

Module-02: A Basic Touchless Dustbin Using DC Motor

In this part of the module, we redesign the basic touchless dustbin system from Module-01 by replacing the *servo motor* with a *DC motor* for lid actuation. A motor driver circuit is employed to control the DC motor, and an ON-OFF controller is used to determine the lid's motion based on distance measurements from the ultrasonic sensor.

The objectives of this module are as follows:

Objectives:

Design an automatic, touchless dustbin system using:

- An ultrasonic sensor to detect the presence of a hand (or object).
- A DC motor, controlled through a motor driver (e.g., L293D), to open and close the lid.
- An ON-OFF control logic to actuate the motor based on the sensed distance.

Report Guidelines:

1. Objectives of the module.
2. Circuit diagram with all components labeled.
3. Block diagram of the designed system.
4. Flowchart showing the control logic.
5. Observations and challenges encountered.
6. Answers to the questions given below.

Answer the following:

1. Draw the complete block diagram of your implemented system, clearly labeling each component and its function. Identify and justify whether the system is an open-loop or closed-loop system.
2. What is the use of the motor driver circuit? Explain its working.

3. (a) Explain how the DC motor is controlled through the microcontroller using a motor driver. Include a labeled circuit and signal timing diagram.
(b) Is the DC motor system operating in an open-loop or closed-loop fashion? Justify your answer based on the control implementation.
4. Provide a complete signal flow diagram starting from the ultrasonic sensor to the DC motor. Explain each step: sensing, computation, decision-making, and actuation. Also mention the types of signals (digital, analog, PWM, etc.) used.
5. (a) Was chattering observed during testing? Describe under what conditions it occurred. If not observed, explain why.
(b) What design choices were implemented to avoid chattering? Justify your answer with experimental results or logic.

OBSERVATION SHEET

This sheet needs to be attached to the report.

1. Demonstrate that the DC motor is interfaced with the Arduino UNO via a motor driver (e.g., L293D or similar). Show that the motor rotates in both directions as per the control logic.

TA Signature with Date:

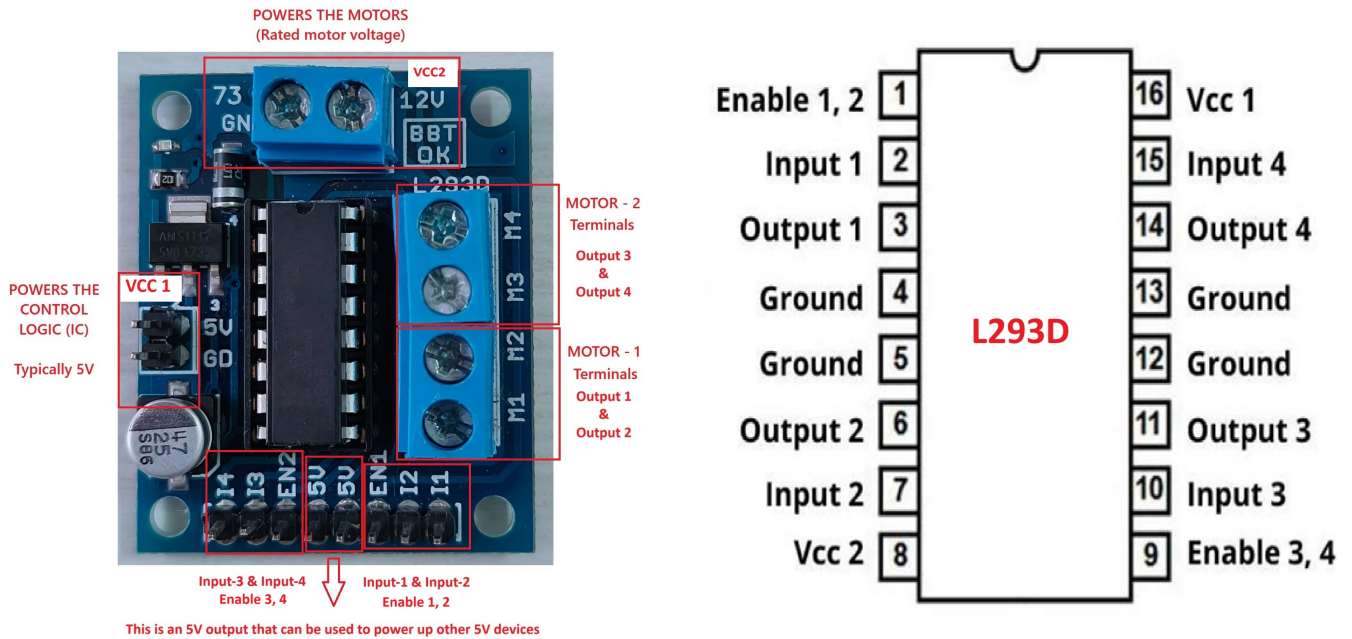
2. Demonstrate successful implementation of the touchless dustbin mechanism using a DC motor.

TA Signature with Date:

3. Show that chattering (if observed) has been addressed in the design. (Refer to Question 5 of the report)

TA Signature with Date:

Pin description of the L293D module



Specifications:

- Operating Voltage: 4.5 to 12 V.
- Maximum supply current: 600 mA per motor.

Refer to following link to know about the working principle of L293D: <https://www.ti.com/lit/ds/symlink/l293d.pdf?ts=1659500482214>

Caution: Do not operate the motor without connecting the motor power supply (VCC2) as shown. If VCC2 is not provided, the Arduino or the connected laptop/PC will attempt to supply the motor's current demand through its own power line. Since these devices have a limited current supply capacity, this can cause overheating and permanent damage ("burning") to the Arduino or laptop.

Note: The rated motor voltage is 3V for the N20 motors.