Smart Cities - from IoT to IoP

by

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FIG III Conference
Romanian Surveying Week
Cluj-Napoca 2019

Overview:

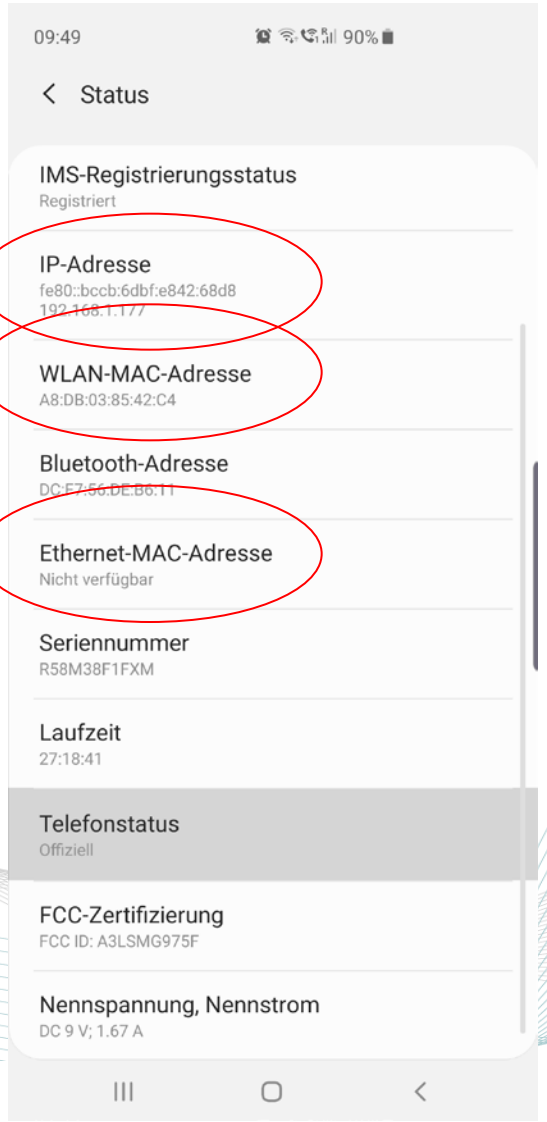
- **Introduction – Learn from your data**
- **Internet of Things**
- **Internet of People**

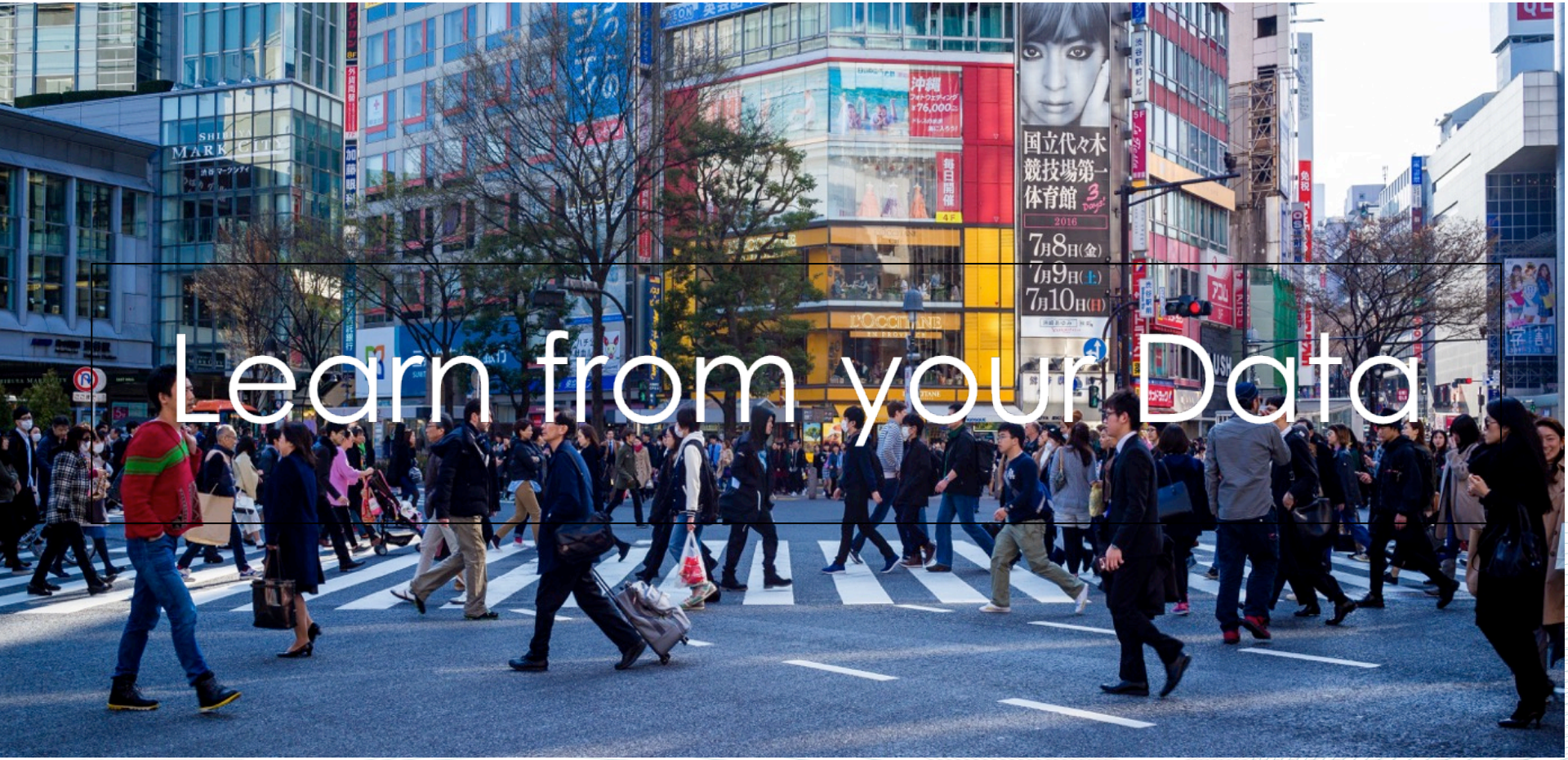
Based on the research and results of the DFRC, Zug, Switzerland

Video Cameras (LAN, WLAN)

Smart Phones

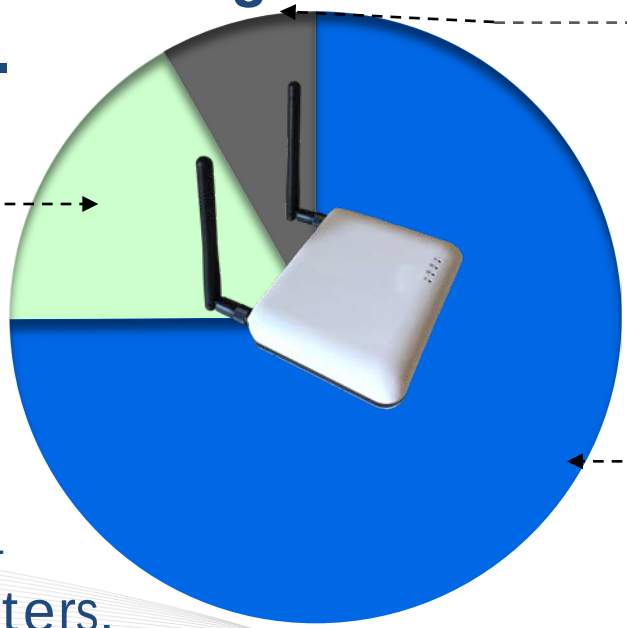
Settings to be used





Ralf Schroth
Cluj-Napoca 25.09.2019
Romanian Surveying Week

People are counted in large areas providing **analytics** for **retailers**, **advertisers**, **event organisers** and **Smart Cities** by **passively detecting** the number of **mobile phones** in the area**.**

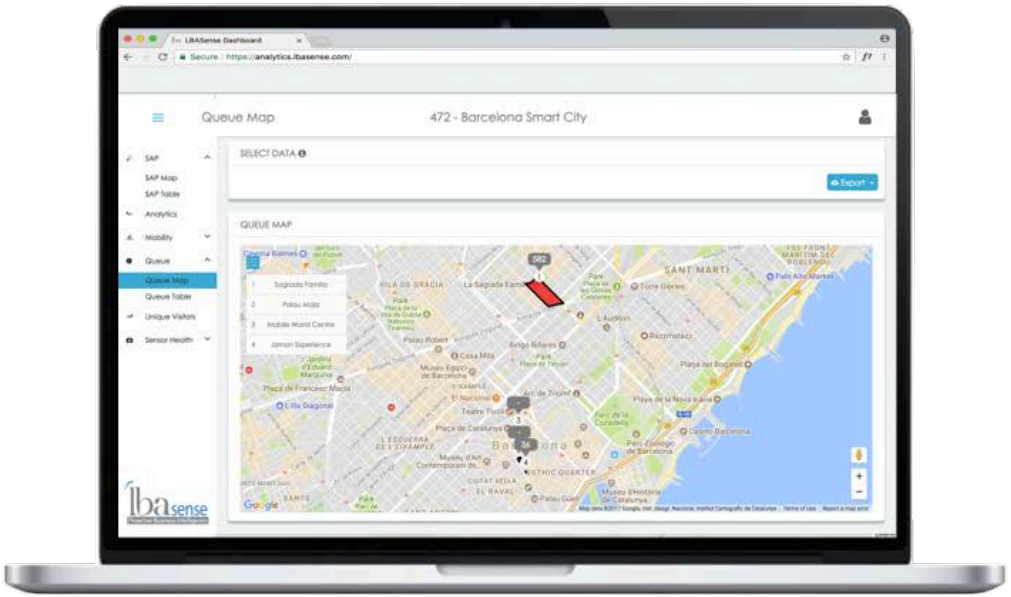


110,000 consumers analysed daily in **Korea**

225,000 devices detected daily in **Barcelona in 2017**

1,000,000 devices detected daily in **Prague in 2017**

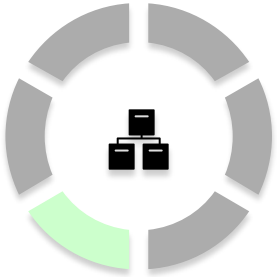
"Not only knowing a size of a crowd matters, but also **knowing the profiles** and **habits of the persons represented**."



A **number of people** in target areas are measured, based on a small number of **sensors** that are able to **locate mobile phone signals**.

This technology enables **location analytics** for large areas like cities or small defined zones such as shops.

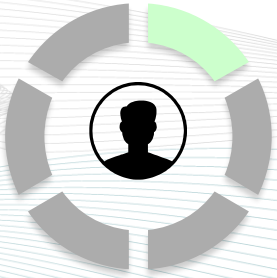
Crowd Analytics' Solutions For **Smart Cities** And **Tourism**



Software Development Platforms For Solution Providers

Engagement Platform And Analytics For **Retails**

Data Analytics and Business Intelligence Services



Security Solutions For HLS And Private Organisations

Productivity Solutions For Large Organisations

Smart Cities - Crowd Analytics for Municipalities and Tourism

Event Monitoring
- Visitor patterns
- Peak hours
- Marketing assessment

Outdoor People Counting
- City-wide deployment
- Duration of stay
- Returning visitors
- Per min resolution

Mobility
- Crowds' mobility in the city between selected zones

Nationality
- Country of origin analysis

Demographics
- Age
- Gender

MAC De-Randomization

iOS devices are transmitting a temporary MAC address while searching for nearby access points. The technology is **capable of detecting the unique device hidden behind the temporary MAC address**.

Location-Based Detection

Sensors are even **capable of detecting mobile phones while the Wi-Fi service is off**, **if the location service is on** (when using many apps such as Google Maps, Weather Apps, Public Trans or Booking for example).

No Double Counting

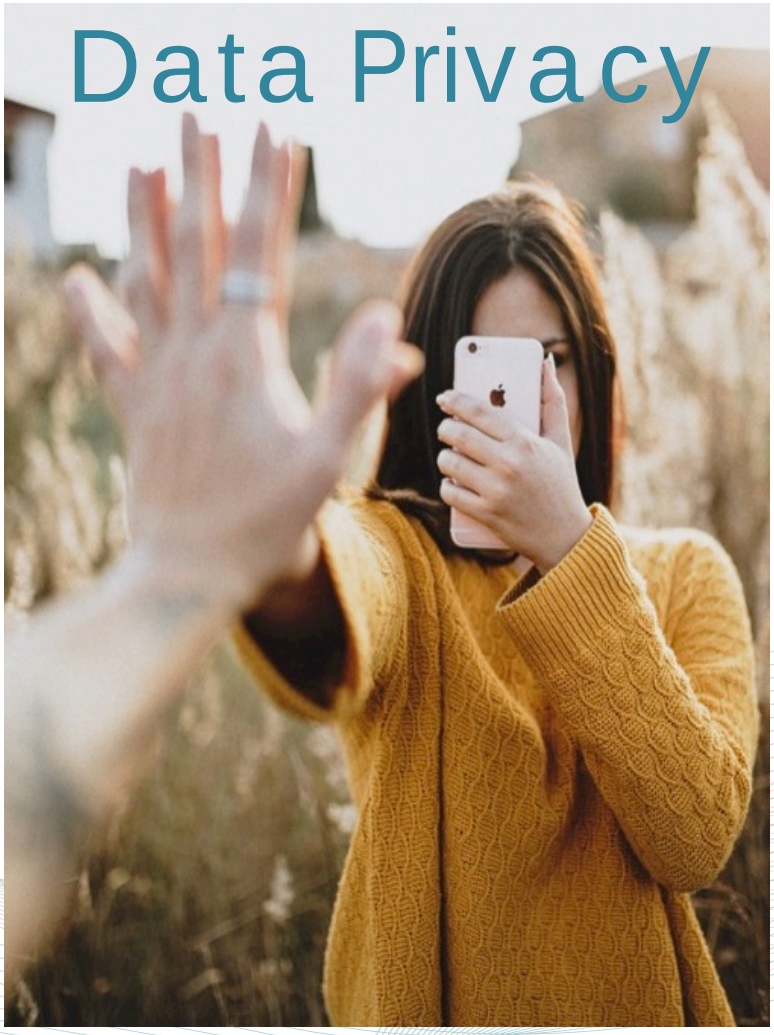
If **the same person** enters the coverage zone multiple times, the systems will count her/him only **once**.

Operator-Independent

The systems are **able to detect and count any mobile phone**, regardless of the mobile operating system or the Telco operator.

Data Privacy

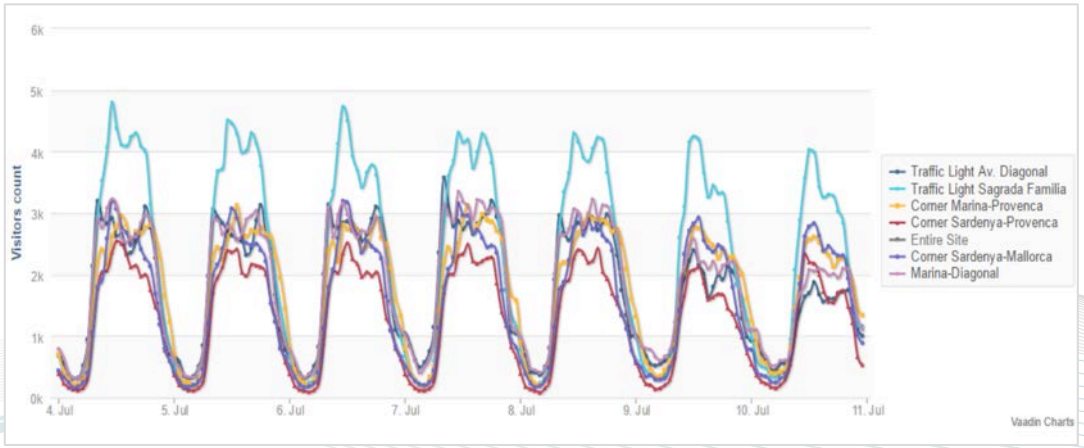
- ✓ **By law, signs** shall be **posted** in the target area to inform all visitors, including not registered ones, about the phone monitoring activity*.
- ✓ User **profiling only** for **visitors** who have **previously accepted** the **terms and conditions** requested during registration.
- ✓ **Push notifications** require **specific permission** from the customers.
- ✓ **Visitors can delete their data** through the captive portal according to the "right to be forgotten".



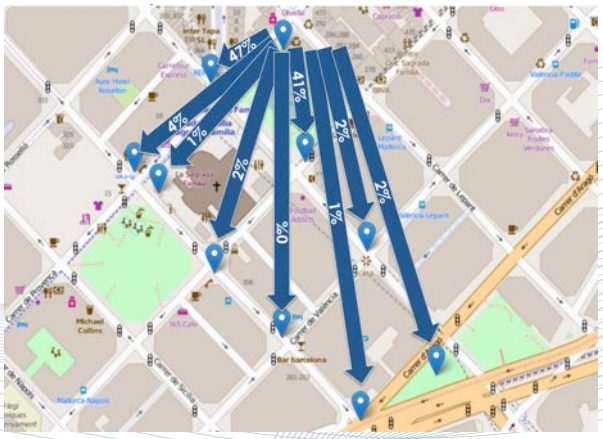
** In compliance with GDPR Art. 13*

Project Goal: analyse the **footfall, nationality** and **mobility patterns** of tourists around and in one of Barcelona's most famous monuments, La Sagrada Familia, in July 2016, in partnership with **Barcelona Turisme**.

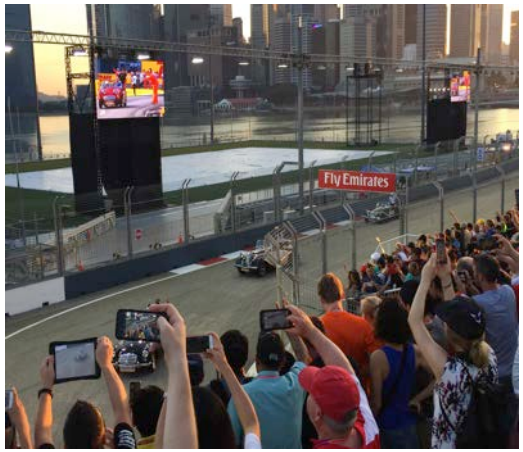
 # Sensors: 10 sensors deployed



Footfall comparison of all regions covered by sensors



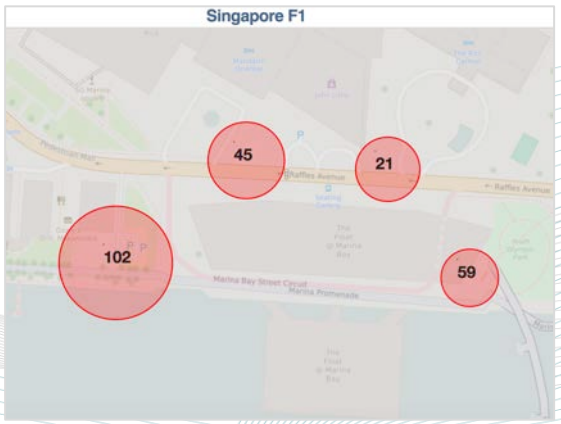
Mobility from one sensor to the others



Project Goal: analyse the **crowd's movement** and **behaviour** during the **Singapore F1 Grand Prix** in September 2016. Focus on the crowd's **mobility** between the covered areas.

 # Sensors: 4 sensors deployed

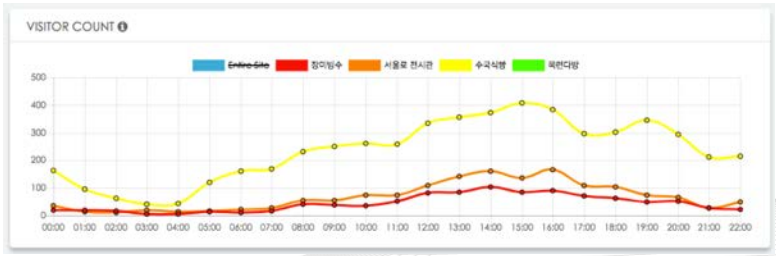
Instant visitors count at the F1 drivers parade

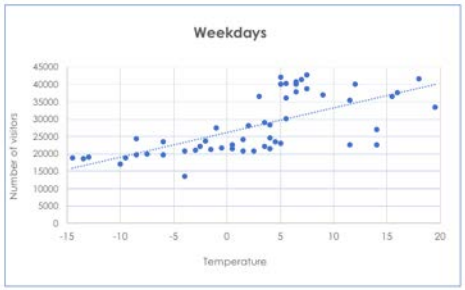


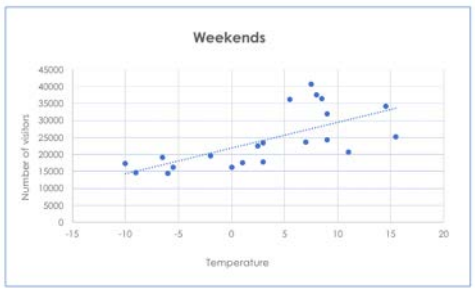
Instant visitors count during the event

Project Goal: analyse the visitor's footfall, duration of stay and visitors vs. outside temperature correlation, in **4 different parts of the Seoullo 7017 bridge in Seoul**, Korea, 2017.

 # Sensors: 4 sensors deployed



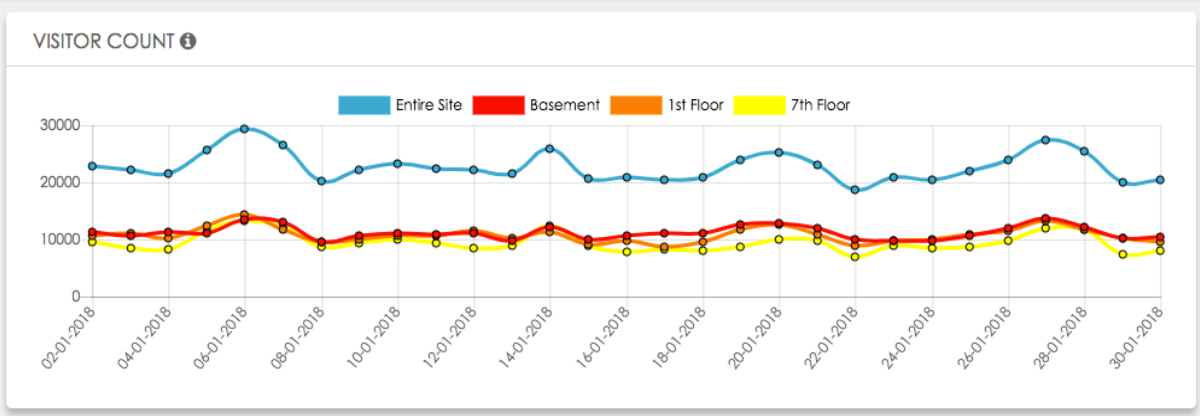




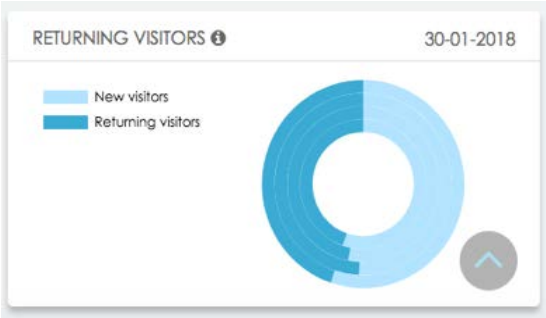
Seoullo 7017, Footfall and Duration Analytics Graphs (left) and Comparative Analysis of Visitors' Number, Outside Temperature on Weekdays and Weekends (right).

Project Goal: analyse the **footfall** and **behaviour** of **potential customers** in **3 different floors** of a central **Lotte Department Store** in Seoul, 2018.

 # Sensors: 3 sensors deployed

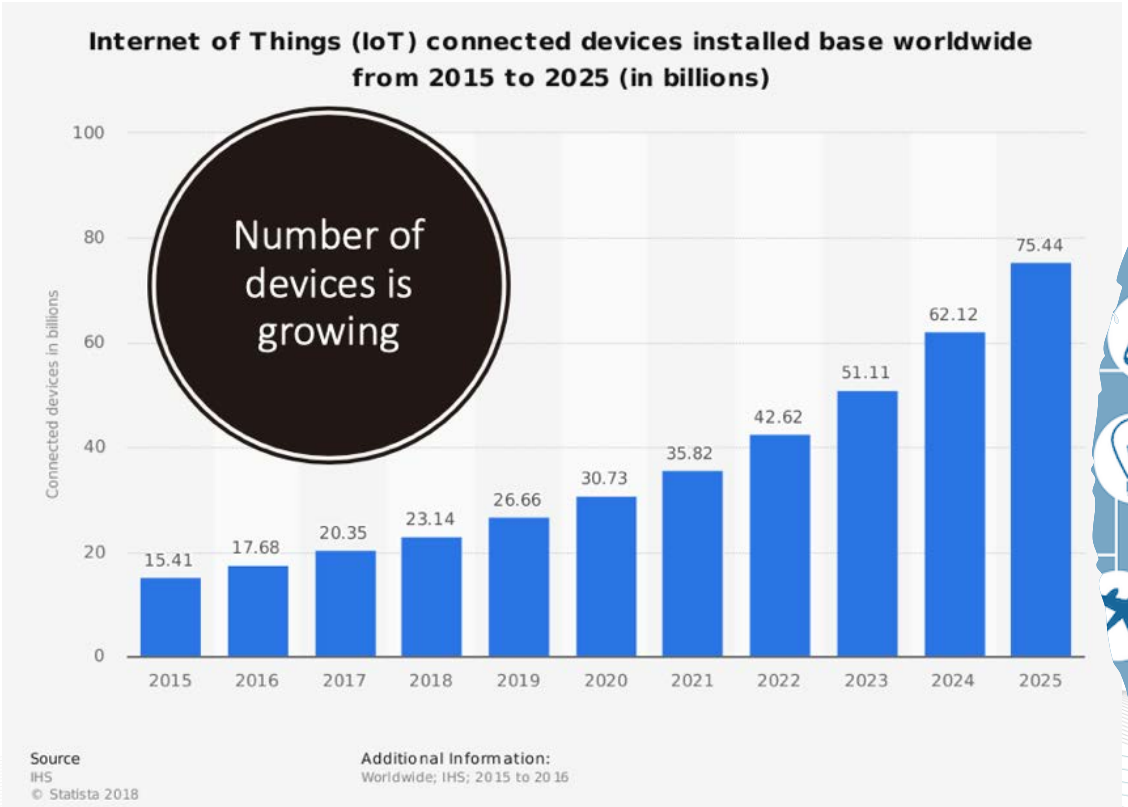


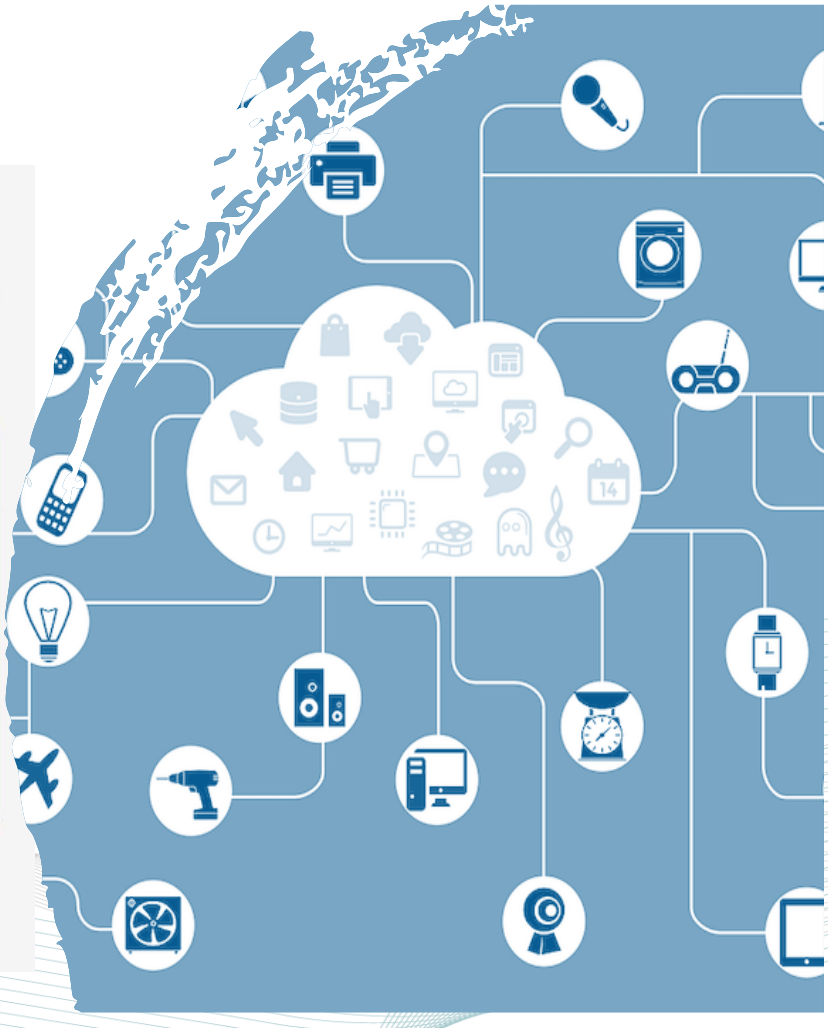
Lotte Department Store footfall comparison in 3 different floors and the entire site, screenshot from the LBASense Dashboard.



Lotte Dept Store returning visitor's pie chart, from the LBASense Dashboard.

WHAT IS IOT?





* Devices with identification and communication capabilities

DIGITAL FOOTPRINT

- ✓ People are leaving digital footprints. This footprint is collected and processed for multiple purposes
- ✓ IoT provides a mechanism similar to "cookies" in the Internet – the capability to track individuals over time and location

Typical Scenario

A SHORT VISIT TO THE SHOPPING MALL

Joe has entered into the parking. An LPR (License Plate Recognition) system records his entrance and exit time.

A second system may be able to count the number of people in his car.

Typical Scenario

A SHORT VISIT TO THE SHOPPING MALL

Joe is entering the mall via the parking door. A People Counting System counts this entrance.

As he looks at the billboard in the entrance – his profile in terms of age and gender has just been analysed, along with all other visitors entering from the parking lot; those profiles get compared with those of visitors using public transportation.

When walking around, Joe's mobility patterns are analysed in order to provide information on his shopping interests.

Typical Scenario

A SHORT VISIT TO THE SHOPPING MALL

- Joe is visiting the golf shop – next time that he will visit the mall an advertisement focus on golf will wait for him.
- Enjoying the shop? Joe's sentiment towards the different products will be measured (but this information is going to a different system).
- Joe didn't make any purchase in the golf shop (and the conversion rate counter has been updated accordingly).

Typical Scenario

A SHORT VISIT TO THE SHOPPING MALL

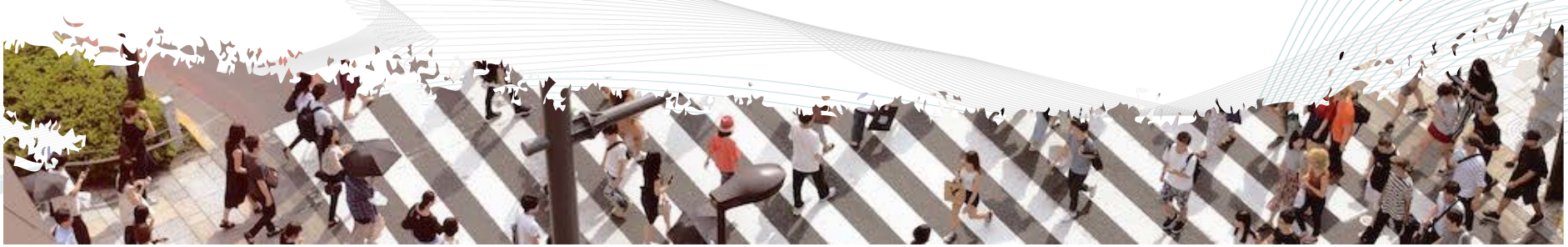
- Coffee time – Joe orders an iced Americano (and the purchase has been automatically added to his loyalty program).
- While he enjoys the coffee, the system updates the prediction engine and increases the probability that Joe will visit the coffee shop during his next visit from 66% to 72%.

What do we know ?

- A person driving a K9 has been in the mall for 90 minutes. He is interested in golf and usually enjoys coffee during his visit.
- He is expected again in 5-10 days.

How to monetize this information?

- ✓ With all this investment, data collected and data processing, it is still not clear how we can return the investment
- ✓ … and where is the benefit for the customer ?



The Internet of People (IoP)

Joe and the shopping mall

Joe

What is my profile ?

What are you willing to offer me *if I accept to expose my identity* ?

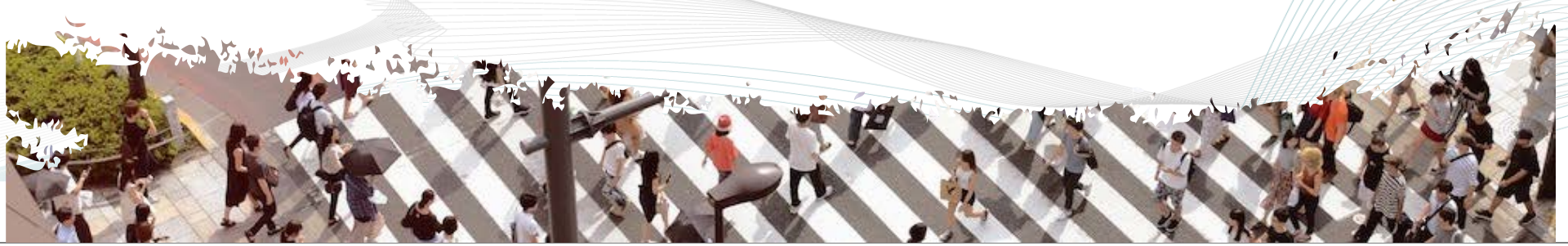
Let's trade

Free Coffee in return,
promotions on Golf equipment

The shopping mall

What is Internet of People?

- ✓ A method to collect, link and process data from nearby sensors and from the cloud
- ✓ A system capable of storing, understanding and creating personal data and preferences
- ✓ A system capable of taking a decision, based on the data collected (deep learning)
- ✓ A system with the capability to interact with humans and other IoP devices



KNOWLEDGE 4.0

Following the Industry 4.0 revolution, companies are measuring the performance of knowledge workers in order to increase productivity

KNOWLEDGE 4.0

Sensors located at the office are able to measure:

- ✓ Employee location
- ✓ Interaction between employees
- ✓ Utilization of office resources (such as meeting rooms)
- ✓ Smoking breaks
- ✓ Utilization of computers

JOE AND THE SMART OFFICE

Joe

What is my profile?

What are my KPIs compared to others?

Register for KPI Alerts

You are smoking too much
Please cancel the booking of the meeting room

Our Office

Image credits to pixabay

With special thanks to:
Iwona Maciejewska
Erel Rosenberg