

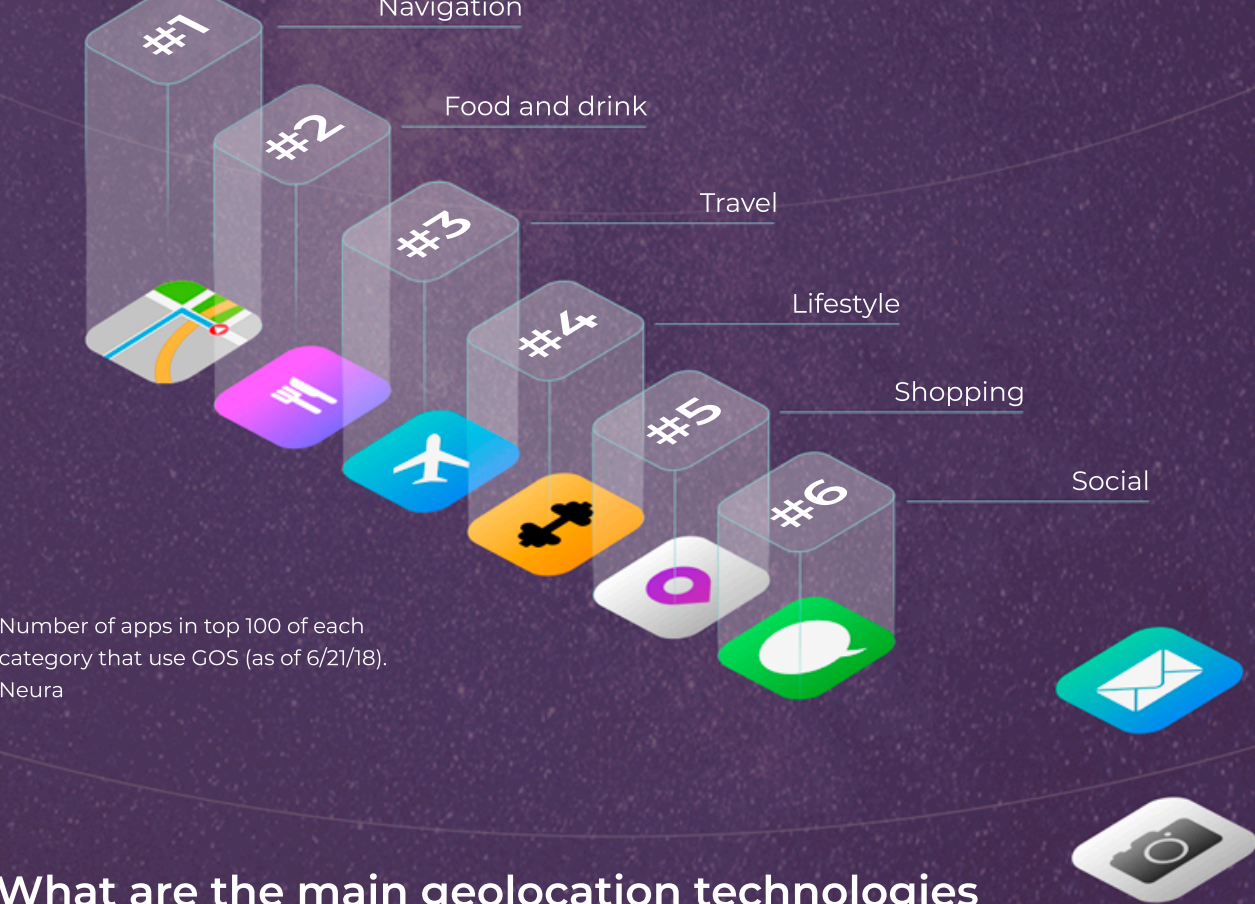
Mobile location tracking

Understanding the location technology used by a smartphone

Over 3.5 billion people now use a smartphone.

Mobile devices use a variety of location technologies to deliver a growing number of location aware services for transportation, gaming, social and mcommerce. The location-based services market will reach \$40 billion by 2024, according to a report by MarketsandMarkets.

Top 6 categories with the most number of location-based apps



What are the main geolocation technologies used by a smartphone and how do they work?



GPS - Global positioning system

GPS geolocation is based on communication satellites that orbit the earth, twice per day on different orbits. The satellites continuously broadcast their status, exact location, and precise time. A GPS device that receives these signals determines its distance from the satellite, using the difference in time between when the signal was sent and when it was received. Using geometry and data from 4 satellites the device is able to determine its GPS location. The accuracy of the GPS location is based on several factors including atmospheric conditions, signal blockage, and receiver design and quality. Due to building interference the quality of the signal degrades significantly indoors, damaging the accuracy of location data.

Accuracy: 10-100 meters (the signal is less accurate if indoors)



Cellular networks

Cellular networks are enabled by a network of cell towers also known as base transceiver stations (BTS), each with a unique Cell ID. These cell towers house the antennas that transmit the radio-waves that are used for mobile communication. Similar to how satellite signal broadcasts are used to locate a device, cell tower signals can also be used for geolocation, although this method is not as accurate as GPS.

Accuracy: within an area of 0.75 miles



Wi-Fi positioning

Wi-Fi positioning, known as WPS or WiPS, is based on Wi-Fi hotspots and wireless access points. The most common method for geolocation is based on measuring the receiving signal strength - known as the Received Signal Strength Indicator (RSSI) from a number of Wi-Fi hotspots of access points. Wi-Fi positioning is particularly useful for indoor positioning where GPS does not perform well.

Accuracy: 5 - 15 m



Bluetooth

Bluetooth is a wireless technology used for communicating short distances over short-wavelength radio waves between devices. The most recent version called Bluetooth Low Energy (BLE) is built into many smartphones. BLE beacons are one-way transmitters that broadcast their identifiers for pickup by any devices within range. Smartphones can determine their location based on picking up signals from BLE beacons enabling an indoor positioning system.

Accuracy: 1 - 2 m



	GPS	Cellular networks	Wi-Fi positioning	Bluetooth low energy
Indoor & outdoor	Outdoor only	Outdoor only	Indoor & outdoor	Indoor mainly
Accuracy	3 - 30 ft	0.75 miles	1.5 - 4.5 ft	0.3 - 0.6 ft
Battery consumption	High	Low	Medium	Low

What on-device sensors provide location and position information?



Accelerometer

Detects acceleration, vibration and tilt to determine the mobile device orientation and movement along three axes. Apps use the accelerometer to tell if the smartphone is in landscape or portrait mode and whether it is facing up or down.



Gyroscope


Also detects acceleration and tilt and can provide information on how much the smartphone is rotated and in which direction.



Magnetometer

This is a compass built into the smartphone so it knows which direction is North


How do I know which apps on my mobile device are using location technology?



Iphone

Go to Settings > Privacy > Location Services.

View a list of the apps using location technology and set permissions.



Android

Go to Settings > Apps > App Permissions > Location

View the apps that could require location access on your mobile device and set permissions.

How is location technology helping in the COVID-19 pandemic?

Social distancing

Using anonymized location data to calculate and track the percentage of population who are staying home.

Contact tracing

Using location technology to keep track of which mobile devices have been in close proximity for contract tracing of people who may have been exposed to COVID-19.



About Incognia

Incognia is a privacy-first, innovator in location technology. Incognia's location technology uses network signals and on-device sensors to deliver highly precise location information without capturing any PII. Companies with mobile apps and connected devices use Incognia's anonymized location technology to deliver private location context aware services, frictionless user ID verification, background authentication, risk assessment and fraud detection, all while protecting user privacy.