

Parallax Inc.	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10	Unit 11	Unit 12	Unit 13
<a href="#">Units from the Arduino Shield-Bot Tutorial Series</a>	Software Setup and Connection Test	Beginning Arduino programming	Simple breadboard circuits	Intro to servo motors	Robot construction	Robot Navigation Basics	Sensor Navigation by Touch	Sensor Navigation by Visible Light	Sensor Navigation by Infrared Light	Robot Control with Distance Detection	IR Remote Control (accessory hardware needed)	Line-following (accessory hardware needed)	Navigation with Ultrasound Distance Sensor on servo turret (accessory hardware needed)
<a href="#">Shield-Bot with Arduino 12-pack Plus (#32339)</a>	<a href="#">12 sets of all Parallax hardware needed for this unit is included in the Shield-Bot 12-pack Plus Kit for Classrooms (#32339)</a>												
<a href="#">Single Robot Shield with Arduino Kit (#32335)</a>	<a href="#">All Parallax hardware needed for this unit is included in one Robot Shield with Arduino kit (#32335)</a>										<a href="#">3-function Universal Remote (#020-00001)</a>	<a href="#">QTI Line-follower AppKit (#28108)</a>	<a href="#">Ping))) Ultrasonic Sensor + Mounting Bracket Kit (#910-28015A)</a>
<b>Other materials needed</b>	none		none	none	masking tape, pen, 5 AA 1.5V batteries	none	none	flashlight	none			black electrical tape, poster board, or printed tracks	target objects such as cans or boxes
<b>Approximate time</b>	20-40 minutes	60-90 minutes	60-90 minutes	60-90 minutes	60-90 minutes	60-90 minutes	60-90 minutes	60-90 minutes	60-90 minutes	60-90 minutes	90 minutes	90-120 minutes	90-120 minutes
<b>Adjustment suggestions</b>	Shorten: IT/Teacher prepare ahead: Test web-based software or install desktop software. Test programming connection on each computer.	Shorten: If students are already familiar with basic Arduino programming; use the Chapter 1 Challenges as self-assessment material, then focus only on activities where a refresher is needed.	Shorten: teacher or volunteers connect Arduino Uno module to Board of Education Shield ahead of time. This can be done before Unit 1 if desired.	shorten: Teacher or volunteers center servos ahead of time.	Shorten: Teacher or volunteers assemble robots ahead of time; center servos first. (Un-assembling each year not necessary; hardware replenishment pieces available)	Shorten: Just observe each maneuver animation and discuss the parameter for servo_speed, but skip the Try This and Your Turn.	Stop after this unit if needing to shorten the course or use only very simple circuits.	Skip this unit if looking to eliminate one navigation sensor option for time's sake.	Test work area for infrared light interference ahead of time. If present, skip this unit.	Shorten: Have each robot just follow a person's hand, instead of forming a large line.	Shorten: skip adding obstacle detection.	No need for Unit 12 first. Shorten: use the Tracks PDF to print out line-following tracks, instead of creating them with poster board and black electrical tape. project.	No need for previous project units
<b>Skills, concepts, &amp; objectives (students will be able to...)</b>	Access the Arduino online desktop software. Know how to load and run a very simple Arduino program to test the connection.	Use a microcontroller program to send messages to a serial monitor for display, use variables, store and retrieve values from memory, solve math problems, make decisions to control program flow, count and control repetitions.	How to connect the Arduino Uno module to the Board of Education Shield. Understand what a breadboard is, and how to build an LED circuit on a breadboard. Understand a timing diagram and how it relates to program code. How to find and include an Arduino library in a project.	Identify the external parts of a servo motor. How to connect servo motors to the BOE Shield for power and program control; writing code to generate pulse widths that control the speed and direction of a servo motor.	Assemble a small robot from written and visual instructions. Identify different mechanical parts. Use a screwdriver and small wrench. Connect power to the robot.	Create programs to make a rolling robot move, understand different types of turns and how to make them by controlling each wheel's speed separately, make observations and measurements to fine-tune robot behavior.	Understand how a whisker switch completes and electrical circuit, build whisker switch circuits connected to a microcontroller, create a program to monitor the state of a whisker switch, program a rolling robot to respond to obstacles detected by the whisker switches.	Understand where visible light wavelengths occur on the light spectrum; build a sensor system connected to a microcontroller that detects the difference in ambient visible light levels reaching two phototransistors; program a rolling robot to navigate based on the difference in ambient light levels detected by two different light sensors.	Understand where infrared light wavelengths occur in the light spectrum; build a sensor system connected to a microcontroller that emits infrared light and looks for reflections, create programs to detect obstacles using reflected infrared light, program a rolling robot to navigate by responding to obstacles detected with infrared light reflections.	Understand the concept of a carrier frequency and peak sensitivity. Use frequency sweep to detect distance. Program a robot to use frequency sweep distance detection to locate and follow an object at a given distance.	Design a user interface; decode IR signals from a Sony-protocol remote; program a rolling robot to perform different actions based on the IR remote signal it receives.	Use an array of sensors to detect a black line on a white surface; program a rolling robot to make navigation decisions based on an array of line sensors.	Mount an ultrasonic rangefinder on a servo turret on the front of a rolling robot. Write programs that sweep the servo turret and allow the rangefinder to scan the area for objects, then let the robot navigate avoiding the objects.

Book page (V 1.1)	Pages 9–26	Pages 27–37	Pages 42–59	Pages 60–70	Pages 76–98	Pages 103–139	Pages 147–167	Pages 176–209	Pages 216–243	Pages 249–262	(N/A)	(N/A)	(N/A)
<b>Web Tutorial link</b>	<a href="#">Chapter 1. Activity 1: Download and Install the Software</a>	<a href="#">Chapter 1: Activities 2-7</a>	<a href="#">Chapter 2. Activities 1-3</a>	<a href="#">Chapter 2: Activites 4-6</a>	<a href="#">Chapter 3: Assemble and Test your BOE Shield-Bot</a>	<a href="#">Chapter 4: BOE Shield-Bot Navigation</a>	<a href="#">Chapter 5: Tactile Navigation with Whiskers</a>	<a href="#">Chapter 6: Light-Sensitive Navigation with Phototransistors</a>	<a href="#">Chapter 7. Navigating with Infrared Headlights</a>	<a href="#">Chapter 8.. Robot Control with Distance Detection</a>	<a href="#">IR Remote Controlled Shield-Bot Project</a>	<a href="#">QTI Line Follower Product Guide</a>	<a href="#">Shield-Bot Roaming with Ping))) project</a>
<b>Resource link (s)</b>	<a href="#">Arduino desktop and online software options</a>	<a href="#">Chapter 1 Challenges</a>	<a href="#">Board of Education Shield for Arduino</a>	<a href="#">Parallax Continuous Rotation Servo (#900-00008)</a>	<a href="#">Small Robot Hardware Refresher Pack (#570-35000)</a>		<a href="#">Small Robot Electronics Pack</a>	<a href="#">Small Robot Electronics Pack</a>	<a href="#">Small Robot Electronics Pack</a>	<a href="#">YouTube video: Robot Follow the Leader with BOE Shield-Bots for Arduino</a>	<a href="#">YouTube video: IR Remote Controlled Shield-Bot</a>	<a href="#">QTI Line Follower Shield-Bot Arduino Code</a>	<a href="#">YouTube Video: Shield-Bot Navigation with Ping))) Sensor</a>
	<a href="#">Fee-based Codebender online software</a>		<a href="#">Arduino Uno R3</a>									<a href="#">Printable Line-following Tracks PDF</a>	