

Vehicle Control with DC Motor in Android Based Systems

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Abstract: - With the widespread use of smart phones, applications using the Android operating system are encountered in many different areas. In the prepared study, the control of a car working with a DC motor was implemented with the interface designed in the Android operating system. Wi-Fi technology is preferred for the communication between the mobile device and the device and the control card on the vehicle. The open source Arduino UNO module is used in the control card on the vehicle. At the end of the study, the forward, backward, right and left movement controls of the vehicle were successfully completed.

Key-Words: Android, Arduino, DC motor, Wi-Fi

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1 Introduction

With the addition of the title of smart to mobile phones, which are one of the most basic tools of mobile communication, mobile phones have started to be mentioned with operating systems. Mobile operating systems such as iOS and Symbian remained on the basis of brands, while Windows mobile could not keep up with the developments of rival operating systems. Against these mobile operating systems, the Android operating system, which has the advantages of being a Linux core and open source code, has found a widespread use. The Android company was acquired by Google in 2005 and then it developed tremendously. Many smartphone manufacturers have preferred the android operating system on their phones [1].

By the widespread use of smartphones using the Android operating system, android-based applications have been developed in many different areas. Some of the Android-based projects are listed below. Kansız and Güvensan developed an android-based accident detection application by using the accelerometer on the phone. In the application they developed, they were able to distinguish a normal movement from falling, and if it was decided to fall, a message was sent to the designated places [2]. Oyediran and his friends used the Android platform in education. With the software they developed, OP-AMP applications were tested remotely via Android. It is possible to observe the output signal for different OP-AMP circuits and input values [3].

Albayrak et al. implemented DC motor control application with Android-based devices. In their applications, they provided speed and direction control of DC motors with bluetooth 2.0 communication, which is commonly found in smart phones. The information sent via the smart phone was received via the HC-06 module on the control card and the motor was controlled via the PWM signal produced by the PIC16F877A microcontroller [4].

In another study, Sefa colleagues implemented the monitoring and control of a speed-controlled DC motor via the android interface. The speed control of the engine was realized with a 32-bit Cortex M-3 class ARM processor. They used Bluetooth technology to communicate with the control card of the device with Android operating system. With the system they implemented, the current, voltage and speed information of the motor could be monitored and controlled remotely. The motor they use has a rated power of 300 W and IGBTs are used for motor driving [5].

Android-based applications have also found their place in social applications. İlhan and Mutlu allow people who will use the same route to travel together with the prepared program. The application they prepared consists of three parts. These are the parts of the server that will pull the data from a central service provider, send the information to the application, and provide the map information. An android-based interface has been prepared for the application part that sends information and communication with other blocks has been provided. The system, which is entered with a password, has enabled vehicle owners and people who will travel on the same route to be informed of each other [6].

2 Literature Reviews

The Android operating system also has applications in the field of health. Tuncer and Alkan performed abdominal image segmentation with mobile devices with Android operating system. In their application, the CT data of the patient was taken from the server and the segmentation process was completed using image processing techniques. The success rate of the system was obtained as 0.7 according to the ZSI criteria [7]. Aslan and Yavuzer Aslan examined the importance of mobile programming, including the Android operating system, and found that it was not sufficiently included in the course curriculum. In order to meet the mobile programmer that the market needs, they suggested that there should be a separate course called "Mobile Programme" in the curriculum [8].

Basarslan et al., carried out the transfer of data from distance and temperature sensors placed on a vehicle to an android-based device. Arduino UNO board is used to receive and process data from sensors. In the transfer of

data from Arduino board to mobile device with Android operating system, MX-05 module, which uses 433 MHz RF communication, is used [9]. In another tool application made using the Android-based operating system; A fare collection system and passenger tracking system were developed for public transportation vehicles. With the software to be installed on the devices with the Android operating system, communication with the reader in the public transport vehicle was ensured and the fee was collected. They stated that they use NFC technology for communication between the mobile device and the reader [10].

Kandemir et al., developed an application for the needs of the visually impaired. The application they developed detects the text in the image taken from the camera of the mobile device with the Android operating system and speaks it out. The software they use during the process is generally open source software. They used Open CV for text finding and Tesseract program for converting the found text into text. In the last step, they performed the vocalization of the characters converted to text with the Android text-to-speech library. The speed test result of the system they implemented was stated to be suitable for real-time applications, and for a 50-image data set, there was text with an average of 182 ms and the recognition process was completed with an average of 4 ms [11].

Another application area of the Android-based operating system has been the advertising industry. Çakır et al., performed the LED signage control via bluetooth with a mobile device with android operating system. The image or animation desired to be displayed in their work has been adjusted with a mobile device with Android operating system and transferred to the Arduino Mega 2560 processor control card via bluetooth. The control card, on the other hand, allows the creation of the desired image or animation by driving RGB LEDs according to the incoming data [12].

As you can see, it is possible to encounter Android-based applications in many different areas. In the following parts of the prepared study, respectively; The materials and methods used will be presented, then the processes will be explained and the completed system will be introduced. In the last part, the successful aspects of the study and the parts that need improvement will be discussed.

3 Material and Method

The main circuits and integrators used to realize the Arduino-controlled DC vehicle control application; Arduino UNO board, ESP8266 Wi-Fi Module, L293B motor driver IC. Other materials used are Li-Po battery, wheels, motors and vehicle body. The features of the cards used are presented in detail below.

3.1. Arduino Uno Board

Arduino; A flexible, easy-to-use hardware developed by Italian electronics engineers from the development environment that includes an input output card and an application of the processing/wiring language, where anyone can download printed circuits and print their own circuits if they wish, with a stylish appearance and ready-printed with components installed. and software-based physical programming platform.

Arduino can be used to develop stand-alone interactive objects, or it can be connected to software running on a computer. Ready-made cards can be purchased, or there is information on hardware design for those who want to produce them themselves.

The microprocessor (AtmegaXX) on the Arduino development board is programmed with the Arduino programming language (wiring-based) and this program is uploaded to the board with the help of the Processing-based Arduino Software Development Environment (IDE) [13]. In the prepared study, it is aimed to control the vehicle with the Arduino Uno card.

Arduino Uno is an Arduino board with ATmega328 microcontroller. It can be said that Arduino is the most basic and widely used board. Arduino Uno has 14 digital input/output pins. 6 of them can be used as PWM outputs. It also has 6 analog inputs, a 16 MHz crystal oscillator, USB connection, power jack (2.1mm), ICSP header and reset button. Arduino Uno contains all the necessary components to support a microcontroller. The Arduino Uno can be connected to a computer, powered by an adapter, or powered by a battery.

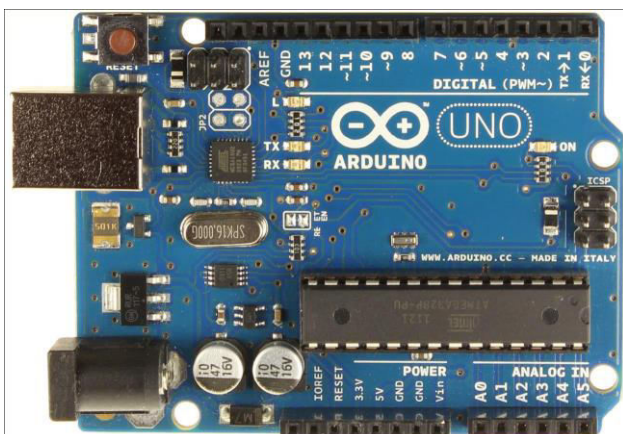


Figure 1. Arduino uno board

3.2. ESP8266 Wi-Fi Module

Wi-Fi (Wireless Fidelity) is the technology that enables devices such as personal computers, video game consoles, digital audio players and smartphones to connect to the internet wirelessly.

It is a compatibility indicator that shows that Wi-Fi products can provide wireless connection and is determined according to IEEE 802.11a, IEEE 802.11b, IEEE 802.11g and IEEE 802.11n standards.

Wi-Fi allows laptops, PDAs, and other portable devices to connect to the local area network through nearby wireless access points. The connection is made at the 2.4 GHz or 5 GHz radio frequency, depending on the IEEE 802.11 protocol, which the wireless access points and the device jointly support. The data is sent and received in accordance with the CSMA/CA (Carrier sense multiple access with collision avoidance) protocol, and thus the problem of error occurring during the transmission of packets is resolved.

Advantages; It has high data transfer rate and network structures. At the same time, it is a great advantage that it is widespread throughout the world. The disadvantages are the high risk of malfunction and the lack of sound transmission. The ESP8266 Wi-Fi module used in the study offers IEEE 802.11 b/g/n support. With this module, data transmission can be provided by easily connecting to the wireless networks around. Here, the program designed for Android systems with the Wi-Fi module on the vehicle communicates over the wireless network, and routing commands are sent to the vehicle.

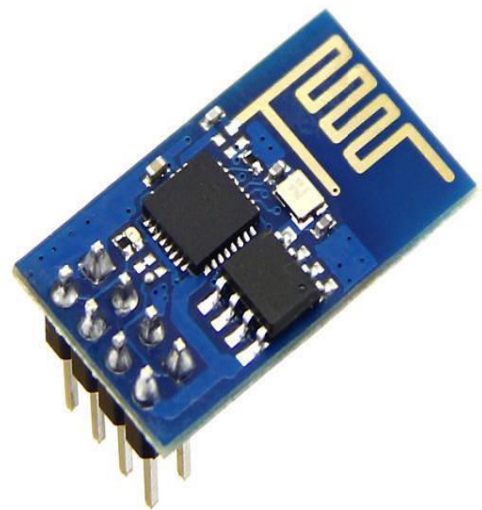


Figure 2. ESP8266 Wi-Fi module

4 Research Findings

Thanks to the ESP8266 module, the vehicle is controlled by using the Arduino board as a server. By using AT commands within the Arduino codes, the ESP8266 module is connected to the Wi-Fi network to obtain an IP address. Again, the server was established with AT commands (Figure 3). HTML commands have been written to Arduino so that the user can connect to this page. The user is enabled to control the vehicle with the HTML buttons created with these commands.

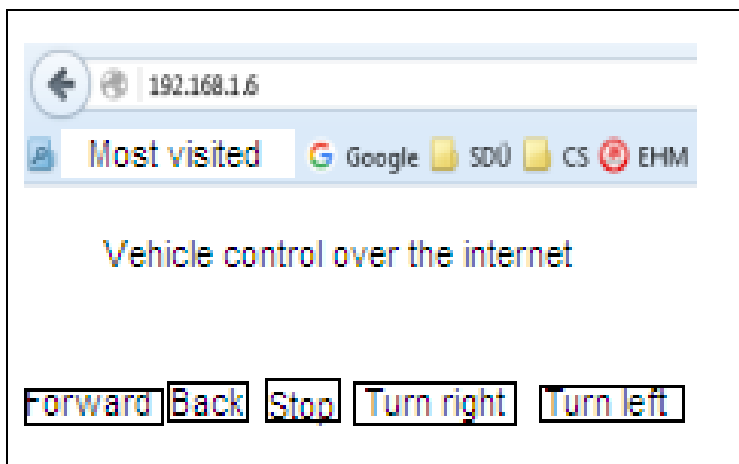


Figure 3. Server and buttons installed with Arduino

Arduino can understand which page the user visits on the server it creates. By using this feature, the movement of the vehicle is determined according to the URL of the page to which the user is connected. For example, when the user presses the "Back" button, the page URL will be "/?pin=back". Arduino will detect this situation and make the vehicle go backwards (Figure 4).

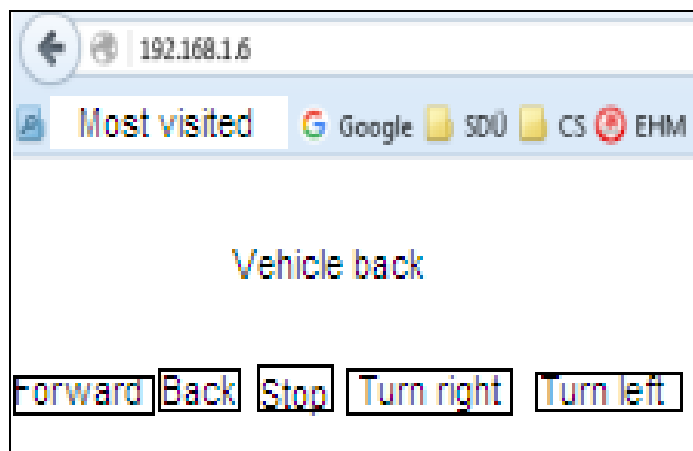


Figure 4. The URL of the page that occurs when the back button is pressed

In the developed interface, there are "FORWARD", "BACK", "RIGHT", "LEFT" and "STOP" buttons. Vehicle control is provided with these buttons. When any button is pressed, a connection to the server established by the ESP8266 Wi-Fi module is established in the background. According to the URL used when connecting to the server, Arduino processes the necessary commands and brings mobility to the vehicle.

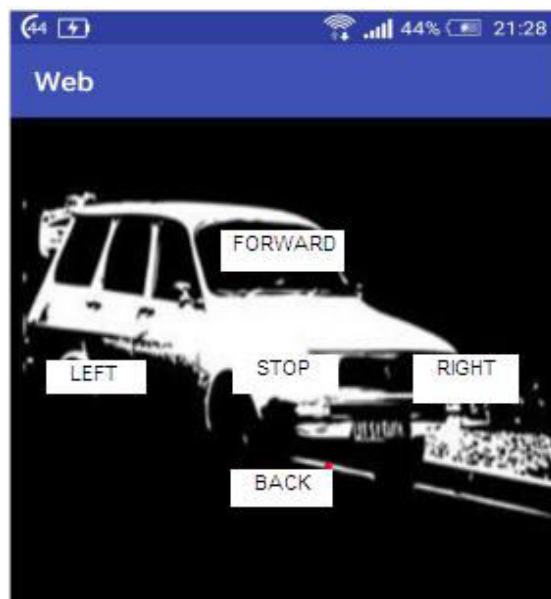


Figure 5. Improved interface

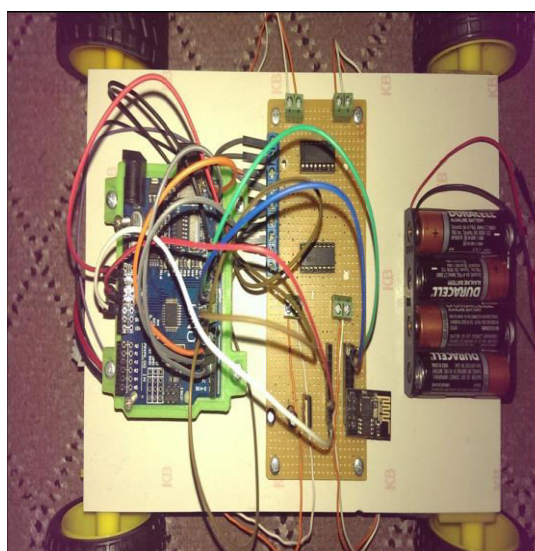


Figure 6. Arduino controlled DC vehicle

5 Conclusions and Discussion

In this study, it is aimed to control the vehicle via wireless network with Android application. With the studies, the Android application was developed and the necessary circuit for the vehicle was designed. The designed circuit has been successfully mounted on the vehicle. According to the codes written on the Arduino uno card used in the vehicle and the button pressed from the Android application, the data was transmitted over the wireless network and the movement of the vehicle was ensured.

In the study, the Android Studio program was used to develop the Android interface. Android Studio is the official programming tool also recommended by Google. Here are the key features Android Studio offers to code developers:

- Gradle-based, flexible project building system.
- Multiple APK output according to different features and versions.
- Quick and easy project generation with basic project templates.
- A drag-and-drop rich editor that facilitates screen designs.
- Test tools to check the application's performance, usability, and operability in different versions.
- Easy and secure APK signing.
- Ability to add Google services to the application without additional effort.

With the introduction of Android operating system devices into our lives in recent years, our life has become easier, and now we have the opportunity to access the information we want directly without the need for computers. Android is an operating system developed by google for mobile devices such as mobile phones, tablet computers and netbooks. Android is GNU software built on the linux kernel base. The GNU kernel is an operating system that includes system tools and user software. As the name suggests, GNU (GNU's Not Unix) is structurally similar to unix, but in fact it is a unique software different from unix and does not contain any unix code.

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