

Supplementary file

Supplementary Table S1. Program code for two metamaterial sensors with buzzers (Code A)

<pre> /* (Program Name: Short Antenna Network Unit/ ShAnNU-A): Code A. Program to lit Green LED, but Red LED will start to blink above a predetermined threshold value, and also the buzzer will ring. */ const int META1 = A0; // Increase in compression const int META2 = A1; // Increase in compression const int ledG1 = 13; // For META1 Green LED const int ledR1 = 12; // For META1 Red LED const int ledG2 = 11; // For META2 Green LED const int ledR2 = 10; // For META2 Red LED const int buzz1 = 5; // Buzzer1 const int buzz2 = 4; // Buzzer2 const int ledState1 = LOW; const int ledState2 = LOW; const int buzzState1 = LOW; const int buzzState2 = LOW; int delay_time = 100; // Time interval to collect reading (in milliseconds) int threshold_min = 1000; // Minimum threshold for green LED to light up int threshold_press = 550; // Threshold for red LED void setup() { Serial.begin(9600); pinMode(META1, INPUT); pinMode(META2, INPUT); pinMode(ledG1, OUTPUT); pinMode(ledR1, OUTPUT); pinMode(ledG2, OUTPUT); pinMode(ledR2, OUTPUT); pinMode(buzz1, OUTPUT); pinMode(buzz2, OUTPUT); Serial.println("CLEARDATA"); //clear excel sheet Serial.println("LABEL, Time, META1, META2 "); void loop() { Serial.print("DATA,TIME, "); Serial.print(analogRead(META1)); Serial.print(","); Serial.println(analogRead(META2)); if (analogRead(META1) >= threshold_press) { </pre>	<pre> // Sensor 1 if (ledState1 == LOW) { ledState1 = HIGH; } else { ledState1 = LOW; } digitalWrite(ledR1, ledState1); digitalWrite(ledG1, LOW); } else if (analogRead(META1) >= threshold_min) { digitalWrite(ledG1, HIGH); digitalWrite(ledR1, LOW); } else { digitalWrite(ledG1, LOW); digitalWrite(ledR1, LOW); } if (analogRead(META1) >= threshold_press) { // Buzzer for Sensor 1 if (buzzState1 == LOW) { buzzState1 = HIGH; } else { buzzState1 = LOW; } digitalWrite(buzz1, buzzState1); } else { digitalWrite(buzz1, LOW); } /* Sensor 2. The, if – else statement here will make the LED light blink for above digital value ≥ threshold */ if (analogRead(META2) >= threshold_press) { if (ledState2 == LOW) { ledState2 = HIGH; } else { ledState2 = LOW; } digitalWrite(ledR2, ledState2); digitalWrite(ledG2, LOW); } else if (analogRead(META2) >= threshold_min) { digitalWrite(ledG2, HIGH); digitalWrite(ledR2, LOW); } else { digitalWrite(ledG2, LOW); digitalWrite(ledR2, LOW); } /* Buzzer for Sensor 2 The if – else statement here will make the buzzer beep in pulse when the digital value is above the predetermined threshold. */ if (analogRead(META2) >= threshold_press) { if (buzzState2 == LOW) { buzzState2 = HIGH; } else { buzzState2 = LOW; } digitalWrite(buzz2, buzzState2); } else { digitalWrite(buzz2, LOW); } </pre>
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Supplementary Table S2. Program code for optimizing the value of external resistor (Code B)

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1  /* (Program Name: Short Antenna Network Unit/ ShAnNU-B): Code B for the study of the Metamaterial
2  Sensor under different external resistors. Readings will be taken for 5 seconds in Microsoft Excel. Take
3  average and plot graph */
4  const int META1 = A0;
5  int delay_time = 100; // in milliseconds
6  int next_interval = 10000; // time before program runs again (in milliseconds)
7  void setup() {
8      Serial.begin(9600);
9      Serial.println("CLEARDATA"); //clear excel sheet
10     Serial.println("LABEL,Time,Sensor Value"); //label for excel
11 }
12 void loop() {
13     for (int x = 1; x < 51; x = x + 1) {
14         Serial.print("DATA,TIME, ");
15         Serial.print(analogRead(META1));
16         Serial.print(",");
17         Serial.print("Reading ");
18         Serial.println(x);
19         delay(delay_time);
20     }
21     Serial.println("--- End ---");
    delay(next_interval); }

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Supplementary Table S3. Program code for real time monitoring when connected to computer (Code C)

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1  /* (Program Name: Short Antenna Network Unit/ ShAnNU-C): Code C for real-time
2  monitoring of META */
3  const int FSR = A0;
4  int delay_time = 100;
5  void setup() {
6      Serial.begin(9600);
7      Serial.println("CLEARDATA"); // Clear Excel sheet
8      Serial.println("LABEL,Time,Sensor Value"); // Label for Excel
9  }
10 void loop() {
11     Serial.print("DATA,TIME, ");
12     Serial.println(analogRead(FSR));
13     delay(delay_time); }

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