Monitoring the Blind Spot.
What is the best technology?

Right turns by trucks are a major risk factor in traffic. Cyclists and pedestrians in the blind spot often go unnoticed, and the consequences can be fatal. State-of-the art turn assist systems can help. What is the best solution?

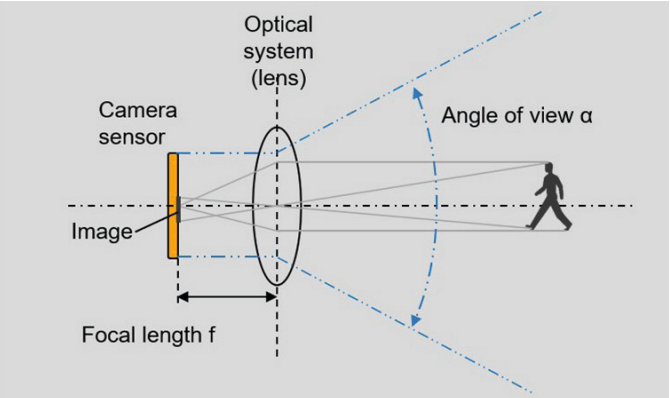
Turning maneuvers by trucks are a significant cause of accidents. Vulnerable road users like pedestrians and cyclists are especially at risk. Research has shown that about 90 percent of turning accidents involving a truck and a pedestrian or cyclist result in a fatality. Frequently, the cause is obstruction of the driver's view owing to the truck's structure – the infamous blind spot is an example.

This is where technical systems for environment recognition can make a contribution. They can help to prevent turning accidents, thus saving lives and taking us an important step towards Vision Zero, a future in which no one is injured on the road. Turn assists are very effective for this purpose. They provide assistance to truck drivers on complex and potentially dangerous right turns and contribute to better road safety. For this reason, an EU regulation will make these devices mandatory for all newly registered vehicles starting in 2024.

Comparing the technologies

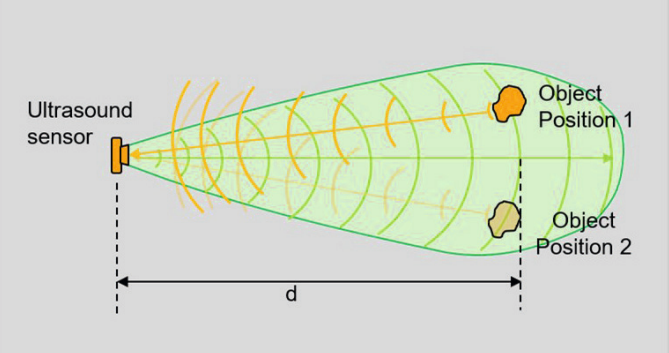
The majority of turn assists make use of one of three technologies: camera, radar or ultrasound. They monitor areas at the right of the vehicle that are difficult or impossible to see, allowing the driver to detect objects and, if necessary, react appropriately.

Turn assists that consist of a camera and a display use digital cameras to keep track of critical areas surrounding the vehicle; the images are transmitted to a monitor in the cabin. These systems can employ additional algorithms to classify objects like pedestrians, cyclists and cars, but the task requires significant computation (Picture 1). Moreover, lighting and weather conditions can impair the functioning of the system, as can dirt.



Picture 1: How a digital camera works: The optical system projects an image of the environment onto the sensor. The area covered by the image depends on the focal length and the angle of view.

Solutions based on ultrasound measure the return time of sound waves emitted by the system and picked up after reflection (Picture 2). Systems of this kind are therefore well suited for determining distances from objects. However, they cannot determine directions or velocities, and they cannot accurately classify the detected objects. Ultrasonic sensors work without difficulty at night, but like cameras they are susceptible to interference from rain, snow and dirt.



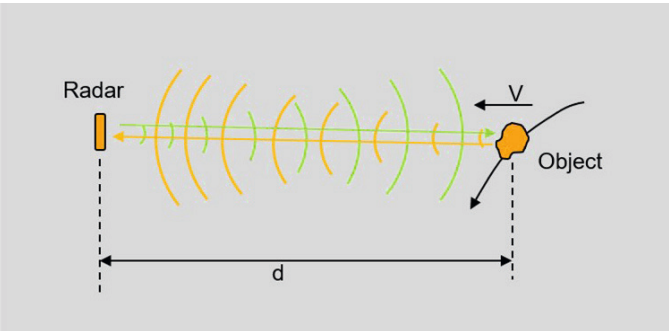
Picture 2: Ambiguity: Ultrasonic sensors can measure the distance to an object by timing the reflection of sound waves, but they cannot determine the object's direction or velocity. The object can therefore be at several different positions in the field of view.

Turn assists that work with radar, like RightViu® from Continental, are able to detect objects in the areas they monitor at the side of the vehicle or behind it. Like systems based on ultrasound, radar-based systems send out signals that are reflected by objects within their range (Picture 3). In addition, they can take advantage of what is known as the Doppler effect. Whereas stationary objects like road signs reflect a signal in the same frequency as it was emitted, moving objects like cyclists and pedestrians return a signal of a different frequency and a varying return time. Radar can therefore accurately measure both distance and velocity. Unlike camera-based and ultrasound-based systems, radar technology has the advantage of being insensitive to environmental factors like weather and lighting conditions. These systems can also be augmented by algorithms that permit classification of the detected objects.

The three technologies thus differ in terms of performance. This is especially true in regard to criteria like classification of objects, measurement of distance and velocity, and sensitivity to weather and lighting conditions. Camera-based systems are by nature superior when it comes to object classification and resolution. However, radar-based systems are generally less sensitive to environmental conditions than camera and ultrasonic systems, and they offer significant advantages when it comes to measuring distance and velocity.

Classification of objects by means of radar

The information supplied by a radar sensor can be processed by classification software like VRU (Vulnerable Road User) software from Continental. In this way, Continental's turn assist, RightViu®, can even recognize motion. For example, it can detect whether a pedestrian who is now standing had been moving just a moment before. In this way it can reliably perceive both pedestrians and cyclists and warn the driver if action is necessary. Thanks to this ability to classify objects, the system will give a warning if it notices pedestrians or cyclists in the vicinity but will ignore stationary objects like traffic lights or road signs. This is a decisive factor when it comes to gaining the acceptance of drivers.



Picture 3: How radar measurement works: Radio waves are reflected by objects, and the reflection time allows their distance to be calculated.

Help from the machine: the different warning strategies

Minimizing the risk caused by objects in the blind spot is just one part of making turning safer for truck drivers. It is also important to supply drivers with the facts they need in order to react appropriately at the decisive moment. Some warning strategies endeavor to provide drivers with a wealth of information in critical situationsso that a particular hazard can be exactly localized. In contrast, Continental's principle is to offer "the right information at the right time". RightViu® is designed to protect drivers from a flood of information in difficult situations. It avoids causing stress, which can happen when too many signals are received at once.

ENVIRONMENTAL CONDITIONS	Radar	Camera	Ultrasound
Day/night	✓✓	neutral	✓✓
Shadows cast by sun	✓✓	✗	✓✓
Rain	✓✓	neutral	neutral
Fog	✓✓	✗✗	neutral
Snowfall	✓	✗	✗
Dirt	✓	✗	✗
TECHNICAL CRITERIA			
Range	✓✓	✓✓	✗
Resolution	✓	✓✓	✗
Measurement of velocity	✓✓	✗	✗✗
Measurement of distance	✓	neutral	✗
Detection of objects	✓	✓✓	✓✓
Classification of objects	✓✓	✓✓	✗✗

A comparison of technologies according to different criteria: from very good (✓✓) to very poor (XX).

The system warns of possible collisions visually by means of a light and acoustically by means of a buzzer, both of which are mounted on the A-pillar of the vehicle. These warning signals can be processed more quickly than information on a monitor, which requires drivers to take their eyes off the road. The principle is to give them exactly the help they need. No system can offer perfect safety; each trucking company must ultimately decide for itself what solution is best for its requirements. Combinations of several sensors might also give drivers a greater feeling of safety.

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