

# Arduino Movement Detector

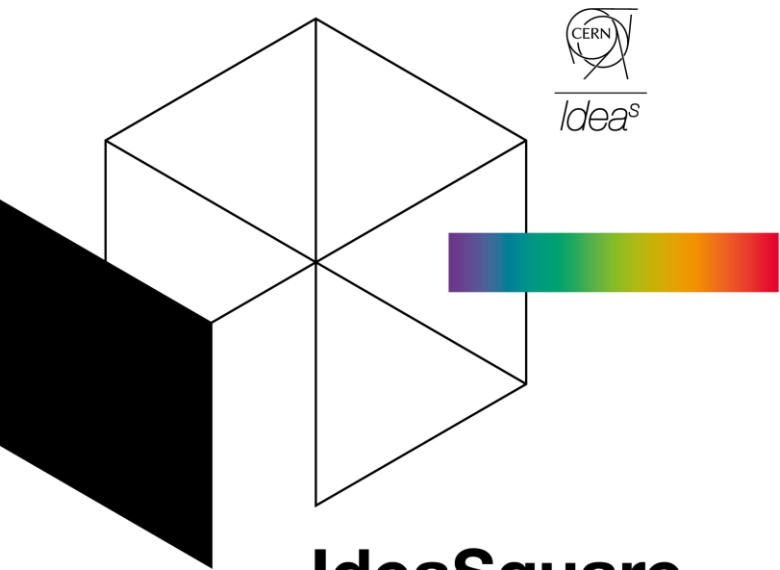
19.01.2023

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Idea<sup>s</sup>





**IdeaSquare**

The innovation space at CERN

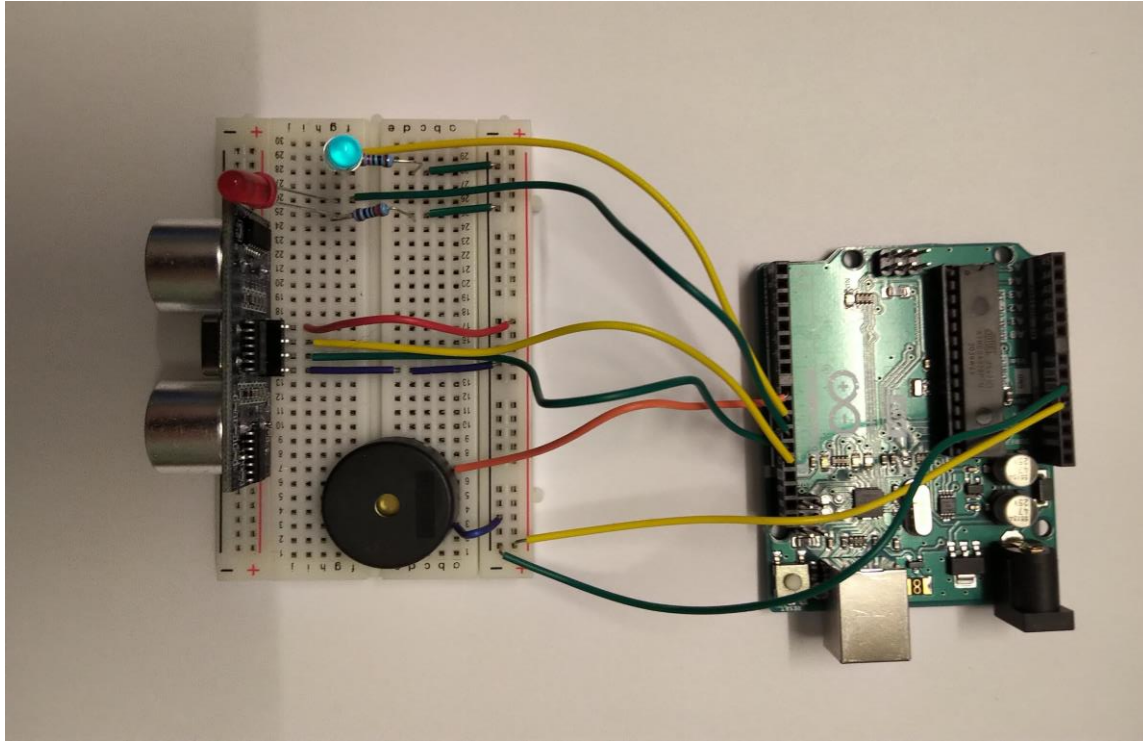
# Agenda

1. Mounting the Breadboard
2. Downloading the Arduino IDE
3. Connecting the Breadboard to the Arduino

☕ Coffee break

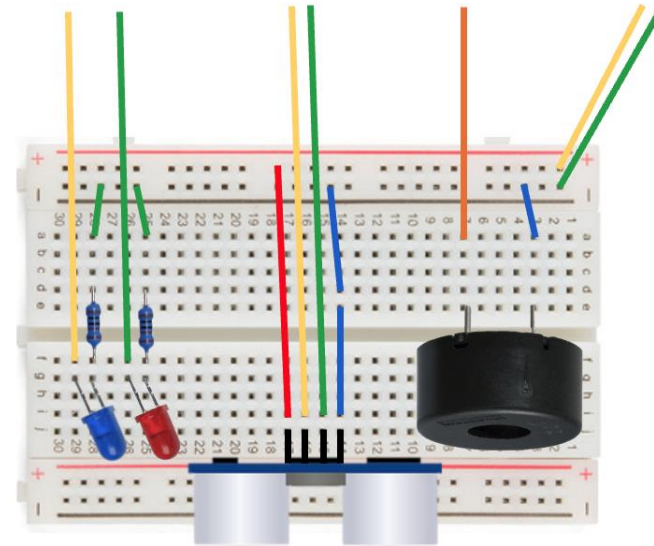
4. Understanding the code
5. Uploading the code on Arduino
6. Experimenting with detector variables

# — Movement detector



# Mounting the Breadboard

Motion Sensor	Place motion sensor in Row j, slots 14-17
Red LED	Place LED in Row g, slots 25-26. Note! Shorter leg (minus) in g25, longer in g26 (plus)
Blue LED	Row g, slots 28-29. Note! Shorter leg (minus) in g28, longer in g29 (plus)
Jumpers (1)	Short <b>Blue</b> jumper from voltage slot -3 to a3 (for the Buzzer) Long <b>Orange</b> jumper to a7, to connect later to Arduino AREF 8
Buzzer	Mount in Row e3-7
Jumpers (2)	<ol style="list-style-type: none"> <li>1. Long <b>Red</b> jumper from +17 to i17</li> <li>2. Long <b>Green</b> jumper from i15, to connect later to Arduino AREF 12</li> <li>3. Long <b>Yellow</b> jumper from i16, leave to connect later to Arduino AREF 13</li> <li>4. Short <b>Blue</b> jumper from -14 to d14</li> <li>5. Short <b>Blue</b> jumper from e14 to i14</li> <li>6. Long <b>Green</b> jumper from f26, leave to later connect to Arduino AREF 11</li> <li>7. Long <b>Yellow</b> jumper from f29, to connect later to Arduino AREF 10</li> <li>8.</li> </ol>
Resistor 1 (220Ω)	Go to page 41 in the Arduino manual to find the magnitude of the resistor. From f25 to d25. Short <b>Green</b> jumper from c25 to -25
Resistor 2 (220Ω)	From f28 to d28. Short <b>Green</b> jumper from c28 to -28
Wires	Long <b>Yellow</b> wire to +1, leave to later to connect to Arduino POWER (5V) Long <b>Green</b> wire -1, leave to later to connect to Arduino POWER (GND).



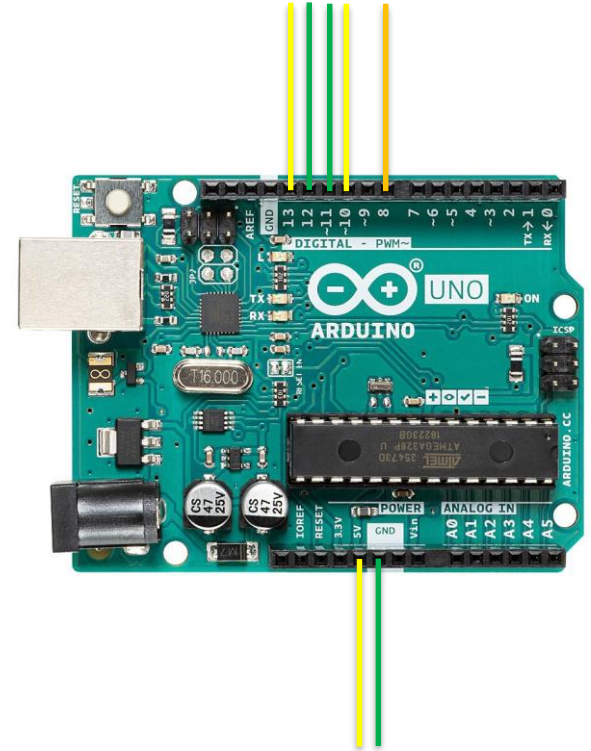
# Downloading the Arduino IDE

Sequence	Component	Step
1	Arduino IDE	Go to <a href="https://www.arduino.cc/en/software">https://www.arduino.cc/en/software</a> Download the Arduino Software (IDE), open the ZIP file, and install on your computer
2	Connector cable	Using the USB cable provided in the Kit, connect the Arduino to your computer. When you do this, the green light on the Arduino is lit
3	Testing of functionalities	<ol style="list-style-type: none"><li>1. In Arduino IDE, in Menu, go to: File -&gt; Examples -&gt; 01.Basics -&gt; Blink</li><li>2. Open new window</li><li>3. Go to: Tools</li><li>4. Select: Board -&gt; Arduino AVR boards (for Mac) -&gt; Arduino Uno</li><li>5. Select: Port -&gt; dev/cu.usbmodem</li><li>6. Make sure you are in: Blink.ino (window that popped up in Step 1)</li><li>7. Upload code to Arduino using 2<sup>nd</sup> button on the top left side (-&gt;)</li><li>8. Verify that the yellow light starts blinking!</li></ol>
4	Removing connector cable	Once verified that the Arduino executes the Test code as anticipated, the connector cable is to be removed.

# Connecting the Breadboard to the Arduino

## Wiring

Motion Sensor	<ul style="list-style-type: none"><li>□ Long <b>Green</b> jumper from Bi15, connect to Arduino DIGITAL pin 12</li><li>□ Long <b>Yellow</b> jumper from Bi16, connect to Arduino DIGITAL pin 13</li></ul>
Buzzer	<ul style="list-style-type: none"><li>□ <b>Orange</b> jumper from Ba7, connect to Arduino DIGITAL pin 8</li></ul>
LEDs	<ul style="list-style-type: none"><li>□ Long <b>Green</b> jumper from Bf26 to Arduino DIGITAL pin 11</li><li>□ Long <b>Yellow</b> jumper from Bf29 to Arduino DIGITAL pin 10</li></ul>
Powering	<ul style="list-style-type: none"><li>□ Long <b>Yellow</b> wire from B(+1) to later to Arduino POWER (5V)</li><li>□ Long <b>Green</b> wire B(-1) to Arduino POWER (GND)</li></ul>





**Coffee break**



# Understanding the code

There are 3 main parts:

1. Defining the variables
2. The setup
3. The loop



# Understanding the code

```
#define trigPin 13
#define echoPin 12
#define redLed 11
#define blueLed 10
#define piezoPin 8
```

```
int normalDistance = 200;
boolean triggered = false;
long duration, distance;
```

```
// motion sensor transmitter pin
// motion sensor receiver pin
// pin to red led
// pin to blue led
// pin to buzzer
```

```
// maximum distance in cm
// variable to know if the motion sensor is triggered or not
// duration and distance variables
```

# Understanding the code

```
void setup() {  
  Serial.begin (9600);  
  pinMode(trigPin, OUTPUT);  
  pinMode(echoPin, INPUT);  
  pinMode(redLed, OUTPUT);  
  pinMode(blueLed, OUTPUT);  
  pinMode(piezoPin, OUTPUT);  
  
  digitalWrite(redLed, HIGH);  
  digitalWrite(blueLed, HIGH);  
  
  while (millis() < 5000) {  
    digitalWrite(trigPin, LOW);  
    delayMicroseconds (2);  
    digitalWrite(trigPin, HIGH);  
    delayMicroseconds (10);  
    digitalWrite(trigPin, LOW);  
    duration = pulseIn(echoPin, HIGH);  
    distance = (duration/2) / 29.1;  
    if (distance < normalDistance) {  
      normalDistance = distance;  
    }  
  }  
  
  digitalWrite(redLed, LOW);  
  digitalWrite(blueLed, LOW);  
}
```

// the setup

# Understanding the code

```
void loop() {  
  if (triggered) {  
    digitalWrite(redLed, HIGH);  
    digitalWrite(blueLed, LOW);  
    tone(piezoPin, 635);  
    delay(500);  
    digitalWrite(redLed, LOW);  
    digitalWrite(blueLed, HIGH);  
    tone(piezoPin, 912);  
    delay(500);  
  } else {  
    digitalWrite(trigPin, LOW);  
    delayMicroseconds(2);  
    digitalWrite(trigPin, HIGH);  
    delayMicroseconds(10);  
    digitalWrite(trigPin, LOW);  
    duration = pulseIn(echoPin, HIGH);  
    distance = (duration/2) / 29.1;  
    if (distance < normalDistance - 10) {  
      triggered = true;  
    }  
  
    delay(20);  
  }  
}
```

// the loop



# Running the Movement Detector

IDE	Visit the Indico page: <a href="https://indico.cern.ch/event/1239023/">https://indico.cern.ch/event/1239023/</a> Go to Timetable and click on "Testing and running the code". Select "View contribution details" and you will find the code named "Movement_detector.ino". Save it in a folder with the same name as the file name.
Connector cable	Re-connect the Arduino to the computer with the connector cable
BA Code upload	In IDE, upload BA code to Arduino using 2 <sup>nd</sup> button ( ->). Leave the code visible in an open, separate window
Test	Test the execution of the code by moving the hand in front of the Motion Sensor. The two LEDs should be blinking and there is a Buzzer sound

The screenshot shows a conference timetable for '3179/1-D06, CERN'. The session 'Testing and running the code' is highlighted in yellow. A red circle highlights the 'View contribution details' button. The session details show a duration of 11:20 - 12:30 and location 3179/1-D06 (CERN). Other sessions include 'Building the hardware' (10:00-11:00), 'Coffee break' (11:00-11:20), and 'Take-aways & Conclusions' (11:20-12:30).



The navigation menu includes: Overview, Timetable, Contribution List, My Conference, My Contributions, Markus Nordberg, markus.nordberg@cern.ch, and +41754114452.

## Testing and running the code

19 Jan 2023, 11:20  
1h 10m  
3179/1-D06 (CERN)

## Presentation materials

Movement\_detector.ino



# Experimenting with the variables



Experiment

Test the functionalities of the BA code by changing e.g. the following parameters:

`normalDistance` (in cm)

`delayMicroseconds` (2)

`delayMicroseconds` (10)

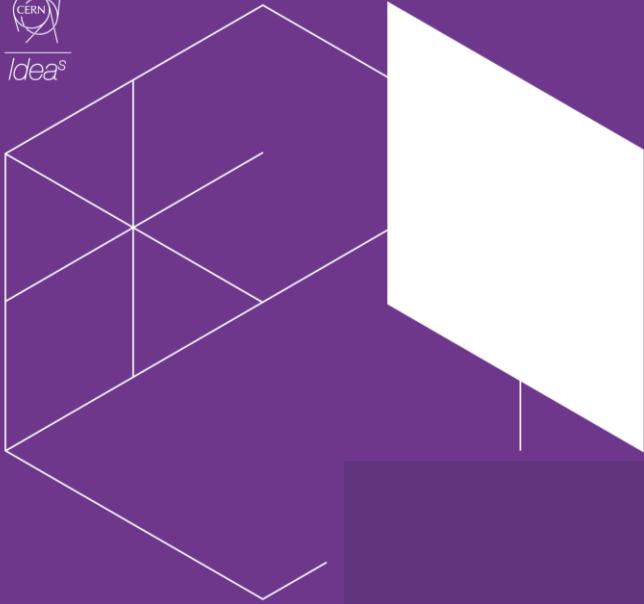
`tone` (`piezoPin`, 635)

`delay`(500)

`tone`(`piezoPin`, 912)



Idea<sup>s</sup>



**Thank you for  
your time!**