Smart Underwear Alert

Creative Project Addressing the Embarrassment of Exposed Underwear Using Technology

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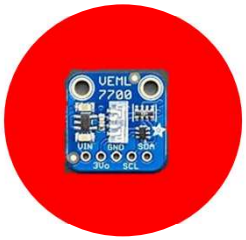
Inspiration

Background: Shame often arises from inappropiate wardrobe malfunctions, such as exposed underwear.

Inspiration

Idea: Use technology to address this awkward situation by providing immediate reminders.



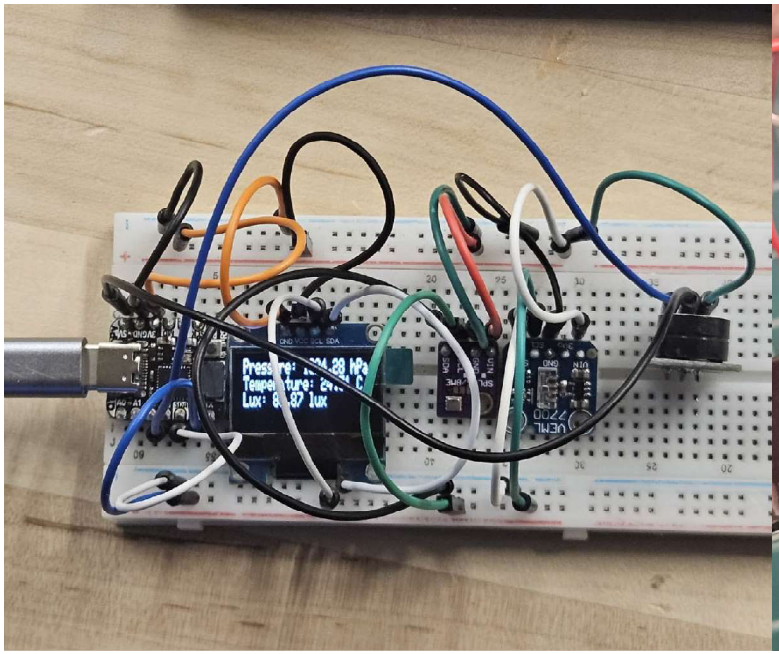
ALERT!

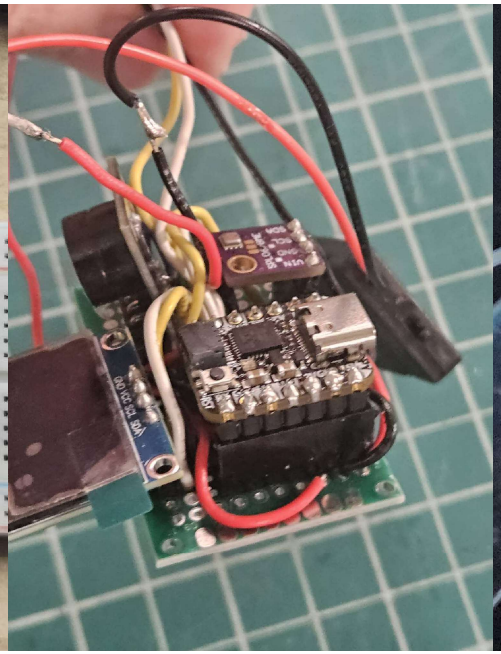
OLED

BME280

VEML7700

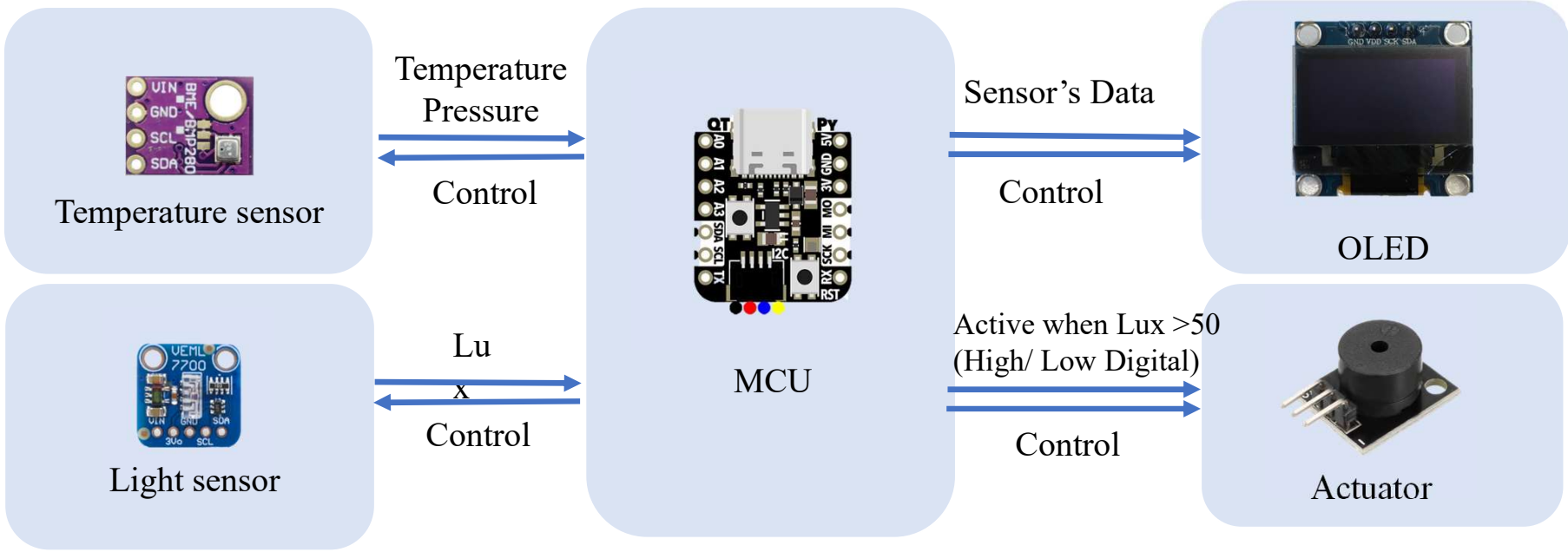
Implementation





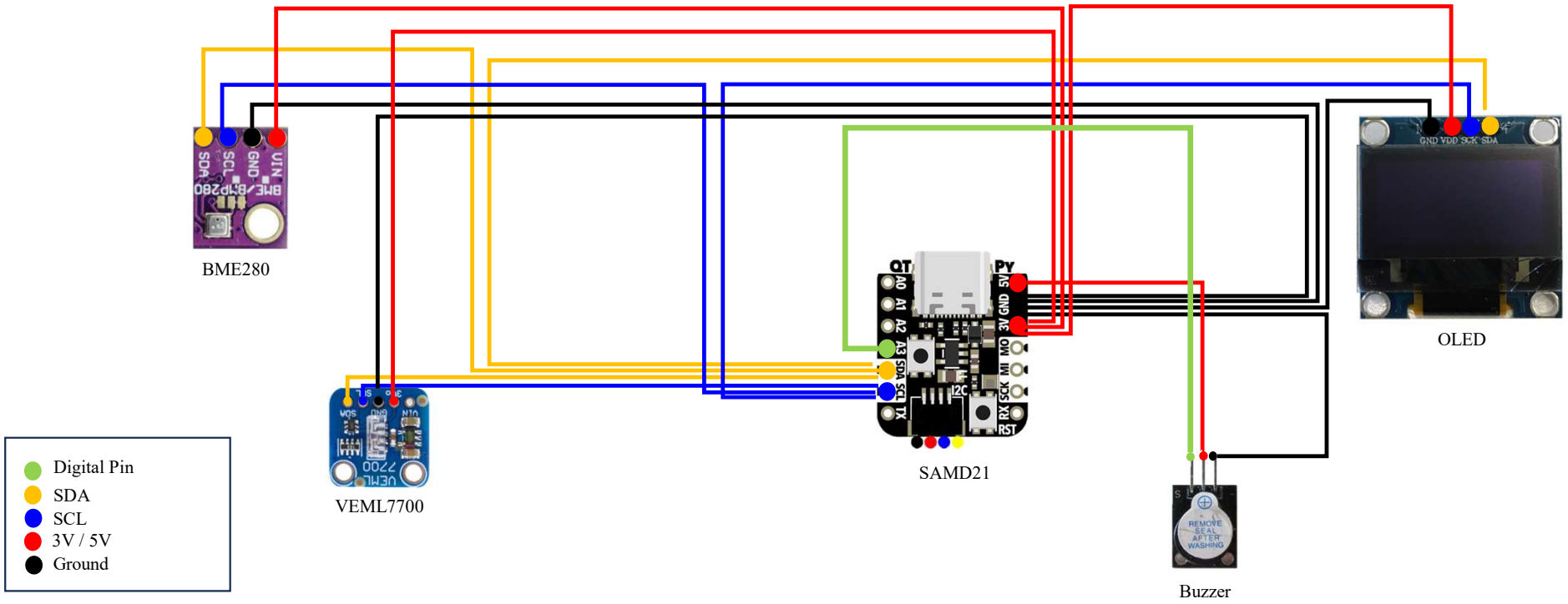
System workflow

1.1 A diagram representing how the sensors, MCU, and screen work together, what information is communicated among sensors, MCU, and screen



System workflow

1.2 A figure shows the wire connection of the system. The figure cannot be a photo of the prototype.



Sensor implementation

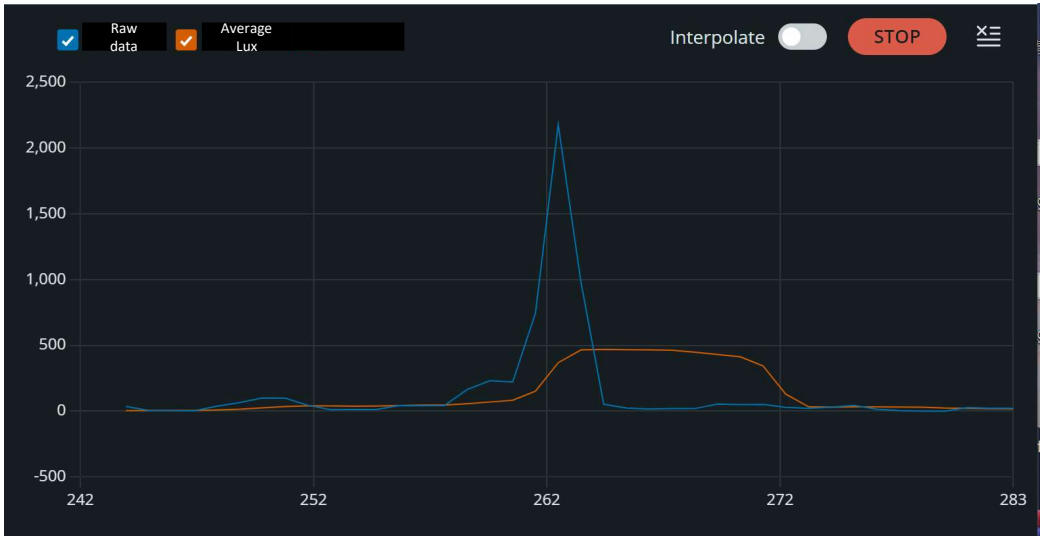
2.1 Basic sensor information: should include at least 1) operating voltage, 2) frequency (how many measurements are obtained every second), 3) digital or analog signal, 4) maximum measurement limit

	Operating Voltage	Frequency	Digital or Analog Signal	Maximum Measurement Limit		
BME280	1.7V ~ 3.6V	1Hz	Digital Pin I^2C	Temperature: -40~85°C	Humidity: 0~100%	Pressure: 300-1100 hPa
VEML7700	2.5V to 3.6V	**For Standard Mode:** ranges from 10 kHz to 100 kHz. **Fast Mode:** ranges from 10 kHz to 400 kHz.	Digital Pin I^2C	0 to 120000 Ambient Light Range(lx)		

Sensor implementation

2.2 Calibration and filtering: for each sensor, at least one calibration or filtering should be applied. How is the calibration performed, and what filter is applied? Show a plot of raw signal VS. calibrated/filtered signal.

VEML7700 applying Moving Average Filter



After applying the moving average filter, the Lux value undergoes a smoothing process. This means that rapid changes or fluctuations in the raw Lux data are reduced, providing a more stable and averaged Lux value. The purpose of this filtering is to obtain a representative Lux reading over time, which can be particularly useful in scenarios where raw sensor data may have variations or noise.

MCU and screen implementation

3.1 1) How does the MCU handle and utilize the sensor readings?

Initialization:
The MCU sets up sensors, the screen, and the buzzer. This involves configuring pins, communication protocols (I2C), and any necessary settings.

Main Loop:
The MCU continuously reads sensor values, processes them, and takes actions accordingly. This loop runs indefinitely for real-time monitoring.

Read Sensor Values:
Sensor values from VEML7700 (lux) and BME280 (temperature and pressure) are read and stored in variables (e.g., lux, temperature, pressure).

Filter Sensor Values:
Optionally, the MCU can apply filters to enhance accuracy or reduce noise in raw sensor readings. Functions like applyFilterToLux, applyFilterToTemperature, and applyFilterToPressure may be used.

Display on Screen:
Filtered sensor values are sent to the screen for real-time display. A function like displaySensorValues formats the data and updates the screen.

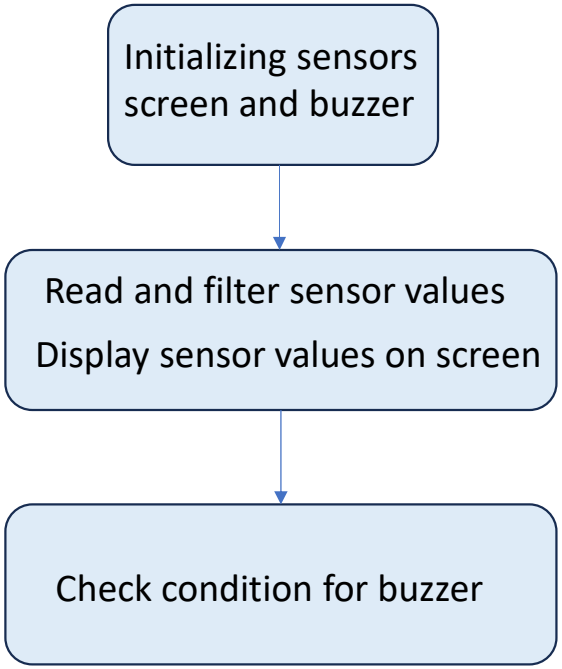
Check Buzzer Condition:
The MCU evaluates a condition based on the filtered lux value (e.g., lux > 50.0). If met, it activates the buzzer using turnOnBuzzer.

Delay:
To control the reading rate, stabilize the system, and prevent rapid display changes, the MCU introduces delays.

Functions:
Various functions are employed for specific tasks such as reading sensors, filtering data, displaying information, and controlling the buzzer. These functions make the code modular and easy to understand.

MCU and screen implementation

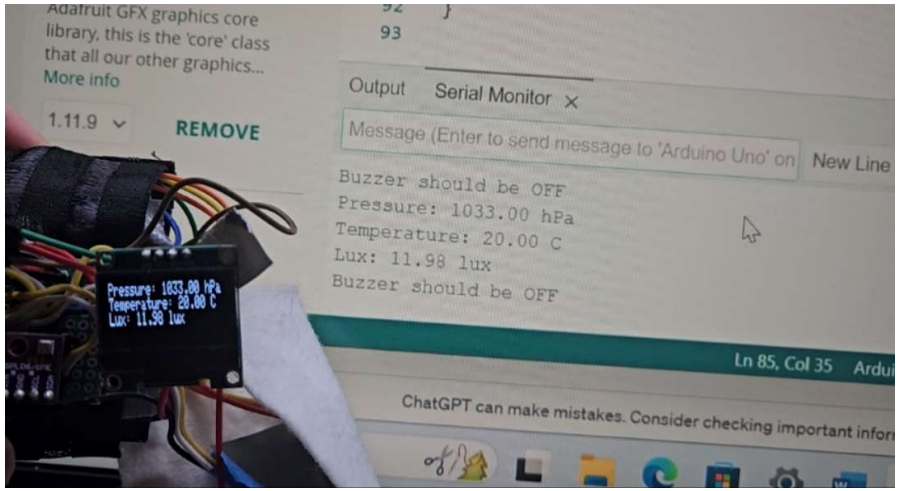
3.1 2) show a flowchart or pseudocode.




```
// Initialize components
initializeSensors();   // Initialize VEML7700 and BME280 sensors
initializeScreen();    // Initialize SSD1306 screen
initializeBuzzer();    // Initialize buzzer

// Main loop for continuous operation
while (true) {
   // Read sensor values
   lux = readLuxSensor();
   temperature = readTemperatureSensor();
   pressure = readPressureSensor();

   // Apply optional filtering
   lux = applyFilterToLux(lux);
   temperature = applyFilterToTemperature(temperature);
   pressure = applyFilterToPressure(pressure);

   // Display sensor values on screen
   displaySensorValues(lux, temperature, pressure);

   // Check buzzer condition
   if (lux > 50.0) {
      turnOnBuzzer();
   } else {
      turnOffBuzzer();
   }

   // Introduce a delay for stability
   delay(1000);  // Adjust the delay time according to requirements
}
```

MCU and screen implementation

3.2 The screen should display information from sensors in real-time. The reading on the screen should be easy to read, clear, and intuitive.



For realtime proof
https://youtu.be/fsSPHuttDug

Enclosure and attachment design

4.1 The hardware should be suitable to wear.

At the front, there's an OLED screen, a BME sensor for temperature and pressure, and a buzzer. Connected to them is a long wire that goes all the way to the back, where it's hooked up to a VEML7700 sensor. This sensor is checking if my underwear is exposed or not. If it is, the buzzer goes off, giving me a discreet alert. It's like a smart belt that helps me avoid any embarrassing situations!

Enclosure and attachment design

4.2 The components should have solid support (5 pts).
Components should be mounted securely
Temperature sensor should be properly exposed for measurement