

We use a 12 volt, 400 rpm dc motor to move the robot, which is connected to a differential to divide the power of the motor between the wheels so that different powers can be transferred to the wheels during rotation. The motor also uses around 2amps of current at the startup and 0.7 amp of current under pressure.

A servo motor is necessary to rotate the front wheels of the robot so that the desired angle can be adjusted to the gear and rack. The servo motor which is used in our vehicle is MG995 which can rotate 180 degrees. Servo motor is the best option to use for steering because we can adjust the angle of the wheel using exact PWM signal that we send using our raspberry pi to the servo motor.

Also a 12 volt battery and a power bank is used to supply energy to the electronic parts of the robot. To start the Raspberry Pi 3b+, we use the energy of the power bank so that electrical fluctuations do not damage the Raspberry Pi. Also, the camera and the color sensor fed from the Raspberry Pi itself. All of the used modules and motors on the vehicle are using 5 volts so we must reduce the voltage to 5 volts. For that we use the Lm2596 voltage reducer module. This module is a step-down DC/DC converter based on the LM2596 regulator IC. In this module, two pins are considered for voltage input and two pins for output. Input pins +IN and -IN and output pins +OUT and -OUT are shown. Acceptable input voltage for this module is between 4 and 35 volts DC. You can adjust the output voltage between 1.5 volts and 30 volts using the potentiometer built into the board.

Also, the important point in designing the circuit is to connect the output GND from the reducer to the raspberry pi GND.

To start the dc motor, we use the E13007 NPN transistor so that the movement of the motor can be controlled using the Raspberry Pi signal. The reason behind choosing this transistor is that it can handle up to 8 amps of current so it is suitable for running our dc motor.

The color sensor that we use to read the color of the game mat is TCS3200. TCS3200 Color Sensor is a complete color detector, including a TAOS TCS3200 RGB sensor chip and 4 white LEDs. The TCS3200 can detect and measure a nearly limitless range of visible colors. Applications include test strip reading, sorting by color, ambient light sensing and calibration, and color matching, to name just a few. The TCS3200 has an array of photodetectors, each with either a red, green, or blue filter, or no filter (clear). The filters of each color are distributed evenly throughout the array to eliminate location bias among the colors. Internal to the device is an oscillator which produces a square-wave output whose frequency is proportional to the intensity of the chosen color.

We use a 5 mega pixel Raspberry Pi camera to detect the colors of the obstacles and determine the distance of the robot from the walls and obstacles and based on the received data, we determine what movement the robot should make for the existing conditions.

The main part of the vehicle is the single board computer which in our case it is a raspberry pi 3b+. Since we have to analyze the camera data we should use an SBC like raspberry pi.

The raspberry pi receives data from camera and process it based on our willing and then generates signals to control motors and other things on the robot. The gpio's of the raspberry pi helps us to transfer output signal without using any other SBC or other microcontrollers.