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Controlling and Monitoring a Robot-Car Based on Smart Phone Applications

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Controlling and Monitoring a Robot-Car Based on Smart Phone Applications

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Abstract. A robot-car is typically an electro-mechanical system driven by electronic programming and computer programming. It can be managed by an Android smartphone APP. The remote buttons in the android app have been created in this paper by monitoring the motion of the car with them, using Bluetooth communication for the controller and android interfaces. The controller can be attached via UART to the Bluetooth module. The robot motion can be controlled according to commands obtained from Android. A robot in a car controlled by Android smartphones using Bluetooth waves will be presented. A video camera will send a video signal to the iPhone or Android device via Wi-Fi without the internet. The implementation will be shown and discussed clearly. The purposes of using this aspect are many and different such as tracking theft cars or exploring areas where humans cannot reach because of danger, pollution, or infested places. The consistent output of a robotic system along with quality and repeatability are unmatched.

Keywords. Arduino, Robot, Smart phone.

1. Introduction

Nowadays, with improved computers, higher loading capacities, ironic entertainment features and more communication methods, smart phones are becoming more powerful. Bluetooth is now generally used for data distribution carrying new capabilities to smart phones. Bluetooth technology demonstrates its benefit by merging with mobile phones created by telecom supplier Ericsson in 1994[1,2]. The way people use digital devices at home or in the workplace have shifted and old-style wired digital devices have been transferred to wireless devices. A host Bluetooth system has the ability to communicate via one connection with up to seven simultaneous Bluetooth modules. The first commercial robot was introduced to the U.S. in the 1960s. Since then, their program has advanced tremendously, generating numerous benefits for robotics. The rise of robotics has also led robots to become more prevalent in diverse sectors, from construction to health care [3]. Robots are known as smart machines that can be built and used in many fields, such as construction, assembly, supply lines, healthcare, etc. In order to simplify our lives and maximize efficiency, these robots accomplish heavy, risky and precise work because they can work 24 hours without rest and can do human work, but more



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reliably and with less time. Assistive mobile robots that conduct numerous forms of daily tasks in many fields are used to enrich our lives. The idea of this research is to use robots to access areas that may pose danger to human life due to the difficulty of moving in those areas or for instance because they are mined areas or for any other reason [4-8].

1.1. Types of robots

Recently, many types of robots appeared in many fields with different tasks. These different types of robots are growing steadily and offering a number of jobs that support human in varied life aspects. Robots can be divided into types based on their applications as follows:

1. Industrial robots: It uses articulated arms built in many applications such as painting, welding, material handling, etc. for industrial purposes [9].
2. Domestic or household robots: It is used at home in many tasks such as robotic pool cleaners, robotic vacuum cleaners, sweepers and others [10].
3. Medical robots : It is used in medicine and medical institutions. Medical robot can perform many tasks in this field such as surgery, automated guided vehicles and maybe lifting aides [11].
4. Service robots: This can offer varied services such as collecting data, show off technologies, research and others.
5. Military robotics: This category of robotics is used for military uses such as robots for bomb disposal, multiple transport robots, military field search and save, and several tasks [12].
6. Entertainment robots: These types of robots are made for entertainment purposes such as Rob sapiens or the running alarm clock. Also it serves the owner or his housemates.
7. Space robots: Often used in space on the International Space Station, as well as on Mars rovers and other space robots. Robots of this type are used in space with truthful software.
8. Hobby and sport robots: Robots of this kind are designed to race with each other for fun.

2. Literature review

In [13], Wener et al. analyzed a human robot NAO. They demonstrate that human robots such as NAO can make some people feel protected and fearless. In addition, the robots can interact with people via a speaker that makes people feel more satisfied. Robots, however, are still not flexible enough to live outside home with people. Some authors designed a robot to follow a specific line. The design is integrated with sensing devices, Bluetooth and Wi Fi systems connected with an Arduino UNO central device. The robot can be controlled by long-range Wi-Fi connectivity linked to the used end and the car pattern can be altered with the used side. In [14], the researchers introduced an Arduino-based vehicle infrastructure that no longer allows cars to be manually operated. Through using the Arduino microcontroller, accelerometer, RF sender/receiver, and Bluetooth, the suggested work was accomplished. In this work, two major contributions are discussed. First, according to the movement and location of the hand, the car can be regulated with hand motions. Secondly, the proposed car system is further expanded to be operated by a smartphone android-based program with multiple modes (e.g. touch button mode, speech recognition mode) [15]. Studies on autonomous navigation and driver assistance systems have been developed by the study community, using the CaRINA I platform for tests and validation. Our framework covers mechanical vehicle adaptations and the development and functional application of an embedded computing architecture. The sensing and actuating infrastructure is addressed in depth in this article. In order to assess both the platform and the proposed algorithms, several experimental tests have been carried out. The study presents the development of the two CaRINA I and CaRINA II outdoor intelligent vehicle systems, their device design, modeling software, and control modules [16]. It also describes the development of smart control system modules that enable mobile robots and vehicles to function autonomously in the control system. Work on tele-operation, driver assistance systems and autonomous navigation using vehicles as tools for training and validation has been carried out. Concerning hardware, software and communication environments with real-time obstacle detection and obstacle avoidance, the concept and implementation of a robotic car was introduced in [17]. To introduce the device, the Arduino platform, the android framework and Bluetooth technologies were used. In this article, the architecture and implementation of robotic cars

using sensor programming on a framework has been implemented. With the interaction of Android-based applications, this robotic system was developed. Arduino Uno was used as the brain of the robot. There are several hardware elements in the robot, such as the Bluetooth module, PIR sensor, ultrasonic sensor, and buzzers. It also contains a smartphone device that uses a software component.

3. Parts of the proposed work

3.1. Arduino

The Arduino Uno which shown in fig.1 is a microcontroller used for the main computing and the key connection between all the components in the robot. It has 14 optical input / output pins, 6 analog inputs, a power port, a USB connection, a 16 MHz crystal oscillator, an ICSP header and a reset button. By attaching it to a device with a USB cable and charging it via a battery or an AC-TO - DC converter to launch, Arduino can easily be used to support the microcontroller. Arduino sampling uses software and hardware and is capable of reading tweet messages, input signals, and turn them to the output. The "UNO" word means "one" and is named to mark the latest version of Arduino 1.0. The differentiation between the Uno and other previous boards does not, however, use the UNO's FTDI USB-to - serial driver chip; instead, it structures the programmed Atmega8U2 as a USB-to - serial converter. The reference version of Arduino will be version 1.0 of Uno. The UNO takes into account the newest board in the USB Arduino series and the Arduino platform reference model. The 14 optical input / output pins, 6 analog inputs, 16 MHz quartz crystal, USB connection, power port, ICSP header, and a reset button (6 of which can be used as PWM outputs) are available. The similarity between the previous edition Arduino and the genuine Uno shows that the ATmega328p datasheet is focused on the microcontroller surface. In order to support the microcontroller and power it to get started with an AC-to - DC converter or battery, it has all the functionality required to simply connect to a device with a USB cable[18].

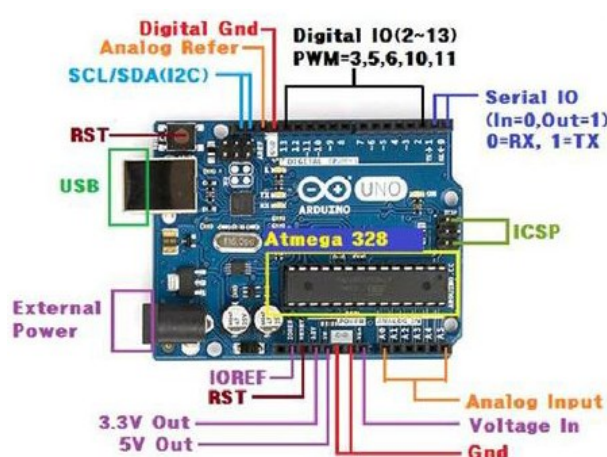


Figure 1. The arduino used in this paper.

3.2. Motor control using arduino

It is called the stepper engine since it splits a complete rotation into a number of equivalent phases. It is very easy to operate the stepper motor using Arduino since the Arduino program comes with a sample servo sketch and servo library that will easily get you up and running. You can control the Arduino Uno with an Usb cable or an external power supply. Through using either an AC-to - DC converter or a battery, electrical power may be provided. By plugging a 2.1 mm center-positive plug into the power jack of the board, the adapter is linked. You should insert leads from the battery into the GND and VIN pin headers of the POWER connector. On an outside supply of 6 to 20 volts, it is possible to power the board. The 5V pin will, however, supply less than five volts if less than 7V is supplied, and the board may be unstable. The voltage regulator can overheat and affect the board if more than 12V is used. 7 to 12 volts is the recommended range [19].

3.3. Bluetooth (HC – 6)

A serial port from which you can send and receive data is defined by the HC-06 which shown in fig.2. Hence, you can manage and track your project using a serial terminal or a personalized Bluetooth program on your computer or phone. As the serial terminal, the researchers used Teraterm. The HC-06 module is disconnected before uploading the code to the Arduino, as it shares the tx / rx pins and will interfere with the upload. Then it is linked again once the code has been successfully uploaded. We can use stepper motors and rails for the X and Y axes from two dvd / cd roms. The printing area will be 4x4 cm overall. You can also use a Bluetooth module (like HC-06) to wirelessly print your things through your computer's Bluetooth link because it works with serial communication [20].

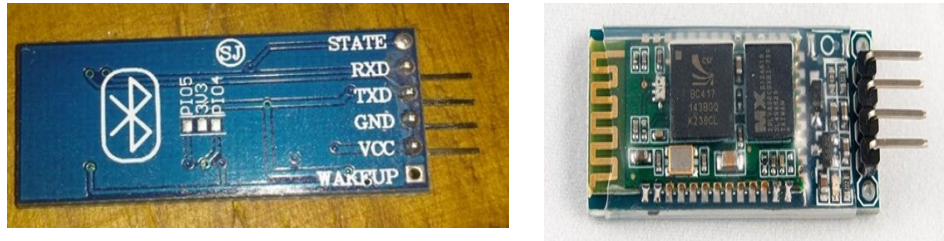


Figure 2. Bluetooth (HC – 6).

3.4. Driver motor

Driver motor bridge H L298N as shown in fig.3. This Bridge H Driver is based on the L298N chip, built to control inductive loads like relays, solenoids, DC motors, and step motors. With this Bridge H L298M Driver, you can independently control the speed and rotation of 2 DC motors or 1 step motor. It has screwable terminals for easy installation and holes in the ends of the plate for fixing[20].

Specifications:

- Operating Voltage: 4 ~ 35v
- Chip: ST L298N
- Control of 2 DC motors or 1 step motor
- Maximum Operating Current: 2A per channel or 4A max
- Logic voltage: 5v
- Logic Current: 0 ~ 36mA
- Temperature limits: -20 to + 135 ° C
- Maximum Power: 25W
- Dimensions: 43 x 43 x 27mm
- Weight: 30g

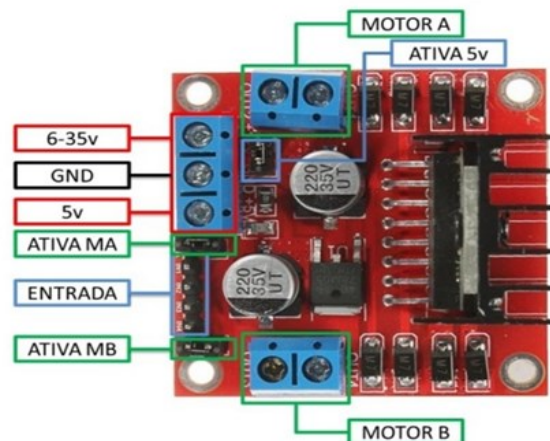


Figure 3. Driver motor.

4. Results and discussion

- 1- Battery: In this project, we use 6 batteries of “Efest Purple IMR 18650 2100mAh 3.7V
- 2- Regulator: Its name is “H1038 LM75H05k Steel Voltage Regulator”
- 3- Diode:
- 4- The Camera: This camera which shown in fig.4 can record videos and take photos in HD mode and SD mode, and it has a speakerphone that can be used on phone.
- 5- 12 v DC Motor: 4 motors are used in our project.
- 6- First, we connect the previous components according to figure 5. Second, we need two phones, the first must contain a v380 program we can download it by “App Store” for iPhone or by “Google Play” for any android phone, figure 6. This app is used to control the camera by its Bluetooth inside the camera as shown in figure 7. The other phone should be the Android phone we download “Bluetooth RC Controller”. This app fully controls the robot in all directions as shown in figure 8.



Figure 4. The Robot camera.

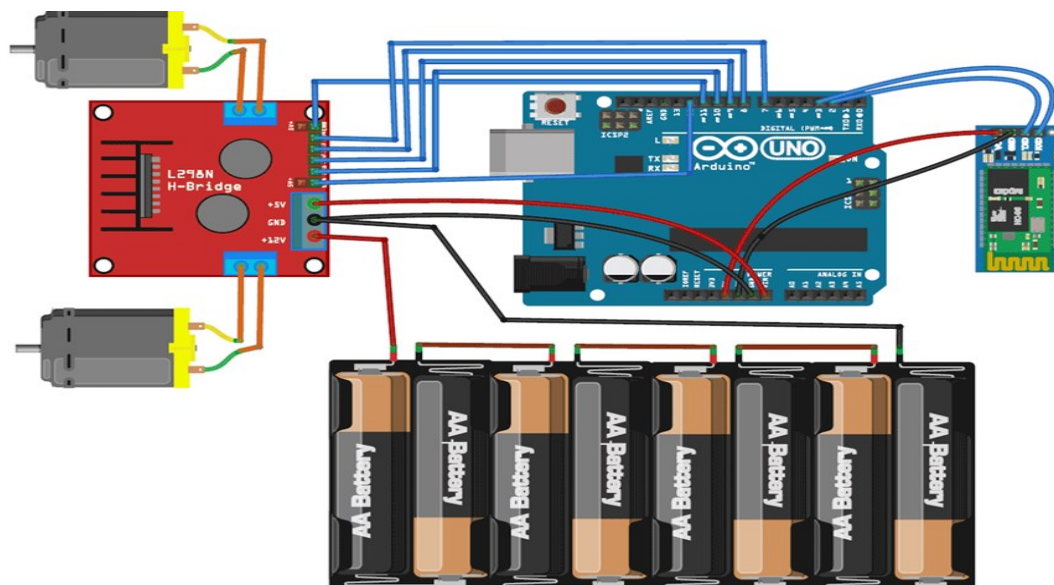


Figure 5. The connection map of the robot circuit.

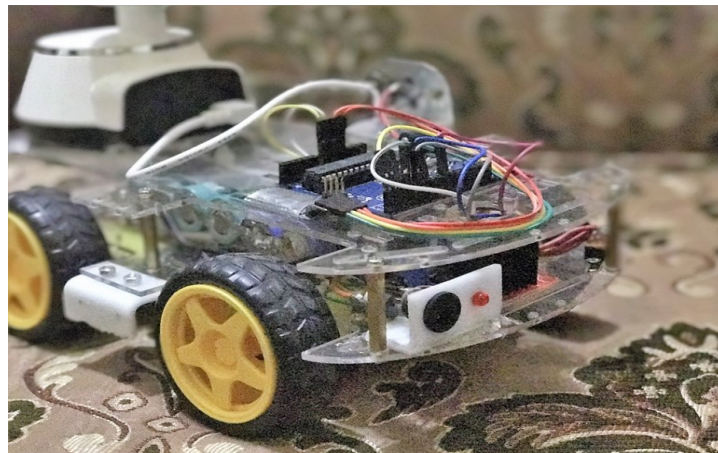


Figure 6. The structure body of the robot car.



Figure 7. The program which can be downloaded from “App Store”.

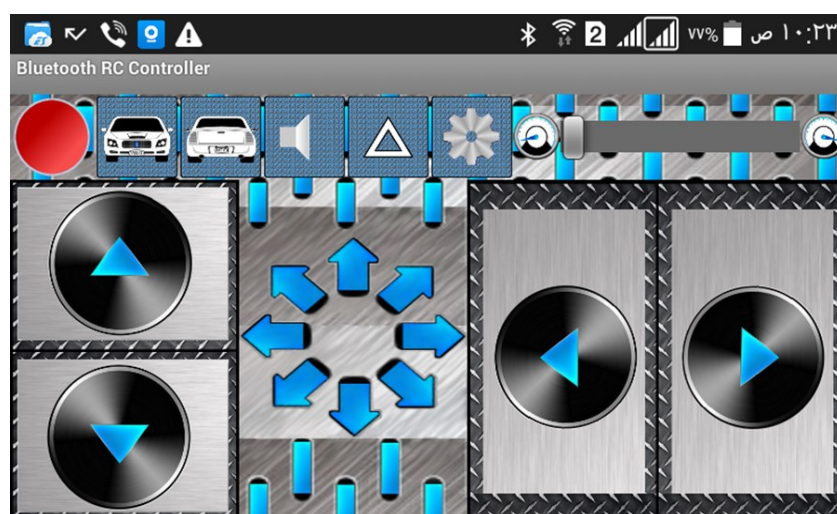


Figure 8. Bluetooth RC controller.

5. Conclusion

In this paper, the Car robot was developed using smartphones that run on Android, Bluetooth, and an Arduino microcontroller. The Arduino program has been implemented with high efficiency and the work of all accessories has been carefully detailed. Ultimately, this will be important in many aspects of life. It will provide great service to people to do their work easily and creatively. Also, this research showed the possibility of vehicles to travel across rough terrains as well as on flat roads.

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