S.O.A.P

SELF ORIENTING ANALOG
PATHFINDER
Topology

Sensors
Sonar
Bump

Navigation
Radio
Arduino
Microcontroller

Main Logic Board
Arduino Mega2560
8-bit 16Mhz
Open source C++ IDE

Drive Motors Control Servo
Analog Pathfinding

The process of getting to a destination using sensors to avoid obstacles

**Inputs**

- Sonar
- Accelerometer
- Bumper
- Magnetometer
- Beacon Data

**Outputs**

Steering servos
What type of sensors work best?

- Infrared
- or
- ultrasound

Is fooled by

Natural Objects

Is fooled by

Reflection
Angle of Incidence equals Angle of Reflection

Man-made Objects
Obstacle Avoidance
directing the rover around barriers

- less urgent object
- urgent difference
Analog Pathfinding

Evolution of an avoidance algorithm

Curves represent the degree of turn each sensor contributes to overall rover turning:

- $1/x$: Simple
- $ax^2 + bx - 1 + c + dx + ex^2$: Highly customizable
- $\cos(x)$: Easy to adjust, Effective in practice
Overcoming Traps

Problem: U-Trap
Solution: U-Turn and avoid

Pit

Bully without avoidance
Direction Finding

• Main Parts:
  • 3-axis magnetometer / 3-axis accelerometer
  • Radio Beacon
  • Beacon Receiver
LS303DLH

- 3 axis Magnetometer (compass)
- 3 axis accelerometer (tilt compensation)
- I2c interface
- Sparkfun Breakout
- RyanTM's Library
Radio Beacon

Components:
- Spinning Yagi directional antenna
- 433Mhz transmitter
- Arduino microcontroller
- Compass

Operation:
- Yagi Antenna spins
- Compass is aligned with antenna node
- Radio transmits current bearing of the antenna
- Radio interface works as a USART
Beacon Receiver

Components
- Arduino Uno
- 433Mhz Receiver

Operation
- Receives each beacon bearing from radio
- Associates a Received Signal Strength for each transmission
- Scans the data to select highest RSS
- The corresponding angle is the bearing
Mechanical

• Suspension System
• Acrylic/ESP

• Wheels
Mechanical

- Whisker Bumper
- Ventilation Fans
Design & Build

• Prototype and Testing
• No Permanent Connections
• Addition of a Second H-Bridge

• The Application of Bus Rails
• Organized Hierarchy Code Structure
• Excellent Use of Resources
Team Work
Conclusion

• Improvements
• Lessons Learned