EXERGEN'S NON-CONTACT SENSORS AVOID FLOODING BY MEASURING SNOW SURFACE TEMPERATURE IN METEOROLOGICAL STATIONS

MICROSTEP-MIS, a state-of-the-art developer and manufacturer specialized in climate monitoring hardware and information systems has been operating in the area of environmental monitoring since 1993. In meteorological stations that are employed in Kazakhstan they use an Exergen IR temperature sensor to predict the melting rate of snow, allowing for a reliable flood warning system.

How a meteorological/weather station works

A meteorological station provides regular observations of atmospheric conditions. These stations are equipped with instruments for measuring atmospheric conditions to provide information for weather forecasts and to study the weather and climate. The measurements taken include temperature, atmospheric pressure, humidity, wind speed, wind direction, and precipitation amounts. The observations are made in accordance with a standard program during a ten-minute interval every three or six hours or in some cases hourly. The data is acquired and send wirelessly to an acquisition system for analysis. This information is essential for organizations in weather forecast services, scientific (climate) studies, airports, road management, agriculture, mountain rescue, ski resorts etc. Microstep MIS has installed more than 20 of these stations in mountainous areas in Kazakhstan to predict flooding.

Flooding is an issue in Kazakhstan where the weather can be precarious: winters with temperatures below -40°C, snowstorms and over 100 days of snow, combined with rapid warming. The Kazakhstan government has invested in flood forecasting systems to warn communities early when floods can occur.

Why is accurate temperature measurement important?

Various variables need to be measured for flood forecasting (e.g. ambient temperature, humidity, thickness of snow layer), yet snow surface temperature being one of the most essential as this is the best indication how fast the snow is melting. A combination of these data allows for a prediction how fast the snow is melting, how much snow is melting and how much melting water will be present, possibly causing a flood downstream. If the snow surface temperature is not measured correctly, the calculations to predict flooding are inaccurate and the system is prone to fail. An unwarned flood can cause dangerous situations and the loss of lives.

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Why Exergen non-contact IR sensors?

In the early days, the snow surface temperature was measured manually. This required tremendous effort and time. Later, weather stations were equipped with PT100 contact sensors. The problem with a contact sensor like a PT100 is that it will only provide accurate snow surface temperature when it is mounted exactly at the snow surface. 1 cm higher and it measures ambient temperature, 1cm lower and it measures snow core temperature. Both are not a good indication of the critical snow surface temperature. Even with multiple PT100 sensors mounted at regular intervals on the vertical pole, it turned out to be too unreliable for snow surface temperature.

Microstep selected the Exergen IRt/c.10. This is mounted at a safe distance above the ground looking down at the surface below the weather station. It has a 10:1 field of view (approx. 5° angle), so regardless is there is little snow or a lot of snow, the sensor will always measure a steady area of snow surface temperature.

Microstep and the Kazakhstan government have tested these sensors intensively and they met all requirements. Some have been in the field for over 5 years and all are functioning satisfactorily.

Benefits achieved

- Always a reliable snow surface temperature, regardless of the thickness of the snow cap.
- One sensor is sufficient, replacing multiple contact sensors (cost efficient).
- Exergen proprietary IR sensor technology consists of unpowered sensors.
- As the sensor provides data in an automated manner, it saves a lot of hours as in the beginning this was done manually.
- The sensors are very robust and able to withstand the harsh conditions in the Kazakh mountains. Even in subzero conditions, snowstorms and heavy rains, they will work reliably. The sensors don't drift, so there is no need to provide maintenance or recalibration in the field.
- Another benefit is that the sensor is unpowered. Meteorological stations have to make use of batteries. They therefore calculate very carefully the functional hours during the day. The fact that the sensor does not require any additional power is a very pleasant additional benefit.
- Very accurate data resulting in early warning and right forecasts.

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