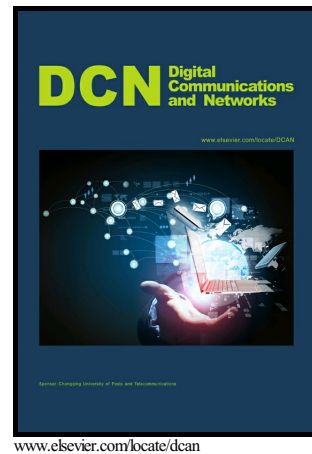


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# Spectrum Handoff Scheme with Multiple Attributes Decision Making for Optimal Network Selection in Cognitive Radio Networks

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## Abstract

It is envisaged that in future Cognitive Radio (CR) networks deployment, the multiple radio access networks may coexist. The networks may have different characteristics in terms of multiple attributes. CR will have choices to select the optimal network out of the available networks. The optimal network selection is a challenging task which can be done by spectrum handoff with Multiple Attributes Decision Making (MADM). The spectrum handoff decision with MADM provides wider and optimum choice with quality of service. This motivates to develop the spectrum handoff scheme with MADM methods such as simple additive weighting, technique for order preference by similarity to ideal solution, grey relational analysis and cost function based method, which is the objective of this paper. The CR preferences are based on voice, video and data services, called triple play services. The numerical results show that all MADM methods are effective for selecting the optimal network for spectrum handoff with reduced complexity in spectrum handoff decision. The paper shows that the proposed spectrum handoff scheme can be effectively implemented to select optimal network according to triple play services in CR networks.

**Keywords:** spectrum handoff; cognitive radio; SAW; TOPSIS; GRA; cost function

## 1. Introduction

Cognitive Radio (CR) networks [1–4] are providing high attention for the researchers as it is the most feasible solution to the problem of spectrum scarcity in wireless communication. As per US Federal Communications Commission (FCC), most of the allocated spectrum is underutilized. This is mainly due to allocation of fixed spectrum bands by the government agencies [5]. In order to overcome the imbalance between problem of the spectrum scarcity and inefficiency in spectrum usage, FCC has allowed Secondary User (SU), called CR to access Primary User (PU)'s underutilized licensed spectrum bands. Hence, the spectrum utilization can be significantly improved by dynamic usage of the underutilized spectrum [6–10]. The dynamic usage of underutilized spectrum can be done by spectrum handoff. The spectrum handoff is the mechanism of transition of spectrum bands for the users in CR networks. The spectrum handoff occurs due to the appearance of PU or CR at the channel. When PU appears and the channel is being occupied by CR, CR needs to vacate the channel as PU has higher priority over CR [11, 12]. Figure 1 presents the frequency bands occupancy status of CR technology enabled networks such as WiMax [13] *etc.* in a highway scenario. Cars are termed as

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