



Analysis and Performance Evaluation of FUTA Network

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ABSTRACT: Network Performance evaluation refers to the measure of the quality of service (QoS) of a network. Performance evaluation of the network of the Federal University of Technology Akure (FUTA) focuses on the quality of service the network provides to her users. This research evaluates the performance of FUTA network in the light of its availability, connectivity and accessibility at various areas under the coverage of the network. A structured questionnaire was distributed among 200 users of the network. Data were analyzed using the Statistical Package for Social Sciences (SPSS) software package (version 11 for windows on PC). The availability, connectivity and accessibility of the network at various locations were analyzed. A critical analysis of the research was made and some challenges users encounter while using the network were also identified. Problems that still hinder the effective performance of the network were cited and some recommendations were presented.

Keywords: performance evaluation, internet, University, wireless network

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INTRODUCTION

In the world of computers, networking is the practice of linking two or more computing devices together for the purpose of sharing data. Networks are built with a mix of computer hardware and computer software and can be categorized in several different ways. One approach defines the type of network according to the geographic area it spans. Local area networks (LANs) for example, typically span a single home, school, or small office building, whereas Wide Area Networks (WANs) reach across cities, states, or even across the world (Tanenbaum and Wetherall, 2011; Frenzel, 2014). The internet which is the interconnection of computer networks using the internet protocol suite (TCP/IP) links computers and smart devices Wetherall (2011), Frenzel (2014) has brought tremendous improvements in technology, communication, entertainment and education to users (Sundaresan et al, 2011; Dahunsi, 2015). Internet connectivity provided by the Federal

University of Technology, Akure's has also brought about a great enhancement to her staff and students in their teaching, research and learning. The network is used for purposes such as E-mail, project research, E-commerce, news and report, E-learning, lecture preparation, general browsing, term paper/ assignments, registration and online chatting.

The Federal University of Technology, Akure (FUTA) was founded in 1981 under a drive by the Federal government of Nigeria to create universities that specialize in producing graduates with practical as well as theoretical knowledge of technologies. FUTA has a wireless local area network (WLAN) network is managed by the Computer Resource Centre (CRC), a unit of the University (FUTA, 2014). FUTA is an academic and research environment with a campus area network that has a single server system with many nodes attached. Users of the network are expected to be only Staff and

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students of the University. As at the time of this research, FUTA network gets her internet service from an internet service provider through Very Small Aperture Terminal (VSAT) technology. The internet service is received via radio signals at CRC and distributed to other buildings on campus via radio link. 1000 users' capacity internet resources are available on the campus. The school subscribed to 15Mbps uplink and 15Mbps downlink bandwidth for upload and download respectively. Due to the importance of the network to FUTA's teaching, learning and research, it is important to evaluate the performance of the network to ensure it provides quality service to users. The objectives of this research is to evaluate the performance of FUTA network in the light of

its availability, speed and accessibility and to determine the factors influencing the use of FUTA internet facilities. This paper will also propose methods of improving the performance of the network based on the result from the analysis.

Generally, there are three techniques for evaluating the performance of services and these are analytical modeling, simulation and measurements (Jean, 2007). Measurement or data collection using questionnaires was adopted for the purpose of this research and the data was analyzed using Statistical Package for Social Sciences (SPSS) software package (version 11 for windows on PC) with methodology proposed by Pallant (2004).

RESEARCH METHODOLOGY

The population considered for the research includes academic staff, non- academic staff, post graduate student and undergraduate student who have access to the internet via FUTA network. A total of two hundred subjects were randomly selected and sampled and a structured questionnaire was used to elicit responses from the respondents. The questionnaire was administered to the

respondents and collected back immediately to ensure high rate return. A four point likert scale of Strongly Agree, Agree, Disagree and Strongly Disagree was used to elicit responses for some of the questions. Both descriptive and inferential statistical methods were used in the data analysis. Percentages, frequencies tables and charts were used to collate, analyze and present the data.

Table 1: Locations where questionnaires were administered

S/N	Location	S/N	Location
1	School of Engineering and Engineering Technology (SEET) building	11	Digital Research And Resource Sharing Centre building
2	School of Agriculture and Agricultural Technology (SAAT) building	12	School of Environmental Technology (SET) building
3	School of Earth And Mineral Sciences (SEMS) buildings	13	School of Management Technology (SMT) building
4	School of Sciences (SOS) building	14	Entrepreneurship Building
5	Post Graduate School building	15	Walkway
6	Centre For Continuing Education building	16	School Library
7	Obakekere	17	Students Union Building (SUB)
8	Obakekere Café	18	Adamu Building
9	Computer Resource Centre	19	Student Hostels
10	Senate building	20	Academic Building

The population for the study comprise of academic and non-academic staff, undergraduate student and post graduate student in Federal University of Technology, Akure, Ondo State because they are the primary users of FUTA wireless local area network.

Questionnaires were given to users at various locations of the University campus to elicit response from a wide range of the respondent and to ensure that the allocation was not biased. Table 1 shows a breakdown of how the questionnaires were administered. The sampling environment was divided into twenty separate areas/places.

The questionnaire has five major sections. Section one handles the demographics of the respondents which includes; the category, gender and age of the respondents. Section two investigates the respondents understanding

and usage of the internet and how they connect to the internet and FUTA network. Section three enquires about the connectivity of the users to the network where they connect and the locations. Section four enquires about the availability of FUTA network at various locations on campus and off campus, the speed of the network at various times of the day (Early morning, late morning, afternoon and evening) and connection to FUTA network when there is no electrical power supply and the means by which the respondents connect to the network during this period.

The fifth section of the questionnaire inquires on how the respondents are affected by some specified factors in the use of FUTA Network. The last question was an open ended question intended to get other user specific factors.

RESULTS AND DISCUSSION

Demographics of Respondents

Academic staff constituted 16% of the population; non-academic staff constituted 3%; undergraduate students constituted 60.5% while post graduate student constituted 20.5% of the respondents. This implies that majority of the respondents were undergraduate students hence, majority of the users of FUTA network are the undergraduate students of the university.

The male respondents constituted 66.5% while female respondents constituted 33.5% of the respondents' population. In the analysis, out of two hundred respondents the age distribution of participants revealed that 11.0% were below 20 years, 69.0% were between 20-30 years, 18.5% were between 31-40 years, while 1.5% was above 40 years.

Table 2: Internet usage pattern of respondents

	Usage	Freq.	Percent	Comment
Usage of Internet	Beginner	15	7.5	This implies that majority of FUTA network users have a good understanding of the internet.
	Expert	135	67.5	
	Casual user	46	23.0	
	Others	4	2.0	
Medium of Connection to the internet	Modem (Laptop)	28	14.0	FUTA network is used by a majority of the respondents.
	Smart phone	44	22.0	
	FUTA network	123	61.5	
	Others	5	2.5	

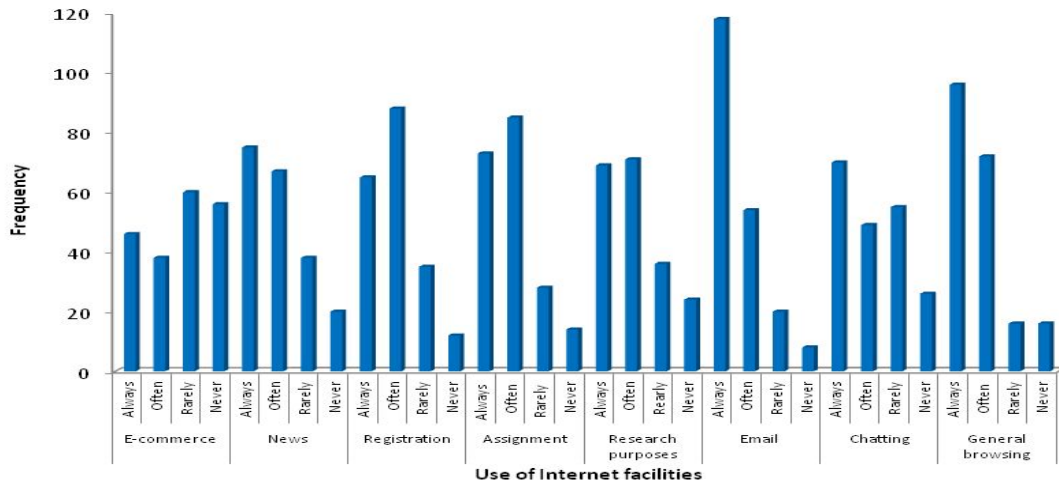


Figure 1: Frequency of use of internet facilities

Internet Usage

Responses show that a greater number of the respondents (67%) were expert users of the internet, 23% were casual users, 7.5% were beginners while 2.5 constitutes others. This implies that majority of FUTA network users have a good understanding of the internet. Table 2 shows a self-evaluation of respondents’ usage of the internet.

The internet facilities on FUTA network are well utilized and such facilities includes E-commerce, E-mails, news, registration, social networking, research purposes, assignments and general purposes. More users on FUTA network use the internet facilities mainly for e-mails and online registration by students as shown in Figure 1.

From the research, 30.0% of the respondents have been using FUTA network for less than a year, 46% have been using the network for 3-5 years, 10% have been using the network for 3-5years while 3.5% have been using the network for above 5 years hence the number of respondents that have used the network for 3-5 years constitute a greater portion of the respondents involved in this research.

Connection at various locations on FUTA Campus

The university cyber café, CRC, SAAT, Library and CCE are the major areas with strong network signal as shown in Figure 2. This is why respondents prefer to use these locations. Other locations with smaller percentages of users get poor signal strength from FUTA wireless network.

Availability of FUTA Network at Various Locations

Measure of availability of FUTA network at CRC is quite high. 53% of the respondents rated FUTA network as always available at CRC, 24.5% rated the network as often available, and 17.5% rated the network as rarely available while 5% of the respondents rated it never available. From the analysis, 5.0% of the respondent opined that the network is always available at School of Agriculture and Agricultural Technology (SAAT) building, 31.5% opined that the network is often available, 53.5% opined that the network is rarely available while 10.5% opined the network is never available. This result indicates that the availability of the network at SAAT building is low.

48% of the respondents graded the availability of FUTA network at Obaekere cyber café as always available 19.5% as often available, 25.5% as rarely and 7% as never. The result shows that the availability of the network at Obaekere cyber café is high. From the research, 11% of the respondents rated the availability of FUTA network at the LTs as always available, 44.5% opined that the network is often available, 35% as rarely available and 9.5 % as never available. The result shows that the network is often available at the location.

4.5% of the respondents graded FUTA network as always available, 17.0 % as often available, 53.0% as rarely available and 25.0 % as never available. This result shows that the availability of FUTA network at the hostels is low. According to the research, 2.0% of the respondents rated FUTA network as always available at the university south gate area, 7.5% rated it as often available, 49.5 rated it as rarely available and 41.5% as never available. This result shows that the availability of the network at the university south gate is very low. This means that the signal of FUTA network is very low at south gate area

hence low availability and connectivity at this area.

4% of the respondents opined that FUTA network is always available at North gate area, 11% as often available, 57% as rarely available and 128 as never available this shows that the signal of FUAT network at this area is very low and too low to establish a wireless connection to the network hence low availability and connection at this location. 15% of the respondent rated the availability of FUTA network at Obaekere network as high, 49.5% as often available, 25.0% as rarely available and 10.5 % as never available. The result shows that the availability of FUTA network in the area is high. A summary of respondents regarding availability is presented in Figures 3.

Accessibility of FUTA network

52% of the respondents opined that FUTA network is available at early morning hours (7:00 -11:30am), 12.5% at late morning hours (11 am - 12pm), 14.5% at afternoon (12.00pm-2.00pm) and 20% at evening hours (3.00pm - 4.00pm). The respondents rating of the accessibility of FUTA

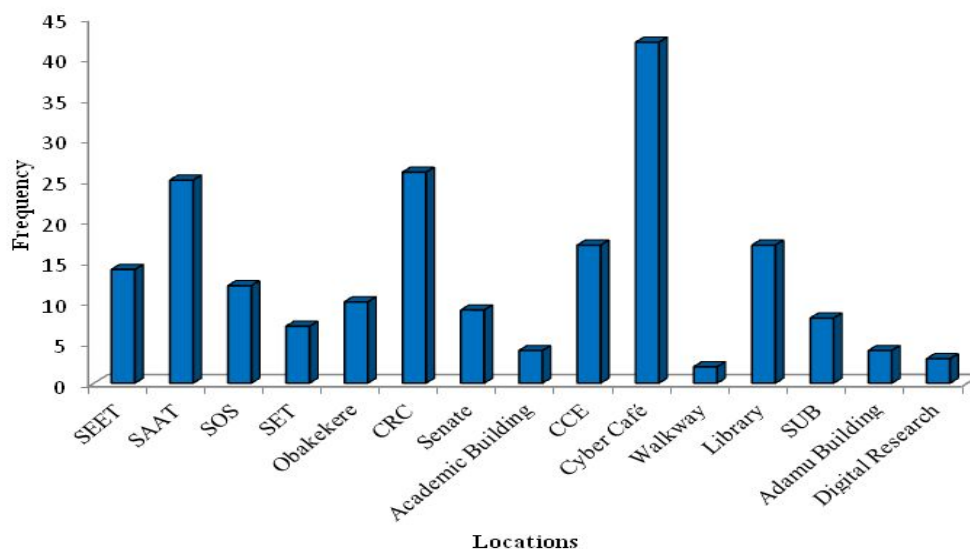


Figure 2: Frequency of users at various locations

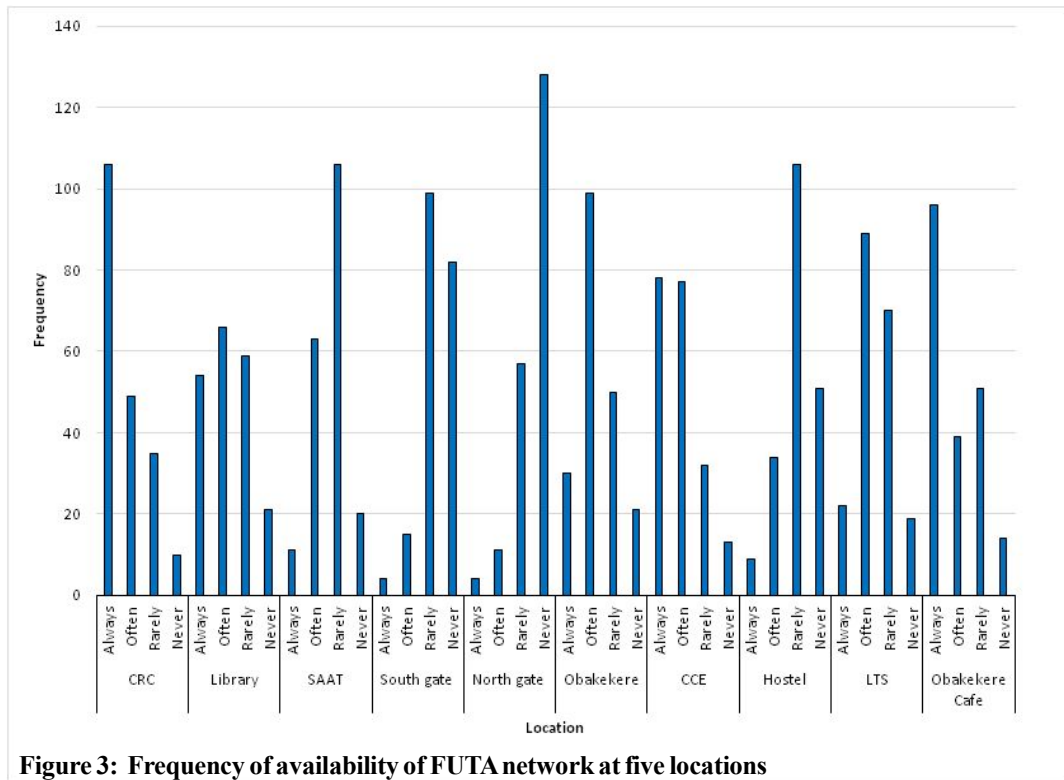


Figure 3: Frequency of availability of FUTA network at five locations

network shows that it is most available at early morning hours, when users are fewer on the network.

Speed Of connection

From the research, the opinion of respondents shows that connection to FUTA network is fast at some times and slower at other times. 50.5% of the respondents opined that the network is fast at early morning hours, 27.5% opined the network is fast in the evening, 11.5% opined that the network is fast at late morning hours while 11.0% opined that the network is fast in the afternoon. From this result, the time when the respondents get fastest connection to the network is during the early morning hours. From Figure 4, it can be seen that the accessibility of the network is directly proportional to the speed.

Challenges encountered by users of FUTA network

Some of the challenges users of the network encounter include poor power supply, loss of server, problem loading a page, expiration of unused browsing tickets, low throughput, short operation hours, slow internet connection, no automatic log out of tickets. 41.5% of the respondents rarely connect to the network when there is power failure, 26% of the respondents don't connect at all, 12.5 always connect while 12.5 often connects in the absence of electrical power supply. Other analysis can be gleaned from Figure 5. A total of 14% of the respondents gets connection to FUTA network when there is no electricity by means of inverter, 19% via generator, while 59% rely on the residual battery on their laptop computers.

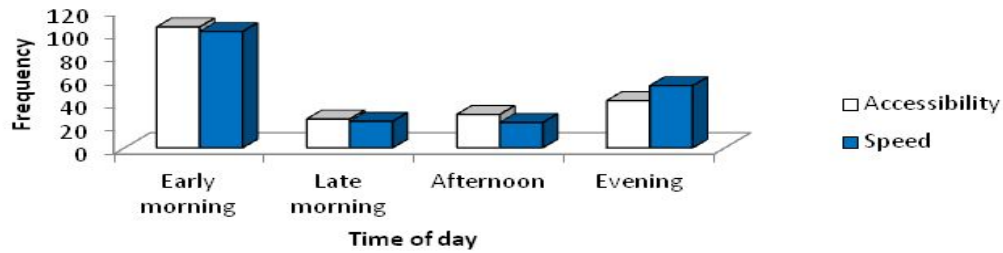


Figure 4: Frequency of availability of FUTA network at five other locations

CRITICAL ANALYSIS OF THE RESEARCH

Respondents to the questionnaire

Respondents were drawn from four major categories (academic staff 16%, non-academic staff 3%, undergraduate students 60.5%, and post-graduate student 20.5%). A majority of the respondents were undergraduate students of the university. This shows that the primary users of the network are the undergraduate students of the university.

Connectivity

FUTA network covers most locations within the university but the signal strength of the network at these locations differ. As a result of this, those

areas with higher signal strength get strong connection to the network while areas with low signal strength secure weak connection some areas rarely gets connection due to poor signal. Results from the analysis shows that the areas with high connectivity are CRC, CCE, Obakekere café, SAAT, SOS and SEET. Other areas get connection to FUTA network but the connection is not very strong hence not reliable at those areas.

The analysis shows clearly that the percentage of respondents who connect to FUTA network off campus areas are negligible. Off campus areas include areas around the university south

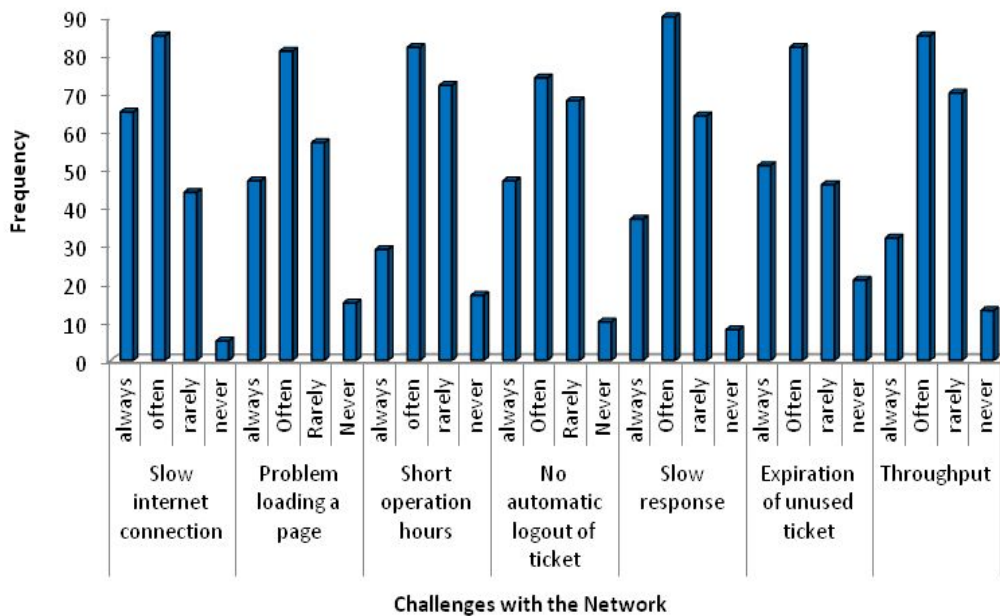


Figure 5: Various challenges encountered on FUTA network

gate and north gate. These are the major areas where students reside since the hostel facilities on campus are not large enough to accommodate the entire population of the university.

Availability

Though the network is available at so many locations, just a few of these locations recorded high percentage of availability. These locations include Obakekere café, Computer Resource centre, Centre for continuing education, the university library and the school of Agriculture and Agricultural technology. These are the areas with signal strength strong enough to establish a wireless connection to the network at operation hours, hence the availability and connectivity to FUTA network is highest at these locations.

Accessibility

The accessibility of FUTA network from the result of the survey indicates that the network is not accessible at some time of the day. The network is most accessible at early morning hours when the workload is low, it becomes less accessible at late morning hours and in the afternoon when the workload is high and then becomes fairly accessible towards the evening hours. This directly determines the performance of the network since it affects the connection to

it. The network could become inaccessible suddenly and this prevents users from logging out their browsing tickets which reads on and could become useless to the users if it expires before the connection is restored. This depends on how long it takes before the network gets accessible again. The issue of no automatic logging out of browsing ticket is one of the major challenges of the network that needs to be addressed quickly.

Challenges of FUTA Network

Many problems still beset efficient performance of FUTA network in the university. Amongst the problems of the network are;

1. unsteady power supply,
2. loss of server,
3. low bandwidth to sustain smooth services on the internet,
4. expiration of unused browsing tickets,
5. low throughput,
6. short operation hours,
7. slow internet connection, and
8. no automatic log out of tickets after specified time elapse.

All these factors have direct effects on the connectivity, speed, availability and accessibility of the network.

PROPOSED SOLUTIONS

Use of Fiber optics

FUTA's network is linked via wireless outdoor radio (ODU); hence it is prone to loss of signal, difficult line of sight, thunder strike, power surge and many more. This often damages the outdoor radio or alters the signal strength. The best way to connect FUTA to her internet service provider and the remote sites to CRC is via fiber optics. Fiber optic is the best proposed media of connection in FUTA because it is less susceptible to noise, secure, fast, scalable, and replaceable and with low latency (Dahunsi, 2015).

Increase data allowance

Assigned/designated data allowance is rather too small for an academic environment where lots of downloads need to be made for research, increase in the data allowance will boost performance capability of FUTA network. The University bandwidth should be increased to avoid congestion which results in slow signal speed. With increase in the size of the university in terms of number of students and staff strength, high internet utilization level is expected which could lead to traffic congestion. If congestion is not controlled, it could lead to system

breakdown (Falaki and Sorensen, 1992; Ali, Asha and Tofik, 2012).

Improved signal strength

Access Point to the WLAN of the University should be provided to all buildings in the university and areas with low signal reception should be investigated and provided with improved signal reception. Considering the fact that FUTA only gives a number of her students' accommodation on campus, University's WLAN should be extended to areas off campus. This will enable students residing in areas off campus (especially those residing very close to the University) to get access to the network from their residence (Jose and Peter, 1994).

Network monitoring

The network should be monitored and the operations that take place on the network should

be streamlined to give educational/academic activities priority over other activities that are less educational so as to conserve the bandwidth and reduce the load on the assigned bandwidth. Network monitoring tools such as should be employed to constantly monitor the network (BWMO, 2006).

Alternative power supply

It is a general knowledge that Nigeria is plagued with incessant power failure and this should be reduced to the barest minimum within the University. The university should put in place alternative means of generating electrical power as suggested by Melodi (Melodi, 2011) especially in designated areas under the coverage of FUTA WLAN to enable better performance of the network and availability.

CONCLUSION

This research work carried out a performance evaluation of FUTA network making use of a structured questionnaire and secondary information from other sources like interviews, literature reviews and online research. The availability, connectivity, accessibility and also challenges and problems limiting the effective performance of FUTA network were studied and some solutions were proffered.

FUTA network plays a vital role in providing internet services for students, Staff and other users of the network. The internet service

provided is utilized by users for purposes like project research, term paper and assignments, online registration, lecture preparation, electronic mail, electronic commerce, chatting, news and general browsing. The availability and accessibility of the network affects the various activities carried out on the network. From the research results, only a few of the numerous locations under the coverage of FUTA network gets optimum availability of the network at the operation hours.

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