PV monitoring solutions

In-situ monitoring of moisture ingress in PV modules

Compatible

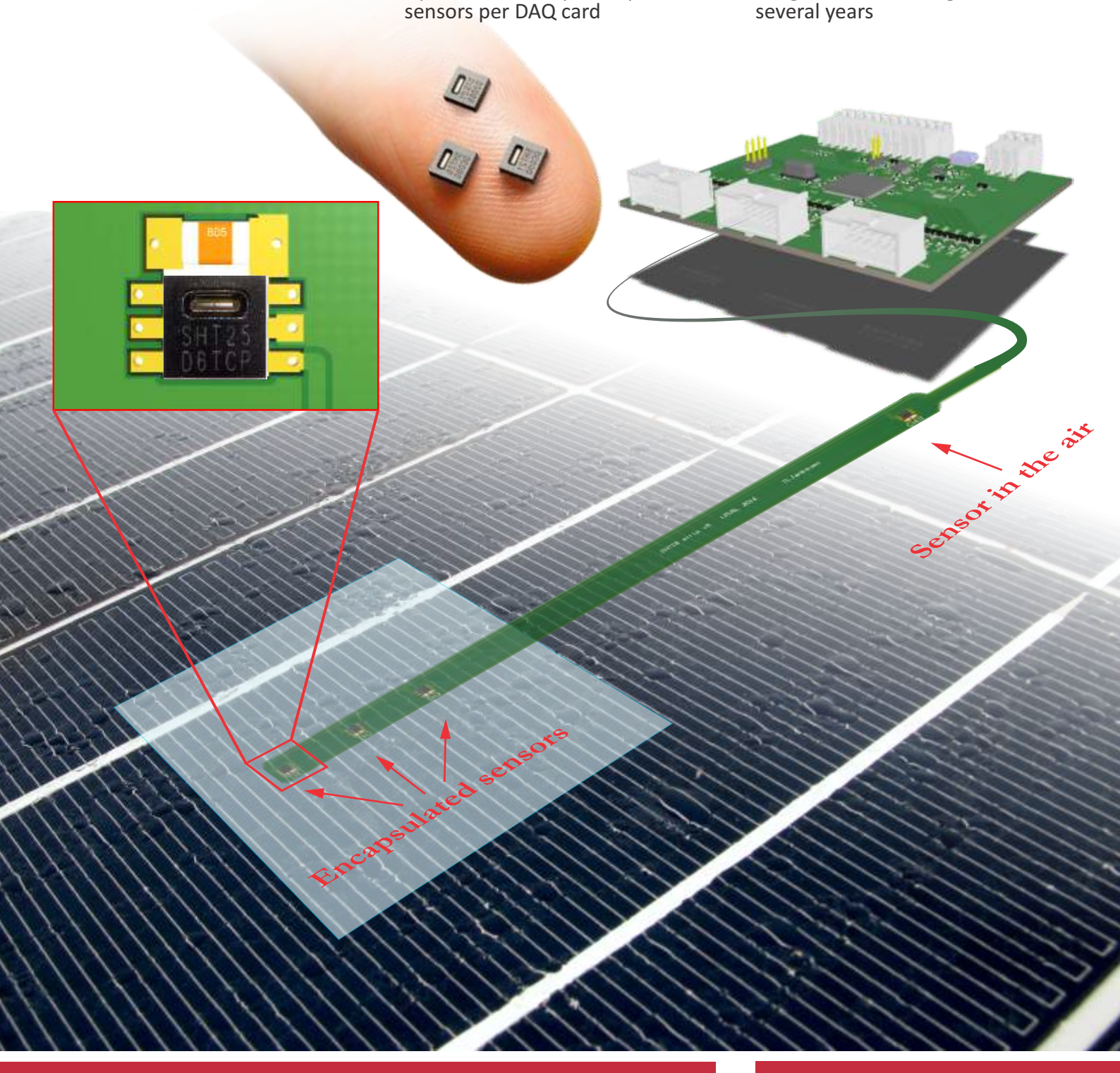
- Reliable *RH* & *T* measurement in different encapsulants, such as EVA, TPO, POE, Ionomer, ...
- WVTR and water diffusion parameters can be determined

Miniature

- Minimal impact to the measured specimen
- Standard I²C interface compatible with most digital sensors
- Up to 10 sensors per strip, 30 sensors per DAQ card

Durable

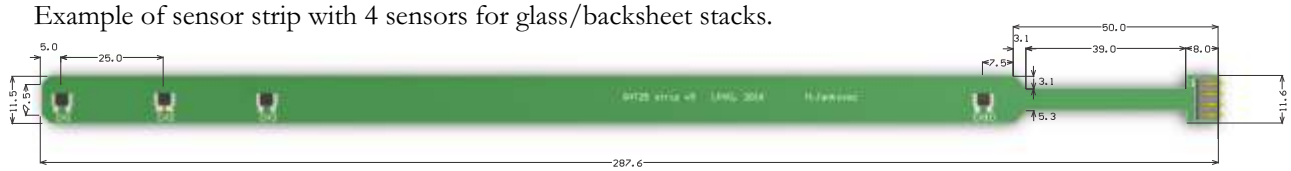
- Large *RH*&*T* measurement range with high measurement accuracy
- Suitable for indoor and outdoor monitoring conditions
- Long term monitoring over several years



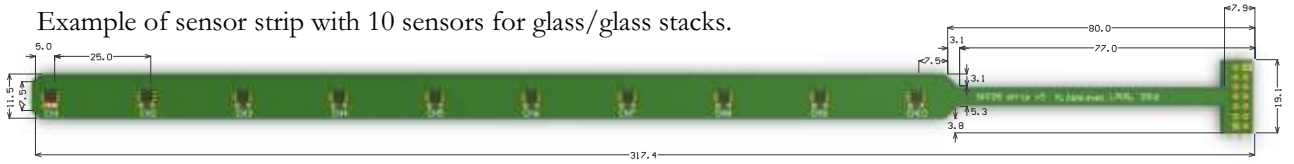
SYSTEM CHARACTERISTICS

- Use of of-the-shelf miniature air relative humidity and temperature sensors SHT-25 from Sensirion.
- Custom made sensor strips holding sensors on fixed positions and connecting to the DAQ card. Sensor strips can be laminated in various PV module stacks. Custom sensors strips can be designed to fit the specimen.

Example of sensor strip with 4 sensors for glass/backsheet stacks.



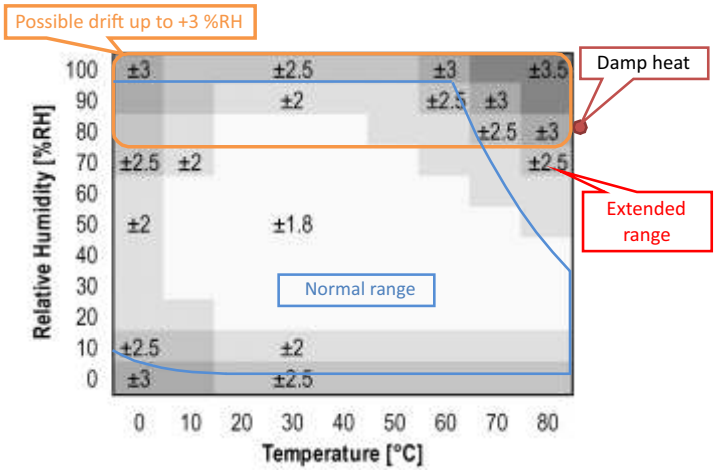
Example of sensor strip with 10 sensors for glass/glass stacks.



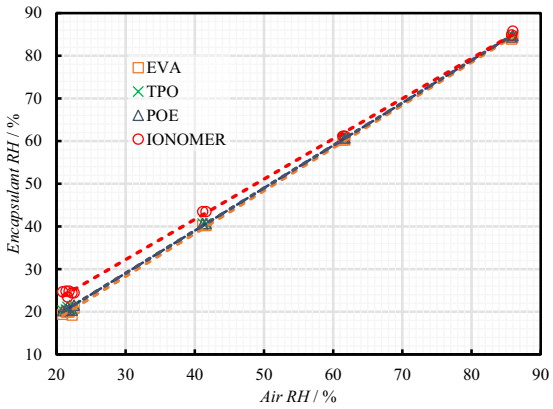
* Strip thickness is 1 mm. All measures are in mm.

- Data acquisition (DAQ) card with USB and RS-485 interface with 30 multiplexed I²C interfaces. Although only SHT25 sensors are currently used, any 3.3 V powered I²C compliant sensors can be supported by firmware upgrades.
- Simultaneous data acquisition of all sensors with adjustable sampling time from 2 s forward.

SENSOR MEASUREMENT RANGE AND UNCERTAINTY



Sensor can be exposed to normal outdoor PV module operation conditions. It has also proven to whitstand long term Damp Heat (DH) conditions (just over the edge of extended measurement range) with drift of +5% RH. Long term exposure to relative humidity above 80% and condensing conditions can cause reversible drift up to +3% RH.



Several sensor were laminated in four different encapsulant materials (EVA, TPO, POE and Ionomer) and exposed to different air humidities at elevated temperature of 50 °C. Results show stabilized readings of sensors showing minimal scattering. Comparison of the external and internal RH readings proves very consistent linear relationship.

REFERENCES

Detailed system and result desription can be found in:
Marko Jankovec et. al. , In-situ monitoring of moisture ingress in PV modules using digital humidity sensors, Journal of Photovoltaics, Vol. 6, No. 5, september 2016

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