DESIGN AND FABRICATION OF AUTOMATIC MONITORING AND CONTROL SYSTEM FOR THE OBJECTS ON THE CONVEYOR BELT

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Abstract— The project deals with the design and fabrication of the control and monitoring system for the different parameters like position , orientation , material , quantity and output of two different objects on a single conveyor belt. The weight of the objects are taken as feedback to the system. The system uses the Programmable Logic Controller and different types of sensors like proximity , load and infrared sensors. The desired output of the system can be set in the program which can be easily altered satisfying the seasonal demand. The system will be automatically stopped after reaching the desired output.
Index Terms— IR sensor , Load sensor , PLC , Proximity sensor.

I. INTRODUCTION

The applications of PLC are increasing day by day in the manufacturing industries due to its flexibility and accuracy. Industries like packaging and food processing uses PLC for the rapid production and less power utilization. It cannot be implemented in small scale industries due to its high cost. In general only a single type of object like bottles or trays are monitored and controlled on a single conveyor belt where as in the proposed system can simultaneously monitor and control two different objects like bottles and trays on a single conveyor. The trays on the conveyor belt are to be stopped at the solid filling station and solid material of fixed quantity is to be filled in the trays where as the bottles are to be stopped at the liquid filling station and liquid material of specified quantity is to be filled in the bottels. This can be done using the induction type proximity sensors and load sensors placed at different positions in the system. The IR sensor is used for safety as interlock. The Allen Bradley Micrologix 1400 PLC is used in the system. The number of trays and bottles to be filled can be set in the program using ladder diagrams. After reaching the desired output the system will be automatically stopped. The output fixed can be easily altered in between the process too.

II. OPERATION

The complete operation of the system can be explained in five sub units. They are :

- Conveyor belt control unit
- Sensing unit
- Safety or Interlock unit
- Production control unit
- Display unit

Conveyor belt control unit consists of a stepper motor and its controlled. A stepper motor is used to drive the conveyor belt and the stepper motor is driven by the stepper motor controller. The signal for the controller is given by the PLC.

Sensing unit consists of proxmity sensors and load sensors. Proximity sensors are used to locate the position of trays and bottles on the conveyor belt and load sensors are used to fill the specified quantity of material in the bottles and trays at the filling stations.
Safety or Interlock unit consists of an IR sensor. The conveyor will automatically stop if any one try to touch the bottles or trays on the conveyor belt.
Production control unit consists of ladder diagrams with which the production can be set to a fixed value. It can be easily altered at any point of time.
Display unit consists of number of bottles filled and rejected , number of trays filled and rejected , total number of production. The system will be automatically stopped after reaching the desired output.

III. PLC AS SYSTEM CONTROLLER

A PLC is a microprocessor-based control system, designed for automation processes in industrial environments. It uses a programmable memory for the internal storage of user-orientated instructions for implementing specific functions such as arithmetic, counting, logic, sequencing, and timing. A PLC can be programmed to sense, activate, and control industrial equipment and, therefore, incorporates a number of I/O points, which allow electrical signals to be interfaced. Input devices and output devices of the process are connected to the PLC and the control program is entered into the PLC memory. The PLC used is MicroLogix 1400 as it has 20 inputs and 14 outputs and has an interface for Ethernet. The MicroLogix 1400 system offers higher I/O count, faster high-speed counter/PTO, and enhanced network capabilities. The programming software used is RSLOGIX 500.

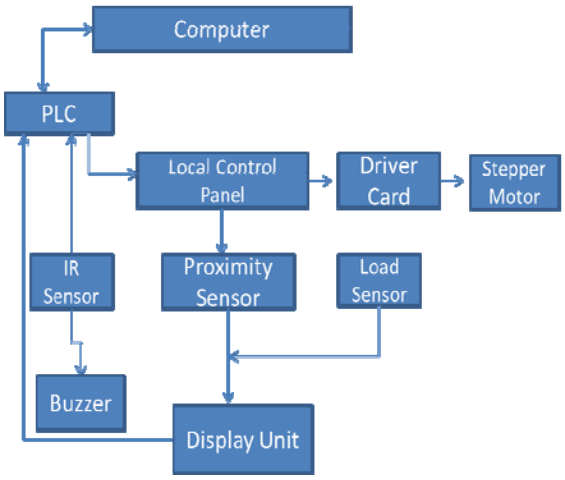
Features of MicroLogix 1400:-

Ethernet port provides Web server capability, email capability and protocol support.
Built-in LCD with backlight lets you view controller and I/O status.
Built-in LCD provides simple interface for messages, bit/integer monitoring and manipulation.
Expands application capabilities through support for as many as seven 1762 MicroLogix Expansion
I/O modules with 256 discrete I/O.
As many as six embedded 100 kHz high-speed counters (only on controllers with DC inputs).
Two serial ports with DF1, DH-485, Modbus RTU, DNP3 and ASCII protocol support.
Proximity Sensors are available in two types namely :

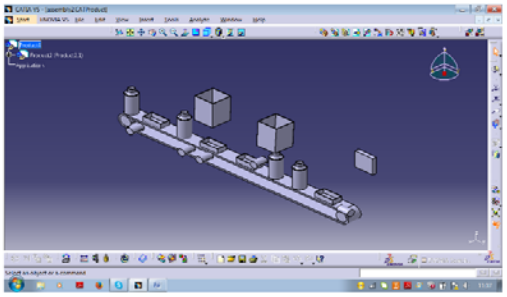
- Inductive sensors
- Capacitive Sensors

Inductive Sensors are cheaper and allow detection of metal objects whereas capacitive sensors are costly and allow detection of metal, plastic and glass objects as well.

IV. METHODOLOGY



V. PROPOSED SYSTEM



VI. APPLICATIONS

- Food Processing Industries
- Beverage Industries
- Pharmaceutical Industries
- Packaging Industries
- Manufacturing Industries

VII. RESULTS

VIII. FUTURE WORK

The system can be monitored and controlled using the SCADA (Supervisory Control And Data Aquisition) software.

Three or more objects can be monitored and controlled simultaneously.

Loading and unloading of trays and bottles can be automated using robot arm.

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