Road Weather Information Systems

Road & weather data, forecasting, early warnings

IMS RWIS
Road Weather Information System

FEATURES:

- Road Weather Stations
- Flexibility - different sensors
- Data Acquisition Solution (UDCS)
- Database and Data Processing
- Fog and Ice Predictions
- Low Visibility Systems
- Real-time displays and early warning

The measurement module offers:

- Interfaces for the various sensors and data loggers: RS232 / RS422 / RS485, TCP/IP (http, ftp and telnet protocols)
- Data collection based on TCP/IP network and/or RS lines, radio, USB
- Numerous input data formats supported (raw text/ binary, XML),
- Data input based on Plain2XML convertors
- Quality control, verification of measured data, format validation
- Real-time weather displays, web screens

The automatic road weather station provides ground-truth data acquired in-field on the road.
The data are displayed on the real time displays. The ground measured data are used as input for the fog (ice) forecasting model, improving the results of the model.

The automatic weather station consists of several parts

- Data Logger
- Sensors
- Meteorological mast
- Accessories

Field Sensors
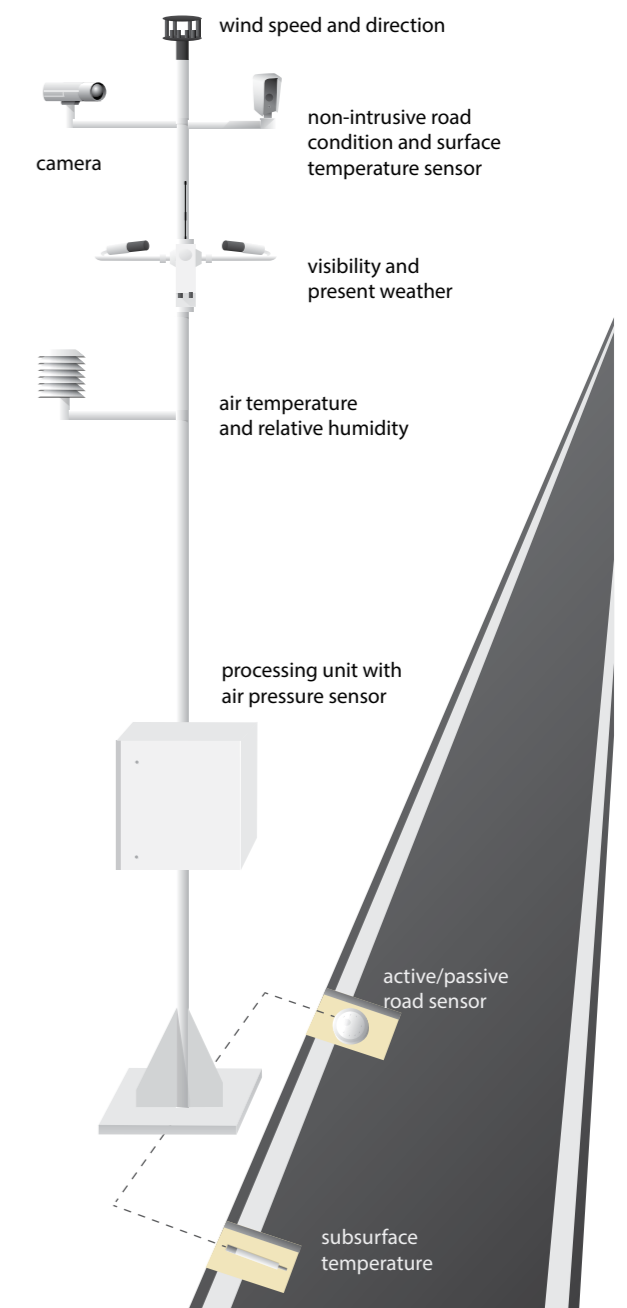
The typical set of field sensors consists of:

- Wind speed and direction sensors
- Pressure sensors
- Temperature and relative humidity sensors
- Visibility and present weather sensors
- Soil temperature and soil moisture sensors
- Camera

I**ntrusive pavement sensors:**

- Intelligent Road Surface (IRS) Condition Sensor measures surface and underground temperature, salt concentration, freezing temperature, water film heightand road condition
- Active/passsive road sensors

Non-intrusive pavement sensors:

- Surface temperature
- Road condition

wind speed and direction

non-intrusive road condition and surface temperature sensor

camera

visibility and present weather

air temperature and relative humidity

processing unit with air pressure sensor

active/passive road sensor

subsurface temperature

IMS Road Weather Information System is a unique system consisting of several meteorological stations strategically located alongside the highway that offer detailed information about weather and road conditions

The Road Weather Infromation System consists of several components. The in-field Automatic Road Weather Stations communicates with UDCS via GPRS (radio modem, TCP/IP,...). UDCS acquires the measured data. The data are processed by a quality control system and are stored in the database. The UDCS communicates over GTS with an external model and receives the weather forecast data, which are stored in the database, as well.

The database provides both measured data and forecast data to the fog and ice modeling software. The fog and ice modeling software computes the fog and ice predictions forecast and sends them to the database. The real-time displays are updated immediately as the data are acquired from the RWS. The operator on duty can directly see the actual situation in the field. The real time displays visualize the fog prediction forecast on the screen, as it is prepared by the fog (ice) modeling software.

The operator on duty is responsible for decision making and issuing of the control commands to the road sign boards. The operator's decision is based on information provided by the real-time display and procedures approved by the local authorities.

The road sign boards can be updated automatically with the actual notification regarding the measured visibility or other meteorological phenomena.

Measurement

The system can interface numerous types of data-loggers and sensors. It is designed to measure, calculate, and process different meteorological quantities as temperature (air, road), wind speed and direction, atmospheric pressure, relative humidity, precipitation (indicator and amount), visibility, road condition (ice, snow, wet, dry), freezing point, and is open to adjust for measuring and processing of other quantities, if needed.

IMS RWIS
System description

Modeling and Forecasting

The fog and ice forecasting models provide the local visibility forecast and prediction of the ice frost.

Although the fog (ice) model cannot prevent the weather conditions, it provides early warning on possible formation of water fog (ice frost). The models are to be taken as early warning to sharpen attention of the operators.

Real-Time Display

The real-time display is a collection of screens installed in the central office. Its main purpose is to display the real-time data acquired from the in-field AWS, to visualize the fog (ice) prediction, as well as the current condition of the road, from the model output. It shall be used by operators on duty to support the decision-making process and to enable early warnings.

Alarms

IMS Road System allows to configure rich set of alarms including:
- Diagnostics of data logger and sensor errors
- Quality control of measured data (limits, internal consistency)
- Operational alarms (user-defined thresholds and limits)
- Communication errors

Road Weather System
(Road & Weather Data)

Weather Forecasting
(Nowcasting/Forecasting) → **Database** ← Mobile Road & Weather Data

Maintenance Decision Support System (MDSS)

Alarms
Low Visibility
Wind Alarm
Black Ice

Real Time Displays

Fog Prediction

Measuring stations are of great importance: firstly, they provided real-time data for operative modelling, secondly, they were used in machine learning of data mining models and finally, they provide instant data for decision-making.

The measured parameters are:
- Temperature at a height of 2 m
- Humidity at a height of 2 m
- Wind at a height of 4 m
- Pressure
- Horizontal visibility at a height of 2.5 m (forward scatter)
- Camera
- Additional soil moisture in 3 depths of 5, 10 and 20 cm
- Soil temperature in 3 depths of 5, 10 and 20 cm

All the data are available with high frequency – every 2 minutes, with exception of the camera. The picture from camera provides additional visual information for users of sensor data and proved useful e.g. for verification of visibility conditions.
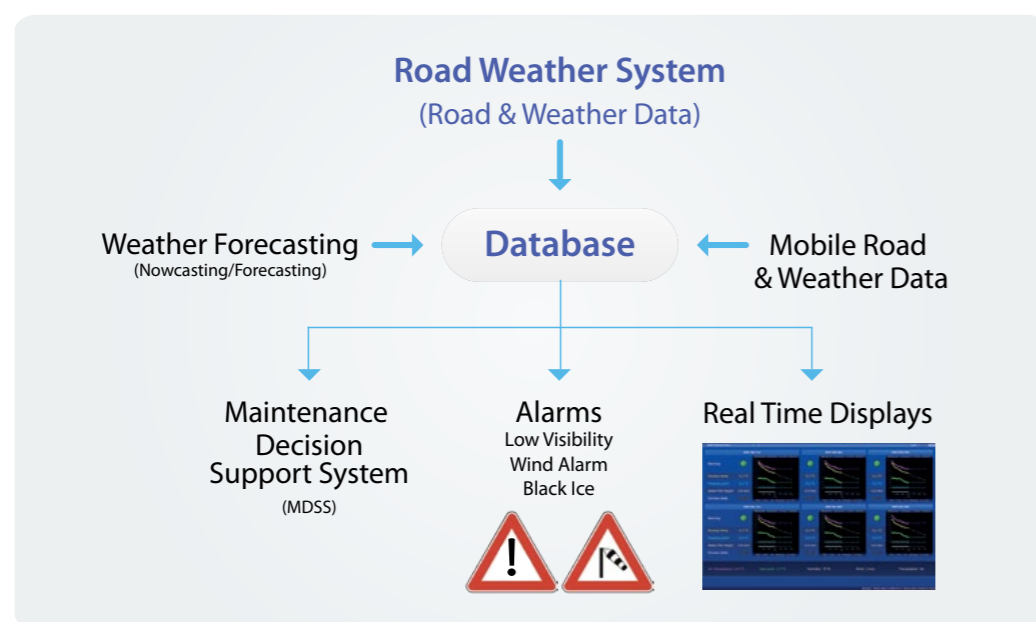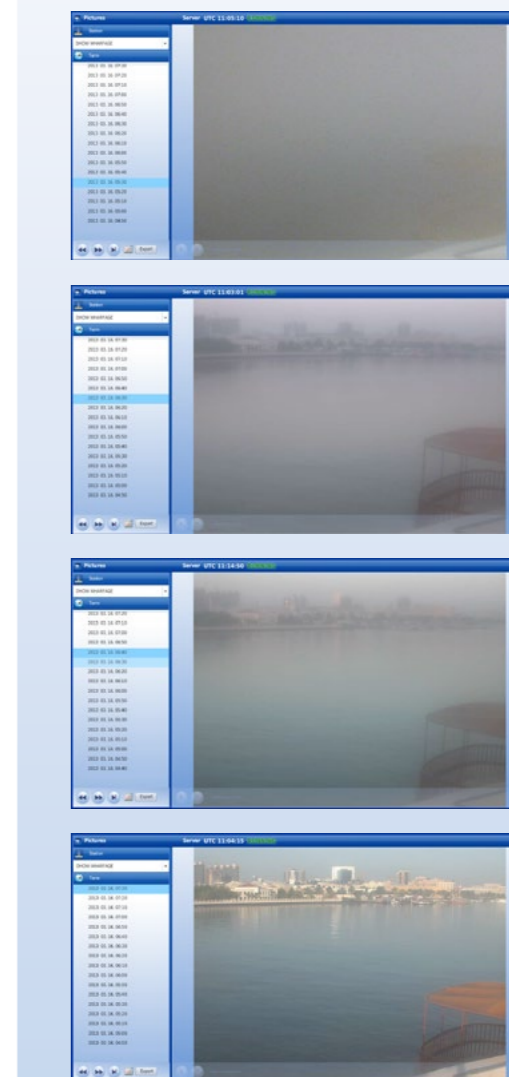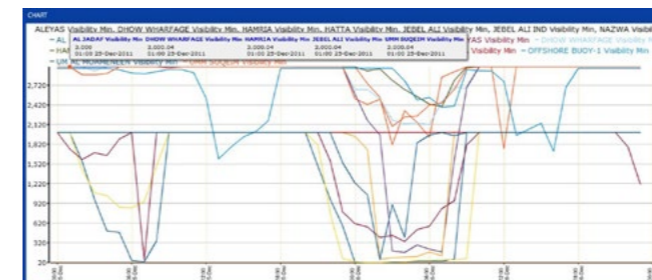
Road Weather Information Systems References

2007	• 43 Road Automatic Weather Stations, Lithuania
2008	• 4 Automatic Weather Stations connected to IMS Road System, Iran Meteorological Organization, Iran
2010	• Visibility Monitoring and Forecasting for Traffic Safety, Dubai Emirate, United Arab Emirates
2012	• Airport Runway Weather Information System, Airport Otopeni, Romania • 50 Road Automatic Weather Station, Lithuanian Road Administration, Lithuania
2013	• Ground Frost System, Vilnius Gediminas Technical University, Lithuania • 5 Ground Frost Systems, SIA FIMA Latvia
2015	• 3 Road Weather Stations, Department of Transportation, Abu Dhabi, U.A.E (in progress)

IMS Road Weather Information System, Dubai
MicroStep-MIS Success Story

Tender:	IMS Road Weather Information System
Client:	Dubai Municipality
Contractor:	Unique System FZE

Dubai Municipality

is the municipal body with jurisdiction over city services and the upkeep of facilities in the Emirate of Dubai, United Arab Emirates

United Arab Emirates

After a serious car accident in March 2008, Dubai Municipality decided to purchase and install a road fog early warning and forecasting system. As for each business opportunity, choice of the right partner is the essential step to be done. MicroStep-MIS with its partner Unique have been chosen by Dubai Municipality to realize the project.

Because of the proven high professionalism and positive experience from the past, we were glad to cooperate with Unique Maritime Group, a global provider of integrated support services for the offshore industries. As a result of creating a strong team together, we have managed to build a unique and complex road warning system for the Municipality of Dubai. The system has been installed in 2009 and is operating properly till today.

In this project, Biral SWS100 road sensor has been introduced by MicroStep-MIS. *"MicroStep-MIS decided to use Biral's SWS100. In spite of the fact that at the time of the tender it was a fairly new product, we had an excellent long-term experience with the HSS series of sensors; therefore we expected the SWS100 would be of a similar quality. After more than one year of operation we can confirm that our expectations were fulfilled. We haven't had any problems with the installed visibility sensors,"* says Jozef Omelka, Managing Director, MicroStep-MIS.

Product description

IMS Road Weather Information System is a unique, complex and highly comprehensive system containing several meteorological stations strategically located alongside the highways that offer detailed professional information about the weather and the road conditions. Specialized cutting-edge hardware equipment and computer software analyze the weather and the visibility, providing inputs for the forecasting models.

System establishes 8 Automatic Road Weather Stations, and further integrates 5 existing weather stations as well as a buoy used for measurement of water temperature and water level. Powering of the devices is ensured by using high performance solar panels.

The data-center delivered by MicroStep-MIS is connected with the Dubai Municipality central database, providing up-to-date and fully comprehensive data for the system 24 hours a day.

Ensuring complex approach to the fog prediction and enriching the visibility measurements, the system is also available online on the Municipality website to provide further monitoring & analysis features.

"The information is used by government departments, initially by Dubai Police and Coastal Guards. It will help them to take appropriate action in case of low visibility and fog. They are able to warn drivers about fog conditions in order to prevent road accidents," said Mohammad Mashroom, Director of Survey Department of Dubai Municipality for Gulf News.

Real-time weather and forecast information

The actual values of temperature, relative humidity, rainfall, water level, as well as wind speed & direction in different parts of the Municipality are provided every two minutes, ensuring continuous and up-to-date data for the traffic safety.

Road stations improve timeliness of maintenance actions, increase winter maintenance efficiency, and minimize the traveling public's exposure to hazardous weather-related roadway conditions.

Modeling and Forecasting

The fog forecasting models provide the local visibility forecast and prediction of fog evolution on traffic locations. Although the fog model cannot prevent the undesirable weather conditions, it provides early warning on possible formation of water fog (ice frost). The models are to be taken as early warning to sharpen attention of the operators

The system provides excellent results. *„For the last fog season in Dubai (10.2011 – 3.2012) we have achieved success in fog forecasting at 95% (the POD score) with only 18% of false alarms,"* Juraj Bartok, forecaster from MicroStep-MIS confirms the quality of the system.

Media inform about our system:

- Khaleej Times – Dubai gets own fog monitoring stations
  http://www.khaleejtimes.com/displayarticle.asp?xfile=data/theuae/2012/January/theuae_January65.xml&section=theuae&col=
- Gulfnews – New system to prevent fog-related accidents
  http://gulfnews.com/news/gulf/uae/environment/new-system-to-prevent-fog-related-accidents-1.960903
- Ame Info – Dubai Municipality delegation visits Slovakia to study about fog control
  http://www.ameinfo.com/281444.html

Challenge

- Improve safety by comprehensive fog predictions
- Rapid development, integratiowwn & delivery

Our solution

- Very complex system
- Emerging technology installation
- Monitoring & forecasting solution preventing road accidents

Achievements

- Wide utilization of the system
- High success in predictions
- Fast delivery

About MicroStep-MIS

MicroStep-MIS operates worldwide and is specialised in development and manufacturing of monitoring and information systems, processing of acquired data, research and numerical modeling.

Company activities cover the complete process of software and hardware systems development and system integration.

MicroStep-MIS products and comprehensive services fully comply with the technical requirements, as well as with the international standards (ISO 9001:2008,

ICAO, WMO, EUROCAE), and are traditionally supplied at a very competitive financial and trade conditions.

Our highly qualified staff of developers and experienced researchers, dynamic product development, and close cooperation with our customers guarantee developing and delivering of the most progressive and outstanding solutions to every, what ever specific, customer's demand.

The company's key fields activities cover:

- **Meteorology and Climatology**
- **Aviation Systems**
- **Road Weather Information Systems**
- **Microclimate Cave Monitoring Systems**
- **Radiation Monitoring System**
- **Emission Monitoring and Air Quality**
- **Marine and River Systems**
- **Warning and Crisis Information Systems**
- **Seismological Monitoring Systems**

MicroStep-MIS new products:

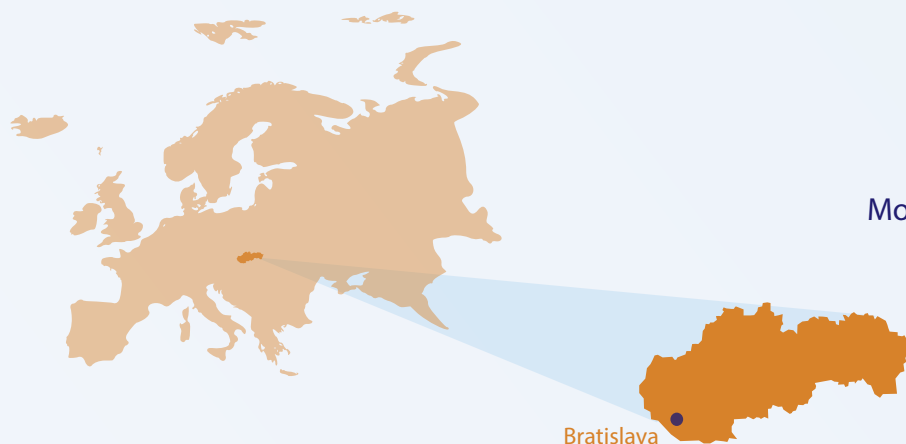### Temperature and Humidity Probes RHT75 & RHT175

- Interchangeable sensing elements
- Great long-term stability
  < 1 % RH / year
- Accuracy typical
  RHT75 ... ± 2 % RH
  RHT175 ... 1 % RH
- Digital & analogue interface
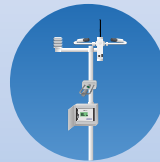
Phenomen 61

- Very high number (61) of recognized phenomenon
- Highly reliable choice for WMO4680
- Configurable thresholds

Contact us for more information

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