



Rummage through a Roomba

The Roomba from iRobot (www.irobot.com) is an autonomous vacuuming robot for use in consumers' homes. The unit is a circular robot that measures less than 14 in. in diameter and less than 3 in. in height. The Roomba can clean hardwood floors and carpets, get dirt from under furniture, avoid stairs, and return to its docking station to recharge its battery. To date, iRobot has sold more than 2 million of the robots worldwide. The Roomba relies on iRobot's Aware Robot Intelligence System, which manages the robot's sensors and can adjust the control systems as many as 67 times per second.

Four IR cliff sensors reside around the front bottom of the unit. If the robot cannot detect a bounce back of the IR signal, it assumes it is on a cliff or stair edge and changes its behavior to avoid falling off. Inside the unit are two IR sensors working with two paddles, each containing a window, to detect when the robot has collided with something. The position of the sensors and the mechanical orientation of the robot frame does not detect collisions or cliffs if the unit is moving backward. Therefore, the proper behavior to moving backward is to rotate the robot and then move it forward.

The 14.4V nickel-metal-hydrate-battery pack is the largest and heaviest single component in the robot. The user can charge the battery directly through the battery-charger socket or through the contact points with the home base station.

The Roomba contains four motors. A separate motor drives each of the large side wheels. No motor drives the front caster wheel, as it provides only stability and not any locomotive force to the robot. A smaller motor drives the two counter-rotating brushes to capture large debris. The smallest motor spins the edge-cleaning side brush, which pushes dirt on wall and furniture edges into the cleaning path of the robot.

iRobot offers a Command Module (not shown) that uses an 8-bit, 20-MHz (Atmel ATmega 168) microcontroller to expand how third-party developers can interact with the unit's onboard microcontroller, motors, lights, sounds, and sensor readings with software written in C or C++.

On the topside of the unit is the IR virtual wall sensor, which allows the user to set up virtual walls with IR transmitters that the kit includes. The virtual wall sensor can also receive signals from the home base station and the handheld remote-control unit (not shown). On the side of the unit is an IR wall sensor, so that the robot can adjust its behavior to clean along walls and furniture. An accessible serial-port interface allows home developers to program the unit for other uses.

