Issue 5 November 8, 2015

BOTS FOR KIDS

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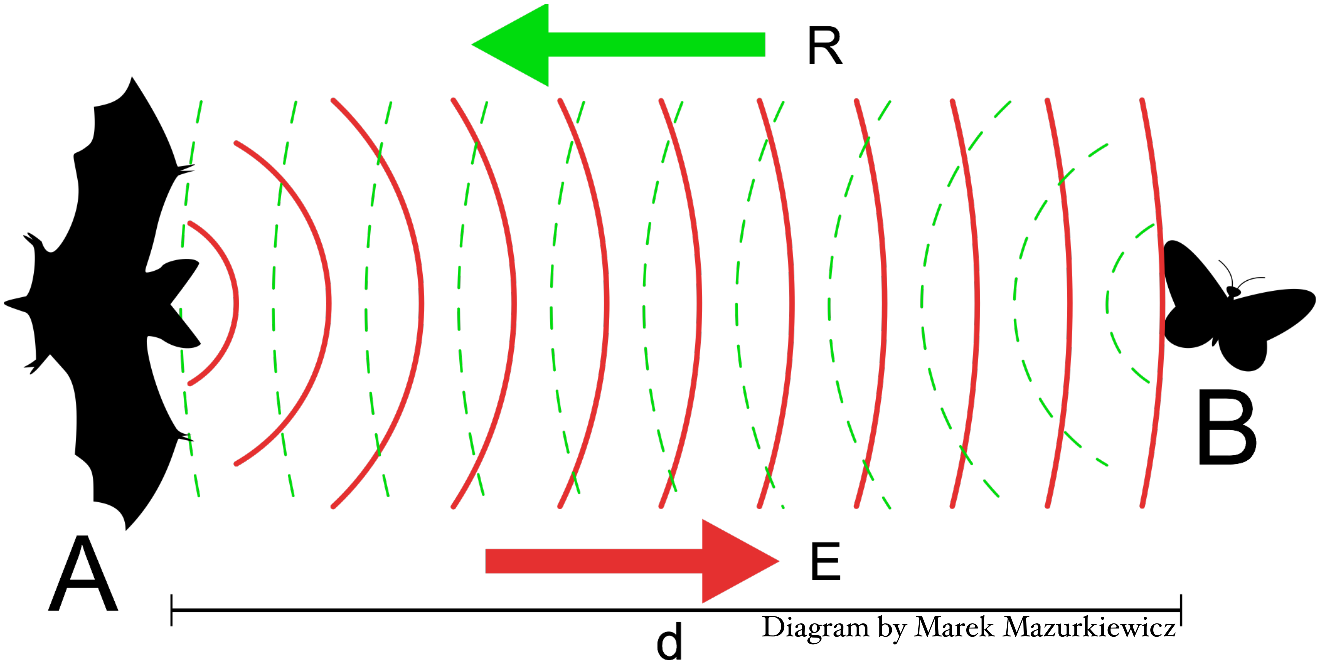


Diagram by Marek Mazurkiewicz

BatBot!

How does a bat see in a pitch black cave?

The process is known as “echo location,” and it allows a bat to “see” with their ears. When a bat is flying in a cave or trying to catch a butterfly out of the air, it emits a high pitched click. The sharp sound bounces off nearby objects, and the echo comes back to the bat. The bat is very good at estimating how much time has gone by from the moment of the click to hearing the echo, and can then tell how far away the target is.

Our bot can do the same thing!

Let’s learn to program it.

Hearing Eyes

Today we will learn to measure the distance the bot is from an obstacle, and how to move to avoid it.

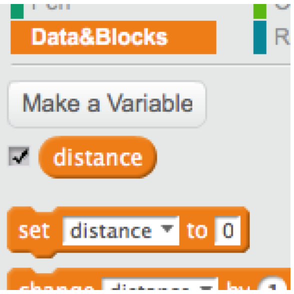
The “eyes” of our mBot are actually a sensor that sees like the bat. One eye sends out “ultrasonic” pings and the other listens for the echo. (“Ultrasonic” means it’s such a high pitched sound that you probably can’t even hear it.) It times how long the echo took to come back, and can then tell the distance to the object.

Now that we know how it works, we’re going to do two things: 1. make a variable to store the distance value from the sensor, and 2. use the variable to make decisions.

Using Sensors

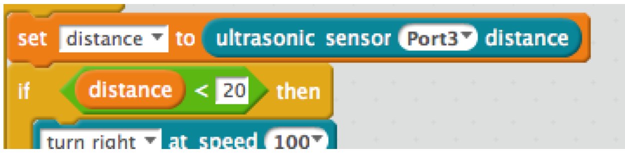
Let's learn how to get, store, and use the distance measurement from the ultrasonic sensor.

The first thing you need to do is set up a variable. A variable lets the program remember something, and gives it a name. In the "Data&Blocks" panel, press the "Make a Variable" button and type "distance" to make a variable with that name. It will also create a few blocks for setting and getting the variable.



```
set distance to 0
change distance by 1
```

Now that we have a place to store the distance value, we'll need to set it to the measurement from the sensor. Start a program, and drag the "set [distance] to [0]" block from "Data&Blocks" into your program. Next, under the "Robots" panel, drag "ultrasonic sensor (Port1) distance" over the "0." Replace Port1 with Port3.



```
set distance to ultrasonic sensor Port3 distance
if distance < 20 then
    turn right at speed 100
```

Now the "distance" variable will have the distance, in centimeters, to our target. By default, the current value of the variable is displayed in the upper-left hand corner of the stage with the Panda.

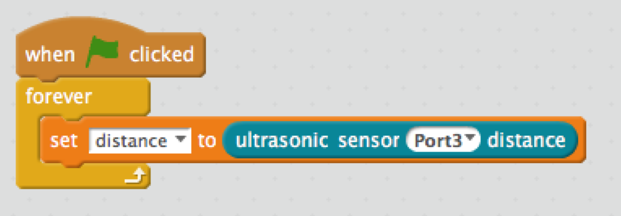
Finally, as you can see below the "set" block in the image above, you can use an "if <> then" or an "if <> then else" block to take action.

Note: Blocks with pointy sides can be "true" or "false" and go in the "if" statement. Many of them can be found in the "Operators" panel.

Police Bot

In this exercise we will approach something, and when we start to get close we will turn on our police siren and lights. When we get very close, we will stop.

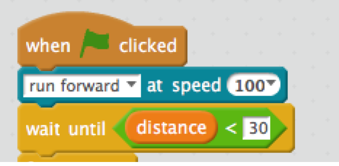
To make it easier to use the "distance" value, let's set up a separate loop that does nothing but update it.



```
when 🏁 clicked
forever
    set distance to ultrasonic sensor Port3 distance
```

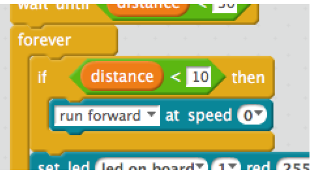
In the picture above, we see that when the flag is clicked, this loop will just keep updating the "distance" variable forever.

Now drag out a second "When flag clicked" Event block for the main program. We'll start by moving forward until we're close.



```
when 🏁 clicked
run forward at speed 100
wait until distance < 30
```

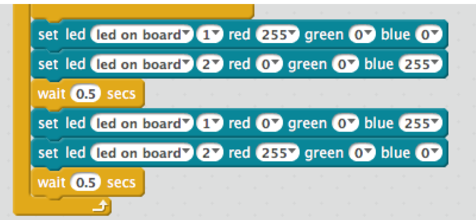
Since the other loop is updating "distance", this one just has to wait until it's close enough. We chose 30 centimeters, but you can adjust that to your liking.



```
wait until distance < 30
forever
    if distance < 10 then
        run forward at speed 0
    set led led on board 1 red 255
```

Now, make sure it stops when it gets close, as you see to the left.

Finally, we want to flash our lights.



```
    set led led on board 1 red 255 green 0 blue 0
    set led led on board 2 red 0 green 0 blue 255
    wait 0.5 secs
    set led led on board 1 red 0 green 0 blue 255
    set led led on board 2 red 255 green 0 blue 0
    wait 0.5 secs
```