Thesis Project Portfolio

Hybrid Humanoid Robot (HHR)
(Technical Report)

Integration of Social Companion Robots in Japanese Elder Care
(STS Research Report)

An Undergraduate Thesis

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Bachelor of Science, School of Engineering

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Executive Summary: Sociotechnical Synthesis on Humanoid Robots in Society and Elderly Care

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Introduction

This synthesis bridges two seemingly disparate realms: the development of a hybrid humanoid robot designed for navigating complex environments, and an exploration into the integration of social companion robots (SCRs) in Japanese elderly care facilities. While at first glance, the technical and sociotechnical endeavors may appear only loosely connected, both projects revolve around a central theme: the profound impact of robotic technologies on human lives and the sociocultural fabric of society. The motivation behind each project, though distinct, converges on a common aim—enhancing human welfare through the innovative application of robotics, guided by thoughtful consideration of societal values and needs.

Capstone Project Summary: Hybrid Humanoid Robot

The technical essence of my Capstone project is the development of a hybrid humanoid robot with the duality of bipedal and wheeled locomotion, tailored for operations in naval warfare vessels. This pioneering endeavor encompasses the integration of mechanical systems, custom code, and mechatronics into a versatile robot capable of real-time environment interaction— detecting obstacles, and dynamically switching between movement modes for optimal navigation. The unique element of this project is the compliant foot/wheel mechanism, a new design enabling the robot to adapt to its environment by having the ability to both roll and walk on the same feet. This compliant mechanism illustrates a leap towards autonomous robotic mobility, aiming to ensure human safety and operational efficiency in high-risk environments.

STS Research Paper Summary

In parallel, my STS research paper delves into the sociocultural implications of deploying SCRs in Japanese elderly care settings, framed through Actor-Network Theory (ANT). This inquiry

examines the nuanced interactions between elderly residents and robots like Pepper, exploring how these technological companions redefine care practices and challenge traditional caregiving norms. Amid Japan's demographic shifts and evolving societal attitudes towards elder care, SCRs offer a lens to assess the interplay between technological innovation and human values. The paper investigates the acceptance, effectiveness, and ethical considerations of robots in caregiving roles, revealing a complex web of benefits, apprehensions, and cultural dynamics at play.

Concluding Reflection

Embarking on these concurrent projects has been a deeply enriching experience, offering unique insights into the intersection of technology and society. The technical project not only honed my skills in robotics and mechatronics but also underscored the potential of robots to navigate and interact with the human world more intimately. Meanwhile, the STS research illuminated the social dimensions of technology adoption, particularly in sensitive areas like elder care, where human touch and emotional connection hold profound significance. This dual inquiry has reinforced the importance of adopting a holistic perspective when developing and implementing robotics technologies. The technical feasibility, social acceptability, and ethical implications of robots in human environments must be further considered when looking at the projects as one piece. Working on both projects simultaneously provided a valuable lesson in the mutual shaping of technology and society, emphasizing that technical innovation must go hand in hand with an understanding of human needs, cultural values, and ethical considerations to truly enhance the quality of life.