Lead America Helicopter Workshop

June/July 2013

Step Zero — 9:00 AM Introduction:

Step One — Breakout, Beginnings & Breadboards

1. How breadboards work.
2. Your kit:
    a. Arduino microprocessor
    b. Helicopter
    c. Breadboard
    d. IR LED array
    e. Amplifier
    f. LED light and resistor
    g. Batteries
    h. A few wires
3. **Be sure to start charging your helicopter!**

Step Two — Blinking LED

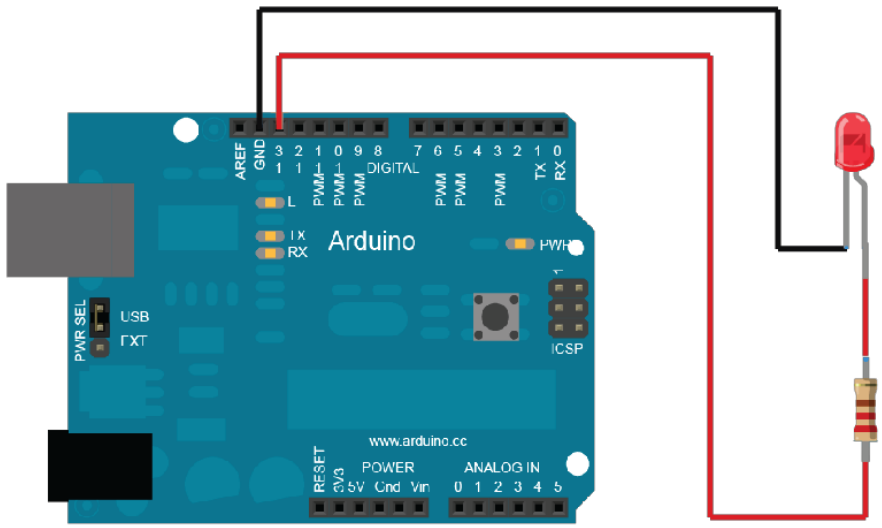
Important to remember:

- Make sure Arduino software is installed: http://arduino.cc/en/Main/Software
- Make sure the correct serial port is connected:
    - Tools > Serial Port > COM4 or COM5 on Windows or /dev/tty.usbmodemfd121 on Mac

Think about:

1. **How do you know which side of the LED is plus (+) or minus (-) ?**
2. Setup the circuit on the breadboard according to **Figure 1**.
3. Connect the Arduino to the computer. Load the default blink code:
    a. **File > Examples > 01.Basics > Blink**
4. Check serial port. Upload.
5. (optional) Change the LED's blinking period
6. (optional) Add another LED and make them blink in sequence

Figure 1 - Simple Blinking LED



Step Three – Flying the Helicopters

Important to Remember:

- **Let everyone get a turn to fly.** You only have about 5 minutes of battery life.
- **Re-charge helicopters after use**.
- The helicopters will sync to the first channel they see when powered on.
- Helicopters must be level and still when turned on to calibrate gyroscope.
- You may need to do a lot of turning them on and off.

Step Four – Fan & Amplifier

Important to Remember:

- **Have an instructor check your circuit before the amplifier is plugged in!**
- Double check the pin configuration of the amplifier
- Make sure the helicopters are charging

Steps:

1. Hook up the fan in the circuit as shown in **Figure 2**.
2. Why doesn't the fan "blink"?
3. Change the code to make it "blink."
4. Fan's is pretty wimpy... let's add more power.

5. Hook up the power amp to the fan in the circuit as shown in **Figure 3**.
6. **Be sure to check the circuit before the amplifier and battery are connected**
7. See if the code can be adjusted to illustrate full fan power

Figure 2 - Low Power Fan

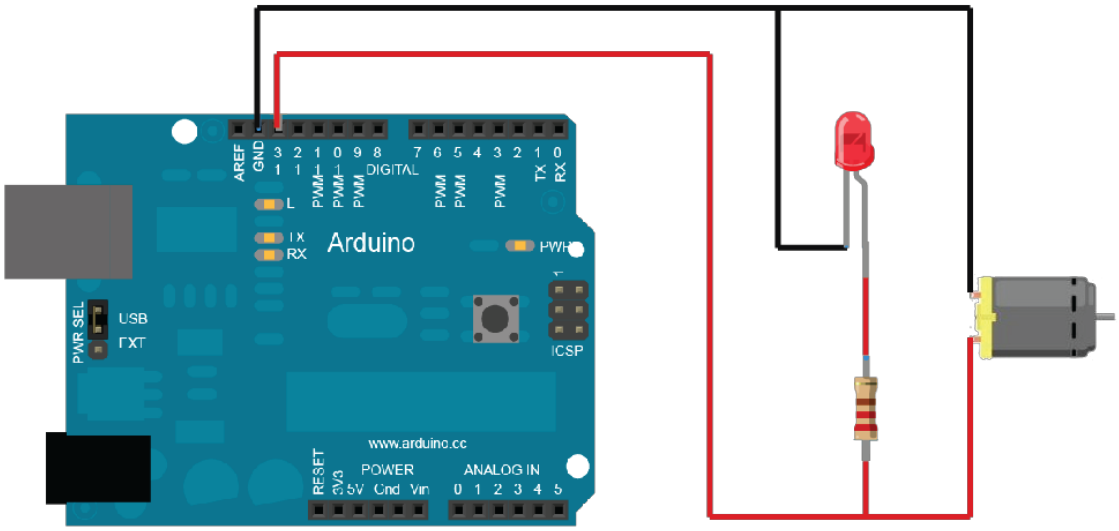
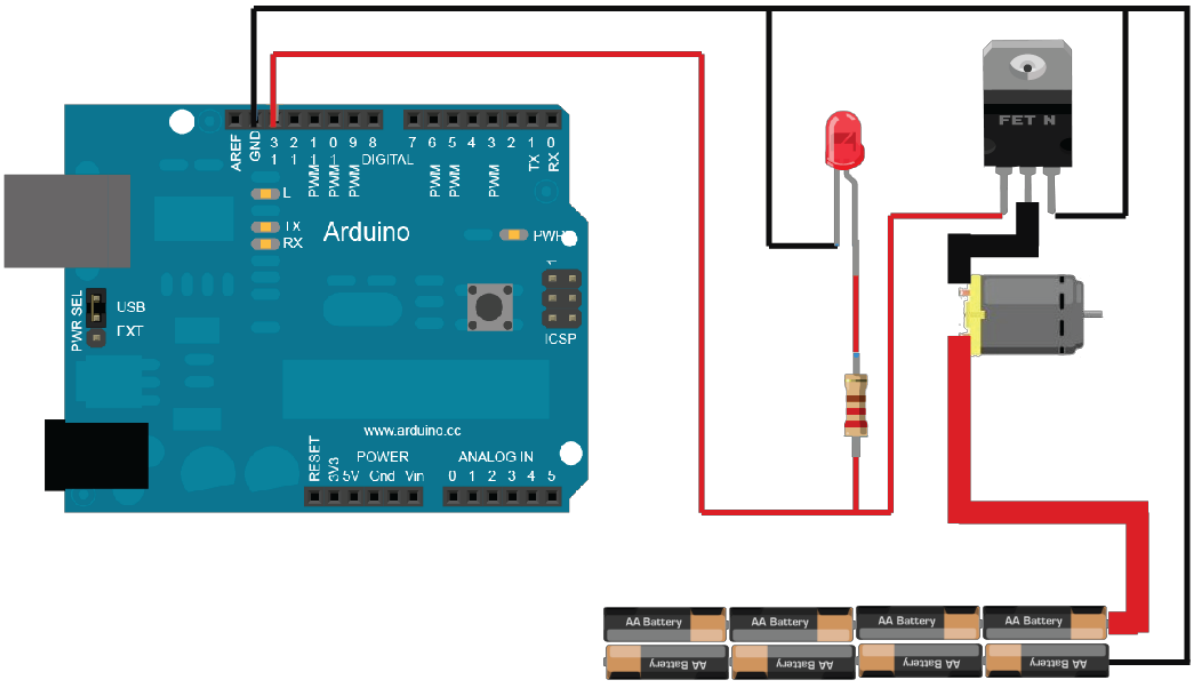


Figure 3 - Amplifier to Fan



Step Five – IR LED Array

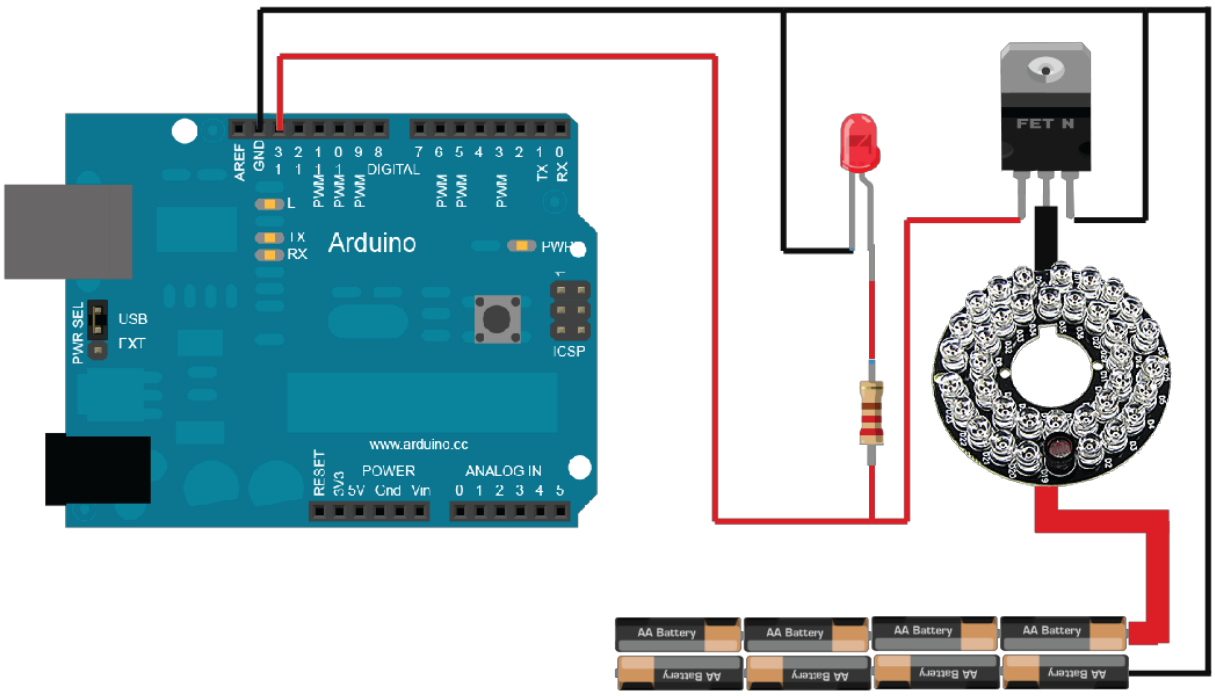
Important to Remember:

- Recheck the circuit when the light array goes in before it gets powered.
- Make sure the helicopters are charging

Steps:

1. Replace the fan with the light as shown in **Figure 4**
2. How can you tell if it's on? Try your cell phone camera...
3. (optional) Blink the IR LED at different rates. How fast can you make it blink?

Figure 4 - LED Array



Step Six — Basic Flight Control

Important to Remember:

- **Always have the helicopters charging between attempts**
- Make sure everyone gets to try and fly.
- Hold the helicopters in your hand and watch the serial monitor.

Steps:

1. Now we're going to control the helicopters via code!
2. Download the helicopter code: http://bit.ly/1ay6JGA
3. Ask your instructor to set the `byte channel` in the code.
4. Open code, switch to the correct channel in the code, compile, and upload.
5. Open **Tools > Serial Monitor**
6. Turn on the helicopters and get them to sync with the correct arduino station.
7. Flying:
    a. Only 1 letter at a time. Must push "Enter" each time.
    b. **When in doubt, type 0 then Enter**
    c. 0 through 9 control throttle. 0 is off. 9 is full.
    d. W - forward | S - backwards | D - rotate right | A - rotate left | R - recenter

e. You might need to power cycle helicopters a lot so the sync to the right channel.
f. Make sure everyone gets to try and “fly-by-letter”

Step Seven — Advanced Flight Control

Important to Remember:

- **Always have the helicopters charging between attempts**

Steps:

1. Add code to fly the following:
    a. Take off
    b. Mid-air box (forward, turn, forward, turn, etc.)
    c. Land
2. Look at how the **HoldCommand** function works for the example takeoff.
3. Got that to work? What about another maneuver?