ANH TUNG HO

Project Portfolio

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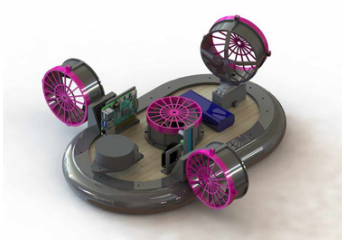
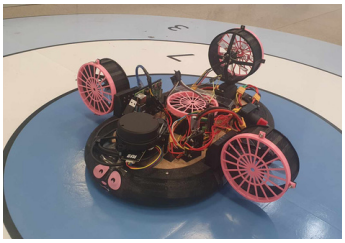
CAPSTONE DESIGN FOR AUTONOMOUS HOVERCRAFT - KAIST





Introduction

- A team project to design an autonomous hovercraft controlled by Raspberry Pi and equipped with an air-cushion lifting mechanism to effectively eliminate friction during movement. The hovercraft navigated around the map within 1 minute and stopped accurately in the targeted zones.
- I led the team of 5 people to finish the lap in the shortest amount of time.

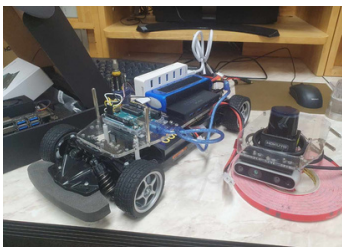
Methodology

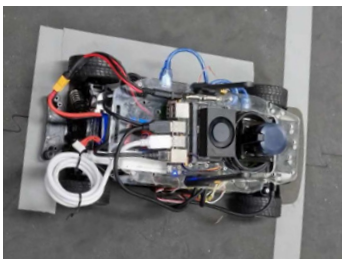
- Used SolidWorks and 3D-printer to design and make prototype. Analyzed dynamic model to improve hardware design for motion control.
- Design mechatronics systems with integration of electronic components, sensors, motors and microcontroller.
- Develop a full-state feedback LQR controller for propellers to optimize thrust and lifting force, ensuring seamless balance and mobility.
- Generated code for A-star global path planning algorithm. Leverage scan-matching algorithm to obtain precise localization with Lidar and IMU sensors.

Result

- The hovercraft automatically travelled around the map within 30 seconds.
- **Video**: Link

AUTONMOUS RACING CAR TOURNAMENT - KAIST





Introduction

- An autonomous racing car contest for 7 teams in which each team had to build up an unmanned racing car controlled by Jetson Nano. Navigated the car to finish 5 laps in the shortest amount of time while avoiding random obstacles and following traffic-light signals.
- I led a team of 7 people to rank the first place in the contest.

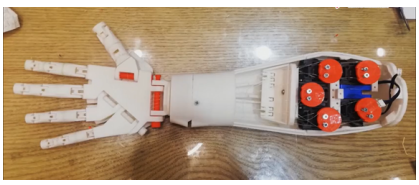
Methodology

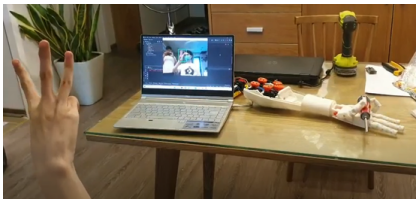
- Developed the code for lidar-based mapping and localization based on Iterative Closest Point (ICP) algorithm.
- Optimized the Stanley lateral motion controller with adaptive looking ahead waypoint according to road curvature for smooth turning and quickly recovery.
- Proposed a novel algorithm for local path planning to avoid obstacles based on Frenet path-planning algorithm, which tripled computer calculation rate, from 10Hz to 30Hz.
- Trained AI model with YOLO V4 to detect traffic-light signals with confidence of 99%.

Result

- Won the first place with the shortest amount of time. The racing car travelled robustly regardless of random obstacles.
- **Video:** Link

VISION-BASED TELEOPERATION BIONIC ARM - KAIST





Introduction

- A 3D-printed bionic arm that can imitate human hand gestures and be controlled remotely through a vision system.
- The purpose of this arm was to perform tasks in hazardous locations without the need for human presence, which ensures safety and efficiency in various applications.

Methodology

- Designed arm model by Solidworks and make a 3D printed prototype.
- Generate codes for Arduino board to establish a Bluetooth connection with a computer, enabling users to control motors remotely via a camera while remaining smooth and precise motions of robot fingers.
- Studied deep-learning image classification and customize pre-trained model to recognize versatile hand gesture.

Result

- The bionic arm can replicate fingers motion and grip simple objects.
- **Video:** Link