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Automation of a rabbit feed dispenser

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----------ABSTRACT----------
This work uses a Programmable Logic Controller (PLC) to automate a feed dispenser for rabbits. This is intended to avoid the problem presented in the Ranches about the current rabbit feeding process in Mexico, since this activity is now done manually.
The programming of the opening and closing sequence of the food dispenser that the PLC must carry out and a graphic interface are developed so that a user activates the dispenser in a desired sequence.
KEYWORDS; *Automation, Food dispenser, Graphical interface,Programmable Logic Controller PLC, Sequence.*

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I. INTRODUCTION

The Grange in Mexico today, present the problem of food waste and loss of time when the animal feeding process is carried out, because the process is carried out completely manually.The worker in most of his workday, is dedicated to fulfilling the task of food, which results in the investment of time in this activity and in turn neglect other tasks that must be performed.This represents a loss of money for the Grange, because it must hire more workers to carry out the activities that are still to be carried out within it, such as, cleaning of pens and other types of activities called administrative, in which, are, the acquisition of food for animals and the marketing of them.

Being a problem feeding animals arises the need to improve this activity, promoting a solution to the problem with a dosing system that operates automatically.For this reason, it is proposed to automate a food dosage dispenser; this will be achieved with the help of a Programmable Logic Controller and a graphical interface, which will allow the system to operate.

This automation proposal is intended to reduce the amount of wasted food, carrying out the rabbit feeding process in a shorter time, reducing the man hours allocated to this task and avoiding having to hire more staff.

II. PROBLEM STATEMENT

Within the facilities of a Ranch there are rabbit cages that are separated into different sections: lactating females, females, stallions and fattening rabbits. For each type of rabbit there is a different feeding dose which is shown in Table 1, this based on the experience of ranch workers.

Rabbit	Foodportionforday
Female	250 gr
Lactating Females	1 kg
Fattening	1 kg
Stallion	250 gr

Table 1. Feeding dose

One of the main problems when carrying out the feeding process is the time used to carry out this task, since, being a large number of cages, the person in charge of this activity must pass to each of they being careful and being aware of the type of rabbit to which they are providing the food, as mentioned above, is not the same dose in each case. This being a great inconvenience when it comes to dosing and, consequently, a large amount of time spent, in addition to that it can be a tedious task if the owner of the Ranch will want to increase his production of rabbits.

Rabbit cages are divided into 3: fattening, maternity and stallions. In the case of fattening rabbit cages they are characterized by containing a maximum of 6 rabbits inside them, therefore, the feeder must always have a good amount of food that can meet the needs of each of them, likewise passes for maternity cages, where there is only 1 rabbit with their young, the feeder should always be with enough food, which covers 1kg a day, so you

can be healthy and breastfeed correctly.On the other hand, the cages of the stallion rabbits, only have 1 rabbit each, and the feeder of this can only have 250 grams of food a day, this to keep it in its weight and do not reach obesity.

III. DESIGN AND PROPOSAL FOR SOLUTION

The development of an automated rabbit feed dispenser seeks to improve the supply task within the farm, saving time and effort in carrying out this task. As it is observed in the process of feeding in the Ranch, 2 different types of feed doses are worked for each rabbit that is why, it is intended to implement 2 types of programming to carry out each of these sequences.

The development of these programs is focused on the rabbits that handle the 1kg portion of food and the rabbits that handle the 250gr portion of food.

The solution proposal is based on the automation of a food dispenser, which consists of a coordinate system of type X, Y, by which the dispensing boat travels along an X axis and a Y axis. On each tour, the dispensing boat will stop at each cage station to carry out the dosage of food, either 1kg or 250 gr, depending on the type of rabbit being fed. Likewise, an HMI interface will be designed, in which the user who manipulates it will be able to choose each one of the programmed sequences in a simple and practical way.

The programming of the route sequence, as well as the opening and closing of the dispensing boat, will be carried out with a PLC programmable logic controller, because it presents adaptability to the conditions and requirements of the farm. The first advantage is that it has expansion of inputs and outputs, since if in the future it is intended to make the expansion in the number of rabbits. Another advantage of the device is that it has resistance to the environmental conditions of the place.

In order to design the proposed system, the requirements and specifications with which the dispenser may carry out its function must be taken into account. In this case, it is considered a dosing container with a capacity of 9kg (food needed to satisfy the course of a row, then return to the starting point and reload food to satisfy the next row), the dosing mechanism will be of the gate type and the movement structure will be based on aluminum profile.

In order to verify the operation of the automation proposal, a test prototype was carried out which has measurements at the scale of the proposed dispenser. The principle of operation is the same, that is to say it consists of an X axis, Y driven by Nema 23 stepper motors and a container responsible for dosing food at each cage.

Before carrying out the construction and assembly of the prototype, the design of the system in SolidWorks was carried out, this in order to have a greater certainty of the mechanical operation and in turn it was decided to 3D print some fastening and support parts the structure to use for the X, Y movement.

In Fig. 1, the finished prototype is shown with all the elements that compose it, as well as the placement of dishes that simulate the cage containers where the food should fall.

To perform the programming in the PLC it is necessary to communicate the equipment, the controller with the computer. The communication process is via Ethernet / IP and for this a UTP cable with RJ45 terminal was used, which consists of 8 pins and allows the interconnection of devices. In the case of communicating the computer with the PLC, direct communication was used since they are different equipment.

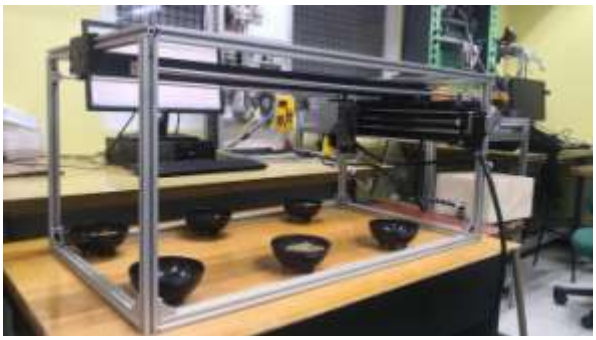

Fig. 1. Prototypefinished.

The BOOTH DHCP server was used, which is Rockwell's own software to establish the IP address of the PLC module, cards or added elements that handle Ethernet communication, the change of the IP can be done when the device has a dynamic IP [3].

RSLinx Classic software was also used, which is an essential communication tool when you want to communicate, configure or diagnose equipment or networks and even carry out the programming since through

this software you can access other Rockwell's own softwares such as RsLogix 500 which is the software where the programming was carried out.

To verify that the communication via Ethernet was successful, the RSWho was opened as shown in Fig. 2, which is an RSLinx tool in which the equipment that had been connected to the PC through Ethernet was visualized by means of the IP address, for the case used only the Allen Bradley MicroLogix 1400 PLC was connected.

The RSLogix 500 software is a ladder logic programming software and was used as it was created in order to improve the development of industrial automation projects, saving time in their development. The advantages that this software manages are the following: it can be applied and adapted to different processes, be it production, security, automation, allows the creation of subroutines, fragmenting the main program into sections and in case of failure to detect the error quickly and It has functions and program blocks for specific tasks.

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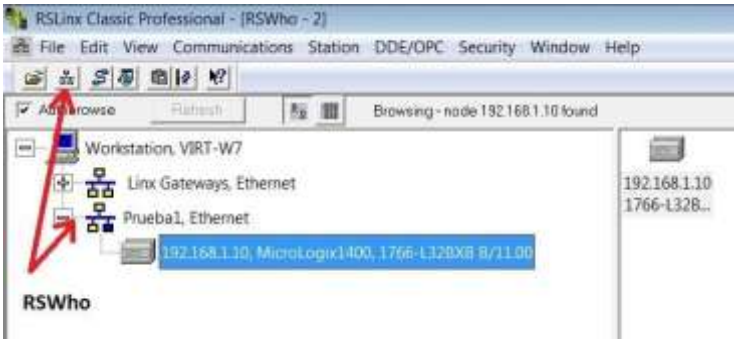

Fig. 2. Test of communication between teams

On the other hand, the realization of a human machine interface was also carried out so that the user can carry out the food dispersion actions in a remote and intuitive way. For this, it was necessary to use Rockwell Automation software, Factory Talk View Studio, which is a human machine interface generator with a friendly graphical environment and easy access to all its components.

To carry out the communication between the RSLogix 500 software and the Factory Talk View, the following steps were carried out: the RSLogix 500 program must be online, with the program running in the PLC and within FactoryTalk View, locate the RSLinx instruction Enterprise and within it the Communication Setup instruction [4].

Once the communication was made, the HMI interface was carried out, see Fig. 3.

Fig. 3. The HMI graphic interface.

This screen allows you to activate the cages that you want to dose, this is done by means of push buttons; each one of the cages has its respective activate button, and if it is activated, the dosing is carried out, since each HMI cage is addressed to the programming carried out in RSLogix.

If it was decided to activate the dosage in the cage, the screen of Fig. 4 is displayed to select the dose.

Fig. 4. Selection of the dose.

In Fig. 5, the screen in which the feeding time is entered is shown, for the hours the 24-hour format is allowed and for the minutes it is entered from 0 to 60, in the same way it was placed the graph of a clock, which shows the time in real time, by linking the time of the computer with the clock on the screen. The time entered is stored in the RSLogix program and is compared with the current time of the clock function, when these times are the same the sequence begins.

Fig. 5. Selección del tiempo de la alimentación.

IV. PROOF

The remote operation of the system with the HMI was simple, since the buttons are, are directed to the internal contacts of the program carried out in RSLogix 500, the application was simply executed and the power mode to be carried out was selected. In Fig. 6, a representation of the system driven by the graphic interface is shown.

And in Fig. 7 the dispensing canister is shown dropping food in the position assigned to it by the HMI.

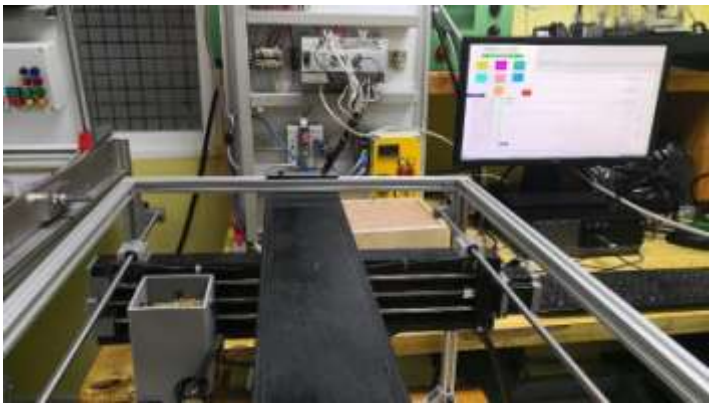

Fig. 6. Test of the operation of the prototype with the HMI graphic interface.

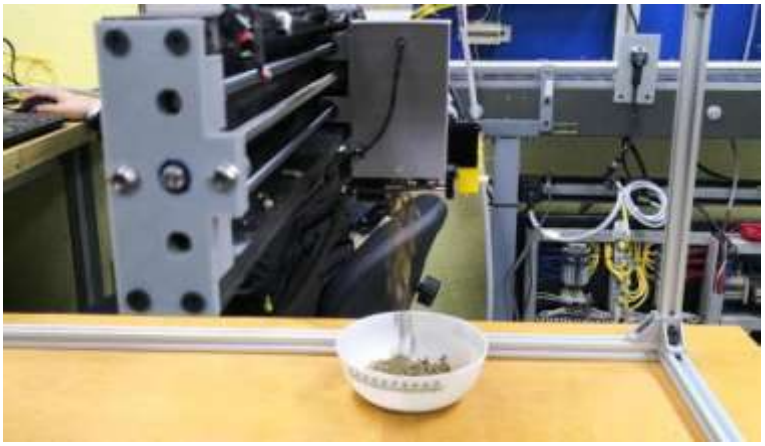

Fig. 7. Test of the operation correct dosage.

With this test, you have the complete assurance that any user who interacts with this interface, can carry out the dosing task in a simple way, only by pressing the supply action that you want to carry out, and with the respective return button to start point in case of power failure.

V. CONCLUSION

According to the tests and results obtained, it can be concluded that the objective of automating a rabbit food dispenser was achieved, with the fulfillment of carrying out the feeding process in a simple and controlled manner.

Also, taking into account the tests performed on the prototype, the operation of each of the feeding sequences can be corroborated as planned, verifying that the dispenser reaches each of the cages and dispenses the necessary amount of food, it should be emphasized, that the amount of food supplied from the actual project will not be the same as that provided for the prototype, since this is only a representation that corroborates physical functioning.

Likewise, with the implementation of the graphical interface, it was possible to carry out the operation of the feeding sequences, with this, any member of the personnel of the place can operate the system, without the need of technical advice or specialized assistance, with simply selecting the mode of operation, the amount of food as cages you want to supply.

In case of any electrical failure, a specific button that could return the dispenser to its starting point was taken into account, which the user will only have to press inside the interface screen so that it returns automatically and is ready to carry out the sequence the user orders.

Similarly, man-hours were reduced to perform the activity of feeding rabbits, since, a worker takes approximately 40 minutes to perform this task daily; while, if the automated dispenser is used, just a few clicks will be enough so that the worker can perform the rodent feeding activity, and in turn perform other required tasks.

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