Smart Jacket

New Mexico
Supercomputing Challenge
Final Report
April 8, 2024

Unknown
La Cueva High School

Team Member:
Paul Kotze

Teacher:
Mr. Jensen

Project Mentor:
None

Table of Contents:

The purpose of this project is to make a simulation of how a smart jacket could work. The program I created asks the user for the temperatures at different sensors and outputs how the user would be heated, guided and warned according to those inputs. This is important because many injuries, illnesses and deaths around the world are caused by people being exposed to cold temperatures.

Why is a Smart Jacket important?

Many injuries, illnesses and deaths around the world are caused by people being

exposed to cold temperatures. Examples are hypothermia, frostbite and trench foot.

A Smart Jacket could warm the user's upper body, neck and hands to prevent hypothermia and frostbite on the heated areas. While it couldn't prevent frostbite on the unheated areas and trench foot (which only affects feet), it can warn the user of cold outside temperatures which can cause the user to be more aware of their body's temperature.

Jacket Features:
- A thicker neck area to keep the neck warm, like a built-in scarf
- A zip under every arm for when the user wants to cool down, 2 zippers so the user can choose where and how large the opening must be
- Insulation under all zips
- Long sleeves with a hole for the thumb
- Insulation between pockets and the body, and between pockets and outside
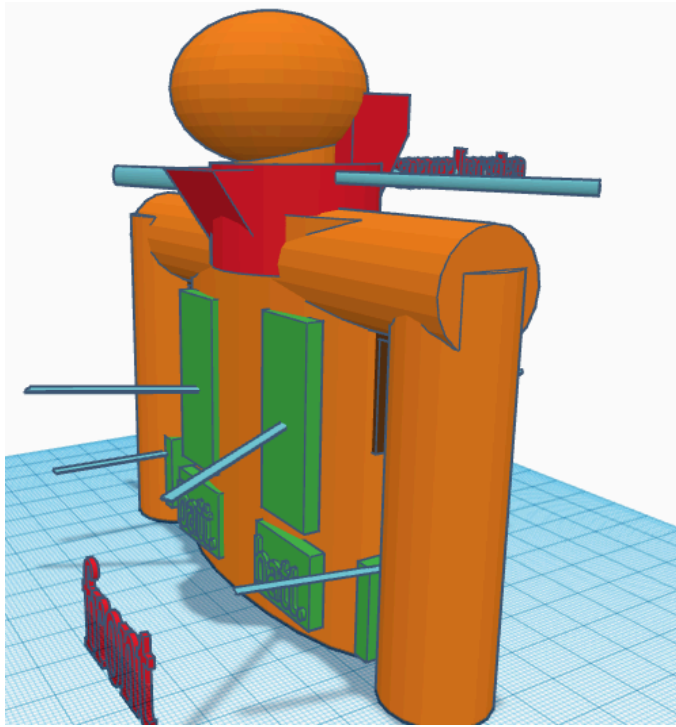- Batteries must be rechargeable

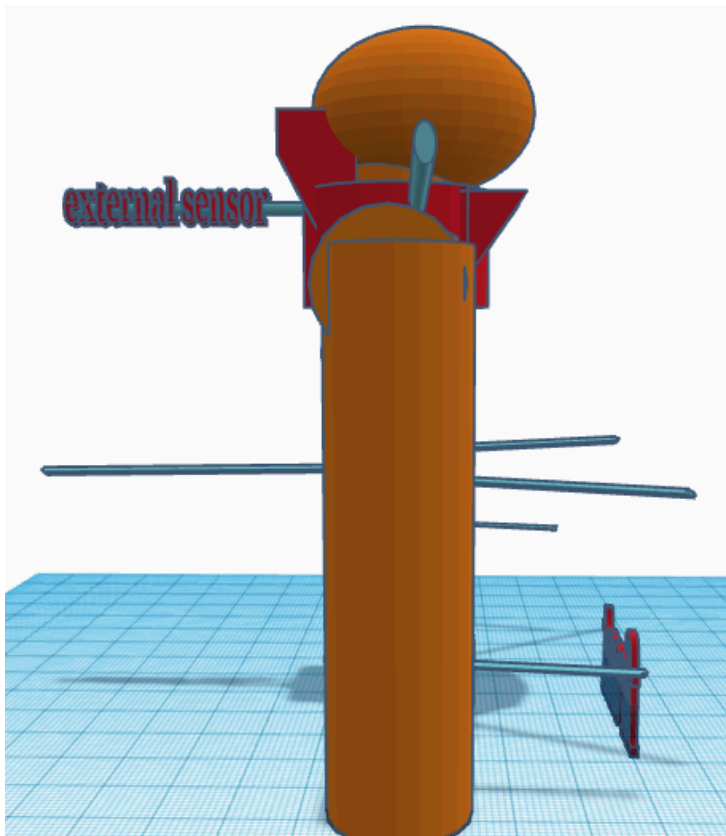**TinkerCAD Model:**
Key for the model:

- Brown is zips - 2 zippers
- Red is important insulation
- Brownish yellow is human
- Light blue cylinder indicates where a sensor will be, the one that says "external" measures the outside temperature
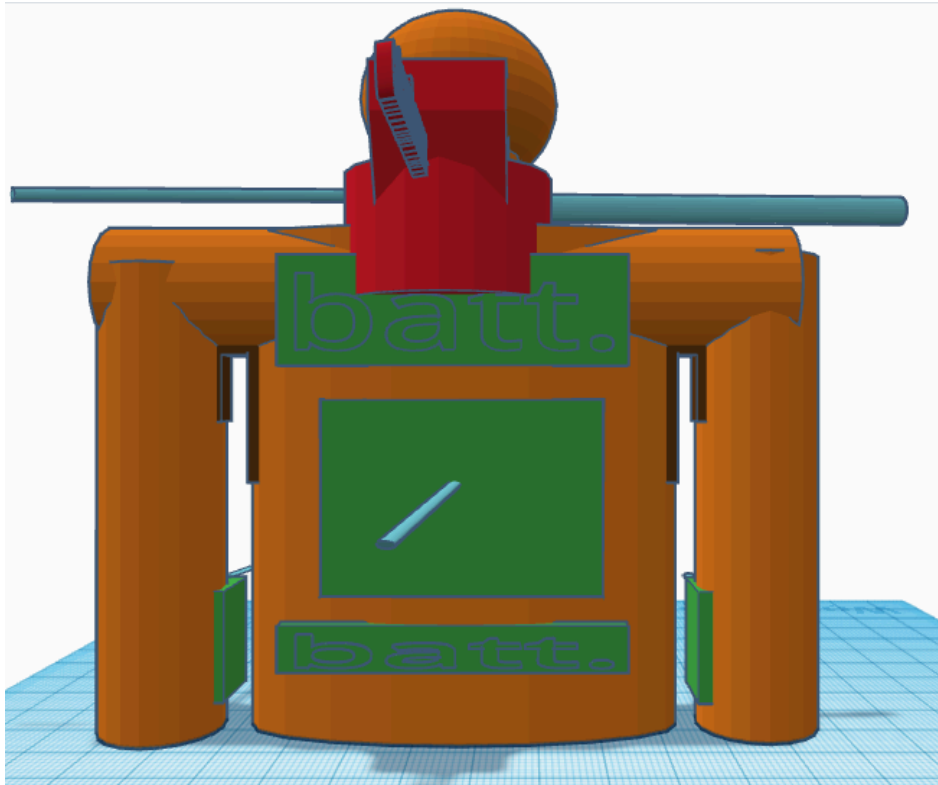- Green is a heater, green with "batt." written on it is a battery
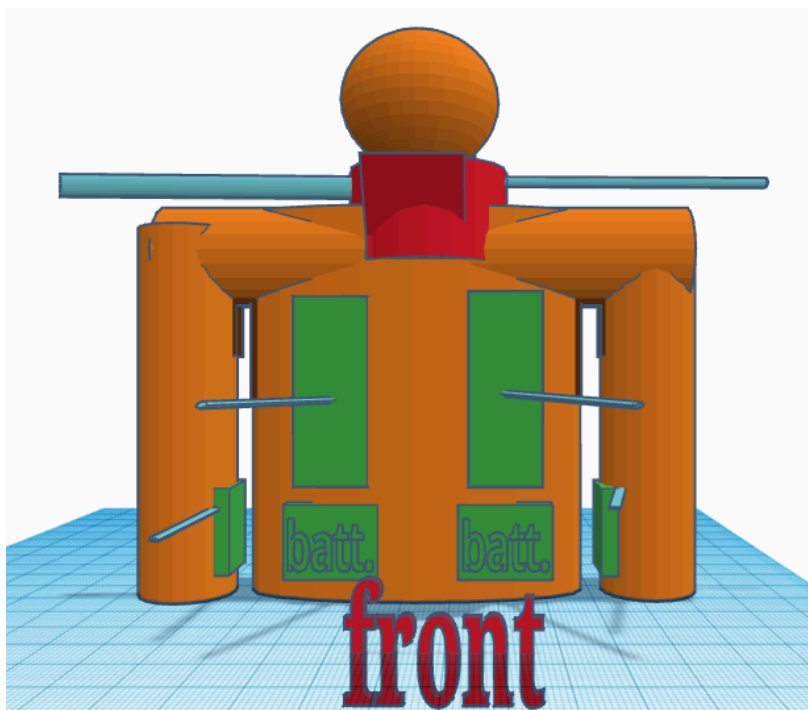
Front View

Front side view

external sensor

Side view

Rear view

Prices for Parts:
Items(examples):
- Temperature sensors $5 each (8 sensors)
- Micro-controller; Example: Arduino (I know how these work, but if I were to actually produce these jackets I would make or use something else.) $30
- Heaters $3 each (5)
- Bluetooth chip $10
- The actual jacket: The rest of the budget which is $ 105

All this adds up to $ 200 (It could be more)

Program Specifications:
- If body part is too cold- heat
- If body is too warm- advise the user to open zips
- If there were an app, a nice User Interface
- Something that displays body temperature in different places and outside temperature
- User must be able personalize their temperature preferences within a reasonable range

Program (Python):
This code is also on the Code Submission. To see how this code works please copy and paste it into wherever you do your coding. (I used Replit)

Please note that indents in Python are merely spaces on this document.

```python
# Supercomputing Challenge: Smart Jacket        - Paul Kotze
# I will use Fahrenheit as it is more commonly used in the United States

#everything is in a loop because the simulation will run constantly
while 1==1:
  extTemp = float(input("In degrees Fahrenheit, what is the temperature at the external sensor? "))
  neckLTemp = float(input("In degrees Fahrenheit, what is the temperature at the left neck sensor? "))
  neckRTemp = float(input("In degrees Fahrenheit, what is the temperature at the right neck sensor? "))
  frontLTemp = float(input("In degrees Fahrenheit, what is the temperature at the left front sensor? "))
  frontRTemp = float(input("In degrees Fahrenheit, what is the temperature at the right front sensor? "))
  backTemp = float(input("In degrees Fahrenheit, what is the temperature at the back sensor? "))
  wristLTemp = float(input("In degrees Fahrenheit, what is the temperature at the left wrist sensor? "))
  wristRTemp = float(input("In degrees Fahrenheit, what is the temperature at the right wrist sensor? "))

  #this adds a line for comfortable reading
  print(" ")

  #this asks the user what their preferred average body temperature is
  prefTemp = float(input("What is your preferred average body temperature? (90 to 100)"))

  #this calculates the average body temperature
  bodyAv = ((neckLTemp + neckRTemp )/2 + (wristLTemp + wristRTemp)/2 + frontLTemp + frontRTemp + backTemp)/5

  #this adds a line for comfortable reading
  print("")

  #this asks the user if they want to have all the heaters on or off for a short period
  #of time or if they want it to be automatically heated
  pref = int(input("Do you want heating to be on (1), off (2), automatic in certain areas(3) or automatic to your average temperature preference (4) ?"))
  if pref == 1 :
    print("HEAT: all heaters")
  if pref == 2 :
    print("NO HEAT: all heaters")
```

```python
if pref == 3 :
  #these if statements will determine if certain heaters are     heating or not
  if neckLTemp < 95.5 or frontLTemp < 95:
    print("HEAT: Left front heater")
  else:
    print("NO HEAT: Left front heater")
  if neckRTemp < 95.5 or frontRTemp < 95:
    print("HEAT: Right front heater")
  else:
    print("NO HEAT: Right front heater")
  if backTemp < 95.5 :
    print("HEAT: Back heater")
  else :
    print("NO HEAT: Back heater")
  if wristLTemp < 95.5 :
    print("HEAT: Left wrist heater")
  else :
    print("NO HEAT: Left wrist heater")
  if wristRTemp < 95.5 :
    print("HEAT: Right wrist heater")
  else :
    print("NO HEAT: Right wrist heater")

if pref == 4:
  if bodyAv < prefTemp:
    print("HEAT: All heaters")
  if bodyAv > prefTemp:
    print("NO HEAT: All heaters")

# the error margin in the parentheses below would be determined by the error margin on the
sensors
print("The outside temperature is " + str(extTemp) + " degrees Fahrenheit. (+/- 1 degree)")
if extTemp < 32 :
  print("The temperature is below freezing outside, make sure you are warm enough.")
if extTemp > 70 :
  print("The outside temperature is above 70 degrees fahrenheit, you do not need this jacket.")
print("Your average body temperature is " + str(bodyAv) + " degrees Fahrenheit. (+/- 1
degree)")

if bodyAv < 85:
  print("You are too cold, get to a warmer place.")
if bodyAv > 99.9:
  print("You are too warm, open the zips under your arms and/or get to a colder place.")
```

```
#this adds a line for comfortable reading
print(" ")
```

Resources Used:
TinkerCAD for the 3D model
Replit for the Python program
Amazon.com for the prices of parts

Reference:
- Unknown. "Types of Cold Related Illnesses." *Cold Stress - Cold Related Illnesses*, CDC, June 6, 2018, https://www.cdc.gov/niosh/topics/coldstress/coldrelatedillnesses.html , Accessed April 5, 2024.