NEW GENERATION OF NON-INVASIVE SENSORS FOR ROAD SURFACE CONDITION

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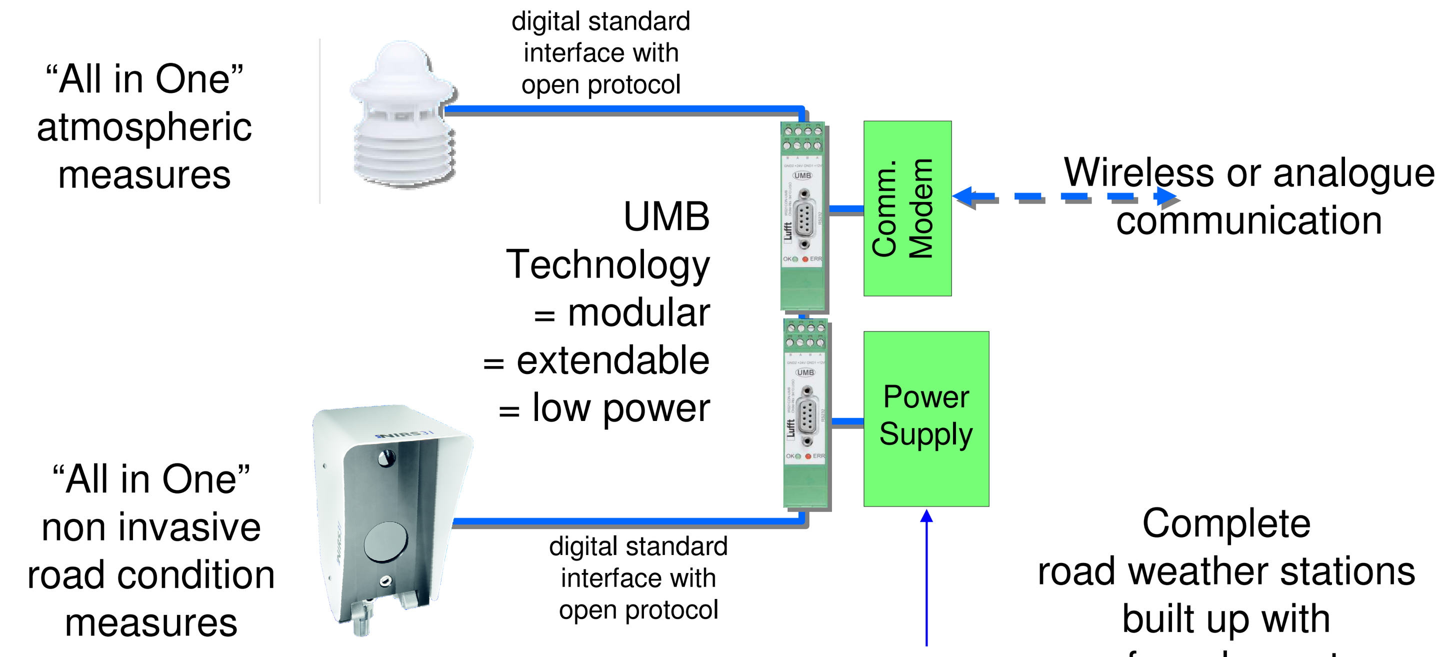
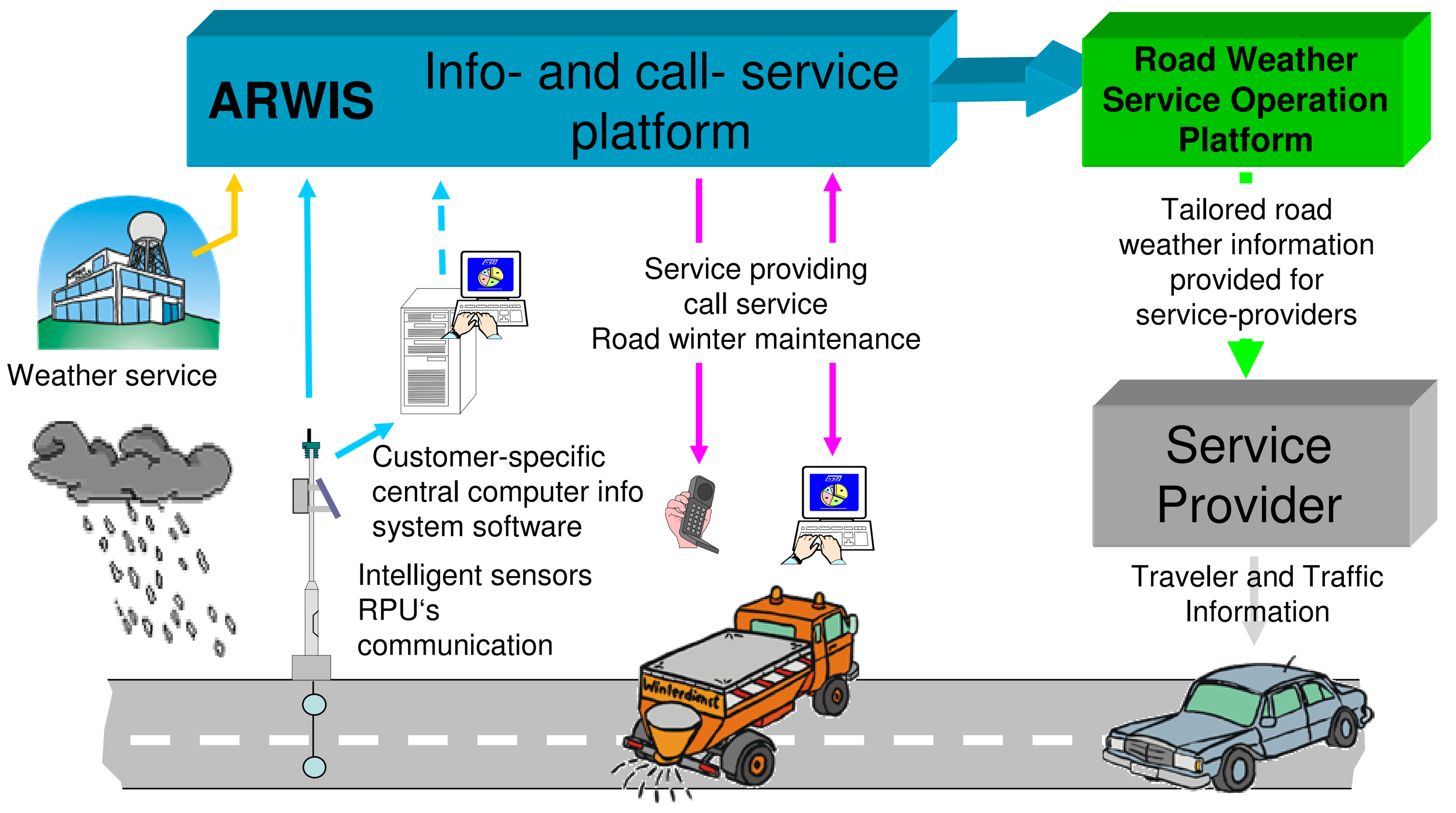
Lakeside Conference 2010

New intelligent sensor technology

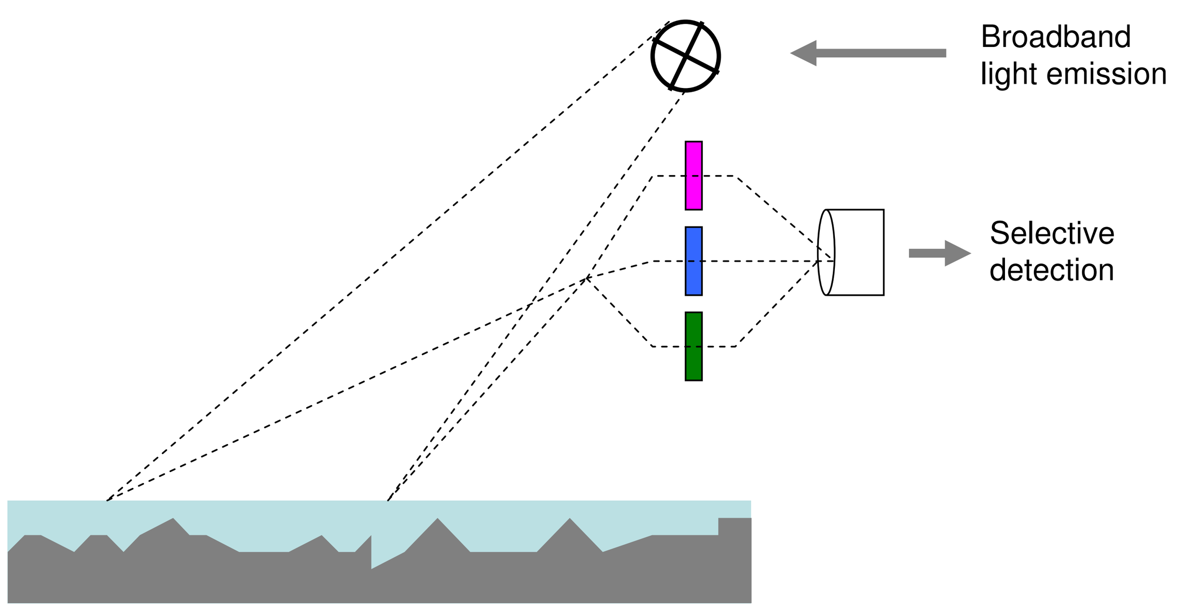


This technology makes it affordable enhance the capability of providing optimal Road Weather Condition Information

The road weather information policy



Current development: Non-invasive detection of road surface condition



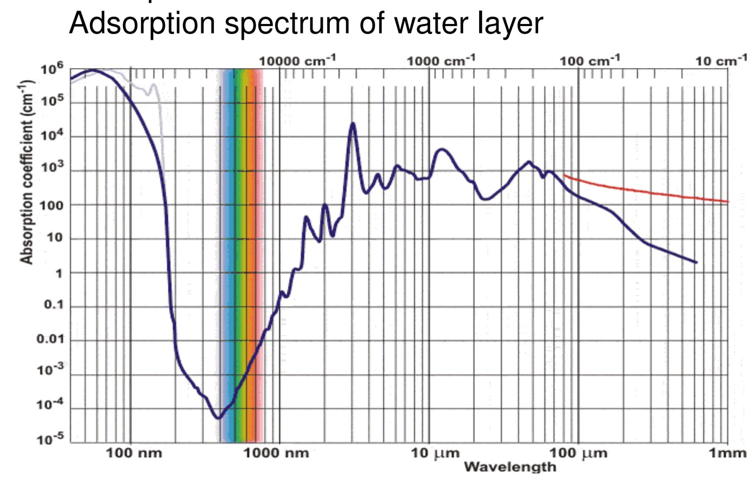
Prototype NIRS

Selective detection of light adsorption at 3 (up to 8) different spectrum lines.
reports:
- Water-layer-thickness
- Ice-layer-thickness
- Snow-layer-thickness
- Friction

Broadband light emission

IR detection
reports:
- pavement surface temperature

Example:
Adsorption spectrum of water layer



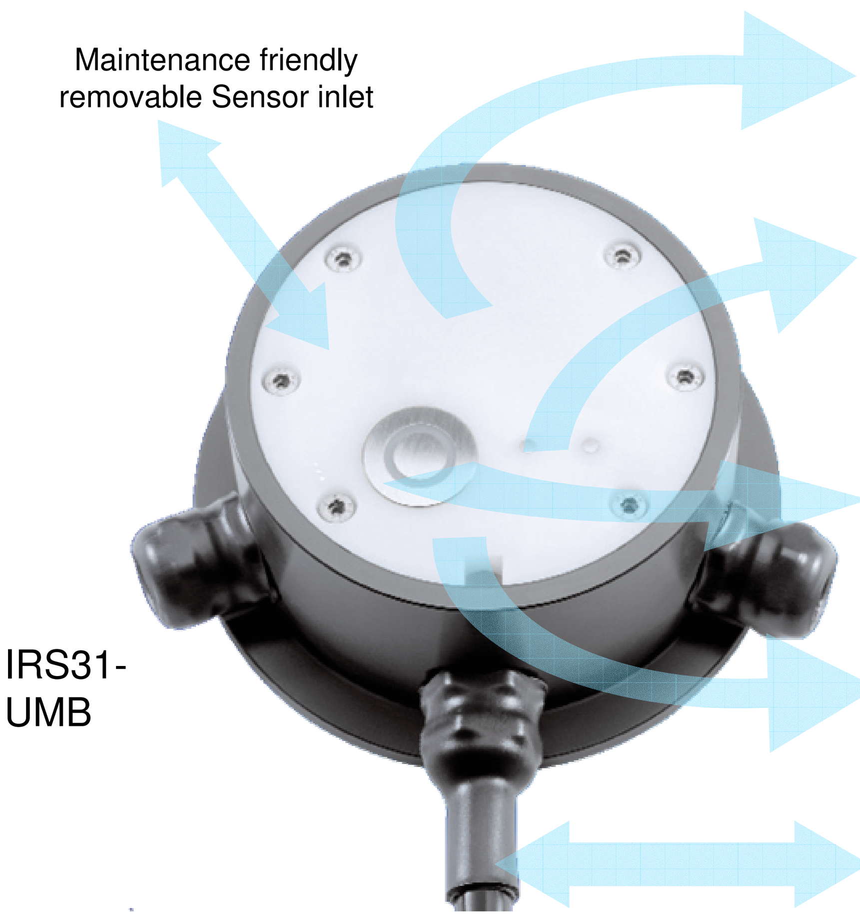
Comparison chart: non-invasive or invasive?

Applications:	IR Camera	IRS31-UMB passive	Combination: IRS31 passive ARS31 active	Non-invasive NIRS31
Winter maintenance on roads	***	****	****	***
winter maintenance on roads with forcast and early warning	***	****	****	**
Winter maintenance on Airports	**	***	****	--
Winter maintenance on Airports with forcast and early warning	**	***	****	--
Automated Traffic control systems	**	****	***	****
Traffic information purposes	***	***	**	****

explanation:		
	****	best suitable
	***	good applicable
	**	applicable
	--	not suitable

Intelligent and compact device for a complete road condition measurement

Maintenance friendly removable Sensor inlet



IRS31-UMB

Innovative **microwave radar** measurement of water film depth up to 4 mm
- Resolution: 0,01 mm
- Accuracy: 0,1 mm + 20%

Passive measurement of salt concentration and freeze temperature by means of **conductivity** allow for water film depth

Surface condition detection by means of measuring the **dielectric** characteristic
→ dry, moisture, wet, ice, snow, slush

Surface temperature with optional 2 sensor interfaces for subsurface temperature (e.g. 30 cm)

Digital data communication interface (RS485) with **open protocol**

Intelligent and compact device for atmospheric measurements

Innovative principle **(R²S)** of measuring precipitation by means of **microwave Doppler radar**.
- Type of Precipitation (Hail, rain, snow, drizzle)
- Intensity of Precipitation (mm/h)

Measurement of wind direction and wind speed by means of **ultrasonic** principle
= precise measurement without mechanical moving parts.

Measurement of air pressure

Protection shield and active ventilation for measurement of air temperature and relative humidity.

Digital communication with open protocol
Power supply in one cable

Active measurement of freeze temperature provided by a compact road surface Sensor

Maintenance friendly removable Sensor inlet

ARS31-UMB

"Active" measurement of freezing point temperature by means of cooling down and heating up a very small area in order to detect the "enthalpy change" of forming ice without a significant impact to the surface condition.

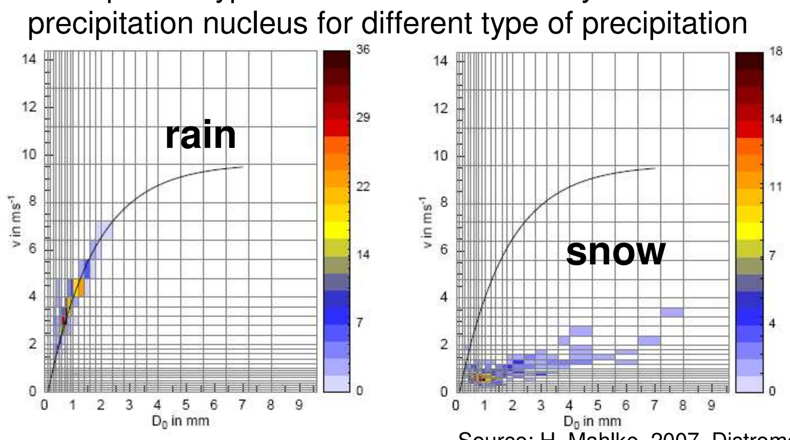
Surface condition detection by means of measuring the **dielectric** characteristic

Digital data communication interface (RS485) with **open protocol**

Doppler radar detector principle

24 GHz microwave Doppler radar measures velocity and dimension of nucleus in order to detect type and intensity of precipitation

Examples of typical distribution of velocity and dimension of precipitation nucleus for different type of precipitation



Source: H. Mahlke, 2007, Distrometer