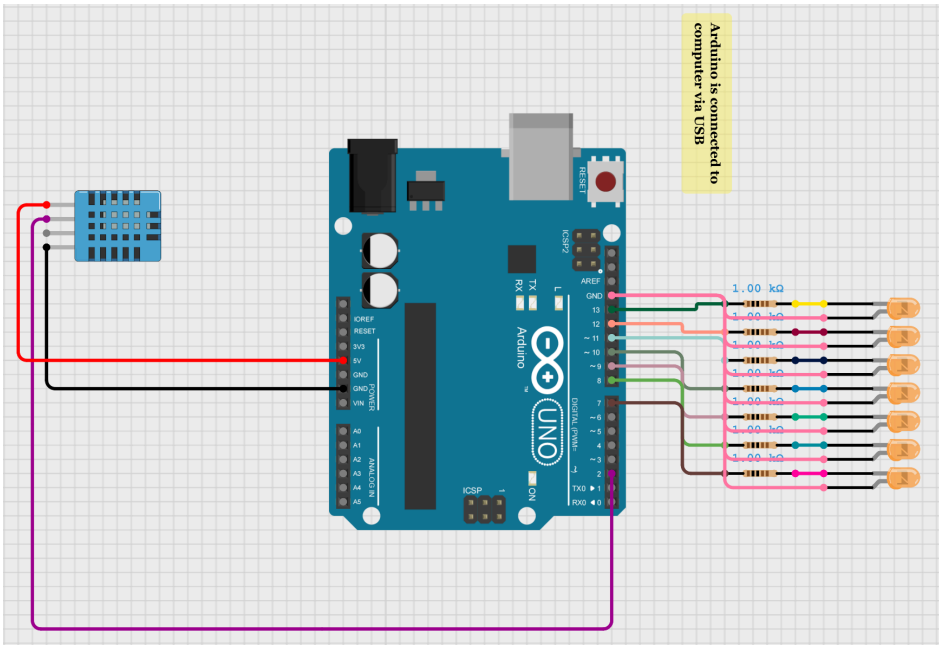
Prototype 3

StressLess Group Project

Final Version (Nana)

For our final prototype, we wanted to combine the light sequences with the embroidered wristband. We first had to combine the LEDs with the temperature sensor and program the LEDs to turn on when high stress levels are detected. In addition to that, we also needed to write code to make our processing display look more like our wireframes and show when high stress levels are detected. We began by making the circuit.



Arduino Code

The Arduino code produces a temperature-responsive LED sequence with a DHT11 temperature sensor and seven LEDs. It is intended to detect a sudden spike in temperature and, in reaction, activate a visual breathing pattern via LEDs. This can be used to detect stress and provide relaxing light feedback. In the setup() function, we first enable serial connectivity and start the DHT sensor. Each of the seven LEDs (7–13) is allocated to a particular digital pin, and all are configured as outputs. To ensure a clean start, all LEDs are initially turned off. The loop() function continuously examines the current time and compares it to the last time the temperature was measured. If a temperature reading is required, the sensor is queried. If a genuine temperature is returned, the application compares it with the previous value. If the

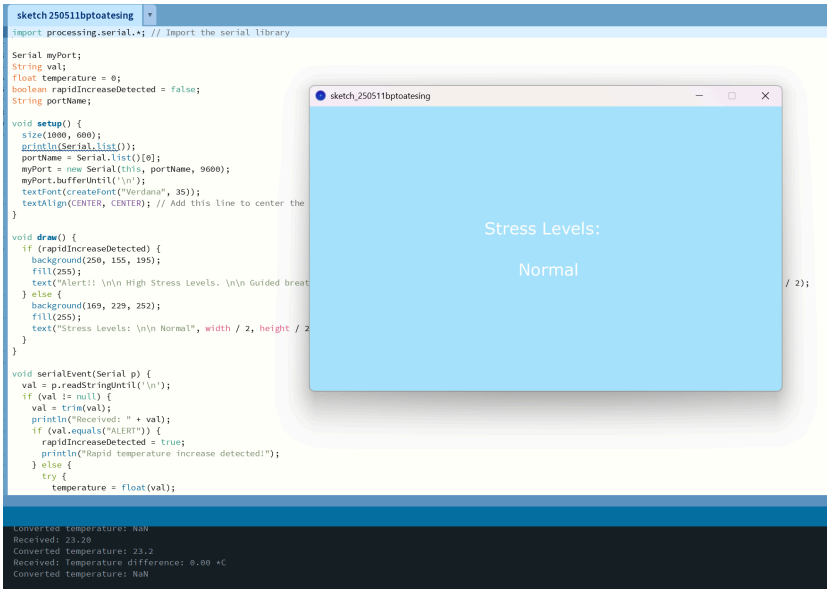
temperature rises rapidly—more than 0.2°C in 1.5 seconds—the code recognises it as a substantial rise, which may indicate stress. It starts an LED sequence by executing playLEDSequence() and keeps it active for one minute.

While the sequence is active, the loop() does not take any additional temperature readings. Instead, it executes playRepeatingLEDSequence() until the one-minute timer expires. Following that, all LEDs are turned off with turnOffAllLEDs(). The playLEDSequence() function initiates a brief version of the breathing animation. LED7 lights on immediately, and the remaining LEDs fade in with minor delays. After a brief wait, they fade away in reverse sequence. This version is used to identify the initial trigger event. The playRepeatingLEDSequence() function handles the continual relaxing effect. It employs a slower, smoother fade-in and fade-out of LEDs in sequence, which continues as long as the warning is active. This visual impact resembles a directed breathing rhythm and functions as a nonverbal, ambient stress signal. Finally, the turnOffAllLEDs() function simply turns off all LEDs as necessary, resetting the wearable's visual state.

Processing Code

The Processing code for our system enhances an Arduino-based stress detection system by visualising feedback on a computer screen. It listens for temperature data and alert signals delivered over a serial connection and changes the interface's layout and text accordingly. The visual signals are intended to represent either a normal state or a high-stress scenario that requires directed breathing. In the setup() function, the canvas is set to 1000 x 600 pixels. It then finds available serial ports and connects to the first one (Serial.list()[0]) at 9600 baud rate, which matches the Arduino's settings. The line myPort.bufferUntil('n'); makes sure that data is read in full lines, separated by newline characters. The font is Verdana at a size of 35, and textAlign(CENTER, CENTRE) guarantees that all text on the screen is vertically and horizontally centred.

The draw() function manages the main visuals and is called in a loop. If a rapid temperature increase is detected (rapidIncreaseDetected == true), the backdrop colour changes to a pinkish tone (250, 155, 195), and an alert message indicating excessive stress appears. This display indicates that guided breathing has begun and provides brief instructions: inhale as the lights turn on and exhale as



they turn off. This message is consistent with the LED animation going on on the Arduino side, which reinforces the breathing rhythm with both visual and physical cues.

If no stress alert is detected, the screen changes to a calmer blue backdrop (169, 229, 252) and simply says "Stress Levels: Normal" in white writing. This generates a peaceful, neutral picture that corresponds to a calm state. The serialEvent() function is called whenever data is received via the serial connection. It scans the input string until it reaches a newline character, then cuts any unnecessary spaces before printing the received data. If the string matches "ALERT", rapidIncreaseDetected is set to true, resulting in the stress alert images. If the message is not "ALERT", the program attempts to convert it to a floating-point value, assuming it is a temperature reading. If successful, it updates the temperature variable and returns rapidIncreaseDetected to false, indicating normal conditions. Any conversion issues are detected and displayed on the terminal for debugging. The screen outcome of this code is above.

Our final step was to put the LEDs in the correct order into the wristband. We used pins and needles to create the holes for the legs of the LEDs so as not to damage them. After completing this step, we attempted to sew the legs down to the wristband with conductive thread but once doing so, realised that the LEDs would not light up properly. We opted instead to use crocodile clips to connect the LEDs to the Arduino.

User Review/Feedback

After presenting our project to potential users, we received 3 responses giving thoughts and feedback on our project.

Response 1:
“What i really liked about your project was the celestial themeing and how it creates a character to the product which as alice pointed reallt stands out from the rest of the bland marketing other fitness bands go for and personally theres almost a philosophical/futurism element to a celestial theme because it does evoke a feeling of unity and serenity which for a stress monitor is perfect as its meant to both analyze user stress levels but also actively try and alleviate as a secondary function.
In my opinion leaning onto that and replacing the led indicators with a small screen or 'watch-like' contraption that kinda of acts like a game or fidget to reduce the stress would be perfect in creating multidimensionality for your product and ofc you can have your stress level

display be its primary focus but i do think that leaning into this secondary function would bring something new to the market and make it stand out even more."

Response 2:
"What did you understand about how to interact with our product?
As the piece is a wearable, i understood that it would be worn on the user's wrist. They could interact with buttons to relieve their stress. Also it was clear how the leds worked as a breathing excercise and actually reflected when the users breathed into the sensor.
What did you like about our project?
I really liked the celestial design aesthetic, and the meaning behind it felt so relevent to your project. i also loved the way the LEDs gradually turning on, it felt calming and focusing. Whereas if they were sudden it would have been jarring.
What do you think we could improve upon?
You could improve the sizing of the wristband, as it stands it only fits one size and isn't adjustable. It also means that aspects of the embroidery would be hidden to fit on a smaller wrist.
Do you have any improvements/ additions to the tactile interactions?
I think it could be interesting to explore different methods of interactivity, such as sliding or spinning the beads."

Response 3:
"What did you understand about how to interact with the product?
So from what i got, u wear it like a normal wristband and it just kinda works in the background, reading your temperature to figure out if you're stressed. Then when it picks something up, the leds light up in this slow sequence that guides ur breathing. It's simple but makes a lot of sense, you don't have to think too much about how to use it which is really nice.

What did you like about it?
i really liked how chill the whole thing felt, like the led sequence was genuinely calming and didn't feel all techy or overwhelming. I also love that you went for something that doesn't just monitor stress but tries to *do* something about it too. the way the lights come on gradually feels kinda meditative?? And using the arduino uno is a smart move, it keeps it accessible and easy to build on.

What could be improved?
Maybe you could make the leds react differently depending on how big the temp spike is, like if it's a really strong one maybe the pattern lasts longer or changes colour or something. Also, the wristband size could be more adjustable, it looked like it might only fit certain people. It would be cool if the embroidery didn't get hidden too depending on who wears it.

Any ideas for more tactile stuff?
Yeah, i think it'd be fun to add something to fidget with, like a little spinner or slider bead you can play with when you're anxious. Sometimes it helps just having something physical to mess with while the leds guide your breathing. Maybe even let the user press a button or touch

something if they wanna start the sequence themselves instead of waiting for the temp to spike.”

Overall, they enjoyed the tranquil LED breathing sequence and the celestial-inspired design, which felt pleasant and distinct from more basic exercise bands. A popular proposal was to provide gentle relaxing vibrations that could be felt alongside the LED breathing guides. This would make the bracelet easier to use without looking at it. We'd add a little vibration motor that was timed to the breathing rhythm and controlled by the Arduino.

Another idea was to incorporate additional tactile elements, such as pop-its or textured materials, to provide people with something physical to interact with when agitated. These might simply be for fidgeting, or we could go one step further and make them practical, such as hitting a tactile button to change the breathing pattern or switch modes. We'd add a basic button and modify the code to respond to various LED or vibration sequences.

One of the more intriguing possibilities was to customise the breathing pattern. Instead of a default rhythm, the user can select a tempo that corresponds to their natural breathing. While we are not adding sensors to this version, we may provide a few preset patterns that people can cycle through using the button. Overall, the input influenced our thinking about the product in a more interactive and sensory approach — not just as a tool for reading stress but as something that responds to the user and actively manages it through touch, light, and movement. It taught us the importance of mixing data, comfort, and play.