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Section
Systems & Control Engineering

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Section Information

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This section is devoted to publishing focused articles related to control aspects of electronics and engineering systems, more specifically including theoretical developments and applications of control engineering as embedded control systems, mechatronics, smart systems, power systems, electrical circuits, computer science, for the enhancement of electronics systems and processes. All submissions are subject to a peer-review process. We encourage the submission of original contributions derived from theoretical and/or application-oriented research studies.

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Selected Papers

Human–Robot Interaction Using Dynamic Hand Gesture for Teleoperation of Quadruped Robots with a Robotic Arm

Authors: Jianan Xie, Zhen Xu, Jiayu Zeng, Yuyang Gao and Kenji Hashimoto

Abstract: Human–Robot Interaction (HRI) using hand gesture recognition offers an effective and non-contact approach to enhancing operational intuitiveness and user convenience. However, most existing studies primarily focus on either static sign language recognition or the tracking of hand position and orientation in space. These approaches often prove inadequate for controlling complex robotic systems. This paper proposes an advanced HRI system leveraging dynamic hand gestures for controlling quadruped robots equipped with a robotic arm. The proposed system integrates both semantic and pose information from dynamic gestures to enable comprehensive control over the robot's diverse functionalities. First, a Depth–MediaPipe framework is introduced to facilitate the precise three-dimensional (3D) coordinate extraction of 21 hand bone keypoints. Subsequently, a Semantic-Pose to Motion (SPM) model is developed to analyze and interpret both the pose and semantic aspects of hand gestures. This model translates the extracted 3D coordinate data into corresponding mechanical actions in real-time, encompassing quadruped robot locomotion, robotic arm end-effector tracking, and semantic-based command switching....

https://doi.org/10.3390/electronics14050860

Towards Dynamic Human–Robot Collaboration: A Holistic Framework for Assembly Planning

Authors: Fabian Schirmer, Philipp Kranz, Chad G. Rose, Jan Schmitt and Tobias Kaupp

Abstract: The combination of human cognitive skills and dexterity with the endurance and repeatability of robots is a promising approach to modern assembly. However, efficiently allocating tasks and planning an assembly sequence between humans and robots is a manual, complex, and time-consuming activity. This work presents a framework named "Extract–Enrich–Assess–Plan–Review" that facilitates holistic planning of human–robot assembly processes. The framework automatically *Extracts* data from heterogeneous sources, *Assesses* the suitability of each assembly step to be performed by the human or robot, and *Plans* multiple assembly sequence plans (ASP) according to boundary conditions. Those sequences allow for a dynamic adaptation at runtime and incorporate different human–robot interaction modalities that are Synchronized, Cooperative, or Collaborative. An expert remains in the loop to *Enrich* the extracted data, and *Review* the results of the *Assess* and *Plan* steps with options to modify the process. To experimentally validate this framework, we compare the achieved degree of automation using three different CAD formats. We also demonstrate and analyze multiple assembly sequence plans that are generated by our system according to process time and the interaction modalities used.

https://doi.org/10.3390/electronics14010190

Advances in Autism Spectrum Disorder (ASD) Diagnostics: From Theoretical Frameworks to AI-Driven Innovations

Author: Christine K. Syriopoulou-Delli

Abstract: This study provides a comprehensive analysis of the evolution of Autism Spectrum Disorder (ASD) diagnostics, tracing its progression from psychoanalytic origins to the integration of advanced artificial intelligence (AI) technologies. The study explores, through scientific data bases like Pub Med, Scopus, and Google Scholar, how theoretical frameworks, including psychoanalysis, behavioral psychology, cognitive development, and neurobiological paradigms, have shaped diagnostic methodologies over time. Each paradigm's associated assessment tools, such as the Autism Diagnostic Observation Schedule (ADOS) and the Vineland Adaptive Behavior Scales, are discussed in relation to their scientific advancements and limitations. Emerging technologies, particularly AI, are highlighted for their transformative impact on ASD diagnostics. The application of AI in areas such as video analysis, Natural Language Processing (NLP), and biodata integration demonstrates significant progress in precision, accessibility, and inclusivity. Ethical considerations, including algorithmic transparency, data security, and inclusivity for underrepresented populations, are critically examined alongside the challenges of scalability and equitable implementation....

https://doi.org/10.3390/electronics14050951

A Class of Anti-Windup Controllers for Precise Positioning of an X-Y Platform with Input Saturations

Authors: Chung-Wei Chen, Hsiu-Ming Wu and Chau-Yih Nian

Abstract: The windup phenomenon occurs and results in performance degradation while the designed positioning controller output makes actuators saturated. This study presents significant and effective anti-windup controllers for performance improvement and comparison of the position tracking. To address real-world industrial scenarios, the trajectory with a T-curve velocity profile is planned to regulate hardware limitations and maintain efficiency throughout the control process. At first, the dynamic model of an inertia load for a servo control system is established using Newton's law of motion. Then, anti-windup controllers are designed and implemented based on basic PID controllers. The conducted simulations validate its effectiveness and feasibility. Finally, experimental results demonstrate that the proposed algorithms achieve smaller overshoot and faster settling time under input saturations when executing specific paths on the X-Y platform, even though the given control commands change. It is verified that the proposed approaches can, indeed, effectively mitigate the windup phenomenon, leading to improved positioning accuracy in industrial applications.

ttps://doi.org/10.3390/electronics14030539

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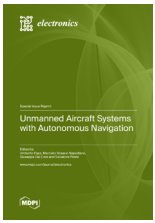

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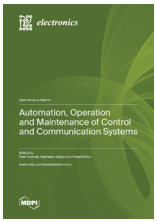

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