Sensing the World and Making Decisions

Week #5

Prof. Ryan Kastner

Scribbler's Internal Sensors

- Previous lecture you learned Scribbler's internal sensors

1) Stall

Why: It could be stuck against a wall!!

2) Time

Why: Knowing the time is important to have more complex robot behaviors!!

3) Battery Level

Why: So you can detect when to change the batteries!!

Scribbler’s External Sensors

- Scribbler also come equipped with a suite of external sensors (exteroceptors) that can sense various things in the environment

- These various things can be seen as **inputs** and Scribbler perform different tasks depending on them

Scribbler's External Sensors

1) Camera

Why: It can take a still picture of whatever the robot is seeing

2) Light Sensors

Why: Scribbler detect variations in the ambience light in a room

3) Proximity Sensors

Why: So Scribbler can detect objects on the front and on its sides

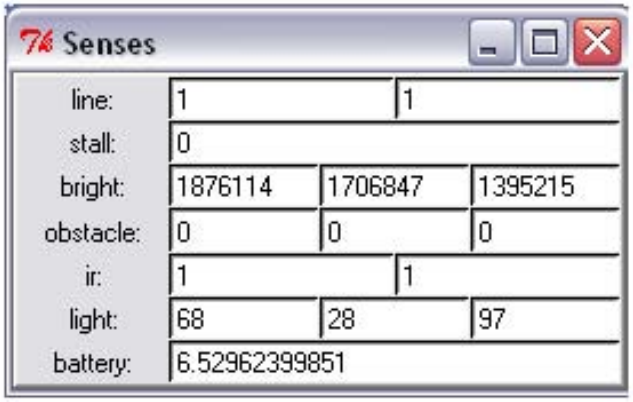
Getting to Know Sensors

- It is important to know
  - How to access the information reported by them;
  - What this information looks like.

- Try

senses()

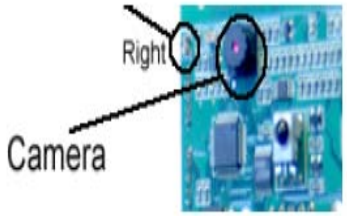
Scribbler Sensors



line:	1	1	
stall:	0		
bright:	1876114	1706847	1395215
obstacle:	0	0	0
ir:	1	1	
light:	68	28	97
battery:	6.52962399851		

Camera

- Camera is located on the Fluke dongle



- To take pictures, use

  takePicture()

  takePicture("color")

  takePicture("gray")

- To show pictures, use

  p = takePicture()

  show (p)

Camera

- Alternatively you can use

  show(takePicture())

- You can do many different things with these pictures, but you might want to save them first:

  savePicture(p, “NAME.jpg”)

- *Exercise: Assume that Scribbler got lost, write a program so Scribbler turns around, takes pictures and shows them so you can locate it*

Camera

```
while timeRemaining(30):
          show(takePicture())
          turnLeft(0.5, 0.2)
```

- Do you know how many pictures it took?

```
N = 0
while timeRemaining(30):
          show(takePicture())
          turnLeft(0.5, 0.2)
          N = N +1
print N
```

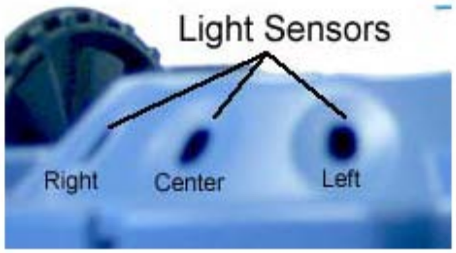
Camera

- Can you create an animated GIF using these images?

```
Pics = []
while timeRemaining(30):
        pic = takePicture()
        show(pic)
        Pics.append(pic)
        turnLeft(0.5, 0.2)
savePicture (Pics, “NAME.gif”)
```

- This code uses **Lists** which we will learn at the end of this lecture.

Light Sensors on Scribbler



- To obtain values of light sensors, use

  getLight()

  getLight(<POSITION>)

  getLight('left') OR getLight(0)

- The values being reported can be in the range of [0…5000]
- Low values imply bright light

Light Sensors on Scribbler

- Move your robot around, and see it values with *senses()* command

- Also try:

```
L, C, R = getLight()
print L
```

Light Sensors on Fluke

- Camera on the fluke has a brightness sensor

getBright()

getBright(<POSITION>)

- The values being reported by these sensors can vary depending on the view of the camera

- Higher values imply bright segments while lower values imply darkness

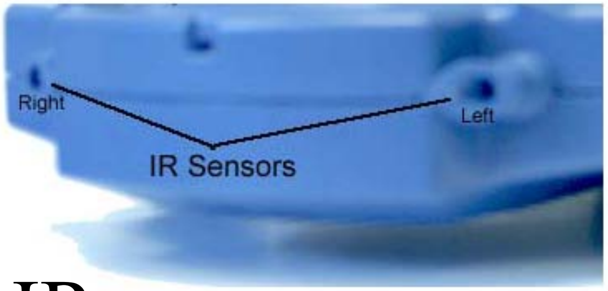
Light Sensors on Fluke

- Important Note:
  - *getLight* reports the amount of ambient light being sensed by the robot (including the light above the robot
  - *getBright* is an average of the brightness obtained from the image seen from the camera

These can be used in many different ways!

Proximity Sensor on Scribbler

- Scribbler has two infrared (IR) sensors on the front of the robot



- To obtain values of the front IR sensors, use

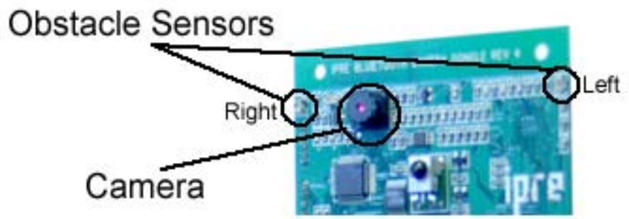
  getIR()

  getIR(<POSITION>)

- IR sensors return either a 1 or a 0.
  - 1 implies that there is nothing in close proximity of the front of that sensor

Proximity Sensor on Fluke

- Fluke has three additional IR obstacle sensors



- To obtain values of the obstacle IR sensors, use

  getObstacle()

  getObstacle(<POSITION>)

- The values reported by these sensors range from 0 to 7000.
  - *A 0 implies there is nothing in front of the sensor*

Lists in Python

- List is a sequence of objects
- These objects could be anything: numbers, letters, strings, images etc.

- Lists are very useful way of collecting a bunch of information
- Python provides many useful operations and functions that enable manipulation of lists

Lists in Python

- Try these:

```
#Empty List
[]

N = [7, 14, 17, 20, 27]
Cities = [“New York”, “Moscow”]
```

Lists in Python

- Try these:

```
>>> N = [7, 14, 17, 20, 27]
>>> Cities = [“New York”, “Dar es Salaam”, “Moscow”]
>>> FamousNumbers = [3.1415, 2.718, 42]
>>> SwankyZips = [90210, 33139, 60611, 10036]
>>> MyCar = [“Toyota Prius”, 2006, “Purple”]

>>> len(N)
>>>len(L)
>>> N + FamousNumbers
>>> SwankyZips[0]
>>> SwankyZips[1:3]
>>> 33139 in SwankyZips
True
>>> 19010 in SwankyZips
False
```

Lists in Python

- Try these:

```
>>> SwankyZips
[90210, 33139, 60611, 10036]

>>> SwankyZips.sort()
>>> SwankyZips
[10036, 33139, 60611, 90210]

>>> SwankyZips.reverse()
>>> SwankyZips
[90210, 60611, 33139, 10036]

>>> SwankyZips.append(19010)
>>> SwankyZips
[90210, 60611, 33139, 10036, 19010]
```

Inputs in Python

- Using the input function, you can input some values into your Python programs:

```
>>> N = input("Enter a number: ")
Enter a number: 42

>>> print N
42
```

Remembering Python Functions

- Basic syntax for defining new commands/ functions:

```
def <FUNCTION NAME>(<PARAMETERS>):
        <SOMETHING>
        ...
        <SOMETHING>
```

- Writing functions that return values:

```
def triple(x):
        # Returns x*3
        return x * 3
```