insight racing

Media Guide

Team History:

Insight Racing has developed the Desert Rat as a cost-effective solution to the DARPA Grand Challenge. While invited to the QID for the 2004 Grand Challenge we were unable to compete due to earlier financial constraints. We have continued to develop our technologies and sponsorships and we are now in a position to compete in this year's challenge with a rugged and robust platform capable of handling any climate and terrain challenges in the desert or around the world. In January of this year, Insight Racing was the first DARPA Grand Challenge team to autonomously complete the JOUSTER course at Virginia International Raceway.

The key to Insight Racing's approach is a software architecture that allows us to integrate the sensor technology from multiple sensors into single vehicle control signals at real-time speeds. This architecture, MURE, or Mobile Unmanned Robotics Environment, enables us to combine location, terrain data, and real time sensor data with minimum processing and power requirements.

We have developed our control system around single board computers developed by BDMICRO. These computers sense vehicle parameters and control the throttle actuator, brake actuator, and the steering motor to drive the vehicle to the speed and direction demanded by the master control computer. This system also controls the E-Stop system for soft stop capability at the lowest level in the architecture. The vehicle can operate in computer controlled autonomous mode, manually from a radio-controlled remote, or in the conventional mode from the standard controls in the passenger compartment.

The master control computer collects data from all our software towers and makes the final determination of speed and direction required by the vehicle. This information then drives the control system. The software towers are configurable and can be run on one or more computers for load balancing and redundancy.
These computers use a high-speed network to exchange information and control the processing on the multiple computers. The use of multiple single board computers allows us to operate with minimal power requirements. Secondary alternators provide power for the onboard systems. No external generator is required to operate our system.

Our emergency stop system is an independent system that monitors the health of the control system, has valid communications with remote E-Stop controller, and connects to Emergency stop switches mounted in and on the vehicle. If any of these systems fail, we command the vehicle to stop and immediately shut down the engine.

All computer and control systems are mounted in a 19-inch rack that is less than 3 feet tall. This control box is mounted in the back of the vehicle and is compact enough to be compatible with most SUV's or extended-cab pickup trucks.

Commercial camcorders that provide image stabilization collect video from inside the vehicle allowing both 2 dimensional and stereo scene analysis. A video software tower processes the incoming data, allowing the system to look for possible roadways and for any objects in our path. The results of this processing are available to the master control computer for use in decision-making.

We use two SICK Lidar units to monitor the terrain in front of the moving vehicle. One SICK Lidar is mounted above the front bumper and searches for objects anywhere in front of the vehicle. The system generates commands that drive the vehicle between or around objects that may be in the path of the vehicle.

A front sensing bumper will cause the vehicle to stop and seek an alternate route when it measures deflections of greater than a few inches. This allows the vehicle to be able to discern between hard immobile objects and softer flexible objects that the vehicle can safely drive through.

Team Insight Racing was formed shortly after the announcement of the first DARPA Grand Challenge, in the Spring of 2003. We started with only five team members, one engineer at IBM and four North Carolina State University students. We quickly added new members to further strengthen our team.

Insight Racing has also sponsored nine Senior Design Project Teams at North Carolina State University over the last four semesters. This has involved mentoring thirty-six seniors in various aspects of the operation of our vehicle. We have incorporated a number of inputs from the students into our vehicle. Members of the Insight Racing team have also been mentors for a high school robotics team competing in the FIRST robotics competition. This team has gone on to win first place in the international competition.

In a second weekend of testing this summer, our team took the truck to Virginia International Raceway to run the previously unopened south hilly course. Again we were able to autonomously navigate this portion of the JOUSTER course.

Downward Looking SICK Lidar, Stereo Cameras & GPS Unit

Front Sensing Bumper

Team Members:

 Grayson Randall is President and team leader of Insight Racing. He is responsible for the overall system design and architecture of our Grand Challenge entry. Specific development responsibilities include vision processing and sensor data management. Grayson started the team in early 2003 in response to the initial DARPA Grand challenge. Grayson is a senior software engineer at IBM. He has 24 years experience in systems design and architecture. At IBM, he has worked on projects involved with manufacturing automation, digital video processing, set top box designs, as well as network processors for high speed network communications. He is currently involved in PowerPC processor development. Grayson's work includes 8 patents and several publications. Prior to IBM, Grayson had 5 years experience in the development of commercial and military flight simulators.

Grayson holds a BSAE from Parks College of St. Louis University. He is chairman of IEEE Robotics and Automation chapter for Eastern North Carolina. He also mentors a FIRST high school robotics team which won 1st place in the international competition last year as well as numerous other awards.

 Walt Sliva is Vice President of Business Operations for Insight Racing. He has a BSEE, BSME and MS Business Economics. He has held various engineering and management positions in the aerospace and automotive industries. His last position was Corporate VP and General Manager. He is currently retired and presently serves as an Adjunct Lecturer in North Carolina State University's Electrical and Computer Engineering Department.

 Kate Caldwell is Secretary and Vice President of Insight Racing. She is also a member of the mechanical division, which is responsible for development and maintenance of all mechanical systems on the vehicle. She graduated summa cum laude with a BS in Mechanical Engineering from North Carolina State University in May, 2005. She began working towards a Masters in Mechanical Engineering at NCSU this fall.

Brendan Shanley is the Treasurer of Insight Racing, as well as a member of the electrical team. He is responsible for power distribution throughout the vehicle's systems. Brendan will graduate in December 2005 with a BS in electrical engineering from NC State University. He hopes to enter the workforce in the beginning of 2006.

Brian Dean joined Insight Racing in 2004 and is responsible for steering, gas, and brake controls, emergency stop systems, remote control operations, and basic truck operating modes. Brian also developed the software used for obstacle avoidance. Brian earned a BS in Physics in 1989 and an MS in Computer Science in 1991 from West Virginia University and is currently employed as a software developer.

Matt Rhinehart is a member of the Mechanical Team for Insight Racing. He is responsible for all welding and heavy machining required for the mechanical systems. Matt is currently finishing his Junior year in Aerospace Engineering at North Carolina State University. He enjoys anything relating to aircraft and was a NASA intern in the summer of 2004.

Steve Kuekes is a member of the Software Team. He is responsible for position and INS sensors as well as Graphical User Interfaces. Steve has a BS in Computer Science from N.C. State University in 1981. He was a founder of Tangram Enterprise Solutions in 1984 and was its Senior Vice President of Engineering. Tangram was a computer software company that was venture capital funded and went public in 1999 by purchasing a public company. Steve was on also on the corporate Board of Directors, until 2001, when he retired. Steve has been on the Strategic Advisory Board for the Computer Science Department at N.C. State University since 2000 and also serves on the Information Technology Committee for the Occoneechee Council of the Boy Scouts of America. Steve is a private pilot with over 1,800 hours flying time and also enjoys fishing and hunting.

Mike Randall is a member of the Software Team. He is responsible for navigation, object avoidance, as well as system management. Mike graduated with a BS in Computer Science from N.C. State University with honors in May of 2005. Mike co-founded Ascot Technologies in 2000 and as Vice President was in charge of software development, specializing in high speed wireless applications. He is currently a Software Engineer for EMC².

Amit Bhatia is part of the Stereo Vision team at Insight Racing. Amit earned a BTech in Electrical Engineering in 1995, an MS in Computer Science in 2004 from NCSU and currently pursuing PhD in Computer Science from NCSU. He has been working for over 10 years in IT area and is currently employed as a software developer.

VIR PRESS RELEASE

CARY TEAM IS FIRST IN NATION

Insight Racing's autonomous driverless vehicle is the first Grand Challenge team to successfully complete the Alpha Course at the Joint Unmanned Systems Test Experimentation and Research (JOUSTER) Site at Virginia International Raceway. Insight Racing's autonomous vehicle conquered the 2.5 mile Alpha Course consisting of dirt roads, numerous winding turns, mud, and man made obstacles prior to any of the other entrants in the 107 team Grand Challenge field. The vehicle is run by computers without human intervention and must react to unanticipated obstacles and unforeseen conditions along the way.

The Triangle based Insight Racing team was formed to develop a completely autonomous vehicle to compete in the 150+ mile Grand challenge race for its $2 Million prize. Insight Racing was one of only 25 teams out of hundreds of entries selected to compete in the first race, which was held in March 2004. The next grand Challenge race will be in the desert southwest in October 2005.

The Grand Challenge is sponsored by the Defense Advanced Research Projects Agency (DARPA) to accelerate the development of vehicles driven entirely by computer, without any human intervention. The anticipated resulting technology is needed to meet a congressional mandate to transform one-third of military vehicles to autonomous, driverless operation by 2015. DARPA plans to repeat the race approximately yearly, until winning technology is developed.

According to Grayson Randall founder of Insight Racing, "The U.S. Department of Defense Joint Robotics Program (JRP) provided us an excellent environment to test our autonomous vehicle. There were many challenging situations on the course which are important to successful navigation in a long distance race. We are proud to be the first team nationally to complete this challenge."

Sponsors: Ascot Technologies, Inc., BDMICRO, Crossbow Technology, Inc., Council & Son Repair Service, Gemini Automotive Care, NC State University, PC MedEvac, and SICK, have provided valuable resources to help Insight Racing reach this important milestone.

About Insight Racing: The Insight Racing Team is part of Insight Technologies, Inc., a company formed to develop autonomous robotics solutions.

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Interesting Facts about the Team:

The Insight Racing's vehicle is nicknamed "The Desert Rat".

For security reasons, the Insight Racing team sets up and tears down all computers and sensors from the vehicle every testing day. This modular design feature makes it feasible to quickly retrofit Insight's solution into another vehicle.

Insight was the first team in the US to successfully complete the Alpha Course at the Joint Unmanned Systems Test Experimentation and Research (JOUSTER) at Virginia International Raceway.

Insight Racing was started by an engineer and 4 college students. Four additional members were added later.

Insight Racing team consists of members employed at IBM, EMCC, SAS, 2 college students, 2 grad students, a retired automotive executive and a retired entrepreneur."

Insight Racing's team members have founded or co-founded 4 companies." (Insight Technologies, Ascot Technologies, BDMICRO and Tangram)

Insight Racing is the only team from the Carolinas or Georgia."

Insight Racing team's first test track was on a farm in rural Deep Run, NC. The townspeople used to meet at the local general store to discuss the team's progress.

While testing at Insight Racing team's first test track in rural NC, team members slept in sleeping bags in an unused farm house.

When Insight Racing purchased their test vehicle, they weren't sure it would pass state inspection. Now, it is running in a race all the way across the country."

Team members of Insight Racing include a father and son team, **Grayson** and **Michael Randall**.

The average age of the Insight Racing team members is 34.

All of the Insight Racing team members live in or around Raleigh, NC."

The test terrain used by Insight Racing includes farm land with 1000 acres of large fields, narrow dirt roads, and chicken coops.

The female member of Insight Racing's team **Kate Caldwell** was a founding member and is currently a grad student at NC State University studying Mechanical Engineering.

The control system was custom designed specifically for Insight Racing by team member **Brian Dean** of BDMICRO.

The Grand Challenge project has been a Senior Design Project for 36 Computer Science students at NC State over four semesters.

Three of the Insight Racing team members are neighbors.

Insight Racing estimates that they have consumed over 100 gallons of GatorAde during their testing of the vehicle."

Insight Racing estimates that they have driven over 4,000 miles in their testing. That's as many miles as it would have taken to drive the vehicle to California and half way back!

Insight Racing would like to thank their sponsors IBM, Red Hat, BDMICRO, Ascot Technologies, Sick, Comtrol, Crossbow, PC MediVac, Gemini, Lord Corporation and North Carolina State University for their help.

Team member **Brendan Shanley**, an Electrical Engineering senior at NC State, is also a long distance cyclist

Team member **Steve Keukes** is a serial entrepreneur.

Team member **Michael Randall** won an Entrepreneurship award while still a student at NC State.

Team member **Grayson Randall** chairs the IEEE Robotics and Automation Chapter for all of eastern North Carolina.

Team member **Walt Sliva** is an avid golfer and volunteers with six different organizations.

Team members **Grayson Randall, Walt Sliva, Kate Caldwell, Brendan Shanley, Matt Rhinehart** and **Michael Randall** were National Champions in the US FIRST High School Robotics competition."

Team member **Matt Rhinehart** served as a NASA intern between his sophomore and junior years at NC State.

"Team member **Amit Bhatia** wrote and transmitted code back to the team while on vacation in India.

The Desert Rat's computer rack weighs several hundred pounds and is shock mounted using mounts made by Lord Corporation of Cary, North Carolina.

 The Desert Rat averages 40 miles of rough terrain autonomous testing every weekend on NC State University owned farmland near Butner, North Carolina.

Sponsors:

NC STATE UNIVERSITY

Ascot Technologies, inc.

High Performance Robot Controllers
BDMICRO
http://www.bdmicro.com

SICK
Detect the Difference

Crossbow
TECHNOLOGY INC.

COMTROL
The Enterprise Connection

PC
MedEvac

Gemini
AUTOMOTIVE CARE

Council & Son Repair Service
2420 Davis Drive
Morrisville, NC 27560
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