Topic: N143-126

Intelligent Automation, Inc.

Thermal Stress Analysis in Protective Equipment (TSAPE)

Infrared sensors have been used to evaluate thermal stress of clothing and Personal Protective Equipment (PPE), but current methods rely on a qualitative assessment of these images and are subjective, prone to errors, and restricted to stationary human subjects or manikins. Our solution, TSAPE, uses a 3D imaging sensor to estimate motion, determine body pose and locate body parts. A thermal camera aligned with the 3D sensor measures temperature. The targeted application is thermal stress analysis of military garment. The solution will enable objective comparison of thermal performance. During Phase I, IAI successfully demonstrated the capability by providing objective thermal measurements for clothing in indoor, shaded outdoor, and at a Navy climatic chamber. The proposed solution will assist researchers to measure heat stress of garments.

Technology Category Alignment:

EO/IR Components for sensing, transmission and communication
Scalable Teaming of Autonomous Systems
Test, Evaluation, Validation, and Verification

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SYSCOM: NAVSUP
Contract: N00189-17-C-Z019
Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N00189-17-C-Z019

Department of the Navy SBIR/STTR Transition Program

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WHO

SYSCOM: NAVSUP
Sponsoring Program:
Transition Target:
TPOC:
(508)233-1351
Other transition opportunities:



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WHAT

Operational Need and Improvement:
NAVSUP has a requirement to develop analytical software that will provide the capability to quantitatively evaluate and compare infrared images. The software should be capable of interfacing with existing hardware while providing quantitative data.

Specifications Required:
Reduce the subjective interpretation of a visual Infrared (IR) color coded representation of the IR image.

Technology Developed:
Our solution, the Thermal Stress Analysis in Protective Equipment (TSAPE), uses a 3D imaging sensor to estimate motion, determine body pose and locate body parts. A thermal camera is that aligned with the 3D sensor that measures temperature. The targeted application will provide researchers at the Navy Clothing and Textile Research Facility (NCTRF) a thermal stress analysis of military garments and protective equipment that they do not currently have.

Warfighter Value:
Provides NCTRF researchers with capability they do not currently have.

WHEN

Contract Number: N00189-17-C-Z019

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Conduct System Requirements Review		Requirements accepted	3	July 2017
Conduct Preliminary Design Review		Preliminary design accepted	3	October 2017
Conduct demonstration, Critical Design Review		Successfuly demonstration, design accepted	5	April 2018
Conduct Validation Test	Low	Measure temperature within +/- .5 degree	7	October 2018
System Acceptance	Med	User Acceptance	8	April 2019

HOW

Projected Business Model:
For this program, IAI will explore transition of TSAPE through license to a market leading thermal camera manufacturer and direct sales as an IAI branded product to designers and manufacturers of outdoor apparel, clothing insulation, and sportswear.

Company Objectives:
TSAPE will assist researchers at the Navy Clothing and Textile Research Facility (NCTRF) and garment designers to measure heat and cold stress of different clothing and PPEs in an objective, accurate, and efficient manner. In the Phase II, IAI's objective is to build and deliver a fully functional unit of TSAPE to NCTRF. The TSAPE system will be used by textile experts and clothing designers at NCTRF to research, test and evaluate novel fabric/textile technology, military uniforms and personal protective ensembles. TSAPE will close the gap in NCTRF's ability to evaluate heat and cold stress on a human subject performing various activities and to quantify thermal analysis in an objective manner.

Potential Commercial Applications:
There is a significant commercial market for protective garments ranging from industrial applications all the way to the recreational adventure sports enthusiast. There is no current method that allows for direct comparison of garments; especially under dynamic conditions. The technology can also potentially be used in physiology research on bio-heat transfer modeling, and medical thermal imaging applications such as diagnosis of joint inflammation.

Another commercial application is in thermal characterization of electronic devices and systems. Thermal management is a critical process of determining thermal hot spots and the temperature rise and distribution analysis and modeling inside these devices. The TSAPE system, with the Kinect sensor generate a 3D point cloud can be used to register the thermal image with a CAD model, thereby providing quantitative thermal measurement of specific zones of the device.

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