



Intelligent Ground Vehicle Competition – Arms & Legs

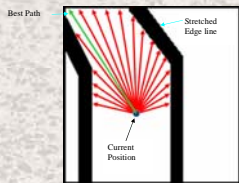
Abstract

Autonomous control of vehicles plays an important role for military, transportation systems, and manufacturing industries. The University of Akron has two electrical engineering design teams tasked to develop a single vehicle to compete in the Intelligent Ground Vehicle Competition (IGVC) of 2008. The team is designing a prototype vehicle for the competition. The design philosophy is to limit mechanical challenges and increase emphasis on software design and interfacing. The hardware component of design is simplified by using a pre-fabricated wheelchair as a vehicle base. Because the University of Akron team is a first year competitor of the IGVC, the team is following a simple design to ensure full functionality and allow for optimal performance at the competition.

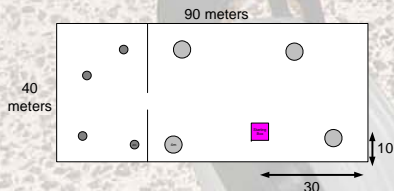
Accepted Technical Design Overview

•Design Team #1 (A&L) will receive an overall two dimensional map of the traversed course from Design Team #2 (E&E).

•Pathfinder program: By calculating the distance to an obstacle over a range of angles, the path with the longest distance to an obstacle will be chosen.



•Navigation program: The given GPS waypoints will be assigned a priority and placed on the map with respect to where the vehicle starts.



•Motor Control: An array of distances and angles will be sent to the microcontroller. Signals (similar to the existing joysticks) will then be sent to the motor controller to initiate movements.

•Encoders will be used to determine if the vehicle has traversed the proper path.

•Power for the wheelchair's electronics and motors is provided through two sets of 12V batteries. An additional set of two 12V batteries and converters will be used to supply power to the components added.

•The emergency stop circuit will be configured to cut power to the wheelchair batteries by the push of the wireless or hardware emergency stop button.

Design Team #1

Project Leader: Ryan Dixon, EE

Archivist: Bill Rodeman, EE

Hardware Manager: Mike Pataki, EE

Software Manager: Joe Lavalley, EE

Faculty Advisor: Dr. Iqbal Husain

Competition Overview

- Design an autonomous vehicle to navigate through two courses.
- In the primary contest, the vehicle travels through painted white lines on the grass, while detecting and maneuvering around various obstacles.
- In the second contest, the vehicle maneuvers around obstacles to eight different latitude and longitude positions.
- Goals of the competition: Travel through the entire obstacle and navigation courses in the shortest amount of time with minimal errors.
- Points are deducted for contacting obstacles, crossing the white lines, or dropping the 20lb payload.
- Further details on competition can be found at: www.igvc.org



Design Specifications

Mechanical (Vehicle) Design

- Vehicle Dimensions: Minimum: 2' X 3' to Maximum: 5' X 6', Height: No greater than 6'
- Maximum Vehicle Weight (including 20lb payload): 490 lbs
- Max Speed: 5 MPH
- Equipped to handle the environment (grass, sand, light rain)

Power System Design

- Batteries must supply power to all the components for both teams
- Minimum Battery Life: 1.5 hours
- Maximum Power Usage: 800W

Material Design

- Wheelchair chassis must hold all equipment totaling 300lbs of load.

Control Design

- A PC will be used for interface between sensors and to motor controller
- A global grid will be received from the Eyes and Ears team.
- The pathfinder program decides the best path to travel through the obstacle course.
- The navigation challenge program decides the best path to travel to nearest waypoints.

- The wheelchair must be controlled through the motor controller, given inputs from the programs above.

Electrical Design

- Emergency Stop Capabilities -

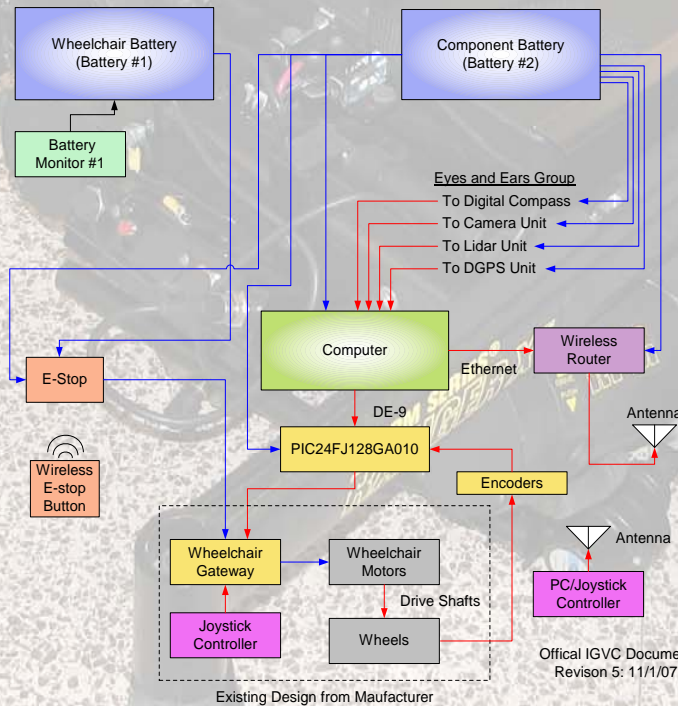
- Both wireless and mechanical emergency stop buttons will bring the vehicle to a quick complete stop
- Mechanical stop button must be placed between two and four feet high, located in the center, rear of the vehicle
- The wireless emergency stop button must work within 50' of the vehicle

Radiation Design

- The wireless emergency stop signal must operate regardless of other wireless communication in the area.

Economic and Ergonomic Design

- Components must be easily replaceable, in case of failure.
- Fuses will be provided for safety and electrical protection



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