QUALITY CONTROL OF CARDBOARD BOXES USING PLC AND MICROCONTROLLER

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ABSTRACT
The main aim of our project is to reduce the human intervention and increase the rate of production. This can be achieved due rate of rejection of improper boxes. Our project could be used at industrial or commercial level. In our project we have mainly implemented the functions of selecting, verifying and rejecting the faulty cardboard boxes. DC motors have been used for running the conveyor and rejection mechanism as well. The Robot used in our project is based on ATMEGA 16 microcontroller. The criteria for sorting the boxes will be shape(only length will vary). The IR sensors will form a frame like structure. On pressing a switch the respective box will move on conveyor for verification. The turning on of the predefined set of sensors will indicate that the verification process is completed. If any of the box fails to satisfy the criteria, it will be rejected. Finally the verified boxes will be delivered to the delivery crate with help of Robot.

KEYWORDS: Programmable logic controller, IR transmission and detection,ATMega Controller,rejection mechanism,limit switch,ladder programming,Timer.

INTRODUCTION

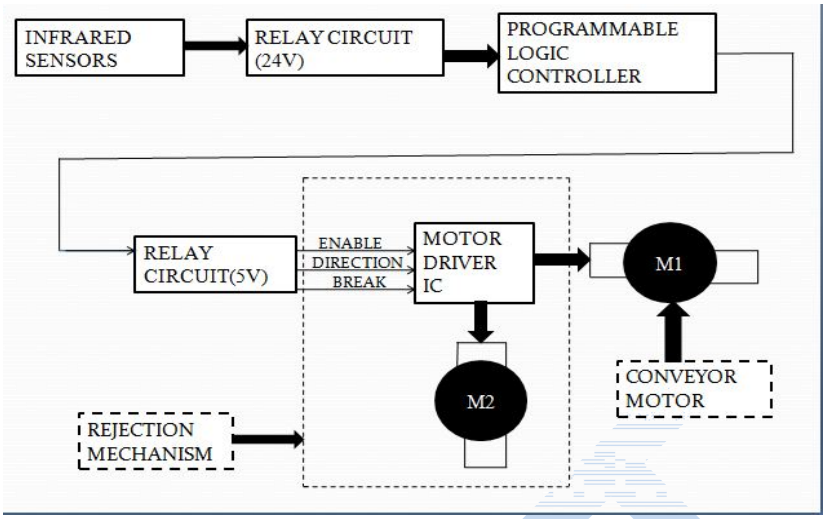
In today's world of development, Automation is one of the major contributors. One of the effective way of increasing the efficiency is to use conveyor system mechanism. Use of Programmable logic controller in automation has scaled up the criteria for selection of various control systems. The industrial growth of the country is the reflection of progress in the phase of development. In the present times, the quality of the product plays a major role, to satisfy the customer requirements and ultimately symbolize the growth of the economy. Our project is quality inspection process in which length and height of the product will be checked with respect to the predefined standards set by the designer. The Cardboard boxes will move on the conveyor for the process of verification. The sensors interfaced to the conveyor will verify the parameters. If the box fulfils the criteria then and then only it will proceed towards the end. If the box fails to fulfil the size parameters then it will simply be rejected by means of rejection rod.

METHODOLOGY

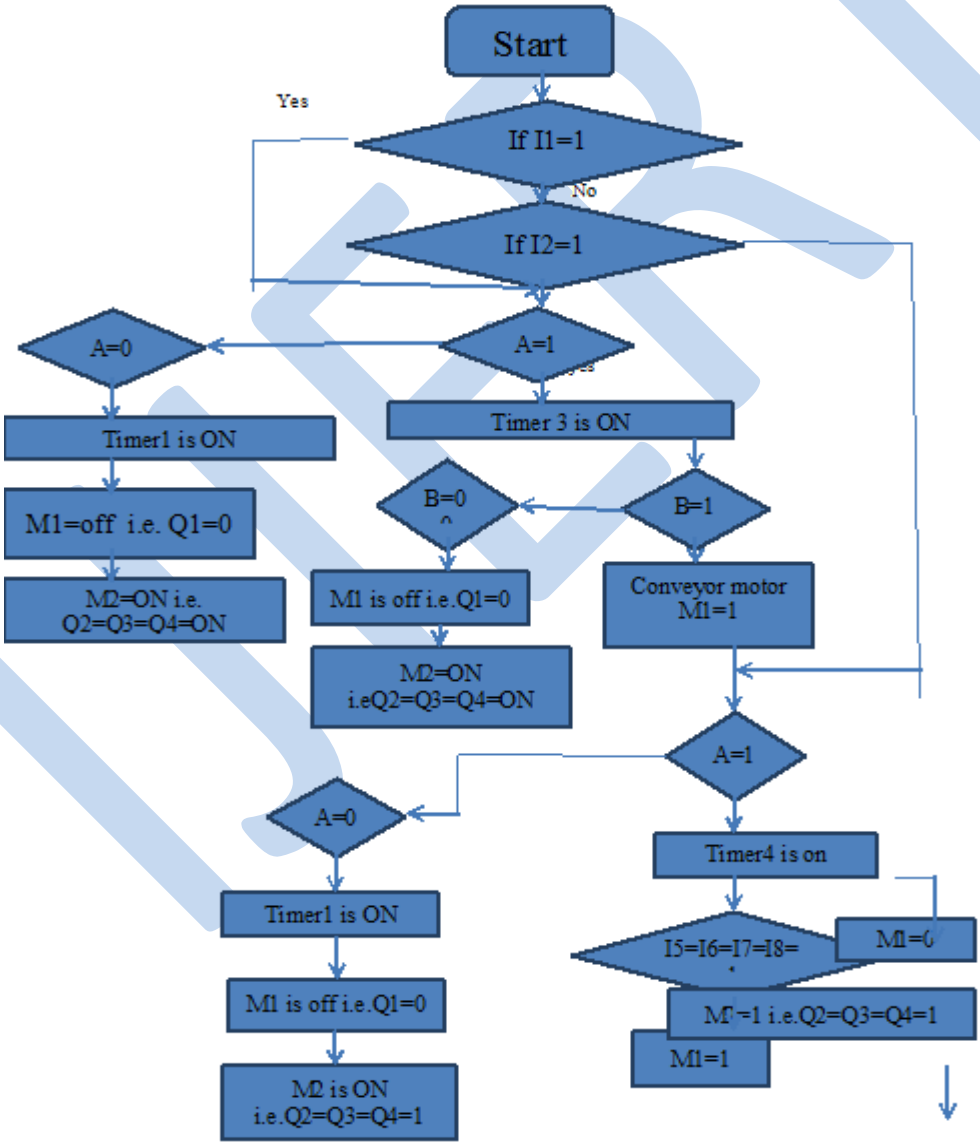
Our project consists of two sections: A. PLC section for quality control. B. Embedded section, Robot for delivering the verified boxes to the destination.

A. PLC SECTION VERIFYING THE QUALITY OF THE BOXES

In this section on the basis of switch combination Box1 will pass through the conveyor for verification. Infrared sensors are used for sensing the parameters of the box. In all 12 sensors have been configured for Box1.If the output of all the sensors is high(logic 1),then the box is up to date. Operating voltage range of sensors is 5V.Since input to PLC should be in range of 12V-24V(DC) ,relay circuits have been used. In case if output of any of the sensor goes low (logic 0),the Box will be rejected with help of rejection mechanism. Similarly the process will continue for Box2 which will pass onto the conveyor by changing the combination of the switch. The motor used for conveyor and rejection mechanism is 12V,10rpm.Due operating voltage of motors, and output of PLC being into the range of 12V-24V(DC) ,relay circuits have to be used to drive the motors.

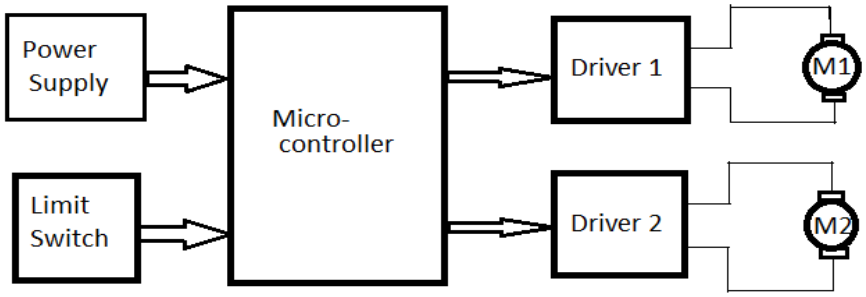


FLOW CHART OF THE SYSTEM

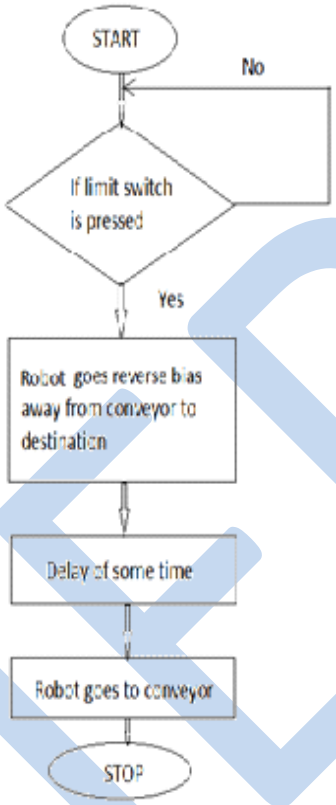


B. EMBEDDED SECTION FOR ROBOT

This section will be interfaced with the conveyor system through limit switches. After the verification of the boxes, the verified boxes will drop onto the Robot. The Robot will take the specific number of boxes at a time to the delivery point. More than one Robots can be included to reduce or avoid the latency. DC Motors of 12V,60rpm are used for the Robot.



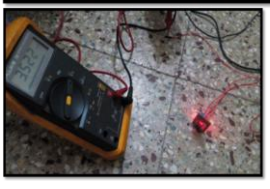
FLOWCHART OF ROBOT



RESULTS

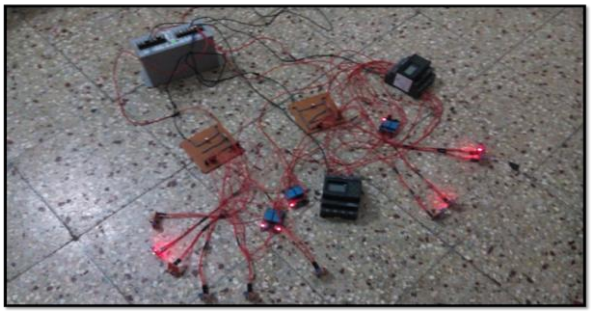
Device Name	Expected Result	Obtained Result
Sensor output(sensor1-sensor12)	5V	3.78V
Relay 1(5V-24V)Relay board1-Relay Board5(at input of PLC)	In between 12V-24V	13.39V
Relay2(24V-5V)Relay Board6-7 for rejection mechanism	In between 12V-24V	13.70V
Conveyor operating voltage	12V	12V

Setup of sensor tuning



Result of sensor tuning.

Interfacing of sensors and relays with PLC



CONCLUSION

The progress in industrial sector is a continuous process. New things and new technologies are being invented. As the technology grows day by day, we can imagine about the future which we may occupy every place.

An effort has been made to maintain the quality of any opaque box in terms of its size parameters. The project is a simple project based on sensor technology and a simple rejection mechanism.

The purpose of the project is to verify the boxes in terms of size parameters using PLC and rejecting the faulty boxes. In order to reduce the latency of delivering product at delivery point we have implemented a small Robot. All the objectives are successfully implemented. This project is very useful in Manufacturing as well as packaging industries.

FUTURESCOPE

1. More sensors can be implemented for crack detection purpose
2.Edges of transparent boxes can be marked so that they can also be verified.

REFERENCES

1) Kelvin T Erickson, "A Programmable logic controllers",IEEE potentials, pp.14-17, march-1996.
2) W. Bolton, "Programmable logic controllers", fifth edition, published by Elsevier, a division of Reed Elsevier India
3) Private Limited.
4) A.A. M.A. A. M. HIRARI. Et al. (2006), "Design and Development of sensor based system." American Journal of Applied Sciences 3: 1745, 1749.
5) Neil M. Schmitt and Robert F. Farwell," Understanding Automation System".