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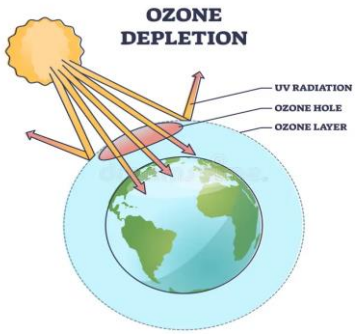
Protecting Construction Workers: AI-Powered Solutions for Climate-Induced Health Risks



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Climate Induced Occupational Health and Safety Risks

Impacts:

- > 70% of global workforce is exposed to climate change health related hazards
- Lost productivity , business disruptions and damaged infrastructure
- Outdoor workers in physically demanding sectors such as construction and agricultural workers are at high risk

High Risk Groups

Kare Medical Clinic
Your community clinic

Excessive Heat

- Excess heat is an emerging Occupational Health and Safety hazard in the working workplace
- Since 1880 average global temperature has increased about 1C
- Projected to warm by about **1.5^{o}C in 2050** and **2-4^{o}C in 2100**
- Heat stress – reduce total working hours by **2.2%** and global **GDP** by **US$2,400 billion** in 2030
- Agricultural and construction workers are expected to be worst affected
- Exposure to excessive heat, resulting in **22.85 million injuries** and **18,970 deaths** annually (ILO July 2024)

Be Aware !

Daily maximum temperatures may reach 34.0°C or more

The impacts of El-Nino to Brunei includes suppressed rainfall activity with increasing air temperature and low relative humidity. Dry and hot weather conditions are expected to occur in the coming months with possible increase in daily maximum temperatures reaching 34.0°C or more in the afternoon, the Brunei Darussalam Meteorological Department (BDMB) stated in a release yesterday.

In view of the likelihood of El-Nino occurring, the BDMB advised the public to take precaution and safety measures as well as follow guidelines from the Ministry of Health with regards to the hot weather condition.

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Brunei will experience excessive hot weather in the upcoming months.
PHOTO: KHAYR ZAKARIYYA

Productivity Loss

Figure 2.4 Equivalent full-time jobs and GDP lost to heat stress, global and by country income group, 1995 and projections for 2030

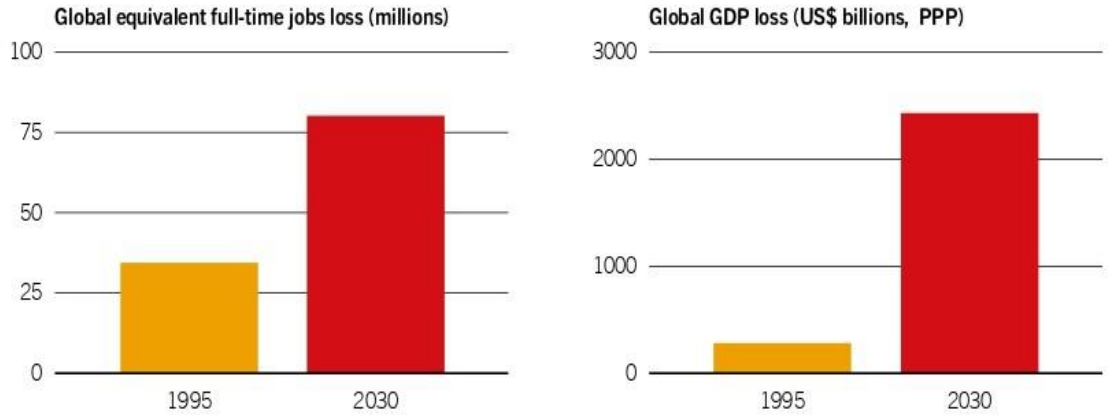
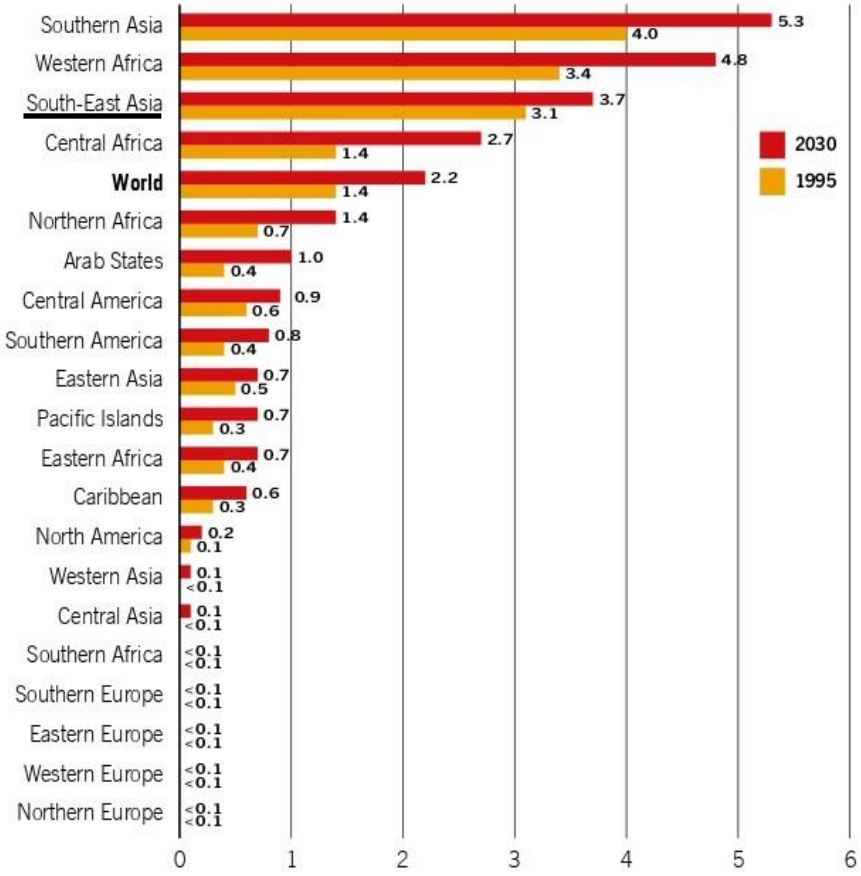


Figure 2.5 Working hours lost to heat stress by subregion, 1995 and projections for 2030 (percentages)



Source: ILO estimates based on data from the ILOSTAT database and from the HadGEM2 and GFDL-ESM2M climate models (using as input the RCP2.6 climate change pathway, which envisages a global average temperature rise of 1.5°C by the end of the century).

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1.Excessive Heat –Heat Related Diseases

Personal Risk factors

- Body heat generation due to exertion
- Obesity
- High blood pressure
- Diabetes
- Heart Diseases
- Resp. diseases
- Medication
- Acclimatization

Heat Stress

Heat cramps
Heat syncope
Heat exhaustion
Heat stroke
Rhabdomyolysis

Environmental Risk factors

- Air temperature
- Humidity
- Air movement
- Radiant heat (sun,hot surfaces)

Job Risk factors

- Workload severity and duration
- Clothing

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Other health and safety effects of excessive heat

Cardiovascular Diseases

Acute /Chronic Kidney Diseases

Accidental Injuries

Mental Disorders

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Protection and Control of Heat Related Disorders

- Risk assessment
- Fitness to work assessment(identification of personal risk factors)
- Heat acclimatization(improvement in heat tolerance)
- Work scheduling (early morning and late afternoon)
- Shaded rest areas
- Adequate water intake
- Worker awareness
- Worker clothing (breathable loose fitting and light coloured clothing)
- Heat stress prevention programme
- AI Technology

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2. Solar UV Radiation

- High Risk jobs: Outdoor workers – eg construction workers
- > 18,960 deaths due to work-related skin cancer due to solar radiation

Health Effects

Sunburn

Eye damage- pterygium, cataracts

Skin Cancer

Weakened immunity

Protection and Control

- Risk assessment
- Avoid sun exposure 10am -4pm
- Rescheduling work activities
- Early identification –Health surveillance
- Education
- (Sun cream application)
- Wear wide brimmed hats
- Tightly woven loose fitting cloths
- (Sun glasses)
- AI Technology

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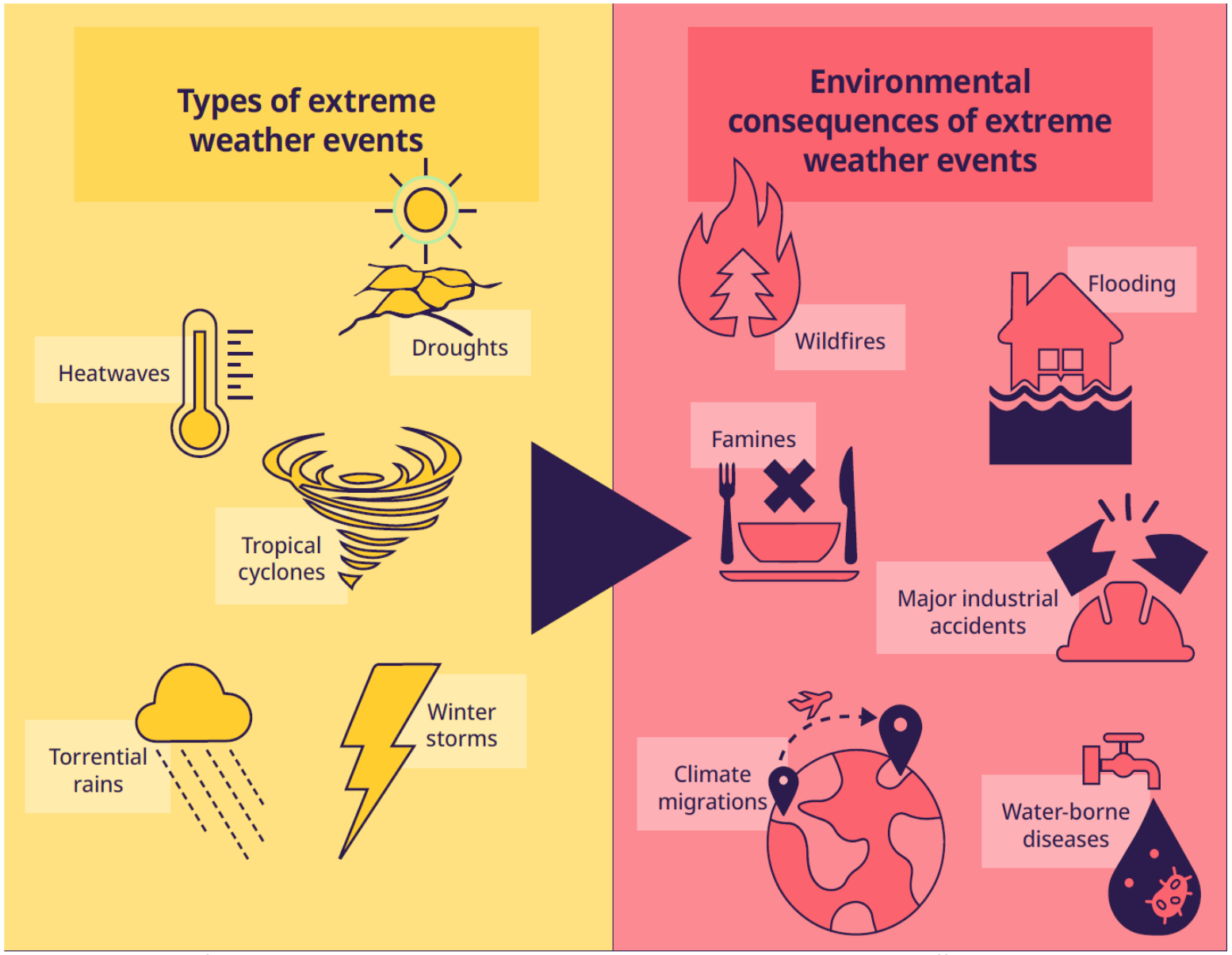
3. Extreme Weather Events



Source: Ensuring safety and health at work in a changing climate, Geneva: International Labour Office, 2024

Health & Safety Impacts

- Traumatic injuries
- Burns
- Respiratory diseases
- Biological Infections –diarrhoea
- Chemical toxicity
- Fatigue
- Stress
- Anxiety
- Post Traumatic Stress Disorders (PTSD)

Protection and Control

- Risk Assessment/Emergency Response Plan and Preparedness Programme
- Pre deployment, deployment and post deployment health screening and surveillance
- Vaccination-HepA &B,Typhoid, Tetanus
- PPE
- Education
- Counselling ,etc.
- AI Technology

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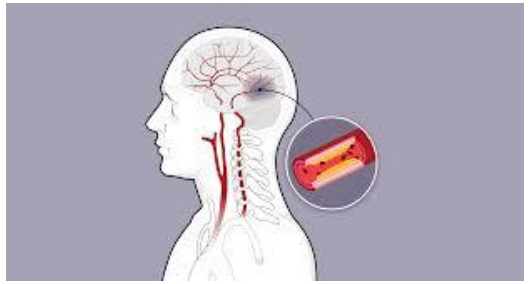
4. Workplace Air Pollution

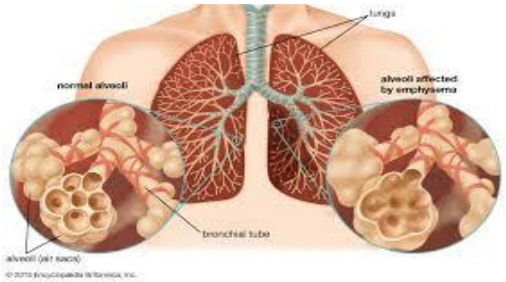
- 860,000 deaths annually due to air pollution
- Main pollutants –$PM_{2.5}$,PM_{10},NO,NO_2,SO_2,Ozone
- High risk jobs –outdoor workers eg construction workers

Health Impacts

Lung cancer-$PM_{2.5}$



Stroke -$PM_{2.5}$



Asthma, bronchitis-NO,NO_2,SO_2,$PM_{2.5,10}$

Cardiovascular diseases-$PM_{2.5}$,NO,NO_2

Protection and Control

- Risk assessment
- Health surveillance
- Appropriate Respiratory protective devises
- Education
- Smoking cessation
- AI Technology

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5. Vector- borne Diseases

- > 15,000 deaths due to work-related vector borne diseases
- Vectors –mosquitoes ,ticks etc.

Health Impacts

Ades

Culex

Anopheles

Protection and Control

- Risk assessment
- Eliminate mosquito breeding places – Avoid water stagnation in workplaces and worker living quarters
- Wear long sleeved shirts and pants at work
- Mosquito nets, mosquito repellents
- Vaccination –eg Japanese encephalitis

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AI-Powered Solutions for OHS Risks in Construction

AI Application	Details	Pictures
Computer Vision for Hazards Detection	Identify safety hazards in real-time Use AI algorithm to analyze images, videos (CCTV) form construction site. Detect unsafe working condition , noncompliance of safety protocols	
Predictive Analytics	AI analyze historical data to predict potential risks and to enable proactive intervention	
Wearable Technologies	AI provides real-time alerts for potential health and safety risks, so immediate action can be takes	
Autonomous Equipment	AI driven bulldozers and excavators operate without human intervention, so that minimize safety risks	
Proximity Warning Systems	RF identification technology and AI, detects proximity to moving vehicles or machinery, issue warnings to prevent accidents	

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Wearable Technology

- Expected to reduce 16% of hospital costs by2027
- By 2037 it could save US$200 billion via remote patient monitoring
- Evolution of wearable technology support health sector as well as workplace health and safety , protecting workers from incidents before it happen.
- Wearable heat stress monitors prevent serious heat-related illnesses and incidents by alerting both the worker and supervisor when preset thresholds are exceeded.

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AI Powered Solution - Heat Stress Wearables

Wearables

Smart PPE

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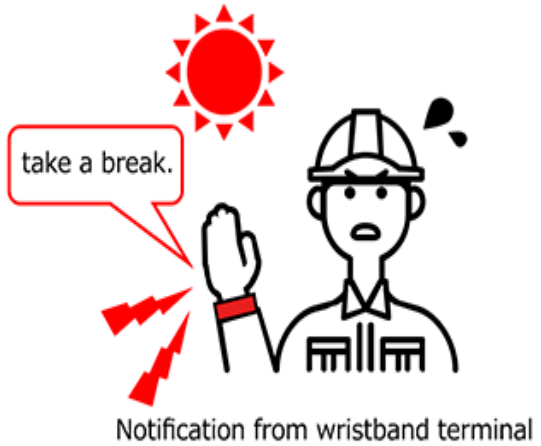
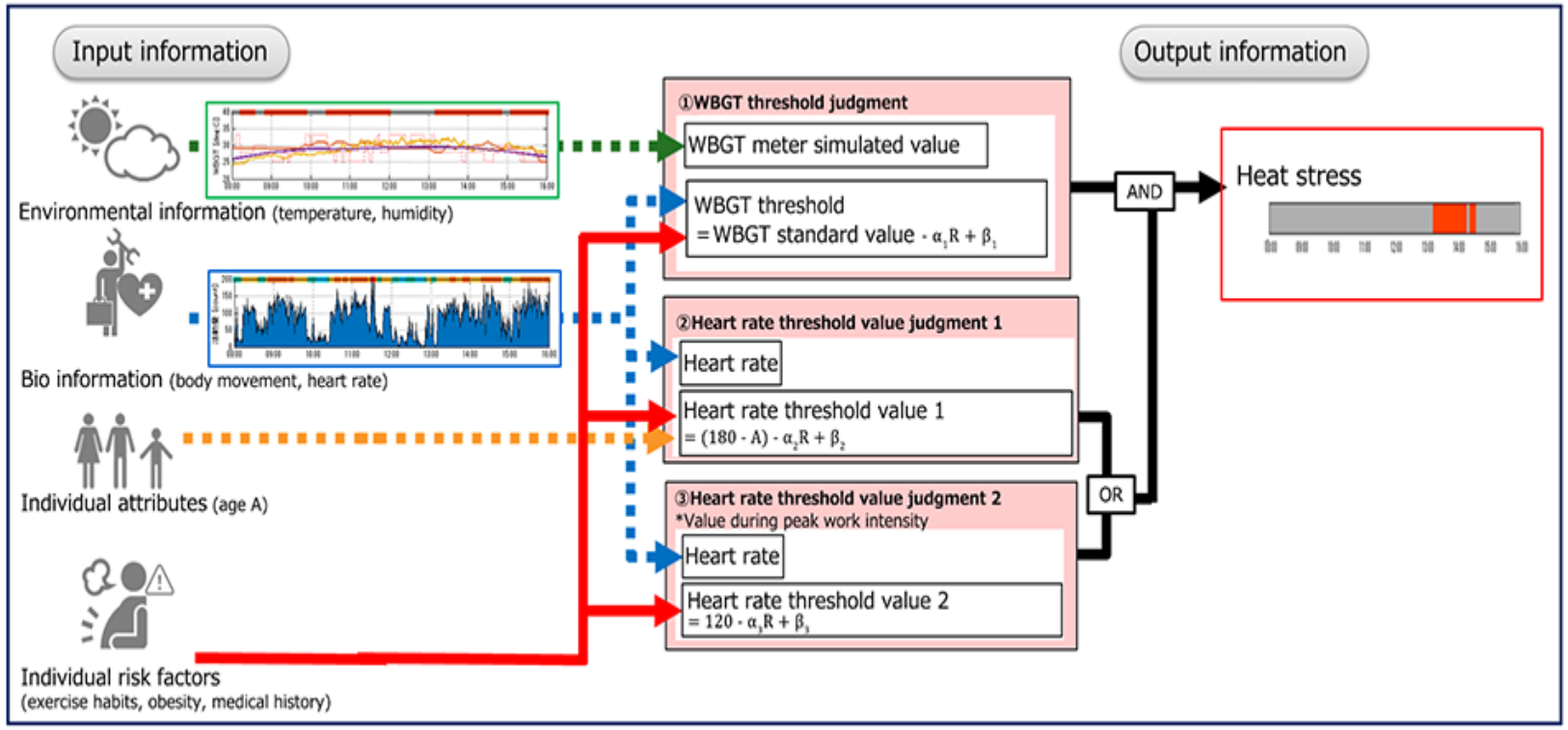
How do the Wearables work?



Notification from wristband terminal



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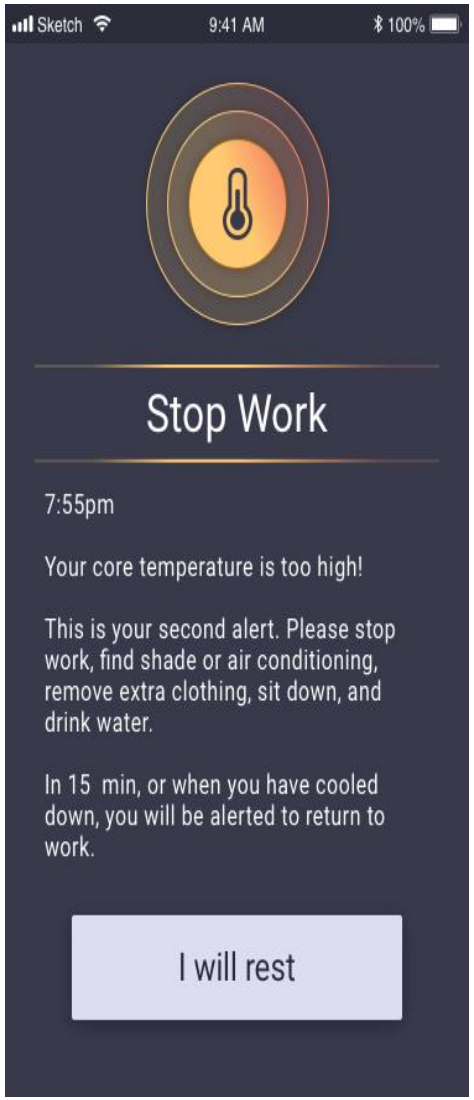
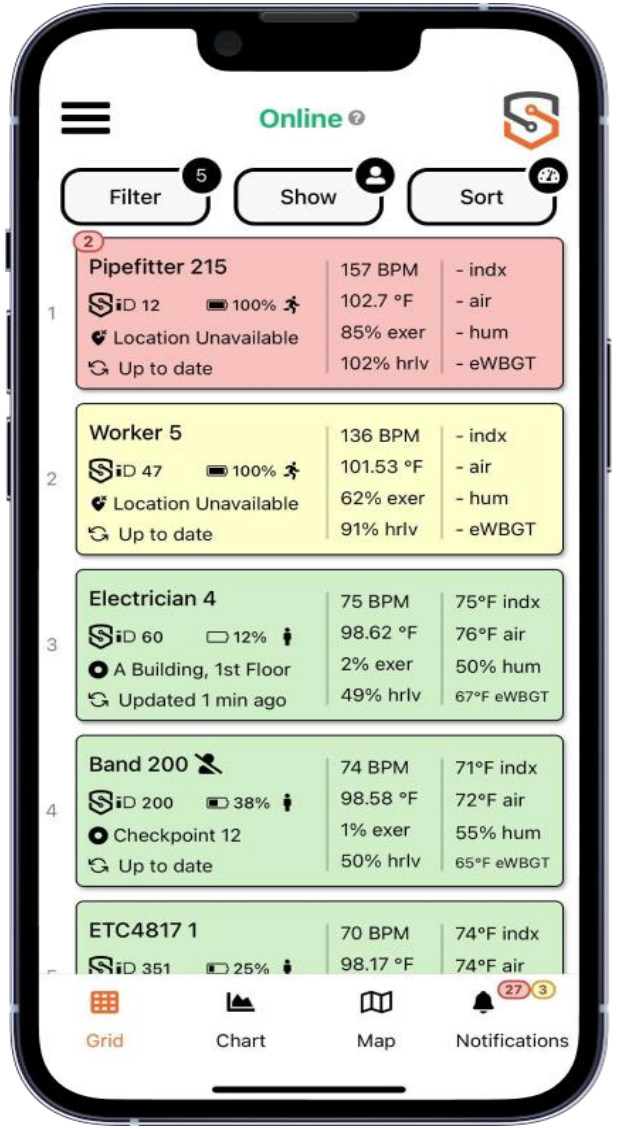
Heat Stress Wearables –Out Put Information





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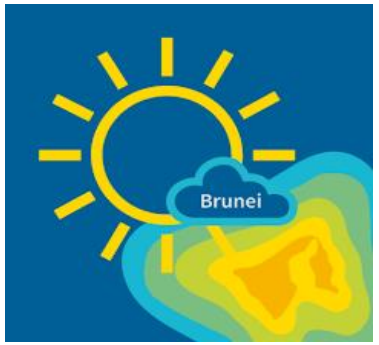
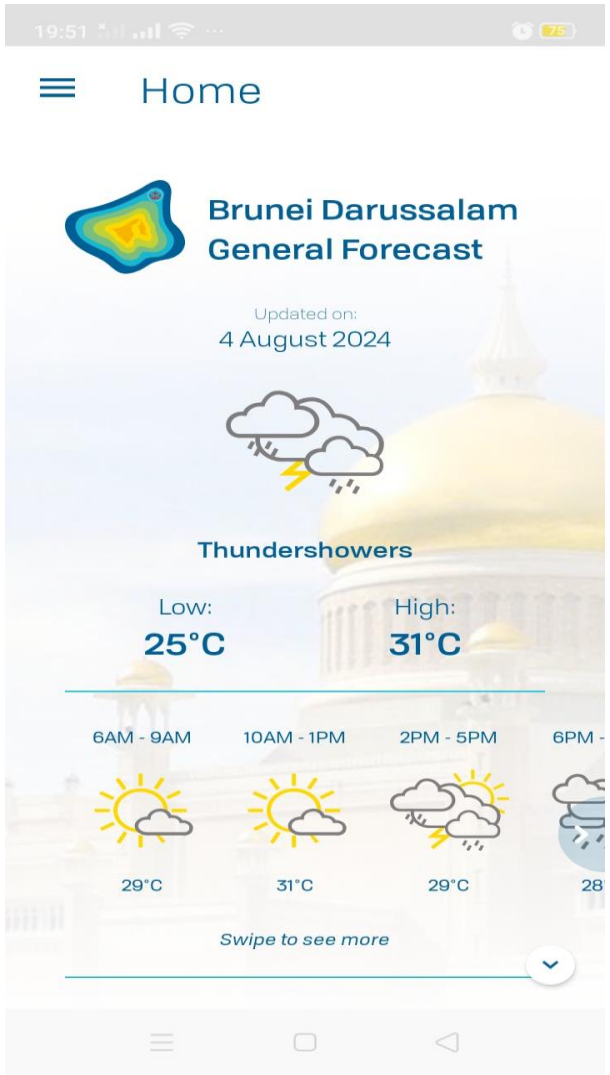
AI Technology -Forecasting unusual weather patterns

- Weather forecast - Mobile App Brunei Meteorological Dept.



Brunei WX



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Protection from UV Radiation Exposure

- SunSmart Global UV App

SunSmart®

Cancer Council Victoria

arpansa

Australian Government Bureau of Meteorology

World Health Organization

WORLD METEOROLOGICAL ORGANIZATION

UN environment programme

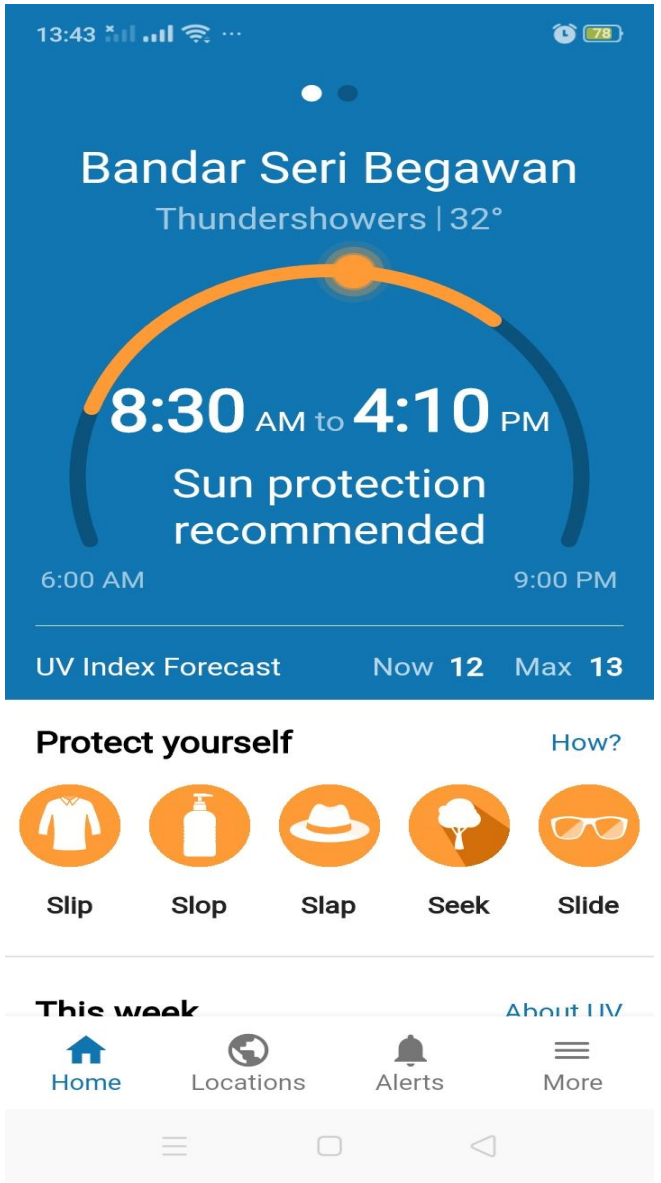
ILO International Labour Organization

ECMWF

A2I2 APPLIED ARTIFICIAL INTELLIGENCE INSTITUTE

pondr.

suvati access to fluid cx



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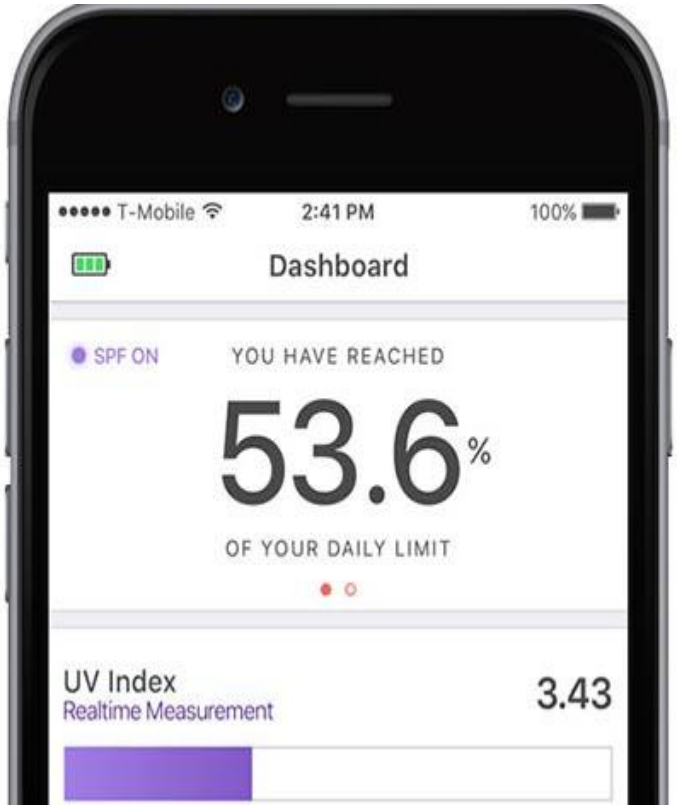
Protection from UV Radiation

- Measuring UV Radiation Exposure

Wearables for UV Radiation



UV Index

Exposure Category	UV Range
Low	< 2
Moderate	3 to 5
High	6 to 7
Very High	8 to 10
Extreme	11 +

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AI Powered Solution – Air Pollution

- **Common Pollutants** - particulate matter (PM) , nitrogen oxides (NOx), ozone (O3), sulfur dioxide (SO2), carbon monoxide (CO), and volatile organic compounds (VOCs)etc.

Stationary monitoring

Mobile air quality monitoring

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Benefits and Drawbacks of AI in OHS

Benefits

- Workers' health monitoring through wearable devices and sensors
- Hazard identification and real time risk assessment
- AI integrated PPE (Smart PPE)
- Able to identify near misses and unsafe conditions(many go unreported and not investigated)

Drawbacks

- AI related ethical issue at the workplace
- Data privacy issues
- Impacts of workers' mental health

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Take Home Message:

- Billions of workers are currently exposed to climate change hazards.
- Increasing awareness among the administrators ,health and OSH professionals, employers , employees ,students and general public is vital.
- AI powered instruments have a major potential in protecting construction workers from climate change induced health and safety risks.

Thank You!