ANH TUNG HO

Project Portfolio

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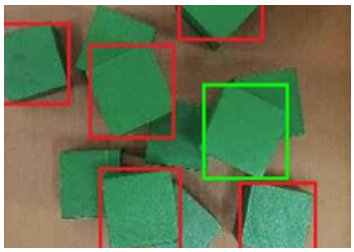
Autonomous Bin-picking System - Thesis



Introduction

- Developed a cost-effective and highly accurate autonomous bin-picking system.
- Proposed novel method to improve the accuracy in object pose estimation in the cluttered bin without intensive training process.

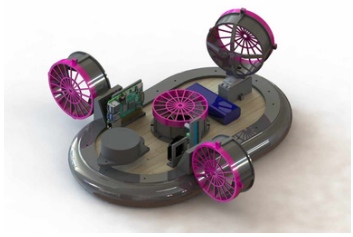
Methodology

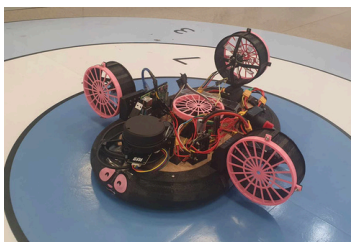
- Designed hardware assembly and control pipeline for bin-picking system with 6-DOF manipulator, low-price RGB-D camera and pneumatic gripper.
- Proposed a novel multi-view scan-matching algorithm to reconstruct 3D scene inside the bin, which compensate the uncertainty of low-price depth camera and increase precise of object pose estimation process.
- Developed a full-state feedback LQR controller for propellers to optimize thrust and lifting force, ensuring seamless mobility.

Result

- The proposal algorithm can enhance robustness and accuracy in pose estimation by twice compared to traditional single-shoot method.
- Robot can successfully detect and remove 98% objects inside the bin.
- **Poster and Video**: Link

Capstone Design for Autonomous Hovercraft - Course Project





Introduction

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

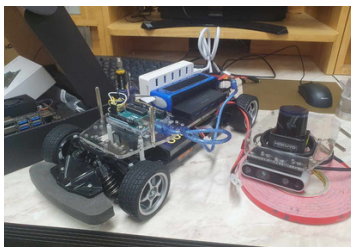
Methodology

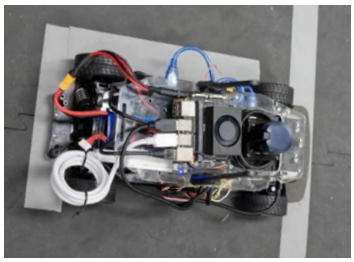
- Involved in designing the prototype. Optimized hardware design to enhance floating dynamic balance.
- Designed mechatronics systems with integration of electronic components, sensors, motors and microcontroller.
- Developed a full-state feedback LQR controller for propellers to optimize thrust and lifting force, ensuring seamless mobility.
- Developed Lidar-Inertial-based path planning and localization algorithm with error within 5cm.

Result

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

Autonomous Racing Car Tournament - Course Project





Introduction

- An autonomous racing car contest for 7 teams in which each team built up a 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 6 people to rank the first place in the contest.

Methodology

- Developed the code for lidar-based mapping and localization with 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, which tripled computer calculation rate compared to Frenet path-planning algorithm, from 10Hz to 30Hz.
- Trained model YOLOv4 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

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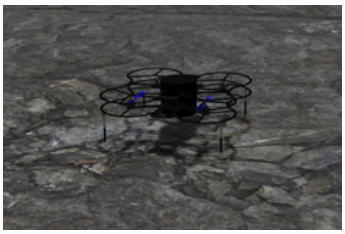
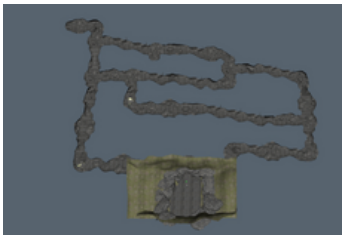
Unmanned Autonomous Drone - Course Project





Introduction

- The objective is to design a controller for an autonomous drone to discover an unidentified tunnel.

Methodology

- Developed dynamic model to tune PID position controller to keep raising time within 2 seconds and overshoot lower than 10%.
- Applied potential-field algorithm to navigate drone avoid obstacles and approach designated waypoints on global map.
- Integrated LeGO-SLAM algorithm to reconstruct the 3D map of tunnel.

Result

- The drone could reach target waypoints inside the tunnel.

Simulator Air Hockey - Course Project

Introduction

- The objective is to create simulator product allows users to play air hockey in any surface and have physical interaction with virtual agents.
- Projector visualized game interface into surface. System used camera to track player's hand motion. Vibrator generated haptic feedback for collision.
- Led a team of 4 people to develop product.

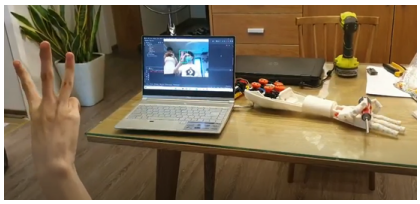
Methodology

- Designed overall system structure to ensure user-friendly product.
- Developed functions for screen surface calibration and hand tracking.
- Completed pipelines for game play with feedback from camera.
- Controlled the vibrator sensor to generate accurate haptic feedback to player.

Result

- Players can easily setup and play with agents.
- **Video:** Link

Vision-based Teleoperated Bionic Arm - Personal Project



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.
- Researched deep-learning image classification and customized pre-trained model to recognize versatile hand gesture.

Result

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