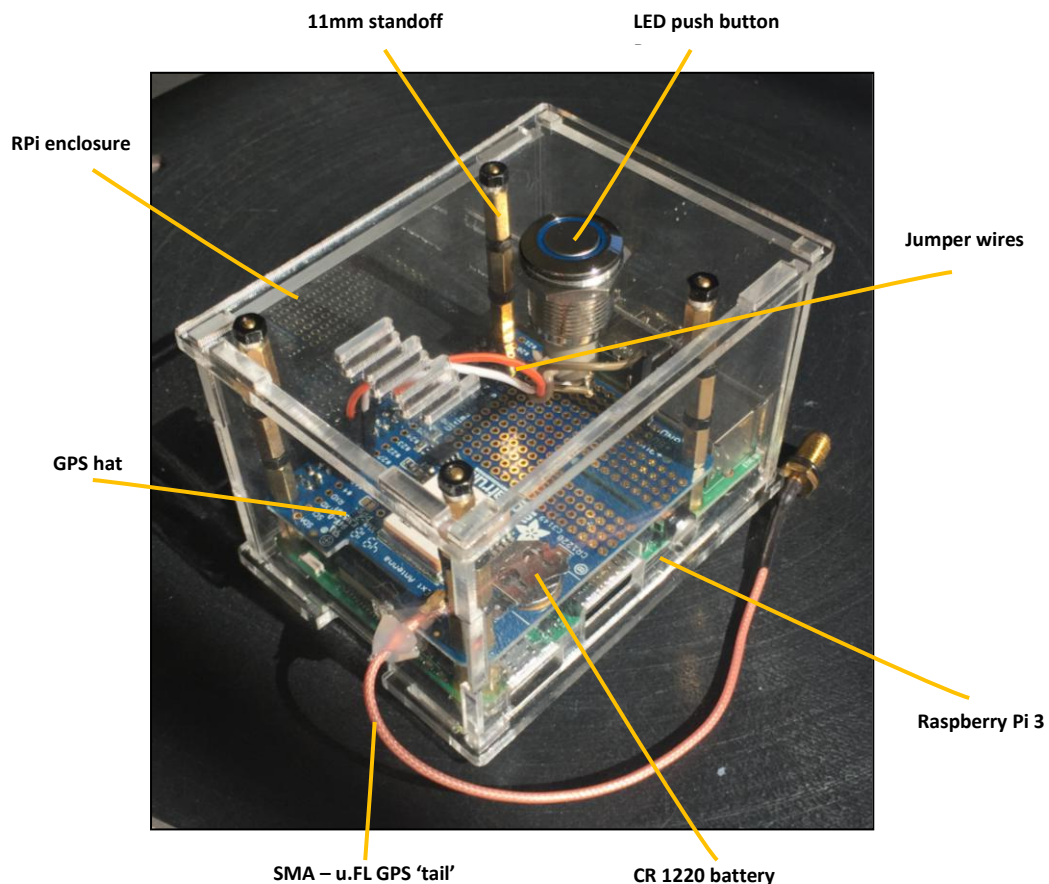## Raspberry Pi 3 for Sensorgnome

Parts:

- Raspberry Pi 3 Model B (1)
- RPi Enclosure – Modified Extra-tall (1)
- M2.5 x 12mm mini machine screws (4)
- M2.5 washers (4)
- 14mm x 14mm x 8mm heat sink (1)
- 11mm brass standoffs (16) and nut (16)
- Adafruit Ultimate GPS hat for RPi (1) with 2x20 header (1) and SMA – u.FL connector (1)
- Female/Female jumper wires 6" (3)
- 0.1" breakaway header extenders (4)
- LED Pushbutton (1) with 0-ring (1) and nut (1)
- 7/32" I.D., 11/32" O.D., 1/16" Cross section O-ring (1)
- Small plastic zip tie (1)
- CR 1220 battery (1)

Tools & Equipment

- Small flathead screwdriver
- Small pliers or hemostats
- Soldering iron (ideally with pointed tip)
- 60/40 rosin activated solder wire
- Plastic solder scraper (for cleaning around soldered connections)
- Electrical wire stripper
- Hot glue gun with hot glue
- Knife or razor blade

Raspberry Pi 3 for Sensorgnome – Enclosure Base

The RPi computer, GPS cap, and wifi button are all enclosed to protect components and wiring.

1) Using four (4) M2.5 x 12mm bolts and four (4) washers, stack the enclosure base, U-shaped spacer, and RPi computer. Secure with four (4) 11mm standoffs (figs 1-5).

2) The black cube in the center of the circuit board is the heat sink and should be attached before soldering the GPS cap. These come with a sticky back, so remove the plastic cover and place on square processor in center of RPi (figs 4-6).

Soldering is necessary to attach the GPS cap and Wifi button to the RPi computer, and is done while assembling and enclosing the Sensorgnome's (SG) computer component.

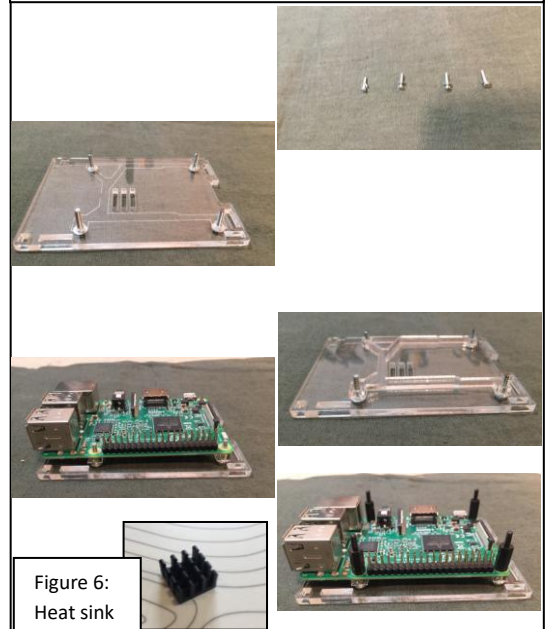Figures 1 – 5: Attaching RPi computer to enclosure base

Figure 6: Heat sink

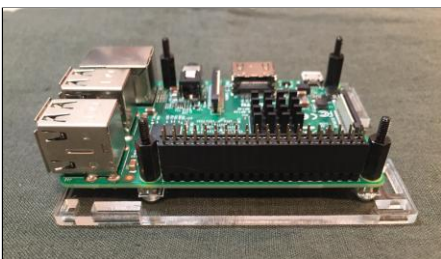3) Place 40-pin header that comes with the GPS cap on RPi pins (Figure 8).

Figure 8: Press the 40-pin header straight down onto the set of pins on the RPi.

4) Place GPS cap on header pin and standoffs with the letters and circular connections facing upwards (Figure 9). At this point, it's a good idea to hand tighten the next set of 4 standoffs to make sure that the GPS cap is snug to the RPi before soldering the 40 pins.
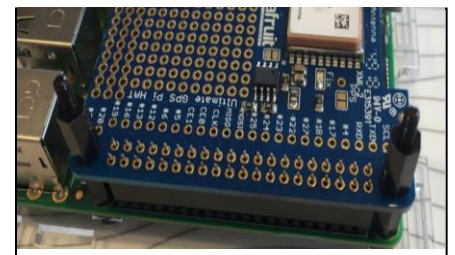
Figure 9: Secure the GPS hat in place with a set of standoffs before soldering.

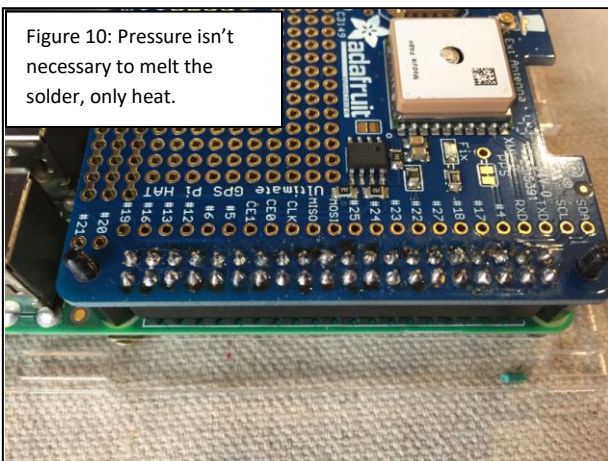Figure 10: Pressure isn't necessary to melt the solder, only heat.

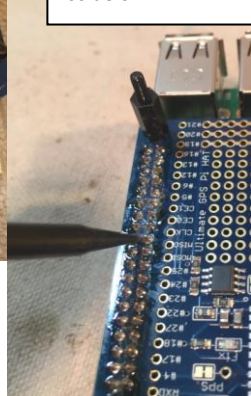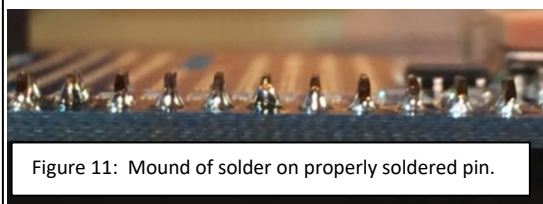Figure 12: Use the plastic scraper to clean around solders.

Figure 11: Mound of solder on properly soldered pin.

5) Solder all 40 pins attaching the GPS cap to the RPi (Figure 10). Using the pointed tip of a hot soldering iron, touch the pin AND the round connection simultaneously to head up both elements. While still applying heat, touch the solder to the connection and melt a small amount of solder to fuse the pin and the board. Remove the solder and iron and check that you made a good connection: melt enough solder to cover the copper circle and create a small mound surrounding the pin (Figure 11).

6) Check all your solders to make sure that no two adjacent connections are touching. Most soldering kits come with a plastic scraper that can be run between pins (Figure 12).

Wifi Button

7) If using a Wifi button, separate your GPS hat and soldered 40 pin connector from the RPi computer. Remove any standoffs holding the GPS in place and pull the GPS and connector straight off the pins of the RPi (Figure 13).
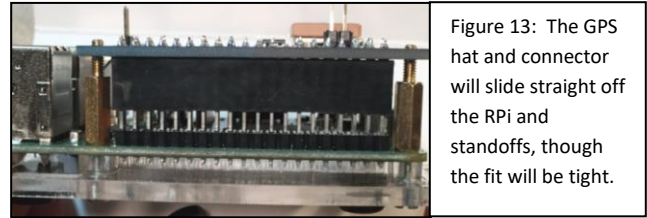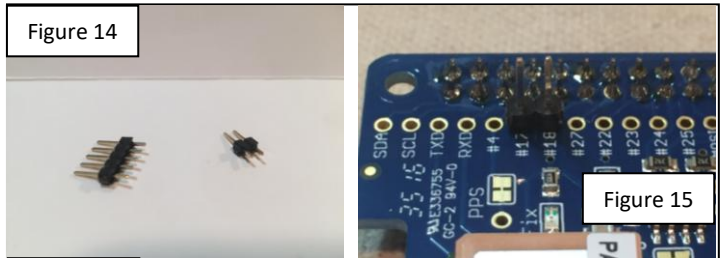

Figure 13: The GPS hat and connector will slide straight off the RPi and standoffs, though the fit will be tight.

8) Break off 2 pin extenders and insert their short ends into ports #17 and #18 on the GPS board (Figures 14 & 15).

9) These need to be soldered from the underside of the board, so flip the GPS board over and prop it up on the unsoldered pins, being sure that the pins are passing through ports #17 and # 18 (Figure 16). Solder the two pins and clean if necessary.
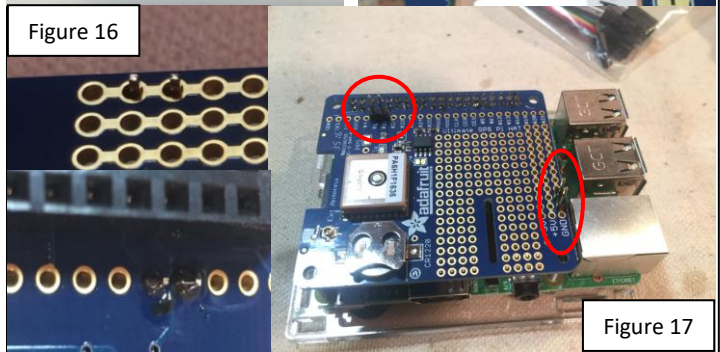
10) Break off two more pin extenders and solder to two adjacent ports labeled GND, using the same procedure as above. Reattach GPS to RPi computer. (Figure 17).

Figure 14

Figure 15

Figure 16

Figure 17

11) Remove three jumper wires from strip for for red (+), yellow (data), and black (-/ground), shorten to approximately 3", and strip a few millimeters of casing from each end to expose the wire (Figure 18 & 19). Strip an extra few millimeters from one end of the black wire, which will need to be soldered to more than one pin on the wifi button.
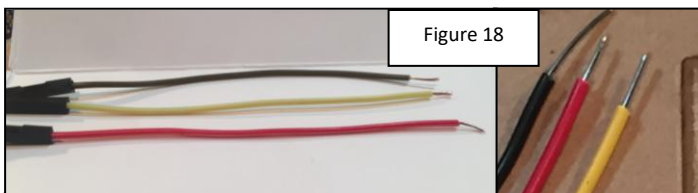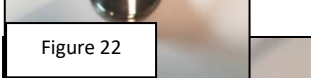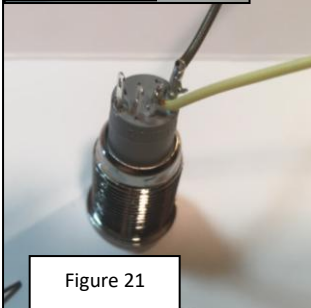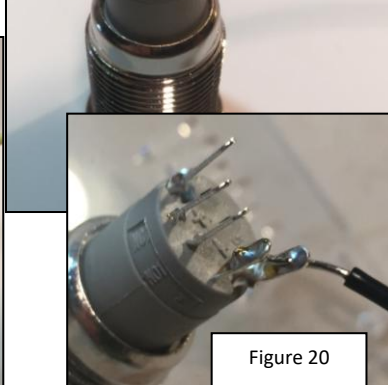

Figure 18

Figure 19

Figure 22

Figure 21

Figure 20

12) Solder the black (-/ground) wire to two (2) of the pins on the wifi button: the negative (-) pin AND the adjacent pin. The yellow wire is soldered to only the center pin, and the red wire is soldered to ONLY the positive (+) pin. Position and solder one wire at a time, making sure that none of your solders are touching adjacent pins.

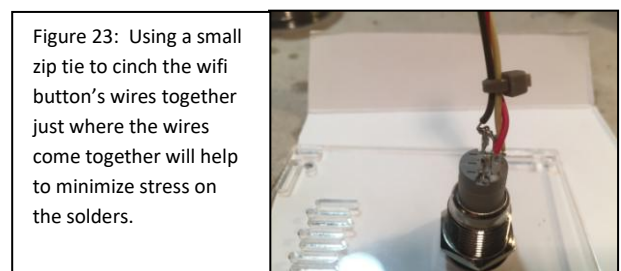13) Once all three wires are soldered, use a small zip tie to bind the wires together (Figure 23).

Figure 23: Using a small zip tie to cinch the wifi button's wires together just where the wires come together will help to minimize stress on the solders.

14) Fit your wifi button into the lid of your enclosure by first slipping on the o-ring that came with your wifi button (Figure 24), then, putting the button and wires through the hole in the enclosure lid and tightening in place with a nut (Figure 25).
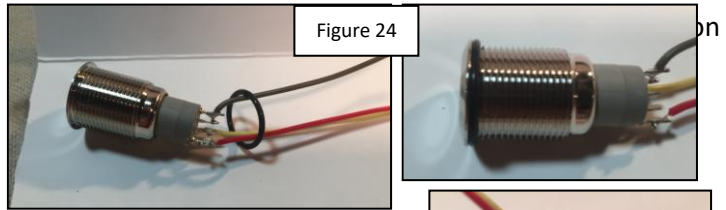
15) Connect jumper cables to pins on GPS board. Connect red (+) to port #17, yellow (data) to port #18, and black (-/GND) to one of the two GND ports (Figure 26).
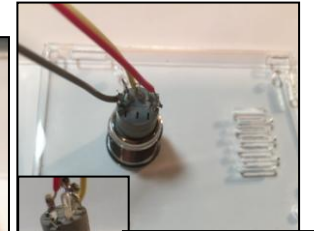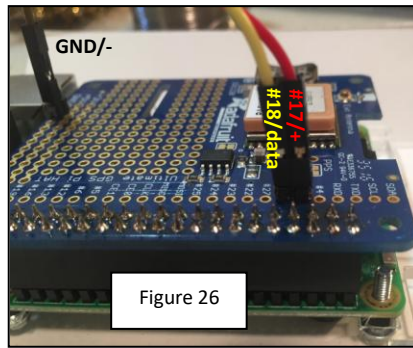

Figure 24

GND/-

#17/+
#18/data

Figure 26

Figure 25: Orient the wifi button to face the vents on the enclosure top.

16) Finish assembling your RPi enclosure by adding spacers and nuts, tightening each with pliers as you go. Each corner will require three 11mm spacers and two nuts (Figure 27). Before inserting enclosure sides, slide the GPS connector "tail" through the hole on the front piece of the enclosure and press to connect to u.FL connector on GPS board (Figures 28 & 29). Remove the nut and washer at the end of the GPS tail and replace with a 7/32" I.D., 11/32 O.D. o-ring (Figure 30).

17) Insert the 4 enclosure sides into the notches on the base and fit the top on the standoffs, guiding the wires into the enclosure. Secure with a final set of nuts.
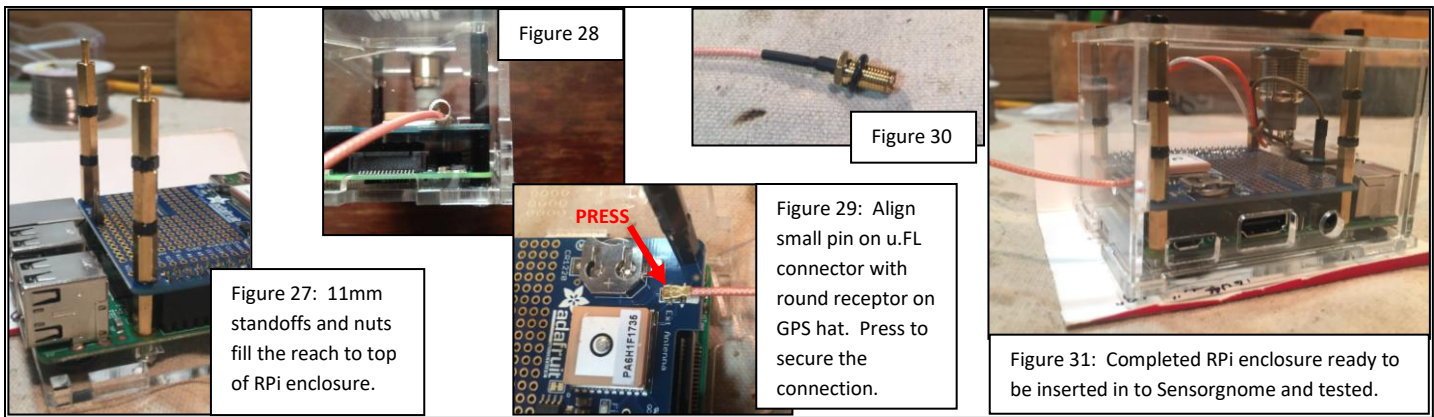

Figure 28

Figure 30

PRESS

Figure 27: 11mm standoffs and nuts fill the reach to top of RPi enclosure.

Figure 29: Align small pin on u.FL connector with round receptor on GPS hat. Press to secure the connection.

Figure 31: Completed RPi enclosure ready to be inserted in to Sensorgnome and tested.

18) Add a drop of hot glue to secure the GPS tail where it exits the enclosure.

Figure 32: Fully surround the GPS tail with hot glue to secure it to RPi enclosure.