Modifying the iRobot Home Base charger

February 8, 2011

WARNING

This document is provided for informational purposes only. Performing this modification is **NOT RECOMMENDED**. Any use of the information in this document is **ENTIRELY AT YOUR OWN RISK**. The modifications described in this document are very crude and potentially unsafe and may pose a risk of electrocution and/or electrical fire. There are many significant dangers when working with household power. **DO NOT ATTEMPT** any handling of high power electricity unless you are fully aware, understand, and accept the risks involved and have appropriate supervision.

Why modify the charging base?

Self-docking and charging is great. That means the robot can be remote operated without any human intervention on the other side. However, the stock charging system will only charge the robot and not any additional electronic devices like a netbook. As mentioned above, this modifications described in this document are extremely crude and arguably quite unsafe and are provided for informational purposes only. **If you do not feel comfortable handling and exposing others to high power electrical wiring, do not attempt to modify your charging base and stop reading this document now.**

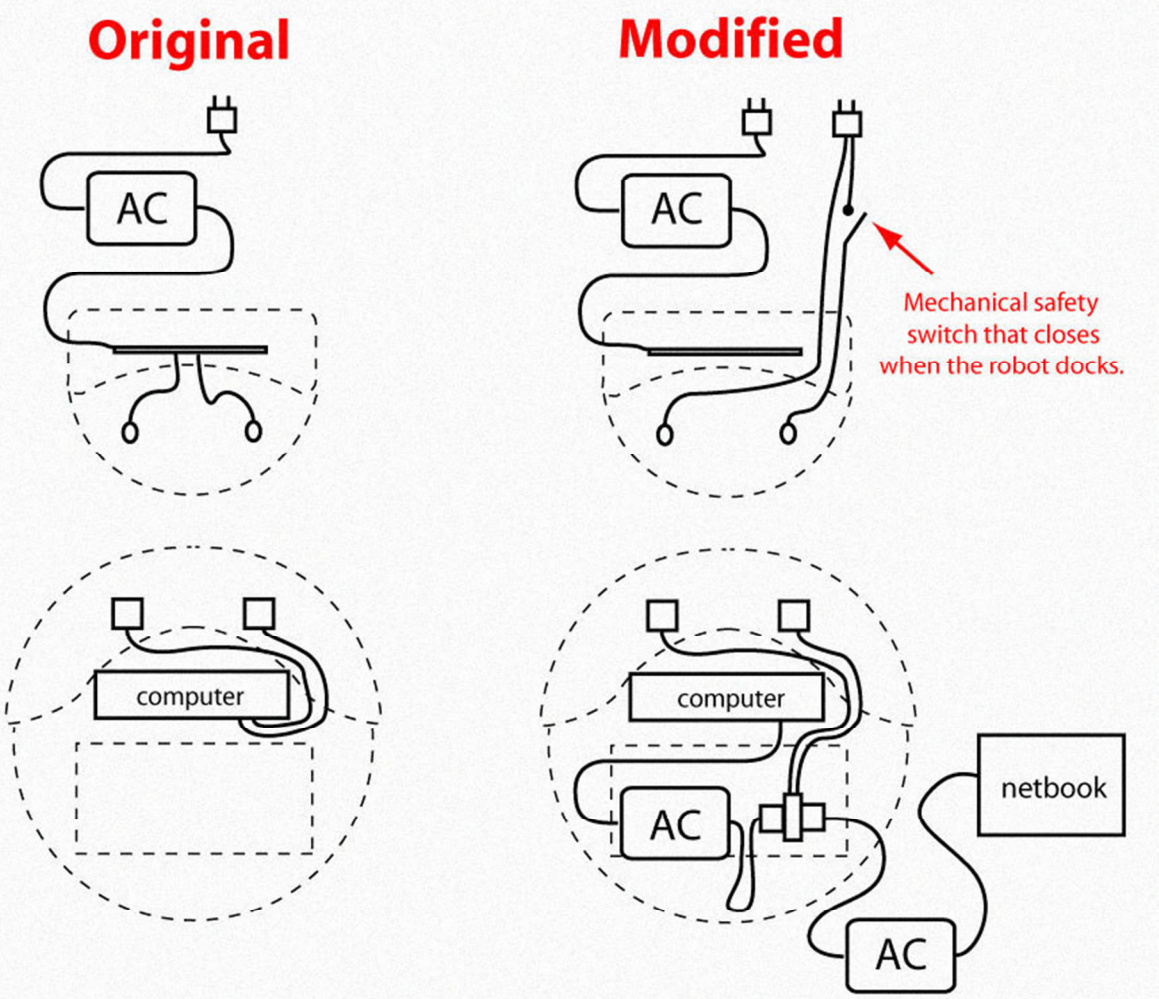
How the Home Base Charger charges the iRobot Create

There are two exposed metal contacts on the docking station that match corresponding metal contact on the bottom of the Create. When idle, the voltage across these contacts is a nice low voltage of 5v. When the robot docks, it detects the presence of the robot, and the voltage jumps up to 18v and pushes out more than an 1A of current. This voltage is can be tapped to charged other devices, but as part of the communication with the robot there is a periodic drop in the charging voltage to 0v for several milliseconds. This makes it non-trivial to charge other devices without making some kind of miniature UPS in addition to a DC-to-DC conversion.

The easiest (though definitely not the safest way) to allow any device to be charged by the docking station is to somehow get 120v AC to the cargo bay of the robot. The only way to do this, without significant modification to both the robot and the base station, is by using the two metal charging contacts. This is a much higher voltage and much higher potential current than these contacts were originally designed for and thus there are many obvious safety issues with doing this. As I mentioned, I accept no responsibility for anything resulting from attempts at recreating this.

Wiring Diagram of the Charging Systems

Below is a high level diagram of the electrical components of the charging system. The modifications are very warranty voiding. On the left is the original system. On the right is the modified version.



You can see that in the modified version household power is wired directly the charging contacts of the base station through a safety switch. Wiring this without an appropriate safety switch is **VERY DANGEROUS AND IS NOT RECOMMENDED** since it will leave exposed 120V AC contacts that if accidentally bridged could cause a fire or severe electric shock. The AC adapter attached to the base station is still required to power the logic board which will light the homing light/beacon so the robot can still locate the dock.

Modifying the iRobot Create requires opening it up. Describing this process is not in scope of this document, but you can find several tutorials by searching for “How to disassemble a Roomba”.

On the robot, the charging pads no longer go directly to the onboard computer, but to an extension cord socket, where another iRobot Create AC power supply is plugged in that then powers the onboard computer. Any other device that has an AC adapter plugged into the docking bay extension cable will also receive power when docked.

This charges the robot battery and does properly signal to the robot that it has successfully docked. But, there is a small delay on the output voltage of the AC adapter. So, the robot may begin to back out of the docking station in an attempt to try docking again before the logic for a successful dock has been triggered. Similarly, it may be a little bit finicky about detecting a successful dock and try multiple times.

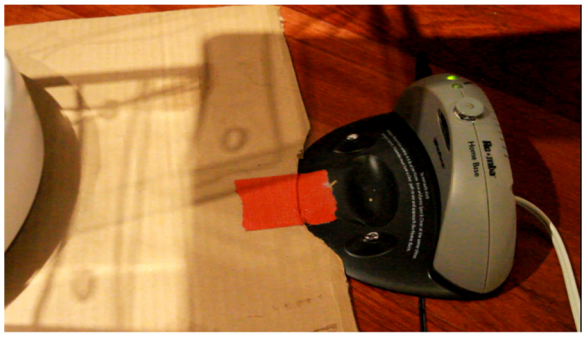
If the robot docks but then backs away a couple inches and then stops, and then plays the docking melody, the robot has gone idle thinking it is properly docked. Using the "Push Forward" button, in the iRobot Create Control program provided, will aggressively drive the robot forward until the bumpers are hit. This will ensure a proper docking. It is generally a good press the "Push Forward" button after trying to dock. If it is already docked, nothing will happen which is an indicator that indeed it is charging. If it isn't properly docked you will hear a different melody play and then it will lurch forward. You should then hear the charging melody play again. If you and pressing the "Push Forward" button yet again, nothing should happen which is a good sign. Otherwise, you are off the mark and you should manually move away from the docking station to give it some space and try to auto-dock again.

Docking: Do it backwards!

The software is written expecting that your netbook camera is facing toward the BACK of the iRobot Create. The reason for this is so that when you connect to the robot over the network, your camera is facing toward the open room and you can undock simply by driving forward. This means the Create must face the wall/corner assuming that's where you've put your charging station. Since the docking process is auto-pilot, it's fine to let it shimmy in to the dock backwards. You likely can't see the floor anyway, so you are blind either way. Just drive toward the general area of the dock, do a 180 turn so you are facing away from the dock and then press the "Dock" button in the control software.

Other modifications: Cardboard ramp/wedge

Because of the additional weight of the stand, AC adapters, and the netbook, my robot had difficulty lifting its front wheel enough to get into the wheel well of the charger. This is partly due to the slow speed that it uses for docking. To help reduce the size of the bump, I used some pieces of cardboard to make a very minimal ramp/wedge (just the thickness of the cardboard itself was sufficient) and that was enough to help it dock easily even at low speeds.



Remote Troubleshooting: Remote Desktop

Sometimes the netbook just gets into a bad state, or something crashed. The best way to easily solve this problem remotely is use remote desktop software. I personally like Team Viewer and they have a free version for non-commercial use.