

Conveyor Belt based Process Plant using ArduinoUno

Mr. Neeraj Gupta¹, Saurabh Chaudhary², Priyanka Bharti³, Randhir Kumar Yadav⁴ and Sumit Kumar Singh⁵

¹⁻⁵Ajay Kumar Garg Engineering College/Department of Electrical and Electronics, Ghaziabad, India

Email: gupta.neeraj@akgec.ac.in, priyanka1821006@akgec.ac.in

Abstract—Industry has a significant impact on a country's economy. In order to survive in today's environment, businesses must concentrate on both product quality and quantity. It is critical to moderately standardize the manufacturing of different product assortments, as well as to attain higher inclusive productivity with minimal investment and equipment. Conveyor belts are the most cost-effective strategy in the market for the aforementioned applications. They are long-lasting and dependable components that are employed in automated spreading and warehousing systems. They're defined as a labour-saving strategy that allows huge dimensions to travel quickly through a process, letting businesses to send or receive higher quantities with less storage space and labour.

Index Terms— sensor, microcontroller, automation, proteus simulation, conveyor Belt.

I. INTRODUCTION

Industries today play a critical role in both the national and international economies. Production efficiency is often seen as the key to success in today's competitive environment. Industry currently requires a great deal of automation. Many enterprises must create a variety of products in a variety of sizes. It's critical to moderately systematize the manufacturing of different assortments of items, as well as to get greater inclusive productivity with minimal investment and equipment. Automation can be defined as a technology that involves the use of mechanical, electrical, electronic, and computer-based technologies in the maneuvering and control of production in an industrial setting. Before the invention of conveyor belts, it was difficult for humans to carry the heavy loads from one place to another as it causes physical strain, musculoskeletal discomfort (MSD) and disability. A lot of time and money was wasted on giving training to the recruiters thereby reducing the productivity of the industries.

With the aforementioned issues in mind, the goal of this project is to construct an automatic object sorting machine based on color, utilizing a microcontroller and sensors, and counting the allowed ones after sorting. Both jobs are carried out on a conveyor belt.

A. Automation and Conveyor Belt

Automation is the use of machines, control systems, and information technology to increase productivity in the manufacture of goods and the delivery of services. The ideal motivation for using automation is to raise productivity and quality beyond what is currently attainable with human labour, in order to realize economies of scale and achieve expected quality standards. Automation has had a significant impact on a wide range of businesses outside of manufacturing. Precision measurement and control technologies are used in industrial automation to optimize energy-efficient motor systems. Energy efficiency in industrial processes is becoming increasingly important nowadays.

Conveyor belts are the most cost-effective strategy in the market for numerous resolutions that are computerized. Conveyors are long-lasting and dependable components used in automated warehousing and distribution. Conveyor Belt is generally used to convey material from a station to another one, particularly in flexible manufacturing system (FMS). It's defined as a labour-saving strategy that allows huge dimensions to move quickly through a process, allowing businesses to send or receive higher quantities with less storage space and less work. Belt conveyors can be used for conventional material handling, such as moving boxes about a plant, or bulk material handling, such as transferring industrial and agricultural goods, such as grain, coal, ores, and other materials, primarily in outdoor locations. Typically, organisations that supply conventional material handling belt conveyors do not provide bulk material handling belt conveyors.

A conveyor can weigh material flowing over the belt while it is in transit. Conveyor technology is also employed in other types of conveyor transportation, such as moving walkways or escalators, as well as in a variety of factory assembly lines. Conveyor belts are frequently used at check-out counters to move things. Conveyor belts are also used in ski resorts to transport skiers up the hill. Screw conveyors, vibrating conveyors, pneumatic conveyors, the moving floor system, which employs reciprocating slats to pass cargo, and the roller conveyor system, which uses a series of driven rollers to transport boxes or pallets, are among the many related conveying machines available, each with its own attitude of operation, resources, and direction of conveyance. Because they are the most versatile and least priced, belt conveyors are the most often utilized powered conveyors. Product is conveyed directly on the belt, allowing for efficient transportation of both regular and irregularly shaped products, large and tiny, light and heavy.

These conveyors should only utilize premium belting of the finest quality, as this lowers belt stretch and decreases the need for tension adjustments. Belt conveyors can deliver goods in a straight line or through elevation or direction changes. Conveyor belt systems are classified based on power supply and mechanical setup, such as pneumatic conveyor systems, vibrating conveyor systems, flexible conveyor systems, vertical conveyor systems and spiral conveyors, vertical conveyor with forks, heavy duty roller conveyors, and mechanical conveyor belt. Height sorting system is particularly beneficial for categorising objects in industry. Colour and size are the most important characteristics for exact product classification and categorization.

II. METHODOLOGY

Reviewing the project scope and study field is the initial stage prior to project implementation. The following step was to design the conveyor belt's mechanical construction. The hardware and circuitry were then implemented once all the designs had been finalized. The programming section took place at the end of the project, specifically for the sensor input, sensing process, and output to the punching mechanism's motors. Finally, various circuitry and software modifications were made in order to make the system function in finer motions (therefore, troubleshooting was done to rectify certain incorrect processes while the system was executing its task). While the whole process as shown in Fig. 01 was completed then a fully operational system had achieved.

A. Components Used

The following components are used in the project: -

- a. Microcontroller
- b. DC Motor (12 Volt)
- c. Shafts
- d. Bearing
- e. Wooden Base
- f. Rubber Belt
- g. Bread Board
- h. Connecting Wires
- i. Transistor
- j. IR Sensor
- k. Liquid Crystal Display (LCD)
- l. Battery
- m. Capacitor

B. Design Factors

The factors considered to design the project are:

- Material strength.
- Sorting time.
- Length.
- Velocity of the motors.
- Power consumed.
- Colour of the object.

C. Working Principal

Different types of motions, control systems, sensors, and power supply must be examined in order to manufacture an automatic conveyor belt with object sorting and counting capability. Initially, a wooden structure was constructed.

Following that, a circuit was built to control the conveyor belt, sorting system, and counting system's movements. As a result, there are primarily three sections to this project's construction. Mechanical, Electrical, and Controlling are the three sections.

II. FINAL SETUP

The final setup is shown below: -

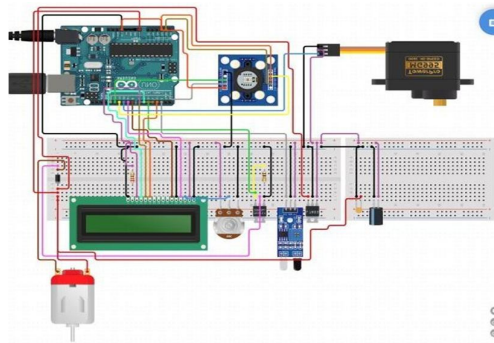


Fig.1 Simulated Circuit

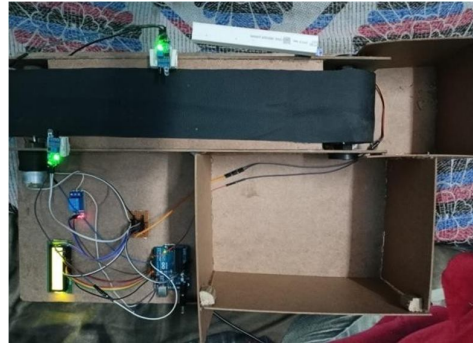


Fig.2 Hardware Model

IV. PERFORMANCE ANALYSIS

A. Applications

The sectors where the system can be implanted are described below:

- Sorting of products on the basis of their colour.
- By some modification, it can be used to sort object on the basis of height.
- In transportation of specific product to a desired place through conveyor belt.
- In different industries where huge amount of production takes place.
- Ensuring quality control in mass production.

B. Advantages

The advantages are below: -

- Less sorting time of the product.
- Lesser requirement of manpower.
- Since the whole work is completed by machine, there is less possibility of mistake.
- It can reduce cost of inspection.
- It can increase the percentage of good product.
- Conveyor belt can handle huge products with low cost at hazardous environment.

- The system is economic as the installation and running cost are low.

C. Limitations

The confines are:-

- Conveyor belt can be used for transporting heavy material at long distance, but the project has designed considering light weight and small distance.
- The sorting machine will only be able to sort the products according to their colour

D. Cost Analysis

The basic components and corresponding approximate prices are listed below:

TABLE I. COST ANALYSIS OF THE COMPONENTS

COMPONENTS	PRICE
Arduino Uno	530
DC Geared motor	380
LCD(16*2)	160
Servo motor	140
Pre wheels	120
Infrared sensor	100
Relay	90
PCB board	20

E. Future Development

Effectiveness of this project can be improved by the following recommendations:

- The limited motor power limits the mechanical structure so a heavy structure can be obtained by increasing power, to have more effective power and smarter look.
- Sorting based on other factors can be done through some modification.
- Sorting can be done more precisely by improving the sensor quality.
- Decreasing time delay, one can make the process fast.

V. CONCLUSION

In today's hyper-competitive world, industries must be well-equipped. The management of a production's highly integrity supply chain, from raw material to finished product, through quality manufacturing, is critical. Automation is necessary to speed up the process while maintaining product quality. It is necessary to introduce automated production processes. It is critical to include a wide range of products in terms of shape, size, and colour. An industry may quickly sort the required product according to its colour, transport them to the appropriate destination, and count them by implementing the concept of this project. Though it has some restrictions, this concept can be applied to a wide range of applications with simple modification.

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