# E-Commerce Door Delivery Robot

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**Abstract.** Delivery services have become nearly a cultural expectation with the spread of e-commerce and door delivery services. Nevertheless, carriage can be quite exhaustive and costly, primarily for multiple storey residences and businesses, applying conventional conventional delivery approaches. Delivery robots that can maneuver stairs are safety solutions for these issues. Using new technologies, these robots are designed to sense the environment and use mobile application software to help them climb stairs. They can also do much more than just deliver packages and can accommodate various sizes and weights of the packages involved. It will be essential to remember that stair-climbing delivery robots are the possible game-changers in e-commerce. These robots can be used to help cut on the delivery costs of the businesses, increase on the delivery efficiency and gain more satisfaction to the clients. Robotics has long been implemented in the automotive assiduity, but many other lines have realized the advantages of robotic automatization They can facilitate deliveries and allow customers to get them at a lower beak while having less of an effect on the environment.

**Keywords**: Online retail, Self-driving transport, climbing cars, Smart connected world, Six-by-six drive

## 1 Introduction

Self-driving delivery vehicles have been developed with the main purpose of delivering packages to the consumers' doorsteps. These robots are proving to be valuable additions to the e-commerce market by providing a more effective and lucrative means of making deliveries. These are equipped with the latest gadgetries including sensors, cameras and stair climbing features to guarantee timely and safe delivery of the parcel. Their main purpose is to make e-commerce deliveries faster, more accurate, and more efficient. Thus, with the help of the presented robotic solutions, businesses can significantly reduce the cost of deliveries, enhance their delivery performance, and significantly improve the quality of services and focusing on safety. These robots are controlled through a 6-wheel drive with

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the operation done through a Bluetooth Remote controller. In addition, the robots have an upper part that is meant for carrying packages, and only the rightful owners are allowed to have access to the interior. This anti-theft mechanism completely reduces the possibility of robbery and also provides a delivery experience that looks like it was done by human robots. Moreover, ultrasonic sensors are incorporated in the robots to avoid contact with people or objects that are within the vicinity. Speaking of construction, the robots have a base consisting of six wheels and six 12V motor drives. The first two motors help the robot move forwards while the last two assist in 'shoving' it, making for easy navigation of staircases. The power source of the robot is supplemented by a rechargeable 12V lead-acid battery [26]. The upper section is a hollow cavity situated on top of the base and designed for package storage. Through the remote camera, the control team keeps the robot's orientation in check and quickly responds to any theft incident. In addition, there is an input as well as an output speech apparatus in the robot through the speaker through which the robot tells the clients that the robot is currently there and they should open the door. This speaker also act as siren and produce a beep whenever intruder tried to unlock the door of the house. It also increases ease and efficient, deliveries due to the addition of what is termed as ascending stairs. Incorporating all these features we have come up with a door delivery robot; an invention which is revolutionizing the e-commerce business mostly because of it's efficiency and cost friendly aspect. They are self-driven robots which are equipped with the modern innovations like the sensors and cameras to aid the robots in prying barriers and that will help deliver the consignment in the right manner. On the same note, integration makes it easy for industries and firms to cut the delivery expenses, improve the delivery, and improve the relations between the firms and the customers.

While robotics has long been employed in the automotive industry, other sectors have recognized the advantages of robotic automation in recent years.

## 2 Working Methodology

The Arduino Uno microcontroller board is the main part of the circuit. L293D motor driver is connected to Arduino Uno to control the motors simultaneously 3-4V li-ion battery supply is provided for power supply and an HC-05 Bluetooth module is used to control the robot with a paired Bluetooth device.

Arduino Uno and the motor driver are connected by placing the motor driver on top of Arduino and 2 sets of 3 parallel connected motors are connected to the motor driver as shown in the circuit diagram. And a total of 12v (3- 4V) supply is given to the circuit. Motor drivers are to control the movement of the wheels. Typically, a motor driver is connected to each wheel or motor. These motor drivers receive commands from the microcontroller and regulate the power supplied to the motors, enabling precise control of the robot's motion. The Motor driver will control the parallel motors as per the signal received from Bluetooth paired device so that we can change the direction of the moving robot.

In the Bluetooth module VCC, TXD, RXD, and STATE connection are connected as per the circuit diagram. By pairing a Bluetooth module with a desired Bluetooth-enabled device or a mobile device, data transmission takes place which acts as instructions that determine the state of the robot.As this robot has 6 wheels, it combines stability, maneuverability, and navigates through diverse terrains, and delivers packages efficiently. Its design and capabilities make it well-suited for outdoor environments, ensuring reliable and timely delivery while minimizing the need for human interaction.

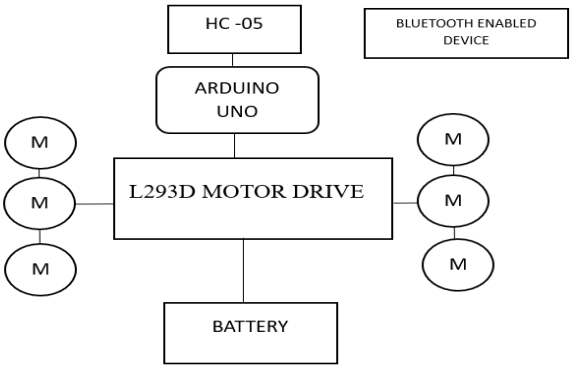


**Fig. 1.** Block Diagram of E-Commerce Door Delivery Robot

## 2.1 Block diagram

The circuit gets power supply from the Rechargeable lithium-ion batteries supplying electrical energy to the system. When Arduino gets a power supply it coordinates various functions and subsystems through the motor drive. It receives inputs from the Bluetooth module and generates control signals for the motors and other components.

The motor driver will be receiving input signals from Arduino which determine the desired motor behavior.

This will determine the direction control and speed control. Direction control allows the motor to rotate in either the forward or reverse direction by configuring the motor driver's control signals accordingly. Motor drivers employ an H-bridge configuration, which enables bidirectional motor rotation. By appropriately configuring the switches, the motor can be made to rotate in the desired direction. Speed control is obtained by using pulse width modulation (PWM).

Then the Bluetooth module gets activated and by pairing it with the desired device we can control the robot by specifying the speed or direction. Control signals which are received from Bluetooth-enabled devices are transmitted through the Bluetooth module which is further transferred as control signals for Arduino. Then as per the specified speed and direction robot will be moving as per the instructions provided.

Motor drive works when voltage is applied, a motor rotates in the forward/reverse direction according to the polarity of the voltage. Arduino board and Motor drive are connected directly by placing the motor drive on the Arduino. Bluetooth module is connected to the motor drive as per the circuit diagram. This motor drive receives instructions from the Bluetooth module and helps to control the motors connected to the motor drive. These motors are connected as 2 sets of 3 parallel motors in connection

## 2.2 Interfacing of dc motor drives using arduino:

To overcome the problems in their interfacing, a motor Driver IC is connected between a microcontroller and the DC motor. The motor driver is a little current amplifier. It takes a low current signal and gives out a high current signal which can drive a motor. It can also control the direction of the motor.

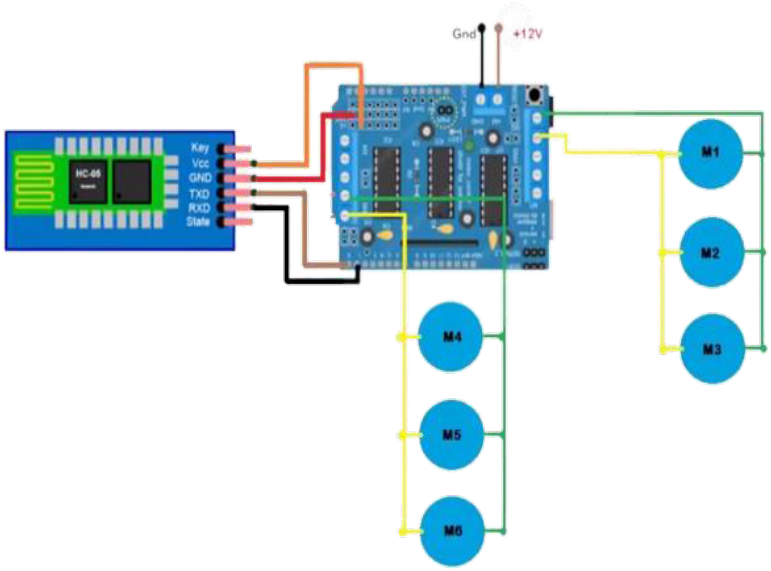


**Fig. 2.** Block diagram of Interfacing of dc motor drives using arduino

We can use any dual H-bridge. The name "H-Bridge" is derived from the shape of the switching circuit which controls the motion of the motor.

There are four switching elements in the H-Bridge as shown in the figure.

- High side left
- High side right
- Low side right
- Low side left

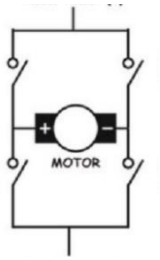


**Fig. 3.** Basic circuit diagram of H- Bridge

| High Left | High Right | Low Left | Low Right | Motor runs |
|---|---|---|---|---|
| ON | OFF | OFF | ON | clockwise |
| OFF | ON | ON | OFF | Anti-clockwise |
| ON | ON | OFF | OFF | Motor stops |
| OFF | OFF | ON | ON | Motor stops |

**Fig. 4.** Table of on and off action for motor

### 2.3 Bluetooth Module Interfacing with Arduino.

The Bluetooth module is a small-range wireless communication device that can be used for various purposes like sending data or controlling devices connected with it. It is a 6-pin module, the device can be used in 2 modes: data mode and command mode. The data mode is used for data transfer between devices whereas the command mode is used for changing the settings of the Bluetooth module. By using HC-05 we will give commands to the motor drive which further becomes instruction for the motors that control the motors.

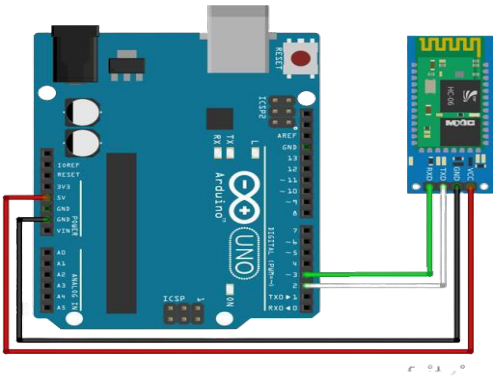

**Fig. 5.** Bluetooth Module Interfacing with Arduino

**Fig. 6.** E-Commerce Door Delivery Robot

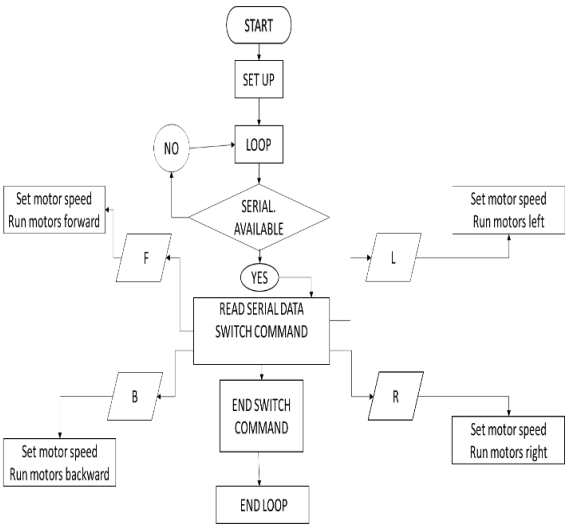


**Fig. 7.** Flowchart for interfacing Arduino and wireless controllers for the motors

## 3 Result

Autonomous door delivery robots revolutionize the e-commerce landscape, employing cutting-edge hardware for optimal efficiency and security. Featuring a 6-wheel drive system, Bluetooth RC control, and anti-theft measures, these robots ensure precise deliveries. The construction includes a 6-wheel base with motor drives for stair climbing, powered by a rechargeable 12V battery. Equipped with a speaker for customer interaction and security alerts, the robots redefine the delivery experience. This robot can climb a stair at a height of 10 centimeters. The program helps to make the robot move in forward, back, left, and right directions with 255 maximum velocities.

Monitored remotely, they offer cost-effective, secure, and swift deliveries, reshaping the e-commerce industry through innovative robotic automation and fostering improved customer relationships.

**Fig. 8.** Step climbing E-Commerce Door Delivery Robot

## 4 Conclusion

1. Lastly, it is evident that door delivery robots have revolutionized the e commerce sector. These self-driving delivery vehicles include an array of new age sensors and cameras to deliver the packages without hitting any object.
2. Their key objective is to enhance the speed, accuracy and efficiency of deliveries of merchandise through e-commerce platforms hence reducing costs while at the same time enhancing customer satisfaction.
3. Since these robots incorporate a 6-wheel drive system and remote-control capabilities, moving packages from one point to another becomes very easy while guaranteeing the safety of the consignments.
4. Among them, there is anti-theft mechanisms, ultrasonic sensors and interactive speakers, all these features can improve the delivery process and make the delivery of goods from one place to another more effective.
5. Delivery robots seem to be a great solution of the problems linked with manual deliveries enabling to save time and increase effectiveness of workplaces in the sphere of e-commerce.

## References

1. Le Yi Koh, Kum, Fai Yuen "Consumer adoption of autonomous delivery robots in cities: Implications on urban planning and design policies" Cities ( IF 6.077 ) Volume 133- Pub Date: 2022-11-29
   DOI: 10.1016/j.cities.2022.104125
2. Murad Mehrab Abrar, Raian Islam and Md. Abid Hasan Shanto "An Autonomous Delivery Robot to Prevent the Spread of Coronavirus in Product Delivery System" 11th IEEE Annual Ubiquitous Computing, Electronics & Mobile Communication Conference October 2020. ISBN:978-1-7281-9656-5
3. Mohsen M. Dalvand & Majid M. Moghadam "Stair climber smart mobile robot (MSRox)" February 2006 Autonomous Robots 20(1):3-14
4. Tharakeshwar Appala & Ghosal Ashitava "A mobile robot with a two-degree-of-freedom suspension for traversing uneven terrain with minimal slip: modelling, simulation and experiments Mech. Mach. Theory Volume 93, November 2015, Pages 83-97
5. P. Xiong, A. Song, P. Ji & X. Huang "Study on ability of a mobile tracked robot for stair-climbing based on static analysis" 2015 IEEE International Conference on Cyber Technology in Automation, Control, and Intelligent Systems (CYBER) (2015)
6. Sewoong Oh, Ali Hussein & Kim Soojin "Development of six-wheeled small mobile robot platform and slip ratio estimation" March 2021 Transactions of the Korean Society of Mechanical Engineers A 45(3):247-257.
7. D Karuna Kumar, B Mahesh, B Umesh & K Rohanth Reddy and M Shashank "Smart Wheelchair with Advanced Assistance and Governing System for Disabled" E3S Web of Conferences 391, 01095 (2023) ICMED-ICMPC 2023
8. More Anusha, Dola Gobinda Padhan and D. Karuna Kumar "A Fuzzy Controlled LCC HVDC System with AC Voltage and Reactive Power Control" E3S Web of Conferences 309, 01190 (2021) ICMED 2021
9. Ranjith Kumar Reddy Banda, Karunakumar Davala, Dola Gobinda Padan and Anil Kumar Rajagiri "Frequency Analysis of Grid Connected EVS by using Artificial Neural Network (ANN)" E3S Web of Conferences 309, 01027 (2021)-ICMED 2021

10. J. Zheng, Z. Liu, H. Gao, et al., A novel active deform and wheel-legged suspension of Mars rover, in: 2016 IEEE International Conference on Robotics and Biomimetics (ROBIO), IEEE, 2016, pp. 7–12
11. Weihua Li, Li Zhencai, Liu Yiqun, et al., Semi-autonomous bilateral teleoperation of six-wheeled mobile robot on soft terrains, Mech. Syst. Signal Process. (2019) 133.
12. Z. Fan, Q. Qiu, Z. Meng, Implementation of a four-wheel drive agricultural mobile robot for crop/soil information
13. n collection on the open field, in: 2017 32nd Youth Academic Annual Conference of Chinese Association of Automation (YAC), 2017, pp. 408–412.
14. X. Wang, X. Xu, Z. Feng, H. Wu, Structural optimization design and performance simulation of a novel six-wheel-legged mobile robot, in: 2018 IEEE International Conference on Robotics and Biomimetics (ROBIO), 2018, pp. 206–1352.
15. A. Suresh, N. Ajithkumar, S.T. Kalathil, et al., An Advanced Spider-Like RockerBogie Suspension System for Mars Exploration Rovers, Robot Intelligence Technology and Applications, vol. 4, Springer, Cham, 2017, pp. 423–447.