SELF-LOCALIZATION AND TARGET TRACKING IN MOBILE SENSOR NETWORKS

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1. INTRODUCTION

Mobile Sensor Networks (MSN) are networks composed of a large number of wireless smart sensors. These tiny devices have communication, computation and sensing capabilities [1]. The main constraint of these sensors is their limited energy since they have non-renewable energy sources. MSN have a variety of applications in different fields, such as target tracking in military domain and environment monitoring [2]. Due to their wireless nature, MSN have no fixed infrastructure and thus, their sensors are able to move. Sensors mobility could be passive or controlled. In the case of passive mobility, sensors move in an uncontrollable manner due to external forces. Here, the mobility of sensors is undetectable in real-time, and thus they need to be localized regularly. In the case of controlled mobility, sensors are mini-robots that move in response to internal or external commands. In such a case, one could take advantage of the mobility of the nodes to improve the accuracy of the sensed data in the network. This contribution addresses the problems of localization and target tracking in mobile sensor networks. It first introduces a localization technique for passive mobility sensor networks. A mobility management strategy for target tracking is then proposed for controlled mobility sensor networks. The resolution of these problems is mainly performed using the interval analysis [3], where uncertainties are represented by intervals.

2. SENSORS LOCALIZATION IN PASSIVE MOBILITY SENSOR NETWORKS

Location estimation is an important task in many innovative applications of mobile sensor networks. Equipping each sensor with localization hardware such as GPS represents a high energy consuming and expensive solution. An alternative solution consists of providing some sensors (denoted *anchors*) with GPS and localizing the other sensors (denoted *nodes*) using exchanged information with anchors. This contribution proposes an enhanced interval-based method using the comparison of Received Signal Strength Indicators (RSSI) [4]. It performs the localization process using a rings overlapping technique. Based on RSSI comparison, the method does not need the knowledge of the channel pathloss parameters. The solution of the problem is performed using the interval analysis. Beside its guaranteed low cost aspect, the proposed algorithm yields a robust range-free localization under irregular radio propagation patterns.

3. TARGET TRACKING IN CONTROLLED MOBILITY SENSOR NETWORKS

One interesting application of MSN is target tracking. It consists of estimating instantly the position of a moving target. It is of great importance in surveillance and security especially in military applications. This contribution considers this problem in controlled mobility sensor networks [5]. It thus presents a mobility management strategy, aiming at improving the estimation of the position of the target. The proposed strategy relocates the sensors using a triangulation technique, followed by an ant colony optimization method. The estimation phase is performed using the interval analysis, leading to boxes including the exact position of the target at each time-step.

4. REFERENCES

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