technische universität dortmund

Fakultät für Elektro- und Informationstechnik
Lehrstuhl für Kommunikationsnetze
Prof. Dr.-Ing. C. Wietfeld

09.06.2021

Design and Evaluation of Cluster-based Model-Predictive Communication Algorithms

Motivation and Problem Statement

The Internet of Things (IoT) is increasingly becoming a reality in Smart Citiy s as well as industrial environments. Emerging long-range communication technologies aim to enable a rising amount of sensor applications that have to meet high requirements regarding a high node density, low cost, long battery life and therefore high efficiency in data communications. Requirements defined for 5G massive Machine Type Communication (mMTC) scenarios target a node density of 1.000.000 devices per square kilometer [1].

Typical IoT devices are periodically sending their data in equidistant time intervals. This behavior, while keeping devices simple, does not enable efficient usage of the limited spectral resources available. In previous works, a model-predictive communication framework was introduced that allows IoT devices to rate the value of measured sensor data in order to reduce communication effort, leaving spectral resources for other participants [2]. This approach can increase the number of devices being able to get allocated resources in licensed bands as well as reduce the interference probability in unlicensed bands. To further enhance this approach, this work extends the model-predictive communication approach by leveraging grouping of co-located sensors and therefore reducing the communication effort of each individual sensor, as depicted in Figure 1.

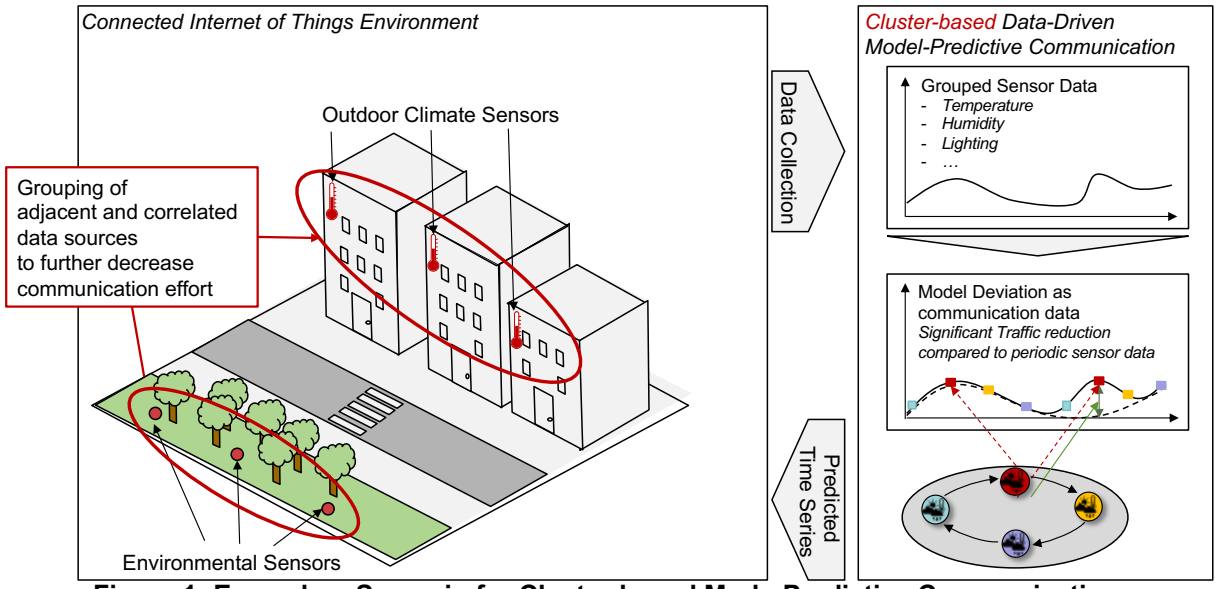

Figure 1: Exemplary Scenario for Cluster-based Mode-Predictive Communication

To achieve this goal, existing approaches for cluster-based communication should be evaluated and adapted for combination with model-predictive communication[3][4][5]. As a data source, OpenSenseMap can be used as open-source data platform with various sensor nodes available [6].

christian.arendt@tu-dortmund.de, stefan.boecker@tu-dortmund.de | www.cni.tu-dortmund.de

Potential Goals:

1. (Automated) extraction of data from OpenSenseMap for selected areas
2. Development of Cluster-based Model-predictive Communication Approaches
3. Cluster-based MPC Scheduling and Evaluation (starting with basic Round Robin)
4. Development of optimized procedures for distributed model-predictive communication
5. Trade-Off Data accuracy vs. Information age
6. Sensor study: comparison of different data (e.g. temperature vs. humidity)

Literature

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