Hello Gabriel! How are you doing???

I'm watching you.
That's right.
I'm watching you…

I am in your computer ☺
I can change your font.
I am black font.
I am green.
I am blue.
I am back to normal

Would you like to play a game?

Before you say "yes," have the instructor point out the various parts (sensors, electronics, components, etc), connected to me, and ask him what they do.

Can you identify the following?

1. Arduino Leonardo
2. Breadboard
3. Jumper cables
4. Ultrasonic rangefinder ("ping" sensor)
5. TMP36 analog temperature sensor (ie: a thermometer)

6. Photoresistor (light sensor)
7. Tri-color LED (RGB LED), and resistors
8. Piezo buzzer
9. Potentiometer (ie: a variable resistor, or user input knob)
10. Servo motor/actuator
11. Pushbutton

(When ready, press the button connected to the Arduino Leonardo to continue.)

I have a whole bunch of cool sensors and things I can do, and I'd like to show you throughout a series of interactive demonstrations!

[FYI: The code I am running contains Demo #1. To change the Demo #, you will have to recompile and upload new code to me.]

Skipping really cool mouse control demos since there are too many demos to fit on the Arduino all at one time. Compile & run the other main demo code to see any skipped demos!

Now, let's read some of my sensors! I think these are pretty neat too! Let's start with my ultrasonic rangefinder, shall we? It has a maximum range of 4~5 meters, or 12~16 ft.
In order to demonstrate another neat thing I can do, for the following paragraph, I'm going to type out the letters one-by-one, slowly, as if I was a human typing at your keyboard.
(Press my pushbutton to continue.)

Press the button for me to begin taking distance readings every 1 second. Aim the ultrasonic rangefinder around the room to measure the distance to various objects. When you are done, press the button again (you may have to HOLD THE BUTTON DOWN FOR A SECOND to get it to register this "stop command" press). Be sure to try this too: hold the

sensor high, up to your head, and aim it downwards at the floor, to measure your height, before pressing the button to move on! Give others a chance too if they would like. Again, press the button on my board to begin, and long-press it when you are done using this sensor. I will output data 2x per second (ie: at 2 Hz).

(Press my pushbutton to continue; press and HOLD it to stop)

Ping time (us) = 1723, dist (in) = 11.54, dist (ft) = 0.96
Ping time (us) = 1719, dist (in) = 11.51, dist (ft) = 0.96
Ping time (us) = 1719, dist (in) = 11.51, dist (ft) = 0.96
Ping time (us) = 1719, dist (in) = 11.51, dist (ft) = 0.96
Ping time (us) = 1719, dist (in) = 11.51, dist (ft) = 0.96
Ping time (us) = 1719, dist (in) = 11.51, dist (ft) = 0.96
Ping time (us) = 1719, dist (in) = 11.51, dist (ft) = 0.96
Ping time (us) = 1719, dist (in) = 11.51, dist (ft) = 0.96
Ping time (us) = 1719, dist (in) = 11.51, dist (ft) = 0.96
Ping time (us) = 1747, dist (in) = 11.70, dist (ft) = 0.98
Ping time (us) = 1747, dist (in) = 11.70, dist (ft) = 0.98
Ping time (us) = 1723, dist (in) = 11.54, dist (ft) = 0.96
Ping time (us) = 1719, dist (in) = 11.51, dist (ft) = 0.96
Ping time (us) = 1747, dist (in) = 11.70, dist (ft) = 0.98
Ping time (us) = 1743, dist (in) = 11.68, dist (ft) = 0.97
Ping time (us) = 1747, dist (in) = 11.70, dist (ft) = 0.98
Ping time (us) = 1747, dist (in) = 11.70, dist (ft) = 0.98

Ok, now it's time for me to demonstrate how I could be used to make a house alarm. Aim me right where you want me to look, at any surface *less than* ~10 ft away, then make sure I am well-secured, that no one is in front of me, and that I do not move. For this demo, you *will* get another chance to try it out in case you do a bad distance calibration. So, if it doesn't seem to work right, press the button to end, and I'll give you instructions to start it over again.

(When ready to calibrate and activate the alarm, press my pushbutton to continue, and then press it again to end my "alarm" mode, when done.)

ALARM ON. My calibrated alarm distance value is 11.54 inches. I have been programmed so that if I ever measure a future distance less than my calibrated value, minus 6 inches (in this case, 5.54 inches or less), it means that there is something blocking my path (ie: a human body), and so I will sound an alarm and assume there is an intruder in front of me! Have people walk in front of me to see me in action!

ALARM, INTRUDER ALERT! – distance to intruder (in) = 5.08

ALARM OFF.

Would you like to redo the alarm calibration and repeat this demonstration? If so, press the pushbutton TWICE in a row (the 2nd press must occur within 3 seconds of the 1st press). Otherwise, press the button only once, then wait 3 seconds.

Button press count = 1

Moving on…
If you'd like to learn how to use this ultrasonic rangefinder ("ping" sensor) truly as a home alarm system, see the "Additional Demo Info – Gabriel.docx" file that came with this demo. This stuff really is powerful!
(Press the pushbutton to continue.)

Is it bright in here? Let's find out! Time for a light sensor demo. I'm going to begin taking light intensity readings, using my photoresistor, and outputting data at 2 Hz (2 times per second). While I am outputting data, cover my light sensor to see how that affects me. I have been

programmed to only recognize three light levels, as you will see. First, however, let's calibrate my sensor to the lighting in this room.

(Make sure my light sensor is NOT covered, then press my pushbutton to calibrate the "bright" light setting.)

The calibrated bright light reading is 727

Now, let's calibrate the "dark" reading.
(Gently cover the light sensor with your finger, then press the pushbutton to continue.)

The calibrated dark light reading is 183

Light sensor calibration done.
Readings below 291 will be considered "pitch black"
From 291 to 618 will be considered "dim", and
Above 727 will be considered "bright".
Now, we will begin taking and printing light readings at 2 Hz. Play around with the light sensor by covering it, either entirely or partially, to see how that affects the results.

(Press my pushbutton to continue; press and HOLD it to stop)

Light reading = 727. It is bright in here.
Light reading = 728. It is bright in here.
Light reading = 721. It is bright in here.
Light reading = 728. It is bright in here.
Light reading = 722. It is bright in here.
Light reading = 728. It is bright in here.
Light reading = 721. It is bright in here.
Light reading = 722. It is bright in here.
Light reading = 608. It is dim in here.

Light reading = 638. It is bright in here.
Light reading = 638. It is bright in here.
Light reading = 622. It is bright in here.
Light reading = 682. It is bright in here.
Light reading = 689. It is bright in here.
Light reading = 667. It is bright in here.
Light reading = 603. It is dim in here.
Light reading = 592. It is dim in here.
Light reading = 673. It is bright in here.
Light reading = 644. It is bright in here.
Light reading = 718. It is bright in here.
Light reading = 724. It is bright in here.
Light reading = 730. It is bright in here.
Light reading = 724. It is bright in here.
Light reading = 729. It is bright in here.
Light reading = 607. It is dim in here.
Light reading = 453. It is dim in here.
Light reading = 627. It is bright in here.
Light reading = 696. It is bright in here.
Light reading = 698. It is bright in here.
Light reading = 697. It is bright in here.
Light reading = 697. It is bright in here.
Light reading = 694. It is bright in here.
Light reading = 690. It is bright in here.
Light reading = 673. It is bright in here.
Light reading = 665. It is bright in here.
Light reading = 618. It is dim in here.
Light reading = 608. It is dim in here.
Light reading = 697. It is bright in here.
Light reading = 711. It is bright in here.
Light reading = 691. It is bright in here.
Light reading = 674. It is bright in here.
Light reading = 682. It is bright in here.

Light reading = 703. It is bright in here.
Light reading = 701. It is bright in here.
Light reading = 714. It is bright in here.
Light reading = 679. It is bright in here.
Light reading = 663. It is bright in here.
Light reading = 613. It is dim in here.
Light reading = 604. It is dim in here.
Light reading = 594. It is dim in here.
Light reading = 586. It is dim in here.
Light reading = 579. It is dim in here.
Light reading = 584. It is dim in here.
Light reading = 582. It is dim in here.
Light reading = 577. It is dim in here.
Light reading = 583. It is dim in here.
Light reading = 593. It is dim in here.
Light reading = 709. It is bright in here.
Light reading = 724. It is bright in here.
Light reading = 723. It is bright in here.
Light reading = 677. It is bright in here.
Light reading = 304. It is dim in here.
Light reading = 222. It is pitch black in here.
Light reading = 224. It is pitch black in here.
Light reading = 220. It is pitch black in here.
Light reading = 220. It is pitch black in here.
Light reading = 221. It is pitch black in here.
Light reading = 229. It is pitch black in here.
Light reading = 227. It is pitch black in here.
Light reading = 222. It is pitch black in here.
Light reading = 223. It is pitch black in here.
Light reading = 224. It is pitch black in here.
Light reading = 227. It is pitch black in here.
Light reading = 225. It is pitch black in here.
Light reading = 227. It is pitch black in here.

Light reading = 229. It is pitch black in here.
Light reading = 236. It is pitch black in here.
Light reading = 235. It is pitch black in here.
Light reading = 225. It is pitch black in here.
Light reading = 234. It is pitch black in here.
Light reading = 230. It is pitch black in here.
Light reading = 230. It is pitch black in here.
Light reading = 220. It is pitch black in here.
Light reading = 223. It is pitch black in here.
Light reading = 227. It is pitch black in here.
Light reading = 283. It is pitch black in here.
Light reading = 717. It is bright in here.
Light reading = 722. It is bright in here.
Light reading = 727. It is bright in here.
Light reading = 728. It is bright in here.
Light reading = 722. It is bright in here.
Light reading = 720. It is bright in here.
Light reading = 708. It is bright in here.
Light reading = 719. It is bright in here.
Light reading = 715. It is bright in here.
Light reading = 701. It is bright in here.
Light reading = 607. It is dim in here.
Light reading = 570. It is dim in here.
Light reading = 532. It is dim in here.
Light reading = 435. It is dim in here.
Light reading = 425. It is dim in here.
Light reading = 440. It is dim in here.
Light reading = 434. It is dim in here.
Light reading = 438. It is dim in here.
Light reading = 487. It is dim in here.
Light reading = 518. It is dim in here.
Light reading = 500. It is dim in here.
Light reading = 410. It is dim in here.

Light reading = 496. It is dim in here.
Light reading = 522. It is dim in here.
Light reading = 530. It is dim in here.
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Light reading = 540. It is dim in here.
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Light reading = 533. It is dim in here.
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Light reading = 539. It is dim in here.
Light reading = 535. It is dim in here.
Light reading = 720. It is bright in here.
Light reading = 724. It is bright in here.
Light reading = 722. It is bright in here.
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Light reading = 726. It is bright in here.
Light reading = 720. It is bright in here.
Light reading = 727. It is bright in here.
Light reading = 720. It is bright in here.
Light reading = 728. It is bright in here.
Light reading = 536. It is dim in here.
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Light reading = 466. It is dim in here.
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Light reading = 464. It is dim in here.
Light reading = 37. It is pitch black in here.
Light reading = 23. It is pitch black in here.
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Light reading = 17. It is pitch black in here.
Light reading = 455. It is dim in here.
Light reading = 466. It is dim in here.
Light reading = 464. It is dim in here.
Light reading = 468. It is dim in here.
Light reading = 472. It is dim in here.
Light reading = 470. It is dim in here.
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Light reading = 549. It is dim in here.
Light reading = 556. It is dim in here.
Light reading = 555. It is dim in here.
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Light reading = 556. It is dim in here.
Light reading = 552. It is dim in here.
Light reading = 549. It is dim in here.
Light reading = 554. It is dim in here.
Light reading = 739. It is bright in here.
Light reading = 737. It is bright in here.
Light reading = 734. It is bright in here.
Light reading = 729. It is bright in here.
Light reading = 716. It is bright in here.
Light reading = 710. It is bright in here.
Light reading = 696. It is bright in here.
Light reading = 707. It is bright in here.
Light reading = 710. It is bright in here.
Light reading = 732. It is bright in here.
Light reading = 729. It is bright in here.
Light reading = 736. It is bright in here.
Light reading = 729. It is bright in here.
Light reading = 732. It is bright in here.
Light reading = 731. It is bright in here.
Light reading = 734. It is bright in here.

Light Sensor OFF.

Would you like to redo the photoresistor calibration and repeat this light sensor demonstration? If so, press the pushbutton TWICE in a row (the

2nd press must occur within 3 seconds of the 1st press). Otherwise, press the button only once, then wait 3 seconds.

Button press count = 1

Exiting light sensor demo.
(Press my pushbutton to continue)

In this next demonstration, I'm going to be using an RGB (Red/Green/Blue) LED. This means that a single LED case has all three of these LED colors built right in, as separate LEDs, but all in the same plastic case. You can turn them on one at a time, or all at once, or whatever you want. Additionally, using the analogWrite() command in Arduino, you can send a PWM (Pulse Width Modulation) signal to an LED to vary its brightness, or intensity. Therefore, using one RGB LED you can mix different intensities of colored light and generate ANY color of the rainbow. Let's see this in action!

(Press my pushbutton to see the red LED turn on).

(Now press my pushbutton to see only the green LED on).
(Now press my pushbutton to see only the blue LED on).
(Now press my pushbutton to see both the RED AND GREEN LED on. This makes Yellow. Practice on your own later to write code to make the RGB LED turn yellow, cyan and magenta).

Now press my pushbutton to see the RGB LED go through the whole rainbow, fading in and out of all of the colors! Press the pushbutton again to stop this demo and continue on.
Rainbow ON.
The color progression is RED □ (YELLOW) □ GREEN □ (CYAN) □ BLUE □ (MAGENTA) □ RED

Rainbow OFF

Whew! Is it hot in here or just me? ☺ My microprocessor seems to be getting all worked up over the excitement of all the cool things I can do! Let's check the room temp. w/my TMP36 analog temperature sensor (thermometer). Gently squeeze the sensor w/your fingers to watch the temp. rise!

(Press my pushbutton to continue; press and HOLD it to stop)

Thermometer ON.
Room temp = 23.80 deg C, or 74.84 deg F.
Room temp = 24.29 deg C, or 75.72 deg F.
Room temp = 24.29 deg C, or 75.72 deg F.
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Room temp = 24.29 deg C, or 75.72 deg F.
Room temp = 24.78 deg C, or 76.60 deg F.
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Room temp = 25.27 deg C, or 77.48 deg F.
Room temp = 25.27 deg C, or 77.48 deg F.
Room temp = 25.27 deg C, or 77.48 deg F.
Room temp = 25.76 deg C, or 78.36 deg F.
Room temp = 25.76 deg C, or 78.36 deg F.
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Room temp = 26.25 deg C, or 79.24 deg F.
Room temp = 26.74 deg C, or 80.12 deg F.
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Room temp = 26.25 deg C, or 79.24 deg F.
Room temp = 26.74 deg C, or 80.12 deg F.
Room temp = 26.25 deg C, or 79.24 deg F.
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Room temp = 26.74 deg C, or 80.12 deg F.
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Room temp = 26.74 deg C, or 80.12 deg F.
Room temp = 26.74 deg C, or 80.12 deg F.
Room temp = 27.22 deg C, or 81.00 deg F.
Room temp = 27.22 deg C, or 81.00 deg F.
Room temp = 27.22 deg C, or 81.00 deg F.
Room temp = 27.71 deg C, or 81.88 deg F.
Room temp = 27.71 deg C, or 81.88 deg F.
Room temp = 27.71 deg C, or 81.88 deg F.
Room temp = 27.71 deg C, or 81.88 deg F.
Room temp = 27.71 deg C, or 81.88 deg F.
Room temp = 27.71 deg C, or 81.88 deg F.
Room temp = 27.71 deg C, or 81.88 deg F.
Room temp = 28.20 deg C, or 82.76 deg F.
Room temp = 28.20 deg C, or 82.76 deg F.
Room temp = 28.20 deg C, or 82.76 deg F.
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Room temp = 29.18 deg C, or 84.52 deg F.
Room temp = 29.18 deg C, or 84.52 deg F.
Room temp = 29.18 deg C, or 84.52 deg F.
Room temp = 29.18 deg C, or 84.52 deg F.
Room temp = 29.18 deg C, or 84.52 deg F.
Room temp = 28.69 deg C, or 83.64 deg F.
Room temp = 28.69 deg C, or 83.64 deg F.
Room temp = 28.69 deg C, or 83.64 deg F.
Room temp = 28.69 deg C, or 83.64 deg F.
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Room temp = 25.76 deg C, or 78.36 deg F.
Thermometer OFF.

Cool stuff, let's keep going!
(Press the pushbutton to continue).

Skipping really cool servo (ex: robotic arm type actuator) demo since there are too many demos to fit on the Arduino all at one time. Compile & run the other main demo code to see any skipped demos!

We are on the final demo! I feel like we've really come close these past several minutes, you know, as we've learned together, so what do you say I serenade you with some of my favorite classical music, using my piezo buzzer?

There is no interaction required from you on this one; all you have to do is listen. When the song is over, it will end automatically. Can you

guess which song it might be? PS. Before the music plays, I will do some sounds sweeps, fast, then slow, to demonstrate the range of notes I can play.

(Press the pushbutton to continue)

soundSweepFast START (To me, this sounds like the sound they make in cartoons when a character slips on a banana
soundSweepFast END
soundSweepSlow START
soundSweepSlow END
serenadeYouWithBeautifulMusic START
serenadeYouWithBeautifulMusic END

Before you go, let me give you a proper introduction: I am an Arduino microcontroller development platform. There are many types of Arduinos. My type is called "Leonardo". I am based on an Atmel ATmega32U4 microcontroller. Today, in these demos, you have seen only a *tiny* sample of what I can do. I can do ANYTHING you tell me to do. ANYTHING you program me to do. I can change the world. I can change the way we live, but only if YOU make me do so. Your students can change the world, they can learn and grow and CREATE, and make it a better place, but only if YOU help them learn to do so. Let's all *strive* to improve ourselves, and remember that it is US who make up the world, and it is US who determine the destiny of the world. Let us use our time wisely, share our talents with each other, and become THINKERS *AND* DOERS, not just HEARERS. "Be a thinker, and be a doer." That is my motto.

Sincerely,
Gabriel Staples

END OF DEMO.

Thanks for your time, Gabriel ☺.

This program was created by Gabriel Staples (http://ElectricRCAircraftGuy.blogspot.com/), June 2014.

I'm still watching you… ☺

Saving file, please wait…
File Saved

NEXT, GET HELP FROM THE INSTRUCTOR TO UPLOAD THE DEMO2 CODE AND BEGIN AGAIN TO SEE THE SKIPPED DEMOS.