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Press Release

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Panasonic Advances Automotive Millimeter-Wave Radar Technology to Detect Pedestrians and Vehicles in Low Visibility Conditions

Osaka, Japan - Panasonic Corporation today announced it has developed an advanced radar technology for next-generation traffic safety systems that enables to detect humans and vehicles in a range of several tens of meters. This millimeter-wave radar technology allows for detecting objects outdoors in poor visibility conditions, such as night, rain and snow, as well as against the sunlight. When applied in traffic surveillance sensors located at intersections, this innovative technology will help increase automotive safety by detecting pedestrians and bicycles hidden in the driver's blind spots.

By alerting the driver of the presence of pedestrians in the crosswalk or bicycles in blind spots, Panasonic's advanced radar technology helps reduce the driver's burden and traffic accidents at intersections, which account for about 50% of all traffic fatalities.

As accidents at intersections account for about a half of all traffic fatalities, preventive measures are required to avoid collisions there involving cars, pedestrians and cyclists. Panasonic's new radar technology enables traffic monitoring sensors at intersections to detect pedestrians and bicycles up to 40 meters ahead even at nighttime and under bad weather conditions that hinder the driver's visibility. By alerting the driver of the presence of pedestrians in the crosswalk or bicycles in blind spots, this technology helps to reduce the driver's burden and traffic accidents.

Panasonic's new automotive radar technology has overcome the difficulties with conventional millimeter-wave radar technologies; the advanced radar technology is capable of detecting humans and cars simultaneously in spite of the fact that human body reflects extremely weak radar signals compared with car body. This innovative radar technology has also achieved high detection performance with a range resolution of less than 50cm and an angular resolution of 5 degrees, which enables to detect pedestrians and vehicles. Furthermore, unlike optical and infrared cameras and laser sensors, whose detection performance can be significantly affected by visibility conditions, this new radar technology will not be subject to such conditions as nighttime, rain, snow or dense fog.

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Panasonic has developed and incorporated the following new element technologies to realize the new millimeter-wave radar technology for automotive applications:

1) Coded pulse modulation technique that employs a newly designed code sequence for pulse radar method[1] to improve sensitivity characteristics, thereby achieving extension of the detection range and finding out small objects that have weak radar reflection.

2) Adaptive antenna technique that combines radar beamforming transmission[2] and adaptive array antenna reception[3] with signal processing algorism for estimation of target direction, thereby achieving high angle resolution even with a smaller antenna compared with conventional one.

With regard to millimeter-wave radars, there presently exist radars for vehicle to measure distance to the vehicle in front. However, these radars cannot detect human body with high resolution due to very weak radar reflection of human body. In addition, an optical camera is commonly used as a traffic surveillance sensor. However, it cannot work well under certain conditions such as nighttime because it can provide almost the same information as the human eye can capture.

Panasonic has achieved the new radar technology as part of the “Research and Development Project for Expansion of Radio Spectrum Resources” supported by the Ministry of Internal Affairs and Communications of Japan. The company will demonstrate the technology at VTC (Vehicular Technology Conference) 2012-Spring (May 7 to 9 in Yokohama, Japan), using a test equipment with an experimental radio license.

On the new radar technology, Panasonic holds eighteen patents in Japan and six patents overseas including pending applications.

<More on the Technology>

1) Coded pulse modulation technique:

In case of pulse radar method, a radar pulse, which modulated by a digital code sequence with good auto-correlation characteristics[4], makes possible to detect reflected pulse in smaller difference of arrival time than radar pulse width. This technique employs a newly designed complementary code sequence[5] for radar pulse modulation. In reception signal processing, this modulated radar pulse shows a good signal-to-noise ratio of more than 40dB, which realizes human body detection even if reflected signal level is as weak as 1/10000 of the levels from car body. This improvement of sensitivity enables detection of humans and objects located in a far area.

2) Adaptive antenna technique:

In order for locating targets in a wide area, it is necessary to know not only range but also angle information from sensor position. One of conventional methods is beam scan method, and angle information is given from scan angle when reflection is detected. However it is necessary to make very narrow beam in case of fine angle detection and this requires wide aperture size for antenna. This technique consists of beamforming transmission to prevent radio reflection from clutter existing in undesired direction area, and adaptive array antenna reception with signal processing algorism for estimation of target direction to achieve fine angle resolution of 5 degrees corresponding to about half of beam angle, as well as wide area detection by electrical beam scanning. This effect realizes small target detection such as pedestrians and bicycles as compared with car body without using wide antenna.

Notes:

[1] Pulse radar method

This is one of the radar methods which sends pulsed radio wave to target and measures time of flight (ToF) of reflected wave from the target. A target range can be calculated by multiplication of light speed and a half of ToF.

[2] Beamforming transmission

This is a radio transmission technique to form a radio beam shape to the specified direction in order to extend a reach of emission. This employs essential radio characteristics of wave interference, and can be realized by emitting radio wave from multiple antennae and controlling output level and phase of radio wave from each antenna.

[3] Adaptive array antenna reception

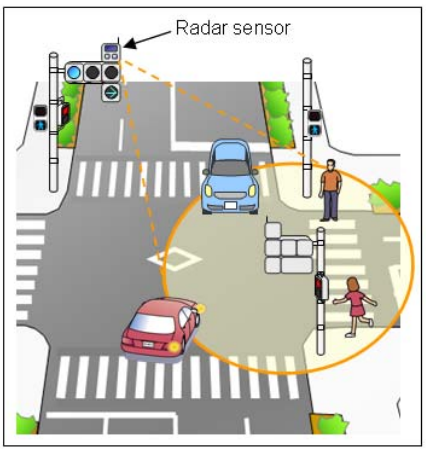
This is a radio reception technique to receive radio wave only from specified direction by receiving from multiple antennae and weighting the reception signal in terms of level and phase for each antenna. In case of radar reception, this is effective because interference wave reflected from clutter in an undesired direction can be suppressed by controlling reception directivity to direction of targeted detection area.

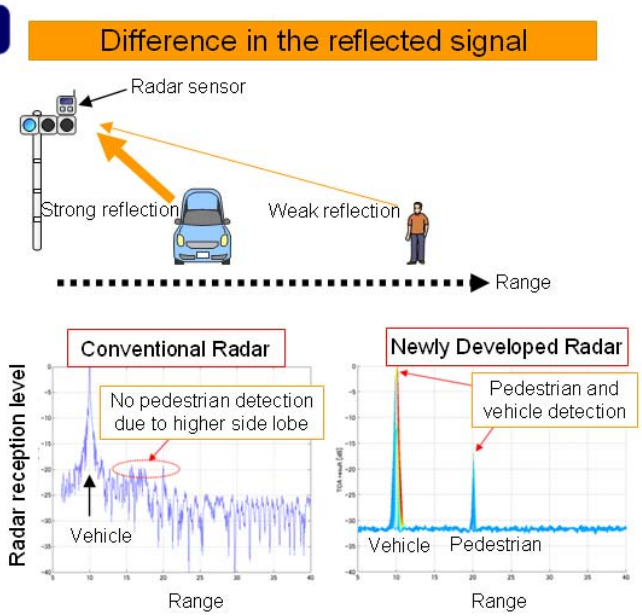
[4] Auto correlation characteristics

This characteristic shows similarity of two signals. In case of pulse radar signal processing, arrival time of reflected radar wave can be found by evaluating this characteristics between received and transmitted radar pulse signals.

[5] Complementary code sequence

This is a kind of digital bit sequence commonly employed in wireless LAN communication, and this shows good auto-correlation characteristics. This code has such a feature that the number of same bit pair is the same as the number of different bit pair in comparison between two complementary code sequences.





About Panasonic

Panasonic Corporation is a worldwide leader in the development and manufacture of electronic products for a wide range of consumer, business, and industrial needs. Based in Osaka, Japan, the company recorded consolidated net sales of 8.69 trillion yen (US$105 billion) for the year ended March 31, 2011. The company's shares are listed on the Tokyo, Osaka, Nagoya and New York (NYSE:PC) stock exchanges. For more information on the company and the Panasonic brand, visit the company's website at http://panasonic.net/.

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