

GPS Gaucho: GPS-Based Self-Navigating Autonomous Vehicle

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What Are We Going To Say?

- What were we planning to do?
- What are we going to do?
 - Components
 - Development Stages
- What have we accomplished?
- Problems we have come across
- Various summaries
 - Previous work being used
 - Equipment being used
- Schedule of tasks

What Were We Going To Do?

- GPS Base Station
- Gaucho with GPS receiver and eBox
- Differential GPS between the base station and the Gaucho
- eBox runs a web server that users use to control the Gaucho
- Gaucho knows where it is, where it wants to be, navigates from point A to point B

What Are We Going To Do?

- Everything we said before
- Need to get the control software for the Gaucho working
- Want to find a way of having permanent base station

What Are We Going To Do: Components

- Base Station
- Gaucho
 - Gaucho Control System
 - GPS Receiver
 - eBox – Main Control System
 - Autonomous Control
 - Remote Control
- Differential GPS Link

What Are We Going To Do: Components - Gaucho Controls

- From a previous graduate project
- Commands are given over serial interface
- Microcontroller on Gaucho interprets and executes commands
 - Forward
 - Reverse
 - Turn wheels left/right a given angle
- **DOES NOT ACTUALLY WORK!**
 - **Was not burned to the microcontroller as we had hoped**
 - **We have the code, however, have not been able to run the code on the Gaucho**

What Are We Going To Do: Components – eBox

- x86 Processor, built-in flash memory, some IO ports
- Runs Windows CE, we are preparing to use version 6
- Will run the primary navigation control system
 - Web Interface for user interaction
 - Remote Control capability
 - Autonomous Navigation capability
- Currently only has one serial port, we need to add another somehow
 - Possibly using a USB dongle

What Are We Going To Do: Components – GPS Parts

- Base Station
 - Antenna on Jobst Hall roof
 - Receiver unit knows how to generate DGPS info
- Differential GPS Link
 - Uses RT-20 spec
 - Over a wireless RS-232 link
- GPS Receiver
 - Takes DPGS data, automatically uses it internally
 - Outputs corrected GPS coordinates

What Are We Going To Do: Development Stages

- Differential GPS
 - Base Station up and running
 - Receiver hooked up to a laptop
 - Move around quad
 - Check for stable signal, consistent data
- Gaucho Control System
 - Program Gaucho microcontroller
 - Test movement controls
 - Check for any minor issues that we may have to work around/fix

What Are We Going To Do: Development Stages

- Remote Control of Gaucho
 - eBox on Gaucho, network connected
 - Web interface to give directions through
 - eBox sends commands to the Gaucho microcontroller
 - eBox reports current location data
- Simple Autonomous Control
 - Point A to Point B-type navigation
 - Shortest distance (straight line)

What Are We Going To Do: Development Stages

- Advanced Autonomous Control
 - Able to identify the 'correct route'
 - Understand where it can go
 - Navigate based on known paths
- Additional Features
 - Obstacle Sensors on Gaucho
 - Electronic Compass
 - Distance sensors in wheels
 - Streaming web cam

What Have We Accomplished?

- Differential GPS
 - Base Station up and running, in one of the labs
 - RS-232 transceivers work
 - Need to test range more
 - Probably need to improve the range
 - Kind of cold to be outside right now
- Gaucho Control System
 - We have the code
 - Have not been able to program the microcontroller
 - Compilation and Debugger/Downloader issues

What Have We Accomplished?

- Lots of pieces of things around
- Ideas of how we want to do things
- Need to get the Gaucho working before a lot of things can take place

Problems We Have Come Across

- Gaucho doesn't do anything
 - Have the code for control system, having trouble getting it onto the Gaucho's microcontroller
- Range issues with DGPS link
 - Don't quite have the range we expected
 - Need to do more testing to determine exact range
 - Two options:
 - Increase range/power
 - Find better location for base station

Various Summaries:

Previous Work Being Used

- Gaucho is from a previous graduate project
- RT-20 is a low-cost, real-time DGPS spec
- RS-232 – who doesn't know what this is?
- The wheel – from cavemen
- Standard network protocols for eBox controls
 - 802.11
 - TCP/IP
 - HTTP

Various Summaries: Equipment Being Used

- Gaucho
 - HCS12DG256B microcontroller
 - Linear Actuator
 - H-bridges
 - DC motors
- eBox Embedded Development System
- Two Novatel PROPACK RT-20 GPS Receivers
- Two Lawn-II+ RS-232 Transceivers

Various Summaries:

Equipment Being Used - Optional

- Electronic Compass
- Web Cam
- Ultrasonic (or similar) sensors for distance/obstacles

Schedule of Tasks

- Well, we thought that some things were just going to work
- They don't, so we're way behind
- Once everything that was supposed to work works, we can actually continue development

Questions?

