GROUP MEMBERS:

1. Aadith S (2)
2. Abhay M Prasannakumar (3)
3. Abhishek S P (8)
4. Akshara S Prasad (22)
5. Arya V (44)
6. Bharath B Chandran (47)
7. Geethika V (49)
8. Jesvin Jobi (56)

STAFF IN CHARGE

INDEX

ABSTRACT

This project details the development of an Android phone-controlled robot utilizing an 8051 microcontroller and Bluetooth communication.

The robot employs DC motors for movement, with directional control achieved by interpreting commands received from a user-developed Android application.

The system also incorporates feedback functionality, transmitting the robot's status back to the smartphone app.

The project offers a practical implementation of HC-05 Bluetooth module interfacing with 8051 microcontrollers.

The bill of materials includes the 8051 microcontroller, HC-05 Bluetooth module, L293D motor driver IC, robot chassis, DC motors, wheels, castor wheels for stability, jumper wheels for maneuverability, and jumper wires for circuit connections.

The project serves as a valuable resource for those interested in building and controlling robots using these technologies.

AIM

To build an **Android Controlled Robo**t using 8051 microcontroller

INTRODUCTION

This project focuses on building an Android Phone controlled Robot using 8051 microcontroller and bluetooth module.

The setup is built using an 8051 microcontroller, HC-05 Bluetooth module, DC motors and L293D Motor driver.

The Android app controls the robot by sending data to the 8051 microcontroller through a Bluetooth module.

The data is received by the microcontroller, which then determines the direction of the motors and the status of the robot.

The robot can maneuver in four directions based on instructions sent from a Bluetooth terminal application.

A DC motor driver circuit is employed by the robot to control its two DC motors.

COMPONENTS USED

1. 8051 microcontroller (AT89S52)
2. HC-05 Bluetooth module
3. L293D Motor Driver
4. Robot chassis
5. DC Motors (4)
6. Wheels (4)
7. Castor Wheel
8. Jumper wires
9. Bluetooth terminal android app
10. 18650 battery(2)
11. Battery holder

COMPONENTS SPECIFICATION

1.Microcontroller (8051):

The brain of the robot interprets commands received from the phone app and translates them into signals that control the robot's movement.

2.Bluetooth Module (HC-05):

This acts as the wireless bridge between your smartphone and the robot. It receives commands from the app and transmits them to the microcontroller.

3.DC Motors:

These are the tiny engines that power the robot's wheels. The microcontroller sends signals to a motor driver to control their speed and direction.

4.Motor Driver IC (L293D):

This crucial component acts as a translator between the microcontroller's delicate signals and the higher power requirements of the DC motors. It ensures the motors receive the correct power to move as intended.

5.Robot Chassis:

This is the robot's body, providing a sturdy base that holds all the components and allows for smooth movement

.

6.Wheels and Castors:

The wheels propel the robot forward, while the additional castor wheels provide stability and prevent tipping. Some robots might use jumper wheels for improved maneuverability.

7.JUMPER WIRES

These act as the robot's nervous system, connecting all the electronic components and allowing them to communicate with each other.

8.Android Application:

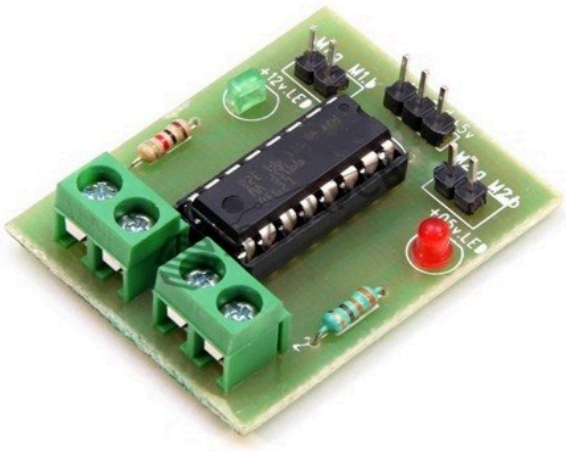
This is the user interface you'll use on your phone to control the robot. Through this app you can send commands (forward, backward, turn) to the robot via Bluetooth

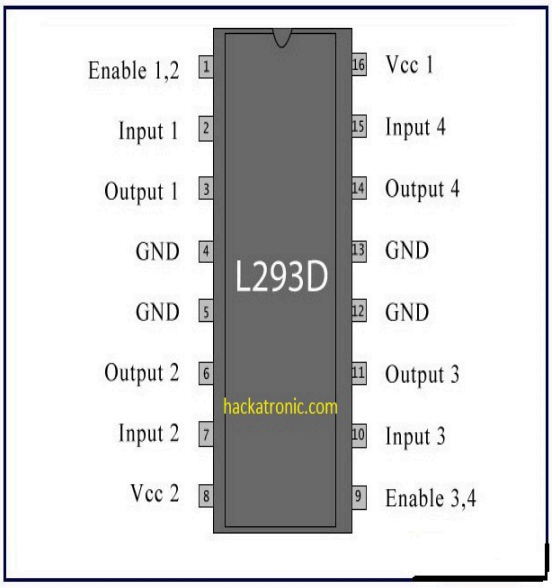
PINOUT DETAILS

L293D MOTOR DRIVER

The L293D is a 16-pin Motor Driver IC that can operate two DC motors in any direction at the same time. The L293D is capable of bidirectional drive currents of up to 600 mA (per channel) at voltages ranging from 4.5 V to 36 V (at pin 8!). It can be used to control small dc motors, such as toy motors.

PINOUT DIAGRAM





FEATURES

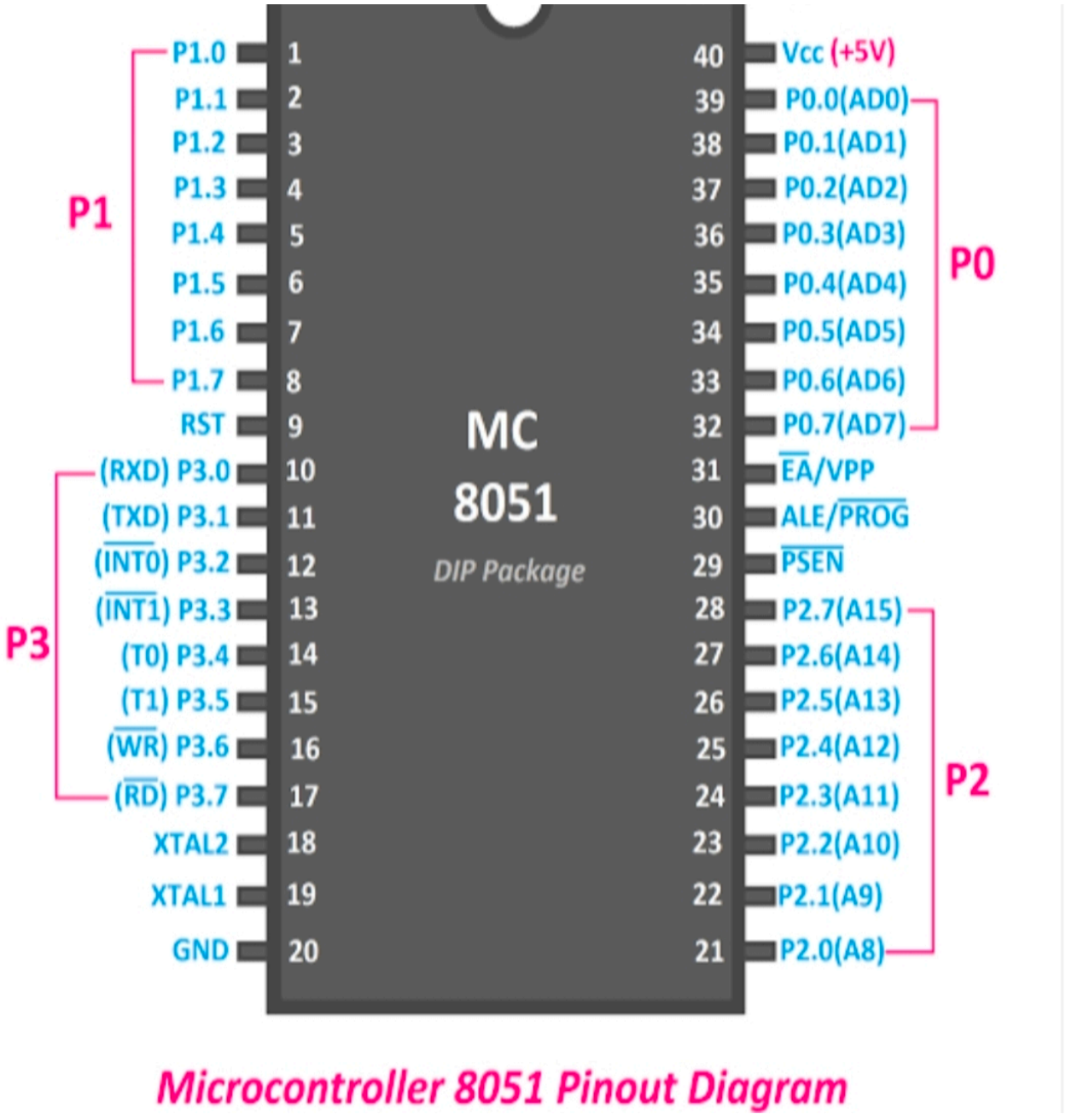
- Motor Supply Voltage (Maximum): 46V
- Motor Supply Current (Maximum): 2A
- Logic Voltage: 5V
- Driver Voltage: 5-35V
- Driver Current:2A
- Logical Current:0-36mA
- Maximum Power (W): 25W
- Current Sense for each motor
- Heatsink for better performance
- Power-On LED indicator

8051 MICROCONTROLLER

8051 is one of the first and most popular microcontrollers also known as MCS-51. Intel introduced it in the year 1981. Initially, it came out as an N-type metal-oxide-semiconductor (NMOS) based microcontroller, but later versions were based on complementary metal-oxide-semiconductor(CMOS) technology. These microcontrollers were named 80C51, where C in the name tells that it is based on CMOS technology. It is an 8-bit microcontroller which means the data bus is 8-bit. Therefore, it can process 8 bits at a time. It is used in a wide variety of embedded systems like robotics, remote controls, the automotive industry, telecom applications, power tools, etc.

It is referred to as a System on a Chip (SoC) microcontroller because it is a chip circuit/integrated circuit that holds many components of a computer together on a single chip. These components include a CPU, memory, input-output ports(I/O ports), timers, and secondary storage. Features – There are some key features of 8051 that work as a foundation for students to learn microcontrollers.

PINOUT DIAGRAM



Microcontroller 8051 Pinout Diagram

FEATURES

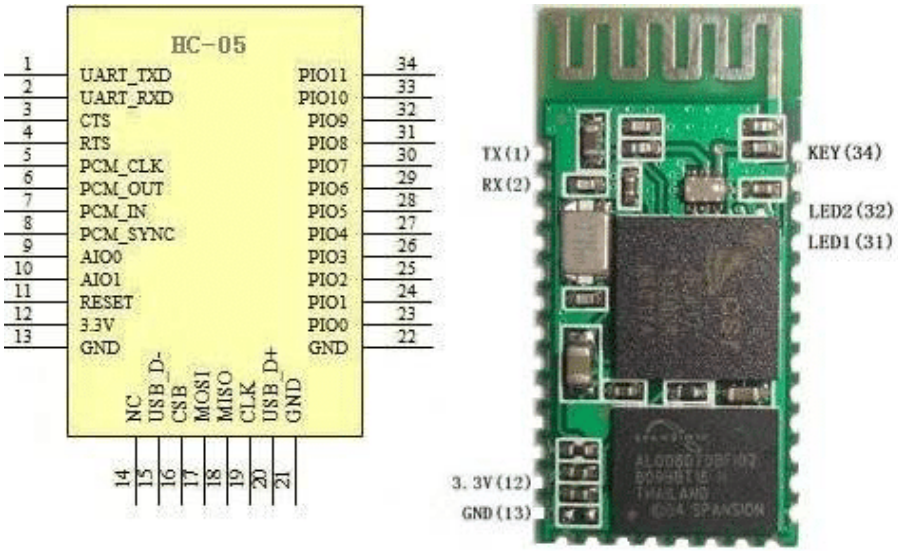
The Key features of the 8051 Microcontroller –

- 4 KB on-chip ROM (Program memory).
- 128 bytes on-chip RAM (Data memory).
- The 8-bit data bus (bidirectional).
- 16-bit address bus (unidirectional).
- Two 16-bit timers.
- Instruction cycle of 1 microsecond with 12 MHz crystal.
- Four 8-bit input/output ports.
- 128 user-defined flags.
- Four register banks of 8 bit each.
- 16-byte bit-addressable RAM.
- The general purpose registers are 32 each is 8-bit.
- 8051 has two external and three internal interrupts.
- 8051 microcontroller specifies some special function features like UARTs, ADC, Op-amp, etc.
- It has a 16-bit program counter and data pointer.

HC-05 BLUETOOTH MODULE

HC-05 is a Bluetooth module which is designed for wireless communication. This module can be used in a master or slave configuration.HC-05 has red LED which indicates connection status, whether the Bluetooth is connected or not. Before connecting to the HC-05 module this red LED blinks continuously in a periodic manner. When it gets connected to any other Bluetooth device, its blinking slows down to two seconds. This module works on 3.3V. We can connect 5V supply voltage as well since the module has on board 5 to 3.3 V regulator. As HC-05 Bluetooth module has 3.3V level for RX/TX and microcontroller can detect 3.3 V level, so, no need to shift transmit level of HC-05 module. But we need to shift the transmit voltage level from the microcontroller to the RX of the HC-05 module. The data transfer rate of the HC-05 module can vary up to 1Mbps and is in the range of 10 meters.

PINOUT DIAGRAM



FEATURES

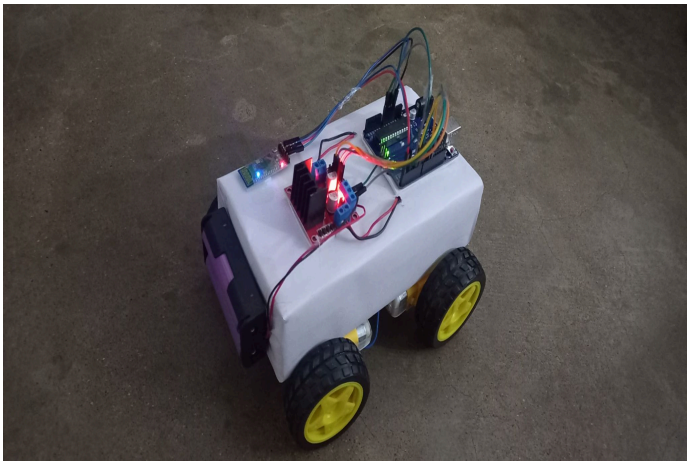
- Bluetooth version: 2.0 + EDR (Enhanced Data Rate)
- Frequency: 2.4 GHz ISM band
- Modulation: GFSK (Gaussian Frequency Shift Keying)
- Transmit power: Class 2 (up to 4 dBm)
- Sensitivity: -80 dBm typical
- Range: approximately 10 meters (or 33 feet) in open air
- Profiles supported: SPP (Serial Port Profile), HID (Human Interface Device) and others
- Operating voltage: 3.3V to 5V DC
- Operating current: less than 50mA
- Standby current: less than 2.5mA
- Sleep current: less than 1mA
- Interface: UART (Universal Asynchronous Receiver/Transmitter)
- Baud rates: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, and 460800
- Operating temperature: -20°C to 75°C (-4°F to 167°F)

WORKING

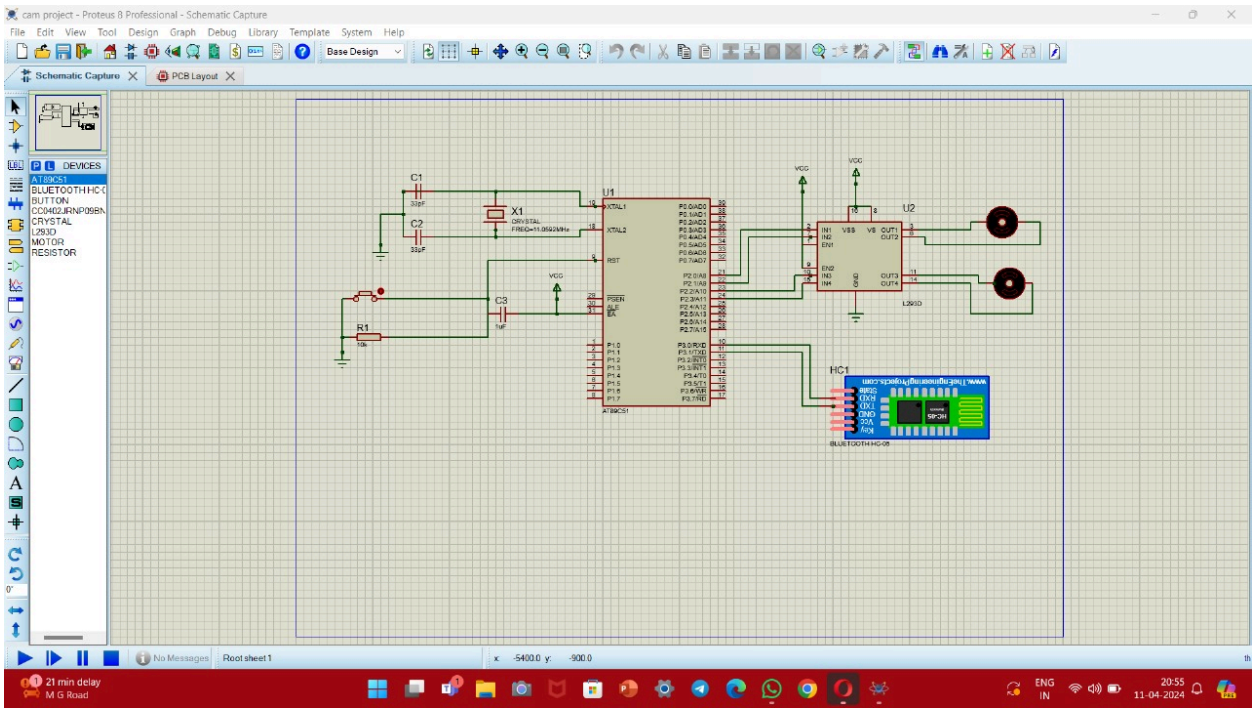
In this **Android controlled Robot**, the user of the android app sends the data to 8051 microcontroller through the HC-05 module. The received data is compared in an 8051 microcontroller and the decision is made accordingly. The below table shows the direction of motors and status of the robot for different received characters.

If we want to move **forward** all the motors rotate clockwise and if we want to move **backward** all the motors rotate anticlockwise.
If we want to move towards the **left**, right side, two motors rotate in clockwise direction and the other two rotate in anticlockwise direction.
If we want to move towards the **right**,left side, two motors rotate in clockwise direction and the other two rotate in anticlockwise direction.

Here we use an android app to control our HC-05 Bluetooth module.This app supports bidirectional communication and this app is compatible with most of the devices.After installing the app, open the app and turn on Bluetooth.Select the device and click on connect option. After successful connection, we can start sending data to the HC-05 module.



CIRCUIT DIAGRAM/SIMULATION



CODE

```
/*this program is for controlling a robot using bluetooth and android app*/

#include<reg51.h>

unsigned char ch1;

unsigned char s;



sbit m1f=P2^0;              // in1 pin of motor1

sbit m1b=P2^1;              // in2 pin of motor1

sbit m2f=P2^2;              // in1 pin of motor2

sbit m2b=P2^3;              // in2 pin of motor2



void delay(unsigned int)  ;        //function for creating delay
```

```
char rxdata(void);                    //function for receiving a character
through serial port of 8051



void txdata(unsigned char); //function for sending a character through serial
port of 8051









void main(void)



 {



unsigned char i;



unsigned char msg1[]={"robot is moving forward"};



unsigned char msg2[]={"robot is moving backward"};



unsigned char msg3[]={"robot is moving right"};



unsigned char msg4[]={"robot is moving left"};
```

```
unsigned char msg5[]={"robot is stopped"};




TMOD=0x20;   //timer 1 , mode 2 , auto reload

SCON=0x50;    //8bit data , 1 stop bit , REN enabled

TH1=0xfd;     //timer value for 9600 bits per second(bps)

TR1=1;




while(1)              //repeat forever

{

     s=rxdata(); //receive serial data from hc-05 bluetooth module

if(s=='f') //move both the motors in forward direction
```

```
    {

          m1f=1;

   delay(1);

          m1b=0;

   delay(1);

          m2f=1;

   delay(1);

          m2b=0;

   delay(1);

         for(i=0;msg1[i]!='\0';i++)
```

```
{

    txdata(msg1[i]);

}



    }



     else if(s=='b')

     {

          m1f=0;

    delay(1);

          m1b=1;
```

```
    delay(10);

          m2f=0;

    delay(10);

          m2b=1;

    delay(10);

    for(i=0;msg2[i]!='\0';i++)

          {

   txdata(msg2[i]);

     }

      }
```

```
     else if(s=='r')

     {

          m1f=1;

          delay(1);

          m1b=0;

   delay(10);

          m2f=0;

   delay(10);

          m2b=1;

delay(10);
```

```
for(i=0;msg3[i]!='\0';i++)

{

    txdata(msg3[i]);

}

                }



     else if(s=='l')

     {

          m1f=0;

          delay(1);

          m1b=1;
```

```
    delay(1);

          m2f=1;

    delay(1);

          m2b=0;

    delay(1);

    for(i=0;msg4[i]!='\0';i++)

         {

    txdata(msg4[i]);

   }

    }
```

```
     else if(s=='s')

     {

          m1f=0;

          delay(1);

          m1b=0;

    delay(1);

          m2f=0;

    delay(1);

          m2b=0;

   delay(1);

   for(i=0;msg5[i]!='\0';i++)
```

```
        {

  txdata(msg5[i]);

   }

    }

      txdata('\n');



                    }

}



char rxdata()

{
```

```
  while(RI==0);   //wait till RI becomes HIGH

  RI=0;           //make RI low

  ch1=SBUF;      //copy received data

  return ch1;     //return the received data to main function.

}

void txdata(unsigned char x)

{

   SBUF=x; //copy data to be transmitted to SBUF

   while(TI==0); //wait till TI becomes high

   TI=0; //mae TI low for next transmission
```

```
}



void delay(unsigned int z)

{

  unsigned int p ,q;

  for(p=0 ; p<z ; p++)    //repeat for 'z' times

  {

    for(q=0 ; q<1375 ; q++);   //repeat for 1375 times

  }

}
```

APPLICATIONS

1**.Home Automation Assistant:** This application leverages the robot's ability to navigate and manipulate small objects, making it a helpful tool for everyday tasks around the house.

2**.Telepresence for the Elderly or Disabled:** The robot can provide crucial assistance and improve quality of life by offering remote connection and allowing for easier navigation within the home.

3**.Personalized Delivery Assistant:** This application has a wide range of potential uses in various environments, improving efficiency and reducing wait times in critical areas like hospitals or large campuses.

4**.Remote Inspection Tool:** The robot's maneuverability and potential for camera integration make it perfect for inspecting hard-to-reach or potentially hazardous areas, ensuring safety and reducing human risk.

5**.Smart Cleaning Assistant:** By combining navigation with cleaning functionalities, the robot can be a valuable tool for maintaining hygiene in high-traffic areas, especially in healthcare settings or public spaces.

RESULT ANALYSIS

An Android Controlled Robot that is capable of maneuvering in all the four directions based on the instruction sent is build successfully.

CONCLUSION

Our project presents an Android-controlled robot, built with user-friendly parts. It demonstrates practical applications like helping around the house, performing remote inspections, and even smart cleaning. This is just the beginning! We can explore further advancements in accessible robotics.

Imagine robots assisting you with daily tasks, making it easier to stay connected with loved ones remotely, or even improving safety in workplaces. The possibilities are endless as technology keeps evolving. These robots have the potential to transform our lives in amazing ways.

We've shown how accessible robotics can be a reality. Thank you for joining us today! Let's keep exploring the exciting future of robots!

friendly parts! It demonstrates practical applications like helping around the house, performing remote inspections, and even smart cleaning. This is just the beginning! We can explore further advancements in accessible robotics.

Imagine robots assisting you with daily tasks, making it easier to stay connected with loved ones remotely, or even improving safety in workplaces. The possibilities are endless as technology keeps evolving. These robots have the potential to improve our lives.

REFERENCES

1.https://circuitdigest.com/microcontroller-projects/bluetooth-controlled-robot-using-8051
2.https://youtu.be/Pyb6Tnq-1fg
3.The 8051 Microcontroller and Embedded Systems Textbook by Mhd Ali Mazidi, Janice Gillispie Mazidi, Rolin D. Mckinlay