A MERN-Based Empathetic AI Framework for Holistic Health Management in Student-Centric Environments

Ashutosh Kumar[1], Ishwari Jawale[2], Sunil Kashyap[3], Krishna Dwivedi[4]

[1] B.tech CSE Student in MIT Art Design and Technology University, Pune, Maharashtra, India
kumar.ashutosh.er@gmail.com

[2]B.tech CSE Student in MIT Art Design and Technology University, Pune, Maharashtra, India
ishwarijawale01@gmail.com

[3]B.tech CSE Student in MIT Art Design and Technology University, Pune, Maharashtra, India
sunillkashhyap@gmail.com

[4]B.tech CSE Student in MIT Art Design and Technology University, Pune, Maharashtra, India
krishnadwivedi9579@gmail.com

Abstract: ***A comprehensive solution is required to create a student-friendly atmosphere to tackle physical, mental, as well as lifestyle-related issues. In this regard, the proposed study attempts to develop a comprehensive MERN Stack-based artificial intelligence framework that is based on empathy and is entirely dedicated to taking care of overall health. It incorporates diverse intelligent components, such as a medication interaction checker which provides suitable food along with medications, as well as a mental wellness platform which tracks emotional status on the basis of quizzes as well as everyday activity. A virtual herbal garden raises awareness among users about Ayurvedic recipes, which act as healthy substitutes to medication. In addition, it incorporates a personalized dietary assistant which changes food plans on the basis of users' physical as well as mental wellness parameters, facilitating easy transition to healthy eating. Moreover, domain-specific artificial intelligence personalities like fitness experts as well as meditation mentors are implemented to generate domain-specific as well as context-specific knowledge. Additionally, it incorporates a digital journal writing assistant which is useful not just to reflect on one's experiences but also to identify emotional patterns.***

Keywords: Emotional ai healthcare, Empathetic artificial intelligence, Holistic wellness system, Natural language processing, Student health management

1. Introduction

In addition, during recent years, students and young professionals are also increasingly faced with health-related issues arising from irregular patterns of life, pressure of studies, hostel food patterns, and undue delays in medical consultations. Physical health hazards like improper usage of medicines along with foods, improper diet, and growing levels of mental stress remain unchecked until they turn into grave health concerns. Although health apps are being used in the digital world, the majority remain unorganized, too generic, or lacking in emotional intelligence.

Compared to other age groups, students and young professionals in recent years are increasingly confronted with health-related issues caused by irregular patterns of life, pressure of studies, hostel food patterns, and undue delays in medical consultations. Physically, improper usage of medicines along

Thus, there was a need to develop a holistic artificial intelligence-based smart health and wellness solution exclusively for college-going young people staying in hostels, and this need gave rise to the formulation of Zenvy. The concept of the system would range over a broad array of aspects-from physical health to safety and wellness to nutrition, and would also include traditional

herbal knowledge. The system is aimed at simplifying health management to being proactive and personalized.

The MERN stack empathetic consists of the following modules:

• Drug interaction checker to evaluate suitable food to consume based on medications.
• Mental wellness platform that tracks emotional wellness by engaging in quizzes and performing daily tasks.
• Digital herbal garden that suggests Ayurvedic recipes as alternative wellness options.
• Personalized diet plan based on the health inputs and mental state of the person.
• Chat personas related to domain-specific artificial intelligence, including fitness trainers and meditation coaches.
• Digital journal writing module for reflection and tracking emotional trends.

The workflow in this system follows this order:

Users register themselves, giving data on their health, lifestyle, and preferences.
Mental and dietary evaluations are carried out using interactive quizzes and daily entries.
The AI engine carries out the analysis of the data obtained from the users to come up with the recommendations.
The users will interact with the specialized chat personalities. Journaling information is processed for the analysis of emotional and behavioral aspects.

Block Quote

Empathetic AI in Healthcare Systems" highlights the importance of integrating emotional intelligence, context, and personalization for user well-being, moving away from data-centric systems in healthcare applications. In a student-centric setting, these applications can prove immensely helpful for preventive healthcare, mental, and physical wellness by providing personalized feedback that caters to physiological and mental needs.

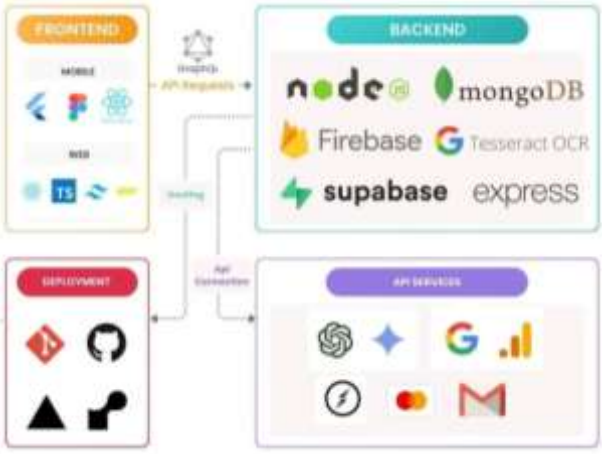

Figure 1: Technical Stack

2. Literature Review

Recently, the use of artificial intelligence has been increasing in virtual healthcare concerning prevention and personalized healthcare. In research papers, the citing of the study of the subjects concerning prevention, performed by artificial intelligence, concerning the study of healthcare, nutrition, and behavior, has been visible. Almost all applications designed have been for some defined uses concerning healthcare, and there has been minimal use concerning applications in research.

When it comes to research studies on drug interactions, there is a requirement for solutions that would guarantee protection against side effects. As evident from research on research papers on mental health issues among students, journaling assisted by AI or NLP can prove effective for recognizing stress, but addressing such an issue requires more attention.

AI-based nutrition recommendations and health care chatbots prove to be effective in terms of interface for context-aware and emotionally intelligent recommendations. Additionally, the digital platform regarding traditional herbal knowledge provides a holistic concept related to well-being. From this study, there is a need for an AI wellness platform intended for students, which indicates a need for a holistic health platform.

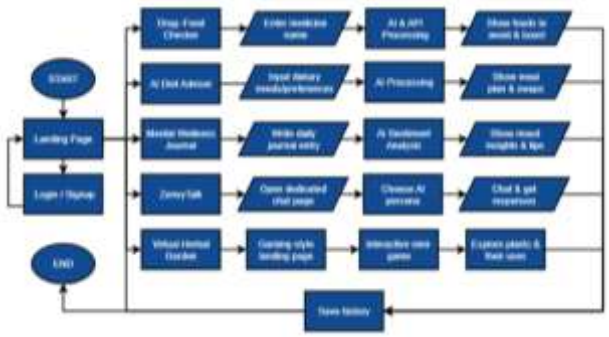

Figure 2: Workflow Diagram

3. Problem Statement

Problems like stress, anxiety, and burn-out have also become common in students. However, the existing stress-related issues in students cannot be addressed by the existing mental health applications and AI applications because these applications cannot provide a student with a customized solution. Moreover, the commonly available knowledge related to herbal healthcare is also not considered in mental health applications and AI applications.

There is a demand for an intelligent, caring, and student-centric health management system that possesses the capacity not only to mitigate but also proactively counteract risk factors in relation to drug-food interaction, mental issues, nutrition, and health, not to mention when combined together. This particular project fills that demand inasmuch as it relates to an artificial intelligence comprehensive wellness program in an academic setting.

4. Objectives

The main aim of this project is the development of an AI-powered holistic wellness system for the target groups of college students and young adults. It will analyze intelligently to detect and prevent harmful drug-food interactions. Moreover, the system strives to develop healthier eating habits with pragmatic context-aware diet recommendations suitable for hostel and canteen environments.

Another goal is to promote mental wellness by facilitating emotional release and detection of early signs of stress through natural language processing techniques. The project further aims at bringing empathetic personalized health guidance through conversational AI personas. In the end, the system is designed to integrate and preserve traditional herbal knowledge within a unified digital wellness platform.

5. Methodology

A. Objectives

The requirement for developing such a proposed system is based on an idea of designing an AI-based comprehensive wellness platform to aid college-going students in handling their physical, mental, nutritional, and preventive requirements of their lives. Hence, such a proposed system is created to design a comprehensive wellness platform.

B. Describe How the System Works

It will be an entirely web-based system where the users will be an interface system. The users will be able to provide details regarding medicines, eating habits, as well as their own comments and suggestions. The system will use this data using AI algorithms combined with a couple of other health databases, and it will be able to send suggestions in the form of alerts based on the result achieved after this processing. The system will also send statements of empathy.

C. Common Flow

A user logs into the system through the sign-in facility available within the system and accesses the function of the required module related to either drug and food interactions, nutrition/treating suggestions, journal entries related to mental wellness, or chat personalities related to artificial intelligence. The user enters their related inputs, which are then sent to the backend securely. The artificial intelligence system processes the inputs provided by the user and provides insights or suggestions accordingly. The insights are delivered to the user in an understandable manner.

D. Data Collection

The data required for this system will be gathered from user interaction on this platform, such as medication names, food information, as well as messages posted using the chatting tool, in addition to diaries filled in. External data will be used when data required is needed from sources that contain accurate interaction information and nutrition.

E. Data Preprocessing

The data acquired undergoes cleaning and normalization for processing. The text data acquired by the use of journals and messages is converted to tokens and undergoes natural language processing. The data devoid of irrelevant characters, repetition, and incompleted messages is used for further analysis.

F. Algorithm / Model Design

Natural processing techniques are used for the analysis of emotional tone and stress patterns from the journal entries. Rule-based matching and AI matching are performed for the analysis of interactions between foods and drugs. The recommendation algorithm works with the options and nutritional requirements for personal recommendations. AI conversation models are designed for effective assistance and interaction with humans.

G. Execution

"The project will be developed on the MERN stack. React.js and Tailwind CSS will be used for frontend development. Back-end operations will be handled by Node.js/Express.js. For storing data, MongoDB will be utilized. The AI functionality will be implemented via API integration. Model development will be implemented in a combined platform."

.

H. Evaluation

The system is then tested and evaluated on functional tests, scenario tests, and user interaction analysis. The evaluation criteria include accuracy of interaction detection, relevance of outputs, response time, and user satisfaction. The feedback from the test user helps to improve performance and usability related to user interaction.

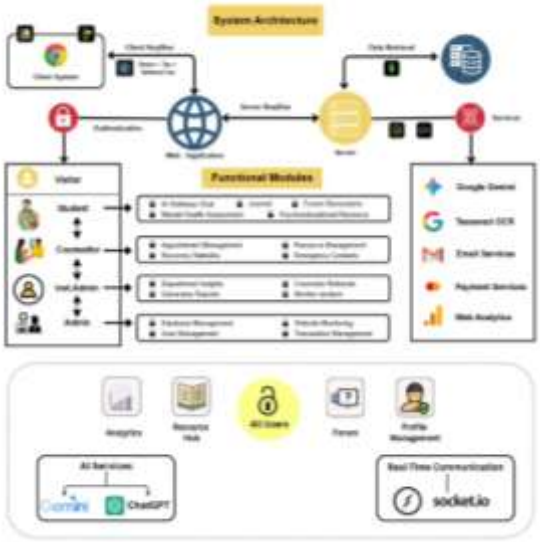

Figure 3: System Architecture

6. Experimental Setup

The system is implemented and tested in a development environment utilizing standard computers and software tools. The system is deployed on a web platform and can be accessed by utilizing web browsers. The system design is done utilizing React and Tailwind CSS for frontend implementation, and for backend implementation, it is done utilizing Node.js Express.js. The database on which user details, health reports, and interaction history are stored is MongoDB.

The functionalities of artificial intelligence are implemented by APIs for natural language processing, drug and food interaction, and nutritional evaluation. Test data includes generic student data, sample medication use charts, nutritional information inputs, journaling entries, and chat inputs. Scenarios are implemented for system functionality testing for purposes of drug and food interaction evaluation, diet plan generation, journaling for mental wellness, and AI chat with personal functionality.

System performance is measured for accuracy of response, latency, functional correctness, and usability. Manual testing, scenario testing, or other testing tools/techniques might be used for testing output for accuracy to make sure that everything works correctly.

7. Results

The designed system successfully exemplifies the working of an AI-based holistic wellness platform for students. The drug-food interaction system effectively identifies dangerous combinations of medication and foods and notifies the user in real-time to avoid risks of ill health. The AI diet plan generator produces relevant diet recommendations based on the availability of food in the canteen.

The mental well-being journal comprehends and recognizes trends of emotional experiences expressed by users in their writings and provides awareness of commonalities such as stress and fatigue. The dialogue AI characters interact with people empathetically and semantically, increasing their engagement and accessibility to health advice.

On the whole, the system works efficiently with less response time and provides reliable and friendly output. The outcomes show that the combination of analysis through AI and empathetic communication can boost the concept of preventive healthcare in a student-centric setting.

8. Analysis

The analysis of the adopted system has shown that combining various concerns of health in one system by AI technology makes it simpler and more efficient for students. The system of interaction between drugs and foods identifies the appropriate reactions for preventive healthcare. The AI diet analyzer provides honest recommendations that correspond to the lifestyle levels of students in terms of space provided for improvement.

The natural language processing aspect of the mental wellness journal helps in recognizing simple emotive patterns and helps ensure that its people get the earliest warning signs of burnout and stress. Moreover, the emotive AI chat personas engage the user through interesting responses and simple directions to grasp. Overall, the functionality of the system is quite efficient with acceptable time and proper intercommunication of the front and back ends and the AI services.

9. Conclusion

Zenvy successfully implements a MERN-based empathetic AI framework that holistically addresses student health challenges through integrated modules for drug-food interaction detection, mental wellness tracking via NLP-powered journaling, personalized diet recommendations, domain-specific AI chat personas, and Ayurvedic herbal guidance. Experimental validation confirms high accuracy in risk identification and empathetic user engagement with efficient response times across all components. By addressing the gaps in generic health apps, Zenvy advances proactive healthcare through compassionate AI by embedding student-centric and context-aware features designed for the hostel environment. These findings validate the effectiveness of integrating emotional intelligence with technical precision, thus laying down a scalable model for preventive wellness in academic settings that effectively melds modern AI capabilities with traditional healing knowledge.

10. Limitations

Even though Zenvy has good technological capabilities in terms of the variety of components that are integrated, there are some gaps that require consideration in relation to improvement in the future. Since the AI calculations for NLP evaluation, drug/food interaction data, and diet recommendations depend on external APIs, it is dependent on the availability of the Internet. A loss of connectivity through the internet network or the APIs could affect its real-time functionality regarding food and drug interaction analysis and answering patient queries.

Further, the quality of recommendations is highly dependent on the data provided by individuals. Inaccuracies in food and medication recording may lead to poor diet and stress pattern suggestions. The incentive to build a profile in a healthy lifestyle service can be an issue in most digital health services.

Zenvy is a preventive wellness companion, not a diagnostic device. It is an evidence-supported alert and lifestyle guide that refrains from both diagnosis and treatment recommendations. It is always recommended that Zenvy be used in consultation with healthcare providers regarding any prescription or change in a medical emergency.

The current web-based architecture is not integrated with wearable devices - such as smartwatches or fitness bands - that would enable real-time biometric monitoring. Physiological data that have been identified to be predictors of decline in mental health, such as heart rate variability, sleep patterns, or activity levels, cannot be passively captured, again limiting the capability of truly continuous health surveillance by the system.

11. Future Scope

The proposed system will, therefore, undergo improvement with the development of a mobile app that will have offline support for the most important health features. The app will, therefore, have the capability of being used along with wearable technology such as health bands and health watches that will record all physical activities, sleep, and health parameters on a real-time basis. Advanced health AI models will, therefore, be employed for health analysis and prediction.

Other features that would bring improvements include adding multi-lingual and voice-interaction functionality to make it more accessible, adding new specialized AI personas such as virtual doctors and therapists, to name a few. The application can also include functionality to offer personalized analytics for health tracking over a period of time.

12. Acknowledgement

First of all, the authors would like to show appreciation to the MIT Art, Design and Technology University for the academic environment that is crucial for carrying out the research work. Finally, they show appreciation to the Computer Science Department faculty members for their assistance throughout the entire project life.

We are also very grateful to the mentors of our projects who, because of their knowledge in AI, MERN Stack Development, and Healthcare Systems, helped shape the final outcome of Zenvy. Their feedback during the testing process was very helpful.

Special thanks go to fellow students and classmates for their active roles as test users in giving significant input regarding student health issues and for endorsing the system's usability in real hostel settings.

We are thankful for the availability of open-sourced AI APIs, health database information, and Ayurveda knowledge bases that fueled the engine of the principal functionalities of Zenvy. Lastly, we thank our loved ones for their unconditional support and assistance in this research endeavor.

References

[1] R. R. PBV et al., “Mental Wellness ChatBot for Students Using NLP,” in Proc. Int. Conf. Machine Learning and Autonomous Systems (ICMLAS), 2025, pp. 1-6.

[2] D. Gupta et al., “Design and Implementation of an AI-Driven Mental Health Chatbot,” IEEE Conf. Publ., doi: 10.1109/ICMLAS.2024.10910363, 2024.

[3] A. Vuyyuru et al., “Mental Health Therapist Chatbot Using NLP,” in Proc. IEEE Int. Conf. Innov. Intell. Syst. Appl., doi: 10.1109/ICMLAS.2024.10882362, 2024.

[4] D. Reker et al., “Machine Learning Uncovers Food- and Excipient-Drug Interactions,” Cell Rep., vol. 30, no. 11, pp. 3773-3782, Mar. 2020.

[5] I. Papastratis et al., “AI nutrition recommendation using a deep generative model and explainable artificial intelligence,” Sci. Rep., vol. 14, 2024, Art. no. 65438.

[6] C. Rathor, “Artificial Intelligence in Ayurveda: A Simple Overview,” J. Ayurveda Integr. Med. Sci., vol. 9, no. 2, pp. 1-10, 2024.

[7] Anjalai Ammal Mahalingam Eng. College Team, “Personalized Nutrition Analyzer using Artificial Intelligence,” Int. J. Adv. Res. Sci. Comput. Technol., vol. X, no. Y, pp. 1-8, 2024.

[8] M. Tohidi et al., “Artificial intelligence in drug-drug interaction checking,” GSC Biol. Pharm. Sci., vol. 28, no. 1, pp. 01-12, 2025.

[9] Limkar, S., Baser, S., Jhamnani, Y., Shinde, P., Jithu, R., & Chinchmalatpure, P. (2019, June). Chatbot: Integration of Applications Within Slack Channel. In International Conference on Intelligent Computing and Communication (pp. 551-558). Singapore: Springer Singapore.

[10] V. Sinha, S. Chinchmalatpure, S. Apte and R. Pawar, "NeuroSight: Brain Tumor Classification using Deep Learning Techniques," 2023 International Conference on Artificial Intelligence Science and Applications in Industry and Society (CAISAIS), Galala, Egypt, 2023, pp. 1-6, doi: 10.1109/CAISAIS59399.2023.10270090.

[11] S. Tyagi, K. Panchal, P. Chitta, S. Todi, S. Priya and R. Pawar, "Emotionomics: Pioneering Depression Detection Through Facial Expression Analytics," 2023 7th International Conference On Computing, Communication, Control And Automation (ICCUBEA), Pune, India, 2023, pp. 1-4, doi: 1109/ICCUBEA58933.2023.10392157.

[12] Chauhan, Y. S., Chinchmalatpure, P., Chinchmalatpure, S., Yelmar, P., Jagdale, S., & Pawar, R. G. (2024). OCR enabled health analysis using ABHA integration. The Journal of Computational Science and Engineering, 2(5), 1–11.