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Understanding electrical circuits and your robot

Are you wondering what is the safest and best way to build power circuits in your robot? With electricity a lot of people get amps (current) and voltage mixed up or think it's the same thing. It is all very confusing and kinda dangerous. Let's look into all this mysterious stuff.

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OK, here we go!

Disclaimer: Electricity could hurt or even kill you. You could even burn down your house. If you do any of this after reading my article below I am not responsible. If you have any doubts about handling electricity please ask a professional to help you.
With electricity a lot of people get amps (current) and voltage mixed up or think it's the same thing. Very simply put, amps are the electrons in electricity that actually make things happen. Voltage is the pressure behind the amps that push them along. Resistance is another component in an electric circuit that you need to be very aware of. Resistance is made up of the type and size of the material that the voltage is pushing the amps through to get to the device you're trying to make work. Some material is easier for the electrons to flow through. For example copper has less resistance than aluminum. With that in mind you would need to use a larger aluminum wire for the same amount of amperage to flow then you would if you used copper wire.
An ampere is the unit used to measure electric current. Current is a count of the number of electrons flowing through a circuit. Here's the fine print: "One amp is the amount of current produced by a force of one volt acting through the resistance of one ohm". Here's another way to say it: Your device will pull Amps from a power source like the power company through a wall outlet (AC power), a battery (DC power) or a switching power supply that will convert AC power to DC power. Your device sucks (pulls) the amps it needs. It doesn't care what is between itself and the power source. Something will heat up If your power supply and/or the wires or connectors in the circuit are not rated to provide the amount of load (amps) being demanded. This heat is the result of the electrons being sucked through a undersized part of your circuit. This is true all the way back through your house and out to the power generation plant that feed power to your neighborhood and your house.
Depending on how much load you pull through an underrated part of your power grid you could just get a little warmth or complete failure with smoke an/or fire.
You could also burn out a device you are trying to power by starving it because of one of the issues mentioned above. Another way to burn out your device is to supply too much or too little voltage. An exception to this are DC motors. You can run your voltage down to zero and a DC motor will only just slow down and stop. However it's still true that with DC devices you need to have a big enough pipeline (wiring, connections, power supply) to feed them the amps they demand. DC motors will also tolerate slightly higher voltage but be careful here.
So, you're thinking about using an extension cord to supply power to your robot? I read all the time on things I buy NOT to use an extension cord. I think it's just fine to use one as long as you keep in mind the things we discussed earlier in my ramblings above. Just make sure it's not too long and it's big enough to carry the load your robot will demand. Don't share the cord with other robots or power hungry devices like a microwave oven. Also you will find that your voltage will drop over very long runs of wire like an extension cord. A larger gauge wire in your extension cord will help here.
There is one other thing to be aware of. This is start up demand. When motors and other devices on your circuit first start up they usually draw more current then when they are just sitting or under normal use. This startup will make the voltage sag (lower) for a short time and starve the devices that are trying to draw the current they need. Always design your circuit (including your power converters) at least 25% larger than your total load (motors and devices).
How do you know what your total amp (load) needs are for your circuit? Simply study each device on your circuit and add up how many amps each one will draw. Pay close attention to motors. They should have a rating for normal load and peak load. Design your circuit around the total amps all your devices will draw under peak and startup load.
One other thing. It's a very very good idea to add fusing to your circuit. This will protect your power supply, motors and devices from shorts, failures and pulling too much current.

Size your fusing using the things we discussed above. Place your fuse between where you're getting the power from and your load.
I hope this was of some help to you or others that may be wondering about feeding power to their robots. Please be safe with electricity and have fun.