

**Understanding Heat Resiliency via Physiological, Mental, and Behavioral Health Factors
for Indoor and Outdoor Urban Environments**

1951928

Suren Jayasuriya, Arizona State University

NSF-JST PG, FY 2020

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Community and Research Partners

Community Partner: Braden Kay, Sustainability Officer, City of Tempe

External Research Collaborator: Alim Al Islam Razi, Bangladesh University of Engineering and Technology

Potential Community Partner: Makoto Seguchi, Miraikan, The National Museum of Emerging Science and Innovation

Project Overview

Visual Schematic



**Extreme
heat**

Physiological indicators: core body temperature, sweat, vitals (pulse, breathing rate)

Sensing: How to sense these? Issues of clinical importance, privacy, etc

Modeling: Individual's exposure, thermal comfort



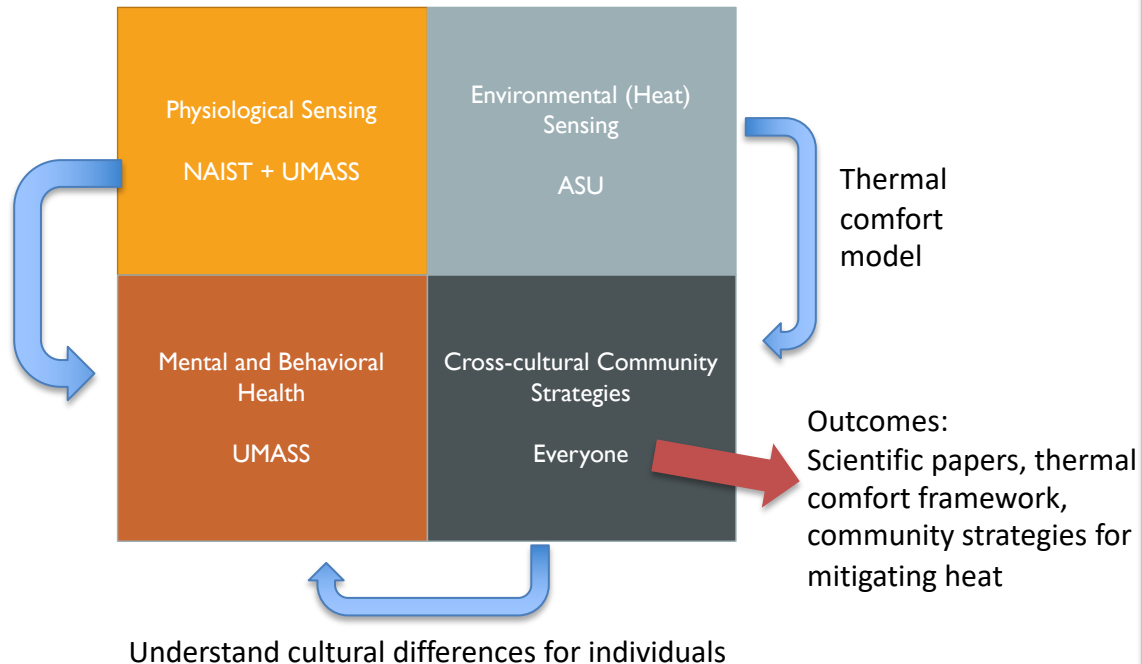
Mental Health: How does this affect mental health of individuals?

Behavior: How do individuals adapt their behavior in extreme heat?



Community: How does cultural factors (Japan, US) affect heat resistance strategies?

Understand behaviors from indicators



Project Vision

- Thermal comfort framework for individual's based on environmental and physiological sensing and subjective factors
- Research informs evidence-based resiliency strategies for extreme heat
- Compare and contrast cultural factors which can tailor resiliency strategies for US and Japan (e.g. impact of individual, community, and national strategies)

Project Overview

Use-Inspired Research

- Need for accurate sensing + qualitative research to help determine individual's thermal comfort behaviors in outdoor spaces and environments (e.g. public park usage in Tempe, AZ in extreme heat, transportation workers in Dhaka, Bangladesh)
- International collaboration is informing us about the need to examine cultural differences in an individual's behaviors (e.g. clothing choice, lifestyle, work patterns)

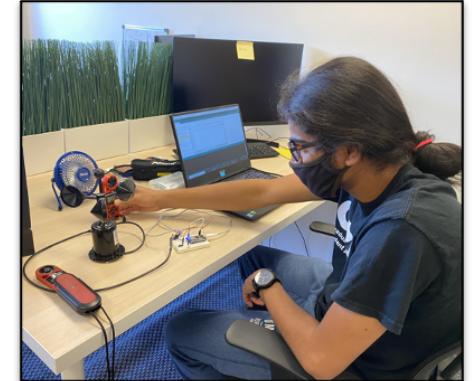
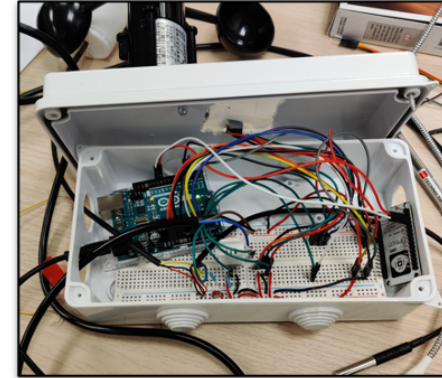
PG Activities

- Initial tools for thermal comfort sensing and crowd behaviors (quantitative aspect)
- Investigation into resiliency studies through the literature and formation of conceptual framework
- Virtual workshop with community partners, stakeholders and researchers
- Deployment of sensing framework in both Tempe, AZ and Tokyo, Japan

Project Update

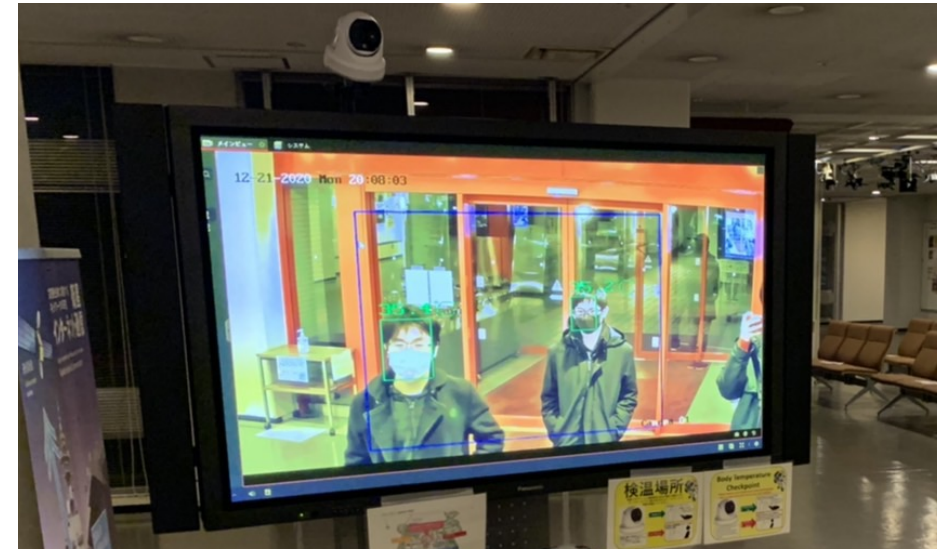
Sensing:

- Built cheap IoT sensing tool for thermal comfort modeling
- Vision algorithms to understand crowd behavior and interaction (including for COVID applications)



Resiliency Factors:

- Interviews for transportation workers in Bangladesh
- Economics research into adaptive (avoidance and/or ameliorative) actions for heat.



Project Evolution

- Planning grant activities -> making the transition from sensing technologies to understand resiliency strategies and behaviors that individuals undertake in response to extreme heat
- *“We were surprised to see in our preliminary research how individuals underrate extreme heat effects, and underrate the beneficial effects of adaptive actions and fail to undertake (and may not even consider) optimal levels of adaptive actions”*
- *“Our international collaboration is allowing us to ask questions: how do behaviors differ from the US and Japan in small individual ways (e.g., clothing choice, use of shade) and larger community ways (access to resources, community response)”*

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Physiological Sensing NAIST + UMASS	Environmental (Heat) Sensing ASU
Mental and Behavioral Health UMASS	Cross-cultural Community Strategies Everyone

Develop a thermal comfort model that can work cross-culturally in US and Japan

Investigate sensing frameworks for understanding human behaviors in extreme heat

Feedback from communities of how this can help them encourage adaptive behavior for their citizens

Use-Inspired Research

- Need for accurate sensing + qualitative research to help determine individual's thermal comfort behaviors in outdoor spaces and environments
- International collaboration is informing us about the need to examine cultural differences in an individual's behaviors (e.g. clothing choice, lifestyle, work patterns)
- Target communities: Tempe, AZ and Osaka/Tokyo, Japan

PG Activities

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