

Generative AI for *sustainable mobility*



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Introduction

Transport decarbonization, which is essential to the fight against climate change, will not only require the electrification of vehicles, but also a substantial shift in traffic towards collective, shared and/or active mobility. But facilitating and accelerating this modal shift is not just a question of developing networks or increasing financial incentives: travelers also need to be attracted by an offer that is clear, appropriate, practical and economical. From the moment they choose their route to the moment they arrive at their destination, their experience must be as personalized and contextualized as possible, ensuring maximum fluidity before, during and after their journey. This seamless process is likely to create a positive perception of the transport modes used, the brand and its offering, and thus a **strong motivation to repeat the experience and recommend it.**

70%¹

of respondents to a survey of the Autonomy community of experts believe that LLMs will help reduce the number of privately owned cars and increase modal shift by enabling mobility operators to offer more convenient solutions.

Attracting and retaining new customers so that they abandon their private car is one of the main challenges facing public transport authorities (PTA) and operators (PTO) today.

Technological innovations, in particular generative AI, will have a decisive role to play in meeting this challenge. We are convinced that this form of artificial intelligence, popularized in 2022 by ChatGPT, is capable of removing a number of major obstacles to the accessibility and attractiveness of sustainable mobility. This is also the opinion of a majority of the members of the Autonomy community, 70% of whom

believe that it will help to reduce the number of privately owned cars and increase modal shift by enabling mobility operators to offer more practical solutions (although 33% see it more as a fad than a genuine lever for change)¹.

As suggested by the first use cases that have been implemented or are still being studied, and as we will see in this document, generative AI will have a very significant impact on two key areas: operational efficiency and the traveler experience, with, as a result, significant benefits for mobility companies, their employees, their customers... and the environment.

¹ Survey addressed to members of the Autonomy community in January 2024.

A few reminders about generative AI

Generative AI, or GenAI, refers to a form of artificial intelligence capable, as its name suggests, of generating text, images, video, audio, or a mixture of these media.

It is based on statistical models trained on an extremely large body of data, including computer code, equivalent to several billion pages of documents, images and thousands of hours of video or audio. On a basis of a written query (prompt), GenAI is able to generate original and unique content, which is similar – but not identical – to the content it has assimilated.

Text / Speech	Code	Image / Video
Summarising a text/ a conversation	Autofill code	Increasing resolution
Translating	Translating a code	Modifying/styling an image
Analysing a corpus/ a conversation	Optimising an existing code	Translating an image into a photo
understanding a question/ an instruction	Documenting an existing code	Detecting an anomaly in an image/video
Re(writing) according to instructions	Writing code based on instructions	Creating a 2D image based on instructions
Describing an image/video	Testing an existing code by units	Transforming 2D into 3D
Answering questions in a factual manner	Orchestrating a workflow	
Solving logical/ mathematical problems		



Figure 1-Maturity of fields of application depending on the nature of the data supplied to GenAI.

Generative AI can be applied to any type of data (text, image, video, sound, code, etc.) both as input and output to the query, so the fields of application are theoretically innumerable: creating articles, personalizing content, producing computer code, generating data sets, correcting images, 3D animation, and many more.

Large Language Models (LLMs), a sub-category of GenAI specializing in language, are now the most mature, robust and widely used GenAIs. They are first trained to predict the next word in a given sequence of words. They are then specialized to perform tasks other than their primary function. In this way, they excel at understanding and producing text across a fairly wide range of applications: classification, research, synthesis, conversation, translation, writing, etc.

On the other hand, because of their probabilistic nature, and despite their often impressive performance, LLMs have intrinsic limitations that should not be overlooked:

- **Bias:** *the model depends on the training data set from which it draws its inspiration. It mechanically reproduces any weaknesses, such as biases, stereotypes, prejudices, errors, obsolescence, etc.*
- **Reliability:** *as models predict the next word in a sequence based on the previous words, they can generate information that seems logical in context, but which is not actually true or accurate. There is therefore never absolute certainty that the answer is accurate, relevant or appropriate. This can even lead to gross factual errors called hallucinations.*





To overcome these limitations as much as possible, it is essential to implement techniques to control the model according to the intended use case, and to set up a certain number of safeguards: ensuring the quality of the data; improving the relevance, accuracy and way of processing the query (prompt-engineering); forcing the model to respond only on the basis of sources provided and traceable in the response (context-engineering); and possibly – although, in practice, much more complex – adapting the model (fine-tuning). In all cases, automated and human controls need to be put in place before the solutions are deployed on a large scale.

All this means that LLM performance can be significantly improved for the application in question. Even so, they will not be able to perform tasks completely autonomously, without user supervision. The user will have to treat them as an assistant, constantly keeping a critical eye on them.

Finally, whatever the project is, we must not forget to consider the issues of security, compliance and environmental footprint that generative AI and LLMs sometimes raise so acutely.

Our vision of GenAI use cases in relation to mobility

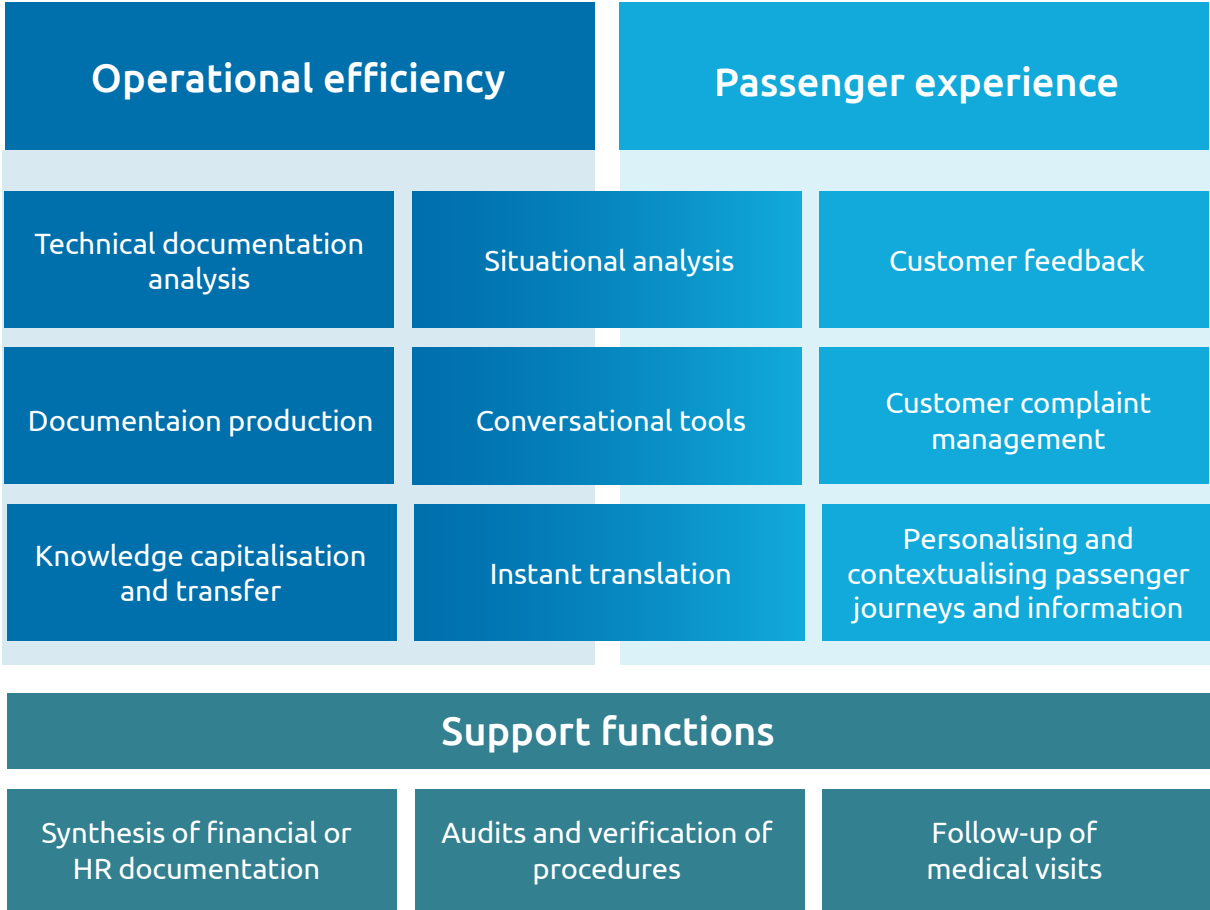


Figure 2 - Major GenAI use cases in the mobility sector.



Generative AI for operational efficiency

In the mobility and transport sector, operational efficiency is the sinews of war. In all sector businesses, improving efficiency in the field means helping to provide a service that is less costly, more reliable, more responsive and more resilient in the face of unforeseen events, and that offers travelers a more satisfactory experience. In this area, generative AI is a powerful lever for improvement, as numerous use cases already illustrate.

Analysis of technical and legal documentation

The mobility and transport sector operates and orchestrates equipment of extremely varied nature, technology and era. It is also a particularly regulated sector, governed by complex provisions and standards that frequently evolve. As a result, the technical and legal documentation is abundant, fluctuating and heterogeneous and needs to be constantly taken into account. Particularly well-suited to enriched and personalized documentary research, generative AI can bring considerable time savings and improve accuracy when it comes to obtaining the right information, so helping you to make the right decision in real time.

Production of reporting documents

In all professions, employees produce numerous reports to provide information on their activity, share their experiences and alert others to any difficulties or incidents they may have encountered. Generative AI can relieve this valuable but time-consuming task, and improve its quality, by assisting employees with data entry, pointing out missing information and even, in the future, directly transcribing voice recordings. It can also facilitate the use of these reports by making unsuspected comparisons, detecting imperceptible similarities, and proposing new categorizations. In this way, generative AI will be able to carry out root cause analyses and suggest ways of resolving problems much more quickly.

Situational analysis

The new generative AIs are multimodal, meaning that they can process all kinds of media simultaneously, text and images for example. They have this fine-tuned ability to describe images and therefore to depict a context. Integrated into surveillance systems, they can be used to detect problem situations that require both object or person detection and context analysis. For example, they can be used to detect high-risk situations (such as illness or aggression, or crowds of people) and assist a security guard to intervene more quickly. It is also possible to characterize damage or quality defects, warn of the presence of obstacles on or near tracks (intruders, vegetation, landslides, etc.), check the cleanliness of premises and equipment to specify cleaning operations, or certify compliance with safety procedures. These capabilities could be combined with traditional computer vision-type AI for greater efficiency and to limit the large energy and environmental impact of generative AI.

Feedback from experience

SNCF Réseau, National Company of the French Railways, improves document-retrieval for its customers

With the opening of rail traffic to competition, SNCF Réseau will be approached by a growing number of operators to handle regulatory technical issues. To provide these customers with a fast and relevant response, Capgemini has helped SNCF Réseau to develop the demonstrator of a search assistant based on generative AI. This solution takes the form of a conversational agent, whose ergonomics and path have been optimized to offer users a simple, fluid and personalized experience. Queried in natural language via this interface, possibly in several languages, the generative AI engine, owned by Capgemini, draws its information from a database of technical documents that has been compiled and qualified in advance. One of the special features of this model is that it displays the sources that support the users' response, which reinforces the users' confidence and enables them, if necessary, to deepen, validate or share their research. Finally, metrics have been put in place to monitor the model's performance and ensure that it durably meets the expectations of SNCF Réseau's customers.

« The implementation of an initial solution based on generative AI will enable our sales forces, and soon our customers, to save time, whether they are railway companies or public transport authorities. The solution we have developed will enable them to find all the information they need in the regulatory railway documentation (the Network Reference Document) in just one minute. Generative AI opens up new creative possibilities for simplifying the day-to-day lives of actors involved in the rail industry. »

Olivia Fischer, Head of Markets, Offer and Customer Experience at SNCF Réseau



Revolutionizing the traveler experience

Transport may be collective, but the experience is individual. All travelers have their own itinerary, their own needs, their own control of the offer and the tools at their disposal. And conditions are constantly changing, so no two itineraries are ever the same. So how can we offer everyone a satisfactory experience when no two travelers expect exactly the same information, at the same time and in the same form? Generative AI can help solve this complex equation of the traveler experience. In push or pull mode, it can provide each customer with precisely the information they need, when they need it, and on the channel that suits them best. In this way, it can help to deliver the personalized, contextualized and optimized experience that is likely to convince as many passengers as possible to opt for greener mobility.

Conversational tools

Generative AI makes it possible to set up conversational agents that are much more advanced than they are today, and capable of communicating in a language comparable to the language of humans. At a time when the search for information (a fare, a timetable, an itinerary, a possible connection, etc.) occupies a predominant place in the customer journey, the possibility of a conversational interface will be a huge advantage. Without necessarily having to change the underlying algorithms of existing chatbots, this will enable passengers to easily express their needs, constraints and criteria, without having to go through a multitude of screens and filters. The tool will also be able to add personalized recommendations to the response, depending on the profile (foreign visitor, person with reduced mobility, cyclist, etc.) and suggestions (directing passengers towards more sustainable solutions, offering custom subscription packages, etc.). 70% of the members of the Autonomy community believe that conversational tools will make it easier to take account of the diversity of needs, thereby creating more inclusive mobility.

70%²

of respondents to a survey of Autonomy community of experts believe that conversational tools will make it possible to take better account of the diversity of needs and create more inclusive mobility.



Customer feedback

Listening to and taking into account the “voice of the customer” is essential for identifying the problems encountered, the needs and the expectations of travelers, and therefore improving the experience on an ongoing basis. Today, however, this is a fairly laborious process, both for passengers who want to express their opinions and for the staff responsible for processing them. Generative AI can considerably help both: the travelers, by enabling them to express themselves in natural language, or even orally, and the teams, by automatically sorting, categorizing, and qualifying the opinions gathered. AI is capable of identifying the key points despite the diversity of formulations, and even of detecting irony. It can then offer an immediate, targeted and personalized response to each individual, create regular summary reports to measure and monitor customer satisfaction; and finally – in the longer term – detect and escalate similar and recurring problems.

Instant translation

Thanks to its translation capabilities, generative AI can remove the language barrier which, for foreign tourists, is often the main obstacle to a positive transport experience. In anticipation of an influx of visitors of all nationalities at the Paris Olympic and Paralympic Games, Paris public transport operator RATP and National Company of the French Railways SNCF are preparing several systems. One of these systems, which is currently being tested, will make it possible to instantly translate the audio announcements broadcast in stations into several languages and then to pronounce them using a synthetic voice. Another solution will provide agents with a specialized instant translation application: the queries, expressed by passengers in their own language, will first be translated into French for the agent, who will be able to formulate their response in French before it is in turn translated into the passenger’s language. This will result in smoother and more efficient exchanges, for both staff and customers, and will improve the traveler/visitor experience.

Customer interview



Mathilde Villeneuve

*Project Director at the RATP
Data Factory*

Can you tell us about RATP's approach to generative AI?

RATP is taking a pragmatic, **value-driven** approach by integrating generative AI into its sustainable mobility strategy. This initiative explores two major areas: **improving the quality of working life and efficiency of its agents**, and **developing solutions tailored to its business units and strategic challenges**. Generative AI solutions are becoming an essential pillar of RATP's toolbox, aimed at accelerating the exploitation of data and improving operational efficiency..

Which ones have you identified?

Several priority themes have already been identified, such as **increased control of mobility needs** in order to plan transport solutions, **improving operational performance and service rendered to passengers** (e.g. incident analysis, chatbot assisting agents in stations), and improving the **quality of working life for agents** (e.g. control of purchasing processes in the context of public procurement contracts).

RATP is industrializing a first use case: a virtual assistant for station agents. Station agents are the first point of contact for passengers and station guards. They need to be particularly **versatile** in order to answer all the questions asked by travelers, ensure compliance with rail safety standards and implement the requirements of public transport

authorities. This system enables agents to be more efficient in carrying out their daily tasks, such as providing clear and precise information to passengers on fares, refunds and access procedures. As well as **optimizing work processes and improving service quality**, this virtual assistant **saves time** for RATP's 5,500 agents.

How is RATP taking up this solution?

RATP is adopting an approach based on **creating value for users** by rapidly industrializing practical applications for its business units. It is focused on **supporting business units** in identifying relevant use cases, and on **involving and training** users from the earliest stages of development. This user-oriented approach also means that the risks and limitations associated with the use of generative AI (impact on employment, algorithmic biases, organizational changes, etc.) can be accelerated and taken into account, while **keeping the human element at the center of the loop**.

RATP, **aware** that the democratization of generative AI within a large company requires an **iterative and collaborative approach**, is building its approach by mobilizing all the **necessary skills internally and via its partners** (data/AI expertise, cloud provider, etc.). To achieve its objectives, RATP relies on its data platforms/AI. It is gradually putting in place a **technical basis** that will enable it to **control and rationalize** practices and solutions, **secure the data** and company's know-how, and **guarantee the ethical and reliable use** of these technologies (transparency of algorithms, evaluation of models, governance of technologies, etc.).



Conclusion

Even as the transport actors imagine and develop their first applications of generative AI, the extremely rapid progress of the technology will very quickly enable them to envisage other use cases, with an even greater impact. For example, the ability to bring more energy- and data-efficient language models to mobile terminals (smartphones, tablets, etc.) will improve the performance and experience of applications, for example for train crews or network maintenance agents. Another expected advance is that multimodal models, capable of processing text, images and/or sound at the same time, will open a vast field of possibilities, enabling, for example, the creation of composite reports combining photos and audio commentary.

However, whether for these applications of the future or those already under development, we must always bear in mind the limitations of generative AI in general and LLMs in particular. The purpose of these tools is to assist, help and accelerate, but not to carry out tasks or make decisions without human approval. The users, whether agents or travelers, must therefore be made aware of the fact that they will need to systematically check the information communicated to them. When they are implemented, technological solutions must always be accompanied by a framework for use and appropriate communication. Despite these precautions, the gains in terms of time, ergonomics and experience are usually considerable, at least if the product has been properly designed and optimized by specialists.

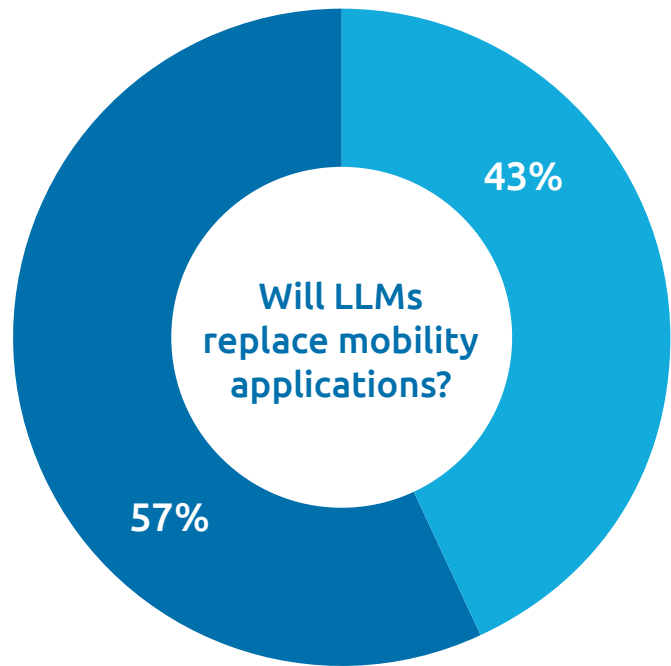
The mobility and transport sector is still in its early stages in terms of the use of generative AI, but the first use cases suggest its immense potential for improving both operational efficiency and the passenger experience. Progress in these two key areas will help to make green mobility more pleasant, more accessible, and more attractive, thereby encouraging modal shift. Generative AI is emerging as a major instrument in the transformation towards sustainable mobility, and public transport operators and authorities alike must seize its tremendous potential without further delay.

Finally, of course, all these benefits depend on users adopting the solutions.

For example, there is no guarantee that customers will accept this technology, even if it meets their needs.

The experts in the Autonomy community are very divided on the subject: 57% of them think that travelers will be searching for their itinerary using an LLM in the future, compared with 43% who believe that traditional applications still have a bright future ahead of them.

Major educational efforts are therefore essential if generative AI is to become the powerful accelerator of sustainable mobility envisaged in this report.



Yes

AI will enable us to identify the best itinerary by having a spoken conversation.

No

We will still use mobility apps to choose and book an itinerary.

Figure 3 - Survey addressed to members of the Autonomy community in January 2024.



Our expertise

Within Capgemini Invent, our R&I Lab is organized around research and innovation programs applied to our customers' challenges, including AI and mobility, drawing on expertise and best practices in research and innovation brought by Quantmetry, an acquisition by Capgemini Invent back in 2023.





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