IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 3, Issue 1, March 2021
Impact Factor: 4.819

Design and Fabrication of Faulty Product Detection and Separation System

Rahul Bhosale[1], Yusuf Suratwala[2], Sumit Ranjan[3] and Rohan Thorat[4]
Professor, Department of Mechanical Engineering[1]
Students, Department of Mechanical Engineering[2,3,4]
New Horizon Institute of Technology and Management, Thane

Abstract: *With recent advances in industrial technologies, automation has become an indispensable part in the manufacturing world. Industrial environments are adopting more and more aspects of automation to increase product quality, accuracy, and reduce product costs. Conveyor systems are used wildly in manufacturing industries. This automated conveyor system works by detecting the size of the material in the conveyor using ultrasonic sensors. The microcontroller analyses this data from the ultrasonic sensor and then directs the pneumatic cylinder material to different directions, height-wise, depending on the height of the material. The position of the conveyor is indicated by a 16X2 liquid crystal display and LED. This project thus automates the material separation process in the conveyor to improve efficiency and increase productivity.*

Keywords: Conveyor systems, Ultrasonic sensor, Infrared Proximity sensor, Fault detection

I. INTRODUCTION

Pneumatic conveying started in 1866 with the application of a fan and ducts to remove the dust and fine particles from woodworking operations. Since then, the field of pneumatic conveying has greatly expanded to include nearly all fine granular bulk materials in the chemical, cement, agricultural, pharmaceutical and food processing industries. Unfortunately, the art of pneumatic conveying is still very empirical and can lead to many misapplications. Research is still being done by many universities around the world, but the theoretical solutions for "two-phase flow" are often too complex for the practicing engineer. Besides, many of these solutions require experimentally-derived coefficients, which are not readily available.

Conveyor belt scales are most important for the production of a great variety of pre-packaged product the main aspect of this project is to increase the accuracy and speed of the checking dimensions of the material in the industry and accept or reject the material as per predetermined standard set by industry based on scalar and pneumatic system. There are various methods of measuring the dimension of the material. These conventional methods are not suitable for the industrial application, because every industry requires an automatic dimension measuring and control machine in order to accept or reject the job as per standard height. This problem is sort out by proposed design of production lines. Introduction to the increasing level of automation, automatic control technology application in the production of quantitative packaging and more in food, fertilizer, oil bottle packaging are widely used in industry. Automation system nowadays are chosen to overcome these problems. Our design produces efficient and productive results.

II. LITERATURE SURVEY

[1] G. Lo Re proposed a model-based method for the fault detection in sensor networks where the measurements are collected from its neighbouring nodes and implementation convergence cast-broadcast method. Ease of use, portability and scalability features of this method makes its implementation with better performance compared to others but the size of the field is limited.

[2] Arash proposed a model-based method stating the detection process using the clusters assuming at least a single cluster with homogeneous nodes where the energy spent by the node is calculated in a cluster and if drops uses recovery algorithm. Energy efficient and faster response and a well performing cluster heed algorithm for clusters are

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 3, Issue 1, March 2021
Impact Factor: 4.819

the features driven but the number of nodes are limited in a cluster.

[3] Jeng-Yang Wu proposed a model-based method for fault detection using the fusion center for monitoring assuming each sensor node has a binary decision rule based observations and equation decreasing the error rate at a time step for the limited number of nodes in the network.

[4] A distributed heuristic method is proposed usesthe tendency value and share the nodes test value which is compared with the other node values and validates them later. The simulation is done using C++. This method minimizes the likelihood of incorrect faulty node diagnosis. But if the status of the node is not acquired then this algorithm does not work.

[5] A time-series analysis method is used for the faulty node identification and arrangement of redundant nodes and replaces the redundant node using threshold model and simulation process which reduced the power consumption and power loss except for the fixed threshold policy condition.

[6] The fault detection in the real-world datasets described defines four fault models: Rule-based, Estimation, Time series analysis and Learning-based models respectively. It also states the detection techniques used in each model. The combination of these classes of methods results in reduced faulty nodes only if the estimated and the tendency value used is determined correctly.

[7] A heuristic approach proposed by S. Gayathri, and Ms.R.Divya, for the detection uses the round trip delay and round trip path computations and compares with the threshold for the identification of faulty nodes improving the network efficiency except for the complex paths.

[8] A new method is proposed for existing fault detection by calculating the difference of test value between the nodes which improves the accuracy in validating the results and in the process of simulation.

[9] For data center monitoring sited uses hardware and software design architectures. The validation of the output is done; it shows a significant increase in the performance, dynamic implementation with low power but it is a time consuming process in testing and implementing the same.

III. COMPONENTS

3.1 Conveyor Belt

The conveyor belt consists of two cylindrical roller operated by DC motor which serves the function of pulleys, with a continuous loop of oil bottles which is to be measured is maintained. The conveyor belt rotates over cylindrical rollers, one of the roller is powered by a DC motor, moving the belt and the components on the belt forward. Here, the conveyor DC motor receives power and signal from the electronic circuit.

3.2 Conveyor Pulley

A pulley is a mechanical device used to change the direction of the belt in the conveyor system, to drive the belt, to tension the belt. The Modern pulleys are made of rolled shells with flexible end disks and locking assemblies a pulley at the discharge end of a conveyor belt; may be either an idler or a drive pulley. The larger diameter of pulleys in the system and is often lagged to increase traction and pulley life. A pulley at the tail of the belt conveyor is opposite to the normal discharge end; may be a drive pulley or an idler pulley.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 3, Issue 1, March 2021
Impact Factor: 4.819

3.3 Pneumatic Cylinder

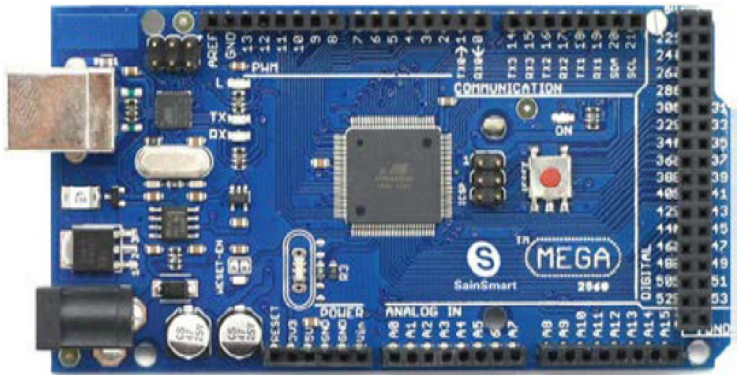
In a pneumatic system, energy is stored in a potential state under the form of compressed air. Working energy (kinetic energy and pressure) results in a pneumatic system when the compressed air is allowed to expand. To perform any applicable amount of work then, a device is needed which can supply an air tank with a sufficient amount of air at a desired pressure.

3.4 Solenoid Valve

A solenoid valve is an electromechanical controlled valve. The valve features a solenoid, which is an electric coil with a movable ferromagnetic core in its center. This core is called the plunger. In rest position, the plunger closes off a small orifice. An electric current through the coil creates a magnetic field. The magnetic field exerts a force on the plunger. As a result, the plunger is pulled toward the center of the coil so that the orifice opens. This is the basic principle that is used to open and close solenoid valves. The term solenoid usually refer to coil used to create magnetic field when wrapped around a magnetic object or core. The solenoid describes transducer mechanism used to convert energy in motion. Solenoid valve are controlled by the action of solenoid and typically control flow of air as a switch. If solenoid is active (Current is applied), it open the valve. If solenoid is inactive (Current does not exist), the valve stay closed. The action of pneumatic solenoid is controlled by pneumatic cylinder.

3.5 Microcontroller

The first and the foremost criterion for selecting a microcontroller is that it must meet the task at hand efficiently and cost effectively. In analyzing the need of a microcontroller based project we must see whether an 8 bit, 16 bit, 32 bit microcontroller can best handle the computing need of the task most efficiently. The Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Mega 2560 board is compatible with most shields designed for the Uno.



The Arduino Mega can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wallwart) or battery.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 3, Issue 1, March 2021
Impact Factor: 4.819

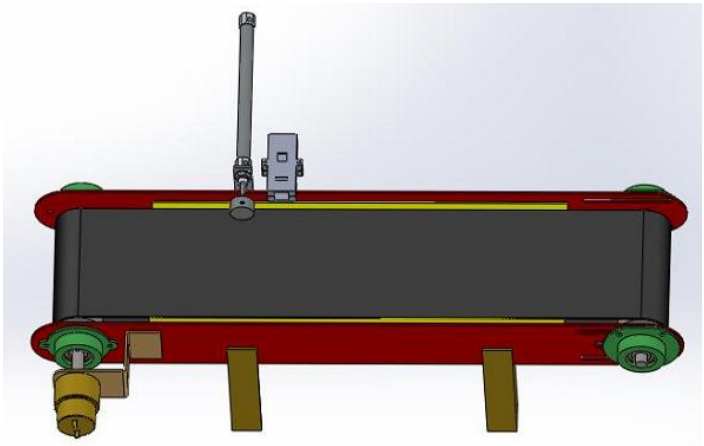
The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack.. Leads from a battery can be inserted in the Ground and V in pin headers of the POWER connector. The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five voltsand the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts. The Mega2560 differs from all preceding boards in that it does not use the FTDI USB-to serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.

3.6 Proximity Sensor

A proximity sensor is a sensor able to detect the presence of nearby objects without any physical contact. A proximity sensor often emits an electromagnetic field or a beam of electromagnetic radiation (infrared, for instance), and looks for changes in the field or return signal. The object being sensed is often referred to as the proximity sensor's target. Different proximity sensor targets demand different sensors. For example, a capacitive proximity sensor or photoelectric sensor might be suitable for a plastic target; an inductive proximity sensor always requires a metal target. Proximity sensors can have a high reliability and long functional life because of the absence of mechanical parts and lack of physical contact between the sensor and the sensed object.

Proximity sensors are also used in machine vibration monitoring to measure the variation in distance between a shaft and its support bearing. This is common in large steam turbines, compressors, and motors that use sleeve-type bearings. International Electro technical Commission (IEC) 60947-5-2 defines the technical details of proximity sensors. A proximity sensor adjusted to a very short range is often used as a touch switch.

IV. Solid Works Design Of The Prototype



IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 3, Issue 1, March 2021
Impact Factor: 4.819

V. WORKING

The system consist of conveyor belt mechanism on which the products will be kept for sorting purpose. A proximity sensor is used to detect the fault in the product. Proximity sensor is adjusted little above the height of the product that are to be tested and hence a faulty product which has more height than the actual product will be detected by the proximity sensor and the sensor will give signal tothe circuit and the circuit will actuate the solenoid valve and further the pneumatic cylinder will actuated. The actuated pneumatic cylinder will push the faulty product outof the conveyor and the faulty product will be collected in a box beside the conveyor. This way fault detection and sorting of faulty product will be achieved.

VI. CONCLUSION

The automatic material separating conveyor system has been constructed and tested. The automatic material separating system is highly useful in quality control system to reject and accept materials/products. The automatic material separating conveyor system will help to separate material accurately. The automatic material separating conveyor system will be cost, time and space saving thus aiding to be beneficial in both the economic and technical aspects. Overall inspection time and enterprise overhead expenses is greatly reduced. It aids in speeding up the process as well as improving efficiency of production line. In proposed system to check the every bottle weight and decide the bottle is passed or fail. The decision to pass or fail a manufactured part based on automatically inspection is extremely important to a production operation. Inspection improvement are necessary to increase the accuracy of product and improve the performance of inspection processes.

ACKNOWLEDGMENT

The Authors would like to thank Prof. Rahul Bhosale of Mechanical Department in New Horizon Institute of Technology and Management, Thane for his valuable guidance.

REFERENCES

[1]. Mr. Shete Yogesh Shreekrushna ,“Fabrication of Faulty Product Detection and Separation System”, RST Pvt. Ltd., Akluj.PaperID: IJSRDV8I60043,Published in: Volume:8,Issue:6,PublicationDate: 01/09/2020,Page(s): 25-30

[2]. Y V Aruna, Beena S, “Automatic convey or System with In–Process Sorting Mechanism using PLC and HMI System”, International Journal of Engineering Research andApplications,Vol.5,Isuue 11,Nov.2015,pp.37-42.

[3]. R. Mattone, G. Campagiorni, F.Galati, “Sorting of items on moving conveyor belt”, Journal Elsevier-Science Direct,17 July 1999,pp.73-80.

[4]. Ryosuke Tasaki, Takanori Yamazaki, Hideo Ohnish, Masaaki Kurosu, “Continuous weighing on a multi-stage conveyor belt with FIR filter”, Journal Elsevier-Science direct, 2006.

[5]. Mustafa Bayran, Mehmet.D.Oner, “Determination of applicability and effect of colour sorting system in bulgur production line” , Journal Elsevier-Science Direct,2006,pp.232-239.

[6]. E.Vargas, R.Ceres, J. M. Martin, L. Calderon, “Ultrasonic sensor for liquid-level inspection in bottles” ,Journal Elsevier Science Direct ,sensor and actuators A 61(1997) 256-259.

[7]. Amir Deshmukh, Mahesh Nagane, vaibhav “Design and Development OfAutomatic Conveyor Controlling System for Sorting of Component on Color basis”, International Journal of science and research ,index value (2013):6.14,pp.1862-1866.

[8]. Kunhimohammed C.K, Muhammed saifudeen K.K, Sahna S, Gokul M.S, “Automatic Color Sorting Machine Using TCS230 Colour Sensor And PIC Microcontroller”, International Journal of Research and Innovation in Science and Technology, vol.2, 2015.

[9]. Vinay Kumar Reddy, “Sorting of Object Based On Colour By Pick And Place Robotic Arm And With Conveyor Belt Arrangement”, International Journal of Mechanical Engineering and Robotics Research, Vol. 3,No.1, January 2014, pp.67-74.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 3, Issue 1, March 2021
Impact Factor: 4.819

[10]. Sheela.S,Shivaram.K.R,Meghashree.S,Monica.L,Prathima,Shriya.M.Kumar,"Low Cost Automation for Sorting of Objects on Conveyor Belt" ,International Journal ofResearch and Innovation in Science and Technology,vol.5, 2016

[11]. Sanjay Prakash Dabade, Rohan Prakash chumble "Automatic Sorting Machine Using Conveyor Belt", International Journal of Research and Innovation inScience and Technology, vol.2, 2015.

[12]. Prof. D. B. Rane, Gunjal Sagar S, Nikam Devendra,Shaikh Jameer u, "Automation of Object Sorting Using an Industrial Roboarm and MATLAB Based Image Processing" ,International journal of emerging Technology and Advanced Engineering, Vol.5, Issue 2, February 2015, pp.187-191.

[13]. R. Schwartz, "Automatic weighing- Principles, Applications and Developments," Physikalisch-Technische Bundesanstalt weighing instrumentd Laboratory, germany.

[14]. S. V. Rautu, A. P. Shinde, N. R. Darda, A. V.Vaghule, C. B. Meshram, "Sorting of Objects Based on Colour, Weight and Type on A Conveyor Line Using PLC" , IOSR Journal of Mechanical and Civil Engineering (IOSRJMCE),march 2017, pp.4-7.

[15]. Emmanuel Atta Williams, John Bentil, "Design and Implementation of a Microcontroller-Based Automatic Waste Management Sorting Unit for a Recycling Plant", American Journal of Engineering Research (AJER), Vol.5, Issue 7,pp.248-252.

[16]. Karamchedu Spandan Harithas1, Naregalkar Akshay, "Integration And Automation Of Systems For Product Identification And Segregation", International journal of Application or Innovation in Engineering and Management, Vol.2, Issue 4, April 2013, pp. 381-386.

[17]. [17] Paresh M. Waghamare, Sachin Gawate, "Development of Testing Device for the Conveyor System using Automation", International Journal Of Research in Engineering and Technology, Vol.5 ,Issue 12 ,December 2016, pp.98-101.

AUTHORS

- **First Author** – Yusuf Suratwala, B.E. Mechanical Engineering, New Horizon Institute of Technology and Management, Thane, yusufsuratwala174@nhitm.ac.in
- **Second Author** – Sumit Ranjan, B.E. Mechanical Engineering, New Horizon Institute of Technology and Management, Thane, sumitranjan174@nhitm.ac.in
- **Third Author** – Rohan Thorat, B.E. Mechanical Engineering, New Horizon Institute of Technology and Management, Thane, rohanthorat174@nhitm.ac.in
- **Correspondence Author** – Rahul Bhosale, Professor of Mechanical Engineering, New Horizon Institute of Technology and Management, Thane , rahulbhosale@nhitm.ac.in