CENG4480 Embedded System Development and Applications

Computer Science and Engineering Department

# The Chinese University of Hong Kong

Laboratory 7: Self-balancing Robot (1) (hardware)

November, 2021

Introduction

In this lab and the next lab you will build a self-balancing robot by applying knowledge you have studied in previous lectures and labs. You should complete all the hardware knowledge work and test the hardware is working correctly during this Lab 7. The self-balancing robot you are going to build is the same as the one shown in Figure 1.
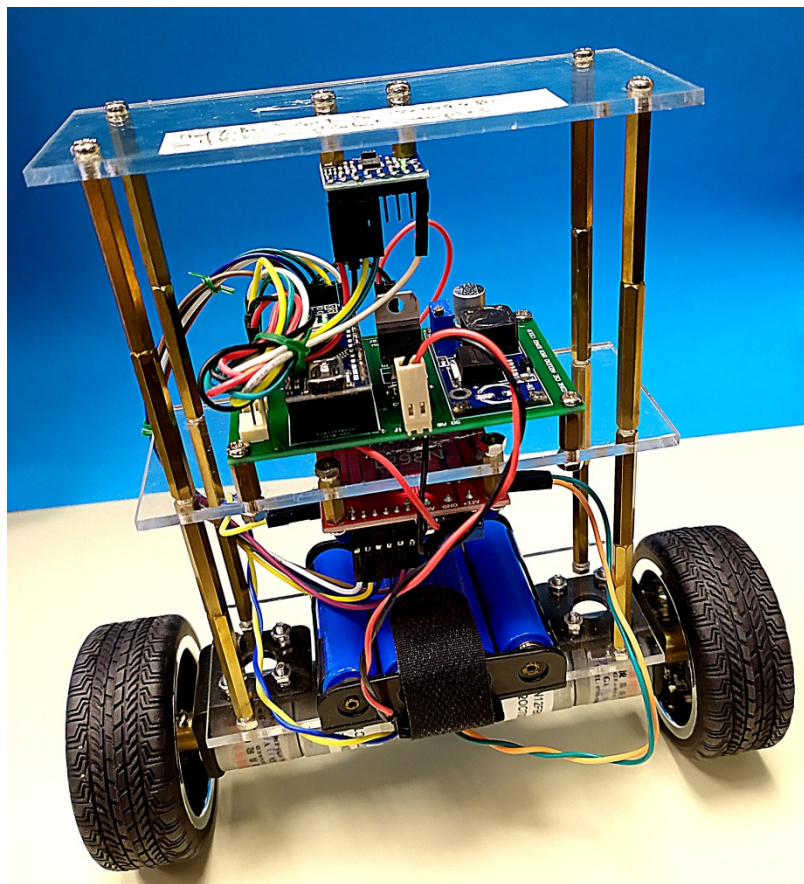
Figure 1. CENG4480 self-balancing robot

Objectives

- To learn how to build an application product using embedded system
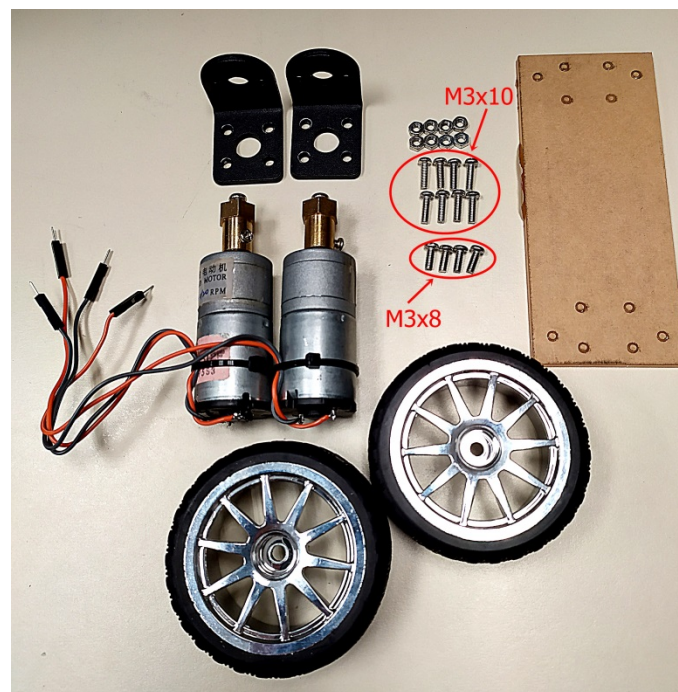- To familiar with the practical work in engineering

The following components will be provided:

1. Three acrylic boards

2. Two motors with mountings and adapters

3. Two wheels

4. An IMU GY-521 module
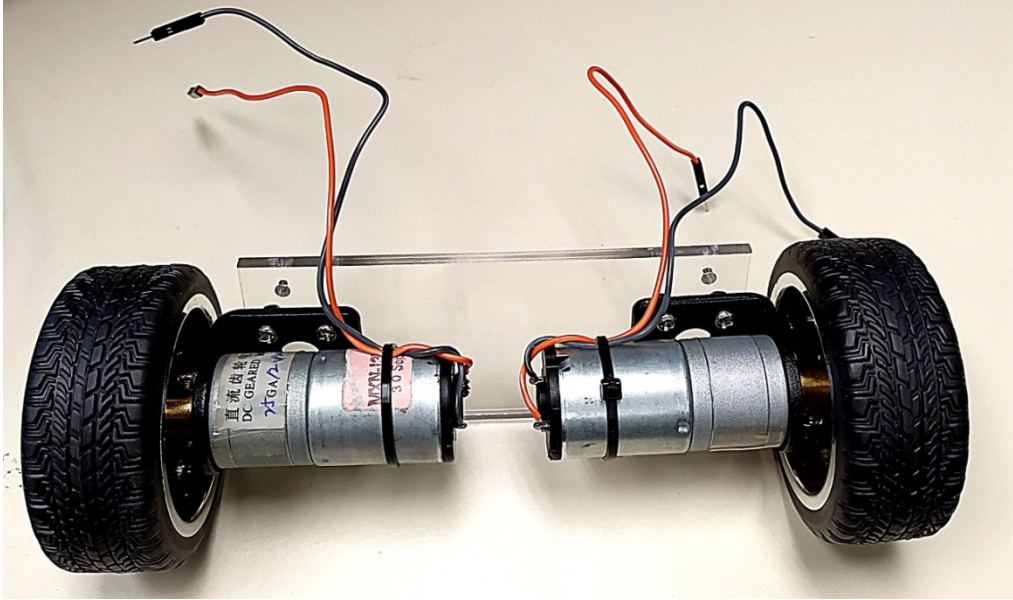
5. A L298N motor driver module

6. A battery pack

Procedures

1. **Assembly the robot wheels**
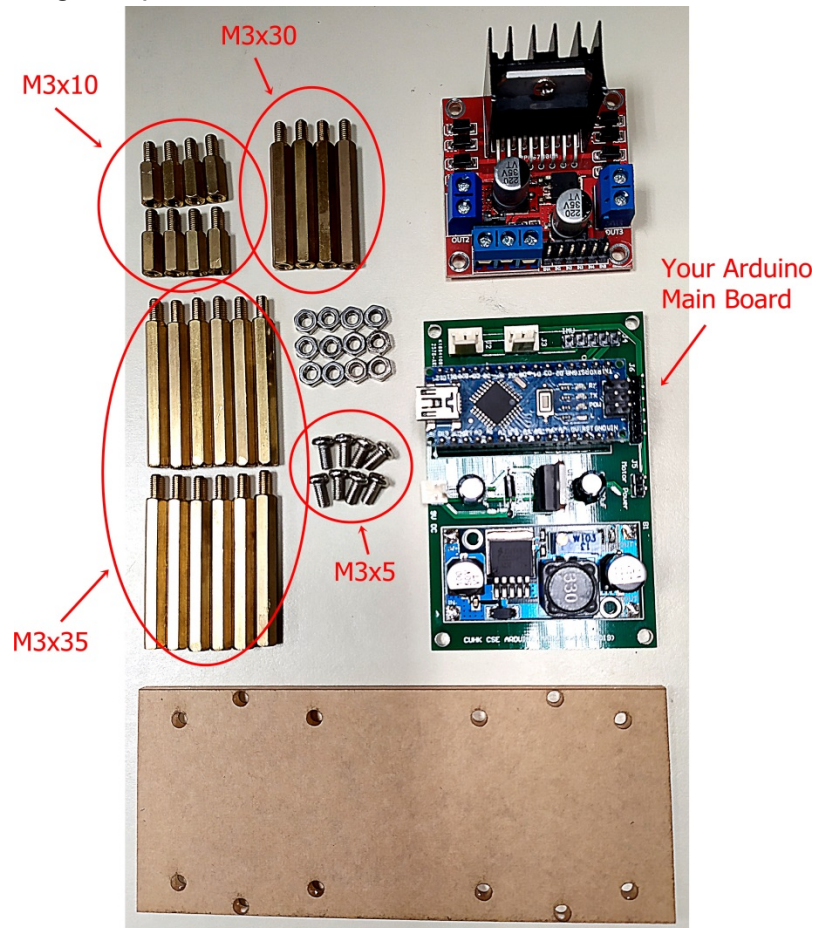   - Collect following components:

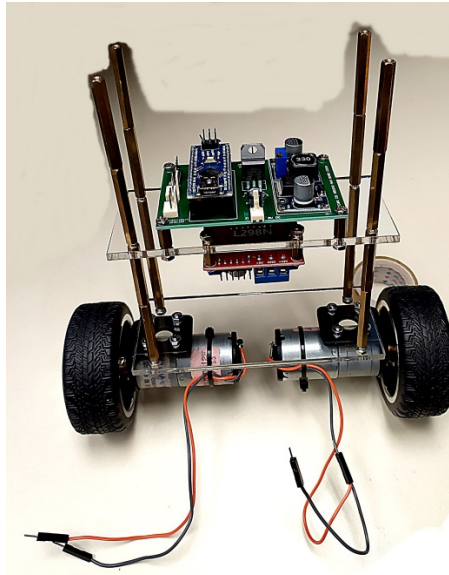- On the acrylic board assembly the motors as shown on the picture below:

2. Assembly the L298N motor driver module and Arduino main board
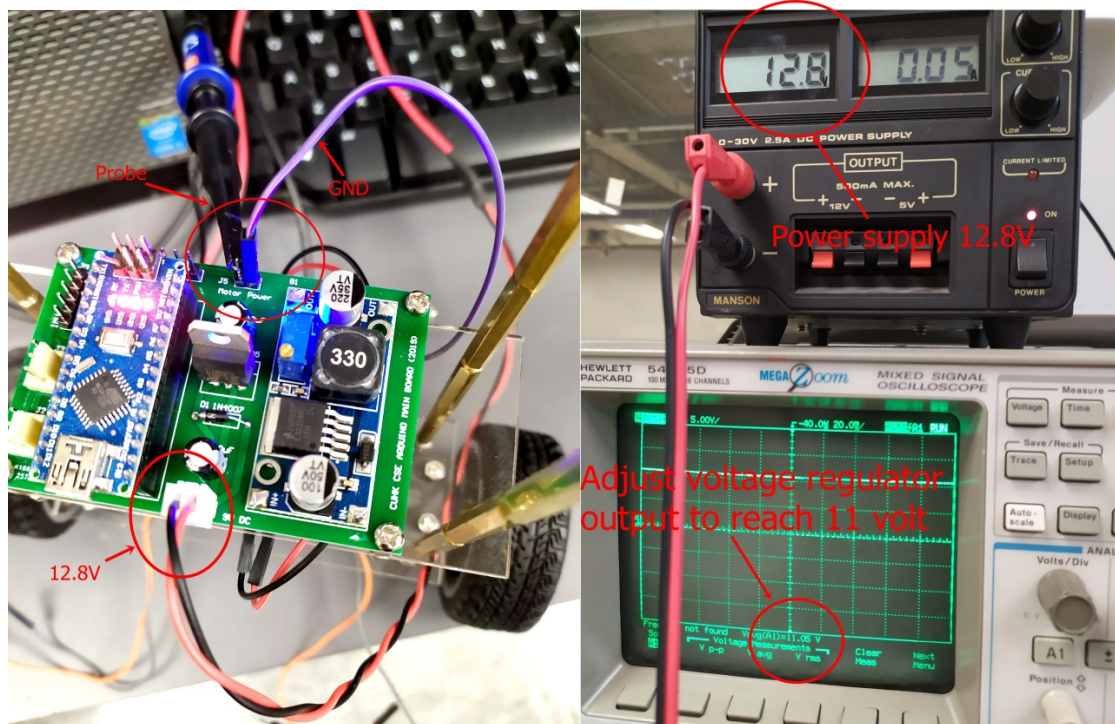- Collect following components:

- Assembly the L298N motor driver module and Arduino main board as shown on the picture below:


3. Adjust the output voltage of regulator module
- Connect 12.8 volt from power supply to J1 on Arduino main board
- Connect the oscilloscope channel 1 probe to motor power J5 pin 1 on the Arduino main board and the ground of the probe connect to J5 pin 2
- Adjust the variable resistor on the regulator module such that output of voltage regulator to reach 11 volt
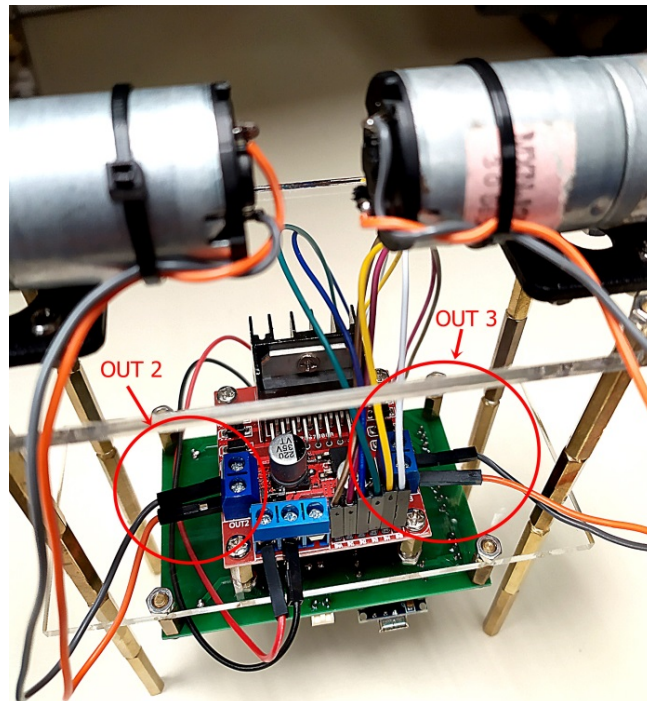
4. **Connect the L298N motor driver to Arduino main board and connect motors to motor driver**
   - Then connect Arduino main board J5 pin 1 (Red wire) to +12V of L298N motor driver module and J5 pin 2 (Black wire) to GND of L298N module
   - Connect Arduino main board J6 pin 1, 2, 3, 4, 5 and 6 (Brown, Violet, Blue, Green, Yellow and White) to ENA, IN1, IN2, IN3, IN4 and ENB on the L298N module
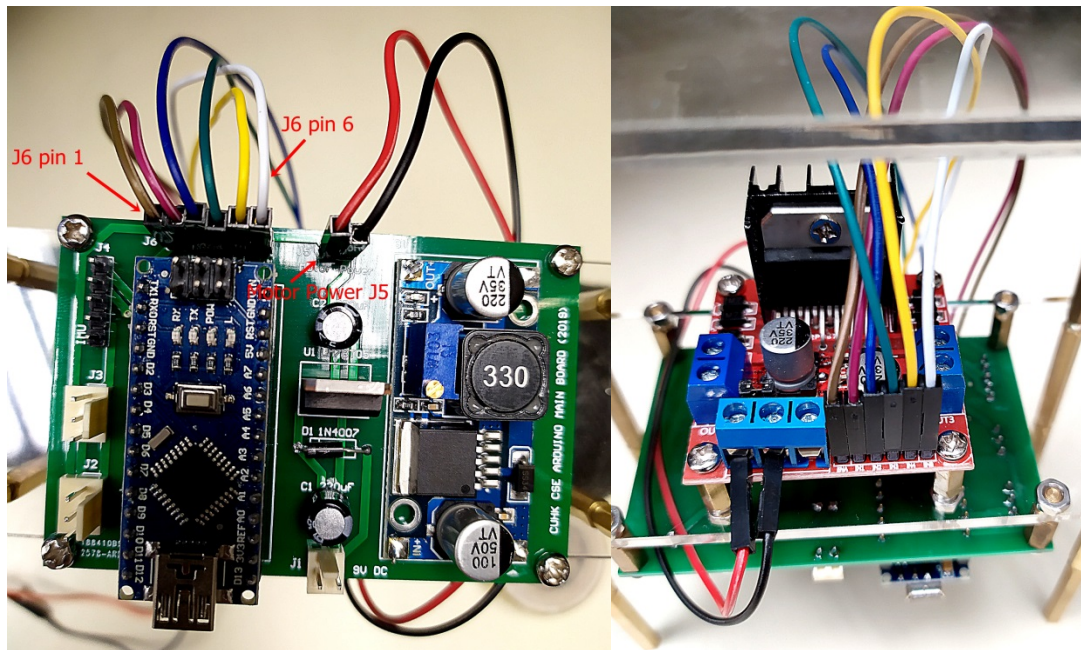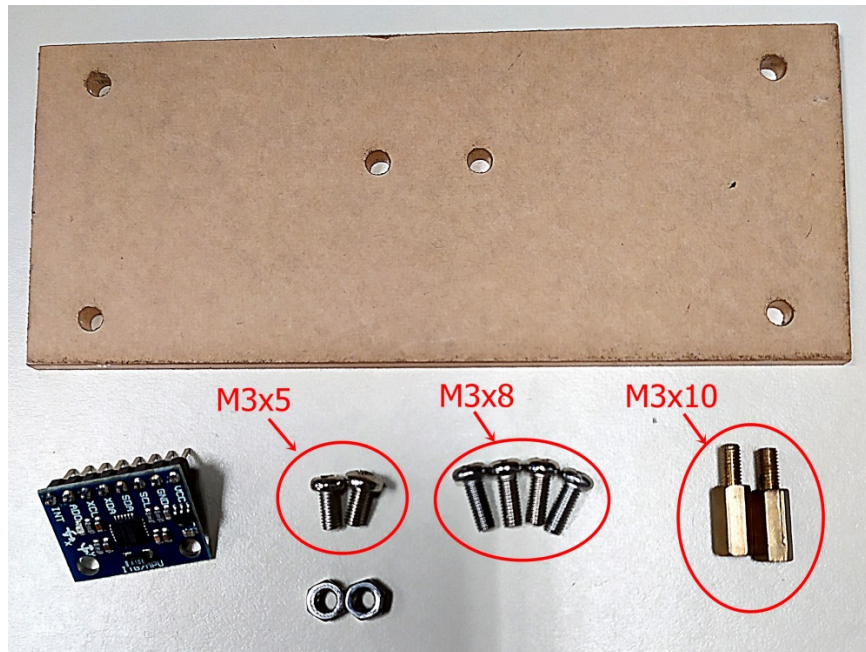

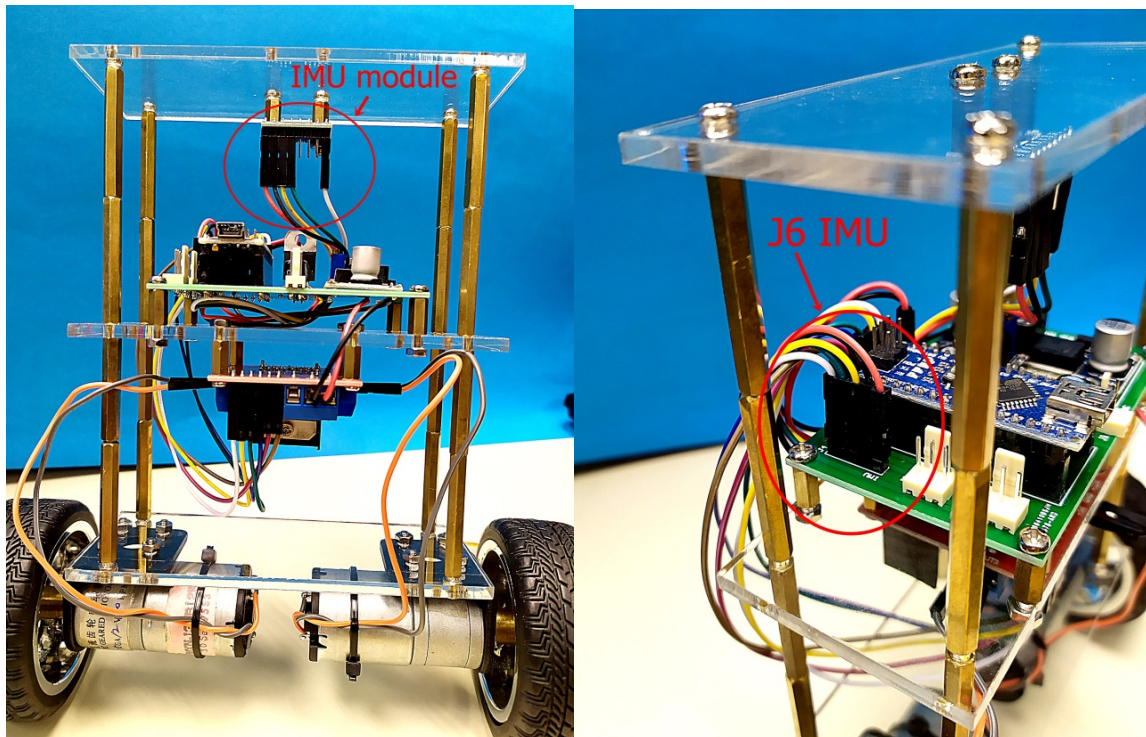   - Connect right motor and left motor to OUT2 and OUT3 of L298N module

5. Assembly and connect the IMU module
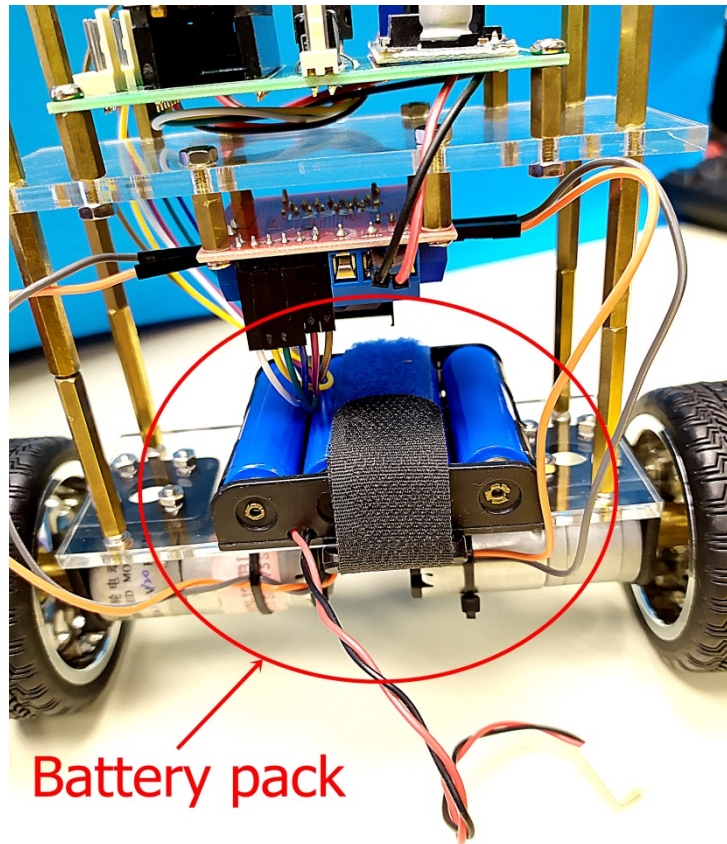
- Collect following components:

- Assembly the L298N motor driver module and Arduino main board and connect VCC (Red), GND (Black), SCL (Yellow), SDA (Green) and INT (White) to the J4 pin 1, 2, 3, 4 and 5 on the Arduino main board as shown on the pictures below:

6. **Attach the battery pack**
   - Attach the battery pack as shown on the picture below:

Battery pack

7. **Testing the robot**
   - Use provided Lab7.ino program to test the robot
   - The robot should move in the same direction of its skew direction
   - If the direction of the wheel is not correct you can just swap the connections of motor wires
   - If you have difficulty in trouble shooting your robot please don't hesitate to ask our technician for help

8. **Demo your robot to TAs**

END