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A Model Scale Real-Time Sorting and Monitoring Production Line System with The Integration of Labview Gui

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Abstract: The main purpose of this project is to provide exposure to the automated process of simulation and theory to compile products among students who are studying in the engineering field. The main research objectives are to design a Model Scale Real Time Autonomous Process Control for Production Line System with the integration of LabVIEW GUI [2] and the scopes of study is will place Lego as the product that moving material on conveyor line. Materials will use camera, servo, dc motor, Arduino, conveyor, IR sensor and a type C metal as the main mechanism, and Labview platform will utilized to obtain the image to analyze and an Arduino hardware to control the output actuator. In the finding output result, performance of image capturing affecting effectiveness sorted product. Emphasizing automated system or process flow can achieve high product quality output beside low time consume and low cost invest in a manufacturing business.

Keywords: Conveyor System, Sorting, Camera Sensor, Autonomous Sorting Production Line, Color Sorting, Defect Sorting

1. Introduction

Most production lines in this sector consist of large, fast machines that perform specific tasks under the direction of an effective control system. The main goal of this project is to familiarize students studying in the field of engineering with the automated process of simulation and theory for creating products. The process design represents a prototype simulation of a production system. This project focuses on the development of a model-scale autonomous process control for the production line system for sorting defective products, more specifically, this project will develop an automated sorting of LEGOs products. The goal is to develop a technique that combines LabVIEW software technologies with the Arduino to control the sorting and defect process flow.

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2. Materials and Methods

This subsection describes the methods and materials used in this project. All information is collected that relates to the process flow, block diagram, software, and hardware used to create the system flow diagram.

2.1 Materials

In this project, the process of sorting objects is shown, which can be monitored, and the sorted product is analyzed as data output, which can be done simultaneously during the process using Labview software. From here, the machine provides feedback to the developer to analyze and capture the data output for manipulation of the sorted product. In addition, the user has the ability to make a special request in real time during the production process to process the products output from the developer. Another way to achieve the goal of this project, which is the main aspect, is monitoring and the analyzed object. A Labview platform will be used to obtain the image to be analyzed, and a coding program will use Arduino software and hardware to control the output actuator. Data can be collected from the input of the Labview interface and the output of the actual machine process. The components and software used in this project are presented below:Arduino Uno Microcontroller

- Labview Software
- Servo SG90 Micro servo
- Dc motor
- Motor Driver L298N
- Infrared (IR) sensor Module with Arduino
- Power supply Adapter AC to DC 9V 2A
- Camera USB 5V
- Belting seatbelt
- Fishing reel Ball Bearing 9mm*14mm*3mm

In this project, there are three input devices used to identify the size and color of the Lego, and another to identify defective objects. The sensor input sends a signal to the Arduino to control the two types of outputs, which consist of the DC motor and a servo motor. In this section, several servos are used; there are servos that push red, green, and blue Legos into the same box as the Lego color. Meanwhile, a Labview controller [2] determines the size and defect of the Lego and sends a signal to the Arduino for the next process output. Figure 1 below shows the block diagram of Lego sorting and color sorting.

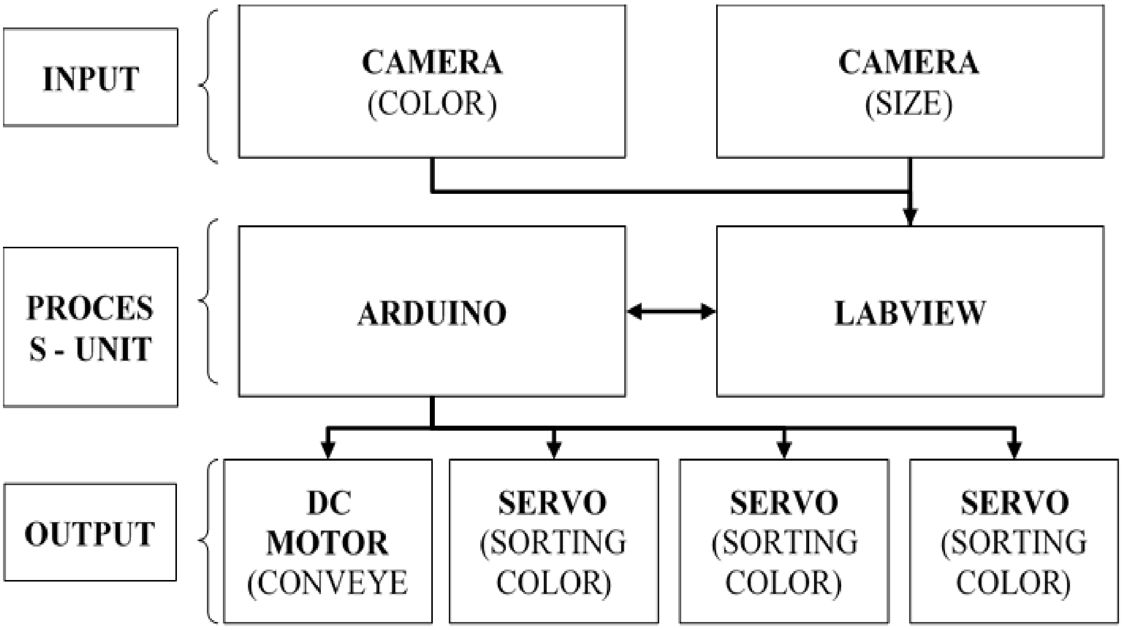

Figure 1: Block Diagram Lego size and Color

2.2 Methods

Figure 2 below is the flowchart Lego Sorting Color and Size that the program starts with the Lego's identified by a camera to detect defective objects and if the defective Lego presents a servo, the defective Lego is pushed out the defect box. If the Lego is in good condition, the conveyor belt moves the Lego to the next section where another camera sensor detects the color of the Legos. A servo takes care of the color separation. And this servo is attached to the conveyor line to separate three types of colors green, blue and yellow.

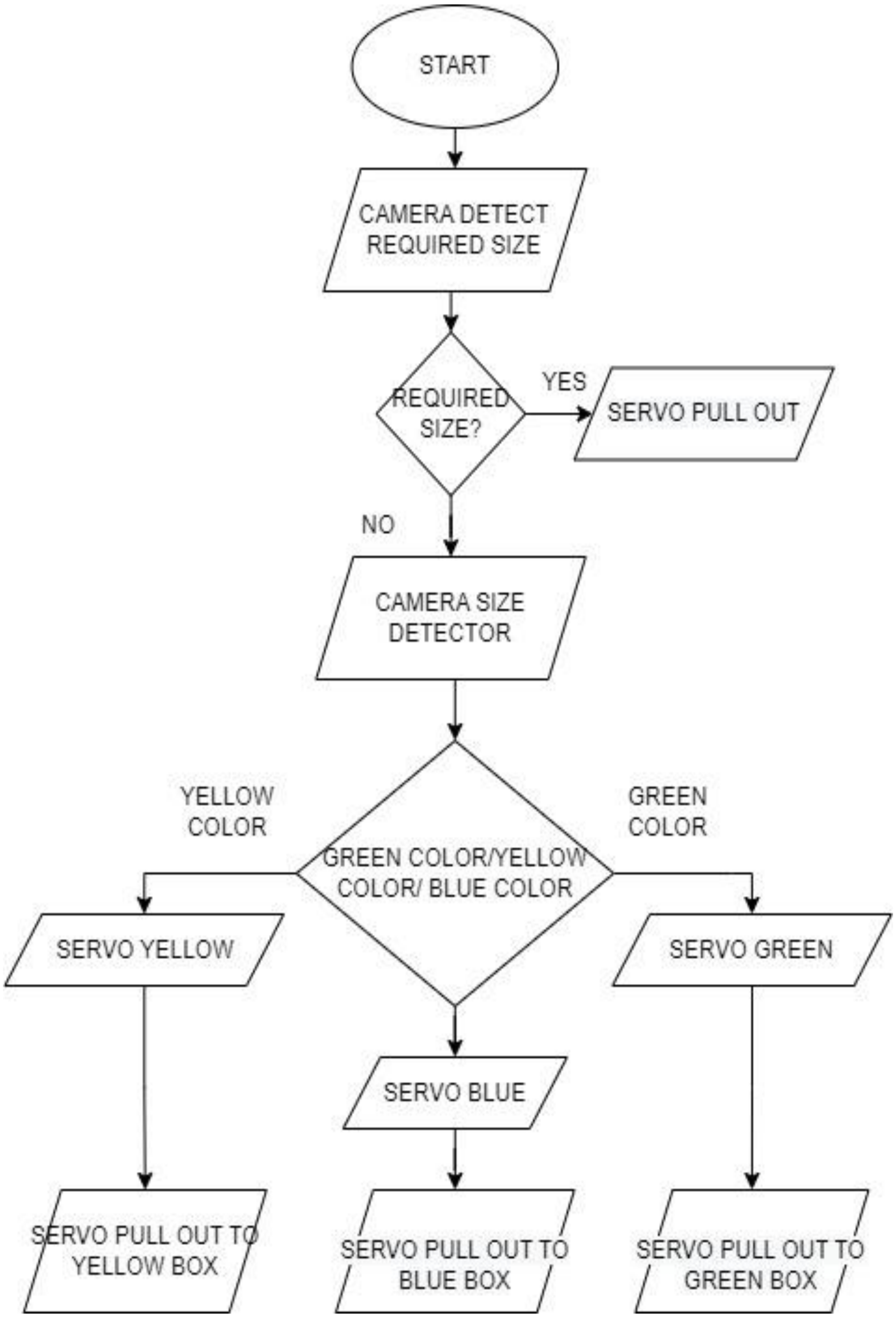

Figure 2: Flowchart Lego Sorting Color and Size

3. Results and Discussion

This subsection presents the data and analysis of the results and observations. The results and observations are from several experiments that were recorded. The goal of the project is to develop a model automated conveyor system for different types of objects in different shapes and colors. Secondly, to develop a model autonomous real-time process control system with graphical user interface (GUI) for a production line system with Labview intergration. Finally, the performance of the developed system shall be evaluated in terms of real-time monitoring, control and analysis. The result will be presented in tabular form to facilitate data output and analysis.

3.1 Project Layout

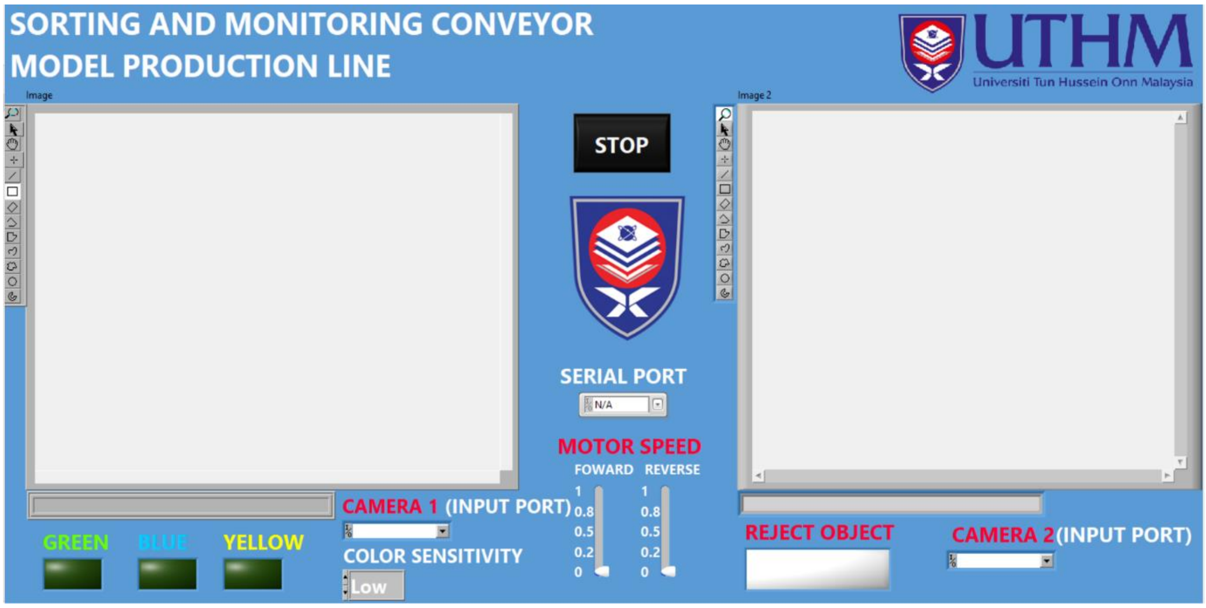

Figure 3: Labview Front Panel

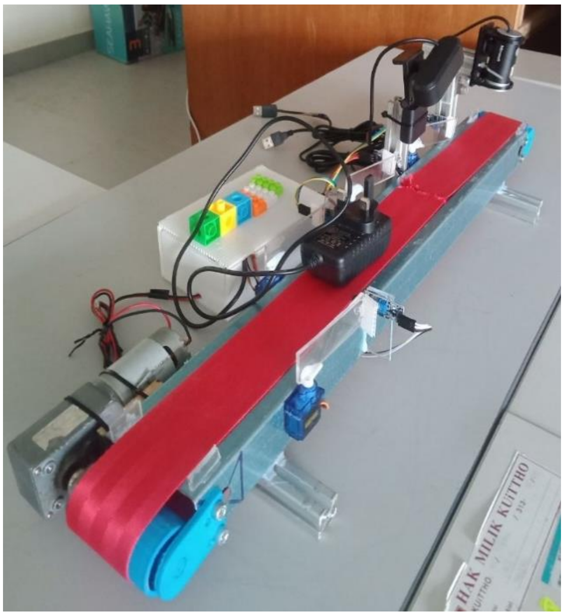

Figure 4: 3D view of the model scale

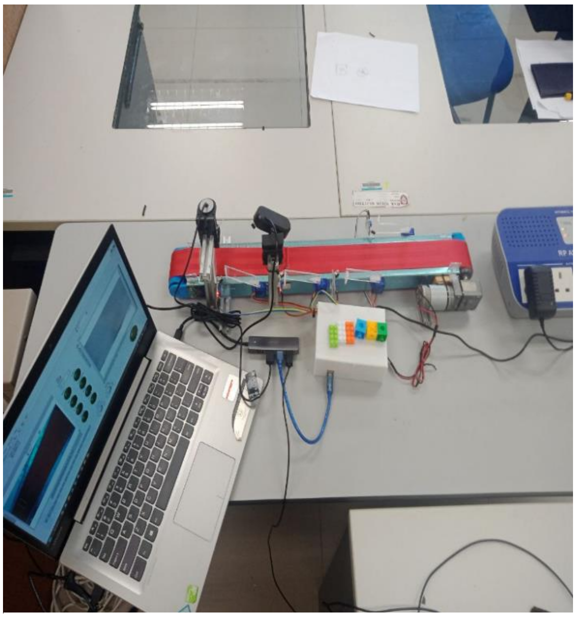

Figure 5: Model scale with GUI control Panel

The figure above shows the layout of the model project and the graphical user interface (GUI) control panel. Figure 3 is the graphical user interface (GUI) of the monitoring system for sorting process control panel. The actual model scale is shown in Figure 4. The system will run simultaneously with the GUI control panel and the model scale, as shown in Figure 5.

3.1 Results and discussion

The sorted lego is determined as the output data, the process flow is tested several times to get the reliable data as long as the efficiency is given. The data can be categorized in a table.

Table 1 : Data Output Sorted Lego

Process	Yellow Lego	Blue Lego	Green Lego	Reject Lego	Reliability (%)
1st	Unsorted	Sorted	Sorted	Unsorted	50
2nd	Sorted	Sorted	Sorted	Sorted	100
3thd	Sorted	Sorted	Sorted	Sorted	100
4thd	Sorted	Sorted	Sorted	Sorted	100
5fth	Unsorted	Sorted	Sorted	Sorted	75
Overall Efficiency					85

The above table shows the test of output data for five processes in one time, the total efficiency of the process is 85 percent. For the first and fifth processes, the desired output condition is incomplete. The problem responsible for the incomplete data output is mainly in the acquisition of images from the camera sensor. The unsorted product occurs when the camera sensor is surrounded by low light conditions. Each camera has its own quality specification, in this project the camera sensor is a webcam camera with a resolution of 640x480 and a frame rate of 25 per second. The time of data acquisition image from the lens of the camera can affect the detection of the color and the size of the product. In addition, the speed of the rolling tape affects the image capture for one second time. The speed DC motor will use the digital input signal, where the scale range of speed is between 0 to 1 voltage. If the input signal is 1 volt, the motor will run at maximum speed. However, the sorting process cannot run at maximum conveyor speed because the product is moving so fast that the camera sensor cannot detect the product. The product can be successfully sorted when the conveyor speed is optimal, i.e., in the range of 0.2 to 0.3 volts input to the motor driver. Apart from this, a less efficient mechanism also affects the movement of items from one place to another. A well-functioning mechanism in the sorting drive enables the complete process of sorting objects.

4. Conclusion

As a conclusion for the development of this project, it is pointed out the problem that the existing methods are still not present in most industrial processes, especially in assembly, where the majority of industry still uses traditional assembly line processes and manual work processes. In addition to the cost, the lack of technology makes it difficult to adopt the new strategy in the business models of the connected industries. This project collects all the problems and gives an idea to solve them by combining the advantages of the new technology with a new platform system program. This project idea is still reliable for implementation in the production system. It provides more opportunities to achieve cost-effective and time-saving production. The automation system brings more advantages than the traditional system.

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