SAHYADRI
COLLEGE OF ENGINEERING & MANAGEMENT
An Autonomous Institution
MANGALURU

Department of Information Science & Engineering and CSE (Data Science)

Mini-Project Synopsis - Academic Year 2023-24

1	**Title of the Project**	Medisynth: AI Driven Virtual Patient with Medicine Prospective for Medical Student
2	**Team No**	IS04
3	**Department**	Information Science & Engineering
4	**Project Area/Domain**	Healthcare
5	**Project Type**	AIML
6	**Name of the Students with USN**	1. Akkil MG (4SF21IS006) 2. Ashish Goswami (4SF21IS015) 3. Saiesh Savanth (4SF21IS081) 4. K Rakshitha (4SF21IS037)
7	**Name of Guide**	Dr Mustafa Basthikodi

8. Abstract

This mini project is an innovative fusion of Machine Learning (ML) and Artificial Intelligence (AI) designed to elevate medical education. Featuring two interfaces for patients and aspiring doctors. A pivotal feature introduces an AI-generated patient exhibiting lifelike symptoms and presenting a simulated body temperature. Students should diagnose and prescribe medications, and then they receive real-time feedback with alternative suggestions through a user-friendly interface. The application will take the access of camera and microphone to get the data from students so as to provide an immersive learning experience. Enhancing realism, the AI patient

expresses emotions through audio and visual cues. Another noteworthy feature is the Optical Character Recognition (OCR), which scans medicines, providing information on about the medicine and its uses . The project facilitates peer-to-peer interactions and introduces AI-driven consultations for remote patient monitoring through a chatbot. The medicine interface covers both English and Ayurvedic medicines for inclusivity.

9. Introduction

Taking a detailed medical history is an essential part of establishing contact with a patient. This involves recording the reason for the consultation and the current complaints on the one hand, but also all relevant information from the patient's history and environment on the other. Medical students must therefore learn and practice the necessary techniques. Especially in the early section of the study, the aim is to learn a well-structured and as complete as possible medical history as a basic framework for the medical interview.

In the first section of medical school, the content of the anamnesis interview is first taught theoretically and then practiced in role plays. For this purpose, the use of simulated patients (SP) is certainly a very good option. Simulated patients are usually medical non-professionals who are trained to perform a certain patient role in order to provide students a training opportunity. However, this form of teaching in small groups is very resource-intensive (actors, lecturers). For this reason, paired role plays between two students are often used. However, since the role of the interviewee is insufficiently defined, the practice effect is limited. If the anamnestic interview shall be practiced for different clinical pictures the student who plays the patient has to have good knowledge about the diseases and the symptoms. Another limitation of the role play is that it is time consuming especially for that student who is playing the "patient". Here a tool would be helpful in which the students can train the anamnestic dialog alone (without fellow student) for a large number of cases. However, since role play is a well established technique of teaching communication skills new techniques have to be compared with it.Against this background, this paper deals with the development and evaluation of a training software for the anamnesis interview using a Virtual Standardized Patient (VSP).The aim of the study was firstly the development of a software teaching tool to practice dialogs for taking medical

history of patients for medical students in the early phase of their study. First of all, it was tested whether simple rule-based are able to simulate the dialog and how the rules can be developed iteratively.

The second question was to analyze whether a drawn image of a patient is sufficient to give the student the impression of a realistic dialog or whether a photorealistic representation is necessary. Thirdly, it was tested whether a computer-generated voice is sufficient to simulate a real patient or whether natural (recorded) speech is necessary. Finally, it was tested whether a speech-to-text tool can be used to give the student the possibility to interact with the software via spoken language. This developmental process (which took a period of more than 2 years) led to a system in which the conversation on the patient side is performed by a chatbot, which responds to the student's questions with an answer that matches the simulated clinical picture. From the graphical point of view optimal results were obtained with photorealistic visualization of the avatar and natural (not computer-generated) speech. The development also clearly indicated the need of a feedback function in which the students receive an assessment of the performance during the dialog. However, it became obvious that just providing a list of missing items which have not (but should be) included in the interview was not enough. For this reason, short additional videos for each clinical case were produced in which an experienced examiner explains the relevant, most important aspects which have to be covered in the anamnestic interview so that the students understand better the feedback list of missing items.

10.Problem Statement and Description

Medical education faces challenges in providing hands-on, immersive learning experiences for aspiring doctors. Traditional methods may lack realism and immediate feedback, hindering the development of practical skills in diagnosis and prescription. There is a need for innovative solutions that combine Machine Learning (ML) and Artificial Intelligence (AI) to enhance medical education by offering a comprehensive and interactive learning platform.

The proposed solution is a groundbreaking fusion of ML and AI designed to elevate medical education. The platform features two interfaces, one for patients and one for aspiring doctors, creating an immersive and realistic learning environment. The pivotal feature involves an AI-generated patient with lifelike symptoms and simulated body temperature, prompting students to diagnose and prescribe medications. The application leverages the camera and microphone to collect data from students, providing a hands-on experience. Real-time feedback, including alternative suggestions, is delivered through a user-friendly interface, enabling students to learn from their mistakes and refine their diagnostic skills.

11. Objectives

- Integrate advanced ML and AI algorithms to generate lifelike patient scenarios with realistic symptoms, ensuring that the learning experience closely mirrors real-world medical situations.
- Enable students to actively practice diagnostic skills by interacting with AI-generated patients, utilizing the camera and microphone for data collection to enhance the hands-on learning experience.
- Develop a system that allows the AI-generated patient to express emotions through audio and visual cues, enhancing the realism of patient interactions and promoting a more empathetic approach in diagnosis and treatment.
- Implement OCR technology to scan and provide detailed information about medicines, enhancing students' knowledge about medications, their uses, and potential interactions.
- Facilitate peer-to-peer interactions within the platform to encourage collaborative learning, knowledge exchange, and the sharing of diverse perspectives among aspiring doctors.

12.Methodology

The project methodology involves a systematic approach to the development of an innovative medical education and diagnosis system. Beginning with a detailed requirements analysis, the project will focus on creating two distinct user interfaces for patients, lecturers, and students. Data collection, including patient information and multimedia data, will be facilitated through the use of cameras and microphones. The implementation of an AI-generated patient, presenting symptoms and body temperature, engages students in diagnostic exercises. The system incorporates interfaces for test instructions, prescription validation, and emotional AI expressions. Optical Character Recognition (OCR) technology will be employed for extracting medicine data, enhancing diagnostic processes. Additionally, the project emphasizes P2P interactions, remote patient monitoring consultations, and a comprehensive medicine interface catering to both English and Ayurvedic medicines. Throughout, rigorous testing, user feedback, and iterative improvements will ensure the efficacy and user-friendliness of the final system.The project employs a powerful and versatile technology stack to deliver a seamless and efficient medical education and diagnosis system. The web application is built using ReactJS, providing a dynamic and responsive user interface for patients, lecturers, and students. Express.js serves as the backend framework, facilitating robust server-side development and seamless communication between the frontend and the database. MongoDB, a NoSQL database, is chosen for its scalability and flexibility, ensuring efficient data storage and retrieval. FastAPI, a modern web framework for building APIs with Python 3, is integrated to handle asynchronous operations, enhancing the system's responsiveness. The AI model, central to the project's diagnostic capabilities, is developed using Python, leveraging its extensive libraries and frameworks for machine learning. This comprehensive technology stack is selected to ensure a scalable, performant, and user-friendly medical education and diagnosis system.

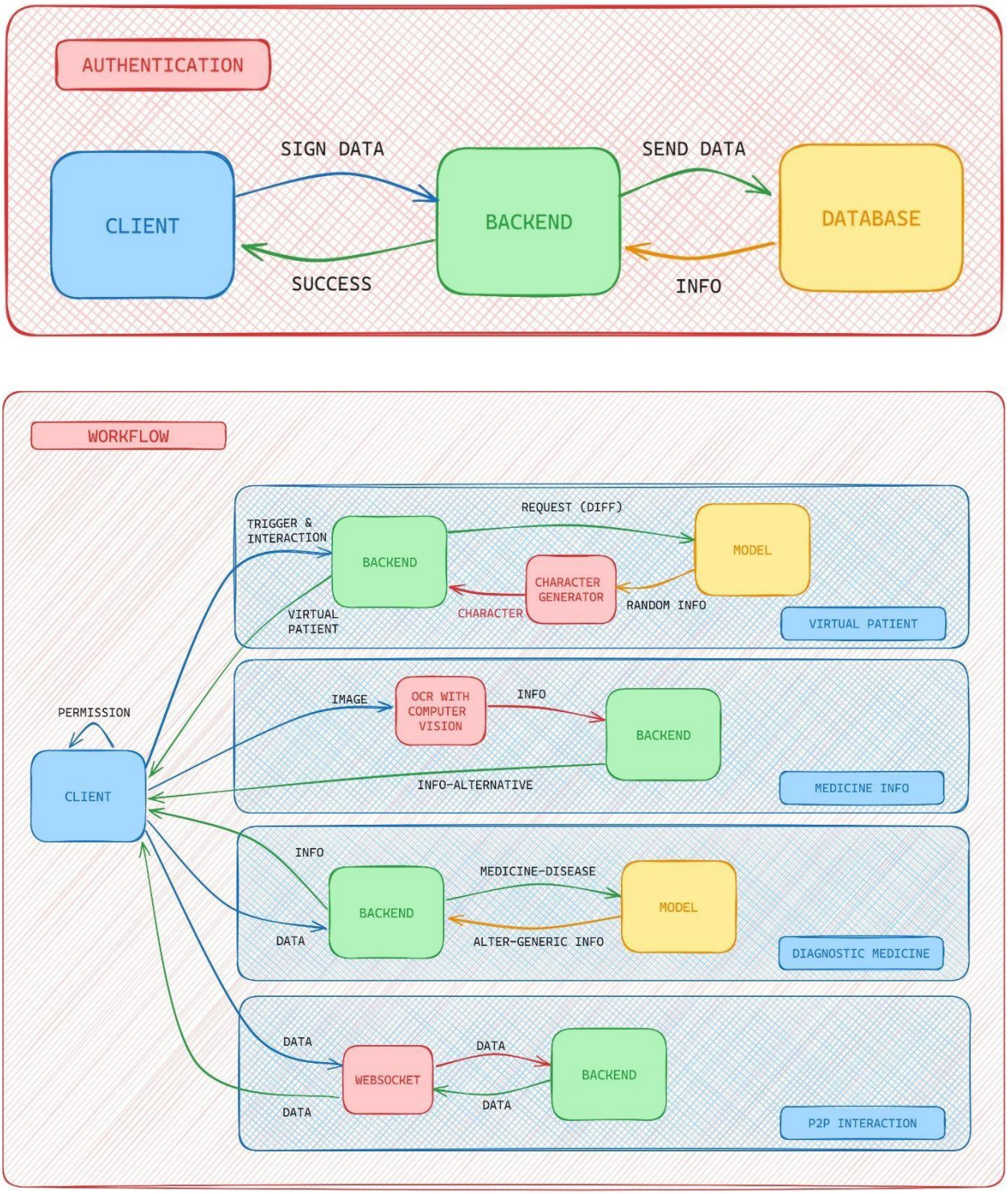

Fig 1 Workflow Diagram Of Virtual Patient Stimulation

The diagram shows a workflow for a virtual patient simulation system. The system is designed to help medical professionals practice their skills in a safe and realistic environment. The workflow starts with a client, such as a medical school or hospital, sending a request to the system. The request

includes information about the type of simulation that the client wants to run, as well as the patient's medical history. Once the request is received, the system triggers a backend process that generates a virtual patient. The virtual patient is created using a combination of data from the patient's medical history and artificial intelligence. The virtual patient is then sent to the client, where it is used to run the simulation. The client can interact with the virtual patient in a variety of ways, such as by taking a history, performing a physical exam, or ordering tests. As the simulation progresses, data is collected about the client's interactions with the virtual patient. This data is then sent back to the system, where it is used to improve the accuracy of the virtual patient model. The workflow also includes a feedback loop that allows the client to provide feedback on the simulation. This feedback is used to improve the system in future iterations.

13. Outcome of the work

- Create a virtual environment that mirrors real-life medical scenarios.
- Incorporate detailed anatomical and physiological models for a lifelike experience. Ensure accurate representation of medical equipment, settings, and patient conditions.
- Implement artificial intelligence algorithms to generate dynamic and evolving medical cases. Develop scenarios that adapt based on user actions, providing a personalized learning experience. Utilize machine learning to simulate diverse patient responses and outcomes.
- Design an intuitive interface tailored for medical students.
- Prioritize ease of navigation and accessibility for users with varying levels of technical proficiency. Incorporate interactive elements such as touch-based controls, voice commands, or VR interfaces to enhance engagement.

14. Conclusion

In conclusion, our project seamlessly merges ML and AI, offering an immersive medical education experience. With realistic AI-generated patients, emotion-driven interactions, and OCR for medicine insights, it transforms traditional learning.The platform not only equips students with practical skills but also pioneers remote consultations.It emerges as an innovative solution poised to redefine medical education, preparing students for the future of healthcare.

15. References

1. https://jvwr-ojs-utexas.tdl.org/jvwr/article/view/707
2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9098350/
3. https://www.sciencedirect.com/science/article/pii/S0169260723006302
4. https://onlinelibrary.wiley.com/doi/abs/10.1111/jcal.12190
5. https://www.proquest.com/docview/2766512444?pq-origsite=gscholar&fromopenview=true&sourcetype=Scholarly%20Journals
6. https://ieeexplore.ieee.org/abstract/document/9119656
7. https://link.springer.com/article/10.1186/s12909-022-03410-x

16	**Signature of Students**	AKKIL MG ASHISH GOSWAMI SAIESH SAVANT K RAKSHITHA
17	**Signature of Guide**	
18	**Signature of the Project Coordinator**	