**A02: LITERATURE REVIEW PROPOSAL**

**Proposed Research Topic:**

**Optimizing Public Transport in Suburban Areas: Exploring the Impact of Call-Based, Multimodal Transit, and AI-Driven Solutions on Emission Reduction in Järfälla Municipality**

This research explores how integrating multimodal transport, call-based buses, and AI-driven technologies can improve public transport efficiency, reduce car dependency, and lower carbon emissions in Järfälla. It will also examine how AI, like real-time data analytics, can optimize resource allocation during peak and off-peak hours.

**What is the Problem?**

Public transport in suburban areas like Kallhäll and Barkaby struggles with inefficiencies due to limited multimodal options, car dependency, and outdated systems that fail to leverage real-time data. The lack of integration between various transport modes, alongside insufficient use of innovative technologies like artificial intelligence (AI), contributes to increased emissions and overcrowded transport during peak hours. Despite ongoing efforts, these issues hinder the municipality’s goals of achieving a fossil-free transportation system and reducing reliance on private vehicles.

**Consequences of the Problem**

The consequences of inefficient public transport in suburban areas are significant:

1. **Environmental Impact**: Inefficient systems lead to higher carbon emissions due to over-reliance on cars and underutilization of public transport.
2. **Resource Misallocation**: Without real-time AI-driven data, public transport services often encounter too many people during peak hours or too few people during off-peak hours, resulting in resource inefficiency during these periods.
3. **Social Inequity**: Suburban residents who can't afford cars or rely on public transport often struggle with unreliable and inefficient services, worsening social inequalities.

**What is my question?**

1. **How can AI-driven real-time data analytics enhance resource allocation in Järfälla’s public transport systems during peak and off-peak hours?**
   * This will focus on how AI combined with data analytics can optimize transportation resources based on demand patterns, improving service efficiency and reducing emissions.
2. **What are the most effective solutions for reducing car dependency in Järfälla, and how can multimodal and call-based transport systems contribute to this shift?**
   * This examines the potential of sustainable alternatives to address Järfälla’s reliance on private cars.

**Examples:**

**International Solutions:**

1. **USA - Via:** In the U.S., the call-based bus service "Via" operates as an on-demand transit system in cities like New York and Chicago. Via allows riders to book shared rides through an app, where AI algorithms match passengers with others heading in the same direction, reducing the need for personal car use and improving transport accessibility. This system can be applied in suburban areas like Järfälla to create flexible and efficient transit options, minimizing emissions while offering reliable service. (Via Transportation, Inc. 2023).
2. **Singapore:** Singapore’s smart urban transportation system integrates AI-driven traffic monitoring and call-based transport services to improve efficiency and reduce emissions. For example, its "Smart Nation" initiative uses AI to predict traffic patterns and optimize public transit routes, allowing call-based buses to be deployed in areas of high demand. This system can serve as a model for Järfälla to adopt AI-driven solutions that make public transport more responsive to real-time commuter needs, helping to lower emissions and improve transit accessibility (Kumar Debnath et al., 2011).
3. **London:** London's transportation system has integrated AI technology to monitor traffic flow in real time, particularly in its Underground network. AI-driven analytics help allocate resources—such as adjusting train frequency based on passenger volume—thereby reducing congestion and improving efficiency. This approach can be adapted in Järfälla to help allocate buses and trains dynamically during peak and off-peak hours, improving service efficiency while reducing the need for private car use.
4. **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.

**Swedish Context:**

1. **Gothenburg’s Self-Driving Buses**: In Gothenburg, the implementation of AI-enhanced autonomous buses is a promising example, though it remains in its pilot stages. These initiatives offer insights into the Swedish approach to AI-enhanced transit.
2. **Västtrafik’s Digital Multimodal Solutions**: The Västtrafik system in Västra Götaland provides an example of integrating multimodal transport, though it lacks the AI-driven approach necessary for further optimization.

**Why is Your Topic Important?**

The importance of this topic lies in its potential to revolutionize suburban public transport, particularly in Järfälla municipality, by addressing both environmental and social challenges. AI's role in improving real-time resource allocation is pivotal for ensuring that transport systems can dynamically respond to commuter demand, reducing energy waste and emissions. Furthermore, as cities move toward fossil-free mobility, integrating call-based and multimodal transport can reduce car dependency, making transport more accessible and efficient for residents of suburban areas. This research will contribute valuable insights into how Järfälla can lead by example in achieving sustainable urban mobility.

**Suggestions or Solutions:**

**International Solutions:**

1. **Singapore**: The use of AI for traffic control, as highlighted in their smart transport initiatives, offers an adaptable model for real-time monitoring and predictive analytics (Kumar Debnath et al., 2011).
2. **South Korea**: The Seoul model of AI in transit, including predicting peak travel times, ensures efficient resource allocation and minimizes emissions.

**My Recommendations:**

1. **Järfälla's Adoption of AI**: I recommend implementing real-time AI monitoring to dynamically adjust public transport services based on demand, particularly during peak hours.
2. **Pilot Programs for Call-Based Transport**: Introduce call-based buses in Järfälla on a small scale to evaluate their impact on car dependency and emissions. This could help assess the scalability of such systems.
3. **Data Privacy Solutions**: Address privacy concerns by incorporating anonymization and encryption in AI systems that gather commuter data, ensuring compliance with GDPR regulations.
4. **Public Awareness Campaigns**: To counter resistance to AI and new technologies, launch campaigns that explain the benefits of AI-enhanced transit systems, focusing on efficiency and environmental impact.

**Chosen Perspective:**

***An Overview of Identified Ways to Navigate and/or Solutions to the Challenges***

This section will review the main solutions proposed to address Järfälla’s public transport inefficiencies, with a specific focus on AI integration, call-based buses, and multimodal transport. Real-time data analytics from AI monitoring systems can help optimize resource allocation by adjusting train or bus schedules dynamically. Call-based buses could operate in areas with low demand, reducing unnecessary energy consumption and emissions. The research will explore these emerging technologies through case studies and assess their potential in reducing emissions and improving transport efficiency in suburban contexts.

**References:**

1. Mohammed Mustafa, M., & Cengiz, K. (2022). Call-Based Smart Transportation Using Artificial Intelligence. In *Multimedia Technologies in the Internet of Things Environment, Volume 3* (pp. 119-133). Singapore: Springer Singapore.
2. Miller, P., de Barros, A. G., Kattan, L., & Wirasinghe, S. C. (2016). Public transportation and sustainability: A review. *KSCE Journal of Civil Engineering*, 20(3), 1076-1083.
3. Kumar Debnath, A., Haque, M. M., Chin, H. C., & Yuen, B. (2011). Sustainable urban transport: Smart technology initiatives in Singapore. *Transportation Research Record*, 2243(1), 38-45.