Digital radar advantages over camera, LIDAR

Introduction

RADAR – radio detection and ranging – has been in existence since the early 1930s. It is most commonly recognized by large spinning antennas to track aircraft and to detect weather conditions. Within the last decade, radar has turned digital with the development and commercialization of radar transceiver integrated circuits. Today, radar sensors can fit in the palm of your hand and be powered by just a few watts of energy. With this miniaturization of size and power and the flexibility to programmatically customize on-board sensing algorithms, radar sensors are providing solutions to many different vertical markets including automotive, transportation, heavy industrial, aviation and ground service equipment.

Features

Core features of digital radar sensors are small form factor, low power and operation in extreme conditions. They can be installed on existing products without disrupting the design styling. In fact, radar sensors may be completely hidden from view by being installed behind non-metallic materials like plastic or glass while maintaining the ability to detect objects. With typical power requirements of just a few watts, digital radar sensors are easily powered by a vehicle's battery. Radar sensors are also able to operate in a variety of weather conditions: rain, snow, fog, dust, ice and a vast temperature range. This is an advantage that radar sensors have over other sensor technologies such as LIDAR, ultrasonic and cameras, which must be clear of dust, dirt, water, snow, etc. in order to be fully functional.

The particular sensing capabilities of a radar sensor is dependent upon its design. The antenna design determines the field of view, ranging from narrow such as 10-degrees for forward collision warning applications with detection distances of hundreds of feet to wide field of view such as 80 degrees for zone monitoring with detection distances of tens of feet. Some radar sensors are designed with just one transmit and one receive channel, whereas others have multiple transmit and receive channels. Multiple channels are needed for applications that require higher accuracy measurements and/or multi-dimensional measurements, e.g. distance and angular position of detected objects.

A key characteristic of digital radar sensors is the flexibility to support different types of signaling and to customize the on-board measurement and signal analysis algorithms. Radar signal types include pulse, frequency shift keying (FSK), continuous wave (CW), frequency modulated CW (FMCW) and variants thereof. Depending on the signal type used, certain characteristics of detected objects can be measured: distance, speed, direction of motion and angular position. In addition, the sensor may be designed to detect only moving objects, or it may detect both moving and stationary objects. Delta Mobile Systems' ultra-near range detection of objects within inches of the sensor is an example of a highly-customized algorithm, which is available on Delta Mobile's **SensOn™** smart radar sensor product line.

Flexibility is integral in meeting different markets' needs.

Market Segments

One problem that arises with sensors in vertical markets is the capacity to function in inclement weather. Heavy rain or heavy fog can be challenging for some sensor technology performance, but radar sensors are able to see long distances through the harsh weather. In industrial markets, dust is a common environmental condition. Whether it's construction, agricultural or factory settings, debris and dust are in the air. Whereas a traditional camera is unable to clearly see through the dust, radar sensors can, helping to improve safety in dangerous environments.

Efficiency is important in the aviation market. By using smart radar sensors, crews do not have to stop to wipe clean a lens. This allows a crew to focus on other functions of the airplane and to get it into operation as quickly and efficiently as possible. In addition, ground service crews at airports are concerned with equipment bumping into airplanes, especially since detecting damage to new fuselages made of composite material is difficult and expensive. Therefore, airline operators are now integrating advanced collision warning systems on ground service equipment to reduce the number of collision events.

The National Highway Traffic Safety Administration (NHTSA) reported that 94% of motor vehicle crashes are caused by human choice or human error. Smart radar sensors are being integrated with vehicles to provide features like blind spot assistance, pedestrian detection and forward and rear collision warning. Those features, whether in the form of passive or active safety systems, are providing assistance to drivers.

Vertical market companies may be concerned about sensor systems affecting their overall product dimensions or weight. Delta Mobile Systems' **SensOn™** smart radar sensors have one of the smallest form factors and thus can be mounted on a vehicle, an airplane or specialty equipment without adding significant weight.

A ruggedized, small form factor and the ability to operate in inclement weather lend digital radar sensors to be an advantage in addressing vertical market needs.

System Integration

When integrating radar sensors with existing products, it is important to note a few things. The first is target market and applications. In certain geographical regions or markets, there may be certification requirements. It is vital to pay attention and seek out any regulations that may exist.

Sensor placement is also significant. Depending on the application, sensors need to be placed in specific areas in order to detect objects. For instance, if zone detection on the outside of a building is the application, sensors must be placed accordingly to detect potential intruders or disruptions. They must also be tuned correctly to detect objects within the desired zone. Another example is surround view. Sensors have to be installed around a vehicle and tuned correctly to be able to detect pedestrians or other vehicles 360 degrees around the vehicle. The number of sensors may vary depending on the desired coverage area and field of view.

Testing is imperative with any sensor system. A multitude of tests should be run to ensure the system functions properly and reliably in the intended operating environment and use cases.

Conclusion

High-performance features like a ruggedized, small form factor and ability to function in challenging environmental conditions are what make digital radar sensors and, specifically, the **SensOn™** 3x smart radar sensor system from Delta Mobile Systems an advanced solution for vertical markets' needs. Because of their design flexibility, digital radar sensors can be semi-customized for aviation, automotive, transportation and heavy industrial markets providing object detection for a variety of needs.

About Delta Mobile Systems

Delta Mobile Systems designs, manufactures and sells intelligent wireless products and smart sensor systems to industry leaders worldwide in vertical markets. The company's evolving portfolio of solutions helps its customers overcome their challenges in fast-changing industries. Delta Mobile's diverse product portfolio is comprised of leading-edge smart radar sensor and sensor fusion technologies. Visit Delta Mobile Systems' website, www.deltamobile.com, to learn about the **SensOn™ 2x** and **SensOn™ 3x** smart radar system product portfolio.