



**SNS COLLEGE OF ENGINEERING**

**(Autonomous)**

**DEPARTMENT OF CSE-IoT ENGINEERING**



# Artificial Intelligence & Natural Language Processing

## FSM Application, Merits & Demerits

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# Fuzzy Logic System - Example

- A fuzzy logic-based washing machine adjusts the wash cycle time, water level, and detergent amount based on the dirt level, fabric type, and load size.

## Step-by-Step Fuzzy Logic Process in a Washing Machine

### 1. Fuzzification (Converting Inputs into Fuzzy Values)

Inputs:

**Dirt Level** → Low, Medium, High

**Fabric Type** → Delicate, Normal, Heavy

**Load Size** → Small, Medium, Large

Example:

If the **dirt level** is **high**, the machine categorizes it as **75% high** and **25% medium**.



# Contd...

## 2. Knowledge Base (Rules for Decision Making)

Rules in the **IF-THEN** format:

**IF Dirt Level is High AND Fabric is Heavy, THEN Wash Time is Long.**

**IF Load Size is Large AND Dirt Level is Medium, THEN Water Level is High.**

**IF Fabric is Delicate, THEN Spin Speed is Low.**

## 3. Inference Engine (Applying Fuzzy Rules)

Based on the **fuzzy rules**, the system determines the best **wash cycle settings**.

Uses fuzzy operations like **AND, OR, NOT** to select the correct washing parameters.



# Fuzzy Logic System (FLS)

## 4. Defuzzification (Converting Fuzzy Values into Crisp Outputs)

Final outputs:

**Wash Time:** 45 minutes

**Water Level:** 80%

**Spin Speed:** 600 RPM

### Why Use Fuzzy Logic?

- ✓ Handles **imprecise and uncertain inputs** (e.g., slightly dirty vs. very dirty).
- ✓ **Mimics human decision-making** (adjusting wash settings like a human would).
- ✓ **Improves efficiency and energy savings** by optimizing cycle settings.



# Merits of Fuzzy Logic Systems

## Merits (Advantages) of Fuzzy Logic Systems

- ✓ **Handles Uncertainty and Approximation** – Unlike traditional logic (which works with binary values), fuzzy logic can handle imprecise and vague information.
- ✓ **Mimics Human Reasoning** – Works similarly to human decision-making by processing linguistic variables (e.g., "slightly cold," "very hot").
- ✓ **Flexible and Adaptable** – Can be easily modified and adjusted without requiring an exact mathematical model.
- ✓ **Works with Incomplete Data** – Can provide meaningful outputs even when inputs are incomplete or noisy.
- ✓ **Simple and Cost-Effective Implementation** – Fuzzy logic systems require fewer computations than complex mathematical models.
- ✓ **Used in a Wide Range of Applications** – Found in washing machines, air conditioners, medical diagnosis, robotics, and automation.



# Demerits of Fuzzy Logic Systems

- ✗ **Lack of Learning Capability** – Unlike AI models such as neural networks, fuzzy logic does not learn or improve from data over time.
- ✗ **Requires Expert Knowledge** – Designing fuzzy rules and membership functions often depends on domain expertise.
- ✗ **Difficult to Tune and Optimize** – Setting up the right fuzzy rules and membership functions can be challenging.
- ✗ **Higher Processing Time for Complex Systems** – If a system has too many rules and fuzzy sets, processing speed may decrease.
- ✗ **Less Accurate Compared to Precise Mathematical Models** – In situations where exact values are needed, fuzzy logic may not be the best choice.



Thank you