

# Daisy Robotics

Find out what robots do and how you can design your own by earning three robotics badges!

## **Badge 1:**

What Robots Do

## **Badge 2:**

How Robots Move

## **Badge 3:**

Design a Robot

# Welcome to the world of robots!

When you've earned these three badges, you'll know what robots do.

You'll know how they move.

And you'll know how to design and build a robot.

You'll also find out how robots can do almost anything — from helping with your chores to exploring the ocean to traveling to Mars!



# Badge 1: What Robots Do

**A** robot is a machine that is programmed to move and act. Robots do things we, as humans, can't or don't like to do. Robots can be super small to go into small spaces or be built to go places that are too hot or cold for us. They can even go to far away planets and send information back to scientists! Learn about the many things robots do, and work in teams, like engineers, to design a robot that solves an everyday problem.

## Steps

1. Learn about robots
2. Find out what robots can do
3. Team up to design your own robots

## Purpose

When I've earned this badge, I will know about the many things robots can be designed to do.

STEP

# 1 Learn about robots

**A robot is a machine that runs automatically.** You've seen them on TV and in movies, but do you think you could tell a robot from something that's not? Discover robots in your everyday world as you search for robots and learn about engineers, the people who create them.



**Robotics Engineer**

## What is a Robot?

A robot is any machine that can follow instructions to do a job. Some jobs are too boring, dangerous or impossible for people to do. Robots can help. Robots can do anything from vacuuming the floor to performing delicate eye surgery!

STEP

# 2 Find out what robots can do

**Now that you know what a robot is, start to design your own, just like an engineer.** What's your robot's name? What can it do? Robots are made to do things that are too boring, dangerous, or difficult for us. Sketch a quick picture of your robot, and check out robots created by other engineers.

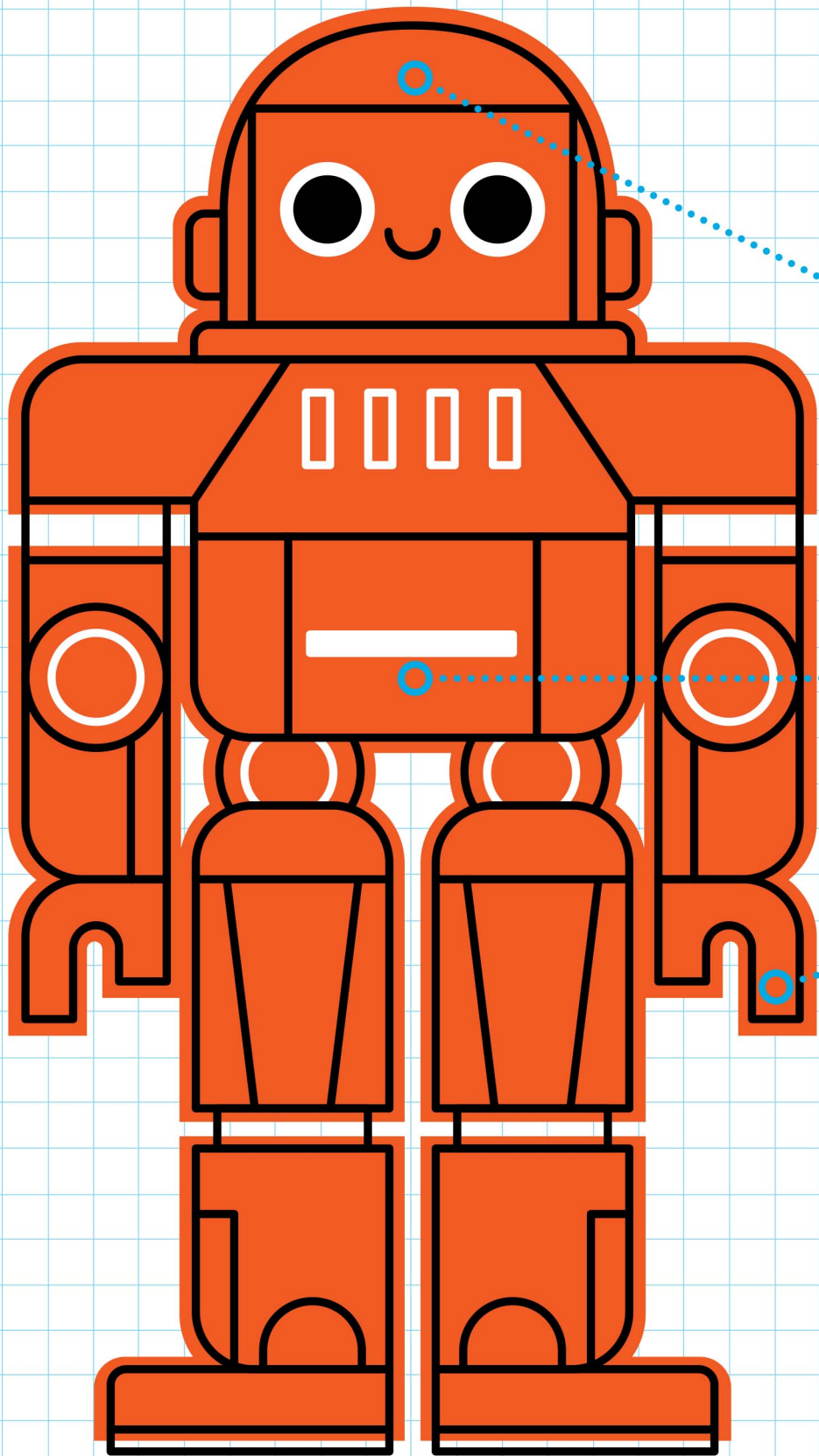
# WORDS TO KNOW

**Prototype** — When you invent something new, like a robot, you want to try it out or show it to people. To do that, you can create a model of your idea first. This model is called a prototype. A prototype can be a drawing. You can also make a model of your robot idea using cardboard, paper, string, rubber bands or other simple materials. You can show it to people and ask them what they think about your design.

**Algorithm** — This is a set of step-by-step instructions for how to do something. A recipe is an algorithm. It tells you the steps you need to take to bake a cake or cook some food. When your friend gives you directions to her house, that's an algorithm, too. She's telling you what you need to do to get to where she lives.

**Program** — This is an algorithm that has been coded into something that can be run by a machine.

**Debugging** — Sometimes a programmer writes code for a robot — but the robot doesn't do what it's supposed to. That means there's something wrong with the code. Programmers say that there's a "bug" in the program. When they find and fix the problem, they call it "debugging."



# BUILDING A ROBOT

Robots can look wildly different. They can be made of plastic, metal, wood or even paper. They can be big or small. They can look like people, insects, or animals. They can also be just a simple shape, like a ball or a box or even a dinner plate! No matter what a robot looks like, it has three main parts:

**1. Brain.** A robot's brain is called the Controller. It's the part of the robot that takes directions from a program.

**2. Body.** A robot's body is made of mechanical parts like wheels, gears, motors and grippers. These parts let the robot move or pick up objects.

**3. Sensors.** Sensors are devices that help robots to take in information from the world around them. Just like we use our eyes, ears or hands to sense things around us, sensors help robots to sense things like light, sound, heat and water.

There are a lot of different kinds of sensors. For example, a camera lens is a sensor that gathers light and translates that light into a picture we can see. A microphone is a sensor that gathers sound information. Temperature sensors can be used to tell how hot or cold it is. Motion sensors tell if something is moving nearby, like the wind or an animal or a speeding car. There are sensors that can help scientists predict the weather. They sense the weight of the air (air pressure) and the amount of water in the air (humidity). Sensors can be created to measure almost anything.

STEP

# 3 Team up to design your own robots

**When engineers design a new robot, they brainstorm common and complicated problems that it could solve.** Once they know what they want their robot to do, they create a plan to design and build it. Work with your fellow Daisies to search for problems and design robots that can solve them.



IDEAS

## What is a Program?

A program tells robots what to do by using code. It is like a step-by-step recipe. Not only is each step important, but the steps have to be in the right order. The programmer writes a code that gives the robot the right steps in the right order. The robot then moves and acts the way the programmer wants.



**Now that I've earned this badge,  
I can give service by:**

**Sharing what I learned about robots with my family and friends.**

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**I'm inspired to:**





# Badge 2: How Robots Move

**R**obots are simple machines that are programmed to run automatically. Programmers are the engineers that create step-by-step instructions, or algorithms, that tell robots how to move, understand, and act. Think you might be a good robot? See if you can follow your programmer's algorithm. After, become a programmer, and create algorithms for robots and friends.

## Steps

1. Learn about the parts of a robot
2. Find out how robots move
3. Make a robot move

## Purpose

When I've earned this badge, I will know how to create a program that could be run by a robot.

STEP

# 1 Learn about the parts of a robot

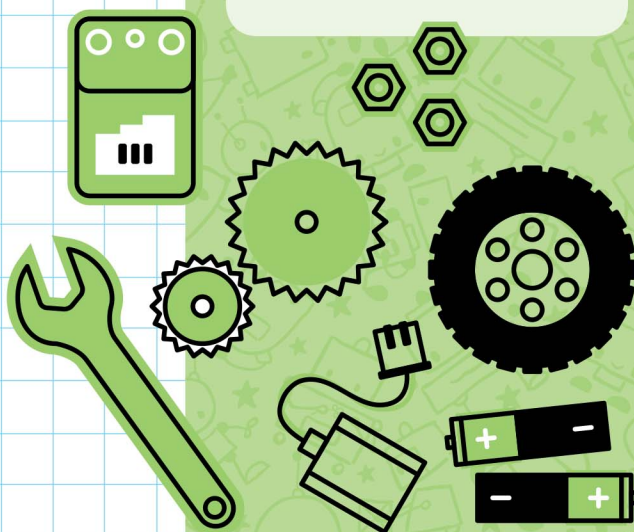
**Robots are simple machines that do what engineers tell them to do.** They are made up of many different parts, each with its own important job to help the robot to work. Some of these create the body, like its wheels, and others, like wires and sensors, help robots to understand their worlds. Explore the different parts that are used in a robot, and see what simple machines you can create!



DRAW  
YOUR  
MACHINE

## Garbage-Eating Robots

Robots are machines. They need fuel for energy to move and work. Some robots are programmed to find their own fuel. They are loaded with bacteria-filled cells. The bacteria breaks down garbage like rotten tomatoes and dead bugs to make their own energy. The energy allows the robots to search and gather more garbage. Then, they transform the garbage into energy which allows them to search for more food ... and so on and so on.



## STEP 2 Find out how robots move

**Without instructions to tell them what to do, robots are just simple machines.** Computer engineers, or programmers, create algorithms, or sets of step-by-step instructions, that are coded into the robot so they can move and act automatically. Do you think you can be a robot? Follow your programmer's commands, and discover how robots move. After, try creating step-by-step programs for the other robots to follow!

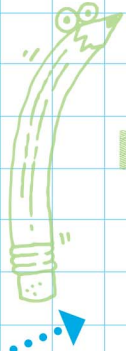
### Robo-Pets

When people get sick and have to go to the hospital, they sometimes feel scared. They often feel better when they're near their pets. The problem is that animals usually aren't allowed in hospitals. Scientists wondered whether a robot could help.

They created a robot named Paro. Paro looks like a warm, fuzzy, baby seal pup that responds to touch and sound. If you say its name, the robot will turn its head and look at you. When someone pats Paro, the robot closes and opens its eyes, moves its tail or snuggles in closer. Doctors noticed that patients felt better when they cuddled and held PARO. Now there are lots of PARO robots helping lots of people in hospitals around the world.

**Engineers created Paro, a robot that provides comfort for sick patients.**





# DRAW A ROBO-PET

## Robot Penguin Spies

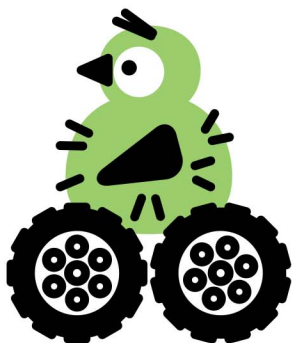
Scientists studying wild penguins had a problem — they couldn't get close without scaring them. Any time someone went near the penguins, they would run away.

The scientists needed a way to get up close — so they made a robot. The robot looked like a fuzzy, gray penguin baby on wheels. It was able to roll up to the penguins without scaring them. In fact, they gathered around the robot, and some penguins even sang to it! The scientists got the information they needed, thanks to the robot penguin spy!



## STEP 3 Make a robot move

**Programmers create algorithms that instruct robots on how to move and react.** Do you think you could create a program to navigate a robot to a prize? Create a step-by-step algorithm to lead a stuffed animal or friend, the “robot,” along a Robot Trail to explore how programmers create algorithms for their robots.



# TAKING THE HEAT

Humans can't go inside a volcano — it's just too hot. Many volcanoes have lava, which is rock that is so hot it has actually melted. Volcanoes are also filled with poisonous gasses. People can't breathe that!

But high heat and poison gas was not a problem for a robot like Dante II. Dante II had eight legs, like a spider. It used the legs to crawl down a cable and into a volcano.

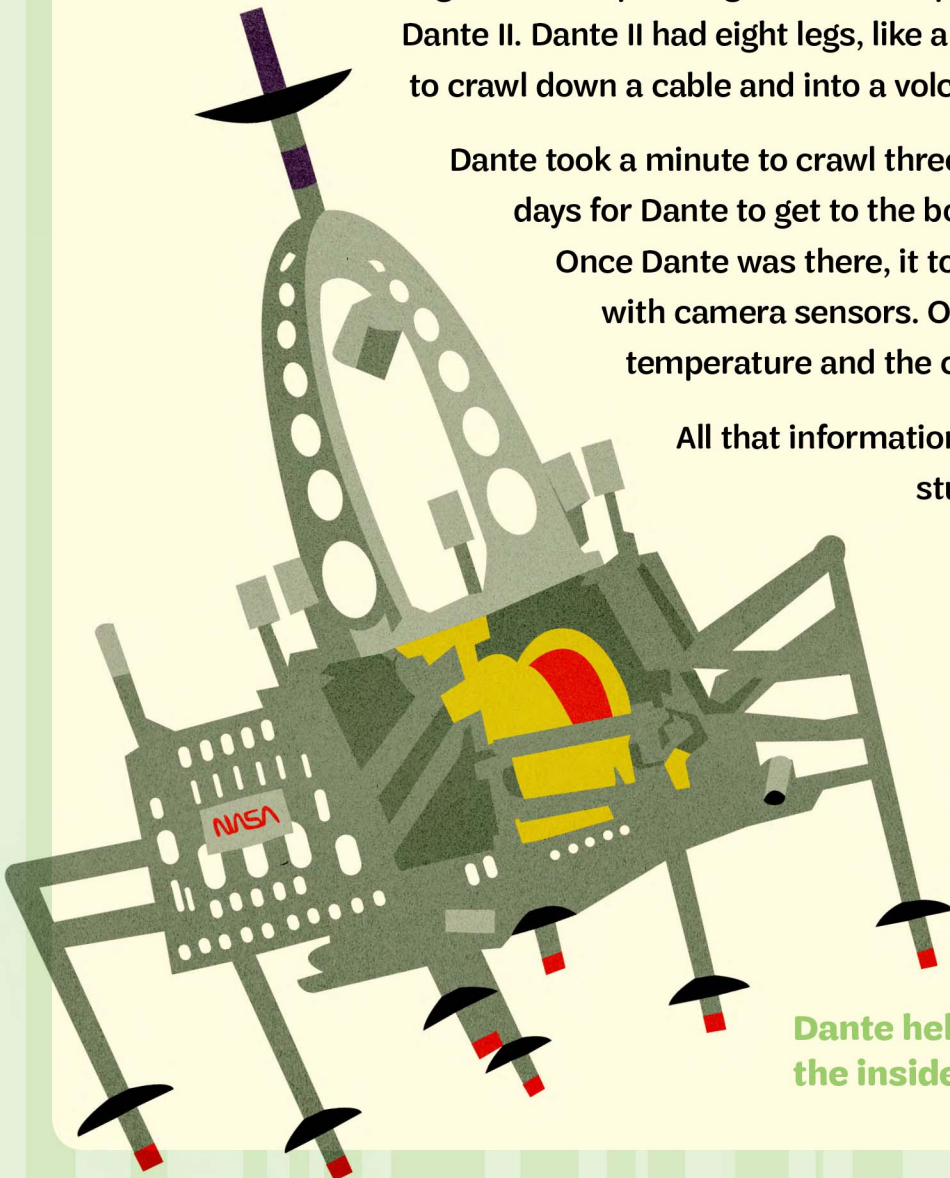
Dante took a minute to crawl three feet. It took three days for Dante to get to the bottom of a volcano.

Once Dante was there, it took video and pictures with camera sensors. Other sensors measured temperature and the chemicals in the gasses.

All that information was sent to scientists studying the volcano.

Before Dante II, no one knew what it was really like to be inside a volcano — but now, thanks to a robot, we do.

**Dante helps scientists to study the insides of volcanoes!**



Now that I've earned this badge,  
I can give service by:

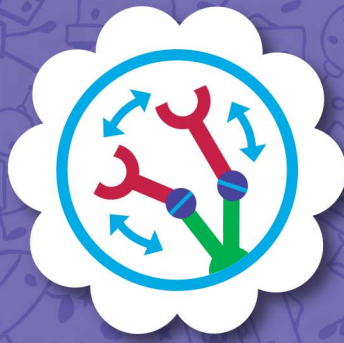
Sharing what I learned about programming with my friends and family.

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I'm inspired to:







# Badge 3: Design a Robot

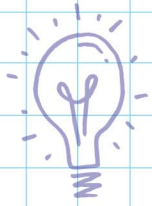
**N**ow that you know what robots can do and how they do it, it's time to design your own! Plan and build a prototype of your robot that solves an everyday problem. Don't forget to make a program for your robot, as it will need it for your prototype to "run." After, test and share with your fellow Daisies for ideas on how to make it even better.

## Steps

1. Plan your robot
2. Create a prototype
3. Get feedback on your robot

## Purpose

When I've earned this badge, I will know how to design a robot that solves an everyday problem.



STEP

# 1 Plan your robot

**As you know, robots solve problems both big and small.** Engineers look for problems in our world and build robots that fix or solve them. If you could build a robot that would solve a problem you have every day, what would your robot do? What would it look like? What parts would it need? Brainstorm and sketch robots that you could design to make your life easier.

STEP

# 2 Create a prototype

**Now that you have all your ideas down on paper, take a look, and choose the robot design that you think will do the best job at solving your problem.**

Now is your chance to build a prototype of your robot. Engineers create prototypes, a quick way to show an idea to others or to try it out. It can be as simple as a drawing or created with common materials, such as cardboard, paper, and string. But remember, you're creating a robot, not a simple machine, so you'll also need to create a step-by-step program for your robot prototype to "run."

# OH, WAITER!

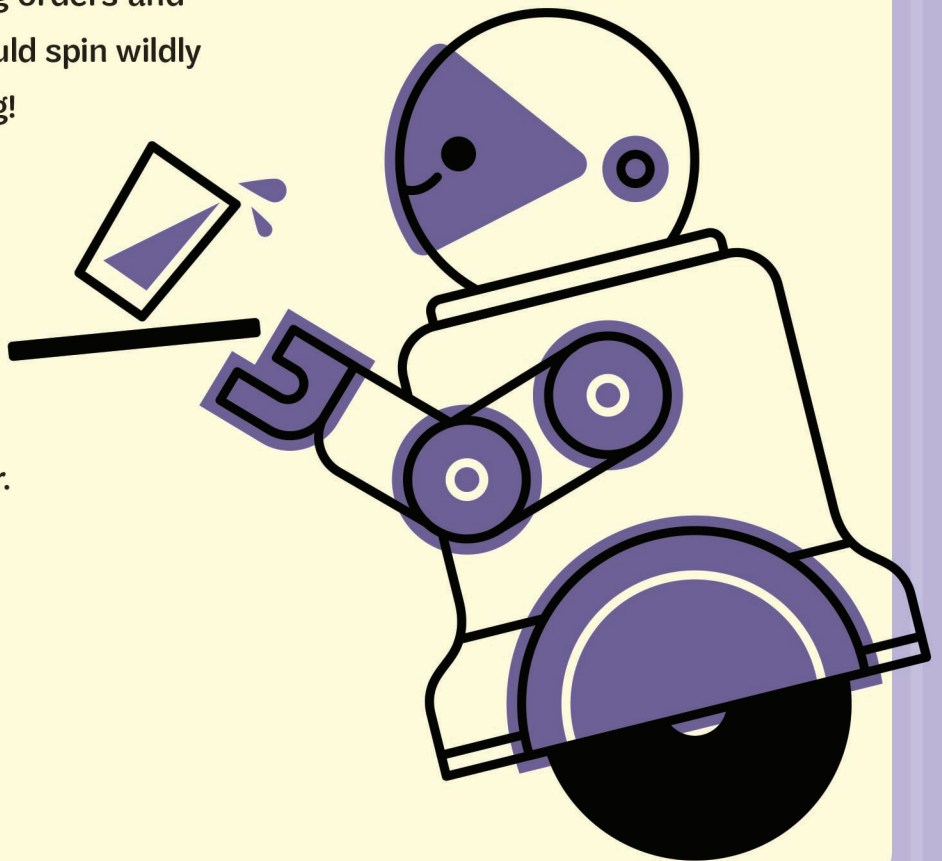
Not all robots do their jobs smoothly. That's okay, though. Mistakes help scientists and engineers to build better robots. They can see what works and what doesn't and figure out how to make things better.

That's what happened with some robots in California. The robots were used as waiters. They could take orders from customers and take food to their tables.

**The problem?** When the robots' batteries were low, the robots started dropping food. And when radios were playing nearby, the frequencies scrambled the robots' programs.

Instead of calmly taking orders and delivering food, they would spin wildly and food would go flying!

Talk about fast food!  
After seeing what didn't work, the robots were redesigned so they could do their job better.



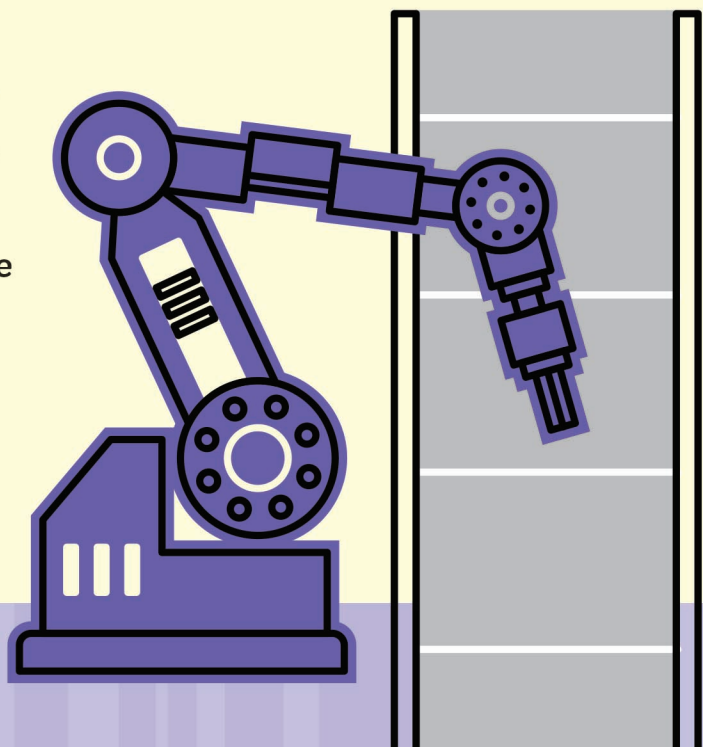
S DULL,  
DANGEROUS,  
DIRTY JOBS,  
ROBOTS  
CAN DO

What do you do when someone gives you a boring job? Or a job where you might get hurt? Or a job that's grimy and dirty? Call a robot!

Here are a few ways robots help people:

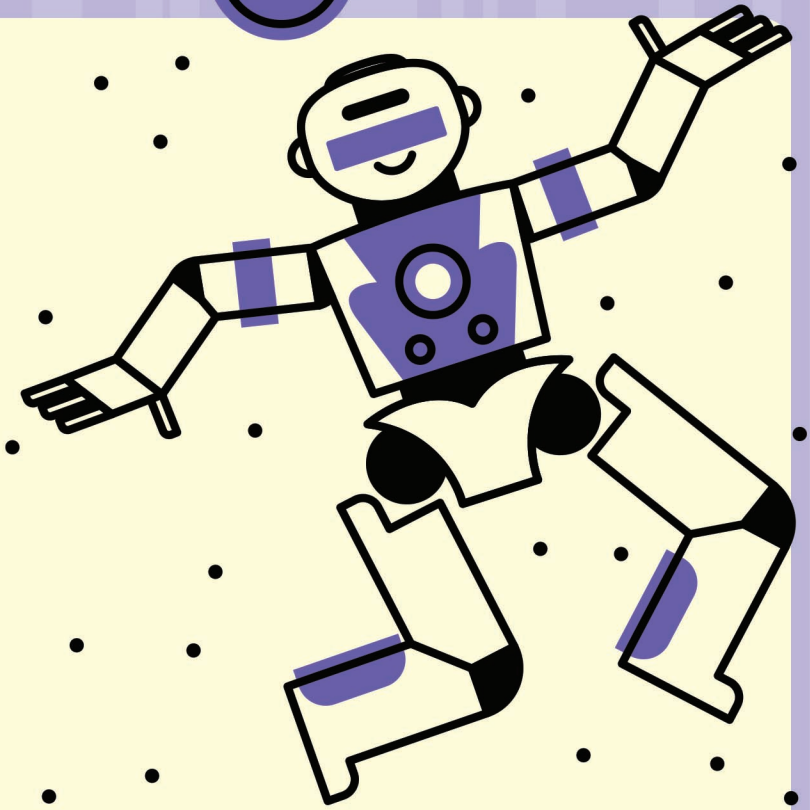
**1. Lifting very heavy objects.** It takes a lot of people to lift and move heavy items, like cars or refrigerators. It's dangerous work for people – but not for robots. They can be designed and programmed to lift heavy objects and load them on to trucks.

**2. Tightening one screw over and over again.** There are robots in factories that put together objects like cars. They do the same job over and over again. A person might get tired, grow bored or even get injured, but robots never complain.



### 3. **Space exploration.**

Robots can go places where people can't, like other planets. Robots have traveled to Mars to gather samples of the soil and the atmosphere. They don't need to worry about poisonous gasses or freezing cold temperatures. Robots can go to far-away planets and explore first. Someday, maybe humans will go there, too.



**4. Cleaning small, tight, dangerous spaces.** Air vents, chimneys, and ducts are small tunnels that allow air and chemicals to move through a building. These ducts can get really dirty over time. They need to be cleaned or they could make people sick. But who wants to crawl into a tunnel and clean out gunk that could be poisonous? A robot, of course! Robots can go into tight spaces and don't have to worry about getting sick.

**5. Exploring Underwater.** The ocean is a beautiful, fascinating place, but exploring it can be extremely dangerous for people. It's hard for us to breathe underwater without help, we can't see without light deep in the ocean, and the pressure from the heavy water can be too much for humans. So scientists send robots to the bottom of the ocean to explore. Robots don't need to breathe, can carry their own lights, and the pressure doesn't harm them. They gather samples of the sands at the ocean floor, take pictures of living things, and measure things like temperature and chemicals in the water.

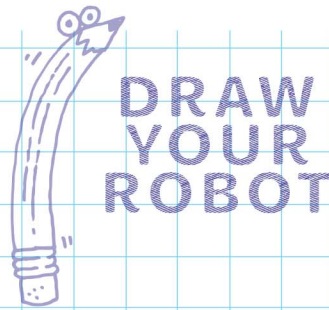
STEP

# 3 Get feedback on your robot

**Once engineers create a prototype, they test it to find ways to improve and redesign their new products.** Work with a fellow Daisy to test your robot prototype. Tell your partner how to move the prototype according to your program so you can “debug” or fix problems before you share your prototype with your Troop. After you share, gather feedback and ideas, like an engineer, on how to improve your robot’s design and make it even better!

## Library-Bots

Need to find a library book? Ask a robot! In some libraries, robots zip up and down the shelves. They find books, pick them up and deliver them to the checkout desk. Another kind of robot is used in some libraries to find books that have been put on the wrong shelves. The robots help librarians, who can have millions of books to sort through.



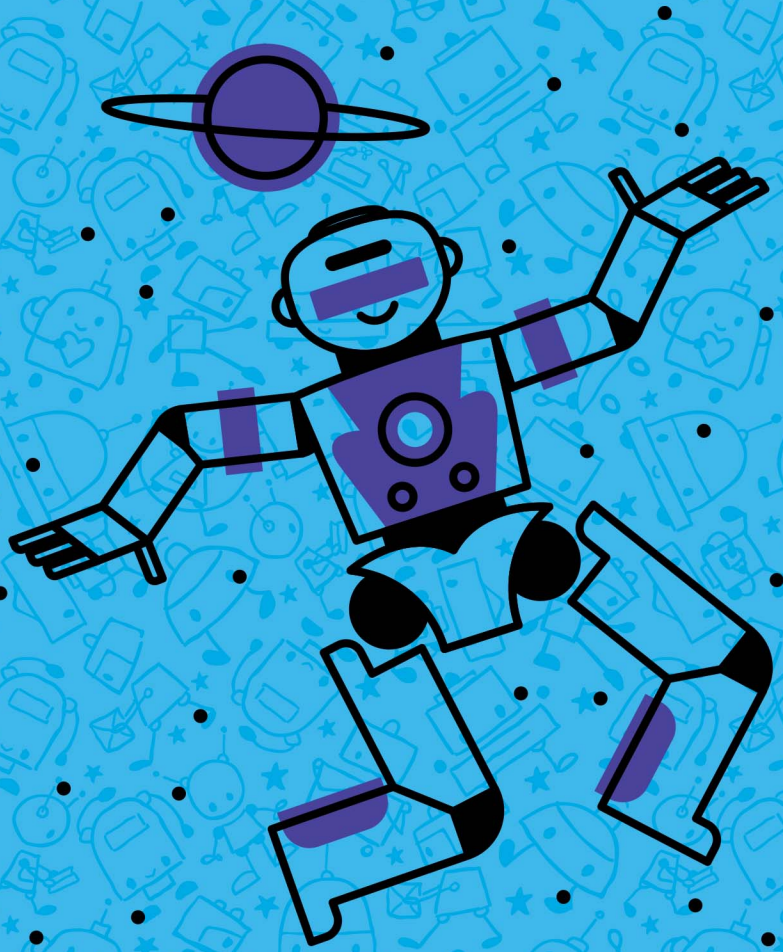
Now that I've earned this badge,  
I can give service by:

Sharing with others how I built my robot prototype or run my program.

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I'm inspired to:





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