Unmanned Ground Vehicle (UGV) kit User Guide

భారతీయ సాంకేతిక విజ్ఞాన సంస్థ హైదరాబాద్
भारतीय प्रौद्योगिकी संस्थान हैदराबाद
Indian Institute of Technology Hyderabad
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NextGen Autonomous Navigation

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COMPONENTS AND SPECIFICATION

1.1 ESP32

SPECIFICATION FOR ESP32 CONTROLLER		
Make	Espressif Systems	
Model	ESP-WROOM-32	
Sr No	**Description**	
	General Data	
1	Processors	• CPU: Xtensa dual-core (or single-core) 32-bit LX6 microprocessor, operating at 160 or 240 MHz and performing at up to 600 DMIPS • Ultra-low-power (ULP) co-processor
2	Memory	320 KiB RAM, 448 KiB ROM
3	Connectivity	• Wi-Fi: 802.11 b/g/n • Bluetooth: v4.2 BR/EDR and BLE (shares the radio with Wi-Fi)
4	Peripheral interfaces	• 34 × programmable GPIOs • 12-bit SAR ADC up to 18 channels • 2 × 8-bit DACs • 10 × touch sensors (capacitive sensing GPIOs) • 4 × SPI • 2 × I^2S interfaces • 2 × I^2C interfaces • 3 × UART
4	Onboard sensors	• BMX160 smart 9-Axis IMU • BNO055 smart fusion sensor • DPS310 provides Pressure, Humidity, and Temperature monitoring. • PDM MIC (L) & (R)

6	Power management	• Internal low-dropout regulator • Individual power domain for RTC • 5 µA deep sleep current • Wake up from GPIO interrupt, timer, ADC measurements, capacitive touch sensor interrupt
7	Other features	• Motor PWM • LED PWM (up to 16 channels) • Hall effect sensor • Ultra-low-power analog pre-amplifier

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1.2. MOTORS

SPECIFICATION FOR DC MOTORS		
Make	Robo India	
Model	DC motor	
Sr No	**Description**	
	General Data	
1	Supply Voltage	9V DC
1	Type	Brushed motor
2	Operating speed	Up to 300 RPM
3	Efficiency	60-75 % with high starting torque

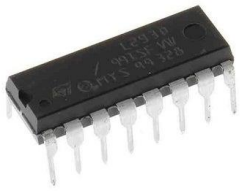
1.3.UGV frame/chassis

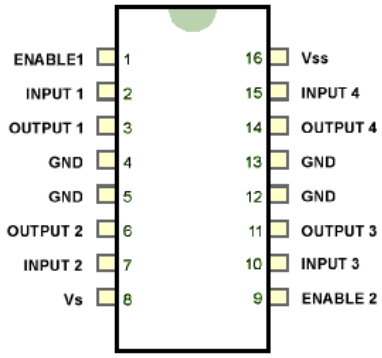
SPECIFICATION FOR CHASIS	
	General Data
	• High-quality acrylic material • Suitable for 2-wheel design. • Supports universal Castor wheel • All necessary screws & nuts

1.4.Batteries for powering various equipment

SPECIFICATION FOR POWER BANK		
	2000 MAh Power Bank	
1	Voltage supply	11.2 V
2	Rechargeable	Yes
3	Relevant components	For DC motors

1.5. L2983D Motor driver circuit

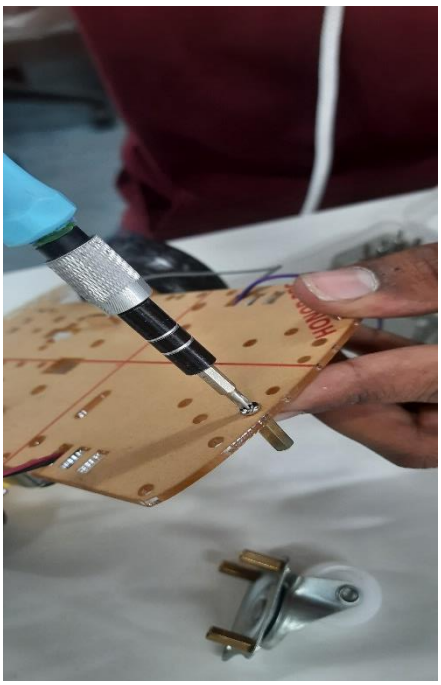


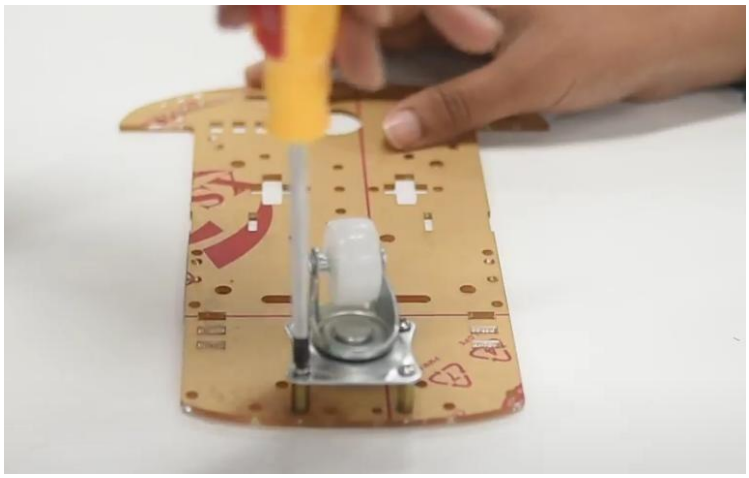


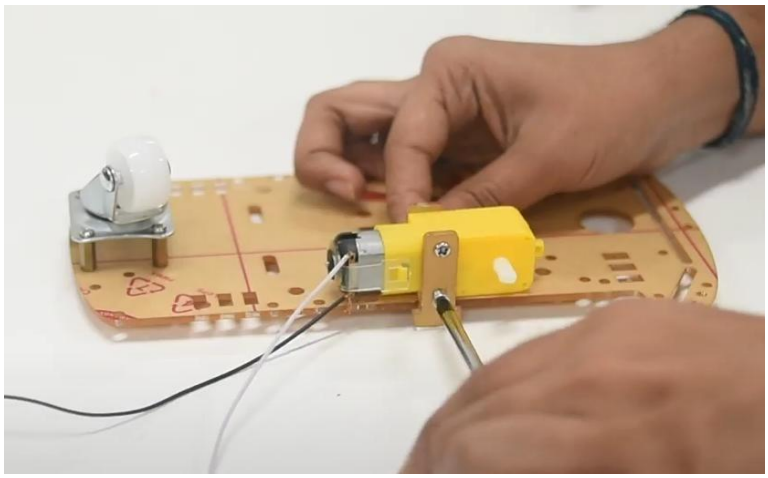
SPECIFICATION FOR L293D		
	L293D Motor Driver	
1	Voltage supply	4.5 to 36V
2	Peak output current	1.2 A per channel
3	Output current	1 A per channel
4	Logic Supply Voltage	36 V
5	Input Voltage	7 V
6	Enable Voltage	7 V
7	Total Power Dissipation at Tpins = 90 °C	4 W
8	Storage and Junction Temperature	-40 to 150 °C

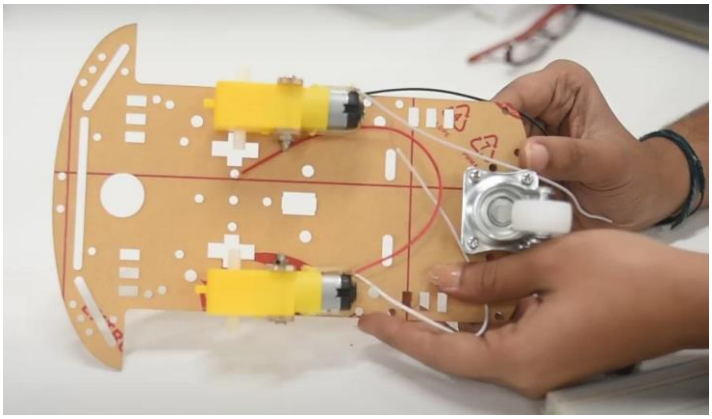
Assembling the UGV kit

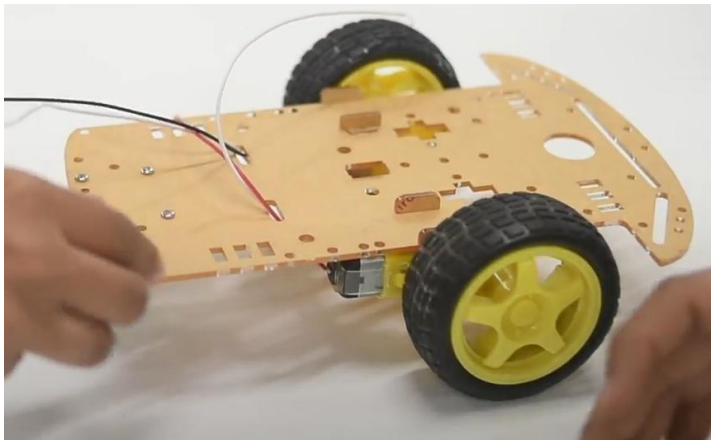
Step 1: Assemble the Chassis using the provided nuts/screws, Wheels, and parts



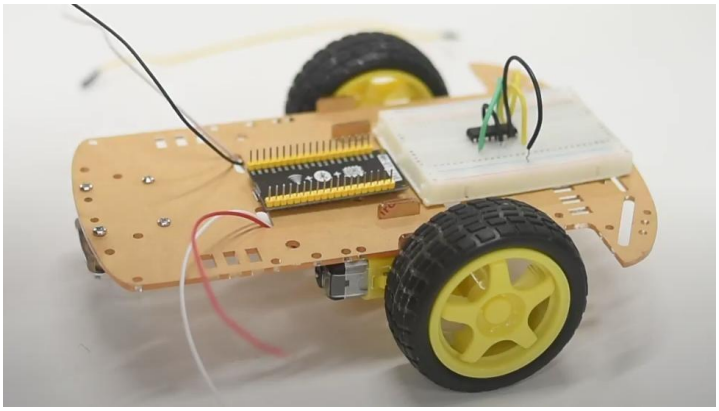


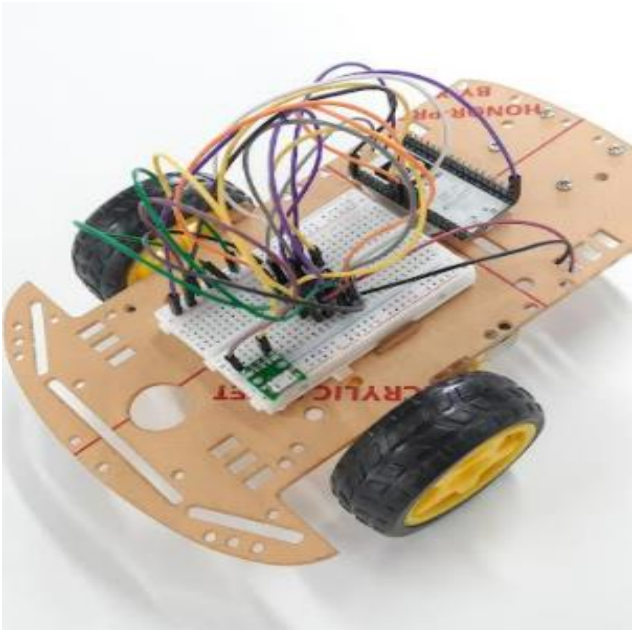


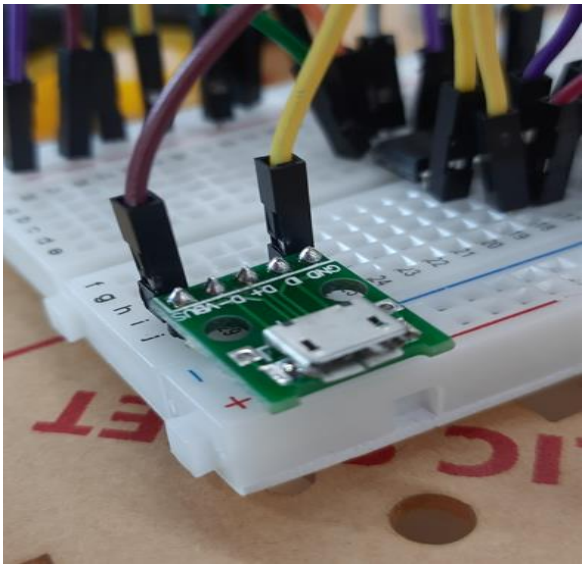


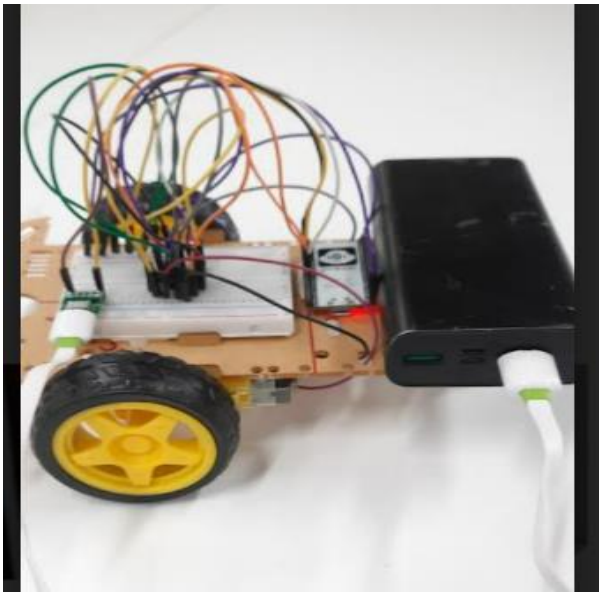


- Step 2: ○ Fix the ESP32 microcontroller and L293D Motor driver on the chassis.
  - ○ Fix the Dual motor driver IC along with a small breadboard on the chassis.
  - ○ Fix the Power bank using usb connector



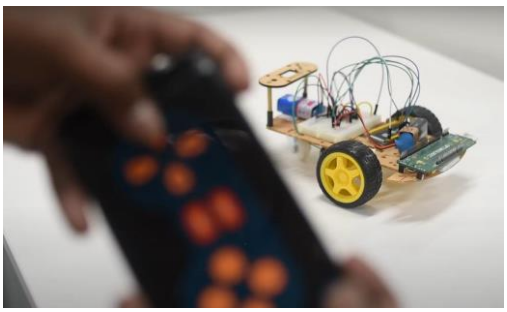






- Step 5:
  - Refer to the Exercise programs (section 3) for guide on wiring connection and programming of the controllers for the desired application. ○ Connect the battery supply and turn on the power to various equipment.

- Step 6: ○ Download the “dabble” application from the play store on an Android phone. ○ Using dabble application, connect to the ESP32 on the UGV kit using Bluetooth connection. ○ Control the navigation of the UGV kit using the GUI controls on the dabble application.



Exercise Programs

3.1. Navigation using ESP32 and Android Phone

3.1.1. Connection diagram:

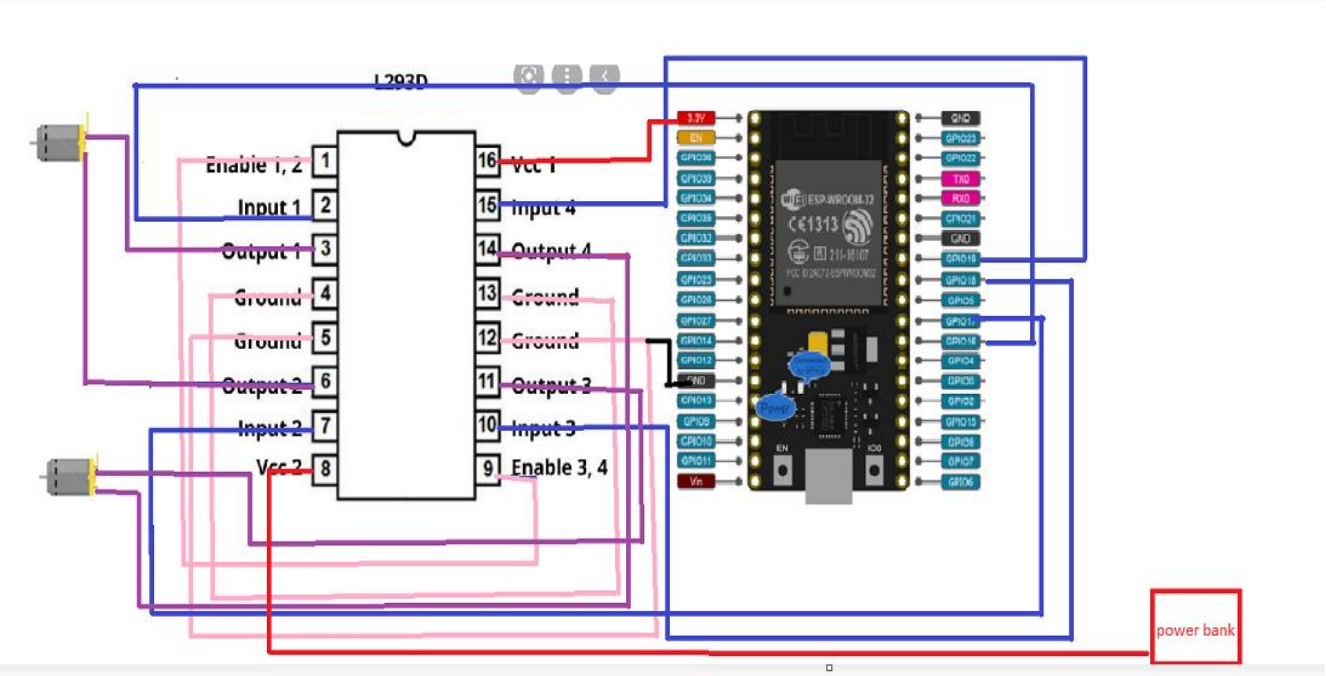
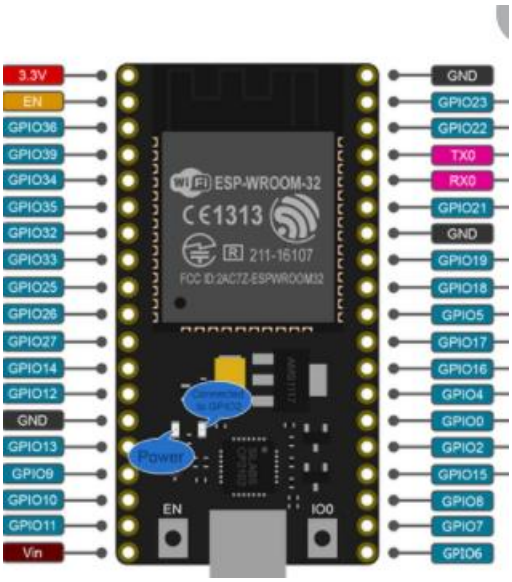


Figure 1 - Connection diagram



-Figure 2 - Pin diagram of ESP32 Microcontroller

3.1.2. Wiring description

- Refer the pin diagram of L298 N motor driver Connect VCC1 pin to Vin pin on ESP32.
- The input and enable pins (ENA, IN1, IN2, IN3, IN4 and ENB) of the L298 N are connected to six ESP32 digital output pins (14, 16, 17, 18, 19 and 15).

- Connect one motor across the OUT1 & OUT2 pins of driver and the other motor across the OUT3 & OUT4 pins of driver.
- Connect external power bank to the VCC2 pin of L293 motor driver.
- Connect external GND pin battery to the GND pin of L293 motor driver
- Go to Arduino IDE and Write the following code:

https://github.com/sachinomdubey/Projects/blob/main/Autonomous%20Navigation/ESP32/IDE/UGV_navigation_using_android_phone/Codes/UGV_navigation_using_andro id_phone.ino

- Click on Compile and Upload the code to" DOIT ESP32 DEVKITV1".
- Now open Dabble app search for Bluetooth devices and Select" MyEsp32" and connect it.
- After connecting click on Gamepad Icon and you will get control panel.

3.1.3. Codes (GitHub link)

https://github.com/sachinomdubey/Projects/tree/main/Autonomous%20Navigation/ESP32/IDE/UGV_navigation_using_android_phone/Codes