

# HAPT-EDGE: HAPTICS IN SOFT EFFECTORS FOR SMART INTERACTIVE ASSISTIVE FRAMEWORKS

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## ABSTRACT

Tactile sensors help in modeling the intrinsic and external touch sensation. Tactile sensing can refer to the touch in multiple points of contact and refer to the process of detecting and measuring a given property of a contact event in a predetermined area at multiple points of contact. The Haptic system helps in creating a “sense of touch” about the environment through stimuli at a single contact point. Effectors are the end point of robotic frameworks that interact with the real world. From prosthetic hands to precision grippers, effectors made of soft flexible materials have been used for various biomedical applications. The research goal of this project is to integrate haptics in soft effectors for two-way communication in an assistive framework. In this research, we will investigate the use of haptics for creating environmental awareness and for taking the user input. Modeling the user input using the haptics will include interpreting the hand gestures. The proposed framework will use the haptic signals at specific frequencies to provide sensor feedback and interpret the user’s hand gestures as user inputs for navigation assistance. In implementing such a framework, the research will also focus on the use of micro actuators or vibration motors for providing precise feedback. The framework will include custom-made soft effectors, robotic cane/walker, algorithms to model the user input, actuators, and vibration sensitive filaments for closing the loop. This research will significantly contribute to the next generation mobility assistive frameworks with interactive feature.

**Keywords:** Assistive technology, robotics, haptic systems, IoT-model, soft effectors.

## INTRODUCTION

While designing assistive technologies, assessing the target population for whom the product is designed is the first and foremost step. With a primary focus to improve the standard of living, the product can be categorized into assistive technologies for elderly [1], audio and vision sensory disabilities [2], mobility-based disabilities [3] and so on. According to the Rural Health Information Hub, there are more than 46 million older adults aged 65 or older living in the U.S. and by 2050 this number is expected to grow to almost 90 million. In pursuit of assisting our rural citizens with easy-to-use assistive technologies, this research, Hapt-edge, will investigate the design and deployment challenges associated with a real-time IoT-based cane that uses haptics as assistive aid and communication device as shown in figure 1. *The research goal of this project is to develop and evaluate a cost-effective edge intelligent assistive framework, Hapt-edge, which can be used for intelligent, personalized haptic signals for providing feedback to the user.* The proposed framework can be used for applications in remote and rural areas without smartphones and with limited access to Internet of Things (IoT) cloud. The COVID-19 pandemic highlighted the benefits of IoT in many different industries that used it to manage power grids, transportation, and more importantly and evidently, healthcare.