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Smartphone-based Robot Design Training with Voice Control for Senior High School in Tasikmalaya City

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Abstract

The main objective of this work is to provide training to build smart phone-based smart robots with voice control to teachers at Senior High Schools, Tasikmalaya City, Indonesia. This robot consists of various electronic components such as Arduino, IC L293D, Bluetooth Module HC05, dynamo, gear box and battery. In addition, we have used several software to build intelligent robots such as Arduino software for uploading a command and AMR voice application for controlling via voice commands. The results showed that the teachers had succeeded in making robots with voice control for forward and backward commands with the help of the AMR voice application. In addition, the results of this training are expected to increase the creativity of teachers in the learning process and as teaching materials to create an active and collaborative class.

Keywords: Robot, Voice Control, Arduino, learning model

1. Introduction

Robotics technology has been widely used in various disciplines such as epilepsy surgery (Eljamel, 2006), military mission (Ha et al., 2019; Vaidyanathan et al., 2017), smart farming technology (Chand et al., 2021; Ula et al., 2021), rehabilitation of upper-extremity after stroke (Babaiasl et al., 2016), firefighting robot (Aliff et al., 2019), shallow-water marine inspections (González-Reolid et al., 2018), precision weed management (Li et al., 2022), robotic dairy farm (Fuentes et al., 2022) and robotic dry-cleaning of solar panels (Parrott et al., 2018).

Learning media is an excellent method to help explain a scientific phenomenon such as education games map material (Nurpratiwiningsih and Setiyoko, 2018), augmented reality application (Dinayusadewi and Agustika, 2020), Jigsaw animation media (Kenedi et al., 2019), snake ladder game (Syawaluddin et al., 2020), smart play wheel (Arifin et al., 2021) and Kandara musical instrument (Fredy et al., 2020).

Studies related to learning media using robotics systems have been intensively researched by various scientists in the world. Buditjahjanto et al. (2020) amalyzed the relationship of the latent variables of assembling, operating and evaluating with the latent variable of psychomotor skill on the arm robotic

concept. They found that the latent variables, such as assembling, operating and evaluating, can make a significant contribution to students' psychomotor skills. Taksapattanakul et al. (2020) presented of the students to easily understand the Pascal's law via studying the effect of fluid volume on movement joint mechanisms degree and applying to build a reuse material robotic as effective physics learning media. They found that the students can understand the Pascal's law after studied and analyzed the effect of fluid volume on join movement of each part of the robot. Nugraha et al. (2021) developed robotic-based learning media that can improve students' critical thinking skills and students' learning outcomes. They show that the developed robotic-based learning media could improve students' critical thinking skills and student learning outcomes with a gain value up to 0.85 (high criteria). However, the above research does not explain in detail the learning media using a smartphone robot using voice control.

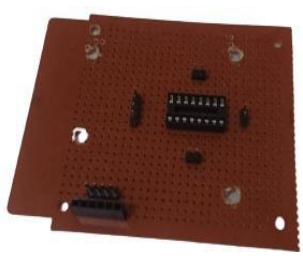
The main objective of this study is to provide training to build smart phone-based smart robots with voice control to teachers at Senior High Schools, Tasikmalaya City, Indonesia. The main part of this work is to provide an explanation regarding the software and hardware used to the workshop participants. In addition, we also provide modules for assembling smartphone-based robots that are controlled by voice control.

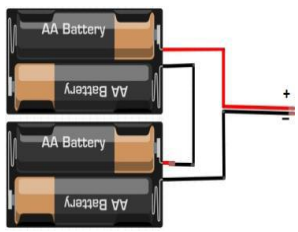
2. Research Methods

This research was conducted at the University of Muhammadiyah Tasikmalaya. Participants in this training are teachers in high schools. In this research method, several materials for robot based on smartphone can be seen in the Table 1.

Table 1. Components for running LED

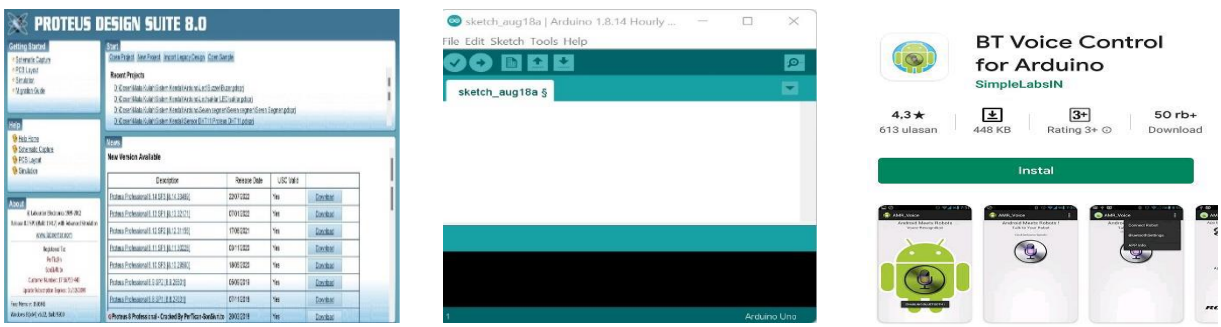
No	Picture	Component	Total
1		Arduino Uno	1
2		Module Bluetooth HC05	1

3		Acrylic	3
4		Dinamo and Gearbox	1
5		Jumper cable	1
6		Serial cable	1
7		Shield Motor Driver	1

8		IC L293D	1
9		Battery AA	4
10		Tenol Paragon	1
11		Pliers	1
12		Screwdriver	1
13		Soldering iron	1

14		Solder Sucker	1

In this study, we used 3 software for the learning process, namely Proteus software, Arduino software and AMR Voice. Proteus software is used to create electronic circuits. While the Arduino software is used to create programs and give commands that are integrated into electronic circuits in the Proteus software. AMR voice is used for robot control systems using voice signals connected to Bluetooth (HC05). Commands in the form of voice will move the robot forward, backward, turn right and turn left. Figure 1 shows the display of the Proteus software, Arduino software and AMR app.



(a) (b) (c)

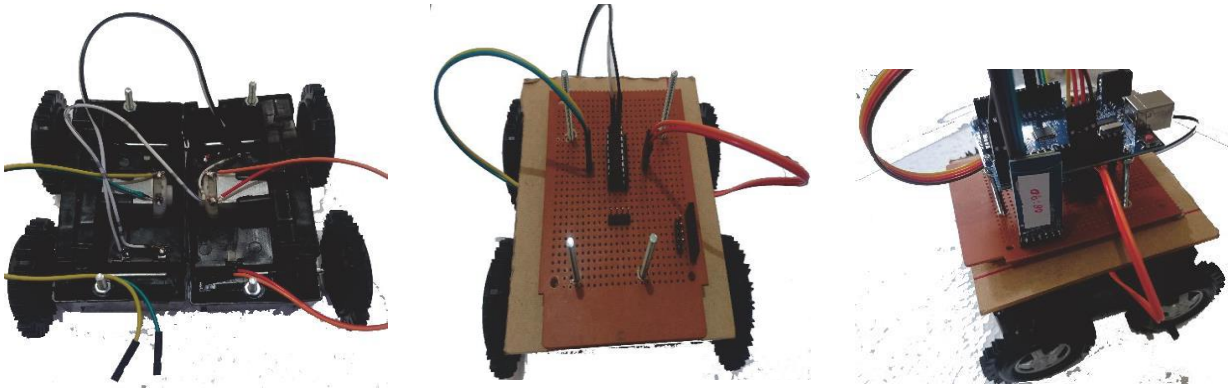
Figure 1. Display of the software (a) Proteus software, (b) Arduino software and (c) AMR app.

3. Results and Discussion

3.1 Hardware

The voice control-based smartphone robot is a robot that is controlled using the AMR Voice application which is connected to google voice. In addition, Bluetooth is used as a communication system between smartphones and robots. When a voice command is given, google voice will translate the command, then it will be sent via Bluetooth from a smartphone which will be processed by the microcontroller, then the output of the process will move the robot.

On the hardware side, this robot is divided into 3 parts. Firstly, we make a construction of a robot consisting of a dynamo, battery and robot design (see Figure 2a). Secondly, we have made a motor driver (L293D) which function to control DC motors both speed and direction of rotation of 2 motors at once. The Motor Driver (L293D) contains logic gates that are very popular in the electronics world as motor controllers (See Figure 2.b). Finally, we integrate Arduino, Bluetooth, motor driver and DC motor. The hardware is ready to use and the next is the programming process.



(a) (b) (c)

Figure 2. hardware of mobile robot based on smartphone (a) actuator, (b) motor driver and (c) mobile robot

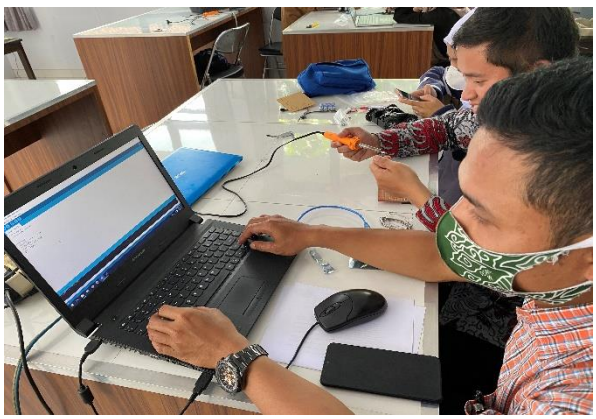


Figure 3. Participant workshop of mobile robot based on smartphone using voice control

The participants of this training were from various senior high schools such as SMK Bina Bangsa, SMK Jaya Mandiri, MAN 1 Tasikmalaya, SMAN 7 Tasikmalaya, SMAIT-TQ Ihya As-Sunnah Tasikmalaya, SMA Quranic Science Boarding School, SMA Negeri 5 Tasikmalaya, SMAI Yappas Albarokah, SMAN 1 Jatiwaras, MAN 3 Tasikmalaya, SMK Ar Ridwan Cintamulya, and SMAS PGRI 43 Singaparna (See Figure 3).

3.2 Software

The software used for voice control is AMR voice. This software is connected to the HC05 Bluetooth by entering the code 1234 on the software. The AMR voice display when ready to use can be seen in Figure 4.

Figure 4. AMR voice view

The logic of the motion of the mobile robot on the Arduino to translate the voice characters from the AMR software can be seen in Table 1. The robot moves forward if the condition of the motor on the Pin on the Arduino is Pin 13 = low, Pin 12 = High, Pin 11 = low and Pin 10 = High. The robot backward if the motor condition is Pin 13 = High, Pin 12 = Low, Pin 11 = High and Pin 10 = low. The robot turns right when Pin 13 = High, Pin 12 = Low, Pin 11 = low and Pin 10 = high. Finally, the robot turns left when Pin 13 = Low, Pin 12 = High, Pin 11 = High and Pin 10 = low.

Table 2. The logic of the motion of the mobile robot on the Arduino

Condition	Pin 13	Pin 12	Pin 11	Pin 10
Forward	LOW	HIGH	LOW	HIGH
Backwards	HIGH	LOW	HIGH	LOW
Turn Right	HIGH	LOW	LOW	HIGH
Turn left	LOW	HIGH	HIGH	LOW

4. Conclusion

In this paper, we provided training to build smart phone-based smart robots with voice control to teachers at Senior High Schools, Tasikmalaya City, Indonesia. The main part of this work is to provide an explanation regarding the software and hardware used to the workshop participants. In addition, we also provide modules for assembling smartphone-based robots that are controlled by voice control. The results showed that the teachers had succeeded in making interactive learning media using robotics technology which was integrated into the programming system. In addition, the results of this study are expected to provide creativity to teachers when teaching in class.

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