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To Maïke, Kurt, Tina, Max and Daniela.

Preface

Declarative query interfaces to Sensor Networks (SN) have become a commodity. These interfaces allow access to SN deployed for collecting data using relational queries. However, SN are not confined to data collection, but may track object movement, e.g., wildlife observation or traffic monitoring. While relational approaches are well suited for data collection, research on Moving Object Databases (MOD) has shown that relational operators are unsuitable to express information needs on object movement, i.e., spatio-temporal queries. In this paper, we study declarative access to SN that track moving objects. The properties of SN prevent a straightforward application of MOD, e.g., node failures, limited detection ranges and accuracy which vary over time etc. Furthermore, point sets used to model MOD-entities like regions assume the availability of very accurate knowledge regarding the spatial extent of these entities. As we show, assuming such knowledge is unrealistic for most SN. This paper is the first that defines a complete set of spatio-temporal operators for SN while taking into account their properties. Based on these operators, we systematically investigate how to derive query results from object detections by SN. Finally, we show how process spatio-temporal queries in SN efficiently, i.e., reduce the communication between nodes. Our evaluation shows that our measures reduce communication by 45%-89%.

