# Haptic Recording and Display System for Guide Dog Training

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***Abstract*— This study proposes a concept of a system to record and display haptic information for guide dog training. A qualified trainer can comprehend dogs' motion status through haptic feedback via the handle, and give instructions accordingly. Such a haptic-based skill is important but difficult to convey as being obtained via personal experiences. The proposed method functions by combining a handle-based sensing system to record haptic interactions and two haptic devices to reproduce forces and poses separately to convey haptic information. We believe this will enable novice trainers to properly sense the appropriate forces from experienced trainers or, conversely, experienced trainers to evaluate novice trainers' performance and further instruct. The article proposes a basic sensing system and a haptic system to reproduce corresponding haptic information.**

## I. Introduction

A guide dog is one means of assisting the visually impaired to walk outside [1]. However, the number of guide dogs is not sufficient [2], and the number of trainers who train them is also limited [3]. Thus, in order to develop more qualified trainers, a scheme is needed by which novice trainers can acquire skills efficiently.

For guide dog training, a qualified trainer should be able to understand the behavior of guide dogs through the haptic feedback via handle and could prompt the dog to behave appropriately by applying forces to handle based on perceived motion information. Since these skills are not easily acquired by simply observing nearby or through video, teaching tactile interaction has been one of the most important challenges.

Based on the above requirements, we propose a basic concept of a sensing system to record haptic interactions between a trainer and a dog via the handle, and a haptic display system to reproduce and utilize these interactions for training.

## II. Proposed System

The haptic system functions through relaying reproductions of forces between trainers and dogs to users. Forces given along handle have variances in directions and values with different instructions. Thus, forces (initially being pulling/pushing forces) including values and directions are to be reproduced. As forces are given via handle, the directions of pulling/pushing along handle are seen as handles' poses.

For handle pose display, we employed the Geomagic Touch developed by Sensable Technology seen in blue box. The Geomagic Touch is widely used for kinesthetic feedback with a serial robot arm featuring 3 rotational joints and a stylus [4]. Users passively feel displayed poses, holding the stylus as handle and do not moving during operations. overall poses of the robotic arm are controlled aligning poses of three joints which are adjusted with individual motors. Ranges of pose angles allowed by Geomagic touch device can perfectly cover handle poses during all kinds of tracks.

For force relay, a linear actuator(12Lf-12F-27) is used seen in green box. Directions of forces are adapted with goal moving directions of actuator rod: user's wrist gets propelled when the rod extends and users can feel pushing forces, and the opposite direction works similarly. Values of force are controlled with current values which are modulated through parameters as velocities, accelerations, and goal distances. The linear actuator is mounted rigidly with one end connected to end joint of Geomagic touch to move in collaboration and the other end attached to user's hand holding the stylus and wearing a hard glove.

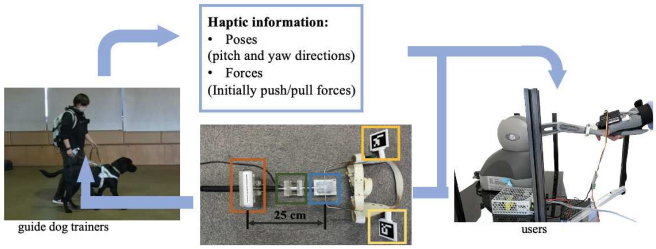


Fig. 1. Illustration of the haptic devices setup.

## III. Discussions and Conclusions

The proposed haptic training system is able to provide users with an accurate reproduction of the recorded haptic experiences. Thus with the system, novice users could learn about appropriate forces to exert in corresponding training scenarios and reversely experienced trainers could evaluate novice trainers performance in training.

## References

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This research was supported by JSPS KAKENHI Grant Number 21H05301.