

New app lets diesel drivers conduct emissions analyses by themselves

Computer scientists at Saarland University have developed a method that lets diesel drivers check in real time the levels of exhaust gases their car emits. For this, only the free app "LolaDrives" and an inexpensive Bluetooth adapter for reading out the car's diagnostic system are needed. The app was developed as part of the transregional collaborative research center „Foundations of Perspicuous Software Systems" funded by the German Research Foundation at Saarland Informatics Campus.

Since September 2017, each car model has to pass a so-called "Real Driving Emissions (RDE)" test in order to be admitted on European streets. This test determines exhaust emissions during driving under realistic, everyday conditions. "Our thought: Anyone should be able to perform this test by themselves," says Sebastian Biewer, PhD student at the chair "Dependable Systems and Software" of Professor Holger Hermanns at Saarland University.

Instead of acquiring measurement equipment worth hundreds of thousands of Euros, the Saarbrücken computer scientists have developed the app "LolaDrives". It uses RTLola, a technology for analyzing real-time systems developed by Bernd Finkbeiner, who is also a professor at Saarland University and faculty at the Helmholtz Center for Information Security CISPA.

The app supports almost all cars built after 2005. "These cars have an interface for on-board diagnostics, OBD," says Sebastian Biewer. OBD is a vehicle diagnostic system that monitors systems affecting exhaust emissions and other control units, such as the speedometer, while the car is in motion. Using a Bluetooth adapter, the on-board diagnostics are accessed. Once the car is running, "LolaDrives" must be launched, and the mobile phone must be connected to the OBD adapter via Bluetooth.

The application then either enables the user to read out the data from the diagnostic system or guides them step-by-step through an RDE test. "To our knowledge, LolaDrives is the only app enabling RDE testing," adds Sebastian Biewer. However, for the app to calculate the emission values, the car's OBD interface must provide the relevant data valued - in particular the data of the nitrogen oxide sensor of the exhaust system, which is only installed in diesel vehicles. Directly upon starting a test, "LolaDrives" displays whether the appropriate data can be retrieved and thus whether an RDE test is indeed possible.

It was important to the developers to make their app as easy to use as possible since numerous constraints must be met for a valid RDE test: The driving time must be at least 90-120 minutes, it must take place over specified distances in different modes (urban, rural and motorway), certain speed specifications must not be violated, and acceleration and braking behavior also play a role. "Our app displays all these elements via an easy-to-understand user interface, and it guides through the different stages of the test in a structured way, by announcing exactly what needs to be done and when. It reports whether the test was successful and also whether the test has failed irrevocably due to a violation of one of the constraints," says Yannik Schnitzer, a computer science student who has been driving the app's development since his second semester.

Users can donate their driving data to the researchers on a voluntary basis and independent of the app's functionalities in a privacy-compliant manner. Computer science professor Holger Hermanns, speaker of the transregional collaborative research center "Foundations of Perspicuous Software Systems," in which the research on LolaDrives is taking place, says: ""Based on the donated data, we aim to build a platform that will bring more transparency and comprehensibility to the automotive sector. Past scandals have shown what it leads to when manufacturers can conceal their irresponsible actions through lack of transparency. We want to help uncover software behavior that is beneficial for the manufacturer of the software, but not desired by the user or by society."

The RDE tests conducted with the app are not legally binding. "Our aim is to satisfy the users' demand for information. The results of our RDE tests are plausible when viewed in the context of published emissions data and threshold values. But ultimately, they are approximations of the 'real' tests, which must necessarily be carried out using expensive and calibrated mobile mini-labs," says Professor Holger Hermanns.

"LolaDrives" is currently available for Android via the Google Playstore. A version for Apple devices is already in development. The project also has a limited supply of Bluetooth OBD adapters at its disposal, which are provided free of charge to interested data donors.

Background TRR 248 „Foundations of Perspicuous Software Systems “:

The Transregional Collaborative Research Center "Foundations of Perspicuous Software Systems - Enabling Comprehension in a Cyber-Physical World " was established in 2018 and is a collaboration of Saarland University, Dresden University of Technology, and the Max Planck Institutes for Informatics and Software Systems. The German Research Foundation is funding the TRR for an initial four years with eleven million euros. The TRR investigates how the decisions of complex computer systems, which increasingly influence our everyday lives, can be made understandable and comprehensible.

<https://www.perspicuous-computing.science/>
<https://gepris.dfg.de/gepris/projekt/389792660?language=en>

Original Publication:

Biewer S., Finkbeiner B., Hermanns H., Köhl M.A., Schnitzer Y., Schwenger M. (2021) RTLola on Board: Testing Real Driving Emissions on your Phone. In: Groote J.F., Larsen K.G. (eds) Tools and Algorithms for the Construction and Analysis of Systems. TACAS 2021. Lecture Notes in Computer Science, vol 12652. Springer, Cham. https://doi.org/10.1007/978-3-030-72013-1_20

App website (with Demo-Video):

<https://www.loladrives.app/>

Further Information:

<https://www.loladrives.app/scientific-background/>
<https://depend.cs.uni-saarland.de/>

Press photographs that can be used free of charge with this press release can be downloaded [here](#).

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Background Saarland Informatics Campus:

800 scientists and about 2100 students from more than 80 nations make the Saarland Informatics Campus (SIC) one of the leading locations for computer science in Germany and Europe. Five world-renowned research institutes, namely the German Research Center for Artificial Intelligence (DFKI), the Max Planck Institute for Informatics, the Max Planck Institute for Software Systems, the Center for Bioinformatics and the Cluster for "Multimodal Computing and Interaction" as well as Saarland University with three

departments and 24 degree programs cover the entire spectrum of computer science.

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