

# Chapter 3

## Expansion modules

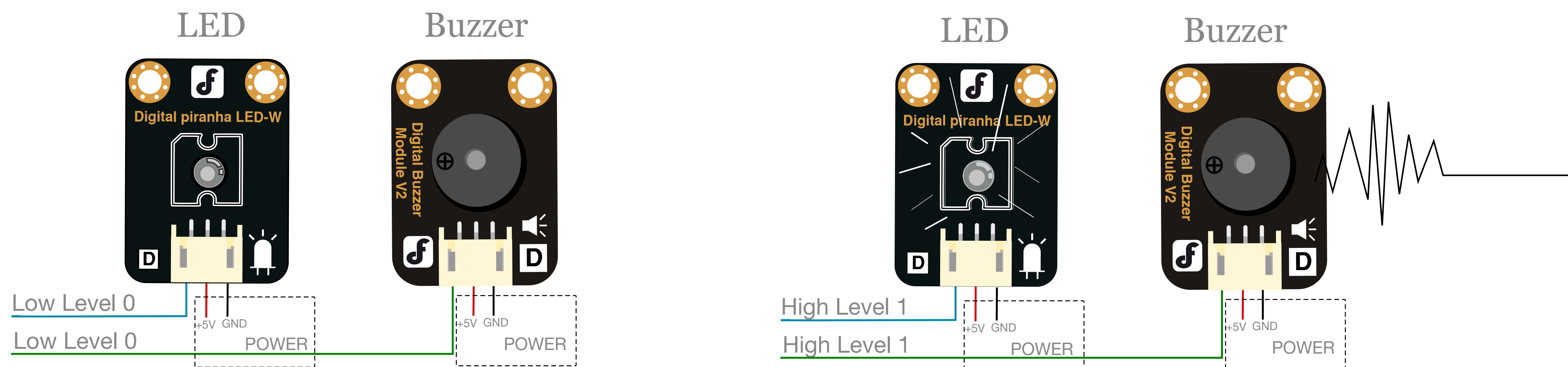
In chapter 2, we learned how to control the movement of the Devastator through programing. However, it's still far from enough for the Devastator to be capable of interacting with people. In the following sessions, we will help you add even more functions to make our robot send feedback to the people nearby.

# Part 1

## Output modules

### LED module and Buzzer module

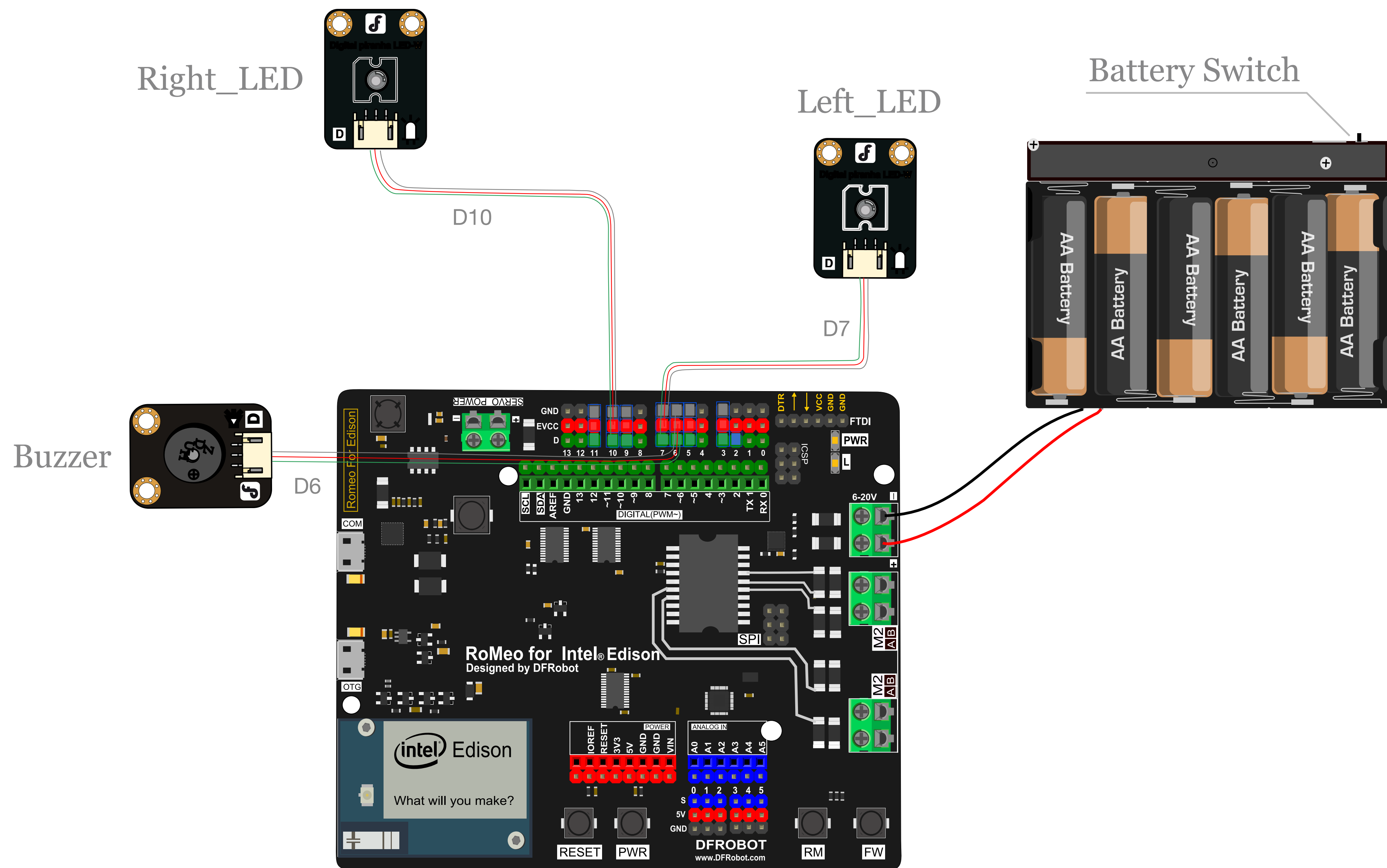
LED module and Buzzer module are output modules controlled by digital signals. Due to simplicity, they are commonly used as light and sound indicators for robots.



In digital circuits, “LOW (0V)” represents for an “off” signal (0) and “HIGH (5V)” represents for an “on” signal (1). However, in practical, voltage of a signal may not be exact. Normally, the voltage of a LOW signal may range from 0V~0.25V and the voltage of HIGH a signal may range from 3.5V~5V. Take the LED module as an example, a LOW signal turns the light off while a HIGH signal turns the light on. The same rule also applies to the buzzer module.

Check the circuit that you built in last chapter with the diagram below. Make sure two LEDs go to the Digital output pin D4 and D5 and the buzzer goes to D6.

# Hardware Connections



Circuit connection

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## Download Sample Code

Upload the sample code to test the LED module. If everything goes right, the LED light on the left side will be switching between on and off for every 2 seconds, each state lasts for 1 second.

### Sample code:

```
int led = 4; // the setup routine runs once when you press reset:
void setup() {
  pinMode(led, OUTPUT); // initialize the digital pin as an output.
}
// the loop routine runs over and over again forever:
void loop() {
  digitalWrite(led, HIGH); // turn the LED on (HIGH is the voltage
level)
  delay(1000); // wait for a second
  digitalWrite(led, LOW); // turn the LED off by making the voltage
LOW
  delay(1000); // wait for a second
}
```

*Using the same sample code, the buzzer module can be tested by simply replacing the pin of the LED with the pin of the Buzzer.*

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## Bonus session

Try to modify the sample code and add following functions to Dev-astator:

LED on the right side lights up when the robot goes right; LED on the left side lights up when the robot goes left; the buzzer beeps when robot goes backward.

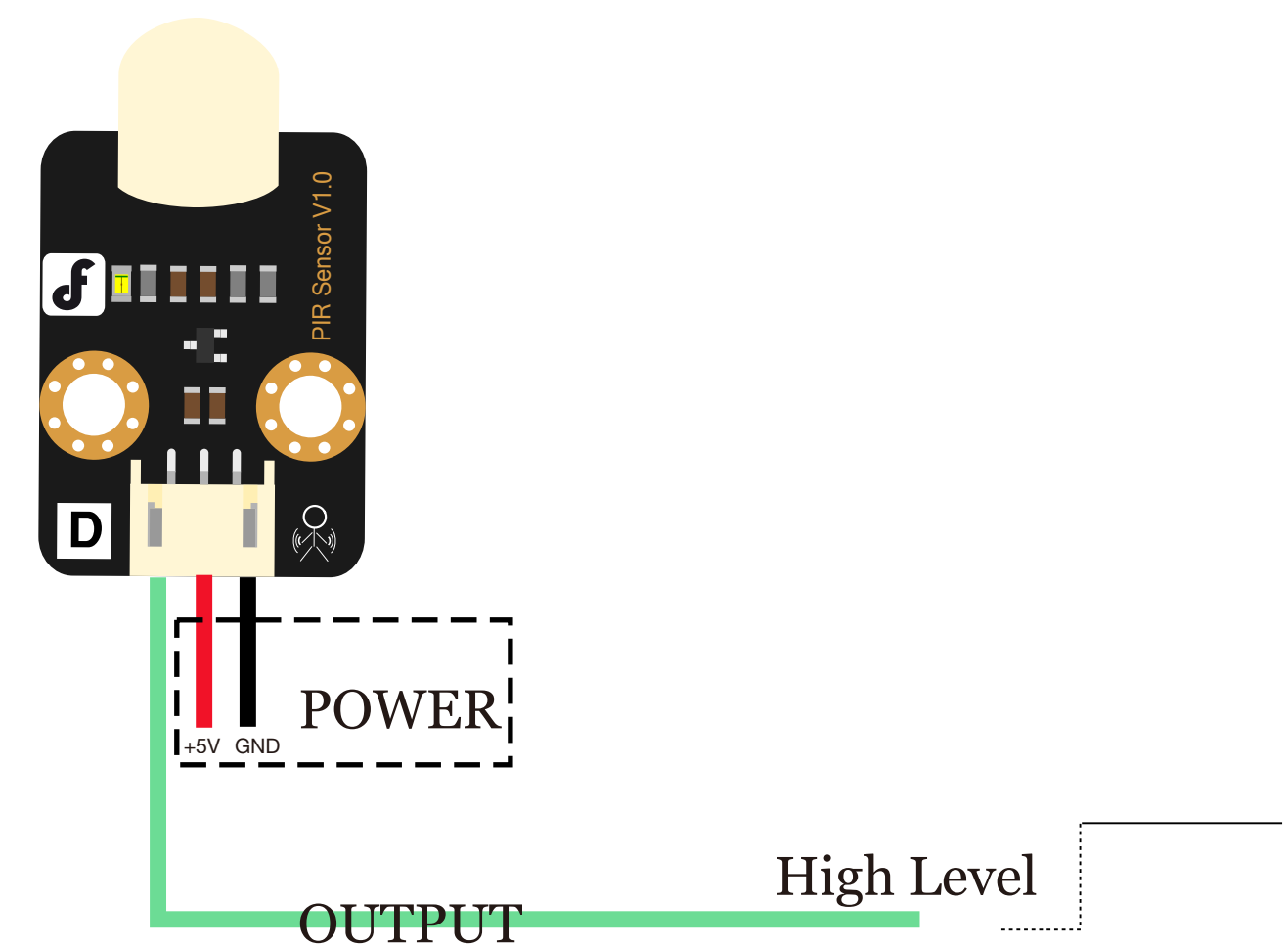
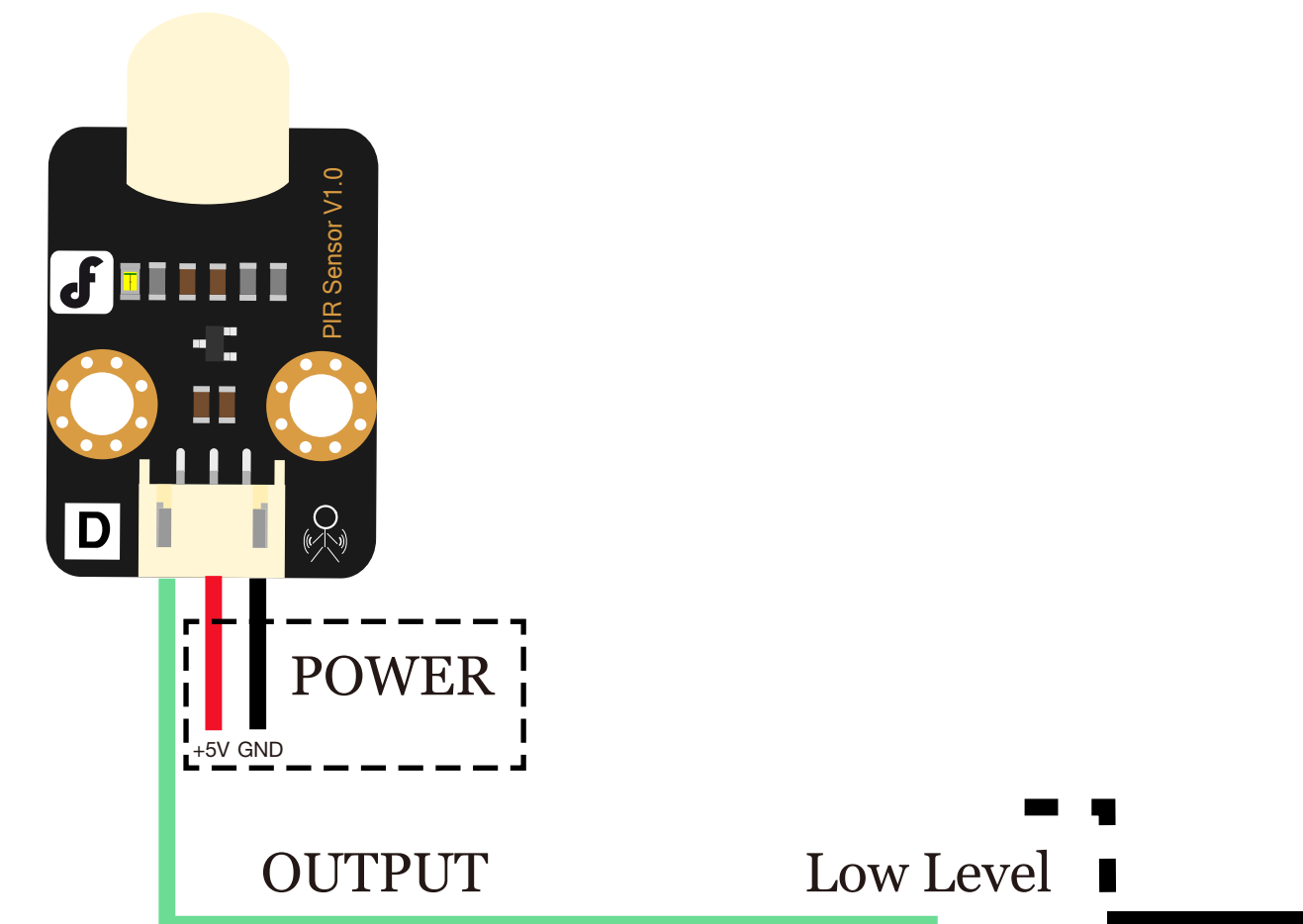
# Part2

## Input modules

### PIR sensor

The PIR sensor is an input module detects infrared radiations with wavelength around 10um exclusively radiated from human body. Its signaling mechanism can be described as following: when someone approaches the sensor, it sends out a HIGH signal as input, vice versa. Therefore, by adding this module, the robot will be able to take actions in reaction to someone passing by.

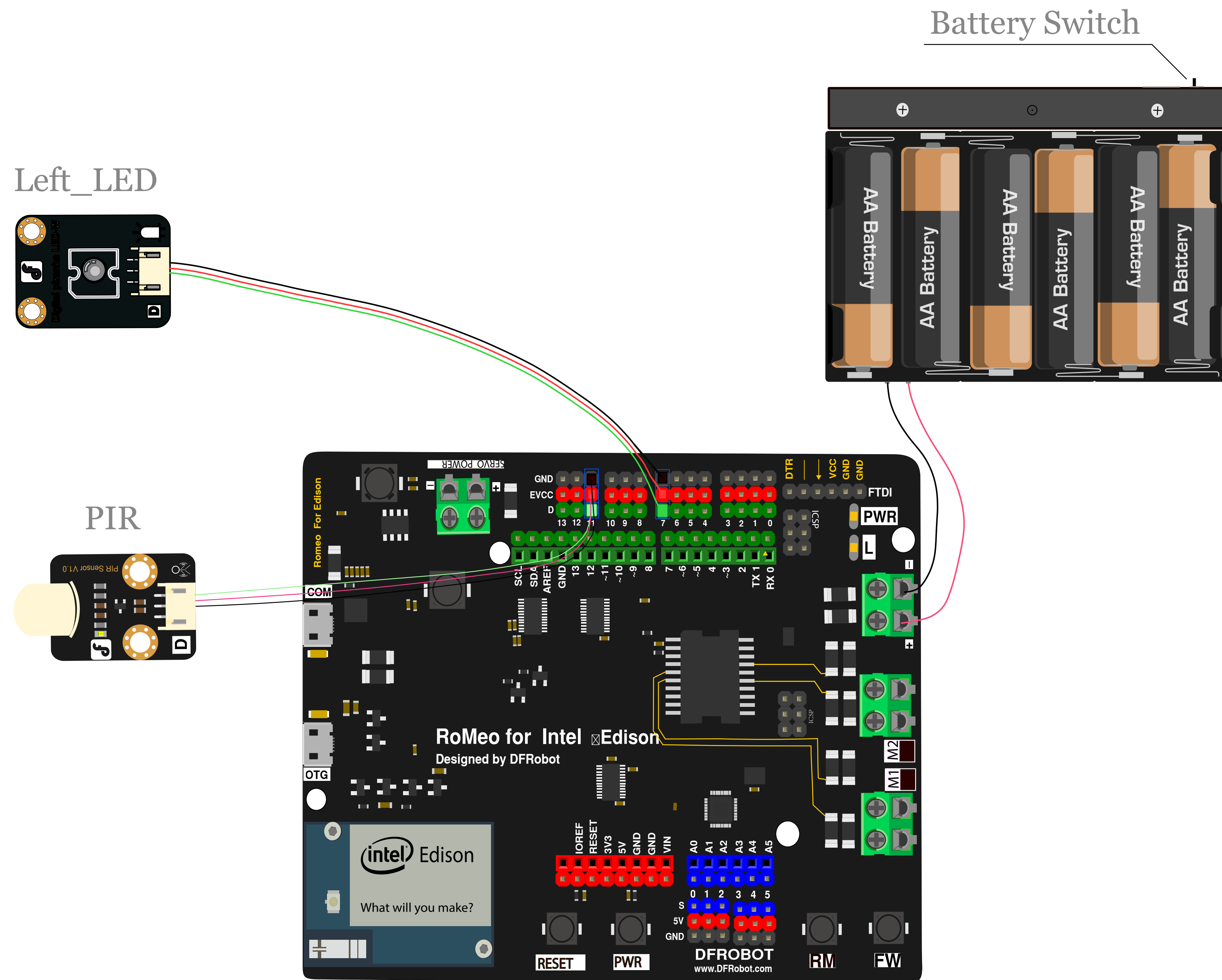
Nobody



The PIR sensor



# Hardware Connections



Circuit connection

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# Download Sample Code

Upload the sample code to the microcontroller to realize the following function: when someone approaches the robot, the LED on its left side lights on, and the words "Somebody is in this area!" shows up in serial monitor, repeats once for each half second, otherwise it stays off and the words "No one!" shows up in serial monitor, repeats once for each half second.

## Sample Code

```
byte sensorPin = 7;
byte indicator = 4;
void setup()
{ pinMode(sensorPin,INPUT);
  pinMode(indicator,OUTPUT);
  Serial.begin(9600);
}
void loop()
{
  byte state = digitalRead(sensorPin);
  digitalWrite(indicator,state);
  if(state == 1)Serial.println("Somebody is in this area!");
  else if(state == 0)Serial.println("No one!");
  delay(500);
}
```



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## Bonus session

Try to modify the sample code and add following functions to Dev-astator:

When someone approaches, the LED indicator on the right side lights up and robot moves forward