Maestría en Ingeniería en Automatización de Procesos Industriales

Instrumentation and semiautomatic control of a type greenhouse

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1. Introduction

Currently, the advance of technology has reached agriculture, developing the automation of greenhouses. The Mexican Standard for greenhouses (NMX-E-255-CNCP-2008) establishes the relevant aspects to be considered in the structures. These must be economical, lightweight, resistant and slender, easy to maintain and maintain, modifiable and adaptable; [1], [2].

The Mexican Association of Protected Horticulture (AMHPAC) indicates that annual growth is around 1200 hectares in the greenhouse [3].

This project presents the contributions to the use of greenhouses:
1.- Controlled irrigation system.
2.- Humidity and ambient temperature control system.
3.- Nutrient injection control.

These three tasks are intended to achieve savings in energy consumption, water savings and a controlled environment for crop growth.

2. Objectives

2.1. General objective

Implement the instrumentation and semiautomatic control of a type chapel greenhouse.

2.2. Specific objectives

- Redesign a greenhouse of type chapel considering the specifications of the Mexican standard NMX-E-255-CNCP-2008.
- Develop a temperature control and irrigation system for the greenhouse.
- Develop a nutrient injection system according to the crop.

3. Methods

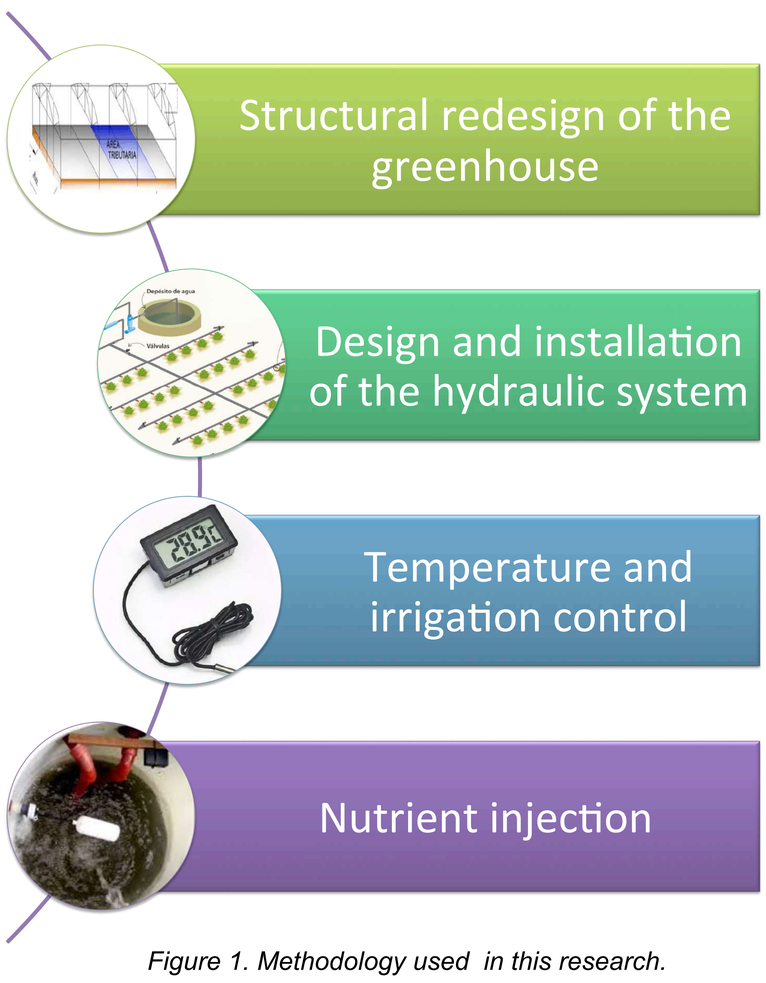

Figure 1. Methodology used in this research.

Greenhouse redesign

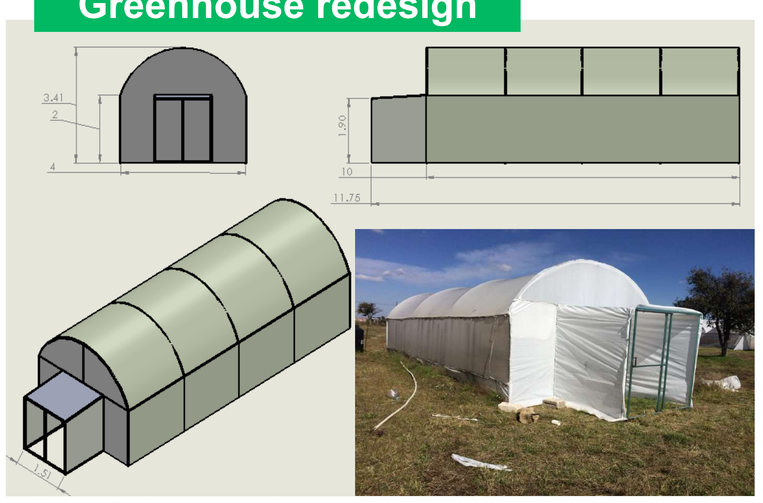

Figure 2 Redesign of the greenhouse structure, designed in Solidworks, Mexican standard NMX-E-255-CNCP-2008.

Installation of the hydraulic system

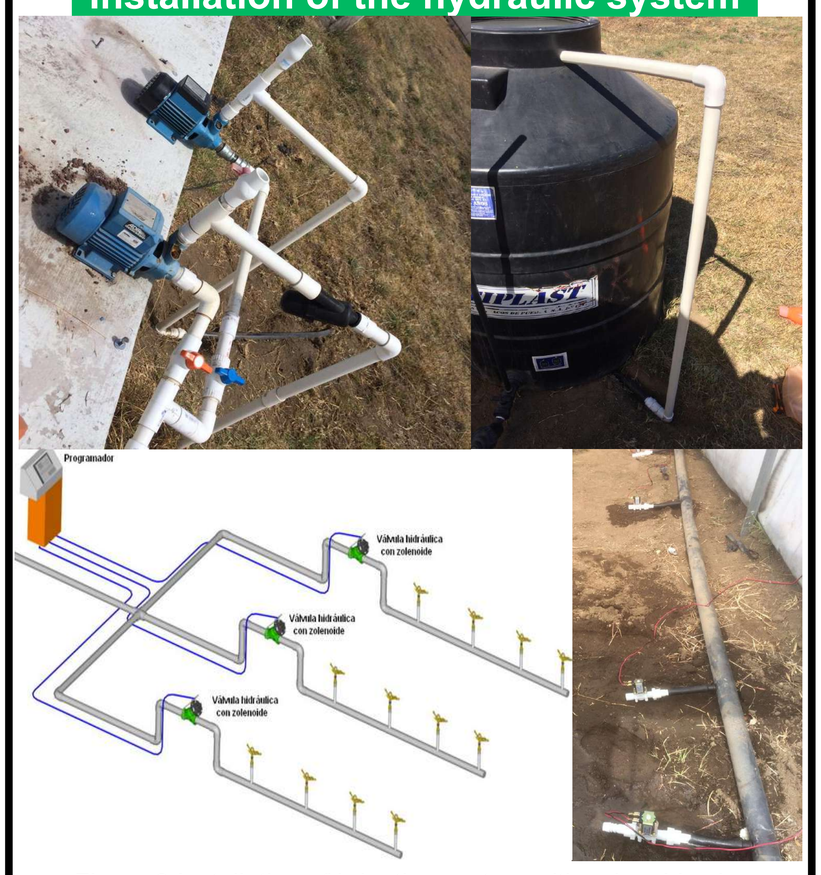

Figure 3 Installation of irrigation system with solenoid valves and water supply from a cistern.

Control system

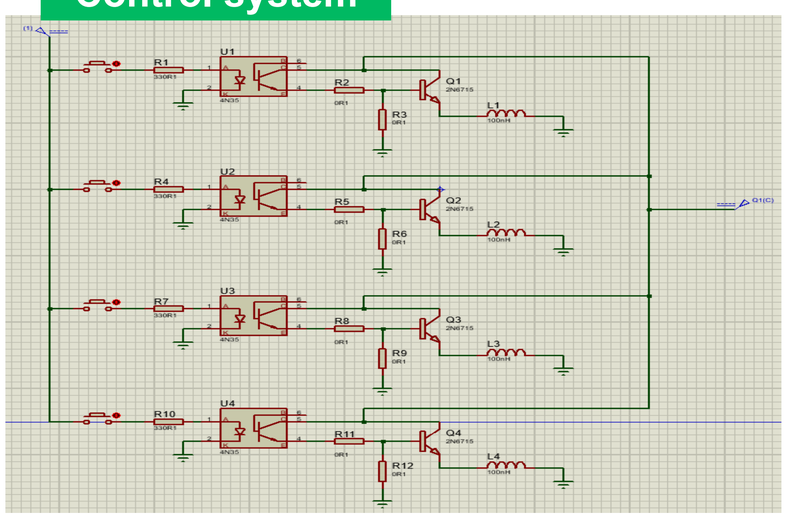

Figure 4 circuit for solenoid valves simulation

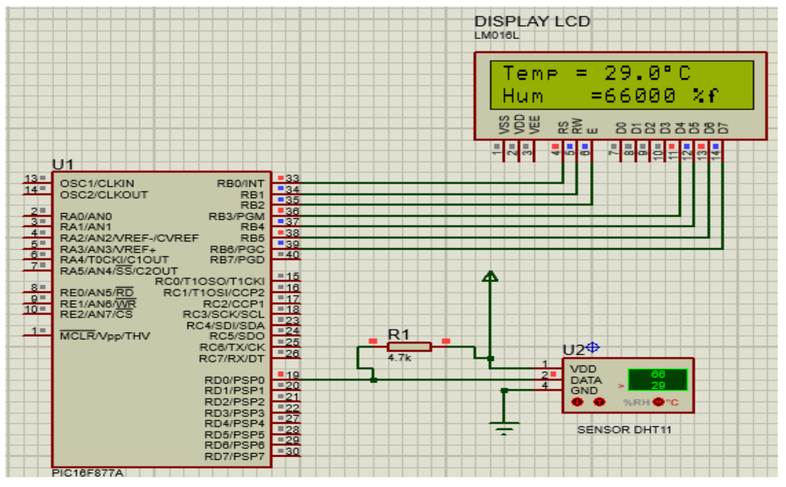

Figure 5 Temperature control simulation.

4. Results

4.1 structural redesign greenhouse.

Figure 6 Profile of greenhouse structure, redesign in Solidworks.

4.2 Irrigation system installed with control inside the greenhouse

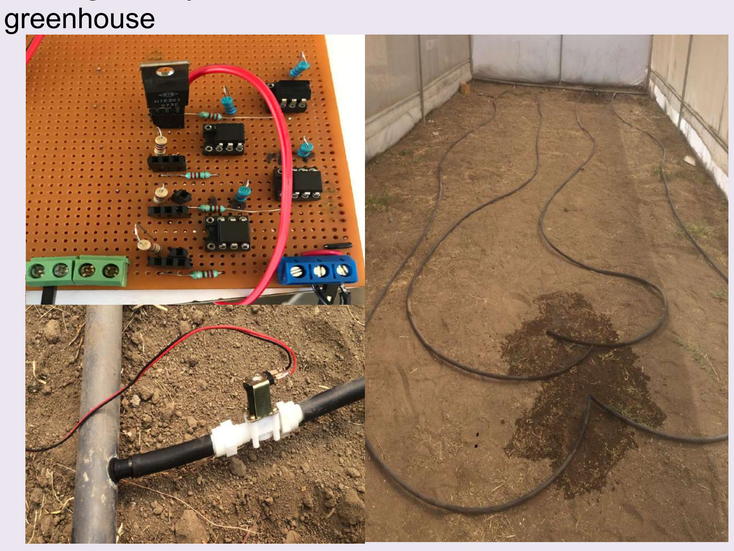

Figure 7 Irrigation system inside the chapel type greenhouse with On/ off control of the solenoid valves..

Table 1 Consumption of energy of solenoids valves.

consumption specification for electro valves	
Operating voltage	12V DC
Operating current	0.6 A
Power consumption	8 W
Minimum working pressure	0.02 MPa (0.2 Bar = 2.04 mca)
Maximum working pressure	0.8 MPa (8 Bar = 81.6 mca)

5. Conclusion

The redesign of the type chapel greenhouse was carried out considering the Mexican standards. The irrigation and temperature control systems were developed and implemented in the greenhouse. In addition, the hydraulic distribution network was installed, it was made with appropriate material according to the type of irrigation.

Acknowledgements

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References

[1] J. Soto, O. Lugo Espinosa, A. Quevedo Nolasco, J. R. Bauer Mengelberg, D. H. d. Valle Paniagua, E. Palacios Vélez, (2011).

[2] P. Castro, M. Águila, N. Quevedo, S. Kleisinger, C. Tijerina, S. Mejía *et al.*, Agricultura Técnica en México **34**, 459 (2008).

[3] D. O. de la Federación. (08/07/2008)., "Declaratoria de vigencia de la norma mexicana nmx-e-255-cncp-2008."

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