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Multiplatform Mobile Robot as Robotics Technology Socialization Media

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Abstract

This study aims to develop a multiplatform robot that can be used as a medium to socialize robotics technology among adolescents. This multi-platform robot is also expected to help teens who are interested in robots to facilitate them in learning robotics technology. The robot made is a wheeled robot with manual control using a controller (manual transporter) and also automatic control using sensors (line follower and automatic avoider). The research methodology used in this study is the 4D development model (Define, Design, Develop, and Disseminate). Based on the test result, the robot runs accurately following the black or white lines and successfully moves items, for automatic avoiders the robot can detect walls and follow the grooves of the wall at an angle of 90 degrees, while for manual transporters the robot can be controlled using a controller application on an Android-based smartphone developed with MIT APP Inventor. In the dissemination stage, it is known that teenagers have a very high curiosity and desire, 86% and 90%. However, their interest and readiness to learn is not as high as their desire to master the robotics technology.

Keywords: *Multiplatform Mobile Robot, Technology Socialization Media, 4D Model*

1. Introduction

Technology is developing very fast and has been proven to contribute to facilitating human life. Microelectronics, communication, automation, navigation, robotics and so on have changed the work environment and become an inseparable part of modern life [1]. But the development of these technologies does not always have a positive impact. Misuse of the use of technology among children and adolescents can threaten physical, psychological health, to brain disorders [2].

Adolescence is the most crucial time in human development [3]. Therefore, adolescents need something that can attract their attention to direct their great potential [4]. One appropriate way to direct that potential is to introduce them to technologies that are close to their lives [5]. By studying the development of technology, teenagers have the opportunity to get a new perspective in viewing life [6].

The application of robotics technology can be an exciting solution that can replace something that is less beneficial for adolescent development [7][8]. However, there are often many challenges in the delivery of robot learning for teenagers [9]. As a result, the introduction of robotics technology is often hampered and disrupts the development process of robotics technology. Therefore, we need an appropriate intermediary so that the process of technology introduction and socialization can take place properly and efficiently [10].

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This study intends to create a socialization media to introduce robotic technology among adolescents [11]-[15]. The media will be used to introduce each part of the robot so that teenagers can understand it [16]. With the use of learning robots that are interesting and easy to program, is expected to be an alternative to increase interest in technology-based learning among teenagers.

2. Material and Methods

This research is a research development that aims to make a multiplatform robot as a medium for the introduction of technology among adolescents. The development model in this study adopted the 4D model (Define, Design, Develop, and Disseminate).

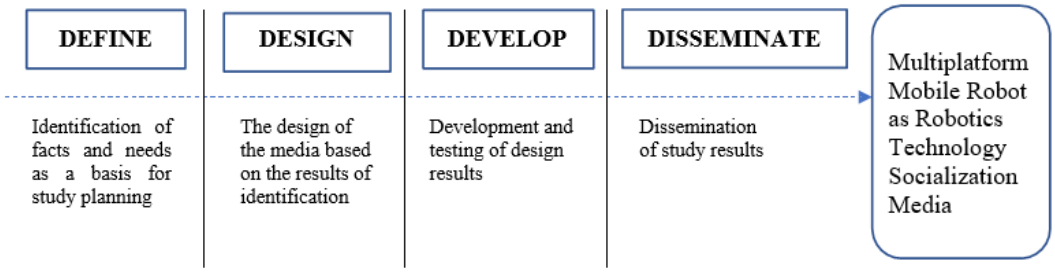

Figure 1. 4D Framework

In general, the multiplatform robot has three features, namely automatic line follower, automatic avoider, and manual transporter. Every function on the robot tested to determine the performance of each of these features. The automated line follower feature tested with the ability of the robot to pass through various lines. The automatic avoider feature is tested with a line with a barrier. In the manual transporter feature, application testing developed with the MIT APP inventor is tested based on the portability aspect by connecting to various smartphone brands with the Android operating system. The next test is checking every button on the controller.

In the last stage, which is to find out the interests of adolescents towards this multiplatform robot, a measurement of interest carried out using a questionnaire consisting of aspects of interest, curiosity, and desire to have skills, readiness to learn.

3. Result and Discussion

3.1. Define

This robot intended to help teens to recognize robotics technology. A multiplatform robot with three features is chosen based on the needs of teenagers so that they can more easily understand the application of robots in their daily lives. Based on this, the robot is designed with three main features with a schematic as follows.

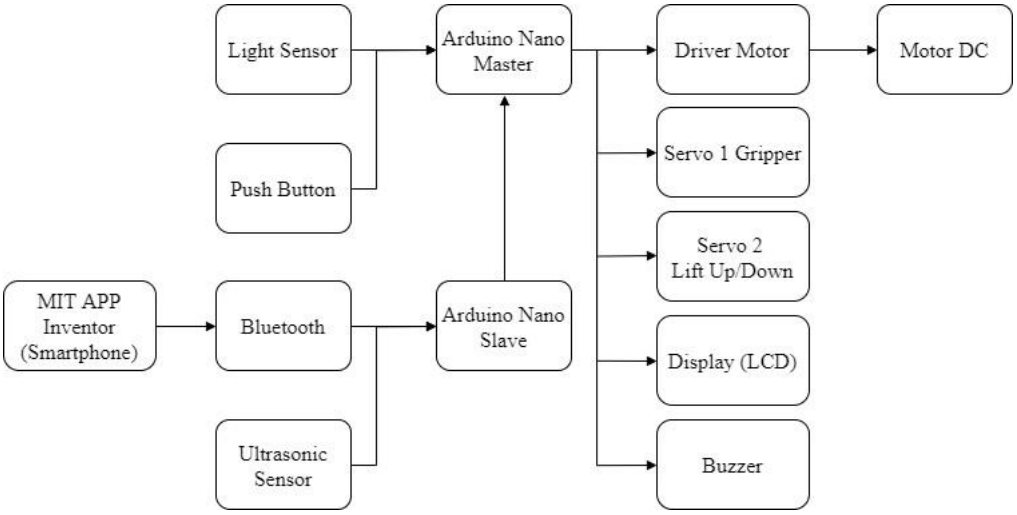

Figure 2. Multiplatform Robot Block Diagram

3.2. Design

Features on the robot can be accessed via menu that displayed on the LCD screen by pressing the push button. The robot designed with three main hardware modules, namely the master module, the light sensor module, and the slave module. The schematic design of the master module can be seen in Figure 3.

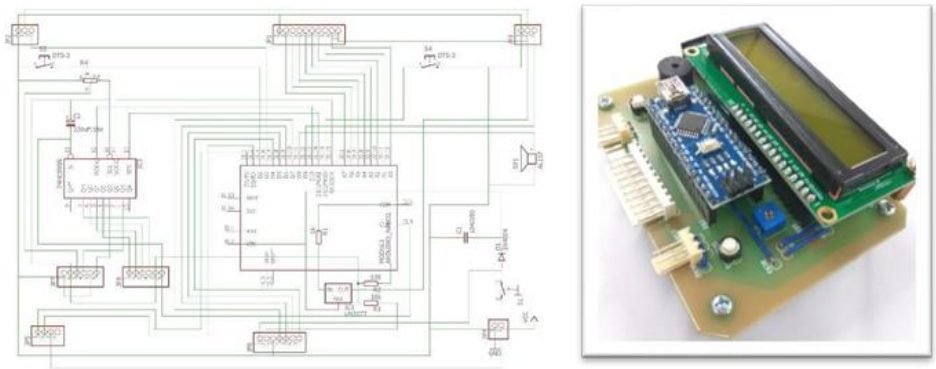

Figure 3. Schematic diagram and physical form of the master module

The line follower feature on the robot is a light refraction-based sensor. The robot is designed by using 8 sensors with a distance of 1-2 cm on each sensor. The sensor is directed under the robot to read black or white lines. The sensor is calibrated with the "Scan Sensor" code found on the menu. "Scan Sensor" is work by passing the robot on the line without lifting the robot, then the highest input reading value is taken as high, and the lowest input reading value as low. The results of the reading of 8 sensors will be used to determine the location of the robot against the line so that the robot can move until the location of the line can be exactly in the middle position of the robot, namely the sensors 4 and 5. The schematic diagram of the light sensor module can be seen in Figure 4.

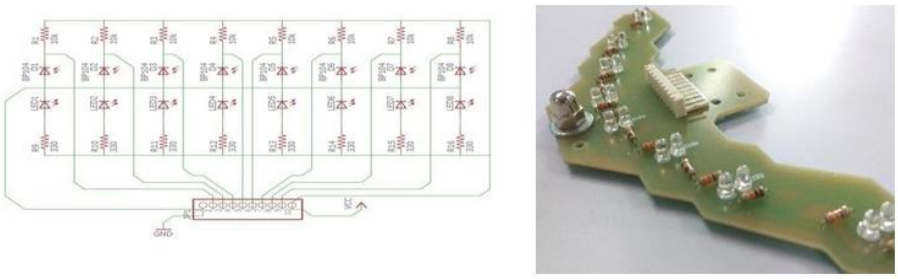

Figure 4. Schematic Diagram and Physical Shape of The Sensor

The automatic avoider feature is designed using ultrasonic sensors. There are 3 sensors placed in a position facing front, left, and right. Laying is intended to detect walls that are around the robot. The scheme and shape of the slave module are shown in Figure 5.

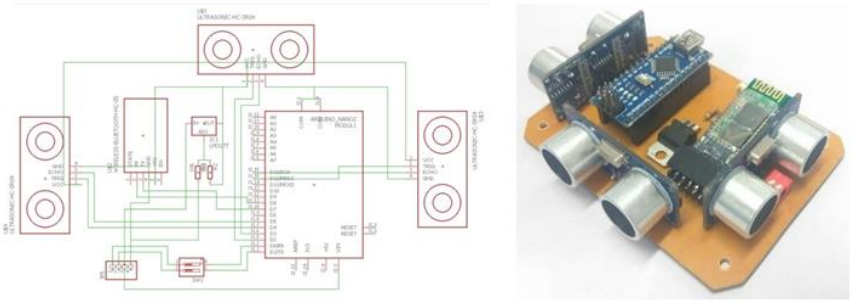

Figure 5. Schematic Diagram and Physical Form of The Slave

In the robot transporter manual feature, the robot is controlled by using a controller in the form of the MIT APP inventor application installed on a smartphone with an android operating system. Sending data from a smartphone to Arduino uses Bluetooth, where the data sent is 8, namely the data from each button with logic 1 and 0. The display controller application developed can be seen in Figure 6.

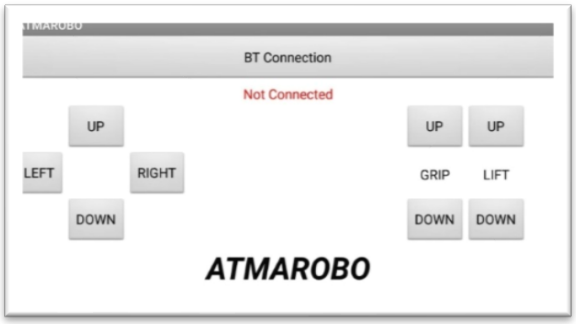

Figure 6. Display of The MIT APP Inventor

3.3. Develop

At this stage, each feature is tested for performance. In the line follower feature, the robot is tested to complete the path with various forms of lines and intersections that exist. On the test track, 3 checkpoints will be tested for each checkpoint as well as the overall test. The design of the line follower test line refers to the rules of the Jakarta State Polytechnic E-Time robot mini industrial competition. The design of the test path can be seen in Figure 7, and the test result can be seen in Table 1.

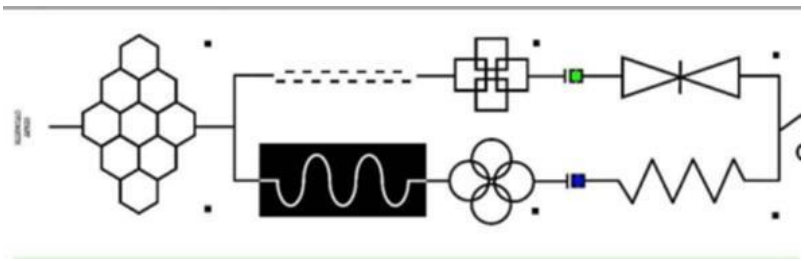

Figure 7. The Design of Robot Testing Path

Table 1. Line follower feature test result

Trials	Line Types					
	Intersection 3	Intersection 4	Dotted Line	Reverse Line	S	Intersection of 4 Circles
1	√	√	√	√	√	√
2	√	√	√	√	√	√
3	√	√	√	√	√	√
4	√	√	√	√	√	√
5	√	√	√	√	√	√

Based on the data in table 1, it is known that the robot is able to pass all types of lines contained in the test path without any obstacles.

In the automatic avoider robot feature, robot is tested to complete the path with 3 wall shapes, namely turn left, turn right, and line end. Each wall shape will be tested individually, and there will also be an overall test where 3 wall shapes are arranged together. The form of automatic avoider testing lines can be seen in Figure 8, and the test result can be seen in Table 2.

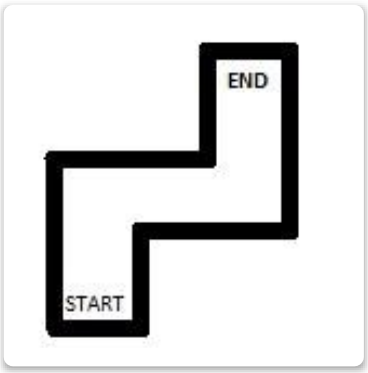

Figure 8. Automatic Obstacle Avoider Testing Path

Table 2. Automatic Obstacle Avoider Feature Test Result

Trials	Obstacles Avoider			
	Turn Right	Turn Left	Line End	Whole Test
1	√	√	√	√
2	√	√	√	√
3	√	√	√	√
4	√	√	√	√
5	√	√	√	√

Based on the data in table 2, it was concluded that the robot successfully detected the surrounding wall accurately and chose a path that could be traversed by turning left or right.

In the manual transporter feature, application testing developed with the MIT APP inventor is tested based on the portability aspect installed on various brands of smartphones with the Android operating system. After that, the controller will try to move the robot by testing each button. The experimental data in the transporter manual can be seen in Table 3.

Table 3. Manual Transporter Feature Portability Test Result

Smartphone	Succes	Failed
Samsung S8	√	
Xiaomi Redmi Note 3	√	
Xiaomi Redmi Note 5	√	

Based on the data in Table 3, it can be concluded that the controller can be installed and compatible with Android OS smartphones without any problems. Each push-button works well, and the gripper manages to lift the beam well.

3.4. Disseminate

Dissemination is an important step as an initial step in implementing the study results. Dissemination results show that teenagers are very interested in learning media that are made to introduce robotic technology as shown in Figure 9.

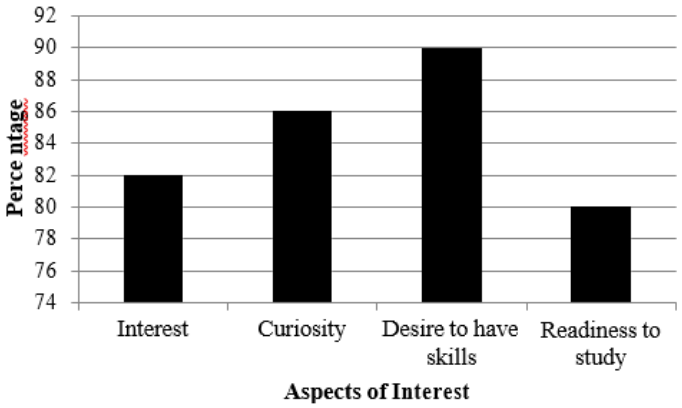

Figure 10. Dissemination Result

Based on Figure 10, it is known that the teenager has a reasonably high curiosity, but his interest does not exceed his curiosity. Even so, the teenagers look very eager to master the skills in the field of robotics, also though the readiness to learn is still not able to compensate for his desire to master these skills.

4. Conclusion

The features contained in the multiplatform robot that has developed is a general description of the application of robotic technology that classified as close to everyday life. Every feature developed on this robot has good system reliability because it has passed the system test on each of its features. In the dissemination stage as the main target in the development of this multiplatform robot, it is known that students have a high enough curiosity by 86%. Besides that, the desire to have student skills is also known to be very high by 90%. The students' interest and readiness to learn that are not as high as 2 other aspects show that motivation is still needed for students so that they are ready to master robotics technology by going through an intense learning process.

5. References

[1] S. Oltean, 2019. "Mobile Robot Platform with Arduino Uno and Raspberry Pi for Autonomous Navigatio," in Procedia Manufacturing, vol. 32, pp. 572–577.

[2] D. Wind, 2019. "Bahaya dan Efek Negatif Kecanduan Game Online bagi Kesehatan," kompasiana.com.

[3] C. K. Marini, 2015. "Strategi Training Within Industry Sebagai Upaya Peningkatan Kepercayaan Diri Siswa Pada Mata Pelajaran Pengolahan Makanan Kontinental," J. Technol. Vocat. Educ., vol. 22, no. 4, pp. 410–423.

[4] R. C. Rus, R. M. Yasin, F. A. N. Yunus, M. B. Rahim, and I. M. Ismail, 2015. "Skilling for Job: A Grounded Theory of Vocational Training at Industrial Training Institutes of Malaysia," Procedia - Soc. Behav. Sci., vol. 204, no. May 2016, pp. 198–205.

[5] G. Simona, 2015, "Teacher Training for Embedding Life Skills into Vocational Teaching," Procedia - Soc. Behav. Sci., vol. 180, no. November 2014, pp. 814–819.

[6] T. Agrawal, 2013. "Vocational Education and Training Programs (VET): An Asian perspective," Asia-Pacific J. Coop. Educ., vol. 14, no. 1, pp. 15–26.

[7] B. Sellin, 2008. "The proposal for a European Qualifications Framework. Making it a reality – possibilities and limitations," Eur. J. Vocat. Educ., vol. 42/43, pp. 4–18.

[8] M. Pakdaman, M. M. Sanaatiyan, and M. R. Ghahroudi, 2010. "A Line Follower Robot from design to Implementation : Technical issues and problems," vol. 1, pp. 5–9.

[9] S. S. yum Ngai, C. kiu Cheung, and R. Yuan, 2016. "Effects of Vocational Training on Unemployed Youths' Work Motivation and Work Engagement: Mediating Roles of Training Adequacy and Self-actualization," Child. Youth Serv. Rev., vol. 63, pp. 93–100.

[10] S. F. C. O. S. Cooper, 2011. Effective Teaching and Learning Vocational Education. LONDON: LSN.

[11] N. Wilson, T. Faisal, H. M. A. A. Al-assadi, and M. Iwan, 2012. "Pick and Place ABB Working with a Liner Follower Robot," in International Symposium on Robotics and Intelligent Sensors2012 (IRIS 2012), vol. 41, no. Iris, pp. 1336–1342.

[12] S. Vaidyanathan, A. Sambas, M. Mamat and W. S. M. Sanjaya, "A new three-dimensional chaotic system with a hidden attractor, circuit design and

application in wireless mobile robot." *Archives of Control Sciences*, vol. 27, no. 4, pp. 541-554, 2017.

[13] I. A. Darmawan, N. E. Budiyanta, D. Aribowo, M. Fatkhurrokhman, M. A. Hamid, Y. Guntara, and S. Nurhaji, 2020. "Electricity course on vocational training centers : a contribution to unemployment management Electricity course on vocational training centers : a contribution to unemployment management," J. Phys. Conf. Ser.

[14] Mujiarto, A. Djohar, M. Komaro, M. A. Mohamed, D. S. Rahayu, W. S. M. Sanjaya, M. Mamat, A. Sambas and Subiyanto. "Colored object detection using 5 dof robot arm based adaptive neuro-fuzzy method". *Indonesian Journal of Electrical Engineering and Computer Science*. vol. 13, no. 1, 2019, 293-299.

[15] N. E. Budiyanta, C. O. Sereati, Lukas, 2020. "P-D controller computer vision and robotics integration based for student's programming comprehension improvement". TELKOMNIKA Telecommunication Computing Electronics and Control, vol. 17, no. 1, pp. 268-274.

[16] I. Salamah and M. A. Ganiardi, 2017. "Development of E-learning Software Based Multiplatform Components," Bull. Electr. Eng. Informatics, vol. 6, no. 3, pp. 228–234.