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Design and Modeling of Automated Dimensional CheckConveyor Belt System for Categorization of Objects

[1]Miss. POURNIMA SANJAY JAWALE
[2] Associate Professor J. D. NANAWARE

[1] Master of Technology Electronics Department, KBP College of Engineering, Satara,415001, India
[2]Electronics Department, Professor at KBP College Of Engineering, Satara, Maharashtra, 415001, India

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Abstract: In today's fast-paced industrial environment, automation plays a key role in improving efficiency, accuracy, and consistency. This project focuses on the design and development of an automated conveyor belt system capable of checking the dimensions of objects and sorting them into categories based on their size. The system uses sensors to measure the length, width, and height of objects as they move along the conveyor.

An ATmega328P microcontroller processes this data and controls a sorting mechanism that directs each item to its appropriate category. The mechanical and electronic components are carefully integrated, and the design is simulated and tested to validate its performance. The results show that the system can effectively reduce manual labor, speed up the sorting process, and maintain accuracy, making it suitable for use in packaging, warehousing, and quality control operations.

Key Words: Conveyor Belt, Rollers, Microcontroller, Ultrasonic sensors, Circuit Manufacturing, Arduino Sketch, Embedded C, Proteus Professional.

INTRODUCTION

In modern manufacturing and logistics, the demand for speed, accuracy, and operational efficiency has led to a significant increase in the adoption of automation technologies. One of the essential tasks in many industrial settings is the sorting and categorization of objects based on their physical dimensions, such as length, width, and height. Traditionally, this process has relied heavily on manual labor or semi-automated systems, which are often time-consuming, prone to human error, and require significant manpower. To address these limitations, the integration of fully automated dimensional measurement and sorting mechanisms into conveyor belt systems has emerged as a highly effective solution. This project focuses on the design and development of an intelligent conveyor-based sorting system that utilizes advanced sensors—such as ultrasonic, infrared, or laser sensors—coupled with a microcontroller or embedded processor. These components work together to accurately measure the dimensions of each object in real time and activate actuators to sort them into designated categories. The proposed system not only enhances accuracy and speed but also reduces labor costs and improves scalability, making it ideal for real-world industrial applications such as packaging, quality control, warehousing, and logistics management.

Current scheme

The existing system used a proximity sensor for measuring a single dimension at one pass. When the inspection is done, the separation of defective objects is done manually. This process consumes time. Also, due to single dimension checking, the efficiency of a system is less as it is semi-automated.

1.2] Proposed System

This project focuses on creating a simple and cost-effective conveyor belt system that can automatically check the size of objects and sort them based on their dimensions. It is designed for small to medium-sized objects with regular shapes like boxes or packages. The system uses basic sensors and a microcontroller to measure the length, width, and height of each item while it moves on the conveyor. Based on this information, the system automatically sends the item into the correct category. The project is meant to help small-scale industries or workshops that want to save time, reduce manual work, and improve sorting accuracy without investing in expensive machinery.

1] METHODOLOGY

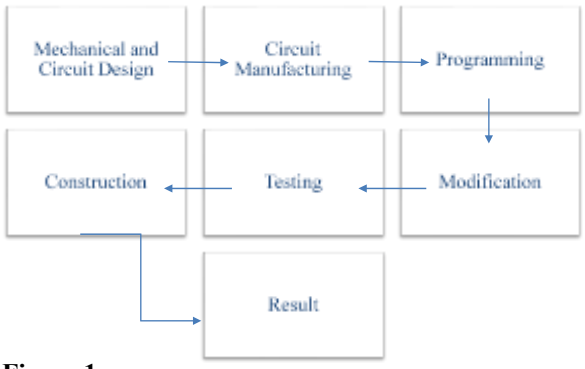

Figure 1

The mechanical design of our conveyor system is done in CAD software, SOLIDWORKS. We have used Proteus Professional software for circuit design required for the working of the electronic components of our system. The dimensions displayed on the LCD are programmed in Arduino Sketch software using embedded C language.

2] COMPONENTS IMPLEMENTED

The main mechanical element designed is the Conveyor Belt, pulleys/wheels, and supporting frame. The different electronic components specified and implemented in the system are a transformer, a bridge rectifier, a voltage regulator, an Atmega328P microcontroller, an LCD, Ultrasonic sensors,Relays, Servo motor, DC motor, motor driver, resistors, and capacitors.

1. CONVEYOR BELT

Figure 2: Conveyor system

In modern manufacturing and logistics, the demand for speed, accuracy, and operational efficiency has led to a significant increase in the adoption of automation technologies. One of the essential tasks in many industrial settings is the sorting and categorization of objects based on their physical dimensions, such as length, width, and height. Traditionally, this process has relied heavily on manual labor or semi-automated systems, which are often time-consuming, prone to human error, and require significant manpower. To address these limitations, the integration of fully automated dimensional measurement and sorting mechanisms into conveyor belt systems has emerged as a highly effective solution. This project focuses on the design and development of an intelligent conveyor-based sorting system that utilizes advanced sensors—such as ultrasonic, infrared, or laser sensors—coupled with a microcontroller or embedded processor. These components work together to accurately measure the dimensions of each object in real time and activate actuators to sort them into designated categories. The proposed system not only enhances accuracy and speed but also reduces labor costs and improves scalability, making it ideal for real-world industrial applications such as packaging, quality control, warehousing, and logistics management.

2. CIRCUIT DESIGN

Figure3: Circuit Diagram

The ATMEGA328p microcontroller is compatible with Internet of things Development. Among other controllers ATMEGA328p having Feature & cheapest of all of them. We can easily Program It with embedded c. It is compatible with the ESP8266 Wi-Fi module. The Power supply provides voltage to the whole circuit. The ATMEGA328p microcontroller used to execute programming for working of the system.

The Ultrasonic sensors are placed to measure the height, width, and length of an object. Ultrasonic sensor sends a trigger wave towards an object and measures the dimension of an object by reflected echo from an object. DC Motors are used to rotate conveyor belt. DC motor drivers are used to control motion of motors. IOT plays important role in automation with Wi-Fi module. ESP8266 Wi-Fi module stores dimensions to cloud and then with the help of internet those dimensions are shown on mobile application.

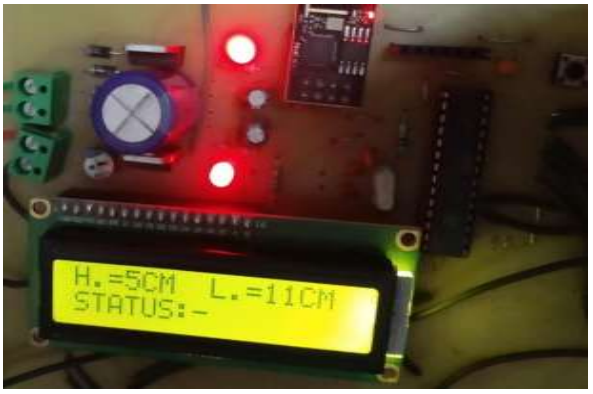

Figure 4: Output

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3] DESIGN CALCULATIONS FOR THE PROPOSEDSYSTEM

Design of belt:

Mass of one object=50g

Distance between two roller/wheels (D) = 55 cm

Diameter of roller 1(d1) =68 mm

Belt Width (B) = 100 m Thickness of belt (t) =1 mm

L = ((π/2)*d1) + ((π/2)*d2) + 2DL =1313 mm =131 cm

Mass of belt(M):

L= 1313 mm, B = 100 mm, t = 1 mm V =L*B*H

V =1313 x 100 x 1

V =1.31 x 10^5= 0.0001313 mm^3

M=ρx V=2500 x (0.0001313)=0.33 kg

Total Belt Pull (F)

Now the total vertical force applied by gear on belt conveyor

F = (Total mass of object) * (Acceleration due to gravity)

= 0.05 x 9.81

F =0.4905 N

Power required for moving conveyor belt (P)

Total power required for moving conveyor belt = belt pull * belt speed P =1.785 x 0.2136

P=0.3813watt

Hence according to these requirements, we have selected a 12V,

60 rpm DC motor for appropriate working of our system

5] *EXPERIMENTAL* WORK

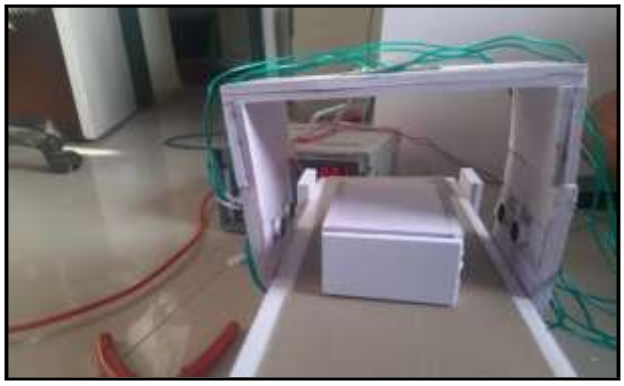

Figure 5: 3D representation of conveyor belt system

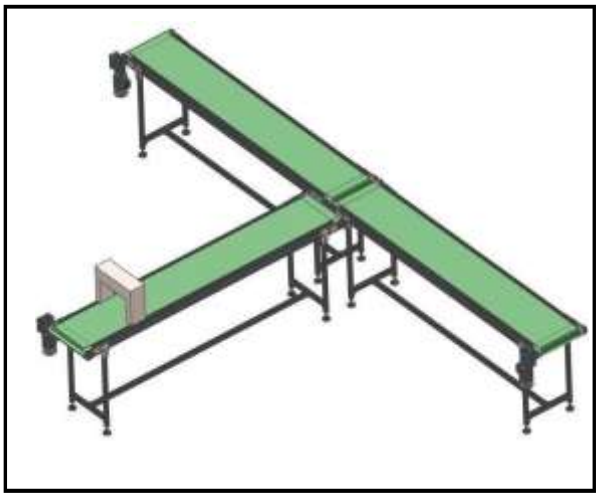

Figure 6.1: Object passing through the check box

EXPERIMENTAL RESULTS

The system can accurately measure the dimensions of an object. If the measured values don't match the specified dimensions, the diverter or separator automatically sorts the item as rejected. On the other hand, if the measurements are correct, the item passes through. This prototype takes about 3.15 seconds on average to measure two dimensions of an object—height and length. It's designed to inspect the dimensions of various lightweight objects.

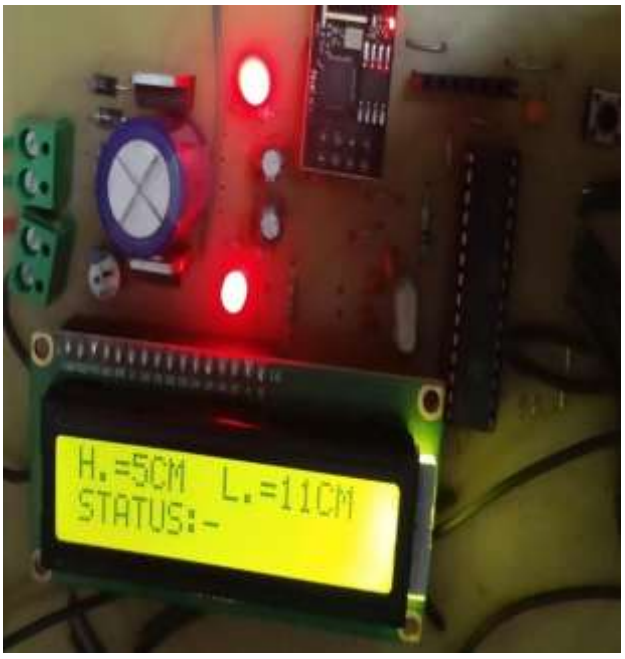

Figure 6.3: Representation of system fabrication

OBSERVATIONS

CONCLUSIONS

In conclusion, our proposed automated dimensional check conveyor system provides a significant improvement over the existing manual sorting methods. By incorporating ultrasonic sensors for precise and quick dimension checking, the system accurately classifies objects based on their size, including length, width, and height. This automated process not only reduces inspection time but also minimizes human intervention, ensuring greater efficiency and fewer errors.

REFERENCES

[1] Mr. Akshay K. Naphade1, Prof. Manish J. Deshmukh2's "Improved Automated Conveyor With Auto Separation System For Oil Packaging Industry" Volume: 04, Issue: May 2017

[2] Nasif Hassan Khan1, Deb Kumar Sarkar2, Asif Siddique3, Md. Mamunur Rahman3, Swarup Chakraborty3's "Fabrication of a Conveyor Belt with Object Sorting and Counting Facility" Issue: May 2017

[3] Prof. Nilima Bargal1, Aditya Deshpande2, Rucha Kulkarni3, Rucha Moghe4's " PLC Based Object Sorting Automation "Issue: July 2016

[4] Simran, Dr. Sangeeta Kamboj, Aditi Diwan's "Development of Automatic Sorting Belt using PLC"

Issue: August 2019

[5] Ho-min Park, Arnout Van Messem, Wesley De Neve's "Item measurement for logistics-oriented belt conveyor systems using a scenario-driven approach and automata-based control design" Issue: 2017

[6] Konakalla Naga Shri Ananth, Vaitla Rakesh, Pothamsetty Kasi Visweswarao's "Design and selecting the proper conveyor belt" Issue: 2017