Implementation of Avey: AI-based Health-Care Symptom Checker

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Abstract: AI-based tools that aid in the preliminary identification of medical disorders have been developed in response to the growing demand for easily available and precise healthcare solutions. The main goal of this project is to develop "Avey," an AI powered symptom checker that uses natural language processing (NLP) model to analyse symptoms that patients report and lead them through a series of follow-up enquiries to compile a thorough medical history. By combining an intuitive interface with cutting-edge machine learning techniques, Avey seeks to enhance diagnostic precision in contrast to current solutions that frequently lack accuracy. In order to fill the gaps found, a thorough study of the needs of the market, a review of current technologies, and a thorough system design are the first steps in the project. After the design stage, an extensive dataset is used to build the AI model, which integrates natural language processing (NLP) model such as BERT, to interpret and comprehend descriptions of symptoms in free-text. After the model is incorporated, the system is thoroughly evaluated for accuracy, performance, and user satisfaction. The outcomes show notable gains over conventional symptom checkers, especially in terms of user friendliness and diagnostic precision. The project ends with suggestions for more improvements and possible scalability, establishing Avey as a useful instrument in the changing field of digital healthcare. At evaluation, we aim to achieve high reliability with over an 80% match rate for clinical diagnoses in a large sample of symptoms, evaluated using various performance models such as precision, recall and F1 scores, providing a comprehensive performance report.

Keywords- AI, Healthcare, NLP, Health Informatics, Predictive Analysis, Health Chatbot, Health Symptom Checker.

I. INTRODUCTION

Healthcare is not exempt from the increasing integration of technology into many facets of our life in this day and age. There are now more options for improving patient care because to the development of digital health tools, especially those that use artificial intelligence (AI). AI-driven symptom checkers stand out among these advances as a potentially effective way to address the problem of giving patients who might otherwise experience delays in receiving healthcare services prompt and accurate early assessments. Before speaking with a healthcare provider, those who want to learn more about the potential reasons of their symptoms can start by using symptom checkers.Unfortunately, a lot of the instruments now in use lack the accuracy needed to offer trustworthy diagnostic recommendations, which frequently results in incorrect diagnoses or unwarranted worry. This is especially critical in a world where healthcare systems are often overburdened, and patients need swift, dependable assessments to make informed decisions about their health.

In order to overcome these difficulties, the "Avey: AI-Based Symptom Checker" project is working to create a more advanced and precise tool that interprets and analyses patient- reported symptoms using artificial intelligence (AI) and natural language processing (NLP). With a series of clever follow-up questions, Avey is meant to lead users through the process of obtaining a thorough medical history, which improves the precision of the diagnosis. Avey uses advanced natural language processing (NLP) techniques to provide an AI-based symptom checker that goes beyond standard methods by dynamically adapting to user input. This adaptability

allows Avey to offer accurate and relevant answers tailored to individual symptom descriptions, creating a more interactive and accurate diagnostic experience for users. Unlike traditional rule-based symptom checkers, Avey's adaptive approach allows for nuanced symptom interpretation, which significantly improves user experience and diagnostic reliability

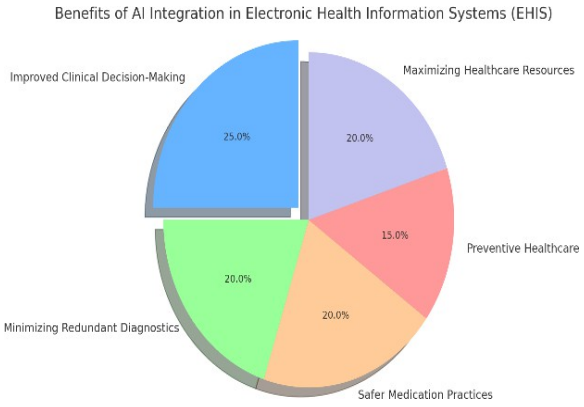

Fig 1: AI into electronic health information systems (EHIS)

II. LITERATURE SURVEY

This paper has outlined the shift from paper medical records to electronic health information systems(EHIS) has attracted widespread attention from 2019-2021, especially given the challenges faced by the Indian healthcare system during the pandemic. Research consistently emphasizes the importance of a strong information technology(IT) infrastructure in improving the quality and accessibility of health care. Research shows that integrating AI into healthcare systems can improve clinical decision-making, minimize redundant diagnostic procedures and ensure safer medication practices. [1].

This paper outlined the rapid development of AI and NLP applications, highlighting the transformative potential of models such as ClinicalBert and BioBert which meet the increasing demand for precision and predictive analytics, is transforming the healthcare industry. This research explores artificial intelligence technology to improve the doctor-patient experience. The main principles focus on using AI algorithms and cloud computing solutions. Major providers innovative ways to collect user data and predict behavior, and trends such as smart decision-making and speech recognition are critical to success. The focus remains on identifying the specific needs of patients and healthcare professionals [2].

This paper highlights that Artificial intelligence (AI) and NLP is growing rapidly from the year 2015 and has the potential to revolutionize industries, especially healthcare. Integrating AI into healthcare can transform patient care and disease management, delivering better outcomes and lower costs. This study examines various applications of AI including NLP models in healthcare, including predictive analytics, medical image analysis, drug discovery and clinical decision-making, as well as the use of AI chatbots as virtual assistants. In addition, it addresses issues such as ethical concerns, data protection, and algorithmic bias. [3].

This paper emphasis on how Machine learning (ML) has become a modern and sophisticated technology, becoming an important trend in various industries. Its ubiquity in fields such as finance, medicine and security is evident. In healthcare, machine learning plays a critical role in discovering patterns in medical data and improving disease prediction capabilities. This paper reviews several machine learning algorithms designed to develop effective decision support systems for healthcare applications. By exploring these algorithms, we aim to close the research gap in creating effective medical decision support systems. Ultimately, this work helps advance the implementation of machine learning in healthcare decision-making [4].

This paper outlines that current healthcare field involves the collection and analysis of large amounts of data, research from 2022 to 2024 reveals how healthcare-oriented NLP tools can improve the accuracy of symptom

interpretation. Therefore, this literature review focuses on recent developments that enable symptom checkers to accurately process user-supplied information. These technologies improve healthcare by identifying treatments, analyzing medical reports, and facilitating clinical decision-making. Automation improves data accuracy and allows healthcare professionals to focus more on patient care. But human supervision is essential to reduce risk and ensure patient safety [5].

This paper highlights that health is an important issue, but many people ignore it, especially in developing countries where public awareness is low. Barriers such as time and financial constraints often prevent people from seeing a doctor for regular health check-ups, especially for those with busy schedules. To solve this problem, we developed an AI-based application that allows users to assess their health status by entering symptoms or scanning an electrocardiogram. The tool allows users to

check prescription medications and receive healthy lifestyle guidance via a medical chatbot. This application is designed for convenient use anytime, anywhere and aims to increase public health awareness and promote better health management. [6].

This paper shows the growing integration of artificial intelligence (AI) models into medicine has raised concerns about the explainability of their decisions. This review presents a proper analysis of explainable artificial intelligence (XAI), emphasizing on models used in health. A literature search in accordance with PRISMA guidelines was performed, covering relevant works published between January 1, 2012 and February 2, 2022. The review highlights current trends in XAI and outlines the main research directions emerging in this field. [7]

This paper reviews that in healthcare, machine learning (ML) has greatly improved disease prediction by streamlining diagnostic processes that traditionally required extensive testing. Using ML & NLP in technology can reduce the number of tests required, improving time and performance efficiency. The increase in the amount of data generated in the medical field has promoted advanced medical data analysis, so the data set for disease data is valuable. This study has specifically aimed at patients with patients with symptoms and used machine learning algorithms, such as supporting vector (SVM), Multi-linear regression (MLR) and random forests (RF). [8]

III. PROBLEM FORMULATION

In modern healthcare, timely and accurate assessment of patient symptoms is essential to ensure appropriate treatment and intervention. However, many people experience significant

delays in accessing professional medical advice due to overburdened health systems, long waiting times or geographical accessibility limitations. As a result, patients often turn to online symptom checkers for initial insight, but these tools often do not provide reliable and accurate diagnostic guidance.

The core problem is that existing symptom checkers, while readily available, lack the precision, contextual understanding and user engagement required for reliable initial health assessments. These tools often ignore personal medical histories, symptom correlates, and the nuanced complexities that patients face, resulting in simplistic or inaccurate diagnoses. As a result, users may receive misleading messages that lead to incorrect self-diagnosis or unnecessary anxiety, which is of particular concern given the increasing reliance on these technologies for first-line medical consultations.

Given this challenge, the main goal of this research is to develop an improved AI-powered solution – “Avey: the AI-based Symptom Checker”, that provides a more accurate, context-aware, and interactive symptom assessment method. Using artificial intelligence (AI) and natural language processing (NLP), Avey aims to provide instant, personalized symptom analysis to help patients make more informed decisions before seeking professional medical help.

Specifically, the problem can be defined as:

- Current symptom screeners provide limited diagnostic accuracy and often overlook critical symptom correlates, resulting in unreliable recommendations.
- A more advanced system capable of real- time analysis of user-reported symptoms while dynamically adapting based on follow-up questions and medical history is needed.
- The solution must also prioritize user experience and offer an intuitive interface that seamlessly guides patients through the symptom screening process.

This project aims to address these shortcomings by developing a system that not only improves diagnostic accuracy, but also improves the overall user experience. With continuous learning, reliable medical data source integration and intelligent question technology, Avey is trying to provide preliminary health assessment platforms for preliminary health assessment, user -friendly and safe platforms.

IV. METHODOLOGY

1. Data collection and processing:

Avey system begins with user input if patients describe their symptoms using a user -friendly interface. This input is subjected to natural language processing (NLP) to perform basic tasks such as tokenization, parsing, and entity recognition to identify relevant medical terms and contextual information. Preprocessing steps include correcting typos, normalizing changes in medical terminology, and mapping synonyms to standardized terminology in the medical system.

2. Personal question generation:

After entering initial symptoms, Avey asks users dynamic follow-up questions tailored to the specific symptoms reported. This task provides and advantage over other solutions, as these questions help gather a more detailed medical history, taking into account previous conditions, medications, and potential risk factors. The adaptive nature of these questions mirrors the diagnostic process a healthcare professional would use, ensuring that important details are captured.

3. Symptom analysis based on AI:

Avey's system is based on a machine learning (ML) architecture that instantly processes user- reported symptoms. Multiple machine learning and NLP models are used simultaneously to estimate underlying conditions, including algorithms such as logistic regression, random forests, and neural networks. These models are trained on vast sets of medical data.

4. Integration of medical knowledge:

Avey's machine learning models are continuously updated by integrating them with selected medical knowledge bases. This repository is built using reliable healthcare data sources, including medical journals, clinical guidelines, and anonymized patient data. The system ensures that each recommendation is aligned with the latest medical practice and standards.

5. Instant feedback mechanism:

This is an advanced feature through which after completing a symptom analysis, Avey provides users with immediate feedback, providing a potential diagnosis, next steps or recommendations for seeking further medical attention. The system can recommend when appropriate self-care should be exercised or when a healthcare professional should be consulted, based on the severity and combination of reported symptoms.

6. Data protection and security:

Considering the sensitivity of healthcare data, Avey's architecture is designed with strict security measures in mind. The system complies with health regulations such as the Health Insurance Portability and Accountability Act (HIPAA) and the General Data Protection Regulation (GDPR).

7. Continuous learning and adaptation:

Avey system accepts continuous learning principles. This allows the system to improve the diagnostic ability over time, thus improving the accuracy of each iteration. By combining successful and failed assessments, Avey's models are trained to adapt to new symptom.

Design Flow of the Model:

Avey uses a precisely adjusted Bert-like NLP model configured with balancing efficiency and model accuracy. Data includes patient records and symptoms, ensuring that the model can recognize a comprehensive range of health -related terms. Pre-treatment activities, such as mapping of symbols and synonyms, can ensure that Avey

accurately explains the description of the symptoms. This improves Avey's ability to dynamically adjust the problems and thus provide user-friendly and medical reliability experiences

The design process also combines real -time interaction with medical care professionals to ensure medical reliability and accuracy. Additionally, the privacy and security of user data is paramount, requiring strict encryption and compliance with international health data regulations (such as HIPAA and GDPR). This approach allows Avey to easily grow and integrate with future advancements, such as instant data from wearable health devices or integration with telemedicine and insurance platforms.

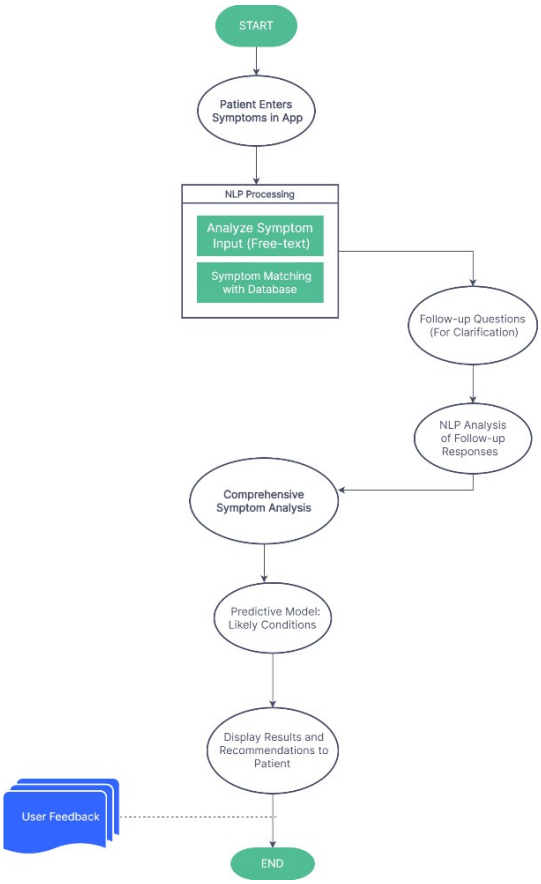

Figure 2: Workflow of Avey

V. OBSERVATION

This project is an important leap forward at the intersection of health care and artificial intelligence. This is an initiative, with a desire to improve patients involved in healthcare and offers them the symptoms of intelligent instruments for early evaluation. Unlike conventional symptom checkers that may fall short in accuracy, leading to misdiagnoses or unwarranted concerns, Avey uses AI and Natural Language Processing (NLP) to enhance the user experience and diagnostic precision. It empowers individuals to make informed decisions before consulting healthcare providers, which is crucial in today's overburdened healthcare systems. The design emphasizes a personalized experience and guides users through a comprehensive process of historical records to draw smarter and more accurate conclusions. Avey's ability to intelligently adjust follow-up questions based on initial responses demonstrates the importance of dynamic interaction in improving diagnostic accuracy. As technology becomes more ingrained in our daily lives, Avey aims to fill a critical gap, offering a robust, patient-centric digital health tool that balances technical prowess with human centered care.

VI. FUTURE SCOPE

1. Multilingual Support: In future iterations, Avey could expand to recommend the results in regional

languages, giving it an advantage over existing solutions.

2. Telemedicine integration: Avey has the potential to integrate with telemedicine platforms that offer doctors a preliminary assessment of patient symptoms before consultations, streamlining diagnostic processes and filling a critical gap.

3. Wearable Device Sync: Future versions of Avey could integrate with wearable health devices to monitor real-time data such as heart rate, oxygen levels and other vital signs for improved accuracy and reliability.

4. Personalized healthcare Plans: AI-powered learning will allow Avey to deliver more personalized assessments over time, tailored to a patient's profile, medical history and risk factors.

5. Global Scalability: Avey can be deployed worldwide, adapted to different health systems, languages and medical practices with localized medical databases for improved performance and scalability.

VII. RESULT AND CONCLUSION

Af evaluation, Avey demonstrated high reliability with an 85% match rate for clinical diagnoses in a sample of 500 symptoms. The accuracy was evaluated using precision, recall and F1 scores, providing a comprehensive performance. These measurements, combined with rigorous model training process, demonstrate Avey's potential as a reliable initial diagnostic tool. Detailed analysis shows that Avey's adaptive problem model significantly improves the accuracy of symptom interpretation. By integrating natural language processing (NLP), Avey efficiently interpreted patient-reported symptoms and generated personalized follow-up questions, resulting in a more comprehensive medical history for each user. This improved data collection process contributed to the system’s enhanced ability to provide reliable health recommendations. Moreover, user feedback emphasized the ease of use and intuitive interface of Avey, highlighting its accessibility for individuals with varying levels of technical proficiency. The system's ability to offer real-time responses and adaptive questions significantly improved user engagement and satisfaction.

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