Don Bosco Institute of Technology, Mumbai

Department of Computer Engineering

BE Computer 2021 - 22

Experiment No.: 6

Course: **Artificial Intelligence & Soft Computing Lab**

Course Code: **CSL703**

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Aim: Design a Fuzzy controller for implementing a washing machine
Learning Objective: Students will be able to design a fuzzy controller.

Learning Outcome: Student are able to successfully design fuzzy controller for washing machine.

Course Outcome

CSL703.4 To realize the basic techniques to build intelligent systems

Program Outcome

(PO 3) Design/ development of solutions: Breadth and uniqueness of engineering problems i.e., the extent to which problems are original and to which solutions have previously been identified or codified?

(PO 12) Life Long Learning

Bloom's Taxonomy Level

- Remembering
- Understanding

Theory:

Fuzzy logic control (FLC) is the most active research area in the application of fuzzy set theory, fuzzy reasoning, and fuzzy logic. The application of FLC extends from industrial process control to biomedical instrumentation and securities. Compared to conventional control techniques, FLC has been best

utilized in complex ill-defined problems, which can be controlled by an efficient human operator without knowledge of their underlying dynamics.
A control system is an arrangement of physical components designed to alter another physical system so that this system exhibits certain desired characteristics. There exist two types of control systems: open-loop and closed-loop control systems. In open-loop control systems, the input control action is independent of the physical system output. On the other hand, in a closed-loop control system, the input control action depends on the physical system output. Closed-Hoop control systems are also known as feedback control systems. The first step toward controlling any physical variable is to measure it. A sensor measures the controlled signal, A plant is a physical system under control. In a closed-loop control system, forcing signals of the system inputs are determined by the output responses of the system. The basic control problem is given as follows:
The output of the physical system under control is adjusted by the help of an error signal. The difference between the actual response (calculated) of the płant and the desired response gives the error signal. For obtaining satisfactory responses and characteristics for the closed-loop control system, an additional system, called as compensator or controller, can be added to the loop. The basic block diagram of the closed-loop control system is shown in Figure 1. The fuzzy control rules are basically IE-THEN rules.

Designing a controller for a complex physical system involves the following steps:

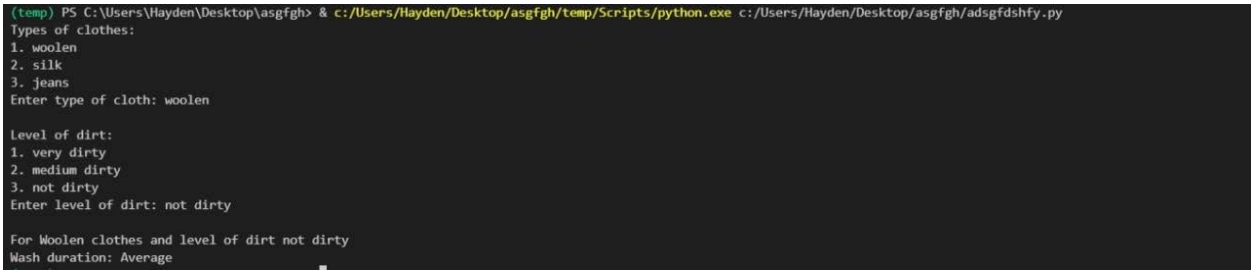
1. Decomposing the large-scale system into a collection of various subsystems.
2. Varying the plant dynamics slowly and linearizing the nonlinear plane dynamics about a set of operating points.
3. Organizing a set of state variables, control variables, or output features for the system under consideration.
4. 4. Designing simple *P, PD, PID* controllers for the subsystems. Optimal controllers can also be designed.

Code

```
print("Types of clothes:")
print("1. woolen")
print("2. silk")
print("3. jeans")
n = input("Enter type of cloth: ")

print("\nLevel of dirt:")
print("1. very dirty")
print("2. medium dirty")
print("3. not dirty")
m = input("Enter level of dirt: ")

def result(n,m):
   if(n=='woolen' and m=='very dirty'): #1
      print("\nFor Woolen clothes and level of dirt very dirty ")
      print("Wash duration: Long")
   elif(n=='woolen' and m=='medium dirty'): #2
      print("\nFor Woolen clothes and level of dirt medium dirty ")
      print("Wash duration: Medium")
   elif(n=='woolen' and m=='not dirty'): #3
      print("\nFor Woolen clothes and level of dirt not dirty ")
```

```
        print("Wash duration: Average")
    elif(n=='silk' and m=='very dirty'): #4
        print("\nFor Silk clothes and level of dirt very dirty ")
        print("Wash duration: Long")
    elif(n=='silk' and m=='medium dirty'): #5
        print("\nFor Silk clothes and level of dirt medium dirty ")
        print("Wash duration: Medium")
    elif(n=='silk' and m=='not dirty'): #6
        print("\nFor Silk clothes and level of dirt not dirty ")
        print("Wash duration: Average")
    elif(n=='jeans' and m=='very dirty'): #7
        print("\nFor Jeans clothes and level of dirt very dirty ")
        print("Wash duration: Long")
    elif(n=='jeans' and m=='medium dirty'): #8
        print("\nFor Jeans clothes and level of dirt medium dirty ")
        print("Wash duration: Medium")
    elif(n=='jeans' and m=='not dirty'): #9
        print("\nFor Jeans clothes and level of dirt not dirty ")
        print("Wash duration: Average")

result(n,m)
```

Output



Conclusion: The fuzzy controller is successfully implemented for the given applications.