



# IPS-401 NB-IoT Parking Sensor



A "smart" city is becoming less imaginable without smart parking solutions. The city's transport system has a fundamental influence on the quality of life of the people living there and the competitiveness of the businesses there. Mainly in city centres a significant part of traffic is of cars looking for a parking space, so a parking optimization solution can significantly improve the efficiency of the entire transport system.

For the optimization of parking, the most important information is the real-time monitoring of the occupancy of each parking space. This is the main information on which navigation solutions, street information systems and statistical analysis systems can be built.

Intelliport Parking Sensor solves this task at the highest technological level available today.

## The most important features of the solution

- **Long life:** with the sophisticated energy management capability of the device and the NB-IoT technology used for communication, the life of the sensors is 5 to 8 years, depending on the network signal quality and the parking frequency. The lifetime of the sensors is increased by the construction, the battery is 5-10 cm below the surface of the road, which means balanced temperature conditions, protecting the battery from extreme cold.
- **Small size:** it is one of the smallest one among parking sensors on the market with similar capabilities and lifetime. With just 5 cm in diameter, it weakens the road structure significantly less than other devices.
- **High precision:** the device detects the magnetic field distortion caused by vehicles. From a 3-dimensional change in the magnetic field, a complex algorithm determines whether a parking event occurred in the given location and if so what. The algorithm has been developed for the different types of parking (parallel, etc.), so it detects the parking change in occupancy with high reliability (95-98%) in all circumstances.



- **Durable:** the device is extremely robust, waterproof and has a high strength. Thanks to the drilled construction under the surface of the road, it is fully protected against both the weather (cold, warm, ice, rain) and the hazards caused by the vehicles (eg. snow plough).

The outstanding capabilities of the solution are due primarily to the application of the following **innovative technologies:**

- **Narrowband IoT (NB-IoT):** special LTE (4G) mobile communication technology with considerably lower energy consumption than conventional mobile communications. The network can be cost-effectively built and operated because it is based on existing mobile networks, no local gateway is required to install and operate. The security of communication is provided by the chip-SIM-based closed APN. There is a wide range of supported frequency band:
  - Band 1: 2100 MHz
  - Band 3: 1800 MHz
  - Band 5: 850 MHz
  - Band 8: 900 MHz
  - Band 20: 800 MHz
  - Band 28: 700 MHz
- **Long life battery:** long-life battery that can provide a near constant voltage level over a long period of time.
- **Energy Management:** Intelliport's innovative hardware and software energy management solutions ensure long-term reliability of the devices without maintenance.

## How the system works

- **Passive state:** before the installation, the sensors are in passive state when they send a life signal at times, but the changes in the magnetic field are not monitored. In this state, the consumption of the sensors is minimal, so the battery lifetime reduction is negligible between manufacturing and installation.



- **Active Status:** after the installation, the sensors can be switched to active state remotely. From this point on, they monitor the change in the magnetic field and indicate to the server if the change is such that it refers to a parking event.
- **Automatic calibration:** the base status (when there is no vehicle in the parking space) is the magnetic field in each location different and changes in time depending on the change in its environment. In addition, the accuracy of the measurement is influenced by the ambient temperature. Therefore, the magnetic sensing must be calibrated after installation and then recalibrated regularly. The system automatically calibrates them with a special algorithm to ensure accuracy even in the long run.
- **Heartbeat:** in addition to parking events, the sensors regularly send a so-called heartbeat signal to the central system administrator, so potential problems can quickly evolve, proactively managed to minimize service loss.
- **Parking events detection:** sensors from the magnetic field change senses that a vehicle moves above them. From the nature and length of the change, considering the calibration data, a special algorithm determines whether a parking status change has really occurred and, if so, what. The algorithm can be parameterized per sensor, thus considering the specificity of the given parking space, it is possible to optimize detection and response times.

## **Intelliport Sensor Management Platform**

A cloud-based server-side management systems that

- receives the login and heartbeat signal data from the sensors
- receive and process raw data from sensors
- determines which parking event happened
- remotely fine-tune sensors
- transfer data automatically to integrated systems supporting industrial standard protocols like MQTT, AMQP, REST, SOAP, etc.



- automatic magnetic calibration
- monitors the status of the battery, predicts discharges
- mobile network coverage monitoring and field statistics indicates potential network problems
- indicating possible operational problems of sensors, predicting their failure

