

## I. User stories and use case analysis.

Cities and government agencies release data available to the public to encourage communities to utilize open data and contribute to the social, economic and environmental benefits. It further serves private organizations to promote their businesses through data-driven decisions, which is led by innovative solutions and growth.

Open-data providers must carefully consider and identify the potential risk of exposing individual-level information. Unfortunately, they often choose not to release the data despite having a great opportunity of creating new knowledge and insights, because anonymization is time-consuming and complicated. This is a challenge most of our active Smart City customers face, and often request robust anonymization techniques so they can distribute their data on their platforms.

Around 6,200 sensors are currently deployed worldwide by Correlation Systems. Most of them are located in smart cities such as Bologna (Italy), Seoul (South Korea), Bat Yam (Israel), Bangkok (Thailand), and Busan (South Korea), who use it for purposes such as: ensuring crowd safety through real-time crowd congestion monitoring, measuring success of public events, tracking paths undertaken by visitors, etc.

Some of these cities wish to participate in the elaboration of the UtiP-DAM solution and decided to join our project as use cases. During frequent online meetings, use case owners will provide us with their feedback to continuously improve our solution and solve potential issues that may arise.

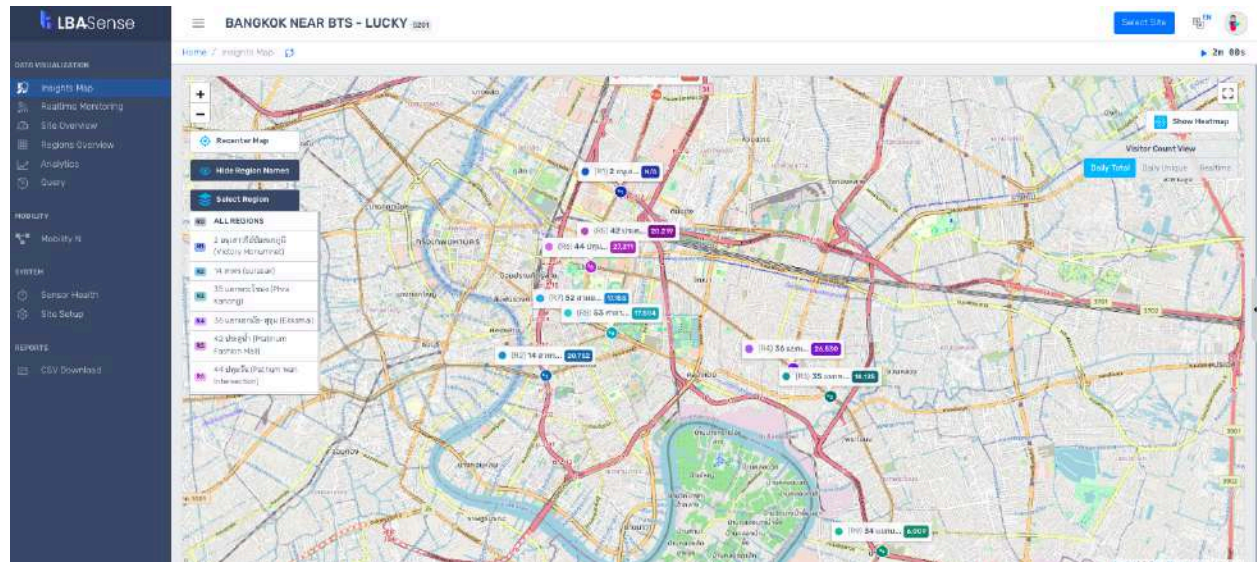
Based on these projects we developed three categorizations of use cases, which aligns with the objectives of this project and the system we are developing.

The use cases are classified into three categories:

1. User Centric Use Cases - A use case that will include the full capabilities of a system including a user centric approach which will allow any end user to check if his data is part of this use case.
2. Data Extraction Use Cases - A use case that will include the data extraction tool but will not be publicly available. Customers will be able to extract the raw data after anonymization using our existing dashboard.
3. Performance only use cases - A use case in which software update is not possible and for those use cases only performance analysis will be done. This is applicable for use cases that are currently not active any more or to use cases where a software update that is required for the data extraction tool is not possible .

## User Centric Use Cases

*Use Case 1: Real-Life Experiments with Bangkok BTS SkyTrain Stations, Thailand (in partnership with MIE, a Thai SME)*



**User Story:** We want to delve into the intricacies of commuter behavior and station usage at the BTS SkyTrain stations in Bangkok. Our objective is to leverage UtiP-DAM to collect and analyze anonymized mobility data, providing valuable insights into how commuters move along the public transport network. By understanding patterns of entry, exit, and dwell times, it will be possible to optimize station layouts and enhance overall efficiency, contributing to the improvement of Bangkok's public transportation experience for its residents and visitors.

**Use Case Analysis:** Teaming up with MIE, a Thai SME, UtiP-DAM is set to be implemented for the sensors deployed at the entrances of stations along the Bangkok BTS SkyTrain route in Thailand. This deployment encompasses a network of ten sensors, yielding approximately 500,000 data points on a daily basis. Through the decentralized k-anonymization process, individual trajectories are safeguarded, allowing the extraction of valuable insights into commuter behavior and station usage. The anonymized data not only preserves privacy but also supports the optimization of transportation services and urban planning efforts in Bangkok. This invaluable information proves beneficial for mobility researchers and city planners seeking to enhance the efficiency and functionality of the city's public transportation system.



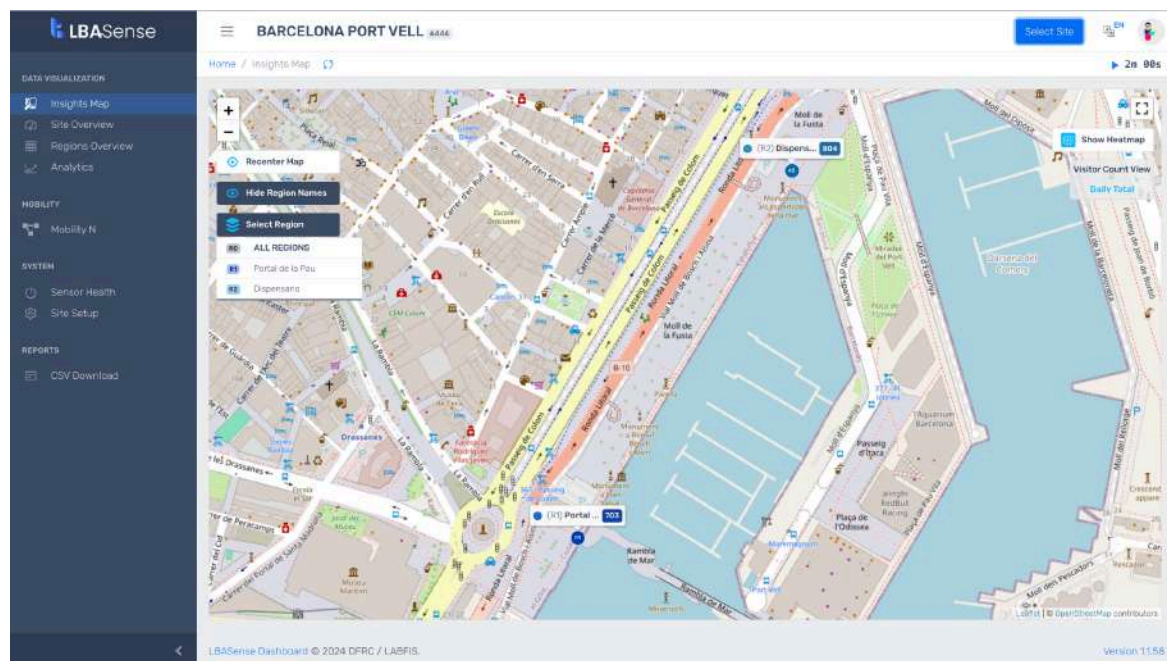
### *Use Case 2: Deployment on La Rambla in Barcelona*

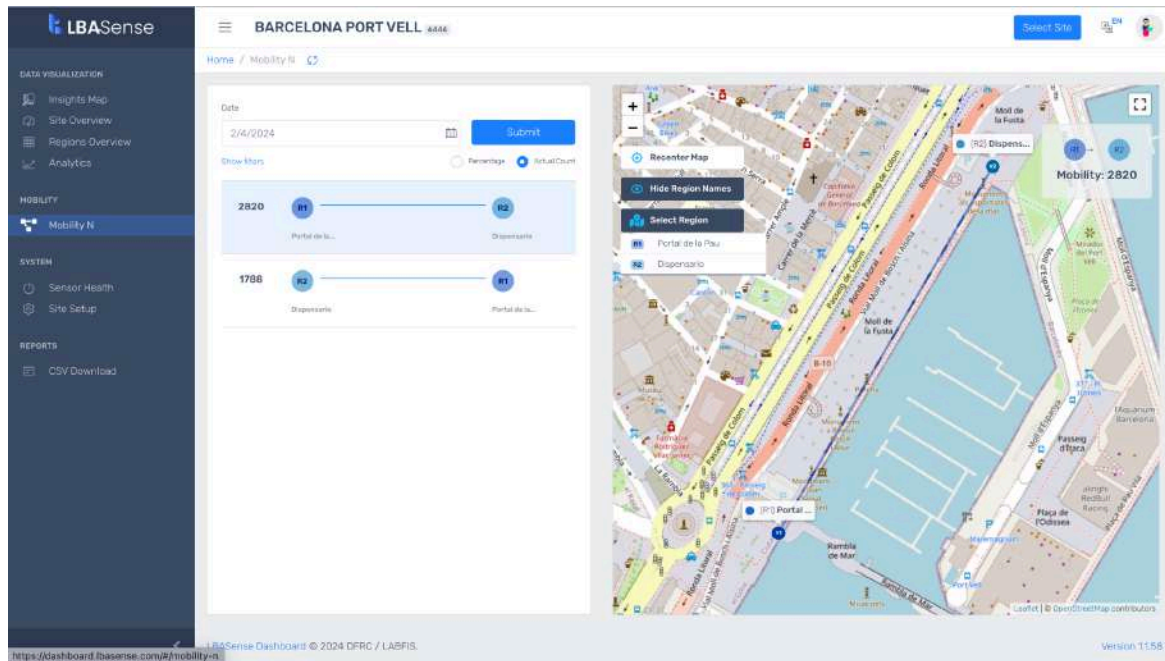
User Story: We aim to understand the pedestrian flow along La Rambla by distinguishing between those strolling along its length and those merely crossing the street. Our secondary objective is to ascertain the direction of movement. Specifically, we are keen on correlating mobility data with the arrivals of cruise liners



at the port of Barcelona, as well as with other noteworthy events occurring in the city.

Correlation Systems has deployed 12 sensors on La Rambla, La Boqueria market and The Port of Barcelona. A data-sharing agreement has been established with the business association of La Rambla, enabling Correlation Systems to distribute the data publicly (this is applicable only to La Ramble and La Boqueria sites). UtiP-DAM will be applied internally to anonymize the data collected by these sensors, ensuring that individual trajectories remain private while still providing valuable insights into the mobility patterns along La Rambla. The decentralized k-anonymization process aligns with privacy requirements, making it suitable for both internal analysis and public distribution of anonymized mobility data.





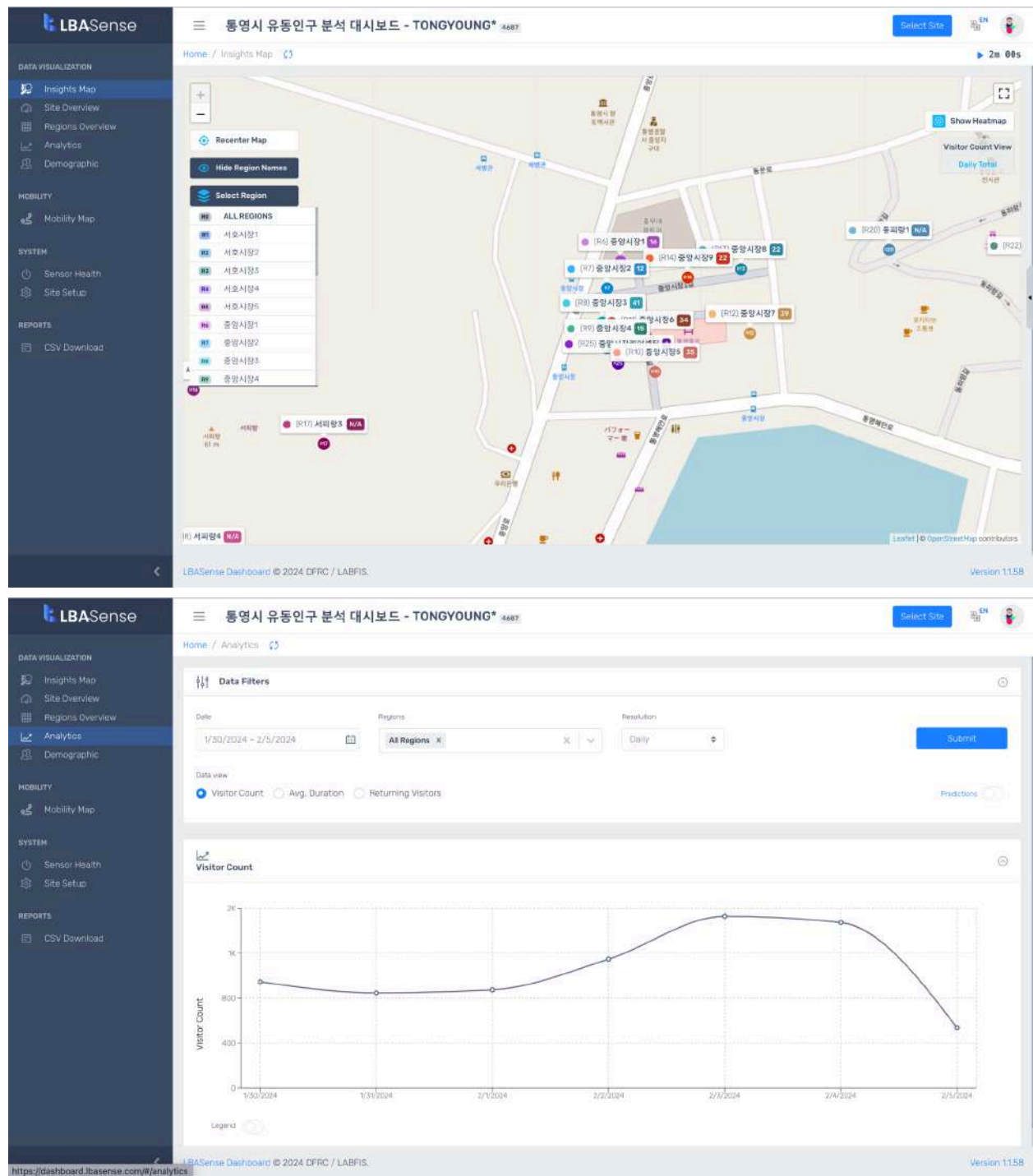
## Data Extraction Use Cases

### Use Case 1: Bus Stops in Tongyeong

User Story: We would like to understand how citizens are using the public transportation in the city, mainly the start / end points of a trip. Waiting time at the bus stops and trips that involved the use of multiple buses.

12 sensors had been deployed on different bus stops along the city focusing specifically on lines in which the city is highly interested in (mainly lines that connect the outer part of the city and downtown) and the city is using the mobility data together with other data sources in order to understand the overall mobility patterns of the local citizens





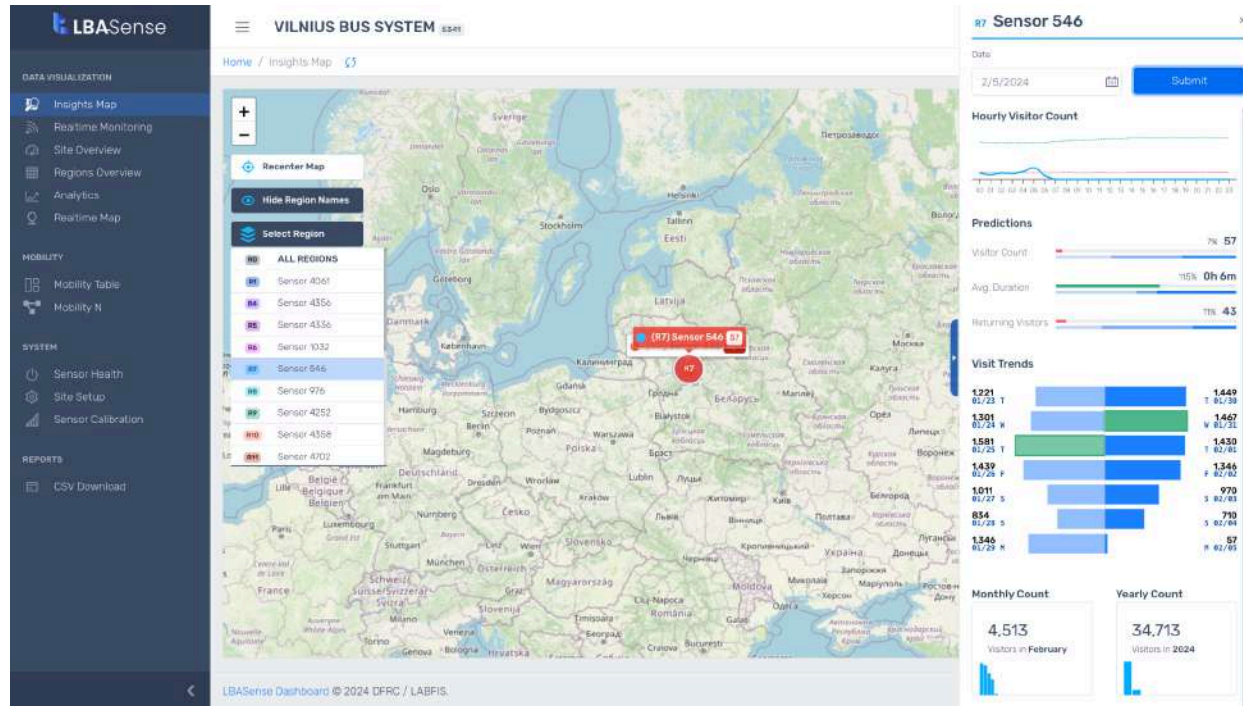
Use Case 2: Vilnius bus system

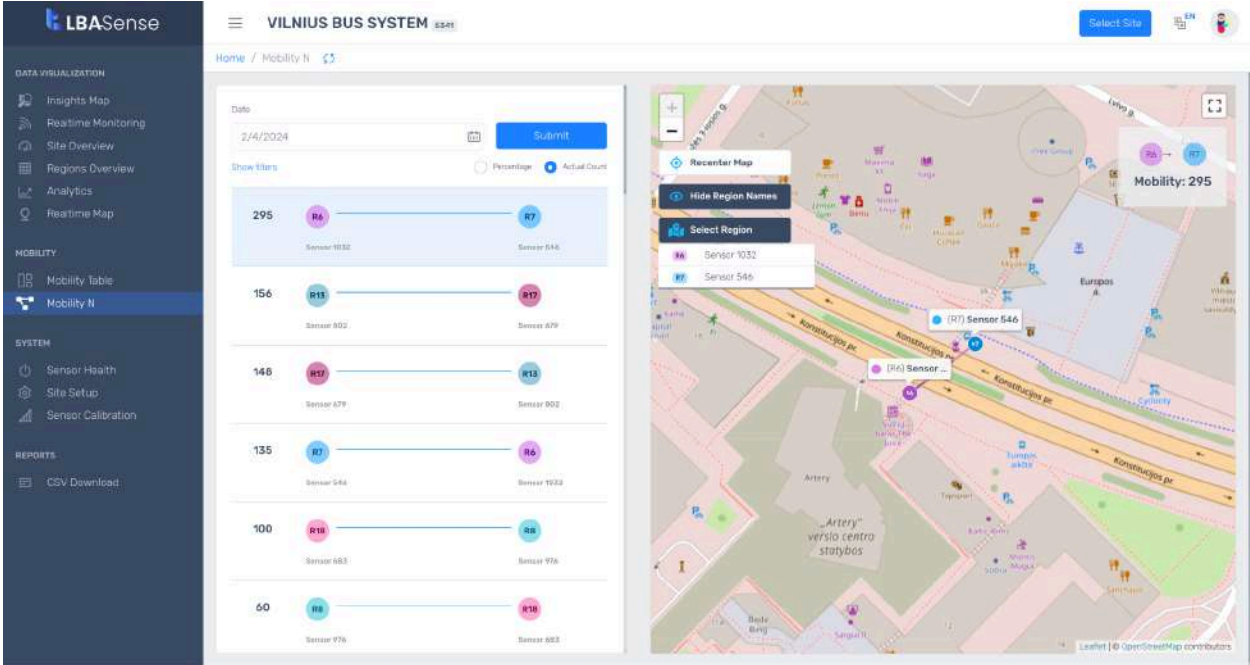
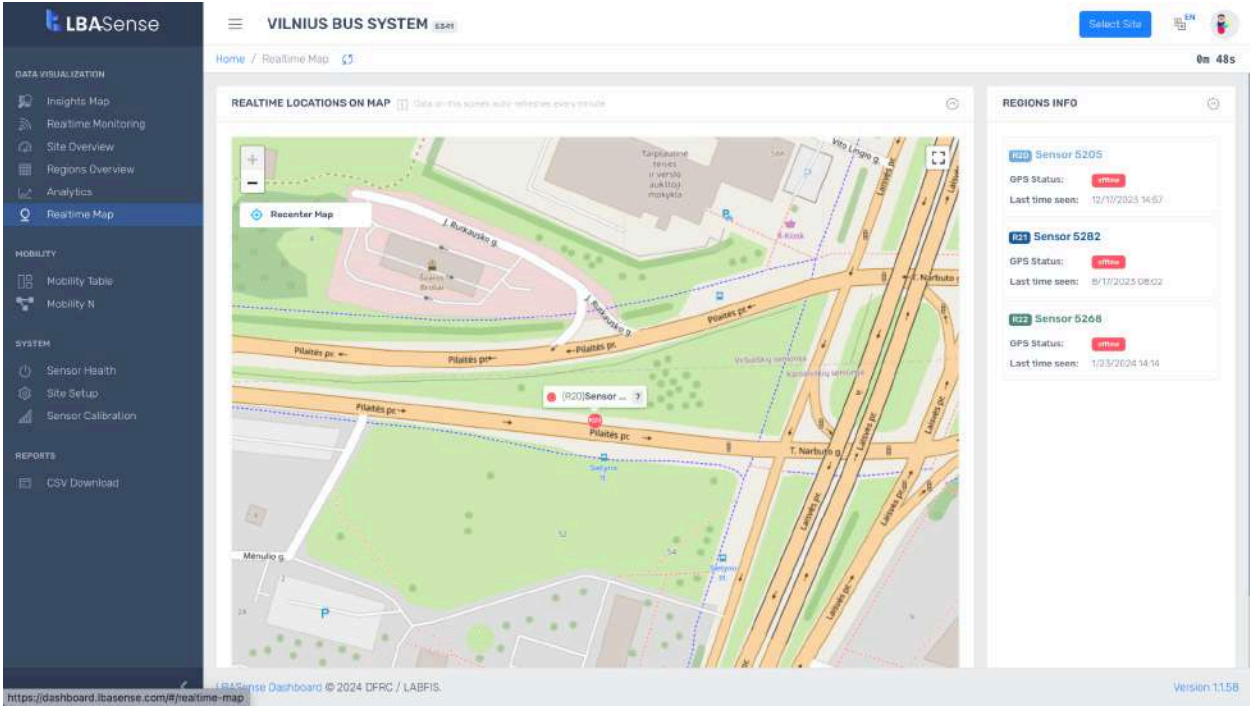
User Story: our goal is to have a public transport system that reacts to changes in demand in real time based on prediction of future demand.



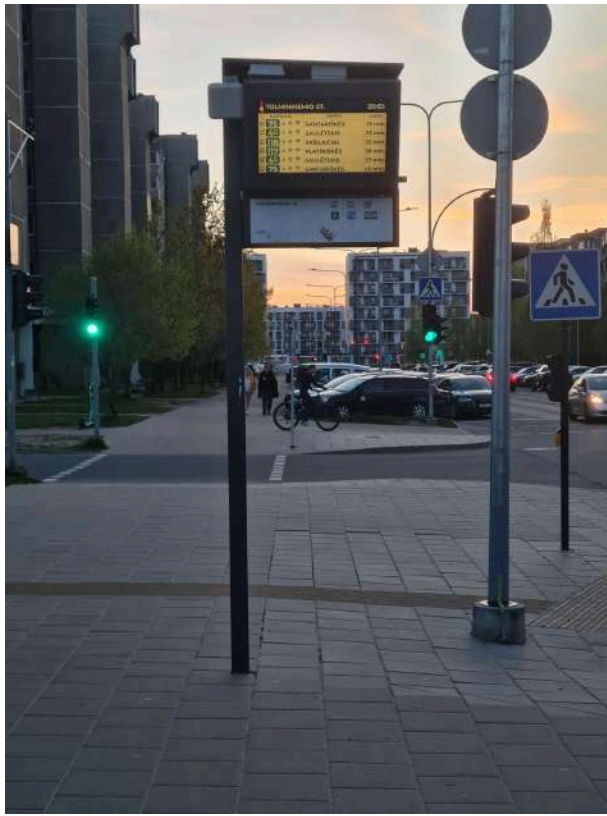
Sensors located in the bus and bus stops are designed to predict the future demand for public transportation service within 2-6 hours. Mobility data is used in order to build a module that predicts the demand as mobility patterns in public transport seem to be reversed during different times of the day. (i.e. people going to an event downtown are expected to take the same bus in the opposite direction.

Data collected from the sensors located inside the bus is associated with the location of the bus stops and the mobility is calculated between bus stops.









### Use Case 3: Esplanade Theater (Singapore)

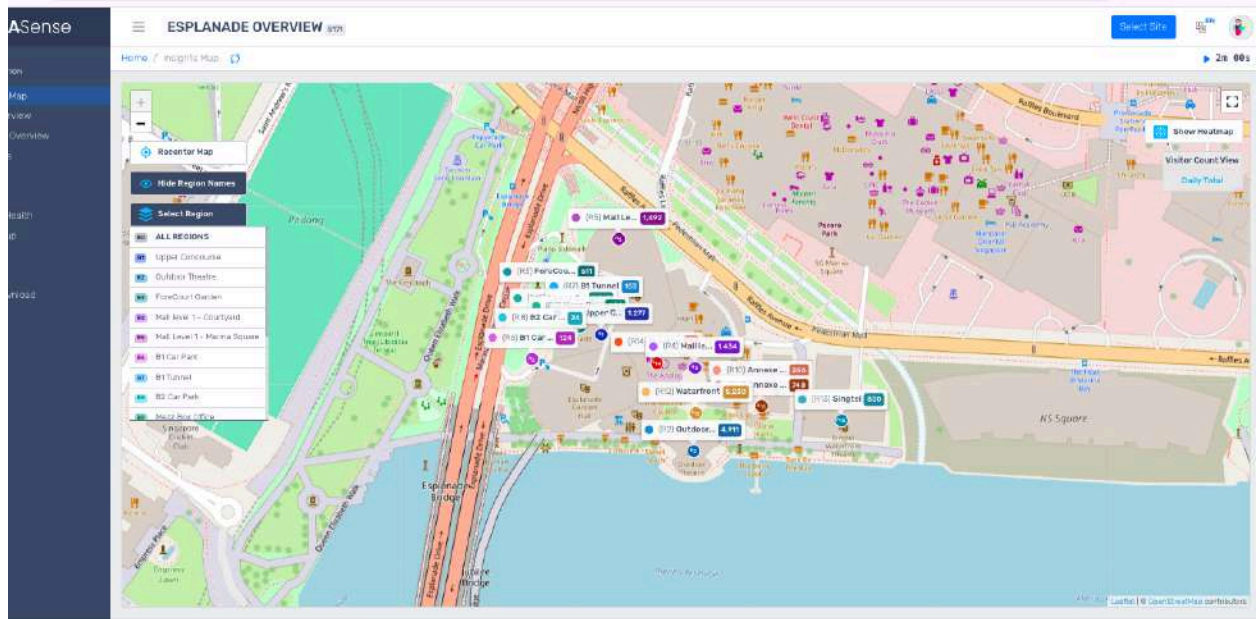
Esplanade – Theatres on the Bay is a performing arts center located in the Downtown Core of Singapore near the mouth of the Singapore River. Named after the nearby Esplanade Park, it consists of two rounded structures: one housing a concert hall with about 1,600 seats; and the other a theater with a capacity of about 2,000 for the performing arts.

For the last 7 years Esplanade has been monitoring the footfall traffic of free shows using Correlation Systems mobile phone detection system. In addition, Esplanade are using mobility data in order to have a better understanding of visitor types.

In general, two types of visitors are visiting the site: tourists that are visiting the marina bay area (the merlion and marina bay sands) and are passing by in from of Esplanade and people that are coming to the theaters for the shows or for the retails area co-located.

By analyzing the entrance vs destination it is possible to differentiate the behavior of those two populations and get a better understanding of how attractive each event is to the different populations.



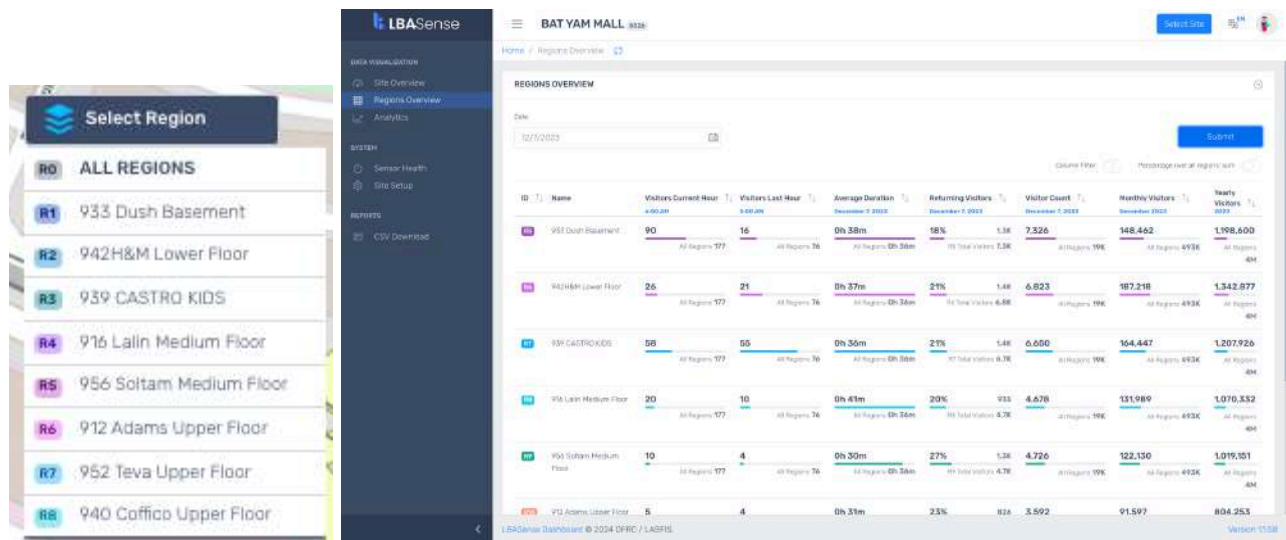


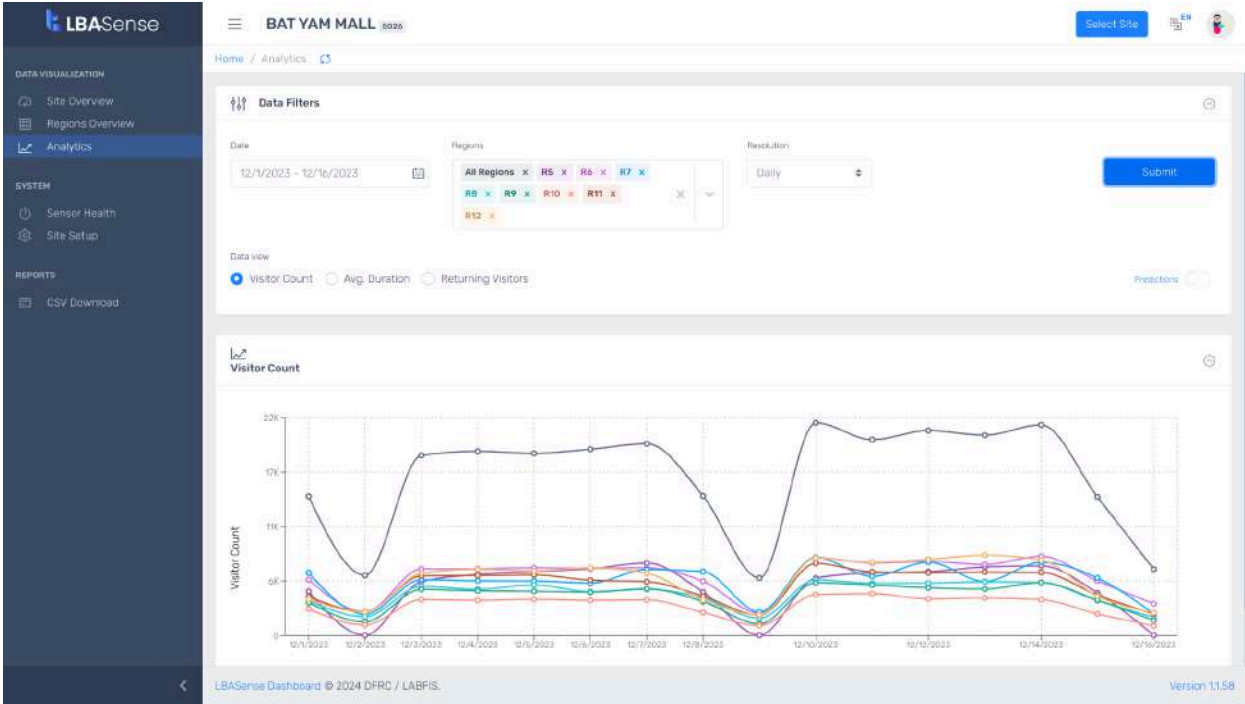


## Use Cases for performance analysis

### Use Case 1: Bat Yam Shopping Mall (Israel)

User story: the goal of the mobility analysis is to analyze the value of anchor stores. The shopping mall has three anchor stores, a grocery store located in the basement, a pharmacy store and the food court. The goal of this analysis is to understand how many visitors are going only to the anchor stores and skip the shopping center (especially applicable for the grocery shop at the basement) and what is the economic impact of the anchor stores on the other shops in the mall .



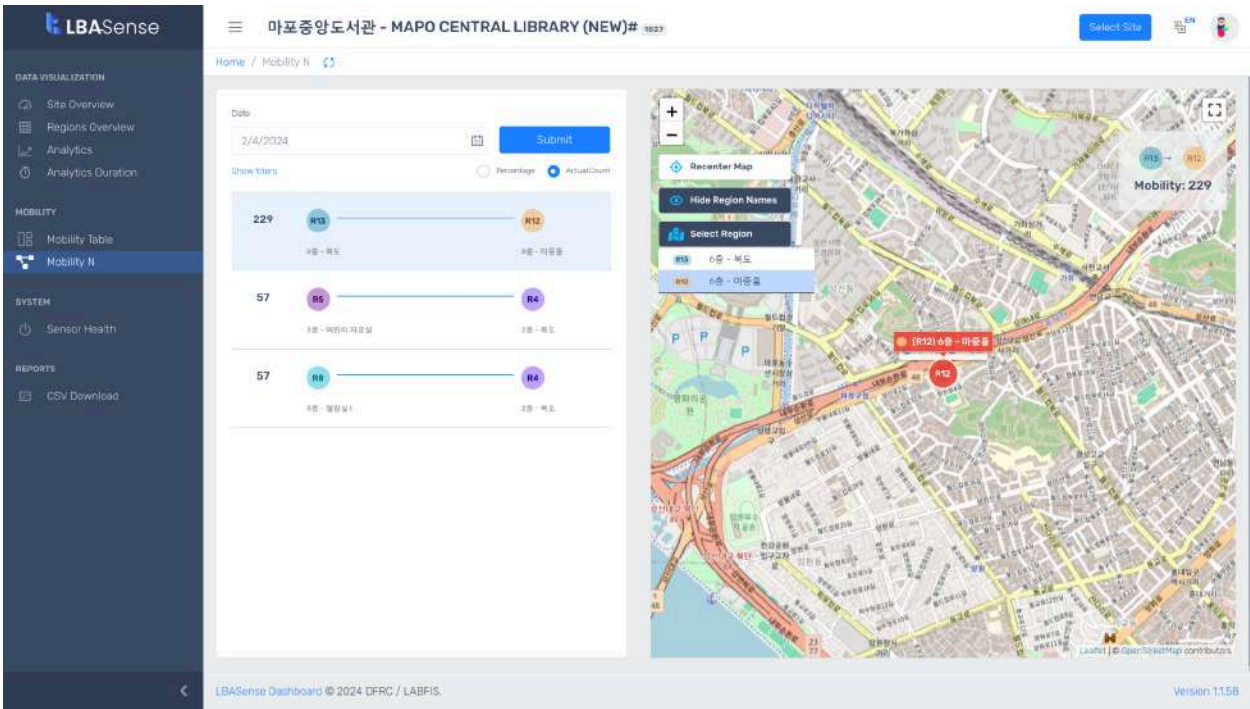
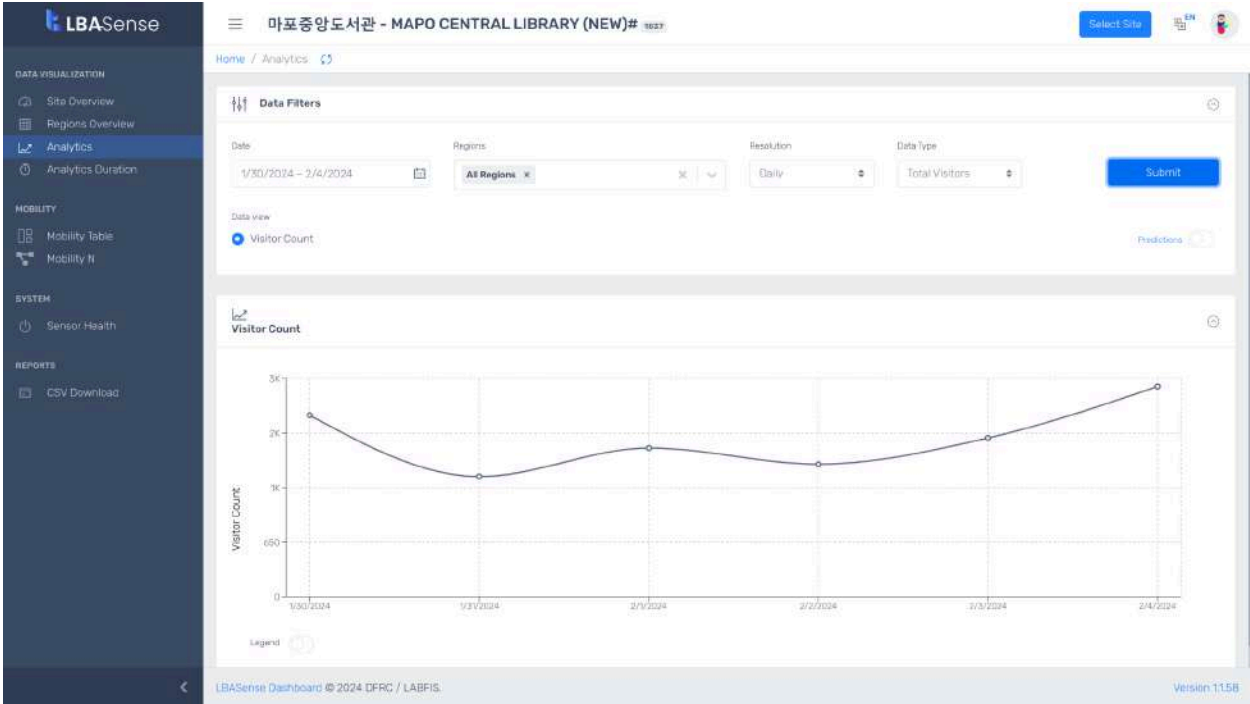




## Use Case 2: Mapo Library

User Story: The library is a 7 stories building which is composed of multiple sections such as co-working area, children area, multimedia library etc.  
The main goal of the mobility in this project is to understand the







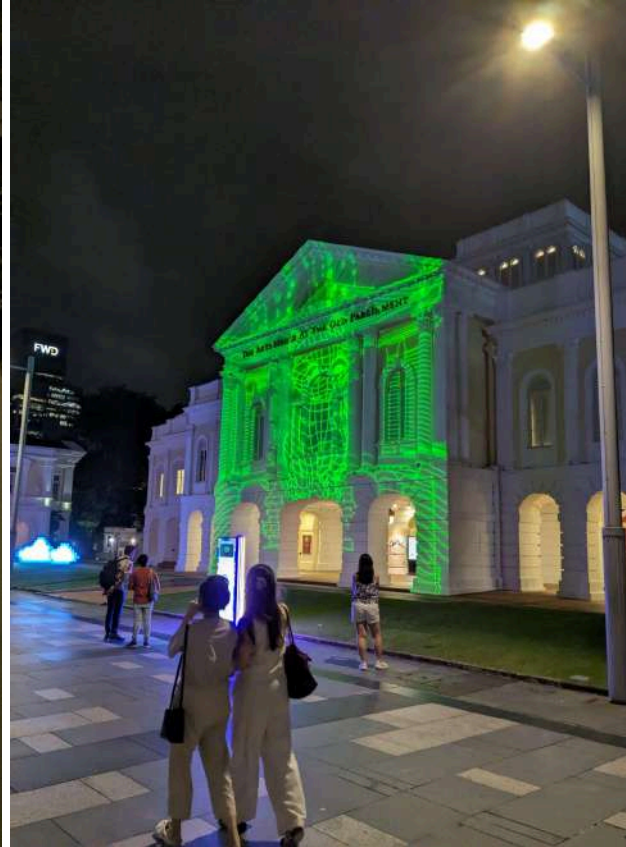


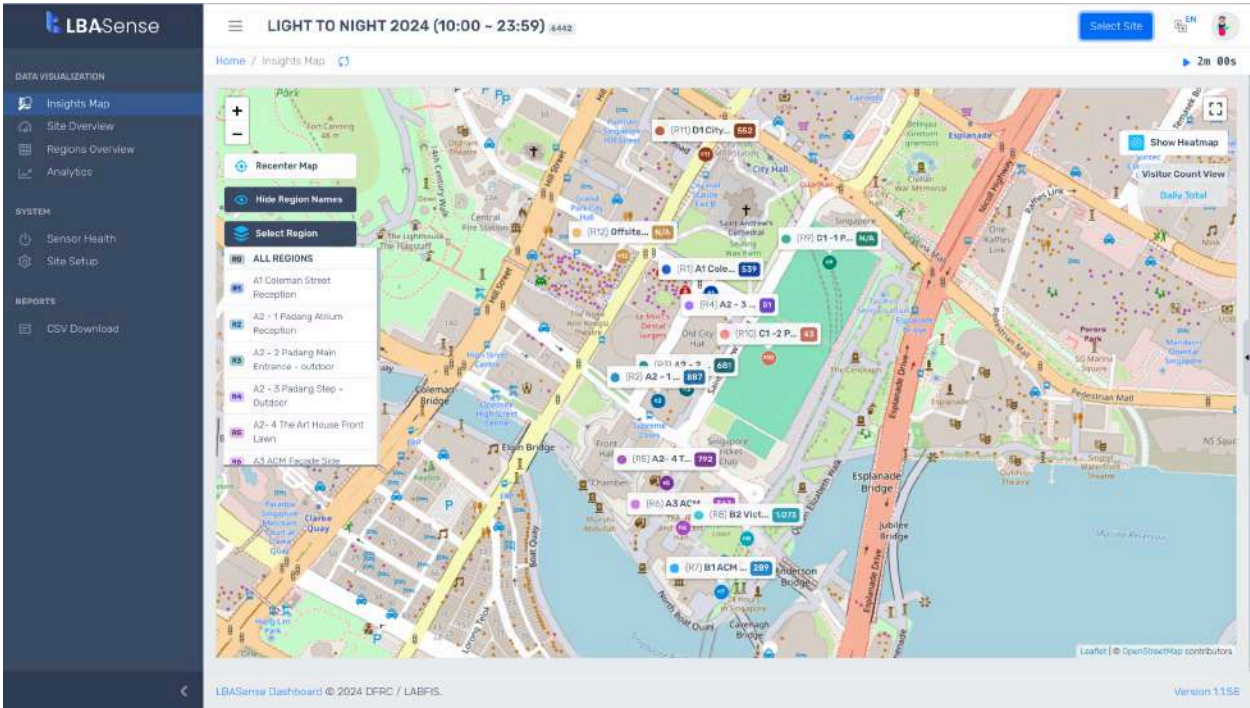
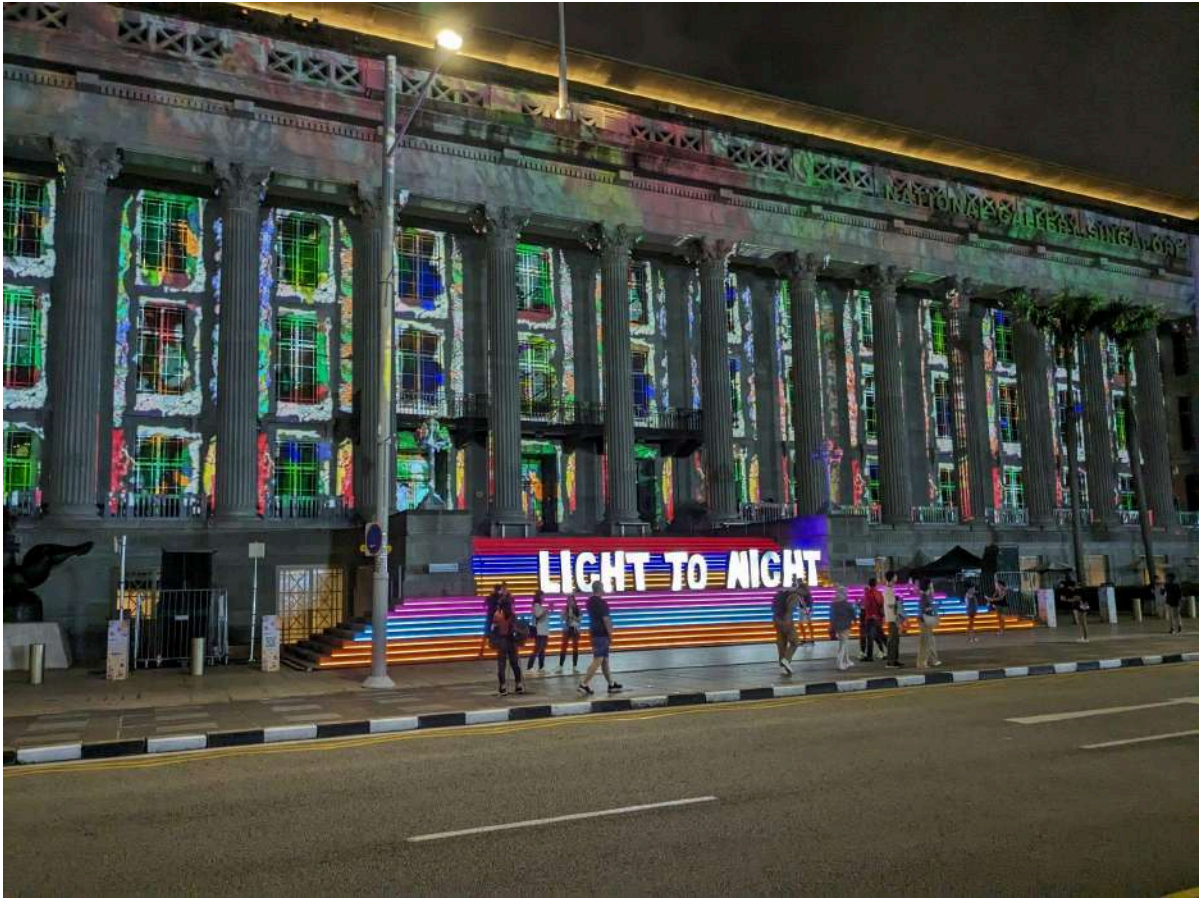
### Use Case 3: Light to Night 2024, 2023 and 2022

User Story: Light to night is a yearly event organized by National Gallery Singapore in the civil district. During this event multiple arts exhibits are deployed and the public is visiting the different exhibits.

The main goal of the mobility is to understand the movement patterns of the crowd in order to prepare better guidelines for next year and to try to have a balanced (higher) number of visitors to all the exhibits









## Use Case 4: Hadong

Hadong province located in South Korea is using mobility in order to understand the behavior of tourists from different cities.

There are three main entrances to the province: from Seoul, Busan and Namhae. The province deployed sensors in the exits from the highway as well as in the main tourist attraction within the province. The main goal of the system is to understand how tourists from different cities behave, which attraction they are visiting and how the move between attractions in order to optimize marketing campaigns and in order to provide advertisement and information in each tourist attraction that will “push” the visitor to the next attraction.

