Development of Haptic Data Gloves for Bilateral Communication

Hao-An Tseng[1], Jasper Tsai[1], Patrick C. K. Hung[1,2], Paolo Bottoni[2,3], Kamen Kanev[1,2]
Atsushi Nakamura[2], Hidenori Mimura[1,2], Masakatsu Kimura[1,2], Benjamin C. M. Fung[4]
[1]Ontario Tech University, Oshawa, Canada, [2]Shizuoka University, Hamamatsu, Japan
[3]Sapienza University of Rome, Rome, Italy, [4]McGill University, Montreal, Canada

Introduction

According to a survey conducted by Japan's Ministry of Labor and Health, over 23000 individuals in the country are deafblind, with many more experiencing gradual losses of both their sight and hearing due to their disabilities. We are developing a haptic data glove that utilizes the mobile Malossi alphabet (Fig. 1) to facilitate two-way communication through tactile and vibratory means. The innovation aims to diminish the reliance of deafblind individuals on caregivers and interpreters, thereby enhancing their independence.

Materials and Methods

Fig.1 The Mobile Malossi alphabet mapping of the 26 letters from the English alphabet applied to the left hand.

Fig.2 The prototype Datagloves. The sender glove (a) has integrated touchpads and wiring for input tracking. The receiver glove (b) includes piezoelectric actuators for haptic feedback. Upgrades like a back-mounted screen and speaker could improve helper interaction.

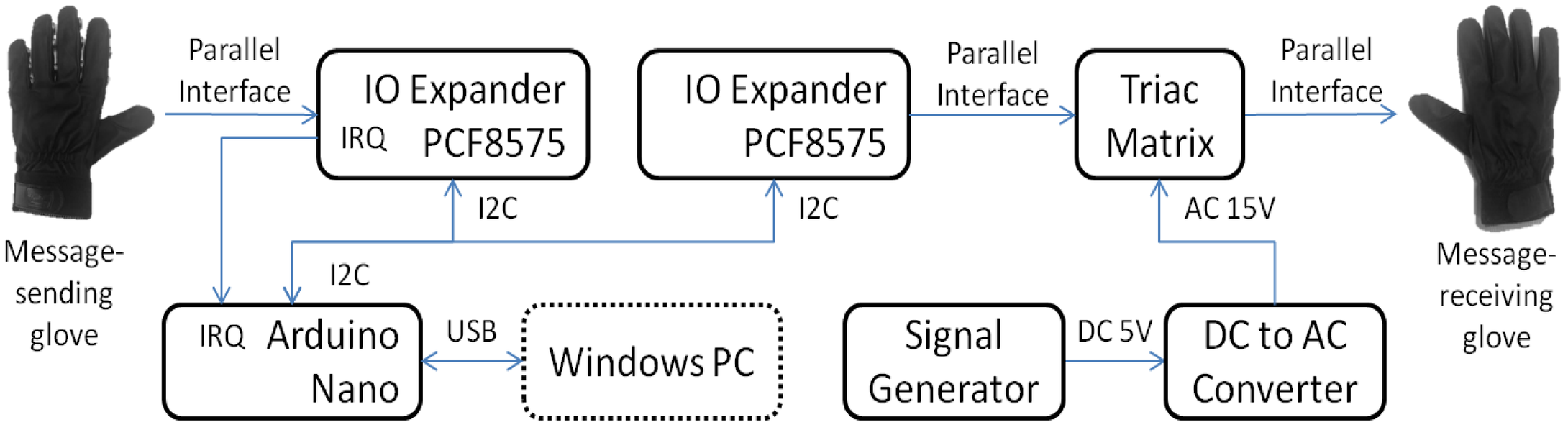

Fig. 3. Signal flow diagram of the integrated system. The integrated system's signal flowchart details an Arduino Nano microcontroller setup with IO Expanders linking the sending and receiving gloves. Communication is IRQ-based for sending and triac matrix-controlled for receiving, enabling immediate data transfer and real-time tactile feedback.

Future works

The prototype data gloves are designed for the deafblind to communicate locally and remotely and can be adapted for emergencies like natural disasters, enabling communication in conditions where sight and hearing are compromised. Future designs will focus on waterproof and fire-resistant versions with reliable, long-lasting communication channels for use in extreme environments.