**Project Topic: Brain Disease Prediction**

**Objectives:**

By the end of this project, you will be able to:

* **Identify ambiguities, inconsistencies, and incompleteness** in the problem statements related to brain disease prediction.
* **Identify and state functional requirements** for developing a brain disease prediction system.
* **Identify and state non-functional requirements** for the brain disease prediction system.

**Understanding Requirements for Brain Disease Prediction**

**Definition of Requirements:**

* **Requirement**: A specification of what the brain disease prediction system should do. It focuses on how the system should behave to predict brain diseases based on input data, such as medical history, symptoms, and test results.
* **Requirements engineering** is the process of understanding the needs and expectations of the end users (e.g., doctors, patients) and documenting them clearly and understandably.
* It is critical that these requirements are well-defined before proceeding with the system’s design and implementation to avoid confusion and ensure customer satisfaction.

**Characteristics of Good Requirements**

1. **Unambiguity**:
   * Requirements should be clear and precise. For example, if the system predicts brain diseases based on MRI scans, the term "MRI scan data" should be clearly defined in terms of format, resolution, and data sources.
   * Ambiguous terms like "high accuracy" should be specified (e.g., 90% accuracy for disease prediction).
2. **Consistency**:
   * There should be no conflicting requirements. For example, one requirement might state that the system should predict brain diseases using MRI scans, while another suggests using CT scans only. These needs to be consistent with each other.
3. **Completeness**:
   * The requirements must cover all necessary functionalities. For instance, the system should not only predict brain diseases but also provide meaningful insights, suggestions for next steps, and the possibility of updating patient data.

**Categorization of Requirements**

For the brain disease prediction system, requirements can be classified as follows:

1. **User Requirements**:
   * These are the requirements expressed in natural language that can be easily understood by the users (e.g., doctors, patients). An example user requirement might be: "The system should be able to predict the likelihood of Alzheimer’s disease from the patient’s MRI scan data."
2. **System Requirements**:
   * These are more technical specifications aimed at developers and testers. An example system requirement could be: "The system should support the processing of MRI data in DICOM format."

Based on the description, requirements can be divided into two groups:

1. **Functional Requirements (FRs)**:
   * **Functional requirements** define the specific functionalities of the brain disease prediction system. These requirements specify what the system should do in response to particular inputs.

**Examples**:

* + **Disease Prediction**: The system should predict brain diseases (e.g., Alzheimer’s, Parkinson’s, tumors) based on medical data such as MRI scans, symptoms, and genetic information.
  + **Data Processing**: The system should process and analyze MRI scan data to detect anomalies indicative of brain diseases.
  + **User Interface**: The system should allow doctors to input medical data, view predictions, and generate reports.
  + **Alerts and Notifications**: The system should send notifications if the likelihood of a severe disease (e.g., brain tumor) exceeds a certain threshold.

1. **Non-Functional Requirements (NFRs)**:
   * **Non-functional requirements** describe how the system should behave in certain situations or constraints. These requirements are crucial to ensure the system is reliable, secure, and efficient.

**Examples**:

* + **Performance Requirements**:
    - The system should provide predictions within 30 seconds of receiving data input.
    - The system should be able to process at least 100 MRI scans per hour.
  + **Reliability**:
    - The system should be available 99.9% of the time to avoid downtime, especially in clinical settings.
  + **Usability**:
    - The system’s user interface should be simple and intuitive, requiring minimal training for doctors to use effectively.
  + **Security**:
    - The system must ensure that patient data is encrypted and secure to maintain privacy and comply with healthcare regulations (e.g., HIPAA).
  + **Scalability**:
    - The system should be scalable to handle increasing volumes of patient data as the hospital or clinic expands.

**Identifying Functional Requirements for Brain Disease Prediction**

To identify **Functional Requirements** for a brain disease prediction system, follow these steps:

1. **High-Level Functional Requirements**:
   * Identify the main functionality the system should provide. For instance, the system should predict brain diseases such as Alzheimer's, Parkinson's, and brain tumors based on MRI scans and patient data.
2. **Key Use Cases**:
   * For a brain disease prediction system, consider the following use cases:
     + **Predict Disease**: A doctor uploads MRI scan data, and the system predicts the likelihood of specific brain diseases.
     + **View Predictions**: A doctor reviews the predictions and is presented with probabilities and possible next steps.
     + **Generate Reports**: The system generates a report summarizing the patient's history, prediction results, and recommended actions.
     + **Update Patient Data**: Doctors can input new patient symptoms or medical records, and the system updates predictions accordingly.
3. **Inputs and Outputs**:
   * **Inputs**: Medical data such as MRI scan images, patient symptoms, medical history, genetic information, etc.
   * **Outputs**: Disease prediction results, probability of disease, suggestions for further diagnosis, and treatment options.
4. **Sub-requirements**:
   * The prediction of brain diseases might depend on the quality of input data. The system should be capable of handling cases where data is incomplete or noisy (e.g., partial scans, low-resolution images).

**Preparing the Software Requirements Specification (SRS)**

Once all functional and non-functional requirements have been identified, the next step is to prepare a **Software Requirements Specification (SRS)** document. This document outlines all the requirements in detail and serves as a reference for the design, development, and testing phases.

* **Verification and Validation**: The SRS must be reviewed with the client (e.g., medical professionals, patients) to ensure that all requirements are accurate and meet expectations.
* **Legal and Contractual Use**: The SRS serves as a formal agreement between the client and the development team. If features are missing or not implemented as expected, the SRS can be referenced to resolve issues.

**Conclusion**

Developing a brain disease prediction system requires clear, unambiguous, and complete requirements to ensure that it meets the needs of its users (medical professionals, patients). Functional requirements focus on the system’s ability to accurately predict brain diseases based on input data, while non-functional requirements ensure the system performs well in terms of security, usability, and scalability. A well-documented **Software Requirements Specification (SRS)** serves as the foundation for successful system development and helps mitigate the risk of misunderstandings or unmet expectations during the development process.