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BLUETOOTH AND OBSTACLE AVOIDING BASED ROBO CAR

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Abstract: Arduino car contains Arduino microcontroller with basic mobility features. The Program contains instructions between android controller car and microcontroller (**ATmega328**). Android mobile Controller uses different mobile sensors to supervise motions. An appropriate program is compiled into Arduino microprocessor by a software known as Arduino (IDE) 1.0 to interact with the android controller. The obstacle avoiding car uses ultrasonic sensors to locate walls using echo Locations. The 4 DC motors are powered by a 3.7V battery and are driven by a motor drive which is instructed by Arduino uno. The car moves forward until it sees a wall less than 35cm (about 1.15 ft) away. If this Condition is met the car backs up and the servo motor rotates 90 degrees to the Left for the sensor to scan how far away the left wall is. The servo motor then Rotates 180 degree to the right to scan the distance of the right wall.in Bluetooth controlled we use an app that has similar buttons or instructions as that of a remote by pressing each of the buttons the car can be controlled. This app contains an accelerometer that can control the speed of the car. Bluetooth after giving instructions to Arduino for various actions through interface via Bluetooth module

Index Terms **–Arduino uno, Ultrasonic sensor, Bluetooth, Obstacle, Arduino, App, Avoidance, Android.**

I. INTRODUCTION

Robots are more efficient as they can perform many autonomous functions in many fields. This project is built using ultrasonic sensors for its movement. This performs tasks according to human guidance as specified. The Arduino obstacle avoiding car uses "**HC-SR04 ultra sonic sensor module"** that is mounted on top of a 9gm servo motor to locate any objects that are present in front of the car. the 4 DC motor are powered by l293d motor drive. the car moves forward until it sees any obstacle that is less than 35cm away. thus, if any obstacle is detected the servo rotates to 90degrees to the left to locate any obstacle by sending ultra-sonic waves. if the obstacle is detected the servo rotates to 180degrees right to scan any obstacle if present. If the distance of the object i.e., obstacle that is in left is greater than right the car turns 90 degrees to the left or vice versa. the ultra-sonic sensor sends sound waves for every 10 microseconds. if any obstruction is present the sensor receives the echo therefore the distance between sensor and object is calculated. therefore, the car creates its own path avoiding all the objects that are appearing in front of it. this project is designed to navigate in unknown conditions where human interaction with the environment can be dangerous.

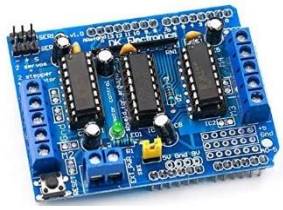
In Bluetooth controlled car we use "**HC-05 BLUETOOTH MODULE"**, we already know that Bluetooth is used for wireless communication between two devices. at first, we pair Bluetooth module with android through an app called "**BLUETOOTH RC CONTROL**." Now while doing different operation such as when we are pressing any keys it sends the data value to the Bluetooth module. We code in such a way that certain conditions for the car to go in certain direction as given by the code hence the car will perform the given functions as specified in the code. This module is important as it is used for communication between two devices. This is controlled by an android app instead of a traditional remote control.

II. Literature survey

The robot intelligently detects the obstacle that is in its path and navigates and moves around as given in the code. So, this system provides an alternate way to the existing system to replace a skilled labour with robotic machinery which can handle more complex tasks in less time increasing the accuracy with less cost with economic growth. With combination of Bluetooth module and motor driver shield we can control this by our android phone app. This technology is not used in many fields due to limitation of communications overhead. We use Bluetooth module for the communication between the app and the device. the android mobile phone is free resource and easily available, that can be used by decreasing the cost of the robot. All the commands are available in the app thus the car can be easily controlled by just touching the buttons on the android-based app.

III. Hardware requirements

ARDUINO UNO BOARD- in this project Arduino uno acts as a brain that controls every part of the project. This is an open-source microcontroller board based on microchip ATmega328. It has digital and analog input/output pins that can be interfaced with various boards and shields. Arduino board can be powered by using the USB cable from your computer. All you need to do is connect the USB cable to the USB connection. The microcontroller is an embedded chip that controls most of the devices it is a 40-pin chip that comes with built in microprocessor. uno is a8 bit ATmega32p that contains other components such as crystal oscillator, serial communication, voltage regulator etc. To support the microcontroller .it has 6 analog pin input,18Mhz microcrystal, USB connection. the operating voltage is 5 v.it contains 32kb of which 0.5KB is used by bootloader and a clock speed of 16Mhz.the important pins such as RXD and TXD pins are used for transmission and receiving the serial data inputs.



MOTOR DRIVE- the l293d motor drive is designed in such way that it fits into Arduino uno r3. This particularly used to drive the DC motors, Leds etc. This is a shield usually used to drive 2 to 6 dc motors, a wire stepper motor, and a set of two pins to drive the servo.it is integrated to adopt high voltage and high current at four channel motor drive to accept load such as relay solenoid, DC motors and four wire stepper motor and switching power transistor. this is suitable for switching application's up to 50hz.the motor driver shield is placed on uno board through which all the sensors and motors are connected. The supply for the motor drive is usually given in between 5v to 36v.

ULTRA SONIC – the ultra-sonic sensor HC-SR04 uses SONAR (sound navigation and ranging) technology. To determine distance of the object. The device measures the distance of an object by emitting ultra-sonic waves and converts the reflected wave into electrical signal. the ultra-sonic sensor travels more than the speed of sound human can hear. The ultra-sonic sensors have two main components first one is a transmitter that emits sound using piezoelectric crystals and second one is receiver which encounters sound waves after the reflection from the object.

BLUETOOTH MODULE –Bluetooth module is used for wireless communication. This was designed to replace wire cables. This uses serial communication with electronics. This module is usually used to connect small devices. to be operated within 4-6v of power supply. It supports 9600, 19200, 34800, 57600 baud rates. This can be operated in master-slave mode which means it will neither send nor receive external data.

SERVO MOTOR- this servo motor is tiny and lightweight with high output power. It rotates 180 degrees, 90 degrees to the right and 90 degrees to the left. This servo is designed to work with control systems. It provides good torque, holding power and faster updates with response to external force. However, these are dead cheap and serve the purpose.

GEAR MOTOR -gear motor is a component that adjusts to the speed mechanism of the motor, thus leading them to operate at a certain speed. These motors deliver high torque at low speeds, as gear head functions as a torque multiplier and can allow small motors to generate higher speeds. This has a combination of gear box and electric motor.

ROBO WHEELS-these are used to navigate in unknown environmental conditions that are paired with gear motors.

JUMPER WIRES- jumper is an electric cable with connector end. This is normally used to connect the components on bread board, test circuits, and connecting the components on embedded chip. Each end is fitted according to the requirements. By using them we can avoid soldering as these come with several types of endings and colors.

Software requirements

ARDUINO - Arduino is an open-source software that makes it easy to write code and upload it to the board. This software can be used with any Arduino boards. We write the codes using Arduino software and these are next compiled into the Arduino boards. This ide software is applicable to windows, Linux, mac, os x. The programming languages that are used are c and c++. After writing the code the upload button is used to compile the code into the Arduino board using an usb cable that is connected to your computer and Arduino board. This has many ranges of programmable printed circuit boards(pcb's). These boards can read both analog and digital input signals. The board that we use can be controlled by sending a set of requirements of instructions to the microcontroller on the board via Arduino software

BLUETOOTH CONTROL-this application is designed to be used with a modified car. This app allows you to control a microcontroller and Bluetooth that is fitted with your Rc car. We control the Rc car with either virtual buttons or phones accelerometer. The slider in the app allows us to control the speed of the car.

IV. Design and implementation

Step1-allign the motor wheels and dc motors to the car chassis.

Step2-place motor drive l293d over Arduino uno and glue it on the chassis. Attach the dc motors to m1, m2, m3, m4 of the motor drive.

Step3- place the ultra-sonic sensor above servo motor with the help of ultrasonic holder. Place the ultrasonic sensor vcc to vcc of motor drive, trig to A1, echo to A0, and gnd(ground) to gnd of motor drive by using jumper wires. Now connect the servo motor to ser1 of the drive by using jumper wires.

Step4- solder RXD, TXD pin of Bluetooth module to pin number 1,0 (Aref pin) of drive. Gnd, vcc of Bluetooth to gnd, vcc of driver shield.

Step5-now attach battery with switch to Ext power of the motor, a supply of 3.7 volts to 9 volts.

Step6-connect board and your computer by a cable, select board and board and then remove rx,tx pins of the Bluetooth, compile the given code to Arduino uno board.

Step6-for obstacle avoidance remove the function comment (// before obstacle ())

Step7-for Bluetooth control remove the function comment (// before Bluetooth ()). again, remove rx,tx pins of Bluetooth now compile the code once again from your laptop to Arduino board. Connect Bluetooth of your android to car and control by using Bluetooth Rc control app. If not, you can pair another Arduino uno to avoid reuploading the program.

The code for the project (note- install library servo.h from GitHub)

```
#include <Servo.h>     // libraries are included

#include <AFMotor.h>

#define Echo A0       //ultrasonic sensor, servo, motor speed is defined

#define Trig A1

#define motor 10
```

```
#define Speed 170
#define spoint 103
char value;   // variables are defined
int distance;
int Left;
int Right;
int L = 0;
int R = 0;
int L1 = 0;
int R1 = 0;
Servo servo;       //objects are created for servo library and AFmotor library
AF_DCMotor M1(1);
AF_DCMotor M2(2);
AF_DCMotor M3(3);
AF_DCMotor M4(4);
void setup() {       //ultra-sonic pins are set to input and output. Gear motors have been included.
 Serial.begin(9600);
  pinMode(Trig, OUTPUT);
  pinMode(Echo, INPUT);
  servo.attach(motor);
  M1.setSpeed(Speed);
  M2.setSpeed(Speed);
  M3.setSpeed(Speed);
  M4.setSpeed(Speed);
}
void loop() {          //in the loop functions, the three main functions are included. We can run functions one by one
  //Obstacle();      //remove the function comment for obstacle avoidance
  //Bluetoothcontrol();   // remove the function comment for Bluetooth control
  //voicecontrol();
}
void Bluetoothcontrol() {       //this functions include Bluetooth control code.
  if (Serial.available() > 0) {
    value = Serial.read();
    Serial.println(value);
  }
```

```
  if (value == 'F') {
    forward();
  } else if (value == 'B') {
    backward();
  } else if (value == 'L') {
    left();
  } else if (value == 'R') {
    right();
  } else if (value == 'S') {
    Stop();
  }
}
void Obstacle() {        //this function includes obstacle avoiding code.
  distance = ultrasonic();
  if (distance <= 12) {
    Stop();
    backward();
    delay(100);
    Stop();
    L = leftsee();
    servo.write(spoint);
    delay(800);
    R = rightsee();
    servo.write(spoint);
    if (L < R) {
      right();
      delay(500);
      Stop();
      delay(200);
    } else if (L > R) {
      left();
      delay(500);
      Stop();
      delay(200);
    }
```

```
  } else {
    forward();
  }
}
void voicecontrol() {
  if (Serial.available() > 0) {
    value = Serial.read();
    Serial.println(value);
    if (value == '^') {
      forward();
    } else if (value == '-') {
      backward();
    } else if (value == '<') {
      L = leftsee();
      servo.write(spoint);
      if (L >= 10 ) {
        left();
        delay(500);
        Stop();
      } else if (L < 10) {
        Stop();
      }
    } else if (value == '>') {
      R = rightsee();
      servo.write(spoint);
      if (R >= 10 ) {
        right();
        delay(500);
        Stop();
      } else if (R < 10) {
        Stop();
      }
    } else if (value == '*') {
      Stop(); }   }   }
 // Ultrasonic sensor distance reading function
```

```
int ultrasonic() {
  digitalWrite(Trig, LOW);
  delayMicroseconds(4);
  digitalWrite(Trig, HIGH);
  delayMicroseconds(10);
  digitalWrite(Trig, LOW);
  long t = pulseIn(Echo, HIGH);
  long cm = t / 29 / 2;   //time convert distance
  return cm;
}
void forward() {
  M1.run(FORWARD);
  M2.run(FORWARD);
  M3.run(FORWARD);
  M4.run(FORWARD);
}
void backward() {
  M1.run(BACKWARD);
  M2.run(BACKWARD);
  M3.run(BACKWARD);
  M4.run(BACKWARD);
}
void right() {
  M1.run(BACKWARD);
  M2.run(BACKWARD);
  M3.run(FORWARD);
  M4.run (FORWARD);
}
void left() {
  M1.run(FORWARD);
  M2.run(FORWARD);
  M3.run(BACKWARD);
  M4.run(BACKWARD);
}
```

```
void Stop() {
  M1.run(RELEASE);
  M2.run(RELEASE);
  M3.run(RELEASE);
  M4.run(RELEASE);
}
int rightsee() {
  servo.write(20);
  delay(800);
  Left = ultrasonic();
  return Left;
}
int leftsee() {
  servo.write(180);
  delay(800);
  Right = ultrasonic();
  return Right;
}

}
```

Working

The robot in this project detects obstacles with the help of ultra-sonic sensors. This measures the distance of the surrounding object with the help of ultra-sonic sensors to achieve desired movements. The motors are connected through motor driver IC to Arduino. This robot is designed to detect objects within a specified distance. The object that is found in front of car is termed as an obstacle, after detecting any of those obstacles the robot changes its direction. The sensor is placed above the servo motor facing in front. thus, if any object detected the signal is sent to the uno board. Further Arduino instructs servo motor for the change of direction. Servo changes the direction as per the instruction given by Arduino. The driver will rotate the motors m3 and m4 in forward direction and m1, m2 in reverse direction. The ultra-sonic sensors send ultra-sonic waves at 300 meter (about 984.25 ft) per second. These waves travel in the air, hit the object, and return to the receiver of the ultra-sonic sensor. The distance between object and sensor is calculated. To calculate the distance between object and sensor, the sensor measures the time it takes between emission of waves by the transmitter to its contact with receiver. The formula for calculation of distance is given by D=1\2 T*C (where D is distance, T is time, and C is speed of sound I.e., 343 meter per second). Similarly, every time whenever the object is found to be in the path it will detect and move in the direction toward the left or right side.

After the code for Bluetooth is compiled. Connect the Bluetooth of your android to HC-05 and open the app. The android phone gets paired with the app. Once Bluetooth gets connected, the app screen opens on your phone. The button which you press, the car follows the same direction. The program is designed in such a manner that when you press the button front and right it moves diagonally towards the right side, similarly when you press the button back and front it moves diagonally opposite direction to the right side. We have paired with another Arduino uno board to avoid re-uploading the program. The RXD pin of Bluetooth receives commands from android and sends to Arduino and sends signal through the TXD pin for transmitting the information.

Objective

1.This requires no external control for obstacle avoiding robot

2.within no time the distance between the obstacle is found, change in direction takes place to create its own path.

3.this operates in unknown environment effectively with good efficiency.

4.make use of Bluetooth connectivity and to understand the different modes of operation and communication with different micro controller board

5.expand knowledge in various micro controller board expand knowledge in IOT.

Advantages

1.used in unknown environmental conditions where human penetration is difficult.

2.this technology can be used for many household purposes like vacuum cleaners, in vehicle technology for back sonar.

3. use of android application that is free of cost.

4.the Bluetooth can be controlled manually as per our instruction.

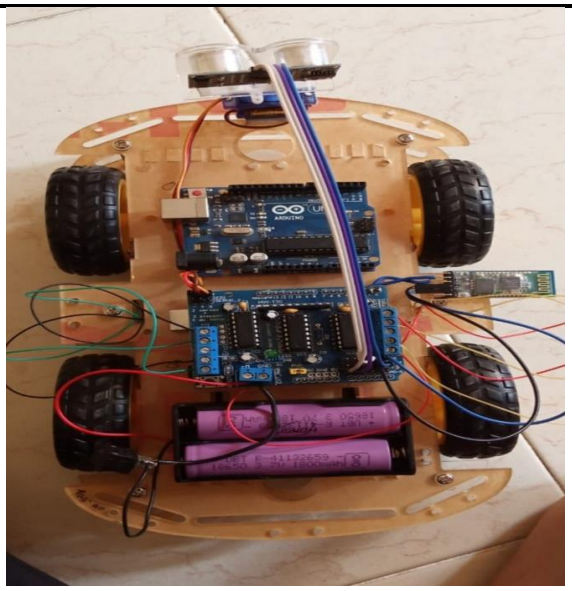
5.no fear in losing the remote control, as we use download remote from play store.

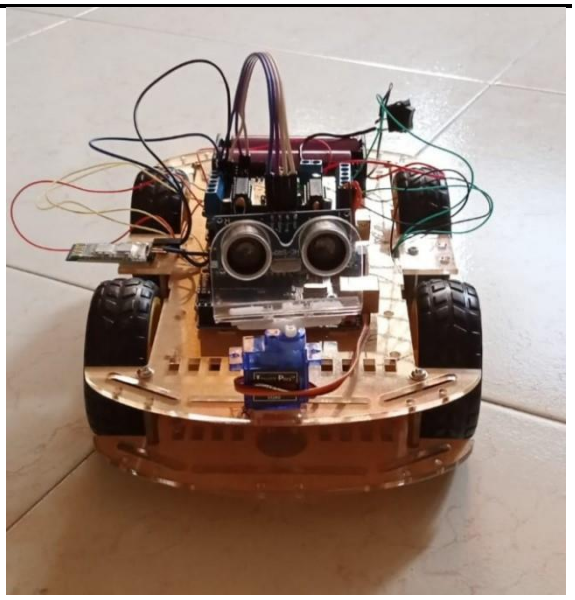
Conclusion

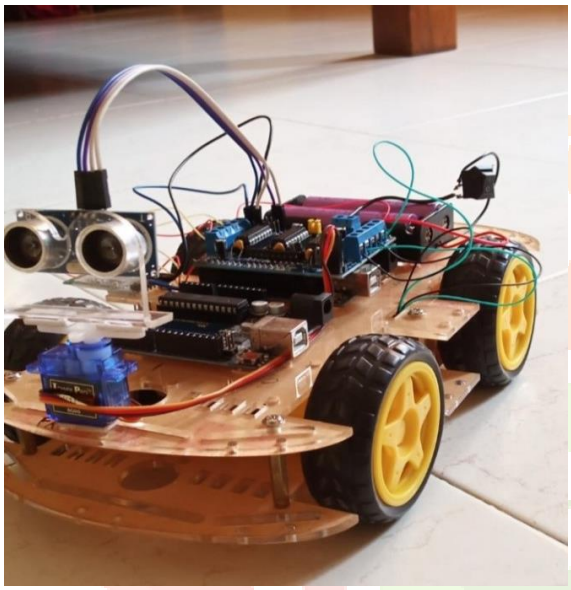
With the combination of ultra-sonic sensor and Bluetooth module the car is designed to have two features. This technology can be used for many other applications. By using the Arduino, we convert digital signals into physical work. No worries of code getting erased once the code compiled into boards. This project is built on Arduino platform for data processing to communicate with the robot and guiding the robot. When a robot is placed in an unknown environmental condition the robot moves freely creating its own path. And the robot is controlled using Bluetooth within a 50 ft radius.

Result

The result is obtained for both obstacle avoidance and Bluetooth control. The robot moves forward if any obstacle detected the robot turns 90 degrees left or right, when there Is no obstacle, the robot moves forward direction. The robot follows the instructions as given by the Bluetooth module and goes to the given direction provided by the instructor.







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