PLUG & PLAY – IQRF IN PRACTICE
IQRF IN THE EPS PARKING SENSOR SYSTEM

PRESENTATION

BRNO – 24th of May, 2016

COMPANY BACKGROUND

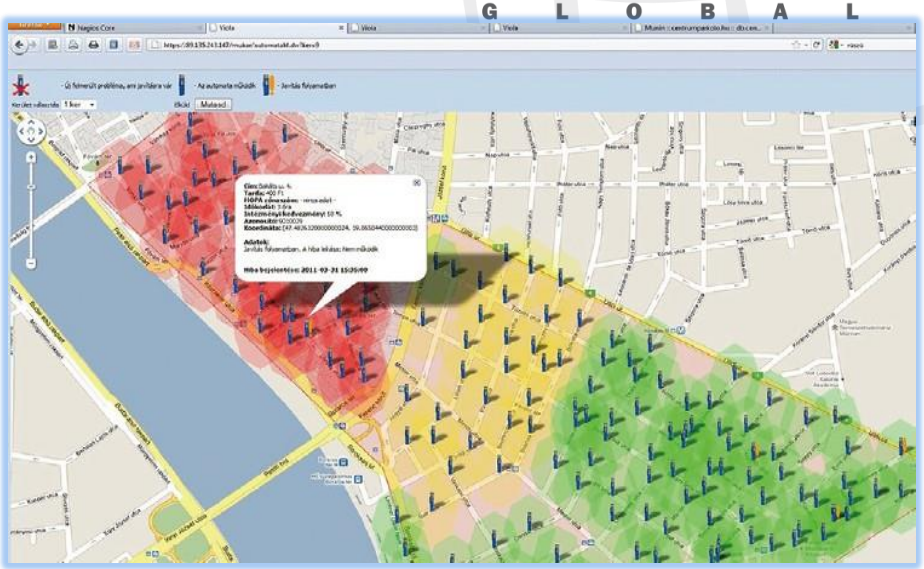
EPS-GLOBAL is a member company of the **EPS-CENTRUM Group**, a group of companies in **Hungarian & German ownership**, active in parking management technologies and operation.

With its predecessor company founded by the Hungarian Government in 1948, the company group now has **67 years of experience** in urban parking systems development and management.

Our largest project was the implementation and operation of the on-street parking system of Budapest with ~44.000 parking lots for over 10 years, realized in a BOT (build-operate-transfer) business model. Innovative company, giving the cell phone payment for parking to the world ☺

As a member of the EPS-Centrum Group, the company **EPS-Global** was established at the beginning of 2012 for the purpose of **capitalizing abroad on the Group's extensive experience and know-how**.

CURRENT OPERATIONS



PARKING SENSOR SYSTEM FOR URBAN TRAFFIC MANAGEMENT, PLANNING &ANALYSIS

APPLICATIONS

Sensors help municipalities, parking operators and vehicle drivers alike, offering a number of benefits. CREATING A HUGE AMOUNT OF DATA!

- **Streamlined and improved parking inspection**
  Sensors help automate and optimize parking inspection, as the system can **deploy inspectors in a semi-automated regime** to visit parking sections where occupancy does not match payments. This reduces inspector workloads, ensures higher sanctioning ratios and reduces corruption.

- **Accurate parking data aggregate**
  Sensors collect **very precise parking occupancy bulk data**, showing which exact spaces are occupied and at precisely what time and for how long. They thus contribute to parking and general traffic planning and management.

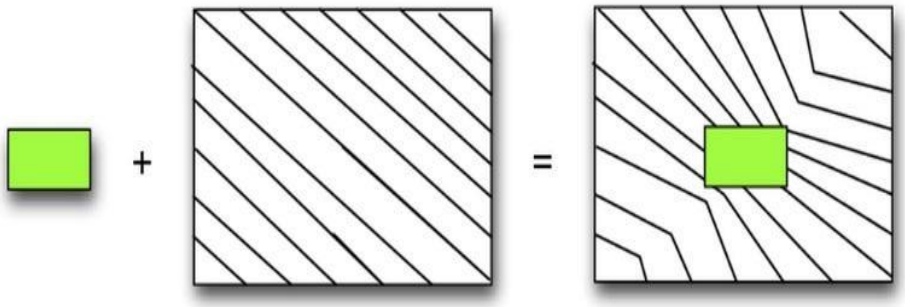
- **Enhanced driver information**
  Sensors **provide real-time data** on available parking places, which may be fed to various **driver information and guidance systems** which direct drivers towards free parking spaces, improving driver morale and drastically reducing search traffic.

THE SENSOR

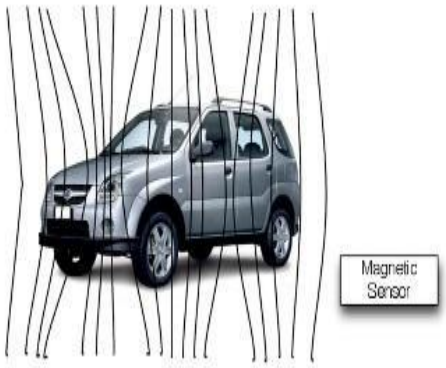
Dimensions

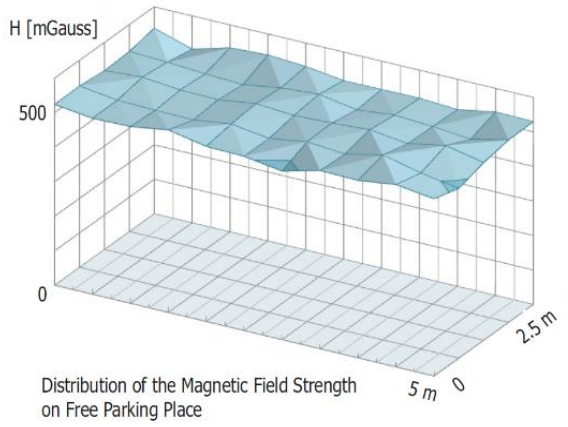
Diameter:	104 mm
Height:	94 mm
Weight:	350 g

Ground fixation: Glued
Resistant to harsh weather conditions
Operating range: -40C to +85C
Resistant to water, salt and snow
Protection grade: IP 68

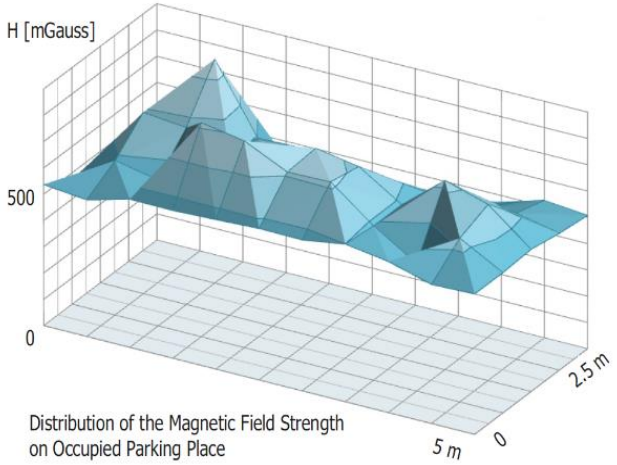


Ferrous Object + Uniform Magnetic Field = Field Disturbance





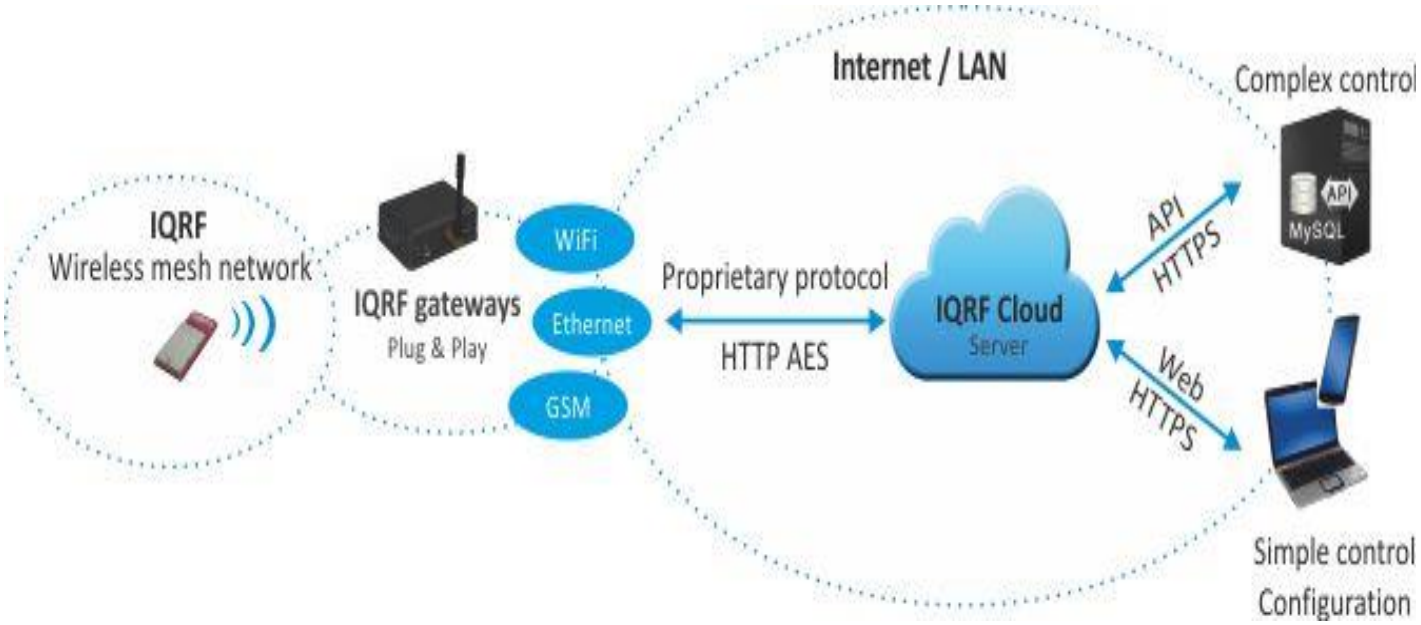
Distribution of the Magnetic Field Strength on Free Parking Place



Distribution of the Magnetic Field Strength on Occupied Parking Place

WE USE IQRF

First demo system overview:

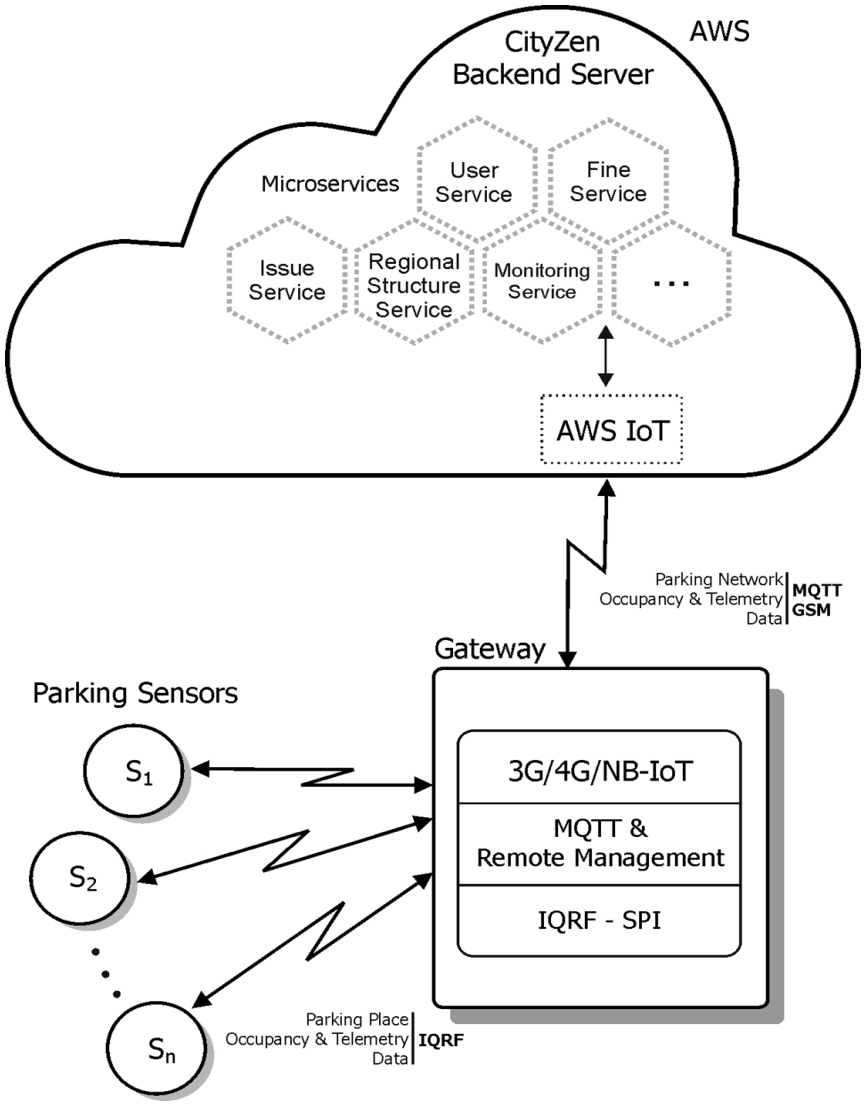


- We used IQRF full solution (IQRF cloud)
- We could demo immediately to our clients
- We could focus on the sensor development, no headache with the communication

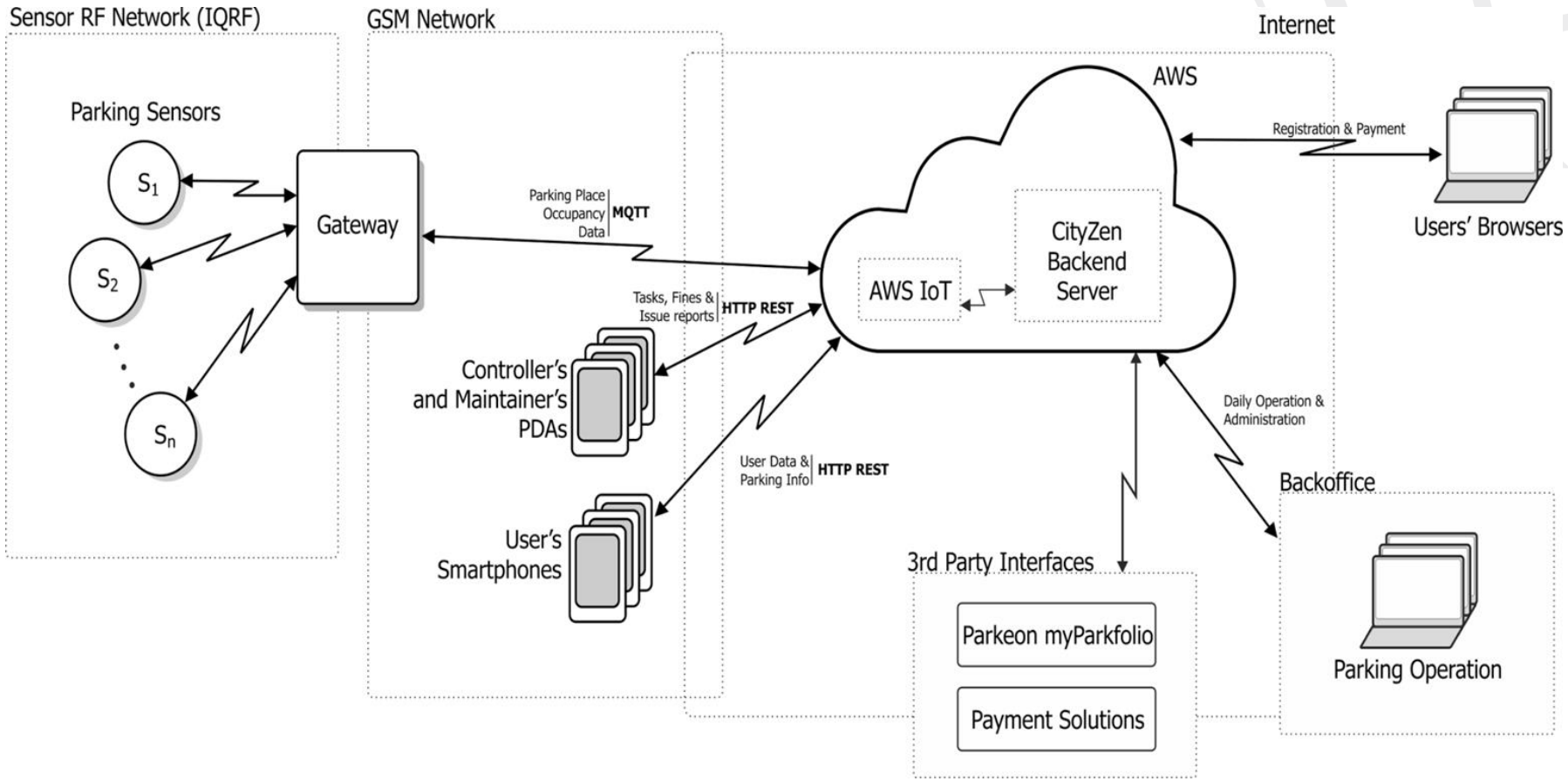
Before we tried to develop our own communication but we failed ☹
Then we made a market research and analyses and chose IQRF, because:
- FULL SOLUTION (TR modul, gateway, cloud, webinterface)
- FAST PRODUCT DEVELOPMENT POSSIBLE FOR THE APPLICATION DEVELOPER
- DEMO OF PRODUCT CAN BE MADE IN VERY SHORT TIME
- VERY LOW ENERGY USE
- GOOD PRICE TO VALUE

	IQRF 56D	IQRF 76D	XBee 868LP	XBee-PRO 868	Miwi MRF89XAM8A
Max. current consumption (transmitting)	14 mA – 24 mA (according to RF output power)	8.3 mA – 19 mA	62 mA	500 mA typical at 3.3V (800 mA max)	25 mA at +10 dBm (typical)
Max. current consumption (receiving)	STD mode: 13 mA LP mode 5 : OS v3.01D: 400 µA, from OS v3.02D: 330 µA XLP mode 5 : OS v3.01D: 35 µA, from OS v3.02D: 25 µA	25 µA	41 mA	65 mA typical	3 mA (typical)
Max. current consumption (sleep)	0.38 µA (if all peripherals including MRF49XA disabled 4)	0.38 µA	2.3 µA	55 uA	0.1 µA (typical)
Frequency	868 MHz, 916 Mhz FSK	868 MHz, 916 Mhz GMSK	868 MHz	868 MHz	863–870 MHz
Maximum line-of-sight range	Up to 300 m @ 19.2 kb/s	500 m 3A, 1100 m 3B	Up to 5.2 miles (8.4 km) w/2.1 dBi antenna, up to 0.4 miles (.64 km) w/PCB embedded antenna	Up to 1800 ft (550 m)	
Data rate	1.2 kb/s 6, 19.2 kb/s, 57.6 kb/s 6, 86.2 kb/s 6	19.836 kb/s	10kbit/s or 80kbit/s	1.2 Kbps to 230.4 Kbps (nonstandard rates available)	- FSK: 40 kbps - OOK: 16 kbps
Communication protocol	IQRF Mesh	IQRF Mesh	DigiMesh	ZigBee	Miwi
Maximum transmit power	programmable in 8 levels (0 – 7), max.3.2 mW	11 dBm (for 50 Ω load), programmable in 8 levels (0 – 7), max.12.5 mW	25 mW (14dBm)	1 mW (0 dBm) to 315 mW (+25 dBm)	
Serial data interfaces	UART, SPI	UART, SPI	UART, SPI	UART, SPI	SPI
Price	20.67 Euro	19.85 Euro	26,97 Euro	28 Euro	8 Euro
web	url	url	url	url	url

EPS' solution (IQRF integrated)



CITYZEN SYSTEM ARCHITECTURE

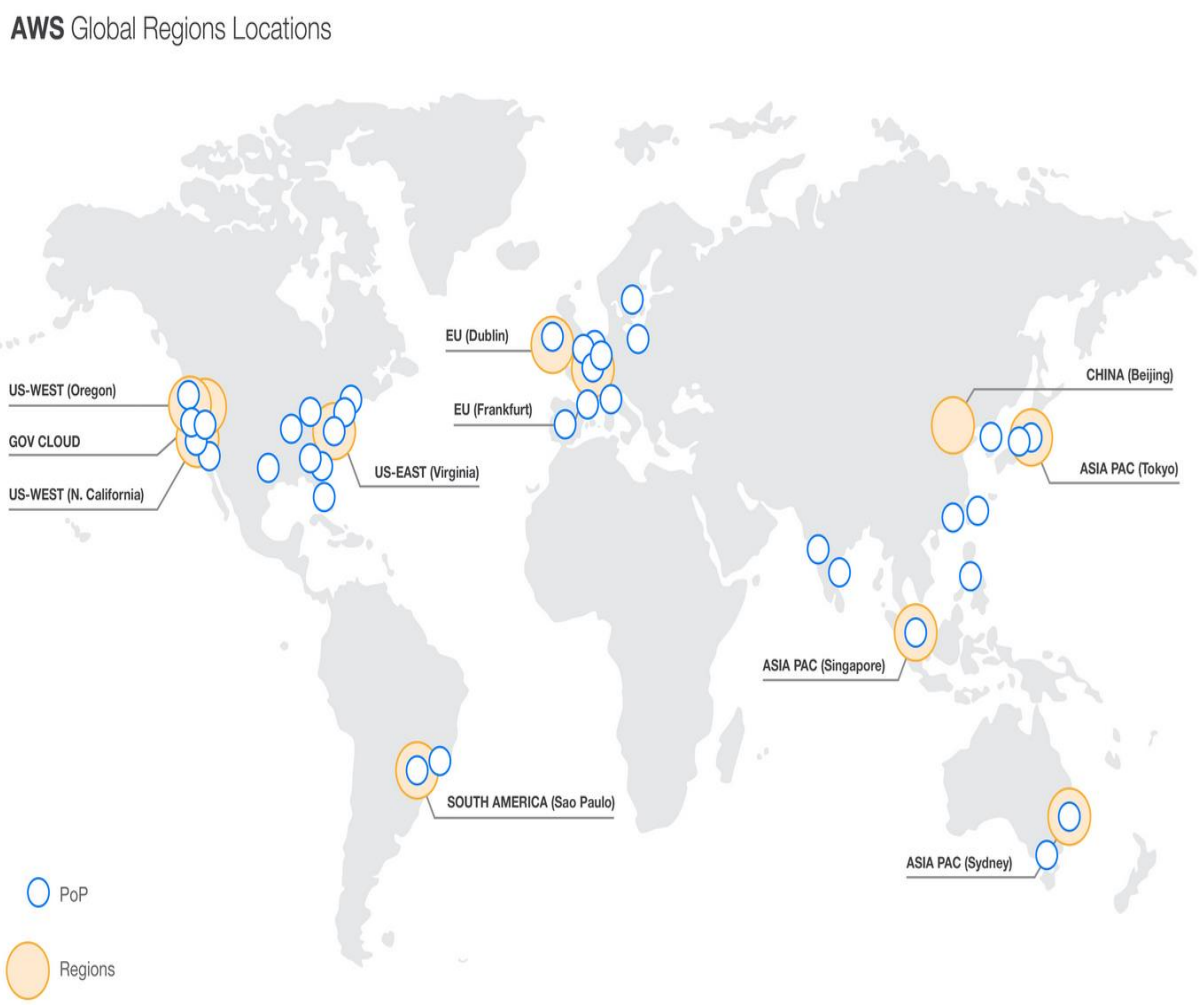


Amazon Web Services

Service Name	Region	Status	365 Day Availability *1 block = 12 mins*	Outages	▲ Downtime
AgileCLOUD	ams	↑	99.9951%	6	13.57 mins
AgileCLOUD	dal	↑	99.9979%	3	6 mins
AgileCLOUD	nyj	↑	99.9966%	1	8.22 mins
Amazon EC2	ap-northeast-1	↑	99.9976%	2	12.75 mins
Amazon EC2	ap-southeast-1	↑	100%	0	None
Amazon EC2	ap-southeast-2	↑	99.9984%	2	8.65 mins
Amazon EC2	eu-central-1	↑	99.9996%	1	44 secs
Amazon EC2	eu-west-1	↑	99.9999%	1	19 secs
Amazon EC2	sa-east-1	↑	99.9938%	7	32.52 mins
Amazon EC2	us-east-1	↑	99.996%	5	21.18 mins
Amazon EC2	us-west-1	↑	100%	1	7.82 mins
Amazon EC2	us-west-2	↑	100%	0	None

https://cloudharmony.com/status-1year (2015.07.27.)

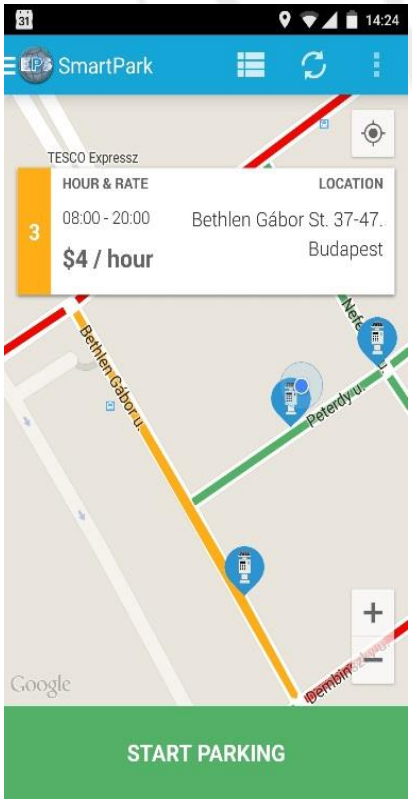
Amazon Global



Data output

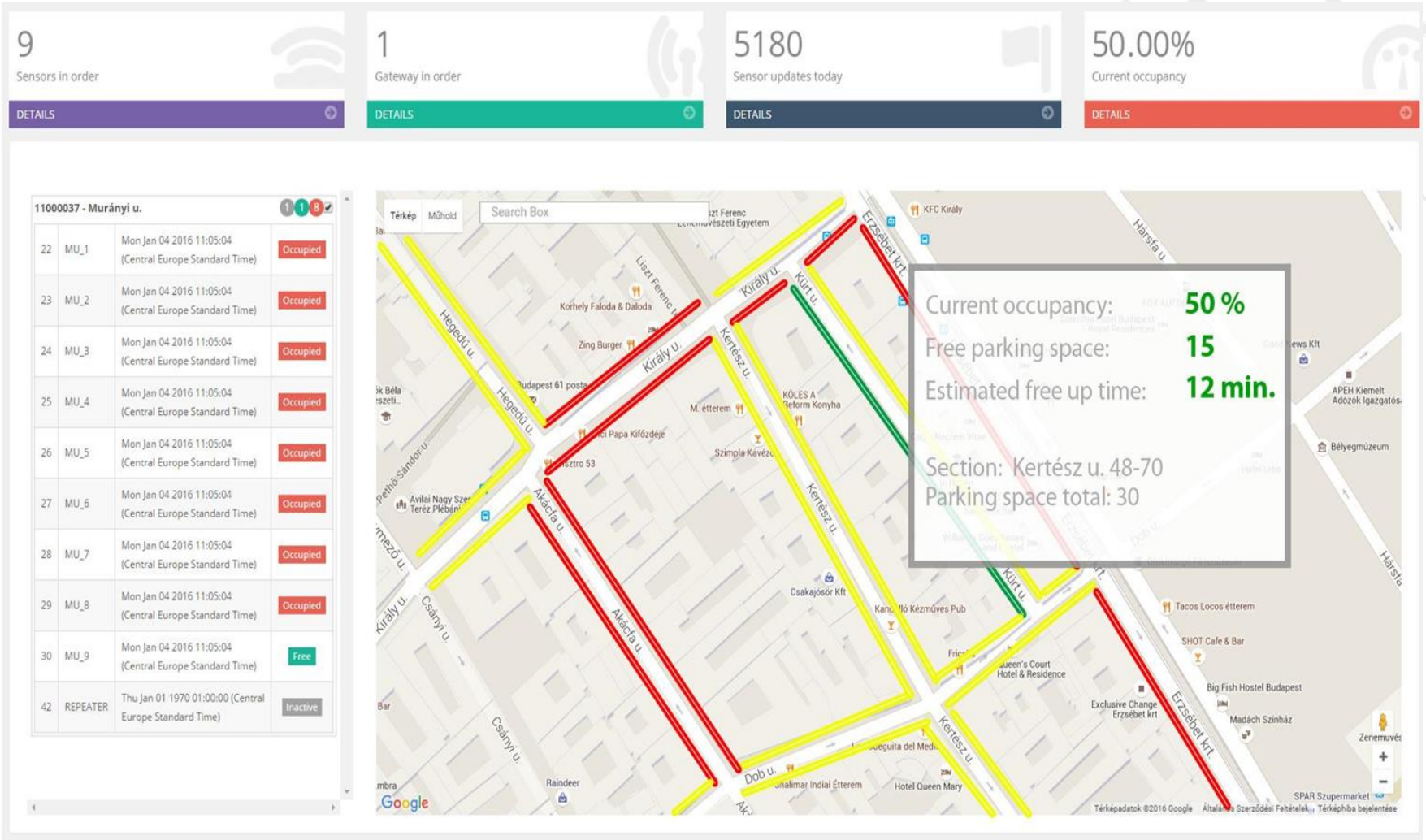
- Interface to 3rd party application
- Occupancy boards
- Mobile applications
- Web portal

UI INTERFACE LAYOUT (MOBILE APP)



Pictures of the mobile app of EPS in English and Chinese language based on Google and Baidu maps

UI INTERFACE LAYOUT (WEB)

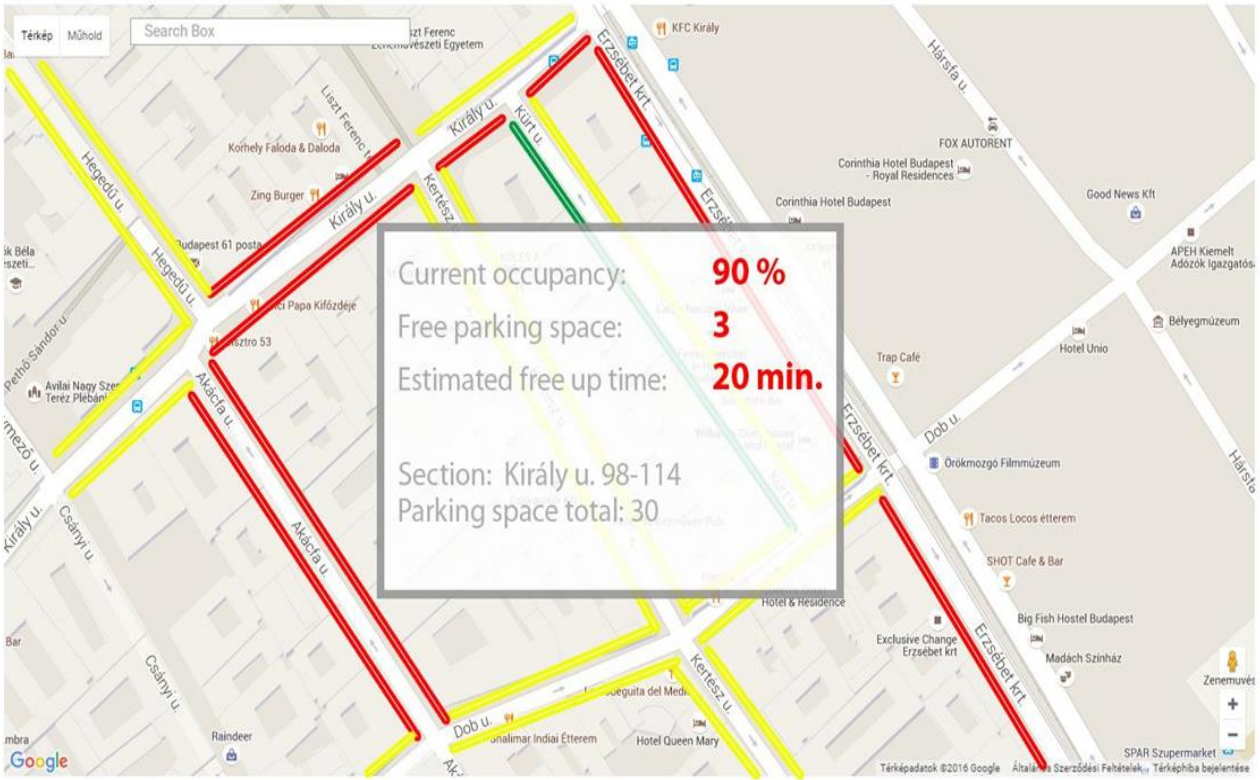


UI INTERFACE LAYOUT (WEB)

9	1	5180	88.89%
Sensors in order	Gateway in order	Sensor updates today	Current occupancy
DETAILS	DETAILS	DETAILS	DETAILS

11000037 - Murányi u.

22	MU_1	Mon Jan 04 2016 11:05:04 (Central Europe Standard Time)	Occupied
23	MU_2	Mon Jan 04 2016 11:05:04 (Central Europe Standard Time)	Occupied
24	MU_3	Mon Jan 04 2016 11:05:04 (Central Europe Standard Time)	Occupied
25	MU_4	Mon Jan 04 2016 11:05:04 (Central Europe Standard Time)	Occupied
26	MU_5	Mon Jan 04 2016 11:05:04 (Central Europe Standard Time)	Occupied
27	MU_6	Mon Jan 04 2016 11:05:04 (Central Europe Standard Time)	Occupied
28	MU_7	Mon Jan 04 2016 11:05:04 (Central Europe Standard Time)	Occupied
29	MU_8	Mon Jan 04 2016 11:05:04 (Central Europe Standard Time)	Occupied
30	MU_9	Mon Jan 04 2016 11:05:04 (Central Europe Standard Time)	Free
42	REPEATER	Thu Jan 01 1970 01:00:00 (Central Europe Standard Time)	Inactive



ACHIEVEMENTS

- CHINESE PROJECT
  Joint Venture together with ZTE ITS
  ZTE ITS obligation for 100.0000 parking spaces in 4 years
  Project in China, Jiangsu province:
  - 20 year long PPP cooperation in BOT business model for the development of a smart parking system and the operation of 10.000 parking places
  - Operation starts in December, 2016
  - A parking sensor system with IQRF communication of minimum 1.000 pieces has to operate by the above written date
  - Test system will be installed in Q3, 2016

- T-SYSTEMS COOPERATION – RIDING THE WAVES OF THE IoT MANIA – real IoT use case
  - 1st phase: Cooperation agreement about a test system of 250 sensors, 5 gateways / the installation starts on the 30th of May, 2016
  - 2nd phase: 2.000 sensor system for the trial of the BC in Budapest CBD, planned to start in Q1 of 2017
  - 3rd phase: Installing the sensor system in the whole CBD of Budapest / estimated size is 35.000 parking spaces (start of project in Q3, 2017)
  - Final goal is a common product with T-Systems, they want exclusive cooperation in all countries where Deutsche Telekom is present

THANK YOU

PARKING IS WHAT WE DO