The background is a solid blue color with a repeating pattern of white icons. These icons include various electronic components like gears, resistors, capacitors, and integrated circuits, as well as tools like wrenches, pliers, and screwdrivers. The pattern is dense and covers the entire slide area.

# Lesson 5: Electronics and Electronic Systems

# **By the end of this lesson, you will be able to:**

- Discuss electronics and electronic systems.
- Identify the most common types of electronics.
- Give examples of where electronics and electronic systems are used in daily life.
- Apply the concepts of electronics and electronic systems to robots.



# Introduction

In the previous lesson, you learned what a chassis is and began assembling one using your Robits kit. In this lesson, you'll learn about electronics and electronic systems, both in a general sense as well as how they apply to robots. In addition to that, you'll learn about where you can find electronics and electronic systems in your everyday life. By the end of the lesson, you will have added electronics to your beginner Robits chassis.



# Discussion:

**With your group, use your prior knowledge to discuss what you think electronics are.**

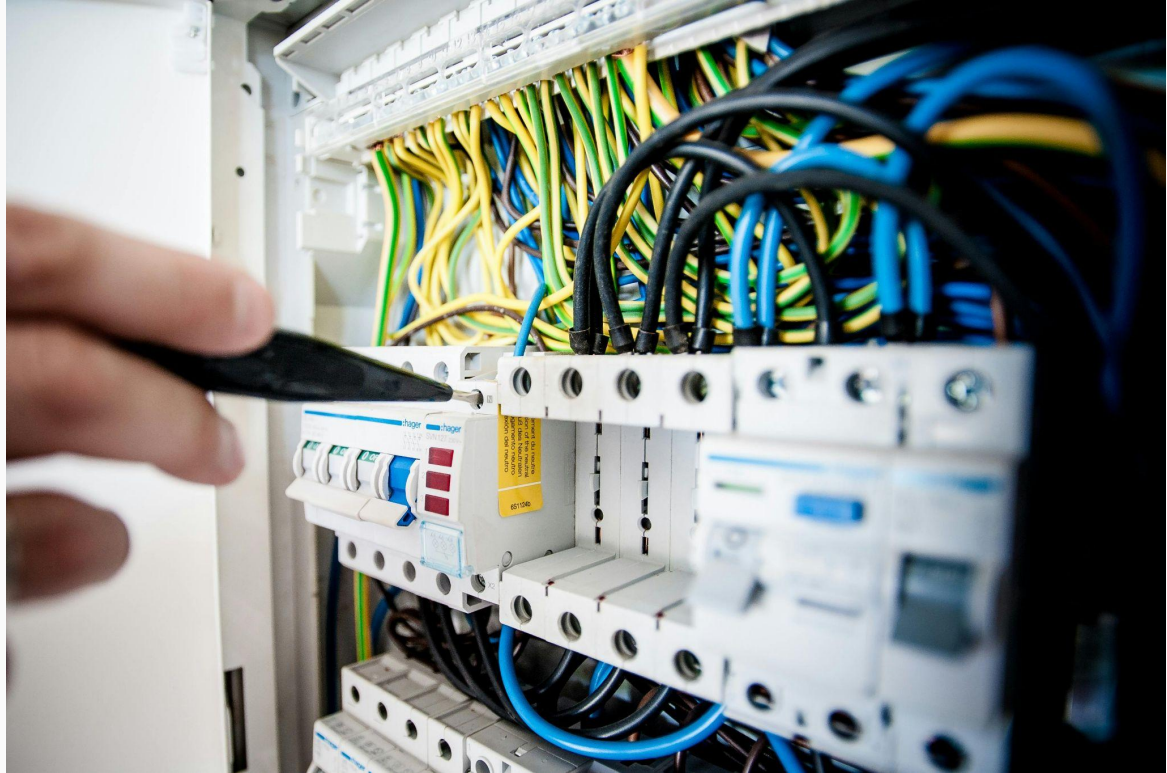


**What are electronics?**



# What are electronics?

As you learned in Lesson 2, electronics are components that can manipulate electricity or signals. There are many different types of electronics, and each type is built for a specific purpose. Electronics of different types are often combined to form complex electronic systems. Electronics have applications in nearly every aspect of our lives, and it is because of electronics that many everyday devices are able to function.



Electronics are complicated and can do a variety of different things.



# Discussion:

**With your group, use your prior knowledge to discuss what you think electronic systems are.**

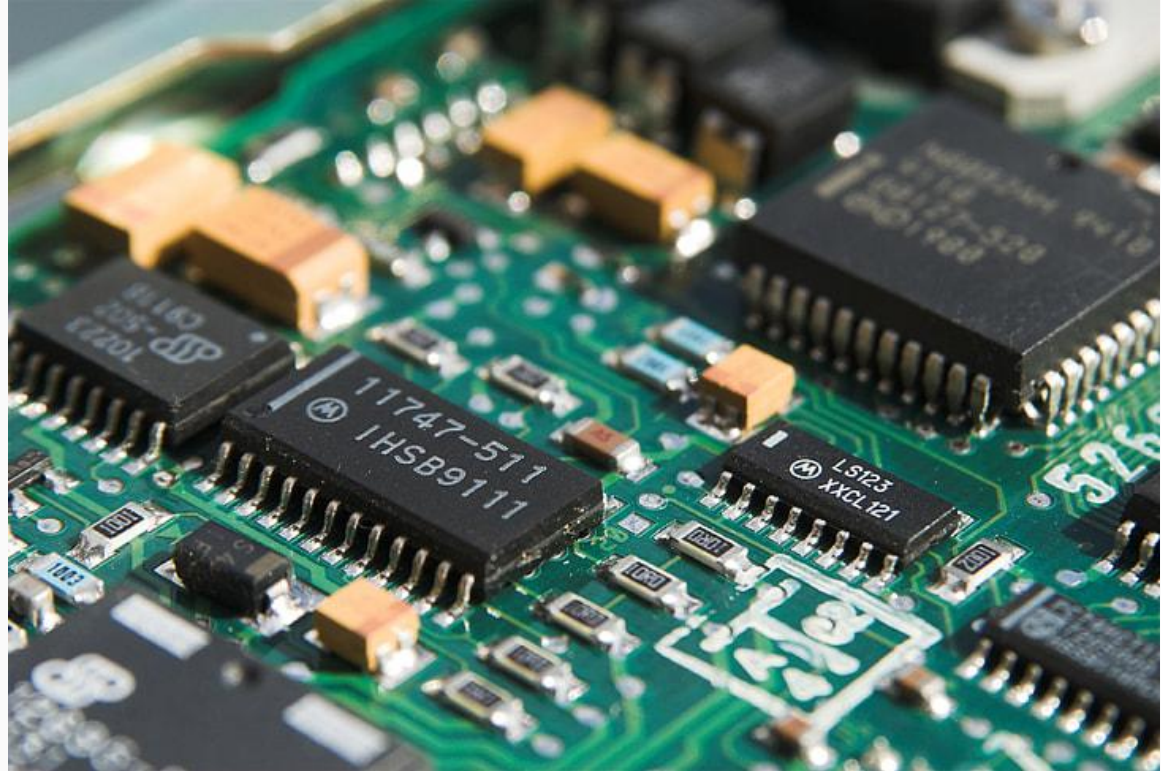


**What are electronic  
systems?**

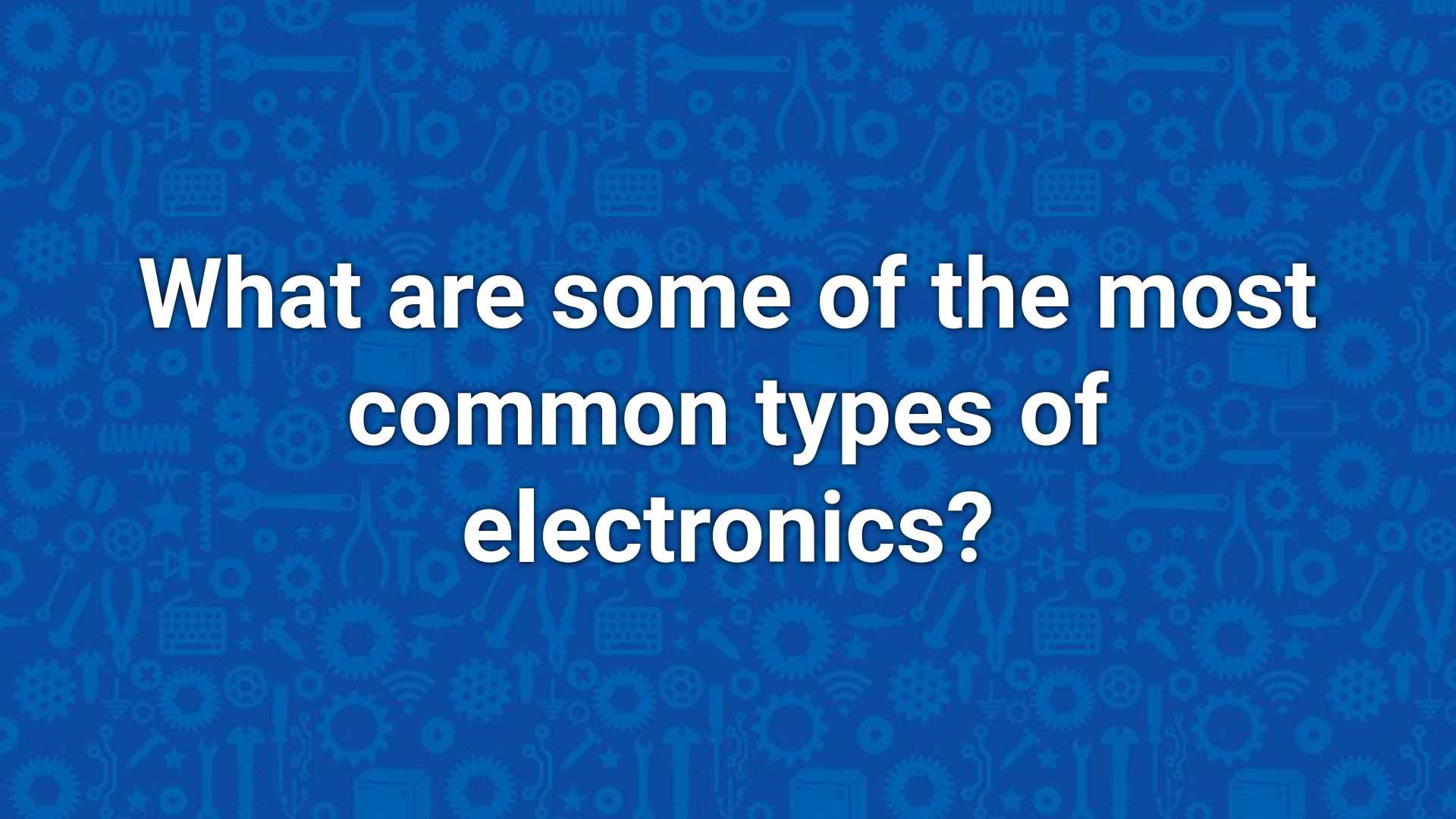


# What are electronic systems?

Electronic systems, otherwise known as circuits, are created when multiple different types of electronics are connected together so that electricity can flow through them. In fact, most electronics are unable to function outside of an electronic system. Electronic systems are used for many different purposes, and can range in size from very small, like the circuits in your phone, to incredibly large, like the circuits that light and heat whole buildings.



Motherboards, circuit boards, and computer chips are very complicated electronic systems.

The background is a solid blue color with a repeating pattern of white icons. These icons include various electronic components like gears, capacitors, resistors, and integrated circuits, as well as tools like wrenches, pliers, and screwdrivers. The pattern is dense and covers the entire background.

**What are some of the most  
common types of  
electronics?**

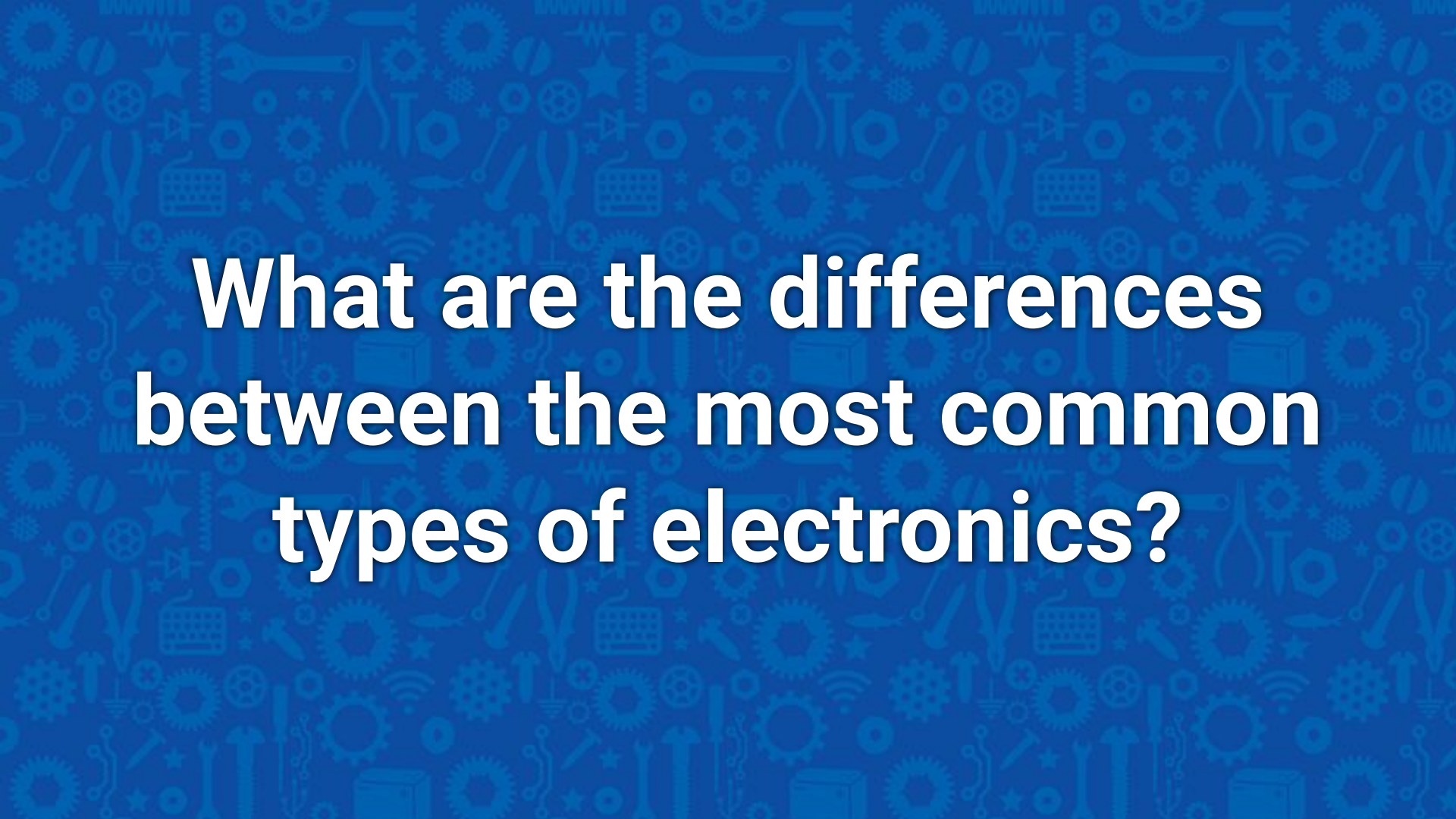
# Types of Electronics:

As was mentioned earlier, there are many different types of electronics, and each type is designed for a specific purpose. The most common types of electronics are as follows:

- Wires/Cables
- Power Sources
- Switches and Buttons
- Sensors
- Emitters
- Motors

In the following slides, we will discuss how each type of electronic fits into an electronic system, as well as what each type is used for, and how it is used.



The background is a solid blue color with a repeating pattern of white icons. These icons include various electronic components like gears, stars, and circuit symbols, as well as tools like wrenches, pliers, and screwdrivers. The pattern is dense and covers the entire background.

**What are the differences  
between the most common  
types of electronics?**



# Wires/Cables

Although not electronics in the traditional sense, wires and cables are fundamental electrical components, as they connect all other electronics together when in an electrical system. As you learned in Lesson 2, wires and cables transport electricity or signals from one location to another. For example, a phone charger transports electricity from the outlet to your phone. Wires and cables come in a variety of different lengths, thicknesses, and colors. They can have a number of different connectors, and they can be used in many distinct ways. What's common among all wires and cables, however, is that they're always composed of a metal alloy strand surrounded by a plastic coating.



The color of a wire generally indicates its purpose. For example, red wires carry power into a system, black or brown wires carry power out of a system, yellow or green wires are used for grounding, blue wires carry signals, white wires can be multipurpose, and orange wires indicate the need for safety.



# Power Sources

As you learned in Lesson 2, a power source is a device that is capable of delivering power to an electronic system. Without a power source, it is impossible for other electronics to function, thus making it one of the most important types of electronics. Power sources can either be internal, like a battery, or they can be external, like an electrical outlet. Additionally, power sources can also be alternating current (AC) or direct current (DC). The type of power source a device uses depends on how much power the device needs, as well as what the device will be used for.



Phones, computers, TV remotes, and even cars are just a few examples of things that have a power source.

# Switches and Buttons

Switches and buttons are similar electronics, as they are both capable of controlling the flow of electricity through a circuit. There is a slight difference in how they work, however. A switch has an on position and an off position. When the switch is in the on position, electricity is able to flow through the circuit, but when it's in the off position the flow of electricity is cut off. A button on the other hand, can be pressed or unpressed. When the button is pressed, electricity is able to flow through the circuit, but when it's unpressed, no electricity can flow. This means that a button requires a person to continuously press it in order for a circuit to be active, whereas a switch can be left alone as long as it's in the on position.



Light switches, like the ones in your home, demonstrate exactly how switches work.



# Sensors

As you learned in Lesson 2, sensors are electronics that can detect changes in the physical environment. There are many different types of sensors to choose from, however most sensors can be classified as either digital or analog. Each type of sensor is capable of detecting a different external stimulus. For example, some types of sensors detect colors, while others detect temperatures. No matter what a sensor detects, it will always output an electrical signal when it registers a change. This signal can then be acted on by whatever device is using the sensor. You will further explore the different types of sensors in Lesson 14.

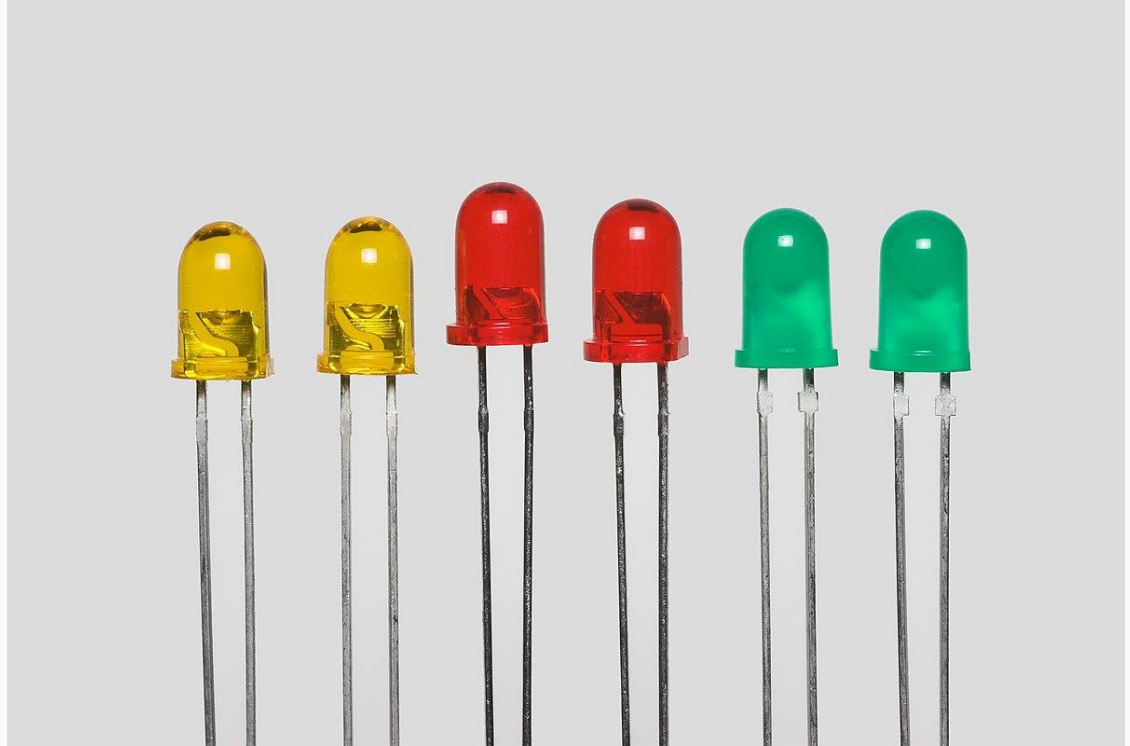


Ultrasonic sensors, like the one above, are used to measure changes in distance.



# Emitters

Emitters are essentially the inverse of sensors. Where sensors take in information, emitters release information, and similarly to sensors, there are many different types of emitters. For example, LEDs are emitters that release light and speakers and buzzers are emitters that release sound. In addition to those examples, there are also emitters that can release various different types of signals. The information released by an emitter can help a device communicate with humans or other devices.



LEDs are a very common type of emitter and they're used nearly everywhere.

# Motors

As you learned in Lesson 2, motors are electronics that rotate in order to generate motion. They are primarily used to make parts of machines move, and they can be found almost anywhere. For example, there are motors in cars, power tools, and laundry machines. The reason why motors can be found in so many places is because of how much they can vary. There are many different types of motors, including brushless motors, DC motors, servo motors, and more, and they can range in size from very small to very large, making them incredibly versatile. You will learn more about the different types of motors in Lesson 8.



The motor above is known as a DC motor, which is a common, but effective type of motor.

## Discussion:

**With your group, come up with a list of places where you've seen electronics or electronic systems used in daily life.**



The background is a solid blue color with a repeating pattern of white icons. These icons include various electronic components like gears, resistors, capacitors, and integrated circuits, as well as tools like wrenches, pliers, and screwdrivers. There are also symbols for Wi-Fi, a keyboard, and a lightbulb.

**Where are electronics or  
electronic systems used in  
daily life?**



# Personal Devices

Phones, computers, tablets, and other devices intended for personal use are great examples of electronics being used in daily life. All personal devices contain thousands of circuits and a massive number of electrical components. Because of this, they're able to store information, process data, and so much more!



Every time you use your phone, computer, or tablet, you're using electronic systems!

# Household Appliances

Household appliances are also great examples of electronics being used in daily life. Washing machines and microwaves, for example, use electronics to keep track of time. Ovens and fridges, on the other hand, use sensors to ensure they are at the correct temperature.



Your daily routine is probably full of interactions with electronics.



# Output Devices

Output devices, like speakers, headphones, and lights are more good examples of electronics being used everyday. These devices work by converting electricity into other forms, such as sound waves or light. In doing so, they turn electronic signals into forms that we can understand.



Many sounds you hear in your day to day life are caused by electronics.

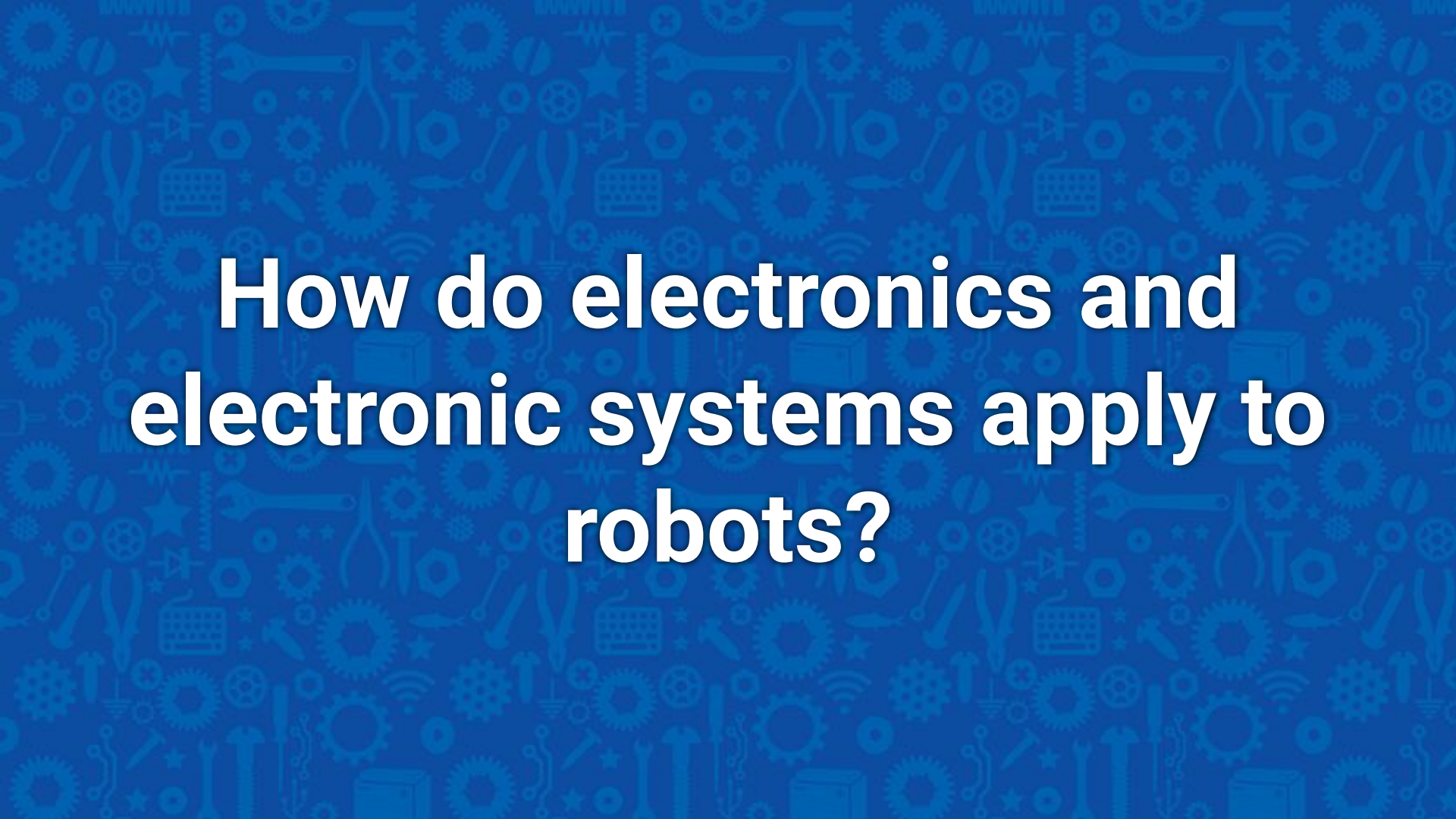
# Vehicles

Even cars and other vehicles are examples of electronics being used in everyday life. Though most vehicles are powered by gas or other fuels, they still need to use electronics, like sensors and motors, and electronic systems to make sure they're performing safely and efficiently.



You can see electronics being used even when you're stuck in traffic!

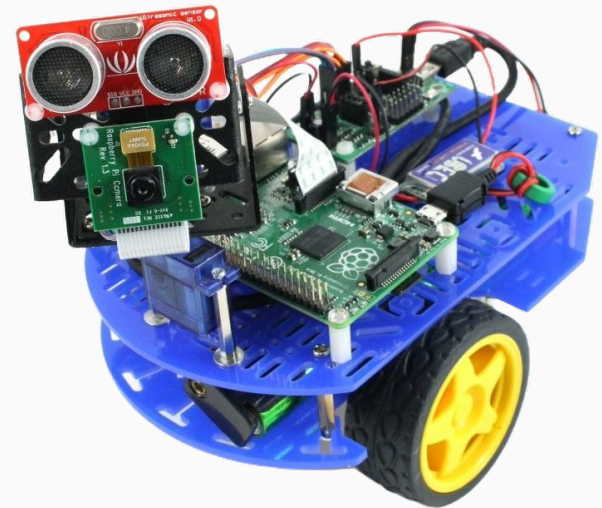




**How do electronics and  
electronic systems apply to  
robots?**

# Electronics and Electronic Systems on a Robot:

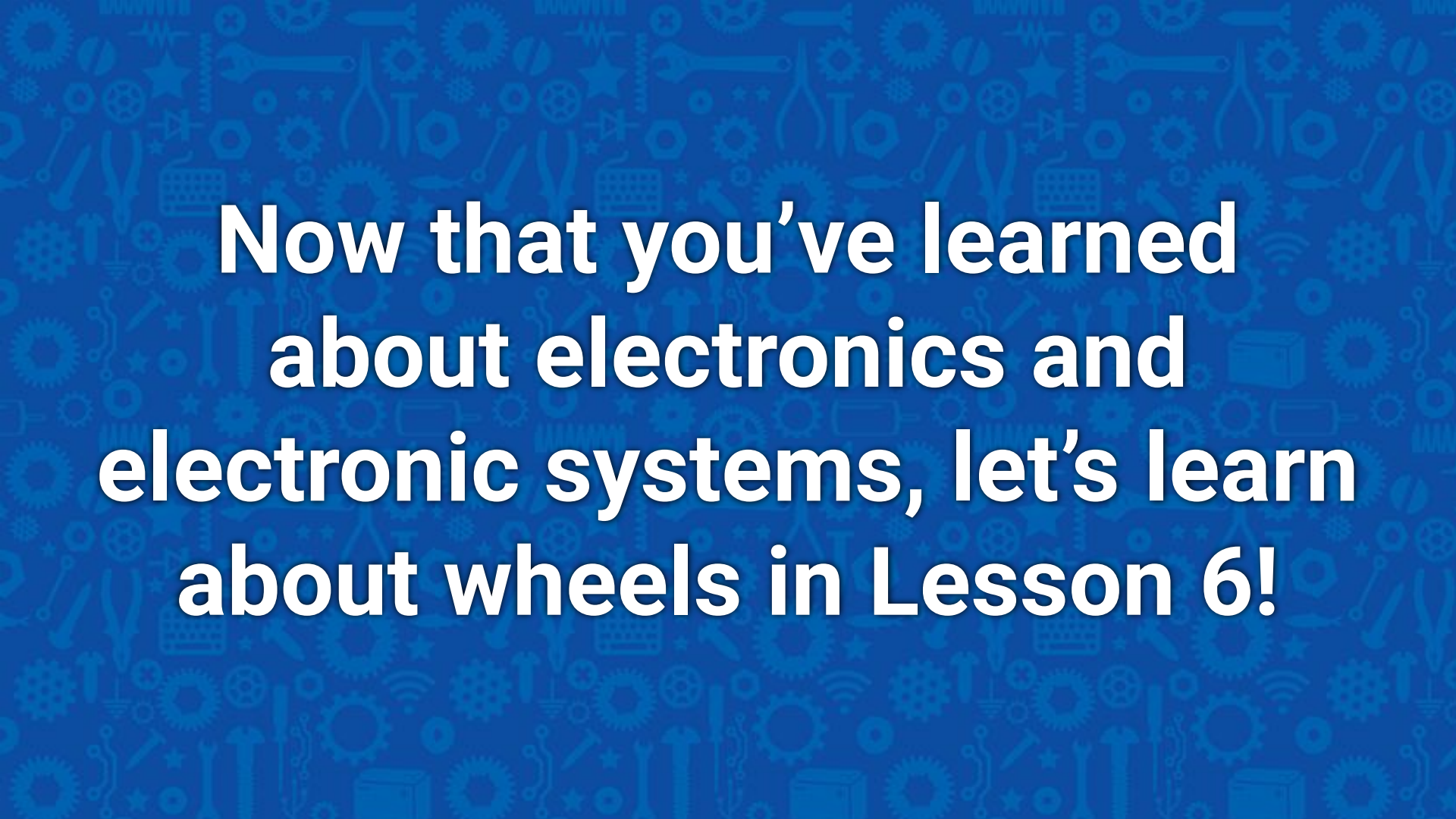
On a robot, electronics and electronic systems bridge the gap between hardware and software. They translate lines of code into electrical signals. Those signals are then turned into mechanical energy, which is used to make parts of the robot move. It is because of electronics that robots are able to gain information from, and interact with, their environment and other robots. Some robots are incredibly complex and contain hundreds of electronics, while others only require a few electronics to be able to function.



## **Activity:**

**Based on the materials that are available to you, follow either the AndyMark Electronics Assembly Instructions or the REV Electronics Assembly Instructions to add electronics to your chassis.**



The background is a solid blue color with a repeating pattern of white electronic symbols. These symbols include gears, stars, wrenches, pliers, screwdrivers, and various circuit components like resistors and capacitors.

**Now that you've learned  
about electronics and  
electronic systems, let's learn  
about wheels in Lesson 6!**

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