

**CHENNAI – PONDICHERRY**

**Method and Analysis of Spectrally Compressed Radio Images for Mobile-Centric Indoor Localization**

**Abstract:**

Large databases with Received Signal Strength (RSS) measurements are essential for various use cases in mobile wireless communications and navigation, including radio resource management algorithms and network-based localization. Because of the constantly increasing number of radio transmitters with various wireless technologies and with the advent of 5G cloud computing and Internet of Things (IoT), the required size of the RSS databases are becoming unmanageably large. Thus, the requirements for the bandwidth and data rates for accessing the memory might become too costly. Therefore, in order to reduce the size of the RSS database, while maintaining the data quality, we have previously proposed the method of spectrally compressed RSS images, which are able to achieve considerable data compression of up to 70 percent. In this paper, we deeply analyze the process of spectral compression and introduce error sources, which affect the compression performance. Based on the analysis, we propose a novel theoretical framework and methods to optimize the performance of the spectral compression. In addition, we derive the Cram\_er-Rao Lower Bound (CRLB) for the RSS-based localization error and compare the CRLB between separate baseline localization approaches. The theoretical analysis is justified and compared with experimental RSS measurements taken from several multi-storey buildings.

**Existing System:**

Due to wide availability of Received Signal Strength (RSS) measurements in communications networks, RSSbased localization has become as one of the most studied network-based localization approach. The vast majority of the RSS-based localization systems are learning-based, meaning that the user location estimate is based on pre-collected learning data from the target area. In this case, the RSS measurements from the observed radio transmitters (TX) together with the measurement coordinates are beforehand stored in the learning database. By the TX notation we refer to any transmitting radio device in a fixed location from which the RSS measurement can be obtained, such as Wireless Local Area Network (WLAN) access points, Bluetooth devices and cellular network base stations. After this, in the localization phase, the RSS measurements of the user are compared with the learning database in order to estimate the user location.

**Proposed System:**

We have introduced a novel approach using spectrally compressed radio images to reduce the size of the learning database, while maintain the localization accuracy at the level of traditional fingerprinting. The main idea in the proposed approach has been to utilize the Discrete Cosine Transform (DCT) to reveal the spectral content of the radio images. Due to spatial correlation of RSS measurements, the energy of the frequency domain presentation is concentrated on a few DCT coefficients, which are then stored in the database. Besides the DCT, also other frequency transforms, such as Discrete Fourier Transform (DFT) are applicable for the spectral compression.

However, since the DCT has been widely applied in numerous data compression applications, especially regarding image and audio processing, it was chosen to be used also in this paper. Moreover, whereas the DFT introduces a complexvalued frequency spectrum, the DCT spectrum is purely real-valued. Therefore, since RSS measurements are given in real-valued numbers, with DCT it is possible to completely avoid handling of complex numbers in the data processing and analytical derivations.