Care and Handling of Swarm Robots
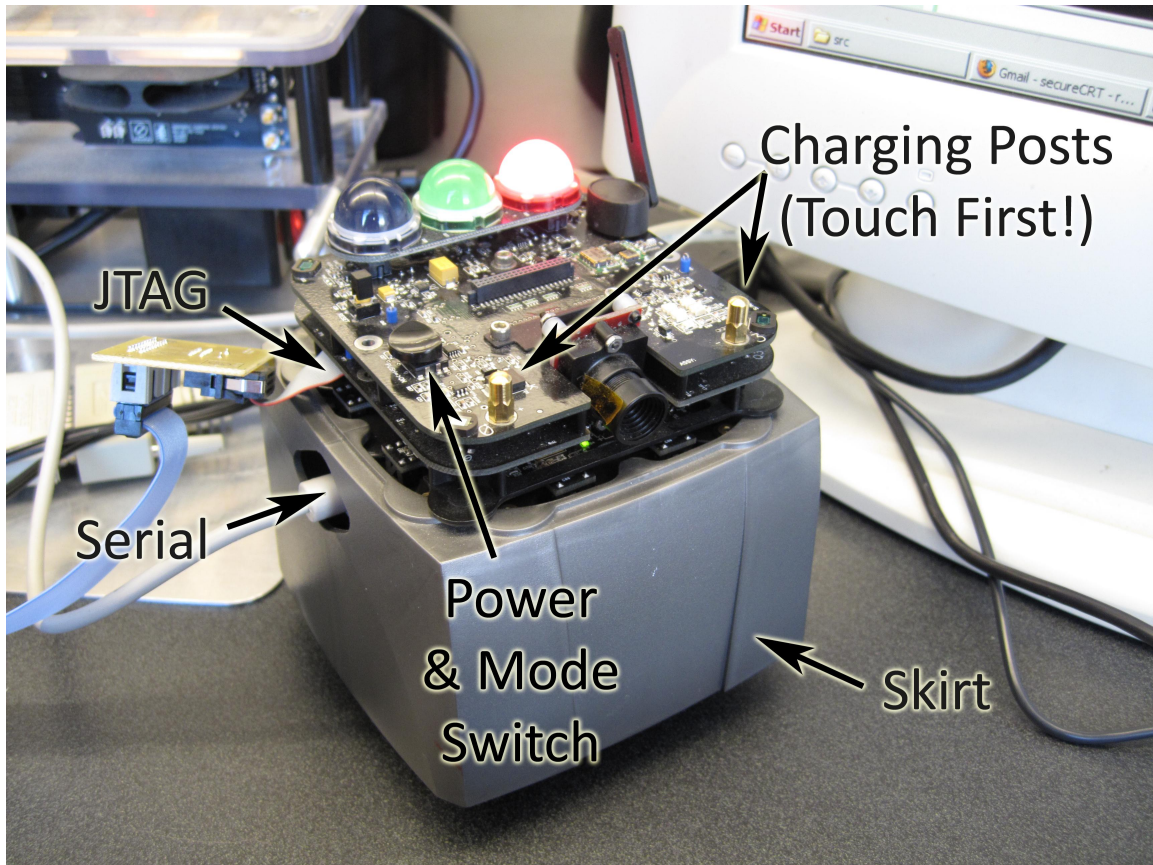

Figure 1: Swarm Robot Labeled Diagram

1 Safe Handling

Before handling any Swarm Robot, *always* touch the charging posts first. This is a safe way to discharge any charge difference built up between yourself and the robot, and thus avoid destroying any of the robot's components.

When moving the robot, grasp it only by its skirt. This part of the robot is designed to interact with the outside world, so it is very robust. The robot's internal structure will move within the skirt – this is normal and well within the tolerances of what the robot can handle.

If you ever have a swarm robot on a desk or any other surface above the lowest point in the room (normally the floor), make sure the robot is on a rubber "Swarm Anesthetizer" pad. The swarm robots like nothing more than finding a way to fall off desks and other high points to relieve themselves of potential energy as quickly as possible.

2   Programming and Debugging

There are three programming tasks that you will encounter this quarter: Updating the Swarm Operating System (SwarmOS), downloading a new Swarm App that you write to flash memory, and debugging your Swarm App in RAM. The first two tasks can be accomplished over the serial port, described next.

The swarm robots can be programed, accept runtime commands, and provide feedback via a serial port. When connecting the serial cable, closely look at both the serial cable connector and the serial port on the robot to ensure that you have the connector lined up correctly with the port before pressing the connector into the port. When removing, it is effective to grasp the connector and use *gentle* circular motions while drawing the connector out.

To communicate with the robots, connect to the proper serial port (usually com1) at 115200 baud, 8/N/1 with Xon/Xoff handshaking. The lab computers in room 003d have installed on them a program that is already set up called SecureCRT that we suggest you use.

To update the SwarmOS or Download a new Swarm App into flash memory:

1. Start SecureCRT, connect to proper com port, and plug serial cable into robot
2. Turn robot on and verify connection
3. Send command "ds" (**d**ownload **s**warmos) or "da" **d**ownload **a**pplication) followed by enter
4. From the menu, select Transfer → Send XModem...
5. Within 20 seconds, navigate to wherever your build directory is located (for an app) or to (SVN directory)\SwarmBotAPI\SwarmOS\bin\robots(externalRAM)\
6. Select "swarmOSRAM.bin" or the ".bin" file with the name of your project (ie, lab1.bin)
7. Click "Send" and then wait for the update to complete

While some programming tasks can be accomplished over the serial port, the JTAG interface makes programming quick and easy and it is the only way to do interactive debugging. To connect the JTAG cable, locate the JTAG port and verify the correct orientation and alignment of the connector to the JTAG port before connecting the cable. Remove the cable gently – the connectors and custom-built and difficult to replace!

To use the interactive debugger, verify that that the file SwarmAppRam.rc is in the bin\Ram sub-directory of your project directory. This is a simple script file that makes debugging easier. Next, start the MULTI tool with your project file (ex, double click on lab1.gpj). Compile the Debug-RAM sub-project, then click the "Debug" button (or press "F5"). Next, change settings on the pop-up dialog if necessary (usually not necessary) and click "Connect". Next you "Reload" the debugger, and interactive debugging will be active. You can set breakpoints, view the contents of variables, step through code, and so forth. Interactive debugging is the best way to quickly discover root causes of errors in your code, and we highly suggest that you become proficient at effectively using the interactive debugger to step through your code and identify errors.

3   Power and Feeding

The Swarm robots have two power buttons: a "hard power" switch that physically disconnects the batteries from the hardware, and a "soft power" button that signals the robot to turn on. The hard power switch is a button that clicks when pressed located on the opposite side of the serial port. The soft power button is the four-way rocker switch located on the top of the robot indicated. When powered down, depressing the button briefly powers the robot up. Depressing the button for a longer period causes the robot to soft power down when it is powered up. The switch can also be used to change the robot's operating mode (which may change the robot's behavior, dependent on the installed Swarm App), by rocking the switch up and down (where up on the button is towards the hard power button side, or left side, of the robot). The switch also rocks left and right, corresponding to towards the back and front of the robot, respectively.

The Swarm robots are over 7000 years old (in robot years), which means they are old and get cranky (by not working) when they are not provided food (power) on a regular basis. The Swarm robots charge themselves in a three-bay charging station. When left powered on in a charging station, the SwarmOS will automatically charge the robot when the battery level drops below a hard-coded level. When the charge is complete, the robots will turn themselves off (soft power down).