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Assignment Report: Role of 5G Network in Improving Performance of IoT Devices

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Summary Research Paper's:

Paper1: “Wireless Communication Technologies for IoT in 5G: Vision, Applications, and Challenges”

In this paper, a vision of the IoT is provided which will serve as the major driving force behind the sweeping digital revolution of the future. It provides a detailed overview of communication technologies in the IoT system along with challenges associated with existing technologies and directions of future research for IoT. Based on the assessment of the vital components for IoT in 5G technologies, a short survey was conducted focusing on low power technologies for communication for IoT in 5G. It is evident from the research of this survey that IoT will become the future of humanity in which everything like people, systems and software would be connected via the internet (Khanh et al., 2022).

Paper2: “Technologies Trend towards 5G Network for Smart Health-Care Using IoT: A Review”

This paper is aimed at highlighting the role of 5G networks in tackling the diverse communication requirements of applications related to healthcare in IoT. It has presented a detailed review of smart solutions of health care in IoT assisted by 5G technology. It has concluded that 5G network has a vital role in improving the functionality of IoT devices. In this regard, four diverse scenarios are taken into account considering different conditions for 5G network. Lastly, it discussed the open challenges along with directions for future research with respect to smart health care related to 5G networks (Ahad et al., 2020).

Paper3: “Utilization of 5G Technologies in IoT Applications: Current Limitations by Interference and Network Optimization Difficulties—A Review”

This study proposes the deployment of 5G technologies in the applications of Internet of Things (IoT) along with network optimization challenges and current limitations through inferences. It has presented 5G as well as IoT technologies by providing an explanation of their common architectures, usual implementation of IoT and recurring challenges. This literature review based paper has also provided an in-depth analysis of inference with respect to wireless applications in general, inference with respect to IoT and 5G in particular, along with a discussion regarding possible techniques of optimization for overcoming these challenges. The research is aimed at highlighting the significance to address interference as well as optimizing the performance of network in 5G networks to assure an efficient and reliable connectivity for IoT based devices, which is crucial for adequate functioning of business process. As per the findings of this paper,

the convergence of IoT and 5G technology is a necessary step towards the achievement of more opportunities for business and boosting global connectivity (Pons et al., 2023).

Paper4: “Internet of Things (IoT) for Next-Generation Smart Systems: A Review of Current Challenges, Future Trends and Prospects for Emerging 5G-IoT Scenarios”

In this study, the IoT technology is presented from a bird’s eye view by covering its architectural trends, cases of usage, along with challenges as well as prospects in future. It has also provided an extensive and detailed synopsis of the emerging scenario of 5G-IoT considering a thorough review of the existing literature. It has also made a detailed discussion regarding challenges associated with QoS requirement in today’s 5G-IoT. The detailed review presented in this research will support both academia and industry for making coordinated efforts in bringing about advancements in 5G-IoT technologies (Shafique et al., 2020).

Paper5: “5G Technology in Healthcare and Wearable Devices: A Review”

This paper focuses on the advantages of 5G technologies, which are applied in health care as well as wearable IoT based devices like continuous monitoring of a patient’s health or chronic diseases using 5G, management of prevention of infections using 5G, etc. Precisely, the 5G technology has the potential to directly affect clinical decision making by improving the performance of IoT devices in healthcare. It has concluded that through the widespread embracement of 5G technology by systems of healthcare, sick people becomes capable of accessing specialist health care providers in need and get convenient health care services in a convenient way (Devi et al., 2023).

Paper6: A framework of 5G networks as the foundation for IoTs technology for improved future network

This study is based on literature review on how IoT and 5G technology can integrate effectively in order to achieve immediate transformation on the way people do things. The 5G technology has the potential to transform the IoT into a realistic reality from a mere cerebral concept. Through this technology, devices can be connected directly amid an external central hub, enabling them to share digital resources in an administered manner. This will lead to a more powerful communication for which less battery power, self-contained as well as partitioned functions are required (Modesta et al., 2019).

Critical Analysis:

All the studies are based on an in-depth review of literature regarding the association between 5G technology and an improved performance of IoT devices for individuals and businesses alike. These articles have also discussed challenges associated with the widespread use of IoT devices, implementation of 5G technologies worldwide and their future prospects. At present, there are several challenges faced by connectivity solutions for IoT, for instance, the support for a huge number of digital devices, power-efficiency, standardization, security and device density. Moreover, in order to overcome the challenges associated with the implementation of 5G-IoT because of high rates of data, there is a requirement of not only edge computing based IoT devices but also cloud-based platforms. The papers are heavily based on existing literature and lacks evidence based support including primary data.

Connections:

- 1- Positive Association between 5G and IoT:** All the papers have associated 5G technology and IoT in a positive manner, highlighting the way 5G can enhance the performance of IoT devices in various domains such as health care, creation of smart cities, etc, for individuals and businesses alike.
- 2- Focus on Applications of IoT:** The papers are more focused towards the applications of IoT that how IoT based smart devices have become crucial for humanity to perform everyday tasks.
- 3- Considered 5G-IoT as the Future:** All the articles have considered the integration of 5G technology and IoT as the future with improved performance of devices.
- 4- Requirement for Lightweight Solutions:** Following the consideration of the limitations of resources with respect to IoT, various studies have highlighted the need for lightweight solutions.

Conflicts between the findings:

- 1- Generalized vs. Particularized:** While in some studies like “A framework of 5G networks as the foundation for IoTs technology for improved future network”, the role of 5G networks in enhancing the performance of IoT devices is generalized, in others such as “5G Technology in Healthcare and Wearable Devices: A Review”, the role of these technologies is particularized based on a specific scenario like healthcare.
- 2- Survey Vs. Overview of Literature:** Although most of the articles were based on the review of existing literature, one of the papers “Wireless Communication Technologies for IoT in 5G: Vision, Applications, and Challenges” is based on a short survey to come up with the conclusion of the research.

Synthesis Matrix for Literature Review:

Study	Author s	Year	Research Design	Key Findings/Results	Methodology	Limitations
“Wireless Communication Technologies for IoT in 5G: Vision, Applications, and Challenges”	Khanh et al.	2022	Descriptive	The study has proved that IoT will become the future of humanity in which everything like people, systems and software would be connected via the internet	No data was collected to support this research. It is based on survey of latest communication solutions.	Not based on primary data.
“Technologies Trend towards 5G Network for Smart Health-Care Using IoT: A Review”	Ahad et al.	2020	Descriptive	This study has concluded that 5G network has a vital role in improving the functionality of IoT devices with respect to health care.	Based on literature review.	Not based on primary data
“Utilization of 5G Technologies in IoT Applications: Current Limitations by Interference and Network Optimization Difficulties—A Review”	Pons et al.	2023	Descriptive	This study has found that the convergence of IoT and 5G technology is a necessary step towards achieving more opportunities for business and boosting global connectivity.	Based on literature review.	Not based on primary data
“Internet of Things (IoT) for Next-Generation Smart Systems: A Review of Current	Shafique et al.	2020	Descriptive	This paper has concluded that its research will support both academia and industry for making coordinated	Based on literature review.	Not based on primary data

Challenges, Future Trends and Prospects for Emerging 5G-IoT Scenarios”				efforts in bringing about advancements in 5G-IoT technologies		
“5G Technology in Healthcare and Wearable Devices: A Review”	Devi et al.	2023	Descriptive	It has concluded that through the widespread embracement of 5G technology by systems of healthcare, sick people becomes capable of accessing specialists and get healthcare services timely and in a convenient way.	Based on literature review.	Not based on primary data
“A framework of 5G networks as the foundation for IoTs technology for improved future network “	Modesta et al.	2019	Descriptive	This study has concluded that through 5G technology, devices can be connected directly amid an external central hub, enabling devices to share digital resources in an administered manner.	Based on literature review.	Not based on primary data

References:

- Khanh, Q.V. *et al.* (2022). Wireless Communication Technologies for IOT in 5G: Vision, applications, and challenges, *Wireless Communications and Mobile Computing*, 2022, 1–12. doi:10.1155/2022/3229294.
- Pons, M. *et al.* (2023). Utilization of 5G Technologies in IOT applications: Current limitations by interference and network optimization difficulties—A Review, *Sensors*, 23(8), 1-41. doi:10.3390/s23083876.
- Ahad, A. *et al.* (2020). Technologies trend towards 5G network for smart health-care using IOT: A Review, *Sensors*, 20(14), 1–22. doi:10.3390/s20144047.
- Shafique, K. *et al.* (2020). Internet of things (IOT) for next-generation smart systems: A review of current challenges, future trends and prospects for emerging 5G-IOT scenarios, *IEEE Access*, 8, 23022–23040. doi:10.1109/access.2020.2970118.
- Devi, D.H. *et al.* (2023). 5G technology in healthcare and Wearable Devices: A Review, *Sensors*, 23(5), 1–21. doi:10.3390/s23052519.
- Modesta, E.E., Francis, A.O. and Anthony, O.O. (2019). A framework of 5G networks as the foundation for IoTs technology for Improved Future Network, *International Journal of Physical Sciences*, 14(10), 97–107. doi:10.5897/ijps2018.4782.