

Smart Parking : innovation;

A smart car parking system using IoT can address many issues and tasks. For example, a driver can view available parking slots directly from their smartphone with such a solution. Companies, in turn, can supervise their parking spaces more efficiently. And most importantly, they can do it remotely.

Here are a few tasks an IoT intelligent parking system can tackle.

Access Control and Management:

Parking lot owners can use access control and management systems to allow only authorized users to enter a parking area. Here's how it works.

The car parking system using IoT takes a user authorization mechanism through a mobile app or license plate scanning. At the same time, the controller on the barrier or gate may allow or refuse drivers to park their cars according to the set parameters.

Parking Monitoring

Another task that an IoT Smart parking management system solves is monitoring the movement of people and cars in a parking lot. Integrating video surveillance into the system can improve parking administration and troubleshoot potential problems, such as traffic accidents or theft, by controlling which cars enter the area.

Parking Reservation:

An IoT-based smart parking system also solves the problem of overcrowded parking lots. It allows drivers to reserve parking spaces in advance through a mobile application or web interface.

It's also possible to use individual solutions like parking locks for reservations. These are devices installed directly on parking slots. When a parking space owner leaves the territory, a parking lock will block entry for other cars.

Parking Management;

Parking administrators can use an IoT-based parking system to supervise all processes at the facility. In particular, this solution monitors parking space availability and facilitates the billing process.

Sensors to collect real-time data on parking lot occupancy and transmits this information to the cloud or local network. It also involves building IoT apps for end-users, like parking administrators and drivers. They can adopt this mobile or web application and access the necessary data on available parking spaces, pricing, etc.

As a rule, an IoT-based parking system comprises the following components

## Hardware:

IoT-based smart parking system deployment requires integrating various devices, sensors, and microcontrollers.

For example, it can be a microcontroller transmitting data to the cloud environment or a Bluetooth beacon. With its help, consumers can control parking locally. Such systems also integrate with video surveillance cameras, video recorders, or automatic number plate recognition (ANPR) cameras.

Generally, there are several options for IoT devices and sensors you can use. It all depends on your business needs.

## Cloud-Based IoT Services:

An IoT-based car parking system usually requires cloud-based services like AWS IoT, AWS Lambda, or Microsoft Azure IoT Hub for data collection and further transmission to the user application. This process involves the following data path:

The sensors send information to the microcontroller

The microcontroller transfers data to the cloud.

## User Interface:

A mobile or web application is the final component of an IoT-based smart parking system. As a rule, such apps ensure parking management, time tracking, reservation, billing tools, data logging, remote video surveillance, guest passes, and driver authorization.

## IoT Sensors Used to Create a Smart Parking System

Smart parking solution development involves various sensors. Let's consider the most common options.

### Ultrasonic Sensors:

The integration of ultrasonic sensors, which measure the distance between objects using ultrasonic waves, allows for precise parking. However, such devices have one drawback — the sensor might get blocked with dirt.

### Electromagnetic Field Sensors:

An electromagnetic field sensor detects and measures changes in the magnetic field. This way, it reacts to the approach of metal objects.

### Infrared Sensors:

Infrared (IR) sensors emit an infrared signal and catch the reflection of this signal from the environment. Integrating such a device enables measuring the temperature or detecting movement.

## How to Create an MVP for an IoT Smart Parking System

Let's now look at the smart parking development process. It consists of the following stages.

#### 1. Concept

First, you come up with the concept of your IoT-based parking solution. At this stage, consider which sensors, microcontrollers, cloud-based services, and network protocols to use. You also decide which app to create: mobile, web, or both.

#### 2. Prototype

Next, you engage the Internet of Things experts to build an IoT prototype. It's the initial version of your smart parking system. You can test and analyze the prototype to suggest further improvements.

#### 3. Design

At this stage, your experts create the user interface and select features for the MVP. The main goal is to create a user-friendly app suitable for all major operating systems.

#### 4. Development

This step involves mobile, front-end, and back-end, hardware developers. They implement the technical side of your IoT-based smart parking system MVP and connect it with ready-made design solutions.

#### 5. Testing

Once every component of your IoT smart parking system is connected, it's time to test it. First, the hired experts examine the MVP for flaws and limitations and check if it achieves the goals set. Then, your specialists fix bugs and offer updates for your system.