



Robotics

Scouts BSA · STEM

Name

Started

Completed

Robotics is where building, coding, and problem-solving come together. You will design your own robot, make it move and sense the world, and learn how engineers test and improve their ideas. Expect some things to fail at first. That's how every good robot gets built.

Requirements

Every official requirement, in plain language. Check the official wording when you sign off (scouting.org/merit-badges/robotics/). Tips and examples are ideas, not extra requirements.

1 Safety

Tips for this section: Think about pinch points, moving parts, batteries, and tools. Make a short list of hazards and how you'd treat a small cut or burn.

- ☐ **1a** Explain to your counselor the hazards you're most likely to face working with robots and how to anticipate, reduce, prevent, and respond to them. Describe the right safety gear and clothing for robotics work

- ☐ **1b** Discuss how to prevent and treat injuries that can happen during robotics activities or competitions, such as cuts, eye injuries, and heat or chemical burns

2 Robotics industry

Tips for this section: Look around you for robots: vacuum robots, factory arms, rovers. For each, ask how it moves and what sensors help it know where it is.

Example for this section: Pick three robots and break each down: a robot vacuum moves on wheels and senses walls with bump and infrared sensors; a factory arm moves on joints and uses position sensors; a Mars rover drives on rocker suspension and uses cameras to avoid rocks.

- ☐ **2a** Discuss with your counselor what robots can do and the best ways robots are used today

- ☐ **2b** Discuss with your counselor how remote-control vehicles, telerobots, and autonomous robots are alike and different

- ☐ **2c** Discuss with your counselor three ways robots can move besides wheels or tracks, and when each would be a good choice

- ☐ **3** Talk with your counselor about three of the five major robotics fields (mobility, sensors, manipulation, programming, human-robot interface) and why each matters, either for one robot system or in general. Use pictures or at least one video

Tip: Pick three fields that sound most interesting to you and find one real example of a robot in each to talk about.

Example: Pick three of the five fields, like mobility, sensors, and manipulation, and show a picture or video for each: how a Mars rover's wheels and suspension carry it over rocks, how a self-driving car's cameras see the road, and how a surgical robot's arm makes tiny, precise moves. Explain why each field matters.

4 Design, build, program, and test

Tips for this section: Start simple with a kit or classroom robot. Build, program one task, test it, then improve it one change at a time.

Example for this section: Build a wheeled robot that follows a black tape line using a light sensor. Write the code, test it on a curve, and when it drives off the line, change one thing at a time, like speed or sensor height, and record the result.

- ☐ **4a** With your counselor's approval, choose what your robot or robotic subsystem will do, making sure the task uses sensor feedback and programming, and record it in your robot engineering notebook

- ☐ **4b** Design your robot to use sensors and programming with at least 2 degrees of freedom, and document the design in your notebook with drawings and a written description

- ☐ **4c** Build a robot or robotic subsystem of your own design to do the task you chose in 4a

- ☐ **4d** Discuss with your counselor the ways your robot could be programmed, then do 4d1 or 4d2 (choose 1 of 2 below)

- ☐ **4d1** Program your robot to do the task from 4a, and put a sample of the source code in your engineering notebook

- ☐ **4d2** Make a flowchart of the steps your robot would follow to do the task from 4a, including actions based on sensor input, and put it in your engineering notebook

- ☐ **4e** Test the robot and log the results in your notebook, with ideas for improving it and pictures or sketches of the finished robot

5 Demonstrate

Tips for this section: Keep your engineering notebook as you go: sketches, code ideas, what broke, and how you fixed it. It makes the demo easy to explain.

Example for this section: Demonstrate your robot doing its task three times, then walk your counselor through your notebook: the first sketch, a design that didn't work, the code change that fixed it, and what you'd improve with more time.

- ☐ **5a** Demonstrate the robot you built in requirement 4 for your counselor

- ☐ **5b** Share your engineering notebook with your counselor and talk about how well the robot did its task, what you'd change in your next design, and what the design process taught you

6 Competitions: Choose 1 of 2

Tips for this section: Check whether a school or library team competes in a youth robotics league nearby, and go watch a match.

Example for this section: Watch a youth robotics competition with your family and note how teams design for the game rules, how they repair robots between matches, and how they work together in the pit area.

- ☐ **6a** Go to a robotics competition and tell your counselor what you saw and learned, including how teams are organized and managed

- ☐ **6b** Learn about three youth robotics competitions and tell your counselor about each: type of competition, time commitment, participants' ages, and number of teams

7 Careers and hobbies: Choose 1 of 2

Tips for this section: Ask an engineer, technician, or robotics club coach what they do and what classes helped them get started.

- ☐ **7a** Name three careers that use robotics skills. Pick one and research its training, education, certification, experience, costs, job outlook, starting pay, and advancement, then discuss it and your interest with your counselor

- ☐ **7b** Find out how robotics skills could become a personal hobby. Research the extra training, costs, and organizations involved, then discuss what you learned and your short- and long-term goals with your counselor