Proc. Annual Symposium on Research & Industrial Training, 03(2016) 69-73
Department of Electronics – Wayamba University of Sri Lanka

CONTROLLING THE WIDTH OF A SLIDING DOOR IN INDUSTRIAL APPLICATIONS

D.L.K.C. Dias*, J.M.J.W. Jayasinghe

Department of Electronics, Wayamba University of Sri Lanka, Kuliyapitiya, Sri Lanka
*chandana.dlk@gmail.com**

ABSTRACT

This study presents implementing an automatic width adjuster for a sliding door. When an object comes closer to the door, it will automatically open according to the object size. This application is useful in industrial applications such as chemical production, pharmaceutical warehouses, large scale food manufacturing industries, etc. That kind of companies use different methods to maintain proper temperature inside their rooms. This door mechanism can be introduced as a method of reducing leakage of air or dust through the door. A prototype door has been built with an ultrasonic sensor, proximity sensors and an ATMEGA 328P-PU microcontroller. The proposed system has been verified by the experimental results.

Keywords: ATMEGA, ultrasonic sensor, proximity sensor, C

1. INTRODUCTION

The aim of this research project is to design and construct a specific automatic sliding door for industrial applications. It can be used in chemical production, pharmaceutical warehouses, large scale food manufacturing industries, etc.

In pharmaceutical warehouses have maintained their conditions according to the guidelines[1] given by world health organization. The book of guidelines for warehousing health condition clearly state that temperature is one of most important characteristics because some medical drugs have to store in precision temperature ranges. When considering chemical manufacturing and storing the temperature should be precision because some chemicals can be liquidized due to some temperature changes. Large scale food industries specially the cool products like ice-cream manufacturing they have large refrigerators as a refrigerator rooms. The main expenditure of those companies are the cost of electricity. In production or a warehouse they normally wants to access through a door. If the door design to control the

opening size it would be a valuable saving. This research project can be implemented in such industries.

2. EXPERIMENTAL

The hardware prototype was created with wood sheets. The door was created using Perspex board. Two bearing were used to reduce the friction between the track and the Perspex. The Perspex slider attached to the rubber belt. This belt go through a motor wheel and free wheel. The motor wheel is connected to the stepper motor. All the sensors and the stepper motor were connected to the ATMEGA 328P-PU microcontroller. The ultrasonic sensor is used to calculate the width of the object. Then microcontroller calculate the rotations according to the width. The relationship between the rotation steps and the ultrasonic sensor reading was derived. The door opening width for a unit angle step was measured for the derivation of the relationship. After the calibration five sizes of object were tested. The flow chart was given below is the process flow chart of the door opening.

The microcontroller programmed[2] by the Arduino UNO R3 Development Board the C programming language is used to create this project.

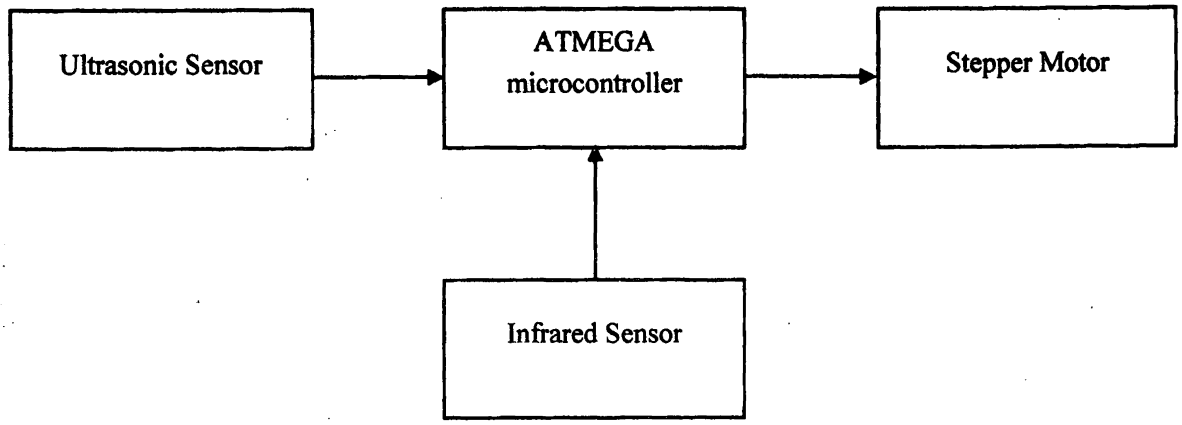

Figure 1: Block diagram of the System

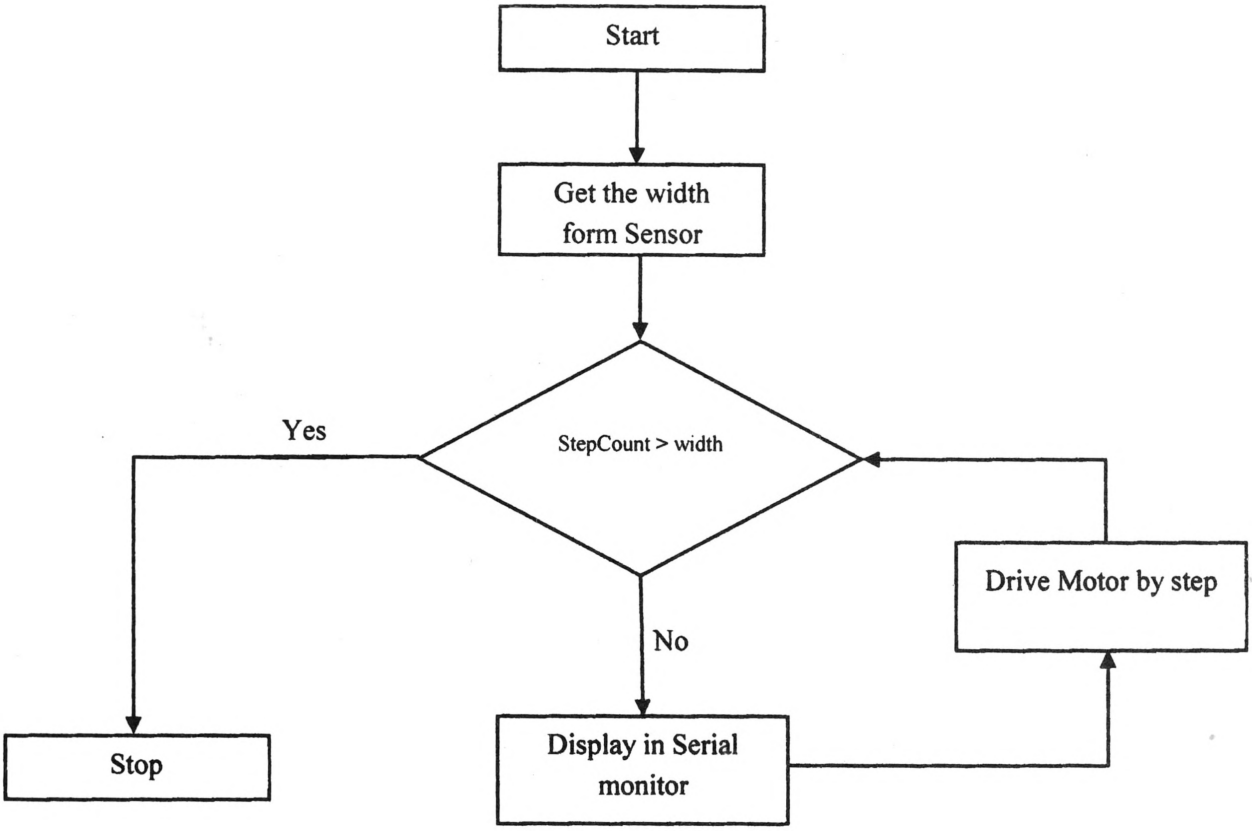

Figure 2: Flow chart of the System

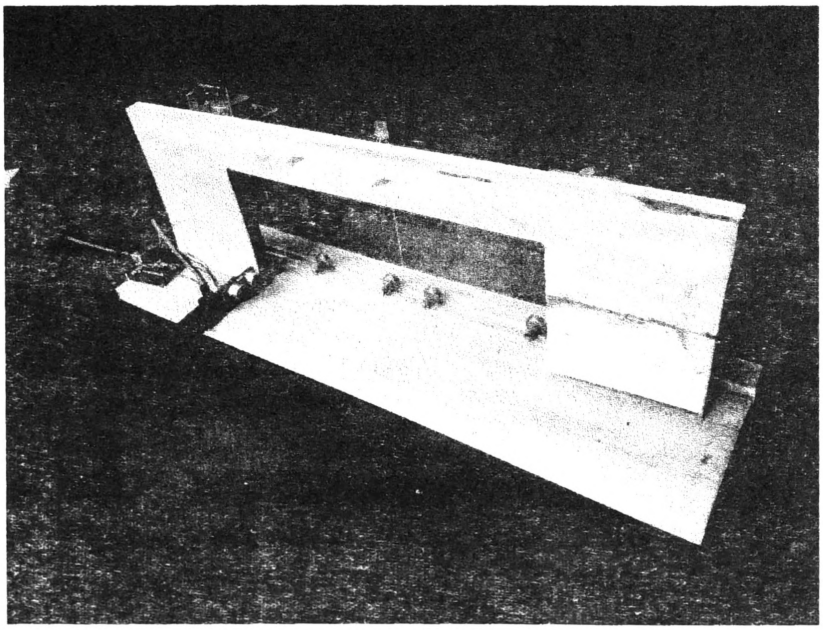

Figure 3: Image of the created prototype

3. RESULTS AND DISCUSSION

According to the experimental results, a relationship have been derived between the ultrasonic sensor value and the motor rotating steps.

When the object come to the center of the door

$$W = \left(\frac{L}{2} - D\right) * 2 \tag{1}$$

Where

W is width of the object, L is full length of the door and D is ultrasonic sensor value

If increase rotating steps the door open width also increase linearly

$$S \propto W \tag{2}$$

$$S = kW \tag{3}$$

Where

k is step count per unit width and S is rotating steps

Where k is a constant value that value was obtained by Experimental result

Rotate the motor 200 steps and observed the door opening width. For 200 steps it was 3 cm then. k is step per unit width so k = 200/3

$$S = \frac{200}{3} * W \tag{4}$$

Using (1) and (4)

$$S = \frac{200}{3} * \left(\frac{L}{2} - D\right) * 2 \tag{5}$$

The result of the experiment that observe different objects go through the door are given below in the table

Table 1: Experimental Results

Sample	Width of the object (cm)	Operated width of the door (cm)
1	4	5.2
2	6	7.8
3	8	9.2
4	12	13.3
5	16	15.2
6	18	18.9
7	20	22.1
8	23	23.8
9	26	27.2
10	28	32

Most of the values are correct with comparing the object size.

4. CONCLUSION

This research implements a method to control the width of a sliding door according to the object to be sent. This automatic sliding door can control its width according to the object size. A prototype door has been designed and constructed. In that prototype door, a 5v stepper motor, an ultrasonic distance measuring sensor[3], two IR proximity sensors and ATMEGA microcontroller have been used. This system can be improved further using high accuracy sensors and high precision motors.

ACKNOWLEDGEMENTS

The first author wishes to extend his gratitude for the assistance given by the Department of Electronics, Faculty of Applied Sciences of Wayamba University of Sri Lanka.

REFERENCES

[1].http://apps.who.int/medicinedocs/en/m/abstract/Js21549en/

[2].http://bitbucket.org/teckel12/arduino-new-ping/wiki/Home

[3].https://electrosome.com/hc-sr04-ultrasonic-sensor-pic/