ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijareeie.com

Vol. 6, Issue 6, June 2017

Automation of Pick and Place Mechanism in Industry

Vallari S. Ansingkar[1], Vrushali G. Raut[2]

PG Student [Digital Systems], Dept. of Electronics, Sinhgad College of Engineering, Pune, Maharashtra, India[1]

Professor [Digital Systems], Dept. of Electronics, Sinhgad College of Engineering, Pune, Maharashtra, India[2]

ABSTRACT:Most of the industry sector in India was found to be using manual methods for finished product, material transfer and picking and placing of products. This consumed time and reduced productivity. This project is for automation of pick and place of components. There is a lot of movement of object under manufacturing before it is picked for dispatch to market or another company. All hardwiring on machines has been now reduced due to PLC-programmable logic controller. Biggest advantage is that logic of the machine can be changed without much alteration on the electrical side. HMI, that is human machine interface is used in the system to start the operation or stop it. The idea is to have sensors to sense objects and indicate to PLC. Program in PLC will move the object to location, pick the object and bring it to predefined location using robotic arm.

KEYWORDS: Automation, Robotics, PLC, Human machine interface

I.INTRODUCTION

Automation involves electronic, electrical and mechanical components. Accuracy, repeatability & productivity of the manufacturing process was the main driving force behind the development of Automation Products. Proposed work is for Automation of Pick & Place of the components. There is a lot of movement of the object under manufacturing before it is picked for dispatch to the market or before it is sent to another shop within the production company. Before automation was integrated into manufacturing, all these movements were either done manually or electromechanically. This consumed time and reduced the productivity. Also, it leads to a lot of inaccuracies due to human fatigue. There are very risky areas of machines which can cause grave human injury. In a fibre winding tension control system unstable tension leads to a strength loss of 20-30% of the fibre wound component [1]. Automation overcomes all these drawbacks in industrial processes.

Manual or semi-automatic machines are making product throughput much less than possible, the efficiency is less, human risk is higher & the production is unpredictable Programmable Logic Controller is the logic controller whose program can be written in very flexible methods. Over a period, all the hardwiring on the electrical panels of machines or processes has been reduced due to PLC [2]. Hence PLC along with human machine interface, servo motor and sensors will automate theentire mechanism ofpicking and placing by sensing the object on the conveyor belt. An example of PLC-HMI system is in CFPID control system in a hydro-electric pumped storage power plant [3]. HMI – Human machine interface [4] are a crucial part of industrial information and control systems (ICS). HMI is used as a component in the supervisory control and data acquisition (SCADA), manufacturing execution systems (MES) and enterprise resource planning (ERP) layers of an ICS. HMI handles all visualizations and user interactions with the datacoming from technological processes, in order tosupport decisions whichhave to be made during a factory lifetime.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijareeie.com

Vol. 6, Issue 6, June 2017

II.SYSTEM MODEL

Main components of the system are PLC, HMI, servo drive, servo motor and robotic arm. The block diagram of the automation system is shown in Figure 1.

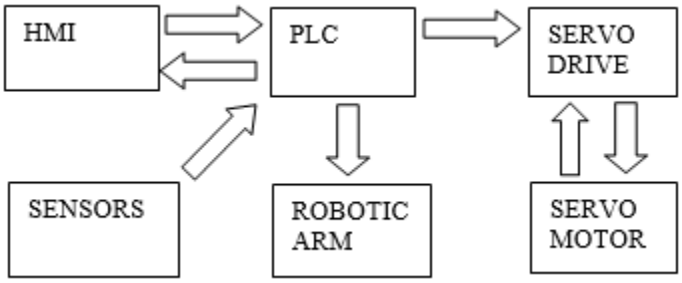

Fig. 1 System Block Diagram

HMI stands for Human Machine Interface, that is, an interface between operator and the controller. The HMI panel takes input data from the applications such as timings from a timer [4]. HMI gives instructions to PLC.

The Programmable logic controller (PLC) monitors the state of output devices. The program of PLC can be changed without too many changes on the electrical side[5]. The PLC has 230V CPU and inbuilt 24V DC power supply. It is programmed using Ladder diagram. Servo drive controls the motion of servo motor. Servo drive and servo motor form a feedback mechanism. There are some special types of application of electrical motor where rotation of the motor is required for just a certain angle not continuously. For such applications servo motor is used. Servo motor has more precision than DC motor. We have used 220 V series servo motor. The Robotic arm [6] is what facilitates the "Pick and Place" motion. An electrical robot is used in this project since electrical robots have many advantages over other sources of robots like pneumatic, hydraulic etc. For picking up the object we first need to sense it. The position sensors are responsible for the same. Infrared sensors have been used considering the factors like range, accuracy, life, cost etc.

HMI takes command from user and instructs PLC. Servo drive gets pulses from PLC. Servo drive communicates with the servo motor which operates the lead screw mechanism on which the robotic arm is placed. A conveyor belt moves parallel to this slide. The object to be picked moves on conveyor belt. When object is sensed PLC instructs servo drive to stop slide motion. The robotic arm then picks and places the object. The robotic arm is controlled by relays.

III.SYSTEM SPECIFICATIONS

Table 1 shows the system specifications.

TABLE 1

System Specifications

Sr. No	Parameter	Specifications
1	Object movement	Pick from position where object has stopped on first conveyor. Place it on a parallel position on the second conveyor.
2	Servo motor torque.	1 N-m OR 0.1 Kg-m
3	PLC	24 V inbuilt DC power supply 230 V CPU

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijareeie.com

Vol. 6, Issue 6, June 2017

		Pulse output feature
4	Robotic arm movement.	220mm forward from and backward
5	Object sensor(IR)	Range :1mm to 400mm
6	Utilization of hard inputs and outputs.	
	inputs	• for object sensing 1 input terminal • for axis limit 2 input terminals
	Outputs	• For Servo motor pulse output 1 output terminal • For Servo motor direction output 1 output terminal • For Robotic arm movement 3 output terminals

IV.RESULTS AND DISCUSSION

Final HMI display screen of HMI after programming is shown in figure 2. Various buttons have been programmed on the display screen to instruct system to start, stop. The safety limit switch is programmed to prevent slide from dashing at either ends.

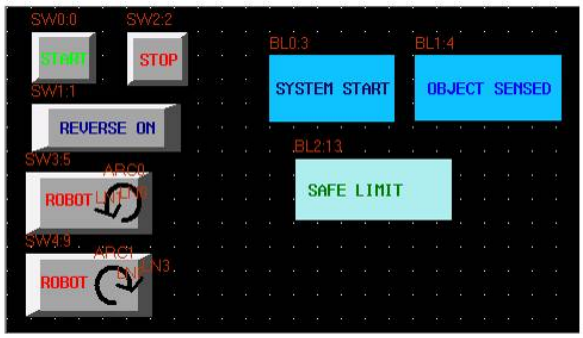

Fig 2. HMI display screen

PLC is programmed using ladder diagram. This program is then burnt into PLC. Snapshot of PLC ladder diagram after programming is as shown in figure 3.

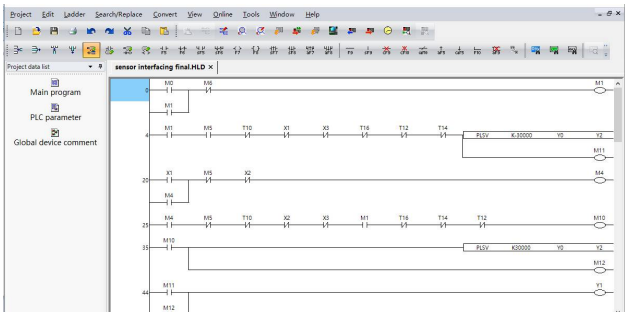

Fig. 3 PLC ladder diagram

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijareeie.com

Vol. 6, Issue 6, June 2017

Experimental setup is as shown in figure 4. This is the lead screw mechanism driven by the servo motor which is controlled by the servo drive. The PLC is connected to servo drive. PLC sends output pulses to the servo drive. The slide moves back and forth depending on the direction of rotation of the servo motor.

Fig 4. Experimental setup

V. CONCLUSION

This system is of great use in the world of automation. It reduces manual efforts in all risky areas of machines in industry. This system also reduces the errors and increases precision. It also reduces the unnecessary time consumption. The servo drive and motor feedback mechanism ensures very high precision. Thus this system overcomes all the disadvantages of earlier manual or semi-automatic machines. It also adds many more features to make a better production system.

REFERENCES

[1]RENSheng-le, LU Hua, WANG Yong-zhang, FU Hong-ya, "Development of PLC-based Tension Control System," Science direct Chinese Journal of Aeronautics, Volume 20, Issue 3, pp. 266-271, 2007

[2]WANG Hong, "Design of PLC-based Hydraulic System for Workpiece Turnover", Science direct Procedia Engineering, Volume 15, pp.122-126, 2011

[3] A. SelwinMichPriyadharsona, R. Ganesanb ,Prabhu Kumar Surarapu , "PLC – HMI Automation based Cascaded Fuzzy PID for Efficient Energy Management and Storage in Real Time Performance of a Hydro Electric Pumped Storage Power Plant",Science direct Procedia Technology, Volume 21, pp. 248 – 255, 2015

[4] Tomas Skripcak, PavolTanuska, ''Toward Nonconventional Human–Machine Interfacesfor Supervisory Plant Process Monitoring'', IEEE transactions on human-machine systems, vol. 43, Issue no. 5, pp. 437-450, 2013

[5]Khin Moe Myint, Zaw Min MinHtun, HlaMyoTun, "Position Control Method For Pick And Place Robot Arm For Object Sorting System",International journal of scientific & technology research, Vol. 5, issue 06, pp. 57-61, 2016

[6]Ms.PujaDhepekar, Prof.Yashwant G. Adhav,''Wireless Robotic Hand for Remote Operations using Flex Sensor'', International Conference on Automatic Control and Dynamic Optimization Techniques (ICACDOT) International Institute of Information Technology (I²IT), Pune, pp. 115-118, 2016