**Working Principle of the Expert System**

**Knowledge Acquisition:** The knowledge about diseases, their symptoms, and treatments is collected from experts and encoded into the system as a knowledge base.

**Knowledge Base:** The knowledge base stores information about various diseases, their symptoms, and treatments. It is implemented as a dictionary where each disease entry includes a list of symptoms and the corresponding treatment.

**Inference Engine**: This component processes the data provided by the user and consults the knowledge base to infer possible diseases. It uses two main methods:

**Forward Chaining:** This method starts with the user's symptoms and looks for diseases in the knowledge base that match all the provided symptoms. It iterates through the knowledge base to find possible matches.

**Backward Chaining:** This method starts with a potential disease and checks if the user's symptoms match those associated with the disease in the knowledge base. It verifies if the specified disease matches the symptoms.

**User Interface:** The web interface, built using Flask, allows users to interact with the expert system. Users can input symptoms, register, log in, and view the diagnosis results.

**CONNECTION AND COMMUNICATION BETWEEN COMPONENTS**

**User Interaction:**

**User Interface:** Users input their symptoms through a web form on the user interface. The interface collects and formats this input for processing.

**Inference Process:**

**User Interface**: The formatted input (symptoms) is sent to the inference engine for processing.

**Inference Engine**: The engine receives the symptoms and consults the knowledge base to identify possible diseases using forward chaining. If multiple diseases are possible, the system prompts additional symptoms. For backward chaining, the system verifies if a specified disease matches the provided symptoms.

**KNOWLEDGE BASE CONSULTATION:**

**Inference Engine:** Queries the knowledge base to retrieve the rules and facts necessary for reasoning. The knowledge base is a structured collection of disease-related data.

**Providing Solutions:**

**Inference Engine:** Once the inference engine identifies a possible disease, it retrieves the corresponding treatment from the knowledge base. The result (diagnosis and treatment) is then sent back to the user interface.

**USER OUTPUT:**

**User Interface:** The system displays the diagnosis results and treatment recommendations to the user in a clear and understandable format. If additional symptoms are needed, the interface prompts the user for more information and repeats the process as necessary.

**COMMUNICATION FLOW**

**User Inputs Symptoms (Forward Chaining):**

* The user inputs symptoms via a web form on the user interface.
* The user interface sends the symptoms data to the inference engine for processing.
* The inference engine uses forward chaining to query the knowledge base for diseases that match the provided symptoms.
* The inference engine identifies possible diseases. If multiple diseases match, it requests additional symptoms from the user.
* Once a single disease is identified, the inference engine retrieves the treatment and sends the results back to the user interface.
* The user interface displays the diagnosis and treatment to the user.

**User Inputs Disease (Backward Chaining):**

* The user inputs a suspected disease via a web form on the user interface.
* The user interface sends the disease data to the inference engine for processing.
* The inference engine uses backward chaining to query the knowledge base to verify if the user's symptoms match those associated with the disease.
* The inference engine retrieves the symptoms and treatment associated with the specified disease.
* The inference engine sends the results back to the user interface.
* The user interface displays the symptoms and treatment for the specified disease to the user.

Diagram Representation

User <----> User Interface <----> Inference Engine <----> Knowledge Base

In this representation:

* The User Interface facilitates interaction between the user and the system.
* The Inference Engine processes user inputs (symptoms) and interacts with the knowledge base to infer possible diseases.
* The Knowledge Base stores the necessary disease, symptom, and treatment information.

Additional Details on Inference Methods

* Forward Chaining: This inference method starts with the symptoms provided by the user. It checks the knowledge base to find diseases that have all the specified symptoms. This method is useful when the user knows the symptoms but not the disease.
* Backward Chaining: This inference method starts with a potential disease. It checks the knowledge base to verify if the user's symptoms match those associated with the disease. This method is useful when the user or system suspects a specific disease and wants to confirm it by checking the symptoms.