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Project "urbanXperience" from the Netherlands
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EXECUTIVE SUMMARY

This report explores the ethical, governance, and technological dimensions of autonomous vehicles (AVs), with a focus on the Netherlands and Amsterdam as a regulatory-ready yet cautious testing ground. Drawing from expert interviews across academia, policymaking, and government, the study examines how AV deployment intersects with urban mobility goals, individual rights, and digitally vulnerable populations. Key questions guiding the research included tensions between efficiency and privacy, challenges in integrating AVs into cycling-centric infrastructures, and barriers to full safety and public acceptance. A central insight was the need for an Urban Experience Center — a modular, immersive interface to engage citizens with AV technologies in context. Such a platform could demystify technical systems, strengthen public trust, and ensure more inclusive, equitable discussions around the future of urban transport. Ultimately, the report highlights that meaningful AV integration requires not just smart technologies, but socially responsive and participatory infrastructures.

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MOTIVATION

Problem Statement

1. The Urban Challenge: Population Growth Meets Aging Infrastructure

Munich, one of Germany's most vibrant urban centers, has experienced significant population growth in recent years. Between 2010 and 2024, the city's population rose from approximately 1.35 million to over 1.59 million, an increase of nearly 18% in just over a decade (Bayerisches Landesamt für Statistik, 2024). This demographic expansion puts immense pressure on urban systems—particularly mobility infrastructure—raising questions about accessibility, efficiency, sustainability, and equity.

At the same time, Munich's transportation backbone relies heavily on a historically inherited system. The U-Bahn, first launched in 1971, still carries the bulk of inner-city mobility demand. As of 2023, many lines and technical subsystems are over 40 years old, requiring continuous maintenance without allowing room for transformative innovation (MVG Annual Report, 2023). Meanwhile, digital technologies—especially AI and autonomous mobility—have rapidly advanced, yet remain underutilized in the urban fabric due to infrastructural, regulatory, and political constraints.

This mismatch between fast-evolving technology and slowly adapting infrastructure creates friction across multiple axes: technological feasibility, user experience, political acceptability, ecological compatibility, and urban aesthetics. Additionally, labor shortages in the public transport and tech service sectors hinder the scale-up of novel mobility services (IHK München, 2024).

2. Socio-Technical Conflict and Under-Served Needs

The result is a socio-technical conflict: while AI and robotics offer promising solutions, the city's complex material history (e.g., cobbled streets, narrow alleys, UNESCO-protected buildings in the Altstadt) limits adaptation. The historic Residenz, the UNESCO-listed Nymphenburg Palace area, and similar heritage sites exemplify this tension between innovation and preservation. Simultaneously, public demand for comfort, safety, reliability, and inclusion is intensifying.

Crucially, public transport systems across Germany—and Munich is no exception—face a severe shortage of skilled personnel. For instance, the Munich Transport Company (MVG) faces a shortfall of around 700 employees by 2030, with a particularly urgent need for bus and tram drivers (Anfang, 2023). This lack of human resources undermines the system's ability to meet current demand, let alone future growth.

Further compounding the issue are political and economic bottlenecks. Despite growing public pressure, financial investment in urban mobility innovation has stagnated in recent years due to competing priorities, complex funding mechanisms, and budget restrictions at the city and state level. At the same time, Munich—and Germany more broadly—risks falling behind in the international race for urban mobility innovation, where cities like Shenzhen, Singapore, and San Francisco have already deployed fully autonomous shuttle corridors, integrated AI-traffic control systems, and real-time citizen feedback loops. Without bold, well-structured, and future-oriented investments, the region may miss critical windows of opportunity for technological leadership and sustainable urban development.

Lastly, the transition toward smart mobility risks marginalizing certain populations. Children, the elderly, people with disabilities, and those facing digital poverty often remain excluded from high-tech advances. These groups require not only physically accessible systems but also trustworthy, human-readable interfaces that integrate into daily urban life.

Project Goals and Justification

1. An Inclusive, Machine-Readable City

This project proposes to design, test, and co-develop a “machine-readable city”: a digitally augmented urban environment in which both humans and AI-based mobility agents (such as autonomous vehicles, drones, or adaptive traffic systems) can safely coexist; a city where organic life and inorganic life co-breathe harmoniously. This vision is not to merely automate transport but to reimagine mobility as a shared ecosystem that respects human dignity, ecological interdependencies, and cultural memory.

2. Objectives

- Retrofitting the Legacy: Develop technical modules (e.g., adaptive traffic lights, embedded sensors, street-level IoT nodes) that can be integrated into existing infrastructure without massive disruption—drawing lessons from Amsterdam’s unsolved conflicts between autonomous mobility system and maintenance of historical architecture. Smart modular buildings

- Participatory AI Design: Co-design mobility interfaces that cater to digitally excluded groups, including voice-based interfaces for the visually impaired, and low-bandwidth modes for digital-poverty zones. What’s more, visual and interactive elements are tailored to different developmental stages and cognitive abilities. children’s data should be protected, and interfaces encourage safe usage without unnecessary risks.

- Cyborg Urban Aesthetics: Collaborate with artists, architects, and ecologists to design “cyborg scenery”—harmonious blends of technological, organic, and cultural elements. From bird-safe sensor placement to low-noise vehicle algorithms that minimize disruption to nocturnal species, the project will aim for multi-species urban compatibility. This includes designing specific urban features—such as safe walking paths, crossing aids, and dedicated seating areas within autonomous vehicles—for companion animals like dogs, allowing them to navigate the city comfortably and securely alongside their human counterparts.

- Governance and Equity Framework: Establish participatory governance models to involve civil society, advocacy groups, and policy-makers in the iterative shaping of the mobility system. For example, Munich could establish a digital feedback platform—MobilitätsMitgestalten—to engage citizens, environmental groups, disability advocates, and seniors in shaping future mobility systems. Prior to implementing projects like autonomous bus routes, the platform could share visual plans and collect input through comments and surveys. Quarterly hybrid “Citizen Mobility Assemblies” would review feedback with policymakers, ensuring iterative, transparent adjustments based on public needs.

3. Who Benefits in Which Way?

- Vulnerable urban populations: elderly, children, disabled individuals
- Urban wildlife and biodiversity: through non-intrusive digital design
- Public mobility workers: facing increasing pressures from labor shortages
- Policy-makers: through tools for more nuanced planning in historic areas
- Start-ups and tech providers: via open technical standards and testbeds
- General public: enjoying safer, more intuitive, and aesthetic mobility

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STATE OF THE ART

Various stakeholders across Europe, particularly in the Netherlands, are actively engaged in advancing autonomous driving technology, with a growing emphasis on its societal implications. The Dutch government, especially, has shifted from an earlier proactive stance to a more cautious position, influenced by past incidents and the understanding that full AV autonomy is a long-term goal.

Autonomous Driving Technology Provider

ADASTEC is a leading provider of Level 4 autonomous driving platforms, primarily focused on enhancing public transportation through electric buses. Their technology aims to significantly reduce traffic congestion and labor costs by enabling driverless operations in pre-mapped, limited areas areas with specific speed limits (up to 40 km/h in Europe, 25 mph in the US). ADASTEC's solutions are being actively piloted and deployed globally, with notable projects including a transition to driverless operation on a Bus Rapid Transit (BRT) route in Stavanger, Norway, expected to open in September for higher-speed applications. Further deployments are underway at Michigan State University and Buffalo University campuses (both in open traffic), in large national parks like Sleeping Bear Dunes, and on a

recently deployed BRT route in Paris, while two vehicles in Rotterdam are set to begin operations connecting a metro station and the airport on July 11th(Ö. İpek, personal communication, June 20, 2025).

Beyond autonomous capabilities, ADASTEC prioritises accessibility, integrating features such as low-floor and kneeling capabilities, precise localisation for accurate bus stop approaches within 3-5 cm, and future plans for visual and audible support for passengers with reduced mobility. The company maintains rigorous performance standards, providing detailed reports to authorities and clients on key metrics like achieving over 95% autonomous driving percentage, limiting Minimum Risk Manoeuvres (MRMs) to no more than one per day, and closely monitoring driver/operator interventions. Passenger comfort is also a focus, with deceleration limits below 2.4 G for standing passengers, and innovative exterior displays are utilised to communicate safety messages to vulnerable road users, such as "We are stopping for you, so you can pass" for pedestrians(Ö. İpek, personal communication, June 20, 2025).

Research and Innovation Hubs

AMS Institute serves as a living lab coordinator for numerous mobility projects, often EU-funded, acting as an intermediary between the city, commercial vehicle operators, scientific partners, and funders. Their mission is to reinvent prosperous, sustainable, resilient, and just cities, with themes including Smarter Mobility and Responsible Urban Digitization. Projects like metaCCAZE involve autonomous water transport ("Roboat") and multimodal waste logistics, including collaboration with Munich. A significant challenge in Amsterdam is its status as a UNESCO World Heritage site, which prohibits major physical adaptations to its infrastructure, meaning mobility innovations must primarily rely on digital solutions. AMS Institute also employs the TADA framework for ethical digitisation and data, emphasising transparency and citizen engagement (D. Scheerooren, personal communication, June 18, 2025).

TU Delft is involved in research on meaningful human control in autonomous systems, working with automotive companies like Toyota, Volkswagen, Honda, and Nissan. They focus on Connected Automated Vehicles (CAVs), researching mechanisms and critical interactions relevant for safety, emphasising that behaviour is based on perceived risk, not just objective facts (R. Happee, personal communication, June 19, 2025). TU Delft is also leading the Amsterdam Living Lab and its 5 pilots within the metaCCAZE project, including multimodal logistics management and mobility credits, supported by operations research and data science expertise. They are also exploring equity by researching how different groups, such as wheelchair users, the elderly, and pedestrians of various ages, experience interactions with AVs using simulators (S. Calvert, personal communication, June 19, 2025).

SWOV (Institute for Road Safety Research) is an independent, partly government-funded organisation focused on road safety, including autonomous driving. They aim for zero

fatalities by 2050 through a risk-based approach. SWOV emphasises that cultural differences in driving behaviour (e.g., signalling, lane changes, interaction with cyclists) are critical factors for AV implementation, especially in a mixed-traffic environment like the Netherlands(R. Zwart, personal communication, June 17, 2025).They also note that the Netherlands' cautious regulatory approach, while ensuring safety, can slow down innovation compared to other countries(A. Picco, personal communication, June 17, 2025).

Government and Policy

City of Amsterdam: The city's Smart Mobility Program focuses on research into innovative mobility concepts and improving data analytics. Key projects include an inclusive route planner using AI for wheelchair users and the redevelopment of gas stations into "mobility hubs". Politically, Amsterdam prioritises inclusivity, climate, and economy, preferring to implement AV technology when it is mature rather than leading its development. They actively engage with diverse communities, including the elderly, migrants, and low-income groups, by working with societal organisations as spokespersons and employing a design thinking (double diamond) approach that includes interviews and small experiments with end-users. The "Amsterdam for All" initiative, exemplified by an AI Playbook, demonstrates their commitment to inclusive and accessible cities through community involvement and proactive transparency(D. Basta, personal communication, June 20, 2025).
CROW: As a program manager for smart mobility, CROW emphasizes the need for user-friendly systems and support for those less able to use digital systems, such as the elderly or blind. They highlight the economic potential of AVs for creating "smarter and better jobs" and preventing Europe from falling behind in technological development. CROW identifies liability and responsibility as the main legal challenges slowing down AV deployment. They also note that industry is more open to collaboration than municipalities or national government, which often face manpower and eagerness deficits (G. Dijck, personal communication, June 18, 2025).

Connect.nl: This neutral, independent non-profit network facilitates collaboration between government, industry, and academia on mobility and logistics challenges. They focus on areas where individual companies cannot cope alone, addressing societal challenges like scarcity, resilience, and competitiveness. Connect.nl is heavily involved in data digitalisation, AI standardisation, Advanced Driver-Assistance Systems (ADAS), and behavioural impact, recognising the critical "human factor" in technology adoption. They observe that while the Netherlands was a frontrunner in 2016 (Declaration of Amsterdam), it later adopted a more cautious approach, with the EU now becoming more active due to global competition(T. Dam, personal communication, June 19, 2025).

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RELEVANT QUESTIONS

Based on the insights gained from these diverse perspectives, several critical questions emerge for further exploration in the context of responsible innovation in autonomous driving:

- Inclusive Design and Deployment: What specific mechanisms and practices ensure the genuine inclusion and meaningful engagement of diverse and vulnerable communities (e.g., low-income, elderly, migrants, disabled) throughout the AV development and deployment process, from design to everyday use? How can their unique needs and feedback be effectively integrated?

- Public Trust and Acceptance: How can public trust in AV technology be fostered and maintained, particularly in light of incidents or when AV behaviour conflicts with established human driving cultures and unwritten rules? What role do transparent communication and public awareness campaigns play?

- Evolving Governance and Regulation: What are the most effective ways for regulatory frameworks to adapt to the rapid pace of AV development, ensuring clear standards for safety, liability, and ethical oversight, while also avoiding stifling innovation? How can the "loophole" of shared responsibility among different governmental levels (EU, national, city) be addressed?

- Contextual Adaptation and Learning: How can lessons learned from pilot projects and living labs in specific contexts (e.g., Norwegian weather, Dutch cycling culture) be effectively transferred and adapted to other geographical and cultural environments without losing crucial local nuances?

- Defining Operational Design Domains (ODDs): How should the specific operational domains for AVs be defined, especially in complex urban environments with existing, often historical, infrastructure? What criteria should guide decisions on where AVs can and cannot operate safely and efficiently?

- Leveraging Social Labs: How can the "social lab methodology" be effectively utilised as a "collective experimentation strategy" to foster social learning and democratic experimentation in the context of RRI for AVs? What are the challenges in ensuring diverse and representative participation in these labs?

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CONTRIBUTION TO MOBILITY IN MUNICH

Description & Idea

The urbanXperience concept emerged from our field research in the Netherlands, where we spoke to stakeholders involved in the development of autonomous mobility. While there were no active pilot projects, the insights gained showed that technological readiness is no longer the main obstacle. Similar observations were made in other German pilot projects, where technology readiness was not the limiting factor, but rather public trust, legal frameworks and integration challenges (BMV, 2023; VDV, 2025).

Instead, legal frameworks, regulatory uncertainties and lack of public acceptance were consistently identified as the main barriers to implementation. We concluded that successful integration of autonomous vehicles requires more than just infrastructure and algorithms - it requires public trust, awareness and willingness. In response, we developed *urbanXperience* as a physical and social interface between citizens and autonomous mobility systems. At the centre of the concept is a modular Experience Hub in the centre of Munich, close to universities and public spaces. It serves both as a starting point for a short autonomous bus test route and as a space for interaction, education and dialogue. The hub includes a real AV bus for test drives, VR stations, interactive displays and rooms for co-creation workshops. Our aim is to create an inclusive environment where people can explore the technology hands-on, gain confidence and contribute their perspective. At the same time, developers and urban stakeholders gain insights into how autonomous systems can better fulfil the different needs of users. This mutual exchange forms the basis of our concept: not just showing innovation but shaping it together. Project *urbanXperience* positions Munich as a pioneer in the social integration of autonomous mobility - with a prototype that focuses on people as much as technology.

Prototype Concept

A modular, container-based experience centre serves as a physical interface between citizens and autonomous systems. It provides access to a real autonomous bus line with a short, closed test track. Visitors can book test rides, explore the technology in a hands-on environment (via VR, UI demos and live displays) and participate in guided workshops and discussions. This step-by-step prototype can evolve into a fully functional public mobility centre. Similar modular pilot formats will be tested in German cities such as Burgdorf and

Hannover, where flexible AV infrastructure allowed for real-world integration with minimized risk and high public visibility (Hannover.de, 2025; ÜSTRA/B&B, 2025).

The modular design is a central element of the concept: the use of shipping containers allows for a flexible, low-investment structure that can be set up quickly, is relocatable and reversible. This temporary architecture is well suited to a pilot project, as it can be scaled, remodelled or dismantled depending on future developments, needs and public feedback. Over the course of the three-year pilot phase, the space can be adapted to new use cases and stakeholder needs - both in terms of function and layout. The *urbanXperience* Hub not only serves the mobility prototype itself, but is also intended to be a public meeting point: a place for dialogue, citizen participation and cultural engagement. It can host city-organised workshops, exhibitions, university-led events and interactive showcases on urban innovation. It is intended to be both an exhibition and a dynamic forum that not only showcases technology, but invites people to help shape it through dialogue and critique. By embedding this space in the daily life of the city, *urbanXperience* helps to demystify autonomous mobility and reduce fears of the ‘unknown’. Through direct contact, transparent communication and the exchange of experiences, the hub becomes an important factor for trust - and ultimately for integration.

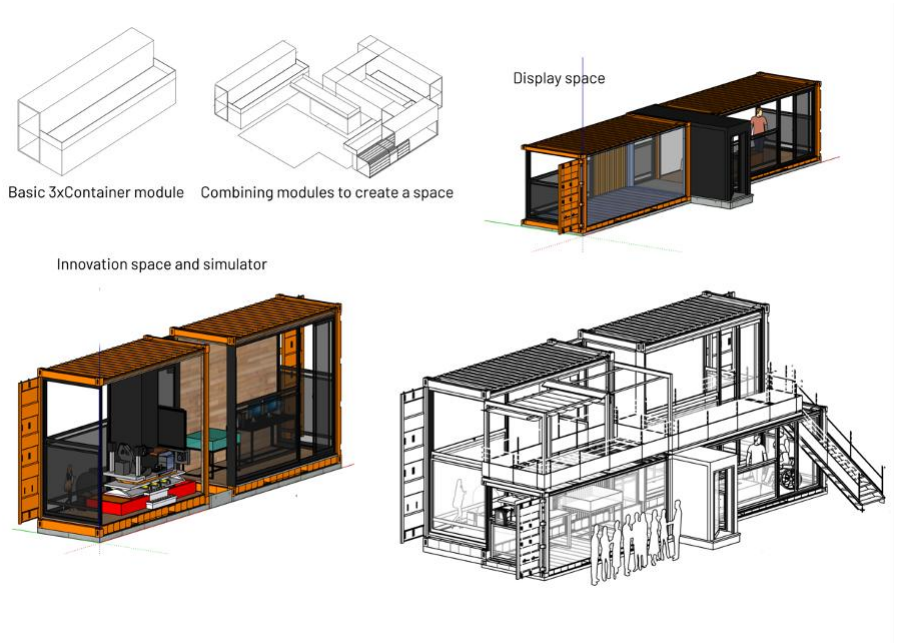

Figure 1: Prototype of a module out of UrbanXperience (own creation)

Figure 2: AV demonstration route plan in Muenchner Freiheit, Munich (own creation)

Figure 3: UrbanXperience Centre (own creation)

Anticipated Challenges

One of the key challenges for *urbanXperience* does not lie in the technology itself, but in society's reaction to it. Although autonomous systems have reached a high level of technical maturity, public perception is still cautious - often characterised by a lack of practical experience, fear of malfunctions or uncertainty about ethical responsibility. This scepticism can significantly limit citizen engagement if it is not remedied through accessible, practical experience and transparent communication. Projects like ALBUS and NoWeL4 in Berlin have highlighted similar findings, confirming that citizen experience and communication are key to building trust (VDV, 2025).

The Experience Hub is therefore designed not only as a demonstration space, but also as an interface for building trust. However, in order to promote acceptance among the general public, continuous efforts are needed that go beyond the physical location - in particular through inclusive dialogue formats and proactive public relations work. At the same time, the legal and institutional framework is a moving target. The operation of autonomous vehicles

on public roads requires close co-operation with local and national authorities, especially as regulations in Germany are constantly evolving. Compliance with safety standards, insurance protocols and liability models will be crucial for the credibility and operational authorisation of the project. In this regulatory environment, agility and adaptive planning become as important as technical robustness.

Another challenge arises from the complexity of embedding autonomous vehicles in Munich's existing infrastructure. The city's dense urban form, multimodal transport network and historic buildings require a careful and context-sensitive approach to integration. The AV service must work seamlessly with physical elements such as stops, pavements and transport systems, as well as digital layers such as real-time planning and payment platforms. Furthermore, this integration must uphold the project's commitment to inclusion. Autonomous mobility should serve all citizens equally, regardless of age, ability or digital literacy. This requires the development of intuitive user interfaces, barrier-free access and support mechanisms that reflect the diversity of urban users. Finally, the long-term viability of the project depends on securing permanent operational funding. While the initial start-up costs can be covered by public grants or innovation programmes, maintaining the Experience Hub, operating the test track, updating the digital components and continuously engaging the public requires a solid financial strategy - possibly through partnerships, institutional support or integration into municipal budgets. Without this continuity, even a successful pilot project runs the risk of losing momentum before it can realise its full potential.

Partners & Societal Engagement

The success of *urbanXperience* depends on a strong, cross-sector partnership between key institutional, civil society and technological stakeholders. The City of Munich and its mobility department are crucial for integrating the project into urban development and infrastructure planning. As a public transport company, *MVG* plays a central role in operating the autonomous bus line, coordinating logistics and ensuring operational conformity. Technical partners such as *ADASTEC* or similar AV developers contribute important vehicle and system expertise, while the Federal Ministry for Transport (BMV), the Federal Motor Transport Authority (KBA) and other regulatory institutions are essential for legal approval and monitoring.

Scientific institutions such as the Technical University of Munich (TUM) act as an independent monitor, providing evidence-based evaluations, user studies and the scientific basis for iterative design. The Bavarian High-Tech Agenda and regional funding organisations can form the financial backbone of the three-year pilot phase. The involvement of the public will be promoted through co-creative and participative formats: Open workshops, citizen labs, analogue and digital feedback tools and events aimed at different age and interest groups. Press and media partners help to increase visibility and public discourse, while civil society actors and local cultural institutions can activate the hub as a public space beyond its focus on mobility. *UrbanXperience* is designed to be more than just a transport testing ground; it is also a platform for dialogue, experimentation and co-production. Stakeholder engagement is therefore an ongoing process of involvement, iteration and mutual learning, with the public at its heart.

The urbanXperience project is designed as a platform for dialogue, experimentation, and co-production, strongly emphasizing Responsible Research and Innovation (RRI) principles: Inclusion, Anticipation, Reflexivity, and Responsiveness. We recognize that public trust, not just technological readiness, is the primary barrier to autonomous vehicle (AV) implementation. Our engagement strategy aims to go beyond mere acceptance, fostering genuine societal co-ownership and collective shaping of AV futures. Public involvement will be promoted through comprehensive, multi-faceted co-creative, and participative formats, ensuring meaningful inclusion from the earliest design and development stages.

We'll leverage Social Labs and participatory action research to create a stable space for "collective experimentation" and "social learning." These labs will unite diverse stakeholders, including policymakers, industry, academia, and crucially, civil society organizations and citizens from various backgrounds. We'll actively seek out and include voices from vulnerable and diverse communities, drawing inspiration from initiatives like Amsterdam's "Amsterdam for All" project.

Beyond traditional feedback tools, we'll facilitate hands-on experiences at the Experience Hub. This includes autonomous bus test drives, interactive Virtual Reality (VR) stations, and live user interface demonstrations. This direct contact aims to demystify autonomous mobility and address public fears through practical exposure. We'll ensure open and clear communication about the project's methods, objectives, and progress, engaging with local news, organizing public events, and even utilizing exterior displays on AVs to communicate directly with vulnerable road users.

A robust mechanism for continuous feedback will be implemented, including surveys, interviews, and focus groups. This feedback will inform iterative adjustments, ensuring the project remains responsive to societal needs. Transparently shared performance metrics (KPIs) will demonstrate progress and accountability. Explicit attention will be paid to potential negative social implications, such as job displacement, which engagement activities will proactively address. The project acknowledges the "human factor" is critical for technology adoption, integrating behavioral scientists where appropriate.

Civil society actors and local cultural institutions are crucial partners in promoting the project and activating the hub as a broader public space for dialogue and critical reflection. UrbanXperience is more than just a transport testing ground; it's an ongoing process of involvement, iteration, and mutual learning, with the public truly at its heart, aiming to shape autonomous mobility to be both technologically robust and deeply aligned with societal values and future aspirations.

Target Groups

The *urbanXperience* project is aimed at a broad and diverse range of target groups that reflect the social implications of autonomous mobility. The core users include everyday public transport passengers in Munich, who can benefit from an improved service, as well as residents along the pilot corridor who are directly affected by the introduction and operation of the autonomous bus line. There is a particular focus on people with limited mobility who do

not have access to a private car or do not have a driving licence - including older citizens, parents with young children and people with physical or cognitive disabilities.

The Experience Hub also aims to appeal to digitally excluded or technology-sceptical groups by providing easily accessible, low-threshold information and real-life demonstrations. At the same time, the project aims to attract students, researchers and innovators in urban mobility who are interested in designing and evaluating future transport systems. Technology enthusiasts and early adopters will be given the opportunity to interact with cutting-edge systems, while car users will be targeted as potential switchers for sustainable and shared mobility options.

Figure 4: Target groups (own creation)

Beyond the local context, *urbanXperience* serves as a model of international relevance and is likely to attract the attention of European municipalities, public transport operators and manufacturers of autonomous vehicle systems. By offering a structured, inclusive and experience-based test environment, the project aims to generate knowledge, foster dialogue and build trust at all levels of society - from private individuals to institutional stakeholders and industry players.

Timeline and Long-Term Strategy

The implementation of the *urbanXperience* project follows a structured, three-phase schedule aimed at sustainable integration into Munich's public transport system. In phase I (2026), the Experience Hub and a dedicated test route for an autonomous bus line will be set up. A closed pilot project will begin with selected users, guided workshops and controlled test drives. In Phase II (2027), the project will enter a public phase in which access will be extended to all citizens, feedback will be collected and iterative adjustments to the route and service will be possible. In Phase III (2028), the prototype will transition into a fully functional

mobility hub that will be integrated into Munich's regular public transport system and serve as a permanent hub for autonomous mobility.

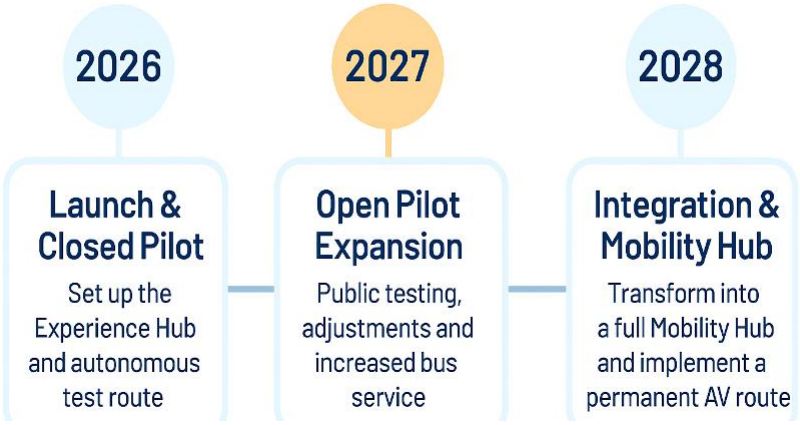

Figure 5: Timeline (own creation)

In parallel to this timeline, the Experience Hub will serve as a platform for collecting real-world data and user feedback to inform strategic decisions in urban mobility planning. This approach ensures that the project not only tests new technologies, but also supports long-term transformation and public acceptance.

The estimated cost of the three-year pilot project is around 5 million euros, subject to available public funding and partnerships. This includes the costs for infrastructure, AV operation, personnel, public involvement formats, communication and evaluation. The aim is to embed the concept in the Munich roadmap for intelligent mobility and to create a scalable model for the future integration of AV. Comparable projects like ALBUS (approx. €6.3 million) or Berlin's NoWeL4 (approx. €9.5 million) confirm that this budget estimate is in a realistic range for a full AV pilot with physical infrastructure and evaluation measures (BMV, 2023; VDV, 2025).

INTENDED IMPACT OF THE PROJECT

The project is intended as a flagship initiative that pursues a trust-based, citizen-centred approach to the introduction of autonomous public transport. Beyond technological innovation, it aims to promote social inclusion, improve spatial and digital accessibility and strengthen the public's willingness to embrace new mobility systems. In the long term, the initiative aims to increase acceptance and trust in autonomous mobility, expand inclusive access to transport and establish a replicable participation model for the responsible introduction of future technologies. By fostering close collaboration between the city, industry, academia and society, the project will generate policy recommendations and real-world data to support wider deployment and strategic planning.

The impact of the project will be assessed using several evaluation criteria, including the number of citizens reached and actively involved, measurable changes in trust and perception (through pre- and post-intervention surveys), ratings of the user-friendliness and accessibility of the service, successful integration into MVG's public transport operations, and the extent to which underserved groups - such as mobility-impaired or digitally excluded people - are included in the experience and design process.

1.Short-Term (0–3 Years)

- Pilot Implementation in two contrasting Munich districts (e.g., a historic center like Sendlingtor vs. a suburban edge like Schwabing)
- Toolkit for Legacy Infrastructure Integration: Open-source technical standards for sensors, signage, and AV compatibility
- Participatory AI Interfaces: tested with user groups facing mobility and digital access challenges
- Comparative studies with other European cities undergoing similar transitions

2.Medium-Term (3–5 Years)

- Extension to wider metropolitan region, adapting to diverse contexts (e.g., Freising's semi-rural setting vs. Garching's research-driven layout)
- Broader public engagement campaigns on urban tech ethics and multi-species design

3.Long-Term (5+ Years, Permanent Outcome)

- A new urban mobility paradigm balancing: one that balances technological intelligence, such as AI-driven systems, with ecological responsibility through urban species co-habitation, and cultural continuity via heritage-aware smart interventions.
- Permanent testbeds across the Munich region for applied urban research
- A replicable model for other historic European cities navigating the smart mobility transition

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CONCLUSION

The urbanXperience project represents a forward-thinking, people-centered response to one of the most pressing mobility challenges of our time: the responsible integration of autonomous vehicles (AVs) into complex urban environments. Drawing on fieldwork and stakeholder interviews in the Netherlands, particularly Amsterdam, a city that exemplifies both high technological readiness and cautious policy frameworks, our research identifies the core obstacles to AV deployment not in technology, but in public trust, regulatory ambiguity, and urban compatibility.

The case of Amsterdam illustrates how historical infrastructure, inclusive governance, and citizen participation can shape, constrain, or enable mobility innovation. From this, urbanXperience emerges as a replicable model grounded in the principle that future mobility must be co-created with those it serves. Our vision is not merely to test autonomous buses but to cultivate a deeper societal understanding of how AVs intersect with ethics, urban form, accessibility, and social inclusion.

The heart of our concept is the Urban Experience Hub - a modular, container-based physical interface that brings AVs closer to people. By enabling hands-on exploration, test rides, VR simulations, and participatory workshops, the hub functions as a public learning and co-creation space. It fosters awareness, dispels fears, and builds confidence through direct experience. This approach is especially critical for digitally vulnerable populations, such as the elderly, children, or those with limited access to or trust in technology, who are often excluded from tech-driven mobility discussions. Through inclusive, iterative engagement formats, we not only address skepticism but elevate diverse perspectives in shaping the AV transition.

What sets urbanXperience apart is its systemic ambition. Rather than treating AVs as isolated innovations, we situate them within a broader ecosystem of participatory urban governance, legacy infrastructure retrofitting, and digital equity. This includes open-source standards for AV infrastructure integration, behavioral design for human-AI interaction, and aesthetic frameworks that harmonize with Munich’s historic and ecological character. The project extends beyond technological demonstration, positioning itself as a platform for democratic experimentation and urban learning.

Over a structured three-year timeline, urbanXperience will evolve from a pilot to a scalable, embedded part of Munich's public transport landscape. By working across sectors—with city officials, transport providers, civil society, academic institutions, and international partners—the project aims to create lasting impact. Its outcomes will not only inform local urban mobility strategies but also contribute to a broader European dialogue on AV governance, equity, and ethical innovation.

In the long term, urbanXperience aspires to help establish a new paradigm of mobility—one that is autonomous, inclusive, participatory, and context-sensitive. As cities around the world face similar tensions between innovation and preservation, this model offers a roadmap for navigating that transition thoughtfully. By placing people—not just vehicles—at the center of AV innovation, urbanXperience proposes a future in which autonomous mobility enhances, rather than disrupts, the social and spatial fabric of urban life.

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CONTRIBUTION STATEMENT

All members of the research group jointly devised the prototype and development of the project. All team members designed the poster and presentations. All authors did individual literature research and contributed to the findings. All authors provided critical feedback on different parts and helped shape the introduction, prototype, and conclusion. The text in this paper was refined using DeepL and Grammarly to improve readability.

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