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Development of Voice Command Control Prototype for Vehicle Mobility

Amirul Azahar[1], Khairunnisa Rosda[1], Nursyahirah Mustafa[1], Afishah Alias[1*]

[1]Department of Physics and Chemistry,
Faculty of Applied Sciences and Technology,
Universiti Tun Hussein Onn Malaysia (Pagoh Campus),
84600 Pagoh, Muar, Johor, MALAYSIA

*Corresponding Author Designation

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Abstract: A voice command control prototypes robot vehicle that can transmit and receive signals when the users give a command to the system, which will navigate the robot vehicle to go, back, left, and right. The voice command control system was built to improve and resolve the flaws, especially to ease the users with a hands-free experience. An Arduino board is the main component for the prototype which acts as a processor that ensures the data reached the destination while the Bluetooth module serves as an interface to connect the robot vehicle with an android application in a smartphone. From the result analysis, the navigation of the robot vehicle changes based on the specific command given by the user that matched the command that was set in the system. The result of the functionality also was tested based on the distance of the smartphone with the robot vehicle which is limited to 50 meters for the user to pair it and the delay time of robot vehicle to react is 100 milliseconds. Overall, the voice command control for this robot vehicle can function well.

Keywords: Voice Command, Robot Vehicle, Bluetooth

1. Introduction

In the past few years, autonomous robot vehicles have been created and undergone many upgrades in their systems as part of the progress toward advancing vehicle technology. In 2003, global speculation in contemporary robots increased by 19%. In 2004, ordersfor robots increased by 18% to the greatest level ever recorded. Overall growth in the period 2004-2007 is expected to be around 7% each year on average. Over 600,000 family-unit robots will be utilized in the next years, with millions more to follow [1]. Manystudies have been conducted by various researchers to build this idea. These robot vehicles have a variety of applications and technologies being developed for them such as a robot that was developed to transfer information wirelessly between smartphone and robot through an Android application, and a robot that was developed with the connection from a Wi-Fi module and android

**Corresponding author: afishah@uthm.edu.my*

smartphone [2][3][4][5][6]. There was a robot developed by Arpit Sharma which can be controlled by using an Android smartphone via Bluetooth system that employs motion sensors and captures gestures that are transmitted from an Android phone [7]. It also has an accelerometer and a Bluetooth module that are used to control the robot's motions [8].

The development of this autonomous robot vehicle paralleled with the evolution of in-car voice systems [9], beginning with Honda's Acura voice control system in 2004, which allowed drivers to control temperature, make calls, navigate, and access information through the Acura-link service [10]. The passage mentions several other developments in voice-controlled car systems, including those from Lexus, Ford and Microsoft, Apple, Skoda, and Ford's collaboration with Amazon to develop the Alexa-powered system. Many of these systems have had limitations, such as poor speech recognition and limited functionality, but they have also seen improvements over time with newer versions featuring more features and better performance.

Due to the difficulties that occurred with the remote-controlling robot vehicle such as the remote signal being distracted, the infrared blocked by an obstacle, and the remote having many gestures or buttons, voice command control can resolve this problem with the aid of appropriate applications and android smartphones. Therefore, the voice command control system was built to improve and resolve the flaws, especially to ease the users with a hands-free experience.

2. Materials and Methods

This voice command control prototype robot vehicle circuit was built and tested using the software Arduino IDE. A voice command control prototype robot vehicle has been developed, that has been functioning without a controller and instead being controlled using voice commands. All the commands that were trained in the system had successfully worked. The robot vehicle was able to recognize voice commands given by the user through an Android application on a smartphone that pairs with the robot via Bluetooth. The commands given were set as “Go, Back, Left, Right and Stop.” Figure 1 shows the schematic diagram of the circuit for the voice command control prototype robot vehicle. The circuit consists of two motors that are connected to the motor driver (Maker Drive). The rotation of the motors was trained and tested using the motor driver that converted the data received based on the programming code that was set. For command “Go” the pin number (4, 5 High) and pin number (3, 6 Low), “Back” pin number (3, 6 High) and pin number (4, 5 Low), “Left” pin number (5 High) and pin number (3, 4, 6 Low), “Right” pin number (4 High) and pin number (3, 5, 6 Low) and “Stop” all pin numbers were Low.

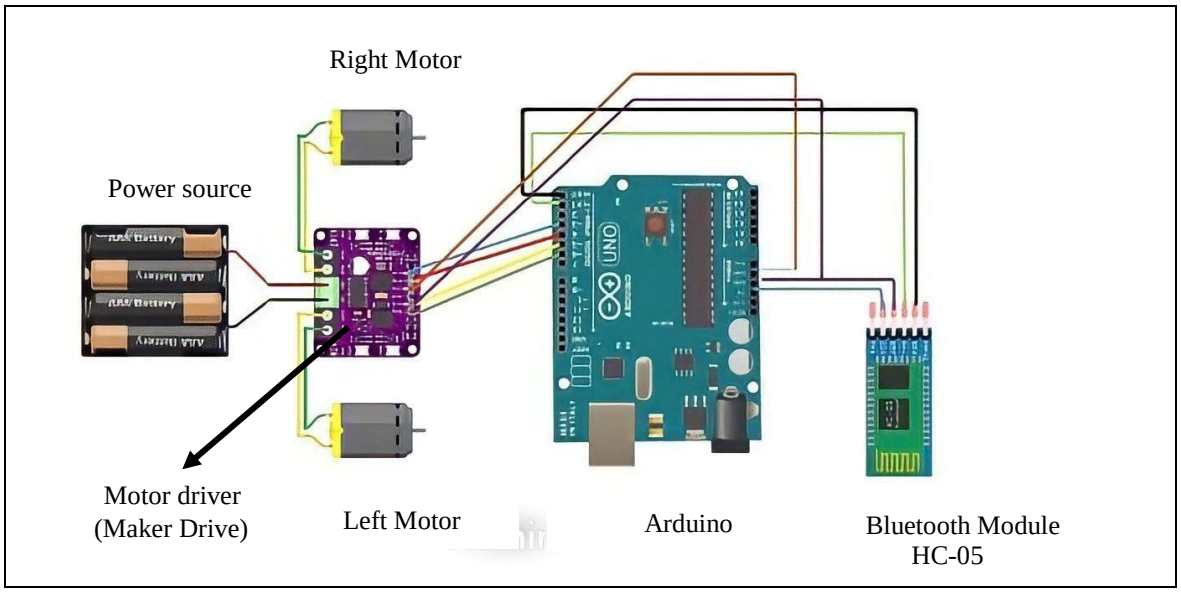

Figure 1: Schematic diagram of circuit for voice command control prototype robot vehicle

The receiver pin (RXD) and transmitter pin (TXD) were connected to the pins number while the GND was connected to the ground pin to protect the circuit from the damaged circuit by draining out any build-up electrical charge while VCC was connected to the 5V pin as the voltage for the circuit. The motors were connected to the motor driver (Maker Drive) that was connected to the pin numbers (3, 4, 5, 6), ground pin, and power source.

The system involved in this prototype is based on the voice command from the user using an Android application (AMR Voice) on the smartphone. This system used Bluetooth module HC-05 as the interface to connect a smartphone and the robot vehicle.

3. Results and Discussion

This mechanism of the voice command control robot vehicle is shown in Figure 2. The data from the voice command was wirelessly transferred to the Bluetooth module HC05, which then converted the commands into a series of characters and sent them to the Arduino microcontroller for further handling. The Arduino decoded the strings it received and then sent the data to the motor driver, thus providing power to the motors according to the given commands. Based on analysis, the connection for the Bluetooth and the smartphone was limited to 50 meters to pair it and the delay for the voice command robot vehicle react to the command was set to 100 milliseconds. Table 1 and Table 2 show the analysis for distance and delay for the voice command robot vehicle.

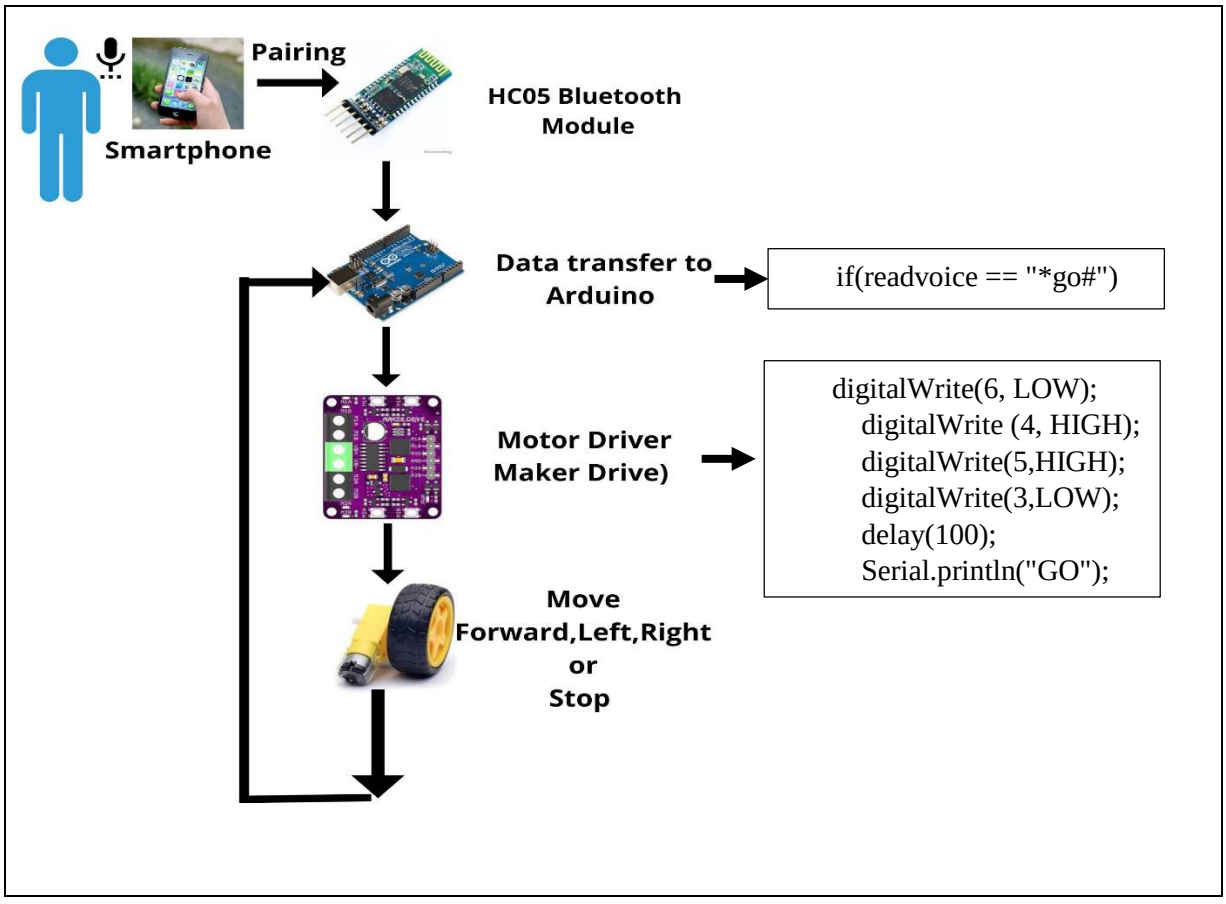

Figure 2: Mechanism of voice command control robot vehicle

Table 1: The bluetooth connection distance with smartphone

Item	Distance Point (m)	Analysis
1	10	Connected
2	20	Connected
3	30	Connected
4	40	Connected
5	50	Connected
6	60	Disconnected

Table 2: The delay of voice command robot vehicle to react

Item	Delay(ms)	Analysis
1	20	Unstable
2	40	Unstable
3	60	Unstable
4	80	Unstable
5	100	Stable
6	1000	Unstable

4. Conclusion

This prototype of a voice command robot vehicle was developed with the function to navigate accordingly to the given command from an Android application on the smartphone by the user. This robot vehicle navigation would ease the user with a simple mechanism that had been developed by connecting the smartphone and the robot vehicle and then opening the Android application and starting to give the command.

Then, this robot vehicle had a limitation of the Bluetooth connection distance with the smartphone by 50 meters and if exceed this distance the connection was lost, and the voice command robot vehicle cannot function.

Next, the delay time that was set to the robot vehicle is 100 milliseconds which is suitable for the robot vehicle to be stable before reacting to another command given from the user or the robot vehicle cannot function well.

Lastly, this robot vehicle was developed parallel with the evolution of the car voice system that will assist and ease users with a hands-free experience. From the vision of this project, it is indeed aimed to create a user-friendly system that can be controlled just using voice such as to pick up a phone call while driving. Hence, this project would be a great solution to reduce the risk of accidents.

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