CONSTRUCTION INSTRUCTIONS: LED PLANT SHELF

Materials

- 1 PVC pipe section, unmodified
- 2 PVC pipe sections with front cut into a U shape
- 6 warm white LEDs (8mm diameter)
- 6 220 ohm resistors
- 1 IR range sensor
- 1 Arduino Uno
- 1 9V battery
- 1 battery cover/port
- Dense paperboard
- Wire in yellow, white, black, and red

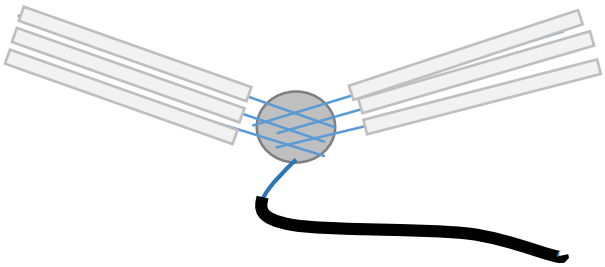
Equipment

- Hand drill
- Clamp
- Wire cutters
- Wire strippers
- Hot glue gun
- X-acto knife
- Dry erase marker
- Large flat file
- Triangular needle file
- Soldering iron (with solder)
- Hacksaw
- Deburring tool
- Scrap wire (optional/maybe helpful to apply hot glue)
- Electrical tape (optional/makes things tidier)

Steps

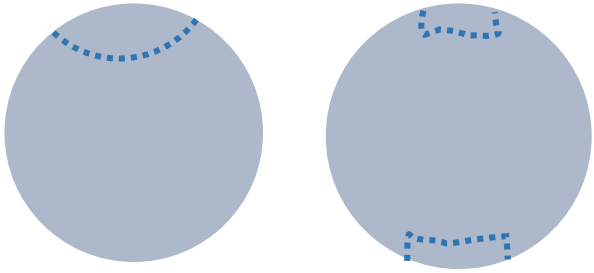
- **Such solder much solder**
    - Cut wire:
        - 6 pieces of yellow wire and 6 pieces of white, each about 9.5” long.
        - 8 pieces of black wire about 3” long.
        - 1 piece of yellow wire and 1 piece of red wire, each about 3” long.
        - Strip the last ¼-inch or so of all wires.
    - Solder a yellow wire to the positive (longer) terminal of each LED and a white wire to the negative terminal.
    - Solder a 220 ohm resistor to the end of each yellow wire.
    - Solder a black wire piece to the other end of each resistor. You’ll have 2 black wires left over.

- Construct the solder spider:
  - The point of the spider is to connect all of the white ground wires together so they can use just one wire to connect to the Arduino.
  - Solder the white wires together, with three pointing left and three pointing right.
  - Solder the remaining black wire to the huge solder blob in the middle.
  - Diagram:



  - Solder the small red wire to the red wire on the IR sensor, yellow to yellow, and black to black.

- **Prepare the plant pots**
  - Make dry-erase marker marks on the pots where you will want to cut/drill:
    - 2 drill marks in the middle of the back of the unmodified PVC pipe (for wires).
    - 1 slot in the bottom center of the front of the unmodified PVC pipe (for IR sensor).
    - 3 drill marks in each U-shaped PVC pipe: one on each side, then one offset near the middle. The mark in the middle should be offset to the outside; see picture/video to make this make sense. (for LEDs)
  - Drill 5/16” holes on each of the 3 marks in each u-shaped PVC pipe. It may be useful to drill a 3/16” pilot hole.
  - Drill 7/16” or larger holes in the back of the unmodified pipe. You may need several pilot holes.
  - Clean up edges of holes with deburring tool.
  - Use needle file to make two notches in each of the 7/16” holes.
  - Use hacksaw to cut sides of slot and chip away at center of slot.
  - Finish slot using file(s).
  - Prepare top/base:
    - Draw two circles with the circumference of the INNER circumference of the PVC pipe on the paperboard.
    - Cut circles out using x-acto knife.
    - Cut notches in paperboard circles for finger handle, IR sensor, and wall mounting screw.



    - Use a few dots of hot glue on the bottom inside of the unmodified PVC pipe to attach the bottom paperboard circle (with the square holes). Scrap wire can be used as a hot glue applicator.
    - Use a lot of hot glue on the sides of the PVC pipes to attach the three sections together.
- **Arduino time**
    - Load FadeThreeLEDs code onto the Arduino.
    - Once it's disconnected from computer, plug the round end of the battery cap into the power supply port on the Arduino.
- **Finish this shelf**
    - Place LEDs:
        - Put the spider in the center pipe and send the LEDs through the large holes to the back of the shelf.
        - Wedge one LED into each circular hole on the side PVC pipe pots.
        - Use a dot or two of hot glue on the back of each LED to hold it in place.
    - Place IR sensor:
        - Place IR sensor, looking out, in the slot in the center pipe pot.
        - Hot glue sensor carefully in place.
    - Finish wiring:
        - Connect spider-ground wire to digital ground pin.
        - Connect yellow LED wires to digital pins 9, 10, 11, 3, 5, and 6.
        - Connect yellow IR sensor wire to analog pin A1.
        - Connect red IR sensor wire to 5v pin.
        - Connect black IR sensor wire to analog ground pin.
        - Tidy up all wires and tape as necessary.
    - Plug 9v battery into battery cap and test system.
    - Congratulations, you're done!