On Node Localizability Identification in Barycentric Linear Localization

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Determining whether nodes can be uniquely localized, called localizability detection, is a concomitant problem in network localization. Localizability detection under the traditional **Non-Linear Localization (NLL)** schema has been well explored, whereas localizability under the emerging **Barycentric coordinate-based Linear Localization (BLL)** schema has not been well investigated. Non-awareness of the node localizability in BLL may cause theoretically localizable nodes to converge to wrong locations because their locations are impacted by the wrong locations of the unlocalizable nodes through the iterative location propagation. In this article, the deficiency of existing localizability theories and algorithms in BLL is firstly investigated and then a necessary condition and a sufficient condition for BLL node localizability detection are proposed. Based on these two conditions, an efficient ***Iterative Maximum Flow (IMF)*** algorithm is designed to identify BLL localizable nodes, and only localizable nodes are selected to enable a **Localizability Aware Barycentric Linear Localization (LABLL)** algorithm, which can guarantee the locations of the localizable nodes converging correctly. The proposed IMF and LABLL algorithms are validated by both theoretical analysis and experimental evaluations.

CCS Concepts: • **Networks** → **Location based services**; • **Computer systems organization** → *Sensor networks;*

Additional Key Words and Phrases: Localizability detection, max-flow, barycentric coordinate, linear localization, wireless networks

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1 INTRODUCTION

Geographical locations of the objects are the most fundamental knowledge [2, 14, 29, 33, 39, 44] to enable various location-based services. Thus, ***Network Localization (NL)***, which calculates the

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