

**CHENNAI – PONDICHERRY**

**Optimization of Fingerprints Reporting Strategy for WLAN Indoor Localization**

**Abstract:**

This paper investigates how to optimize the fingerprints reporting strategy to improve localization accuracy, and how the optimal strategy theory can be utilized to streamline the design of WLAN fingerprinting localization systems. In particular, we first reveal that the fingerprints reporting problem is essentially an NP-Hard size-constrained supermodular maximization problem, and then show the inapplicability of the state-of-the-art approximation algorithms to the problem. We then propose a new algorithm and show that if the number of fingerprints measurements is large enough, then the localization accuracy is at most 1*􀀀"* times worse than the optimal value, with *"* any given constant close to 0. Moreover, we demonstrate how the optimal strategy theory can be utilized to improve accuracy of location estimation by resolving the issue of similar fingerprints for both faraway and close-by locations, with an iterative algorithm developed to cross check fingerprints sampled in different locations, in order to derive the best possible result of localization. Further, we reveal the relationship between accuracy of location estimation and coverage of Wi-Fi signals in indoor spaces when planning deployment of APs. Experiment results are presented to validate our theoretical analysis.

**Existing System:**

Many indoor localization systems have been developed with the fingerprinting approach. Early systems such as Radar are based on the nearest neighbor(s) in signal space (NNSS) technique, which is to compute the Euclidean distance between reported RSSes and the RSSes in the database. Later systems such as Horus utilizes probabilistic techniques to estimate the user’s location, where information about the signal strength distributions is derived from the database. The recent trend for designing the indoor local- ization system is to leverage crowdsourcing for data training and collaborative location estimation, where data from sensors embedded in smartphones are utilized. Empirical studies are presented to evaluate performance of existing localization systems, where extensive experimental results are analyzed to obtain an empirical quantification of accuracy limits of RSS localization.

**Proposed System:**

We reveal the implication behind the best strategy for fingerprints reporting, based on which we streamline design methodologies of important components in localization systems. We first reveal that the objective function of the optimal fingerprints reporting strategy is supermodular, and the fingerprints reporting problem is essentially an NP-Hard size-constrained supermodular maximization problem. We then present analysis of the stateof- the-art approximation algorithms and show their inapplicability to the fingerprints reporting strategy optimization case. We propose a new algorithm and show that if the number of fingerprints measurements is large enough, then the localization accuracy is at most 1*−ε* times worse than the optimal value, where *ε* is a given constant close to 0.

We then demonstrate how the best strategy theory can be utilized to improve accuracy of location estimation by resolving the fingerprints similarity issue, which means that fingerprints observed in faraway locations can be similar to each other due to the randomness of radio propagation. An iterative algorithm is developed to cross check fingerprints sampled in different locations, which is based on extra information provided by the best strategy theory.We further illustrate that the proposed algorithm can benefit the localization accuracy, even if locations with similar fingerprints are near to each other and the associated best strategies are the same.