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Multi Featured Robot Car with Arduino

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ABSTRACT: Arduino is based on easy-to-use hardware and software having an open source prototyping platform. Arduino uses an ATmega328 microcontroller. Since robotics has become a major part in our daily life and also in the engineering field and it plays a vital role in the development of new technology. This is a very easy and simple type form of remote control robot car, where the ordinary micro-controller has been replaced by Arduino. The remote can be any android or IOS cell phones. This project can be made in a bigger scale for real time vehicles.

KEYWORDS: motor driver, Bluetooth Module, ultrasonic sensor, microcontroller.

I. INTRODUCTION

Robots are the future and the future is now! This robot was mainly built from Arduino and combining various projects of Arduino to form a Multi Featured Arduino Robot. The robot acts as a smart car which is capable of understanding, controlling as an RC car and even avoiding obstacles while moving. It is mainly controlled through an Android phone which is connected to it through Bluetooth. Based on features involved and Tilt sensing, it can really behave like a cute, smart robot car.

II. RELATED WORK

The concepts which are in creation in reality are somewhat costly in nature. This project features the use of automated safety and remote access securely using a cheap alternative. Also we can use it in a normal car without much addition of parts and weight. Luxury and Safety are one of the important features we see in this project. This car features characteristics which are needed by people to reduce accidents percentage per day.

III. PROJECT OVERVIEW

Motors having moderate rpm (60 to 100). This would help to keep the speed of the robot under control, as no other speed control circuit is installed. And 8 aa batteries are enough to power the robot car for a good time. And considering the Bluetooth, HC 05 is suitable for the robot because it is cheap enough, and the performance is outstanding too. The 1 GB micro SD card is needed to store voice files which are played when any question is asked to the robot.



fig 1: Important Components

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Hardware requirements:

1. Arduino Uno
2. 2x L293d motor controller circuit
3. 4x bo motors and wheels
4. HC SR04 ultrasonic sensor
5. 8 AA battery holder and batteries
6. 1gb micro SD card
7. small switch box for chassis.
8. HC 05 Bluetooth Module

Software Requirements:

1. Language like C.

IV. ARCHITECTURE

3.1. Bluetooth Control Theory-

Bluetooth controlled car is controlled by using Android mobile phone instead of any other method like buttons, gesture etc. Very easy to use as only needs to touch button in android phone to control the car in forward, backward, left and right directions. So here android phone is used as transmitting device and Bluetooth module placed in car is used as receiver. Android phone will transmit command using its in-built Bluetooth to car so that it can move in the required direction like moving forward, reverse, turning left, turning right and stop. The positive polarity cable will move the car forward for motor movement or back side while for the direction motor or front side, the positive polarity cable will move the wheels left. You can build the circuit on a trial basis using a small breadboard first to confirm all connections as it is essential to connect the State pin of HC-06 with the Arduino pin 2. A big RC car will require more power and therefore you should use L298 module board as L293D motor driver can only give max 0.5A per channel and is overheated in a while. While L298 module board is bigger L293D that can give 1A per channel and also has a heat sink. The code for this project is embedded using Code

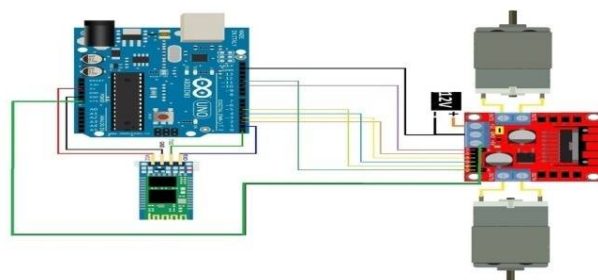


fig 2:circuit diagram of Bluetooth control

3.2. Obstacle avoidance theory-

The obstacle detection is primary requirement of this autonomous robot. The robot gets the information from surrounding area through sensors mounted on the robot car. Some sensing devices used for obstacle detection like bump sensor, infrared sensor, ultrasonic sensor etc. Ultrasonic sensor is most suitable for obstacle detection and it is of low cost and has high ranging capability. Its ability to operate autonomously is based on the bot's ultrasonic sensor. The ultrasonic sensor emits high-frequency sound waves (these waves can't be detected by human ears because they are too high), and waits for those sound waves to reflect off of an object, and calculates how long it takes for the sound to return to the sensor. The sensor I used comes with **send** and **receive** pins labeled "trigger" and "echo," respectively. These pins do most of the work for us. You can find additional details about interfacing to the sensor module if you look through the code. We need to control the sensor's high-frequency emission. To do this, we need to send the sensor module a logic HIGH signal that's at least 10 μ s wide to the trigger pin. We first write the pin **LOW**,

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then **HIGH**. It waits for at least $10\mu s$, and then writes it **LOW** again. This tells the sensor to emit the signal. When the sound emitted by the sensor reflects off of an object and returns to the sensor, the sensor sends a digital signal to the Arduino. This digital signal indicates the ultrasonic signal's round-trip travel time.

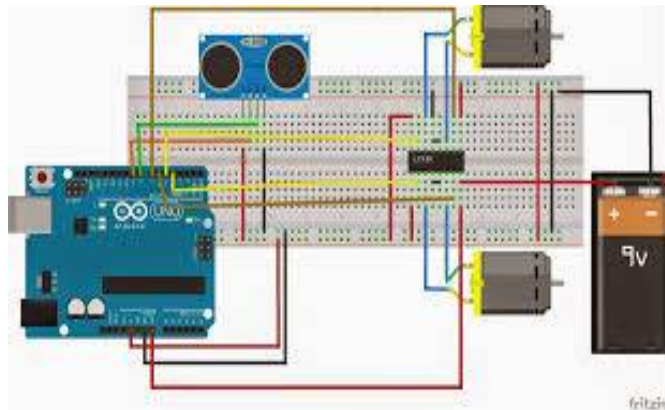


fig 3: circuit diagram of Obstacle avoidance theory

V. WORKING

The robot works as a general RC car. Nothing new in this, it is just the same as a general remote controlled car available in the market, the only difference being that we are using an Android app to control the robot. There are different buttons in the android app, each having different characters associated with it. When any key is touched, a character is sent to the robot through Bluetooth, just like the gesture control mode. Further, the same characters are sent when the respective keys are touched, and the robot follows the incoming characters. 360 and -360 degree buttons are available in the app to make the robot look right and left.

This robot contains following features:

1. Bluetooth Control Theory:- Using an Android app to control the robot. Different buttons in the app, each having different characters. In the following diagram there is left, right, top and bottom buttons used to control robot car. First we have to connect to the Bluetooth module of robot car through android phone. After the established connection car can move according to instructions given by user.



Fig 4: Bluetooth control App

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2. Obstacle Avoidance Theory:-preventing itself from colliding with any object.

The obstacle avoidance robotic vehicle uses ultrasonic sensors for its movements. A microcontroller of 8051 family is used to achieve the desired operation. The motors of car are connected through motor driver IC to microcontroller. The ultrasonic sensor is attached in front of the robot. Whenever the robot is going on the desired path the ultrasonic sensor transmits the ultrasonic waves continuously from its sensor head. Whenever an obstacle comes ahead of robot car the ultrasonic waves are reflected back from an object and that information is passed to the microcontroller. The microcontroller controls the motors left, right, back, front, based on ultrasonic signals. In order to control the speed of each motor pulse width modulation is used (PWM).

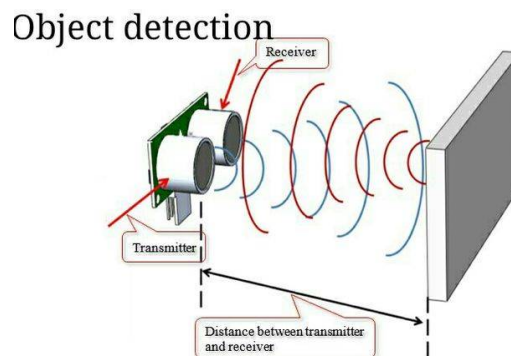


fig 5: Obstacle Avoidance Theory

VI. OUR WORK

This project of ours is controlling car not by using a sensors or transmitter but using Bluetooth which is a very simple communication medium in the present day. The remote in this project is an android device which has an inbuilt Bluetooth module. The Bluetooth is a serial communication medium through which we can connect two devices. Here we have inserted a Bluetooth module which gets connected to the phone's Bluetooth, that allows us to communicate and allows to take command over it. The Bluetooth module does not work on its own in controlling the car. The main part in controlling the car is played by the Arduino UNO which houses the micro-controller ATMEGA32. Arduino has played a major role in the robotic section and has made it easier to convert digital and analog signal to physical movements. The project is Bluetooth based because it gives us wider range of control and more efficiency. It also gives us the advantage of changing the remote anytime, meaning that we can use any android devices including phones, tablets, computers. Physical barriers like walls, doors, etc. do not effect in controlling the car. It will also have obstacle avoidance theory to avoid obstacles in path.

WHY ARDUINO?

- We have used Arduino because it is an open source device which can be programmed through any operating system like Windows, Mac, Linux, etc.
- The language used is understandable and easy.
- Arduino can be used by beginner in robotics to professionals.
- Changing of program is easy.
- Shield (external circuits) are available for various purpose like, if we want to connect the Arduino to a network then a wi-fi shield is available. For controlling the motor a motor shield is available, and for this project a Bluetooth shield is used.

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VII. ADVANTAGES

- It is feasible to implement Bluetooth.
- .03 communication between smart phone and microcontroller.
- The development of apps for Android in Android is easy and free of cost.

VIII. APPLICATIONS

- It can be used in various industries where human intervention is not desired.
- It can be used to develop robot with military applications.
- It provides more application based on Android operating system.
- With tremendous smart phone in markets, it is bound to have many more applications in near future.
- Especially military applications.
- It can be used for city wars.

IX. FUTURE SCOPE

- We can interface sensors to this robot so that it can monitor some parameters.
- We can add wireless camera to this robot.

X. EXPERIMENTAL RESULTS

Results of obstacle avoidance theory is based on SONAR (Sound Navigation And Ranging). The HC SR04 sensor continuously emits ultrasonic sound waves. These waves get bounced back after striking a solid surface and come back to the sensor. The time taken by the waves to come back to the sensor is recorded. Since sound travels at 340 m/s approximately and we know that $SPEED \times TIME = DISTANCE$, we can determine the distance ahead. For example, if the sound takes 2 seconds to come back, we can determine the distance through the above formula i.e. $340 \times 2 = 680$ m. This is how the robot can measure the distance ahead of it through the sensor. While moving, the robot continuously measures the distance ahead through the sensor. If it senses that the clear space ahead of it is less than 30 cm, it stops moving. Then it looks left and right and compares the distance of each side. If the left side has a greater distance, the robot turns left. Else if the right side is greater, the robot turns right. If both sides have equal distances, the robot turns back.

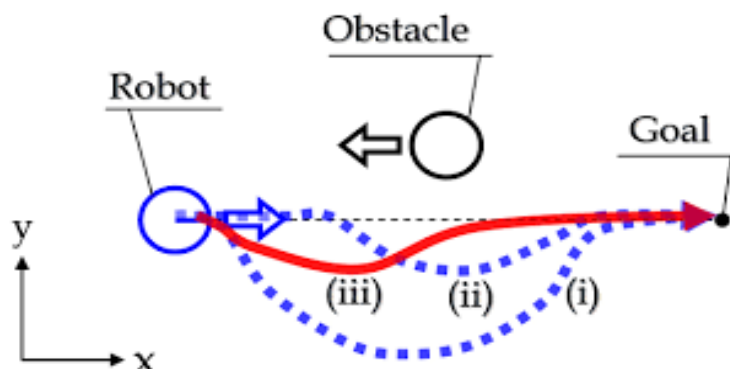


fig 6: Experimental results of Obstacle Avoidance Theory

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XI. CONCLUSION

The combination of multiple features on a single robot makes it efficient. Also has Effective Cost. Arduino being an open source hardware is a versatile and easy platform for this project.

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