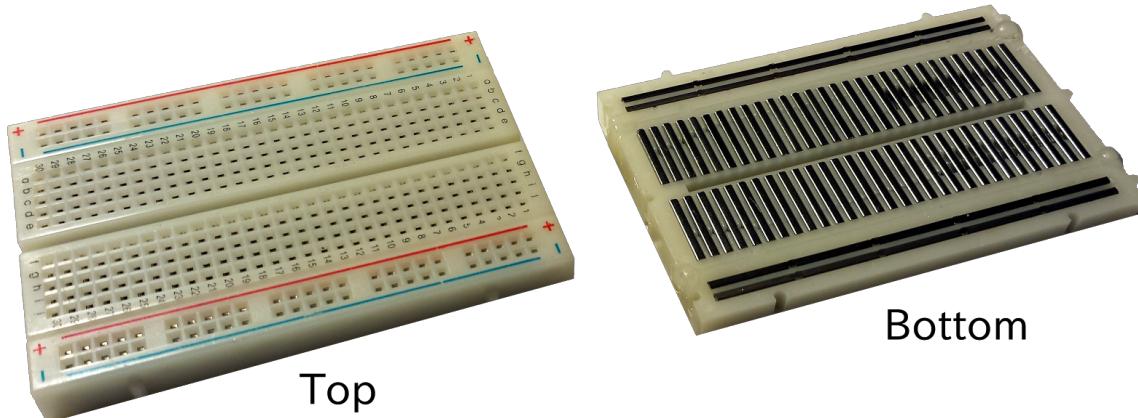


Helicopter Workshop

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Breakout, Beginnings & Breadboards

1. How breadboards work:



The upsidedown breadboard on the right shows the connection pattern of a breadboard. This pattern is pretty standard - it makes connecting wires together easy and convenient!

2. Your kit (14 items):

- a. Arduino microprocessor
- b. USB cable
- c. Helicopter
- d. Helicopter controller
- e. Breadboard
- f. IR LED array
- g. Amplifier
- h. LED light and resistor
- i. AA Battery holder
- j. 9V battery snap
- k. Batteries
- l. Small button
- m. Fan
- n. A few wires

Don't forget!

3. Be sure to start charging your helicopter!

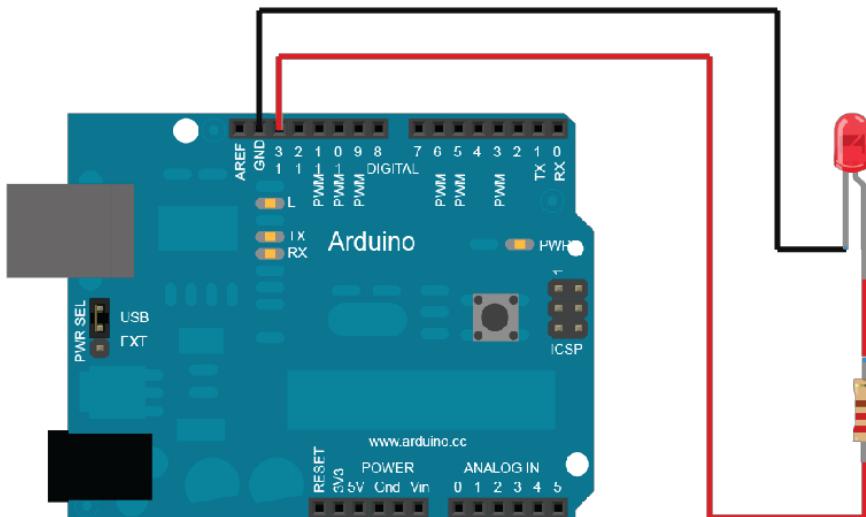
- a. You need to turn the helicopter off for it to charge.
- b. If the light on the USB connector is off, it is charging.

Blinking LED

- **Keep the helicopters charging**

Steps

1. Install the Arduino software from your USB drive.
 - If it asks, say 'yes' when the installer asks about installing the drivers.
2. Plug the Arduino into the computer USB port
3. Make sure the correct serial port is connected:
 - **Tools > Serial Port > COM1 (or 2,3....)** on Windows or **/dev/tty.usbmodemfd121** on Mac
 - Not working? Check:
 - Arduino plugged in (try disconnecting and reconnecting)
 - Try a different COM port
4. Setup the circuit on the breadboard (figure below).
4. **How do you know which side of the LED is plus (+) or minus (-) ?**
 - a. The longer lead is (+), connected to pin 13 in the diagram below.
5. Load the default blink code:
 - a. **File > Examples > 01.Basics > Blink**
6. Check serial port. Upload. The button looks like this: 
7. (optional) Change the LED's blinking period
8. (optional) Add another LED and make them blink in sequence



Flying the Helicopters

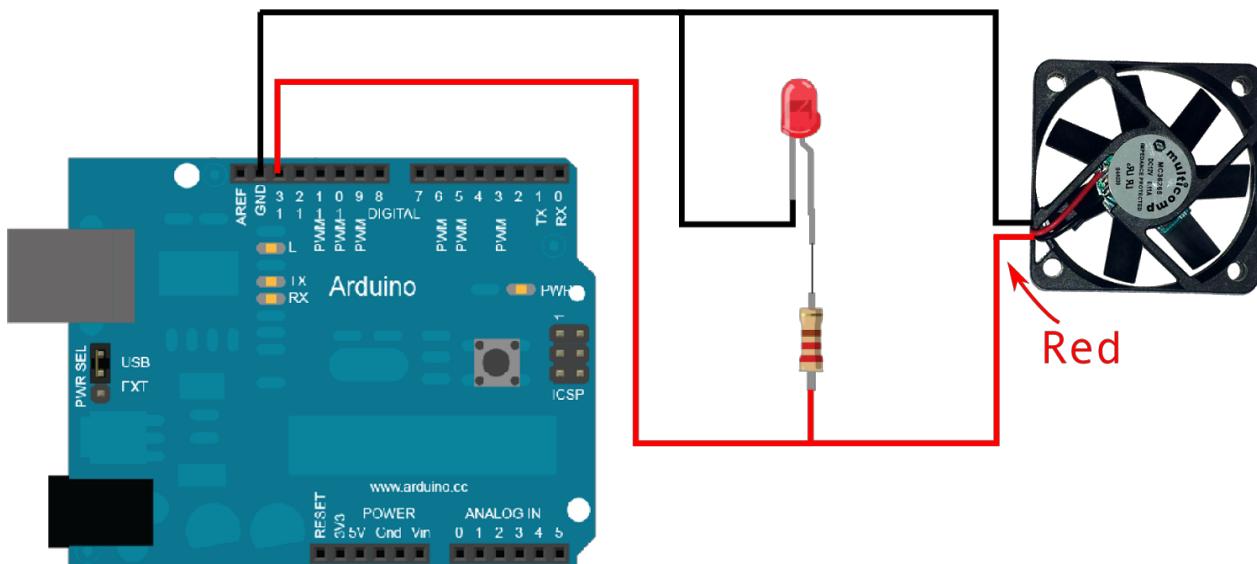
- **Everyone flies. You only have about 5 minutes of battery life.**
- The helicopters will sync to the first channel they see when powered on.
- Helicopters must be level and still when turned on to calibrate gyroscope.
- You may need to do a lot of turning them on and off.

Fan & Amplifier

- **Recharge your helicopter.**

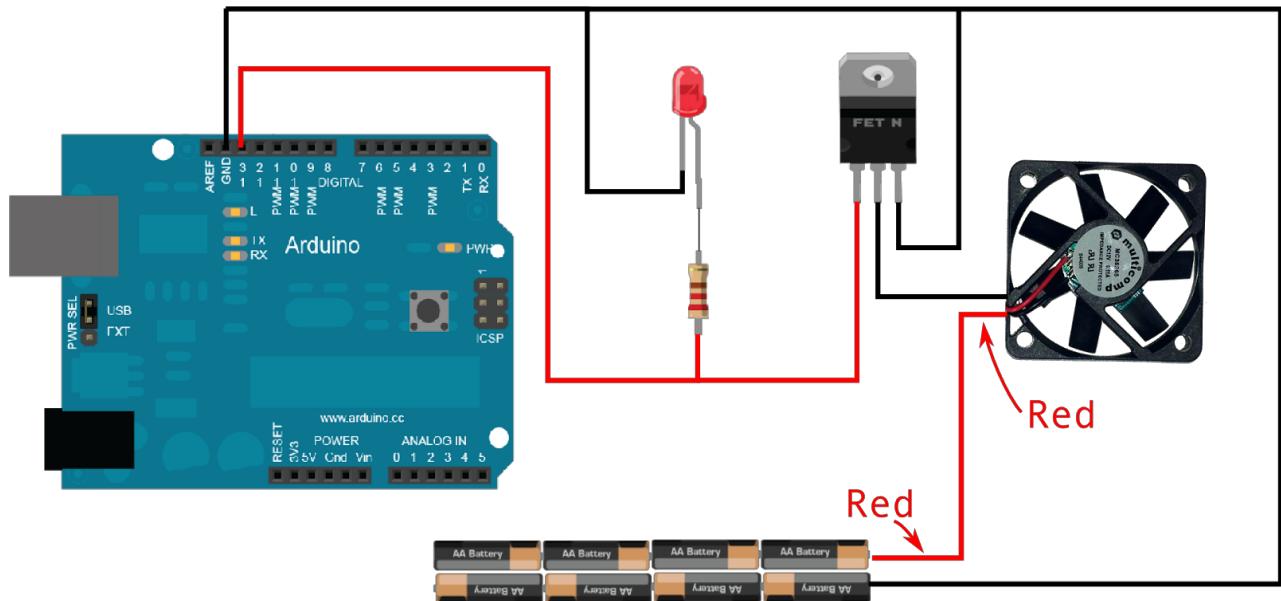
Steps

1. Hook up the fan to the Arduino, as shown below:



2. Why doesn't the fan "blink"?
3. Change the code to make it "blink."
4. Fan's pretty wimpy... let's add more power....

5. Hook up the power amplifier to the fan in the circuit below.
6. **Be sure to check the circuit. Don't connect the battery positive to pin#13!**
7. Your instructor has the final battery, ask them to come over and give you the final battery

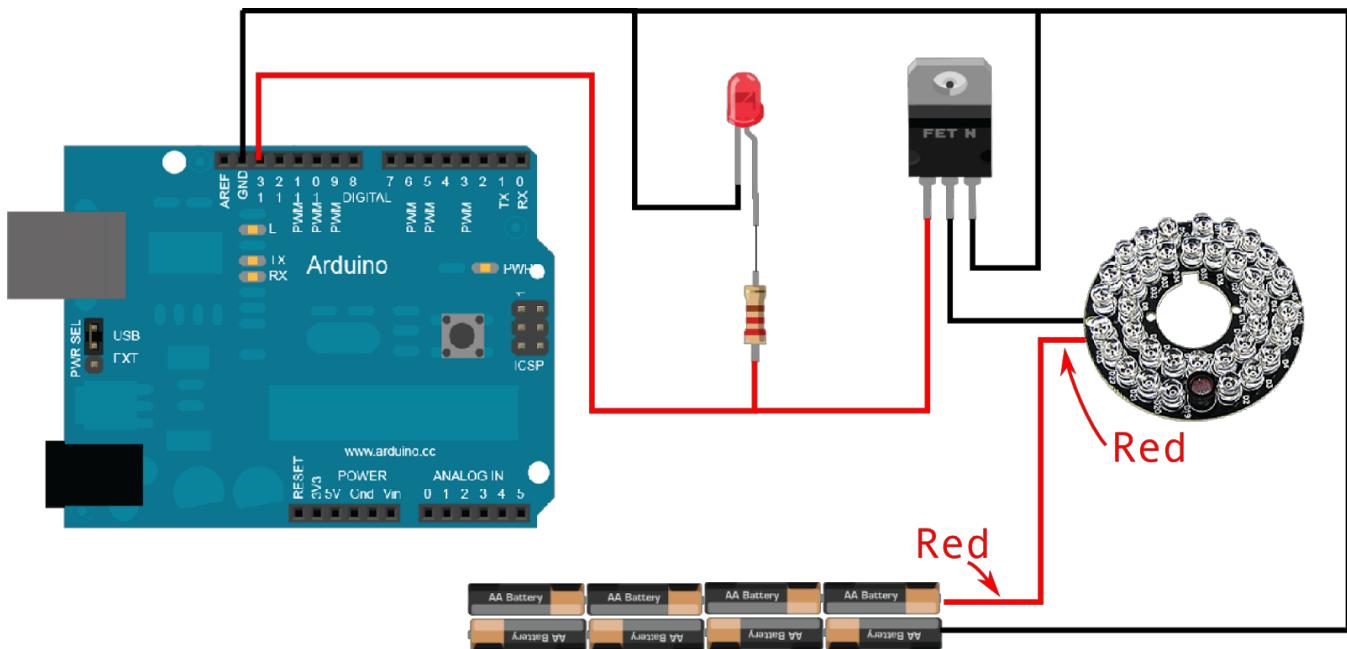


8. See if the code can be adjusted to illustrate full fan power.
9. (Optional) What about half-power?.

IR LED Array

Steps:

1. Replace the fan with the light as shown in below.
2. How can you tell if it's on? You can't see infrared, but these also leak a little into visible light...
3. (optional) Blink the IR LED at different rates. How fast can you make it blink?



Basic Flight Control

- Always have the helicopters charging between attempts
- Everyone flies.
- Hold the helicopters in your hand and watch the serial monitor.

Steps:

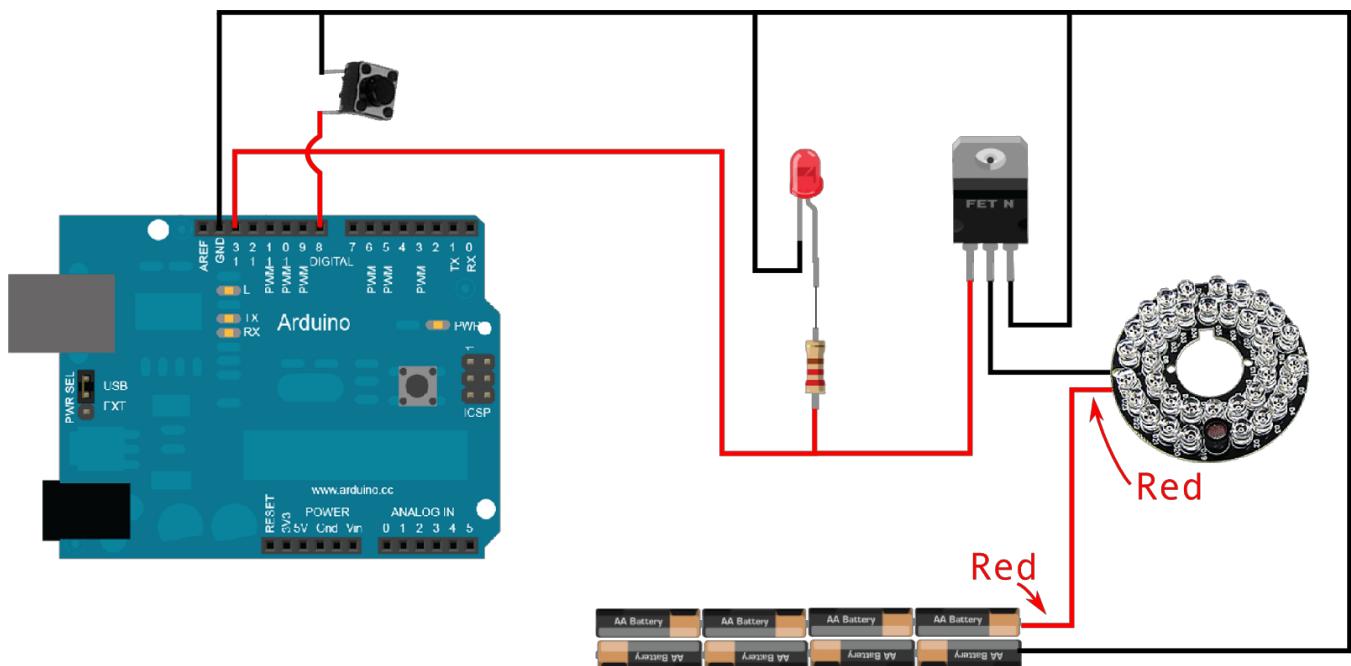
1. Now we're going to control the helicopters via code!
2. Open the helicopter code file: **helicopter_2_channel.ino**
3. Ask your instructor to set the `byte channel` in the code.
4. Open code, switch to the correct channel in the code, compile, and upload.
5. Open **Tools > Serial Monitor**
6. Turn 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. **U** and **J** control throttle. **U** is higher throttle, **J** is lower throttle.
 - 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"

Adding a Button

- Charge your helicopter while you modify the circuit

Steps:

1. Modify your circuit to include a button. This is the “go into autonomous mode button.”
2. Make sure your button connects to #8 on the Arduino.
3. When the code is running, check that when you hit the button, the **Serial Monitor** says “You hit the button.”



Advanced Flight Control

- Always have the helicopter charging between attempts

Steps:

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

