



# Simulation Of Robotic Car Using 8051 Microcontroller And L293d Motor Motor Ic In Proteus 8.6 Software Platform

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**Abstract:** This paper presents the simulation of a robotic car utilizing an 8051 microcontroller and L293D motor driver IC within the Proteus 8.6 environment. The objective is to design and validate a control system for a robotic vehicle, enabling it to perform basic movements such as forward, backward, and turning. The 8051 microcontroller is programmed to send control signals to the L293D motor driver, which then drives the DC motors. The simulation setup includes configuring the microcontroller and motor driver, programming the control logic, and analyzing the system's performance. The results demonstrate the effectiveness of the design, providing insights into the operation and control of robotic systems. This simulation facilitates understanding the integration of microcontroller-based control systems and motor drivers in robotics.

**Index Terms** - Robotic Car, 8051 Microcontroller, L293D Motor Driver IC, Proteus 8.6, Simulation, Embedded Systems, Motor Control, Microcontroller Programming, DC Motors, Circuit Design, Proteus Simulation, HEX File, Motor Driver Circuit, Schematic Design, Power Supply Configuration, Code Compilation, Microcontroller Interfaces, Robotic Control Systems, Electronic Simulation Tools, Control Algorithms, Hardware-in-the-Loop Simulation, Electrical Engineering Automated Testing, Embedded Control System, Digital Logic, Proteus Virtual Instrument Motor Driver Integration, Robotic System Testing, Circuit Troubleshooting, Simulation Debugging.

## I. INTRODUCTION

### Background

- Robotic cars, or autonomous vehicles, are advanced systems designed to navigate and perform tasks without human intervention. These vehicles rely on a combination of sensors, controllers, and actuators to perceive their environment and make decisions in real-time. The core technology behind robotic cars includes microcontrollers, which act as the brain of the vehicle, and motor drivers, which control the movement of the wheels.
- Robotic cars have a wide range of applications across various fields. In the automotive industry, they are used for developing and testing self-driving technology, which aims to enhance road safety and improve transportation efficiency. In industrial settings, robotic cars are employed for tasks such as material handling and automated transport within factories and warehouses. Additionally, they play a crucial role in research and education, offering a platform for experimenting with algorithms and control systems in robotics.
- The integration of microcontrollers like the 8051 with motor drivers such as the L293D allows for precise control of robotic car movements, enabling tasks such as path-following, obstacle avoidance, and automated navigation. Simulation tools like Proteus 8.6 facilitate the design and testing of these systems in a virtual environment, providing valuable insights before physical deployment.

**Objective:**

- **To Develop a Control Algorithm:** Create and test code to control the car's movements.
- **To Integrate Components:** Ensure the microcontroller and motor driver work together correctly.
- **To Simulate Behaviour:** Check the car's performance in different scenarios.
- **To Analyze Performance:** Evaluate how well the car responds to commands and performs tasks.

**Components Overview:**

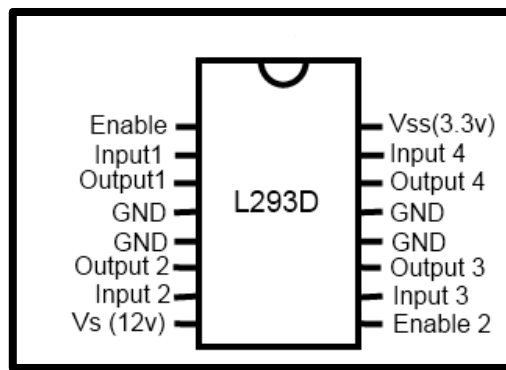
- *8051 Microcontroller*  
The 8051 microcontroller is a popular 8-bit microcontroller designed by Intel. It features a simple and efficient architecture with a 16-bit timer, four parallel I/O ports, and a serial communication interface. The 8051 is widely used in embedded systems for its ease of programming and robust performance. It's ideal for controlling various devices and performing tasks like data processing and decision-making in robotics.
- *L293D Motor Driver IC*  
The L293D is a dual H-bridge motor driver IC used to control the direction and speed of DC motors. It can drive two DC motors or one stepper motor, allowing bidirectional control. The IC can handle up to 600 mA per channel and provides built-in protection against overcurrent and thermal overloads. It interfaces with a microcontroller to manage motor functions, making it essential for driving motors in robotic applications.
- *Proteus 8.6*  
Proteus 8.6 is an advanced electronic design automation (EDA) tool used for designing and simulating electronic circuits. It allows users to create and test circuit designs in a virtual environment before physical implementation. Proteus provides a comprehensive set of features for circuit simulation, including microcontroller emulation, which is crucial for validating designs and debugging before building the actual hardware.

**2. Components and Tools***8051 Microcontroller*

- **Architecture and Functionalities:** The 8051 is an 8-bit microcontroller with a simple architecture featuring 4KB ROM, 128 bytes RAM, four 8-bit I/O ports, two 16-bit timers, and a serial communication interface. It processes 8-bit data and supports various peripherals for embedded applications.
- **Selection Criteria:** It is chosen for its ease of use, ample documentation, moderate processing power, and cost-effectiveness. It fits projects needing basic control with sufficient I/O, memory, and peripheral support.

*L293D Motor Driver IC*

- **Description and Working Principle:** The L293D is a dual H-bridge motor driver IC that controls the direction and speed of DC motors. It can drive two motors simultaneously and handle currents up to 600 mA per channel, with built-in protection against overcurrent and overheating.
- **Suitability for Robotics:** It's ideal for robotics due to its ability to provide bidirectional control, manage moderate power requirements, and integrate easily with microcontrollers for precise motor control.



### Proteus 8.6

- **Introduction to Proteus:** Proteus 8.6 is an electronic design automation tool that enables the simulation and testing of electronic circuits. It supports modelling and virtual testing of circuits, including microcontroller systems, before physical construction.
- **Key Features:** It offers integrated microcontroller emulation, real-time simulation, and extensive component libraries, making it ideal for designing and validating robotic control systems efficiently.

## 3. Circuit Design

- **Microcontroller Circuit:**
  - **Power Connections:** Connect the 8051 microcontroller's VCC pin to the positive supply voltage (typically 5V) and GND pin to ground.
  - **Input/output Pins:** Connect I/O pins (e.g., P1.0, P1.1) to the L293D motor driver for controlling motors. Ensure pull-up resistors are included if needed.
- **Motor Driver Circuit:**
  - **Connections to 8051:** Connect the microcontroller's output pins to the L293D input pins (IN1, IN2 for one motor, IN3, IN4 for the other). Use these connections to control motor direction.
  - **Enable Pins:** Connect the L293D enable pins (EN1, EN2) to VCC to enable the H-bridges.
- **Motor Connections:**
  - **To L293D:** Connect the L293D output pins (OUT1, OUT2 for one motor, OUT3, OUT4 for the other) to the terminals of the DC motors. This setup allows control of motor direction and speed.
- **Power Supply:**
  - **Configuration:** Use separate power sources if necessary—5V for the 8051 microcontroller and a suitable voltage (e.g., 12V) for the motors. Ensure common ground between the microcontroller and motor driver.

### Proteus Simulation Setup

- **Setting Up the Simulation Environment:**
  - **Create a New Project:** Open Proteus 8.6, start a new project, and select "Create a schematic from scratch."
  - **Add Components:** Search and place the 8051 microcontroller, L293D IC, DC motors, and power sources from the component library.
- **Component Placement and Wiring:**
  - **Place Components:** Arrange the 8051 microcontroller, L293D motor driver, and motors logically on the schematic workspace.
  - **Wire Connections:** Connect the microcontroller's output pins to the L293D inputs. Link the L293D outputs to the motors and connect the power sources to the respective components. Ensure all connections are properly made, and verify the circuit for errors.

## 4. Programming the Microcontroller

**Overview:** The code for controlling the motors involves configuring the 8051 microcontroller's I/O ports to send control signals to the L293D motor driver. The code typically includes initialization routines for the ports and loops to control motor direction and speed based on input conditions or predefined sequences.

```
// *****Motor Interfacing with L293D *****//
```

```
#include <reg51.h>
```

```
sbit IN1 = P2^0;
```

```
sbit IN2 = P2^1;
```

```
sbit IN3 = P2^2;
```

```
sbit IN4 = P2^3;
```

```
sbit F = P2^4;
```

```
sbit REV = P2^5;
```

```
sbit R = P2^6;
```

```
sbit L = P2^7;
```

```
void delay()
```

```
{
    inti, j;
    for(i = 0; i < 255; i++)
        for(j = 0; j < 200; j++);
}
```

```
void main()
```

```
{
    while(1)
    {
        if(F==0)
        {
            //ALL Motors Clock Wise Rotate
            IN1 = 1;
            IN2 = 0;

            IN3 = 1;
            IN4 = 0;
        }
        else if(REV==0)
        {
            //ALL Motors Anti Clockwise Rotate
            IN1 = 0;
            IN2 = 1;

            IN3 = 0;
            IN4 = 1;
        }
        else if(R==0)
        {
            //Upper Two motorsClock wise Rotate
            IN1 = 1;
            IN2 = 0;

            //Lower Two Motors STOP
            IN3 = 0;
            IN4 = 0;
        }
        else if(L==0)
        {
            //Upper Two Motors Anti Clockwise Rotate
            IN1 = 0;
            IN2 = 1;

            //Lower Two Motors Stop
            IN3 = 0;

```

```

        IN4 = 0;
    }
else
{
    //All Motors Stop
    IN1 = 0;
    IN2 = 0;

    IN3 = 0;
    IN4 = 0;
}
}
}

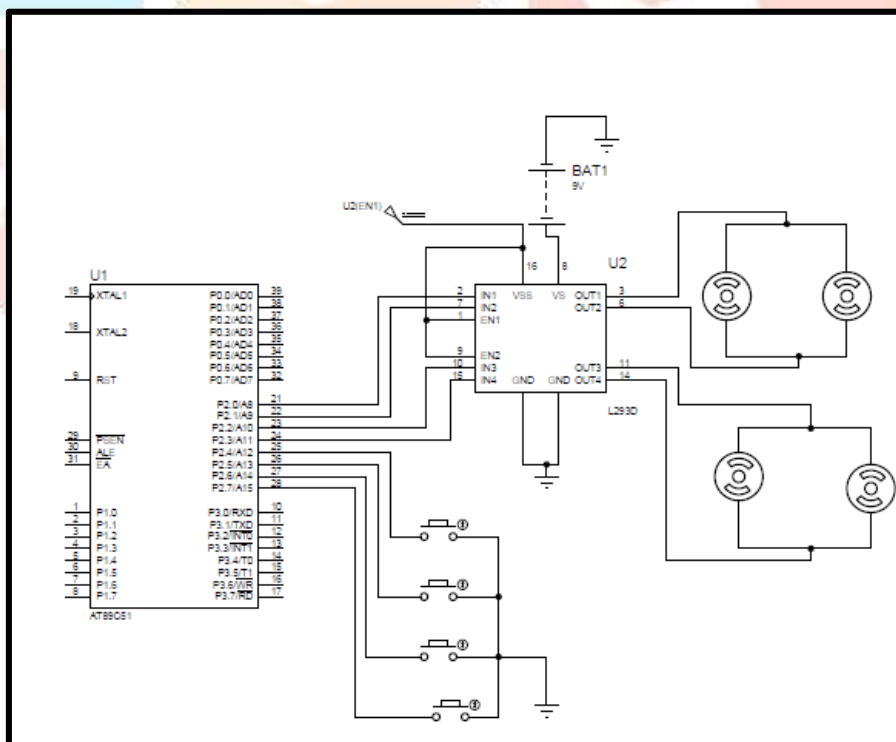
```

**HEX File Generation**

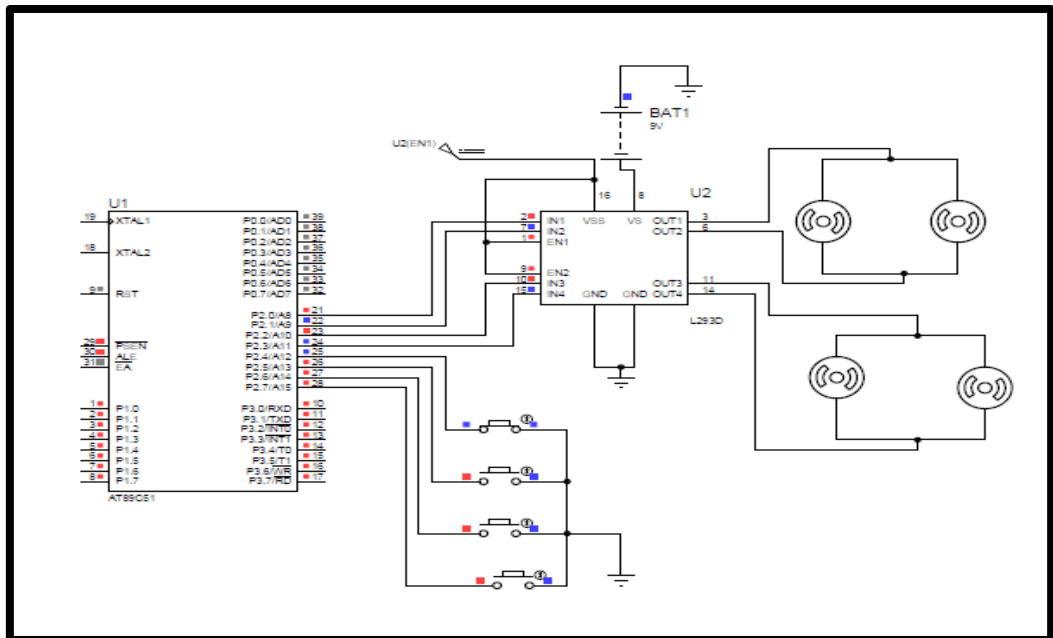
- **Compiling the Code and Generating the HEX File:**
  1. **Write Code:** Develop your code using an IDE like Keil uVision or another compatible compiler for the 8051 microcontroller.
  2. **Compile:** Use the IDE to compile the code into machine code. The IDE will generate a HEX file, which contains the binary code for the microcontroller.
  3. **Verify:** Ensure that the compilation process completes without errors and that the HEX file is correctly generated.
- **Loading the HEX File into Proteus.**

**5. Results and Discussion&Simulation and Testing**

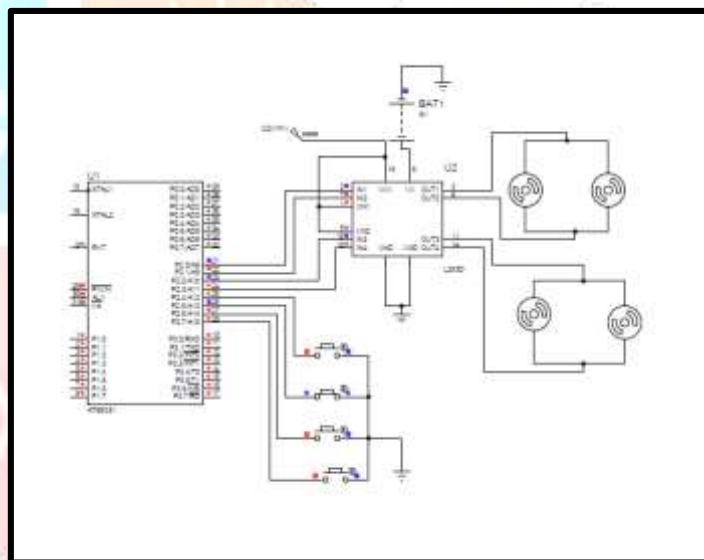
- **All Motors Stop**



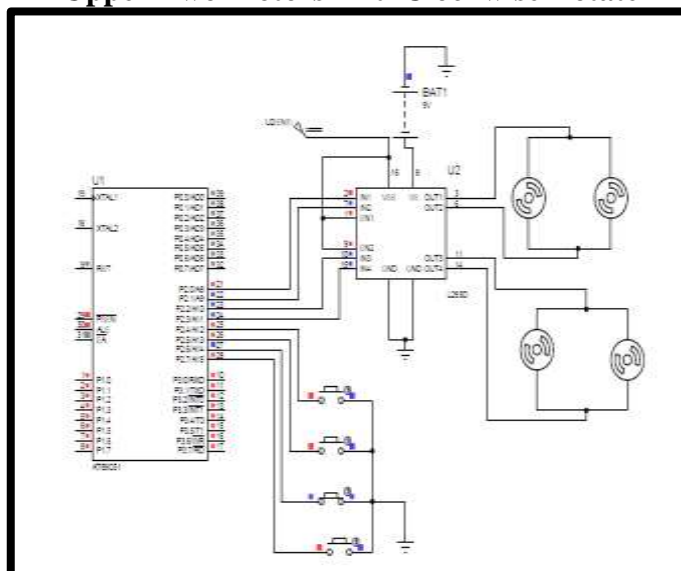
- **ALL Motors Anti Clockwise Rotate**



- **Upper Two Motors Clock Wise Rotate:**



- **Upper Two Motors Anti Clockwise Rotate**



- **Analysis of Results:**

<b>Instructions For switch /Button</b>	<b>Fore left Motor</b>	<b>Fore right Motor</b>	<b>Rare left Motor</b>	<b>Rare right Motor</b>
BUTTON 1 ON	Clock wise	Clock wise	Clock wise	Clock wise
BUTTON 2 ON	Anti-clock wise	Anti-clock wise	Anti-clock wise	Anti-clock wise
BUTTON 3 ON	Clock wise	Clock wise	Stop	Stop
BUTTON 4 ON	Anti-clock wise	Anti-clock wise	Stop	Stop

## 7. Conclusion

The simulation of the robotic car using the 8051 microcontroller and L293D motor driver IC in Proteus 8.6 effectively validated the design and control logic. The results confirmed that the system could accurately manage motor movements, demonstrating the integration of components and functionality. This approach proved efficient for testing and refining designs before physical implementation. Overall, the project showcases the benefits of simulation for developing reliable and functional embedded systems.

## 8. References

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