German autonomous car travels across Mexico

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The AutoNOMOS team (from left to right) Prof. Dr. Daniel Göhring, Dipl.-Inf. Tinosch Ganjineh, Prof. Dr. Raúl Rojas, Fritz Ulbrich

An autonomous car developed at Freie Universität Berlin has traveled through Mexico without any human intervention. Named AutoNOMOS, the car traveled 2400 kilometers and reached Mexico City on Tuesday. According to the researchers' knowledge, this was the longest journey ever completed by an autonomous vehicle in Mexico. The car traveled 2250 kilometers on freeways and 150 kilometers through cities; part of the route led through the semi-arid Sonoran Desert. Designed by researchers in the groups of Professor Raúl Rojas and Professor Daniel Göhring, the car had previously traveled autonomously in Germany, the United States, and Switzerland. Long-distance test drives of autonomous vehicles routinely take place in the USA and in Europe. The researchers have no knowledge of reports of this type of journey in Latin America up to now.

The scientists spent almost a year preparing for this test drive. Last Sunday the autonomous car reached the city of Guadalajara after traveling 1650 kilometers from the US-Mexico border. The car passed through four Mexican states, crossed the semi-arid Sonoran Desert as well as tropical regions in Sinaloa, and then crossed the mountains to Jalisco. The road conditions included everything from new freeways to numerous construction sites, as well as narrow old roads lacking lane markings and hard shoulders. The Nogales-Guadalajara freeway is also interrupted several times by urban areas. The "driving intelligence" required by the autonomous vehicle was thus higher than that required for perfectly built and wide highways. "These challenges are exactly what attracted us to the experiment in Mexico, which was accompanied by police cars of the Mexican Federal Police," said Rojas.

The team consists of scientists led by Professor Raúl Rojas and Professor Daniel Göhring from the Department of Mathematics and Computer Science. In September some of the computer scientists drove through parts of the USA and Mexico, collecting data from 6000 km of freeways in both countries. They did this in cooperation with the

University of Nevada in Reno. The navigation maps required for autonomous drives are much more detailed and complex than those required for conventional devices. The calculations for the creation of maps with the collected data took place in Berlin up to the beginning of October. The maps were tested on the road.

"An autonomous vehicle works almost like a taxi," said Raúl Rojas, "with the main difference being that the taxi driver is a computer." The worldwide interest in autonomous driving has increased by leaps and bounds in recent years. Within this context, the car industry is preparing for the introduction of an autopilot for freeways. Those responsible expect that by 2020 it should be possible for drivers to push a button to start an autopilot that would be able to keep the vehicle in its lane and, if necessary, pass other vehicles. However, they also expect that it will take decades before the technology is advanced enough to enable autonomous driving in cities.

The test drive vehicle of Freie Universität Berlin, AutoNOMOS, has been approved for driving on streets in the city of Berlin since 2011, including both the urban freeways and all the other streets and roads in the city. The scientists in the project at Freie Universität do pioneering work, also for industry, because the problems of the cars of the future can be identified at an early stage. The scientists at Freie Universität Berlin are also working on solutions that would enable the vehicles to automatically recognize the intentions of other traffic participants.

For the long journey through Mexico, the many sensors in the car were essential. The AutoNOMOS has seven laser scanners, nine video cameras, and radar at the front, back, and on the sides, as well as a highly accurate GPS system. Thanks to all of the sensors, the traffic situation, the position and speed of other vehicles, the presence of pedestrians, and the traffic light phases can all be reliably detected. All of this information is bundled together in a world model and passed to the host

computer, which plans and makes decisions about how to drive in compliance with the traffic rules.

The aim is that the computer-controlled car always accelerates and brakes gently and without unnecessary steering. This was largely achieved by Freie Universität's autonomous car. The former German Federal Minister of Education and Research, Annette Schavan, the Berlin Senator for Economics, Technology, and Research, Cornelia Yzer, and the governor of the U.S. state of Nevada have already ridden along in the car as passengers while it was driving in normal Berlin city traffic. A lot of adjustments were necessary to cope with the Mexican roads. The numerous potholes make things very difficult for autonomous cars. During the long test drive in Mexico, driving parameters were adjusted, and the results were very impressive: very smooth passing, even at the speed of 130 km. The car recognized all of the dangers on the freeways and reacted appropriately.

The project in Mexico was supported by the research agency CONACYT, the Technical University (IPN), and the Berlin-based companies Autonomos Gmbh and IAV Gmbh. Not without reason: these types of experiments provide important insights that are necessary for the development of autonomous vehicles.

Back in Berlin, the team will begin with the development of the next vehicle. "We now want to design a miniaturized driving system, one in which the sensors and computer are no longer visible, and that would also be much more affordable," said Daniel Göhring.

In Mexico the long test drive received extensive press coverage. The team from Freie Universität had already visited Mexico City in 2012, but the rides there only covered a few kilometers. This time the scientists achieved a personal best record with regard to both the complexity of the trip and the length of the distance covered. In Berlin they will continue

working on developing the car of the future as of November.

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