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Navigating The Future: A Systematic Review on the Role of Quantum Computing in Multi-Robot Systems

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Abstract
More and more, multi-robot systems (MRS) are being used for hard tasks like industrial automation, surveillance, and autonomous navigation. Nevertheless, these systems have significant computation difficulties especially in path planning, task distribution and coordination. Quantum computing is capable of computing information based on such concepts as superposition and entanglement. This provides an alternative solution to optimization problems that are more efficient than the conventional methods. A systematic review approach based on PRISMA was used. We used pre-set search terms to look for useful papers in databases including Google Scholar, Scopus, IEEE Xplore, and Web of Science. We found peer-reviewed articles that had come out in the last 10 to 15 years based on some rules for which ones to include and which ones to leave out. A total of thirty papers, mainly focusing on algorithms, applications and constraints were included in qualitative synthesis. The review demonstrated that quantum algorithms, such as the search and QAOA algorithms created by Grover, can be helpful in optimizing the problems of MRS. These methods have the benefits of parallelism and speed. Nevertheless, they are used in simulations only due to the limitations of technology, scaling issues, and integration challenges with real-time robotic system.

Keywords: Quantum Computing, Multi-Robot Systems, Optimization, QAOA, Security, Hybrid Models.

1. Introduction

Multi-robot systems (MRS) are groupings of autonomous robots that can work together and coordinate their efforts to get a job done faster than a single robot can.These systems are often deployed in areas such as search and rescue, environmental surveillance, warehouse automation and military activities due to their scalability, adaptability and robustness (Cao et al., 1997; Parker, 2008). MRS has the ability to enhance productivity, reduce operating time and provide redundancy in case one robot breaks down by assigning duties to multiple agents. Recent advancements in distributed control and artificial intelligence have further improved the capabilities of MRS to support complex decision-making and adaptive behaviours in dynamic environments (Brambilla et al., 2013).

1.1 Challenges in Multi-Robot Systems

Although they have certain benefits, MRS have a number of acute challenges:

Path Planning

Path planning in multi-robot systems entails identifying optimal, non-colliding trajectories for several robots functioning inside shared settings. Due to inter-robot dependencies and dynamic impediments, the complexity increases exponentially with the robots. Traditional algorithms are often incapable of being both scaled and responsive in highly dynamic environments (LaValle, 2006).

Task Allocation

Task allocation is the process of giving robots jobs in a way that will make the system work best. This is typically modelled as a combinatorial optimization problem, and is computationally expensive when the number of tasks and robots increases. Though frequently employed, strategies like heuristic algorithms and market-based mechanisms do not necessarily produce the best results (Gerkey & Mataric, 2004).

Communication Complexity

Cooperation between robots needs effective communication. Nevertheless, the constraints of communication such as limited bandwidth, latency, network outages, etc. can significantly impact the performance of a system. The ability to keep coordination decentralized and minimise communication overhead remains a major challenge in MRS (Yan et al., 2013).

1.2 Quantum Computing

Quantum computing is a revolutionary computational paradigm, which is fundamentally different to classical computing using the principles of quantum mechanics. Quantum computers utilize quantum bits, or qubits, which are capable of becoming multiple states at once as a result of the phenomena of superposition, in contrast to classical computers that work with binary bits (0s and 1s). This greatly increases computational capability for some problem classes by enabling quantum systems to encode and process enormous amounts of data in parallel (Nielsen & Chuang, 2010). Besides superposition, there is one more essential concept, quantum entanglement, which enables physically separated qubits to exhibit correlated behavior, i.e., the direct impact of the state of one qubit on the other. Highly effective information processing and sophisticated problem-solving skills are based on this interconnection (Preskill, 2018).One of the best things about quantum computing is that it can solve optimization and search problems better than regular methods. Combinatorial complexity, in which the number of alternative solutions increases exponentially with system size, is present in many real-world situations, such as those in robotics and multi-agent systems. Optimal solutions are frequently difficult for classical algorithms to provide in an acceptable amount of time. On the other hand, quantum algorithms take advantage of quantum parallelism to assess several options at once. As an illustration, the search algorithm developed by Grover saves time required to locate a specific item in an unsorted database by providing the quadratic acceleration as compared to the conventional search algorithms (Grover, 1996). The skill is particularly needed in robotics applications where speedy search and optimization is required such as path planning and decision-making. The Quantum Approximate Optimization Algorithm (QAOA) is another key step forward in quantum computing. It was created to overcome problems with combinatorial optimization. Since QAOA is a hybrid quantum state evolution model with classical optimization methods, it can be used with near-term hardware and noisy quantum devices. It has shown promising results in solving difficult optimization problems such as resource distribution, scheduling, and partitioning of graphs (Farhi et al., 2014). These kinds of issues immediately relate to multi-robot systems, where effective coordination and work distribution are crucial. Researchers hope to improve optimization performance over conventional heuristic or classical methods by utilizing QAOA.Even though it was said that quantum computing will be the next big thing, it is still in its early years, often known as the Noisy Intermediate-Scale Quantum (NISQ) era.Some of the shortcomings of the existing quantum technologies are error rates, limited scalability, and qubit instability. However, these difficulties are progressively being overcome by continuous developments in quantum hardware and hybrid quantum-classical algorithms (Preskill, 2018). It is due to this that quantum computing is increasingly being explored as a powerful means to solve computationally difficult problems across a wide range of applications including robotics, artificial intelligence, and cryptography.

2. Aim Of The Study

Examining and summarizing previous studies on the use of quantum computing in multi-robot systems is the main goal of this systematic review. The goal of the project is to assess how quantum algorithms can improve important MRS components, such as coordination, optimization, and decision-making, task allocation.

3. Research Questions

The following research questions are developed in order to accomplish this goal:

1. How are multi-robot systems using quantum computing?
2. What quantum algorithms are most effective to solve multi-robot system problems?
3. What are the present restrictions and difficulties in combining multi-robot systems with quantum computing?

4. Methodology

4.1. Study Design

In order to thoroughly examine the body of research on the use of quantum computing in multi-robot systems, this study used a systematic review design. Finding, assessing, and synthesizing pertinent research findings to address particular research questions can be done in an organized and transparent manner via a systematic review. This strategy reduces bias, guarantees scientific rigor, and improves the dependability and repeatability of results (Kitchenham & Charters, 2007). The review follows the PRISMA guidelines, which stand for the Preferred Reporting Items for Systematic Reviews and Meta-Analyses. PRISMA provides a standardized model of reporting systematic reviews that contains clear procedures of data extraction, synthesis, study selection, and search of the literature. The work ensures a clear and reproducible way of identifying relevant studies on the application of quantum computing to multi-robot systems through the use of PRISMA (Page et al., 2021).

The primary focus of the systematic review is peer-reviewed articles and great conference papers that explore the implementation of quantum computing methods, including hybrid quantum-classical methods, quantum optimization algorithms, and quantum search methods, in multi-robot systems. Interdisciplinary nature of the topic makes the study combine the research in the fields of robotics, artificial intelligence, and quantum computing.

The overall review process follows the four key phases outlined in PRISMA:

Identification Systematic search of databases to get potential studies.

1. Screening - Elimination of duplication and irrelevant studies using titles and abstracts.
2. Eligibility Full-text evaluation of the selected studies based on inclusion and exclusion criteria.
3. Inclusion - Final selection of the qualitative synthesis studies.

This systematic approach will allow the study to evaluate systematically the role of quantum computing methods in tackling essential problems in multi-robot systems, including path planning, task allocation, and coordination and also discover current limitations and future research opportunities. (Jayasri et al. 2025)

4.2. Search Strategy

The systematic search technique was employed to identify material pertaining to the application of quantum computing in multi-robot systems. The search was conducted across multiple well-established academic databases to ensure broad coverage of interdisciplinary research in robotics, artificial intelligence, and quantum computing.

The following electronic databases were used:

- IEEE Xplore
- Scopus
- Web of Science
- Google Scholar

These databases were chosen because they have a wide indexing of quality journal articles, conference proceedings and technical papers in the area of interest in the study.

A mixture of Boolean operators and keywords was employed to access pertinent studies. The search strings were carefully designed to capture literature that integrates quantum computing techniques with multi-robot systems and associated optimization challenges. An example of the search string used is as follows:

AND (quantum computing OR quantum algorithms).
AND (Multi-Robot Systems) OR (Swarm Robotics).
AND (Optimization OR Path Planning OR Task Allocation)

The search process has been repetitive where the keywords and combinations have been optimized to enhance the relevance and breadth of the retrieved studies.

4.3 Inclusion Criteria

In order to make sure that the choice of studies was relevant and of high quality, the following inclusion criteria were used:

- Publications that are not older than 1015 years old, so that they are relevant today.

Peer-reviewed journal articles and quality conference papers.

- Papers that explicitly investigate how quantum computing can be used in robotics, multi-agent systems, or even optimization problems with respect to multi-robot systems.
- Articles in English language.
- Articles that have adequate methodological and experimental information.

4.4 Exclusion Criteria

The relevant but low-quality studies were filtered out using the following exclusion criteria:

- No-technical articles like editorials, opinion papers, and blogs.
- Studies focusing solely on robotics without any integration of quantum computing concepts
- Duplicate records identified across multiple databases
- Studies lacking sufficient methodological clarity or empirical evidence

4.5 Study Selection Process

The PRISMA framework was used in selecting the study and this ensured an effective approach towards locating relevant literature in a systematic manner. This was done in four consecutive steps:

1. **Identification:** Database searching using predetermined keywords helped to identify all the relevant studies.
2. **Screening:** Duplications were eliminated and titles and abstracts were filtered to eliminate irrelevant studies.
3. **Eligibility:** Articles were evaluated according to the inclusion and exclusion criteria and those that were found suitable were the full-text articles.
4. **Inclusion:** Final studies that met all criteria were included for qualitative synthesis.

The whole process is described in the form of a PRISMA flow diagram, which visually shows the quantity of studies in every phase of the selection.

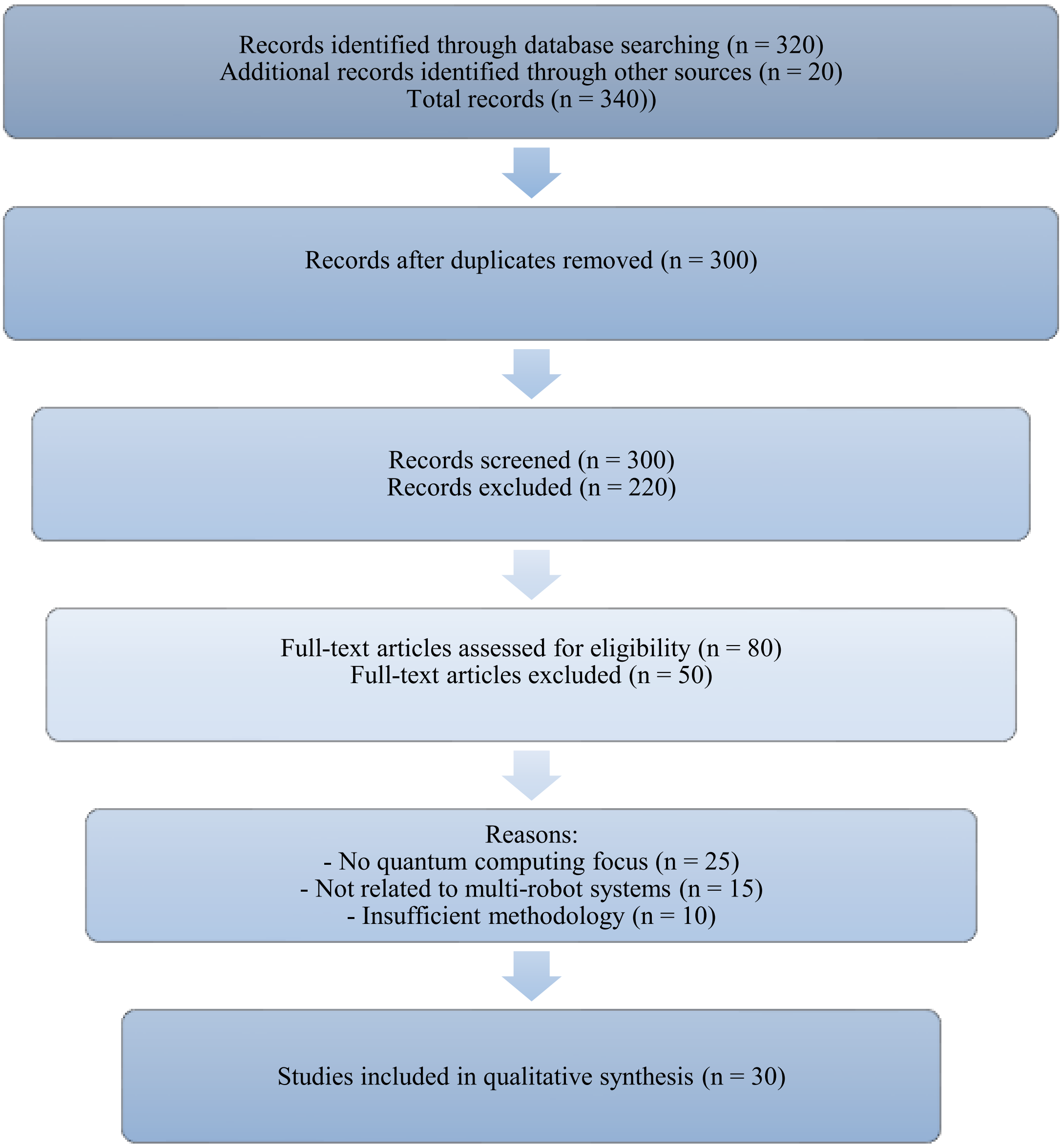

Figure 1: PRISMA Diagram

The PRISMA flow diagram shows the step-by-step process used to pick the studies that are relevant for this review. The initial total of 340 records came from searches of databases like IEEE Xplore, Scopus, Web of Science, and Google Scholar. The other 20 records came from various sources, like reference lists and manual searches. After removing duplicates, there were 300 unique records left for further review. After screening such records using the abstracts and titles, 220 papers were dropped since they did not have any relevance to the study question.

They were then checked to see if they were eligible by looking at eighty full-text publications to see if they met the established criteria for inclusion and exclusion. Of these, 50 publications were eliminated for particular reasons, such as poor methodological rigor (10 studies), relevance to multi-robot systems (15 studies), and lack of focus on quantum computing (25 research). In the end, thirty papers that matched all the requirements were included in the qualitative synthesis.This systematic selection process enhances the validity and reliability of the findings since the review is based on relevant and high-quality literature.

4.6 Data Extraction

A structured data extraction technique was utilized to systematically gather pertinent information from the chosen studies. The following key variables were extracted:

Author(s) and Year of Publication.

- Quantum Method or Algorithm Used (e.g., QAOA, Grover's algorithm, quantum annealing)

Application Area (e.g., path planning, task allocation, scheduling, coordination)

- Major Results and Recommendations.
- Weaknesses and obstacles found.

The data were extracted and tabularized to help in comparing and analyzing data across studies.

4.7 Quality Assessment

The studies that were included were checked for quality based on the criteria that were given to make sure they were dependable and valid. A checklist known as the CASP (Critical Appraisal Skills Programme) was regarded as a helping guide in determining the quality of a study.
Also, an individualized assessment methodology was used in accordance with the following criteria:
• **Clarity of Methodology -** Does the research design and methodology have a clear description.
• **Experimental Validation -** Simulations, experiments or empirical findings exist.
• **Reliability to the Research Topic** – Level of correlation with quantum computing applications in multi-robot systems.
All the studies were evaluated on the basis of these criteria so that only high-quality and relevant research would be included into the review.

4.8 Data Synthesis

The synthesis approach used to analyze and interpret the findings of the selected studies was thematic synthesis as the topic under investigation is interdisciplinary and emergent. By doing this, it becomes possible to identify major patterns, trends, and research topics.
The synthesis was systematized into the following broad thematic categories:

- **Quantum Optimization Techniques**

Research that is concerned with the application of quantum algorithms (e.g., QAOA, quantum annealing) to solve optimization problems in multi-robot systems.

- **Hybrid Quantum-Classical Models**

Research integrating quantum computing with classical algorithms to enhance computational efficiency and practical applicability

- **Swarm Intelligence and Quantum Integration**

Research on how swarm robotics can be used together with quantum computing to enhance coordination and decisions. Various latest bio inspired algorithms with quantum integration studied for the same. (Dabass & Sangwan 2025)
This conceptual classification helps to organize the comprehension of the role of quantum computing in solving important problems of the multi-robot systems and to point out the possible way forward in future research.

5. Results

5.1. Study Selection Summary

A total of 340 studies were first identified in the systematic search, and 300 records were retained in the systematic search process following the elimination of duplicates. After the title and abstract screening, 220 studies were dropped due to irrelevance. Fifty studies were eliminated based on predetermined criteria, such as lack of focus on quantum computing, irrelevance to multi-robot systems, and inadequate methodological rigor, after the remaining eighty full-text papers were evaluated for eligibility. Ultimately, the qualitative synthesis contained thirty studies. These research serve as the foundation for examining how quantum computing can improve multi-robot systems, especially in areas like task allocation, coordination, path planning, and optimization.

Table 1: Study Characteristics Table

S. No.	Author(s) & Year	Method / Algorithm Used	Application Area	Key Findings
1	Farhi et al. (2014)	Quantum Approximate Optimization (QAOA)	Task allocation, optimization	Demonstrated improved optimization efficiency over classical methods
2	Grover (1996)	Grover's Search Algorithm	Path planning, search problems	Achieved quadratic speedup in search operations
3	Li et al. (2009)	Quantum Evolutionary Algorithm	Multi-robot coalition formation	Increased coordination and dynamic distribution of tasks.
4	Neukart et al. (2017)	Quantum Annealing	Traffic optimization, routing	Better management of large scale optimization.
5	Rao et al. (2024)	Hybrid Quantum-Classical Approach	Coverage path planning	Showed promising results for real-world robotic navigation
6	Yan et al. (2021)	Quantum Affective Computing Framework	Multi-robot interaction	Introduced emotional modeling for improved coordination
7	Clark et al. (2019)	Quantum Routing Algorithms	Real-time multi-robot routing	Demonstrated feasibility of near real-time routing improvements

5.2. Thematic Findings

Quantum Optimization in Robotics

The use of quantum computing to solve optimization problems in multi-robot systems is highlighted in a large number of the examined research. Combinatorial problems such as work allocation and scheduling have demonstrated significant potential for algorithms like the Quantum Approximate Optimization Algorithm (QAOA) (Farhi et al., 2014).The exponential expansion of potential solutions as the number of robots rises makes these challenges intrinsically complicated.

By investigating several solution states at once, quantum techniques offer a significant advantage and increase computational efficiency. This is further supported by research on quantum annealing, which demonstrates superior performance than traditional heuristics in addressing large-scale optimization problems (Venturelli et al., 2015; Neukart et al., 2017). This implies that multi-robot coordination decision-making procedures can be greatly enhanced by quantum optimization.

5.3. Path Planning Using Quantum Algorithms

Another crucial area where quantum computing shows potential is path planning. Scalability problems and unpredictable situations are common challenges for traditional path planning algorithms. In order to solve collision avoidance and shortest path issues more effectively, quantum algorithms, especially those based on quantum annealing, have been investigated (Boyda et al., 2017).

Additionally, the algorithm of Grover has been discovered to be a useful technique to hasten the search-based path planning methods by reducing computational complexity (Grover, 1996). The above advances suggest that quantum computing could allow multi-robot systems to use faster and more flexible ways to navigate, especially when things get tough or unexpected. (Dabass & Sangwan 2025)

5.4. Swarm Intelligence and Hybrid Quantum Models for Task Allocation

The combination of swarm intelligence and quantum computing, especially via hybrid quantum-classical models, is another developing area. Decentralized decision-making and local robot interactions are the foundation of swarm robotics, which can profit from quantum-enhanced optimization and learning methods (Brambilla et al., 2013).

To get beyond current hardware constraints in quantum computing, hybrid models that integrate quantum algorithms with classical control systems have been proposed (Preskill, 2018). This is also enabled by the study of quantum machine learning, which demonstrates better pattern recognition and decision-making in complex systems (Biamonte et al., 2017; Schuld et al., 2015). These approaches promise a lot in improving the coordination, flexibility and scalability of multi-robot systems and thus they are worth investigating. (Mohseni et al. 2017)

6.Discussion

The results of this comprehensive research show that quantum computing has a great deal of promise to improve multi-robot systems' (MRS) performance, especially when it comes to resolving challenging optimization issues like task distribution, path planning, and coordination. By utilizing quantum superposition and parallelism, quantum algorithms like the Quantum Approximate Optimization Algorithm (QAOA) and quantum annealing show that they can explore huge solution spaces more effectively than classical approaches. For combinatorial issues, where the number of potential solutions increases exponentially with system size, these features are very helpful. (Yevsieiev et al. 2025)

The review does, however, also show that the majority of current research is still theoretical or simulation-based, with little practical application. Due to technological constraints, quantum simulators are employed in many studies rather than actual quantum equipment. This means that quantum computing has a potential but its practical application to robots is still in its early stages. (Sikarwar & Srinivasan 2026)

Comparison with Classical Approaches

When compared to classical approaches, quantum computing offers both advantages and limitations.

Advantages

1. Speed and Computational Efficiency

Quantum algorithms can provide speed advantages for certain problem classes. As illustration, Grover algorithm can provide a quadratic speedup to search problems; whereas QAOA is expected to efficiently approximate solutions to combinatorial optimization problems. These benefits render quantum computing especially applicable in time-sensitive robotic tasks like real-time decision-making and path planning that are dynamic. (Fazilat & Zioui 2025)

2. Parallelism and Search Capability

Superposition is used in quantum systems to consider the solutions that are possible in parallel as opposed to classical systems that consider solutions one at a time. This parallelism inherent enables quantum algorithms to be more efficient in solving large-scale optimization problems, which is essential in the field of multi-robot coordination where a group of agents needs to make decisions simultaneously.

Limitations Compared to Classical Methods

Despite these advantages, classical algorithms still outperform quantum methods in many practical scenarios due to the maturity and robustness of classical computing technologies.

1. Hardware Constraints (NISQ Limitations)

The existing quantum computers are based on the Noisy Intermediate-Scale Quantum (NISQ) age, which is limited in the number of qubits, noise, and instability. Qubits are very prone to decoherence and errors and it has a profound impact on computational accuracy and reliability. Moreover, current quantum machines are not as yet powerful to cope with large scale real world robotics. (Chella et al. 2023)

2. Scalability Issues

Scalability remains a major challenge in quantum computing. Current systems typically support fewer than a few hundred qubits, making it difficult to scale quantum algorithms to large multi-robot environments. As problem size increases, quantum circuits become deeper and more error-prone, limiting their effectiveness. Furthermore, achieving fault-tolerant quantum computation requires millions of qubits, which is still far from current technological capabilities.

3. Integration and Practical Constraints

When quantum computers are integrated into robotic systems, new challenges including the data encoding issues, communication overheads, and real time processing requirements are introduced. Low-latency decision-making is needed in robotics applications, and it is challenging to implement such a facility with the existing quantum cloud-based systems. (Haldorai, 2024)

This review identifies several important research gaps that must be addressed to advance the integration of quantum computing in multi-robot systems:

1. Lack of Real-World Implementation

The majority of studies that have been done are restricted to simulations or small-scale experimental setups. The application of quantum algorithm to real-world robotic systems is wanting substantially. This gap is primarily due to hardware limitations and the difficulty of integrating quantum systems into real-time robotic environments.

2. Limited Scalability Studies in Robotics Context

Although quantum algorithms can be theoretically scaled, very little has been done to assess their scaling to large-scale multi-robot systems. The next generation of research should examine the comparison of quantum solutions to classical problems on a large scale.

3. Hybrid Quantum-Classical Frameworks Need Development

Current evidence suggests that hybrid quantum-classical approaches are the most practical solution in the near term. However, there is still a lack of standardized frameworks and architectures for effectively integrating quantum computation into robotic systems .

4. Problem Formulation Challenges

It is also a complicated and insufficiently studied area to map real-world robotic problems into quantum-compatible formats (e.g., QUBO models). Numerous real-world robotics applications are not readily solvable in a form that is amenable to quantum algorithms.

To conclude, quantum computing could be of great benefit to multi-robot systems in terms of improved speed and parallelism to solve complex optimization and coordination problems. Nonetheless, it has a current limitation in its practical implementation due to hardware limitations, scalability factors, and integration problems. Although classical methods are still prevalent in their practical application, the development of hybrid quantum-classical models is one of the encouraging perspectives of the future research. The identified research gaps, in particular, the absence of real-world application, will be essential to achieving the full potential of quantum computing in multi-robot systems.

7. Conclusion

The goal of this work was to thoroughly examine how quantum computing can improve multi-robot systems (MRS), especially when it comes to handling difficult problems like task allocation and distribution, route planning, and coordination. The results unequivocally show that quantum computing has great potential as a revolutionary instrument in this field. Quantum annealing and Quantum Approximate Optimization Algorithm (QAOA) methods are promising in solving combinatorial optimization problems, which are crucial to multi-robot operations. These characteristics presuppose that quantum computing might make the effectiveness of decision-making significant, reduce the time spent on calculations, and make robotic systems smarter and more versatile.

However, in the same breath, the study notes that quantum computing in robots is in its early stages yet these are promising advantages. Most of the existing studies remain theoretical or simulation based with minimal practical implementation. The limitations of existing quantum hardware, which functions in the Noisy Intermediate-Scale Quantum (NISQ) era, are mostly to blame for this. Still, the practical implementation of quantum algorithms in real-time robotic systems is limited due to the instability of qubits, errors, limited availability of qubits and fault-tolerance. Because of their dependability, scalability, and existing infrastructure, classical computing techniques continue to be dominant in real-world multi-robot systems.

Future prospects for combining quantum computing with multi-robot systems seem very bright, especially with the creation of hybrid quantum-classical models. Based on these approaches, quantum algorithms are combined with the benefits of conventional computing, such as stability and real-time processing. Hybrid frameworks are especially suitable in near-term applications, where quantum computers can be used to solve specific subproblems (as in optimization tasks) but overall control and execution is done by a classical system. It is anticipated that this cooperative strategy will close the gap between present technological constraints and quantum computing's full potential. Furthermore, real-time applications of quantum-enhanced robots are a crucial area for further study. Quantum algorithms may be used in dynamic and time-sensitive settings including autonomous navigation, swarm coordination, and disaster response situations as quantum technology develops. Developments in quantum hardware, algorithm design, system integration, and communication frameworks that enable low-latency decision-making are all need to achieve this.

In conclusion, quantum computing provides a potent supplementary strategy that can handle some of the most difficult computational issues in robotics, even though it is not yet ready to completely replace classical techniques in multi-robot systems. Its full potential and the development of next-generation intelligent robotic systems will require further research, especially in hybrid models and practical applications.

8. Future Research Directions

With the ongoing development of multi-robot systems (MRS) and the progress of quantum computing, several key areas of research are visible that will be necessary to take this subject not only out of the theoretical landscape but also to practice. Quantum computing together with machine learning & artificial intelligence will be among the most promising directions. The Multi-robot systems already widely utilize the AI and ML methods of perception, decision-making, and adaptive learning. When used with quantum computing, these methods can significantly enhance their performance, particularly in the case of high-dimensional data and difficult optimization problems. An example is that quantum machine learning algorithms are capable of accelerating training processes, as well as improving pattern recognition capabilities, by exploiting quantum parallelism. This may lead to faster response to changing environment, improved predictive decision making, and more efficient learning of collaborative behaviours in multi-robot environments. But there are drawbacks to this integration as well, such creating appropriate quantum data encoding methods and creating hybrid architectures that enable smooth communication between quantum computers and traditional AI models.

The creation of scalable quantum hardware is another crucial subject for further study. Current quantum systems have a limited number of qubits, noise, and error rates, which serve only small-scale applications. quantum computing will require significant hardware advances to have any meaningful impact on large-scale multi-robot systems. Increasing qubit counts, enhancing qubit coherence times, and putting in place efficient quantum error correction methods are some examples of this. More sophisticated algorithms might be executed by scalable and fault-tolerant quantum computers, which would also enable researchers to tackle real-world robotic issues involving several agents and jobs. In addition, the development of quantum cloud infrastructure and accessibility will allow further experimentation and integration with robotic platforms.

The creation of practical robotic simulations and testbeds for quantum-enhanced systems is another crucial avenue. The majority of current research is based on theoretical models or classical simulations of quantum algorithms, which do not adequately represent the difficulties associated with practical implementation. Future studies must focus on the creation of feasible simulation systems that integrate robotic simulators such as Gazebo and ROS (Robot Operating System) with quantum computing systems. Such environments would allow scientists to evaluate the effectiveness of quantum algorithms in reality with dynamically hindered impediments, sensor noise, and communication delays. Moreover, real robot-connected quantum processors (or hybrid system) experimental testbeds would provide valuable data on latency, real-time decision-making, and system integration.

To sum up, a multidisciplinary collaboration among AI advancement, hardware creation, and system-level integration will be required to continue the use of quantum computing in the multi-robot systems.

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