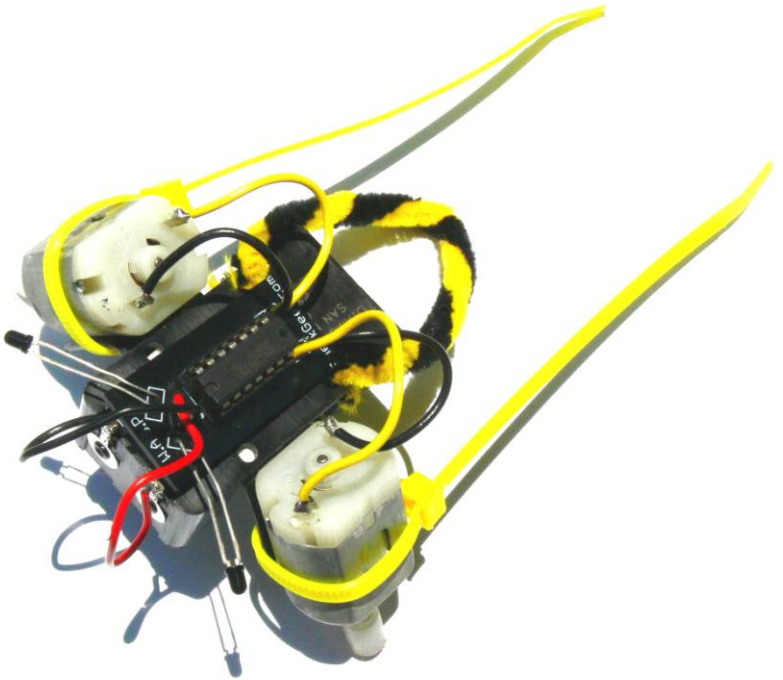


The

W.A.S.P.

Original



Sheek **GEEK**.com

Warning: CHOKING HAZARD -Small Parts. Not for Children Under 9 yrs.

Kit Recommended for Ages 12 and up.

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Welcome to the world of robotics! We hope that this kit sparks your interests and helps you further your knowledge of robots.

DISCLAIMER OF LIABILITY

SheekGeek is not responsible for any damages. By purchasing or building this kit, you waive all rights to any compensation due to any damages to person and/or property. SheekGeek is not responsible for any special, incidental or consequential damages resulting from any breach of warranty, or under any legal theory, including lost profits, downtime, goodwill, damage to or replacement of equipment or property, and any cost or recovering of any material or goods associated with the assembly or use of this product. Please observe all safety precautions when building this kit. SheekGeek reserves the right to make substitutions and changes to this product without prior notice.

GETTING STARTED

Check to make sure you have all of your pieces. Your parts list is as follows.

- 1 74HCT14 Chip



- 1 14 Pin DIP Socket



- 2 Phototransistors



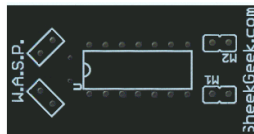
- 2 Hobby Motors



- 1 9 Volt Battery Pack




- 1 Printed Circuit Board (PCB)



- 1 3" Plastic Mounting Bracket



- 2 Pieces of 2 sided tape

- 
- 2 Zip Ties
 - 2 3" Pieces of 24 Gauge Yellow Wire
 - 2 3" Pieces of 24 Gauge Black Wire
 - 1 3" Piece of 24 Gauge Black Wire
 - 1 3" Piece of 24 Gauge Red Wire



- 2 12" chenille stems (Pipe cleaners)
- 2 Pieces of Glue Stick "Feet"

Note that the RED wire and one of the BLACK wires are smaller than the others. These wires are only for the power connections on the robot because the larger wire will not fit in the provided holes.

Got it all? I know you do, I packed it myself. However, if you are missing something, please contact us online. Go to the homepage (www.sheekgeek.com) and click "Support." Or contact us at support@sheekgeek.com.

Other things that you may need:

1. Soldering Iron and solder
2. Pliers
3. Lighter
4. Wire strippers

SOLDERING

(Written by a girl!)

Soldering is an important skill for anyone interested in and/or who may potentially work in electronics. It may look and sound intimidating, but soldering is an easy skill for anyone to master. All it takes is a little practice and correct caution. **WARNING!** A soldering iron can and will become very hot while in use. Be sure not to touch the iron. Also, do not breathe the fumes while soldering. Most solder contains lead, which is a hazardous material. Make sure you solder in a well-ventilated area. Always wash your hands after handling solder.

What is Soldering?

Soldering is a method of using a material with a low melting point to fuse materials together. This process requires the application of heat, which is provided by a soldering iron, and the use of solder. For making a robot, a soldering iron that is around 20-30 watts is sufficient. A soldering iron over 35 watts will "fry" your components and will result in a broken robot. Most craft or electronics stores carry soldering irons for 5 dollars or less. You can even find soldering irons at dollar stores; however, you may want to find a soldering iron that comes with extra tips. It is much easier to solder with a *pointed* tip. Keep in mind that the solder you use should be electronics solder, NOT plumber's solder.

How to Solder (The fun stuff!)

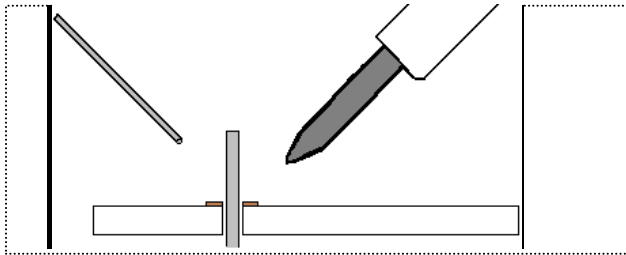
If you have never soldered before, or need to brush up on your skills, it is best that you first practice soldering on spare parts. You should not begin on

your kit until you have perfected your soldering skills. Now, the correct way to solder is:

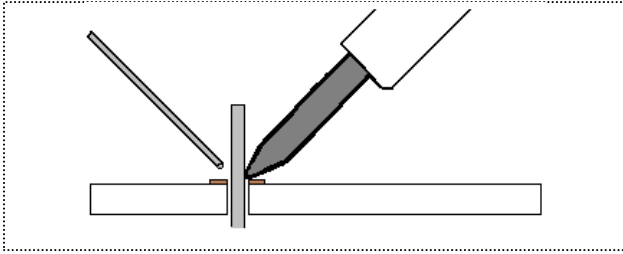
1. Allow your soldering iron to heat up. Generally, after you plug in the soldering iron, it will take about 5 minutes for it to warm up. If this is the first time you are using your soldering iron -or have just put a new tip on- it is important that you "tin" the tip. Tinning is the process of heating up the iron and applying a thin coat of solder to the tip. This helps to achieve maximum heat transfer to the item you are trying to solder.

2. As I mentioned before, if this is your first time soldering; practice, practice, practice! Once the iron is hot, and tinned, you should practice soldering on a scrap board with scrap parts.

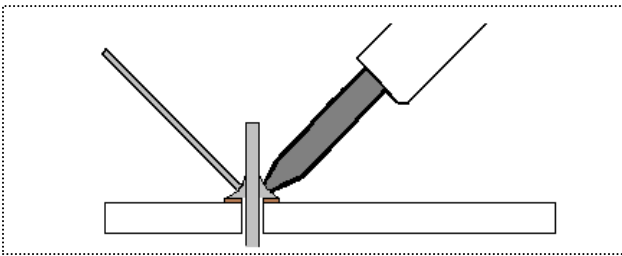
3. Place the leads of the piece you want to solder through the holes in the board where that piece goes.



4. Make sure you place the piece you want to solder so that only the leads stick out on the side of the board with the solder traces and pads.



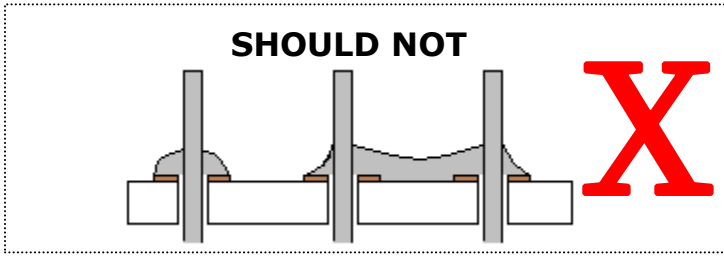
5. Then APPLY THE IRON TO THE LEAD AND PAD you want to solder, and apply solder to that lead where it is closest to the pad on the board.



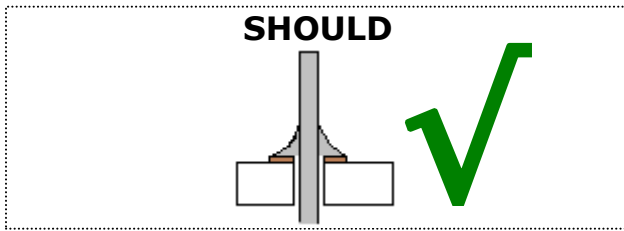
Try not to heat the lead for more than 3 seconds. This will ensure that you do not “fry” any of the pieces.

6. Make sure not to apply too much solder to the iron or connection. Too much solder equals a big mess.

Here are some examples of what the finished connection should and should not look like:



In the picture above the first soldered connection contains too much solder. This is indicated by the semi-circular, rounded appearance. The next two soldered connections are joined together or "bridged" by the solder. This is bad because the bridge is connecting parts of the circuit that does not need to be connected. This will result in a non-working robot.



The above picture is how your soldering junctions should look. With a little practice, and the help of this manual, your soldering junctions should look like this in no time.

HOW THE W.A.S.P. WORKS

Now, time to learn about how your robot works. It's not much, just a little introduction to what you are building and how it works. Do not build anything yet, if you do, it won't work, (and that's not just a trick, it really won't work.) I am going to go through and explain how this robot works for you, piece by piece.



This symbol stands for the positive side of the battery. It is also known as "logic high," "Vcc," and "1."



This symbol stands for the negative side of the battery. It is also known as "logic low," "ground," and "0."

This is the schematic symbol for a phototransistor.



These will be the eyes of our robot. They work like switches that only turn on when light hits them. They will see which side of the robot more light is coming from, and tell the other brains of the robot where to go.

This is the schematic symbol for an inverter.

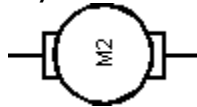


These are found in our chip. An inverter does just what the name says; it inverts the input. The input is on the base of the triangle in the symbol, and the

output is just after the little circle shape on the other side. This works with logic inputs. Logic inputs are "high" (which means the positive side of the battery, which is shown as "1",) and "low" (which means the negative side of the battery, shown as "0.") If the input to an inverter is a logic high (1) then the output is a logic low (0.) If the input is a logic low (0) then the output is a logic high (1.) These values are easier to see in a truth table.

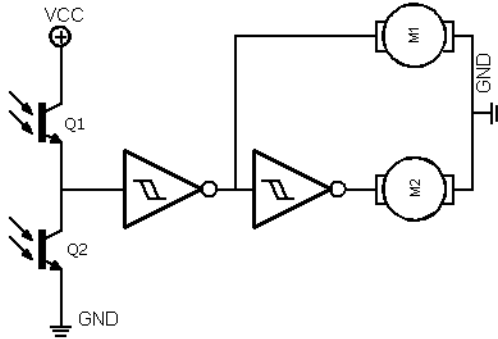
Input	Output
0	1
1	0

This is the schematic symbol for a motor.



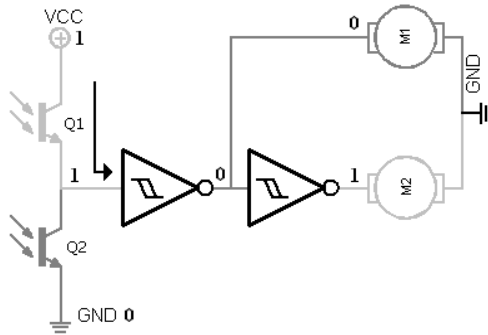
Most people know how a motor works on a basic level; a motor spins. A more scientific way of saying that is "a motor turns electrical energy into kinetic energy." Inside a motor, there is a coil (a long wire wrapped up) and some permanent magnets. When electrical current flows through a wire, it creates an electromagnetic field. The electromagnetic field of the wire pushes and pulls against the magnetic field of the magnets inside the motor, making the coil spin, creating kinetic energy from the original electrical energy. But enough of that; all you need to know about a motor for this project is that when you put the positive (+) on one lead and the negative (-) on the other, it spins.

This is the basic schematic of what you are building:



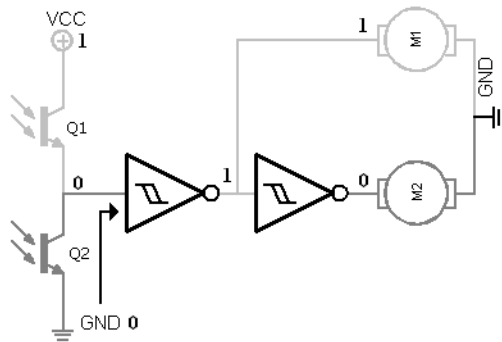
We connect the phototransistors (parts labeled "Q1" and "Q2") together in such a way that it creates a voltage divider, or "photobridge." A photobridge varies the output (the point in the center of the two phototransistors) depending on which photosensor gets the most light. If more light is on Q1, then the output of the photobridge will be logic High, and if Q2 gets more light, then the output of the photobridge will be logic Low. The output of the photobridge is connected to the input of the first inverter, which ultimately controls which motor does what.

Let's take a closer look at this:



In the picture on the bottom of the left page, the **LIGHT GREY** shows where there is a logic high, and the **DARK GREY** shows where there is a logic low. Remember, that to make the motor spin, you need a logic high on one side, and logic low on the other, so in this robot, only one motor will be on at a time. The arrow shows which phototransistor is currently getting more light. Q1 is getting more light than Q2; therefore, the input to the first inverter will be a logic high, or "1." This means that when Q1 is on, M2 is on. Technically this robot is not following light; it is running away from the dark because the motor on the side with the LEAST light on it turns on, rolling the robot away from the dark.

Now let's look at what happens when the opposite side gets more light.



A closer look here shows that when Q2 is on, M1 is on. This produces a robot that will follow light or, in other words, run away from the dark. It turns out that IF you actually want your robot to hide from light, you can switch which side either Q1 and Q2 or M1 and M2 are on. This will make the motor on the side with more light on it turn on, making the robot try to find a nice dark spot to hide in.

Okay, enough with the hard stuff, my brain hurts. Let's get to the fun part already, the build!

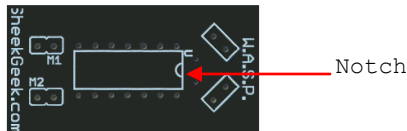
THE BUILD

It is easier if you have all the parts and equipment ready. Gather it together now.

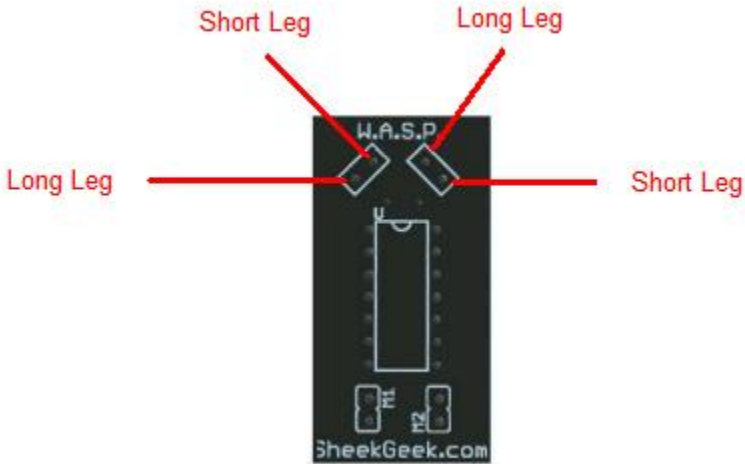
1. Strip two black pieces and two yellow pieces of wire. Place the motor so the vents are facing up and the shaft is pointed away from you. On the right lead of that motor, solder the yellow wire. (You can call this practice, but it is okay to kind of glob it on the motor leads.) Make sure it looks like the one below. Do the other motor exactly the same way.



2. Place the socket onto the board so that the leads go through the holes. Be sure that the notch on the socket lines up with the notch shape drawn on the board. Bend the first lead of the socket on the other side of the board at the top right corner, and the last lead on the bottom left corner. This will hold the socket in place while you solder.

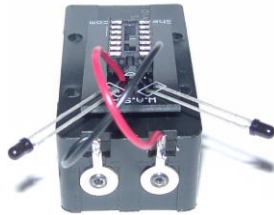


3. Solder the phototransistors onto the board. The phototransistors should be bent on the ends. One side should be longer than the other. With the bend pointing down, as in the picture below, the longer side should always be on the right. Simply place one of the phototransistors into the holes at the top of the board directly under the word "W.A.S.P." Solder them in place one at a time.



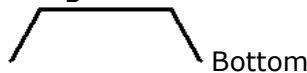
4. Solder the battery pack to the board. First, twist the ends of the wire to try to make them as thin and pointy as possible. This way the wire will fit easier into the holes in the board. Insert the red wire into the hole on the RIGHT side of the notch on the IC socket (the right side is closer to the "P" on "W.A.S.P."). Solder it in place and grab the black wire. Insert the black wire into the hole on the LEFT side of the IC socket (the side closer to the "W" on "W.A.S.P.") and solder it into place. With the open part of the battery pack facing down, and the PCB facing down, cross the wires and solder the RED wire

to the LEFT side of the battery pack, and the BLACK wire to the RIGHT side. If you don't get this right, the robot won't work. The power connections are not labeled on the circuit board, so read carefully. Again, the BLACK wire goes to the hole above the chip, next to the "U" (the left hole.) The RED wire goes on the other side (the right hole.) Do not attach the board to the battery pack with the tape yet. See the picture below for a reference on how to solder the power connections.



5. Take the two pieces of glue stick and put them on each of your motor's shafts. The easiest way to do this is to heat up a thumb tack with a lighter, and push it into the glue stick until the glue stick is melted in the middle, then put the motor shaft into the hole you just made. Refer to the picture on the cover to see how they should look when they are finished.

6. Make your mounting bracket for the motors. Take the 3" plastic piece and make sure that the ends are bent to 45 degree angles like in the picture below.



7. Attach the mounting bracket to the body using the two-sided tape. Make sure attach the bracket is

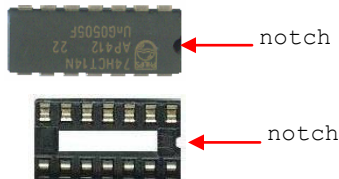
under the inside of the battery pack as far to the front as you can put it.

8. Attach the motors to the mounting bracket. Hold a motor on one side with the vents facing out, and the motor shaft pointing down below the bottom of the mount. Close the zip tie around the motor to hold it in place. Do the same with the other motor.

9. Solder the wires of the motors into the boards on the SAME SIDE as the motor is on. Make sure you don't cross any wires. The yellow wire should always be to the left of the black wire. This means that on each side, the yellow wire will be under the "M2" or "M1" writing on the circuit board.



9. Plug your 74HCT14 chip into the socket. Make sure you line up the notch in the chip with the notch on the socket. If the chip is in backwards it will get fried!

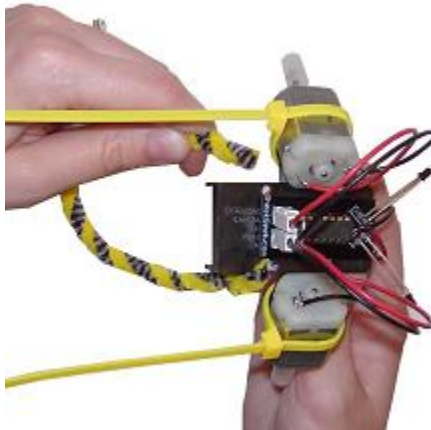


10. Attach the PC board to the battery pack with the other piece of 2 sided tape.

11. Take your two chenille stems (pipe cleaners) and cut them to about 7.5 inches. Next, twist them together.



Put each end into one of the holes on the back of the battery holder and bend it over to hold it in place. Adjust it so it looks like a triangle, and try to make it stop the battery from touching the ground when you set it on the table. Make sure it is not too high or it will fall forward.



12. Plug the battery all the way in. As soon as you connect the battery, only one of the motors should come on at a time. As you will find out, your robot works best in darker rooms and on a hard, flat surface. Grab a flashlight and play with your new creation for a while.

Congratulations, you have built a working robot! You should be very proud of yourself; we are! Show off your final product and spread the word about the exciting and challenging world of robotics.

TROUBLESHOOTING

If the motors do not come on, or if you have trouble, please read this section. If you are still having trouble, contact us online at support@sheekgeek.com.

Question: My robot doesn't respond to light; it just spins in a circle all the time.

Answer: This means that one of your phototransistors isn't connected all the way. Check the solder connections at the phototransistors and if they are bad. A little reheating of them with the soldering iron will usually fix the problem. If that did not help, one of your motor connections may be bad. Reheat them as well.

Question: Both of my motors are always on, and the robot only goes straight.

Answer: This means that both of your phototransistors are not connected. Go back and check to see if you soldered them in. If they are soldered in, please check to see if they have good connections. Again, reheating the solder joints may remedy the situation.

Question: My robot does not work after I finished building it.

Answer: Is your battery dead? If not, make sure you did every step in the manual. Check all solder connections; look for solder bridges and bad connections. Check the battery connections to the PCB, and that the battery is inserted the right way and plugged in all the way.

Another common problem would be that your chip isn't inserted correctly. This can be fixed by

taking the chip out of the socket and turning it so the notch on the chip lines up with the notch on the socket.

We bent the phototransistors so that they would work easily with the kit. However, there could be a chance that we bent one of them the wrong way. If nothing above works to fix it, take out only one of your phototransistors and bend the legs CAREFULLY the other way and solder it back into place. Don't bend them too much or too fast, or they will break off.

LAST RESORT. The chips we use in our kits are rated for about 2–6 volts. We are using a 9 volt battery in our kit, so there is a possibility of “frying” the chip. We have tested this thoroughly, and the risk is very low, but it is possible. If nothing you do fixes your kit, please contact us at support@sheekgeek.com and we will fix you right up.

