Energy Saving Wearables

NAU NORTHERN ARIZONA UNIVERSITY
Office of Undergraduate Research and Creative Activity

Team name: Energy conservers

Client: Samkruth Aluru

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Team Logo:

energy conservers

Introduction and Objective

Introduction:

Climate change calls for the conservation and effective utilization of energy. Buildings are considered to be on of the greatest energy consumers. Therefore, for our project, we need to monitor energy in buildings and make changes using that monitored data. This monitored data is in the form of the data logging subsystem and is needed due to the fact that buildings are primarily used by today's society as a safezone, a care facility, an educational facility, etc. Keeping occupant comfort in mind in order to save energy is part of the system. Therefore, the data logging subsystem is incharge of logging (measuring) the current environmental conditions of the room. These conditions consist of 5 variables: **temperature, humidity, carbon dioxide, light, and activity level** (beats per minute). After that, we have two subsystems, one to calculate the comfort of the room (whether the room is comfortable or not) and one one to calculate the energy efficiency of the room (whether the room is energy efficient or not). Finally, we have a joint subsystem to combine the comfort and energy efficiency subsystems.

Objective:

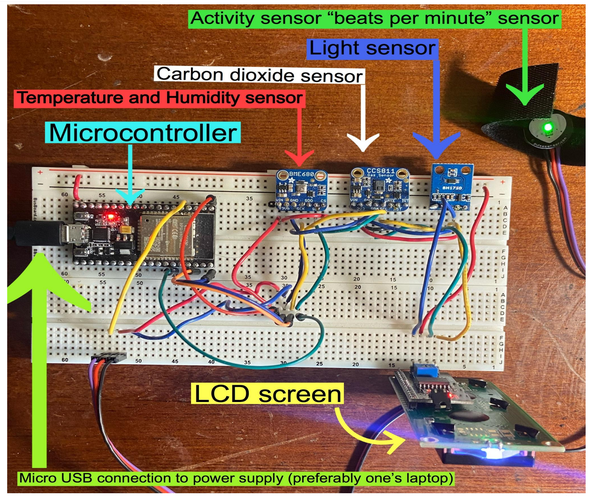
- Measure the current environmental conditions of the room (data logging subsystem).
- Calculate the comfort of the current environmental conditions of the room (comfort calculating subsystem).
- Calculate the energy efficiency of the current environmental conditions of the room (energy efficiency subsystem).
- Conclude if the room if comfortable and energy efficient or not (joint index subsystem).

Team roles:

- The data logging of current environmental conditions and concluding if the room is comfortable and energy efficient or not (developed by Mohammad Altarfa "Momo" and Raymond Holgate)
- The room comfort calculating aspect of the project (developed by Mohammad Altarfa "Momo")
- The energy efficiency aspect of the project (developed by Raymond Holgate)

Built device and Results

Built device:



Flipped

Front view of the LCD screen from this side of the device

Results:

EnergySavingWearables-S20's Room comfort and energy effiency calculator

Current Room readings (data logging subsystem):

Variable (Unit)	Value
Outside room tempurature (Fahrenheit)	90.00
Inside room temperature (celcius)	24.45
Inside room temperature (Fahrenheit)	76.71
Humidity (Percent)	22.34
light (lux)	46
"Co2" equivalent calculated carbon-dioxide (ppm)	466.00
Beats per minute (Bpm)	65

The data logging subsystem

Current Room comfort sensation (comfort calculating subsystem):

comfort sensation Lookup table	Value
Tempurature Sensation	0.00
Humidity Sensation	-0.50
Co2 sensation	0.00
light sensation	0.00
BPM sensation	0.00
Current sensation of the room (comfort index)	-0.50

The comfort calculating subsystem

Current room energy effiency (Energy effincy subsystem)

comfort sensation Lookup table	Value
HVAC set (Fahrenheit)	77.00
HVAC tempurature (Fahrenheit)	78.00
Current energy efficincy index (Energy effincy index)	0.66

The energy efficiency subsystem

Status report of the room (Index translations):

	status
Current room sensation	Neutral tempurature conditions,Kinda dry humidity conditions,Neutral light conditions,Neutral carbondioxide conditions,Resiting BPM conditions.
Current energy efficiency of the room	non-energy efficient due to HVAC cooling

The status report table

comfort calculator (Final veridict of room current)

Condition	value
Current comfort value of the room	uncomfortable
Current energy efficiency value of the room	non-energy efficient

The final verdict of the room

Joint index of (comfort and energy index's) of the room

Variale index	Index Value
Current comfort value of the room	uncomfortable
Current comfort index of the room (Comfort index)	-0.50
Current energy efficiency value of the room	non-energy efficient
Current energy efficiency index of the room (Energy index)	0.66
Joint Index of the room (|comfort index| + energy index = Joint index)	1.16
Final status report of the room	uncomfortable and non-energy efficient

The joint index subsystem

Theoretical Background, Methods and Hypothesis

Theoretical Background:

- After carrying out the research regarding the project last semester, we have decided to follow the American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE) widely adapted modified version of Fanger's predicted mean vote (PMV) formula to calculate the current comfort of the room.
- Analyzing building energy usage provided in many research papers we read, we determined that the focus of our energy efficiency would be on heating ventilation and air conditioning (HVAC) systems and lighting. These two systems account for a large part of most building energy usage.

Methods:

Using the arrangement of sensors (sensor array, seen at the top right of the built device), our data logging subsystem measures the current environmental conditions of the room. Using these current environmental conditions, the comfort subsystem, and the energy efficiency subsystem, the device calculates the comfort and energy efficiency of the room. Finally, the joint index subsystem deduces whether the room is comfortable and energy efficient or not.

Hypothesis:

As we are the first team to work on this capstone project for the client, we feel like this device is a good stepping stone for next year's capstone teams to work towards control the HVAC of a room. The built in wifi of the controller will allow additional satellite systems to be added to control room conditions.

Discussion

In the results section, we have on display a view of the system outputs. The top section displays the data logging system. Below that is the comfort calculating subsystem, followed by the energy efficiency subsystem. Finally, the status report table, final verdict of the room, and joint index subsystem are shown. For the results shown, the energy efficiency subsystem has an index of 0.66 and the comfort index of -0.5. Using the joint index formula, we combine these values to attain a joint index of 1.16. A joint index of zero is ideal and five is not ideal. The current room conditions are not optimal, but are closer to ideal than not ideal.

Conclusion

To conclude, once the user inputs the internet protocol (IP) address, they will be presented with the webpage that displays the results. Once the user inputs the webpage address (the series of numbers displayed in the screen), they will be presented with the data logging subsystem which consists of the current temperature, humidity, carbon-dioxide level, lighting, and beats per minute (heart rate). The user will have a clear analysis of the room conditions and will be able to determine ideal energy and comfort settings. Additionally, this system has been designed to allow additional systems to be added in future projects.