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A Review of Over 20 Years of Autonomous Vehicle Designs at Cedarville University

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CEDARVILLE UNIVERSITY

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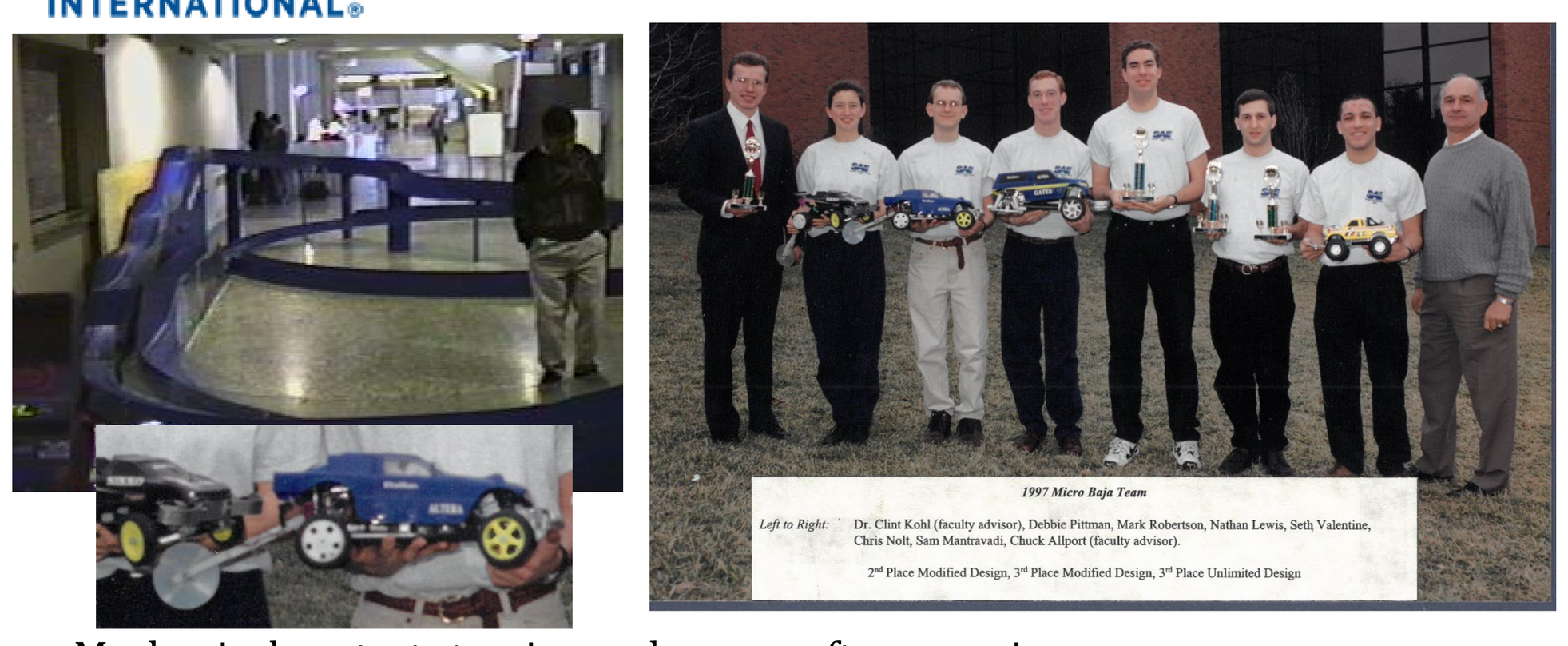
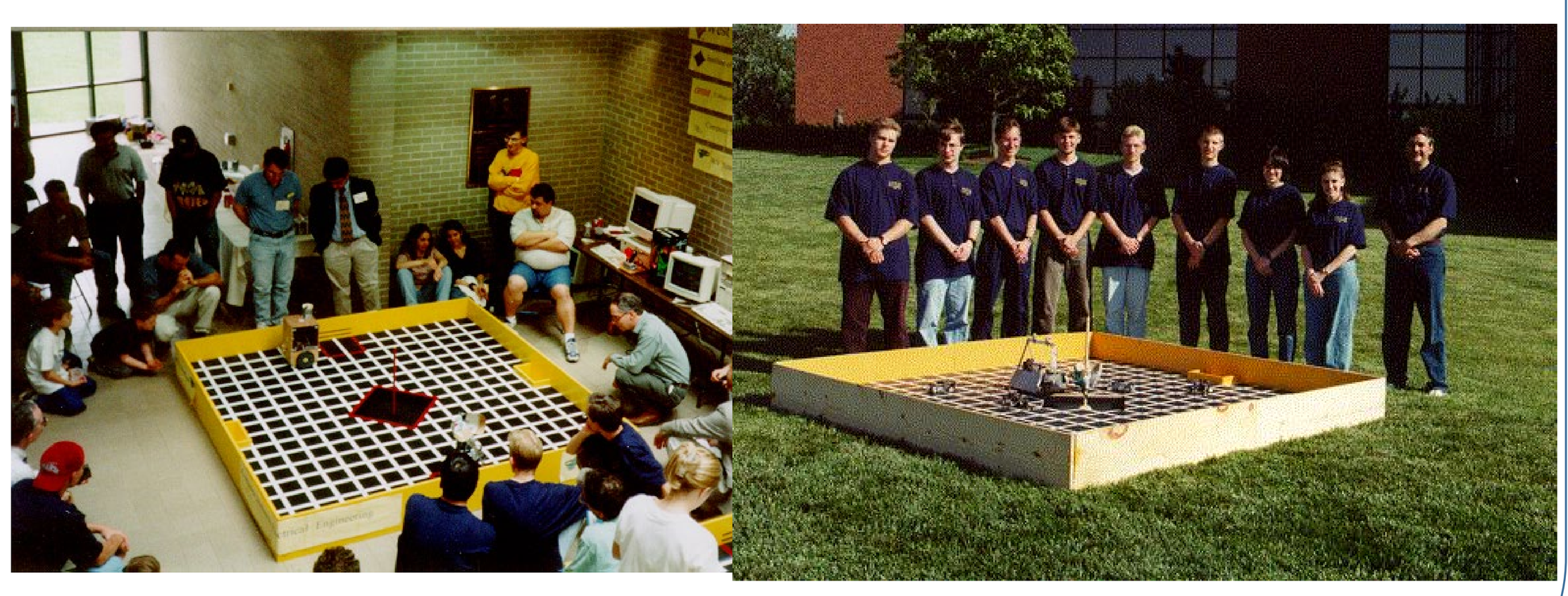
SAE International – Micro Baja 1997-2000



Mechanical contact steering and super soft suspensions
Large rear encoding wheel with microcontroller based variable throttle playback

IEEE Summit Challenge 1999 - 2000

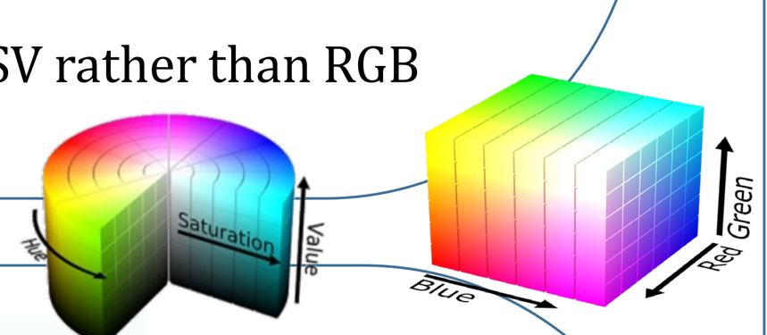


Multi-vehicles descending from mother ship on tethers proved very ineffective
Magnets connected to rotating wheel proved very effective at collecting steel balls

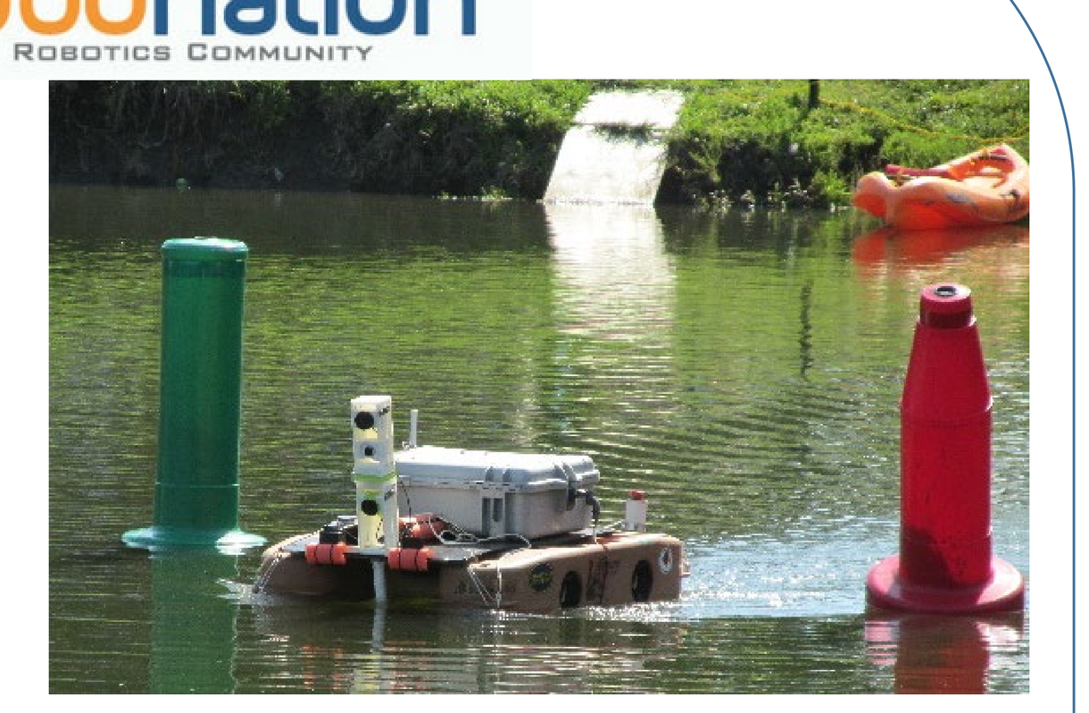
IGVC – Intelligent Ground Vehicle

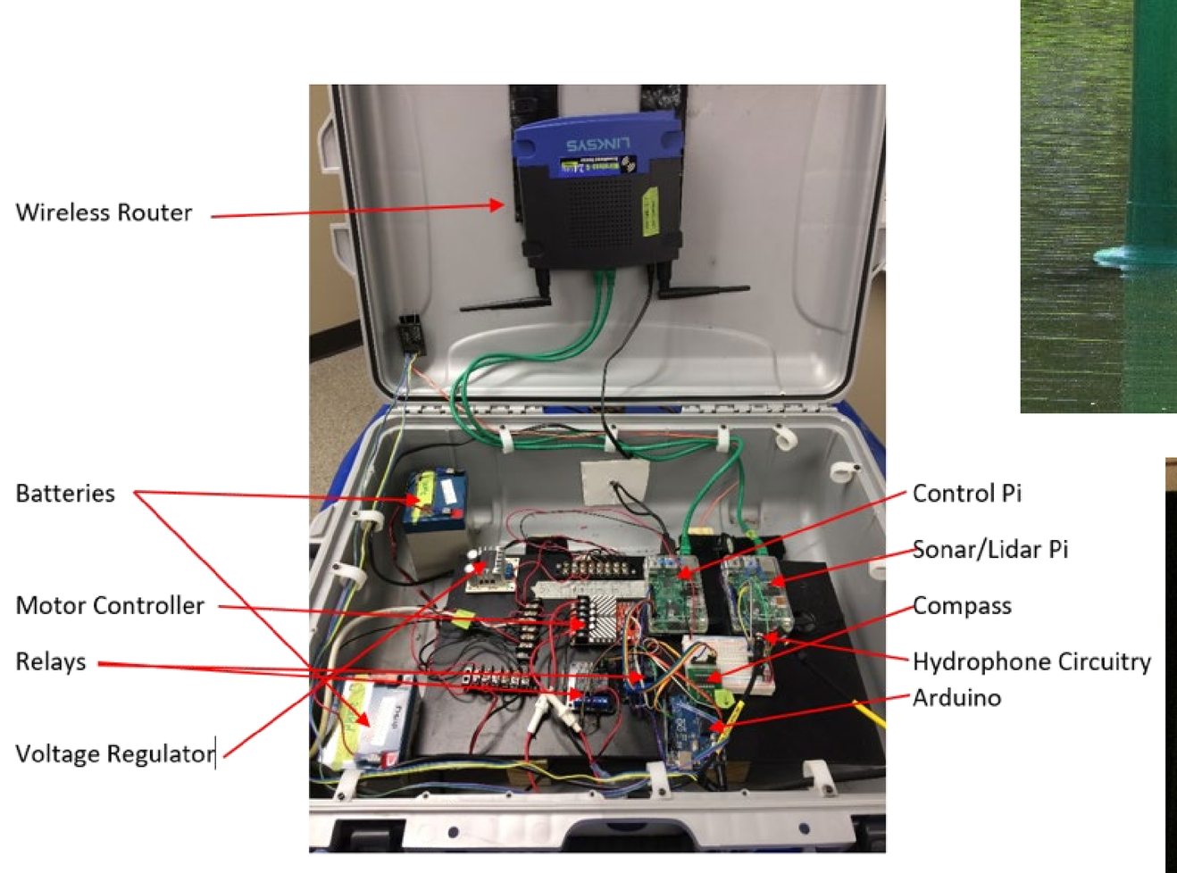
2006

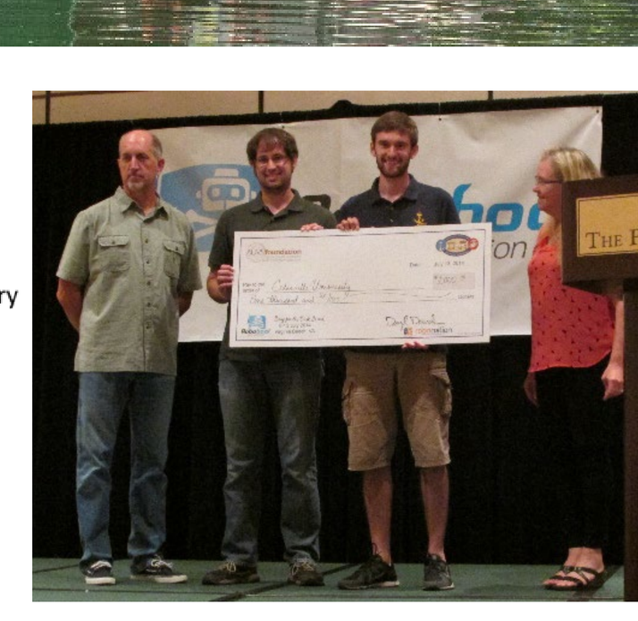
- Initial Dixie Chopper Chassis was large and hard to control
- Wheel chair design easier to control with more margin of error
- FireWire camera running OpenCV
- Lighting changes were difficult to handle
- Switched to HSV rather than RGB



RoboBoat Competition – robonation

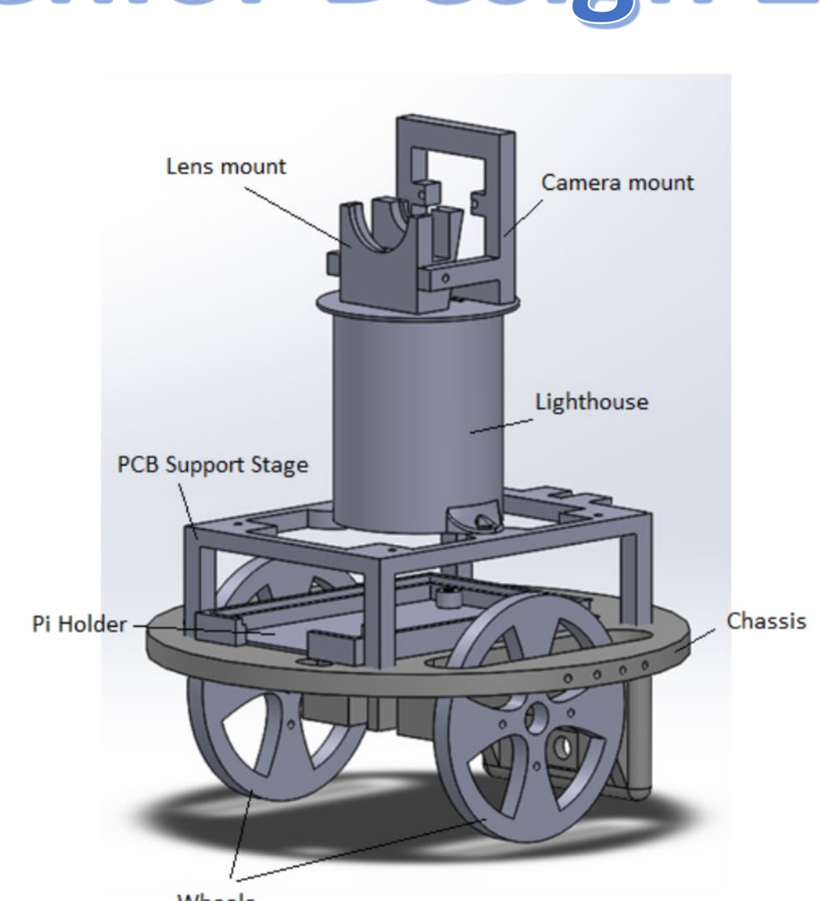


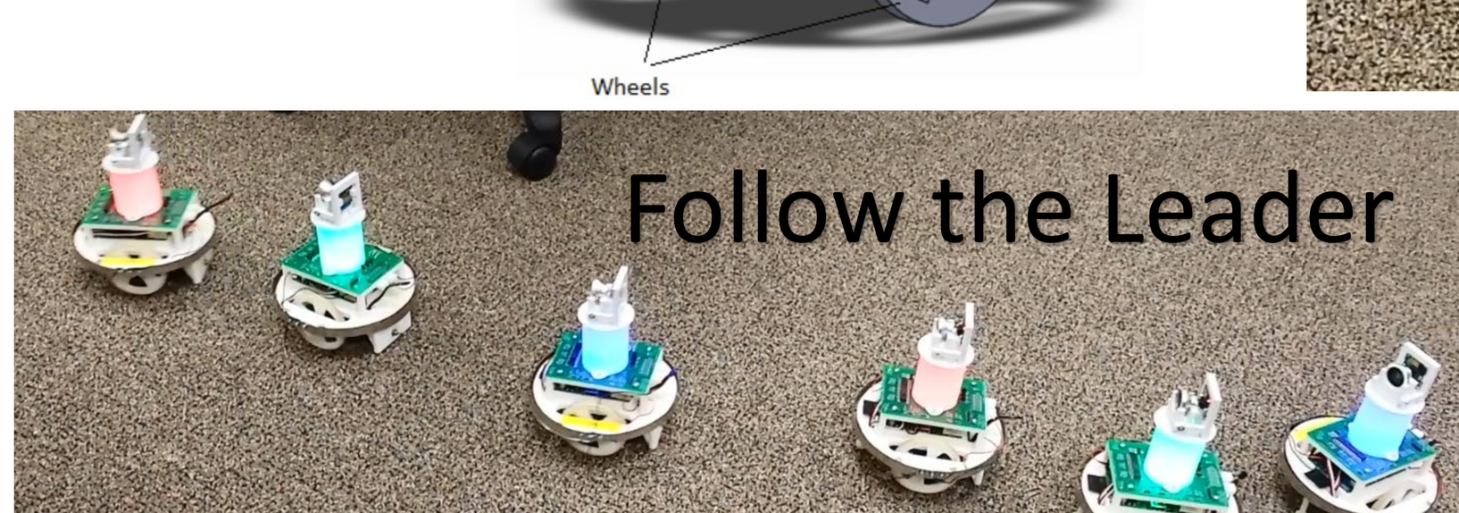




- Stable pontoon hull with 2 thrusters provide differential drive
- Raspberry Pi plus laptop network provides all processing
- Sensors include Microsoft LifeCam, GPS, and digital compass
- Image processing and sensor fusion using MATLAB
- Key innovation led to good results: Drivable region centroid technique
- Placed 9th out of 21 in 2005
- Placed 8th out of 28 in 2006
- Won "Biggest Bang for the Buck" award in 2014 ($1000)

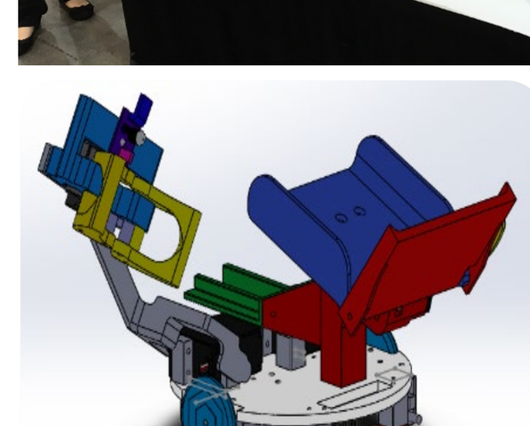
Swarm Robots Senior Design 2014-2015





Raspberry Pi with Pi camera
Wi-Fi communication
Servo motor locomotion
Bump sensor for proximity
3D printed parts

ASEE American Society for Engineering Education – Autonomous Robot Model Design 2001-Present



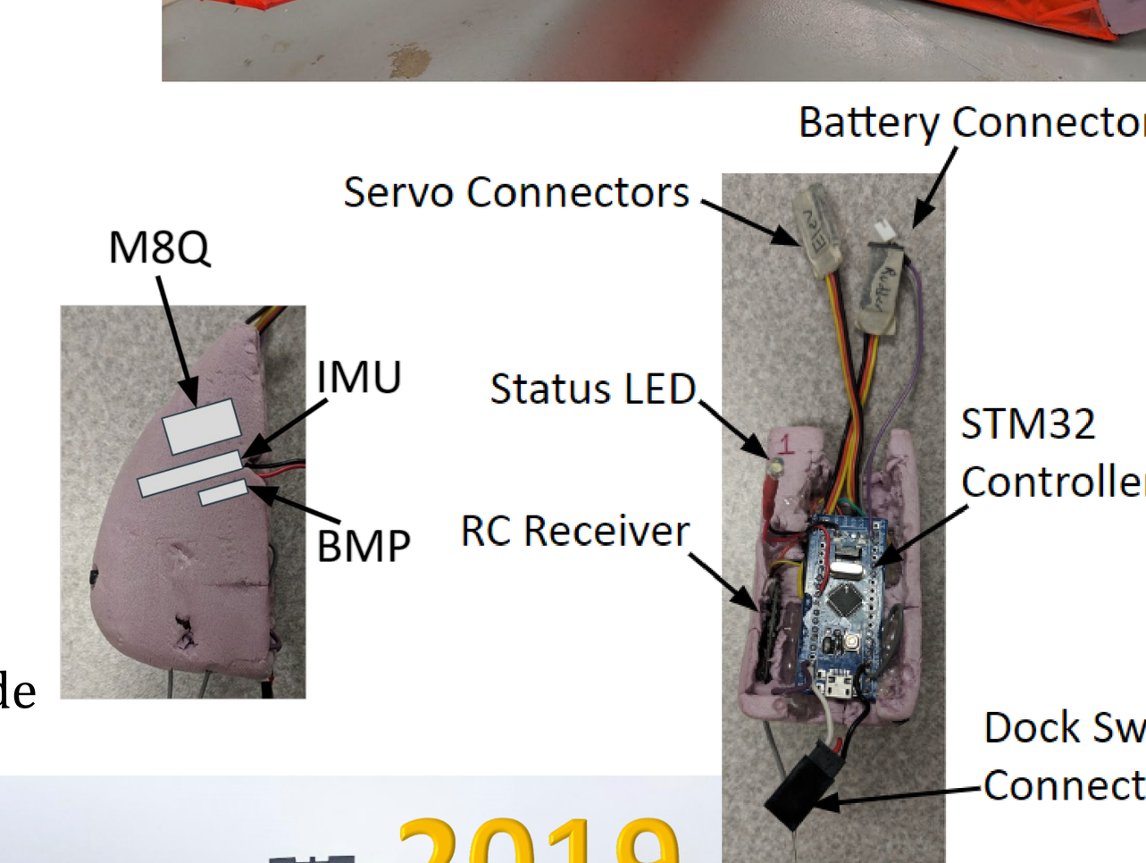
17 years of competition
7 First, 4 Second and 3 Third Place finishes

From King Starboard Plastic to 3D Printed parts
From CPLD to Microchip Pics to STM32 Micro Controllers
Infrared Distance and Line sensors to TOF Lasers
Servos, DC Motors, Springs and Computer Fans

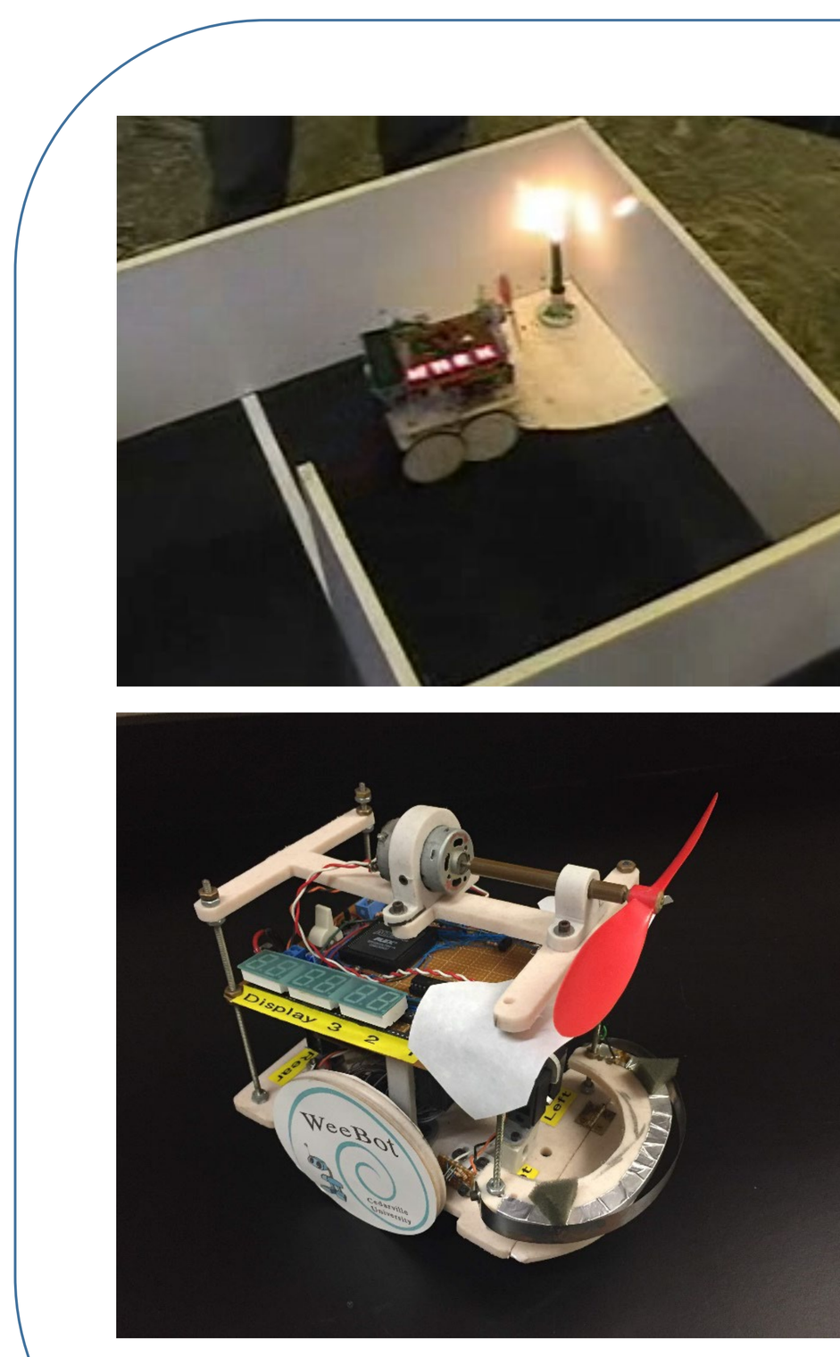
SAE International – AERO DESIGN

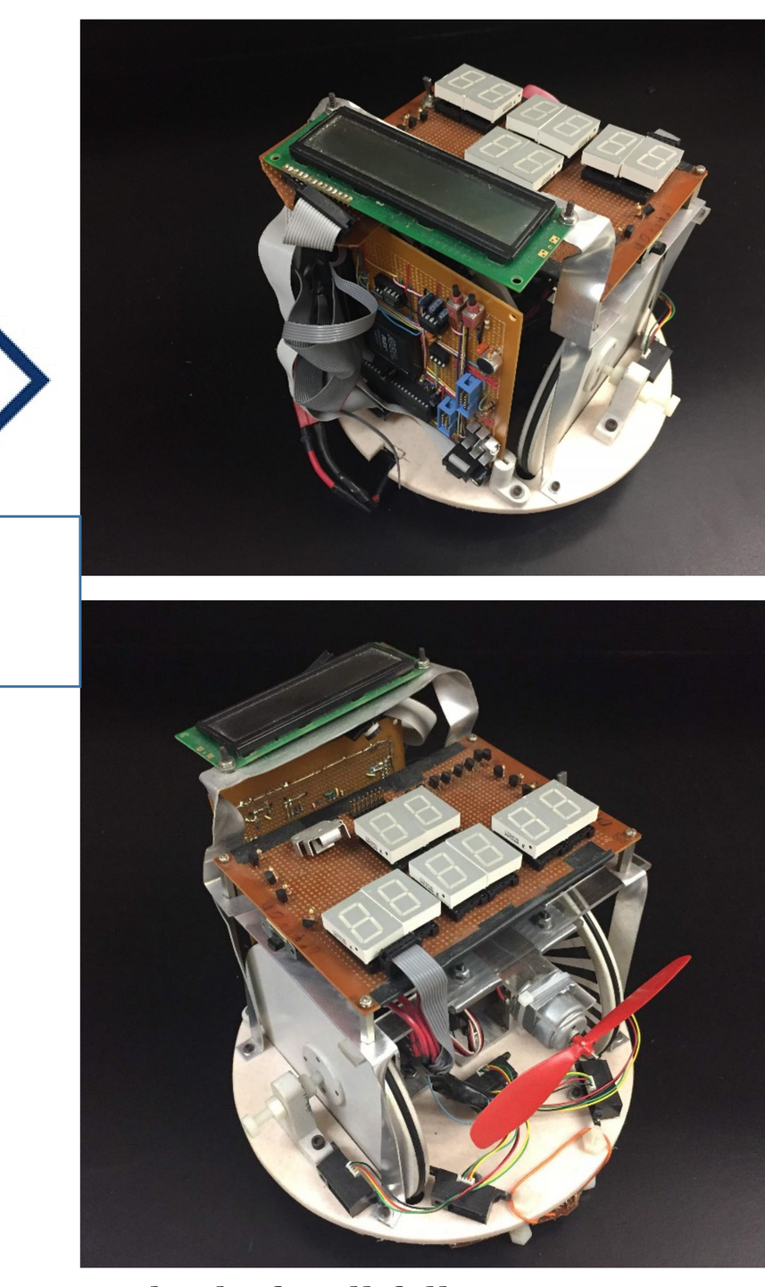
Wide Array Of Sensors

- UBlox M8Q
  - 3D compass
  - GPS Receiver
- IMU: MPU6050
  - Three Axis gyroscope
  - Three Axis accelerometer
- BMP180
  - Barometer
  - Relative Altitude



Trinity College Fire Fighting Home Robot Contest

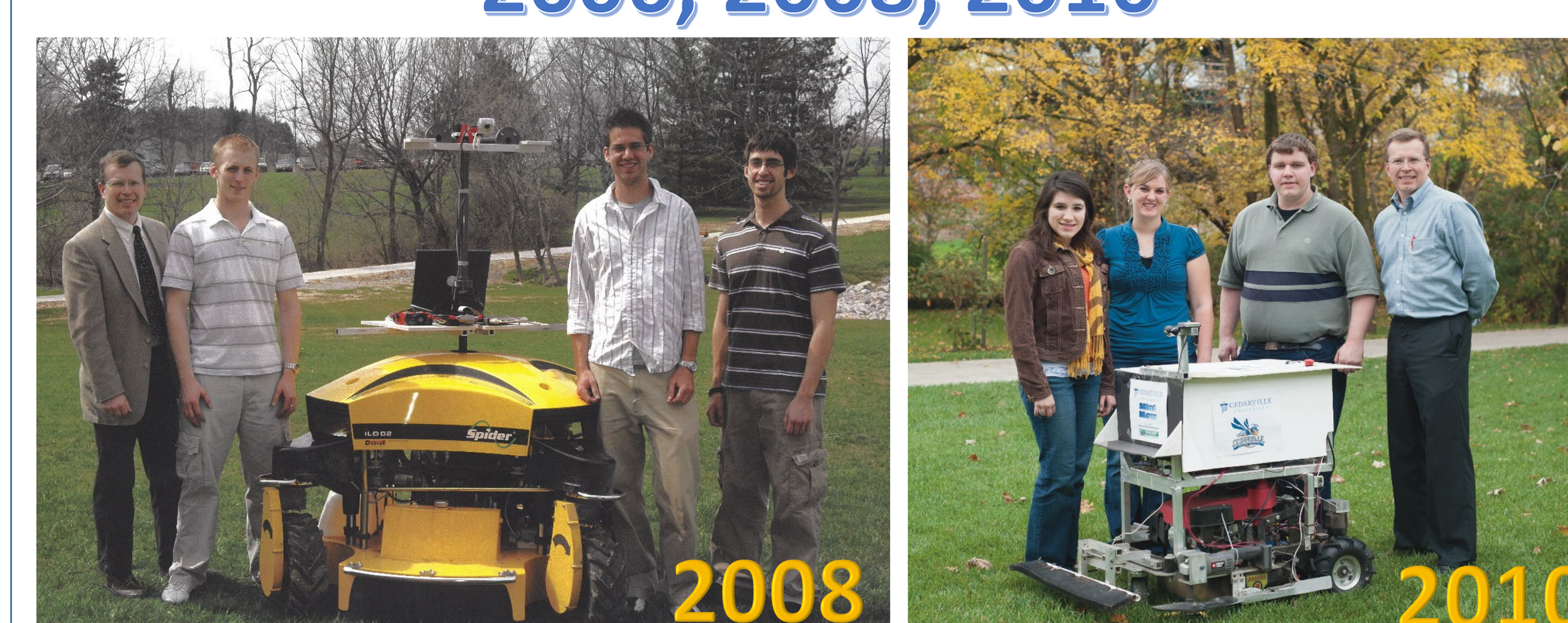




Hand Wired Boards
Infrared Distance Sensors
Infrared line and Flame Circle Detection
CPLD for Hardware Logic
Flame Sensor
Bump Contact Sensor

Differential IR Distance Sensors (front & rear) were an effective method of wall following
Two Wheel Robots are easy to control and provide nearly zero turning radius

ION Institute of Navigation – Autonomous Lawnmower Competition 2006, 2008, 2010

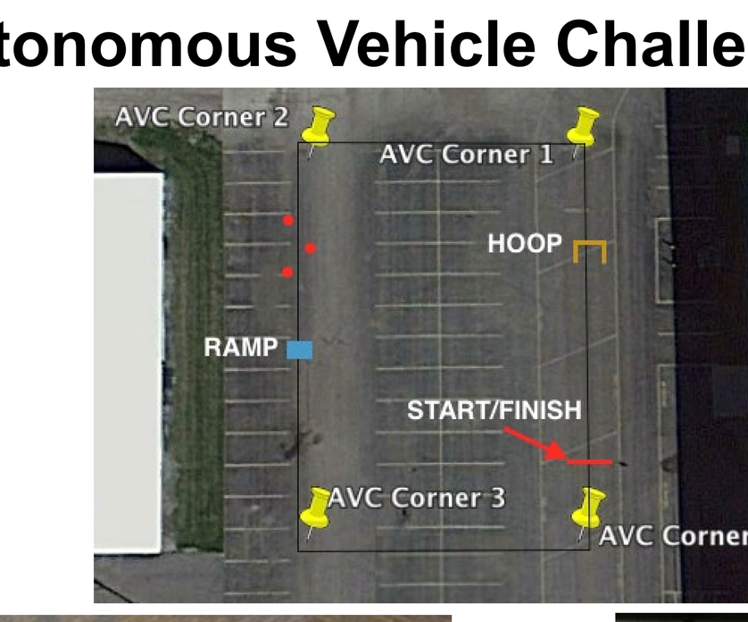


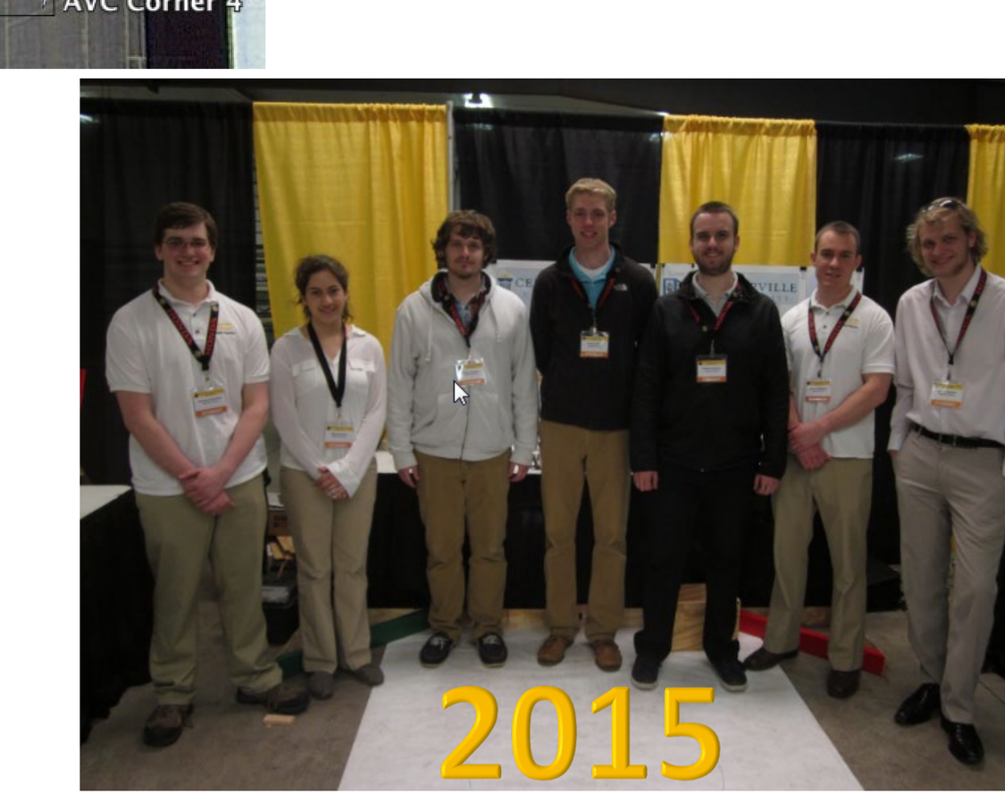
2008 Camera Based with Laptop 2010 Added Compass, Shaft Encoder and Bumper

Large Mower was not well suited for small mowing area
Compass, Bumper and Distance Odometer was effective
Tall grass and rough lawn was difficult to turn in with smaller mower

Autonomous Vehicle Challenge (AVC)

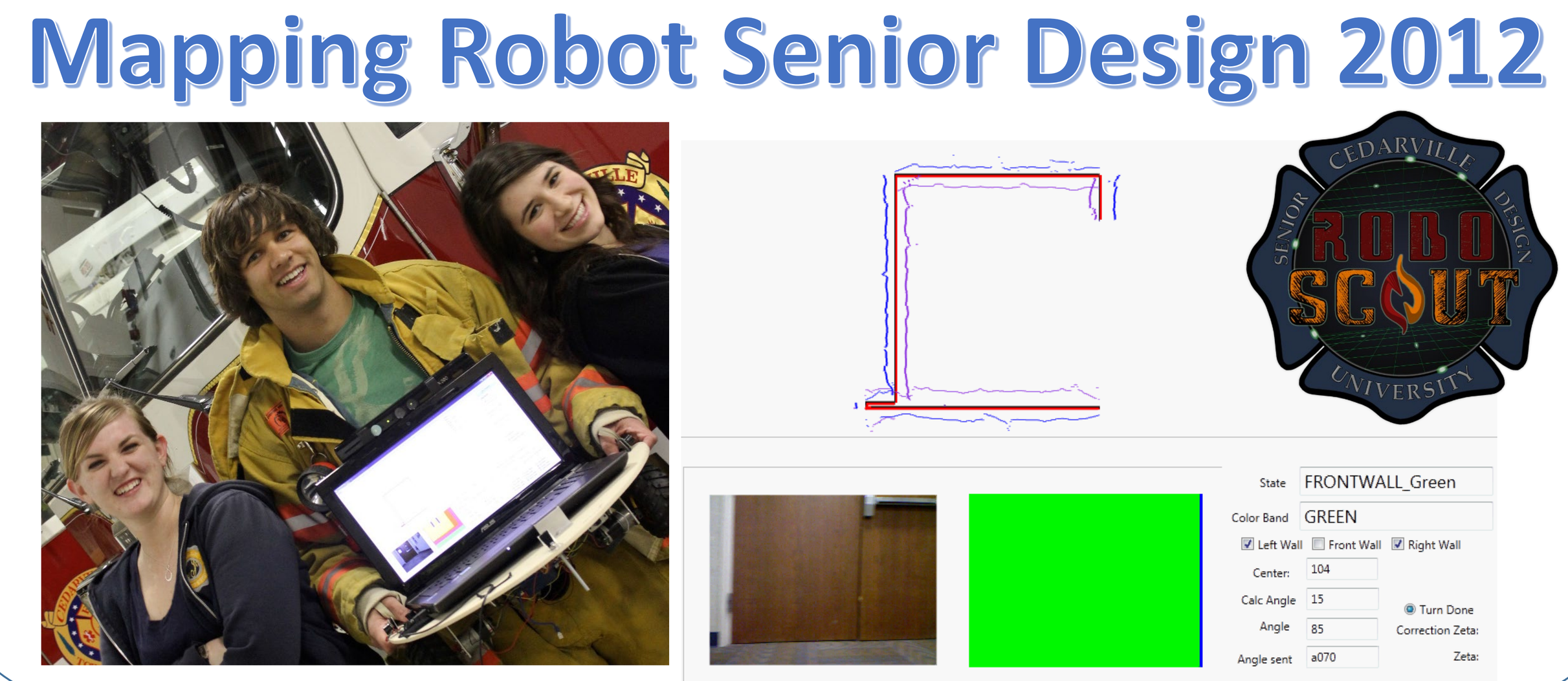
National Robotics Challenge – sparkfun ELECTRONICS





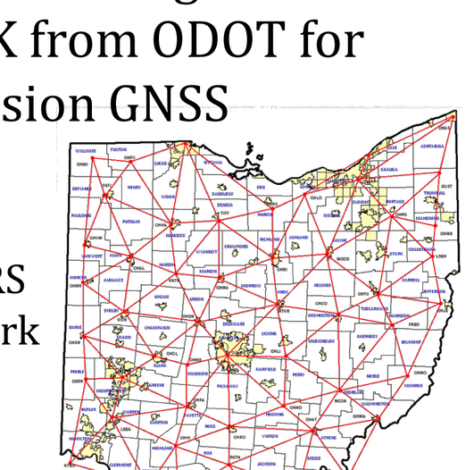
Electronic Compass must be calibrated before accurate readings were available
Encoding wheel proved very effective for odometry
Handle was very helpful to catch run away robots

Simultaneous Localization and Mapping Robot Senior Design 2012



Autonomous Golf Cart Senior Design 2018-2019

Autonomous navigation using RTK from ODOT for high precision GNSS



ODOT's VRS RTK Network

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NAECON POSTER FINALISTS

1 message

Felicia Harlow <fharlow@ieee.org> Thu, Jul 18, 2019 at 8:45 AM
Cc: Ken Simone <KSimone@tdkc.com>, Barbara Frantom <barbaraatnaecon@gmail.com>, "SIMONE, KENNETH C CTR USAF AFMC AFRL/RYWA" <kenneth.simone.ctr@us.af.mil>, Robert Penno <rpenno1@udayton.edu>, "CERNY, CHARLES L DR-04 USAF AFMC AFRL/RYMR" <charles.cerny.1@us.af.mil>, "EWING, ROBERT L CIV USAF AFMC AFRL/RYMD" <robert.ewing.2@us.af.mil>, Guru Subramanyam <gsubramanyam1@udayton.edu>
Bcc: kohlc@cedarville.edu

Authors,

Congratulations! You have been selected as finalists for your posters. Please be at your poster at 1:15PM for the final judging session. If your poster was in the Challenger/Discovery room it has been moved to the ballroom foyer. Other posters are in their original locations.

All authors must be present at this session to publish their final manuscript.. Winner will be announced at conference closing session.

Finalists attached here.

Thanks.

Felicia