ELROB 2024

24 June - 28 June 2024

Trier, Germany

Team Information

Picture of vehicle:

Name of vehicle: MuCAR-3 (right) and MuCAR-4 (left)

Picture of team leader:

Name of team leader: Thorsten Luettel

Team Name: MuCAR

Team E-mail: elrob@mucar3.de

Logo:

Website: https://www.unibw.de/tas

Location: Neubiberg, Germany

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Team Description:

Our Team MuCAR consists of about 15 team members under the leadership of Thorsten Luettel. Most team members work as research assistants at "Autonomous Systems Technology" institute of the University of the Bundeswehr Munich, which is headed by Univ.-Prof. Dr.-Ing. Mirko Maehlisch (he is the successor of Prof. i.R. Dr.-Ing. Hans-Joachim Wuensche).

Our team develops and operates the two robot vehicles "MuCAR-3" and "MuCAR-4", the third resp. fourth generation of our Munich Cognitive, Autonomous Robot Cars. The first two vehicle generations drove on German Autobahns under the leadership of Prof. i.R. Ernst-Dieter Dickmanns as far back as 1987. Both vehicles already have retired to museums.

MuCAR-3 is based on a stock VW Touareg with a V6 TDI engine, modified to allow computer control of steering, brake, throttle and automatic gearbox. Full body skid plates allow testing in rough terrain.

MuCAR-4 is based on a stock VW Tiguan with a TSI engine, modified to allow computer control of steering, brake, throttle and automatic gearbox.

Currently, we are building our new research vehicle MuCAR-5 based on an Audi Q8. Maybe, this will be ready for ELROB 2024.

Apart from inertial and odometry sensors, we continue to focus on vision as a main sensor for perception, as this sensor provides most of the information humans need for driving. In addition, we use a high definition 360 degree LiDAR sensor mounted on the roof of the vehicle and a 360 degree system of multiple radar sensors. These sensors are advantageous in special applications such as off-road driving, with fog or dust, or at night.

The main vision sensors are forward looking color cameras. Two of them are placed on a pan-tilt-platform inside the vehicle, others are roof-mounted. MuCAR-4 is additionally equipped with some stereo cameras of the roof, providing 3D information in forward and backward direction. Some more cameras working in different spectral regions (SWIR, NIR) complete the camera setup.

Our robust and fast machine perception algorithms are based on an innovative fusion of vision, LiDAR and radar data and excels in offroad environments featuring poor GNSS

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conditions. We combine modern AI-based algorithms with proved traditional methods. A Multi-Object-Tracking estimates both the positions and dynamics of the convoy lead vehicle as of other dynamic objects. For motion planning, an environment model provides a representation of the static environment. Different planning algorithms have shown their capabilities during the last trials and will be extended to provide the more complex behavior needed for ELROB 2024.

Team MuCAR participated at the ELROB 2007, 2008, 2009, 2010, 2012, 2016, 2018, 2022 and Eurathlon 2013 with great success. At the DARPA Urban Challenge 2007, where we participated together with TU Karlsruhe and TU Munich through Team AnnieWAY, this team was one of only 11 teams which made it into the finals on 3 Nov. 2007.

Sponsors: none

Selection of scenario:

___ Reconnoitring of structures (3D mapping & find OPIs)

___ Mule (shuttle between two locations)

_X_ Convoying (transport with two vehicles)

___ Search & Rescue (SAR) / CasEvac (find and drag a dummy body)

___ Reconnaissance and disposal of bombs and explosive devices (EOD/IED; **for professionals only!**)

Proof of citizenship: A copy of team leader passport will do (will not be published)!

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