WHEELED ROBOT WITH ARDUBLOCK PROGRAMMING FOR ELEMENTARY SCHOOL STUDENTS

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WHEELED ROBOT WITH ARDUBLOCK PROGRAMMING FOR ELEMENTARY SCHOOL STUDENTS

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ABSTRACT

Robotics technology can be implemented into the elementary school curriculum with the presence of extracurricular robotics or better as robotics only. Robotics in students is taught to assemble and program simple robots packaged in robotics learning media. Robotics activities basically use wheelled robots but have different functions. With the basic assumption of the robot, we can reduce the cost of procurement by making a robot with one wheel but with various functions. The wheeled robot is portable, so it is easy to disassemble. Robotics activities in generaly uses an Arduino controller with the C programming language. Elementary school students have difficulty understanding the language. Ardublock as one of the easy and open-source solutions. This research focused on the working system of a wheeled robot with various features (line tracer, transporter, and wall tracking) as well as the success in using ardublock logic as the programming language of the robot. The results test show that the ardublock program can be used to program the Arduino controller on the robot. The wheeled robot with the line follower feature recorded a travel time of 6.0 seconds on a 200cm trajectory. The wheeled robot with a transporter feature on a 200 cm trajectory takes an average of 8.9 seconds with the success of lifting objects 7 times out of 10 attempts.

Keywords: *extracurricular robotics; ardublock; wheeled robot; line follower robot; transporter robot*

1. INTRODUCTION

Robots are the result of today's technology. Robotics technology can be implemented into the elementary school curriculum with extracurricular robotics or better known as robotics. There are three objectives of robotics extracurricular in elementary school, namely: motorically to provide students with basic robotics skills from an early age; cognitively as the implementation of the Thematic and Science knowledge that has been obtained by students; affectively builds the spirit of teamwork in completing the manufacture of robots. Robotics extracurriculars often get information to take part in robotics competitions at the elementary school level. The competition purpose is to increase the experience and competitiveness of students in the field of robotics between elementary schools. The competition categories held in general are line tracer and transporter.

The types of robots in the competition category are studied in robotics activities. In robotics students are study to assemble and program simple robots packaged in robotics learning media. Robotics learning media is a complete package of learning media with technology that can help achieve student future success, so the media needs to be integrated with the school curriculum [1]. In a previous study, the application module for learning robotics logic for elementary school students, using the AT89s51 microcontroller and C programming language as the program [2]. Two-wheel drive robot as a robotic learning medium for SMA 05 BARU students, using Arduino Uno controller and C programming language as the program [3]. Educational robot model using Arduino programming with m-Block language [4].

Robotics activities basically use wheeled robots but have different functions. With the basic assumption of the robot, we can reduce the cost of procurement by making a robot with one wheel but with various functions. The function of the wheeled robot is portable, so it is easy to disassemble. In general, robotics for robotics activities uses an Arduino controller with the C programming language. Elementary school students have difficulty understanding logic in C programming language, but if it is explained using simple logic students will be easy to understand. Robotic logic will be easy to understand if you use visual programming with drag and drop so it doesn't require a long narrative. Ardublock

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as one of the easy and open-source solutions. Ardublock programming with an Arduino controller that uses the drag and drop program instruction facility so that the programming logic can be easily used and understood by elementary school students.[5][6][7]

This research focuses on the wheeled robot system with various features (line tracer, transporter, and wall tracking) as well as the success in using ardublock logic as the programming language of the robot. Measurement of success using a wheeled robot test method with line follower and transporter robot functions, so that the measurement results of each robot experiment can be obtained.

2. ROBOTICS LEARNING AND ARDUBLOCK PROGRAMMING

2.1 Robotics Learning

Robotics technology can be implemented into the primary school curriculum with extracurricular robotics. The purpose of the study robotics in primary school, there are three, namely: by motor providing basic skills to students of robotics from an early age; cognitively as the implementation of the Thematic and Science knowledge that has been obtained by students; affectively builds the spirit of teamwork in completing the manufacture of robots. elementary school students who follow extracurricular robotics comes from Grade 4, 5 and 6 with the aim that students already have the ability to program the robot logic.

Robotics activities often get an offer to participate in a robotics competition from outside the school. Each participating school is encouraged to continue to hone its abilities. Category competition held in general is a line tracer and transporters. Starting from stringing the framework of a robot, the robot adds features that will be used (line tracer and transporters) stringing wiring system, and the last one to enter the program.

2.2 Arduino

Arduino is a controller with an open-source platform generally used to create electronic projects. Arduino consists of a programmable board and software to run the controller. The microcontroller used is an AVR product from Intel. Some of the microcontrollers used are ATMega168, ATMega328 and ATMega2560, depending on the type of board used. On the Arduino Uno using the ATMega328 micro controller this board has 14 digital input or output pins (of which 6 can be used as PWM), 6 analog inputs, 16 MHz Crystal oscillator, USB connection, power jack reset button. These pins contain everything needed to support the microcontroller, just connect it to a computer with a USB cable or a voltage source can be obtained from an AC-DC adapter or battery to use it[8].

2.3 Ardublock Programming

Ardublock is free software, a programming language that can be used to program the Arduino easily. Ardublock use blocks making up the sketch, Ardublock can reduce errors that often occur when using an approach that mengguanakan written language (text). By using the block, most likely forgot to write the semicolon at the end of the statement or must remember the syntax of programming languages can be avoided. That is why, by using ardublock anyone can learn robotics easily and quickly, including elementary and junior high school children [5]. Ardublock run concurrently with Arduino IDE, in the process of the block program to generate source code into the IDE Arduino subsequent upload to Arduino process. Figure 1 is a view programming ardublock.

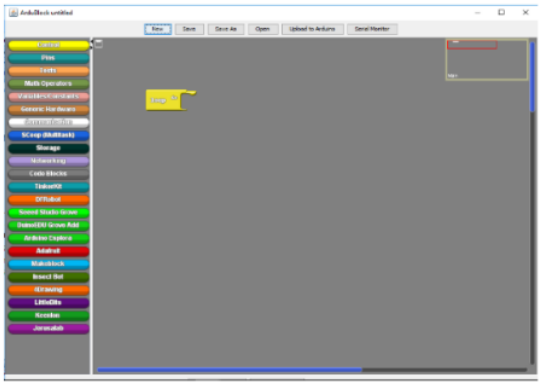

Figure 1. ardublock programming display

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3. METHOD

Extracurricular robotics refers to competitions that are generally contested, namely wheeled robots with features to follow the trail (robot line follower) and move objects (robot transporter). Line follower robot works by using two photodiodes as a sensor line (R and L) that feeds the controller (Arduino) for controlling the rotation of the wheel robot. The wheels of the robot are rotated using two DC gearbox motors driven by a motor driver. The robot is

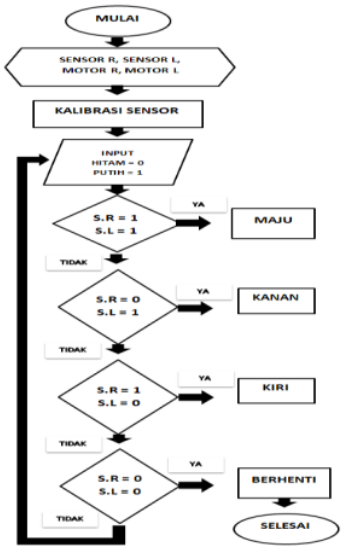

Figure 2. Flowchart of line follower robots

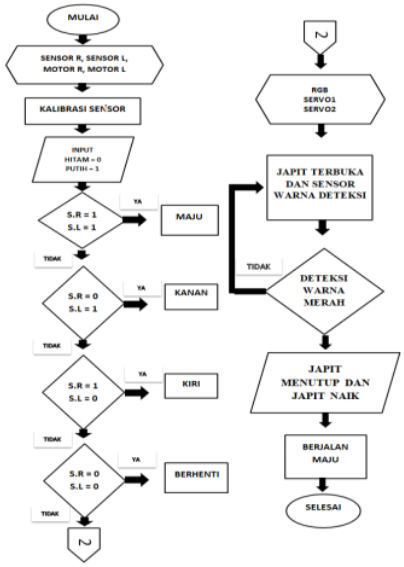

Figure 3. Flowchart of transporter robots

programmed with the sensor readings of the R (Kanan) and L (Kiri) lines, if the R and L sensors detect a white line, the robot advances. if the sensor detects a black line R and L sensor detects a white line then the robot turns right, if the R sensor detects a white line and a black line sensor L detects the robot turn left. The robot will stop if the sensors R and L to detect the black line, as shown in the flowchart of Figure 2.

Robot transporter works with double work, to follow the black line tracks and move objects encountered as instructed in the program. The logic in moving objects using existing logic online follower robot. The process of moving objects utilizes an RGB color sensor. The RGB color sensor to detect a specific color setting so that it can distinguish the presence of objects. The RGB sensor will give a signal to the controller (Arduino) to open the gripper (clamp the object carrier). Objects will be brought to a stop when the robot R and L line sensor detects the black line, as shown in the flowchart figure 3.

The wheeled robot base design for this extracurricular robotic robot emphasizes the ease of installation of line sensor modules, RGB sensors, grippers, wheel drive motors and batteries. The position of the front of the robot consists of two modules line sensor, RGB sensor, gripper, position the left and right side there is a motor complete with wheels rear position is equipped with a battery, position the top is equipped with a controller with terminal shield for the sensor and the motor driver. The robot hardware is shown in Figure 4.

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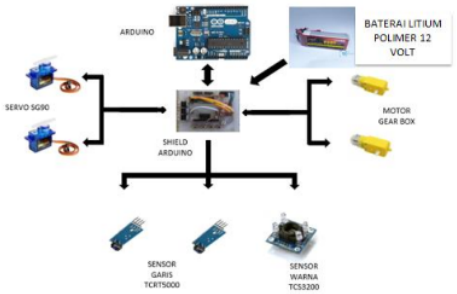

Figure 4. Robot hardware

Resource use lipo battery 4s 2200mAh, Arduino UNO as the main controller for robots to work menegendalikan working robot, Shield Arduino UNO as terminal sensors and actuators robot, Servo as driving gripper or penjapit objects, two sensor lines are used to detect the black and white stripes, the color sensor is used to detect the color of objects, two DC motors used to turn the wheels of the robot. Wheeled robot programming for elementary school extracurricular using Ardublock programming. Ardublock programming with existing drag and drop menus composes into a robot program logic. the program is generated into C programming language on the Arduino IDE, then the process is uploaded to Arduino.

Testing Methods at this wheeled robot using the method robot line tracer function test performed on the path along the 200 cm, with 10 attempts on the same track. Furthermore, the method of robotic transporter function test performed on a track sepajang 200 cm, with 10 attempts on the same track, and the objects placed at distance of 100 cm to the robot.

3. RESULTS AND DISCUSSION

Wheeled robot with features to follow the trail (robot line follower) and move objects (robot transporter) can be completed within 2 months of work. As shown in Figure 5. The robot base is made of 5mm acrylic, the front wheel uses a wheel caster, so it is easy to move, the right and left wheels are made of solid rubber so that it does not cause slippage on the track. The robot gripper on the front is made of acrylic as an object clamp, on the back there is a battery as a power source for the robot. Programming using ardublock based on visual and simply makes it easier for elementary school students to program robots. Figure 6. Shows the use of digital input pins 4 and 7 used for line sensors. Digital pins 5, 6, 7, 8, and 9 as logic outputs are directed to the motor driver to drive the DC motor that drives the robot wheel.

Testing of the robot with the line follower feature was carried out with a path length of 200 cm, 10 trials with a time of 60 seconds. Table 1 shows the average test results at 6.0 seconds. Testing of the robot with the transporter feature is carried out on a 200 cm long path, with 10 trials on the same path, and objects are placed at distance of 100 cm from the robot. Table 2 shows the average test results in 8.9 seconds, with the success of lifting objects 7 times out of 10 trials.

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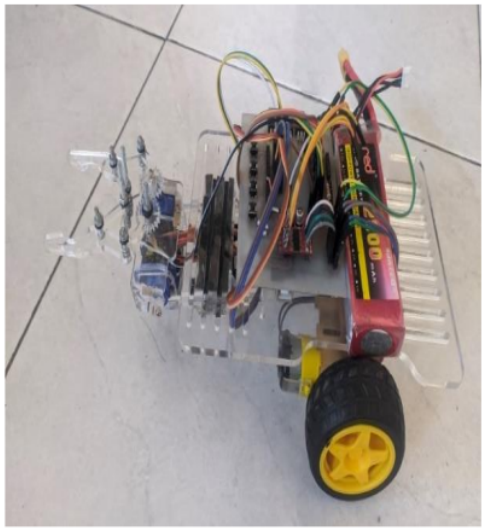

Figure 5. Wheeled robot

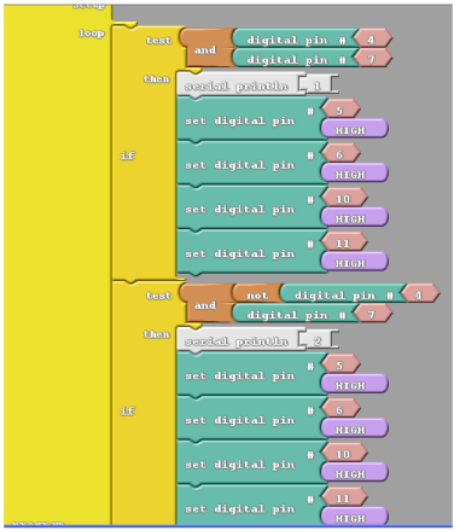

Figure 6. Part Program ardublock wheeled robot

Table 1. Testing table of line follower robots

No	Start	Finish	Actual Time
1	00.00	00.06	6 second
2	00.00	00.05	5 second
3	00.00	00.05	5 second
4	00.00	00.06	6 second
5	00.00	00.07	7 second
6	00.00	00.06	6 second
7	00.00	00.06	6 second
8	00.00	00.07	7 second
9	00.00	00.06	6 second
10	00.00	00.06	6 second
Total	60 second		
Average	6,0 second		

Table 2. Testing table of transporter robots

No	Start	Finish	Actual Time	Lifting Object
1	00.00	00.06	6 Second	failed
2	00.00	00.10	5 Second	successful
3	00.00	00.09	9 Second	failed
4	00.00	00.05	5 Second	failed
5	00.00	00.10	10 Second	successful
6	00.00	00.09	9 Second	successful
7	00.00	00.10	10 Second	successful
8	00.00	00.09	9 Second	successful
9	00.00	00.10	10 Second	successful
10	00.00	00.11	11 Second	successful
Total	89 Second			7:3
Average	8,9 Second			successful

The wheeled robot with acrylic material is equipped with a 2-line sensor and an RGB sensor as an object detector, a gripper actuator as an object clamp and two DC motors as a wheel drive. Ardublock used as easy to use Arduino controller programming for elementary school students. Robot with two features that line follower robots and robotic transporter regarding test results, the design of the robot can be used for extracurricular activities robotics elementary school students.

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4. CONCLUSION

Wheeled robot based on testing and manufacturing design, the conclusions are as follows: Wheeled robot design for extracurricular robotics can be used for two features, namely line follower robot and transporter robot; The ardublock program can be used for programming the Arduino controller on the robot; Wheeled robot with folower line features recorded travel time of 6.0 seconds on the track as far as 200cm; Wheeled robot with transporter features on the track 200 cm Average travel time - average of 8.9 seconds with the success of lifting 7 times out of 10 attempts.

As a suggestion in this research, the wheeled robot can then be tested on elementary school students to determine the success rate of the robot as a learning medium in elementary schools.

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