CareBotix in Motion II: Integrating Advanced Manipulation, Autonomous Navigation, and Social Interaction in a Platform Agnostic Robotics System

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By 2052, one quarter of the population will be over the age of 65, with adults over 85 the fastest growing segment. Supporting older adults to maintain their independence is a global priority. This project extends the original CareBotix system into a platform agnostic robotic system integrating manipulation, navigation, social interaction, and multimodal artificial intelligence. The manipulation system was tested on object handling tasks using the Isaac GR00T framework. These trials evaluated the performance as well as adaptability of the unified manipulation logic. Navigation paired cuVSLAM for indoor localization with the Cosmos-Reason2-2B reasoning LLM architecture for goal interpretation and adaptive planning. Older adults interacted with the robot's social interface to assess how well the system supported natural engagement, emotional responsiveness, and design acceptance. The manipulation subsystem achieved approximately 90% task success and low joint trajectory variance, indicating stable execution and adaptation to pose variation. A VLA style reasoning layer produced correct action sequences for reaching, grasping, and handling. cuVSLAM built a stable map in 10 seconds, maintained 5–10 cm localization error, and tracked 400 features per frame. For human–robot interaction, a Multi-MiniLM model was used to understand multimodal inputs. The model used four classifiers with the following accuracies: Toxicity (96%), Sentiment (85%), Intent (95%), and Emotion (81%). These evaluations demonstrated that a modular, platform agnostic architecture could scale across robotic systems while delivering robust manipulation, reliable navigation, and safe and naturalistic interactions - all important factors for acceptance by older adults.

Awards Won:
Fourth Award of $600
International Council on Systems Engineering - INCOSE: Certificate of Honorable Mention, a 1-year free student membership to the INCOSE, and free virtual admission to the 2022 International Symposium of the INCOSE