Developmentof a Propagation Model for IEEE 802.11 Wireless Networks: Case of GidanKwano Campus, FUT MINNA

Sunday OgunjideUsman Abraham Usman, Henry Ohize, Umar Suleiman Dauda
Department of Electrical and Electronics Engineering
Federal University of Technology, Minna, Nigeria
favouredben78@gmail.com,usman.abraham@futminna.edu.ng, usdauda@gmail.com

ABSTRACT—Wireless propagation modeling is an essential task in planning wireless networks. In the last few decades, the use of Wireless Local Area Network (WLAN) popularly referred to as Wi-Fi(Wireless Fidelity) in communication system has been on the increase with the exponential usage of handheld cell phones, laptops, and palm-tops to mention but a few. Notwithstanding, WLAN faces a peculiar propagation issue which lies in its changing propagation environment and this affects the quality of service. Poor quality of service is experienced on WLAN of GidanKwano campus of Federal university of technology, Minna. This arises due to signal propagation impairment caused by the terrain and the structures within the campus. Received Signal Strength (RSS) measurements were conducted at different locations away from the selected Access Points (APs) both in Line of Sight (LOS) and Non- Line of Sight (NLOS) situations. The path loss exponent (n) and standard deviation (σ) were estimated for the environment. The obtained results were contrasted with the already published work to show the level of agreement. The empirical models were developed for LOS and NLOS situations and compared with the existing standard models.

KEYWORDS—Wireless Local Area Network, Path loss model, Path loss exponent, Propagation impairment, Access Points (APs)

INTRODUCTION

Wireless Local Area Networks (WLANs) popularly referred to as Wi-Fi (Wireless Fidelity) have recently gained prominence in various walks of life, including medical centre, retail, assembling, warehousing, and academic environment [2] [4][9]. These sectors have benefitted immensely by utilizing hand-held gadgets and notebook computers for real time data transmission [13]. Wireless communication offers clients and associations numerous advantages, for example, compactness and adaptability, increment profitability, and lower cost of installation when compared to the wire line communication systems [18] [23]. WLAN gadgets enable clients to move their cell phones from place to place without the requirement for wires [5]. Less wiring implies more noteworthy adaptability and increment proficiency. Handheld gadgets, such as, Personal Digital Assistants (PDA) and mobile phones permit remote clients to synchronize individual databases and give access to network services, for example, remote email, web browsing, and other web administrations [6]. However, as wireless signals move from a transmitter to a receiver, they get diffracted, scattered, and absorbed by the territory, trees, building, vehicles and individuals which constitute the environment of propagation [1] [3] [11] [20] [21] [23]. The nearness of obstacles along the path of wireless signal may cause great signal attenuation more noteworthy than it would under free space conditions [8] [12] [14]. Radio signal attenuation and path losses are greatly due to the terrain of propagation [10] [15] [16] [17]. Poor network planning is a factor responsible for WLAN poor quality of service [18] [19] [20] [24]. For accurate network planning, a good knowledge of propagation characteristics is of great importance [22] [25]. In the literature, empirical propagation models are most prevalently used for handling network planning issues. However, due to changes in the environment of propagation, the empirical models are not globally applicable [1] [21]. Accordingly, it is important to determine the particular radio propagation characteristics that will be ideal for the environment under study while carrying out network planning [23].The Gidan Kwano campus of FUT, Minna often times encounter poor quality of service arising from the signal propagation impairment. The accurate prediction of well-known propagation models is not suitable to evaluate the propagation characteristic of this campus due to the peculiarity of its terrain. This paper is geared toward developing a propagation model for this campus using received signal strength measurements from a selected access points within the campus.

METHODOLOGY

Many techniques and materials have been utilised in taking information from an access point (or a base station) [17] [22]. These techniques include radio frequency (RF) overview and drive test among others [18] [7] [2]. For this work, the technique for RF overview was utilised and this section describes the materials and strategies used to achieve this investigation. Figure 1 shows the summary of the methodology deployed.

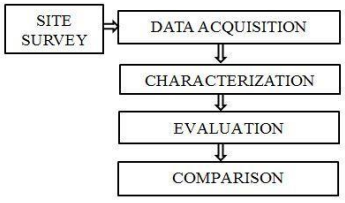

Fig.1. Summary of the methodology