

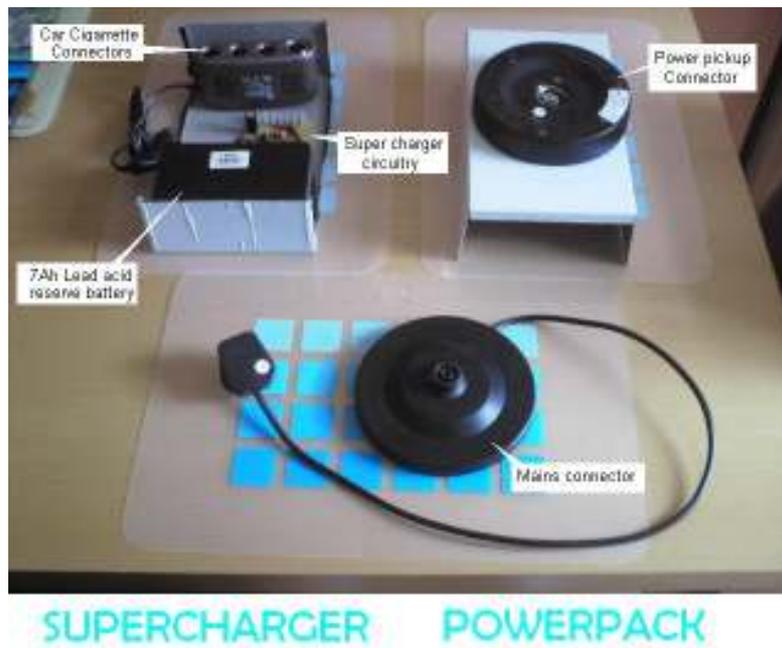
914 Charger Location by Beaconing and Odometry by c6jones720

This project represents the logical conclusion of all of my previous 914 power and charging experiments.

Before I get started I wish to thank both Frank Cheney and Chris Schur for the valuable information and ideas they made available about robot charging methods. Their help has allowed this project to move forward at a greatly accelerated pace.

Charging

I had already built a regulated battery charger for my robot which I called the 'Supercharger Powerpack'. Originally this charger was bolted onto the back of my robot and charging was achieved by applying mains 240v into it. To accomplish this safely and easily I used the quick release connector from the base of a kettle.



Now this method worked perfectly fine for charging the robot but after experimentation I saw quite quickly that it was not suitable for use in autonomous charging because of the precision required for docking. It was too difficult to align the connectors of the robot and the charger up automatically because they both used concentric rings.

To accomplish this task properly the robot would require very precise and accurate information on exactly where to go to dock. If the charger moved or the robot was misaligned then it would just crash into the wall (I've got a nice big chunk of plaster missing from my wall to prove it!)

I was relying on software odometry to ascertain where in 3dimensional space where my robot was.

Improving the docking

In his document on charging methods <http://www.schursastrophotography.com/robotics/dockinglogic.html> Chris Schur makes a point about charger bays that feature electrical contacts which are separated vertically. This simple concept is absolutely key to autonomous docking. Vertical contacts completely remove the need for high precision and have been used successfully in the past on robots such as the Hero 2000.

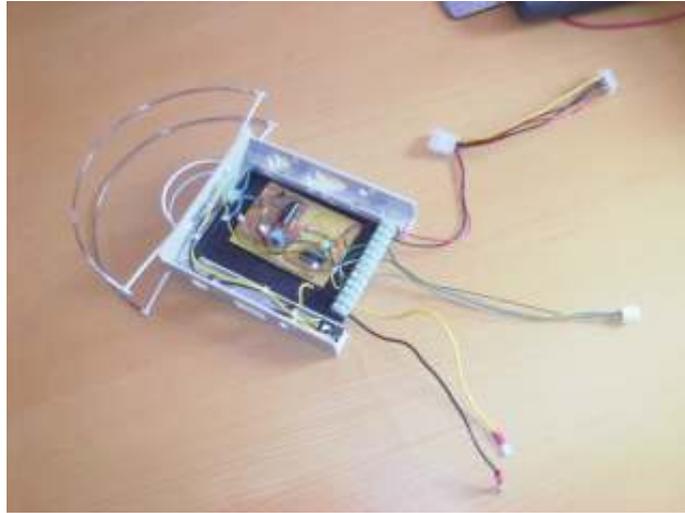
The first thing I did when I thought about it was remove and rebuild the supercharger. The power comes from two mild steel plates that a robot can touch. It's safe because it's all fused and earthed and the plate voltage never goes above 18v DC (max). The supercharger is now a separate stand alone unit that the robot can drive right into:



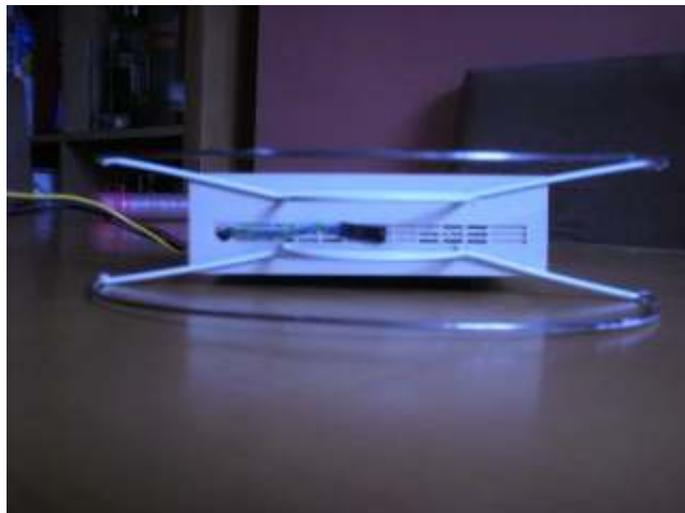
The charger unit features three infrared LEDs which each output a different signal. These signals correspond to a different angle. The LEDs are displaced by 45 degrees. When the robot sees one of these beams it will know what angle it is relative to the charger.

How does the robot get power from the new supercharger though?

I designed a special computer drive bay that interfaces to both the charger and robot computer. Remember, a 914 is a lot more than just a computer on wheels.



This drive bay is wired into the robot battery electrical system and features some electronics to measure the relevant voltages and also detect when the robot has docked with the charger. The front features a pair of curved electrodes that are displaced vertically. The curve means that the robot can dock with the charger from a very wide range of angles.



You might recall earlier that I talked of difficulties using odometry to get a robot to dock with the charger?. An alternative docking method is to use infrared beaconing. The front of the charge bay has an infrared sensor to detect direction signals transmitted by the charger.

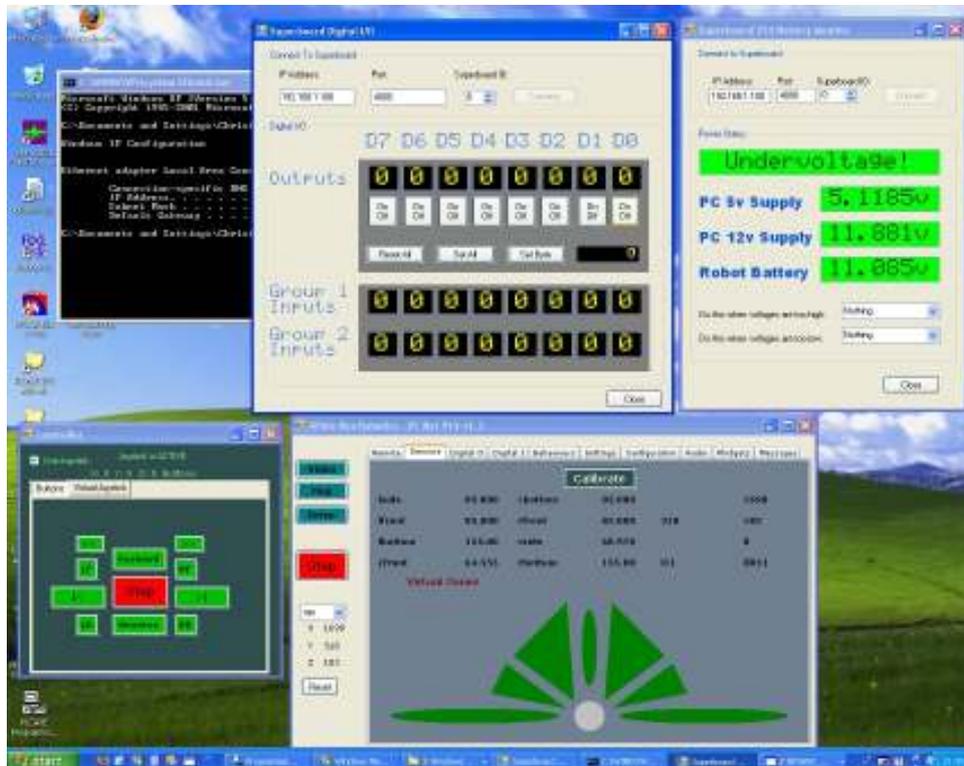
The power drive communicates information to the computer allowing the robot to know whether it has docked with the charger or if not where the charger is.

As long as there is a line of sight path to the charger the robot is perfectly capable of following the path to the charger. If the line of sight path is broken then the robot can search for the charger by using a wandering algorithm. If this fails then odometry can be used instead.

Software

I have successfully used a combination of Brian and my own telemetry and monitoring software to dock a robot with a charger under program control. You can see a video of this happening on YouTube:

<http://uk.youtube.com/watch?v=F7EdHpGK2xl>



Robot Docked and charging