

READING CHALLENGE

How Your Phone Knows Where You Are

The invisible satellites that help you find your way

Level	A2 — Elementary
Age Group	Teens (11-16)
Topic	True Stories
Duration	~10 min read
Skill	Reading

You are walking in a city you have never visited before. You take out your phone, open a map app, and a small blue dot shows exactly where you are. You type the name of a restaurant, and the app draws a line showing you how to get there. It even tells you how many minutes it will take to walk. This feels normal today. But have you ever stopped to think about how your phone actually knows where you are? The answer is above your head — about 20,200 kilometres above your head, to be exact.

What Is GPS?

GPS stands for Global Positioning System. It is a **navigation** system that uses **satellites** in space to tell you where you are on Earth. The system has three parts: satellites in space, control stations on the ground, and a **receiver** in your phone or other **device**. These three parts work together every time you open a map on your phone.

There are at least 24 GPS satellites **orbiting** the Earth right now. In fact, there are usually about 31, because extra satellites are sent up in case some stop working. Each satellite is about the size of a large car and weighs around 1,000 kilograms. They fly at a height of 20,200 kilometres above the **surface** of the Earth. At that height, each satellite takes exactly 12 hours to go around the Earth once. They are arranged so that from any place on Earth, at any time, you can always "see" at least four satellites in the sky above you.

How Does It Work?

Each GPS satellite sends out a **signal** — a radio wave that travels at the speed of light. This signal contains two important pieces of information: the exact time the signal was sent, and the exact position of the satellite in space. Your phone has a tiny GPS chip inside it. This chip is the receiver. It listens for signals from the satellites above.

When your phone receives a signal from a satellite, it looks at the time the signal was sent and compares it to the time it arrived. The difference tells your phone how far away that satellite is. Radio waves travel at the speed of light — about 300,000 kilometres per second. So if a signal takes 0.067 seconds to arrive, your phone can **calculate** that the satellite is about 20,200 kilometres away.

But knowing the **distance** from one satellite is not enough. That only tells you that you are somewhere on a big invisible circle around that satellite. To find your exact position, your phone needs signals from at least three satellites. Where the three circles overlap — that is where you are. In practice, your phone usually connects to four or more satellites to be even more **accurate**. This is how your phone can **locate** you to within about three metres.

Who Built GPS?

GPS was built by the United States **military**. The idea started in the 1960s, during the Cold War. The US Department of Defense wanted a system that could tell soldiers, ships, and planes exactly where they were, anywhere in the world, at any time. The first GPS satellite was launched in 1978. By 1993, all 24 satellites were in place, and the full system was working.

At first, GPS was only for the military. **Civilians** — ordinary people — could use it too, but the government made the civilian signal less accurate on purpose. Civilian GPS was only accurate to about 100 metres. That was good enough to know which neighbourhood you were in, but not which street.

Then something terrible happened that changed everything. In 1983, a Korean passenger plane, Flight 007, flew into Soviet airspace by accident because of a navigation error. Soviet fighter jets shot it down, and all 269 people on board died. After this tragedy, US President Ronald Reagan announced that GPS would be made available to civilian aircraft to prevent similar disasters. And in May 2000, President Bill Clinton ordered the military to stop making the civilian signal less accurate. Overnight, GPS became accurate to about 10 metres for everyone — for free.

GPS in Your Daily Life

Today, GPS is everywhere. You use it when you follow directions on Google Maps or Apple Maps. Taxi apps like Uber use GPS to find your location and send a car to you. Delivery companies use GPS to track packages. Farmers use GPS to drive their tractors in perfectly straight lines across fields. Airlines use GPS to fly planes safely. Ships use GPS to cross the oceans.

Your phone uses GPS in ways you might not even notice. When you take a photo, your phone often saves the GPS location in the photo file. When you check the weather on your phone, the app uses GPS to show you the weather for your exact location. Fitness apps use GPS to track how far you run or cycle. Even the clock on your phone is kept accurate by GPS — the satellites carry atomic clocks that are accurate to one second in 100 million years.

The numbers are impressive. More than four billion people around the world use GPS every day. GPS helps generate an estimated four **trillion** dollars in economic value every year. It is one of the most important technologies ever invented, and most people use it without thinking about it at all.

GPS Is Not the Only System

The United States built GPS, but other countries have built their own satellite navigation systems too. Russia has a system called GLONASS, which has 24 satellites. The European Union built Galileo, which has 30 satellites and is even more accurate than GPS in some situations. China has BeiDou, which has 35 satellites. Japan and India have smaller, regional systems.

Most modern smartphones can use signals from all of these systems at the same time. That means your phone might be listening to 80 or more satellites at once. The more satellites your phone can hear, the more accurate your position is. In open areas with a clear sky, modern phones can locate you to within about one metre.

When GPS Does Not Work

GPS is amazing, but it is not perfect. The signals from the satellites are very weak by the time they reach the Earth. They can be blocked by buildings, mountains, and thick forests. That is

why GPS sometimes does not work well inside buildings or in city centres with very tall buildings — the signals bounce off the walls and give wrong positions. This is called the "urban canyon" problem.

Weather usually does not affect GPS, but very thick clouds or heavy storms can slow the signals slightly. The biggest problem is something called "jamming" — using a device to send fake signals that confuse GPS receivers. This is illegal in most countries, but some criminals use small jammers to stop tracking devices on stolen cars.

Another problem is that GPS uses battery power on your phone. The GPS chip needs energy to listen to the satellites. That is why your battery runs out faster when you are using a map app for a long time. Some phones solve this by using Wi-Fi networks and mobile phone towers to estimate your position when GPS is not needed for high accuracy.

GPS and Emergencies

One of the most important uses of GPS is in **emergency** situations. When you call the emergency number — 112 in Europe, 911 in the United States, 110 in Japan — your phone can send your GPS location to the emergency services. This helps ambulances, fire trucks, and police find you quickly, even if you do not know your exact address. In mountains, at sea, or in remote areas, GPS can save lives by guiding rescue teams to the right place.

Search and rescue teams use GPS to coordinate their work. If a hiker gets lost in the mountains, a helicopter with GPS can fly directly to the hiker's phone signal. Ships in trouble at sea send their GPS position in a distress call. Even some watches and bracelets for elderly people have GPS inside, so family members can find them if they get lost.

The Future of GPS

GPS technology is still getting better. New satellites are being launched that send stronger and more accurate signals. Scientists are working on systems that can locate you to within a few centimetres — useful for self-driving cars that need to know exactly which lane they are in. Indoor positioning systems are being developed too, using Bluetooth and Wi-Fi signals to guide you inside shopping centres, airports, and hospitals.

It is strange to think that just 30 years ago, most people found their way using paper maps. They stopped at petrol stations to ask for directions. They got lost regularly. Today, getting lost is almost impossible if you have a phone in your pocket. And all of this works because of 31 machines, each the size of a car, flying silently through space at 14,000 kilometres per hour, sending invisible signals down to Earth — just so you can find the nearest pizza restaurant.

Vocabulary

#	Word	Definition
1	satellite	a machine that moves around the Earth in space, used for communication or collecting information
2	signal	a sound, light, or radio wave that sends information from one place to another
3	orbit	to move around a planet or star in a curved path; the path itself
4	locate	to find the exact position of something or someone
5	receiver	a piece of equipment that picks up signals, like radio or satellite signals
6	accurate	correct and exact, without mistakes
7	military	relating to the army, navy, or air force of a country
8	civilian	an ordinary person who is not in the army or police
9	calculate	to find an answer using numbers and mathematics
10	distance	how far it is from one place to another
11	surface	the outside or top part of something, like the surface of the Earth
12	navigation	the act of finding your way from one place to another
13	device	a machine or piece of equipment made for a particular purpose
14	trillion	the number 1,000,000,000,000 — a million million
15	emergency	a sudden, serious situation that needs fast action

Comprehension Quiz

1. How many GPS satellites are orbiting the Earth?

- A) 12 satellites
- B) At least 24 satellites
- C) Exactly 100 satellites
- D) 6 satellites

2. Which country built the GPS system?

- A) Japan
- B) Germany
- C) The United States
- D) China

3. How does your phone calculate its position?

- A) It takes a photo of the sky and reads the stars
- B) It connects to the internet and downloads its location
- C) It measures how long signals take to travel from satellites to your phone
- D) It uses a compass inside the phone

4. Why did the US government make GPS free for everyone in 2000?

- A) Because the satellites were getting old
- B) Because a Korean passenger plane was shot down after getting lost in 1983
- C) Because they wanted to sell more phones
- D) Because Europe asked them to share

5. What is one problem with GPS mentioned in the article?

- A) It only works during the day
- B) It does not work well inside buildings or in areas with tall buildings
- C) It needs batteries in the satellites
- D) It can only show your location in English

Answer Key

Q	Answer	Question
1	B	How many GPS satellites are orbiting the Earth?
2	C	Which country built the GPS system?
3	C	How does your phone calculate its position?
4	B	Why did the US government make GPS free for everyone in 2000?
5	B	What is one problem with GPS mentioned in the article?