

robonation
ROBOTICS COMMUNITY

26th Annual Intelligent Ground Vehicle Competition (IGVC) 1-4 June 2018 Oakland University



Self Drive Overview



www.IGVC.org

Jerry Lane IGVC Co-Chairman & Co-Founder
Gerald.lane50@gmail.com 586-980-1142

IGVC & Self Drive Background

- Established 1992 by Association for Unmanned Vehicle Systems International,
- 1st Annual Competition 1993
 - Only FHWA & ITS interest -- minimal automotive interest
- Autonomous Driving for Defense & Automotive
- Robotic Objectives
 - Defense Unmanned Systems
 - Automotive Intelligent Vehicles
- College & University Student Teams: Undergraduate & Graduate
- Co-Hosted by Oakland University, US Army TARDEC & AUVSI Great Lakes Chapter
- Past 25 years competed 500+ Teams, 80+ Universities and 7 Countries

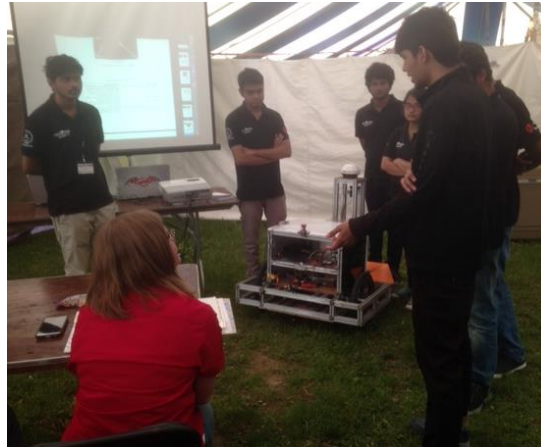


- **As automotive smart vehicle industry advanced**
 - **more advanced & relevant IGVC platforms & challenges were Identified**



2017
Spec 2
Teams

IGVC Student Preparation



2017 IGVC Teams

<u>Vehicle</u>	<u>University</u>	<u>Vehicle</u>	<u>University</u>
SeDriCa	Indian Institute of Technology - Bombay, INDIA	BEAST	Florida Institute of Technology
Sparky	Roger Williams University	PANthAR (Spec 2-withdrawn)	Florida Institute of Technology
Charlie	Michigan Technological University	Jaymi	Georgia Institute of Technology
Lazarus	Bob Jones University	iWheels 3	Lawrence Technological University
Orange 2017	Hosei University	MOBIS-Dataspeed-LTU (Spec 2)	Lawrence Technological University
DOLLE	Embry-Riddle Aeronautical University	AMOS III	Rochester Institute of Technology
Daksh	Indian Institute of Technology - Kanpur	Apollo II	CART, Inc. at Bluefield State College
Night Owl	Kennesaw State University	M.A.S.K.	Lawrence Technological University
Penguin	Oakland University	Acadia	The College of New Jersey
SubaRoo	The University of Akron	Dokalman	University of Cincinnati
SQUIRREL	Trinity College	OHM 5.0	University of Michigan Dearborn
Betsy	Universite' de Moncton	Great Uncle ViktorAS	University of Texas at Austin
Bender	Boise State University	Jack Frost	University of British Columbia
Iggy	United States Military Academy	Abhiyaan	Indian Institute of Technology - Madras
R.E.V.O.	University of Illinois at Chicago	Spec 2 Vehicle	Bob Jones University
Continental-OU (Spec 2)	Oakland University	Autobee	Istanbul Technical University
Cilantro	Old Dominion University	Lancebot	University of Detroit Mercy
Octagon v3.0	Oakland University		

IGVC Challenge Evolution

1993 - 2012 Autonomous Challenge

1994 Design Competition

1999 – 2000 Road Debris Course

1999 – 2001, 2003 Follower The Leader

2001 – 2012 Navigation Challenge

2006 – 2013 JAUS Challenge

2013 – Auto-Nav Challenge: Basic & Advanced Courses

2014 – IOP Challenge

2107 – Auto Nav Enhanced

2017 – Spec 2 Demo

2018 – Self Drive (Spec 2) Challenge

Self Drive Design Specifications

<http://www.igvc.org/spec2.htm>

Entries must conform to the following specifications :

- **FMVSS 500 Platform**
- **Design:** Side by Side 2-person four-wheel ground vehicle
- **Type of Vehicle:** Electrical, no gas
- **Maximum Length:** 115 in (Polaris Gem e2 is 103 in, Renault Twizy is 91 in)
- **Maximum Width:** 60 in (Polaris Gem e2 is 55.5 in, Renault Twizy is 47 in)
- **Maximum Height:** 75 in (Polaris Gem e2 is 73 in, Renault Twizy is 57 in)
- **Maximum Weight:** 1500 lbs
- **Maximum Speed:** Speed is limited to 5 mph in 2018
 - Speed will increase as safety features of Self-Drive course are developed.
- **Mechanical E-stop Location:** The E-Stop button must be a push to stop, red, one inch dia.
- **Wireless E-Stop** must be effective for a minimum of 100 feet.
- **Vehicle E-stops** must be hardware based and not controlled through software.
- **Safety Light:** must have easily identified brake lights red in color and reverse lights yellow
 - A strobe light mounted on roof and activated when the vehicle is under robotic control.
- **Teams may build their own drive-by-wire kits or use off the shelf drive-by-wire solutions :**
 - TORC Robotics,
 - Dataspeed,
 - AutonomousStuff
 - Clearpath Robotics.
- **FMVSS-500 Vehicle Example - Polaris GEM e2**



2017 Spec 2 Demo Run on grass

<http://www.gl-systems-technology.net/spec-2-demo-run-igvc.html>

Self Dive Qualification & Safety Check

Qualification the vehicle must pass or perform all of the following criteria:

- **Length:**
- **Width:**
- **Height:**
- **Weight:**
- **Mechanical E-stop:**
- **Wireless E-Stop:**
- **Passenger(s) Safety:**
- **Safety Light:**
- **Speed: Min & Max**
- **Lane Following:**
- **Obstacle Avoidance:**
- **Waypoint Navigation:**

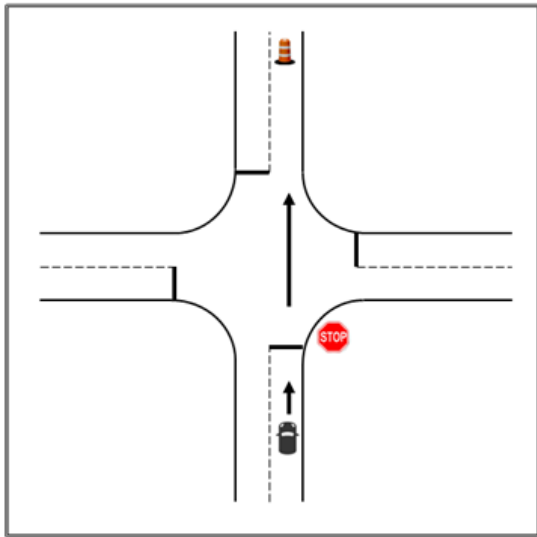
2018 Self Drive Course



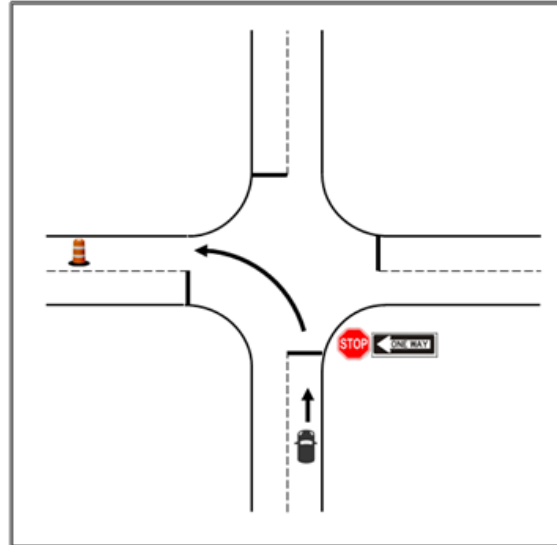
Function Testing

Intersection Testing. Lane Keeping
Intersection Testing. Left Turn
Intersection Testing. Right Turn
Parking. Pull Out
Parking. Pull In
Parking. Parallel
Obstructed/ Unobstructed pedestrian detection
Pedestrian & Obstacle detection. Lane Changing
Merging
Curved Road evaluation. Lane Keeping
Curved Road evaluation. Lane Changing
Pothole detection

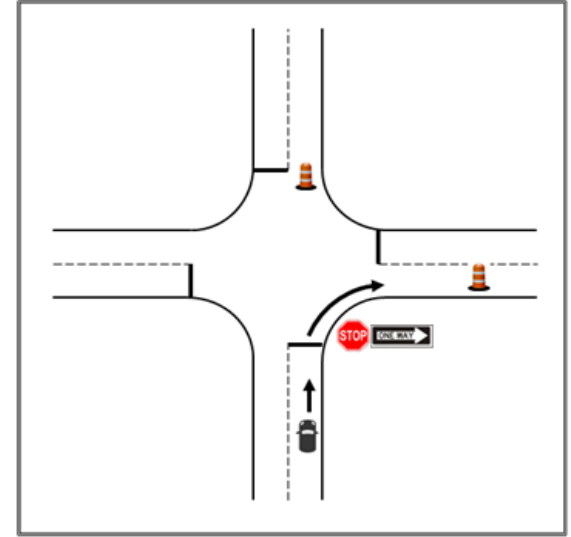
Lane Keeping & Turns



Lane Keeping

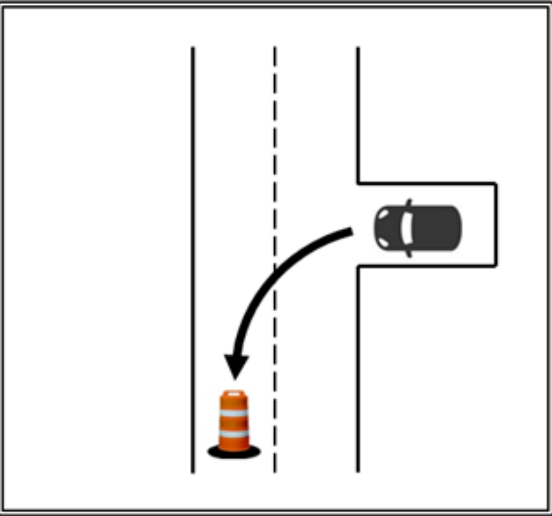


Left Turn

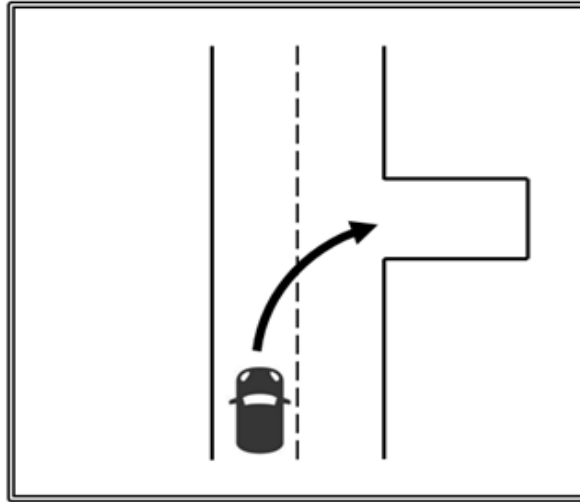


Right Turn

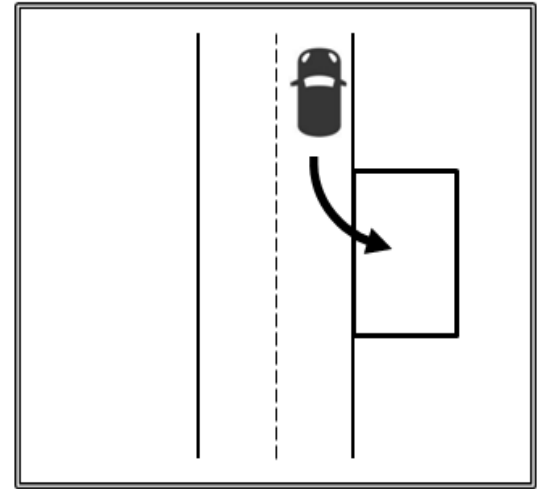
Parking



Pullout

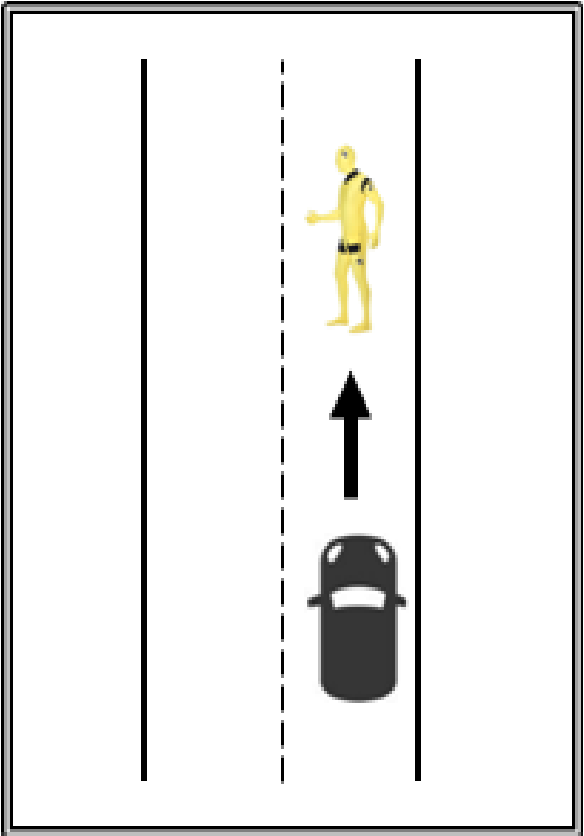
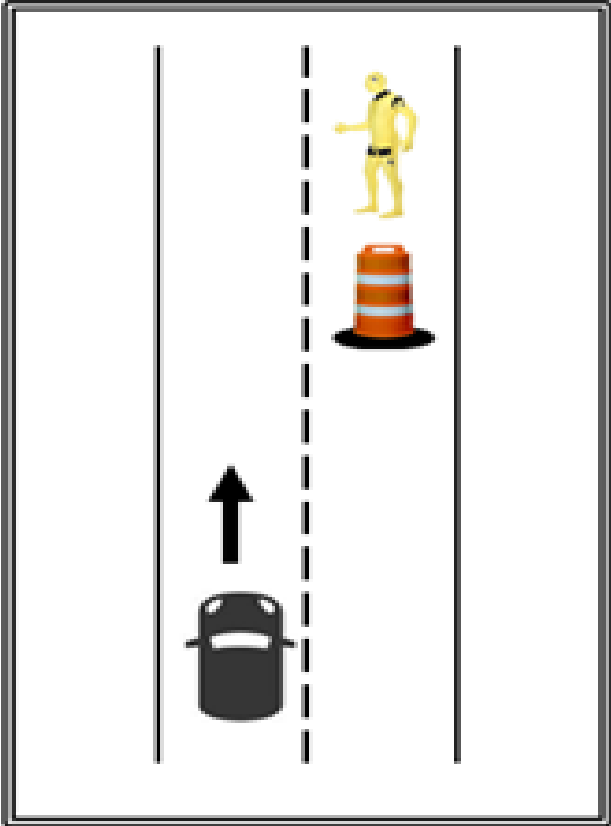


Pullin

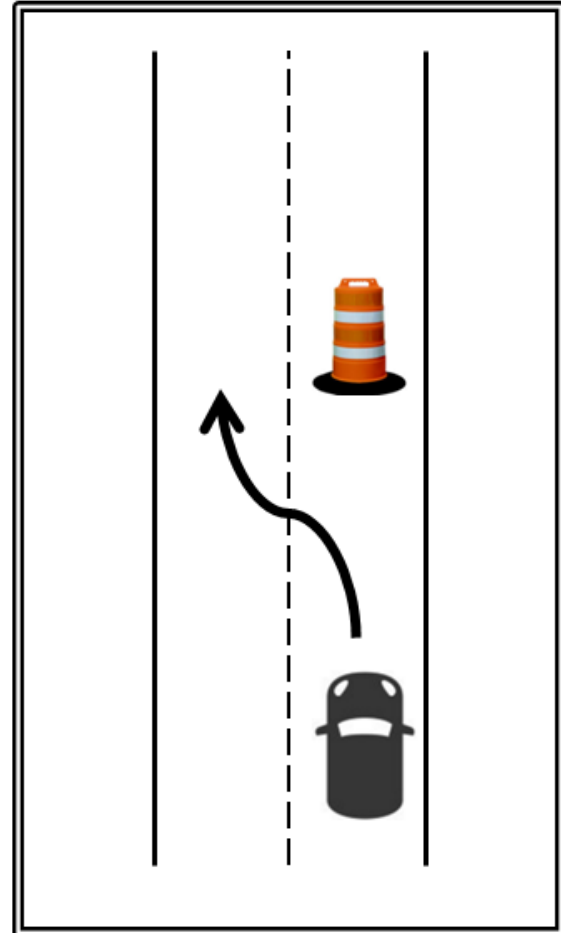
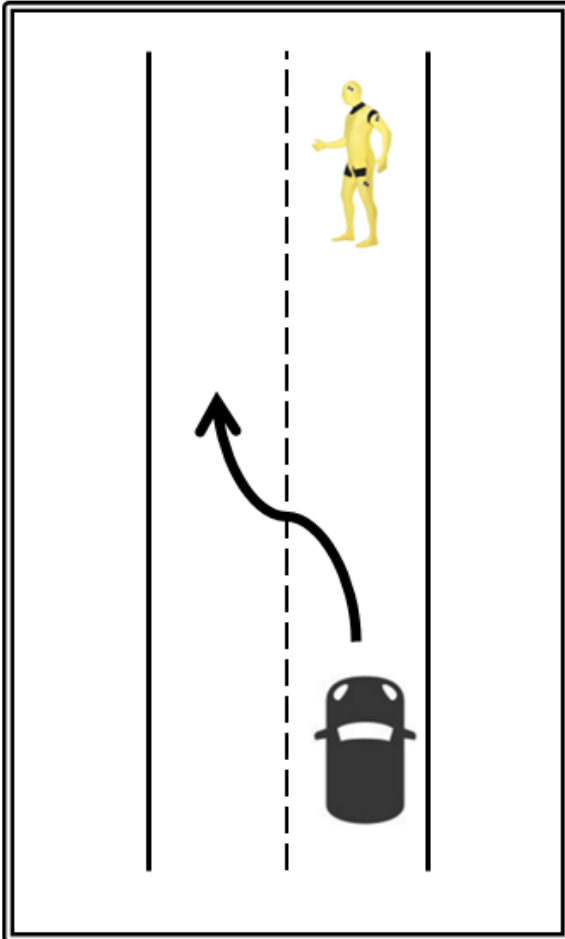


Parallel

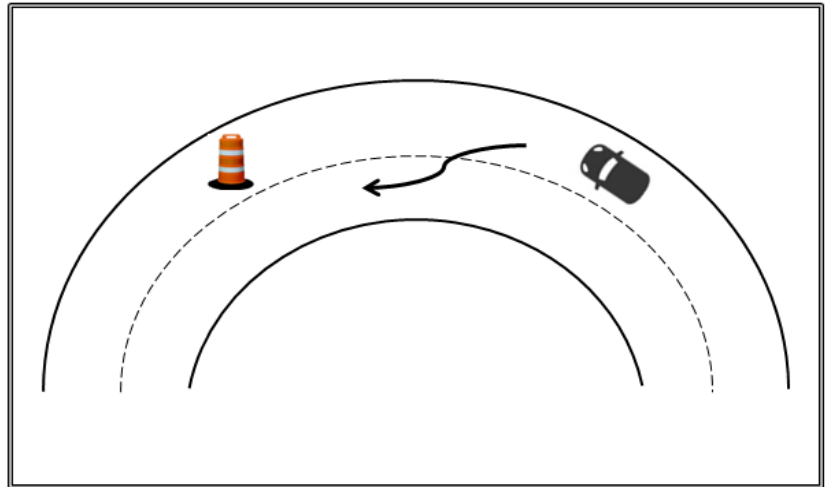
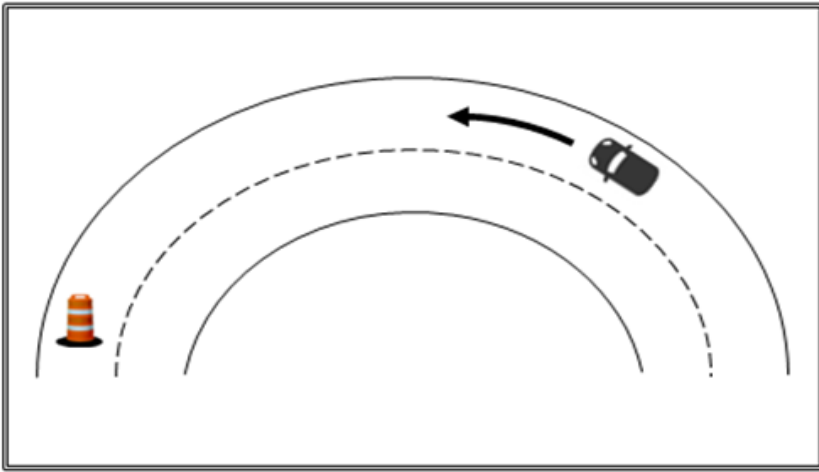
Obstructed/ Unobstructed pedestrian detection



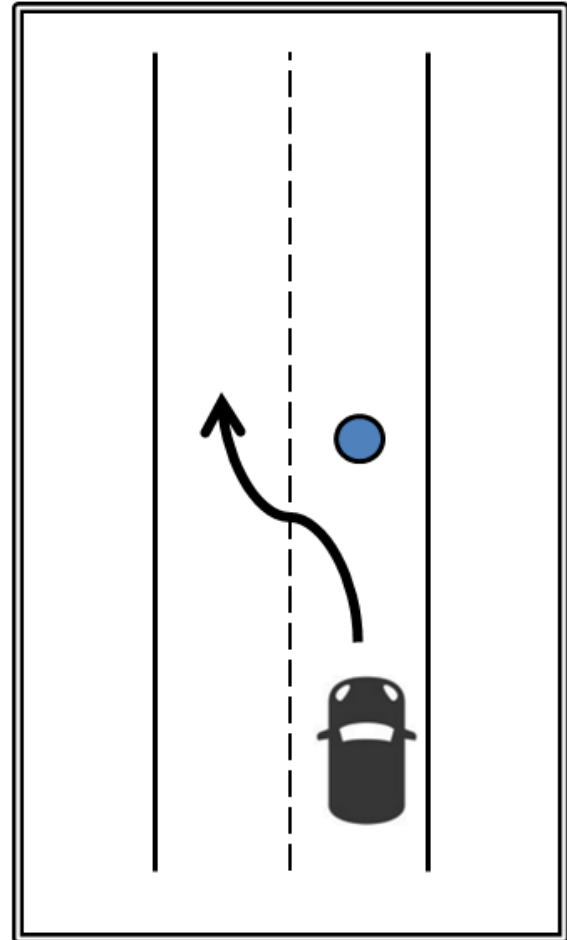
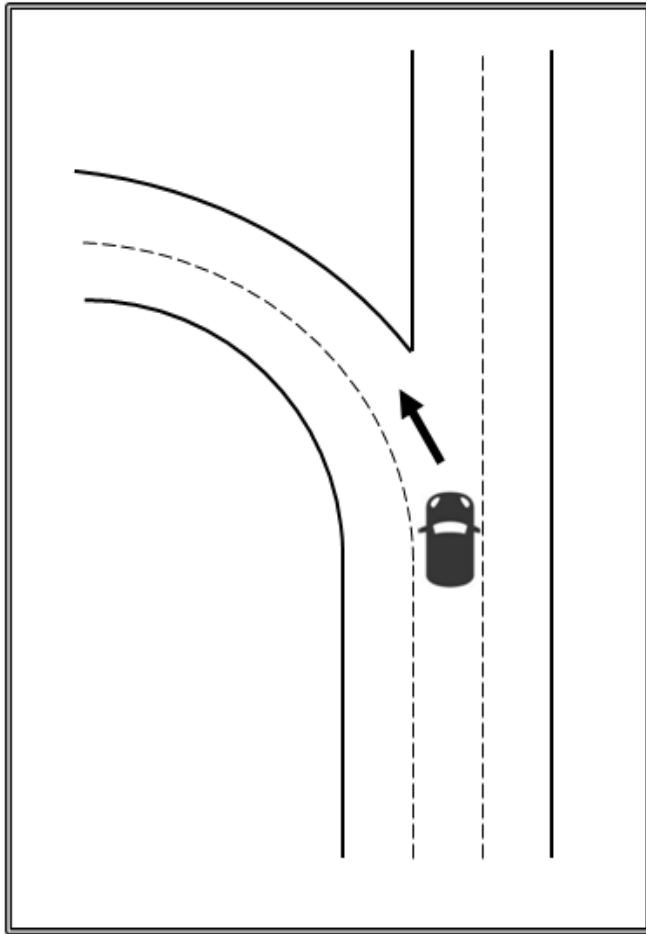
Pedestrian & Obstacle detection. Lane Changing



. Curved Road Evaluation. Lane Keeping & Lane Changing



Merging & Pothole detection



Self Drive Awards

Awards Based on top cumulative point score

Place	Amount (\$)
1st	\$3,000.00
2nd	\$2,000.00
3rd	\$1,500.00
4th	\$1,000.00
5th	\$750.00
6th	\$500.00

Self-Drive Standard Award vehicles must perform all functions on course autonomously .

Place	Amount (\$)
1st	\$1,000.00
2nd	\$800.00
3rd	\$600.00
4th	\$500.00
5th	\$400.00
6th	\$300.00

Self-Drive Nominal Awards Nominal \$ table below is for vehicles not performing all functions autonomously.

IGVC Organizing & Technical Team

- Professor KaC Cheok: Oakland University, Co-Chairman & Co-Founder
- Bernard Theisen: US Army TARDEC Robotics, Co-Chairman
- Jerry Lane: Great Lakes Systems & Tech, Co-Chairman & Co-Founder
- Andrew Kosinski: US Army TARDEC Robotics, Operations Director
- Steve Gadzinski: Ford (Ret) , Chief Design Judge
- Matt Skalny: US Army TARDEC Robotics, Interoperability Chief Judge
- Jane Tarakhovsky: Hyundai Mobis, Self Drive Chairman
- Markhanna McBurrows: Oakland University(Ret), Administrative

2017 IGVC Sponsors



HYUNDAI



NORTHROP GRUMMAN



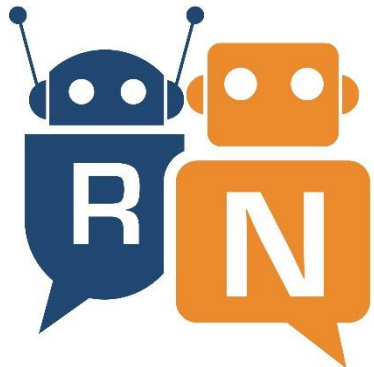
New 2018 Sponsors to date Joining IGVC

- Open JAUS
- Robotic Research Corp.

For More information on IGVC Sponsorship and Sponsor Benefits
click on

<http://www.igvc.org/sponsors.htm>

www.igvc.org



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