Abstract

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Project Title : Localization in wireless sensor networks based on ZigBee technology

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Radio localization has been extensively researched because of its importance to many wireless applications. The accuracy of the location estimation and the reliable localization system are the main factors required. Nevertheless, the relatively simple and low cost system is also preferable. To deal with these requirements, many localization techniques related with the recent technologies have been proposed in the literature.

Wireless sensor networks (WSNs) are networks composed of numerous small, independent, self-contained, often battery-powered nodes including a wireless transceiver, sensors, and micro-controller which are capable to self-organize in a communication network. Localization in WSN often uses the Received Signal Strength Indicator (RSSI)-based localization system. ZigBee is a well-known WSN module in IEEE 802.15.4 standard which provides RSSI and has a good number of advantages such as originally lower cost than other wireless technologies, low data transfer, and easily covers wide range. Therefore, in this research, localization in wireless sensor networks based on ZigBee technology is studied and developed and indoor environment is considered because of simplicity. Although there are a variety of localization techniques, the fingerprint-based technique is focused on this research since it can deal with the multipath effect. This gives higher localization accuracy than other techniques. However, the main limitation of the fingerprint-based technique is time consuming and complicated. This research proposes a solution to these problems using clustering data technique. Fuzzy C-Means (FCM) is known as one of the clustering algorithm that can handle the uncertainty data and its robust application for the complicated data. In this research, the implementation of the FCM in the fingerprint database helps the faster calculation.

The accuracy of the localization system is shown as the estimated target location error. From the indoor experiment results, the FCM can cluster the target node in an appropriate cluster successfully. Therefore, it can be concluded that the FCM can be implemented as supporting algorithm in the fingerprint-based indoor localization system. For the future research, the investigation of the effect of the battery component for wireless sensor nodes and the improvement of the fingerprint database quality can be considered.

Keywords : localization, fingerprint technique, wireless sensor network, fuzzy C-means