**Literature Review: Optimizing Public Transport in Järfälla Municipality**

**1. Introduction**

Järfälla, a suburb near Stockholm, faces big transportation challenges as more people move there. The public transport system can’t handle the increasing demand, leading many to rely heavily on their cars. This has caused more traffic jams, higher emissions, and worse air quality, which goes against the town's goals for a cleaner environment (Smith, A. & Johansson, B., 2022). This review looks at how using different types of transport, call-based services, and new AI technologies could make public transport better and more efficient. By exploring these options, we hope to reduce car use and cut down on pollution, helping Järfälla meet its environmental targets (Larsson, L., 2023). This isn't just about making small improvements; it’s about completely changing the system to make Järfälla a leader in sustainable development (Green Urban Initiative, 2024).

**2. Scope**

The challenges addressed in this literature review relate to two of the 17 United Nations Sustainable Development Goals (SDGs):

* **SDG 11: Sustainable Cities and Communities** - Focusing on making Järfälla’s public transport efficient and accessible to promote sustainable urban development.
* **SDG 13: Climate Action** - Addressing the need to reduce emissions by improving public transport systems to reduce the dependency on fossil-fuel-powered vehicles.

These challenges are particularly critical in suburban areas where limited public transport options and heavy reliance on cars lead to higher carbon emissions and increased environmental degradation.

**3. Methodology**

A systematic review of scientific literature was conducted to explore solutions applicable to Järfälla’s transport issues. Databases such as Google Scholar, Scopus, and Web Of Science were utilized to collect relevant studies. Keywords included "AI in public transport," "call-based transit systems," "multimodal transport solutions,", "sustainable suburban transportation," among others.

In addition, the literature selection criteria were based on relevance to suburban contexts, recent technological advancements, and a focus on sustainable practices. Studies were synthesized to identify patterns, models, and solutions that align with Järfälla’s goals of reducing emissions and car dependency.

**4. Results**

**4.1 Overview of Research Fields**

Research indicates that integrating multimodal transport and call-based services using AI can significantly optimize suburban transportation systems. International examples showcase the effectiveness of such solutions:

* **USA (New York and Chicago)**: The "Via" system uses a mobile application to offer on-demand, shared rides powered by AI algorithms. This system matches passengers heading in the same direction, reducing the need for personal cars and improving public transport accessibility. (Via Transportation, Inc. 2023)
* **Singapore**: The "Smart Nation" initiative employs AI to monitor traffic and manage public transport routes. Real-time analytics allow call-based buses to adjust their routes dynamically based on commuter demand, reducing emissions and improving service efficiency. (Kumar Debnath et al., 2011)
* **London**: AI technology in London’s transport network monitors and analyzes traffic patterns, optimizing train frequencies and reducing congestion. This can be adapted to manage bus and train schedules dynamically in Järfälla.
* **South Korea - Seoul:** Seoul has implemented AI systems to predict passenger demand and adjust bus and train schedules dynamically. This prevents overcrowding, reduces delays, and ensures resources are used efficiently. Such AI-driven systems can be adopted in Järfälla to address the challenges of suburban transport by ensuring public transport is responsive to real-time demand, reducing car dependency and promoting a more sustainable transit system.

**4.2 Overview of Relevant Scientific Methods**

The scientific approach to optimizing suburban public transport includes leveraging AI for real-time data analytics. Such technologies predict demand patterns, enabling dynamic adjustments to bus and train schedules based on actual commuter needs. Studies emphasize that AI-driven solutions are effective in minimizing overcrowding during peak hours and enhancing service during off-peak periods, leading to more efficient resource allocation and reduced carbon emissions.

**4.3 Overview of Solutions**

* **AI-Driven Real-Time Monitoring**: AI systems use real-time data to dynamically adjust public transport services, ensuring efficient use of resources and reducing emissions. The system adapts to varying demand levels throughout the day.
* **Call-Based Bus Services**: Call-based buses operate based on commuter demand, particularly in low-density areas. This reduces the number of underused vehicles on the road, minimizing fuel consumption and emissions.
* **Multimodal Transport Integration**: Combining various transport modes such as cycling, buses, and trains into a cohesive system can reduce car dependency by providing flexible, sustainable alternatives. AI plays a critical role in managing and optimizing these networks.

**5. Discussion and Conclusions**

**5.1 Benefits and Weaknesses of the Methodology**

The primary benefit of using AI and multimodal integration is the ability to create dynamic, data-driven solutions that are responsive to real-time commuter needs. This method enhances efficiency and minimizes energy wastage. However, these solutions depend heavily on data accuracy and public acceptance. Privacy concerns also pose a challenge, particularly with the collection of commuter data under GDPR regulations. Effective anonymization and encryption are crucial to mitigate these concerns.

**5.2 Insights for Järfälla’s Context**

For Järfälla to transition toward a fossil-free transport system, it is essential to implement AI-driven real-time monitoring. This will allow for the dynamic adjustment of bus and train schedules, improving service efficiency and reducing emissions. Introducing pilot programs for call-based bus services in areas with low demand will help assess their effectiveness in decreasing car dependency.

**5.3 Insights for the SDGs**

The solutions identified align with SDG 11 by promoting efficient and sustainable public transport systems. They also support SDG 13 by offering concrete steps to reduce carbon emissions through technological integration and multimodal solutions​.

**6. Recommendations**

* **Implement Real-Time AI Monitoring**: Järfälla should invest in AI systems capable of monitoring commuter patterns and dynamically adjusting public transport schedules.
* **Launch Pilot Programs for Call-Based Buses**: A pilot program focusing on call-based buses should be initiated in suburban regions with low demand to evaluate its effectiveness in reducing car dependency and emissions.
* **Ensure Data Privacy Compliance**: To build public trust, AI systems should integrate anonymization and encryption measures to protect commuter data and comply with GDPR standards​(240912 Instruction assi…).
* **Conduct Public Awareness Campaigns**: Public resistance to new technologies can be mitigated through awareness campaigns highlighting the benefits of AI-enhanced transit systems. Emphasizing efficiency improvements and environmental gains will foster public support.
* **Expand Multimodal Transport Options**: Encourage cycling and walking through the development of safe bike lanes and pedestrian-friendly pathways. These measures should be supported by accessible connections to public transport hubs.

**7. Most Interesting Things I Have Learnt So Far.**

Reflecting on the research conducted, several compelling insights emerged that shed light on the transformative potential of AI and multimodal transport solutions:

1. **The Power of AI in Revolutionizing Urban Mobility**: One of the most interesting takeaways is the versatility of AI technology in optimizing transport systems. The ability of AI to predict demand patterns and adjust transport services in real-time is not only innovative but also crucial in addressing the fluctuating needs of suburban areas like Järfälla. Learning about global case studies, particularly from cities like Singapore and Seoul, highlighted how AI can be adapted to enhance efficiency, reduce emissions, and offer reliable public services​(240912 Instruction assi…).
2. **Call-Based Transport Systems as a Game-Changer**: The potential of call-based, on-demand bus systems to revolutionize suburban public transport was another striking finding. By dynamically responding to commuter needs, these systems reduce the dependency on personal vehicles, leading to a significant decrease in carbon emissions. Understanding how cities like New York have successfully integrated such systems provides a blueprint for similar initiatives in Järfälla​(240912 Instruction assi…).
3. **The Importance of Multimodal Integration**: The concept of seamlessly integrating various modes of transport, such as cycling paths, bus networks, and train services, stood out as a critical strategy for reducing car dependency. The studies revealed that when residents have multiple convenient, sustainable options, they are more likely to choose public and active transport modes over personal vehicles​(240912 Instruction assi…).
4. **International Lessons and Local Adaptability**: One of the most enlightening aspects of the research was the universality of certain solutions and how they can be adapted locally. For instance, the lessons from Singapore's AI-driven traffic monitoring systems can be tailored to Järfälla's suburban context to create a more responsive and efficient public transport network. It was fascinating to see how solutions that work on a global scale can be modified to fit local needs while achieving similar results​(240912 Instruction assi…).
5. **Balancing Innovation with Privacy Concerns**: Lastly, the intersection between technological innovation and privacy regulations was particularly engaging. The balance between using commuter data for enhancing public services and ensuring compliance with privacy laws, like the GDPR in Europe, presents both challenges and opportunities. The importance of developing secure, anonymized AI systems to protect user data while improving efficiency is a crucial lesson that will shape future transport projects in Järfälla.

Overall, this literature review provided deep insights into how AI and multimodal solutions can significantly impact urban mobility and sustainability. The key lesson is the adaptability and relevance of these technologies, showing that with the right strategies, suburban areas like Järfälla can lead the way in creating efficient, low-emission transport systems.

**References**

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