



INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Conveyor Belt Based On Product Counting

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Abstract:- In modern industrial automation, product counting and material classification are crucial for enhancing efficiency, reducing human errors, and optimizing manufacturing processes. This project presents a Conveyor Belt System for Product Counting and Material Separation, designed to accurately count products passing through the conveyor while distinguishing between metal and non-metal items. The system integrates advanced sensing technology to automate the counting process and classify products based on their material composition. The automated classification of metal and non-metal items can be utilized in various industries, including manufacturing, packaging, recycling, and quality control. By integrating smart automation and real-time monitoring, this conveyor belt system enhances productivity and operational accuracy while reducing labor-intensive tasks. The system is designed for scalability, making it adaptable to different industrial applications where material differentiation and product counting are essential. This project demonstrates a step forward in industrial automation by providing a cost-effective, efficient, and intelligent solution for automated product counting and material separation.

Keywords: Conveyor Belt, DC Motors, PLC Microcontroller, Color Sensor, LCD

INTRODUCTION

In the modern era of industrial automation, conveyor belt systems play a crucial role in manufacturing, packaging, and sorting industries. The increasing demand for efficiency, accuracy, and cost-effectiveness has led to the development of advanced conveyor belt mechanisms that integrate automation and smart sensing technologies. One such innovation is the Conveyor Belt-Based Product Counting System, which is designed to not only count products moving through the belt but also to detect and separate metal and non-metal items automatically. This project enhances productivity by providing a real-time count of products while ensuring effective material sorting, which is essential for quality control and operational efficiency. Traditional conveyor belt systems lack automated product differentiation and rely heavily on human supervision, leading to errors and inefficiencies in industries dealing with bulk materials. In contrast, this project offers a smart and automated approach to handling products with enhanced accuracy. The integration of sensors and microcontrollers allows the system to differentiate between metal and non-metal products, thereby enabling automated sorting without manual intervention. Such a system finds wide applications in manufacturing units, recycling plants, food industries, and warehouses, where precise counting and sorting are essential for maintaining workflow efficiency.

LITERATURE REVIEW

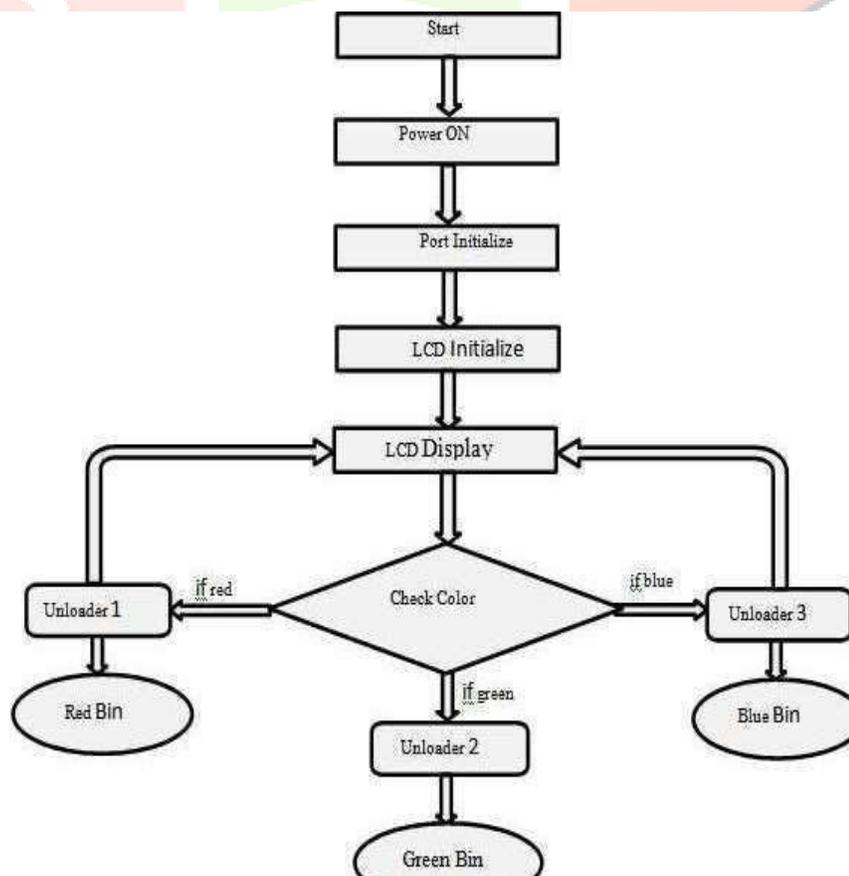
1)The paper entitled by MoghaddamVahedet.al.^[1][2014], This paper deals with sorting Date fruits based at different stages of maturity, namely Khalal, Rotab and Tamar to meet consumer's demands. The system comprises a conveying unit, illumination and capturing unit, and sorting unit. Physical and mechanical features were extracted from the samples provided, and the detection algorithm was designed accordingly.

2)The paper entitled by Vishnu R. Kale et.al.^[2][2014], This paper presents a smart approach for a real time inspection and selection of objects in continuous flow. Image processing in today's world grabs massive attentions as it leads to possibilities of broaden application in many fields of high technology. The real challenge is how to improve existing sorting system in the modular processing system which consists of four integrated stations of identification, processing, selection and sorting with a new image processing feature.

Methodology:-

The Allen Bradley1000 PLC is the core component of the proposed system and can be programmed in ladder programming. The proximity sensor used has a range of 300 mm which is given as input to the PLC. A DC Motor is attached to the conveyor belts which will move after the motor is energized by the 12 V DC battery. When the sensor detects any object on the conveyor belt, it emits a beam of electromagnetic radiation. The transmitter and receiver are always in the same housing so that the light transmitted is reflected in the receiver as reflection and hence the object is sensed. A relay is connected to the PLC which is used to control high current circuits using low current signals. When 12V supply is given from the battery further connected to a motor the motor generates back emf which may damage the PLC.

Flowchart



Working

Basically conveyor belt is a device which is able to detect metal and nonmetal and secret metal or nonmetal which is continuously moving through the conveyor belt. This project is able to move a product one direction to another or one place to another place. With the help of power supply this project is run. With the help of motor belt is continuously run. Once the metals sensor sense metal and IR sensor sense nonmetal then Arduino send the signal to Saurav motor and this Motor is rotated 260 degree and then nonmetal components or the nonmetal product separate in one direction and the another one which is metal which is continuously going through the conveyor belt and that how this project is work which is able to separate metal and nonmetal product and display over all product which is going through the conveyor belt.

COMPONENT DETAIL

Conveyor Belt Speed Sensor: -

Conveyor belt sensors can monitor and control various parts of the conveyor belt, including its speed, temperature and position. Conveyor belt speed sensors are designed to accurately monitor the speed of a conveyor belt. These sensors work by detecting the rotational speed of the rollers or by using optical or magnetic encoders to measure the speed of the conveyor belt directly. The primary applications of speed sensors include.

Ultrasonic sensor:-

An ultrasonic sensor is an instrument that measures the distance to an object using ultrasonic sound waves. What is an ultrasonic sensor? It is a device that uses a transducer to send and receive ultrasonic pulses that relay back information about an object's proximity. High-frequency sound waves reflect across boundaries to produce distinct echo patterns.

Conveyor belt :-

Conveyors are specialized conveyor systems designed to handle materials that need to be transported at steep angles or require controlled spacing between products. These conveyors feature cleats, or vertical barriers, attached to the belt at regular intervals. Cleats prevent materials from sliding backward, making cleated belt conveyors ideal for transporting loose or bulk materials on inclines or declines.

Metal Detector :-

Product Quality Control – Ensures that no unwanted metallic contaminants are present in food, pharmaceuticals, and other sensitive product. Sorting and Separation Differentiates between metal and non-metal objects, enabling automated separation of materials for recycling, manufacturing, and waste management.

Proximity Sensor :-

Object Detection Proximity sensors detect the presence of products moving on the conveyor belt, ensuring accurate counting without physical contact. Automated Product Counting The sensor triggers a count whenever an object passes through its detection range, eliminating manual errors in product tallying. Metal and Non-Metal Classification Inductive proximity sensors detect metallic products, while capacitive proximity sensors can identify both metal and non-metal items, enabling automated sorting management.

Connecting Wire:-

Power Supply Wires – Provide electrical power to motors, sensors, and control units in the conveyor system. Sensor Wires Connect infrared (IR) sensors, optical sensors, inductive sensors, and metal detectors to the microcontroller for object detection and counting. Communication Used for transmitting data between the microcontroller, display unit, and external monitoring systems (e.g., RS232, I2C, SPI). Motor Control Wires Connect motor drivers (such as L298N) to the conveyor motor for controlling speed and direction. Grounding

Wires Provide electrical grounding to prevent short circuits and ensure system safety. Display Wires Connect the 16x2 LCD or any other display.

Servo Motor (MG996R):-

Product Sorting Mechanism. The servo motor can be used to divert metal and non-metal objects after detection. It helps in actuating a flap or arm to push objects into different bins. Controlling Conveyor Belt Speed The servo motor can be used to regulate the speed of the conveyor belt based on counting requirements. Ensures smooth operation, preventing miscounting of objects. Position Control for Precision Counting The MG996R offers precise angular movement, allowing controlled motion for accurate product counting. It helps in stopping or slowing the belt momentarily when required. Gate Control for Object Flow The servo motor can control a gate or stopper that allows only a certain number of products to pass through at a time.

16*2 LCD Display:-

1. Displaying Product Count Shows the total number of products passing through the conveyor belt. Continuously updates the count in real-time.

Displaying Metal and Non-Metal Detection Indicates whether the detected product is metal or non-metal.

Example Display :

"Metal Detected: YES" "Metal Detected: NO"

Displaying Conveyor Belt Status Shows whether the conveyor belt is running or stopped. Example Display:

"Conveyor: RUNNING"

MICROCONTROLLER :-

AT89C51 is a 8-bit microcontroller with the 4kb Flash which is more than enough for any small scale industry for memory storage. The number of IO's provided by this controller is enough for interfacing external peripherals and the interface can internally modified by using LED indication for the purpose of debugging. The operating frequency of the controller is around 11.059MHz is a crystal oscillator also known to be a 3pin resonator. It works for a supply of +5v on pure DC.

IR SENSORS :-

TSOP1736 is said to have a photo detection response of 36KHz. This sensor is known to produce LOW output on detection else in an idle state. This sensor is also driven by BC557 transistor for biasing and then provided to the input of a micro-controller. The inputs of these microcontroller are external which can internally be modified to internally trigger the controller from the sensor.

Applications:- 1) Automates

product counting.

2) Reduces human error.

3) Speeds up sorting process.

4) Enhances efficiency in packaging.

5) In industries producing water bottles

Advantages :-

1) Automates product counting.

2) Reduces human error.

3) Speeds up sorting process.

4) Enhances efficiency in packaging.

Conclusion :-

Conveyor belt based on product counting efficiently detects and separates metal and non-metal items, ensuring accurate sorting. It also displays the total number of products passing through in real-time. This system enhances operational efficiency and reliability in industrial use. The project, built on a robust metal body, demonstrates reliable performance for industrial applications.

Future Scope :-

"The future of conveyor belt systems lies in integration with AI for smarter sorting, enabling real-time decision-making and optimized product categorization. Wireless data monitoring and control will further enhance system efficiency, allowing for remote tracking and adjustments. Expanding to multi-material detection will broaden the system's applicability across various industries. To cater to large-scale production demands, enhancements in speed and accuracy will be crucial.

By employing high-resolution cameras and powerful image processing techniques, machines can accurately identify and sort products, paving the way for intelligent and automated manufacturing processes."

Result :-



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