

Michael Margolis

Make an Arduino- Controlled Robot



Learn by
Discovery

Autonomous and Remote-Controlled
Bots on Wheels

CREATING WITH
SENSORS AND
OPEN SOURCE
HARDWARE



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Make an Arduino-Controlled Robot

by Michael Margolis

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Table of Contents

Preface	vii
1. Introduction to Robot Building	1
Why Build a Robot?	4
How Robots Move	5
Tools	6
2. Building the Electronics	9
Hardware Required	9
Construction Techniques	10
Soldering	10
Building the Motor Controller	10
Soldering the Reflectance Sensors	17
Making a Line Sensor Mount	17
Next Steps	20
3. Building the Two-Wheeled Mobile Platform ..	21
Hardware Required	22
Mechanical Assembly	23
Lay Out the Chassis Parts	23
Motor Assembly	24
Assemble the Chassis Components	26
Attaching the Control Electronics	37
Mounting the IR sensors	38
Mounting the IR Sensors for Edge Detection	39
Mounting the IR Sensors for Line Following	41

Next Steps	43
4. Building the Four-Wheeled Mobile Platform ...	45
Hardware Required	46
Mechanical Assembly	47
Lay Out the Chassis Parts	47
Motor Assembly	49
Assemble the Chassis Components	51
Solder the Power and Motor Connections	54
Connecting the Battery Pack and Power Switch	55
Building the Optional Trickle Charger	56
Assemble the Chassis	57
Mounting Arduino and Connecting Wires to the Shield	58
Mounting the IR sensors	65
Mounting the IR Sensors for Edge Detection	65
Mounting the IR Sensors for Line Following	67
Next Steps	68
5. Tutorial: Getting Started with Arduino	71
Hardware Required	72
Arduino Software	72
Arduino Hardware	72
Installing the Integrated Development Environment (IDE)	74
Installing Arduino on Windows	74
Installing Arduino on OS X	75
Installing Arduino on Linux	76
Driver Installation	76
Connecting the Arduino Board	78
Using the IDE	78
Uploading and Running the Blink Sketch	81
Using Tabs	82
Installing Third-Party Libraries	83
6. Testing the Robot's Basic Functions	85
Hardware Required	85
Software Prerequisites	86
Sketches Used in This Chapter	87
Load and Run helloRobot.ino	88
About the Sketch	95
Troubleshooting	98
Making the Sketch Easy to Enhance	99
7. Controlling Speed and Direction	103
Hardware Required	103

Sketches Used in This Chapter	103
Types of Motors	104
Motor Controllers	106
Controlling Motor Speed	109
How Motor Speed Is Controlled	109
Code for Motor Control	110
Calibrating Rotation and Tracking	116
Software Architecture for Robot Mobility	119
Functions to Encapsulate Robot Movements	123
Core Movement Code	124
Additional Core Functions	126
Functions to Rotate the Robot	127
Higher-Level Movement Functions	130
8. Tutorial: Introduction to Sensors	133
Hardware Discussed	133
Software	134
Infrared Reflectance Sensors	134
Sonar Distance Sensors	137
Maxbotix EZ1 Sonar Distance Sensor	139
Sharp IR Distance Sensor	141
Proximity Sensor	142
Sound Sensor	143
Arduino Cookbook	146
9. Modifying the Robot to React to Edges and Lines	147
.....	147
Hardware Required	147
Sketches Used in This Chapter	148
The Look Code	149
Edge Detection	150
Line Following	154
Seeing Sketch Data	160
10. Autonomous Movement	163
Hardware Required	163
Sketches Used in This Chapter	164
Mounting a Ping Distance Sensor	165
Making a Mount for the Ping Sensor	166
Mounting the Ping Sensor in a Fixed Position	168
Mounting the Ping Sensor on a Servo	168
Letting the Robot Wander	170

Adding Scanning	178
11. Remote Control	185
Hardware Required	185
Sketches Used in This Chapter	186
Design of the Remote Control Code	186
Controlling the Robot with a TV Type IR Remote	190
Installing the IR Decoder Chip	190
The IR Remote Software	192
Appendix A. Enhancing Your Robot	201
Appendix B. Using Other Hardware with Your Robot	205
Appendix C. Debugging Your Robot	211
Appendix D. Power Sources	221
Appendix E. Programming Constructs	231
Appendix F. Arduino Pin and Timer Usage	235

Introduction to Robot Building

1

This book takes you through the steps needed to build a robot capable of autonomous movement and remote control. Build instructions are provided for 2WD (two wheel drive) and 4WD (four wheel drive) platforms. The platforms shown in [Figure 1-1](#) and [Figure 1-2](#) will make the construction a snap, but you can build your own robot chassis if you prefer. The connection and use of the control electronics and sensors are fully explained and the source code is included in the book and available for download online (see [“How to Contact Us”](#) (page xv) for more information on downloading the sample code).

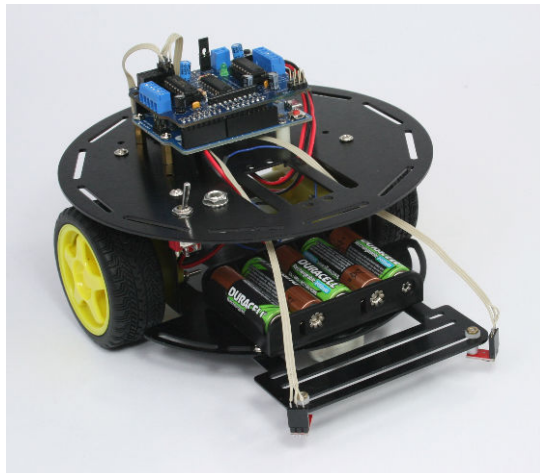


Figure 1-1. *The assembled two wheeled robot chassis*

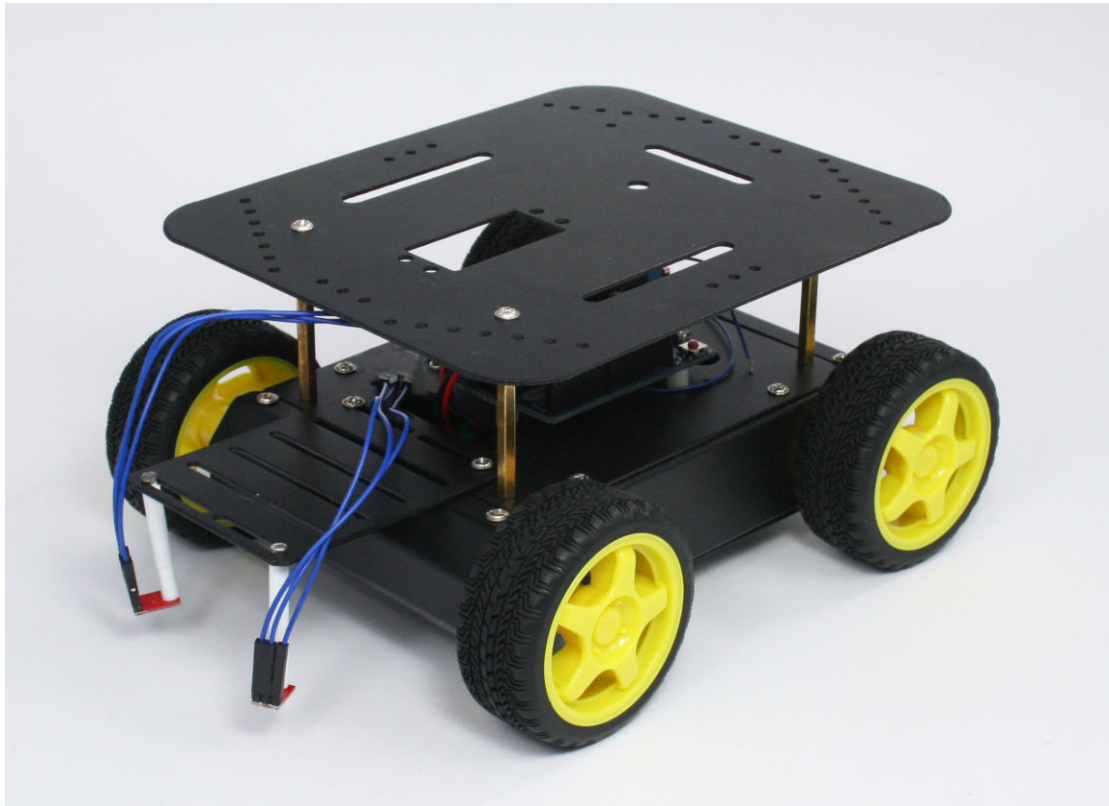


Figure 1-2. *The assembled four wheeled robot chassis*

Here is a preview of the projects you can build:

- Controlling speed and direction by adding high level movement capability.
- Enabling the robot to see the ground—using IR sensors for line and edge detection (see [Figure 1-3](#) and [Figure 1-4](#)).
- Enabling the robot to look around—scanning using a servo so the robot can choose the best direction to move, as shown in [Figure 1-5](#).
- Adding remote control using a TV remote control or a wired or wireless serial connection.

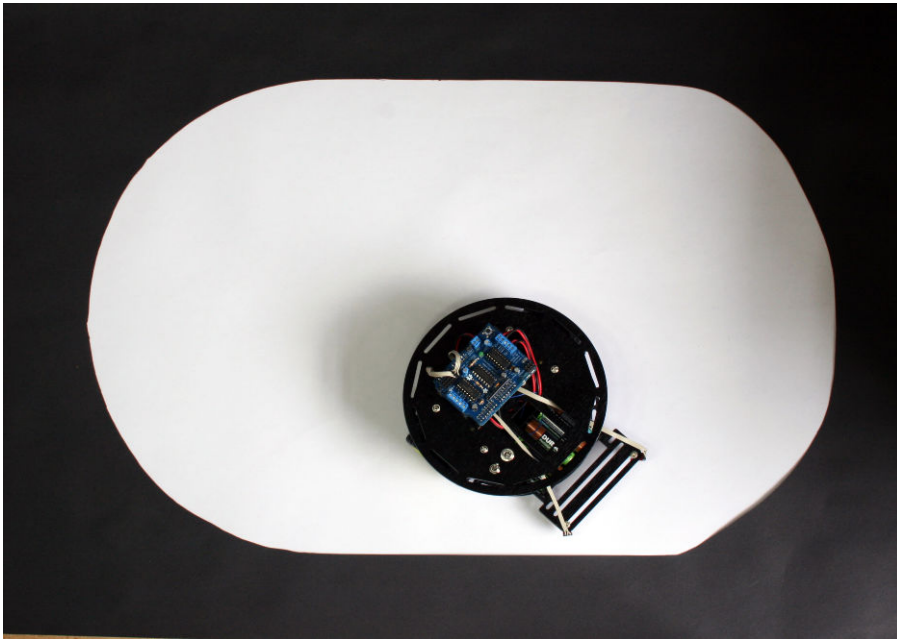


Figure 1-3. Robot moves around but remains within the white area

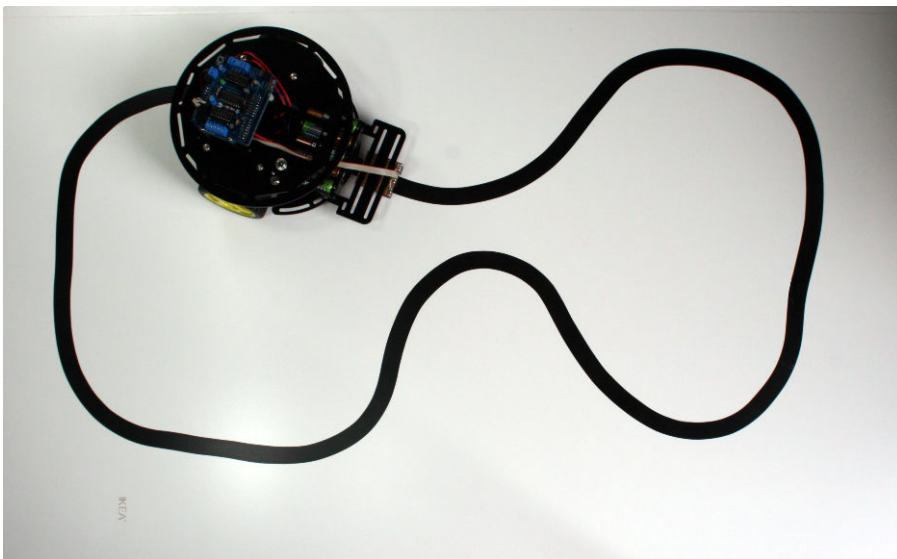


Figure 1-4. Robot follows black line

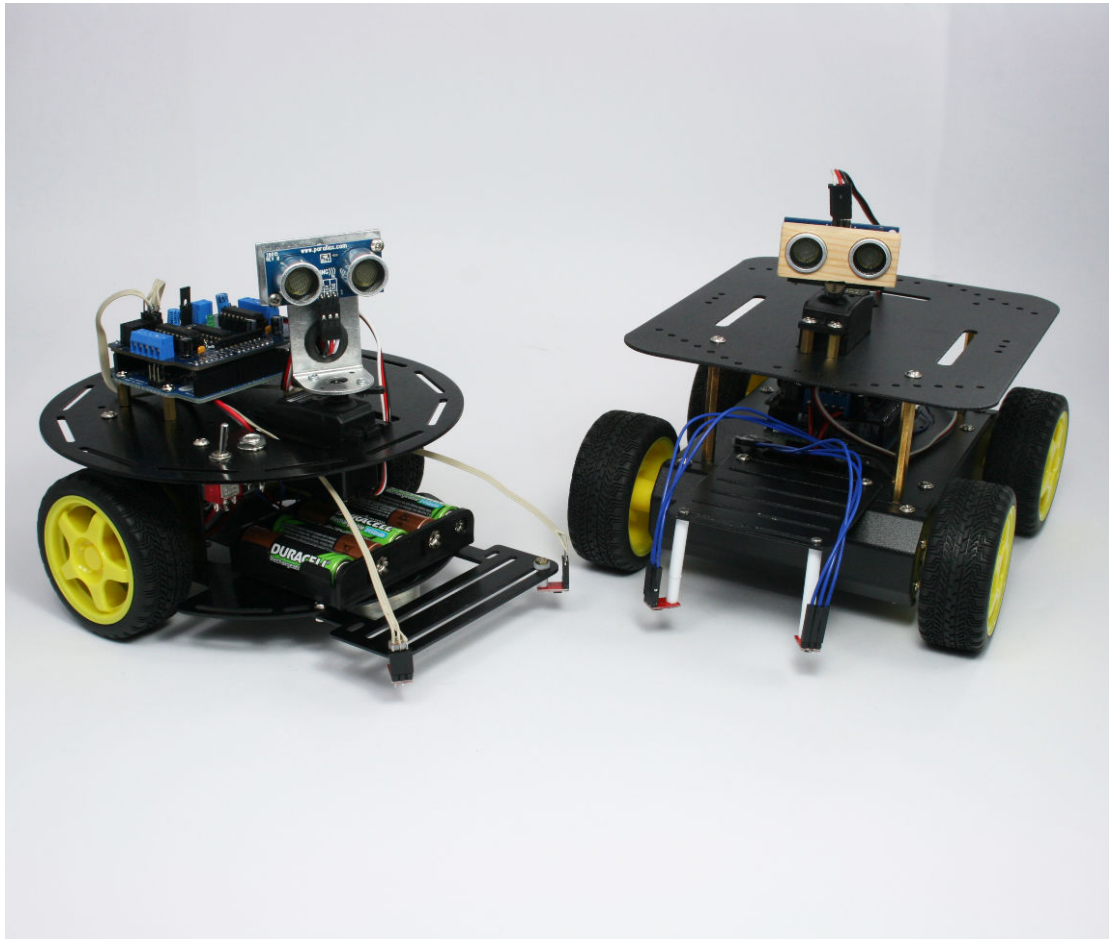


Figure 1-5. *Two wheeled and four wheeled robots with distance scanners*

Why Build a Robot?

Building a robot is different from any other project you can make with a microcontroller. A robot can move and respond to its environment and exhibit behaviors that mimic living creatures. Even though these behaviors may be simple, they convey a sense that your creation has a will and intent of its own. Building a machine that appears to have some spark of life has fascinated people throughout the ages. The robots built over 60 years ago by neurophysiologist W. Grey Walter (see <http://www.extremenxt.com/walter.htm>) explored ways that the rich connections between a small number of brain cells give rise to complex behaviors.

There are many different kinds of robots, some can crawl, or walk, or slither. The robots described in this book are the easiest and most popular; they use two or four wheels driven by motors.

Choosing Your Robot

The projects in this book can use either a two or four wheeled platform, but if you are still deciding which is right for you, here are some factors that will help you choose:

Two Wheeled Robot

Light and very maneuverable, this is a good choice if you want to experiment with tasks such as line-following that require dexterous movement. However, the caster that balances the robot requires a relatively smooth surface.

Four Wheeled Robot

This robot's four wheel drive makes this a good choice if you want it to roam over rougher surfaces. This platform has a large top plate that can be used to carry small objects. The robot is heavier and draws more current than the 2WD robot, so battery life is shorter.

How Robots Move

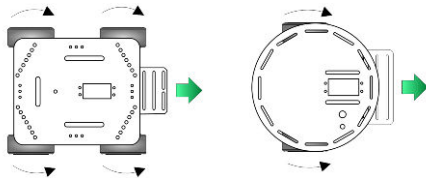


Figure 1-6. Left and Right wheels turn forward, Robot moves Forward

The robots covered in this book move forward, back, left and right much like a conventional car. [Figure 1-6](#) shows the wheel motion to move the robot forward.

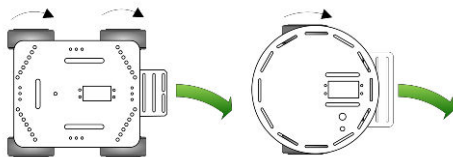


Figure 1-7. Only Left wheels turn, Robot Turns Right

If the wheels on one side are not driven (or are driven more slowly than the other side) the robot will turn, as in [Figure 1-7](#).

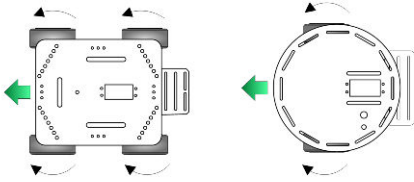


Figure 1-8. Left and Right wheels turn backward, Robot moves Backward

Figure 1-8 shows that reversing the wheel rotation drives the robot backward.

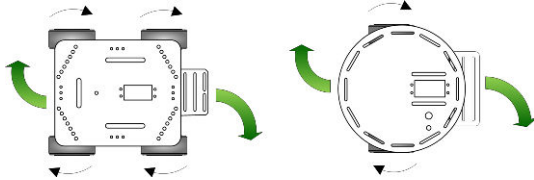


Figure 1-9. Left wheels turn forward, Right wheels reverse, Robot rotates Clockwise

Unlike a car (but a little like a tank), these robots can also rotate in place by driving the wheels on each side in different directions. If the wheels on each side are spinning in opposite directions, the robot will rotate. Figure 1-9 shows clockwise rotation.

Tools

These are the tools you need to assemble the robot chassis.

Phillips Screwdriver

A small Phillips screwdriver from your local hardware store.

Small long-nose or needle-nose pliers

For example, Radio Shack 4.5-inch mini long-nose pliers, part number 64-062 (see Figure 1-10) or Xcelite 4-inch mini long-nose pliers, model L4G.

Small wire cutters

For example, Radio Shack 5" cutters, part number 64-064 (Figure 1-11) or Jameco 161411

Soldering iron

For example, Radio Shack 640-2070 (Figure 1-12) or Jameco 2094143 are low cost irons suitable for beginners. But if you are serious about electronics, a good temperature controlled iron is worth the investment, such as Radio Shack 55027897 or Jameco 146595.

Solder 22 AWG (.6mm) or thinner

For example, Radio Shack 640-0013 or Jameco 73605.



Figure 1-10. *Small Pliers*



Figure 1-11. *Wire Cutters (Side Cutters)*



Figure 1-12. *Soldering Iron*

