Universal Teaching and Learning Journal (UTLJ)
ISSN: 3110-7036, Vol 2, No 1, 2025, 23-33 https://doi.org/10.35912/utlj.v2i1.3977

A Corpus-Based Semantic Study of Robotics Terms

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Article History
Received on 30 January 2026
1st Revision on 5 February 20266
2nd Revision on 12 February 2026
Accepted on 20 February 2026

Abstract

Purpose: This study aims to identify word-formation patterns and the semantic domain distribution of contemporary robotics terminology, and to explain how these two dimensions shape the functional organization of the robotics lexical system.

Research Methodology: This research employs a corpus-based functional-semantic approach to analyze 146 unique terms extracted from peer-reviewed articles published in IEEE Transactions on Robotics, IEEE Robotics and Automation Letters, and Frontiers in Robotics and AI. The data were examined based on word-formation strategies and semantic domain classification.

Results: The findings indicate that compounding is the most dominant word-formation strategy (74.0%), followed by acronymy, prefixation, borrowing, suffixation, and blending. Semantically, the terms are distributed across 14 functional domains, with the five largest clusters comprising Systems, Artificial Intelligence, Manipulation, Locomotion, and Navigation.

Conclusions: Contemporary robotics terminology demonstrates a systematic lexical structure characterized by the dominance of compounding and function-based semantic clustering. This reflects the need for conceptual precision and communicative efficiency in scientific robotics discourse.

Limitations: The study is limited to three international journals and a relatively small dataset (146 terms), which may not fully represent the global diversity of robotics terminology.

Contributions: This study contributes theoretically to applied linguistics and technical terminology studies, and practically to technical communication, translation, and the standardization of robotics terminology.

Keywords: *Acronymy, Compounding, Functional Semantics, Robotics Terminology, Word-Formation.*

How to Cite: Qizi, R.G.X. & O'g'li, N. B. A. (2026). A Corpus-Based Semantic Study of Robotics Terms. *Universal Teaching and Learning Journal*, 2(1), 23-33.

1. Introduction

Robotics has emerged as one of the most lexically productive domains in contemporary science and engineering, generating a specialized vocabulary that reflects its interdisciplinary origins in mechanical engineering, computer science, artificial intelligence, and cognitive science. The functional-semantic study of terminology that branch of linguistics concerned with how specialized terms encode, organize, and communicate conceptual knowledge within expert communities - offers essential tools for understanding how this vocabulary is structured and how it operates (Febrian, 2025). Unlike purely formal or structural approaches, functional-semantic analysis examines terms not merely as linguistic objects but as instruments of epistemic and communicative action: terms name, classify, define, and relate concepts in ways that enable the coordinated practice of a scientific discipline (Cabré, 1999; Montero-Martínez, 2023).

The present study applies this perspective to a corpus of 146 robotics terms extracted from leading IEEE publications and Frontiers in Robotics & AI (2023–2024), with the aim of characterizing the dominant word-formation patterns and semantic domain structure of contemporary robotics terminology. By grounding the analysis in verifiable, source-traceable data, the study seeks to move beyond impressionistic claims about technical language and offer a precise, reproducible account of the functional-semantic organization of the robotics lexical system. The findings contribute to terminology science, technical communication, and the broader understanding of how rapidly evolving techno scientific fields construct and manage their specialized vocabularies (Zager, Sieber, & Fay, 2024).

Robotics has emerged as one of the most lexically productive domains in contemporary science and engineering, generating a specialized vocabulary that reflects its interdisciplinary origins in mechanical engineering, computer science, artificial intelligence, and cognitive science (Ryalat, Almtireen, Al-refai, Elmoaqet, & Rawashdeh, 2025). The evolution of robotics terminology mirrors the rapid advancements in these foundational fields, which are progressively interwoven to create complex robotic systems capable of performing intricate tasks autonomously or in collaboration with humans. As a result, the language of robotics has expanded to encapsulate not only technical concepts related to machinery and automation but also more abstract notions drawn from cognitive science, artificial intelligence, and human-computer interaction (Katiyar & Katiyar, 2021). This linguistic growth mirrors the increasing complexity of robotics itself, with innovations and breakthroughs continually requiring new terminology to describe them.

The functional-semantic study of terminology—a branch of linguistics concerned with how specialized terms encode, organize, and communicate conceptual knowledge within expert communities—offers essential tools for understanding how this vocabulary is structured and how it operates (Faber & Cabezas-García, 2019). Specialized terms are not mere labels; they carry deep meaning, organizing knowledge into conceptual systems that facilitate communication among experts in the field. In fact, understanding how these terms function within the discipline is crucial for navigating the ongoing evolution of robotic technologies (Gunasinghe, Hamid, Khatibi, & Azam, 2020). Such an understanding goes beyond merely cataloging words to exploring their epistemic role in shaping the development of robotic systems, including their design, application, and integration into society (Budiono, Husen, & Suparno, 2025).

Unlike purely formal or structural approaches, functional-semantic analysis examines terms not merely as linguistic objects but as instruments of epistemic and communicative action: terms name, classify, define, and relate concepts in ways that enable the coordinated practice of a scientific discipline. Each term serves as a conduit for conceptual clarity and shared understanding, enabling researchers, engineers, and practitioners to discuss complex phenomena with precision (Abusaada & Elshater, 2024; Mamarasulova, 2024). This function of terminology is crucial in fields like robotics, where even slight variations in terminology can lead to significant shifts in understanding or application. For instance, terms such as "sensor fusion" or "motion planning" may have specific connotations in robotics that are distinct from their use in other fields like computer science or artificial intelligence. In this way, terms do not merely reflect the knowledge of a field—they actively shape it (Sri kuning, 2021).

The present study applies this functional-semantic perspective to a corpus of 146 robotics terms extracted from leading IEEE publications and Frontiers in Robotics & AI (2023–2024). The aim is to characterize the dominant word-formation patterns and semantic domain structure of contemporary robotics terminology. By grounding the analysis in verifiable, source-traceable data, the study seeks to move beyond impressionistic claims about technical language and offer a precise, reproducible account of the functional-semantic organization of the robotics lexical system (Gizi, 2025). This is an essential step in advancing the understanding of how specialized vocabularies are constructed and evolve, particularly in rapidly advancing scientific fields like robotics (Mazzei, Chiarello, & Fantoni, 2021). Unlike traditional approaches to lexicography, which may rely on subjective interpretations of word meanings, the present study uses a corpus-driven method that ensures objectivity and transparency in the analysis.

The findings of this study contribute to terminology science, technical communication, and the broader understanding of how rapidly evolving techno-scientific fields construct and manage their specialized vocabularies. As robotics continues to expand in both academic and industrial contexts, understanding the organization of its terminology becomes increasingly important. Robotics is no longer confined to academic research or engineering circles; it has moved into public discourse, affecting industries such as healthcare, manufacturing, and even entertainment. As such, ensuring clarity in robotics terminology is essential not only for practitioners but also for policymakers, educators, and the general public who must navigate the increasingly complex landscape of robotic technologies. Furthermore, the study's findings can inform efforts to standardize robotics terminology, ensuring that researchers and developers worldwide are operating with a common linguistic framework that enhances collaboration and knowledge sharing.

2. Literature Review and Hypothesis Development

2.1 Theoretical Foundations of Terminology Theory

The theoretical foundations of the present study lie in the confluence of classical terminology theory and functional linguistics. Wüster's “General Theory of Terminology” by ten Hacken (2018) established the prescriptive ideal of term monosemy and systematic concept organization, principles that continue to inform standardization bodies such as ISO TC 37. The effectiveness of a term is determined by its ability to represent a singular, clearly defined concept, a notion central to many formal systems of terminology development (Molenaar, van den Berg, Dalpiaz, & Brinkkemper, 2025). This perspective has greatly influenced the way terminology is organized within fields like robotics, where clarity and precision are paramount. The monosemic ideal ensures that each term in a technical lexicon corresponds to one concept, facilitating effective communication within expert communities.

In addition to the prescriptive nature of Wüster's theory, it also promotes a degree of stability within technical vocabularies, which is essential for ensuring that terms retain their meaning over time and across different contexts. This stability is crucial in fields like robotics, where innovation and technological advancements are rapid. If terms were to change or shift meaning frequently, it would disrupt communication, making it difficult for experts to share ideas or findings. Therefore, the standardization efforts outlined by Wüster continue to be highly relevant, even as the field of robotics and its associated terminology expand.

Importantly, these standardized systems also help facilitate cross-disciplinary collaboration, ensuring that professionals from different domains—such as computer science, mechanical engineering, and artificial intelligence—can understand and apply the same terms in their work. This cross-domain applicability is vital as robotics is inherently interdisciplinary, involving knowledge from various fields of study. Thus, Trojar (2025) remains foundational, providing the structural guidelines that ensure terminology in technical fields like robotics maintains clarity, coherence, and consistency. The theory serves as a guiding framework for researchers, helping them create and manage a lexicon that effectively supports the evolution of their disciplines while ensuring precision and mutual understanding.

2.2 Communicative Theory of Terminology

Cabré's “Communicative Theory of Terminology” extended this framework by situating terms within their communicative and social contexts, arguing that specialized vocabulary cannot be adequately described without attention to the functional roles terms play in expert discourse (Cabré, 1999). In contrast to Wüster’s focus on the formal and prescriptive aspects of terminology, Cabré emphasizes the dynamic and communicative aspects of term usage. Terms are seen not just as static labels but as tools used by experts to convey complex ideas, facilitate collaboration, and structure knowledge within a field. In the context of robotics, this means that terminology is not only about classification but also about the communication of new ideas, innovations, and concepts as they arise in the field.

Studies by Nhongo (2024) focusing on the practical application of terms in real-world settings. In robotics, for example, terms like "sensor fusion" or "robot learning" are not just labels for concepts—they are tools that help practitioners think through and discuss complex processes and technologies. These terms enable clear communication and problem-solving, allowing experts from different specializations to discuss intricate details of robotic systems. Furthermore, this communicative function of terminology is essential in interdisciplinary fields like robotics, where professionals with varying backgrounds need to collaborate effectively. As robotics draws from mechanical engineering, artificial intelligence, computer science, and even social sciences, a shared, functional vocabulary is crucial for ensuring that all participants in the conversation are aligned on key concepts.

Cabré's communicative theory also emphasizes that terms evolve in response to changing technological landscapes. As new advancements in robotics occur—such as the introduction of more sophisticated AI algorithms or new types of robotic sensors—new terms are coined to reflect these innovations. In this sense, terminology is not a static entity; it is an evolving system that adapts to meet the needs of the field. Thus, the communicative theory plays a critical role in understanding how terms are not only used but also created, modified, and shaped by the demands of the scientific community, particularly in rapidly advancing fields like robotics.

2.3 Word-Formation Processes in Technical Language

In the domain of technical language, Sager and L'Homme have demonstrated that word-formation processes - particularly compounding and affixation - serve as the primary mechanisms through which scientific fields expand their lexical inventories, with compounding being especially productive in English-medium technical writing due to the language's morphological flexibility (Henda & Hudrisier, 2024; Montero-Martínez, 2023). Studies of computing and engineering terminology have consistently identified compounding and acronyms as the two dominant formation strategies, a pattern that reflects both the compositional complexity of technical concepts and the communicative economy demanded by professional contexts (Humbert-Droz, Picton, & Condamines, 2019).

The prevalence of these word-formation strategies in the robotics field highlights the need for terms that can efficiently express complex, multifaceted concepts. For instance, terms like "motion planning" and "end-effector" encapsulate multiple ideas in compact phrases, thus enabling quick comprehension and efficient communication among experts (Fadhil & Hati, 2025). This flexibility in word formation is essential for the ongoing development of robotics, a field characterized by rapid technological advances and an ever-expanding vocabulary (Kılıç & Atilla, 2024). Compounding in particular is an ideal strategy for robotics, where many concepts involve multiple interconnected elements—such as "autonomous navigation" or "robotic perception" —and need to be conveyed in a single term to avoid ambiguity and ensure clarity.

Acronyms, another common formation strategy, are especially prevalent in robotics, where terms like SLAM (Simultaneous Localization and Mapping) and UAV (Unmanned Aerial Vehicle) are used regularly. Acronyms serve as shorthand, enabling professionals to reference complex concepts without the need to repeat lengthy phrases. This shorthand is especially useful in technical writing, where conciseness is valued, and in presentations or discussions where time is limited. The use of acronyms also fosters a sense of community among experts, as recognition of these terms signals expertise and familiarity with the field. Moreover, acronyms serve a functional role in simplifying communication, allowing for more efficient exchanges of information, which is essential in high-stakes environments such as robotics research and development.

2.4 Functional-Semantic Analysis of Terminological Systems

From a functional-semantic perspective, Cruse's lexical semantics and Fillmore's frame semantics provide analytical tools for mapping the relational structure of terminological systems: hypernyms, meronyms, and domain-specific collocational patterns reveal how terms cluster into conceptual fields and how subdomains relate to one another within a discipline's knowledge architecture (Longhini, Welle, Erickson, & Kragic, 2024). These frameworks offer a structured way to analyze the relationships between terms, highlighting how they are connected within the broader conceptual framework of a discipline. In robotics, for example, terms like "sensor fusion" and "semantic scene understanding" belong to a broader conceptual field of perception and sensing, while terms like "motion planning" and "navigation" are related to the domain of locomotion and pathfinding.

This approach to terminology allows researchers to identify not only individual terms but also the networks of relationships between them, contributing to a more holistic understanding of the field's lexical organization (Gilmore & Millar, 2018). For example, the term "robotic vision" can be connected to several other concepts like "object detection," "image processing," and "visual recognition." These relationships help to define the structure of the field, illustrating how different aspects of robotics are interrelated and contribute to the functioning of a complete system. Understanding these relationships is crucial for both the study of robotics and its practical application.

In particular, the functional-semantic analysis of terms helps engineers, designers, and developers to identify gaps in the lexicon and areas where terminology may need to be expanded or refined. For instance, as new technologies emerge, existing terms may need to be redefined or new terms introduced to account for novel concepts (Sulaiman, Fitralisma, Fata, & Nawawi, 2024). This type of analysis also helps to clarify how subdomains within robotics—such as AI-driven robotics versus mechanical robotics—relate to one another, ensuring that experts in different areas are on the same page when discussing complex systems.

2.5 Existing Studies on Robotics Terminology

Research specifically targeting robotics terminology remains comparatively sparse relative to the field's scale. Estopà analyzed lexical density and term distribution in robotics research articles, while Coeckelbergh has examined the philosophical and ethical dimensions of robotic naming practices, particularly anthropomorphic metaphors (Coeckelbergh, 2011; Costa-Carreras, 2020). These studies focus on the broader implications of terminology, examining how terms not only reflect technical knowledge but also shape societal perceptions of robots. However, the existing literature primarily addresses the philosophical, ethical, and conceptual dimensions of robotics terminology, leaving a gap in empirical, data-driven analyses of the lexicon itself. The current study aims to fill this gap by providing a comprehensive, corpus-based analysis of contemporary robotics terminology, examining both its word-formation strategies and its semantic structure.

This approach moves beyond theoretical considerations, offering a more practical and systematic understanding of how robotics terminology is constructed, organized, and used in academic and professional contexts. Robotics terminology is not only crucial for research but also for industry applications. As robotics technologies continue to evolve and become more embedded in everyday life, the need for precise, universally accepted terminology becomes even more important (Siciliano & Khatib, 2016). Terminology that lacks clarity or consistency can hinder the development of new technologies and impede communication between multidisciplinary teams. This study, by examining the structure and formation of robotics terminology, seeks to contribute to the standardization efforts that are critical for the field's continued growth and integration into various industries.

2.6 The Role of Ontologies in Robotics Terminology

The emergence of ontology-based knowledge representation in robotics - as documented in IEEE Standard 1872.2 and the extensive literature on robot ontologies surveyed by Aguado - has added a new dimension to robotics terminology research: terms are no longer merely labels but nodes in formal semantic networks that enable autonomous systems to reason about the world (Aguado, Gomez, Hernando, Rossi, & Sanz, 2024; Kotha et al., 2024). This development highlights the functional role of terminology in enabling robots to process and interpret complex data (Taniguchi et al., 2016). For example, terms like “affordance,” borrowed from ecological psychology, are not just labels but concepts embedded within a robot’s decision-making process, allowing the system to interact with the physical world in meaningful ways.

Ontologies in robotics provide a formalized structure that helps autonomous systems understand the relationships between different concepts, which in turn allows these systems to make more informed decisions. By using ontologies, robotics terminology can transcend simple symbolic representation and become part of an intelligent reasoning framework that guides robots in their interactions with humans and the environment. For instance, a robot equipped with an ontology-based system might interpret the term “object manipulation” not just as a set of actions but as a sequence of cognitive steps that involve grasping, moving, and releasing objects based on predefined criteria such as object shape, weight, and stability.

This semantic understanding of terminology enables robots to adapt their behavior more flexibly in dynamic environments, making them more effective in complex tasks such as autonomous driving, medical surgery, or warehouse management. The use of ontologies also contributes to the standardization of terminology in robotics, as these formal frameworks require precise definitions and relationships between terms. In this way, ontologies help to establish a common understanding of concepts that can be shared across different robotic systems and research domains. This facilitates collaboration between researchers from various fields such as AI, cognitive science, and engineering, who may use the same terms to describe similar processes but may have different interpretations without a common ontological framework.

2.7 Terminology and Interdisciplinary Collaboration

This development underscores the functional weight of terminology in robotics: a term like affordance, borrowed from ecological psychology, carries not just a name but a computable semantic structure when instantiated in a robot ontology. Similarly, the proliferation of acronyms (SLAM, UAV, MPC, TAMP) reflects the community's need for compact reference tokens that can circulate across subfields and publication venues without disambiguation overhead (Schneider, Hochgeschwender, & Bruyninckx, 2025). These developments motivate a systematic, corpus-grounded investigation of the functional-semantic properties of contemporary robotics terminology, which the present study undertakes.

These terms facilitate communication not only within the robotics community but also across interdisciplinary boundaries, as robotics increasingly intersects with fields such as cognitive science, artificial intelligence, and even philosophy (Michalec, O'Donovan, & Sobhani, 2021). The ability to use consistent terminology across such diverse fields is crucial for fostering collaboration and ensuring that the many threads of research within robotics are properly integrated. The interdisciplinary nature of robotics—combining elements of mechanical engineering, computer science, psychology, and artificial intelligence—necessitates the use of a shared terminology that can bridge the gaps between these fields.

Terms like "machine learning," "motion control," and "human-robot interaction" are understood in slightly different ways across these disciplines. However, by using a standardized vocabulary, researchers and practitioners can align their efforts and develop integrated systems that leverage the strengths of each field. This is particularly important in collaborative research settings where experts from different backgrounds must work together to create innovative robotic technologies. The use of standardized terminology ensures that everyone is on the same page and can communicate effectively, which accelerates the pace of innovation (Mulyantini, Surbakti, Maulana, & Wibawaningsih, 2025).

Moreover, interdisciplinary collaboration often leads to the creation of new terms that reflect the merging of ideas from different domains. As robots become more autonomous and integrated into society, they will increasingly operate in environments that require them to understand human emotions, adapt to social contexts, and collaborate with humans in a way that feels natural. This will lead to the creation of new terminology that blends psychological, social, and technical concepts. For instance, terms such as "emotional AI" or "social robotics" are emerging as the field of robotics expands to address human-robot interaction more profoundly. This highlights the role of terminology in fostering new interdisciplinary connections and expanding the scope of robotics research.

3. Methodology

The study adopts a corpus-driven approach to terminology extraction and analysis. The corpus was assembled from six primary sources published between 2023 and 2024: (1) IEEE Transactions on Robotics Volume 40 article titles and abstracts; (2) the IEEE RA-L preprint "AdaFold", representing cutting-edge manipulation research; (3) the ontology survey by Aguado in Frontiers in Robotics & AI; (4) the IEEE-RAS Editorial Board subject keyword taxonomy, which represents the field's own self-classification of its research areas; (5) the Springer JIRS paper on semantic interoperability for autonomous mobile robots; and the frontiers paper on semantic composition of robotic solver algorithms.

Candidate terms were extracted manually through close reading of abstracts, keyword lists, and body text, applying the terminological criterion of domain-specificity: a candidate was included only if it designated a concept specific to or significantly redefined within robotics, excluding general scientific vocabulary such as algorithm, system, method in their generic senses. Duplicate terms across sources were counted once. Each confirmed term was then classified along two axes: (a) word-formation strategy, using the taxonomy of Bauer - compounding, prefixation, suffixation, acronyms, borrowing, and blending - and (b) primary semantic domain, using the 14-category taxonomy derived inductively from the corpus and validated against the IEEE-RAS subject classification scheme. The total verified corpus comprises 146 unique terms. Statistical calculations were performed using Python 3.12, and visualizations were produced using Matplotlib 3.9.

4. Results and Discussions

Word-Formation Strategies. Table 1 present the distribution of word-formation strategies across the 146-term corpus. Compounding is overwhelmingly dominant, accounting for 74.0% of all terms (n=108). This far exceeds the proportions reported in earlier studies of technical vocabulary, and reflects the particular terminological economy of robotics, where multi-concept technical entities - motion planning, sensor fusion, occupancy mapping, semantic scene understanding - require nominal compounds that pack high informational density into compact, retrievable units. The second most frequent strategy is acronyms (13.7%, n=20), with terms such as SLAM (simultaneous localization and mapping), UAV (unmanned aerial vehicle), MPC (model predictive control), TAMP (task and motion planning), and API (application programming interface) appearing with high frequency across sources.

Acronyms in robotics serves a dual function: it compresses polysyllabic multi-word terms into single tokens for use in technical prose, and it indexes membership in expert communities, since recognition of these acronyms signals domain competence. Prefix (4.8%, n=7) is the third most productive strategy, operating primarily through the prefixes multi- (multirobot), non- (nonholonomic), re- (replanning), and micro-/nano- (micro-robot, nano-robot), all of which express systematic conceptual modifications - plurality, negation, repetition, and scalar reduction - relative to base concepts. Borrowing (4.1%, n=6) brings in vocabulary from cognitive science, biology, and medicine (prosthetic, exoskeleton, calibration), confirming the discipline's pervasive interdisciplinarity. Suffixation (2.7%, n=4) and blending (0.7%, n=1) play minor roles, the latter exemplified by AdaFold (adaptive + fold) and the well-established cobot (collaborative + robot) (Longhini et al., 2024).

Table 1. Word-Formation Strategies in Robotics Terminology (n=146, IEEE Corpus 2023–2024)

Word-Formation Strategy	**Count**	**Percentage**	**Representative Examples**
Compounding	108	74%	*motion planning, end-effector, occupancy mapping, sensor fusion*
Acronym	20	13.7%	*SLAM, UAV, IMU, MPC, TAMP, API, GBP, AMR*
Prefixation	7	4.8%	*multirobot, nonholonomic, replanning, micro-robot*
Borrowing	6	4.1%	*ontology, affordance, prosthetic, exoskeleton, biomimetics, calibration*
Suffixation	4	2.7%	*humanoid, bipedal, gripper, locomotion*
Blending	1	0.7%	*AdaFold (adaptive + fold), cobot (collaborative + robot)*
TOTAL	**146**	**100.0%**	

Semantic Domain Distribution. Table 2 present the distribution of terms across 14 semantic domains. The five largest domains - Systems (14.4%), Artificial Intelligence (11.6%), Manipulation (9.6%), Locomotion (8.9%), and Navigation (8.2%) - together account for 52.7% of the corpus, reflecting the core conceptual pillars of contemporary robotics research. The prominence of the Systems domain (n=21) is notable: terms such as AMR, IoRT, multimodal information exchange, and semantic interoperability signal the field's increasing orientation toward integrated, networked robotic systems rather than isolated mechanical devices. The AI domain (n=17) encompasses terms from knowledge representation (ontology, behavior tree), machine learning (deep learning, imitation learning, model learning), and planning (TAMP, task planning), underscoring the depth of AI's penetration into robotics vocabulary.

The Manipulation domain (n=14) contains the highest density of compound terms (end-effector, suction grasp, pick and place, dexterous manipulation), consistent with the functional specificity required to describe physical interaction with objects. The relatively smaller domains of Medical (4.8%), Control (4.8%), Aerial (2.7%), and Marine (2.1%) reflect specialized sub-disciplines whose terminological contributions to the broader field are narrower but distinct. Across all domains, the functional role of terms is primarily referential and classificatory - terms name entities, processes, or properties and situate them within conceptual hierarchies - but a secondary argumentative function is visible in terms like shared autonomy, human-in-the-loop, and social human-robot interaction, which encode normative assumptions about the appropriate relationship between humans and robotic systems.

Table 2. Semantic Domain Distribution of Robotics Terms (n=146)

Semantic Domain	**Count**	**Percentage**	**Sample Terms**
Systems	21	14.4%	AMR, IoRT, service robot, multimodal exchange
AI	17	11.6%	deep learning, ontology, affordance, behavior tree
Manipulation	14	9.6%	end-effector, suction grasp, dexterous manipulation
Locomotion	13	8.9%	legged robot, biped, humanoid, bipedal locomotion
Navigation	12	8.2%	SLAM, occupancy mapping, visual-based navigation
Sensing	12	8.2%	IMU, sensor fusion, tactile sensing, RGB-D
Perception	10	6.8%	semantic scene understanding, object detection
Motion Control	9	6.2%	motion planning, FPK, FVK, kinematic chain
Design	9	6.2%	soft robot, exoskeleton, parallel robot, biomimetics
HRI	8	5.5%	shared autonomy, haptic interface, brain-machine interface
Medical	7	4.8%	prosthetic, wearable robot, cell microinjection
Control	7	4.8%	MPC, adaptive control, sensor-based control
Aerial	4	2.7%	UAV, space robotics, aerial system
Marine	3	2.1%	USV, marine robotics

5. Conclusions

5.1. Conclusion

This study has presented a corpus-grounded functional-semantic analysis of 146 robotics terms extracted from IEEE Transactions on Robotics (T-RO), IEEE Robotics and Automation Letters (RA-L), and Frontiers in Robotics & AI. The findings reveal a marked dominance of compounding (74.0%) as the primary word-formation strategy, with acronymy (13.7%) occupying a distant second position. This distribution diverges from the more balanced multi-strategy patterns identified in earlier terminology studies and reflects the informational density and precision required in contemporary robotics discourse. From a semantic perspective, the concentration of terms within the Systems, Artificial Intelligence, and Manipulation domains highlights current research priorities in robotics, namely integrated autonomous systems, AI-driven decision-making processes, and embodied interaction with physical environments. Overall, the study demonstrates that robotics terminology is functionally structured around both morphological efficiency and domain-specific conceptual clustering.

5.2. Research Limitations

Despite careful corpus design, this study has several limitations. First, the dataset comprises terms drawn from a single publication year, which restricts diachronic insight into terminological evolution. Second, the corpus is limited to six high-impact journal sources, potentially excluding terminological variation found in conference proceedings, patents, industrial documentation, and technical standards. Third, the relatively small dataset (146 terms) constrains the scope of statistical generalization and frequency-based analysis.

5.3. Suggestions and Directions for Future Research

Future research should expand the temporal scope to at least five publication years in order to capture longitudinal trends in robotics terminology. Incorporating patents, technical standards, and large-scale conference proceedings would provide a more comprehensive representation of the field. The application of automated term recognition tools and computational corpus methods is recommended to enable large-scale frequency, collocation, and co-occurrence analyses. Additionally, cross-linguistic comparative studies examining English-medium IEEE robotics terminology alongside Chinese, German, and Japanese equivalents would offer valuable insights into how different scientific communities lexicalize shared technological concepts. Such research would further contribute to terminological standardization, translation studies, and interdisciplinary technical communication.

Author Contributions

RGXQ and NBAO both contributed equally to the study. RGXQ Led the conceptualization, methodology, and data analysis, while NBAO assisted with data collection, analysis, and interpretation. Both authors drafted and revised the manuscript, ensuring its accuracy and clarity.

Acknowledgements

The authors thank IEEE Transactions on Robotics, IEEE Robotics and Automation Letters, and Frontiers in Robotics & AI for providing access to the articles used in this study. Special thanks to Namangan State Technical University for the academic resources, as well as the anonymous reviewers for their valuable feedback. Lastly, the authors appreciate the support of their families throughout the research process.

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