ISSN 2080-9069
ISSN 2450-9221 online
„Edukacja – Technika – Informatyka" nr 4/26/2018
www.eti.rzeszow.pl
DOI: 10.15584/eti.2018.4.43

HADI M. SALEH[1], **VELOZ LLANO JUAN GABRIEL**[2]

The Main Areas of Formation Telemedical Communication Systems of Republic Ecuador

[1] Ph.D., associate Professor, Vladimir state university named after Alexander and Nikolay Stoletovs, Russia
[2] Postgraduate student, Vladimir state university named after Alexander and Nikolay Stoletovs, Russia

Abstract

Health care market is one of the largest and fastest growing segments in developed countries. This article is devoted to the problem of creating a city segment of the infocommunication telemedicine system in the Republic of Ecuador, taking into account the importance of attenuation of radio waves due to territorial and climatic features in this territory.

Keywords: telemedicine systems, base station, Ecuador, radio wave propagation

Introduction

The territory of the Ecuador Republic is divided into urban areas, provinces with poorly developed city infrastructure and the insular area of the Galápagos Islands (5 of the 12 are inhabited). It suggests that the centers of socially important services, medical centers in particular, are spread unevenly throughout the region. Medical centers in such big cities as Quito and Guayaquil are equipped with up-to-date diagnostic facilities and can afford to employ highly-qualified medical workers; health care centers in rural areas can provide only basic services and lack specialists. The number of medical centers is also not sufficient in Galápagos Islands, thus, if performing a surgery is inevitable, patients have to be transported to larger towns by plane and hospitalized there. According to statistics, one physician is in charge of 980 patients, which makes the observation of out-patients quite difficult the problem may be solved by introducing distant consulting and diagnostics, which is possible within info communication telemedicine systems. The telemedicine development sets the goals connected with the distribution of basic stations, which are the base of distribution chains, the calculation of basic station characteristics (presented in this article), and the order of scaling medical snapshots in order to transmit the visual information through the telecommunication channels.

Evaluate the performance of base stations

When assessing the coverage area of the base station, it is necessary to calculate the level of losses on the radio channel, which includes an indicator of the degree of attenuation, depending on the characteristics of the terrain 3

$$\gamma = a - b \cdot hb + \frac{c}{hb}$$

Where hb = [10;80] – height of the base station, (m); a, b, c – constants depending on the type of terrain.

Differentiation of types of localities by the corresponding parameters is given in Table 1.

Table 1. Types of terrain and characteristics [4].

Terrain	Description	a	b	c	S
C	Mostly flat landscape with little building density	3,6	0,0065	20	8,2 dB
B	The area is quite smooth, the density of development is small	4,0	0,007	17,1	9,6 dB
A	Uneven hilly terrain with moderate density.	4,6	0,007	12,6	10,6 dB

Illustrates the dependence of the signal attenuation on the station height for different types of terrain.

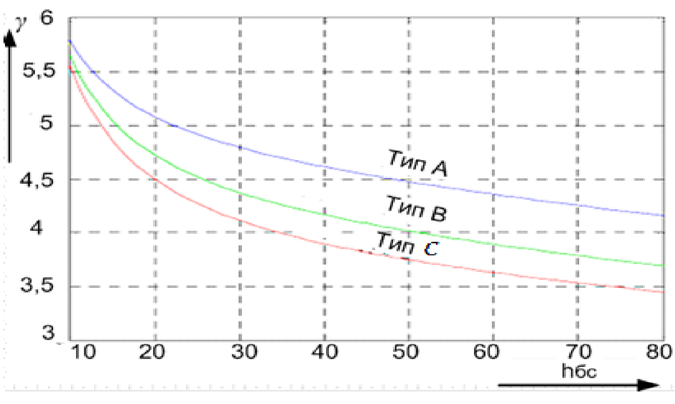

Figure 1. The graph of the exponential loss of the height of the base station for various types of areas.

Taking into account the possible height of the base station of 30 meters (the damping coefficient is within 5), as well as the type of terrain characterized by uneven terrain (due to the presence of hills and active volcanoes, for example, Pichincha in the intermountain basin of the Andes), we calculate the damping factor for the estimated base stations of the info communication system of telemedicine for Ecuador

$$\gamma = 4{,}6 - 0{,}007 \cdot 30 + \frac{12{,}6}{30} = 4{,}81$$

The attenuation coefficient

$$L = A + 10\gamma \lg \frac{d}{d_0} + X_f + X_h + S$$

Where d0= 100 m;d-the distance between the subscriber and the base stations, at d>d0,(m); γ – the degree of attenuation of radio waves (exponential losses); A — the loss of signal power in the free space; Xf — frequency correction factor; Xh —the height correction factor; S – the shading factor.

$$\sigma = \frac{MALP - A - X_f - X_h - S}{10_\gamma}$$

MAPL-losses in the path of radio wave propagation

Conclusion

The creation of telemedicine system in Ecuador is determined by several aspects: the lack of specialists, the location of health centers mainly in large cities, long distances between central and outskirt areas of the country. The development of such system first depends on the distribution of repeater devices throughout the area, which form a united chain for data transmission. It requires the calculation of losses at the radio path and the size evaluation of the basic stations. Empirical models for such calculations are based on the landscape characteristics and should consider the uneven landscape on the territory of Ecuador. When introducing the telemedicine system, one should pay specific attention to the disease statistics, also diseases which most commonly occur in the region, in order to distribute the load of work connected with distant consulting and diagnostics among specialists, and enable the automatic working--place creation. The development of electronic resources for pixel medical graphic improvement is also essential as it gives an opportunity to change the size of the picture in real time without significant artifacts.

References

Belenky, V.G. (2003). *Calculation of Coverage Area of Base Stations in Communication Systems with Mobile Objects*. Novosibirsk: HOWTO/ SibSUTI.

Brauchli, K. *et al.* (2005). iPath: A Telemedicine Platform to Support Health Providers in Low Resource Settings. *Journal on Information Technology in Healthcare*, *3*(4), 227–235.

Makoveev, M.M., Shinakov, Y.S. (2002). *Communication Systems with Mobile Objects: Textbook for Universities*. Moscow: Radio and Communication.

Sistema de Salud de Ecuador. *Saludpública* (2011). *53, suplemento 2*,

Zhurkin, I.G. (1988). *Methods of Computation in Surveying: A Manual*. Moscow: Nedra.