Navtech Radar Ltd
Unit 16 Home Farm
Ardington
Wantage
Oxfordshire, UK
OX12 8PD

Tel: +44(0)1235 832419
Fax: +44(0)1235 821675
info@navtechradar.com
www.navtechradar.com

Navtech Radar W800-V Autonomous Vehicle Navigation and Obstacle Detection Sensor

77GHz FMCW Radar

Background

Navtech Electronics Limited was founded in 1999 by a team of engineers with more than ten years experience with millimetre wave radar. Our engineering and manufacturing team are dedicated to providing the most technically advanced industrial radar sensors and systems available, enabling us to translate clients ideas and needs into cost effective solutions. Navtech is uniquely qualified to tailor millimetre wave radar technology to client requirements.

Autonomous Vehicle Navigation

Autonomously guided vehicles (AGVs) are becoming increasingly common in the industrial workplace. Small vehicles have been utilised inside factories as an aid to transport components of completed assemblies for decades. The environment on a factory floor can be set up to provide optimum conditions for these machines to operate effectively. This may include the placement of markers on the floor for the machine to follow or retro-reflective strips for a laser scanner. Adverse weather and uneven surfaces are rarely a problem in these situations.

Patrick Corp. AutoStrad®

AGVs are increasingly being used in mines, ports and other unstructured environments. For robust, reliable operation they must operate over the full range of climatic conditions, including rain, fog and dust. To this end, a sensor is required that can accurately measure surrounding features under all operating conditions. The ability of an autonomous vehicle to use such measurements in order to localise is probably one of the most important aspects of AGV control.

Officially opened in December 2005 by Queensland Premier the Hon. Peter Beattie MP, the Patrick Corporation's $106 million AutoStrad® Terminal at Fisherman Islands Brisbane is Australia's first automated container terminal.
The automated 10-metre high, 65-tonne straddle carriers are fitted with uses Navtech FMCW 77GHz radars as an integral part of sophisticated motion control and navigation system which allows them to operate unmanned - moving and stacking containers from the quay, into holding yards, onto vehicles, and back to quay cranes with pin-point accuracy as the world's first 'free-ranging' automated straddle system

Vehicle Obstacle Detection

In addition to the navigation function, the Navtech radar is ideal for use as an obstacle detection sensor. If a radar is placed at a suitable point on a vehicle, it can be used to detect obstacles such as people or rocks in the vehicle's path. This can provide a useful safety sensor for operation at night or in bad weather, as an aid to the driver in manually operated vehicles. For autonomously guided vehicles, radar may provide the only safety function.

In the dark or in bad weather the man won't be visible to a vehicle operator. In an autonomous operation the obstacle detection system is the only means of detecting the man. If an obstacle is not detected within a given time period, a health message is sent this serves as a heartbeat message. If this message is not received, the controller can assume there is a problem with the obstacle detection safety function and take appropriate action with the vehicle.

The Defense Advanced Research Projects Agency (DARPA) organised a desert race for self-navigating robotic vehicles. The race was named the Grand Challenge because of its requirements to cross 200 miles of unfamiliar, rough terrain in 10 hours or less, without any human assistance fell well beyond the capabilities of any robot yet designed.

The robotic racers had to be fully autonomous; during the race they could not receive signals of any kind (except a stop command) from humans. The vehicles had to stay on the ground and within the boundaries of the course.

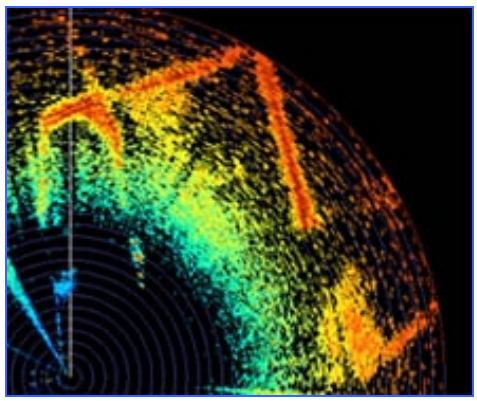
Two of Navtech's FMCW 77GHz radar were procured by Carnegie Mellon University, financed by Boeing, and Duke University, financed by SAIC, respectively, to provide obstacle detection on their vehicles to pick up obstructions even when the dust or glare blinded the other sensors. Both vehicles completed the course in 2005, finishing second and third.

DARPA Grand Challenge Red Team Vehicle

Navtech Radar supplies Frequency Modulating Carrier Wave (FMCW) 77GHz commercial off the shelf radar, including signal processor, control system, Ethernet interface, housing, radome and scanner to the following technical specification :

Specification:

Transmit frequency	76 to 77 GHz transmit frequency
Beam width	2 deg Azimuth, 2 deg Elevation
Transmit Power	15dBm max
VCO Bandwidth	600MHz
Sweep time	1mS
Scanner Resolution	0.09 degrees
Scanner field of view	360 degrees
Range resolution	25 cm
Max Range	500 m
Scan Speed	2.5 Hz.
Interfaces	RS232, 100Base-TX Ethernet
Supply voltage	+24V nominal (18-36V)
Environmental	IP66, NEMA-4X
Temperature	-20 to +70 degrees C
Vibration	6.8g 5-200 Hz
Approx Size	323x323x479 mm, Cast aluminium housing



Example code and radar viewer software for windows will be provided.