

Concept Validation of Windtech 'Cold' Sensation Measurement Device

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Problem & Solution

The first wearable cold-exposure sensor & risk management system

WINDTECH AS in license agreement with UiT-The Arctic University of Norway has developed the first **wearable real feel cold sensor**, to monitor an individual's cold exposure, in real-time, when outdoors and exposed to the elements.

The technology is based on a patented sensor. Our cold exposure sensor can help improve operational performance and reduce risk of cold-related injury in all cold-climate outdoor activities:

- Industrial Operations
- Exploration/Expedition
- Winter Sports Activities (ski, skating)
- Military (political)



WINDTECH AS – We Develop Cold Climate Technology



**Smart home
Smart tech**



WINDTECH



Home weather station that considers all the factors



**Know when
to move on**

*Real-time cold exposure sensor
for risk management*





WINDTECH

**Get the benefits
of napping
outdoors**



Monitor your baby's conditions
in real time, anywhere

Monitor your
real cold exposure



WINDTECH

know when to turn back

Regulations

Wind Chill Temperature (WCT)

Wind Chill Temperature (WCT/°C) Chart

Wind Speed (km/h)	Air Temperature (°C)													
	Calm	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50
10	9	3	-3	-9	-15	-21	-27	-33	-39	-45	-51	-57	-63	
15	8	2	-4	-11	-17	-23	-29	-35	-41	-48	-54	-60	-66	
20	7	1	-5	-12	-18	-24	-31	-37	-43	-49	-56	-62	-68	
25	7	1	-6	-12	-19	-25	-32	-38	-45	-51	-57	-64	-70	
30	7	0	-7	-13	-19	-26	-33	-39	-46	-52	-59	-65	-72	
35	6	0	-7	-14	-20	-27	-33	-40	-47	-53	-60	-66	-73	
40	6	-1	-7	-14	-21	-27	-34	-41	-48	-54	-61	-68	-74	
45	6	-1	-8	-15	-21	-28	-35	-42	-48	-55	-62	-69	-75	
50	6	-1	-8	-15	-22	-29	-35	-42	-49	-56	-63	-70	-76	
55	5	-2	-9	-15	-22	-29	-36	-43	-50	-57	-63	-70	-77	
60	5	-2	-9	-16	-23	-30	-37	-43	-50	-57	-64	-71	-78	
70	5	-2	-9	-16	-23	-30	-37	-44	-51	-59	-66	-73	-80	
80	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	

¹ Blue shaded region represents WCT associated with frostbite in 30 minutes or less.

WCT - Risk Class

WCT

Classification of risk categories risk of frostbite and recommended limits for work (modified from ISO 11079:2007)



<-9 °C

Low risk, <5% chance of frostbite for most people



-10 to -24 °C

Low risk, <5% chance of frostbite for most people, uncomfortable cold



-25 to -34 °C

Moderate risk, increasing risk of frostbite for most people in 10-30min, very cold



-35 to -59 °C

High risk, risk of frostbite for most people in 2 to 10 min, bitterly cold



-60 °C and colder

Extreme risk, risk of frostbite for most people on 2 min or less, extremely cold

WCT – Recommended limits for work

WCT

Classification of risk categories risk of frostbite and recommended limits for work (modified from ISO 11079:2007)



<-9 °C

Normal work; emergency work;
planned maintenance



-10 to -24 °C

Normal work (reduced work
periods); emergency work



-25 to -34 °C

Normal work (reduced work
periods); emergency work



-35 to -59 °C

Emergency work only



-60 °C and colder

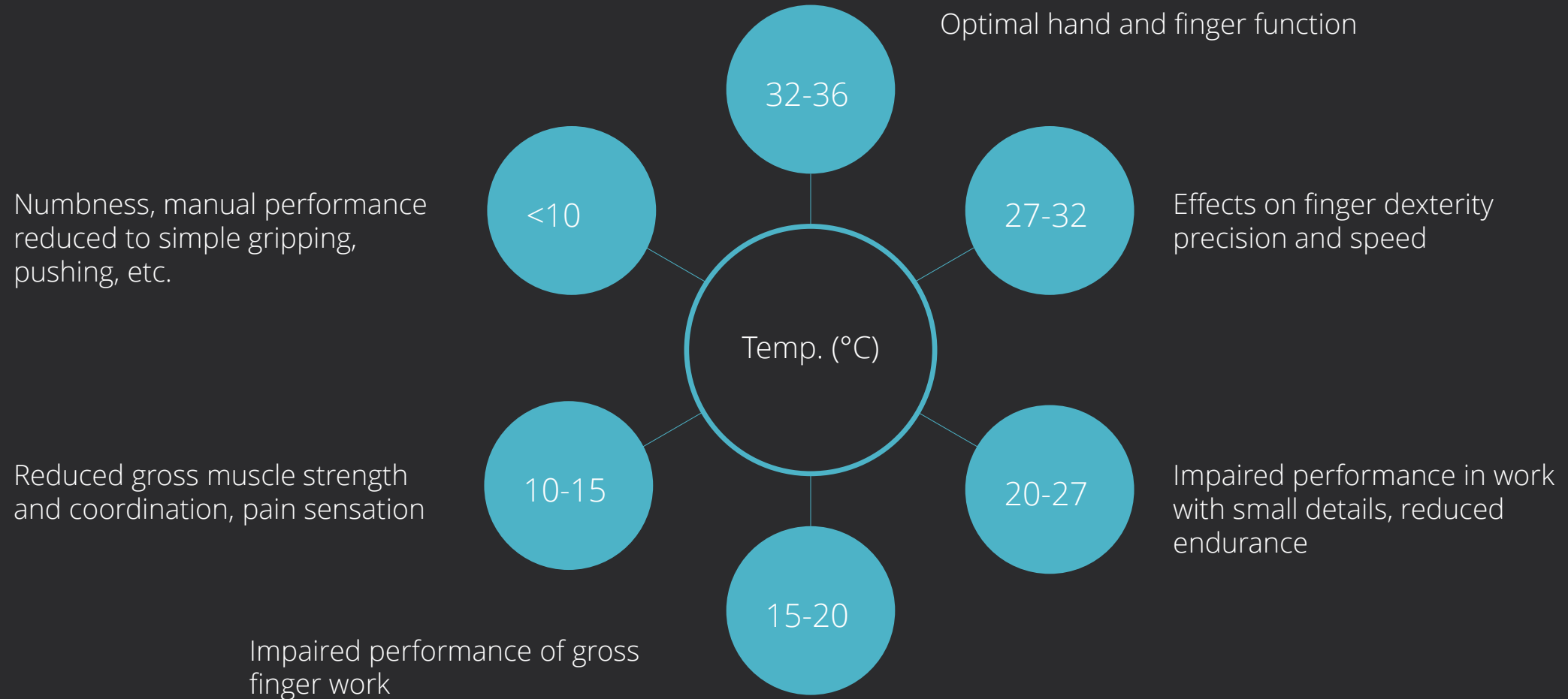
No work outside

Negative effects
due to cold

Effects on Cognitive Performance



Effects on Performance



Hand Skin Temperature

Effects on nerves and muscles



Levels of Hypothermia



Mild hypothermia
35-32°C

- Judgement may be affected
- Feels cold, looks cold, uncontrollable shivering
- Coordination and gait impacted



Moderate hypothermia
32-30°C

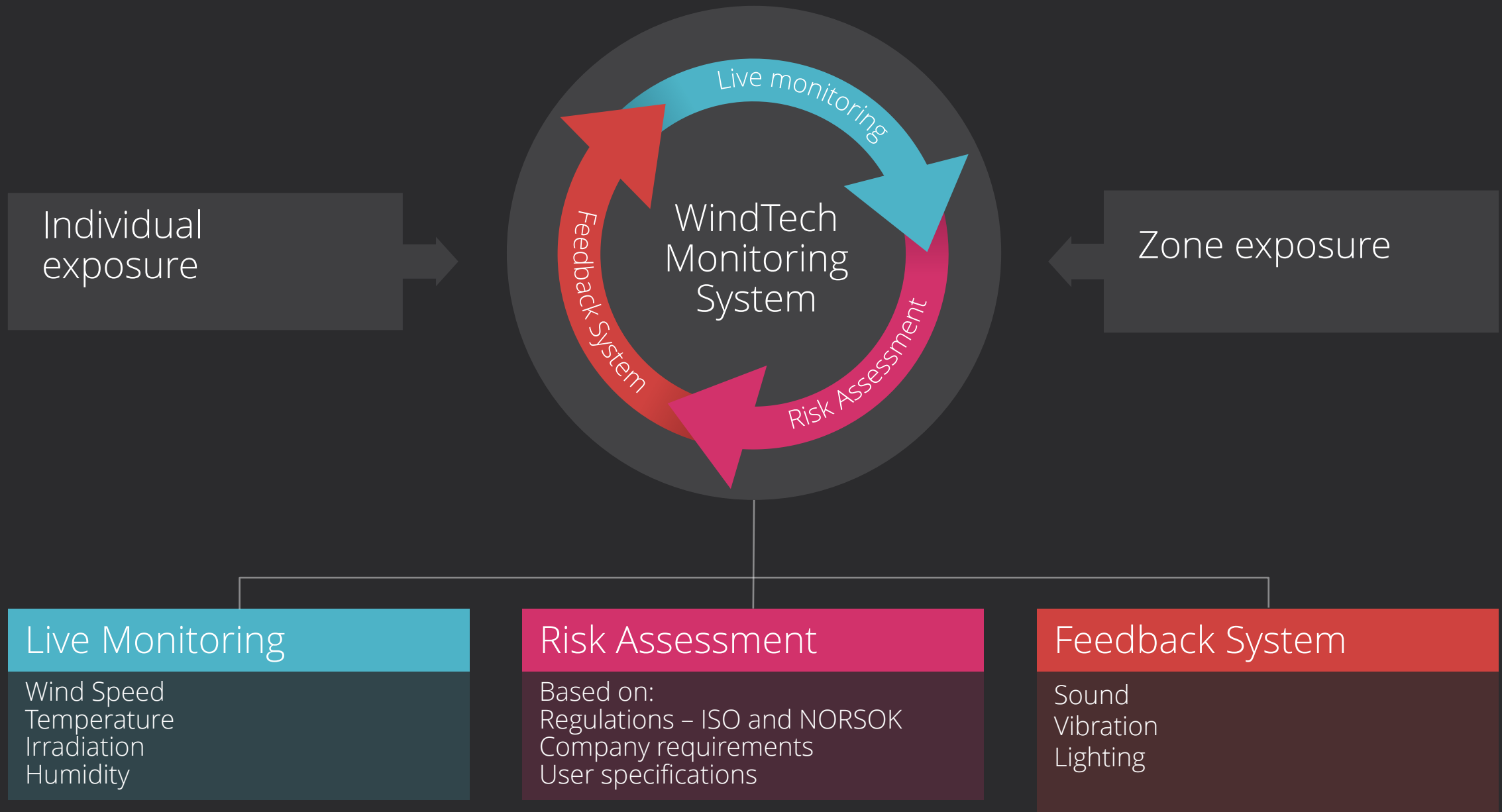
- Change of personality
- Sleepiness and careless
- Sensation of warmth, as a result person may start to undress



Severe hypothermia
30°C and below

- Unconsciousness
- Life in risk

Risk Management System



WindTech Risk Assessment

Stage 1
Observation

Stage 2
Analysis

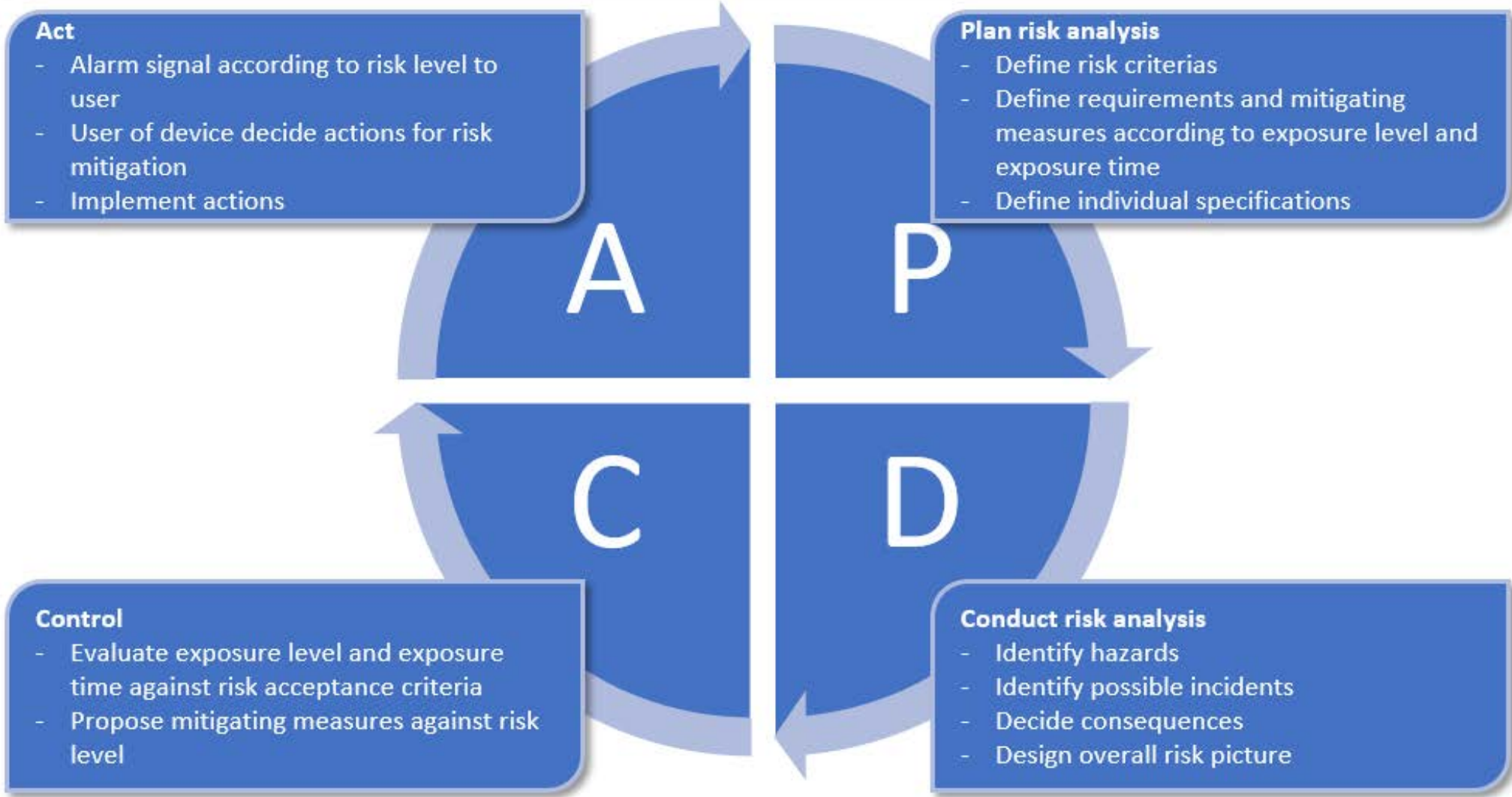
Stage 3
Expertise

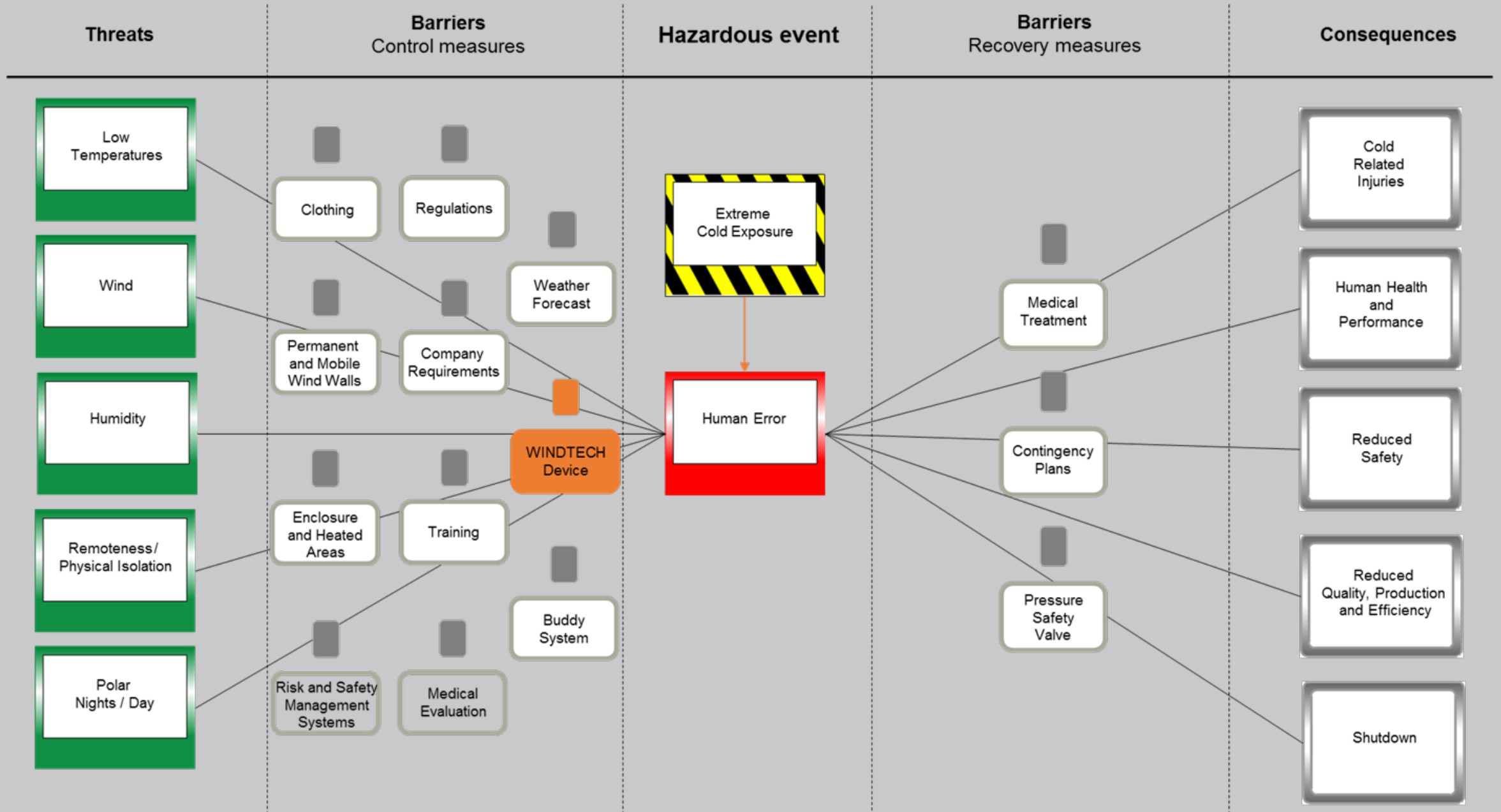
Identify Cold Exposure
Based on weather parameters; ambient temperature, wind speed, humidity and radiation

Risk Analysis
Quantify, analyse and estimate cold exposure and assess against risk criteria

Risk Evaluation
Suggest mitigating measures; according to regulations and company requirements

WindTech Risk Management System





Project Update

Project Development

01

Cold Climate Project

- Test of hypothesis
- ANSYS 2D-simulations
- MATLAB calculations
- Correlation test
- Hypothesis approval

02

Pilot-project

- ANSYS 3D-simulations
- Simulations prove new potential
- Prototype planning
- Continued correlation test

03

Project

- Effects of cold
- Device optimization - Risk and reliability analysis
- How workers and technical equipment will benefit from the technology
- Prototype development

04

WindTech

- Cooperation with Norinnova and UiT
- Company establishment
- Patent Granted

Patent

(12) UK Patent Application (19) **GB** (11) **2588580** (13) **A**
 (43) Date of A Publication 05.05.2021

(21) Application No: 1914757.8	(51) INT CL: G01K 17/08 (2006.01) G01K 13/00 (2021.01) G01K 17/20 (2006.01) G01W 1/17 (2006.01) G08B 21/02 (2006.01)
(22) Date of Filing: 11.10.2019	(56) Documents Cited: WO 2012/154212 A2 WO 1981/002638 A1 DE 003611094 A1 JP 2012217566 A US 20050126280 A1 US 20040039254 A1 US 20020009119 A1 JP S60186741 KR 1020160056856
(71) Applicant(s): Windtech AS Stakkevollvegen 333, Tromsø, 9019, Norway	(58) Field of Search: INT CL A61B, G01K, G01W, G08B Other: WPI, EPODOC
(72) Inventor(s): Hassan Khawaja Daniel Swart Ståle Antonsen	
(74) Agent and/or Address for Service: Dehns St. Bride's House, 10 Salisbury Square, LONDON, EC4Y 8JD, United Kingdom	

(54) Title of the Invention: **Measuring environmental exposure**
 Abstract Title: **Wearable environmental exposure measuring device**

(57) A wearable sensor device 100 comprises a heater 108, a power supply 104 and a surface 102a exposed to an external environment. Heat energy from the heater 108 is emitted to the external environment from the exposed surface 102a. A temperature sensor 110 is arranged to sense a temperature at a region that is thermally coupled with the heater 108 and with the exposed surface 102a. A processing system 112 receives one or more signals from the temperature sensor 110 representative of the temperature at said region, and processes signals to determine a value representative of heat flow through the exposed surface 102a. The device 100 further comprises means for attaching the sensor device 100 to an individual. The device may output indications of determined heat flow and exposure level in the form of a risk factor representing a risk of over exposure for the wearer.

FIG. 1

GB 2588580 A

Intellectual Property Office

Certificate of Grant of Patent

Patent Number: **GB2588580**
 Proprietor(s): **Windtech AS**
 Inventor(s): **Hassan Khawaja**
Daniel Swart
Ståle Antonsen

This is to Certify that, in accordance with the Patents Act 1977,

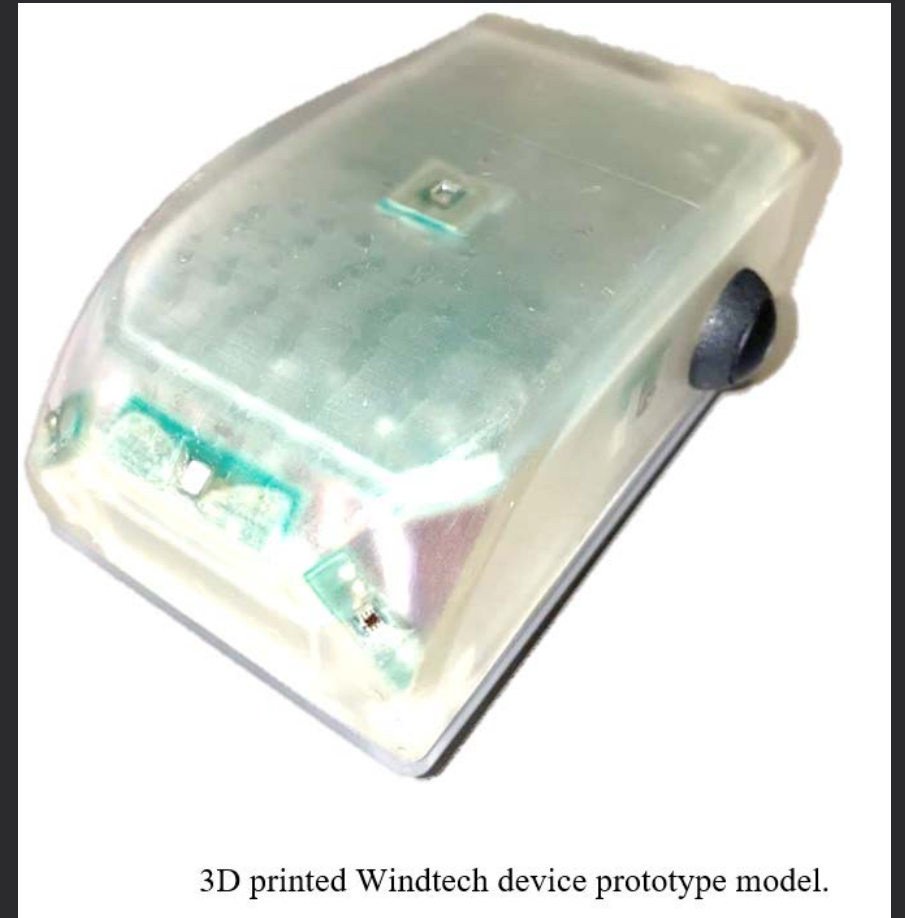
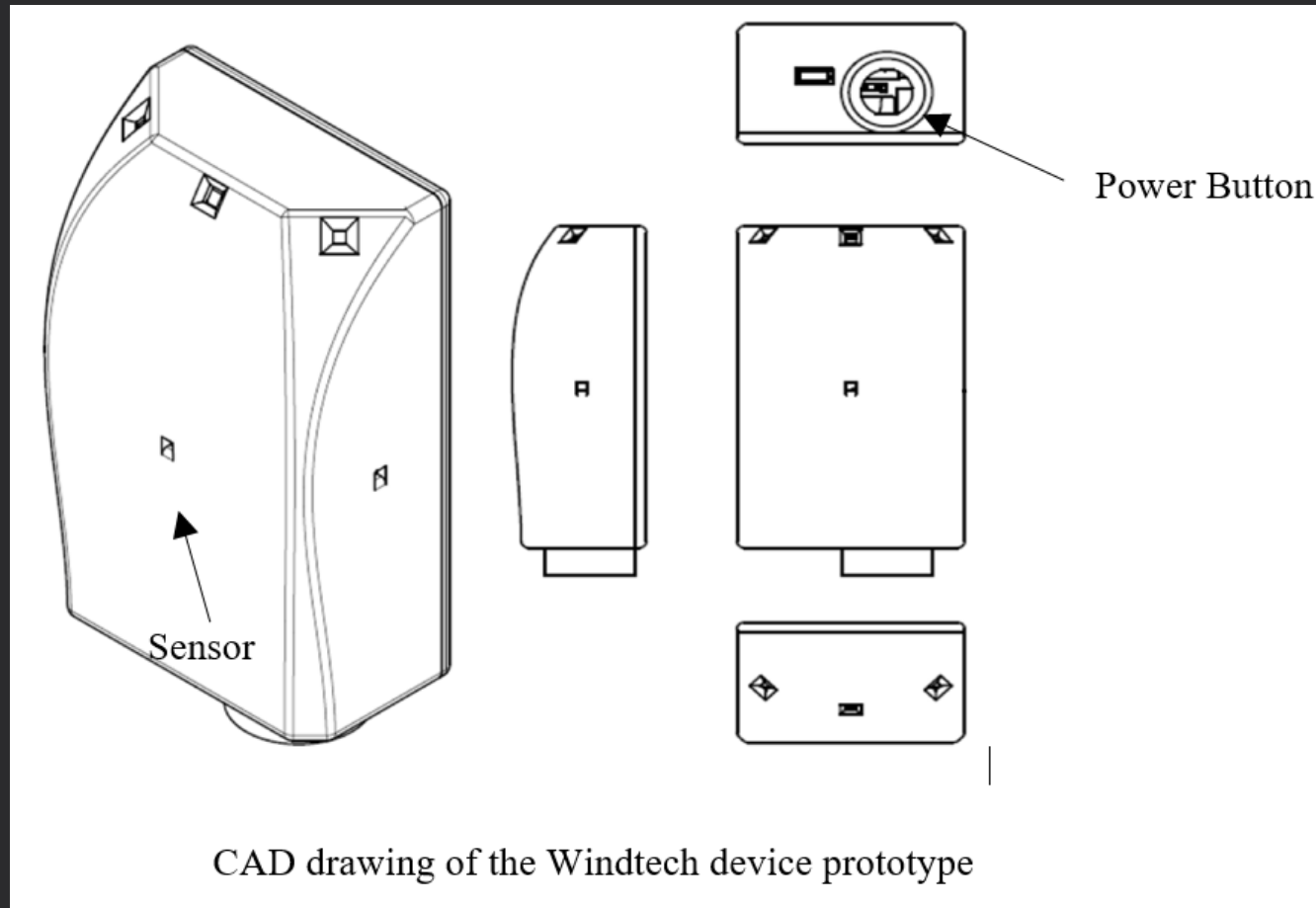
a Patent has been granted to the proprietor(s) for an invention entitled "**Measuring environmental exposure**" disclosed in an application filed **11 October 2019**.

Dated 22 June 2022

Tim Moss
 Comptroller-General of Patents, Designs and Trade Marks
 Intellectual Property Office

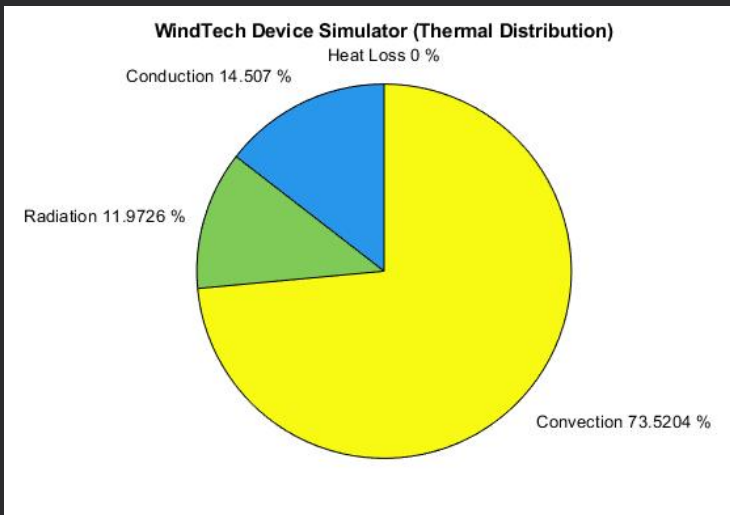
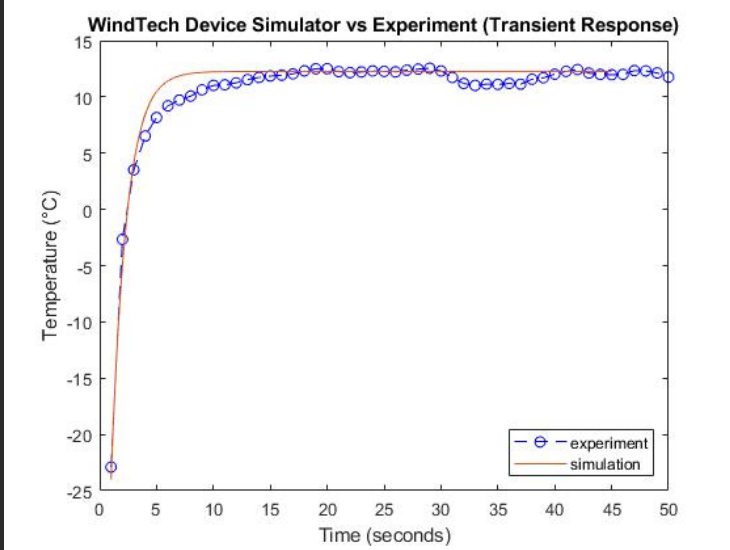
The attention of the Proprietor(s) is drawn to the important notes overleaf.
 Intellectual Property Office is an operating name of the Patent Office

Prototype

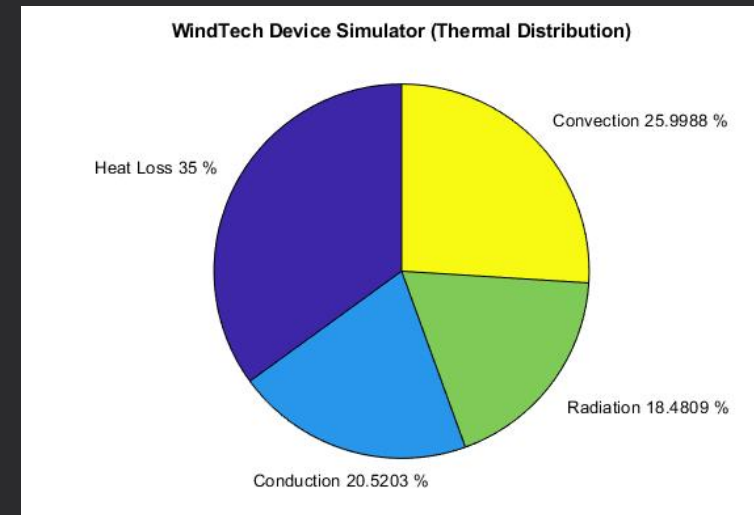
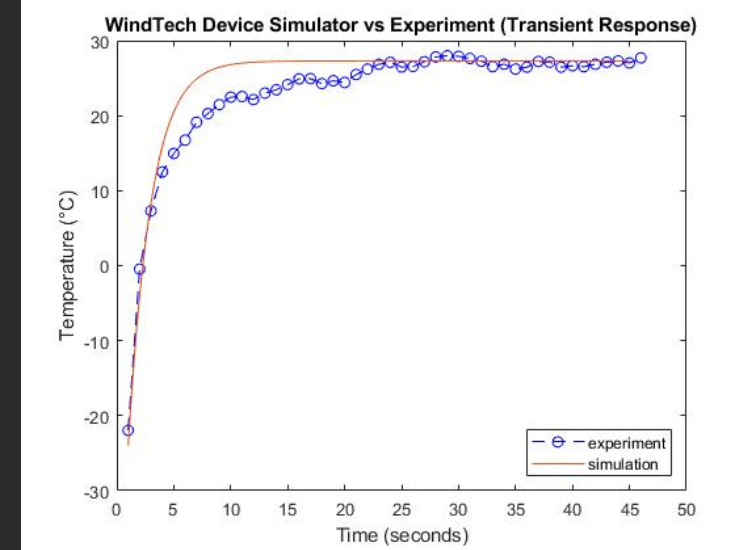


Validation

Ambient Temperature = -23°C , Relative Humidity = 72%, Wind Velocity = 8 m/s
resulted Heated Temperature = 12.1°C



Ambient Temperature = -23°C , Relative Humidity = 72%, Wind Velocity = 0.5 m/s
resulted Heated Temperature = 26.9°C



Thank you & Questions!



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