

**CHENNAI – PONDICHERRY**

**Automatic Radio Map Adaptation for Indoor Localization using Smartphones**

**Abstract:**

The proliferation of mobile computing has prompted WiFi-based indoor localization to be one of the most attractive and promising techniques for ubiquitous applications. A primary concern for these technologies to be fully practical is to combat harsh indoor environmental dynamics, especially for long-term deployment. Despite numerous research on WiFi fingerprint-based localization, the problem of radio map adaptation has not been sufficiently studied and remains open. In this work, we propose AcMu, an automatic and continuous radio map self-updating service for wireless indoor localization that exploits the static behaviors of mobile devices. By accurately pinpointing mobile devices with a novel trajectory matching algorithm, we employ them as mobile reference points to collect real-time RSS samples when they are static. With these fresh reference data, we adapt the complete radio map by learning an underlying relationship of RSS dependency between different locations, which is expected to be relatively constant over time. Extensive experiments for 20 days across 6 months demonstrate that AcMu effectively accommodates RSS variations over time and derives accurate prediction of fresh radio map with average errors of less than 5dB, outperforming existing approaches. Moreover, AcMu provides 2\_ improvement on localization accuracy by maintaining an up-to-date radio map.

**Exisitng System:**

It is well-known that RSS is vulnerable to environment dynamics, including transient interferences such as moving subjects, door opening and closing, and prolonged changes like variations of light, temperature, humidity and weather conditions. Dense multipath in complex indoor environments further exaggerates the RSS temporal fluctuations. Hence real-time RSS samples measured in localization phase could drastically deviate from those stored in the initial radio map. As a consequence, a static radio map may gradually deteriorate or even break down, especially over long-term deployment, leading to grossly inaccurate location estimation. To overcome this problem, an intuitive solution is to repeat the site survey procedure, which is, however, labor-intensive and time-consuming. Early efforts resort to a set of fixed reference anchors additionally deployed to draw fresh RSS observations to adapt the radio map. Deploying extra devices, however, is expensive and not scalable, hampering the intrinsic advantages of fingerprint-based localization. Crowdsourced radio maps pave the way for automatic generation, however, most of them are designated for automatic construction instead of continuous adaptation and thus no specific and practical solution has emerged as yet.

**Proposed System:**

We design a self-updating method for the radio map of wireless indoor localization by leveraging mobile devices, which requires no additional hardware or extra user intervention.

We propose a trajectory matching algorithm for accurate localization. Different from previous probabilistic methods, our approach optimizes the residual errors of an entire trajectory.

We investigate the static behaviors of mobile devices and exploit their potentials for radio map updating. While previous works mostly focus on the mobile attributes, we dive into the static counterpart that is largely unexplored.

We prototype AcMu in real environments. Encouraging results demonstrate that AcMu makes a great progress towards fortifying WiFi fingerprint-based localization as a fully practical service for wide deployment.