ARC - AUTONOMOUS RC

High-speed, autonomous obstacle avoidance and navigation

Project Introduction and Background

Introduction

Autonomous RC (or ARC) is a research project aimed at seeing if autonomous, high-speed navigation at speed can be achieved, at a $1/10^{th}$ scale, using hardware that can be obtained through major retailers, for a reasonable cost.

Our implementation will be a small-scale version of the Defense Advanced Research Projects Agency (DARPA) Grand Challenge, where autonomous vehicles navigate themselves 100 miles through the Mojave Desert, in under 10 hours.

Our goal is to implement an RC car able to navigate to a given point as fast as possible, which is a small-scale version of the challenge.

The RC car should be able to navigate within a set amount of time through a room or defined map based area, without prior knowledge of the environment.

RC Car V2

Project Background and Motivation

Millions, if not billions of dollars are invested in autonomous vehicles each year. Most of these systems are cost prohibitive for the average user, looking to replicate them at a small scale. Our motivation for the project includes the following:

- Seeing if commodity hardware can be used to help reduce the cost of autonomous systems.
- Provide an affordable test platform for scaled high-speed obstacle avoidance with GPS navigation.
- See if there are solutions that could be scaled up from the RC car, to be used as a DIY project or product for the average consumer.

Project Description and Outcomes

Project Description

For our software implementation, we used ROS (Robot Operating System) to implement our solution on top of Georgia Tech's AutoRally Platform. This gave us a starting point for sensor fusion and waypoint following, that we were able to modify to use less custom hardware and add obstacle avoidance.

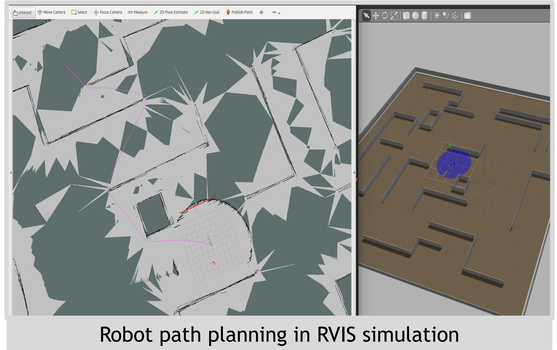
Software features:

- GPS waypoint following
- High-speed obstacle avoidance
- Parallel parking
- Remote control

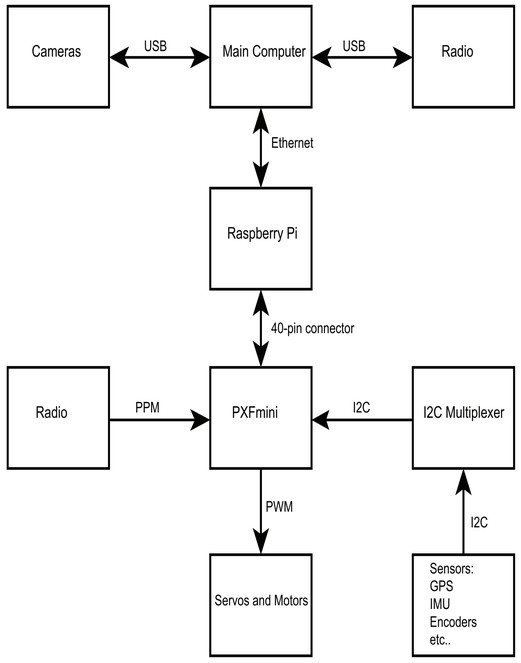
Hardware components:

- Intel® NUC Skull Canyon
- LeddarTech M16 (vision system)
- U-Blox Neo8 GPS and compass
- UM7 Inertial Measurement Unit (IMU)
- Arduino Uno
- Adafruit 16 Channel PWM driver
- RPLidar
- 150W Voltage Converter (12V -> 19V)

We used ROS and RVIS in order to simulate our software package before testing on the car. This allowed us to move forward with our software implementation while the hardware side of the project was being worked on.



Robot path planning in RVIS simulation



System Hardware Layout

Project Outcomes/results (expected)

With the hardware that we chose, we would like to conclude that it is [possible/partially possible/not possible] to build an autonomous RC under the budget of $2000.

Using a modified version of the AutoRally platform that we have written, an engineering student or a hobbyist can make their own RC car to perform similar behaviors as our vehicle does.

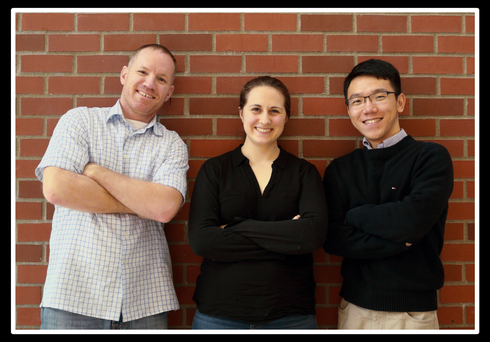
Various configurations for different car-like RC vehicles, will mean that various levels of performance will be obtained on different vehicles.

Throughout the entire development process, we tried to write as less codes as possible. In fact, we used open-source software packages for almost all autonomous features.

The importance of this conclusion is that without a big budget and too much knowledge on autonomous driving, one could make an autonomous driving vehicle.

As self-driving cars becoming more prevalent in both research and the consumer market, we proved that the core concept of autonomous driving is within our reach.

Senior Capstone Project Group 44



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Conclusion

In conclusion, we are awesome and had the best project ever. No project is better than ours, and we are going to make sure that autonomous RC cars are put first when making decisions on our team.

If any project thinks they are better than ours, they are wrong. No project is better.

This is a really good project, and the car drives really fast. I promise you, it is the fastest.

Our car is really cool. It can theoretically drive itself. No car drives itself better than our car.

Oregon State UNIVERSITY