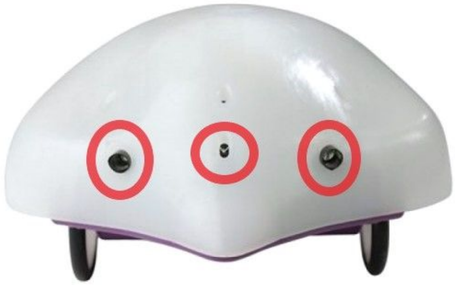
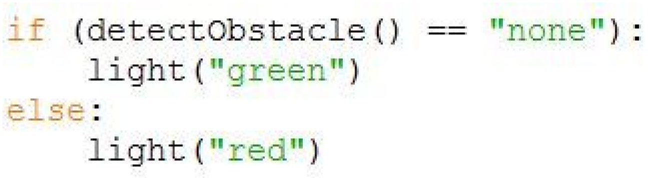
Responding to the Environment

Checking for Obstacles

So far, the Finch has been moving about wildly, relying on the user to provide a clear path for the unit to navigate. However, the Finch can check for obstacles on its own. The Finch uses two infrared obstacle sensors on the front of the unit and an infrared emitter on the center of the unit towards the front.. The obstacle sensors are surrounded by black plastic and protrude from the ‘face’ of the Finch, while the emitter lies in an indentation above the ‘nose’ of the Finch. These sensors determine if an obstacle is present within 3 to 12 inches in front of the FInch.



To check these sensors, use `detectObstacle()`. Unlike other functions you’ve seen, `detectObstacle()` returns a value instead of doing something (please refer to the Functions unit for information about return functions. `detectObstacle()` returns “`left`” if there is an obstacle that the Finch sees only on the left side, and returns “`right`” if there is an obstacle that the Finch sees only on the right side. The Finch returns “`both`” if the Finch detects obstacles on both sides and returns “`none`” if there are no obstacles that the Finch can see. You can use this in combination with a conditional to prevent the Finch from moving. Here’s an example of using a conditional:



```
if (detectObstacle() == "none"):
    light("green")
else:
    light("red")
```

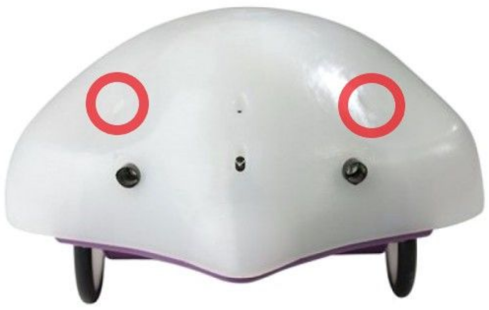
If there are no obstacles present, the above code will turn the nose green. If there is an obstacle present, the nose will turn red. Remember that the double equals sign in the above code denotes equality. So, the code above is using the double equals to detect if `detectObstacle()` is equal to, or the same as, none.

In addition to `detectObstacle()`, you can check each obstacle sensor individually, should you need to determine if the obstacle is on the left or the right. `detectObstacleLeft()` checks the left sensor and `detectObstacleRight()` checks the right sensor. They work like `detectObstacle()` for all other intents and purposes.

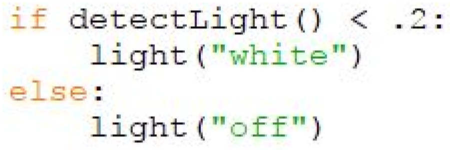
`Try it yourself`: check whether or not there is an obstacle. If there isn't, turn the nose green and move the Finch forward some distance. If there is, turn the nose red and make a short noise.

Checking Light Levels

The Finch is equipped with light sensors that can determine the brightness of the light at its location. The two light sensors are above the obstacle sensors. They are hard to see because they are hidden in small indentations on the top of the Finch.



To read the value from these sensors, use `detectLight()`. `detectLight()` returns a float (a decimal value) between 0 and 1. At 0, the Finch is in absolute darkness and at 1, the Finch is in blindly bright light. Here is an example of code that represents this:



```
if detectLight() < .2:
    light("white")
else:
    light("off")
```

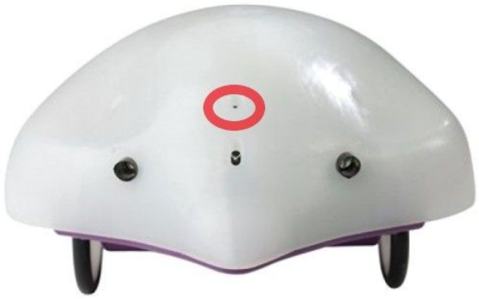
The above code will turn the light white when the Finch is in relative darkness. If the Finch is in bright enough light, the light will turn off. Again, you can use `detectLight()` as though it is a number.

The finch also allows you to check the light levels on each side individually. To do this you can use `detectLightLeft()` and `detectLightRight()`. These functions return the same range of values as `detectLight()` except they only use the light level from one side of the Finch.

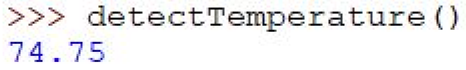
`Try it yourself`**: check the level of light. If there is a large amount of light, make a high noise and turn the nose green. If there is a low amount of light, make a low noise and turn the nose red.**

Checking the Temperature

The Finch has a temperature sensor that tellsyou how hot the environment is within 2 degrees Fahrenheit. The temperature sensor is in the upper middle portion of the Finch's face. It looks like a small black dot.



To check this sensor, use `detectTemperature()`. `detectTemperature()` returns the temperature in Fahrenheit.



```
>>> detectTemperature()
74.75
```

`Try it yourself`**: check the temperature. If it is above room temperature, turn the nose red. If it is below room temperature, turn the nose blue. Average room temperature is about 70°F.**

Checking The Orientation

The Finch has an accelerometer in the center of its shell. This accelerometer determines the forces applied to the Finch ranging from -1.5G to 1.5G. This allows you to test the orientation of the Finch. It also allows you to check whether or not the Finch is tapped or shaken.

The following functions allow you to check the Finch's orientation.

- `isOnTail()` **- returns `True` if the Finch is standing on its tail. Returns `False` otherwise.**
- `isOnWheels()` **- returns `True` if the Finch is sitting on its wheels. Returns `False` otherwise.**
- `isFlippedOver()` **- returns `True` if the Finch is on its back. Returns `False` otherwise.**

The following functions allow you to determine events that happen to the Finch. These will be more useful when we cover continuous behaviour. For now, it is okay to know that these exist and use to use the accelerometer in the mean time.

- `isTapped()` **- returns `True` if the Finch was tapped since the last time you checked acceleration data. Returns `False` otherwise.**
- `isShaken()` **- returns `True` if the Finch was shaken since the last time you checked acceleration data. Returns `False` otherwise.**

`Try it yourself`**: check the Finch's orientation. If it is on its back, turn the nose red. If it is on its wheels, turn the nose green. If it is on its tail, turn the nose blue.**

Key Points

- **Use `detectObstacle()` to check for obstacles. Use `detectObstacleLeft()` and `detectObstacleRight()` to check each obstacle sensor individually.**
- **Use `detectLight()` to check for light.**
- **Use `detectTemperature()` to check the temperature in Fahrenheit.**
- **Use `isOnTail()`, `isOnWheels()`, and `isFlippedOver()` to check the Finch's orientation.**
- **Use `isTapped()`and `isShaken()` to check if the Finch was tapped or shaken.**

Exercises

1. **Turn the nose green and move the Finch forward a foot. If there is an obstacle at the end of the movement, turn the nose red, move the Finch backward 6 inches, and turn the Finch left 90 degrees. Repeat this process 3 times.**

2. **Write a program that changes the led color based on the light level. Make the light red at 0, yellow at .2, green at .4, blue at .6, violet at .8 and white at 1.**