

## Community based E-commerce package delivery robot

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### Abstract

The community based e-commerce package delivery robot is meant to be a substitute for a goods delivery person. The delivery robot is capable of navigating through a cluttered space environment from a home location to a destination point while avoiding obstacles in the process. It uses an photoelectric sensor to detect if anything has been placed inside the bin and only once when something is placed inside, the robot starts moving from a position to another.

This robot uses ESP8266 Microcontroller which consists of Memory and Wi-Fi Module for storing the coded data and maintaining connectivity respectively, where the motions are coded in an Aurdino Integrated Development Environment in c-language.

**Keywords:** Microcontroller, wi-fi module, photoelectric sensor.

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### I. INTRODUCTION

Robotics" is the term practically defined as the design and utilization of robot systems for industry . Robots are usually preferred to use for performing hazardous, complicated as well as highly monotonous, and unpleasant jobs . These are installed in many workstations where ever heavy loads and hectic operations has to be perform such as material handling, different part assembly.

Autonomous delivery system, not yet intelligent enough to deliver goods across cities, but able to deliver small objects from one place to another in small boundaries. The use of DonkeyCar represents the robot, open source platform, which will be powered by the Raspberry Pi and Pi Camera to create an autonomous vehicle. The delivery robot is trained meticulously with support of Open CV and TensorFlow, which are a part of DonkeyCar library to allow run simulations and can be used to teach or create autopilots or models. Thus, allowing the car to manipulate itself by the judgment bestowed upon it through rigorous training.

The use of autonomous robots is not a new advance in the field of delivery as multinationals companies such as Amazon and DHL have been known to use such robots for the purpose to handling packages in their warehouses, it seemed quite favorable to propose something of such equivalence particularly in the eye of such firms and companies. Autonomy can be scaled to various prospects depending on the usage. The initial step is to introduce a robot capable of carrying out minimalistic jobs mentioned earlier. Teaching, specifically training the robot to travel is the most challenging section . The main focus was to teach the robot about obstacle avoidance as well as navigating to the destination with accuracy. With a heavy data set on us, we can implement obstacle avoidance as well as reach our final desired destination with the marginal error.

In India, most deliveries are performed by human beings. The main idea of the self-driving system is to have a robot which can transport physical objects from one place to the other. The objective of the robotics field is to create intelligent machines that can assist humans in a variety of ways. The model uses artificial intelligence technology to navigate the waypoint and reach the destination successfully. This technology has the capability of a computer-controlled robot to do the tasks commonly associated with intelligent humans. Artificial intelligence is the simulation of human intelligence processes by machines, especially digital computer systems. Stuart Russell and Peter Norvig defined Artificial Intelligence which differentiates computer systems on the basis of rationality and thinking vs acting. The human approach defines the functionality of the systems that think like humans and the systems that act like humans.

#### 1.1 Types Delivery Robot

Delivery robots can be used in different settings such as food delivery, package delivery, hospital delivery, and room service.

### **1. Food delivery robot**

Deployments of food delivery robots were in a small scale prior to the COVID-19 pandemic. continued on, demands for food deliveries had increased significantly. This caused the demands for food delivery robots in college campuses to surge as well Starship and other companies such as Kiwibot deployed hundreds of food delivery robots to several college campuses and some city streets in the United States and United Kingdom. Food delivery service companies also added delivery robots to their platform.

### **2. Grocery delivery robot**

The first African American-owned autonomous grocery store in the world. The new store processes transactions using computer vision equipment in tandem with artificial intelligence-based voice and gesture technology. Nourish + Bloom offers delivery service using robotic vehicles supplied by Daxbot.

### **3. Package delivery robot**

In January 2019, Amazon launched an experimental service to deliver small packages to their Amazon Prime customers using delivery robots called Amazon Scout.

### **4. Hospital delivery**

Delivery robots can perform several tasks in hospital settings to reduce operational costs. The first set of tasks are for food, medical specimens, and medicine deliveries. With multiple sensors, the delivery robots can navigate the interior layout of the hospitals.

### **5. Room service**

A room service robot named Relay was introduced by a robotics startup company, Savioke. When hotel staff received an order from a guest, the staff would put items inside Relay and the robot would deliver items to the guest room.

Robotics is the term practically defined as the design and utilization of robot systems for industry. Robots are usually preferred to use for performing hazardous, complicated as well as highly monotonous, and unpleasant jobs. These are installed in many workstations where ever heavy loads and hectic operations has to be perform such as material handling, different part assembly, various types of welding, different spraying, painting also can be used to placing small parts with accuracy etc. The two major segments of assistive robots were an assistive service robots and nonassistive industrial robots. Assistive service robots are normally operates partially or fully autonomously to execute different services helpful to the humans and machines. The ISO definition of Assistive industrial robot are those robot which autonomously performed also multipurpose programmable in three or more axis. Assistive industrial robot are designed to shift work objects, various tools, or dedicated devices through adaptive planned motions to execute a diversity of tasks.

An non assistive Industrial robot system incorporate many devices and sensors incorporated by the robot to execute its overall tasks as well as chaining or supervising communication interfaces. It has two windows, front panel and block diagram. Block diagram contains the actual code whereas front panel is the area that holds control/indicators which enables user interaction.

## **1.3 Advantages, Limitations and Applications :**

### **Advantages**

1. Using our project, we can substitute the job of a delivery person since this robot is capable of delivering goods from one place to another which can thus, help save money over time as this option will be cheaper for a company to use for delivery purposes in the long run.
2. It can also help reduce man-power which in turn will help save energy, time and the problem of availability of an individual in times of need.
3. The robot has onboard sensors and cameras to operate and which makes the wires or magnetic tape obsolete.
4. Instead of following hard-set paths, the robot can dynamically create their efficient pathways from Point A to Point B within a facility, helping them to avoid obstacles, hence increasing the flexibility.

### **Limitations**

1. Firstly, the robot can't be used for delivery over long distances or over the roads keeping precarious roads caused due to holes might create problems for the mobility of the car.
2. Secondly the making of the robot is a lengthy procedure since a lot of training with regards to not only the precision of the model but also the obstacle avoidance feature is required urging an eclectic and abundant data and collection of which can be a very time-consuming procedure.
3. Thirdly, the current project agenda doesn't comprise of a locking mechanism leaving the material susceptible to theft during the of delivery goods. Fourthly, If the load capacity is excessive, a change of scale for the RC will be required which can bring complication if a smaller scale was opted for.

## Applications

1. In a workplace or office, comprising of various departments working together and the need to transport physical documents from one station to the other.
2. Transporting something as a letter or small parcel from one your letter box outside to you in the house.
3. In an environment such as a hospital where biohazard samples requiring minimal human contact need to be transported.
4. Warehouse delivery robot.

## II. HARDWARE COMPONENTS

### Hardware components

1. ESP8266 Microcontroller
2. Batteries
3. L298D
4. Dc Motors
5. Solenoid switch
6. Photoelectric sensor

### 1. ESP 8266

An ESP8266 Wi-Fi module is a SOC microchip mainly used for the development of end-point IOT (Internet of things) applications. It is referred to as a standalone wireless transceiver, available at a very low price. It is used to enable the internet connection to various applications of embedded systems.

The ESP8266 Wi-Fi module comes with a boot ROM of 64 KB, user data RAM of 80 KB, and instruction RAM of 32 KB. It can support 802.11 Wi-Fi network at 2.4 GHz along with the features of I2C, SPI, I2C interfacing with DMA, and 10-bit ADC. Interfacing this module with the microcontroller can be done easily through a serial port. An external voltage converter is required only if the operating voltage exceeds 3.5 Volts. It is most widely used in robotics and IoT applications due to its low cost and compact size.

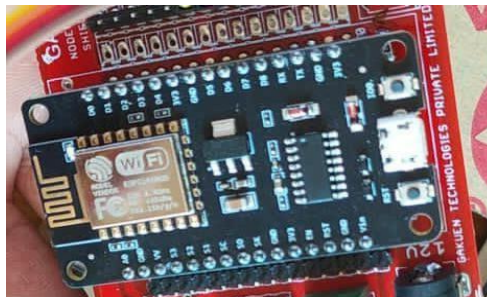


Figure ESP8266

### 2. BATTERIES

A lithium-ion or Li-ion battery is a type of rechargeable battery which uses the reversible reduction of lithium ions to store energy. It is the predominant battery type used in portable consumer electronics and electric vehicles. It also sees significant use for grid-scale energy storage and military and aerospace applications. Compared to other rechargeable battery technologies, Li-ion batteries have high energy densities, low self-discharge, and no memory effect (although a small memory effect reported in LFP cells has been traced to poorly made cells) generate CPU interrupts.

ADC Channel The NodeMCU is embedded with a 10-bit precision SAR ADC. The two functions can be implemented using ADC. Testing power supply voltage of VDD3P3 pin and testing input voltage of TOUT pin. However, they cannot be implemented at the same time.

UART PINS NodeMCU/ESP8266 has 2 UART interfaces (UART0 and UART1) which provide asynchronous communication (RS232 and RS485), and can communicate at up to 4.5 Mbps. UART0 (TXD0, RXD0, RST0 & CTS0 pins) can be used for communication. However,

Chemistry, performance, cost and safety characteristics vary across types of lithium-ion batteries. Most commercial Li-ion cells use intercalation compounds as the active materials. The anode or negative electrode is usually graphite, although silicon-carbon is also being increasingly used.

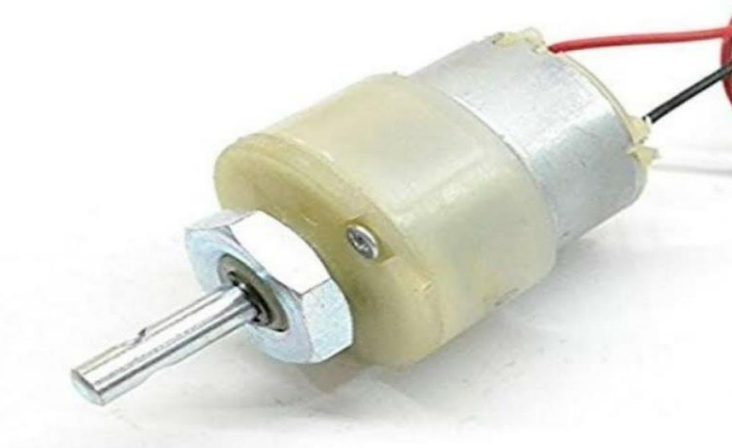


**Figure Lithium-ion Battery**

### 3. DC MOTORS

A DC motor in simple words is a device that converts direct current (electrical energy) into mechanical energy. It's of vital importance for the industry today.

A DC motor is designed to run on DC electric power. Two examples of pure DC designs are Michael Faraday's homo-polar motor (which is uncommon), and the ball bearing motor, which is (so far) a novelty. By far the most common DC motor types are the brushed and brushless types, which use internal and external commutation respectively to create an oscillating AC current from the DC source— so they are not purely DC machines in a strict sense. We in our project are using brushed DC Motor, which will operate in the ratings of 12v DC 0.6A.



**Figure DC motor**

### 4. Solenoid switch

A solenoid is a type of electromagnet where the coil is usually tightly wound and tends to be longer than its diameter, but it could be any shape. The magnetic field created by electrical currents is very similar to the magnetic field created by bar magnets. In the solenoid, the field is uniform and strong.



**Figure Solenoid switch**

## 5. Photoelectric sensor

Photoelectric sensor detect objects, changes in surface conditions, and other items through a variety of optical properties. A Photoelectric Sensor consists primarily of an Emitter for emitting light and a Receiver for receiving light. When emitted light is interrupted or reflected by the sensing object, it changes the amount of light that arrives at the Receiver. The Receiver detects this change and converts it to an electrical output. The light source for the majority of Photoelectric sensor is infrared or visible light.



Figure Photoelectric sensor

## 6. L298D

L298 is a high power version of L293 motor driver IC. The L298D is a popular motor driver IC .As the name suggest it is mainly used to drive motors . L298N Dual H Bridge Motor Driver is a motor controller breakout board which is typically used for controlling speed and direction of motors. It can also be used to control the brightness of certain lighting projects such as high powered LED arrays. An H-bridge is a circuit that can drive a current in either polarity and be controlled by pulse width modulation.

### WORKING PRINCIPLE:

A single L298D is capable of running two DC motors at the same time; also the direction of these two motors can be controlled independently.

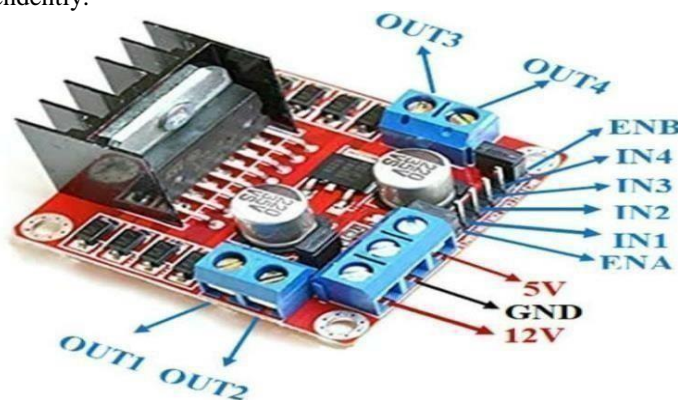


Figure L298D Motor driver

## III. SOFTWARE COMPONENTS

Robot software is the set of coded commands or instructions that tell a mechanical device and electronic system, known together as a robot, what tasks to perform. Robot software is used to perform autonomous tasks. Many software systems and frameworks have been proposed to make programming robots easier.

Some robot software aims at developing intelligent mechanical devices. Common tasks include feedback loops, control, path finding, data filtering, and locating.

## SOFTWARE USED

### Arduino IDE :

Arduino Integrated Development Environment (IDE) is an open-source software program that allows users to write and upload code within a real-time work environment. As this code will thereafter be stored within the cloud, it is often utilized by those who have been searching for an extra level of redundancy. The system is fully compatible with any Arduino software board.

## CODE

Code for importing hotspot & web server modules

```
#include <ESP8266WiFi.h>
#include <WiFiClient.h>
#include <ESP8266WebServer.h>
const char *userId="vk";
const char *password="12345678";
```

## INITIATING AND DECLARING VARIABLES

```
ESP8266WebServer server(80);
String page="";
String page2="<p>LED_ON</p>";
String page3="<p>LED_OFF</p>";
String page13="";
```

## SETUP FOR DECLARING THE INPUT AND OUTPUT PINS

```
void setup() {
pinMode(D2,INPUT);
pinMode(D3,OUTPUT);
pinMode(D4,OUTPUT);
pinMode(D5,OUTPUT);
pinMode(D6,OUTPUT);
pinMode(D7,OUTPUT);
pinMode(D8,OUTPUT);
Serial.begin(9600);
WiFi.softAP(userId,password);
IPAddress myIP=WiFi.softAPIP();
Serial.print(myIP);
server.begin();
page="<title>Robotics</title><center><body><h1>Gnit Major Project</h1><p><a href=\"LOCK\"><button >
LOCK</button></a></p><p><a href=\"UNLOCK\"><button>UNLOCK</button></a></p><p><a href=\"F\"><button>Forward</button></a></p><p><a href=\"B\"><button>Reverse</button></a></p><p><a href=\"S\"><button>STOP</button></a></p><p><a href=\"RIGHT\"><button>RIGHT TURN</button></a></p><p><a href=\"LEFT\"><button>LEFT TURN</button></a></p></body></center>";
server.on("/", webpage);
server.on("/LOCK",LOCK);
server.on("/UNLOCK",UNLOCK);
server.on("/F",FORWARD);
server.on("/B",REVERSE);
server.on("/S",STOP);
server.on("/RIGHT",RIGHT);
server.on("/LEFT",LEFT);
}
```

## FUNCTIONS

```
void RIGHT(){
digitalWrite(D5,HIGH);
digitalWrite(D6,LOW);
digitalWrite(D7,LOW);
digitalWrite(D8,LOW);
```

```
String page7="TAKING RIGHT TURN";
server.send(200,"text/html",page+page7);
Serial.print("TAKING RIGHT TURN");

}
void LEFT(){
digitalWrite(D5,LOW);
digitalWrite(D6,LOW);
digitalWrite(D7,HIGH);
digitalWrite(D8,LOW);
String page8="TAKING LEFT TURN";
server.send(200,"text/html",page+page8);
Serial.print("TAKING LEFT TURN");
}
void FORWARD(){
digitalWrite(D5,HIGH);
digitalWrite(D6,LOW);
digitalWrite(D7,HIGH);
digitalWrite(D8,LOW);
String page4="Motor moving forward";
server.send(200,"text/html",page+page4);
Serial.print("FORWARD");
}
void REVERSE(){
digitalWrite(D5,LOW);
digitalWrite(D6,HIGH);
digitalWrite(D7,LOW);
digitalWrite(D8,HIGH);
String page5="Motor moving backward";
server.send(200,"text/html",page+page5);
Serial.print("REVERSE");
}
void STOP(){
digitalWrite(D5,LOW);
digitalWrite(D6,LOW);
digitalWrite(D7,LOW);
digitalWrite(D8,LOW);
String page6="Motor STOPPED";
server.send(200,"text/html",page+page6);
Serial.print("STOPPED");
}
void UNLOCK(){
String page11="<p>Package is unlocked</p>";
digitalWrite(D3,LOW);
digitalWrite(D4,HIGH);
server.send(200,"text/html",page+page11);
}
void LOCK(){
String page12="<p>Package is locked</p>";
digitalWrite(D3,LOW);
digitalWrite(D4,LOW);
server.send(200,"text/html",page+page12);
}
void webpage(){
int digital = digitalRead(D2);
if(digital == 0){
String page13="<p>Package is available</p>";
digitalWrite(D3,HIGH);
digitalWrite(D4,LOW);
```

```
server.send(200,"text/html",page+page13);
}
else{
String page13="<p>Package is unavailable</p>";
digitalWrite(D3,LOW);
digitalWrite(D4,LOW);
server.send(200,"text/html",page+page13);
}
}
void loop() {
server.handleClient();
}
```

#### IV. CONCLUSION AND FUTURE SCOPE

##### Conclusion

This Community based E-Commerce Package Delivery Robot can substitute the delivery job of a delivery person since this is capable of delivering goods within the community. The robot operator requires less energy compared to when delivering the packages physically. It avoids physical contact between the delivery person and customer which is significant during times like COVID-19. The robot has photoelectric sensor to sense whether the package is available or not which let the operator know if the delivery is done or not.

##### Future scope

In future we include machine learning technology therefore it works without operator. This will also be customized to use in hospitals, restaurants and offices for respective works. We can improve the range of delivery through internet rather than using local wifi.

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