Type of the paper (article or review)

DESIGN COLOR SORTING WITH CONVEYOR AND ROBOT ARM USING LEGO MINDSTROOM NXT

[a]Yudhi Gunardi, [b]Jumadri JN

[a] *Universitas Mercu Buana, Jakarta, Indonesia*
[b] *Universitas Batam, Batam, Indonesia*

** Corresponding author*: yudhi.gunardi@mercubuana.ac.id

Abstract: Lego Mindstroom's education robot is an interactive robot because it can be used to design various kinds of robot applications. This robot can be used to design sorting robots before they are applied to real robots.
Many sorting techniques are in the form of colorful objects, but only for one-time sorting. This research will design and implement a color sorting robot with 2 detection stages, namely the conveyor and the robot arm, the initial sorting is carried out by the conveyor for sorting color objects, the next sorting uses the robot arm. to move the selected color object to a place that matches the desired color.
The final results obtained in sorting color objects using 1 color sensor and Bluetooth for communication between the conveyor and the robot arm via Bluetooth works well where three objects in red, blue and green can be moved according to the desired color object.
Keywords: color sorting, robot arm, conveyor, Lego Mindstorm

Manuscript received: date; Accepted: date; Published: date

© 2020. IJATEC-IRIS. All rights reserved

1. Introduction

The development of robot technology is very rapid, marked by advances in robot intelligence, robot intelligence is determined by the robot's ability to work optimally. Robot intelligence supporting tools in the form of sensors and actuators. Sensors are part of the robot that functions to receive information signals from the environment and forward them to the processor. Meanwhile, the actuator is the part of the robot that is used to perform the action ordered by the control unit.
One of the industrial applications is a color object sorting robot, many workers who when sorting will feel tired, causing errors in sorting objects, for this reason, robot technology can help humans to work continuously without experiencing errors.

Currently, a lot of research is being done, especially in the field of sorting objects by color, arm robot control using genetic algorithm methods used for logistics and scheduling [1], robot control simulation and dual arm design using matlab simulation [2], arm robot control using image algorithms used for logistics and scheduling [3], arm robot control using matlab simulation [4], robot arm control using voice [5].

LEGO Mindstroom's education robot is an interactive robot because it can be used to design various kinds of robot applications such as Nxt robot design for robot movement with front-wheel rotation of bicycle tires [6], telling the development technology of the robot nxt [7] 8-10], Designing the lego nxt robot movement using fuzzy method for wheeled robot [8], and application for robot using NXT lego midstrom [9-12].

Therefore the lego mindstroom robot is an interactive robot because it can be used to design various kinds of robot applications, in this research the lego robot is used to design a sorting robot with 2 detection stages, namely the conveyor and the robot arm, initial sorting is carried out by the conveyor for sorting color objects. , the next sorting uses the robot arm to move the object of the selected color to a place that matches the desired color by using 1 color sensor that is shared by the conveyor and the robot arm where the sensor will provide information to the conveyor and the robot arm using Bluetooth.

2. Working Principle

The working principle of the robot that I made is the Lego Mindstorm NXT robot that uses a conveyor and arm robot work system. For how the conveyor works, it functions to carry boxes and sort them with a color sensor to separate the red, green and blue boxes. Then after the box is separated and enters the container according to the predetermined color, then the arm robot works by transporting and moving the box to the final container that also matches the color of the box.

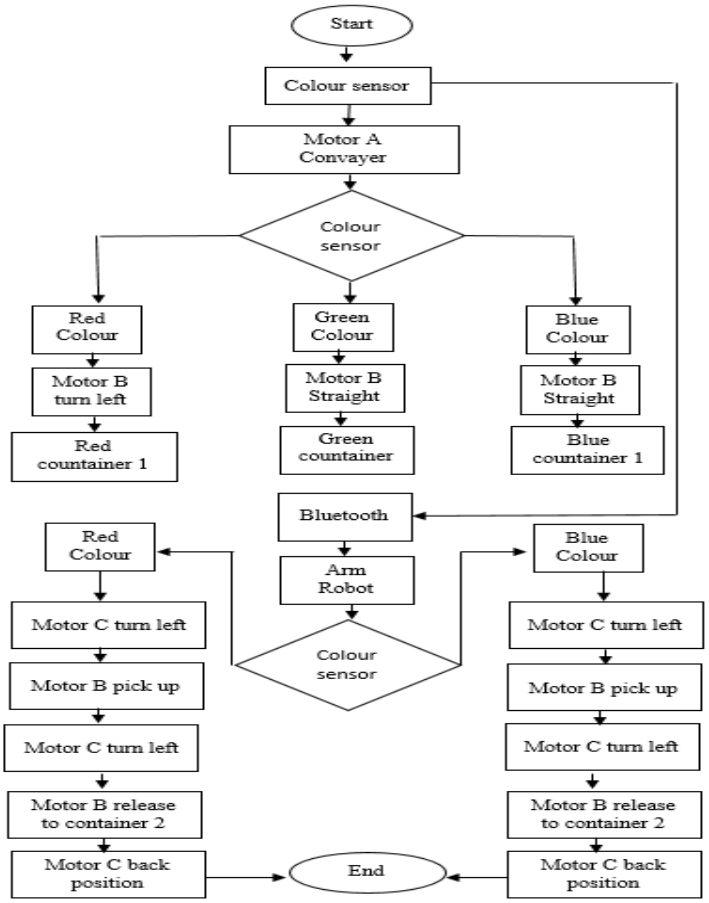


Figure 1. flowchart of how the conveyor robot & arm robot works

3. Program Arm Robot and Robot Conveyor

NXT-G program. Where the program uses the icons that have been provided, we only need to arrange them according to the program we want. We also usually use mathematical logic in compiling the program.



Figure 2. Robot Arm Program

Number 1, 16 is Bluetooth, number 2 - 30 is the setting of the motor robot arm motion

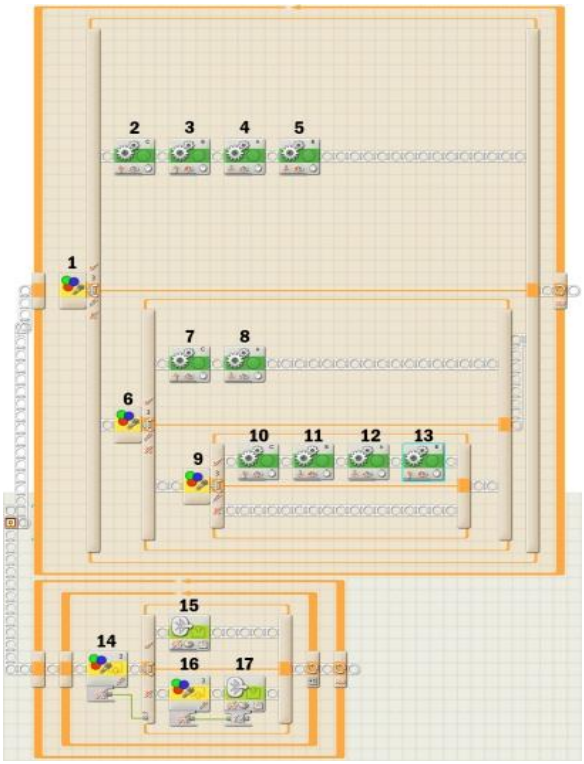


Figure 3. Conveyor Robot Program

Numbers 1, 6, 9, 14, 16 are color sensors, numbers 15 and 17 are bluetooth, while numbers 2, 3, 4, 5, 7, 8, 10, 11, 12, 13 are the motor programming process at the converter up to 13 are programs DC motor used for convayer movement

4. Result and discuss

For the simulation arena, an activity map is made as follows:

a. There are 3 places for goods consisting of 3 baskets in blue, green and red
b. Item transfer occurs when the item is red and blue which will be moved to another location by the robot arm according to the color of the item.
c. Green items are not moved

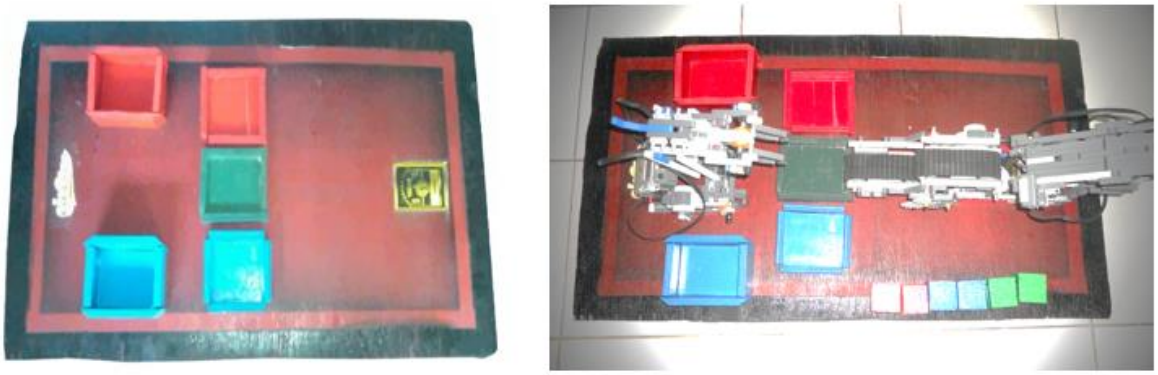


Figure 4. Design arena

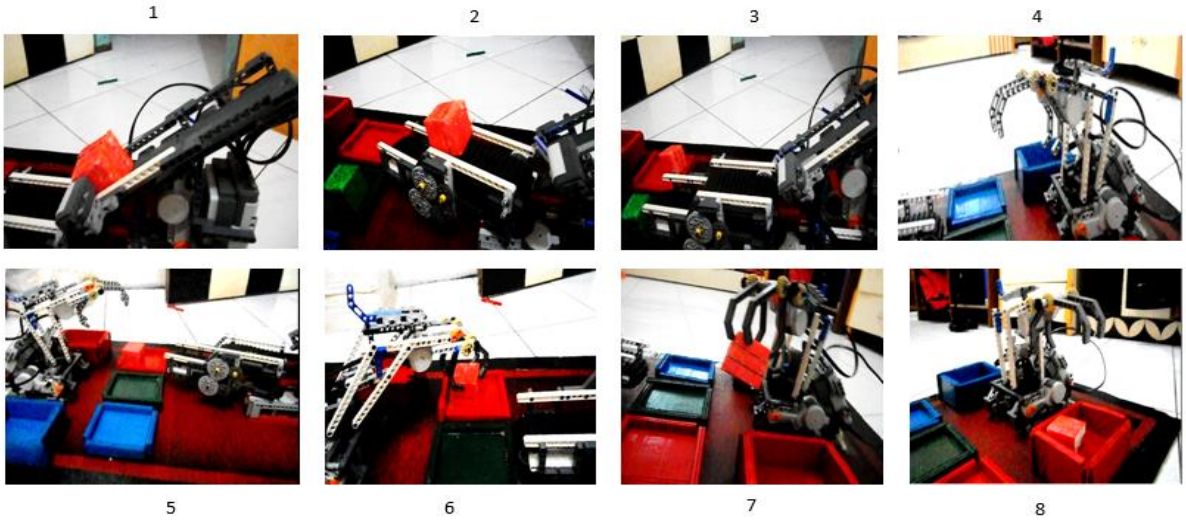


Figure 5. The red sorting process on a conveyor

In the above process the convayer will move to the red 1 contaener after receiving instructions from the color sensor, when the color detection is successful, the color sensor will send information via bluetooth to the robot arm to go to red to pick up a red object and move it to the container 2. The same process When the blue object occurs, the blue object is moved from container 1 to container 2.On the green object, the transfer occurs only on counter 1.

Table 1 conveyor motion

CONVEYOR		
Colour	Sign	Information
red	√	Succes to container 1
green	√	Succes to container 2
blue	√	Succes to container 3

Table 2. Arm Robot motion

ARM ROBOT		
Colour	Sign	Information
red	√	Succes to container 2
blue	√	Succes to container 3

Table 3. Sensor Colour

Sensor Colour		
Colour	Sign	Information
red	√	detect
green	√	detect
blue	√	detect

Table 4. Communication Sensor Colour + bluetooth

Sensor Colour + bluetooth		
Colour	Sign	Information
red	√	detect
green	√	detect
blue	√	detect

5. Conclusion

Based on the results of testing and analysis that have been described in the previous chapter, the following conclusions can be drawn:

From testing the sensors used, it can be concluded that the sensors used for this Lego robot are working well. Like a color sensor that can detect colors and sort them. Like a conveyor robot reading red, green and blue colors to sort boxes and carry boxes to the initial container. Besides, the robot arm can also move the red and blue boxes from the initial container to the final container as well as communication between the color sensor and Bluetooth.

References:

[1] S. Harun and M. F. Ibrahim, "A genetic algorithm based task scheduling system for logistics service robots," *Bull. Electr. Eng. Informatics*, vol. 8, no. 1, pp. 206–213, 2019.
[2] B. Liu, "Design and Analysis of Dual-arm SCARA Robot Based on Stereo Simulation and 3D Modeling," *2018 IEEE Int. Conf. Inf. Autom.*, no. August, pp. 1233–1237, 2018.
[3] K. Hwang, J. Lee, A. I. Base, and V. Servoing, "Intelligent Image Base Visual Servoing controller for Robot Arm," *IEEE Conf. Intell. Transp. Syst. Proceedings, ITSC*, pp. 33–34, 2017.
[4] K. A. Gouda and K. A. Bozed, "Kinematics Analysis and Simulation of a Robotic Arm using MATLAB 3 2," in *Proceedings 2016 4th International Connce on Control Engineering & Information Technology (CElT -2016) 16-18 December 2016 - Hammamet, Tunisia Kinematics*, 2016, no. December, pp. 16–18.
[5] C. Wang, "Voice control dual arm robot based on ROS system," in *Proceedings of the 2018 IEEE International Conference on Intelligence and Safety for Robotics Shenyang, China, August 24-27, 2018*, 2018, pp. 232–237.
[6] C. Budaciu and L. Apostol, "Dynamic Analysis and Control of Lego Mindstorms NXT Bicycle," in *2016 20th International Conference on System Theory, Control and Computing (ICSTCC), October 13-15, Sinaia, Romania Dyn*, 2016, pp. 145–149.
[7] K. Poikselk, "Evolutionary Robotics on Lego NXT Platform," in *lligence 2015 IEEE 27th International Conference on Tools with Artificial Intelligence Evolutionary*, 2015.
[8] N. F. J. and N. M. A. G. M. A. AKMAL, "fuzzy logic controller for two wheeled ev3 lego robot," *IEEE Conf. Syst. Process Control (ICSPC 2017)*, December, pp. 15–17, 2017.
[9] Nursyswanti. Dwi Maya and Astuti, Dian Widi, "Perancangan aplikasi *mobile remote control* berbasis android pada robot lego *mindstorms* nxt 2.0", Jurnal Teknologi Elektro, Universitas Mercu Buana Vol.6 No.3 Desember 2015.
[10] Adriansyah, Andi, "Sistem multi-robot dengan nxt mindstorms robot menggunakan bluetooth", Jurnal sinergi, vol 17, no.3, 2013.
[11] C. Lapusan, O. Hancu, C. Rad, L. Dache, and V. Maties, "Integrated learning platform based on Lego NXT and Matlab for teaching mechatronics," in *ECAI 2016 - International Conference – 8th Edition Electronics, Computers and Artificial Intelligence 30 June -02 July, 2016, Ploiesti, ROMÂNIA*, 2016.
[12] J. Felipe, M. Lee, U. Quindío, J. A. Buitrago, and U. Quindío, "Map generation and localization for a LEGO NXT robot," in *2015 15th International Conference on Control, Automation and Systems (ICCAS 2015)*, 2015, pp. 6–10.