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## [DIY] Spider Robot(Quad Robot, Quadruped)

By RegisHsu (/member/RegisHsu/) in Circuits (/circuits/) &gt; Arduino (/circuits/arduino/projects/)

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Spider Robot v3.0 demo (quadruped, quad robot)





(/member/RegisHsu/)

By **RegisHsu**

(/member/RegisHsu/)

<http://regishsu.blogspot.tw/>

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About: My Chinese name is 許英豪. My background is Electronic and software engineering. I have over 30 years design experience on the SmartPhone, Tablet and Digital camera. I love DIY! More About RegisHsu » (/member/RegisHsu/)

**If you need extra support from me, it will be better that make some suitable donation to me:**

<http://paypal.me/RegisHsu> (<http://paypal.me/RegisHsu>).

#### **2019-10-10 update:**

The new compiler will cause the floating number calculation problem. I have modified the code already.

#### **2017-03-26 update:**

Share the MG90 servo version - <http://www.thingiverse.com/thing:2204279> (<http://www.thingiverse.com/thing:2204279>).

you can download it and build with MG90 servos.

#### **2016-11-1 update:**

The all new spider - [https://youtu.be/bxJC\\_vvgglc](https://youtu.be/bxJC_vvgglc) ([https://youtu.be/bxJC\\_vvgglc](https://youtu.be/bxJC_vvgglc))

#### **2016-04-01 Modify:**

Correct the Battery model name and dimension.

#### **2016-01-24 update:**

Open the all of design that including the software, Sketchup, EaglePCB, <https://github.com/regishsu/SpiderRobot> (<https://github.com/regishsu/SpiderRobot>).

2015-10-11 upload the PCB layout image file.

#### **2015-10-04 update:**

Step 2: schematic pdf file - spider\_2015-10-04-open-v2.pdf

Step 10: picture 1.

## **2015-11-19 update:**

Upload the Arduino sketch file which is "special dance" included(step13). Someone who are asking about it, they are interested in it. :-)

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This is my first project for the 4 legs robot and it took me about 1 year development.

It is a robot that relies on calculations to position servos and pre-programmed sequences of legs.

I'm doing this by handmade way is because of it could be fun and educational for 3D design/printing and robot control.

This is the fourth generation of my design, you can take a look here if you are interested the history.

<http://regishsu.blogspot.tw/search/label/0.SpiderR...>

(<http://regishsu.blogspot.tw/search/label/0.SpiderRobot%E8%9C%98%E8%9B%9B>)

2 more projects sharing -

Spider Robot simulator by vPython

<https://www.instructables.com/id/vPython-Spider-Rob...>

(<https://www.instructables.com/id/vPython-Spider-Robot-simulator/>)

Remote control by bluetooth

<https://www.instructables.com/id/DIY-Spider-Robot-P...> (<https://www.instructables.com/id/DIY-Spider-Robot-PART-II-Remote-control/>)

Building this project is fun, however, it should take you more time and patient to implement.

If it is a hard job to you, the product comes from Sunfounder might a good choice.

<https://www.sunfounder.com/robotic-drone/quadruped/crawling-quadruped-robot-kit.html>  
(<https://www.sunfounder.com/robotic-drone/quadruped/crawling-quadruped-robot-kit.html>)

Before going to next step, please aware that the **soldering tools and 3D printer** will be used in this project.

Let's get start and have fun!

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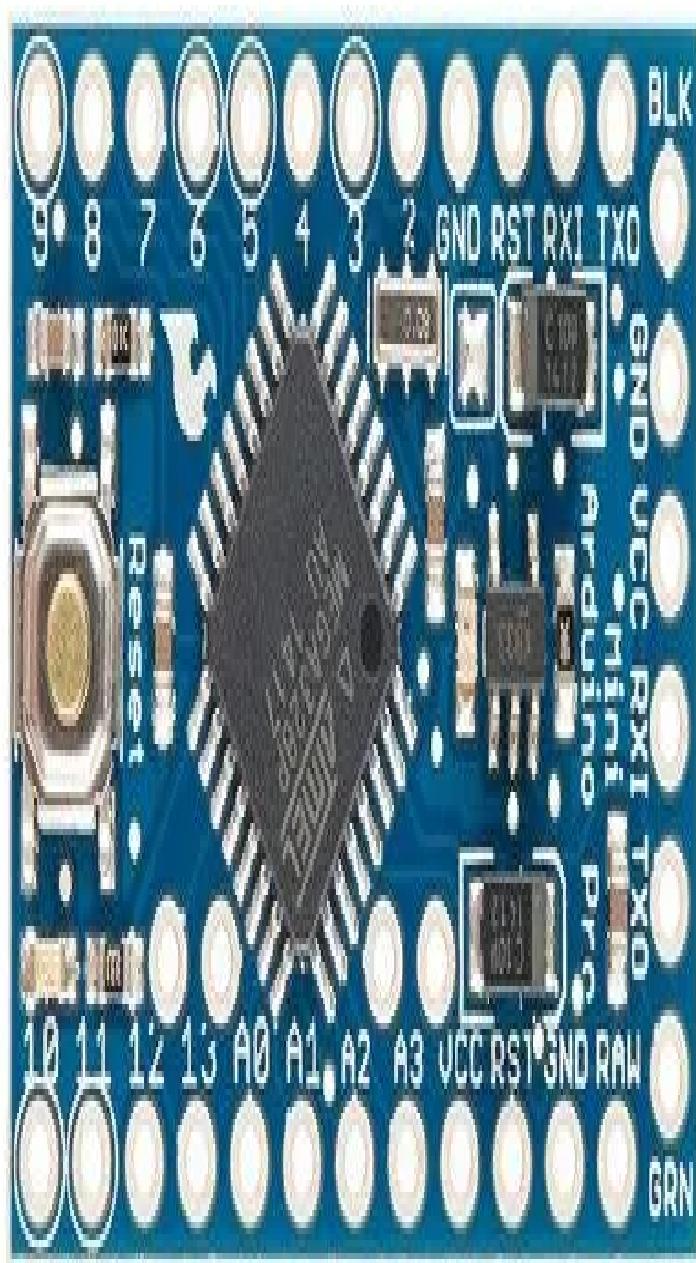
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## **Step 1: Electrics Parts Preparation**





Here are the parts:

1x Arduino Pro Mini

1x DC-DC(12-5v/3A output)

1x HC-06 Bluetooth module(option)

12x SG90 servo(3DOF for 4 legs)

1x 3000mhA Li battery (DC12300, 90x43x17mm)

1x 12V Jack

1x 680 Ohm 1/4 watt 5% Resistor

1x 3mm Blue LED

1x Tactile Switch

1x 5x7cm perfboard

Some male and female pin headers

Small guage wire(Solid or Stranded)

I believe that these parts are most popular and not expensive. They are just cost me about 2,000 Taiwan dollar.

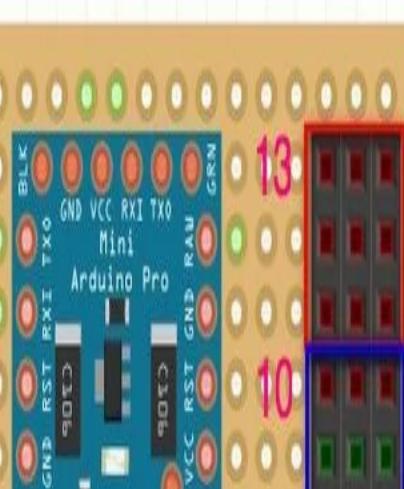
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## Step 2: Make the Main-board





2015-10-11

upload the PCB layout image file, you should download the zip file would be better.

You can come here for more information about PCB DIY.

<http://regishsu.blogspot.tw/search/label/0.SpiderR...>

<http://regishsu.blogspot.tw/search/label/0.SpiderRobot%E8%9C%98%E8%9B%9B>

\*\*\*\*\*

Refer to the schematics file, and place all components like the pictures. you can make the board as small as passable.

The main-board that the last one picture is the newest version, just for you reference.

Here are some tips while you are going to building the PCB:

1. Be sure the output voltage of DC-DC module **should be 5v** before mount to the perfboard.
2. The servos consume a lot of power, almost 3A in full loading condition. Please use more thick wire for "power" and ground" traces.
3. **Do the "open/short" test with the multi-meter for your PCB when you finish the soldering, that is the important process.**
4. Using the female pin header instead of solder the modules(Arduino, DC-DC) on the perfboard directly
5. The LED will be on while the "Switch" turns off. Why I design this way is because I would like to check the power source is ok or not when I plug in the power source like battery or something else, it is a simple way for protection..
6. While you see the LED turns on after connect the 12v battery to the board, congratulation!



[spider\\_2015-10-04.pdf](https://cdn.instructables.com/094/094/spider_2015-10-04.pdf) (https://cdn.instructables.com/094/094/spider\_2015-10-04.pdf)  
(https://cdn.instructables.com/094/094/spider\_2015-10-04.pdf)



[spider\\_pcb\\_2015-09.zip](https://cdn.instructables.com/AVRL/IFLC5K1E/F16AVRLIFLC5K1E.zip) (https://cdn.instructables.com/AVRL/IFLC5K1E/F16AVRLIFLC5K1E.zip)  
(https://cdn.instructables.com/AVRL/IFLC5K1E/F16AVRLIFLC5K1E.zip)

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### **Step 3: Test the Main-board**

The screenshot shows the Arduino IDE interface with the title bar "legs\_init | Arduino 1.6.5". The menu bar includes File, Edit, Sketch, Tools, and Help, with Tools being the active tab. A red oval highlights the "Board" option in the Tools menu, which is currently set to "Arduino Pro or Pro Mini". Other options in the Tools menu include Auto Format (Ctrl+T), Archive Sketch, Fix Encoding & Reload, Serial Monitor (Ctrl+Shift+M), Port, Programmer (AVRISP mkII), and Burn Bootloader.

```
1 // Locate
2 // Register Servos
3
4 #include <
5
6 Servo servos;
7
8 //define servos' ports
9 const int servo_pin[4][3] = { {2, 3, 4}, {5, 6, 7}, {8, 9, 10} };
10
11 void setup()
12 {
13     //initialize all servos
14     for (int i = 0; i < 4; i++)
15     {
16         servos.attach(servo_pin[i][0], servo_pin[i][1], servo_pin[i][2]);
17     }
18 }
```

[https://www.instructables.com/F4VIEICHIEQI7ZC/F4VIEICHIEQI7ZC-LARGE\\_16x2auto-with-8frames-1.0-fit-bound/](https://www.instructables.com/F4VIEICHIEQI7ZC/F4VIEICHIEQI7ZC-LARGE_16x2auto-with-8frames-1.0-fit-bound/)

## Test process:

1. **Don't** plug the DC-DC and Arduino Pro Mini into the main-board
  2. connect the battery to the 12v-Jack of main-board
  3. Check the LED, if LED turns on, that is a good start.
  4. Push the POWER-Switch, the LED should be off.

**4. Using the multi-meter to check all of +5V and GND pins are correct**

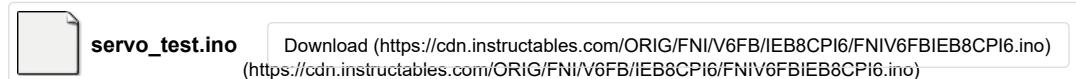
  5. Push the POWER-Switch back to turn off the power, the LED turns on
  6. Plug the DC-DC and Arduino Pro Mini into the main-board
  7. Push the POWER-Switch, the LED turns off, but the LED of Arduino Pro Mini turns on

Then power off, and connect a servo to the first row of Leg1 connectors of main-board(pin2 of Arduino)

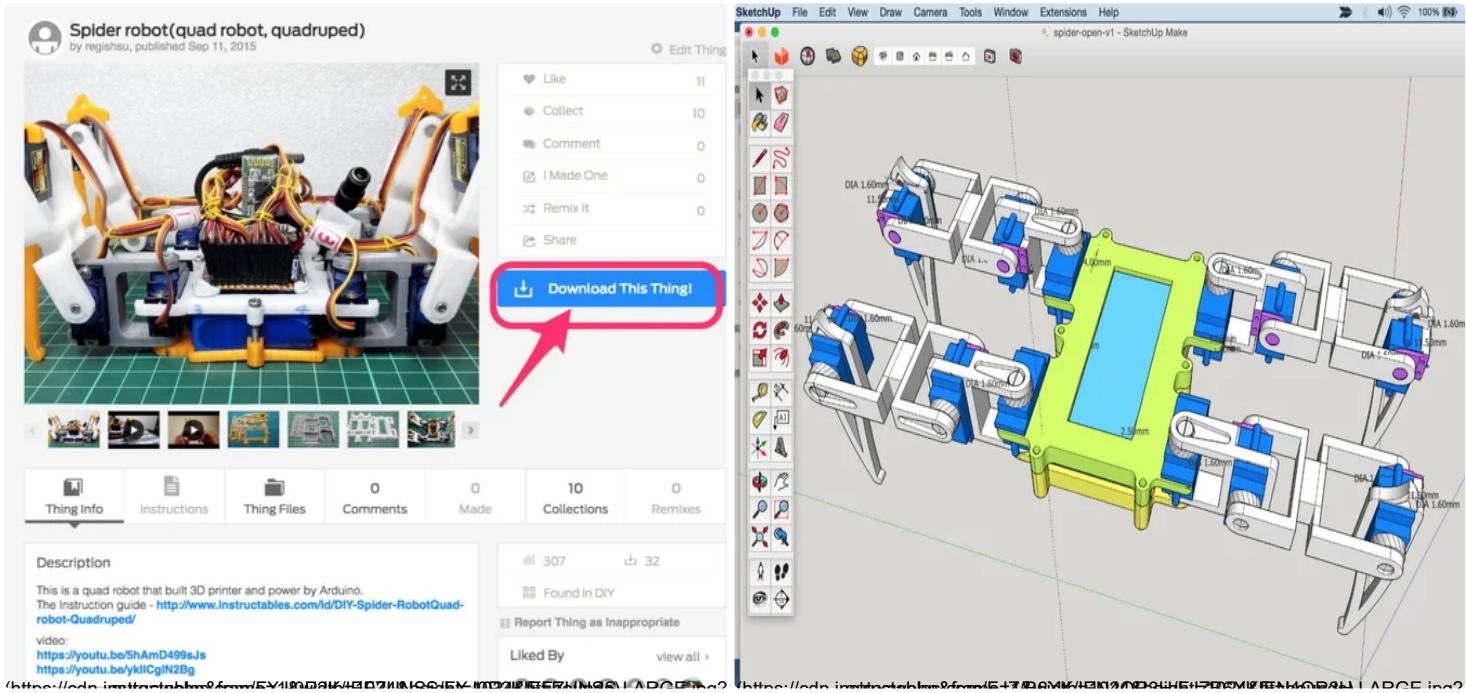
upload the "servo\_test" code to Arduino and you will see the servo sweeps from 0 - 180 degree.

If you are here without any problem, that is a great progress!

## servo test source code:



## Step 4: Building the Mechanical Parts - Download 3D STL Files



This step is going to build the robot mechanical parts, you can print the parts by yourself or ask someone who has 3D printer to help you.

I also open the 3D model design which is design by Sketchup Make version and you can modify it with your great idea.

Download the STL file from <http://www.thingiverse.com/thing;1009659>  
(<http://www.thingiverse.com/thing;1009659>).

Print parts list:

1x body\_d.stl

1x body\_u.stl

2x coxa\_l.stl

2x coxa\_r.stl

2x tibia\_l.stl

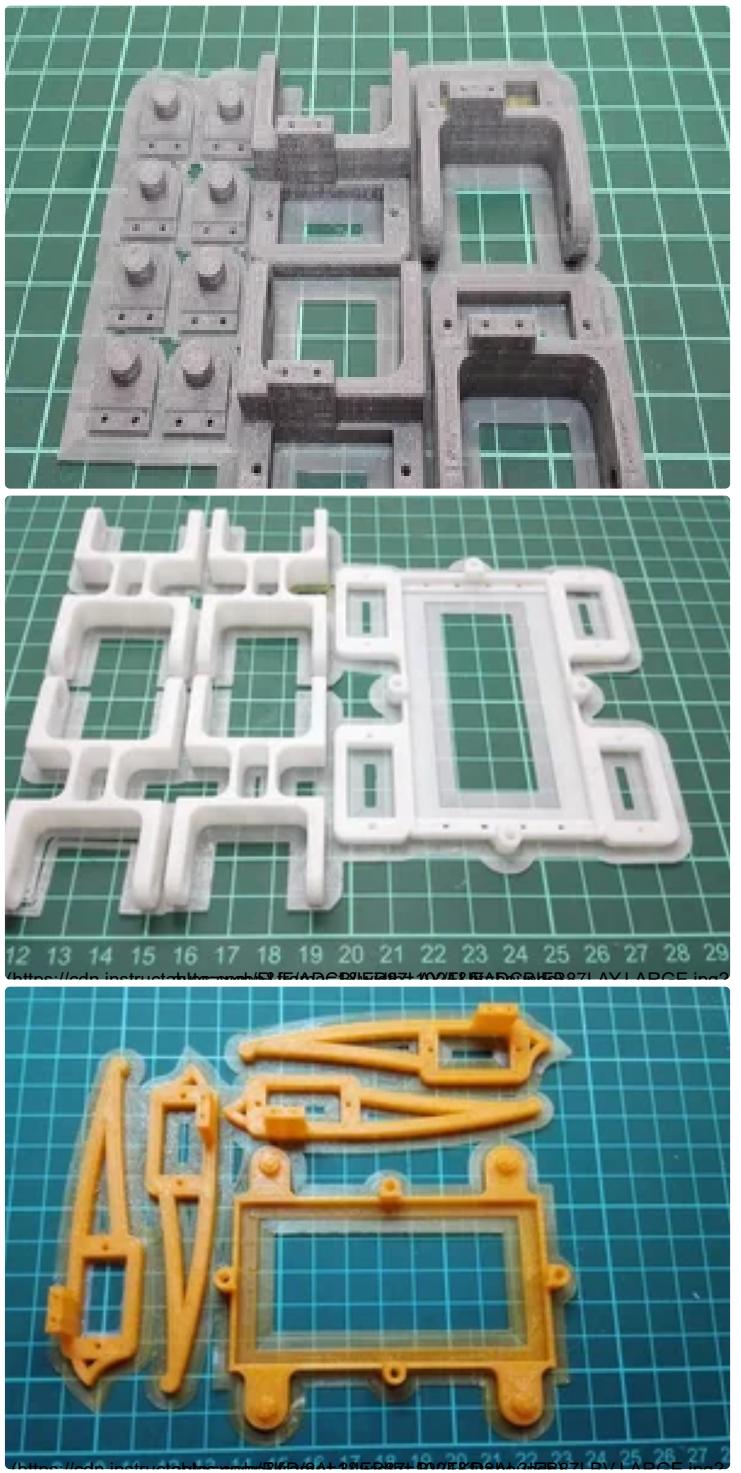
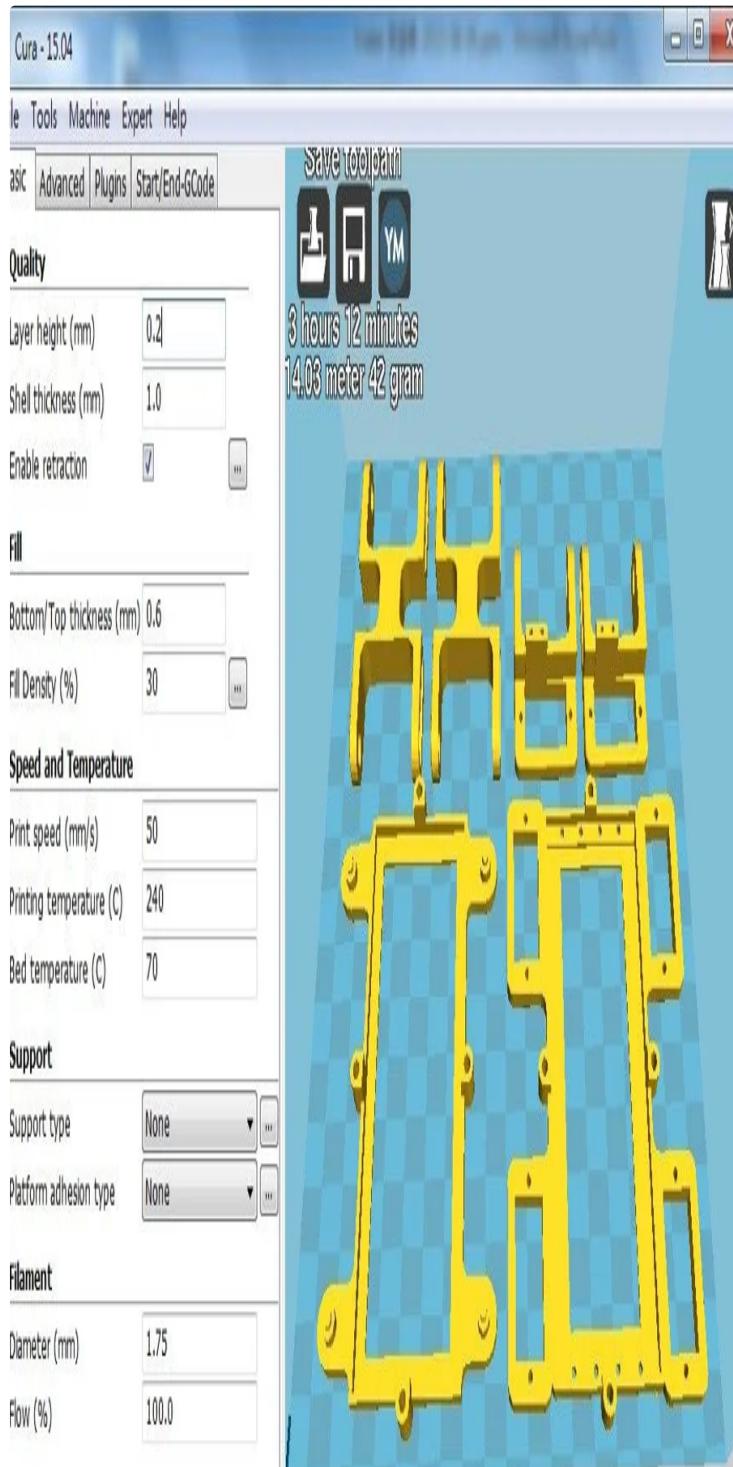
2x tibia\_r.stl

4x femur\_1.stl

8x s\_hold.stl

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## Step 5: 3D Objects Printing



And print them out by your 3D printer.

Please check the configuration of 3D printer before start to print because of it will take a long time about 7~8 hours to print them all. Be patient~~~~

There are my print setting:

- The fill density - 15%
- Nozzle - 0.3mm
- Print speed - 65

you can print these parts separate by color group.

## Step 6: Preparing to Assemble



tear down the parts and check the objects printing quality, and using the sandpaper to polish the surface to make it looks good.

Refer to here to get more information: <http://regishsu.blogspot.tw/2015/07/robot-quadruped-robot-re-design-3-round.html>

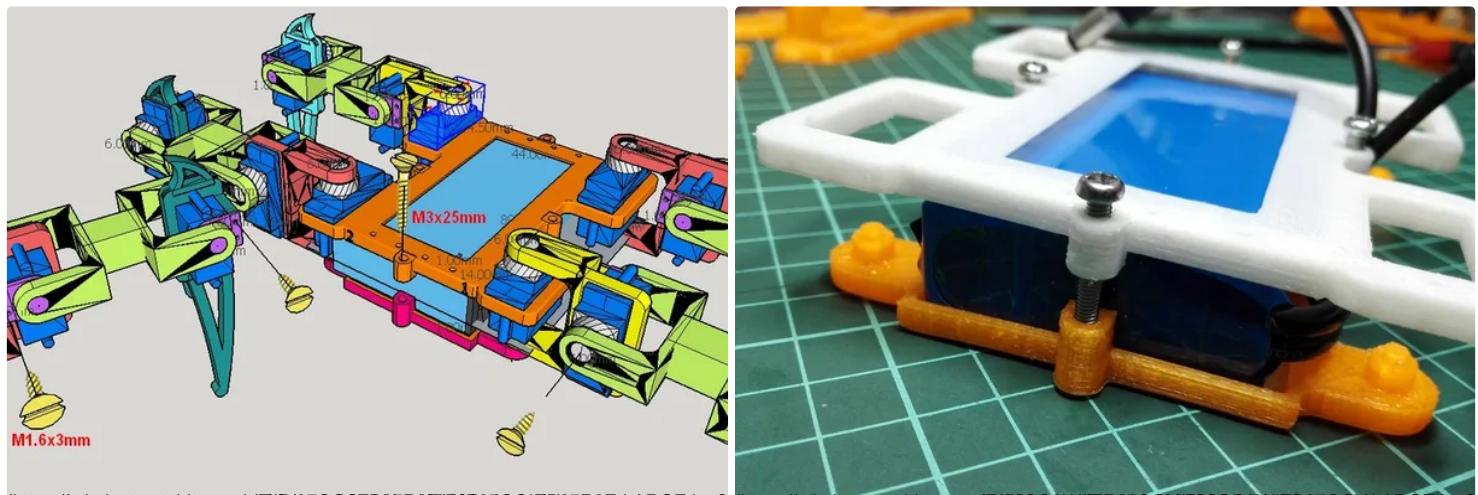
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## Step 7: Assemble the Body



Put the battery between the upper body case and lower body case with 4 screws(M3x25mm)

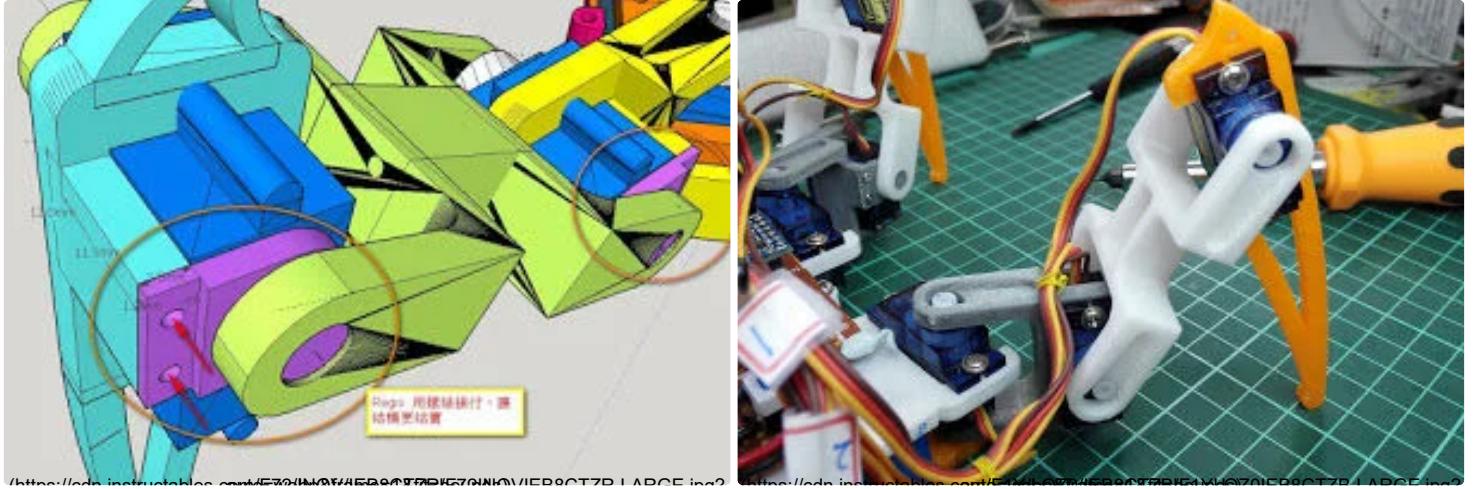
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## Step 8: Assemble the Leg



And, install all of servos with legs parts, one leg comes with 3 servos and 4 screws(M1.6x3mm, or glue it anyway)

Notes: 1. Connect to all parts with screws and servos, but **do not install the servo rocker arm** in this step 2. Be sure the leg direction, refer to the picture 1 Refer to here to get more information:<http://regishsu.blogspot.tw/2015/07/robot-quadruped.html>  
[\(http://regishsu.blogspot.tw/2015/07/robot-quadruped-robot-re-design-3-round.html\)](http://regishsu.blogspot.tw/2015/07/robot-quadruped-robot-re-design-3-round.html)

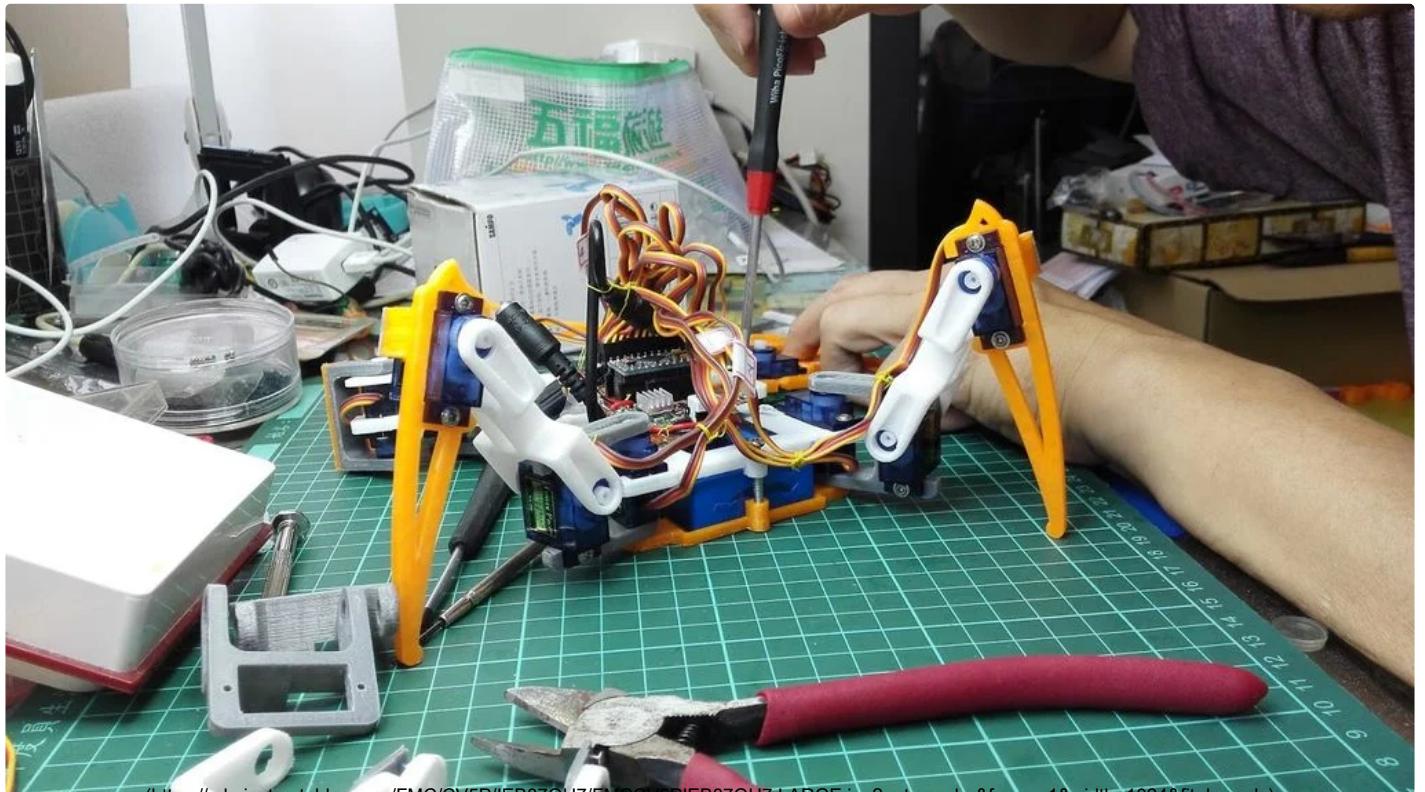
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## Step 9: Integrate 4 Legs to Body



connect all of legs to the body, and check all servos and joints are move smoothly.

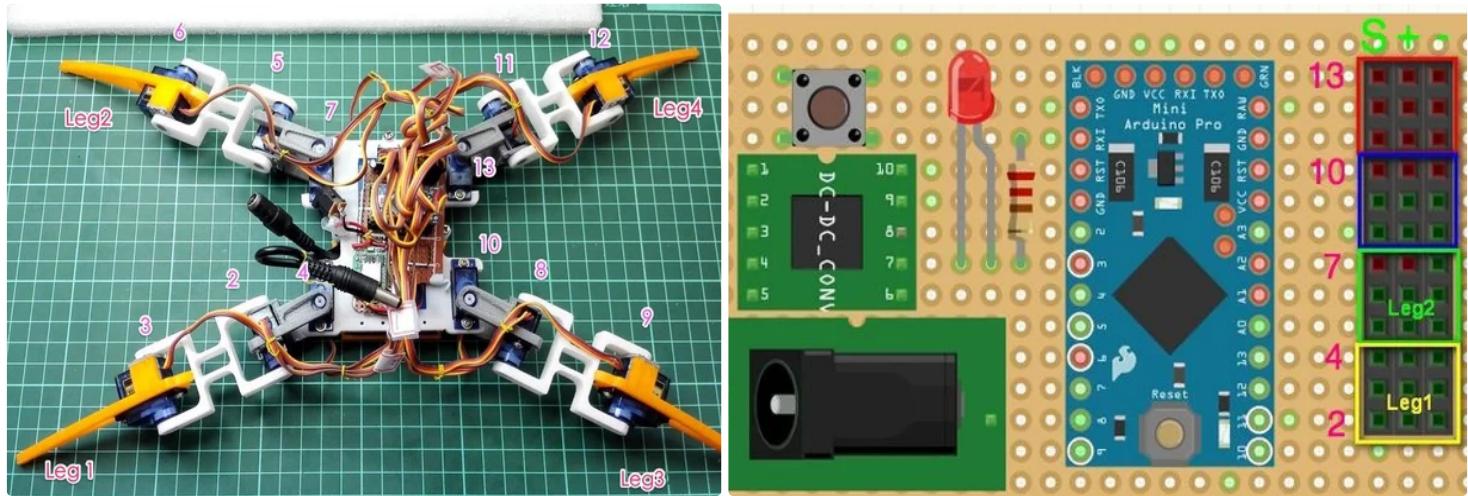
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## Step 10: Connect Servos to the Main-board



2015-10-04

update the picture1 which is wrong pin assignment.

|||||||||  
|||||||

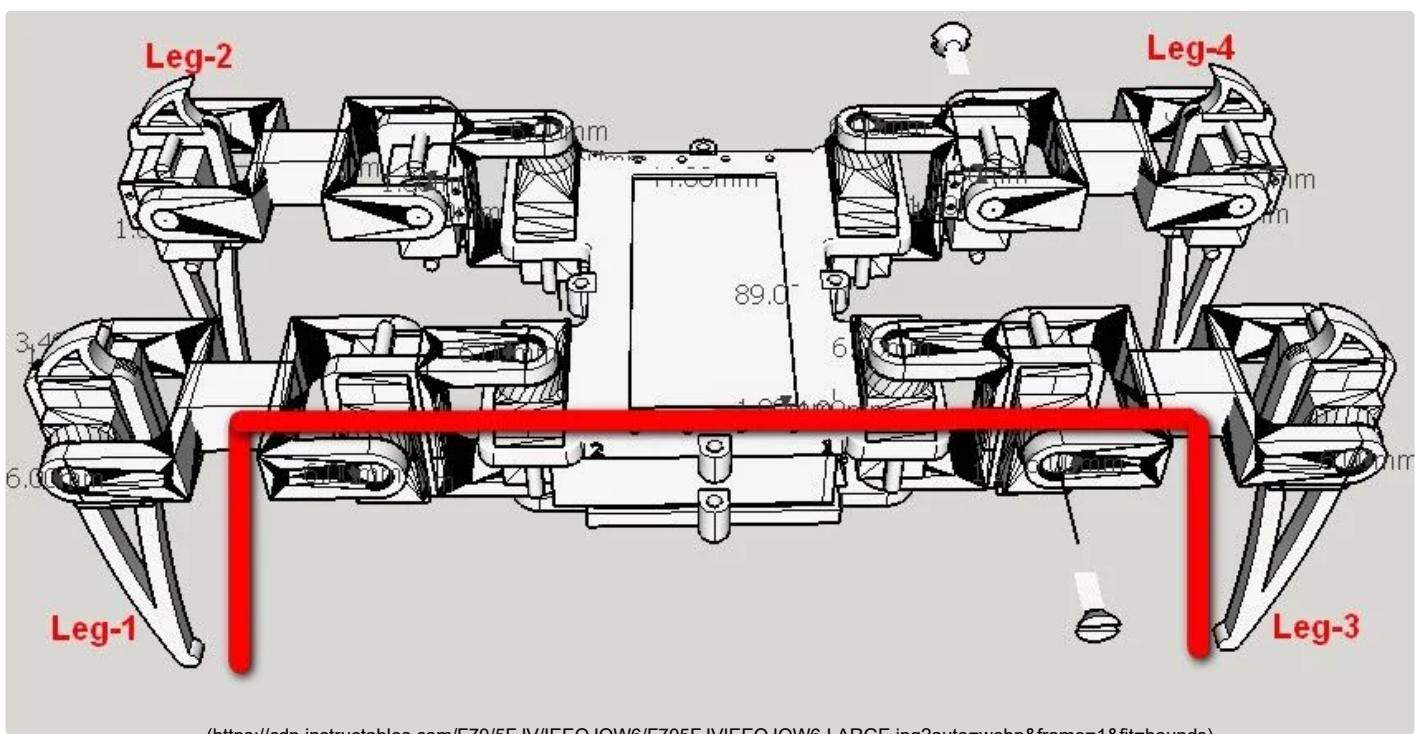
Place the main-board onto the body-case and use the polymer clay to fix it.

And then, refer to the picture, follow the pin number which mark by pink color to connect all servo wire to the main-board, and green color is present the signal direction of servo wire, yellow connect to "S", red to "+", brown to "-".

Be sure the servo of legs should match the pin number of main-board and leg direction, otherwise, the legs will get crazy...

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### **Step 11: Locate the Initial Position for Legs**



This is an important procedure, the install procedure:

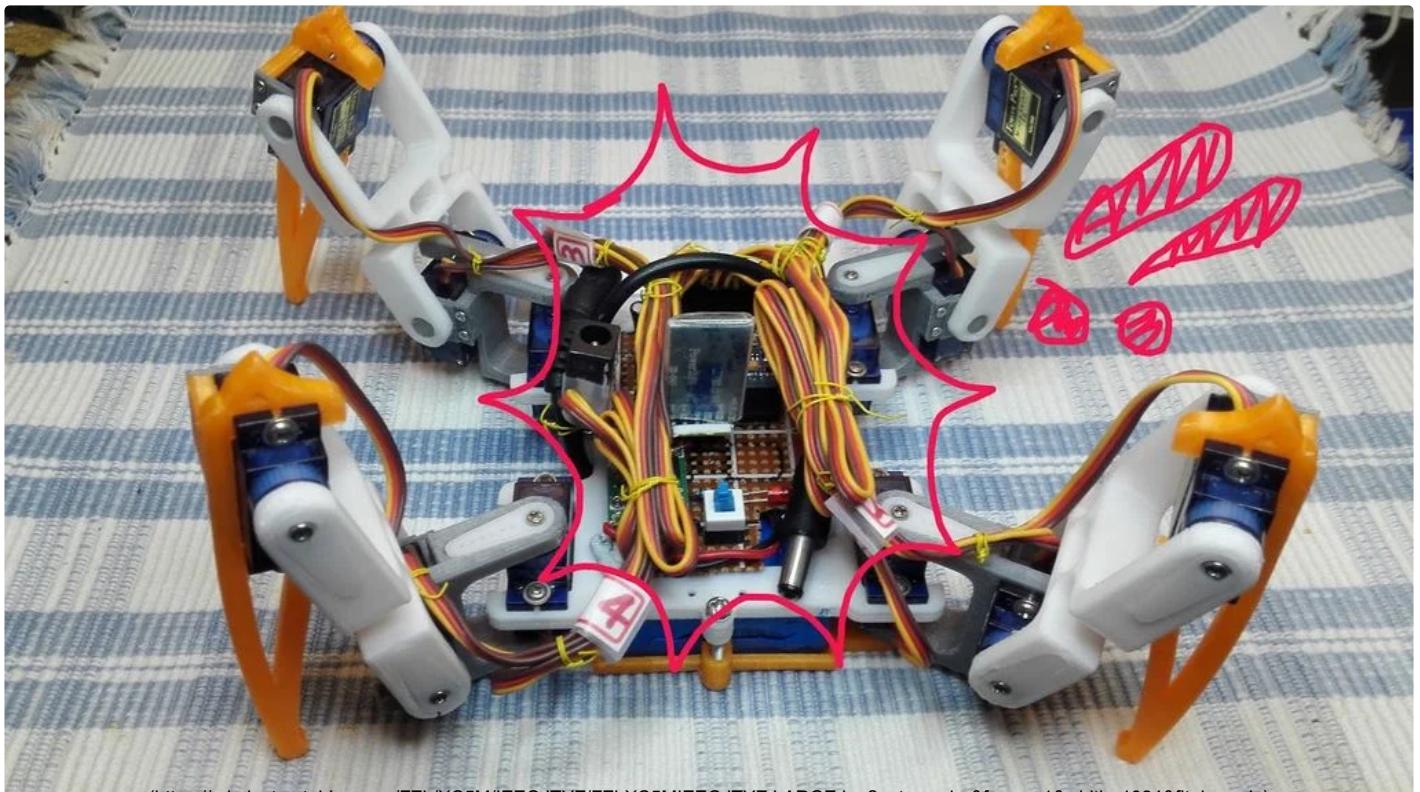
1. upload the "legs\_init" code to Arduino to activate the servos
2. place the legs as the position shows the picture 1, and install the servo rocker arm with screws.
3. tighten all of the screw

**legs\_init source code:**

 **legs\_init.ino** Download (<https://cdn.instructables.com/ORIG/FJ3/EXUC/ISCB1DZ5/FJ3EXUCISCB1DZ5.ino>) (<https://cdn.instructables.com/ORIG/FJ3/EXUC/ISCB1DZ5/FJ3EXUCISCB1DZ5.ino>)

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### Step 12: Organize the Wires



Then, organize the wires of the servos to make it great looking.

Now, all of hardware installation was finished.

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### Step 13: It Is Showtime!!

Spider Robot v3.0 demo (quadruped, quad robot)



It is excited to go this step.

Let's upload the "spider\_open\_v1" code to Arduino to make it moves!

Please download and install the lib FlexiTimer2 first before do compile the code,

<http://playground.arduino.cc/Main/FlexiTimer2> (<http://playground.arduino.cc/Main/FlexiTimer2>)

you will see the action as following

1. stand up, wait 2 sec
2. step forward 5 steps, wait 2 sec
3. backward 5 steps, wait 2 sec
4. turn right, wait 2 sec
5. turn left, wait 2 sec
6. wave the hand,, wait 2 sec
7. shake the hand, wait 2 sec
8. sit down, wait 2 sec
9. back to 1

Enjoy!

PS. the spider\_open\_v3 is add an interesting movement of "body dancing"

[spider\\_open\\_v1 source code:](#)

**spider\_open\_v1** [Download](https://cdn.instructables.com/ORIG/FOW/SGJ6/IEFIAEWY/FOWSGJ6IEFIAEWY.ino) (<https://cdn.instructables.com/ORIG/FOW/SGJ6/IEFIAEWY/FOWSGJ6IEFIAEWY.ino>)

**spider\_open\_v3** [Download](https://cdn.instructables.com/ORIG/FCY/XMF9/IH58PKOF/FCYXMF9IH58PKOF.ino) (<https://cdn.instructables.com/ORIG/FCY/XMF9/IH58PKOF/FCYXMF9IH58PKOF.ino>)

**spider\_open\_v4** [Download](https://content.instructables.com/ORIG/F4X/A5X8/K1MOH67H/F4XA5X8K1MOH67H.ino) (<https://content.instructables.com/ORIG/F4X/A5X8/K1MOH67H/F4XA5X8K1MOH67H.ino>)



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## Step 14: Do Something Special

as live creature (quadruped, quad robot)





you can add more special feature like change the move speed dynamically with remote control, that will let your robot more attractive.

If you find my design interesting, you could make a small donation:

<http://paypal.me/RegisHsu> (<http://paypal.me/RegisHsu>)

Welcome to share the funny gaits or movement.

The remote control

<https://www.instructables.com/id/DIY-Spider-Robot-P...> (<https://www.instructables.com/id/DIY-Spider-Robot-PART-II-Remote-control/>)

Here are some idea share with you in my blog.

<http://regishsu.blogspot.tw/2015/09/robot-quadruped.html>  
<http://regishsu.blogspot.tw/2015/09/robot-quadruped-robot-remoter.html>

or

Add the IR-detector to detect the obstacle.

<http://regishsu.blogspot.tw/2015/08/robot-quadruped.html>

(<http://regishsu.blogspot.tw/2015/08/robot-quadruped-robot-ir-fc-51-ir.html>)

or

handmade the PCB

<http://regishsu.blogspot.tw/2015/09/robot-quadruped.html>

(<http://regishsu.blogspot.tw/2015/09/robot-quadruped-robot-pcb-fail.html>)

<http://regishsu.blogspot.tw/2015/09/robot-quadruped.html>

(<http://regishsu.blogspot.tw/2015/09/robot-quadruped-robot-pcb.html>)



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(/member/waprice454/) waprice454 (/member/waprice454/) Question 2 days ago on Step 1

[Answer](#)[Upvote](#)

hi, what websites/ stores did you order the parts from.i live overseas and i would love to get the links/ names of the websites

(/member/baklouti\_khalil/) baklouti\_khalil (/member/baklouti\_khalil/) 24 days ago

[Reply](#)[Upvote](#)

Hi, can i use a small breadboard instead of pcb..i mean i wanna put all things in the breadboard (nano,servos,Bluetooth module,9v battery), it's possible ?

(/member/nargis+begum/) nargis begum (/member/nargis+begum/) 7 months ago

[Reply](#)[Upvote](#)

hi,

/// I made the spider robot with demo version.Now I am doing the bluetooth one but I am having some problem with the android input command.Please, help me out.....

2 replies ▾

(/member/LukasM55/) LukasM55 (/member/LukasM55/) 2 years ago

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Hello can someone help me  
all servo turns wrong.  
can one change this in the program?  
Thanks

1 reply ▾

(/member/anjay4705/) anjay4705 (/member/anjay4705/) Question 8 weeks ago on Step 14

[Answer](#)[Upvote](#)

can anybody tell me please what are these pins for?

(<https://content.instructables.com/FT9/TXFR/K8WK2P6P/FT9TXFRK8WK2P6P.LARGE.jpg?fit=bounds&width=1024>)

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i downloaded the pieces but i cannot make an assembly with this in solidworks

[Answer](#)[Upvote](#)

Why u added bluetooth module

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```
length_a = 55;
length_b = 77.5;
const float length_c = 27.5;
const float length_side = 71;
const float z_absolute = -28;
```

what are these please help me to understand this ???

1 reply ▾

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Plz help mine isn't working , not moving my project is tomorrow and the servos isn't working i changed them for the fifth time

[Answer](#)[Upvote](#)

When I upload the leg init code, the servos just keep moving and don't fix. What have I done wrong and how can I fix it? Thank you very much

1 answer ▾

[Answer](#)[Upvote](#)

Did you do any testing in matlab?

[Answer](#)[Upvote](#)

can i know the uses of this robot in daily useage

1 answer ▾

[Answer](#)[Upvote](#)

I used a uno board with a sensor shield. When using the demo code it works fine no problems. When upload spider\_robot with the hc-06 attached it will only work when held in the air with no force on the legs. If any force is applied to the legs it hesitates then acts like the program is started over. It shows the initialization process on my phone. Help please!

(<https://cdn.instructables.com/FQY/Y9CG/JY578PB1/FQYY9CGJY578PB1.LARGE.jpg?fit=bounds&height=1024&width=1024>)

---

(/member/vedantnarayan13/) vedantnarayan13 (/member/vedantnarayan13/) Question 1 year ago

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How much pla material is required to print all the 3d parts??

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