robotics@MARYLAND

Autonomous Ground Vehicle

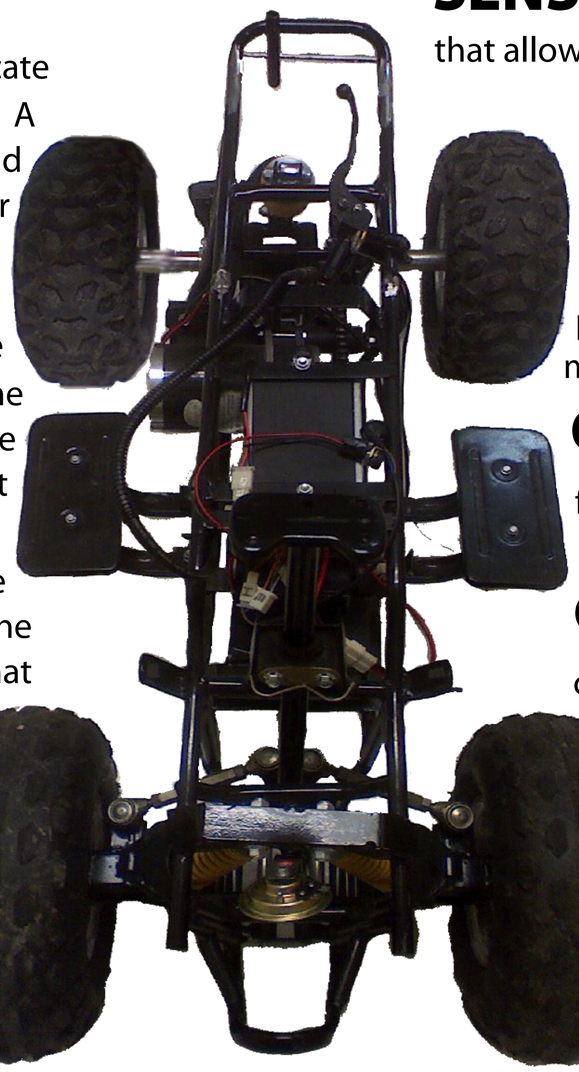
INTRODUCTION

The autonomous ground vehicle (AGV) subteam of Robotics@Maryland will compete in the national summer 2009 Intelligent Ground Vehicle Competition (IGVC). For this competition, an ATV has been modified to navigate through an obstacle course and an off-road course marked with geolocation markers. The team comprises undergraduate students of various academic disciplines (aerospace, computer, electrical and mechanical engineering and computer science). It is the team's goal and opportunity to learn, create and win.

CONTROL SYSTEMS

Communication: The robot's components communicate through a custom multi-language messaging interface. A central computer receives all inter-component messages and forwards them to the appropriate components. Sensor observations, identified obstacle representations and command messages all travel across the messaging layer.

Mapper: The mapper stores obstacles and course information of interest in navigation and keeps track of the location of the vehicle relative to the course. When the mapper receives a query from the navigation system, it provides a list of obstacles that may affect the robot's path.



SPEED CONTROL

We use an Open Source Motor Controller to control the robot's acceleration. The OSMC is a modified H-bridge that allows for control of magnet DC motors. Combined with the Arduino microcontroller, the high-power H-bridge produces regulated voltage to propel/reverse the ATV.

STEERING

For steering, the robot uses a chain drive with a high-torque servo. A MotionMind microcontroller controls the servo.

POWER

The vehicle has two electrical systems: Three stock 12V lead acid batteries provide power to the ATV, while a 12-volt, 70-amp-hour sealed lead acid battery powers the onboard computer.

SENSORS

are the most important piece of any intelligent system; to our vehicle, they are the eyes and ears that allow the vehicle to avoid fatal crashes.

LADAR allows the robot to register obstacles up to 30 meters from the front of the vehicle. The Hokuyo UTM30LX module scans at 40 Hz with 30mm accuracy. This sensor provides data for the primary obstacle identifier and is the vehicle's most trusted sensor.

QuickCam is a webcam produced by Logitech that captures high-resolution images at a high frame rate. This sensor allows for visual identification and confirmation.

GPS helps determine location and velocity with 5-meter accuracy. In combination with Kalman filtering, the accuracy of the GPS data allows for reliable waypoint navigation.

SONAR enables the vehicle to have near obstacle detection. Mounted on angled servos, the SONAR modules prevent collisions with obstacles within a 1-meter radius.

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The images of the Hokuyo LADAR scanner and the Logitech QuickCam are promotional photographs courtesy of the products' respective manufacturers.