Autonomous Vehicle With Room Mapping And Obstacle Avoidance

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Background

- **Motivation:** Need an effective, user-friendly and affordable way to physically communicate and send medical supplies between severe patients and doctors in hospitals.
- **Goals:**
  - Create a small unmanned vehicle as a communicator between patients and doctors
  - The unmanned vehicle can generate 2D maps at locations it travels through, which enables the autonomous driving and effective interaction in the hospital.

Core Technology

- **Motor:**
  - Our codes are developed from the DYNAMIXEL-Workbench (DW) library, which is a variant of the Robot Operating System (ROS) library. DW library allows us to control the motor on two modes: Joint Mode and Wheel Mode. Joint mode controls the motor with respect to position, and wheel mode operates with respect to speed.
  - Function `itemWrite()` allows us to set a goal position/speed for the motor, and `itemRead()` allows us to read the current position/speed of the motor. `syncWrite()` function is used when we want to run both motor simultaneously to minimize the discrepancy between the two. We use a combination of those functions to accurately control the position and direction of the car.

```c
  dw.write(CTRL_ID, "Goal_Position", goal_position);
  present_position = dw.read(CTRL_ID, "Present_Position");
```

- **RPLidar:**
  - The RPLidar sensor is a time of flight rangefinder that takes measurements while rotating to create a 2D map of its surroundings. This was used in the car to measure relative distances between the car and obstacles as well as to provide a visual understanding of its location.
  - The RPLidar spins at 330 rotations per minute, and takes 2000 samples per second. This allows it to create an accurate real-time map of its surroundings.

- **Ordroid:** An onboard, small computer used to process the sensor data without the need of an external PC

Construction of the Vehicle

- **Chasse:** Designed and manufactured by our team

- **Components:** Ordroid, RPLidar, OpenCR, Stablizer, DYNAMIXEL motor, LiPo Battery

Future Goals

- The team has decided to search for ways to improve the car and make it more effective in its application. These goals include:
  1. Add a robot arm to enable safe movement of dangerous items.
  2. Develop an algorithm using machine learning to make the car more effective in navigating its environment.
  3. Add voice control capabilities to allow the car to be controlled by anyone.

Conclusions/Results

This model of the robot car demonstrates that the unmanned vehicle can navigate its surroundings while avoiding obstacles and generating a 2D map. These capabilities are made possible by the RPLidar sensor data, accurate positioning of DYNAMIXEL motors, and real-time data processing of the Odroid. In the future, we would like to collaborate with the hospitals in order to develop something that can benefit them the best.

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