

Index

Note to the Reader: Throughout this index **boldfaced** page numbers indicate primary discussions of a topic. *Italicized* page numbers indicate illustrations.

A

AARON art, 168
accuracy of distance and angle measurements, 125, 125
acid flux solder, 385
actionPerformed method, 143
actions
 driving. *See* driving actions
 translating MIDI notes into, **163–164**
ActionScript language, 134
active components, 409
Adams, Bryan, 367–368
Adams, Ricci, 154
addEventListener method, 118
addKeyListener method, 105
addresses. *See* IP addresses
alarm clock, **200–202**
Altium software, 405
ampere-hours, 14
analog sensors, **190**
analogWrite method, 291
AND operator
 in bit operations, 31
 for sensor data, 120
Angle, Colin, 4
ANGLE command, 190
angle sensors
 as mouse pointers, 191
 packets for, 424
angles
 computing, 37
 measuring, **124–125**, 125
 for mouse simulation, 190
 rotating, **101–102**
angular speed, 101
annulus, 90, 91
antennae for theremins, 194
anti-static bags, 402, 402
anti-static foam, 402
applications
 RoombaFX framework for, **372–373**, 373–374
 SCI tester, **373–374**
Arduino microcontrollers, **276–277**
 for bump turns, **288–290**
 coding and running modes in, **286–288**, 287
 environment for, **279–281**, 280
 hooking up to Roomba, **282**
 for mobile mood light, **290–294**, 291–292
 overview, **277–279**, 278

 prototyping shield for, **284–286**, 285–286, 293
 starting, **281–282**, 282
arp command, 219
art, **167**
 brushes for, **170–174**
 canvas for, **174–175**, 175–176
 parts and tools for, **168–169**, 169
 by robots, **168**
 spirals. *See* spirals
 testing modifications for, **176–177**, 177
at method, **98–100**
ATMega8 microcontroller
 in projects, 278, 279
 in schematic diagrams, 412, 412
 serial ports in, 287
auto-refreshing webcam images, 342–343, 343
autonomous operations, sensors for, **122–123**
autonomous Roombas, **365–366**
 Erdos, **370**
 Gumstix boards, **367–368**, 367–368
 iPaq PDAs, **368–369**, 369
 Mind Control, **366**, 366–367
available power, 14
AVR Butterfly board, 282
AVR-Libc library, 281
AVRLib library, 281
AWARE robotic intelligence, 10

B

bad solder joints, **393**, 393
Banzi, Massimo, 279
Barragan, Hernando, 279
BASIC language interpreter, 261
Basic Printing Profile (BPP), 68
Basic Stamp microcontrollers, **261**
 Basic Stamp 2, **262–263**
 for bump turns, **268–272**
 environment for, **264–265**, 264–266
 hooking up to Roomba, **266–268**, 267
 for robot roach, **273–275**, 273–274
 in schematic diagrams, 412, 412
batteries and battery packs, **14**
 Basic Stamp 2, 262, 266
 in schematic diagrams, 411, 411
 SitePlayer Telnet, 221
 upgrading, **376–378**, 377
 vision systems, 358–359
 WL-HDD device, **325–328**, 326–328
 WRTSL54GS, **337**, 337–338
 XPort, 221
battery charge value, 38
battery current value, 38
BAUD command and baud rates
 Arduino, 288
 Basic Stamp 2, 268
 Bluetooth interface, 82
 opcodes and data bytes for, 27
 overview, 29
 specification for, 419
 WiMicro, **245**
beepers, piezo, **151–153**, 152
behavior-based robotics architecture, 4
belkin_sa driver, 317
bin release, 307
bits
 for LEDs, 32
 for sensors, **120**
 setting and clearing, **31**
blu2i module, 71
BlueSMiRF boards, 66. *See also* Bluetooth interface
Bluetooth interface, **65–66**, 66
 benefits, **66**
 building, **71–76**, 72–77
 cable for, **72**, 74–75, 75
 circuit for, **70–71**
 configuring, **82–83**
 connection tests for, **75–76**, 76
 enclosures for, 76, 77
 for Erdos, 370
 operation of, **67**
 pairing with, **78–80**, 79–80
 parts and tools for, **68–69**, 69, 72–73, 73
 power classes for, **67**
 profiles for, **68**
 soldering for, **73–75**, 74–75
 testing, **83**
 virtual serial ports for, **80**, 81
 voltage checks for, 74
 working with, **83**
Bluetooth Setup Assistant, **78–80**, 79–80
Board of Education, 263, 263
 for robot roach, 273, 274
 setup for, 265, 266
 wiring, 267, 267
Bonjour networking, 214
boot_wait bootloader, 299, 305
bootloaders
 for Arduino, 281
 for single board computers, 299
BPP (Basic Printing Profile), 68
braid, desoldering, 394, 394–395
brain replacement, **257**
 Arduino for. *See* Arduino microcontrollers
 Basic Stamp for. *See* Basic Stamp microcontrollers
 microcontrollers vs. microprocessors in, **257–258**, 259
 parts and tools for, **258–260**
 solderless breadboards for, **260–261**, 260
 in vision systems, **334–346**
breadboards, **260–261**, 260
bricking routers, 299
Brooks, Rodney, 4

- brushes
 - attaching, **171–174**, *171–174*
 - types of, **170**
 - bump sensors
 - for mouse simulation, **191**
 - operation, **15**
 - optical interrupters, **112**, *112*
 - bump turns
 - Arduino for, **288–290**
 - Basic Stamp for, **268–272**
 - bumpLeft method, **120**
 - bumpRight method, **120**
 - bumps wheeldrops sensor packets, **423**
 - BumpTurn.bs2 program, **270–272**, *275*
 - BumpTurn.Java program, **122–123**
 - BusyBox program, **302**
 - button sensors
 - micro-switches for, **113**, *114*
 - packets for, **424**
 - buttons
 - commands for, **36–37**, *36–37*
 - MyGUI for, **142–144**, *144*
 - in schematic diagrams, **411**, *411*
 - on WRTSL54GS, **363**
 - bytes
 - bits in, **31**
 - for ROI commands, **27–28**
 - for sensor data, **121**
- C**
- C language and libraries
 - for Linux, **303**
 - for vision systems, **346–351**
 - cables, **21–23**, *21*, *23*
 - Bluetooth interface, **72**, *74–75*, *75*
 - drive motor unit, **89**, *90*
 - serial interface tether, **42–43**, *49–50*, *51*, *54*, *55*
 - SitePlayer Telnet adapter, **211–213**, *213*
 - vision systems, **353–357**, *354–357*
 - calculators, graphing, **182**
 - cameras in vision systems, **333**, **339–340**, *340*
 - drivers for, **341**
 - power consumption by, **359**
 - for taking pictures, **341–342**
 - for viewing pictures, **342–343**, *343*
 - canvases, laying out, **174–175**, *175–176*
 - capacitive touch sensors, **16**
 - capacitors
 - for MAX232 transceivers, **48**
 - in schematic diagrams, **410**, *410*
 - voltage ratings for, **46**
 - in voltage regulators, **45**
 - capacity sensor packets, **424**
 - Capizzi, Craig, **376**
 - carpets, current variations from, **14**
 - carrier-sense multiple access with collision avoidance (CSMA/CA)
 - technique, **233**
 - carrier-sense multiple access with collision detection (CSMA/CD)
 - technique, **232**
 - cell phone sync cable hack, **42–43**
 - CF (Compact Flash) board, **298**
 - CGI (Common Gateway Interface), **351**, *352*
 - chalk, **170**, *175*
 - channelLoop method, **198–199**
 - charge sensor packets, **424**
 - charging state sensor packets, **424**
 - circles, unit, **180**, *180*
 - Circuit Cellar magazine, **258**
 - clamps for attaching brushes, **171–174**, *172–174*
 - classes for Bluetooth power, **67**
 - Clean bit, **32**
 - Clean button for mouse simulation, **191**
 - CLEAN command
 - modes for, **26**
 - opcodes and data bytes for, **28**
 - overview, **29**
 - sending, **98**
 - specification for, **420**
 - cleaning motors, **30**
 - clearing bits, **31**
 - cliff front left sensor packets, **423**
 - cliff front right sensor packets, **423**
 - cliff left sensor packets, **423**
 - cliff right sensor packets, **423**
 - cliff sensors
 - for line-following Roombas, **375**
 - optical object detectors, **113**, *113*
 - for pitch control, **198–199**
 - for theremin simulation, **195**, *195*
 - wheel-drop, **16**
 - cliffFrontLeft method, **120**
 - clock, alarm, **200–202**
 - Cobox Micro, **222**, *236*
 - cockroach, robot, **273–275**, *273–274*
 - code stick programmers, **366**, *366–367*
 - code structure, **84**
 - coding mode in Arduino, **286–288**, *287*
 - Cohen, Harold, **168**
 - coils in schematic diagrams, **411**, *411*
 - cold solder joints, **391**, *391*
 - collision avoidance, **232–233**
 - color of Power LEDs, **32**
 - command center for vision systems, **360–362**, *361*
 - command line
 - for driving actions, **97**
 - for OpenWrt, **324–325**
 - commands
 - in ROI specification, **419–422**, *425*
 - structure of, **27–28**
 - CommAPI, **85**
 - Common Gateway Interface (CGI), **351**, *352*
 - Compact Flash (CF) board, **298**
 - compatibility of Processing, **135**
 - compilers vs. interpreters, **276–277**, *277*
 - compiling
 - Java programs, **96**
 - roombacmd program, **349–350**
 - components
 - motors, **15**
 - power, **14**
 - sensors, **15–16**
 - soldering, **391**, *392*
 - underside, **13**, *13*
 - computeRoombaLocation method, **148**, *190*
 - computeSensors method, **117–118**
 - computing
 - angles and distances, **37**
 - position, **147–148**
 - configuring
 - Bluetooth interface, **82–83**
 - OpenWrt, **309–313**, *309–313*
 - Telnet, **245**
 - vision systems, **352–353**
 - WiMicro boards, **243–246**, *243*
 - XPort, **223–225**, *224*
 - connect method
 - RoombaComm, **62**, **85–87**
 - RoombaCommTCPClient, **226–227**
 - connections, **396**, *397*
 - Bluetooth interface, **75–76**, *76*
 - ROI specification for, **418**
 - in schematic diagrams, **406–407**, *407*
 - serial interface tether, **54–56**, *57*
 - connectors, ROI, **21–24**, *21–24*
 - constants in RoombaComm, **98**
 - control, ROI for, **20**
 - CONTROL command
 - modes for, **25–26**
 - opcodes and data bytes for, **27**
 - overview, **29**
 - specification for, **419**
 - control method, **62**, **84**, *87*
 - conventions for schematic diagrams, **406**
 - converting
 - note names to MIDI note numbers, **154**, *155*
 - radius/velocity to left/right speeds, **94–96**, *94–95*
 - core MIDI, **164–166**
 - cost of Processing, **134–135**
 - costumes
 - building, **372**
 - RoomBud, **370**, *371*
 - CP2103 chip, **317**
 - cpuinfo command, **320**
 - createSong method, **156**, *160*
 - Creative Instant webcam, **340**, *340*
 - cross-platform compatibility of Processing, **135**
 - crystals, **152–153**
 - CSMA/CA (carrier-sense multiple access with collision avoidance)
 - technique, **233**
 - CSMA/CD (carrier-sense multiple access with collision detection)
 - technique, **232**
 - Cuartielles, David, **279**
 - current
 - through LEDs, **46–47**
 - monitoring, **38**
 - in Ohm's Law, **47**
 - variations in, **14**
 - in vision systems, **358–360**, *359–360*
 - current sensor packets, **424**
 - currentTimeMillis method, **127**
 - curves
 - moving in, **102–104**, *103*
 - parametric, **178–181**, *179–180*
 - cutters, **388**, *388*

D

D/A (digital-to-analog) converters, 89
 data bytes for ROI commands, **27–28**
 Data Set Ready (DSR) line, 85–86
 DataSignature site, 168
 Date class, 200
 DateFormat class, 200
 DB-9 cables, 50, *51*
 DBT-120 dongle, 69, *69*
 DD signal, 21–23
 DD-WRT distribution, 301
 debugging
 DNS names, **216–217**
 IP addresses, **217–218**
 MAC addresses, **218–219**
 network devices, **216–219**
 USB devices, **320–321**
 Wi-Fi networks, **234–235**
 defaults in RTTTL format, 159
 delay method, 279
 desoldering tools, 394, *394–395*
 destinationCreate method, 164–165
 diagonal cutters, **388, 388**
 diagram schematics. *See* schematic diagrams
 Dialup Networking Profile (DUN), 68
 differences in angle calculations, 124
 dig tool, 216
 digital mewling, 154
 digital multimeters, **388, 389**
 digital sensors for input, **190**
 digital-to-analog (D/A) converters, 89
 digitalWrite method, 288
 diodes
 LEDs. *See* LEDs (light-emitting diodes)
 in schematic diagrams, **410, 411**
 direction, drive motor commands for, **29–30**
 Dirt detect bit, 32
 dirt detector left sensor packets, 423
 dirt detector right sensor packets, 423
 dirt sensors, 16
 in input device applications, 190
 in second generation cleaners, 6
 dirtLeft method, 121
 disconnects in Wi-Fi, **233–234**
 DISTANCE command, 190
 distance sensors
 as mouse pointers, 191
 packets for, 424
 distances
 computing, 37
 measuring, **124–125, 125**
 moving, **100–101**
 dmesg program
 for detected USB drives, 345
 on OpenWrt, 320
 DNS names, **216–217**
 DOCK command
 opcodes and data bytes for, 28
 overview, 29
 Dodds, Zachary, 370
 doNote method, 166
 DPAC Airborne modules, **238–240, 239**
 draw method
 musical keyboard, 158
 Processing, 134, 139, 147, 149

RoombaAlarmClock, 201
 RoombaSketch, 192
 RoombaSpiro, 184
 SpiroExplorer, 182
 theremin simulation, 196
 drawGridlines method, 149
 drawing
 with rotation and translation, **146–147**
 virtual Roombas, **144–146**
 drawRoombaStatus method, **145–147**
 drawStatus method, 148–149
 DRIVE command, **92**
 converting radius/velocity to left/right
 speeds, **94–96, 94–95**
 opcodes and data bytes for, 28
 overview, **29–30**
 radius value in, **93, 93**
 specification for, 420
 velocity value in, **92**
 Drive.java program, 99–100
 drive method
 RoombaComm, 84
 RoombaSpiro, 184
 for tank-like motion, **98–100**
 drive motor unit, **89–92, 90–91**
 drive motors, 15
 commands for, **29–30**
 for sound, 154
 DriveRealTime.java program, 105–107
 drivers
 for cameras, **341**
 in OpenWrt, **317–321, 318, 344–345**
 driving actions, **89**
 command-line for, 97
 for curves, **102–104, 103**
 drive and at methods for, **98–100**
 DRIVE command, **92–97, 93–95**
 drive motor unit, **89–92, 90–91**
 real-time, **104–107**
 rotating specific angles, **101–102**
 send method for, **98**
 for specific distances, **100–101**
 Dropbear server, 303
 dropouts, 45, *46*
 DSR (Data Set Ready) line, 85–86
 duct tape
 for attaching brushes, **170–171, 171–172**
 damage from, 175
 DUN (Dialup Networking Profile), 68
 Dust Bin Alert feature, 12
 dynamic graphical programs, 134

E

Eagle program, 405
 echo tests, **57–60, 58–60**
 electrical diagram schematics. *See* schematic diagrams
 electrical tape, 389
 ellipse method, 132, 144
 embedded systems, 258, 297
 emitter/detector pairs, **110, 111**
 enclosures
 Bluetooth interface, **76, 77**

serial interface tether, **55, 56**
 WiMicro board, **253, 254**
 WL-HDD device, **328–329, 329–330**
 encryption for OpenWrt, 312
 enumerations for sensor data, **121**
 epicyclic gearing system, 90, *91*
 epitrochoid curves, **181**
 Erdos, **370**
 error_log file, 248
 Ess library, **197–198**
 ESSIDs, 306, 312
 Ethernet protocol, **205–207, 207**
 execute method, 165
 expanding spiral turns, 102, *103*
 Export Application command, 140
 export.txt file, 137
 Express version, Visual Basic, 374
 eyes. *See* vision systems

F

Familiar software, 368
 fights, 167
 firmware
 OpenWrt, **306–308, 316**
 upgrading and replacing, **299**
 first generation of Roomba cleaners, **5–6, 6**
 fixed resistors in schematic diagrams, 409, *409*
 flash chips for OpenWrt, 302
 flash drives for vision systems, **344–346, 344**
 flash-wl-hdd.sh script, 308
 floor types, current variations from, 14
 flush-cut cutters, **388, 388**
 flux in solder, 385–386
 foam, anti-static, 402, *403*
 Force-Seeking-Dock command, 422
 forwarding, port, 253
 frames in Ethernet, 206
 frequency hopping spread spectrum, 67
 front bumper sensors, 109–110, *110*
 ftdi_sio driver, 317
 FULL command
 opcodes and data bytes for, 27
 overview, 29
 specification for, 420
 Full mode, **26**
 fuses, PTCs as, 378
 Future Dial Mobile Phone Data Cable, 42

G

Gabbert, Kevin, 372
 GCalc program, 182
 GCC (GNU Compiler Collection), 280–281
 gear system, **90–92, 91**
 gEDA project, 405
 generations of Roomba cleaners, **5–12, 6–12**
 Genghis Robot, 4
 GND signal
 in ROI connectors, 21–23
 in schematic diagrams, **408–409, 408**
 GNU Compiler Collection (GCC), 280–281

goBackward method
 in Arduino, 289
 for specific distances, 100–101

goForward method
 in Arduino, 289
 in real-time driving, 104
 in RoombaComm, 63
 for specific distances, 100–101

goggles, 390

Goodman, Liz, 372

goStraight method, 100

goStraightAt method, 100

Grapher calculator, 182, 183

graphical buttons, 142–144, 144

graphing calculators, 182

graphs, 407

Greiner, Helen, 4

ground
 in ROI connectors, 21–23
 in schematic diagrams, 408–409, 408

grounding straps, 401, 401

Gumstix system, 298–299, 367–368, 367–368

H

Hands Free Profile (HFP), 68

Headset Profile (HSP), 68

heat-shrink tubing, 389, 399, 400

heat sinks, 326, 326

helping-hand tools, 387, 387

HFP (Hands Free Profile), 68

HID (Human Interface Device Profile), 68

hiding serial events, 117–118

HIGH command, 264

home base docks for self-charging, 8

hookup wire, 389

host tool, 216–217

hosts in MIDI, 162

hot glue guns, 389

HSP (Headset Profile), 68

Human Interface Device Profile (HID), 68

HyperTerminal program, 58

HyperWRT distribution, 301

hypotrochoid curves, 181–182, 183

I

ICs (integrated circuits) in schematic diagrams, 412, 412

ifconfig command, 219, 244, 315

Igoe, Tom, 279, 284

images
 taking, 341–342
 viewing, 342–343, 343

indicator commands, 32–33

inductors in schematic diagrams, 411, 411

industrial, scientific, and medical (ISM) bands, 232

Infinite Fractal Loop webring, 168

infrared sensors, 15–16, 112

input device applications, 189
 alarm clock, 200–202

mouse, 190–193, 191, 193–194
 sensors for, 189–190, 198–199, 199

sound, 197–198

theremin simulation, 194–196, 195, 197

installing
 OpenWrt, 305–306, 335–337, 336
 Processing libraries, 137–138, 138
 USB serial port drivers, 317–319, 318

instruments
 live, 157–158, 157
 MIDI, 161–162, 162–163

insulation, heat-shrink tubing for, 399, 400

integrated circuits (ICs) in schematic diagrams, 412, 412

intensity of Power LEDs, 32

internal sensors, 16, 36–37, 36–37

internal state, ROI for, 20

Internet connections, 205
 Ethernet protocol for, 205–207, 207
 modifications for, 225–228
 parts and tools for, 207–208
 SitePlayer Telnet. *See* SitePlayer Telnet
 XPort, 221–225, 221–224

Internet Protocol (IP), 206

interpreters vs. compilers, 276–277, 277

interrupters, optical, 15, 112, 112

IP addresses, 216
 debugging, 217–218
 for OpenWrt, 306, 308, 310, 311
 ports for, 253
 for WiMicro, 246

iPaq PDAs, 368–369, 369

ipconfig tool, 219

ipkg packaging systems, 315–316, 318, 350

IR remote transmitter, 379–380, 380–381

iRobot Corporation, 4–5

Irving robot, 107

ISM (industrial, scientific, and medical) bands, 232

iStumbler tool, 235

iwlist tool, 235

iwspy tool, 235

J

jacks
 in Ethernet, 206
 for SitePlayer Telnet adapter, 211–213, 213

Jameco, 43

JamVM, 321

Java Archive (JAR) files, 136

Java programs
 libraries for, 84
 writing, 96–97

Java VM, 131, 135

JavaSound API, 197

JFrame windows, 105

jumper wires
 from cut leads, 396, 397
 for serial interface tether, 51–52
 for solderless breadboards, 260–261, 260
 solid wire for, 389

K

Kamikaze firmware, 306

keyboards
 Bluetooth, 66
 as musical keyboards, 157–158, 157

KeyListeners, 104

keyPressed method, 104

DriveRealTime, 106
 for musical keyboard, 158
 RoombaView, 141

Keyspan adapters
 for Linux, 317
 for SitePlayer Telnet, 219

Kismet tool, 235

kmmod-usb-ohci package, 317

kmmod-usb-serial package, 317

kmmod-usb-storage package, 344–345

Konar, Murat N., 264

L

ladybug costume, 372

Lamar, Hedy, 67

LAMP (Linux, Apache, MySQL, PHP) suite, 248
 for databases, 255
 for web pages, 248–253, 252

lead, toxicity of, 390

lead-free solder, 386–387

lead solder with rosin core, 385, 386

LEDs (light-emitting diodes)
 for Arduino, 281
 for Board of Education, 265
 in DBT-120 dongles, 69
 indicator commands for, 32–33
 in infrared sensors, 15–16
 in mobile mood light, 290, 291–292
 in OpenWrt, 308
 for optical interrupters, 15, 112
 for optical object detectors, 113
 for optoisolators, 112
 orientation of, 47–48
 schematic diagrams for, 407, 407, 410, 411
 in serial interface tether, 44, 45, 46–48, 47
 for WiMicro boards, 243

LEDS command, 32
 opcodes and data bytes for, 28
 specification for, 420–421

left bump sensors for mouse simulation, 191

left/right speeds, converting radius/velocity to, 94–96, 94–95

Lego Mindstorms NXT, 66

LF1S022, 209, 212

libraries
 Arduino, 281
 Ess, 197–198
 Java, 84
 Linux, 303
 MyGUI, 142–144, 144
 Processing, 136–138, 138
 RXTX, 84–87

light-emitting diodes. *See* LEDs (light-emitting diodes)

line-following Roombas, 375
 line method
 Processing, 132, 144, 146
 SpiroExplorer, 181
 line sensors, 375
 Linksys WRT54G, 300–301, 300
 Linksys WRTSL54GS
 button on, 363
 power for, 337, 337–338, 359, 359
 for vision systems, 334–335, 335
 Linux, 297–298
 Basic Stamp tools for, 264
 OpenWrt. *See* OpenWrt distribution
 RoombaCommTest for, 61
 for single board computers, 298–299
 for wireless routers, 299–301, 300
 Lissajous curves, 181–182, 183
 live instruments, 157–158, 157
 logic levels, 22
 logical operators
 in bit operations, 31
 for sensor data, 120
 Logo language, 40, 132
 Logo-like programs, 107–108
 logs, LAMP, 248
 loop method, 279, 289, 294
 loopback connections, 57
 loops for sensor data, 121–122
 LOW command, 264
 low-level debugging, 235
 lsmod command, 320
 lsush command, 320, 358
 LTRX_IBSS network, 243–244

M

MAC addresses, 216, 218–219
 Mac OS X
 echo tests in, 58, 58
 RoombaCommTest for, 61, 61
 MacBS2 environment, 264, 265
 macosx_setup_command script, 61
 Macsat site, 340
 mAh (milliamp-hours), 14
 main brush, MOTORS command for, 30
 Makefiles, 348, 350
 makeMoveButtons method, 142–143
 malloc function, 281, 303
 MAMP suite, 248–249
 mapping, port, 253
 marker pens, 170
 masks for sensor data, 120
 Math Page website, 180
 Mathematica calculator, 182
 matrices, transformation, 146
 Max bit, 32
 MAX command
 modes for, 26
 opcodes and data bytes for, 28
 overview, 29
 specification for, 420
 MAX232 chip, 48, 51, 52

mct_u232 driver, 317
 measuring distances and angles, 124–125, 125
 Mellis, David, 279
 Menefee, Michael, 368–369
 mewling, digital, 154
 MiAD (myRoomBud Is Alive Dashboard),
 371, 371
 mice
 Bluetooth, 66
 Roomba as, 190–193, 191, 193–194
 micro release, 307
 micro-switches, 113, 114
 microcontrollers, 48
 and Linux, 297–298
 vs. microprocessors, 257–258, 259
 MIDI notes and instruments, 161–162,
 162–163
 core MIDI for, 164–166
 in SONG, 154, 155
 translating notes into actions, 163–164
 Miller, Ben, 375
 milliamp-hours (mAh), 14
 millis method, 140
 Mind Control, 366, 366–367
 Mini-DIN cables and plugs, 21–23, 21, 23
 Bluetooth interface, 72
 serial interface tether, 49–50, 51
 SitePlayer Telnet adapter, 211–213,
 213, 221
 vision systems, 356
 mobile mood light, 290–294, 291–292
 modes, 25–29, 26, 419
 modules file, 319, 352–353
 Mooba the Cow, 370
 mood light, 290–294, 291–292
 MOSFET transistors, 409
 motor over-current sensor
 location of, 114
 packets for, 423
 motors, 15, 29–30
 drive motor unit, 89–92, 90–91
 Roomba section for, 13
 for sound, 153–154
 MOTORS command
 bit operations in, 31
 opcodes and data bytes for, 28
 overview, 30
 specification for, 420
 mouse
 Bluetooth, 66
 Roomba as, 190–193, 191, 193–194
 moving
 in curves, 102–104, 103
 specific distances, 100–101
 multimeters, 388, 389
 multiple programs, running, 297
 music. *See also* sound
 commands for, 32–33
 instruments, 157–158, 157, 161–162,
 162–163
 MyGUI library, 142–144, 144
 myRoomBud, 370
 myRoomBud Is Alive Dashboard (MiAD),
 371, 371

N

names in RTTTL format, 159
 namespaces, 84
 needle-nose pliers, 388, 388
 negative logic, 22
 netstat tool, 219, 315
 NetStumbler, 235
 network devices, debugging, 216–219
 networks. *See* Internet connections
 nickel metal-hydride (NiMh) cells, 14
 nmap tool, 217–219
 noise, 45, 46
 Nokring language, 159
 non-blocking periodic sensor readings, 122
 non-volatile RAM (NVRAM), 302
 NOT operator, 31
 notes
 actions from, 163–164
 converting to MIDI note numbers, 154,
 155
 in RTTTL format, 159
 nslookup tool, 216
 NSLU2-Linux hackers, 356–357
 NVRAM (non-volatile RAM), 302

O

object detectors, 113, 113
 Object Push Profile (OPP), 68
 odometry data for distance measurements,
 124–125
 Ohm's Law, 47
 On mode, 25
 opcodes for ROI commands, 27–28
 open_port method, 116
 open source software, 134
 OpenSSH standard, 303
 OpenWrt distribution, 301–302
 configuring, 309–313, 309–313
 drivers in, 319, 344–345
 environment for, 306
 features, 302–303
 firmware for, 306–308, 316
 installing, 305–306
 parts and tools for, 303
 roombacmd build for, 349–350
 scripting language control in, 321–325
 USB serial port drivers for, 317–321, 318
 for vision systems, 335–337, 336
 wireless routers for, 303–304
 WL-HDD device for, 304–307, 304–305,
 325
 battery packs for, 325–328, 326–328
 enclosures for, 328–329, 329–330
 working with, 314–316
 OPP (Object Push Profile), 68
 optical emitter/detector pairs, 110, 111
 optical interrupters, 15, 112, 112
 optical object detectors, 113, 113
 optoisolators, 112
 OR operator, 31
 OrCAD software, 405
 orientation of LEDs, 47–48

OSMO/hacker, **16–17**, 17
 over-current events, 27
 over-current sensors, **114**

P

pack method, 253
 packages, 84
 packaging systems
 ipkg, **315–316**, 318
 for RoombaComm, **136**
 PackBot series, 4–5
 packets
 in Ethernet, 206
 sensor, 423–424, 426
 paintbrushes
 attaching, **171–174**, 171–174
 types of, **170**
 painters tape, 175
 pairing with Bluetooth interface, **78–80**, 79–80
 PANs (personal area networks), 66
 parametric curves, **178–181**, 179–180
 parametric equations, 178–179
 parseRoombaSensors method
 RoombAlarmClock, 202
 RoombaSketch, 192–193
 for theremin simulation, 196
 in touchless sensing, 198–199
 parsing sensor data, **118–119**
 parts and tools
 art, **168–169**, 169
 Bluetooth interface, **68–69**, 69, 72–73, 73
 brain replacement, **258–260**
 Internet connections, **207–208**
 OpenWrt, **303**
 serial interface tether, **43–44**, 51, 52
 soldering, **383–384**
 vision systems, **334**
 Wi-Fi, **236**
 passive components, 409
 Passive mode, 25
 passwords for OpenWrt, 309, 310
 pause method, 87, 104, 140
 PBASIC language
 for Basic Stamp 2, 262, 264, 268–269
 limitations of, 276
 for SCI tester, 374
 PC/104 standard, 298
 PCB123 software, 405
 PDAs, **368–369**, 369
 pens, 170
 periodic sensor readings, 122
 Perl language
 in OpenWrt, **322–324**
 for SitePlayer Telnet, 221
 personal area networks (PANs), 66
 personalities, **371**, 371
 phone sync cable
 for serial interface tether, **42–43**
 for vision systems, **353–357**, 354–357
 photocells
 for robot roach, 273, 275
 in schematic diagrams, 409, 409
 photodetectors, 15

photodiodes
 for optoisolators, 112
 in schematic diagrams, 410, 411
 phototransistors, 112
 php_error_log file, 248
 PHP web pages, **248–253**, 252
 physical connections, ROI specification
 for, 418
 physical sensors, commands for, **34–36**, 35
 PI constant, 147
 PICPATH variable, 351
 pictures
 taking, **341–342**
 viewing, **342–343**, 343
 piezo beepers, **151–153**, 152
 ping command
 for IP addresses, 217
 for Wi-Fi networks, 235
 for WiMicro boards, 244
 Pink Ribbon Edition, 10, 11
 pitch antenna for theremins, 194
 pitch control
 cliff sensors for, **198–199**
 Ess library for, **197–198**
 with theremins, 194–195, 195
 pivot point in drive motor unit, 90
 PL-2303 chip, 355, 355
 pl2303 driver, 317, 352
 planetary gearing system, **90–92**, 91
 PLAY command
 opcodes and data bytes for, 28
 for songs, **32–33**, 155
 specification for, 422
 playAlarm method, 201
 Player software, 368
 Player Stage program, 369
 playMidiNote method, 163–164
 playNote method, 62, 156–157, 160
 playSong method, 156
 pliers, **388**, 388
 polarized capacitors, 410, 410
 popMatrix method, 146–147
 ports
 Arduino, 287
 Bluetooth interface, **80**, 81
 for IP addresses, 253
 mapping, 253
 OpenWrt, 311, 312, **317–321**, 318
 ROI, 24, 24, 418
 SitePlayer Telnet, 219, 220
 in third generation cleaners, 8
 wireless routers, 303
 WRTSL54GS, 334, 335
 XPort, 223–224
 position computations, **147–148**
 positive logic, 22
 positive temperature coefficient (PTC)
 resistors, 378
 power and power supplies, **14**
 Arduino, 282, 286–287, 287
 Basic Stamp 2, 262, 266
 Bluetooth interface, **67**, 70
 iPaq PDAs, 368
 in schematic diagrams, **408–409**, 408
 serial interface tether, **44–46**, 45–46

SitePlayer Telnet, 221
 Virtual Wall, 380
 vision systems, 355–356, **358–360**,
 359–360
 Wi-Fi, **234**, 241
 WL-HDD device, **325–328**, 326–328
 WRTSL54GS, 335, **337**, 337–338
 XPort, 221–222, 225
 Power button for mouse simulation, 191
 POWER command
 operation of, 26
 opcodes and data bytes for, 27
 overview, 29
 specification for, 420
 Power LEDs
 settings for, 32
 for WiMicro boards, 243
 power sensors
 commands for, **37–38**, 38
 operation of, 16
 PPTP protocol, 307
 pptp release, 307
 print method, 288
 printf function, 281, 303
 printSensors method, 126–127
 /proc virtual file system, 320–321
 Processing language, **131–132**, 132–133
 benefits, **134–135**
 exporting from, **140**
 libraries for, **136–138**, 138, **197–198**
 limitations, **135**
 MyGUI library in, **142–144**, 144
 operation of, **133–134**
 for RoombaView. *See* RoombaView
 program
 sketches in, **138–140**
 processMIDIEvent method, 165–166
 Procyon AVRLib library, 281
 profiles in Bluetooth, **68**
 ProTel software, 405
 prototyping boards, 51, 52
 prototyping plug
 for Basic Stamp, 266
 for SitePlayer Telnet adapter,
 212–213, 213
 prototyping shield, **284–286**, 285–286, 293
 ps program, 315
 PTC (positive temperature coefficient)
 resistors, 378
 pulse-width modulation (PWM), 15
 pushMatrix method, 146–147

Q

\$QUERY_STRING variable, 351
 Quicker Electronics, 260

R

radioCmd variable, 200
 radius
 in DRIVE command, **93**, 93
 turn, 30

- radius/velocity, left/right speeds from, **94–96**, 94–95
 - RC`TIME` function, 275
 - real-time driving, **104–107**, 141
 - RealTerm program, 58, 59–60
 - reboot, driver loading at, **319**
 - receiving
 - sensor data, **115–117**
 - serial data, 269
 - rect method, 144
 - refreshing webcam images, 342–343, 343
 - refreshIt function, 343
 - regulators. *See* voltage regulators
 - relays in schematic diagrams, 411, 411
 - remote control
 - codes for, **36–37**, 36–37
 - hacks for, **378–379**, 378–379
 - in third generation cleaners, 8
 - remote control sensor
 - orientation of, 16
 - packets for, 424
 - remote transmitter, **379–380**, 380–382
 - Rendezvous networking, 214
 - replacing
 - brain. *See* brain replacement
 - firmware, 299
 - resistance
 - in Ohm's Law, 47
 - in solder joint tests, 396
 - resistors
 - in LED circuits, 47
 - in schematic diagrams, **409–410**, 409
 - Restriction of Hazardous Substances (RoHS)
 - directive, 386
 - RF interference, 45, 46
 - RGB LEDs, 290, 291–292
 - right bump sensors for mouse simulation, 191
 - Ringing Tones Text Transfer Language (RTTTTL), 159–160
 - ringtones, **159–161**
 - RJ-45 jacks
 - in Ethernet, 206
 - for SitePlayer Telnet adapter, 211–213, 213
 - roach, robot, **273–275**, 273–274
 - roaming in Wi-Fi, **233–234**
 - robot roach, **273–275**, 273–274
 - robots
 - art by, 168
 - vs. telepresence devices, 257
 - RoHS (Restriction of Hazardous Substances)
 - directive, 386
 - ROI protocol, **24–25**. *See also* Roomba Open Interface (ROI)
 - RooAVR processor, 261
 - Roobit the Frog, 370
 - Roomba 2.1, 10, 11
 - roomba_backward method, 323
 - Roomba Discovery, 8, 9
 - Roomba Discovery SE, 10, 10
 - roomba_drive method, 250, 346–348
 - roomba_forward method, 323
 - roomba_forward.sh script, 322
 - roomba_go_backward method, 249
 - roomba_go_forward method, 249
 - roomba_init method, 250, 322–323
 - roomba_init_serialport method, 346–347
 - Roomba Mind Control, **366**, 366–367
 - Roomba Monitor, 373
 - Roomba Open Interface (ROI), 3, 415–416
 - cleaning motor commands, **30**
 - commands
 - specifications, 419–422, 425
 - structure, **27–28**
 - connectors, **21–24**, 21–24
 - for control, **20**
 - drive motor commands, **29–30**
 - indicator commands, **32–33**
 - for internal state, **20**
 - limitations, **20–21**
 - mode commands, **28–29**
 - modes, **25–27**, 26, 419
 - OSMO//hacker upgrade for, **16–17**, 17
 - for physical connections, 418
 - protocol, **24–25**
 - for sensing, **19–20**, **33–38**, 35–38
 - sensor packets, 423–424, 426
 - serial port settings, 418
 - in third generation cleaners, 8
 - Roomba Pink Ribbon Edition, 10, 11
 - Roomba Pro, 6, 7
 - Roomba Pro Elite, 6, 7
 - roomba_read_sensors method, 250–252, 346, 348
 - Roomba Red, 8, 8
 - Roomba Sage, 8, 9
 - Roomba Scheduler, 12, 12
 - roomba_send_cmd method, 250
 - roomba_spin_left method, 250
 - roomba_spin_right method, 250
 - roomba_spinleft method, 323
 - roomba_spinright method, 323
 - roomba_stop method, 249, 323
 - Roomba Terminal application, 373, 373–374
 - Roomba Wi-Fi adapter
 - building, **241–246**, 241–243
 - enclosure for, **253**, 254
 - testing, **247**, 247
 - RoombAlarmClock, **200–202**
 - roombacam.html file, 342–343, 343
 - roombacmd.c file, 346
 - roombacmd-ipkg directory, 350
 - roombacmd.mpl script, **322–324**
 - roombacmd.php file, **249–253**, 252
 - roombacmd program, **346–348**
 - building, **349–350**
 - listing, **348–349**
 - RoombaComm API, 39–40
 - code structure in, **84**
 - commands for, **62–63**
 - packaging, **136**
 - RXTX serial port library for, **84–87**
 - RoombaComm class, 84, 98
 - RoombaComm.Drive program, 102
 - RoombaComm.Waggle program, 104
 - RoombaCommSerial class, 84, 116–117
 - RoombaCommTCPCClient class, 84, **225–228**
 - RoombaCommTest program, **60–63**, 61
 - RoombaDevTools.com, 373
 - RoombaFX framework, **372–373**, 373–374
 - roombalib.c file, 346–348
 - roombalib library, 346
 - RoombaMidi, **161–162**, 162–163
 - core MIDI for, **164–166**
 - translating MIDI notes into actions, **163–164**
 - RoombaNet board, 367, 367–368
 - roombapanel.cgi file, 351, 352, 361–362
 - roombapanel.html, 360–361
 - RoombaRing, **160–161**
 - RoombaRoach, **273–275**, 273–274
 - RoombaSketch, **191–193**, 193–194
 - RoombaSpiro, 184
 - RoombaView program
 - features, **140–141**
 - finishing, **149**, 150
 - MyGUI library for, **142–144**, 144
 - position computations in, **147–148**
 - in real-time, **141**
 - rotation and translation in, **146–147**
 - sensor data in, **144**
 - status display in, **148–149**
 - virtual Roombas drawings in, **144–146**
 - Roombongle, **353–357**, 354–357
 - RoomBuds, **370**, 371
 - RooStamp board, 261
 - RooStick, **42**, 42
 - RooTooth circuit, 65, 66
 - rotate method, 147
 - rotation
 - in RoombaView, **146–147**
 - specific angles, **101–102**
 - routers, wireless
 - for OpenWrt, **303–304**
 - as toys, **299–301**, 300
 - RS-232 communication
 - for serial interface tether, 44, 45, 48
 - voltages for, 22
 - RTTTTL (Ringing Tones Text Transfer Language), 159–160
 - RTTTTLParser class, 159–160
 - RTTTTLPlay.java program, 160
 - rulers for attaching brushes, 173–174, 173–174
 - running mode in Arduino, **286–288**, 287
 - runRadioCmd method, 200–202
 - RXD signal, 21–23
 - RXTX serial port library, **84–87**
- ## S
- SableVM, 321
 - SAFE command
 - modes for, 26
 - opcodes and data bytes for, 27
 - overview, 29
 - specification for, 420
 - Safe mode, **25–26**
 - safety considerations, **43**, **390**
 - sags, 46, 46
 - saving WiMicro configuration, **246**
 - SBCs (single board computers), **298–299**
 - scalex value, 147
 - scaley value, 147
 - scheduling in third generation cleaners, 8
 - schematic diagrams, **405**
 - for Arduino-to-Roomba connection, 282, 283

- for Basic Stamp, 266, 267
- capacitors in, 410, 410
- for connections, 406–407, 407
- conventions for, 406
- diodes in, 410, 411
- for integrated circuits, 412, 412
- for line-following Roombas, 375, 375
- miscellaneous components in, 411, 411
- for mobile mood light, 290, 291
- power and ground symbols in, 408–409, 408
- resistors in, 409–410, 409
- for robot roach, 273, 273
- for serial interface tether, 44, 45
- for wires, 407, 408
- SCI (Serial Command Interface), 3
- SCI tester, 373–374
- Scooba robot, 12
- ScooBuds, 370
- scripting language control in OpenWrt, 321–325
- second generation of Roomba cleaners, 6, 7
- self-charging, home base docks for, 8
- send method
 - RoombaComm, 87
 - RoombaCommTCPClient, 226–227
 - for sensor data, 115
 - for tank-like motion, 98
- sending
 - sensor data, 115
 - serial data, 269
- sensors, 15–16
 - for autonomous operations, 122–123
 - bit fields for, 120
 - byte values for, 121
 - commands for, 33
 - for distance and angle, 124–125, 125
 - enumerations for, 121
 - for input device applications, 189–190
 - location of, 109–110, 110–111
 - loops for, 121–122
 - micro-switches, 113, 114
 - motor over-current, 114
 - optical interrupters, 112, 112
 - optical object detectors, 113, 113
 - optoisolators, 112
 - packets for, 423–424, 426
 - parsing data from, 118–119
 - printing data from, 126–127
 - Roomba section for, 13, 13
 - in RoombaView, 144
 - SENSORS command, 115–118
 - for theremin simulation, 195, 195
 - types of, 19–20
 - word values for, 119
- SENSORS command, 33–34
 - for hiding serial events, 117–118
 - opcodes and data bytes for, 28
 - for receiving data, 115–117
 - for sending data, 115
 - specification for, 422
- Sensors screen, 373
- sensorsAsString method, 127
- Serial Command Interface (SCI), 3
- serial communication, 22
- serial data with Basic Stamp 2, 269
- serial events
 - receiving, 116–117
 - visibility of, 117–118
- serial interface tether, 41
 - building, 48
 - cables for, 42–43, 49–50, 51, 54, 55
 - cell phone sync cable hack, 42–43
 - circuit for, 44–48, 45–47
 - computer connections to, 56, 57
 - connection checks for, 54–55
 - echo tests for, 57–60, 58–60
 - enclosures for, 55, 56
 - LED lamps for, 46–48, 47
 - parts and tools for, 43–44, 51, 52
 - power supply for, 44–46, 45–46
 - preparing, 49, 49
 - RoombaCommTest for, 60–63, 61
 - RooStick, 42, 42
 - soldering, 52, 54, 55
 - USB, 56, 57, 353–357, 354–357
 - voltage checks for, 53, 54
- serial parameters for XPort, 224
- Serial Port Profile (SPP), 68, 70
- serial ports
 - Arduino, 287
 - OpenWrt, 317–321, 318
 - ROI specification for, 418
 - SitePlayer Telnet, 219, 220
 - in third generation cleaners, 8
 - wireless routers, 303
- serial speed for Basic Stamp 2, 268
- serialAvailable method, 288
- serialEvent method
 - RoombaCommSerial, 116–117
 - RoombaCommTCPClient, 227
- serialRead method, 288
- SERIN command, 269
- SEROUT command, 269
- servers for Wi-Fi devices, 238–240, 239
- setSpeed method, 101
- setting bits, 31
- setup method
 - Arduino, 279, 288–289, 293–294
 - for musical keyboard, 158
 - Processing, 133, 139
 - RoombAlarmClock, 201
 - SpiroExplorer, 182
 - for theremin, 199
- setupMidi method, 164–165
- setupWindow method, 105–107
- shell script control in OpenWrt, 321–322
- side brush, MOTORS command for, 30
- signals for connectors, 21–23
- signed words, 119
- SimpleTest class, 227–228
- SimpleTest.java program, 138
- singing. *See* sound
- single board computers (SBCs), 298–299
- single notes, playing, 156–157
- SitePlayer Telnet, 208–209, 209–210
 - adapter for, 211–213, 211–213
 - debugging, 216–219
 - hooking to Roomba, 219–221, 220–221
 - setting up, 214–215, 214–215
 - testing, 219, 220
 - for Wi-Fi, 240–241, 240
- Sleep (Off) mode, 25
- small circle turns, 102, 103
- Smith, Greg, 371
- SNAPPATH variable, 351
- Snooze button for alarm clock, 200
- Soban, Bogdan, 168
- solder, 385–387, 386
- soldering, 383
 - Bluetooth interface, 73–75, 74–75
 - cutters and pliers for, 388, 388
 - fixing mistakes, 394, 394–395
 - process, 390–393, 391–393
 - remote control, 379, 379
 - safety considerations, 390
 - serial interface tether, 52, 54, 55
 - solder for, 385–387, 386
 - soldering irons for, 384–385, 385
 - testing, 396, 396
 - third-hand tools for, 387, 387
 - tools for, 383–384
 - wires, 398–399, 398–400
- soldering irons, 384–385, 385
- solderless breadboards, 260–261, 260
- SONG command
 - MIDI note numbers with, 32–33, 154, 155
 - opcodes and data bytes for, 28
 - specification for, 421
- sound, 151
 - live instruments, 157–158, 157
 - MIDI instruments, 161–166
 - motors for, 153–154
 - piezo beepers, 151–153, 152
 - PLAY command, 155
 - ringtones, 159–161
 - single notes, 156–157
 - SONG command, 154, 155
 - songs, 155–156
 - theremin simulation, 194–197, 195, 197
 - cliff sensors for, 198–199, 199
 - Ess library for, 197–198
- spca5xx driver, 340
- spca5xx_lite driver, 340–341
- speccat program, 341–342
- spectrum analyzers, 235
- spinLeft method
 - Arduino, 289
 - in real-time driving, 104
 - for specific angles, 102
- spinLeftAt method
 - Drive.java, 100
 - for specific angles, 101
- spinning, DRIVE command for, 96
- spinRight method
 - Arduino, 289
 - in real-time driving, 104
 - for specific angles, 101–102
- spinRightAt method
 - Drive.java, 100
 - for specific angles, 101
- Spiral.java program, 104
- spiral turns, 102, 103, 104
- spirals, 178, 179
 - parametric curves for, 178–181, 179–180
 - result, 185, 185–197
 - RoombaSpiro for, 184
 - SpiroExplorer for, 181–184, 183

SpiroExplorer, 178, **181–184**, 183
 Spirograph toy, 178, 179
 Spot bit, 32
 Spot button for mouse simulation, 191
 SPOT command
 modes for, 26
 opcodes and data bytes for, 28
 overview, 29
 specification for, 420
 Spot mode for art, 176
 SPP (Serial Port Profile), 68, 70
 spread spectrum technique, 67
 springs in drive motor unit, 90
 Spy.java program, 126–127
 square method, 108
 stacks, TCP/IP, 206
 standards, wireless, **232**
 Stang, Pascal, 281
 START command
 modes for, 25
 opcodes and data bytes for, 27–28
 overview, 28
 specification for, 419
 startup method, 62, 84, 87
 states, ROI, **25–27**, 26
 static IP addresses for OpenWrt, 306
 static-sensitive components, 71, **401–402**,
 401–403
 status, displaying, **148–149**
 Status bit, 32
 stop method, 104
 straight direction, 96
 stroke method, 144
 stty command, 322
 stumbler applications, 235
 subsumption architecture, 4
 Sveasoft distribution, 301
 switch method, 158
 switches in schematic diagrams, 411, 411
 sync cables
 for serial interface tether, **42–43**
 for vision systems, **353–357**, 354–357

T

tail command, 248
 “tailing the logs”, 248
 tank-like motion
 drive and at commands for, **98–100**
 rotating specific angles, **101–102**
 send command for, **98**
 tape
 for attaching brushes, **170–171**,
 171–172, 175
 electrical, 389
 TCP (Transmission Control Protocol), 206
 TCP/IP protocol, 206
 telepresence devices, 257
 Telnet
 SitePlayer. *See* SitePlayer Telnet
 for WiMicro, **245**
 temperature sensors
 location of, 377, 378
 packets for, 424

testing
 art modifications, **176–177**, 177
 Bluetooth interface, **83**
 SitePlayer Telnet, **219**, 220
 soldering, **396**, 396
 WiMicro boards, **247**, 247
 tethers. *See* serial interface tether
 text method, 132
 TFTP (Trivial File Transfer Protocol), 299,
 306–307
 TFTP.EXE program, 306
 Theremin, Leon, 194, 195
 theremin simulation, **194–197**, 195, 197
 cliff sensors for, **198–199**, 199
 Ess library for, **197–198**
 thermistors in schematic diagrams, 409, 410
 thick carpets, 14
 third generation of Roomba cleaners,
 8–12, 8–12
 third-hand tools, **387**, 387
 thumb drives, 344, 344
 tinning
 components, 390
 wires, 398, 398
 tip types for soldering irons, 384
 toascii function, 281
 tokens in interpreter systems, 277
 toothed discs for optical interrupters, 112
 torque in gear system, 92
 toShort method, 119
 touchless sensing, **198–199**, 199
 toUnsignedShort method, 119
 toys, wireless routers as, **299–301**, 300
 traceroute tool, 219
 transceivers, 44, 45, **48**
 transformation matrices, 146
 transistors
 MOSFET, 409
 in schematic diagrams, 411, 411
 translate method, 147
 translation
 MIDI notes into actions, **163–164**
 in RoombaView, **146–147**
 Transmission Control Protocol (TCP), 206
 Trivial File Transfer Protocol (TFTP), 299,
 306–307
 Turn off alarm feature, 200
 Turn on or off radio feature, 200
 turns
 Arduino for, **288–290**
 Basic Stamp for, **268–272**
 DRIVE command for, 96
 radius of, 30, **93**, 93
 spiral, 102, 103, 104
 waggle, **102–104**, 103
 turtle graphics, **107–108**
 TXD signal, 21–23

U

UARTs
 for OpenWrt, 316
 for wireless routers, 303
 underside components, **13**, 13
 unit circle, 180, 180

universal remotes, 378
 unpack method, 253
 unsigned words, 119
 update_xy method, 181–182
 updateDisplay method, 105–106
 updateLEDs method, 291, 294
 updateRoombaState method, 149
 updateSensors method
 Arduino, 290
 in loops, 122
 RoombaCommSerial, 117–118
 RoombaCommTCPClient, 227
 Spy.java, 127
 upgrading
 batteries, **376–378**, 377
 firmware, **299**
 usage method, 322–323
 USB devices
 Bluetooth dongle, 69, 69
 cell phone sync cable, **42–43**
 debugging, **320–321**
 for OpenWrt, **317–321**, 318
 for serial tether, 56, 57, **353–357**, 354–357
 thumb drives, 344, 344
 US-19HS serial adapter, 56, 57
 webcams in vision systems, 339–340, 340
 WRTSL54GS ports, 334, 335
 USB-to-serial devices
 for Arduino, 281
 for SitePlayer Telnet, 219
 for vision systems, 355, 355

V

v4l (Video For Linux) device, 341
 vacuum motor connectors hacks, **375–376**, 376
 vacuum motors
 MOTORS command for, 30
 overview, **15**
 for sound, 153
 vacuum section, 13
 variable resistors in schematic diagrams,
 409, 409
 velocity
 drive motor commands for, **29–30**, **92**
 measuring, **124–125**, 125
 ventilation, 390
 Video For Linux (v4l) device, 341
 viewing images, **342–343**, 343
 Virtual Machine (VM), 131, 135
 virtual Roombas, drawing, **144–146**
 virtual serial ports, **80**, 81
 virtual wall sensor
 orientation of, 16
 packets for, 423
 virtual walls
 in first generation cleaners, 6
 hacking, **379–380**, 380–381
 visibility of serial events, **117–118**
 vision systems, 333
 assembling, **357–358**, 358
 C for, **346–350**
 cameras for, **339–343**, 340, 343
 CGI for, **351**, 352
 command center for, **360–362**, 361

- configuring, **352–353**
 - current consumption in, **358–360**, 359–360
 - in Erdos, 370
 - final product, **362, 362**
 - flash drives for, **344–346, 344**
 - OpenWrt for, **335–337, 336**
 - parts and tools for, **334**
 - USB serial tether for, **353–357, 354–357**
 - WRTSL54GS for, **334–337, 335**, 338–339, **363**
 - Visual Basic, 374
 - VM (Virtual Machine), 131, 135
 - voltage checks
 - Bluetooth interface, **74**
 - serial interface tether, **53, 54**
 - voltage ratings for capacitors, 46
 - voltage regulators
 - Arduino, 282
 - Bluetooth interface, 70
 - Roomba Wi-Fi adapter, 241, 241
 - serial interface tether, **44–46, 45–46**
 - SitePlayer Telnet, 209
 - WL-HDD device, 325–326, 326
 - voltage sensor packets, 424
 - voltages
 - logic levels, 22
 - in Ohm's Law, 47
 - in schematic diagrams, **408–409, 408**
 - volume control for theremins, 194
 - Vpwr signal, 21–23
 - VxWorks operating system, 301
- ## W
- Waggle.java program, 103–104
 - waggle turns, **102–104, 103**
 - waitForDSR clause, 85–86
 - wall sensors
 - location of, **113, 113**
 - packets for, 423
 - walls, virtual
 - in first generation cleaners, 6
 - hacking, **379–380, 380–381**
 - WAMP suite, 248–249
 - WAN ports, 311, 312
 - warranty-voiding hacks, **375**
 - battery upgrades, **376–378, 377**
 - line-following Roombas, **375**
 - remote control, **378–379, 378–379**
 - vacuum motor connectors, **375–376, 376**
 - virtual wall, **379–380, 380–381**
 - wattage for soldering irons, 384
 - Web Console, **309–313, 309–313**
 - web pages, **248–255, 252**
 - webcams
 - power consumption by, 359
 - in vision systems, 339–340, 340
 - wedged clamps for attaching brushes, **171, 172**
 - wheel speed detection, **112, 112**
 - wheelbase in radius conversions, 94–95
 - wheeldrop sensors
 - for cliff detection, 16
 - overview, **113, 114**
 - for theremin simulation, 195, 195
 - wheelDropCenter method, 120
 - wheels
 - commands for, **29–30**
 - driving. *See* driving actions
 - White Russian RC5 firmware, 306–307
 - Wi-Fi, **231**
 - debugging, **234–235**
 - for iPaq PDAs, 369
 - overview, **232–233**
 - parts and tools for, **236**
 - power in, **234, 241**
 - roaming and disconnects in, **233–234**
 - Roomba adapter, **241–247, 241–243, 253, 254**
 - servers for, **238–240, 239**
 - SitePlayer Telnet for, **240–241, 240**
 - WiMicro boards for, **236–238, 237–238**
 - Wi-ME product, 238
 - wick, desoldering, 394, 394–395
 - WiMicro boards, **236–238, 237–238**
 - configuring, **243–246, 243**
 - enclosure for, **253, 254**
 - for Roomba Wi-Fi adapter, **241–243, 241–242**
 - testing, **247, 247**
 - Windows 2000/XP echo tests, **58, 59–60**
 - wireless bridges, 240
 - Wireless client mode for OpenWrt, **312, 313**
 - wireless connectivity
 - Bluetooth interface. *See* Bluetooth interface
 - web pages for, **248–255, 252**
 - Wi-Fi. *See* Wi-Fi
 - Wireless Ethernet, 232
 - wireless routers
 - for OpenWrt, **303–304**
 - as toys, **299–301, 300**
 - wires
 - hookup, 389
 - schematic diagrams for, **407, 408**
 - soldering, **398–399, 398–400**
 - tinning, 398, 398
 - Wiring microcontroller, 279
 - WL-330g portable access points, 240
 - WL-HDD device, **304–307, 304–305, 325**
 - battery packs for, **325–328, 326–328**
 - enclosures for, **328–329, 329–330**
 - word values for sensors, **119**
 - WRT54G, **300–301, 300, 303–304, 317**
 - WRTSL54GS
 - button on, **363**
 - power for, **337, 337–338, 359, 359**
 - for vision systems, **334–335, 335**
- ## X
- Xhaard, Michel, 340
 - XPort, **221–222**
 - configuring, **223–225, 224**
 - working with, **225**
- ## Z
- Zambetti, Nicholas, 279
 - ZeroConf/Bonjour/Rendezvous protocol, 224
 - ZeroConf networking, 214
 - zipped files, **136**
 - ZTerm program, 58, 59