Development of a Robotic Ground Vehicle

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The Project

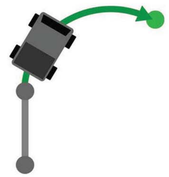
- Development of an autonomous all-terrain vehicle.
- Replicable, expandable research solution.
- Durable, weather resistant, safe autonomous missions

Over the course of the 2009-2010 academic year, a team of Olin students collaborated with Draper Labs to produce an autonomous ground vahicle based off of the John Deere Gator ATV platform. The team developed a comprehensive mechanical, hardware, and software solution to run several types of autonomous missions.

The Mission

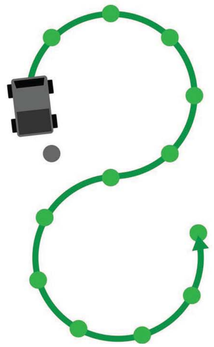
Simple waypoint following

The first step in autonomy is to drive to GPS waypoints - starting with driving in a straight line and hitting a single waypoint.



Turning

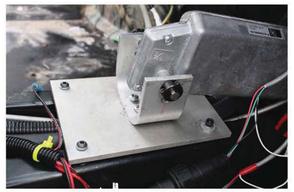
Once the vehicle can drive to a single waypoint, the next step is to follow multiple waypoints and add basic curvature control. This allows the vehicle to make controlled turns, as well as driving straight.



Complex path planning

Once the vehicle can drive from waypoint to waypoint, the next step is to implement curve planning. This allows the vehicle to plan and follow complex paths from waypoint to waypoint - like a figure 8 or the letters in “Olin”.

Hardware Modifications



Accelerator

To control the vehicle’s velocity, a linear actuator is connected to the accelerator rocker arm.

Steering

A steering assist kit is connected to the steering column, allowing computer control of the steering wheel.

Brake

For safety and additional velocity control, a linear actuator is connected to the brake pedal.

Sensors

INS

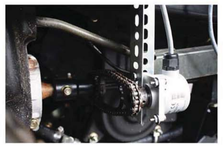
Inertial Navigation Systems are important for dead reckoning and tracking position

GPS

A high precision GPS gives the vehicle centimeter-level accuracy, perfect for +/-5 meter waypoint following.

LIDAR

A laser rangefinder on the roof allows the vehicle to detect obstacles - and to stop before and accidents occur.



Encoder

An encoder on the drive shaft tracks wheel rotations, allowing for position and speed estimation.

SCOPE
Senior Capstone Program in Engineering

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