Queen's University
Department of Electrical & Computer Engineering

ELEC299 Q2WD Robot Project

More Bot Assembly

Assembling the Pan/Tilt/Gripper Assembly

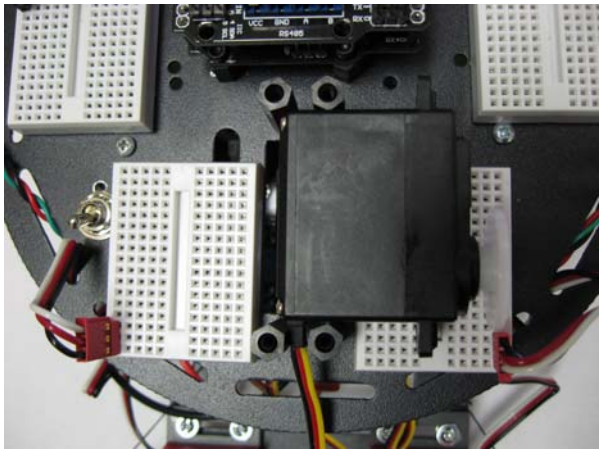
The three servo motors of the pan/tilt/gripper assembly will each be powered and controlled from the DFRobot I/O board – it provides 3-pin groupings at each pin position of (D, VCC, GND) where D=servo control signal from Arduino pin, VCC = servo +6V power from servo_PWR terminal block, GND = ground. You will plug the 3-wire servo cable (YELLOW, RED, BLACK) onto the 3-pin group at the chosen Arduino pin number as described below.

1) BASE SERVO:

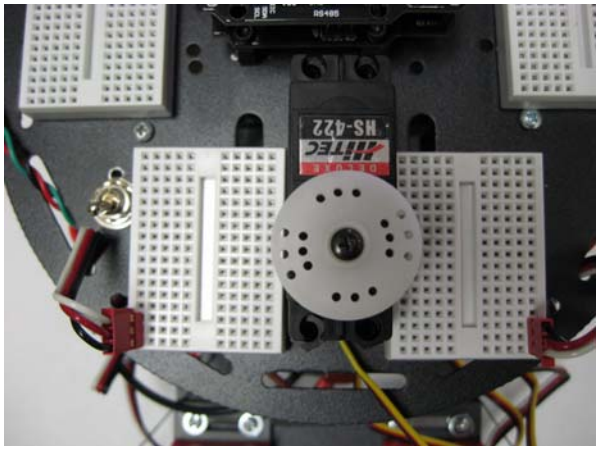
The "base" or "pan" servo forms the "shoulder" joint of the gripper assembly. To install the base servo on the four black nylon standoffs which you had earlier attached to the robot top plate:

a) Remove the servo from its package and return the bag of mounting hardware that came with it (we use our own hardware).

b) The servo must be installed carefully in order to avoid pulling too much on its 3-wire cable. Flip the servo onto its side with its 3-wire cable positioned at the front of the Bot, then slide it down between the vertical standoff posts (STEP 1), rotating it back upright to get it all the way down (STEP2-- you may need to "help" the servo cable down to the bottom with the tip of a pen if the fit is too tight.



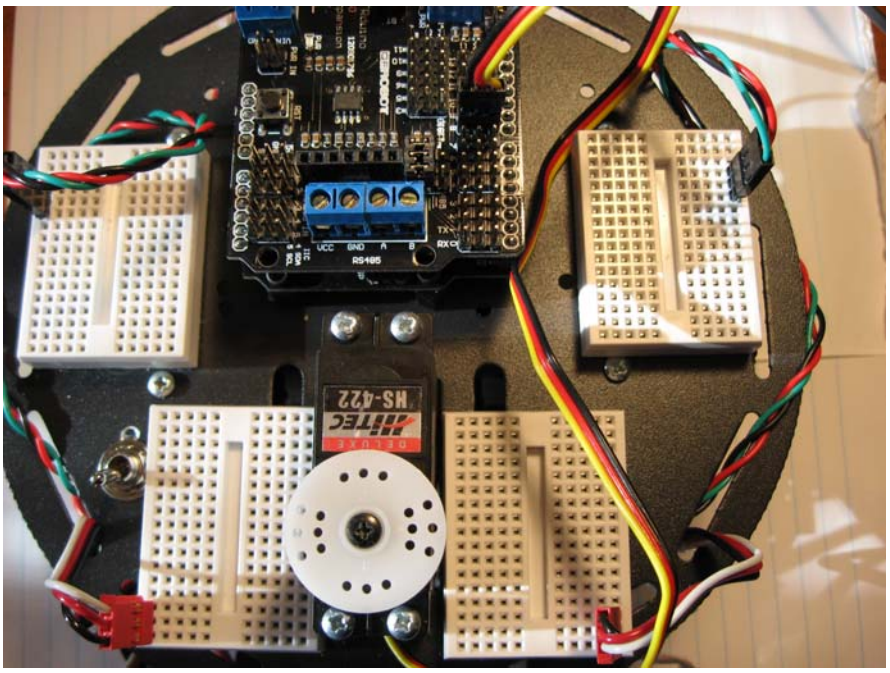
STEP1



STEP2

c) Screw in four #4-40-by-1/4-inch machine screws and snug up to clamp the servo onto the standoffs.

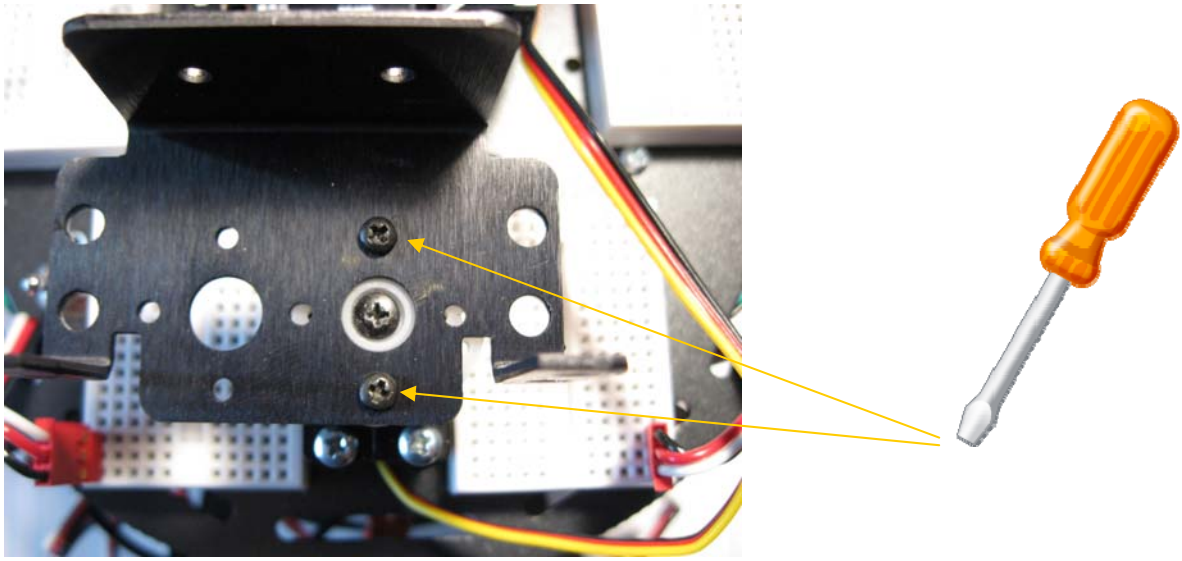
d) Plug the other end of the servo cable onto the 3 pins at the "pin-8" position on the DFRobot I/O board – MAKE SURE THE YELLOW WIRE IS ON THE OUTSIDE PIN OF THE TRIO – **see photo below**.



2) PAN AND TILT ASSEMBLY:

a) First, **rotate the servo "horn" (the white nylon disk) fully clockwise as shown in thephoto above** (each servo of the assembly can be commanded to rotate between positions 0 degrees and 180 degrees – fully clockwise corresponds to the 180-degree position.

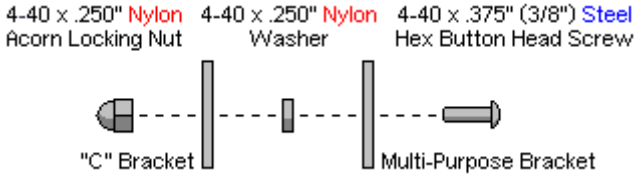
b) Attach the multi-purpose bracket to the pan servo's horn using ***TWO*** of the small #2-by-1/4 inch self-tapping screws provided in the **middle plastic sleeve of the kit's bag** – they take some downward pressure to install so before you screw them in ***GRIP THE TOP PLATE WITH YOUR FINGERS UNDER THE SERVO TO AVOID PUTTING DOWNWARD PRESSURE ON THE BOT'S WHEELS.***



Use hand support under the top plate while screwing these in !!

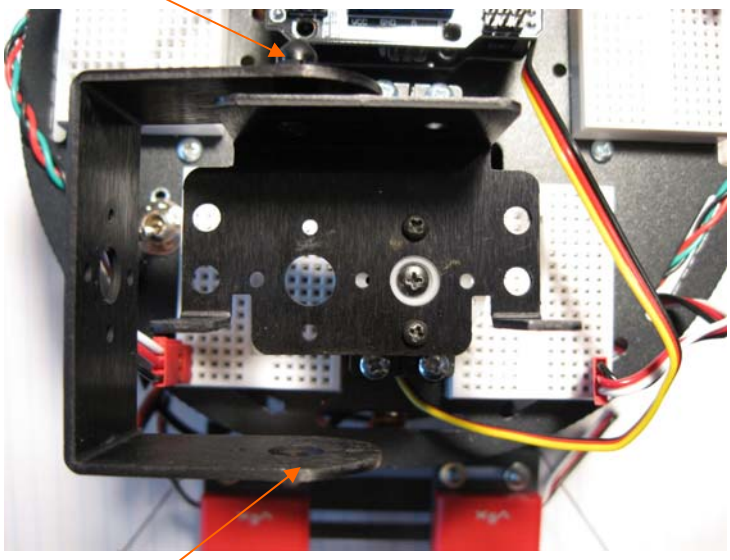
c) The "C" servo bracket will be attached using the hardware in the **top plastic sleeve of the kit's bag** (one "button head" screw with a small hex-shaped socket in it, one washer, one acorn-head nut as shown in bullet item d) next. The screw is a tight fit in the acorn locking nut, so it may help to screw it in once first before using it to attach the bracket as shown below.

d) Push the button head screw through the multi-purpose bracket, and add a nylon washer (see assembly cross-section below).



Put the "C" acket on the screw, and secure it with the nylon acorn nut. **Tighten with the small Allen-key wrench provided in the kit, and your own needle nose pliers, but only just enough so it still rotates freely and the wobble is gone.**

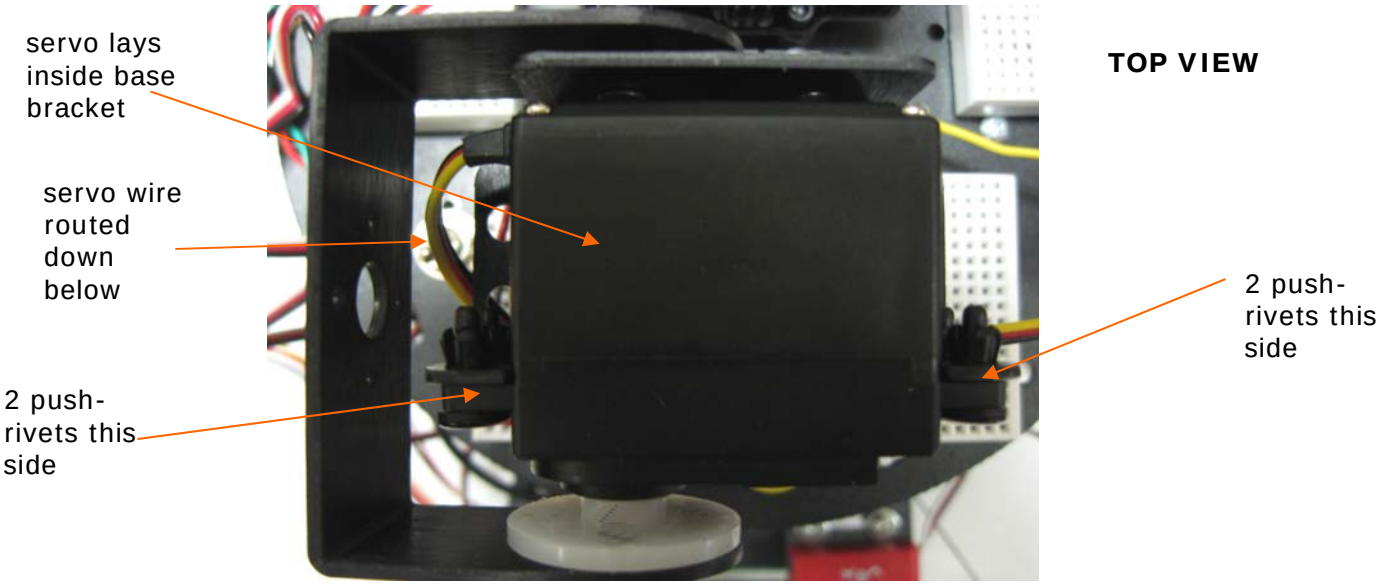
this end has the single small hole, and is fastened to the base bracket with the screw. washer, and acorn nut



this end has the larger hole encircled by 4 smaller holes, and is free-hanging

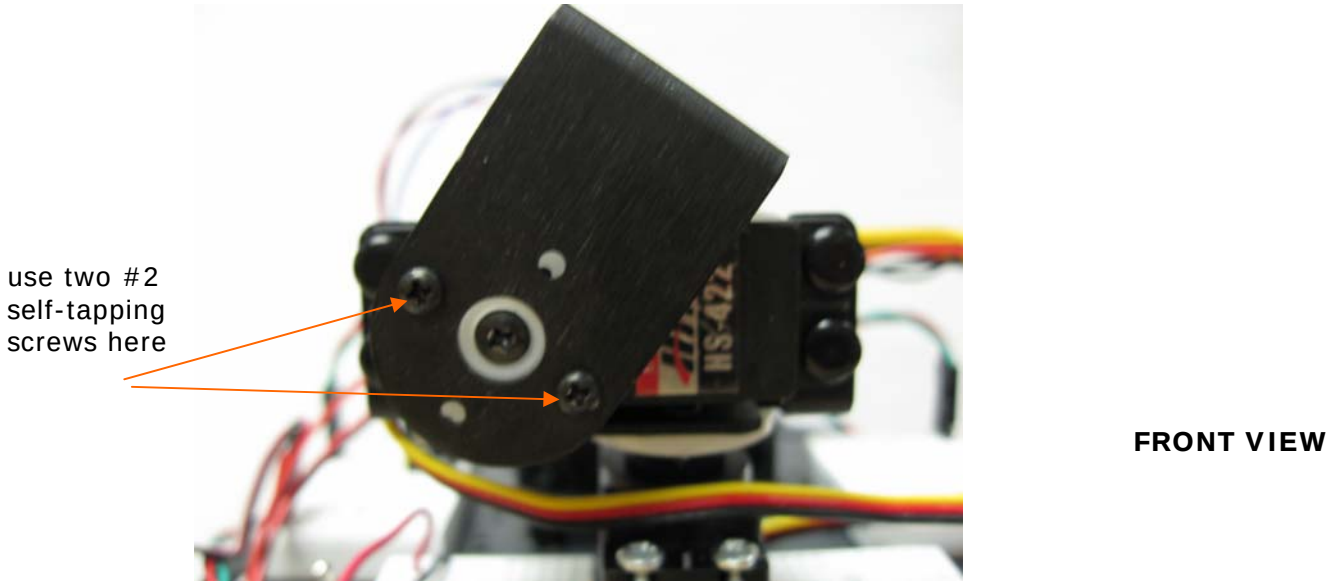
e) Open a second servo ***and rotate its horn fully clockwise before installing.*** Lay the second servo into the multi-purpose bracket as shown below, and fasten using four push-in rivet-like plastic fasteners:

.172" x (.187"-.250")
Nylon Rivet Fastener



TOP VIEW

f) Rotate the C-bracket up as shown below. Use two more of the small #2-by-1/4-inch self-tapping screws to fasten the free-hanging end of the C-bracket to the servo horn. You should be in last one of the holes in a group of 3 adjacent holes on the servo horn, giving maximum upward tilt (**this will be the maximum vertical tilt position, corresponding to 180 degree servo position**).



FRONT VIEW

g) Run the servo cable to the I/O board and plug in at the 3-pin group at Arduino pin position " 9".

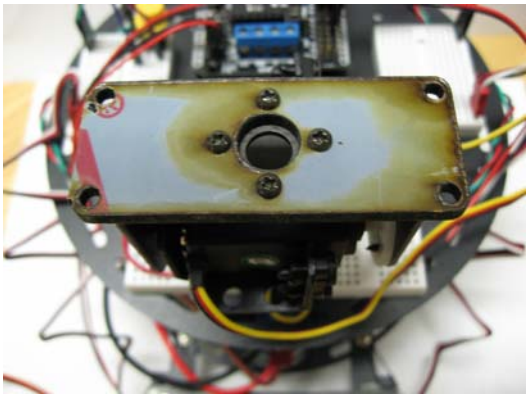
3) GRIPPER ASSEMBLY:

We first need to attach the "LGA-KT kit" plate to the C bracket (that was just installed), and then attach the little gripper to that LGA-KT plate. Open the LGA-KT kit and remove the rectangular Lexan plate. Use the tip of your screwdriver to push the plastic plugs that are remaining in the four interior and four exterior holes. Remove the thin plastic covering if it has started to peel off, otherwise just leave it on.

a) First, rotate the servo assembly so that C bracket is now at the front the Bot, and tilt it 90 degrees up until the holes of the C backet are in a level plane.

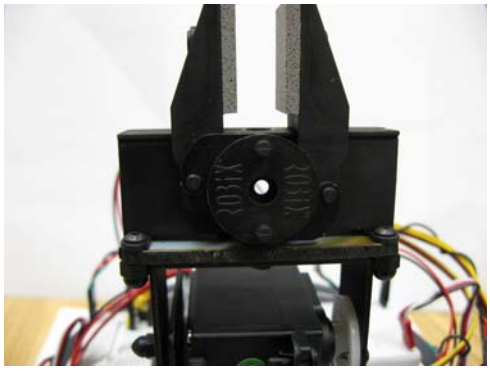
b) Lay the Lexan plate flat on top of the C bracket, line up the four interior holes, and insert the four #2-56 machine screws provided in the kit.

c) Place your Phillips screwdriver on one of the screws just inserted (to hold it in place) then bring up from below one of the #2-56 nuts (provided in the kit) on the pad of your finger, and thread it onto the screw and tighten (**press the nut down into your finger pad first so it stays in place while you are moving it**). Repeat for the other three screws.



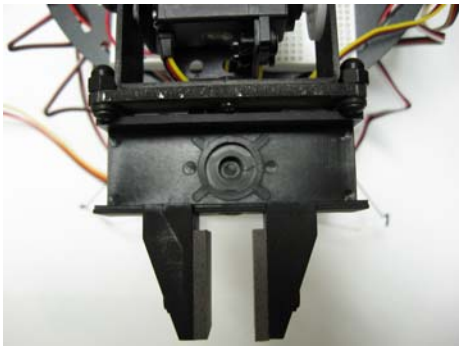
d) Open the Little-Grip kit and remove the gripper (**take off and save the small elastic band** – you'll need it later to install the force sensor to be handed out later). Stack the gripper vertically on top of the LGA-KT that you just installed so that its circular actuator is at the front of the Bot.

e) Align the holes and insert the four hex button-head machine screws in the corner holes and fasten using the four acorn nuts installed underneath. This is a bit tricky– it seems to be easiest if you tilt the C bracket at an appropriate angle and pinch the flat of the acorn nut tight against the side of the C-bracket ***with the screws backed almost fully out***, then use the long arm of your Allen key like a screwdriver to thread the hex button-head screws into the acorn nut.



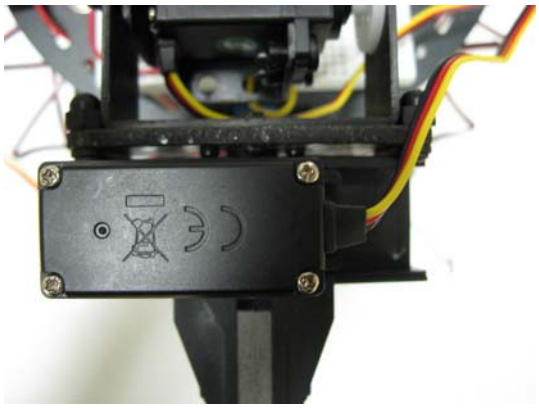
FRONT VIEW with gripper tilted up

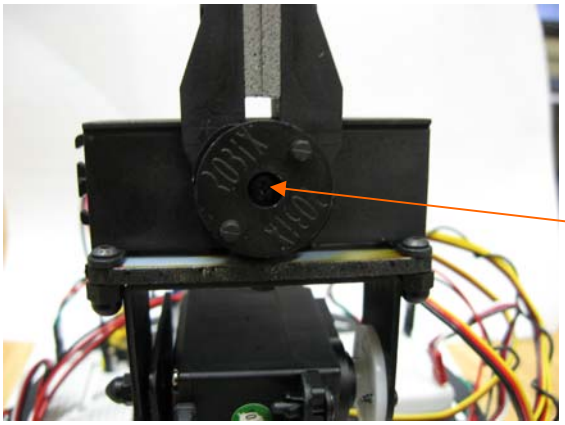
TOP VIEW with gripper tilted level



f) Open a third servo ***and rotate its horn fully clockwise before installing –this 180 degree position will correspond to fully closed gripper jaws (if your gripper jaws are not already closed, pinch them closed BEFORE installing the servo)***

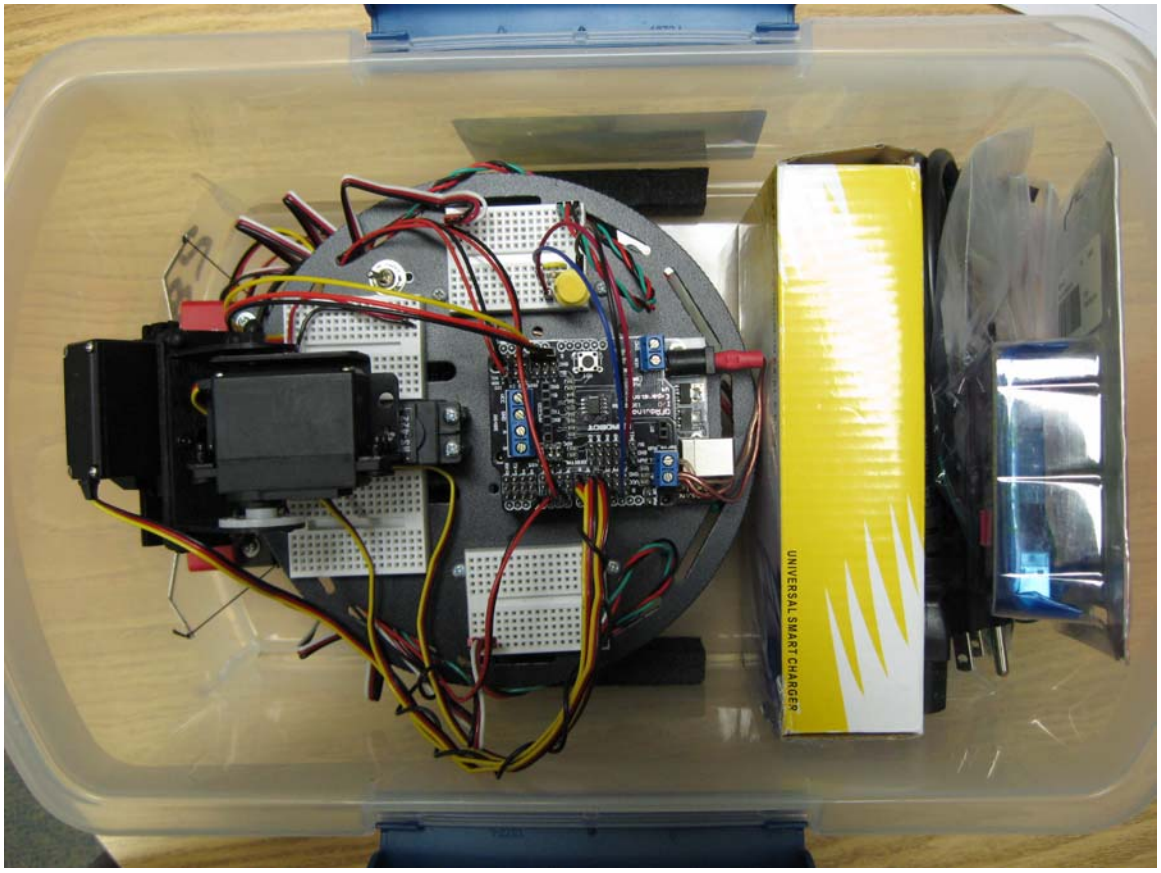
g) Unwrap the servo cable from the servo body, and unscrew the circular servo horn – **keep the screw handy**. With the gripper tilted level, insert the servo into the body of the gripper (as shown below), seating the splined output shaft of the servo fully into the mating socket in the gripper actuator. Tip the gripper back up to its maximum tilt and thread the servo screw back into the servo shaft (not too tight). Plug in to I/O board at "pin 10"





servo screw goes here (tighten , then back off a bit to prevent binding)

Stowed back in its kit box:



Tip the gripper assembly down to get the Bot back inside the kit box.