At a minimum, the parking guidance system should meet several baseline performance metrics. These metrics should improve traffic flow, parking efficiency and user experience:

I.   Performance Metrics Minimum Requirements

1. Space Detection Accuracy:
    a. ≥99% detection accuracy in detecting whether a space is occupied or vacant. Accuracy should remain consistent across lighting conditions and vehicle size. Sensors must avoid false counts from:
        - Pedestrian
        - Luggage carts
        - Bicycles
        - Temporary objects in detection zones.

2. License Plate Recognition
    a. ≥95% license plate read accuracy.
    b. Capture license plate image when vehicle occupies a stall.

3. System Uptime/Availability
    a. ≥99.5 to 99.9% operational uptime annually.

4. Detection and update speed.
    a. Space status updates should occur within 1-3 seconds after a vehicle enters or leaves space.

5. Data Transmission Reliability
    a. ≥99% between sensors, controllers and displays.
    b. Packet loss or communication failures should be minimal.

6. Guidance sign accuracy.
    a. Directional signs showing available spaces per zone should maintain ≥98%
7. Mean Time Between Failures (MTBF).
    a. Sensors should typically meet 50,000-100,000+ hours MTBF.
    b. Sensor life expectancy of 5-10 years. This ensures maintenance costs don't skyrocket.

8. Dynamic Parking Signage Requirements
   - Full matrix LED display
   - Minimum 5-inch character height
   - Support alphanumeric characters and symbols
     - ADA spaces
     - EV Charging
     - Motorcycle parking

9. Maintenance response time.
   a. Fault detection within minutes.
   b. Failed sensors or displays should be repairable within 24-48 hours.

10. User Search Time Reduction.
    a. A functional system should produce measurable operational improvements: 30-50% reduction in time spent searching for parking.
    b. 15-30% reduction in internal parking traffic.

11. Scalability and Integration.
    a. The system should support API integration with mobile apps, payment systems and reservations.
    b. Integrate with existing HUB-ZEAG PARCS system. Explain what other PARCS system your PGS integrates with.
    c. Expansion to additional zones without replacing core infrastructure.

12. Environmental performance:
    a. Sensors should operate reliability in -20F to 140F environments.
    b. Humidity tolerance up to 95% non-condensing.
    c. IP rated hardware for dust/moisture protection (commonly IP65 or higher) Enclosure rating NEMA 4 weatherproof.

II. Rooftop System Minimum Requirements:

Minimum Requirements-Rooftop counting parking Guidance System
1. Vehicle Detection (Entrance/Exit Counting)
   - Bidirectional Vehicle detection using paired sensors or loop detectors to determine direction of travel
   - Sensors installed in pairs at each entrance/exit lane
   - Sensors spaced 48-60 inches apart to ensure proper direction detection
   - Sensors must detect vehicles up to 9ft height above the driving surface
   - Vehicles traveling less than 20 mph must be reliably detected

2. Counting Accuracy and Performance
   - Accuracy ≥98% vehicle counting accuracy
   - False detection rate < 2%
   - System automatically reconciles entry/exit counts
   - Space availability updates in real time or within 10 seconds

3. Rooftop Hardware Requirements
   - Sensors outdoor rated IP65-IP67 minimum enclosure.
   - UV resistant housing
   - Vibration resistant mounting
   - Adjustable mounting brackets

4. System Architecture
   - Vehicle detection sensors
   - Lane counting controller
   - Central system controller
   - Parking guidance signs
   - Management software

5. Communications Infrstructure minimum requirements
   - RS-485 network length – 4,000 ft per bus
   - Shielded twisted-pair communication cable
   - Ability to integrate with:
     - PARCS
     - Airport parking website
     - Mobile apps
     - Digital signage

6. Power and Resilience
   - System connected to UPS backup power
   - Surge protection and grounding
   - NEMA rated equipment cabinets
   - Automatic restart and data retention.

7. Signage Requirements
   - LED variable message signs showing available space count
   - Visibility from 100-150 ft
   - Minimum IP65 outdoor rating
   - High-brightness LED display for daylight visibility

8. Software and Data Minimum capabilities
  - Real-time occupancy dashboard
  - Historical reporting
  - API integration with parking system
  - Alarm notification
  - Remote firmware updates
  - Sensor health monitoring.

III. Minimum Requirements- Find Your Car Kiosk

1. Functional Requirements

The Kiosk shall allow parking customers to locate their parked vehicle within the parking facility.

The system shall support the following search methods:
  - **License Plate Number Search** (primary method)
  - **Parking Ticket/QR Code Scan**
  - **Parking Space Number Search** (if space sensors are used)
  - **Mobile phone number or parking receipt lookup** (optional)

The Kiosk shall display:

  - Parking Level
  - Row/zone location
  - Walking directions
  - Map to vehicle location

Results shall be displayed within **5 seconds of search submission**

2. Hardware Requirements

Touchscreen Display
Minimum Specifications:

Requirement	Minimum Standard
Screen Size	32" minimum
Display type	Industrial LCD or LED
Resolution	1080p minimum
Touch Technology	Capacitive multi-touch
Brightness	> 400 units
Anti-glare coating	Required

The screen shall remain readable under high ambient lighting conditions.

Processing Hardware

Requirement	Minimum Standard
CPU	Industrial Grade processer
Memory	8 GB Ram Minimum
Storage	128 GB SSD Minimum
Operating System	Windows

The Kiosk shall support remote monitoring and Software updates.

Peripheral Devices

The Kiosk shall include:

Barcode/QR Code Scanner

License Plate search interface

Optional License plate camera integration

Speaker for audio instructions

Bar code scanner shall support:

- 1D and 2D barcode format
- Parking Ticket scanning
- Mobile QR scanning

3. **User Interface Requirements**
The interface shall:
- Support simple three step vehicle lookup
- Display large readable text
- Provide multi-language capability (English minimum)

UI features shall include:

- Touch friendly navigation
- Large on-screen keyboard
- ADA accessible layout
- Visual map or parking structure

4. Mapping and Directions
   The system shall display:
   - Parking Level
   - Zone or section
   - Vehicle location marker
   - Walking path to vehicle

   Map updates shall occur in real time as parking date updates.

5. Integration Requirements
   The kiosk shall integrate with:
   - Parking Guidance System (PGS)
   - License Plate Recognition (LPR) system
   - Parking Access and Revenue Control System (PARCS)
   - Airport parking database

   The system shall support

   - REST API Integration
   - TCP/IP communication
   - Ethernet network connectivity

6. Environmental Requirements
   The kiosk shall be designed for public indoor parking requirements.

Requirement	Minimum Standard
Enclosure rating	NEMA 4 or IP54 minimum
Operating temperature	32F – 104F
Vandal resistance	Reinforced Steel Housing
Mounting	Foor mounted or wall mounted

7. Accessibility (ADA)
   The kiosk shall comply with Americans with Disabilities ACT accessibility requirements:
   Minimum ADA features include:
   - Maximum screen center height 48 inches
   - Audio assistance option
   - Tactile input options
   - Wheelchair accessible clearance

8. Communications
   The Kiosk shall support::
   Ethernet connection (primary)
   Wi-Fi capability
   Secure communication protocols

Network monitoring capability

9. Minimum Reliability Requirements
   - System uptime > 99%
   - Search response time < 5 seconds
   - Hardware lifespan 7+ years
   - Data refresh rate < 30 seconds
10. Minimum Warranty Requirements
   - 2-year hardware warranty
   - Software updates included
   - Onsite response time 48-72 hours

IV. Reporting and Analytics to include:
- Occupancy by level and zone
- Historical parking utilization
- Peak usage reports
- Sensor health monitoring
- Real-time alarm notification

Data export must be integrated with airport parking revenue control system (PARCS), Dynamic Road Signs, Airport Website

V. Maintenance Requirements:
Automated fault detection, remote diagnostic, replacement time less than 48 hours. Vendor support for 6 years.

VI. Warranty:
1. **Standard Warranty Period:**

   Coverage should include:

   - Sensors
   - LED Indicators
   - Dynamic Signage
   - Controllers and Servers
   - Communication hardware
   - Software licenses and firmware

The vendor must cover:

- Parts,
- Labor,
- Travel
- Software fixes.

No cost to the airport during warranty period

2. **Performance Guarantee during warranty**
   - Vendor should maintain system performance levels such at:
     - ≥95-97% detection accuracy
     - ≥99% system uptime.
   - If the system drops below performance thresholds, vendor must:
     - Recalibrate sensors
     - Repair faulty equipment
     - Update software

At no cost during the warranty period.

3. **Response and Repair time:**
   - Remote response within 2-4 hours.
   - On site technician within 24 hours.
   - Critical component repair within 24-48 hours.
4. **Spare parts requirement:**
   - 10% Spare Parts
   - Supply spare sensors
   - Spare LED indicators
   - Spare communication modules
   - Spare controllers

To be delivered at system commissioning.

5. **Software and Cybersecurity Updates**

Warranty to include:

- Firmware Paches
- Software Patches
- Cybersecurity updates
- Bug fixes
- Minor feature updates

No additional Licensing cost during warranty

6. **Post Warranty Support Requirements**

Even after warranty expires, BAA requires vendors to provide support for 5 years:

- Technical support
- Help desk availability
- Remote diagnostics capability
- Software support.
- Parts Availability

- Vendor must guarantee replacement parts for at least 7-10 years after installation.
- Service Contracts
- Annual maintenance agreement to include:
  - Preventative maintenance visits
  - System recalibration
  - Software updates
  - Replacement of failed components

7. **Preventive maintenance Requirements for one full year after formal system acceptance**

- Quarterly or semi-annual inspections:
  - Sensor Calibration checks
  - Cleaning sensors and lenses
  - Network diagnostics
  - Signage testing
  - Database maintenance

8. **Documentation and Training**

Vendor must provide:
- System manuals
- As built drawings
- Network diagrams
- Maintenance procedures
- Staff training for airport personnel

Training is required before system acceptance

9. **Software Licensing after warranty**
- Perpetual software Licenses
- Annual cost should only apply to upgrades, Optional features, support contract

VII. System Resilience (Server Failure Behavior)

- The parking guidance system shall maintain operational functionality in the event of a central server or network communication failure. Space detection, zone counting, and signage shall continue operating using local controllers or edge processing. System data shall synchronize with the central management platform once connectivity is restored.

VIII. Network Infrastructure Requirements

- Vendors shall provide documentation identifying network requirements including bandwidth utilization, IP addressing requirements, port/protocol requirements, and VLAN segmentation recommendations.