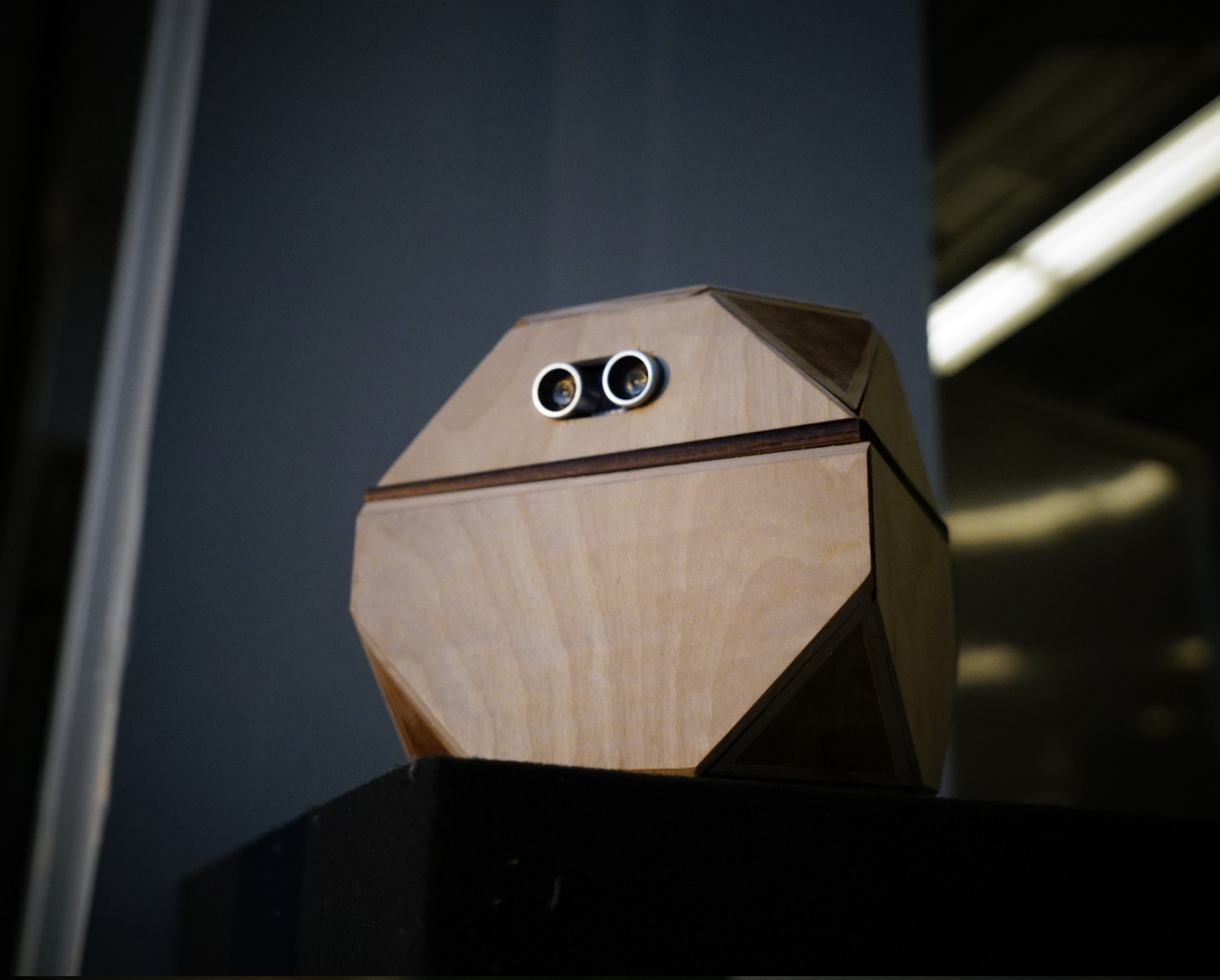
ivb64 - 5592897
10/04/23

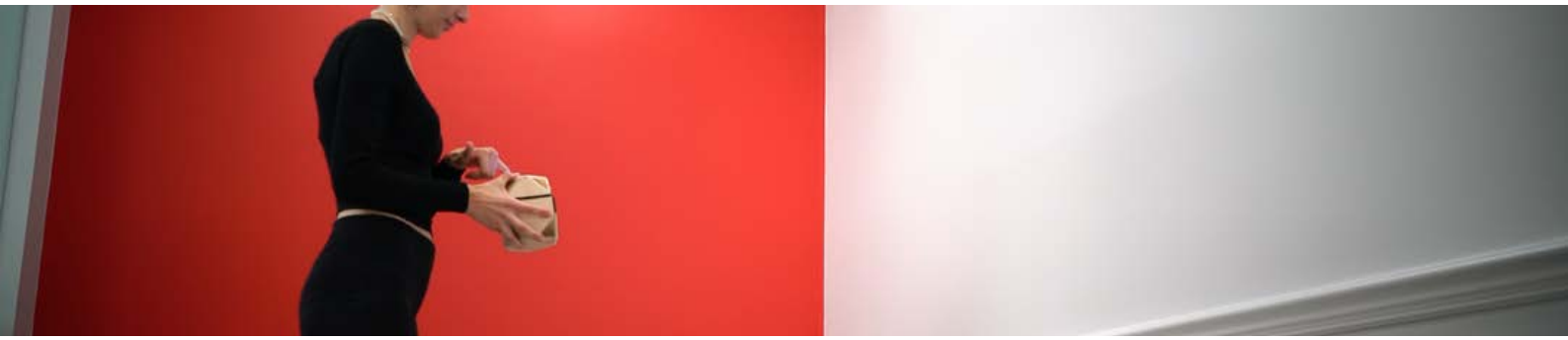
THE ICEBREAKER

DEA 6210
Architectural Robotics

Inez van Winden

CONTENTS





INTERACTING WITH THE ROBOT

Page 8.
One morning, I found her on her knees beside the sofa.

"Come here quickly," she said, "it seems like the house is trying to tell us something."

And it did. The usually towering walls of the living room ominously curved over us, all pointing toward the sofa, positioned centrally in our living space. It appeared that not only the walls but also the tables, chairs, and even the floor were all aligned in a compelling manner, directing their focus toward the sofa. Fay, still kneeling on the floor, awkwardly reached her hand under the sofa's fabric and pulled out a solid wooden box.

The box held little of note, except for a elongated strip of led lights forming a lamp. It seemed the previous occupants had left it behind or forgotten about it. Fay delicately ran her fingers over the wooden carvings on the top side of the box. Slowly, she opened it, the creaking sound adding an air of mystery. Peering over her shoulder, I glimpsed inside to find several pieces rolled up and held together by a piece of ribbon. The paper looked old, but the writing was still readable. Underneath the lid of the box, a simple white note explained its purpose.

"In the realm of mystical connection, behold the enigmatic box, a vessel divinely guided to seek those in need. Select a question that resonates with your essence, and as you observe the mystical glow of the LED lights. To convey your sentiment, position the box either nearer or farther from the sacred wall, thus marking your essence on the scale of perception. In the aftermath, share with your companion the profound reasons that led you to your chosen position. For this mystical box serves as a conduit for deeper communion, a means to fortify the bonds that reunite your spirits."

The once ominous atmosphere in the house had transformed suddenly into one of tranquility and homeliness. Though my emotions were lagging behind this sudden turnaround, I made an effort to relax, allowing myself to sink into the sofa. Fay seemed entirely at ease, evident in how she immediately began to tinker with the box. She reached into the box with her hand, carefully selected a note, and began unfolding the question. She handed the note to me to read aloud.

I cleared my throat. "Rate your sense of intimacy and emotional connection with each other this week."
Fay looked at me for a while in silence, taken aback. In recent times, our relationship hadn't been the easiest aspect of our life together, and communication had been quite a challenge.

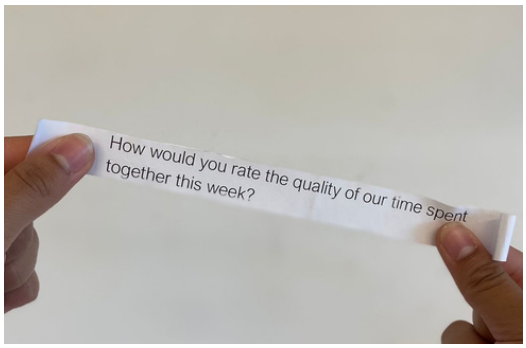
She positioned the box at a distance from the wall. I saw her hands trembling, it was clear this was a topic we needed to discuss. After some hesitation, she showed me the box. Seven out of the 15 lights were lit.

I looked at her, trying to conceal my surprise. I looked at her and tried to hide my surprise. "You've only got 7 out of 15 lights lit up. That's not a lot, why is that?"

She met my gaze in a long silence, then slowly began to explain how she had felt over the past week. I tried the box too and we both shared our viewpoints. We tried a second question which turned out to be a lot more casual. “How entertaining was the funniest moment of today?” In the end we’ve spent the entire evening talking I felt relieved, as if a heavy force has been taken off my chest. The conversation started heavy, and the mood lightened with the second question. I laughed with Fay, which felt like an eternity ago. We haven’t been good at communicating for a while now, but it was a good thing to do. It felt as though I understood Fay better than I had in a long time, and she understood me. The wall of ice between us has finally broken.

HOW IT WORKS

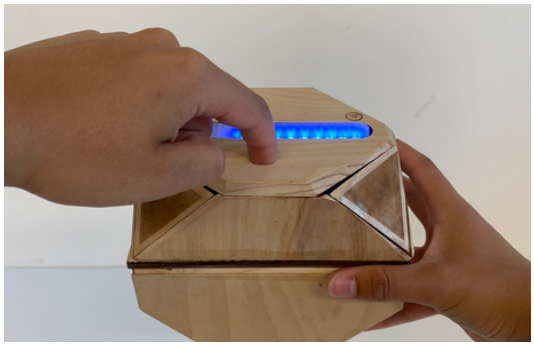
Open the box and pull out a question



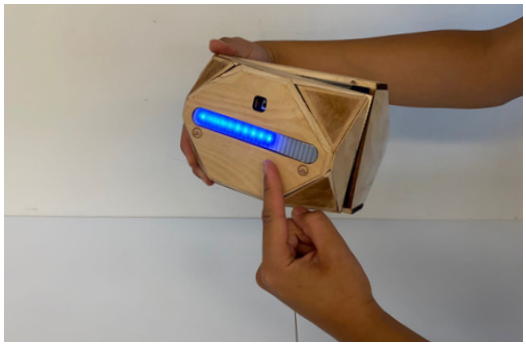
Unfold the paper and read the question aloud

Close the box and press the button on top of the box. A series of LED lights will turn on.

Use the series of LED lights to answer the scaled question. You do this by moving the box back and forth a distance away from an object



Press the button a second time once you are satisfied with your answer. The LED lights will freeze.



Show your answer to your partner and reflect on it together. Have your partner answer the same question.

QUESTIONS

The questions contained in the box are diverse, ensuring that the couple always has something new to talk about when they use the box. This keeps the conversation varied and light when needed. There are two types of questions: questions that open up discussions about the state of the couple's relationship (2), and questions that are lighter in nature, leading to enjoyable and cheerful conversations (1). Below are examples of these types of questions.

How would you rate the enjoyment of your workweek?

Rate your level of satisfaction with any new recipes or foods you tried this week

How would you rate the excitement of the plans or outings you had during the past week on a scale

Rate your enthusiasm for any interesting movies or TV shows you discovered recently

How much did you enjoy the time spent with your partner today

Rate your sense of accomplishment for any personal or professional goals you achieved this week

Rate your interest in any new hobbies or interests you explored in the past week

How effectively did you handle any challenges you encountered this week

How entertaining was the funniest moment of the today

Rate your enjoyment of any special events or gatherings you attended this week

How physically active were you during the past week?

Rate your time and productivity management this week

How surprised were you by something new you learned today

Rate the deliciousness of the most memorable meal you had this week

How much did you explore interesting places or your city this week?

Rate your interest in any intriguing books or articles you read during the week

Rate your level of interest in outdoor activities

How would you rate your communication skills

How important is traveling to you?

How much do you enjoy reading books?

Rate your interest in arts and culture

How spontaneous do you consider yourself?

1.

How well do you feel we communicate with each other?

Rate the level of trust you have in our relationship

How would you rate the quality of our time spent together this week?

How supported do you feel in pursuing your personal goals and dreams within our relationship?

Rate your sense of intimacy and emotional connection with each other this week

How would you rate the level of appreciation and gratitude we express toward each other

How connected do you feel to our shared future together

How much do you think we understand and respect each other's individuality and differences?

Rate your level of emotional support and comfort within our relationship

How would you rate the overall positivity and happiness in our relationship

How well do you feel we listen and empathize with each other?

Rate the extent to which we share common values and goals

How content do you feel with the balance between personal space and togetherness in our relationship

How well do you think we support each other's well-being and self-care?

Rate the degree of excitement and anticipation you have for our future adventures together

How would you rate the level of affection and physical closeness in our relationship

How well do you feel we maintain a healthy work-life-love balance?

Rate your overall satisfaction with our relationship

These scaled questions can help couples delve deeper into their relationship dynamics, allowing for introspection and open dialogue about important aspects of their partnership.

2.

VIDEO

HOWARD AND FAY
FINALLY **BREAK THE ICE**

...WITH SOME HELP

THE LINK:

HTTPS://VIMEO.COM/USER208682342

TECHNICAL DESCRIPTION

OPERATING SYSTEM

This Arduino code is designed to control a system that uses an ultrasonic sensor, a NeoPixel LED strip, and a button to create different lighting effects based on the distance measured by the ultrasonic sensor. The code contains 3 different states that the robot can enter, which are triggered by pressing the button.

1. The robot starts in a state where all the lights in the LED strip are off. The robot is in a sleeping state, which I call the **off-state**.
2. One click on the button will cause the LED lights to turn on. The amount of LED lights displayed on the strip is driven by the measured distance of the ultrasonic ranger from the wall, or other large-area objects. This is the **variable-state**.
3. A second click of the button will cause the amount of LED lights currently on to "freeze" at that level. The ultrasonic ranger has no functional value from that point forward. This state allows the user to move the robot around freely and be able to reflect the indicated amount of lights on the LED strip in response to the question. This is the **freeze-state**.
4. The third click on the button will cause the robot to return to the off-state.

CODE

```
#include <Adafruit_NeoPixel.h>
#include <Ultrasonic.h>

// Define the pin numbers for the ultrasonic ranger, LED strip, and the button
const int ultrasonicPin = A2;   // Analog input pin for ultrasonic sensor
const int ledStripPin = 5;      // Digital output pin for NeoPixel LED strip
const int buttonPin = 6;        // Digital input pin for the button

// Define the number of LEDs in your strip
const int numLeds = 15;         // Number of LEDs in the NeoPixel strip

// Define the maximum and minimum distances for brightness control
const float maxDistance = 200.0; // Maximum distance (2 meters) in centimeters
const float minDistance = 10.0;  // Minimum distance (10 centimeters)

// Create an Ultrasonic object
Ultrasonic ultrasonic(ultrasonicPin);

// Create an Adafruit NeoPixel object
Adafruit_NeoPixel strip = Adafruit_NeoPixel(numLeds, ledStripPin, NEO_GRB + NEO_KHZ800);

// Define states for the button
enum ButtonState {
  STATE_VARIABLE, // State where LED brightness varies with distance
  STATE_FREEZE,   // State where LED brightness is frozen
  STATE_OFF       // State where LEDs are turned off
};
```

```
ButtonState buttonState = STATE_OFF; // Start in the OFF state
int previousButtonState = LOW;
unsigned long lastDebounceTime = 0;
unsigned long debounceDelay = 50;

void setup() {
  // Initialize the LED strip
  strip.begin();
  strip.show(); // Initialize all pixels to 'off'

  // Serial communication for debugging (optional)
  Serial.begin(9600);

  // Set the button pin as an input
  pinMode(buttonPin, INPUT);
}

void loop() {
  // Declare distance and brightness variables here
  float distance;
  int brightness;

  // Read the state of the button
  int buttonReading = digitalRead(buttonPin);

  // Check for button click with debouncing
  if (buttonReading != previousButtonState) {
    lastDebounceTime = millis();
  }
  if ((millis() - lastDebounceTime) > debounceDelay) {
    if (buttonReading == HIGH) {
      // Button is pressed
      switch (buttonState) {
        case STATE_OFF:
          // Transition from OFF state to VARIABLE state
          buttonState = STATE_VARIABLE;
          break;
        case STATE_VARIABLE:
          // Transition from VARIABLE state to FREEZE state
          buttonState = STATE_FREEZE;
          break;
        case STATE_FREEZE:
          // Transition from FREEZE state to OFF state
          buttonState = STATE_OFF;
          break;
      }
    }
  }

  previousButtonState = buttonReading;

  // Handle LED strip and ultrasonic based on button state
  switch (buttonState) {
    case STATE_OFF:
```

```
    case STATE_OFF:
      // Turn off the LED strip and stop ultrasonic measurement
      for (int i = 0; i < numLeds; i++) {
        strip.setPixelColor(i, strip.Color(0, 0, 0)); // Set LED color to off
      }
      strip.show();
      break;
    case STATE_VARIABLE:
      // Read the distance from the ultrasonic ranger
      distance = ultrasonic.read();

      // Map the distance to the LED brightness range
      brightness = map(distance, minDistance, maxDistance, 0, 255);
      brightness = constrain(brightness, 0, 255);

      // Calculate the number of LEDs to light up
      int numLedsToLight = map(brightness, 0, 255, 0, numLeds);

      // Set the LED strip brightness
      for (int i = 0; i < numLeds; i++) {
        if (i < numLedsToLight) {
          strip.setPixelColor(i, strip.Color(brightness, brightness, brightness));
          // Set LED color to the calculated brightness
        } else {
          strip.setPixelColor(i, strip.Color(0, 0, 0)); // Turn off the remaining LEDs
        }
      }
      strip.show();
      break;
    case STATE_FREEZE:
      // Do nothing, maintain the current LED strip state
      break;
  }

  // For debugging, print the distance and brightness to the serial monitor
  Serial.print("Distance (cm): ");
  Serial.print(distance);
  Serial.print(" | Brightness: ");
  Serial.println(brightness);

  delay(100); // Delay for stability
}
```

HARDWARE

GROVE ULTRASONIC RANGER

The ultrasonic ranger uses sound waves to measure the distance to an object. The sensor emits ultrasonic sound pulses and measures the time it takes for these pulses to return after reaching the object and being reflected.

BUTTON

The button is a simple but powerful switch. They are an essential part of user interaction and provide a tangible way to exert control over technological devices and applications.

GROVE RGB LED STRIP

The Grove RGB LED strip works by independently adjusting the intensity of three colors, red, green and blue, to create different colors. This is done by controlling the current through the respective LED elements. The 15 LEDs can work separately from each other.

```
1   #include <Adafruit_NeoPixel.h>
2   #include <Ultrasonic.h>
3
```

LIBRARIES

Adafruit Neopixel:

Arduino library for controlling single-wire-based LED pixels and strip.

Ultrasonic:

Minimalist library for ultrasound module to Arduino

CODE EXPLANATION

Starting off the beginning, the code incorporates two essential libraries. **Adafruit NeoPixel** for LED strip control and **Ultrasonic** for the ultrasonic ranger data. After this, the pins for sensor input, LED input, button control are defined. LED strip details are named and brightness control tresholds. With the maxDistance and minDistance functions in the code, I set a distance of 10 centimeters from an object to be equal to no burning LED lights and a distance of 2 meters from an object to be equal to 15 burning LED lights. This distance is suitable in a living room.

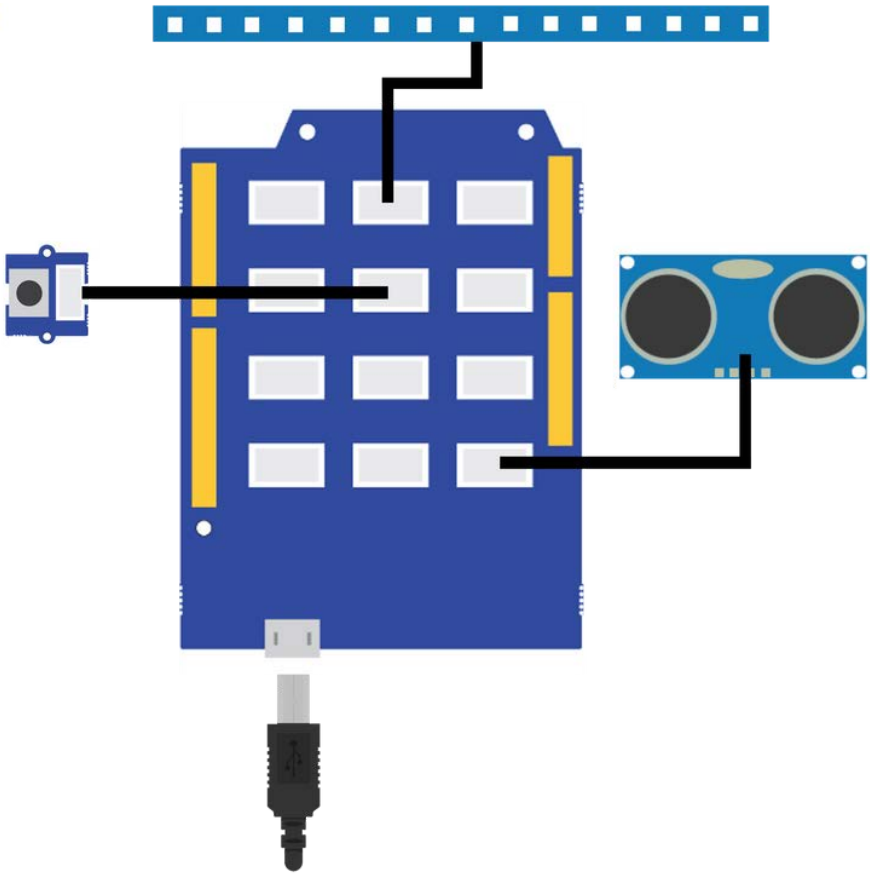
The three states I talked about in a previous piece dictate the systems behavior. During setup, the LED strip is prepared, all LEDs are extinguished, and serial communication for optional debugging is enabled. The button pin is configured as an input to detect user interactions.

While the system is generally running, the state of the button is constantly monitored. Problems with debouncing are addressed by measuring the time between button changes using millis() and comparing it to a debounceDelay. If the elapsed time is greater than the debounce time and the button is still pressed, the button action is considered valid and the button state is updated accordingly. This minimizes erroneous detections of button actions. With a button press, the system switches between states, transforming the behavior accordingly.

The colors are now set to 0,0,0 (RGB), but they can be changed by changing these values. In the robot's story and function, it had no added value and therefore these are neutral. The LEDs are set to the brightness value 55 to make it pleasant to look at.

For the curious, the code also shares its insights by sending distance measurements and brightness values to the serial monitor. To maintain stability, a short pause is made at each iteration. Together, these elements form a harmony of an Arduino-powered lighting system, where technology and humans blend seamlessly.

```
5   const int ultrasonicPin = A2;
6   const int ledStripPin = 5;
7   const int buttonPin = 6;
```



PHYSICAL COMPONENTS

Besides the wooden box, the robot's hardware consists of 5 components. An ultrasonic ranger, a button, an LED strip, a power bank and a seeeduino lotus microcontroller that everything is plugged into. Here the ultrasonic ranger is connected to pin A2 of the microcontroller, the LED strip is connected to pin D5, and the button to D6. These pin assignments enable the components to interact with the Arduino.