CASE STUDY

Deutsche Bahn: Data-Driven and Optimal Operations

CHALLENGE

Deutsche Bahn (DB) is the biggest train operator in in the world and its operations cover almost every station in Germany as well as in Europe. Amongst others, the main problem DB faces, is the optimal revenue share between its subsidiaries, which requires the identification of routes and transitions between trains that passengers follow, in line with privacy. Moreover, they were in search for developing predictive maintenance for their operations in- and out of stations. Besides;

- Navigation of people inside the stations

- Number and location of passengers in each compartment of the train

- Optimal use of their spaces and

- Understanding their passengers and the trends

were some of their concerns.

SOLUTION

With the deployment of Ariadne surveyor devices, Deutsche Bahn is enabled to monitor its passengers throughout their entire journey, without violating any European privacy regulations. The accurate data and detailed analytics that Ariadne provided, allowed DB to measure the following KPIs in real time:

- The density of people in each compartment

- The number of people getting in and getting off the train in each station

- Actions of people after getting off the train – e.g. taking another train or leaving the station

- Occupancy of each area in real time

- The number of people each advertisement attracts and

- Success of products in the retail area

"You presented to us what we expected to see in at least 7 years. Monitoring passenger flow is helping us to optimize the length of trains, improve our train schedule, distribute ticket revenue between subsidiary Deutsche Bahn companies and of course increase passenger satisfaction at the stations and in the train"
**Janis Diekman**
Innovation Manager at Deutsche Bahn

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BENEFITS

Ariadne surveyor system, and its combination with Ariadne Precise Localization and Dashboard, enabled Deutsche Bahn to understand their passengers better and find out the trends that they are forming. In particular,

• Ariadne surveyors have generated aggregated data of the people at the stations, which enabled Deutsche Bahn to better manage and offer improved service to its passengers. Besides, with the accumulated data, now the density of people at each point in time is predicted and necessary cautions are taken.

• Previously made by extra personnel, now the people counting operations are digitalized, which reduces costs and makes this service 7/24 possible. Consequently, this results in more accurate and better decisions.
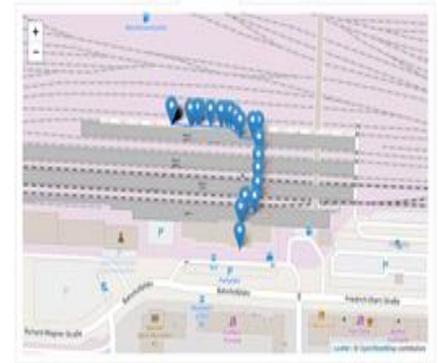

FURTHER BENEFITS AND USE CASES

- Navigation application for passengers

- Equipment monitoring in the warehouse

- Suspicious behavior monitoring – safety

- Optimal and efficient space usage

- Data and analytics provision to the retail hub

- Targeted advertising and marketing

- Lights adjusted according to the presence and the number of passengers

FLOOR IDENTIFICATION

During our project with Deutsche Bahn, we achieved a great accuracy in identifying floors of the station.
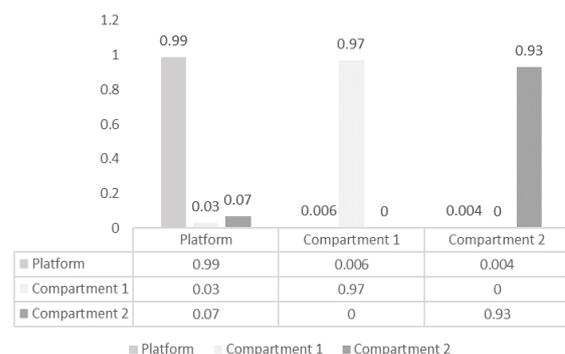
As can be seen in the figure below, we could identify with 95% accuracy whether someone is located at level 0, while we could identify with 89% accuracy whether someone is located in at level 1.
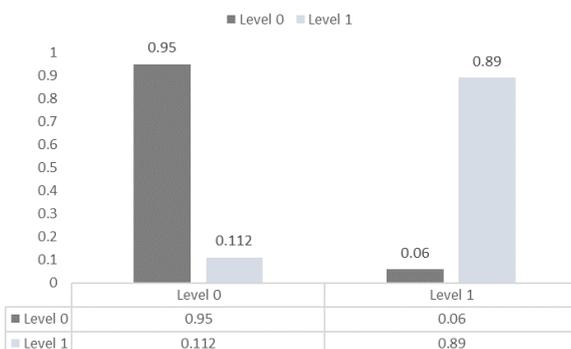
COMPARTMENT IDENTIFICATION

In the next figure, three possible context situations were introduced. One can be either on the platform, or inside the compartment 1 or the compartment 2.

We identified with an accuracy of 99% whether one is standing on the platform, 97% whether one is located in the compartment 1 and with accuracy of 93% whether one is located in the compartment 2.

	Level 0	Level 1
Level 0	0.95	0.06
Level 1	0.112	0.89

	Platform	Compartment 1	Compartment 2
Platform	0.99	0.006	0.004
Compartment 1	0.03	0.97	0
Compartment 2	0.07	0	0.93

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TECHNICAL DESCRIPTION

Technology:	RF localization Based: Difference Time of Arrival
Scanning Frequencies	
- **Surveyor Type A**	2.4 GHz & 5 GHz
- **Surveyor Type B**	500 GHz – 5 GHz
Power Connection	5V Micro USB
Current	330mA
Size:	12 cm x 2.4 cm x 9 cm
Operation Temperature:	0º – 70º

HOW DOES IT WORK?

Ariadne enables the anonymous, non-invasive, precise and real-time passenger location and tracking through our advanced, patented artificial intelligence solution, applied on sensor fusion from data freely emitted to the environment by smartphones. Ariadne is the only solution available that efficiently fuses radio-magnetic signals, captured by its surveyor devices with the geometry, topology and semantics of an area. A collection of Ariadne surveyor devices can provide real time precise location tracking immediately after their installation. Ariadne surveyors require the minimum installation time since each surveyor can be installed in less than two minutes making it a real plug-n-play solution.

One Ariadne surveyor can monitor presence in up to 1000m^2 area, while with one sensor per 50m^2 ultimate tracking accuracy can be achieved. Each device can be installed next to power plugs, without being limited to explicit location for installation. The devices do not have to be visible and hence will not affect the appearance of the walls or ceilings, and more importantly, they do not give the sense of surveillance to customers, like cameras.

Ariadne devices detect signals emitted in frequencies varied between 500MHz and 5GHz, and is the only available device that can track locations of visitors to all communications channels, such as GSM, LTE, WiFi or Bluetooth.

Visitors are localized throughout their entire journey inside the building and most popular trajectories of visitors can be mined. Staff can be easily excluded, even by opt-out or by dynamically identifying and assigning their role.

Ariadne can recognize unusual long queues or even predict them before happening. Ariadne surveyors can guarantee 95% correct customer counting and tracking, and 97% correct waiting times estimation.

Ariadne devices can also be powered via power over internet using exclusively ethernet cable for data transfer and as electricity source. Data sensed by Ariadne surveyors are anonymized on the fly, following mathematically proven anonymization techniques, respecting the privacy of your customers. Ariadne location computation can be executed on Ariadne Cloud or in your private edge or cloud, providing the ownership of the data to the customer.

ABOUT ARIADNE MAPS

Ariadne enables infrastructure owners to optimize their space by precisely and anonymously tracking the location of their visitors. Precise tracking is being achieved through our patented technology that enables the fusion of electromagnetic signals emitted by smartphones in frequencies varied between 500MHz to 5GHz. The signals are captured through our proprietary hardware technology and estimation of the distance is performed based on the signal attenuation as well as the time difference of arrival, of the same signal to reach our surveyors. We do not need to interact with the user in order to track her. We do not require application installations or network connection, while we anonymize the user data via mathematically proven anonymization algorithms optimized for spatial streaming data. Our product does not require large upfront investment and long installation procedures. Each of our surveyors can be installed by the user in less than two minutes, making it a real plug-and-play solution.

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