DEPARTMENT OF COMPUTER SYSTEMS
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USING DATA MINING TECHNIQUES TO PLAN MOBILE BASE STATIONS LAYOUT IN THE PRESENCE OF OBSTACLES

A Thesis Submitted to the Department of Computer Systems,
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ABSTRACT

Long Term Evolution “LTE” Advanced-based Heterogeneous Networks are introduced to improve spectral efficiency per unit area. A mix of Femtocell, Pico, Macro and Relay base stations are used in LTE Advanced-based Heterogeneous Networks. Low cost and flexible deployments and a uniform broadband experience are to be provided to users anywhere in the Heterogeneous networks. The network specialist try to deal with these challenges by adding indoor base stations, but other problems appear to them because they are adding them without considering critical constraints such as a number of users, type of base stations, indoor and outdoor interference.

In this thesis it is proposed that a system using cluster technique to facilitate the process of cell planning, that involves locating and configuring infrastructure for mobile networks by modifying the Density –Based Spatial Clustering of Application with Noise algorithm (DBSCAN).

A new Clustering algorithm has been proposed to solve the problem of interference in placement of Femtocells by modifying the original DBSCAN algorithm taking into consideration one floor and multi-floor building scenarios where numerous interfering sources are presented and then considered in the early network planning phase.

In this Thesis, DBSCAN algorithm was modified to solve the problem of coverage indoor area, with the existence of obstacles to choose suitable femto base stations which satisfy minimum path loss and maximize coverage area, and minimize cost with guaranteed path loss threshold.

These modifications developed the DBSCAN algorithm to be heterogeneous networking clustering to define for each user a specific femto to serve him.

By calculating path loss for each user in setting, the optimal clustering locations of femto base stations detected.

This modified algorithm called Optimal Clustering with granted PathLoss and maximized Signal to Interference plus Noise Ratio “OptCPLSINR”.

Subsequently, Hierarchical Agglomerative Clustering (HAC) is applied after using OPTCPLSINR to optimize clusters to guarantee minimum cost.

All points are tested by this algorithm to keep the SINR maximum, also suitable penetrations of 4G and 5G are used and different types of obstacles taking into consideration there penetration values.

In the proposed algorithm it is supposed that femto cells are fixed at the middle of the ceiling to serve maximum number of users in multi floors.

Other solutions (as my knowledge) plan for one floor and repeat it in other floors which means that the ceiling path loss is infinity, this is not correct, or they didn’t take into consideration the interior obstacles.

The results of this algorithm indicate that the proposed algorithm conducts to decrease number of Femtocells so minimize the cost and maximize SINR with a grantee pass loss.

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LIST OF PUBLICATIONS

1. Hesham A. Salman, Lamiaa F. Ibrahim, Ghadah Aldabbagh and Zaki Taha, " Using Clustering techniques for Topological Planning of Heterogeneous Mobile Networks in Dense Population Areas", Accepted in Jökull journal, 2017, ISI Thomson Reuters impact factor= 0.883.
2. Hesham A. Salman, Zaki Taha, Lamiaa F. Ibrahim, "Analysis and Evaluation of Parameters Used to Plan Indoor Heterogeneous Mobile Networks in Dense Areas", Accepted in Computer Engineering & Information Technology journal, 2017.
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1.1 Introduction

With rapid growth of the mobile networks, operators are willing to solve the problem of coverage in the indoor area, where more than 70 percent of this data traffic predicted to generate in indoor environments. Indoor subscribers with outdoor macro base transceiver stations (MBS) is very hard to serve at higher carrier frequencies. Again, higher-frequency waves have a harder time penetrating buildings, making life a lot tougher for service providers deploying Long Term Evolution Advanced “LTE-Advanced”, at 2.6 GHz rather than 700 MHz.

A heterogeneous network is a good solution of a coverage problem. To handle indoor cellular data demands without significantly increasing operators' expenditure, use of femtocells has been suggested [1]. Femtocell or Femto Access Point (FAP) is a small, low cost, low power cellular base station deployed in users' homes, public areas, or office buildings. Indoor femtocell technology gained attention because it extents the capacity and coverage at low cost [2]. The femtocell network enhances the cellular coverage and capacity in the indoor area by use the advantage of an Internet backbone [3]. Base stations of Femtocell inside homes permit users of mobile phone using their Internet broadband connection to do their calls. Femtocells are consumer useable base stations that use the broadband connection of consumer as backhaul. The inherent low transmission power capabilities of femtocells allow efficient reuse of available spectrum without significantly increasing interference to nearby users. Additionally, indoor users benefited by stronger