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Design of a Fuzzy Controller for the calculation of atmospheric comfort in a greenhouse

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***Abstract*—This article describes the design of a fuzzy controller to monitor atmospheric comfort in a greenhouse. Well-being inside a greenhouse is reflected in two significant parameters: temperature, which ranges between 20°C and 25°C, and relative humidity, which should be around 50%. For the monitoring and control of the parameters similar above, the optimal formation of the microclimate in a greenhouse is necessary. Relative humidity and temperature calculation was performed, which helps to predict comfort by implementing a soft sensor using fuzzy logic. The objective of this research is to demonstrate the effectiveness for the automation and monitoring of artificial intelligence processes, in this case «fuzzy logic», which is based on the user experience. In addition, in this article basic electronics, programming and intermediate level knowledge in fuzzy logic were applied to obtain effective parameters for the implementation of a greenhouse control system.**

***Keywords*—comfort, artificial intelligence, fuzzy control, greenhouse**

I. Introduction

The idea of conformity has evolved in such a way that at different times it has acquired different meanings. According to the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), compliance "is the state of mind that expresses satisfaction with the environment." Some factors to consider are temperature, humidity, lighting, noise, fumes, odors, the presence of smoke, and the degree of air pollution [1]. Comfort is the climatic well-being that provides certain favorable conditions and circumstances for the greenhouse, creating a suitable microclimate for it. In the control and monitoring of industrial systems that measure variables such as temperature and humidity, the classic control is mainly used, either ON / OFF or PID control, but there are more sophisticated algorithms such as Fuzzy Logic control (or fuzzy control) that uses artificial intelligence algorithms and methods [2]. That is why the following problem arises: What will be the design of a fuzzy controller for the calculation of atmospheric comfort inside a greenhouse?

In previous studies [3], implementation of the greenhouse climate control simulator based on a dynamic model and a vapor pressure deficit controller is described. The implementation of the greenhouse climate control simulator based on a dynamic model with an intuitive user interface that provides various options for simulating the greenhouse climate under open and closed loop control conditions is discussed.

In a similar case [4], a variable conditioning system was designed for the cultivation of red tomato under a greenhouse using fuzzy logic, for which a review of the issues related to climatic conditions and their influence on tomato production was carried out. red and that served as a theoretical basis. Indicators were obtained that, when analyzed and contrasted, resulted in better quality and a higher production index in the harvest of the automated part compared to the traditional one.

Finally, [5] made a greenhouse temperature control system based on fuzzy theory. A mathematical model was built for the air temperature in the greenhouse. The fuzzy control system was implemented using Simulink and then performed in Visual Basic. At last, the fuzzy controller was made using Visual Basic. The results show the validity and reasonableness of the fuzzy control strategy for the greenhouse temperature control.

This project consists of measuring the relative humidity and temperature and then calculating the comfort and controlling the actuators; in our case, the variation of degrees of the servomotor for the opening and closing of the greenhouse ventilation hatch [6].

II. Materials and Methods

At present, the integration of technologies in crop processes increases the quality and production of plants, as well as the efficiency of the resources available for their production. This being of great importance due to the current competition that exists in the national and international market, as well as the demand for quality by customers.