INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X

Impact factor: 4.295

(Volume 4, Issue 2)

Available online at: www.ijariit.com

Green Communications and Energy Efficiency

K Vishrutha
k.vishrutha2016@vitstudent.ac.in
Vellore Institute of Technology, Vellore, Tamil Nadu

G Janvi Sruthi
janvi.sruthi2016@vitstudent.ac.in
Vellore Institute of Technology, Vellore, Tamil Nadu

G Vedavasu
gamidivedavasu.2016@vitstudent.ac.in
Vellore Institute of Technology, Vellore, Tamil Nadu

T Yeswanth Reddy
yeswanthreddy.2016@vitstudent.ac.in
Vellore Institute of Technology, Vellore, Tamil Nadu

K Manikandan
kmanikandan@vit.ac.in
Vellore Institute of Technology, Vellore, Tamil Nadu

ABSTRACT

With the advancement of technology, there is a considerable increase in the usage of mobile phones and other telecommunication devices. Today we are in the development phase of building a Smart City. People want the technology to develop further because it has influenced their living. It is very difficult for a person to survive without using a mobile phone. In the earlier days, people used pigeons for communication. With the increase in technology, many environmental problems arise because they consume power. CO_2 emission has increased drastically during the last few years. CO_2 emission leads to greenhouse effect which further leads to global warming. Energy efficient network technologies have to be developed which consume less power and produce a better Quality of Service (QoS). Renewable sources of energy can be used for power generation and the power generated can be effectively used by the base stations only during the active hours of the day. [1] Green communications should be implemented for the development of "An Eco-friendly Smart City".

Keywords: *Green Communication, Energy efficiency, Simulator, Cognitive Radio, Renewable Energy, 5G.*

1. INTRODUCTION

Green Communication is used to increase the Energy efficiency by considerably reducing the Energy consumption. It provides the users with a better QoS. There has been a drastic increase in the emission of CO_2 in the last few years. According to the Carbon Dioxide Information Analysis Center, Environmental Sciences Division, Oak Ridge National Laboratory, Tennesse, United States CO_2 emissions from gaseous fuel consumption(% of total) in India was highest of all the past 54 years in 2010. The needs of the people have to be satisfied but at the same time, the Ecological Balance has to be maintained. The 3G era has been replaced by 4G and the 5G era has already begun. 4G technology cannot handle the massive increase in the users. The Fifth Generation Communication system enables the users with a high data rate, lower energy consumption and improved Quality of Service. [2] There has to be a communication link established between things to form a network. The most important challenge to achieve this is that "everything" in the network should have an ID. Due to advancements in the technology many people have started using the network and have entered the cloud. To maintain this, a better power management system has to be established that would be beneficial both to the environment and the people. Effective power consumption and quality output will lead to a city where "everything is connected" which is the basic building blocks of IoT (Internet of Things). Iot with Green communications will lead to eco-friendly communication networks. A User Equipment (UE) model has been considered. Each Base Station (BS) has a hexagonal layout and each of it has its own battery. Base stations are interconnected using optical fibers. The system is if any of the Base stations has less energy to transmit the signals then another Base station in its vicinity can share its energy. [1] Since the Base stations consume energy we can consider cluster heads (CH) instead of them.[7] This leads to less utilization of energy. Collisions in the transmission of signals can be handled by CSMA (Carrier Sense Multiple Access) algorithms. A cognitive radio (CR) can intelligently detect the free communication channels and this can be used to minimize the interference to other users. [9] In this paper we have discussed the energy efficiency of 5G networks and the differences between 5G and 4G [2], a cognitive radio

© 2018, www.IJARIIT.com All Rights Reserved

technique for efficient power consumption, [9] usage of renewable energy sources and the description of a simulator[1] , device to device communications [7].

The paper is divided as follows. Section II gives the explanation of various methods used and Section III gives the Literature review followed by the conclusion (Section IV).

2. METHODS

Renewable energy sources can be used for running a base station. A simulator has been designed to manage the energy consumption on an hourly basis. All the BS's are connected to a Macrocell BS and all these are connected using optical fibers to minimize energy loss during transmission.

Now in this model, each of the BS is provided with a separate solar panel which acts as a source. Since all the BS's are connected and if one of the BS is deficient then the nearest BS should supply the energy. One of the major challenges in this model was the inefficiency in power generation because of the varying intensity of solar radiation and to overcome this problem each of the BS is also provided with a separate battery that would help data transmission during the night. The traffic demand varies with the solar profile. The algorithm states that if the supply is greater than demand then the BS makes transmissions using its storage and the difference is considered as the "Power gain" of the base station. But if it is not the case then it contacts other BS's in its vicinity. To coordinate with others each and every BS must know the location of the other stations and the power remaining in the respective BS. To decide which user has to be contacted next, there is a separate "User Association Policy" and the results of the policy are dependent on the strength of the received signal.

Conventional: Nearest BS is contacted as shown in Fig 1 [1]. But it doesn't ensure best SINR (Signal to Noise Ratio)

CoMP-DPS: The power remaining in each is calculated and then sorted in descending order. The station which gives the highest value of SINR will be selected first. This technique is called "Coordinated Multi point Dynamic Point Selection"

CoMP-JT: When there is a collision, that is when two or more signals are received at the same time then the station with maximum SINR will be selected by the UE. Note that the stations are sorted in descending order. The protocol is called "Coordinated Multi-Point Joint Transmission."

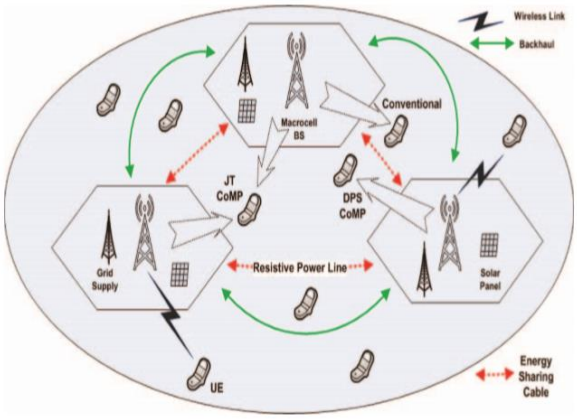

Fig. 1. Network layout.

This method can abstract the power usage and maintain the solar profile and optimize various parameters that encourage sharing of energy which would reduce the energy loss and it is one of the best methods for efficient usage of solar energy. Here Energy efficiency is obtained by energy sharing and usage of renewable energy.

The base stations can be replaced by cluster head (CH) since they consume less energy. If we introduce various actors then communication can be done.

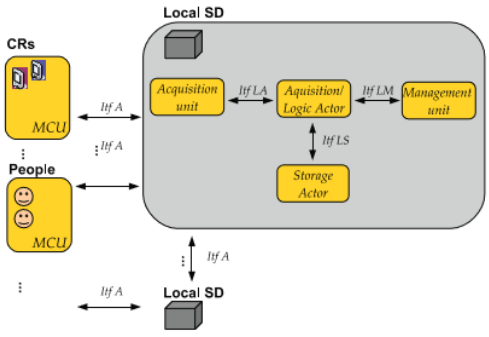

Fig. 2. Interfaces among the actors of the network

The actors introduced in the model are:

Cognitive device actors: They transmit information, receive signals and manage power consumption and spectrum efficiency.

Logic Actors: They use the social networking sites to transfer information and they form a local SD with the capabilities of both

© 2018, www.IJARIIT.com All Rights Reserved

logic and storage actors.

Storage Actors: They store the information related to the location of different cluster heads. They create a database with all the information related to the local storage system.

People actors: This allows a human interface to the system. They can collaborate with other actors to take decisions.
All these actors make a model as shown in Fig 2 [9]. The model involves the cognitive technique with a human interface for reducing energy loss.

The cognitive actor asks for a registration to a storage actor, who contacts the logic actor to take the decision using air as a medium. Logic actor and storage actor's interface known as LS interface reads the stored data and asks for measurements and it is further transmitted to the MCU using air as the medium. The MCU sends the measurements to the logic actor and based on it the decision is taken. Then the result is sent to the MCU using the Logic management interface LM.
Note that the measurements here refer to the measurements of energy consumption. The resource management is also achieved using this method.

Human interface and cognitive radio can be used for effective transmission of messages which reduces the energy consumption which is the main aim of green communications.

The model has distributed system architecture and it is used to conserve energy efficiently. Since it involves human beings it gives people an opportunity to take part in building a "Green community".

Interference is one of the causes of energy loss. If more than one signal wants to be read by the same BS then such a situation is known as "Interference". Normally radio waves are used for communication but to reduce the interference and conserve energy we can use millimeter waves for transmission. Millimeter waves are radio waves with a wavelength ranging from 1 to 10 mm and they have a frequency range of 30 G to 300 GHz.

In this system, if a user is connected to more than one BS at the same time and if the bandwidth of any one of the BS gets reduced due to obstacles in the path, then the user can change his BS. That is the user can choose a BS with better signal strength for transmission of the required message. The user uses a "Route correction scheme" to select the nearest BS with more bandwidth. To do this the user scans the nearest Mobile station (MS) and the MS scans all the BSs in the vicinity and sends the user a report consisting of the number of users, a number of transmitted packets and the user checks whether the transmitted value is within the standard value. If the transmitted value is less than the standard value then a message is sent to the MS and then the BS decides whether or not to perform the route correction scheme.

If a user occupies most of the bandwidth of the BS then the user must be assigned to a different BS with more bandwidth.
If the amount of transmission exceeds the original amount then a notification will be sent to the particular MS.

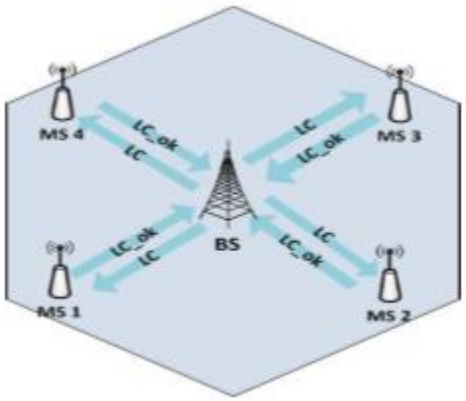

Fig. 3

They setup is shown in Fig 3 [6] .There is a considerable difficulty in the reflection of the Millimeter waves. Attenuation may occur because of various factors of light such as reflection, refraction and the speed of light is different in different media and it is also different while penetrating through different obstacles.

When a beam comes across an obstacle a part of it gets absorbed and a part of it gets reflected. The reflected part is used to transmit and receive signals. But this is not an efficient approach because high packet loss ratio when the actual simulation was performed. This model still gives an idea of reducing energy consumption by avoiding collisions. Thus this model also encourages the idea of less energy consumption. The Quality of Service is low but it can be implemented on a smaller scale.

3. LITERATURE REVIEW

The paper titled "A CoMP Based LTE-A Simulator for Green Communications" [1] concludes that novel techniques can be used to minimize the energy consumption and the proposed simulator can be used for 5G technologies. The paper described a method to utilize solar energy efficiently by inserting solar panels on each BS. The proposed model can be implemented on a larger scale and it is capable and efficient to handle large power supplies. The paper titled "Software defined energy harvesting networking for 5G green Communications" [2] proposed an Energy trading model for nodes and various results indicate that SD-EHN supports energy scheduling which can improve the energy efficiency which can be used for energy saving. The paper titled "A Green Communication Model for 5G Systems"[4] concludes that 5G access networks consider the temporal variation of traffic and it also

© 2018, www.IJARIIT.com All Rights Reserved

calculates the number of SCNs required during the different hours of a day. It also proves that Green communication models can be used for lowering power consumption. Power consumption is increased due to network densification and it should be avoided that is only the required SCNs must be used at a particular time and all the other SCNs can be put in a sleep mode so that energy is saved effectively. The paper titled "Interference Reduction by Millimeter Wave Technology for 5G-Based Green Communications" [6] concludes that the problem in using millimeter waves is a reflection. As soon as the beam encounters an obstacle it gets reflected. During the process, a part of the beam gets absorbed by the obstacle while the other part of the beam is used for transmission and hence there is a slight energy loss. Though this model helps to reduce the energy loss by reducing the interference between the waves there is a slight energy loss during the collision time and hence the model doesn't give effective results. But the idea can be implemented with certain other changes so that there is a future scope of the proposed system. The paper titled "Energy-Efficient Device-to-Device Communications for Green Smart Cities"[7] gives a clear idea about the D2D communications. It concludes that a subcarrier assignment algorithm has been proposed to deal with the subcarrier assignment subproblem and a power scheme was also made to solve the nonconvex power allocation subproblem. The paper titled "Smart Distributed System Architecture for Green Communications"[9] concludes that a distributed system architecture has been proposed and an energy efficient resource management system has been developed. The paper titled "Power VS Energy Efficiency Conflict and Its Solution by Cognitive Radio In Green Communication"[10] concludes that there is a conflict between spectrum and power efficiency and hence a cognitive radio technology has been applied for energy consumption. The paper titled "Key Techniques in Green Communication"[11] introduces cognitive network, network coding, and smart grid. Internet of things, Green communications and cloud computing will play a key role in building a "Smart city".

4. CONCLUSION

This paper gives a brief summary of the three proposed models for Green communications. Each of the models has its own advantages and disadvantages. The technology described above will be implemented in future for better results. This will make people understand that development can be done without causing much harm to the ecosystem. Renewable sources of energy are used as a power generator and it paves the way for the development of an "Eco-Friendly Smart City". Techniques are being developed to maintain the ecological balance. High emission of CO2 is one of the most important problems that we are facing today. We cannot reduce the level of CO2 but we can control the amount of emission. As the population is increasing, people are developing new devices for leading a better life but if this continues there would be no life!
Green communication, Internet of Things, Cloud Computing and Big Data will become the future and they would help us a lot in the construction of a Smart city.

5. ACKNOWLEDGMENT

This project would be incomplete without the mention of people whose ceaseless cooperation made it possible, whose constant guidance and encouragement crowns all effort with success. We are grateful to Dr. Manikandan K and all the faculty members of CSE Department for their guidance, inspiration and constructive suggestions that helped us in the preparation of this report.

6. REFERENCES

[1] C.Engineering, "A CoMP based LTE-A simulator for green communications," vol. 2, no. 1, pp. 1751–1756, 2017.
[2] X. Huang *et al.*, "Software Defined Energy Harvesting Networking for 5G Green Communications," *IEEE Wireless. Commun.*, vol. 24, no. 4, pp. 38–45, 2017.
[3] T. Zhou, N. Jiang, D. Qin, Z. Liu, and C. Li, "Joint Cell Selection and Activation for Green Communications in Ultra-Dense Heterogeneous Networks," *Proc. - 2017 IEEE Int. Conf. Comput. Sci. Eng. IEEE/IFIP Int. Conf. Embed. Ubiquitous Comput. CSE EUC 2017*, vol. 2, pp. 32–37, 2017.
[4] M. M. Mowla, I. Ahmad, D. Habibi, and Q. Viet Phung, "A Green Communication Model for 5G Systems," *IEEE Trans. Green Commun. Netw.*, vol. 1, no. 3, pp. 1–1, 2017.
[5] A. S. Sadiq, T. Z. Almohammad, R. A. B. M. Khadri, A. A. Ahmed, and J. Lloret, "An Energy-Efficient Cross-Layer approach for cloud wireless green communications," *2017 2nd Int. Conf. Fog Mob. Edge Comput. FMEC 2017*, pp. 230–234, 2017.
[6] T. Y. Wu and T. Chang, "Interference Reduction by Millimeter Wave Technology for 5G-Based Green Communications," *IEEE Access*, vol. 4, pp. 10228–10234, 2016.
[7] C. Kai, H. Li, L. Xu, Y. Li, and T. Jiang, "Energy-Efficient Device-to-Device Communications for Green Smart Cities," *IEEE Trans,Ind, Informatics*, vol,3203, no, c, pp, 1-9, 2018.
[8] B. Aziz, A. Nafkha, J. Palicot, and H. Zhang, "Blind wireless standard identification for green radio communications," *Int. Conf. Adv. Technol. Commun.*, pp. 295–300, 2013.
[9] A. Vizziello and L. Favalli, "Smart distributed system architecture for green communications," *Proc. - 27th Int. Conf. Adv. Inf. Netw. Appl. Work. WAINA 2013*, pp. 1577–1581, 2013.
[10] H. Yunru, "Power VS energy efficiency conflict and its solution by cognitive radio in green communication," *World Autom. Congr. (WAC), 2012*, 2012.
[11] F. Chuan and L. Anqing, "Key techniques in green communication," *2011 Int. Conf. Consum. Electron. Commun. Networks, CECNet 2011 - Proc.*, pp. 1360–1363, 2011.

© 2018, www.IJARIIT.com All Rights Reserved