Metal Object Recovery Machine

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Abstract- Sorting systems are used to bridge between production and packaging machinery. Sorting is also the primary stage in most of the production lines. Sorting systems are used to sort items based on various criteria so that they can be packaged accordingly. Height, weight, magnetic properties are few of the sorting parameters. In this fast-paced world, one cannot rely on human sorting. Manual sorting is a time consuming and effort intensive process. Also, manual sorting is less accurate and is easily affected by work duration, age, fatigue and many other such factors. Thus, it is necessary to develop Low Cost Automation (LCA) for sorting these products in accurate and timely manner. Automatic sorting systems allow for fast and efficient sorting of products. Here we have developed a sorting system that sorts metallic and non-metallic objects. This system can be used for sorting metallic and non-metallic nuts and bolts in industries. It also finds its application in large warehouses containing a mixture of various objects

Keywords- PLC, Servo, Conveyer, Inductive Proximity

I. INTRODUCTION

Many godowns, garages and storage rooms contain a mixture of different items – small and large, magnetic and non-magnetic items. It is very difficult to separate these manually. It is very time consuming and a toiling job. Many a time vehicle waste, electrical and electronic equipments are often discarded as waste since it may be impractical to sort these materials in a cost-effective manner. Also, after items are packed in any industries sometimes the parcels are mixed. Thus, to separate them we will have to open it. Instead we can use this system to separate these packages on basis of metal and non-metal. Its comparative low costs make it affordable for the use of medium scale industries as well.

PLC is used as a controller of the system. Over the recent years, PLC has emerged as practical alternative to classical control schemes. Automation is one of flourishing field in today's world. PLCs are one of the most efficient and widely used tools in industrial automation. The oldest method in process control was manual control in which all actions and decisions were taken by human but considering errors of method, this method was followed by hard wired logic control. Logic gates were considered to be one step forward in this method. As circuit became larger the complexity of logic gate went on increasing. Thus, the hard wirings became intense and it became very strenuous task to control these complex circuits using hard wirings. This paved way for microcontrollers. Thus, microcontrollers came into picture followed by PLC programming. Control of output signals is done using these devices as per the input signals coming from devices.

In many industrial applications there is need of sorting. Sorting can be done by using many ways like sorting of object according to their dimensions (height, length etc.), according to their colors, according to their weight, using machine vision (image processing), according to the material of an object etc. This paper here aims in designing a real time application which helps in sorting the metallic and the non-metallic objects of any shape, color and size. At the end of a complete sorting cycle the output would contain two boxes, one filled with metallic objects and other with non-metallic objects.

II. SYSTEM SPECIFICATIONS

2.1. Relay and Contractors:

It is one of the oldest system controllers. Relay and contactor logic use relay which is an electromagnetic switch which opens and closes the contacts to control electrical circuit like as shown in Figure 1. The energized coil with a suitable supply controls the circuit. A simple RC circuit is usually installed across the coil to dissipate and absorb the spikes of voltages which may damage the coil winding. Similar to this a contractor is an electrically controlled switch used for switching a power circuit activated by a control input.

2.2. Supervisory Control and Data Acquisition (SCADA):

SCADA is an acronym for Supervisory Control and Data Acquisition system. It is software with necessary hardware to accomplish the task assigned. SCADA is a computer system gathers and analyzes the data on real time. SCADA is used to monitor and control a plant or equipment in industries such as energy system, sugar, ceramic, cement, power, telecommunications, water and waste control, oil and gas refining and transportation etc. SCADA intern need PLC, necessary control mechanism, communication systems to fetch

the data or information from the field and control effectively. The role of operator in SCADA system is very important and crucial.
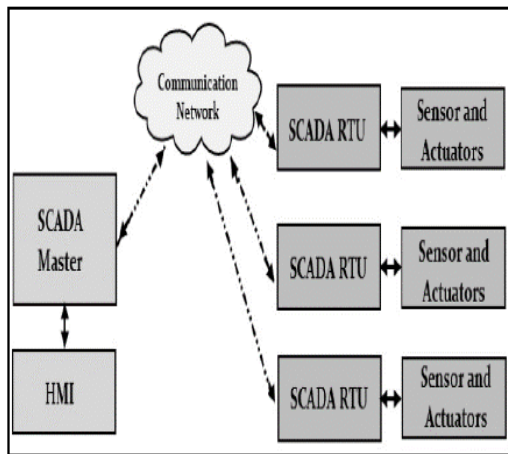

Figure 1: SCADA with field instrumentation

2.3. Programmable Logic Controller:

To determine the most suitable PLC to be used in the automation task need several basic considerations to be made namely, number of input/outputs, digital/analog I/O, memory capacity needed, speed and required power for the CPU and coding instructions, manufacturer's service support etc. All these parameters are interdependent and choice need to be judicial.
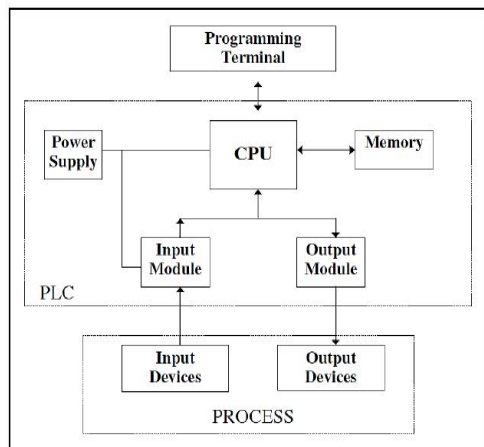

Figure 2: Basic block diagram of PLC

The PLC mainly consists of a central processing unit (CPU), memory and I/O modules to handle input/output data. PLCs have the basic structure as shown in Figure 4. PLC has four main units

III. EXPERIMENTAL SETUP

3.1 Conveyer Belt:

Conveyer belt is a durable and reliable component handling and distribution element in any system. We have constructed conveyer belt using a strong wooden base with a rubber tube acting as a belt It is supported to at an elevated level. Difference from standard conveyer is that it is not metallic base and gear driven, instead a Dc motor is used to drive a single side belt and other end is kept free.

3.2 Servo Motor:

A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled with a sensor for position feedback. A servomotor is a closed loop servomechanism that uses position feedback to control its motion and final position.

Figure 3: Servo Motor

The input to it is a signal representing the position commanded for the output shaft. The motor is paired with some type of encoder to provide position and speed feedback.

3.3 IR Sensor:

An infrared sensor is an electronic device that emits in order to sense some aspects of the surroundings. In order to sense objects, the proximity sensor radiates or emits a beam of electromagnetic radiation, usually in the form of infrared light, and senses the reflection in order to determine the object's proximity or distance from the sensor

3.4 Inductive Proximity Sensor:

The Inductive proximity sensor triggers when any metallic object comes within its range. A high-frequency

magnetic field is generated by coil L in the oscillation circuit. When a target approaches the magnetic field, an induction current (eddy current) flows in the target due to electromagnetic induction. As the target approaches the sensor, the induction current flow increases, which causes the load on the oscillation circuit to increase
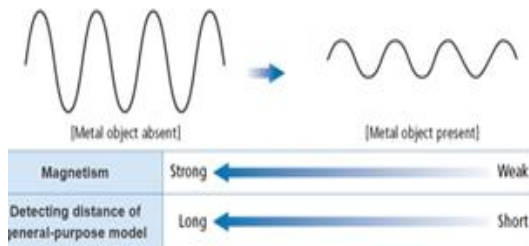

Figure 4: Change in oscillation amplitude when a metal is detected

IV. CONCLUSION

The items are correctly separated as metals and non-metal at the end of the process. The system is simple and cost efficient. It can be used in industries as well. The future scope of the system is that after adding new sensors, we can use it for more specific sensing based on color, size and weight.

REFERENCES

[1] Y V Aruna, Beena S "Automatic convey or System with In–Process Sorting Mechanism using PLC and HMI System", Int. Journal of Engineering Research and Applications ISSN: 2248-9622, Vol. 5, Issue 11, (Part - 3) November 2015, pp.37-42

[2] Manjunatha "Postal Automation System for Mail Sorting" International Journal of Emerging Technology and Advanced Engineering (ISSN 2250-2459) Volume 5, Issue 3, March 2015)

[3] Albert T. Jones , Charles R. McLean ,"A proposed hierarchical control model for automated manufacturing systems", National Bureau of Standards, Gaithersburg, Maryland, USA

[4] Saurin Sheth,Rahul Kher, Rushabh Shah, Parth Dudhat, Pratyush Jani "Automatic Sorting System Using Machine vision", DOI: 10.13140/2.1.1432.1448 Conference: Multi Disciplinary International Symposium on Control, Automation & Robotics, At DDIT, Nadiad, Volume: 1

[5] D. A. Wahab, A. Hussain, E. Scavino, M.M. Mustafa and H. Basri "Development of a Prototype Automated Sorting System for Plastic Recycling" American Journal of Applied Sciences 3 (7): 1924-1928, 2006 ISSN 1546-9239 © 2006 Science Publications

[6] J.M. Farcot, The Servo-Motor; J. Baudry, Paris, 1873. Copy available Smithsonian Institution, National Museum of American History, Branch Library, Washington, DC.

[7] Otto Mayr, The Origins &Feedback Control, MIT Press, Cambridge, 1970

[8] https://www.phcfirst.com/words-in-motion/2014/6/30/the-history-of-conveyors

[9] https://blog.swantonweld.com/types-of-conveyors-and-uses