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Rain Simulation for the Test of Automotive Surround Sensors

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The WHO Global Health Observatory data indicates that over 1.25 million people die in traffic accidents annually. To save lives, car manufacturers spend lot of efforts on the development of novel safety systems aiming to avoid or mitigate accidents and provide maximum protection for vehicle occupants as well as vulnerable road users. All the safety features mainly rely on data from surround sensors such as radar, lidar and camera and intelligent vehicles today use these environmental data for instant decision making and vehicle control. As already small errors in sensor data measurements could lead to catastrophes like major injuries or road traffic fatalities, it is of utmost importance to ensure high reliability and accuracy of sensors and safety systems.

This work focuses on the influence of environmental factors such as rain conditions, as it is known that rain drops scatter the electromagnetic waves. The result is incorrect measurements with a direct negative impact on environment detection. To identify potential problems of sensors under varying environmental conditions, systems are today tested in real-world settings with two main problems: First, tests are time-consuming and second, environmental conditions are not reproducible.

Our approach to test the influence of weather on automotive sensors is to use an indoor rain simulator. Our artificial rain maker, installed at CARISSMA (Center of Automotive Research on Integrated Safety Systems and Measurement Area), is parametrized with rain characteristics measured in the field using a standard disdrometer. System behavior on artificial rain is compared and validated with natural rainfall. With this simulator it is finally possible to test environmental influence at various levels and under reproducible conditions. This saves lot of efforts required for the test process itself and furthermore has a positive impact on the reliability of sensor systems due to the fact that test driven development is enabled.