CSS frameworks for predefined design components.

Tradeoffs:

While Tailwind CSS offers flexibility and faster development, it requires a learning curve compared to traditional CSS or Bootstrap.

Real-time AI model processing may increase server load, necessitating trade-offs between computational accuracy and response time.

References

- **Tailwind CSS Documentation**
Official documentation for Tailwind CSS, providing comprehensive guidelines on utility-first CSS framework usage and customization.
https://tailwindcss.com/docs

- **Hugging Face Models**
Information about the BLIP (Bootstrapped Language-Image Pre-training) model used for image captioning and other AI models integrated into CureAI.
https://huggingface.co/models

- **GDPR Compliance Guidelines**
Detailed guidelines on the General Data Protection Regulation (GDPR) for ensuring data privacy and protection for users within the European Union.
https://gdpr.eu/

- **HIPAA Compliance Overview**
Health Insurance Portability and Accountability Act (HIPAA) guidelines for maintaining data security and privacy in healthcare applications.
https://www.hhs.gov/hipaa/

- **W3C Accessibility Standards (WCAG 2.1)**
Web Content Accessibility Guidelines (WCAG) 2.1 for designing inclusive and accessible web content for users with disabilities.
https://www.w3.org/WAI/standards-guidelines/wcag/

- **AI in Healthcare: Applications and Trends**
A detailed overview of the latest trends and applications of artificial intelligence in healthcare, which influenced the development of CureAI.
https://www.healthcareitnews.com/ai-healthcare

- **Introduction to Secure Coding Practices**
Guidelines and best practices for secure coding to prevent common vulnerabilities like SQL injection and cross-site scripting (XSS).
https://owasp.org/www-project-top-ten/