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A Scalable Big Data Framework for Real Time Traffic Monitoring System

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Abstract: *Traditional traffic management systems struggle to handle the massive volume and high velocity of data generated by modern urban environments, including GPS sensors, traffic control devices, and car embedded systems. This paper introduces a scalable and real-time intelligent transportation system based on a big data framework to address these challenges. The system is architected to process large-scale stream data continuously, enabling the real-time detection of critical traffic events such as incidents, crashes, and congestion.*

The proposed architecture is built on a distributed computing platform, leveraging components from the Hadoop ecosystem like the Hadoop Distributed File System (HDFS) for scalable storage and MapReduce for processing large historical datasets. The real-time stream processing layer, which can be implemented using technologies such as Apache Kafka or IBM InfoSphere Streams, allows for immediate data analysis and rapid response to dynamic traffic conditions. This layer incorporates operators for filtering, correlating, and aggregating data streams to identify abnormal events and traffic jams based on metrics like vehicle speed and density.

Experimental results demonstrate the system's ability to gather and manage large-scale data from numerous sensors efficiently and with high fault tolerance, processing hundreds of thousands of tuples per second while consuming minimal hardware resources. The framework's capacity to provide instant, high-precision information to end-users (via web consoles and smartphones) facilitates effective decision-making for traffic management and urban planning. The system effectively satisfies the 4V criteria of big data, offering a robust solution for enhancing urban mobility and road safety.

Keywords: Traditional traffic management systems

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