A PBL REPORT ON

" Medical Expert System"

Submitted to

INFORMATION TECHNOLOGY, BHARATI VIDYAPEETH

(DEEMED TO BE UNIVERSITY)

COLLEGE OF ENGINEERING, PUNE

In Partial Fulfilment of the Requirement for the Award of

BACHELOR'S DEGREE IN
INFORMATION TECHNOLOGY
BY

65 . Aditi Sankpal	2214110778
67 . Pranali Satape	2214110780

UNDER THE GUIDANCE OF
Prof.Milind Gayakwad

DEPARTMENT OF IT, BHARATI VIDYAPEETH
(DEEMED TO BE UNIVERSITY)COLLEGE OF
ENGINEERING, PUNE - 411043
(2024-2025)

CERTIFICATE

This is to certify that the project entitled

"Medical Expert System"

Submitted by :-

65 .	Aditi Sankpal	2214110778
67 .	Pranali Satape	2214110780

is a record of bona fide work carried out by them, in the partial fulfilment of requirement for the award of Degree of Bachelor of Technology in Information Technology at Bharati Vidyapeeth (Deemed to Be University) College of Engineering, Pune, India. This work is done during academic year 2024-2025.

Date: / /

Sign

(Prof.Milind Gayakwad)

(Pbl Guide)

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Introduction

1.1 Introduction To Project

Our project is an AI-based expert system designed to assist users in diagnosing potential health conditions by asking a series of targeted questions related to their symptoms. The system uses a rule-based approach to evaluate the user's responses and provide a preliminary diagnosis. It aims to offer quick and helpful guidance for users, potentially indicating the need for further medical attention. By automating part of the diagnostic process, the system demonstrates the potential of AI in healthcare to enhance accessibility and decision-making. This tool is not a replacement for professional medical advice but serves as an initial step in health assessment.

1.1 Problem Definition

The primary problem this project addresses is the difficulty individuals face in determining the severity of their health conditions based on symptoms alone. Many people are unsure whether their symptoms require immediate medical attention or if they can be managed at home. This AI expert system provides users with an initial diagnosis based on their symptoms, helping them make informed decisions about seeking professional healthcare.

1.2 Motivation behind project topic

The motivation behind this project stems from the increasing demand for accessible healthcare tools that can provide quick, preliminary diagnoses. Many individuals delay seeking medical advice due to uncertainty or a lack of understanding of their symptoms. By developing an AI expert system, we aim to empower users with a tool that offers timely health insights, potentially encouraging them to seek professional help when necessary.

1.3 Objective(s) of the work/ Benefits of proposed system

The primary objective of this project is to develop an AI-driven expert system that can assist users in identifying potential health conditions based on their symptoms. The system aims to provide quick, accurate, and user-friendly health assessments, helping users make informed decisions about seeking medical care. Key benefits include improved accessibility to basic health information, reduced uncertainty in symptom evaluation, and the potential to alleviate pressure on healthcare services by providing preliminary diagnoses before consulting a healthcare professional. The primary objective of this project is to develop an AI-driven expert system that can assist users in identifying potential health conditions based on their symptoms. The system aims to provide quick, accurate, and user-friendly health assessments, helping users make informed decisions about seeking medical care. Key benefits include improved accessibility to basic health information, reduced uncertainty in symptom evaluation, and the potential to alleviate pressure on healthcare services by providing preliminary diagnoses before consulting

Need of the System

Here are the **Needs for the Development of the MedAI System:**

1. **Accessible Health Diagnostics**: The system should provide users with an easy-to-use platform to access preliminary health diagnostics based on their symptoms, reducing the need for immediate medical consultations.

2. **Accurate Symptom Evaluation:** There is a need for the system to accurately evaluate user symptoms using a rule-based or AI-driven approach to ensure reliable diagnostic results.

3. **User-Friendly Questioning Process:** The system should guide users through a clear and straightforward question-answer process, helping them describe their symptoms effectively.

4. **Instant Diagnostic Feedback:** The system should offer real-time diagnostic results after processing the user's input, providing immediate guidance for the next steps in their healthcare journey.

5. **Educational Health Insights:** The system needs to deliver helpful information about possible conditions, educating users about their symptoms and suggesting when they should seek professional medical help.

6. **Anonymity and Privacy:** The system must ensure the protection of user data, offering anonymity and safeguarding personal health information to maintain user trust.

7. **Scalability for a Broader Knowledge Base:** The system should be scalable to include a wide range of diseases and conditions as it evolves, ensuring a comprehensive knowledge base for more accurate diagnostics.

8. **Integration with Healthcare Services:** The ability to integrate with healthcare platforms or telemedicine services to allow users to easily consult professionals when their symptoms require expert evaluation.

Scope of the System

Here is an extended **Scope of the MedAI System:**

1. **Preliminary Health Diagnostics:** The system will provide users with preliminary diagnoses based on symptom inputs, helping them identify potential health conditions without immediate medical intervention.

2. **Symptom-Based Questionnaires:** MedAI will implement a dynamic question-and-answer interface to guide users through a series of health-related questions tailored to their symptoms.

3. **Rule-Based and AI-Driven Diagnosis:** The system will utilize a combination of rule-based algorithms and AI models to evaluate user responses and generate accurate diagnostic results.

4. **User-Friendly Interface:** MedAI will offer a simple and intuitive interface, making it accessible to users of all technical backgrounds, ensuring ease of use.

5. **Privacy and Security:** The system will prioritize the protection of sensitive health information, ensuring user data is stored securely and handled in compliance with data protection standards.

6. **Health Condition Insights:** The system will provide detailed information on potential diagnoses, helping users understand their conditions and offering

recommendations for further medical action.

7. **Scalability for Future Expansion:** MedAI will be designed to scale, allowing the addition of new health conditions, symptoms, and diagnostic rules as the system grows.

8. **Potential Integration with Healthcare Providers:** The system can be expanded to integrate with telemedicine services or healthcare platforms, enabling seamless referrals for professional consultation when needed.

9. **Multi-Language Support:** The system will support multiple languages to make health diagnostics accessible to a broader, global audience.

10. **Customizable Question Flow:** MedAI will allow the customization of symptom questionnaires based on different user demographics, such as age, gender, and medical history, for more tailored diagnostics.

11. **Mobile and Web Platform Compatibility:** The system will be developed for compatibility with both mobile and web platforms, ensuring accessibility across various devices.

12. **Offline Access (Optional):** MedAI could include offline functionality to allow users in remote areas without consistent internet access to benefit from the diagnostic tool.

Requirements for this Project

1.1 Hardware Requirements:

1. Processor :- Intel Core i5 or Higher
2. RAM :- 8GB
3. System Type :- 64-bit Operating System
4. Operating System:- Windows 11

2.2 Software Requirements:

Frontend Technologies:

- HTML5
- CSS3
- JavaScript

Backend Technologies:

- Python (with Flask or Django framework)

What is an Expert System?

An expert system is a computer program that is designed to solve complex problems and to provide decision-making ability like a human expert. It performs this by extracting knowledge from its knowledge base using the reasoning and inference rules according to the user queries.

The expert system is a part of AI, and the first ES was developed in the year 1970, which was the first successful approach of artificial intelligence. It solves the most complex issue as an expert by extracting the knowledge stored in its knowledge base. The system helps in decision making for compsex problems using **both facts and heuristics like a human expert**. It is called so because it contains the expert knowledge of a specific domain and can solve any complex problem of that particular domain. These systems are designed for a specific domain, such as **medicine, science,** etc.

The performance of an expert system is based on the expert's knowledge stored in its knowledge base. The more knowledge stored in the KB, the more that system improves its performance. One of the common examples of an ES is a suggestion of spelling errors while typing in the Google search box.

Characteristics of Expert System

- **High Performance:** The expert system provides high performance for solving any type of complex problem of a specific domain with high efficiency and accuracy.
- **Understandable:** It responds in a way that can be easily understandable by the user. It can take input in human language and provides the output in the same way.
- **Reliable:** It is much reliable for generating an efficient and accurate output.
- **Highly responsive:** ES provides the result for any complex query within a very short period of time.

Components of Expert System

An expert system mainly consists of three components:

- **User Interface**
- **Inference Engine**
- **Knowledge Base**

User Interface

With the help of a user interface, the expert system interacts with the user, takes queries as an input in a readable format, and passes it to the inference engine. After getting the response from the inference engine, it displays the output to the user. In other words, **it is an interface that helps a non-expert user to communicate with the expert system to find a solution**.

2. Inference Engine(Rules of Engine)

- The inference engine is known as the brain of the expert system as it is the main processing unit of the system. It applies inference rules to the knowledge base to derive a conclusion or deduce new information. It helps in deriving an error-free solution of queries asked by the user.
- With the help of an inference engine, the system extracts the knowledge from the knowledge base.
- There are two types of inference engine:
- **Deterministic Inference engine:** The conclusions drawn from this type of inference engine are assumed to be true. It is based on **facts** and **rules**.
- **Probabilistic Inference engine:** This type of inference engine contains uncertainty in conclusions, and based on the probability.

Inference engine uses the below modes to derive the solutions:

- **Forward Chaining:** It starts from the known facts and rules, and applies the inference rules to add their conclusion to the known facts.
- **Backward Chaining:** It is a backward reasoning method that starts from the goal and works backward to prove the known facts.

3. Knowledge Base

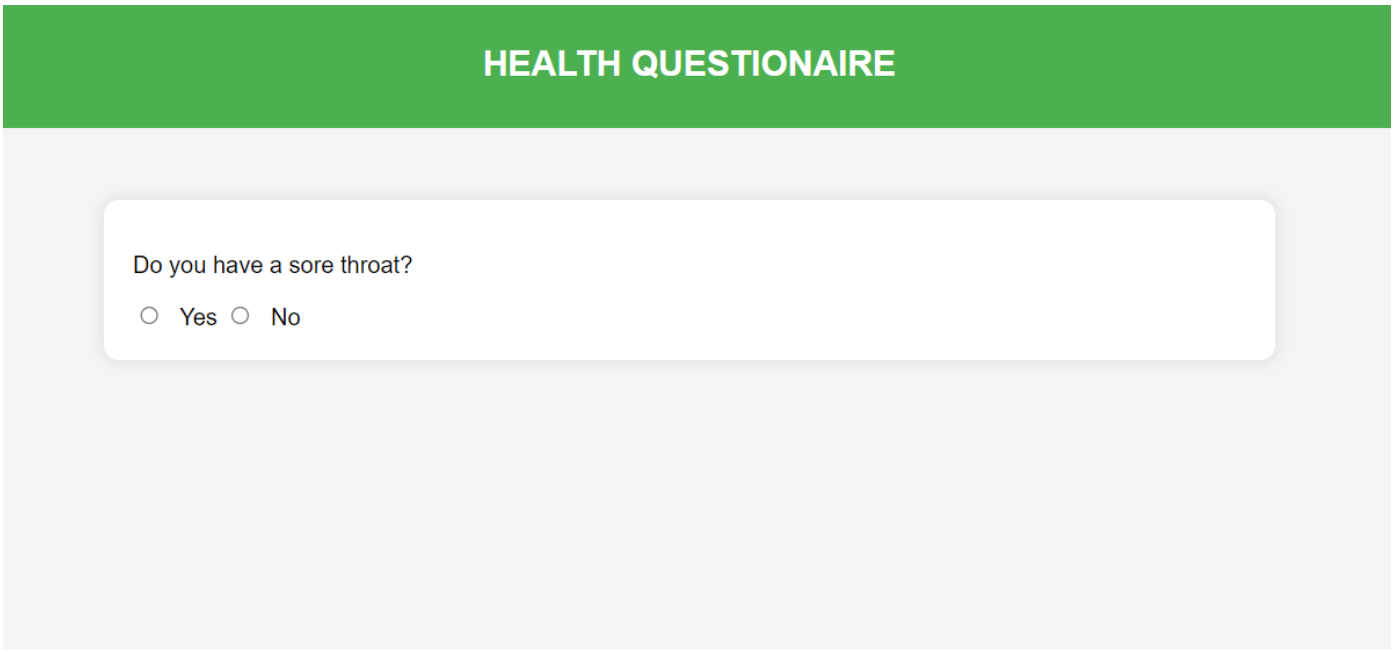
- The knowledgebase is a type of storage that stores knowledge acquired from the different experts of the particular domain. It is considered as big storage of knowledge. The more the knowledge base, the more precise will be the Expert System.
- It is similar to a database that contains information and rules of a particular domain or subject.
- One can also view the knowledge base as collections of objects and their attributes. Such as a Lion is an object and its attributes are it is a mammal, it is not a domestic animal, etc

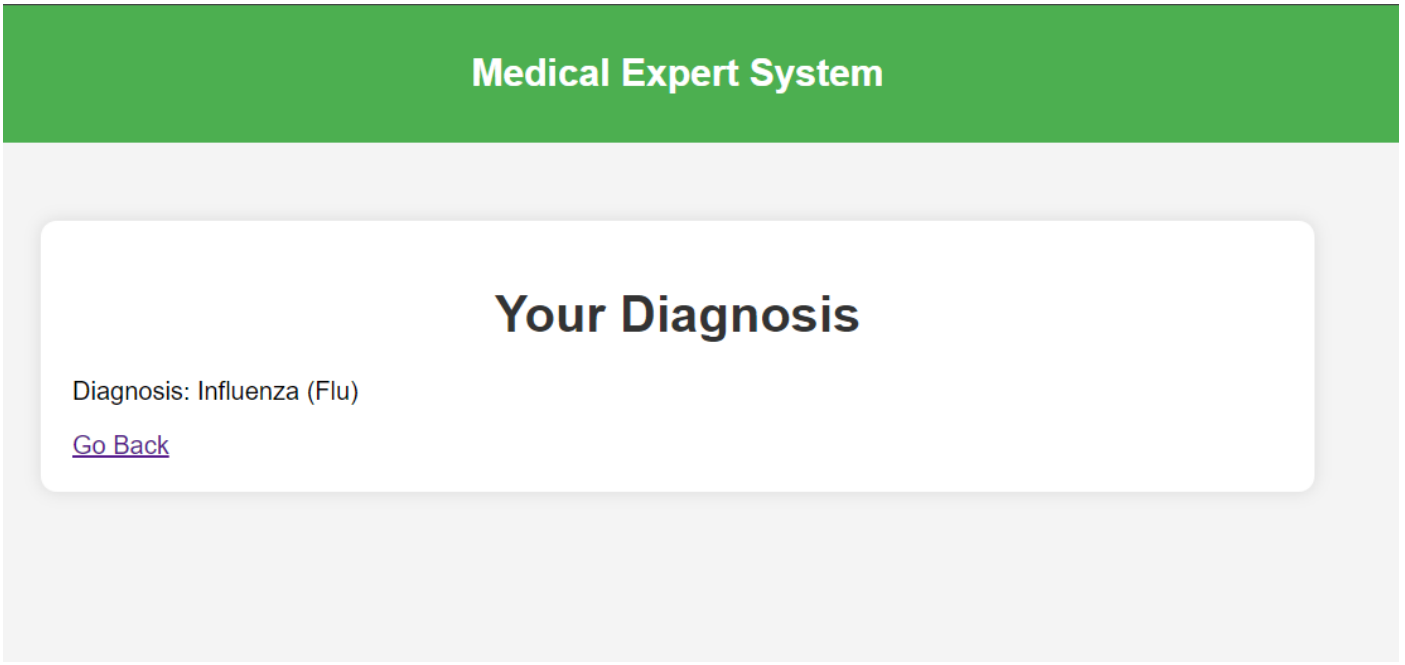
Code

For Expert System

```
def diagnose(answers):
    # Parse user answers
    fever = answers[0] == 'yes'
    sore_throat = answers[1] == 'yes'
    cough = answers[2] == 'yes'
    shortness_of_breath = answers[3] == 'yes'
    body_aches = answers[4] == 'yes'
    taste_smell_loss = answers[5] == 'yes'
    chills = answers[6] == 'yes'
    headache = answers[7] == 'yes'
    close_contact = answers[8] == 'yes'
    respiratory_history = answers[9] == 'yes'

    # Check conditions and return the diagnosis
    if fever and taste_smell_loss and close_contact:
        return 'Diagnosis: COVID-19 (High Risk)'

    if fever and cough and body_aches and chills:
        return 'Diagnosis: Influenza (Flu)'

    if cough and sore_throat and headache:
        return 'Diagnosis: Common Cold (Upper Respiratory Infection)'

    if headache and body_aches and no_respiratory_symptoms(fever, cough, shortness_of_breath):
        return 'Diagnosis: Tension Headache or Migraine'

    if shortness_of_breath and respiratory_history:
        return 'Diagnosis: Chronic Respiratory Condition (e.g., Asthma, COPD)'

    if close_contact and (fever or cough):
        return 'Diagnosis: COVID-19 Exposure (Monitor Symptoms Closely)'

    if sore_throat and cough:
        return 'Diagnosis: Acute Pharyngitis (Sore Throat Infection)'

    # Default case if no specific diagnosis is found
    return 'Diagnosis: Unknown (Consult a doctor for more information)'

def no_respiratory_symptoms(fever, cough, shortness_of_breath):
    return not (fever or cough or shortness_of_breath)
```

Output


HEALTH QUESTIONAIRE
Do you have a sore throat?
Yes
No


Medical Expert System
Your Diagnosis
Diagnosis: Influenza (Flu)
Go Back

Conclusion

The MedAI system serves as a valuable tool in the healthcare domain, providing users with preliminary health assessments based on their symptoms. By leveraging advanced algorithms and a comprehensive medical knowledge base, the system enhances accessibility to health information and empowers users to make informed decisions regarding their well-being. Throughout the development process, emphasis was placed on user experience, data security, and the integration of cutting-edge technologies. As a result, MedAI not only streamlines the diagnostic process but also holds the potential for future enhancements, such as incorporating machine learning for improved accuracy and expanding its integration with healthcare providers. Ultimately, the MedAI system aims to bridge the gap between users and healthcare resources, promoting proactive health management and timely interventions.