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CARRERA DE INGENIERIA EN MECATRÓNICA

TECHNICAL REPORT

TOPIC:

“WEIGHT CONTROL SYSTEM FOR FILLING MEAL BAGS 50 KG”

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WEIGHT CONTROL SYSTEM FOR FILLING MEAL BAGS 50 KG

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ABSTRACT

This project consists of a heavy control system in the process of filling of sacks of flour in quickly and accurately as production standards. The control system is designed to fill and weigh 50 kg bags.

Control subsystem, which performs data acquisition sending weighing platform through a load cell generates a signal, this is entered into a computer program in a PLC which drives a closing and opening system output the hopper. It also has an interface that will display a count of the bags produced daily.

Mechanical subsystem, consisting of an adjusting mechanism of the sacks at the outlet of the hopper with the purpose of maintaining the bag subject and prevent product from spilling while being filled, and another mechanism to open or close the butterfly valve is incorporated in the hopper.

Response subsystem which are connected to the solenoid to actuate pneumatic cylinders to start and end of the filling and weighing of flour.

I. INTRODUCTION AND BACKGROUND

In small and medium-sized flour milling industries is done manually weighing of your product, located at the outlet of the hopper that attaches the bag with leather straps, one proceeds in proportion to manipulate a lever that opens the retaining cap product and brings down the meal with the help of internal paddles containing internally and closed system to see that the bag is full. Then he removed the straps and passes a digital scale which is extracted or placed flour to determine the required weight. (Fig.1)

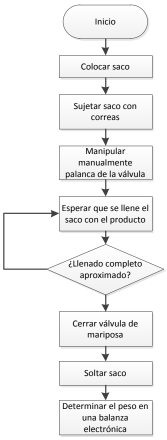

Fig. 1. Diagram manual weighing and filling sacks of flour 50 kg

Today with the advancement and various forms of technology available, you can innovate with a control system which helps you solve the weighing procedure sacks of flour, keep a tally of daily production without the need for it count at the end of the day's work and further modernize the facilities.

II. SYSTEM ARCHITECTURE AND REQUIREMENTS

The project consists of three subsystems that are integrated into one to meet the development of weight control system. (Fig. 2)

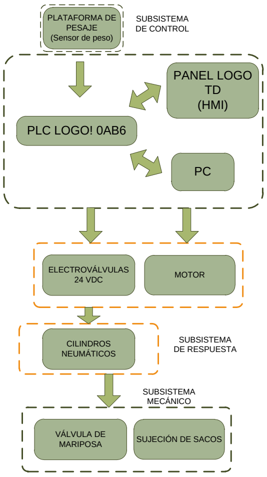

Fig. 2. General block diagram

A. Mechanical Subsystem

The mechanical subsystem consists of three parts, the adjustment mechanism of the bags to help support the empty bags to be filled with flour, the mechanism for opening and closing the throttle valve which provides the passage of flour into the bags and the weighing platform that is responsible for sending signals to weight control subsystems.

B. Control Subsystem

The control system is responsible for receiving the signal from the weighing platform and in coordination with the response subsystem is responsible for starting the cycle of filling of sacks of flour.

C. Control Subsystem

The control system is responsible for receiving the signal from the weighing platform and in coordination with the response subsystem is responsible for starting the cycle of filling of sacks of flour.

III. CONTROL SYSTEM DEVELOPMENT

A. Mechanical architecture

For the closing mechanism of the hopper is carried out with the joining of two double-acting pneumatic cylinder, which is attached to the shaft of the butterfly valve, obtaining two locking positions, it helps to have the most accurate weighing at time to fill the bag of flour. (Fig. 3)

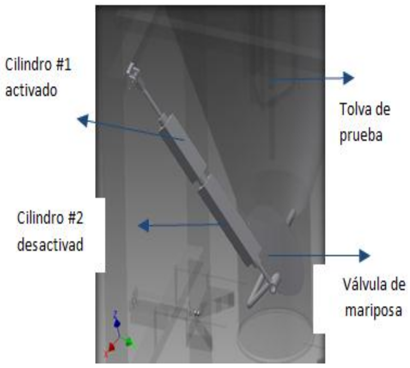

Fig. 3 Mechanism of closing / opening intermediate position

In the bag clamping mechanism employs two pneumatic cylinders that are located perpendicular to the position of the hopper, that is the grip that the bag will be held through the force exerted by the two pistons towards the wall of the mouth of the hopper. (Fig.4)

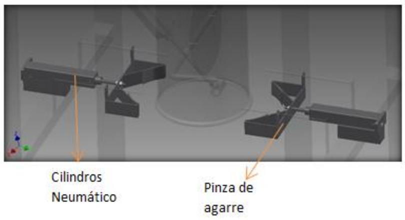

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Fig.4 Sacks adjustment mechanism

In the weighing platform is indicated as part of its structure is installed load cell that is responsible for sending the data to the PLC of the weight that is being filled in the sack. (Fig. 5)

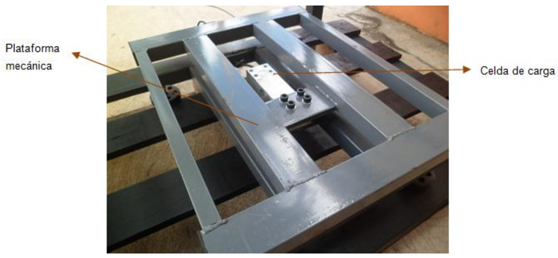

Fig. 5 weighing platform

B. Control Subsystem

The essential basis of the weight control system is to measure the amount of product being filled, this requires a weight sensor in this case a load cell that is one of the most common sensors for industrial weighing and commercial, and for measurement of forces, normally 4 bridges typically mounted gauges, as this would exploit the advantages of linearity and interference compensation offered by this arrangement.

The model of the load cell used in this prototype is the LS6E1 with a maximum capacity of 200kg, this load cell has two points of compression and with a resolution of 2.0 mV/1kg, when this sensor is generating a full-scale 20mV signal to be amplified normalized values to be sent to an analog input expansion module AM2 LOGO!.

At the wide range of existing types of amplifiers in the electronic marketplace, we investigated the amplifiers that can be used and integrated AD822 was selected, which is an instrumentation amplifier low cost, high accuracy and recommended for acquisition systems applications and interface data transducers, the gain depends upon the resistance (Rg) of the following proposed circuit. (Fig. 6)

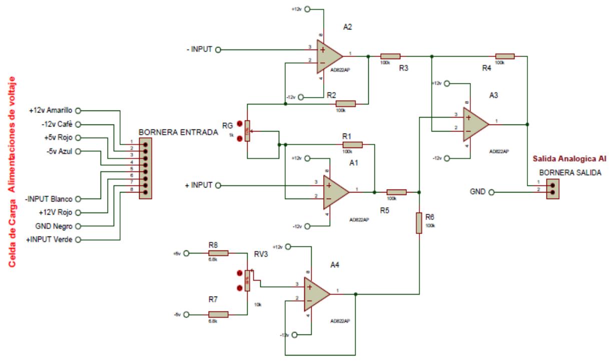

Fig. 6 Diagram of an instrumentation amplifier

The data gives the load cell with a set of weight of 0-80 kg are 1mv to 7.8 mv, then the voltage generated to send the signal to the PLC must be normalized ie 0-10 VDC, for this you need to have a gain of 1000 in the instrumentation amplifier circuit.

C. Response subsystem

It is very important that at the time of scheduling must be precise because in industrial processes is transcendental to consider even the smallest second, otherwise it may cause loss of life, such as material losses.

(Fig. 7)

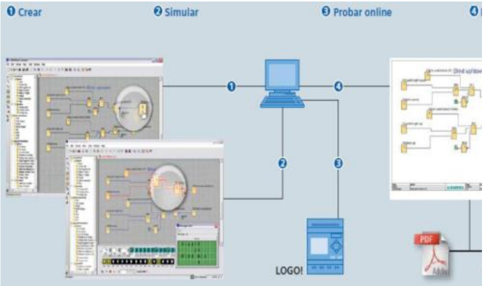

Fig. 7 Scheme programming generally LOGO! Soft Comfort

Through an analysis of the software prior to take place, to carry out this project, it has been divided into following sub in a sequential

- Thread 1. - Starting the System
- Thread 2. - Set the required weight
- Thread 3. - Selecting manual or automatic system
- Thread 4. - Start of cycle
- Thread 5. - Activation of solenoid
- Thread 6. - Weight counted
- Thread 7. - End of cycle.
- Thread 8. - Counter to 0

In versions prior to 0BA6 LOGO! is integrated HMI connection to the TD which is a 4-line display and a keyboard which presents the visualization and control of the process control system, making it easier for operators in the management of weight control system for filling sacks of flour.

The HMI software TD indicates the configuration detailed below:

- Screen 1. - Viewing welcomes the system.
- Screen 2. - Display greeting.
- Screen 3. - Display the required weight.
- Screen display 4.-system selection process.
- Screen 5. - Display of weight in the process.
- Screen 6. - Count display and reset daily production.

At the time of the PLC goes to RUN the function of message texts and parameters of all functions of other blocks are displayed on the HMI TD as the programming done for this project.

IV. IMPLEMENTATION AND TESTING

A. Mounting the mechanical subsystem

For mounting the closing mechanism must take into account the shaft connections of the lever of the hopper and the support of this mechanism.

Fig. 8 Mechanism of opening and closing

Mounting the retention mechanism involves several elements sacks, the first step is the installation of the pneumatic cylinders to test the hopper, then proceeds to the installation of the gripper to the pneumatic cylinder and the anti-rotation system, and thereafter proceed to the connection of the hoses leading the compressed air to allow activation of this mechanism.

Fig.9 Bag clamping mechanism

For performing weight measurement being filled into sacks, the platform is placed in the bottom of the hopper mouth, a distance determined by the dimensions of bags of flour on the market, to perform good counted.

Fig. 10 Mounting weighing platform

B. Mounting the control system

The control subsystem assembly mounted it in a cabinet of dimensions 40x40x20 cm for wiring with the other elements. (Fig. 11)

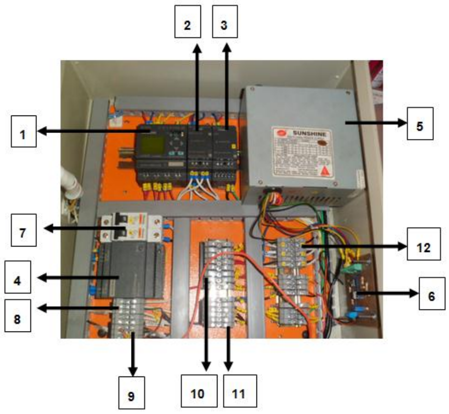

Fig.11 Internal Control Cabinet

Fig. 12 External control cabinet

1. PLC LOGO! 12/24 RC
2. Digital module DM8
3. AM2 Analog Module
4. Source of power
5. CPU Power Supply
6. Conditioner load cell
7. Ignition Breakers
8. Connection terminal blocks 110 V AC line
9. 110 V AC neutral terminal block
10. 24 V DC positive terminal blocks
11. 24 V DC negative terminal blocks
12. Inputs and outputs connection blocks

The outside of the control cabinet is installed lights on (yellow light), off (red light), a cycle in process (light blue), the HMI TD LOGO, emergency stop button, selector system weighing and system fuses. (Fig. 12)

C. Testing signal conditioning circuit

Once installed weighing platform load cell proceeds to make the necessary connections to begin taking evidence.

These tests take the number of bits generated load cell analog input PLC will then this signal can be linearized and indicate the weight on the LOGO! HMI.

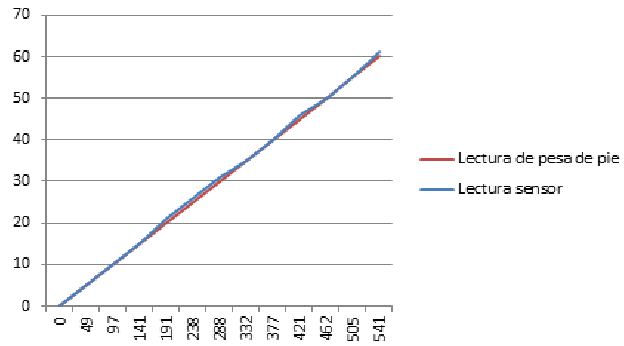

Fig. 13 Graphic diagram of measurement error

D. Analysis of Results

The end result of this thesis plan designed to increase the number of bags produced in one hour and bring facilities to small and medium industries of flour to present contemporary technology, and therefore in a day's work, for this we hold in tests in the previous.

The following table shows the characteristics of weighing forms considered in this project.

		Sistema de control	
	Características	Anterior	Actual
1	Mano de obra (obreros)	2 a 3	1
2	Tiempo de sujeción de sacos (seg)	20	1
3	Tiempo de llenado (seg)	25	3
4	Tiempo de pesaje (seg)	16	3
5	Sacos llenados en una hora	45	60
6	Sacos llenados en un día	225	300
7	Versatilidad (%)	40	100
8	Modernización (%)	40	100

Table 1 Analysis of Results

E. End system implemented

In fig. 14 shows the control system in operation.

Fig. 14 Final system test

V. CONCLUSIONS

- By implementing the control system optimizes the process of filling of sacks of flour, reducing time and increased daily production of processed bags.
- The use of PLCs in industrial processes help increase production, improve product quality also upgrade the facilities in the industry, using current technology existing in our midst.
- Costs that are generated to automate a process are high, but keep in mind that using a cost-benefit analysis, is a long-term investment because it increases the production of sacks of flour produced in a given time, which will allow the recovery of capital invested.

VI. RECOMMENDATIONS

- When you choose to automate industrial type process is recommended to train operators to ensure smooth operation of the control system.
- In the event of some unforeseen with securing bags or the opening or closing of

the throttle valve to use the emergency stop button to stop the process and prevent that type of accident.

- For the system of tire maintenance is recommended that every 6 months or as suggested by the inspector or maintenance chief.

VII. THANKS

To my parents, Abraham Rosero for their unconditional support and my mother Margot Rosero for always being in my care pending. My brother Kevin Rosero for being the source of inspiration of the goals accomplished.

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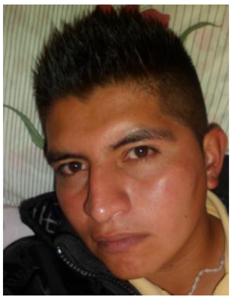

Luis Gabriel Rosero Rosero (Author), was bon on September 20th 1989, in Tulcán. He did his primary education at Colón School. He was study secondary course in Bolivar Technological Institute specializing in Physical Mathematics. Currently he is a graduate of the Universidad Técnica de Ibarra, the career of Mechatronics engineering in 2013.

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