

5G Mobile Communication Integrating Robot Controller Communication Model

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Abstract

In broadening its applicability to a variety of industries, 5G technology not only meets the vast data traffic demands but also broadens the potential for the development of intelligent communication while increasing productivity. Despite the widespread usage of 5G mobile communication technology in communication engineering, market development has become more complex due to the quick pace of technological innovation. The actual use of 5G technology in communication engineering is constrained by this circumstance, which impedes advancement in both fields. This paper incorporates a communication technique using robot controllers to address this issue. We thoroughly study the use of 5G technology in communication engineering by examining the features and present uses of mobile communication technology. This study conducts simulated tests, analyzing the use of 5G technology in communication engineering based on three crucial aspects: throughput rate, energy efficiency, and signal suppression impact. This is done to illustrate the efficacy of the robot controller communication technique. The outcomes are then contrasted with conventional communication techniques. The results of the signal suppression trials are compelling: whereas the average peak signal level used in conventional communication methods is 18.134 dB, the average peak level used in the method described in this work is substantially lower at 11.296 dB. As a result, communication engineering professionals can benefit practically from combining 5G technology with the robot controller communication approach.

Keywords: practically, communication, conventional, 5G technology

I. Introduction

In the age of information technology, the development of mobile communication technology has improved social production and everyday living efficiency while also enhancing the material and spiritual well-being of individuals. As 5G technology becomes more widely used, the mobile communication sector is developing toward higher-quality services. The quick transmission of data in communication engineering is made possible by 5G technology, which is a significant advancement over 4G

technology. This raises the bar for communication project building and offers crucial support for the development of intelligent network communication in the years to come.

The uncertainty surrounding its growth and the complexity of the market environment and structure present difficulties for the actual deployment of 5G technology in communication engineering, notwithstanding the potential benefits. As a result, there are still important problems in both sectors that need to be solved. Therefore, it becomes crucial to improve the

alignment and compatibility between the two as well as the practical utility of 5G mobile communication technology in communication engineering.

Target task execution is greatly assisted by the robot controllers' chosen method of communication. It plays a crucial role in attaining control goals as a means of communication that enables interactions between autonomous machine systems. As wireless communication and robot technologies have made considerable strides lately, researchers have recently looked into a variety of 5G mobile communication technology topics in communication engineering. To solve the uncertainties in communication engineering, Bhattacharjee designed a 5G mobile communication authentication system based on artificial intelligence [1]. In order to improve data dependability for 5G mobile communication technologies, particularly on multipath fading channels, Hussain and Audah introduced hard-decision decoding approaches for orthogonal frequency division multiplexing systems [2]. To improve the service quality of 5G mobile communication technology and enable seamless vertical handovers in communication engineering, Gharsallah et al. developed an improved vertical handover approach [3]. The ability of 5G networks to achieve exceptionally low latency and high-speed data transmission was stressed by Abbas et al. [4], who also described their uses and recent advancements in communication engineering. An end-to-end hybrid satellite-terrestrial network was introduced by Zhang et al. to improve the manageability and robustness of upcoming 5G technologies in communication engineering [5]. With the goal of reducing power consumption while still achieving user quality of service

standards in communication engineering, Mowla et al. suggested an energy-efficient communication model for 5G heterogeneous networks [6].

II. Overview of 5G Mobile Communication Technology

The progression after 4G is represented by 5G mobile communication technology. It provides society with quicker and more convenient mobile communication services as an update and enhancement of 4G. Figure 1 depicts its core structure. 5G technology has drawn more and more public attention as communication technical infrastructure continues to advance. Research and deployment initiatives for 5G mobile communication technology have been actively started by many nations and organizations, including China, who have well-established mobile communication sectors.

In contrast to 4G technology, 5G technology significantly increases the speed and efficiency of resource use. This is made possible by its distinctive characteristics, which include high capacity, high stability, low latency, and wide coverage. These all significantly improve the effectiveness and convenience of both daily life and manufacturing. Table 1 lists the technical requirements for 5G technology.

As shown in Table 1, when compared to earlier mobile communication technologies, 5G technology sets high expectations for technological performance. Its middle- and high-frequency bands dominate its standardized frequency spectrum, providing users with a superior experience, advancing communication engineering constantly, and opening up new development frontiers.

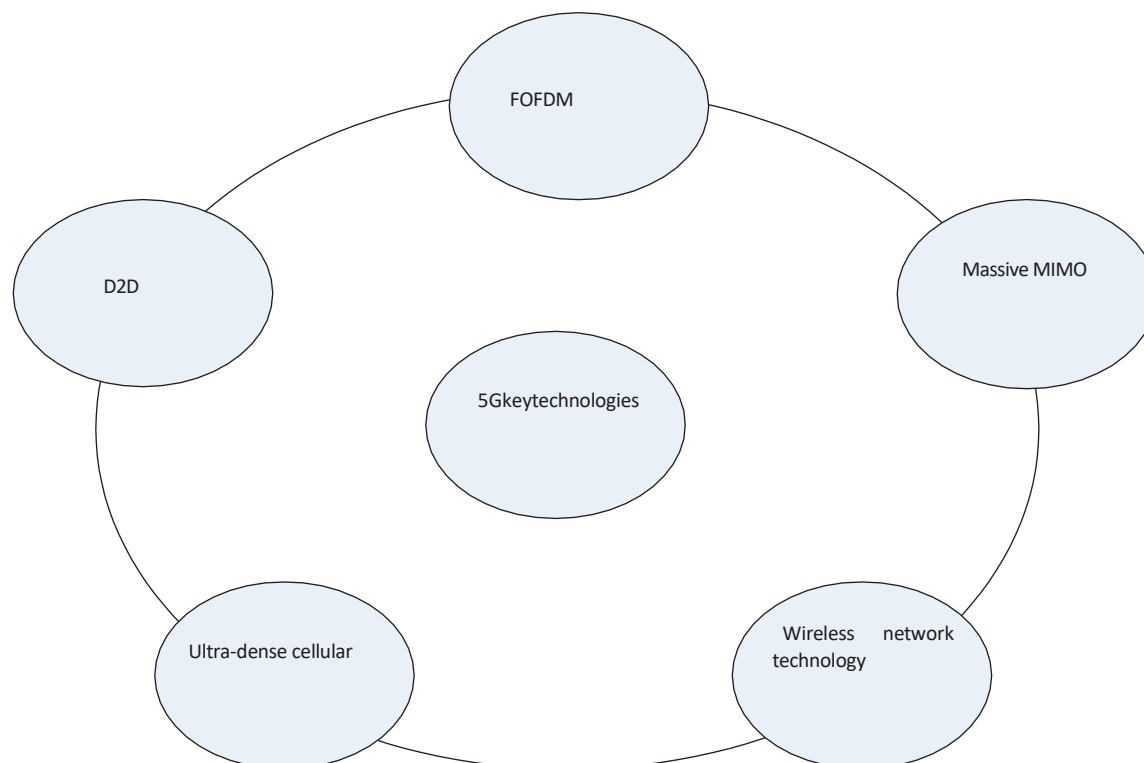


Fig.1 : 5G Technology

The cost of coverage, however, rises as parameter criteria are raised since there is a commensurate rise in transmission losses. As a result, a number of key technologies are required for 5G technology to be realized [9]. Currently, the industry-recognized key technologies for 5G mobile communication include Device-to-Device (D2D) communication, Massive Multiple-Input Multiple-Output (Massive MIMO), Software-Defined Wireless Network Technology, Filtered-Orthogonal Frequency Division Multiplexing (F-OFDM), and Ultra-Dense Cellular Networks (UDCN).

III. Related Work

Since the middle of the 1980s, when the communication industry began to grow quickly, the use of 5G mobile communication technology in communication engineering has significantly gained momentum. For large operators, communication engineering has taken center stage. The costs and dangers involved with communication engineering building have risen, nevertheless, as a result of the telecoms industry's intense competitiveness. Practicality and value are

becoming increasingly in-demand in communication engineering construction.

One of the most popular mobile communication technologies available today, 5G has found extensive use in many communication applications. It has significantly increased project advantages and efficiency, raising the standard of construction for communication engineering while boosting operations' intelligence and flexibility. The following four points serve as a summary of the application value of 5G in communication engineering:

Network Capacity: By permitting direct connections between users and moving away from the conventional base station-centric strategy, 5G technology improves network capacity. Ultra-high access speeds, ultra-low latency, and ultra-high dependability all result in an improved user experience. It maintains data transmission efficiency while balancing data access and output, lowering expenses.

Level of Intelligence: By enabling increases in sensing and judgment, 5G raises the level of intelligence in communication engineering. Based on numerous construction requirements and

situations, including geographic location, user preferences, terminal state, and network context, it customizes solutions. This makes it possible to deploy features, configure resources, and automate processes using data.

Functional Services: 5G technology offers individualized functions and services that support a variety of Internet services. It streamlines and reorganizes network operations, increasing the adaptability and efficiency of network control and forwarding. Ad hoc networks may be directly accessed in the access network thanks to 5G, which also makes deployment and maintenance simple.

Network Environment: By fostering an open technical environment, 5G fosters the growth of new network ecosystems and vertical enterprises. It enables the flexible deployment of services for third parties and promotes communication engineering and third-party application interaction. This raises the network environment's ecological value.

This study addresses numerous communication technical difficulties in addition to the use of 5G technology. These include problems like high energy usage and large signal peaks that have poor transmission impact. The research suggests

integrating the robot controller communication approach to address these issues.

A new area in robotics is the communication between robot controllers. Using wireless networks, it involves real-time information exchange and integration between robots and controllers. This approach offers various crucial qualities, including unpredictability during communication, and improves work efficiency while ensuring system stability

IV. 5G mobile communication technology application simulation in communication engineering:

This study used the MATLAB platform to do simulation experiments in order to show the viability of 5G technology when paired with the communication technique of the robot controller in communication engineering. In the context of communication engineering applications, these studies looked at the throughput rate, energy efficiency, and signal suppression effect of 5G. The performance of 5G technology was also assessed using the conventional communication method in order to offer a comparative analysis.

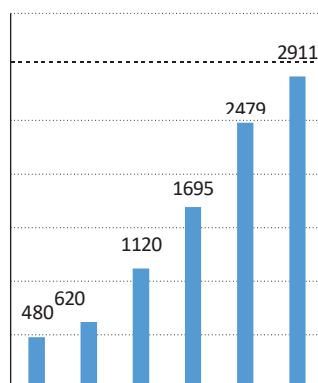


Fig. 2: Robot controller communication method

Test of Throughput Rate: The greatest amount of data that engineering equipment interfaces can take and transmit without any communication issues is referred to as the throughput rate in communication engineering. It serves as an important yardstick for assessing the success of communication projects. This experiment tested the throughput of 5G technology using two

alternative communication techniques while taking into account varied numbers of nodes (ranging from 50 to 100).

The findings, shown in Figure 5, lead to the following important conclusions: Figure 5's results for both methodologies show that, in general, as the number of nodes rises, there is a greater

likelihood of network congestion, which can result in an increase in throughput rate.

However, it becomes clear that the throughput rate attained with the 5G technology under the communication technique in this study showed a noticeable rise when taking into account the entire test results and the magnitude of change. In particular, the throughput rate peaked at 2911 bits per second when there were 100 nodes. This result demonstrates how the communication strategy suggested in this study, when combined with 5G mobile communication technology, efficiently uses the network environment to convey data traffic.

V. Energy-efficiency test

The energy efficiency test evaluates how effectively 5G technology in communication engineering uses energy resources. The market is currently undergoing a thorough construction of communication engineering, and in a setting characterized by supply-demand imbalances, the effective use of communication engineering resources is crucial. The test circumstances

employed in this paper's energy efficiency test are described in Table 3, and the test results are shown in Figure 3

The energy efficiency test results, shown in Figure 3, show that the 5G mobile communication technology, when combined with the robot controller communication method in communication engineering, significantly outperforms the conventional communication method in terms of energy resource utilization efficiency. The findings from 50 rounds of simulation tests using the robot controller communication approach are shown in Figure 3, with the majority of the fluctuations falling between 387 and 453. The test results showed considerable oscillations under the conventional communication approach shown in Figure 6(b), which led to a reduced network lifespan with values ranging from 297 to 379. Surprisingly, the lowest value obtained with the robot controller communication approach was higher than the highest network lifespan value under the conventional method.

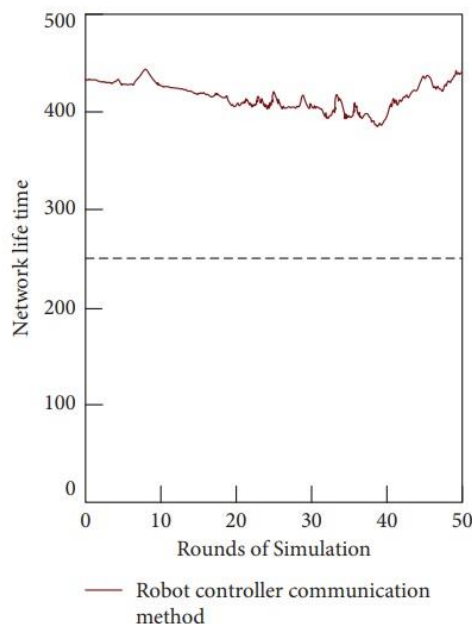


Fig.3: Robot Communication

The combination of the communication technique described in this study with 5G mobile communication technology clearly extends the life of the communication engineering network and

exhibits good energy efficiency from the perspective of network lifespan. The robot controller communication technique can manage and optimize communication engineering network

nodes in real-time while simultaneously taking into account the energy and density of network nodes during following operations. This strategy lessens the wasteful energy use connected with 5G mobile communication technology, resulting in greater energy efficiency and resource allocation during engineering construction, a problem that older communication methods find difficult to solve.

VI. Signal suppression's impact

Signal suppression is the effect of 5G technology on reducing strong signal peaks while communication projects are really operating. Different carrier counts (4, 16, 64, 256, and 1024)

were investigated in this experiment. The signal peak suppression impact of 5G in communication engineering was observed under various circumstances, and the results are shown in Figure 4. Communication engineers may encounter unexpected signal peaks while transmitting data, which can exacerbate spread spectrum interference and signal distortion. This not only makes communication engineering more operationally complex but also reduces its effectiveness. Mobile communication technologies must therefore be used to address this problem.

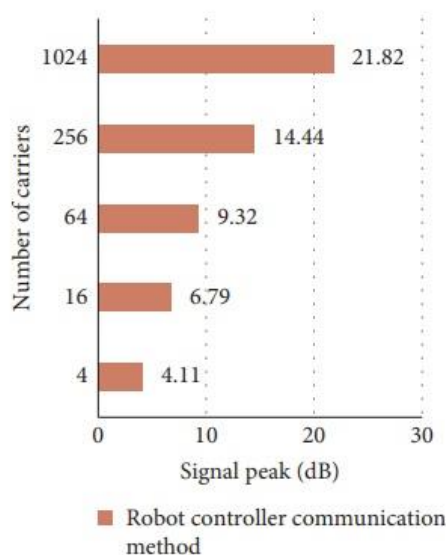


Fig.4: Robot Communication

It is clear from the data shown in Figure 4 that while signal peaks rose with the number of carriers, the impact of the two approaches on signal suppression were very different. The signal peaks in Figure 7(a) were measured at 4, 11, 6, 7, 9, 32, 14, 44, and 21, 82 dB, 6.79, 9.32, 14.44, and 21, 82 dB, respectively, with an overall average value of 11.296 dB. The signal peaks in Figure 7(b) were 6.03dB, 12.77dB, 18.32dB, 23.74dB, and 29.81dB, with an average value of 18.134dB across all carrier numbers. These findings demonstrate the two approaches' capacities to suppress signals, with the robot controller communication method doing better than the conventional method at reducing signal peaks.

VII. Conclusion

Market requires more application value from 5G technology in the area of communication engineering due to changing application scenarios and more complicated business requirements. Utilizing 5G technology's benefits to improve communication effectiveness and support the construction of communication projects has taken center stage in current development initiatives. This study explores the integration of the robot controller communication method and carefully examines the use of 5G technology in communication engineering. This article aims to increase the usefulness and value of 5G technology through real-world applications.

This research solves performance impact issues resulting from high signal peaks by increasing data transmission efficiency and energy efficiency, ensuring the stability and creative growth of communication engineering. It is crucial to note that there is potential for improvement, particularly in experimental testing, even if this work has made great progress in addressing development challenges within the contemporary communication business from a variety of viewpoints.

Since this work mostly depends on simulation analyses, it would be desirable to test the application impacts under actual operational circumstances. In addition, this paper's research area has to be bigger. It is essential to concentrate on fixing these issues and gaps in the research in the future. To further improve the practical use of 5G technology in communication engineering, experimental procedures and settings can be continuously improved.

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