FaceWalker Part 1

By Michael Simpson

Important

Requires ZeusPro
V1.70 or later

Build the FaceWalker
Part 1, The Foundation
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For years I always wanted to attend the Robot Fest in Baltimore but something has always interfered with my plans to attend. This year I decided nothing would stand in my way. Gary Mauler, one of the organizers of the event set me up with a nice booth with lots of space in a very key location at the event. With Gary going to all the trouble I couldn't let him down. I had to bring something to knock the socks off all the attendees.

Several years ago I attended a modern art show and was impressed with a piece that had incorporated a CRT and a video loop of an animated human face. It was so eerie that I found myself constantly staring at the piece throughout the show.

My idea was to build a walker robot with a human face that could react to the spectators.

Before I get into the construction of the FaceWalker I want to tell you about the effect it had at the show.
From the time I walked into the show and set the FaceWalker on the table I had a packed crowd around my booth. The

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FaceWalker was so popular that I had individuals waiting 20 minuets while I charge batteries just so they could get a second look at the robot in action.

What made FaceWalker so unique was the fact that the main controller was a Pocket PC that had an animated human face with various expressions as well as sound that was timed to the mouth and eye movements. When I placed the FaceWalker in attack mode the face would show a rather nasty expression and growl.

FaceWalker Construction

There are three key components that make up the FaceWalker

- The base, which consists of the LynxMotion EH3-R and a SSC-32 servo controller and support components such as batteries and connectors and Pocket PC mount.
- A Controller and Controller Interface which consist of a wireless PS2 Controller and DiosPro Microcontroller.
- A 500Mhz IPAQ Pocket PC was used for the brain.

I want you to be able to build the FaceWalker or something similar so I am going to break each key component down into a separate article. This will allow me to provide enough detail for you to recreate that component for your own project. In this article I will concentrate on the base and its construction. Next month I will provide you with the instructions to build the controller interface, and the last article will provide you with details I used to build the brain.

We have a lot to cover and only a few pages to do it so let's dig in and get our hands dirty.

Base

No matter what kind of robot you build, you have to build a base that is strong enough to hold all the components and batteries. I calculated that I would need a base that would support almost 10 Lbs of total weight. For a walker this consideration is more critical than a track or wheel based robot since the legs have to support the weight and still be able to articulate.

While I was searching the web I found plenty of walker bases but none stood out like the LynxMotion EH3-R Hexapod base shown in Figure 2. The EH3-R is a special round version of their Hexapod. The round base gave me two distinct features that I wanted in this particular robot.

- I wanted to be able to move the robot in any direction independent to the direction it was facing.
- I wanted the robot to look like a spider.

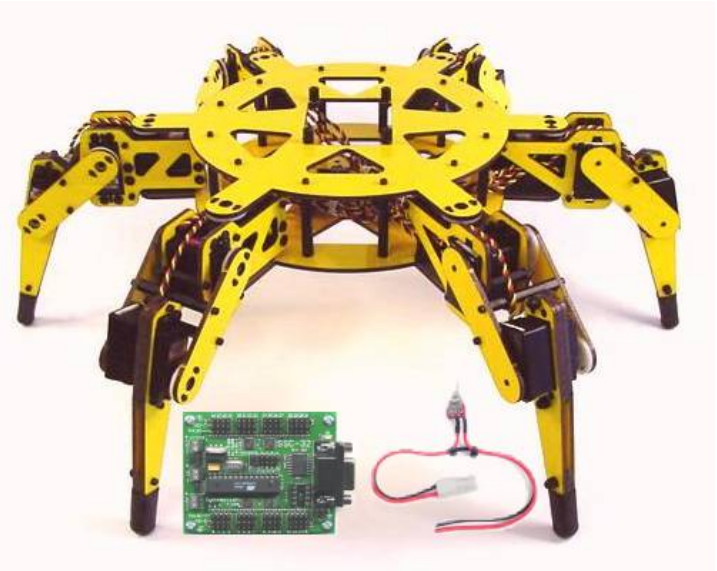

Figure 2

Originally I thought I could use standard servos to control the robot, but after talking to Jim Frye he assured me that standard servos just did not have the power to handle the kinds of force that I was going to place on them.

I decided to go with the EH3R and 18, HS645 servos. The HS645 servos are much more expensive but I wanted something that would hold up to the payload and speed I was going to put the robot through at the various shows and demos I would attend.

I only had two weeks until the show so while I waited for the EH3R to arrive I started sourcing other components I would

need for the base. I will list the source and location for all the items I used to create the FaceWalker base at the end of this article.

Figure 3 shows the additional components I needed: 7.2v Stick Battery, 6-Cell AA Battery Holder, 9v clip, 6 AA Batteries, SPDT switch, Velcro strip. Most of these items can be obtained at your local department store or nearest Radio Shack.

Figure 3

Figure 5

You will also need some additional hardware shown in Figure 4. The hardware is used to attach a platform on which we will install our Pocket PC mount. You will need 22 #4 machine screws, 20 #4 lock washers, and 6 hex nuts. You will also need some 1-1/2" standoffs but because they are hard to find, I used 11, #4 M-F .5" and 11 #4 F-F 1" long to create what I needed.

Figure 4

The platform on which we will attach our Pocket PC mount will need to be at least 7" in diameter. You can also create a bit more of a bug shape as shown in Figure 5.

It is important to note that you can use any material you wish for this platform. However, if you are going to use a Pocket PC mount with a suction cup you will want as smooth as surface as possible. I used 1/8" clear Lexan. I then painted the underside black.

SSC-32 Prep

Before we start assembling the base the SSC-32 needs to be prepped. First set the jumpers as shown in Figure 6. You will need to remove the VL=CS1 jumper and the TX jumper. Place both the baud rate jumpers to set the speed to 115200.

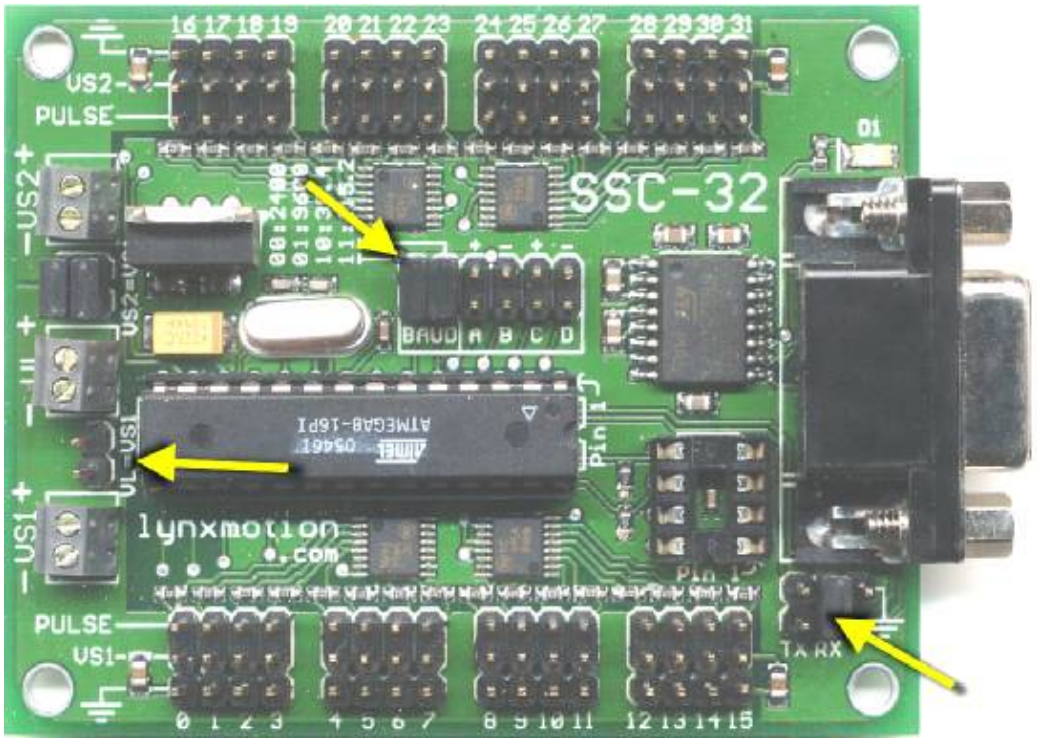

Figure 6

Take about 12" of hookup wire and strip about 1/8" of insulation off one of the ends. Attach this end to the back of the SSC-32 as shown. This is the DTR pin on the 9 pin cable. This will be used tell the PS2 controller that we want a reading. This will be connected to the interface in Part II of the FaceWalker.

The FaceWalker has two power sources. An RC Stick battery is used to power the servos and a set of 6 AA batteries are used to power the logic and various other components such as the wireless controller. You will want to be able to switch this power source on and off so a switch will have to be wired in series with the 8" 9v battery clip as shown in Figure 8. Use some heat shrink to insulate the connections on the switch. This also adds reinforcement as well.

Once you create the logic power harness, connect to the VL header as shown in Figure 9.

At this point you can proceed with the EH3R base assembly.

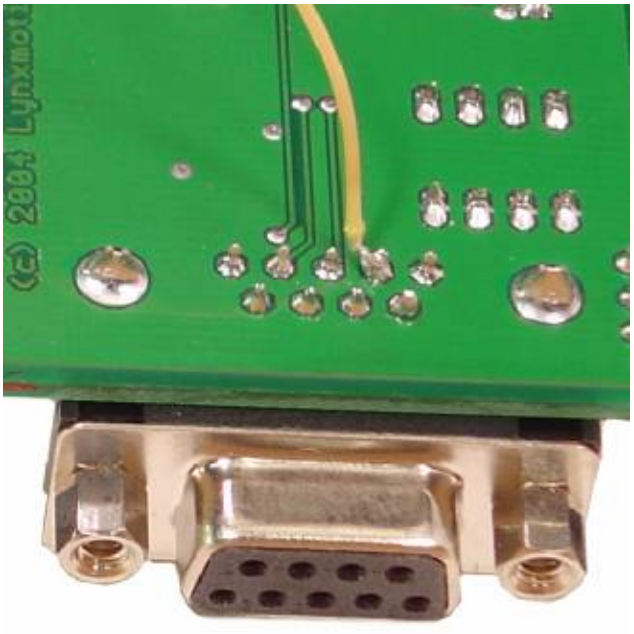

Figure 7

Base Assembly

The EH3R base arrived after 4 days via UPS. Figures 10 and 11 show the EH3R Lexan and hardware. The 18 HS-645 Servos are packaged separately. You will need to download the assembly instructions from the Lynxmotion web site at:

Leg Assembly Instructions
http://www.lynxmotion.com/images/html/build38b.htm

Body Assembly Instructions
http://www.lynxmotion.com/images/html/build42b.htm

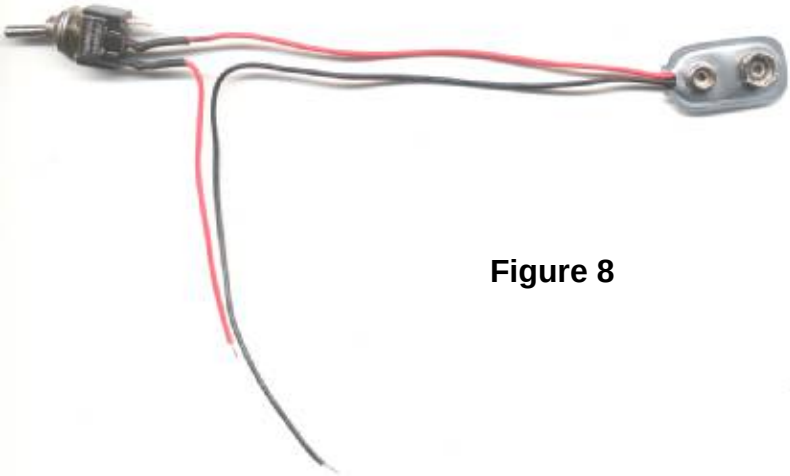

Figure 8

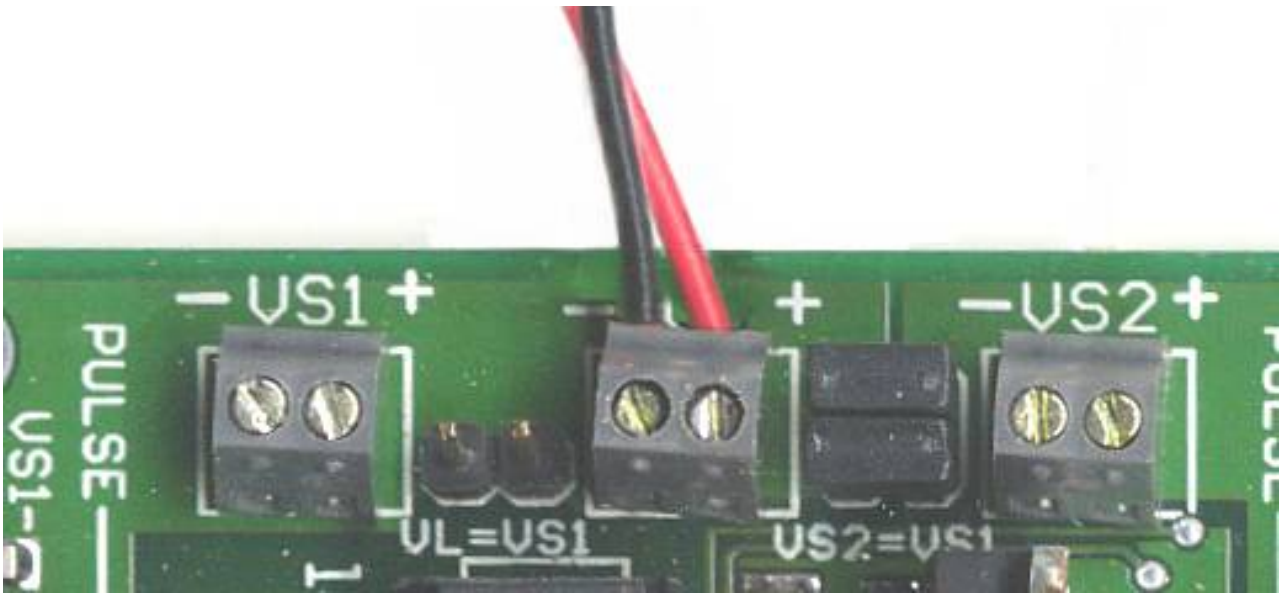

Figure 9

Figure 10

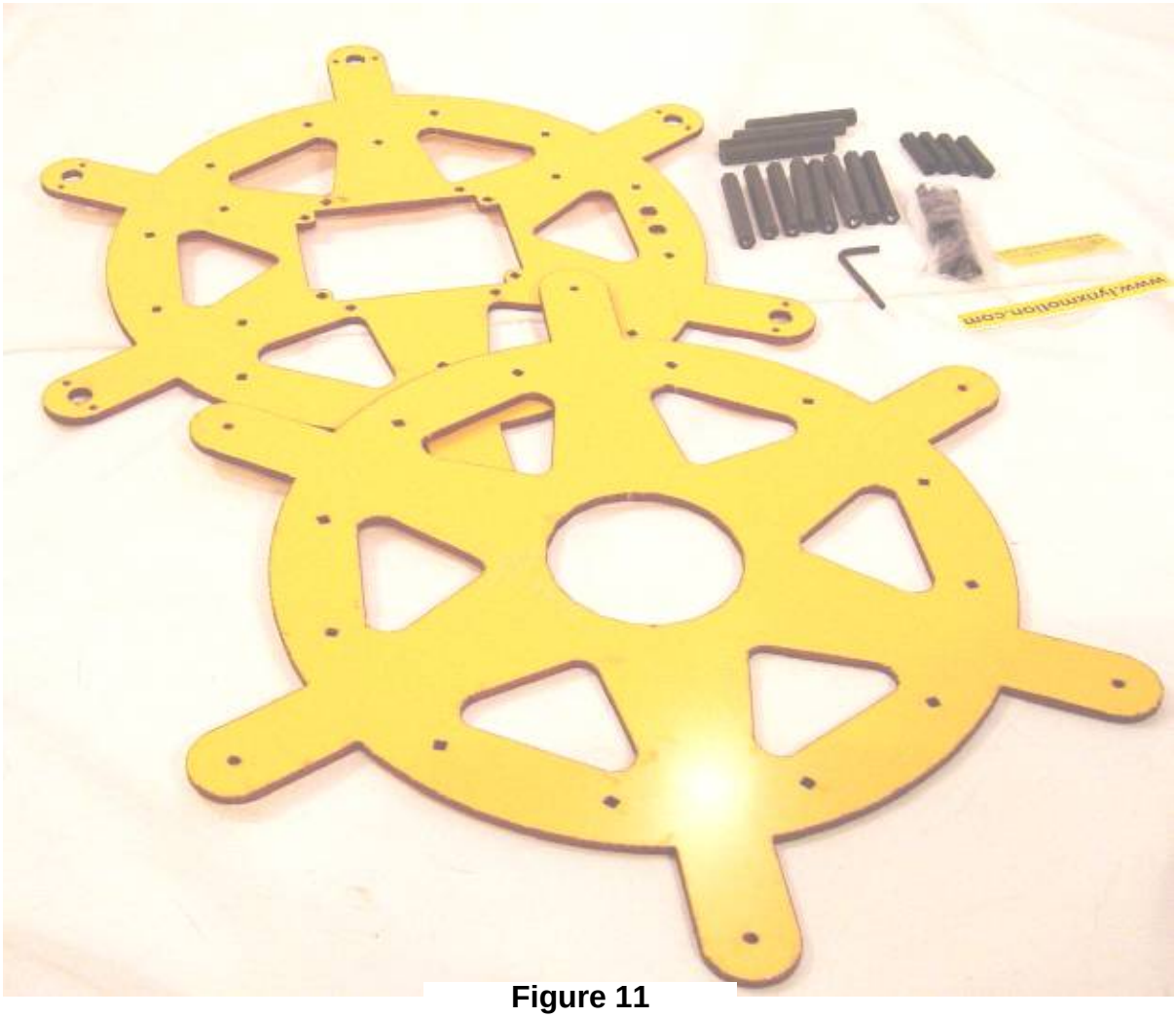

Figure 11

Before doing any assembly I recommend that you do the following.

- Read the information about Polycarbonate on the Lynxmotion website at: http://www.lynxmotion.com/images/html/infolexa.htm
- Remove and separate all pieces from the sheets. The individual pieces are laser cut from Lexan sheets. The pieces are still attached to the sheet and need to be separated. You could do this as you assemble but it will slow you down.
- Remove the protective plastic covering from the Lexan surfaces. If you wait till after assembly it is much harder to remove.
- Punch out all the small holes. There will be small Lexan pieces in each of these holes left over from the cutting process. Again, it is much easier to do this all at once.

The first thing you will need to do in the assembly process is to assemble the legs. Refer to the leg assembly instructions. You will need to assemble 3 right legs and 3 left legs as shown in Figure 12. The left legs are a mirror image of the right but I got a bit confused as I was building them.

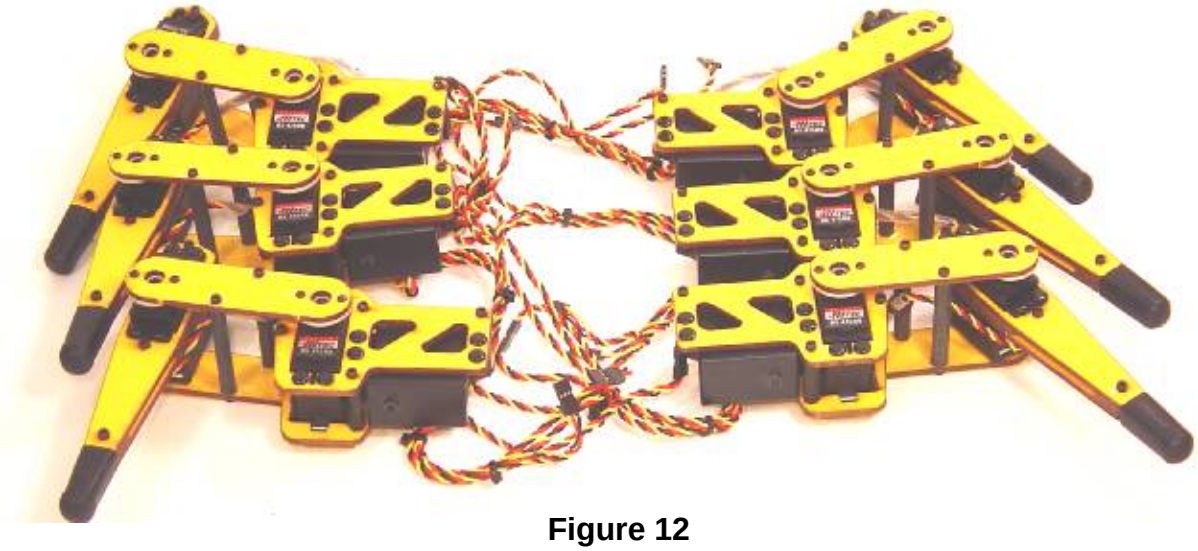

Figure 12

Figure 13 shows a partial assembly for the left legs. This should help.

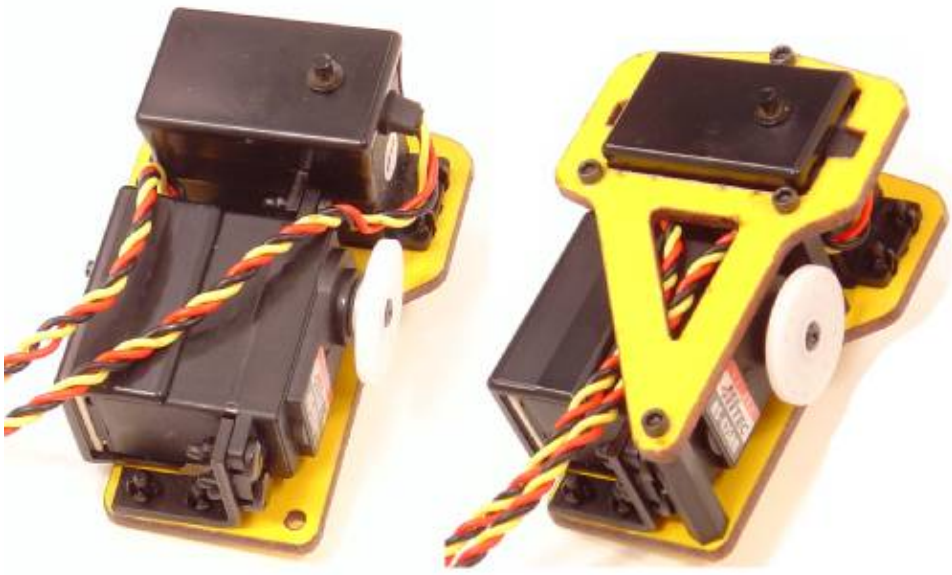

Figure 13

With the legs built we can move on to the body. Again, you will need to refer to the body instructions mentioned previously. Before you start with the body, connect the 1/2" standoff to the 1" standoff to create a 1.5" standoff and attach it to the top side off the top panel as shown in Figure 14.

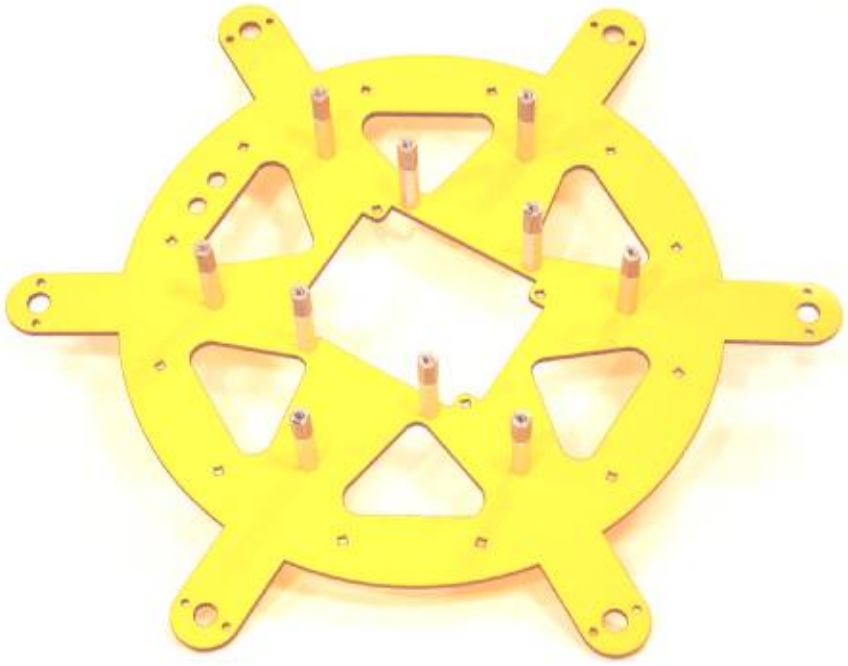

Figure 14

You will need to add the standoffs to 10 holes. Six of them are attached to the middle ring of holes. The remaining 4 connect to the four holes near the center square, not the corner holes, which are used to mount the servo controller. Notice that the top panel has a slight cup. These standoffs connect to the convex side of the cup. Later we will attach our platform to these standoffs.

When you get to step 3 of the body instructions, Do Not install the VL=VS1 jumper. Just connect the RC battery harness as shown in Figure 15.

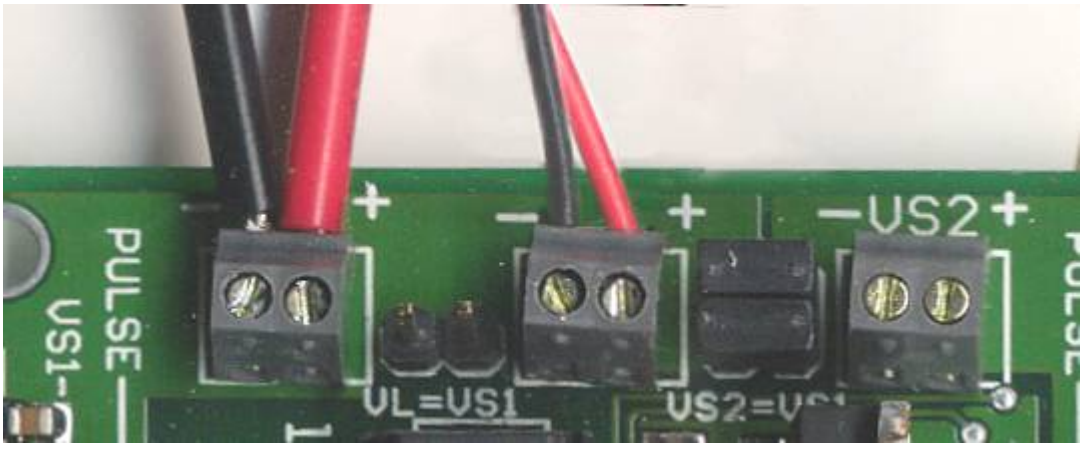

Figure 15

In Step 4, install the Logic Power switch into the first hole as shown in Figure 16.

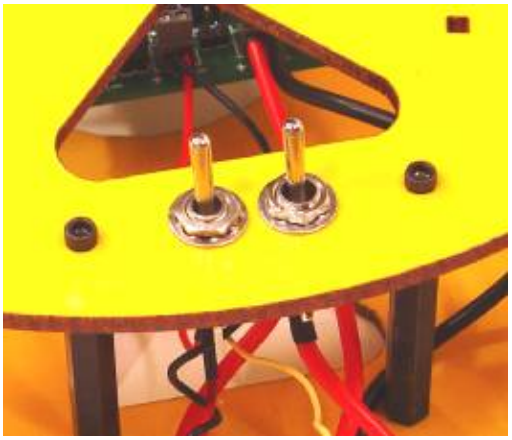

Figure 16

Once you have completed the construction of the body there needs to be a few finishing touches made. First you will need to create a battery compartment for the stick battery. This is done by cutting a 9" section of hook and loop (Velcro). You will need to attach the hook portion to the loop portion with some hot glue as shown in Figure 17.

Once the two pieces are connected, add a small loop to the end of the Hook side. Note that the Loop section is the piece that feels like soft carpet.

The key here is to attach the loop that you made around the first standoff then weave the Velcro around the other posts as shown in Figure 18. This creates a nice padded battery compartment. You should dry fit the pieces of hook and loop before you actually hot glue them in order to get the placement correct. You may find it easier to add the small loop first.

Next you need to create a small compartment to hold the 6-cell logic battery. This is done by connecting a piece of Velcro to the posts to the left of the switches as shown in Figure 19. Wrap a hook piece around one post and secure it with hot glue. Then wrap a loop piece around the other post and secure. Dry fit first so that you can get the orientation of the hook and loop correct. Next, route the 9v clip into this space as well. Now all you need to do is connect the battery clip to the 6-cell pack and slip it into the small space. Connect the two pieces of Velcro to hold the pack in place.

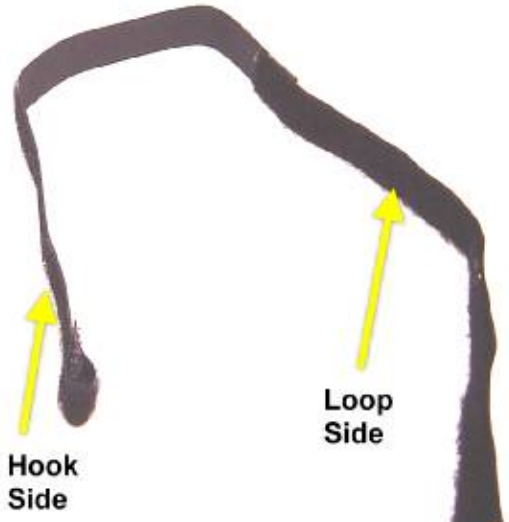

Figure 17

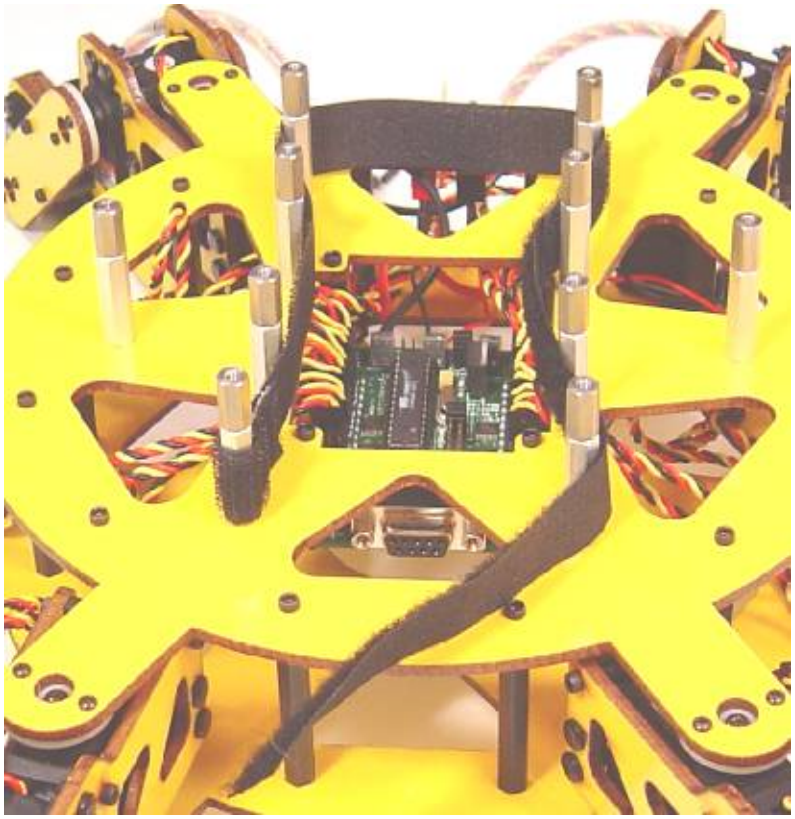

Figure 18

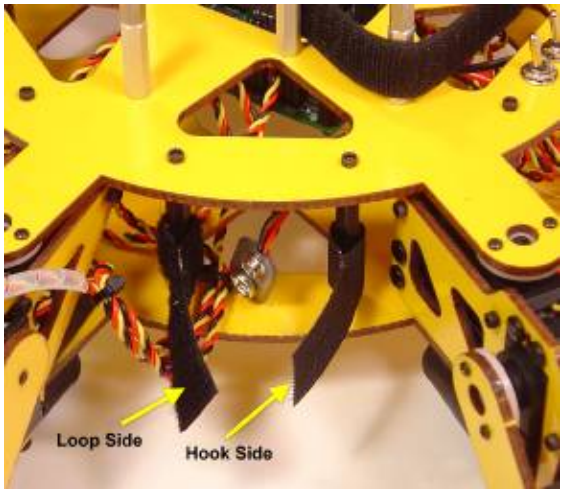

Figure 19

The last step is to connect the platform to the completed body. As a minimum, the platform needs to be 7" in diameter. You can make the shape whatever you wish. I created a segmented shape for mine as shown in Figure 20. If you are using clear Lexan the attachment is very simple. Place the platform on top of the standoffs and mark the 6 outermost posts. Don't create holes for the inner 4 standoffs as they may get in the way of your Pocket PC mount. Once marked, drill 1/8" holes and attach with #4 machine screws. Do Not paint the platform yet as we will be tooling it a bit more in parts 2 and 3 of this article.

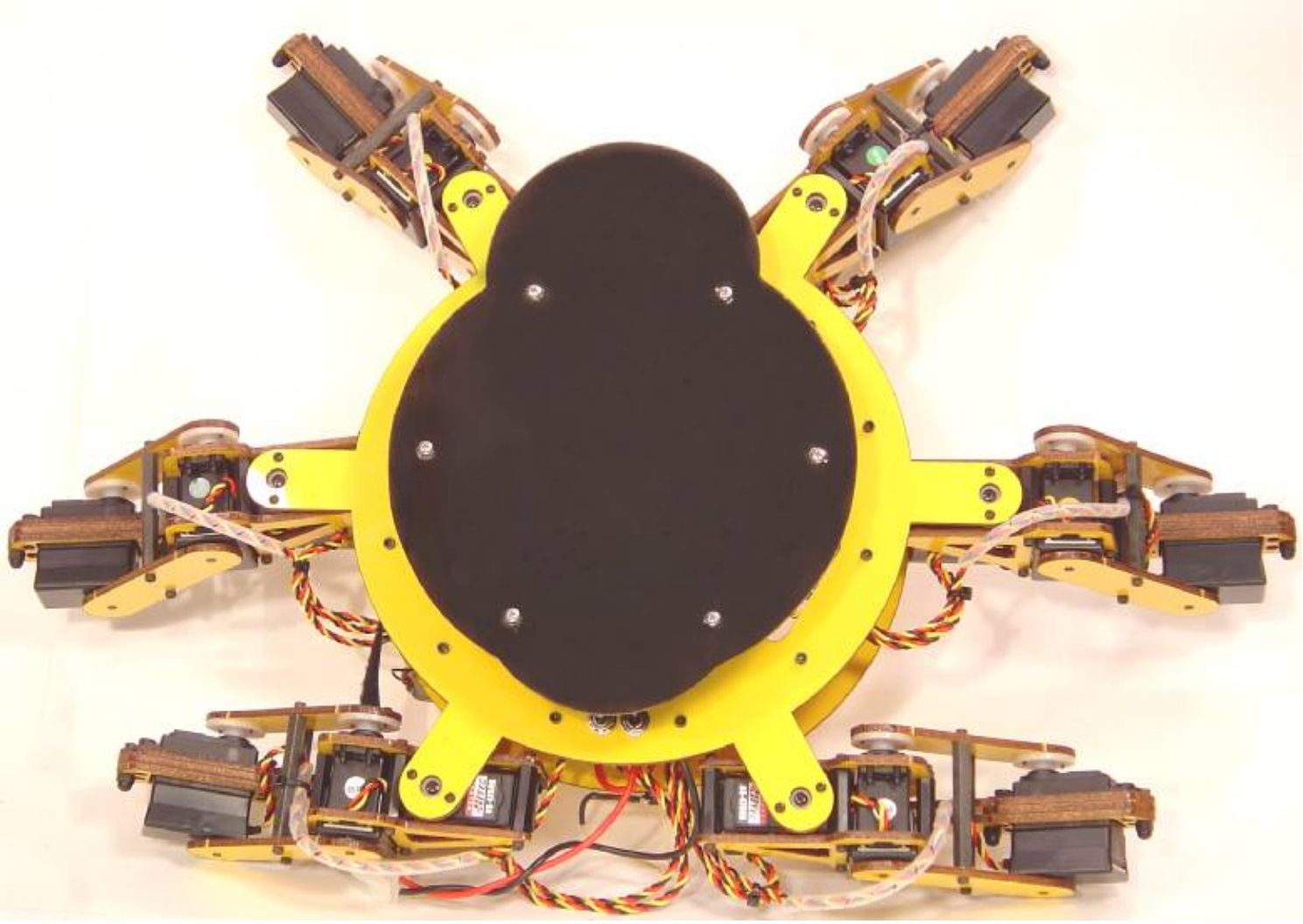

Figure 20

While we don't have our Pocket PC or PS2 controller connected there are a few things we can do to test our FaceWalker. I have included a two test programs that will allow you to connect your Desktop or Laptop to the walker with a serial cable. The first program is called SSC32Test (Figure 21). This program lets you set any servo connected to the SSC32 to any position. The second program is called FaceWalker1 (Figure 22). This program is a desktop program that will allow you to put your walker into motion. The speed of the walker has been fixed at a slow pace as the program is meant for testing your walker only.

What's Next

In Part 2 of this series I will add an interface that will allow you to plug a PS2 controller into the FaceWalker. In Part 3, the final article, we will finish up construction and I will show you how to add a Pocket PC to the base. I will go into detail about the software so you can add your own special actions.

The Zeus source code used to create the two programs as well as project updates can be downloaded from the Kronos

Robotics web site at
http://www.kronosrobotics.com/Projects/FaceWalker.shtml

ZeusPro is a very simple and inexpensive way to create both Windows and Pocket PC software. Please be aware I won't be going into any details about the software until the Part 3 of the series.

Parts

LynxMotion www.lynxmotion.com

- Round base with 18 Servos #EH3R-KT
- HS-645 Upgrade #SUP-04
- Servo Controller #SSC-32
- Wiring Harness #WH-01

Jameco www.jameco.com

- 22, #4 3/8" Machine Screw #40969CK
- 20, #4 Lock Washers #4106850CK
- 6, #4 Hex Nuts #40942CK
- 11, #4 M-F .5" Standoff #111755CK
- 11, #4 F-F 1" Standoff #139184CK
- SPDT Switch #22832CK

Kronos Robotics www.kronosrobotics.com

- 6-Cell Battery Holder#16321
- 9v Battery Clip 8" #16264
- 5, Heat shrink strips#16287

Other

- 7.2v 2000MaH - 3000 MaH Stick Battery. Check Local Hobby shop, Radio Shack or LynxMotion.
- 6, 1.2v - 1.5v AA Batteries Rechargeable or Alkaline. Check department store.
- Velcro Strip - 3/4" x 1 Yard. Should be the non sticky type. Check fabric section of department store.
- 8"x10" Plexiglas or compressed PVC. Check local hardware or home center.
- Universal PDA Mount. Check Auto Store or Amazon.com
- Hookup Wire 22-26Ga. Different colors will be helpful.

!! Important !! Don't use a battery that supplies more than 7.2v or you will burn up the servos. Even at 7.2v we are pushing the servos.

KRMicros www.krmicros.com

- ZeusPro
http://www.krmicros.com/Development/ZeusPro/ZeusPro.htm

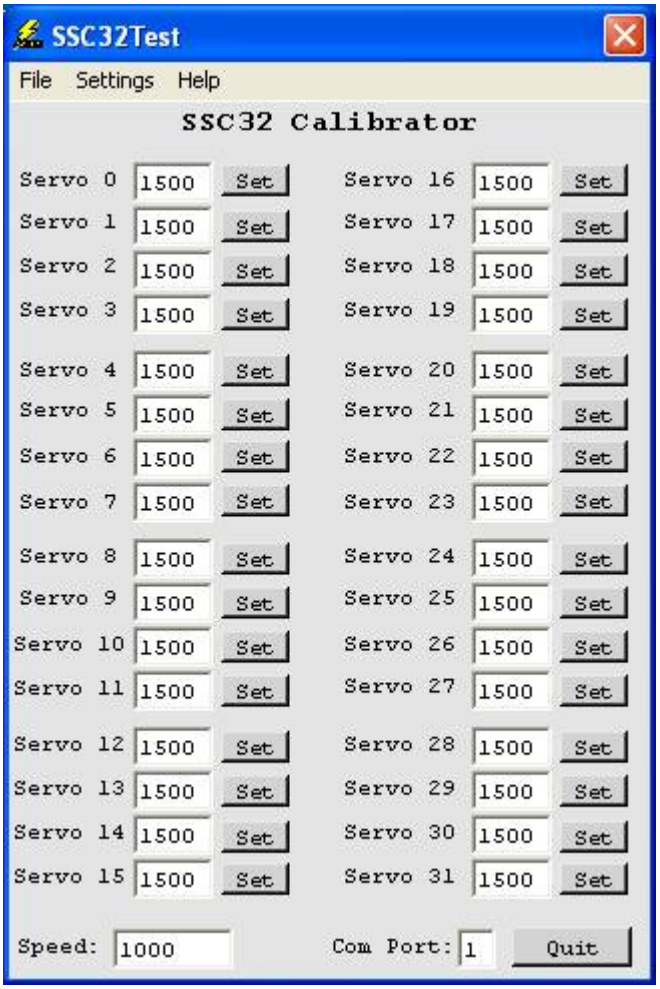

Figure 21

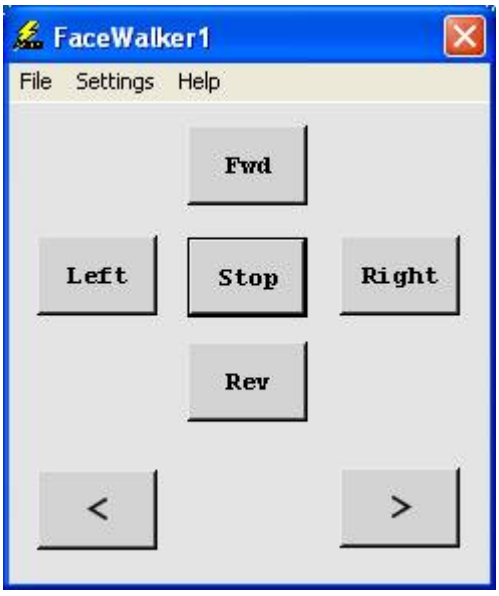

Figure 22