

# Lucky Larry

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## Arduino – Sonic range finder with SRF05

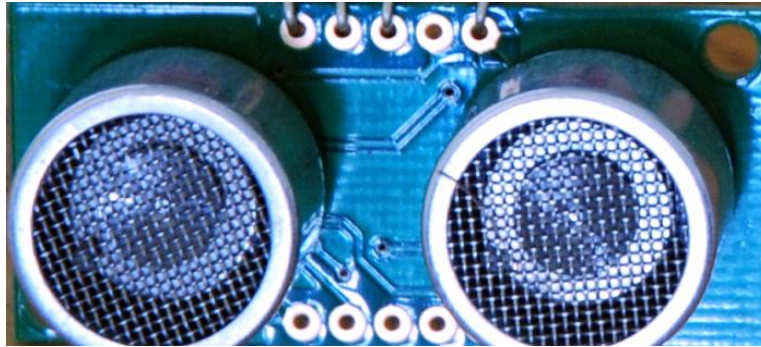
July 12, 2009

By larry

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24 Comments



A guide to using the **SRF05 Distance Sensor** with **Arduino** in order to calculate distances from objects. In this case I'm also altering the output of an LED with PWM according to how close an object is to the sensor. So the nearer you are the brighter the LED.

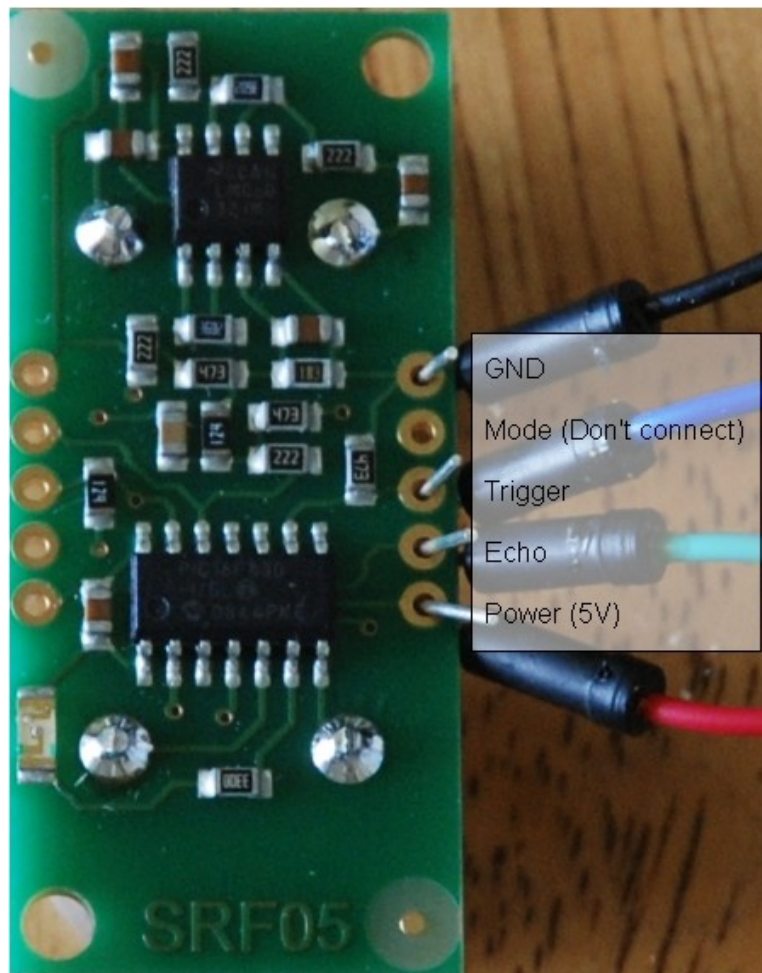
[Arduino – Control a DC motor with TIP120, potentiometer and multiple power supplies](#)

So if we start with the SRF05, it's an IC that works by sending an ultrasound pulse at around 40Khz. It then waits and listens for the pulse to echo back, calculating the time taken in microseconds (1 microsecond =  $1.0 \times 10^{-6}$  seconds). You can trigger a pulse as fast as 20 times a second and it can determine objects up to 3 metres away and as near as 3cm. It needs a 5V power supply to run.

Adding the SRF05 to the Arduino is very easy, only 4 pins to worry about. Power, Ground, Trigger and Echo. Since it needs 5V and Arduino provides 5V I'm obviously going to use this to power it. Below is a diagram of my SRF05, showing the pins. There are 2 sets of 5 pins, 1 set you can use, the other is for programming the PIC chip so don't touch them!

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### SRF05 Arduino Components

220 Ohm resistor (Red, Red, Brown, Gold)

SRF05 Ultrasonic range finder

LED

Arduino Deumilanove w/ ATMEGA328

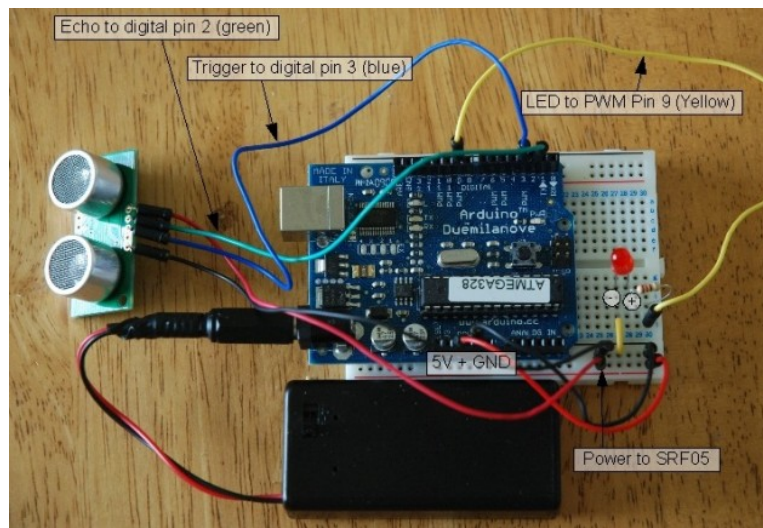
Breadboard / Prototyping board

Jumper/ Connector wires

Optional **9V DC power supply** or use the USB power for the Arduino

### Arduino SRF05 Circuit

Very, very simple circuit, I've used the breadboard to share the GND connection and to add the LED which I could probably have done with out the breadboard. You'll see the most complex thing is the code later on.



### SRF05 Arduino Distance Sensor sketch

All the work is done here, I've added code that averages the distance readings to remove some of the jitter in the results as the SRF05 is calculating distances very rapidly and there can be a lot of fluctuation. Also I convert the time in microseconds to distance by dividing the time by 58.

Why 58? Well because if you take the time in microseconds for a pulse to be sent and received e.g. for 1 meter it takes about 5764 microseconds – at least from my wall anyway. If I divide this time by the distance in cm in I will get 57.64 so I just round this up – you can calculate distance in any other unit with this method.

Here I've also decided that for every cm under 255 my LED will get 1 step brighter. I've been lazy here for the sake of the sensors 3 metre range I didn't see the point in making this any more complicated. Otherwise I would calculate the brightness on the percentile of proximity out of total range.

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```
// written at: luckylarry.co.uk
// variables to take x number of
// readings and then average them
```

```
// to remove the jitter/noise from
the SRF05 sonar readings

const int numOfReadings = 10;
// number of readings to take/
items in the array
int readings[numOfReadings];
// stores the distance readings in
an array
int arrayIndex = 0;
// arrayIndex of the current item
in the array
int total = 0;
// stores the cumulative total
int averageDistance = 0;
// stores the average value

// setup pins and variables for
SRF05 sonar device

int echoPin = 2;
// SRF05 echo pin (digital 2)
int initPin = 3;
// SRF05 trigger pin (digital 3)
unsigned long pulseTime = 0;
// stores the pulse in Micro
Seconds
unsigned long distance = 0;
// variable for storing the
distance (cm)

// setup pins/values for LED

int redLEDPin = 9;
// Red LED, connected to digital
PWM pin 9
int redLEDValue = 0;
// stores the value of brightness
for the LED (0 = fully off, 255 =
fully on)
```

```
//setup

void setup() {

    pinMode(redLEDPin, OUTPUT);
    // sets pin 9 as output
    pinMode(initPin, OUTPUT);
    // set init pin 3 as output
    pinMode(echoPin, INPUT);
    // set echo pin 2 as input

    // create array loop to iterate
    over every item in the array

    for (int thisReading = 0;
    thisReading < numOfReadings;
    thisReading++) {
    readings[thisReading] = 0;
    }
    // initialize the serial port,
    lets you view the
    // distances being pinged if
    connected to computer
    Serial.begin(9600);
    }

    // execute
    void loop() {
    digitalWrite(initPin, HIGH);
    // send 10 microsecond pulse
    delayMicroseconds(10);
    // wait 10 microseconds before
    turning off
    digitalWrite(initPin, LOW);
    // stop sending the pulse
    pulseTime = pulseIn(echoPin,
    HIGH); // Look for a
    return pulse, it should be high as
    the pulse goes low-high-low
```

```
distance = pulseTime/58;
// Distance = pulse time / 58 to
convert to cm.
total= total -
readings[arrayIndex];          //
subtract the last distance
readings[arrayIndex] = distance;
// add distance reading to array
total= total +
readings[arrayIndex];
// add the reading to the total
arrayIndex = arrayIndex + 1;
// go to the next item in the
array
// At the end of the array (10
items) then start again
if (arrayIndex >= numOfReadings)
{
    arrayIndex = 0;
}

    averageDistance = total /
numOfReadings;    // calculate
the average distance

    // if the distance is less than
255cm then change the brightness
of the LED

    if (averageDistance < 255) {
        redLEDValue = 255 -
averageDistance;    // this
means the smaller the distance the
brighterthe LED.
    }

    analogWrite(redLEDPin,
redLEDValue);    // write
current value to LED pins
    Serial.println(averageDistance,
```

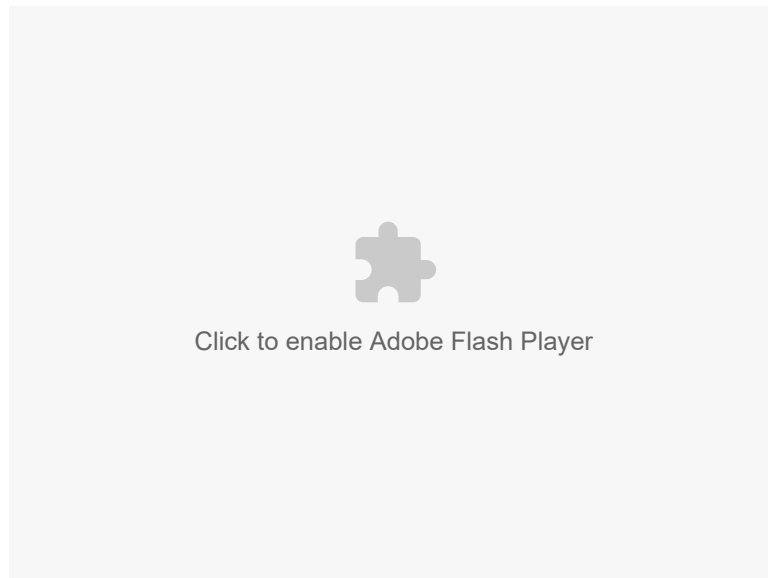
```
DEC);          // print out the
average distance to the debugger
  delay(100);
// wait 100 milli seconds before
looping again

}
```

---

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Well this is going to make the sensor for a robot methinks. I'll alter this to control a servo so turn left or right when blocked, or perhaps to alter the speed of the motors. Or maybe I'll just give myself bat like senses, maybe even fight crime! Anyway below is the quick video of it in action:



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## 24 Comments

**December 17, 2009**  
**9:13 PM**

By LORENC XHUVANI

Hey  
Great work at all. But I have a problem with the code: when a paste the code in the arduino software "Arduino 0015 running it it comes out some problems that I am not able to resolve. Can you please tell me what I can do and change the code?  
Thank you

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**December 17, 2009**  
**10:05 PM**

Hi, if you can let me know the error that you get and I'll try to see if I can fix it. I'm also using Arduino 0015 release to do this.

By larry

[Log in to Reply](#)

**December 22, 2009**  
**9:38 PM**

Hello Larry  
the error is

By LORENC  
XHUVANI

“error: expected constructor, destructor, or type conversion before ‘(‘ token” .

Is in the row

“digitalWrite(initPin, HIGH); // send 10 microsecond pulse”

Thank you

Ps I am passing also in the Arduino 0017 and it gives the same

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**December 23, 2009**  
**9:57 AM**

Ah... if you look for the line ‘// execute void loop() { ‘

By larry

WordPress has messed up my code a bit, you can see that the // starts a code comment and there should have been a return after my comment of // execute.

The void loop() { is a method needed to run your Arduino code and its been commented out. Anyway I've updated the post to fix that.

Hope that helps.

[Log in to Reply](#)

**December 25, 2009**  
**11:38 AM**

Great Larry!!!  
It funtion all.  
Thank you!

By LORENC  
XHUVANI

**December 25, 2009**  
**1:00 PM**

Hey Larry

I wanted to ask you something other. I am not able to interface the SFR05 with the software MaxMSP 5. I am trying to do it with the Arduino instructions but no way till now. If you have any idea will be great.

Thank you and Merry Christmas!

By LORENC  
XHUVANI

**December 26, 2009**  
**10:38 PM**

Not sure what you want to do with MAX MSP? I've never used it myself – but from the looks of it you can link it up using information here:

By larry

<http://www.arduino.cc/playground/Interfacing/MaxMSP>  
and here: <http://www.soundplusdesign.com/?>



[p=1305](#) And it looks like its fairly straight forward.

I personally use Processing which I think does the same kind of things – I've done a few projects here:

<http://luckylarry.co.uk/tag/processing/>

Specifically check out this post involving the SRF-05 and Processing:

<http://luckylarry.co.uk/2009/11/arduino-basic-theremin-meets-processing/>

Hope the links help.

**January 24,  
2010  
6:43 PM**

By LORENC  
XHUVANI

Hello Larry

How are you?

I am using you for different things and I hope you did not get tired of this.

I wanted to use some Wii object but with the mac. You think that it exist a mood to get the controller in my computer?

I am trying right now but nothing happen

Thank you

Lorenc

**January 24,  
2010  
8:21 PM**

By larry

Hey Lorenc,

I've got a Wii myself but I've not tried working with the controllers yet. I see a few tutorials online though – I guess its a case of receiving the signal from the Wii controller so you'll need an RF receiver (not IR) the sensor bar doesnt receive data from the Wii controller, it sends it. You can disconnect the Wii sensor bar and use TV remotes, IR leds etc... instead and the Wii controller will still work. The IR bit in the controller is actually an IR camera! cool huh?

Check this out: <http://www.arduino.cc/cgi-bin/yabb2/YaBB.pl?num=1172459283>

And: <http://www.windmeadow.com/node/45>

Loads of stuff already online about Arduino and Wii.

Looks like you can plug the wiimote in by using the expansion port – the bit where you connect the nunchuck to the Wiimote, if you take the plug off you'll have 6 pins that you can wire into Arduino.

BUT – I reckon there must be a way of receiving the RF signal from the remote which would be better. Can't think of how else the signal is sent wirelessly other than RF.

Good luck! Let me know how you get on as I've yet to try doing any of this myself.

Larry

**August 28, 2012**  
**8:00 AM** hi larry.. my project is about human follower can you help me.. tnx God bless

By melvin

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**August 28, 2012**  
**8:01 AM** what sensor could be easy to use in following the human.. can you help me please..

By melvin

[Log in to Reply](#)

**January 22, 2010**  
**3:53 AM** Larry, great stuff, thanks for posting. We are working on a way to locate water level in our educational river models and thinking of ultrasound. Specs on commercial units are all over the place—did you test accuracy on this and if so would you share? We need ~2mm precision over a range of about 100mm.

By Steve Gough

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**January 22, 2010**  
**9:16 PM** Hi Steve,

By larry

The measurement is worked out from the time the signal is detected bouncing back – I worked this out by setting an object a metre away and dividing the time in microseconds by the distance in centimeters/ inchs etc... So if you're using a different ultrasound sensor the first stage for calibration is to record the time when the echo is detected and go from there.

I generally found that for large surface areas its very accurate.

Larry.

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**November 17, 2010**  
**5:48 PM** Hi Larry,

By Martin Su

Just wondering, would this same sketch work with the SRF10 Ultrasonic Sensor?

[Log in to Reply](#)

**January 08, 2011**

**12:01 PM** Should do, just depends on the pin configuration as I think the  
By larry SRF10 use only one set of pins for both echo and trigger.

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**February 15, 2011**  
**10:04 PM**  
By SRF05 Ultrasonic [...] experimenters and not robotics people, so screw 'em. I stole the timing algorithm from the luckylarry.co.uk website, just like pretty much everyone else who uses the SRF05. Good old Lucky Larry was the only [...]

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**July 06, 2011**  
**6:23 AM**  
By Bryce Hey Larry,  
can you explain how these lines work?  
  
total= total – readings[arrayIndex]; // subtract the last distance  
readings[arrayIndex] = distance; // add distance reading to array  
total= total + readings[arrayIndex]; // add the reading to the total  
  
won't the total always be readings zero? I've ran your code and I can see that it doesn't but this just doesnt make sense to me.

Thanks

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**August 19, 2011**  
**10:43 AM**  
By Costyn I've been puzzling over this a while too, but I think I finally get it. What is stored in the array is the 10 readings from the previous 10 cycles. In each cycle the current reading is averaged with the reading of 10 cycles ago.

[Log in to Reply](#)

**August 08, 2011**  
**4:37 AM**  
By Martini Hi larry, I'm pretty interesting in building my own experimental produce but to start with, I stayed in Singapore. How do i get my hands on Arduino chip and SRF05?

Is there like a website that deals international orders?

Thank you!

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**February 21, 2012**  
**6:40 PM**  
By Lemorlenny Beware the SRF pins, mine have pins in reverse order than your pics!.

[Log in to Reply](#)

**April 07, 2012**  
**11:03 AM**

Great – works a treat – thanks for sharing...

By teejay

[Log in to Reply](#)

**April 24, 2012**  
**8:36 AM**

how about we use Ping ultrasonic sensor which have only 3 pin??how it connection??

By lee

[Log in to Reply](#)

**August 23, 2012**  
**2:42 AM**

Hey is there a way too use a speaker instead of a red LED?

By Shawn

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**August 27, 2012**  
**3:06 PM**

Hi,

Great idea and description. I love when people are sharing things like this to benefit of all of us so big thank you for sharing.

By Tom

I am not a specialist and just about to begin learning about arduino and I was wondering if you could tell me if i can use a speaker instead of a LED. the idea is to use speaker to transmit audio/sound as a feedback rather than light. I am trying to build a small device that you can use for simple school project .Kids can use this device to not only learn about but also experience echolocation. they will have to navigate true simple obstacle course just using sound as main feedback. So I was thinking of connecting in a speaker instead of the LED. My question is your code has to be changed/adjusted or will do just fine. I know I could just swap the LED wth the speaker to find out but I am afraid to brake something.

Thank you for your help.

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