1. Briefly list the research domain(s) and the contributions of the manuscript

Research Domains:

Internet of Things (IoT)

Smart City Applications

Data Fusion Models

Semantic Web and RDF Stream Processing

Distributed Computing (Edge, Fog, Cloud)

Query Execution Optimization

Contributions:

1) Introduction of DiSIF (Distributed Semantic Information Fusion Architecture): A novel three-layer architecture (Edge, Fog, Cloud) for distributed data fusion in smart cities.

2) Horizontal and Vertical Data Fusion Models: Horizontal fusion (data concept change) and vertical fusion (data scale change) to reduce query execution time and improve data integration.

3) Reduction in Query Execution Time: A distributed query execution model that breaks down independent and dependent queries, reducing execution time and resource usage.

4) Enhanced Privacy and Reduced Network Load: By processing data locally at different layers, reducing raw data transmission, and ensuring data privacy.

5) Comparison with Centralized JDL Model: Demonstrates how the DiSIF framework reduces network load, query execution time, and memory consumption compared to the traditional centralized JDL model.

Briefly describe the novel aspects of the manuscript. Authors whose manuscript extends work previously published, should identify the parts of their submission that contain novel contributions

Novel Aspects of the Manuscript:

The manuscript introduces several novel contributions:

1) Distributed Semantic JDL Fusion Model: A new distributed version of the Semantic JDL model, organized across three layers (Edge, Fog, Cloud), enabling parallel processing and improving decision-making. Unlike centralized models, it enhances speed and efficiency by separating fusion operations and performing them at different levels.

2) Horizontal and Vertical Fusion Models: The manuscript presents two unique fusion models. Horizontal fusion integrates data from different concepts (e.g., vehicle movement and congestion), while vertical fusion scales up data from smaller units to larger aggregates (e.g., street-level to area-level traffic flow), reducing query execution time.

3) Distributed Query Execution Model: A novel approach for handling independent and dependent queries across layers and nodes. By distributing queries between master and worker nodes, it significantly reduces execution time, memory usage, and optimizes resource efficiency.

4) Reduction of Network Load and Enhanced Privacy: Unlike centralized systems that transmit raw data, this distributed model processes data locally, minimizing the amount of data transmitted and ensuring privacy by keeping raw data local.

These innovations address key challenges in smart city data fusion, providing a more efficient, scalable solution.

1. Briefly explain how the manuscript match with the journal’s scope.

Alignment with the Journal’s Scope:

The manuscript aligns well with the Applications and application support domain by addressing Big Data registration, processing, and analysis in the context of smart cities. The proposed Distributed Semantic Information Fusion Architecture (DiSIF) enhances the handling of heterogeneous data streams and improves high-performance computing for real-time decision-making in urban environments. The framework addresses challenges related to semantic and knowledge-based systems and supports collaborative infrastructures by distributing data fusion tasks across edge, fog, and cloud layers.

In the Methods and tools domain, the manuscript introduces novel techniques for distributed dynamic resource management and scheduling, reducing query execution time across multiple layers. It also enhances information management by reducing network load and ensuring data privacy.

From a Theory perspective, the manuscript contributes to scaling and performance theory by demonstrating how the distributed approach reduces network inefficiencies and query execution time compared to centralized models, directly supporting theoretical aspects of large-scale communication and computation.