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Smart In-Line Inspection System

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Abstract: ***The goal of this paper is to propose an automatic system to assert the dimensional (length) accuracy of a product and the rejection of the defective products. Use of IR sensor is used to cause detection of object. after arrival of project then the motor starts running and as well as start conveyor belt. A laser is used which cuts the product and hence the system knows when the product would pass through the camera. The camera then clicks the image of each product and then compares with the image of the product with the actual dimensions. In this way a defective product can be easily identified after which it is removed from the production line with the help of a pneumatic cylinder.***

Keywords: Dimensional accuracy, Automation, Motor, Micro Controller, IR Sensor, Camera and Conveyer belt.

I. INTRODUCTION

It is the era of science and technology. Now a days people are making new inventions for their day to day uses. They want comfort, but not high cost of quality. So man thinks of something new which is easy to use but in the same time it can prove itself useful. Nowadays important role in the national economy of India is being played by industries .So it is very important for an industry to maintain the range. Keeping this consideration this paper published a method which would be very useful for industries. The scope quality of the product they produce. At the same time it is also a curse for an industry if their product is not accepted by the customers. Many industries need to produce various types of product at various types of of this method is huge in modern manufacturing industries. It gives knowledge about the different branches of science and technology. Two sectors of engineering science are widely used to take place this idea.

They are-

1) Mechanical Engineering
2) Electrical and Electronic Engineering

II. AUTOMATION

Automation is the use of control systems such as numerical control, programmable logic and other industrial control systems, in concern with other application of information technologies such as computer aided technologies CAD, CAM, to control industry or industrial machineries and industrial process or processes, reducing the need for human intervention.

A. Automation Tools

Automation tools engineers can now have numerical control over automated tools. Computer-aided technologies (or CAX) now serve the basis for mathematical and organizational tools used to create complex systems. Important examples of CAX include Computer-aided design (CAD software) and Computer- aided manufacturing (CAM software).The enhanced design, analysis, and manufacture of products enabled by CAX have been beneficial for industry. Together information and technology with industrial machinery and processes, can assist in the design, implementation, and monitoring of control systems. One applications of an industrial control system is a programmable logic controller (PLC). PLCs are specialized hardened computers which are normally used to synchronize the flow of inputs from (physical) sensors and events with the flow of outputs to actuators . Human-machine interfaces (HMI) or computer human interfaces (CHI), formerly known as man- machine configuration, are usually employed to communicate with PLCs and other computers.

Different types of automation tools exi

1) ANN - Artificial neural network
2) DCS - Distributed Control System
3) SCADA - Supervisory Control and Data Acquisition
4) PLC - Programmable Logic Controller etc.

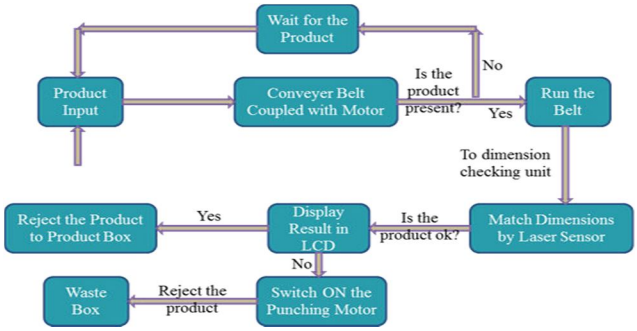
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B. Advantages of Automation Compared to Manual

1) It is used to avoid human errors.
2) By using automation it reduces the testing lifecycle with respective to time.
3) We get more reliable result.
4) Man power is reduced .

III. WORKING PRINCIPLE

The target of this model is to assert the dimensional (length) accuracy of a product and the rejection of the defective products. For this, first of all an IR sensor is being used which will detect the presence of the object. When a product is arrival then the motor starts running and so as the conveyor belt. As the product is on the conveyor belt, due to the movement of the belt it moves forward. The LASER cut the object surface. As a result, the counter is ON and starts counting time. After a while, the LASER cuts the LDR (light depending resistor). So the counter is OFF and stops counting time. This time is calculated and is compared with the time which was set earlier knowing that how much time the product will be in contact with the laser. From this a decision comes whether the length of the product is right or wrong. If the length of the product is correct then it is allowed to pass through. At the end of the system there is a sensor which will detect whether the product is passed or not. If the product moved then the motor stops running and will wait for the arrival of the new product on the other hand if the product is found defective (wrong length) then another sensor will ensure the arrival of the defective product in the rejection zone. Then the rejection motor will start and will reject the defective product from the conveyor belt.



A. Block Diagram of the Working Principle

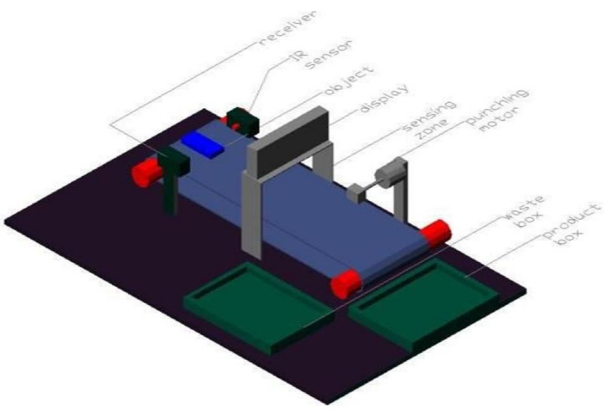
A block diagram of the working principle has been shown in Figure 1. From this diagram it is clear that when a product is reached to the detection zone its length is measured with the help of IR sensor. If the length of the product is accurate it is shown in the LCD display and the product is moved to the product box by the movement of conveyor belt and if the length is wrong then it is dumped to the waste box by means of a punching motor.

IV. DETAILS OF THE DESIGNED

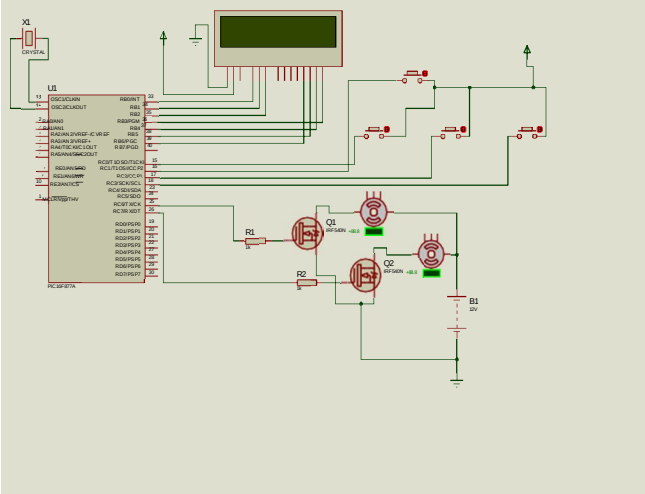
The detail of the model is presented below step by step:

A. CAD Model of the System

A three dimensional CAD model, showing different mechanical component of the designed model.



B. Circuit Diagram of the Designed Model



The connection diagram of the control system of the proposed model is shown above in Figure 3. A PIC-16F877A microprocessor is used to control the system. LCD display shows the status of the product. IR sensor is used for the detection purpose and two stepper motors are used as actuator. For the ease of operation some switching devices are also used.

C. Programming Language

To program the microprocessor PYTHON platform is used.

V. RESULT

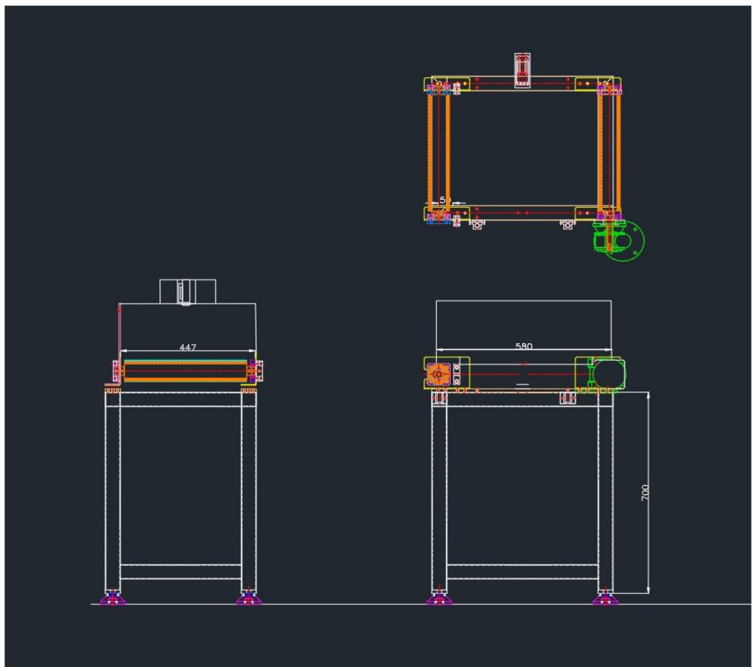


Figure 4: The 2D view of the Smart in-line system .

The dimensional accuracy assertion system can measure the length of the product accurately. And based on this measurement can also take the decision whether to pass a product to the product box or dump it to the waste box.

VI. FUTURE SCOPE AND RECOMMENDATION

1) The developed dimensional accuracy assertion system can measure the length and height of the product. If more sensors are used then it will be possible to measure more dimensions such as width.

2) In order to manufacture accurate products rapidly, there is no alternative of a dimensional accuracy assertion system in the production line. For this cause if a large scale production of dimensional accuracy assertion system is possible then the price of this product will be cheaper than present manufacturing cost. Due to its simple mechanical design and use of available sensors in the market it will be cheaper.

3) For more precise and accurate dimensional accuracy , more accurate structure could be designed.

4) Steps can be taken to mesh the teeth of the pinion and the timing belt perfectly to avoid the slipping of conveyor belt and get more precise performance.

5) For actual industrial application Limit switches can be used in replace of sensors and pressure coil or pneumatic system can be used to remove the rejected product from the conveyor belt.

6) The response time of electromechanical system is relatively fast. But it can be made faster by using industrial grade motor. The microcontroller and motor used nowadays developed dimensional accuracy assertion system are properly synchronized. When the industrial grade motor will be used, then the system should be synchronized to perform smoothly and in a faster way.

VII. CONCLUSION

In today's highly competitive global world, the management of the integrity of the supply of a product from raw material to delivered finished product, through quality manufacturing is of paramount importance. For the declaration of a product high quality, dimensional accuracy assertion is a must. So our developed model of Smart Inline Inspection System is an excellent one because of its working principle and wide implementation. By applying the idea of this model an industry can easily sort the required product according to its demand. Though it has some limitations, but by having done some modification this concept can be implemented in a wide range of application.

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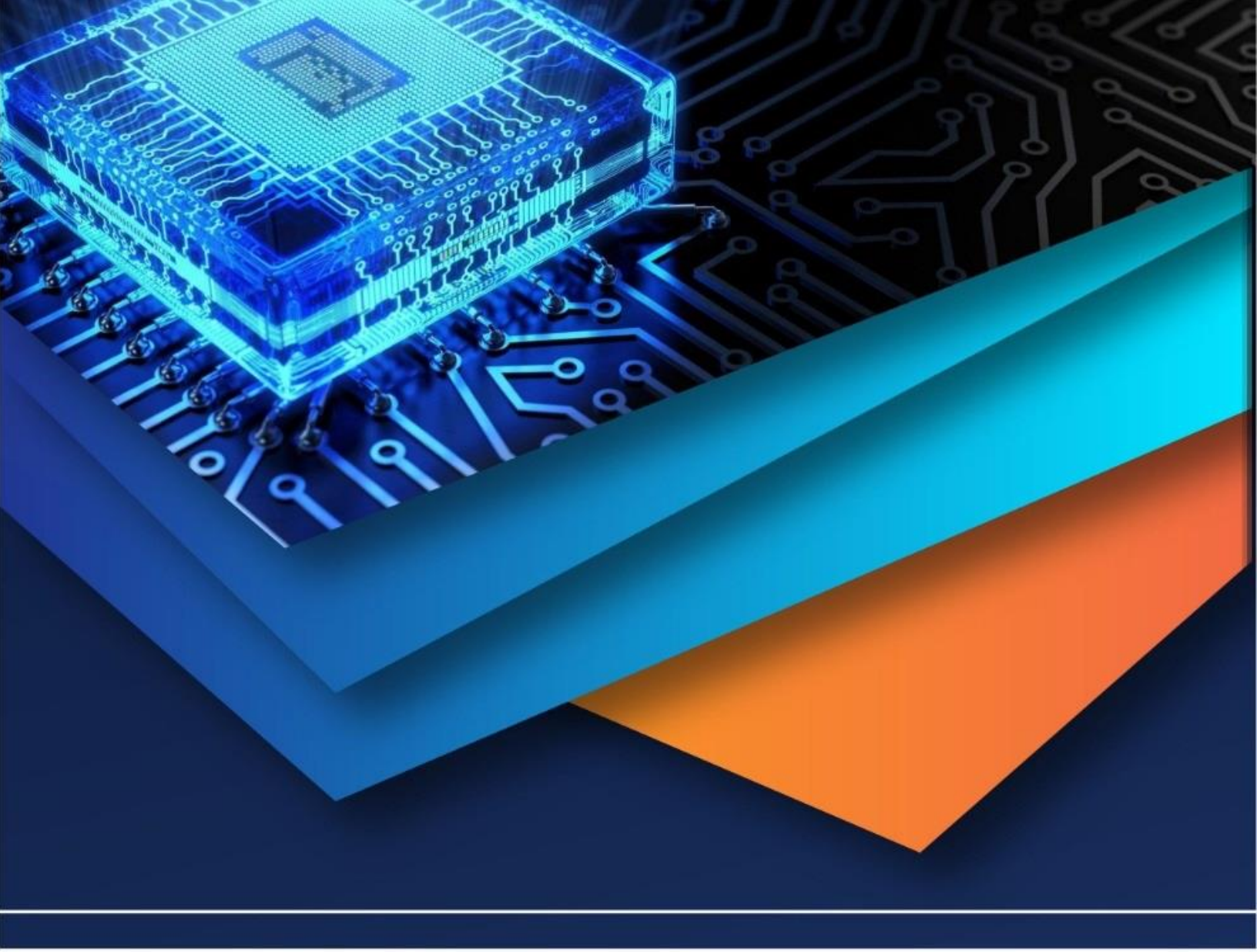
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