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A Survey on 5G Network for the Internet of Things: Communication Technologies and Challenges

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Abstract – *The Internet of things has introduced multiple technologies, real-time analytics, machine type communication, Long term evolution, wireless network. The state-of-the-art research on 5G network technologies is reviewed with the focus on important technologies 5G Internet of things promises to support in one integrated network: IoV, IoT, MCC, SG, Big Data, and D2D communications, enhanced machine type communication, 3rd Generation Partnership Project, cellular-based Low Power Wide Area. In the world of IoT, Machine-to-Machine Communication (M2M) and Smart Factories the available mobile networks most likely will not be able to handle the high traffic load sufficiently. The 5G networks support a wide range of applications such as smart home, autonomous driving, drone operations, health and mission critical applications, Industrial IoT and entertainment and multimedia.*

Key Words: **LPWA, M2M, Device-to-Device communication, Indoor System, smart health, Cloud Computing, Big Data, Wireless Communication.**

1. INTRODUCTION

Now-a-days and in the coming future, to accomplish difficulties of the coming era, mobile communication networks of today will have to develop in various manners. In addition, a fully mobile and connected society is expected, which will be characterized by an incredible amount of growth in connectivity, traffic volume, and a much broader range of usage scenarios. A number of key enabling technicals in 5G are developed to offer new infrastructure and design with inherent capabilities required by the future IoT. The status of work present on the important technologies and service models for the next generation of mobile systems and networks.

In general, the various applications opportunities enabled by the IoT are countless and its full potential will only be realized by ensuring that more smart devices are connected through the Internet. Survey on 5G mobile networks are search to ensure that massive devices and new services such as enhance Mobile Broadband, massive Machine-Type Communications, Critical Communications and Network Operations are efficiently support. It is a conceptualization of a cyber-physical system, a way for using embedded technologies in the future-generation network. Digitalization builds incredible prospects for mobile communication but suffers from severe challenges towards mobile communication technologies. To improve the performance innumerable technologies are applied to 5G systems, such as Heterogeneous Networks, Massive Multiple-Input Multiple-Output, Internet-of-Vehicles, Device-to-Device communications and Software Defined Network. A notion to switch towards fifth generation is based on drifts of current; it is often presumed that fifth generation mobile networks must resolved six problems that are not successfully resolved by fourth generation mobile communication networks i.e. higher data rate, massive device connectivity, higher capacity, less cost & consistent, Quality of Experience and lower End-to-End latency. Although 5G is not expected until 2020, an increasing number of companies are investing now and are creating 5G products. Development of the new mobile wireless standard is being led by companies such as Intel, Qualcomm, Nokia, Ericsson, BT, Verizon, AT&T, Samsung, etc.

II. OBJECTIVES

- To find out if networking is more fastest to communication when other network compared to the 5G network.
- To understand the challenges through the network.
- To analyze different methods that can be used in networking process.

These objectives will be attained by checking through survey analysis based on the following hypotheses as under:-

H1: "5G network for the Internet of things is the best because most of the earlier people preferring to using this network as it fastest network for any communication."

H2: "5G network works best because they use powerful broadband of network which to help improving our communication & technologies of Internet of things.

III. SPEED Of 5G NETWORK

5G "G" means Generation.5G design to meet the very large growth in data and connectivity of the today's modern. 5G is suit of radio, Network, and Software Technology used for mobile and Wireless Communication. Compared to the first four generation of wireless, 5G will use a far wider array of radio spectrum- low frequencies for broad coverage and high frequencies for super-high data speeds. Society, the internet of things with billons of connected devices, and tomorrow's innovations. For communities, 5G will enable the connection of billons of device for our smart cities, smart schools and smart homes, smart and safer vehicles, enhance health care and education, and provide a safer and more efficient place to live. For business and industry, 5G and IOT provide a wealth of data allowing them to gain insight into their operations like never before. Business will operate and make key decisions driven by data innovate in agriculture, smart farms and manufacturing paving the way for cast savings, better customer experience and long-term growth.5G will keep s connected in tomorrow's smart cities, smart homes and smart schools, and enable opportunities that we haven't even through of yet. The primer benefits of 5G devices will be significantly faster speeds in data access, downloading and streaming content. In addition, 5G devices will have increased computing power and make use of the lower latency, meaning that the devices will enjoy virtual instantaneous connections to the network, as well as greater connectivity when on the move due to the use of advanced antenna beam streaming. Most operators will initially integrate 5G network with existing 4G networks to provide a continues connection. 5G networking is end-to-end strategy. The Radio Access Network- consists of various types of facilities including small cells, towers, masts and dedicated in-building and home system that connect mobile users and wireless devices to the main core network. Many of the advanced features of 5G including network function virtualization and network slicing for different applications and services, will be managed in the core. The following illustration shows the examples of local cloud servers providing faster content to users (movie streaming) and low latency applications for vehicles collision avoidance systems.

IV. BROADBAND CONNECTIVITY

A method of Communication which uses and provide wide band of frequencies. Broadband is also called as wideband. The wider (or border) the bandwidth of channel, the greater the information-carrying capacity.

Bandwidth able to provide speed in Mbits/sec. Mainly ADSL Broadband is used in Homes and offices. One characteristic that measures network performance is bandwidth. However, the term can be used in two different contexts with two different measuring values: bandwidth in hertz and bandwidth in bits per second. The term bandwidth can also refer to the number of bits per second that a channel, a link or even a network can transmit. For example, one can say the bandwidth of a Fast Ethernet network is a maximum of 100 Mbps. This means that this network can send 100 Mbps. A digital signal that carries information is nonperiodic. The bandwidth is theoretically infinite, but many of the components have such a small amplitude that they can be ignored. Although the actual bandwidth of a digital signal is infinite, the effective bandwidth is finite. The bandwidth used for transportation analogy, the number of vehicals, not the number of people being carried, affects the traffic. More changes in signal mean injecting more frequencies into the signal. The bandwidth reflects the range of frequencies. There is the relationship between the baud rate (signal rate) and the bandwidth. In addition, the amplitude of each component is an important issue.

V. LITERATURE REVIEW

In a study published by Akpakwu, et al. [1] in 2017, in this paper has unique features of the current IoT infrastructure, with main focus on 5G mobile networks for enabling the new service requirements.

In a study published by Li, et al. [2] in 2018, the paper introduced the current research state-of-the-art of 5G IoT, key enabling technologies, and main research trends and challenges in 5G IoT.

In a study published by Tripathi, et al. [3] in 2019, in this survey the paper briefly introduced various wireless generation, various issues and challenges in implementation of 5G networks and its solutions are discussed.

In a study published by Hossain, et al. [4] in 2016, in this survey, they discussed the network architecture, service framework, and topologies that will play an important role to meet the requirements of future networking infrastructure that is 5G network.

In a study published by Gohil, et al. [6] in 2013, in this paper publisher surveyed 5G technology for mobile communication. Current work is in the modules that shall offer the best Operating System and lowest cost for a specified service using one or more than one wireless technology at the same time from the 5G mobile.

In a study published by Al-Falahy, et al. [7] in 2017, the publisher surveyed various researched works done on wireless networking challenges and impact for this paper that will play an important role to analyze all networking challenges.

In a study published by Temesvári, et al. [9] in 2019, in current paper publisher presented mobile communications were analysed in terms of manufacturing, elaborating on outdoor and indoor radio systems and available and future mobile technologies. The paper involved a detailed study on radio frequency, enabling technologies to proved that more of the network problem are arise from networking frequency.

In a study published by Cengiz, et al. [10] in 2018, the publisher gives a convenient background and some reasonable solutions are discussed systematically in terms of several titles for next generation 5G system. The paper introduced novel technology and challenges are unique in each technique and they proved to be each technology analyzed separately. They envisaged data rates which not meet user demands in cloud-based applications. Some reasonable solutions are proved systematically in terms of several titles.

In a study published by Pereira, et al. [11] in 2013, in this research paper, the architecture was composed of Embedded internet systems and used standard communication protocols. One important feature was used of the Service-oriented architecture paradigm. The researcher presented, a new architecture for mobile cloud sensor applications based on the Internet of Things. They proposed solution is a viable solution for standards-based high performance sensor and actuator platforms.

In a study published by Hong, et al. [12] in 2014, the researcher presented recent research progress on the EE-SE trade-off of cognitive cellular networks with respected to different architectures, levels of analysis, and capacity metrics. They have demonstrated that the EE-SE relationship in cognitive cellular networks can be rather different from conventional systems.

In a study published by Wübben, et al. [13] in 2014, the researcher presented recent research progress on the EE-SE trade-off of cognitive cellular networks with respected to different architectures, levels of analysis, and capacity metrics. This article discussed benefits and challenges that may be implied by cloud-computing platforms on signal processing algorithms. The novel RANaaS concept was introduced, which realizes cloud technologies in 5G mobile networks and allows for a flexible functional split between RAPs and the centralized cloud-platform.

In a study published by Bhalla, et al. [15] in 2010, the researcher presented evolution and development of various generations of mobile wireless technology along with their significance and advantages of one over the other. In this research paper, Current research in mobile wireless technology concentrates on advance implementation of 4G technology and 5G technology proved systematically.

In a study published by Yassein, et al. [16] in 2017, in this paper publisher discussed IoT applications and requirements, while in 5G as IoT requirements solution we explain what many researchers are proposing for 5G to achieve these requirements. The researcher are also discussed features and challenges of each technology.

In a study published by Yassein, et al. [17] in 2006, this researcher briefly introduced the performance of Adjusted

Probabilistic flooding on the AODV protocol which is based on simple flooding in MANETs to increase saved rebroadcasts. The researcher proved algorithm determines the rebroadcast probability by taking into account the network density.

In a study published by Ju Xingzhong, et al. [19] in 2019, The researcher presented studies and analyzes the current status of the development of the Internet of Things, focusing on the analysis of the arrival of 5G technology, and the opportunities and challenges brought about by the development of the Internet of Things.

In a study published by Palattella, et al. [20] in 2016, the researcher presented some technologies which are prevalent in a specific application domain, such as Bluetooth Low Energy in Personal Area Networks, Zigbee in Home Automation systems and many more.

In a study published by Ejaz, et al. [21] in 2017, in this paper publisher proposed a spectrum sharing framework for IoT in cognitive networks, framework consists of multiband spectrum access and cross-layer reconfiguration for resource allocation.

In a study published by Ni, et al. [22] in 2018, In this paper researcher proposed an efficient and secure service-oriented authentication framework for IoT services in 5G network also publisher demonstrated the security and privacy preservation of the proposed framework and its efficiency and practicality through simulation.

VI. METHODOLOGY

A. Participants

A study was conducted to know people's interest and experience with 5G network as source of other technologies and also the population facing networking problem needed to be analyzed. This study was conducted through Google forms which was circulated randomly since the study planned according to the availability need not require specific population but a population which uses networking technologies on daily basis. A total of 40 participants were involved in this survey (28 females and 12 males). The survey was conducted within the city limits of Mumbai and it involved no biased condition since adapting the technique of random sampling.

B. Materials

Google Forms were the source of the conducted survey. The population of the conducted survey was done out of convenience and availability therefore in the population maximum were students. The only criteria which was to be accomplished was to find out the population which had an average use of network technology on a daily basis

C. Procedure

A google form which was chosen as a medium to conduct the survey was circulated by using the sampling technique of simple random sampling which involves an equal chance of in a population of inclusion which will help in having a fair opportunity to test the both hypothesis. The Google Form was circulated for almost a week which resulted with a set of 40 responses.

VII. EXPERIMENT

The test scores of the hypothesis-oriented parameters were taken into consideration by performing Chi-Square test with a confidence level of 95 percent. The questions that was appropriate for our study was sorted out the survey results which may result in the impact of our hypothesis. The participant in the survey must go through the details of the 5G Network and came across various question which provided an opinion towards their need for improvement in speed of network for their respective devices. A distinguishing factor which was to be considered in the survey was to be chosen which was gender parameter to notice the difference in response values while performing the tests. A calculated value for the analysed values in accordance to the parameter oriented questions was further compared to a tabulated value by considering the degree of freedom as 5% according to which the rejection of null hypothesis could be impacted which is inversely proportional to alternate hypothesis. One of the survey questions: Do you think 5G network is faster than 4G network? One: Have u faced any broadband issues while using 5G network? calculated value of 1.1111. These values were calculated by applying formulas which moved in accordance with the observed as well as expected values out of which a further calculation is required for expected values. These values were checked with a tabulated value of 3.84 (having a confidence level of 95 percent).

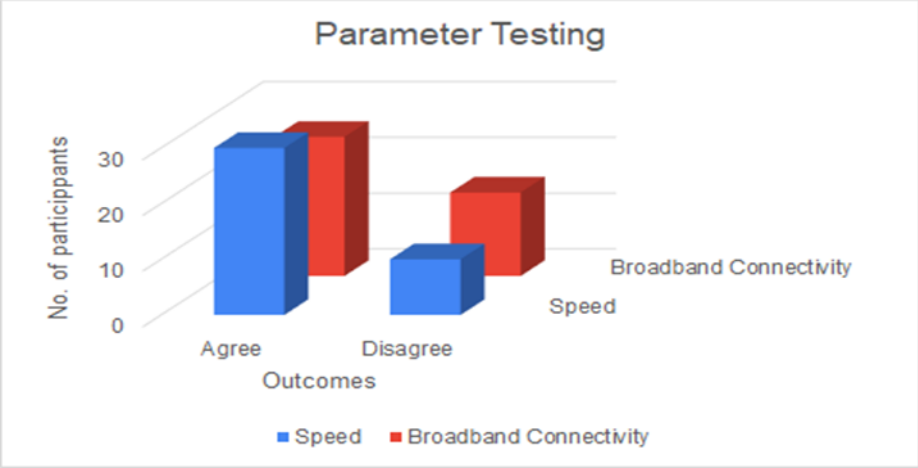

Fig. 1 The comparison of test values obtained through survey regarding i] Speed ii] Broadband Connectivity

VIII. RESULT

The test scores of the survey which was analysed and experimented on a random population on the basis of the specific parameters resulted that the population is likely to trust the Speed for 5G network since major population had been using it for networking purposes therefore if such a mechanism was implemented on fully furnished scale, the acceptance for such a 5G networking technology would be majorly supported which is a big step towards proving H1.

The test scores in accordance with H2 could just provide some outcomes which supports the hypothesis. Since the participant's experiences in the Broadband Connectivity was specific a partial proof of the H2 is resulted. For the complete proof, the population must be specific, which provides a proper description of Broadband Connectivity out of which categorizing of Broadband Connectivity based on networking problem could be done. The proper explanation of how the Broadband Connectivity problem scenarios are present is provided in the section IV. Out of which readers may understand about the Broadband Connectivity Problem and then consider it for a survey which can be attributed to future work.

IX. FUTURE WORK

For some applications, such as process monitoring, healthcare, and vehicle testing, a reliable stream of sensor data is important. This is especially true for high-frequency data such as vibration data, audio signals, CAN-bus data, etc.

In 5G technology will offer high resolution for crazy cell phone user and bi-directional large bandwidth shaping. order to fully support these types of applications, the system should be enhanced with support for Quality of Service. The advanced billing interfaces of 5G technology will makes it more attractive and effective. 5G technology will provide subscriber supervision tools for fast action. The 5G technology will provide up to 25 Mbps connectivity speed. The new 5G technology will take all delivery service out of business prospect. The uploading and downloading speed of 5G technology will touch the peak. The 5G technology network will offer enhanced and available connectivity just about the world.

X. CONCLUSIONS

As a prospect for future work, There are some other projects, which are undertaken for 5G technologies. 5G technologies and the Internet of Things are among the main elements which will shape the future of the Internet in the coming years.

The role which 5G communications might play in the shift of IoT from infrastructure-driven to business-driven, and some indications on how the cellular value chain might get transformed by massive IoT deployments.5G technology play a vital role in smart cities, smart schools, smart homes and business-industry etc. This scenario was highlighted in the performed study and hope these scenarios are well considered in future to accomplish a mission to provide an 5G networking communication and challenges in IoT.

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XII. GLOSSARY

[1] 5G: Fifth generation mobile technology which provides broadband access.

[2] Wi-Fi: Wireless Fidelity

[3] Chi-Square Test: Non parametric test of independence used for comparison with categorical and associated variables.

[4] M2M: Machine-to-Machine Communication.

[5] D2D: Device-to-Device Communication.

REFERENCES

[1] Akpakwu, G., Silva, B., Hancke, G. P., & Abu-Mahfouz, A. M. (2017, December 4). A Survey on 5G Networks for the Internet of Things: Communication Technologies and Challenges. IEEE Access, 05(12), 3619–3647. https://doi.org/10.1109/ACCESS.2017.2779844

[2] Li, S., Xu, L. D., & Zhao, S. (2018, February 1). 5G Internet of Things: A survey. Journal of Industrial Information Integration, 10, 1–28. https://doi.org/10.1016/j.jii.2018.01.005

[3] Tripathi, A. K., Rajak, A., & Shrivastava, A. K. (2019, August 30). Role of 5G Networks: Issues, Challenges and Applications. International Journal of Engineering and Advanced Technology (IJEAT), 8(6), 3172–3178. https://doi.org/10.35940/ijeat.F9270.088619

[4] Le, N. T., Hossain, M. A., Islam, A., Kim, D., Choi, Y.-J., & Jang, Y. M. (2016, December 12). Survey of Promising Technologies for 5G Networks. Mobile Information Systems, 2016, 1–25. https://doi.org/10.1155/2016/2676589

[5] Singh, S., Saxena, N., Roy, A., & Kim, H. (2016, February 18). A Survey on 5G Network Technologies from Social Perspective. IETE Technical Review, 34(1), 30–39. https://doi.org/10.1080/02564602.2016.1141077

[6] Gohil, A., Modi, H., & Patel, S. K. (2013). 5G Technology of Mobile Communication: A Survey. 2013 International Conference on Intelligent Systems and Signal Processing (ISSP), 288–292. https://doi.org/10.1109/issp.2013.6526920

[7] Al-Falahy, N., & Alani, O. Y. (2017). Technologies for 5G networks: Challenges and opportunities. IT Professional, 19(1), 12–20. https://doi.org/10.1109/mitp.2017.9

[8] Zikria, Y. B., Kim, S. W., Afzal, M. K., Wang, H., & Rehmani, M. H. (2018, October 11). 5G Mobile Services and Scenarios: Challenges and Solutions. Sustainability, 10(10), 1–9. https://doi.org/10.3390/su10103626

[9] Temesvári, Z. M., Maros, D., & Kadar, P. (2019). Review of Mobile Communication and the 5G in Manufacturing. ScienceDirect, 32, 600–612. https://doi.org/10.1016/j.promfg.2019.02.259

[10] Cengiz, K., & Aydemir, M. (2018, March 15). Next-Generation Infrastructure and Technology Issues in 5G Systems. JOURNAL OF COMMUNICATIONS SOFTWARE AND SYSTEMS, 14(1), 33–39. https://doi.org/10.24138/jcomss.v14i1.422

[11] Pereira, P. P., Eliasson, J., Kyusakov, R., Delsing, J., Raayatinezhad, A., & Johansson, M. (2013, June 10). Enabling Cloud-connectivity for Mobile Internet of Things Applications. 2013 IEEE

[12] Hong, X., Wang, J., Wang, C.-X., & Shi, J. S. (2014, July 15). Cognitive Radio in 5G: A Perspective on Energy-Spectral Efficiency Trade-off. IEEE Communications Magazine, 52(7), 46–53. https://doi.org/10.1109/MCOM.2014.6852082

[13] Wübben, D., Rost, P., Bartelt, J., Lalam, M., Savin, V., Gorgoglione, M., Dekorsy, A., & Fettweis, G. (2014, October 14). Benefits and Impact of Cloud Computing on 5G Signal Processing: Flexible centralization through cloud-RAN. IEEE Signal Processing Magazine, 31(6), 35–44. https://doi.org/10.1109/MSP.2014.2334952

[14] Jain, A. K., Acharya, R., Jakhar, S., & Mishra, T. (2018, September 27). Fifth Generation (5G) Wireless Technology "Revolution in Telecommunication." ICICCT, 1867–1872. https://doi.org/10.1109/ICICCT.2018.8473011

[15] Bhalla, M. R., & Bhalla, A. V. (2010, October 8). Generations of Mobile Wireless Technology: A Survey. International Journal of Computer Applications, 5(4), 26–32. https://doi.org/10.5120/905-1282

[16] Yassein, M. B. Y., Aljwarneh, S. A., & Al-Sadi, A. A.-S. (2017, November 21). Challenges and Features of IoT Communications in 5G Networks. International Conference on Electrical and Computing Technologies and Applications (ICECTA), 1–5. https://doi.org/10.1109/ICECTA.2017.8251989

[17] Yassein, M. B. Y., Ould-Khaoua, M., Mackenzie, L. M., & Papanastasiou, S. (2006, January 1). Performance Evaluation of Adjusted Probabilistic Broadcasting in MANETs. Performance Evaluation of Adjusted Probabilistic Broadcasting in MANETs, 1–5. http://eprints.gla.ac.uk/3406/

[18] Pandey, S., Kumar, M., Panwar, A., & Singh, I. (2013, April). A Survey: Wireless Mobile Technology Generations with 5G. International Journal of Engineering Research & Technology (IJERT), 2(4), 33–37. https://www.ijert.org/research/a-survey-wireless-mobile-technology-generations-with-5g-IJERTV2IS4073.pdf

[19] Ju Xingzhong, J. X., Qingshu, X., Haifeng, M., & Jiageng, C. (2019, October). The Research on Identity Authentication Scheme of Internet of Things Equipment in 5G Network Environment October 2019. 2019 19th IEEE International Conference on Communication Technology, 312–316. https://doi.org/10.1109/ICCT46805.2019.8947126

[20] Palattella, M. R., Dohler, M., Grieco, A., Rizz, G., Torsner, J., Torsner, J., & Ladid, L. (2016, February 30). Internet of Things in the 5G Era: Enablers, Architecture, and Business Models. IEEE Journal on Selected Areas in Communications, 34(3), 510–527. https://doi.org/10.1109/JSAC.2016.2525418

[21] Ejaz, W., & Ibnkahla, M. (2017, November 20). Multiband Spectrum Sensing and Resource Allocation for IoT in Cognitive 5G Networks. IEEE Internet of Things Journal, 5(1), 150–163. https://doi.org/10.1109/JIOT.2017.2775959

[22] Ni, J., Lin, X., & Shen, X. S. (2018, December 3). Efficient and Secure Service-Oriented Authentication Supporting Network Slicing for 5G-Enabled IoT. IEEE Journal on Selected Areas in Communications, 36(3), 644–657. https://doi.org/10.1109/JSAC.2018.2815418