International Journal of Engineering Science Invention
ISSN (Online): 2319 – 6734, ISSN (Print): 2319 – 6726
www.ijesi.org Volume 3 Issue 1 ǁ January. 2014 ǁ PP.48-51

Neuro-Fuzzy Controller Based Washing Machine

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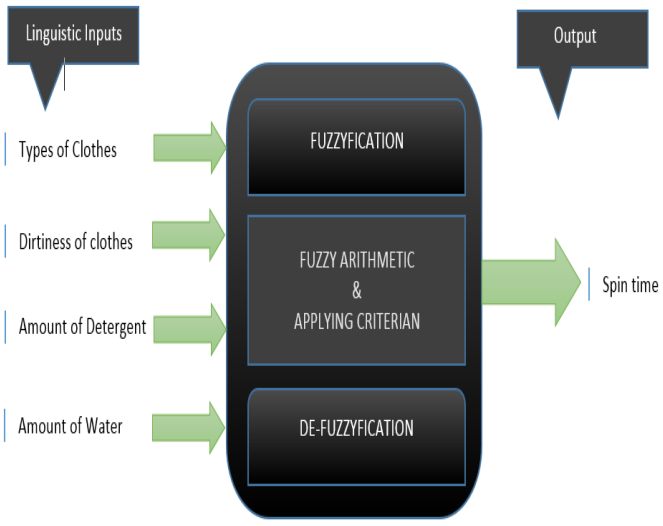
***ABSTRACT*:** *The general washing machine is an example of the advance washer control with a great technology. This advancement helped the household scenario very well. But we need to make it more advance from the previous one. Here, the system will consist of the neuro- fuzzy and fuzzy techniques that will help the system to take its own decisions like release of water and washing powder as per need of cloth. Also the fabric detection technique will implement with the help of these techniques.*

KEYWORDS: *Fuzzy –controller, Neuro-fuzzy logic, Washing machine, Fuzzy techniques*.

I. INTRODUCTION

At present, the washing machine has becomes an essential electrical appliance in our life. In this project we will introduce an intelligent algorithm to the system. In this, we will build a neural network fuzzy control model on the basis of the washing machine's own characteristics and some external factors.

Many washing machines have internal electrical heating elements to heat the wash water, to near boiling if desired. Chemical cleaning action of the detergent and other laundry chemicals increases greatly with temperature. Washing machine with internal heaters can use special detergents formulated to release different chemical ingredients at different temperatures, allowing different type of stains and soils to be cleaned from the clothes as the wash water is heated up by the electrical heater. Higher-temperature washing uses more energy, and many fabrics are damaged at higher temperatures. Temperatures exceeding 40 °C have the undesirable effect of inactivating the enzymes when using biological detergent. Higher spin speeds remove more water, leading to faster drying. If a heated clothes-drier is used after the wash and spin, energy use is reduced if more water has been removed from clothes. However, faster spinning can crease clothes more. Also, mechanical wear on bearings increases rapidly with rotational speed, reducing life. Early machines would spin at only 300 RPM and, because of lack of any mechanical suspension, would often shake and vibrate.



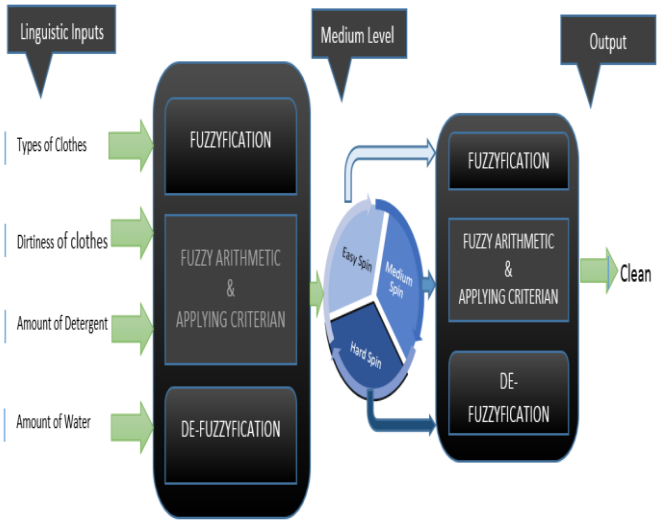
ny system that built is needed to consume less energy and power. Also the most advance system at very low cost is the first requirement of the industries as well as science. The present system need to interface some extra advance techniques with it in order to provide the fully automated advance system. Flexible objects such as clothes and small plants are hard to be handled by robots because the shapes of flexible objects are hard to predict. But such works as to handle clothes are highly desired to be automated.Therefore, we need to develop a household product with low energy consumption, low cost and efficient.

II. SYSTEM OVERVIEW

A. ARCHITECTURE

The washing process uses energy, which can be subdivided into heating, mechanical action and pumping. The amount of energy used for heating is influenced by the amount of water, the wash load, the temperature of the cold water inlet and the temperature to be reached. The energy used for mechanical action depends on the total wash time. The energy use for pumping is in general fixed in the wash programme.During the washing process the energy used to heat the water also flows to other parts of the machine, for example the steel drum, the glass door and the wash load, and part is lost to the environment.

Figure 2.1: Block diagram of Proposed Architecture



The amount of energy that is lost to the environment depends on a number of variables, among which the insulation of the machine, the duration of the cycle, the ambient temperature and the temperature of the heated water. Future energy savings are expected through efficient motor technology, lower washing temperature, increased load capacity, rinsing phase optimization and sophisticated electronic controls.

III. KEY PARAMETERS

Load Auto Sensor: This sensor will use to determine the size of a load of dirty clothes, and then add the appropriate amount of water to the washing machine.

Automatic Temperature Control: It adjust the water to the correct temperature for the cycle you are using.

Automatic Dispensers: Automatic dispensers for bleach, detergent at the appropriate time in the cycle.

Fuzzy Control: It will contain load sensors, which indicates the water and detergent amount that is required.

Neuro-fuzzy Control: It features sensors that automatically detects the fabric type and determine the detergent and water needed.

IV. IMPLEMENTATION

Here, a group of optical sensors is used in order to sense the load as well the other factors of the washing machine like dirt, fabric type, temperature of water and many more. According to these sensors output the automatic dispenser of washing powder and water will release. An optical sensor is a device that converts light rays into electronic signals. It measures the physical quantity of light and translates it into a form read by the instrument. The features of an optical sensor are its ability to measure the changes from one or more light beams.A washing machine includes an optical sensor for detecting a light permeability of detergent solution and rinse water in a washer tank. The optical sensor includes a light emitting element and a light receiving element.

A microprocessor (Fuzzy Controller) is provided for controlling a luminous intensity of the light emitted from the light emitting element.

V. WORKING OF SENSOR

The working of the sensors is not a matter of concern. We assume that we have these inputs at our hand.

1. The degree of dirt is determined by the transparency of the wash water. The dirtier the clothes, less transparent the water being analyzed by the sensors is.
2. Type of dirt determines the quality of dirt. Greasy cloths, for example, take longer for water transparency to reach transparency because grease is less soluble in water than other forms of dirt. Type of dirt is determined by the time of saturation.

Saturation is a point, at which there is no more appreciable change in the color of the water. Unfortunately, there is no easy way to formulate a precise mathematical relationship between volume of clothes and dirt and the length of wash time required. Because the input/output relationship is not clear, the design of a washing machine controller has not in the past lent itself to traditional methods of control design. We address this design problem using fuzzy logic. Fuzzy logic has been used because a fuzzy logic controlled washing machine controller gives the correct wash time even though a precise model of the input/output relationship is not available.

VI. NEURAL AND FUZZY

Regularization modifies the network's performance function (the measure of error that the training process minimizes). By including the sizes of the weights and biases, regularization produces a network that performs well with the training data and exhibits smoother behavior when presented with new data.
Early stopping uses two different data sets: the training set, to update the weights and biases, and the validation set, to stop training when the network begins to over fit the data.

The strength of neuro-fuzzy systems involves two contradictory requirements in fuzzy modeling: interpretability versus accuracy. In practice, one of the two properties prevails. The neuro-fuzzy in fuzzy modeling research field is divided into two areas: linguistic fuzzy modeling that is focused on interpretability and precise fuzzy modeling.

VII. SOFTWARE

Matlab

MATLABis a high-level language and interactive environment for numerical computation, visualization, and programming. Using MATLAB, you can analyze data, develop algorithms, and create models and applications. The language, tools, and built-in math functions enable you to explore multiple approaches and reach a solution faster than with spreadsheets or traditional programming languages.
Type of Dirtiness VS Degree of Dirtiness

	notGreasy	medium1	greasy
small	Vshort	midium	long
medium	short	midium	long
large	midium	long	Vlong

Rules in Matlab

```
rulelist=[ ...
    1 1 1 1 1
    2 2 3 1 1
    3 3 5 1 1
    1 2 3 1 1
    1 3 3 1 1
    2 1 2 1 1
    2 3 4 1 1
    3 1 2 1 1
    3 2 4 1 1 ];

a=addrule(a,rulelist);

z = evalfis([p q], a);
```

VIII. CONCLUSION

The advance washing machines have the load sensors in it in order to automate the system. This system gives advancement to the technology so as to the science. A more fully automatic washing machine is straightforward to design using fuzzy logic technology. Increasing the controller work that controls only the wash time of a washing machine, to design process can be extended to other control variables such as water level and spin speed. The formulation and implementation of membership functions and rules is similar to that shown for wash time.

Full "Fuzzy Logic" automatic control system includes the temperature control, washing time, and washing speed. The general use of fuzzy in the system will implement in the machine that will control the load as well as the water and washing powder dispensers. Many other product maker and industries used the fuzzy techniques in their own way. There are various applications developed using this technology but the combination of neural and fuzzy is new in this area. This combination will give rise to a new contribution to the science and technology. This combination of fuzzy and neural network will used to detect the fabric type that will the most advance system and the contribution towards the system.

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