My name is Lu Zhuoyi, an undergraduate studying Mechanical Engineering in Robotics and Mechatronics stream at Nanyang Technological University, Singapore. I have exhibited excellence in academic performance among the 4 years of Bachelor degree, achieving a **CGPA of 4.64** and two consecutive **Dean's list** certificates at academic year 23/24 and 24/25. My research interest mainly lies on legged loco-manipulation, that is to amplify the manipulation capability by considering whole body control of the legged robot as a mobile base.

With a growing fascination for motor dynamics and robot kinematics, I approached Prof. Domenico and secured a research intern role at the **Robotics Research Centre at NTU**. My First research project is to study motor parameters based on estimating the electro-mechanical model for a HEBI motor. I have designed experiments to approximate parameters like Armature constant (Kt) and Velocity constant (Kv). I was therefore able to understand how the motor dynamics is shaped and contribute to the overall performance of the robot.

Under the guidance of my PhD supervisor Yang Lin, I was able to build a 2DOF dual-arm manipulator with HEBI joints and derived its kinematics analytically. Based on that, I also build a third 6DOF arm and write a teleoperation-based impedance controller for both set-ups.
As a co-author to the paper *"A Planning Framework for Stable Robust Multi-Contact Manipulation"*, I help with multi-manipulator (2DOF dual arm + 7DOF Kinova) set-up for the planar peg-in-hole task with extension to Multiple Peg-in-Hole. From the discussions with Lin, I understand the principle underneath optimizing DMP/trajectory parameters using BBO with designated cost functions modelling the interaction between the robot and real world, which indeed shares certain similarity with the idea of Policy Improvement in Reinforcement Learning.

Inspired by this experience, I establish a pipeline which integrate perception, planning and manipulation. (Project ongoing)

During my Internship at Delta Electronics, my work mainly focuses on designing a compliance control strategy for Quadruple Jumping when encountering obstacles or travelling between terrains at different height. Referencing to the paper *"Quadruped-Frog: Rapid Online Optimization of Continuous Quadruped Jumping."*, jumping amplitude and direction can be achieved by each leg generating forces in designated direction. By treating each leg as a 3DOF manipulator, I derive the FK\IK and Jacobian of each leg, and model the Cartesian forces at foot by Virtual spring-damper system attached between the hip and foot. Through the impedance controller, the unitree Go2 is able to jump forward/backward and CW/CCW in both simulation in ROS Gazebo and Mujoco, and in real robot by Unitree_Mujoco Package. Aside from that, I also help 2D map construction using Lidar and write some simple ROS2 code for velocity and orientation control for an AGV travelling in a 2D map.

During the summer research in Rice University, Texas USA, I have been through an enjoyable time at Robot-Pi Lab. Prof. Kaiyu and my mentor Gaotian have provided me a lot of insightful ideas regarding the future of Robotics, while I also enjoy the vibe by discussing with researchers with different research focuses in the lab. My project is to develop the basic control (e.g., Keyboard, XBOX joystick and VR Teleoperation Control) for a low-cost mobile manipulator XLeRobot: (https://github.com/Vector-Wangel/XLeRobot). We believe the great potential of legged/wheel manipulator as they not only have the agile motion traveling through terrains, but also having extended the manipulation workspace compared to a stationary manipulator. Based on Stones's LeRobot Sim2Real repository, I implement RGB/Semantic Segmentation based Reinforcement Learning (PPO) via ManiSkill for LeRobot SO101, serving as a low-level controller for the XLeRobot.