

Step-by-Step Instructions for Building and Programming an Arduino-Controlled Robot

Scientist in Residence Grant Project

Supplies Needed Per Robot:

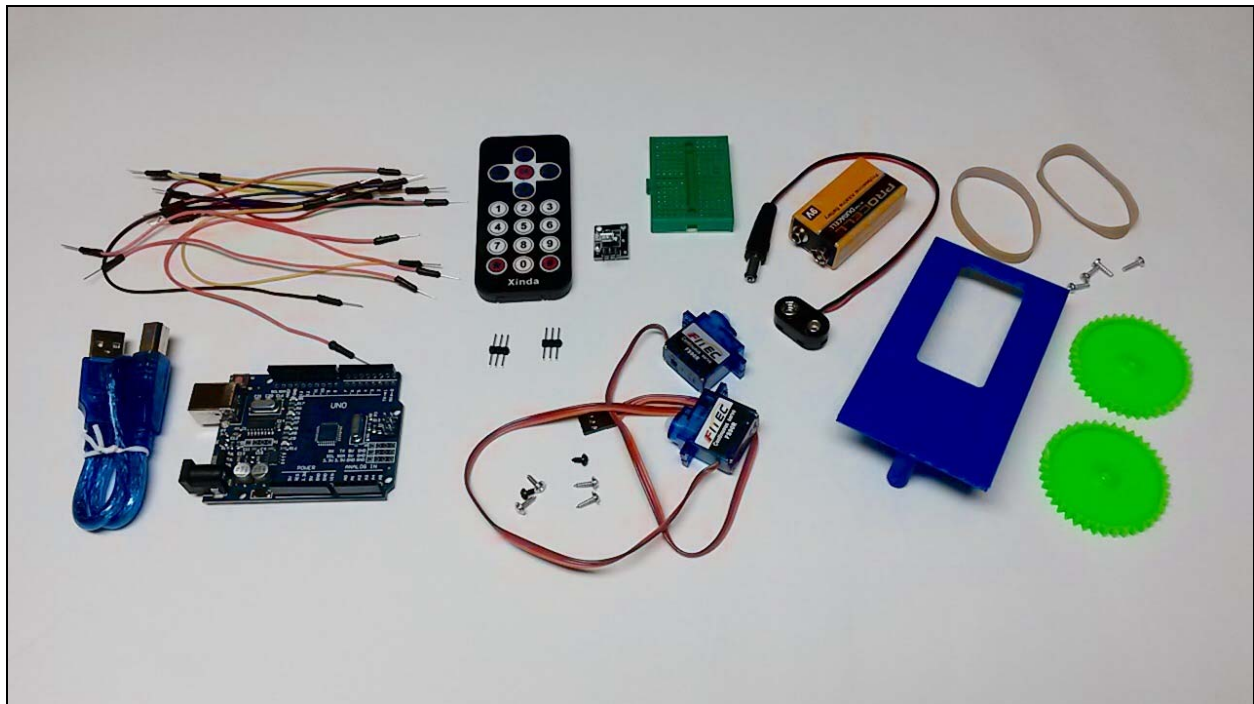
- 1 - Arduino Uno microcontroller board
- 1 - USB Cable to connect Arduino to computer
- 1 - Mini breadboard
- 1 - Remote control with infrared receiver
- 2 - Continuous Rotation Servo Motors
- 9 - Conductors (jumper wires)
- 1 - 9V battery
- 1 - 9V battery clip
- 1 - 3D printed chassis
- 2 - 3D printed wheels
- 4 - 5/16" screws to attach Arduino to chassis
- 2 - Screws to attach wheels to servo motors (one screw is included with each servo motor package)
- 2 - 3 Pin Extended Length Headers (same length on each side)
- 2 - ¼" rubber bands to provide traction for your wheels (optional)

You will also need:

Small Phillips head screwdriver


Scissors to open component bags

Computer with Arduino Genuino IDE software (Windows needs CH340 Win driver installed)



Before assembling your robot, confirm that your Arduino is working correctly. Open Arduino IDE software. Under the *Tools* menu, select *Board* and choose *Arduino/Genuino Uno*. Connect your Arduino to the computer using the USB cable. The software will assign a communications port (COM port). Access the *Tools* toolbar, then *Port*. Select the Com Port for your Arduino.

Blink

Access the *File* menu → *Examples* → *01.Basics* → *Blink*. Click the  in the upper-left corner. This will verify the code is correct. When you click the check mark, the software will compile the code. When finished, text on the bottom of the screen will show “done compiling.” Once you have verified the code is correct, you can upload the code to the Arduino by clicking the right-pointing arrow button. Text on the bottom of the screen will read “Done uploading” when the upload is complete. You should now notice a green LED light blinking on your Arduino. You can change the speed of the light by changing the code (and uploading it to the Arduino). Look at the portion of code under “void loop.” Delay is currently set to 1000. Change it to 100, then re-upload the code to the Arduino to see the change. (When you upload the software will verify the code before it uploads.)

Note: Make sure your Arduino is not touching anything metal. You could damage the USB port on your computer. Put your Arduino on top of the anti-static bag it came in, or on a wood or plastic table.

Robot Assembly (The wiring diagram is shown on page 3)

- 1- Attach the Arduino to the chassis by lining up the screw holes. You will need 4 – 5/16” screws. Be careful not to overtighten the screws!
- 2- Attach the breadboard, peel and stick.
- 3- Attach the servos using the screws included in the servo package. (There are three screws in the bag, the small screw attached the wheel to the servo.) Turn the bot over. The output shaft (white gear sticking out the side) goes closer to the middle of the chassis. Two silver screws came with each servo. Use them to attach each servo. One servo will be label up, the other will be label down. They will be mirror images.
- 4- Screw on the wheels using the smaller screw that came with each servo. **The 2nd generation wheels (see photo, right) require you to insert the white, round plastic part into the wheel first. It should snap into place. Then attach the wheel to the servo and screw into place.**
- 5- We now want to connect the servos to the Arduino. The servo conductor and the breadboard are “female” only, so we need to use pins that came with the Arduino to convert the “female” end of each servo so there are “male” ends. In other words, we need to turn sockets into plugs. We need 3 pins for each servo.
- 6- Open the remote control bag and find the receiver (looks like a tiny circuit board with 3 pins sticking out). Plug it into the breadboard in the middle rear so that it is facing out (to the rear). Bend down the receiver to it is at a 45 degree angle, but not touching the pins (the breadboard).



Servos = Output

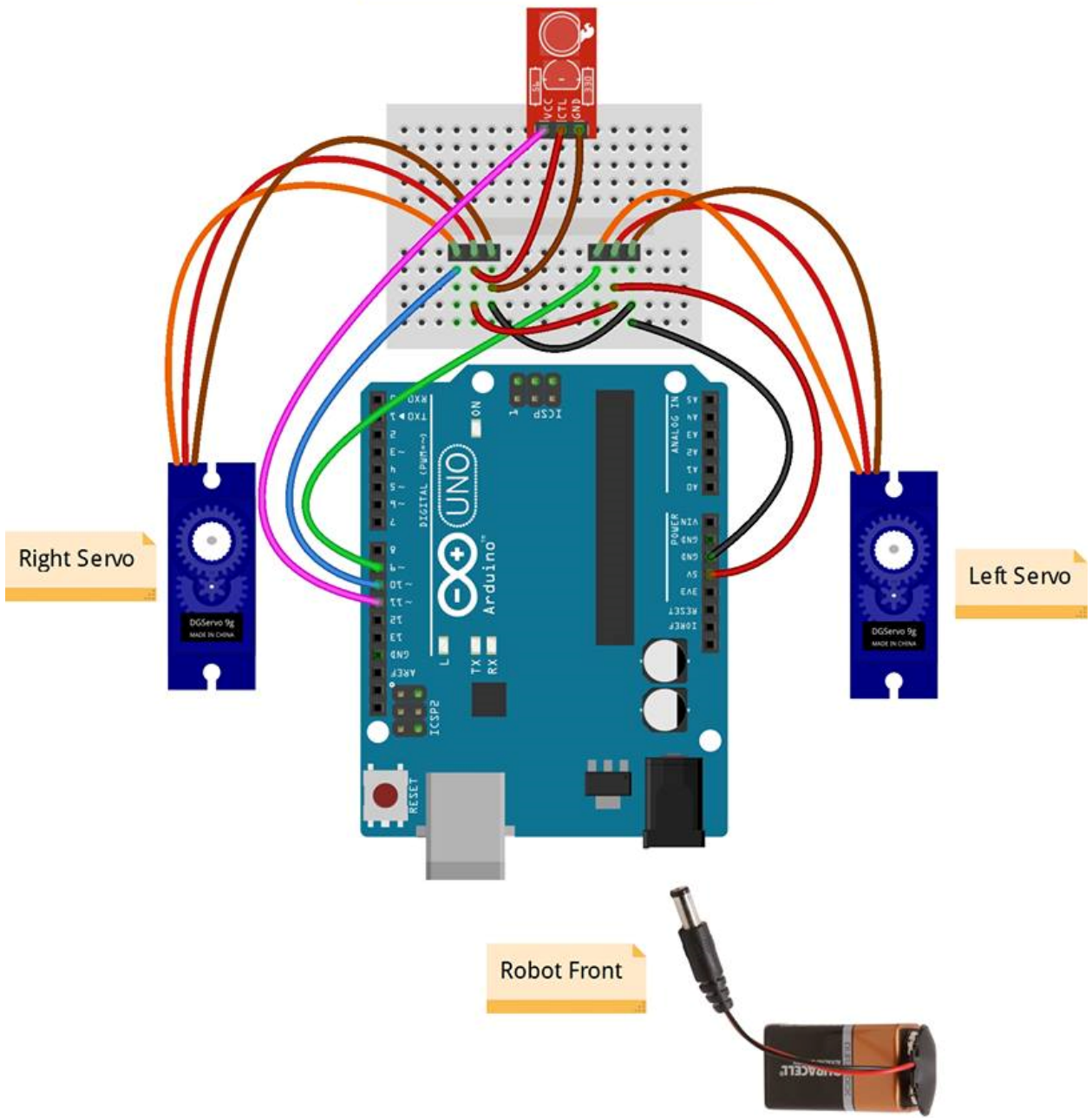
Servos do what the Arduino tells them to do.

Receiver = Input

Input is received when you press a button on the remote and that input is communicated as output through the Arduino to the servos.

- 7- Take a conductor (jumper wire) and plug it into the negative (brown) servo wire. Take the other end of the conductor (wire) and plug it into the brown slot on the other servo. Do the same with the red wires on the servos. **DO NOT CONNECT ORANGE TOGETHER.**
- 8- Connect ground on the servo (brown) to ground (GND) on the Arduino.
- 9- Red wires on the servos need to be connected to 5V on Arduino.
- 10- Servos: The orange conductor (wire) for the left servo plugs into PIN 9 on the Arduino. PIN 9 was selected in the code to “talk” to the left servo. The right servo plus into PIN 10.
- 11- Infrared Receiver: Connect negative (-) to common ground (GND) on the Arduino. Connect positive (middle) to 5V on the Arduino. Connect the signal wire (s) to PIN 11.

Infrared (Remote Control) Receiver



Right Servo

Left Servo

Robot Front

fritzing

Upload the Code

Now it's time to upload the code to your robot to make sure it works. The code for this project will be provided during the class.

NOTE: If you connect the Arduino to your computer (via USB) and the embedded LED does not light up, unplug it immediately! There is a short.

Remote Control

Remove the plastic tab from the remote battery so the battery will make connection. Hold the robot by the USB connector because the wheels might spin. You might need to lower or increase the servo center position in the code if your wheels are spinning.

```
int leftservocenterposition=94  
int rightservocenterposition=87
```

If the wheels are spinning, lower the center position a little at a time until it stops, then upload the adjusted code. This is called "finding a neutral position" for your servo.

Installing the 9V Battery

First attach the battery clip. The wire should be facing up.

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