Writing 1: Project Summary

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Text Box 1: Overview, Keywords, and Subtopic Name

The project involves Ecological Furniture: personalizing HVAC furniture with self-control processes in an office space. The project requires areas of technical expertise in Mechanical Engineering - provision and construction of suitable furniture for physical and thermal comfort, Computer-Vision - identifying a user at their desk space, and Embedded Systems - the technology used to control the HVAC system provided with the furniture. The project will be applied to the fields of Environmental Sustainability – reducing the cost of energy spent on commercial and residential HVAC systems, and Control Systems – the ability to control the ecological furniture using embedded hardware.

Text Box 2: Intellectual Merit

This Small Business Innovation Research Phase I project produces office furniture that can accurately predict the comfort of individual users using thermal sensors, a thermal imaging camera, and HVAC and embedded systems. To do so, the embedded system must regulate the transfer of temperature-controlled air from the source (the HVAC) to the user - according to the data produced from the thermal sensors and thermal imaging camera (spotting the user's presence and temperature of the environment respectively). The office furniture will be designed to accommodate in-built AC/Heating for microclimate control around an individual, when present, using said furniture.

Text Box 3: Broader/Commercial Impact

According to the U.S. Energy Information Administration (EIA): in 2016, 39 Quadrillion British thermal units of energy were being consumed in the residential and commercial sectors[1]. Converted, this is 4.11×10^{19} Joules. Approximately 40% of this is contributed by Heating, Ventilation and Air Conditioning (HVAC) systems. HVAC systems can be inefficient today because energy fed into these systems end up being used to heat or cool large volumes of indoor space. With the rise of global warming, and the recent decision in the White House to leave the Paris Agreement, It is more important than ever for us to reduce our carbon footprint and improve the efficiency of these HVAC systems. This project aims to change this approach, as it targets the thermal comfort of an individual in their immediate area, rather than heating or cooling the large space around said individual. This model also follows the technological trend of home and office automation, and can bring about a change in the culture of heating, cooling and ventilation in the respective industry.

[1] https://www.eia.gov/tools/faqs/faq.php?id=86&t=1