CO2-Mute

Fighting CO2 emission with data spaces

Smart Cities, Smart Mobility and Smart Environment

CO2-Mute: Fighting CO2 emission with data spaces

With the contribution of:

- **Sis.Ter srl**

- **Hostabee SAS**

- **MONTEM A/S**

- **DIH Faubourg Numérique**

Challenge & Context

In order to mitigate climate change and pollution levels and to improve the quality of life for citizens, the European Union has set ambitious targets of CO2 reduction to be reached by 2030. Within these policy frameworks set at the EU level, member states are left free to determine strategies and targets appropriate to their specific circumstances. It then becomes the responsibility of the individual regions and cities to put those policies into practice, adapting them to the local context and assessing their feasibility and effectiveness. The modern transportation sector is one of the main contributors to environmental impacts due to its role in air pollution, greenhouse gases and CO2 emissions.

Local governments are starting to invest in Mobility-as-a-Service strategies and infrastructures to stimulate the use of alternate means of transportation (public transport, cycling, etc.) to reduce traffic congestion and the related environmental impact, it is still a big challenge to change the habits of the citizens.

On the other hand, as Nature Based Solutions (NBS), urban green infrastructure (parks, gardens, urban forests, vertical gardens, etc.) directly contributes to air quality and carbon neutrality - through the removal of air pollutants, carbon storage and carbon sequestration - as well as indirectly - through reducing energy needs and pollutant emissions. Furthermore, urban green also contributes to other policy targets such as health, well-being, climate change adaptation, biodiversity, urban regeneration, stormwater management and social equality.

The CO2-Mute project aims to support local governments in these specific challenges in the deployment of policies for sustainable mobility and urban green infrastructure, in the frame of their local environmental and digital transition strategies. CO2-Mute will first focus on supporting local authorities to understand their situation and to define local governments policies, in terms of mobility and green challenges. This experiment will also prepare the citizens' involvement to participate in the concrete implementation of the policies to change mobility habits.

CO2-Mute would like to gamify alter-mobility usage and enhance green spaces' role in pollution mitigation, by proposing collective and individual achievements to commuters and workers to evaluate the effective impact on costs, on the traffic and on the environment (air and noise pollution).

Solution

CO2-Mute experiment uses various data sources about traffic (Tom-Tom and Here APIs) and data from five air quality and noise sensors provided by MONTEM A/S, together with data obtained from local weather stations about the environmental status and time range. This data will be correlated, developing a custom algorithm in order to calculate the estimated impact of traffic reduction on air pollutants concentrations.

The results of the analysis will be made available to the concerned local government and ecosystem, especially in order to be integrated into the urban planning decision processes with a specific focus on green spaces. When needed, the data will be anonymized in order to comply with the GDPR.

At each stage of the CO2-Mute value proposition, seamless access to heterogeneous data coming from various sources and data providers is crucial to deliver relevant services and reliable analysis.

CO2-Mute has a high level of flexibility in its' configuration and a strong capacity to deal with various types of data thanks to its "interoperability by design" approach and the use of a Digital Twin platform implementation based on the NGSI-LD standard. Then, this capacity to personalize and correlate the data depending on local situations is crucial to measure impacts. As the fair and controlled sharing of heterogeneous data plays a central role, and as transparent business models are needed, CO2-Mute relies on i4Trust architecture.

The pilot city area (Béthune city centre) has been analysed according to several characteristics that influence the measured pollution and traffic flow. This helps to understand which factors could have contributed to any reductions in particulate matter concentration registered during the Béthune Rétro Festival (26-28 August 2022).

Sis.Ter srl has performed the expected impact calculation, and insights were shared through NGSI-LD Notification (subscription) mechanism and direct access to the shared NGSI-LD entities (GET /entities). Then, Hostabee delivered relevant information about the result of the test to the pilot city, by building a dashboard to present analysis and global results and suggest the local mobility strategy.

How it works

The proposed architecture aims to implement the CO2-Mute value chain involving the three SMEs and the pilot city. From a technical point of view, all the partners implement their own instances of NGSI-LD Context Broker, KeyRock and Kong. There are mainly two phases in the CO2-Mute information flows that require data sharing mechanisms:

● Data collection/analysis during the period of the local mobility challenges, such as Béthune Rétro Festival (26-28 August 2022), collect mobility and environmental information and make analysis about the local situation

● Impact and results dissemination after the end of each local mobility challenge, such as Béthune Rétro Festival (26-28 August 2022)

Data collection, sharing and analysis during the mobility challenges

All the data collected are accessible for the data science service provider (Sis.Ter srl) through the NGSI-LD API. Then, Sis.Ter have the possibility to analyze the required (remotely stored) data using Big Data/ML analysis through the Context Broker and specific Node-Red processors that make available all the required data for tools like PySpark. The definition of access policies are managed on the CO2-Mute Marketplace associated with offers in order to allow Sis.Ter to GET the data provided by MONTEM, Hostabee and by the pilot City. When Sis.Ter acquires the specific offers from Hostabee and MONTEM, the CO2-Mute Marketplace submits the policies to the related Authorization Registries of the different data owners (MONTEM, Hostabee, pilot City).

Impact and results dissemination

The results of the performed analysis are shared in the marketplace, therefore, an adequate FIWARE data model is required. We identified the Key Performance Indicator (KPI) as the best suitable one. This generic model allows us to represent a wide variety of results and has some interesting keys that can fit with our goals. Then the offer (with analysed data) will be submitted on CO2-Mute Marketplace which submits the policies to the related Authorization Registries of the data owner (Sis.Ter srl) to be accessible to the application provider (Hostabee).

Identification, authentication and authorisations

As all the involved stakeholders could have had the role of data providers, they had to expose their services on the i4Trust Marketplace global instance. In the CO2-Mute data flows, there are only Machine-to-Machine interactions between the systems of the stakeholders. Of course, all the partners also have to get their certificates from iSHARE and the partner systems in order to be authenticated through the JSON Web Tokens and the validation process involving iSHARE satellite when access tokens are requested.

In this architecture, the identity provider and authorisation registry are placed for every entity. It is understood that these are certified roles in iSHARE and that each party needs to be onboarded as certified parties in terms of iSHARE framework (which has some extra steps compared to onboarding of data consumers/providers).

Benefits & Impact

At each stage of the CO2-Mute value proposition, the seamless access to heterogeneous data coming from various sources and data providers is crucial to deliver relevant services and reliable analysis. That is why we think the i4Trust architecture is the ideal one to implement and scale the CO2-Mute project: for instance, the data reflecting air quality in the pilot city are coming from three different data providers, and they have to be harmonized through Smart Data Models, and shared for the CO2-Mute services.

The CO2-Mute Partners have used the powered by FIWARE solution ouranos-ws provided by DIH Faubourg Numérique, in order to prototype the data models and to start testing datasets publications. MONTEM has developed and implemented an NGSI-LD connector that enables the CityProbe 2 to be certified 'Powered by FiWARE'. The IoT agent has been developed as a part of MONTEM's CityPlatform backend, specifically their serverless webhook/call-back microservice, where NGSI-LD now exists as a type of webhook for future use cases.

The webhook is triggered each time a device sends a new measurement from the field, checking whether the device itself is within an organizational network that has webhooks enabled. If enabled, the connector checks the type of webhook and for our experiment, this has been set to the NGSI-LD connector for our experiment in Bethuné. After checking the type, the service will match hardware-specified device IDs with entity UUIDs for both the AirQualitySensor and the related AirQualityObserved entities. Finally, the service will transform

the raw payload into a series of spatial and temporal properties for upserting in the Context Broker.

Benefits and impact will be evaluated at the end of the experiment, but in general, we believe that such a kind of data-driven solution should make visible to the local municipality the state of the art of its mobility and air quality status.

Added value through i4Trust

Participating in and contributing to i4Trust is a starting point for C02-Mute to achieve the goal of delivering digital technology, addressing major environmental challenges, and creating new fair and sustainable revenue streams for innovative SMEs in the emerging framework of data spaces. Starting with the city of Béthune is also an important asset to gain visibility and adoption of continuity in all the cities as this city - and its related community CABBALR – have recently adopted a very ambitious climate plan addressing air quality and energy efficiency, and a strong commitment in supporting digital innovations.

On the technological side, the participation has enabled independent stakeholders to combine their technology through the i4Trust and FIWARE ecosystem of components, giving us a platform for testing and validating system interaction using a real-life business case. The added benefit is that the experience gained in creating connectors, securing access using iSHARE and achieving greater integration with each other's systems can further develop the project consortium's ecosystem of data providers and consumers.

Next steps (if applicable)

In its next phase, the CO2-Mute concept will be to gamify alter-mobility usage by proposing collective and individual achievements to commuters, workers, and citizens to evaluate the effective impact on costs, traffic, and the environment (air and noise pollution). The definitions of collective and individual alter-mobility challenges will be directly linked to local government policies. The collective and individual challenge definitions are directly linked to the local government's policies, to the available local offers and possibilities for alternative and sustainable means of transport and to the existing urban green infrastructure.

Indeed, an important challenge for the replicability, sustainability and scalability of the CO2-Mute solution is the construction of the business model and the identification of the possible revenue streams. In this perspective, as the strategic proposition of CO2-Mute is to support local governments in the deployment of their MaaS policies, the main business model is to sell the CO2-Mute through public (innovative) procurement processes. Additional revenue streams are envisaged, namely the qualified leads generation for public or shared transport operators.

References

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