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Using HAPS to Present a Multi protocols Library by UserDemands

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Abstract*—*Today, the majority of communication networks tend to use the IP based structure to establish their communication. The use of such structure has led to a convergence in broadband communications. These structures describe a system that uses internet protocol on a network infrastructure to provide a wide range of services. These services are provided for users through a broadband connection. Multiple terminals support the opportunity to use voice call and receive high quality audio and video. Recently, the appearance of HAPS as a new technology has attracted the attention of ITU as an alternative for providing high quality VOIP, video conference and high speed data communication for wireless users. In this research, we will consider a multiprotocol mobile terminal with a mechanism to switch between three protocols, WIMAX, UMTS and GSM, enabling user to select one of this protocols based on their needs or position by HAPS. Eventually, the bit error rate, the number of errors and the total number of bits processed will be displayed. This method is flexible and useable for various protocols.

Keywords—**High altitude platforms, Multi-protocol library, WIMAX, UMTS, GSM**

I. Introduction

The demand for wireless systems has been developed for years. These systems such as planes or Airships are for communication. Those systems on high altitude are called communication towers that are considered as GEO Satellite which provide a good sight for applicants.

During the past 30 years communications have been passed down from third generation, which were mobile phones, to the forth one. In this era applicants are able to download the multimedia files at a high speed and Watch online video. Wireless technology lead us to a very united system. This project wants to analyze a digital library for WIMAX ، UMTSandGSM to provide the applicants choose one of these protocols. First we need to talk about HAPS standards on these three protocols. Then we will present its application and method and finally we will take a look at the results and the suggestions of the simulator.

HAPS Structure: the Earth atmosphere consists of several layers. The first layer is called troposphere which is 10 km above the Earth level. At this layer, as the altitude increases the temperature and Pressure decreases. The second layer is the stratosphere which is from 10 to 50 km above the Earth. One of its features is the stability of its atmosphere. (Figure 1)so that is the best place to put HAPS stations. [1]

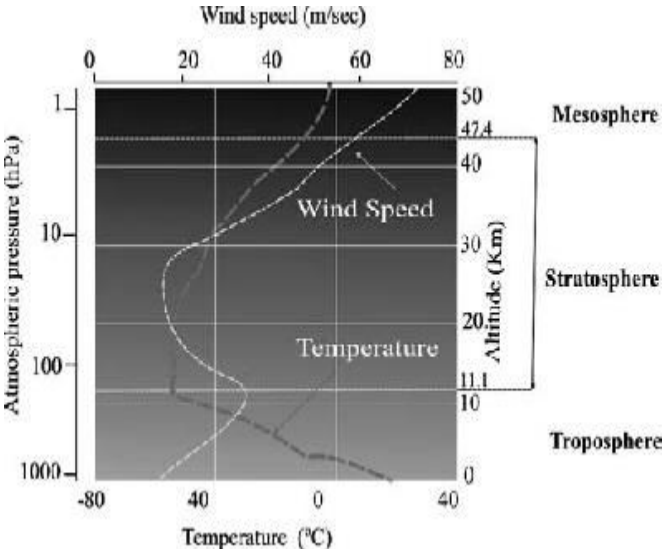

Figure 1plot of wind speed and temperature for different heights

The advantages of HAP communications are [3],[2]:

- Large area coverage (compared with terrestrial systems)
- Assessment of natural disasters such as floods and earthquakes (Figure 2)
- monitoring of disaster areas (Figure 3)
- Guidance for rescue vehicles
- Providing and sharing information for search teams
- Emergency Television and Radio Broadcast
- mobile communications
- traffic monitoring
- Environmentally friendly
- Low cost - cheaper to launch than a geostationary satellite or a constellation of Low Earth Orbit (LEO) satellites, cheaper to deploy than a terrestrial network.

Figure 2-2 HAPS airships

Figure 2-3 Drones HAPS

The modern technology has made a small community to put everybody together. Today people try to be up-to-date. Some tools such as smart phones can be used everywhere even if in far distances. These tools play an important role in this modern era and they are used for checking Emails, fax, shopping and etc. they are also used for Wired and wireless technologies such as WIMAX, UMTS, WLAN and DSL. [4]

Recently, the appearance of a new technique called High Altitude Platforms (HAPs) has gain the notice of the

International Telecommunications Union (ITU) as an alternative way of providing high quality VoIP, video conferencing and high speed data communications to wireless users.

[5]Multiple terminals are able to use voice calls, receive voices and videos and send data. In this research we analyze a multi-protocol terminal which supports GSM and UMTS. This terminal is also able to support Bluetooth, WIMAX and WIFI. [6][7]This terminal is able to switch between the protocols. So that the applicants can choose one according to its situation. That is a flexible way of downloading elevating your system. The basic functions are saved with MATLAB software and by the time of call they will return to the algorithm. Applicants think that this method reduces the time between the applications. [8] HAPS is able to make connection among the protocols such as GSM, UMTS and WIMAX.

The introduction of protocols GSM ،WIMAX ،UMTS:

GSM[1] (originally GroupeSpécial Mobile), is a standard developed by the European Telecommunications Standards Institute (ETSI) to describe the protocols for second-generation (2G) digital cellular networks used by mobile phones.Mobile services based on GSM technology were first launched in Finland in 1991. Today, more than 690 mobile networks provide GSM services across 213 countries and GSM represents 82.4% of all global mobile connections. According to GSM World, there are now more than 2 billion GSM mobile phone users worldwide.

Currently GSM networks operate on the 900MHz and 1800MHz frequency bands .One of the main advantages of the GSM standard is the ability to roam and switch carriers by using individual mobile units (if partner networks are located in their destination). The longest distancethat GSM can support is 25 km.

Data transfer rates in GEM is 80 kilobytes per second. [9] Many applicants think that one the main advantages of GSM is the reduction of expenses both on calls and messages.

UMTS[2]is a third-generation (3G) broadband, packet-based transmission of text, digitized voice, video, and multimedia at data rates up to 2 Mbps. UMTS offers a consistent set of services to mobile computer and phone users, no matter where they are located in the world. UMTS is based on the Global System for Mobile (GSM) communication standard. Once UMTS is fully available, computer and phone users can be constantly attached to the Internetwherever they travel and,asthey roam, will have the same set of capabilities. Users will have access through a combination of terrestrial wireless and satellite transmissions.[10] the longest distance that UMTS can support is 30 Km, One of the UMTS advantages is its speed.

WIMAX[3] is a wireless industry coalition dedicated to the advancement of IEEE 802.16 standards for broadband wireless access (BWA) networks. WiMAX would operate similar to WiFi, but at higher speeds over greater distances and for a greater number of users. WiMAX has the ability to provide service even in areas that are difficult for wired infrastructure to reach and the ability to overcome the physical limitations of traditional wired infrastructure. WIMAX current version is based on the IEEE802.16e-2005 standard. [9]

Features and technical advantages of WIMAX are as follows:

- frequency range from 2 GHZ to 66 GHZ
- Bandwidth from 1.5 GHZ to 20 GHZ
- Exchange rate information up to 70 Mbps
- Cover the area within a radius of 50 Km
- Exchange data between sender and receiver LineofsightAnd Nonlineofsight

History

There have been many studies on HAPS, including the use of HAPS for WIMAX, UMTS, GPRS, GSM or TETRA, But in none of the previous studies were on combination HAPS with these protocols.

First, in 2008 I. R. Palma-Lázgare [11] This would potentially allow a single aerialplatform to replace several terrestrial base stations, andtherefore the system is regarded to be cost-efficient since it canreduce the number of deployed base stations,which are determining cost factors in the capital expenditures and affecting the operational expenditures by less sites leasing and less updating on base stations of a WiMAX network. In that year, T. Hult et al. [12], the performance of both downlinkand uplink WiMAX broadband standard transmitted froma HAP cellular system in the 3.5 GHz band across a coveragearea of 30 km radius, operating in the same frequencyband with terrestrial WiMAX deployments, is investigated.

In 2009 Ali Imran and co-workers [9] studied HAPS-WIMAX function on different altitudes to check the power which works at 30GHZ frequency. They studied the effect of rain on the area and proved that the circle ray increases by the power.

After that in 2010 Israel R. Palma and José A. Delgado [11] They have briefly presented the idea of the use of HAPS as base stations to provide and face emergency services. Advantages of such an application include rapid deployment, large coverage area and certain immunity to most catastrophes. Having considered that HAPS operates from a 17 km altitude, HAPS GSM cell was limited to 30.5 km radius. In 2011 P. Lähdekorpi et al. [13] A HAP station has been launched to the disaster location to provide UMTS service. The results show that the HAP is able to improve the performance in the radio network by providing UMTS coverage from the HAP station. The HAP station is able to restore the disaster area throughput to the level of 70 % from the original level. However, to achieve good network performance using HAP, careful configuration planning is required. Thus with careless HAP configuration design, the HAP service performance could totally be lost. And finally, in 2013, Nicholas Vaiopoulos, Harilaos G. Sandalidis, DimitrisVaroutas [14] they propose a way of delivering WiMAXtraffic using a serial multi-hop HAP network configuration. HAPs are located at specific locations in the stratosphere,pick up thetraffic from the Earth region they cover, andcommunicate with each other using optical links.

[1]Global System for Mobile Communications

[2]universal mobiletelecommunications system

[3]World Wide Interoperability for Microwave Access

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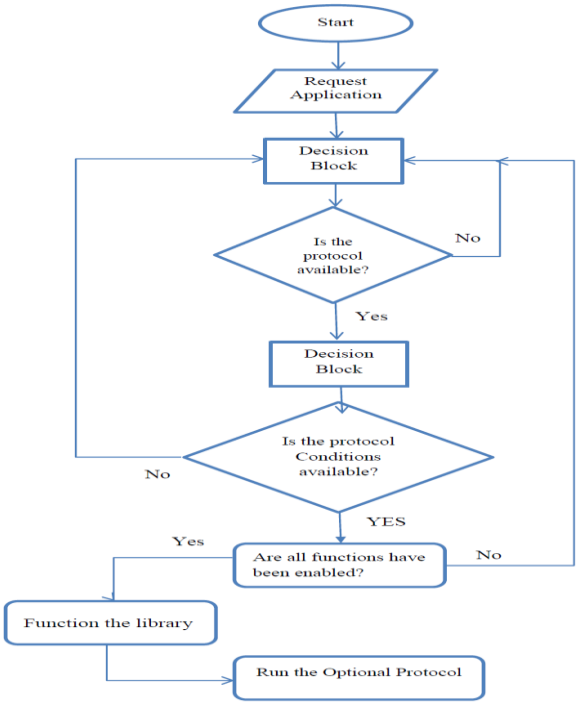
II. Material and Methodology

In this paper, we present a multi-protocol library which consists of GSM, UMTS and WIMAX in which the applicant chooses one by HAPS. This system helps to plan a multi-task system fir applicants. We choose GSM because it is not expensive, UMTS for its high mobility and It's a good standard for voice transmission and WIMAX for its good function and Because of its high bit rate .

HAPS features are in high quality in compare with Terrestrial systems. In Terrestrial systems the power to receive data decreases. In addition there is fast fading because of non line of sight for Rayleigh contribution.On the other hand in HAPS there is line of sight and the contribution is of Ricean. In Ricean there is a key parameter called K which is a connection between main factor and contribution. If K reaches zero Ricean turns into Rayleigh. This algorithm starts from application mediator and ends on software screen. Finally, the bit error rate monitor for each network will be determined after the election.



Protocol GSM

First we join generator to the entrance. Then we codify data and modulate GMSK by minimum method and after passing AWGN channel to the demodulator we will decode data. At the end we calculate errors and bytes. Eventually, the bit error rate, the number of errors and the total number of bits processed will be displayed

Protocol UMTS

This model shows turbo codes both on sender and the receiver and provides tools to communicate. In this method, LTE is used for Universal MobileTelecommunications System (UMTS) [15] and to choose the components. Turbo codes invention leads to a wide range of applicationssuch as space communications, wireless standards and digital videos and televisions.

Protocol WIMAX

In this model, first we should change non-linear or digital situation. Then reinforce digital non-linear parameters. This increases signal to receive an ideal error.

III. Results and Tables

In GSM Protocol by changing the parameters such as SNR and Eb / N0 and Variance the following results Can be achieved :

By increasing SNR the bit error rate and the number of errors are reduced. And by changing the parameter Eb / N0, bit error rate and the number of errors does not change. But by changing the bit error rate and the number of errors does not change. (Figure 3- 1)

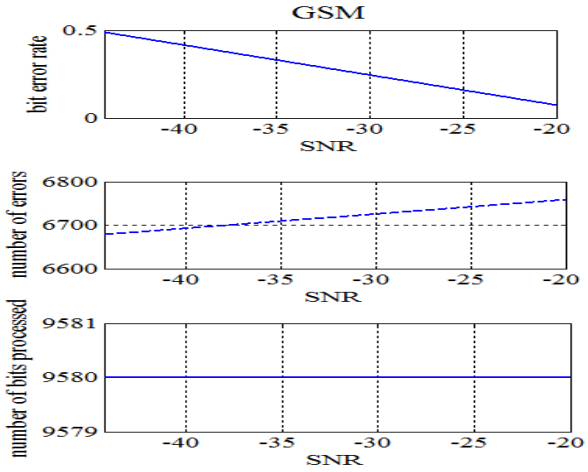


Figure 3-1 GSM Protocol variations based on SNR and bit error rate

In WIMAX Protocol by changing the parameters such as SNR and Eb / N0 and Variance the following results Can be achieved :

By increasing SNR the bit error rate and The number of errors increases. And by changing the parameter Eb / N0, bit error rate will increase, but The number of errors does not change. By changing variance the bit error rate and The number of errors does not change. (Figure 3- 2)

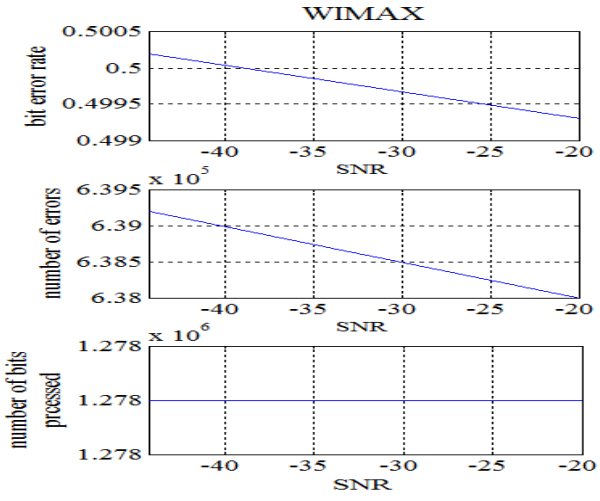


Figure 3-2 WIMAX Protocol variations based on SNR and bit error rate

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In UMTS Protocol by changing the parameters such as SNR and Eb / N0 and Variance the following results Can be achieved :

By increasing SNR the bit error rate and The number of errors is reduced and by changing the parameter Eb / N0, bit error rate decreases, but does not change the number of errors. By changing the parameter variance the bit error rate can be reduced but does not change The number of errors. (Figure 3- 3)

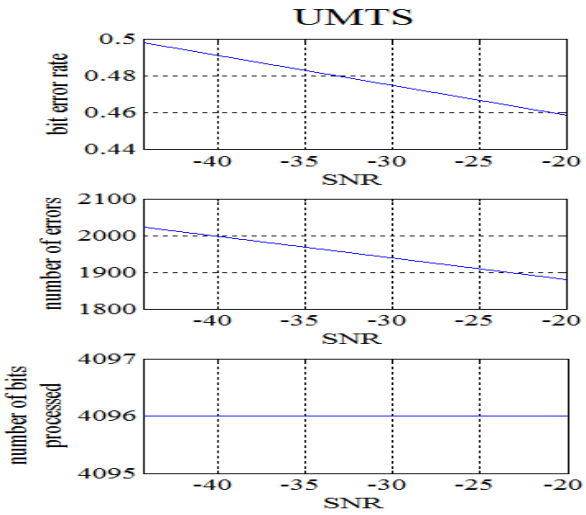

Figure 3-3 UMTS Protocol variations based on SNR and bit error rate

In tabel (3-1 , 3-2) the Calculation of SNR, Eb / N0 and variancefor all three protocols WIMAX, UMTS and GSM is given and also brought the bit error rate, the number of errors and the total number of bits processed.

Table 3-1Calculation ofSNR, Eb / N0 , Variance			
SNR = -44.3Eb/N0 = 1Variance = 1			
	GSM	WIMAX	UMTS
Bit Error Rate	0.488	0.5002	0.4892
Number of errors	6.68×10^{3}	6.392×10^{5}	2.023×10^{3}
The total number of bits processed	9.58×10^{3}	1.278×10^{6}	4.096×10^{3}

Table 3-2Calculation ofSNR, Eb / N0 , Variance			
SNR = -44.3Eb/N0 = 1Variance = 0			
	GSM	WIMAX	UMTS
Bit Error Rate	0.4884	0.5002	0.4939
Number of errors	4.681×10^{3}	6.392×10^{5}	2.023×10^{3}
The total number of bits processed	9.58×10^{3}	1.278×10^{6}	4.096×10^{3}

The changes in these three protocols In terms of power and bit error rate are mentioned in chart 3-4. In this diagram with increasing variance the bit error rate in UMTS protocol will be increased. In both Wimax and GSM protocol remains constant.

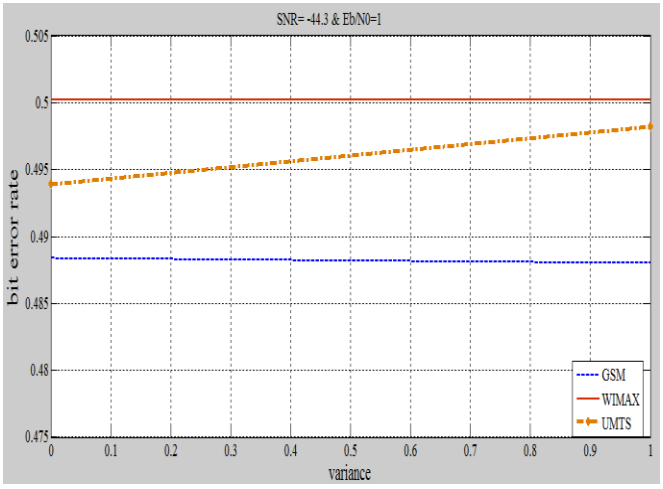

Figure 3-4 three protocols changes WIMAX, UMTS, GSM in terms of Variance and bit error rate

IV.Conclusion

There has been several researches on HAPS, but this research presents HAPS on three different protocols such as WIMAX, UMTS and GSM and a multi-protocol library for the applicants. This library enables us to plan a multi-task system. In this method software functions must be saved in a library and Eventually by Choosing protocols the bit error rate, the number of errors and the total number of bits processed will be displayed.

By adding other protocols such as TETRA, NNTP and SMTP to the applicants we can give them a chance to choose. Also this Protocols WIMAX, UMTS and GSM can provide as adaptive for users.

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