LIDAR vs RADAR FOR APPLIED AUTONOMY.

In order to reach full autonomy, vehicles must be able to take in and understand their surroundings. And then make the correct decision based on the information. This can be done using different sensor technologies. We are going to look into and compare two of the technologies on the market: LIDAR vs RADAR – which one is best suited for Applied Autonomy?

Just like a creature of flesh and blood, an autonomous vehicle needs to perceive the world through different senses. You can achieve this type of perception and sensing by using various types of sensors, which gather information about the surroundings and format it into something that a computer can understand. Much like the human senses, there are different strengths and weaknesses, would you rather smell or taste a cup of coffee, would you be able to drink it without sight or touch? Using the correct sensor for the correct application will be crucial to a successful autonomous product. One of the many questions to look into is when to use LIDAR over RADAR,

What is Applied Autonomy?

At Semcon, we are at the forefront of developing self-driving cars. The area of Applied Autonomy focuses on services developed in order to automate all other types of vehicles and machines. Examples of applications are drones used to put out forest fires, rock drilling, vehicles used inside factories and autonomous snowploughs. Research and development in the automotive industry will pave the way for technologies, but the actual implementation in Applied Autonomy will vary depending on for example environment, safety, tasks and system optimisations.

LIDAR vs RADAR – which is the better sensor for applied autonomy?

The Applied Autonomy field is a diverse one. A technological solution perfect for one project might not work at all well for another. Applications can range from drones used to put out forest fires, rock drilling, vehicles inside a factory and autonomous snowploughs. In order to explore LIDAR vs RADAR technology we will start by learning more about each solution.

What is LIDAR and when is it better than RADAR?

LIDAR, Light Imaging Detection and Ranging, is a surveying technology using laser light pulses, as opposed to the RADAR's use of radio waves. The precision provided by LIDAR sensors is hard to beat, thanks to the large amount of laser pulses forming so called point clouds. The point cloud can then be used for various algorithms, AI, machine learning or other analysis software as you have a digitalised representation of the world. That is a clear advantage for LIDAR compared to RADAR.

As mentioned earlier, in the area of Applied Autonomy, the speed of the vehicles is not usually the problem. Large vehicles ploughing a field or moving in a restricted construction site will not have to worry about pedestrians, racing drivers or traffic lights. For this area LIDAR would in most cases be a better option over RADAR, though the technology is still expensive to use on a larger scale.

Why choose LIDAR over RADAR?

- Good at detecting small objects thanks to short wavelength
- Great precision, can build an exact 3D monochromatic image of an object.

LIDAR disadvantages

- Limited usage in the dark or in bad weather
- Quite expensive technology

What is RADAR and when is it better than LIDAR?

Both RADAR and LIDAR sensors use similar principles in order to scan the surroundings, detect objects at a distance and define their speed and disposition. RADAR, Radio Detection and Ranging, uses radio waves, and the system consists of a transmitter producing electromagnetic waves in the radio or microwave domain, a transmitting antenna, a receiving antenna [often the same antenna is used for transmitting and receiving] and a receiver and processor to determine the properties of the object[s]. Radio waves from the transmitter reflect off the object and return to the receiver, giving information about the object's location and speed.

Why choose RADAR over LIDAR?

- Long operating distance
- It can operate in more varied conditions and environments. Since it is not as sensitive to dirt, for example, and it does not have any mechanical moving parts.

RADAR disadvantages

- It can sometimes detect objects in situations where reflection and/or disturbance give the object a false size. For example, a soda can on the road can be identified as a building.
- Does not have the same fidelity as some other sensors, which means it is not as accurate as some other options.

For vehicles travelling at speed [50-70km/h or more], reaction time is extremely important and that is one of the major advantages of RADAR sensors over LIDAR. RADAR sensors are frequently used in autonomous cars today. For Applied Autonomy, where vehicles often travel slowly and in controlled surroundings, RADAR might in some cases be a good choice. But since the need for quick reaction times is less important and a construction site setting, for example, provides a lot of objects for the RADAR to react on – another sensor might be a better choice.

LIDAR vs RADAR – the conclusion

At Semcon, we work with several projects within Applied Autonomy and they all provide different sensor needs, depending on the kind of project. RADAR technology might be the perfect choice over LIDAR for an autonomous drone designed to put out forest fires or machinery ploughing large fields. But for a rock drill application or a vehicle on a construction site the long operating distance of a RADAR is useless and the meticulous precision of a LIDAR sensor is a better fit. So, to answer the question of LIDAR vs RADAR it all depends on the area of use.