CONTROL OF A VEHICLE THROUGH A SMARTPHONE APPLICATION

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ABSTRACT: The aim of the paper is to deepen and acquire new practical and technical knowledge about how to work with the Arduino platform, the Android operating system and related technologies. The theme offers the opportunity to put into practice the knowledge acquired during the college years, but also to be able to obtain new knowledge, proving innovation and creativity.

KEY WORDS: vehicle, Arduino, Smartphone application, creativity.

1. INTRODUCTION

The main objective of the paper is to monitor the control under certain optimal conditions, to be able to demonstrate that a standard device can be controlled remotely via Bluetooth. Responses to commands were tracked in terms of efficiency and accuracy of parameters: speed and direction control and their response in a timely manner[1], [2].

The objective is based on the premise that a remote-controlled car can, for example, inspect certain objects or packages that are abandoned in crowded places or public places, and in this way they can be checked without endangering people's lives. You can also come to the aid of activities in the military, industry or search or espionage activities [3], [4].

Therefore, these aspects are the basis of any type of remote control system, based on which certain sensors, monitoring equipment, auxiliary elements can be added depending on the purpose of the application. The work can be developed very simply towards a specialization in a certain field, as an obstacle would be the necessary resources in order to purchase important equipment, because the more complex the project, the higher the costs will be. [5], [6].

A major advantage of building such a vehicle is that a mobile phone can be used to control the vehicle, which would replace a conventional remote control through which the vehicle would normally have to be controlled, and the mobile phone has the advantage that Most of the time, everyone uses or has a mobile phone at hand [7].

2. ANALYSIS, DESIGN AND IMPLEMENTATION

The following software components and programs were used:

- Arduino uno r3 board
- Shield bridge l293d
- A 2-wheel WD and a rotating chassis
- A smartphone with Android platform
- An hc-05 bluetooth module
- Arduino version 1.8
- Android Studio is 2.3.

After checking each component individually, they connected and tested the entire circuit, looking for certain defects or functionality

problems, either related to the application or related to the practical part.
The written code for the vehicle commands has been implemented. [6], [7].
The vehicle was tested on various types of terrain, in which it was highlighted that the control and parking controls work in real time, looking for problems that may occur in the electronic part. After several tests, it was concluded that both the application and the vehicle are perfectly synchronized and there is no error. [8], [9].
The application created in Android Studio allowed the practical development of a virtual remote control, used on a smartphone, so that through it the car can be controlled [9].
The car model, with a scale of 1:10, basically consists of a three-wheel axle, with two engines and a bluetooth module attached. The necessary Arduino components were placed on this vehicle, respectively:
Arduino board one r3;
Shield bridge l293d;
An hc-05 bluetooth module;
Batteries;
Peripherals.

The design of the vehicle was structured in several stages:
-the first stage consisted in the acquisition of electronic parts, then the vehicle was assembled, continuing with tests in the related programs for electronic circuits
-in the second stage the software application was developed, testing various sequences of code independently
-in the third stage, the source code was designed in Android studio on the actual application of the smartphone,
-the final step was the initial testing between the application and the vehicle by connecting via Bluetooth, tracking whether the commands within the application run efficiently and in real time. [9-14].
Fig. 1 shows the schematic electrical circuit of the vehicle.
Each Arduino program is divided into two sections. The setup section that will run only once when the board is powered, or the reset button will be pressed, as well as the loop section, which will run in the cycle while the board is powered.

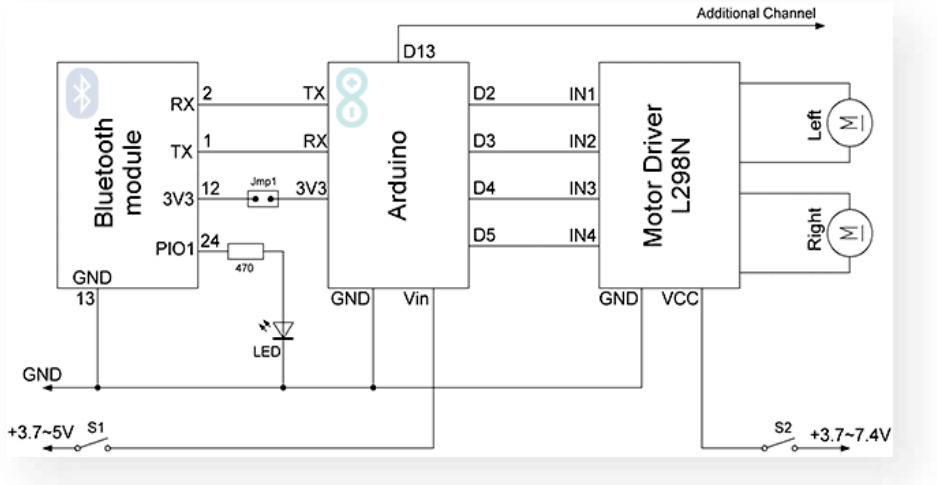

Figure 1. Schematic electrical circuit of the vehicle

The smartphone application for vehicle control is called Bluetooth RC Controller, it will be implemented in the Play Store, it was worked with the help of Android Studio application. Through the Bluetooth RC Controller application, available from Android Studio, the control of the vehicle was performed.

Figure 2 is attached to the graphical interface of the application through which the vehicle can be controlled. [11-14].
The application was created using the Android Studio program, the interface has buttons in the shape of arrows to control the vehicle, a button for connecting via bluetooth, as well as other functions that will be

implemented in the future. The source code is developed entirely in the Android Studio program [10-14].
This application has a simple user interface and is easy to configure. It will associate the Android device with the Bluetooth module, in our case a smartphone, it will connect to the Arduino device and after it connects via Bluetooth, it is ready to test and ready to work. This handy app allows your device to have different directions:
"The interface of the application is simple, it has a button that activates the bluetooth in the application settings, the rest of the buttons represent the direction of travel and the directions of the vehicle" [15], [16].

3. TESTING AND VALIDATION

The verification of each component was taken into account, and the program code was rewritten, so it was possible to eliminate any error and a favorable result was reached.
An important aspect at the base of my project was related to the operation of the engines, implicitly the steering. It was found after the tests that the drive circuits respond efficiently to the commands sent from the Android application to the Arduino platform.
The communication between the application itself and the Arduino platform is done through the bluetooth interface, the commands coming to respond in real time which eliminates the error rate of the response time of the vehicle.
The vehicle as test scenarios was tested on various surfaces, as an example was tested in a mud and water environment where the difficulty of advancing had a degree of intense friction, so the vehicle could have been much more difficult but in the case of my project did not encounter any difficulty in this regard.
It was then tried, driving the vehicle on rough terrain given the fact that the scale is 1:10, there were some difficulties in controlling the vehicle on rough terrain in terms of uneven terrain.
And the biggest challenge in testing was the limit at which the vehicle can move from a fixed point, here we tried to test the distance that the application can transmit information via bluetooth to that vehicle.
The maximum distance that could be obtained in a straight line was about 100 m.
Environmental factors such as wind, precipitation, sun and the train itself will be taken into account as disruptive factors [4], [10-16].
Following these tests, I obtained some favorable results that confirmed to me that through a smartphone application you can control a vehicle in normal parameters, having an optimal command response, so it can be used in the real field.
Figure 2 shows the vehicle assembly in the starting position.

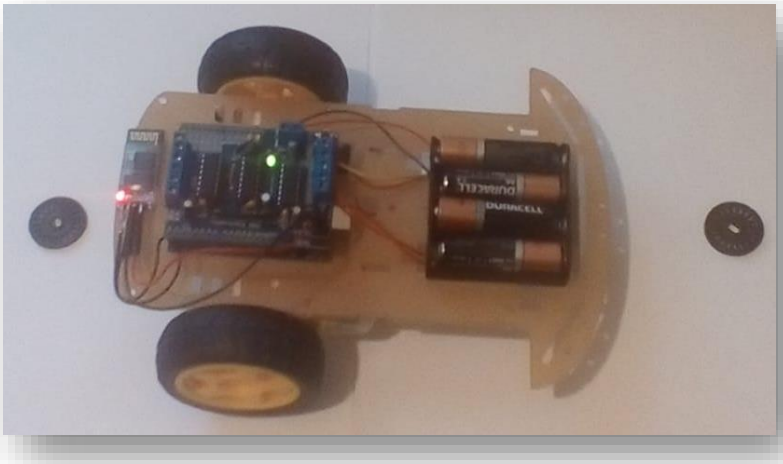

Figure 2. Vehicle assembly

Regarding the execution of the parking maneuver, the vehicle will be positioned in the starting position, the reverse gear will be used and then it will be turned to the left. When you reach the preferred position for parking, stop and turn right until the vehicle is straight.
Regarding the automatic mode of operation, the parking algorithm was taken into account, with the following factors: reversing, turning right, misalignment or any new obstacle, so that it may not fit in the parking place, if does not encounter any obstacles, the vehicle will move forward, turn left then move forward
Manual parking will be done using the Android application, using the arrows and tracking the vehicle.
In both situations, the vehicle will be started and observed, looking to find the parking space, then the maneuvers will be performed and in case of certain problems, the human factor will be involved in finding solutions.
As the identified problems may appear too small steering angle, as for the automatic parking may appear erroneous readings of the bluetooth module and the lack of delimiting obstacles, in the automatic system must be the appropriate parking result, movement control procedures and execution automatic parking maneuvers, if in the future the automatic parking function will be implemented.

4. DEVELOPMENT DIRECTIONS

Replacing or adding new items:
Future researchers can implement this task by adding, for example, a buzzer or a smoke sensor, which allows the system to generate a tone that can be perceived as an alarm. If an alarm circuit is additionally added with the existing system, the system will be able to notify the user when an alarm sounds with an audible signal.
Implementing a camera:
Installing a camera with the current system will allow the vehicle to operate in difficult areas that are either outside the human realm or are dangerous to human life.
Implementing the PWM load controller:
Future researchers can strive to determine the possibility of implementing a controller circuit based on pulse width modulation (PWM) to manage the charging and discharging of the battery not only with the help of photovoltaic energy, but also wind energy.
Changes in system operation:
The operation of the system can be easily changed and this vehicle can be used for a variety of purposes.
Making adjustments in the design and body of the system will allow this vehicle to serve as a remote control robot to perform a wide range of operations. Some of these operations are highlighted below:
Remote control racing vehicle:
Robotic racing cars can be easily designed through simple changes in this design. The cars will compete on a pre-designed track, and users will control the car's navigation.
Vehicle bomb detector:
Future researchers can easily modify this vehicle and use it as a bomb detection robot. This can be done effectively by implementing a program to track the exact positions of the bombs on a pre-designed map.
The robot will be designed to detect bombs in a remote controlled way and the user will control the robot and locate the landmines and update the information in the program database.
Fire-fighting device:
This project can be easily modified and can be implemented as a prototype model for the fire robot.
The robot with the microcontroller will go through a structure, will detect the fire with the help of sensors and then will extinguish it with the help of a blower or will notify the fire service with the exact location of the fire.

5. CONCLUSION

The main purpose of this prototype is to control a vehicle on which an Arduino kit is mounted by using a smartphone.
The project offers a wide range of works and a varied control. The results of this project are expected to help researchers focus their

research on the latest innovations in research in the field of connected vehicles and advanced vehicle systems using Arduino and Android technology.
The results could also be used by carmakers in critical decisions to equip vehicles with gadgets from robotic vehicles. This system uses a source code for order management, based on Android technology and the transmission of data via bluetooth technology for its operations.
The second part of this project highlights the implementation of the electronic and practical system, the actual construction.

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