If you're looking at **alternatives to cameras** for monitoring parking (occupancy, duration, violations, turnover), there are several mature and emerging technologies — each with different cost, privacy, and scalability profiles.

Below is a structured breakdown used in smart-city deployments.

1️⃣ In-Ground Magnetic Sensors

How it works

A puck installed in the pavement detects changes in the Earth's magnetic field when a vehicle is present.

Pros

- Very high space-level accuracy (95–99%)
- Weather-independent
- No privacy issues
- Low power (battery 5–10 years)

Cons

- Requires drilling per space
- Installation cost scales per bay

Used in:

- San Francisco (SFpark program)
- Barcelona smart curb deployments

Best for: **High-value urban curb space**

2️⃣ Ultrasonic (Above-Ground Bay Sensors)

How it works

Mounted overhead (garage ceiling or pole), emits ultrasonic pulses to detect vehicle presence.

Pros

- No road cutting

- Good for structured parking
- 95–98% accuracy indoors

Cons

- Outdoor performance varies
- Needs mounting infrastructure

Best for: **Garages, off-street car parks**

3️⃣ Radar-Based Detection (Non-Imaging)

How it works

Low-power radar scans a curb segment to detect vehicle mass/shape — without capturing images.

Pros

- Covers multiple spaces per device
- Privacy-friendly
- Works in darkness and rain

Cons

- Slightly lower precision than per-bay sensors
- Requires calibration

Emerging as strong alternative to cameras for curb analytics.

4️⃣ LiDAR (Non-Image Spatial Scanning)

How it works

Laser pulses create a 3D occupancy map of curb space.

Pros

- High accuracy
- Covers multiple bays
- No identifiable imagery

Cons

- More expensive
- Requires edge processing

Best for: **High-density smart corridors**

5️⃣ Inductive Loop Detectors

How it works

Wire loop embedded under pavement detects metal mass.

Pros

- Extremely reliable
- Long-proven technology

Cons

- Expensive installation
- Not scalable curb-by-curb

Mostly used for traffic lanes, not individual bays.

6️⃣ Smart Meter Telemetry

How it works

Occupancy inferred from payment activity at digital meters.

Pros

- No new hardware
- Already deployed in many cities

Cons

- Only tracks paid parking
- Cannot detect illegal or unpaid occupancy

Low-cost but incomplete.

7️⃣ Vehicle-to-Infrastructure (V2I)

How it works

Connected vehicles broadcast presence to curb systems.

Pros

- No roadside hardware per bay
- Real-time dynamic allocation possible

Cons

- Depends on fleet penetration
- 10+ year adoption horizon

Future-facing.

8️⃣ Acoustic Detection

How it works

Microphones detect engine noise patterns and arrival/departure events.

Pros

- Cheap hardware
- Multi-space coverage

Cons

- Urban noise interference
- Lower accuracy

Still experimental.

9️⃣ Pressure Plates / Weight Sensors

How it works

Measures axle load or vehicle weight at the bay.

Pros

- Highly precise
- Can detect vehicle type

Cons

- Mechanical wear
- Expensive install

Used more in industrial zones.

🔟 Bluetooth / MAC Address Sensing (Anonymous)

How it works

Detects vehicle Bluetooth signals to infer presence/duration.

Pros

- No roadworks
- Good for turnover analytics

Cons

- Privacy regulation risk
- Not all vehicles detectable

More useful for flow than per-bay occupancy.