Enhancing Transport Safety Through Disdrometer-Based Environmental Sensing

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Abstract. *Accurate information about rainfall and snowfall is important for weather-aware intelligent transportation systems (ITS), but optical disdrometers produce large amounts of data that are hard to collect and process on small edge devices without losing quality. This paper describes a compact system in which a Thies Clima laser precipitation monitor is connected to a single-board server through an RS-485-to-Ethernet gateway, and in which an extract-transform-load (ETL) pipeline handles data collection, checking and storage in real time. Instead of treating the sensor as a passive data source, the system uses a state machine to switch between collecting data on individual particles and reading aggregated weather values, while a separate processing state keeps the shared communication bus from being blocked. Data checking is built directly into the pipeline: readings whose velocity, diameter or time value fall outside realistic ranges are removed immediately, and automatic recovery keeps the dataset complete when the connection is interrupted. The system ran continuously for three months. One representative autumn week, with more than 1.4 million recorded particles, is analysed in detail and shows stable operation and drop-size and fall-velocity results that match known rainfall behaviour, including a power-law relationship between fall velocity and diameter that stays the same across temperature groups. The results show that simple control running on low-cost edge hardware is enough to obtain reliable precipitation data suitable for automated traffic-safety uses such as dynamic speed limits and hazard warnings.*

Keywords. disdrometer, environmental monitoring, ETL pipeline, intelligent transportation systems

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