

# Haptic Voice Recognition (HVR): A Multimodal Interface Combining Speech and Touch Inputs for Efficient and Robust Text Entry on Mobile Devices

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## Abstract

*This demo proposal describes a novel multimodal interface for text entry on modern mobile devices equipped with both microphone and touch screen display. This interface enables users to speak to the microphone and tap/scribble on the touch screen display to provide two data streams (speech signal and haptic events), either concurrently (synchronous mode) or sequentially (asynchronous mode). Both the acoustic and haptic inputs are processed and converted into texts using an integrated framework known as Haptic Voice Recognition (HVR).*

*HVR was first introduced in [1] and preliminary studies have shown that potential recognition performance improvements both in terms of speed and robustness to noise can be achieved using HVR. HVR essentially augments the traditional Automatic Speech Recognition (ASR) with haptic events, which are used to prune away competing paths during the decoding process. In addition to the regular beam pruning, haptic pruning provides further reduction in the search space, thereby improving the runtime efficiency of HVR. Moreover, haptic events are not affected by acoustic noise, making HVR more robust in noisy environment.*

*This demo will show a fully functional HVR prototype implemented on the iOS platform. For this demo, the initial letters of the words in the spoken utterances are augmented as haptic events for HVR. For example, to enter the text "Ashley and her sister Frances will be visiting Amarillo tomorrow," the user will speak the sentence and use the touch screen to generate a sequence of haptic events that correspond to "A", "A", "H", "S", "F", "W", "B", "V", "A" and "T". The demo prototype provides two ways of generating haptic events. The first way uses an onscreen virtual keyboard where haptic events are generated by simply tapping on the appropriate keys. The second way allows users to scribble the letters on an onscreen scratchpad. Two screenshots depicting the prototype iPad app with HVR interface operating with the keyboard and keystroke haptic input methods are shown in Figure 1 and Figure 2 respectively. The prototype accepts single-stroke letters for keystroke input. Example keystrokes for the letters are shown in Figure 3.*

*Along with the demonstration of the prototype HVR interface running on iPad, a poster will also be presented to provide detailed explanation of the design and operation of HVR as well as some analyses of the user data collected using the HVR prototype.*

## References

- [1] Khe Chai SIM, "Haptic Voice Recognition: Augmenting Speech Modality With Touch Events For Efficient Speech Recognition", *IEEE Workshop on Spoken Language Technology*, 2010.

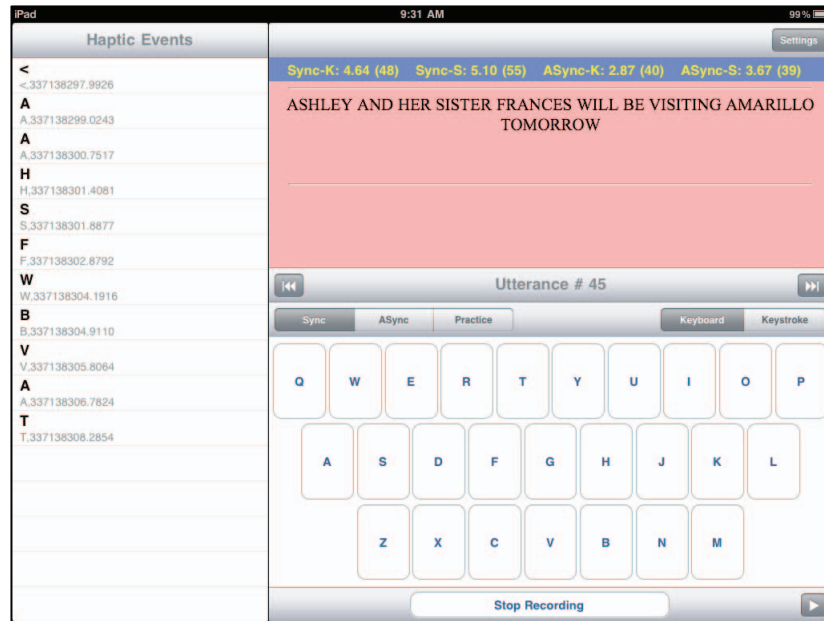


Figure 1: Screenshot of the HVR prototype iPad application using an onscreen virtual keyboard to input haptic events

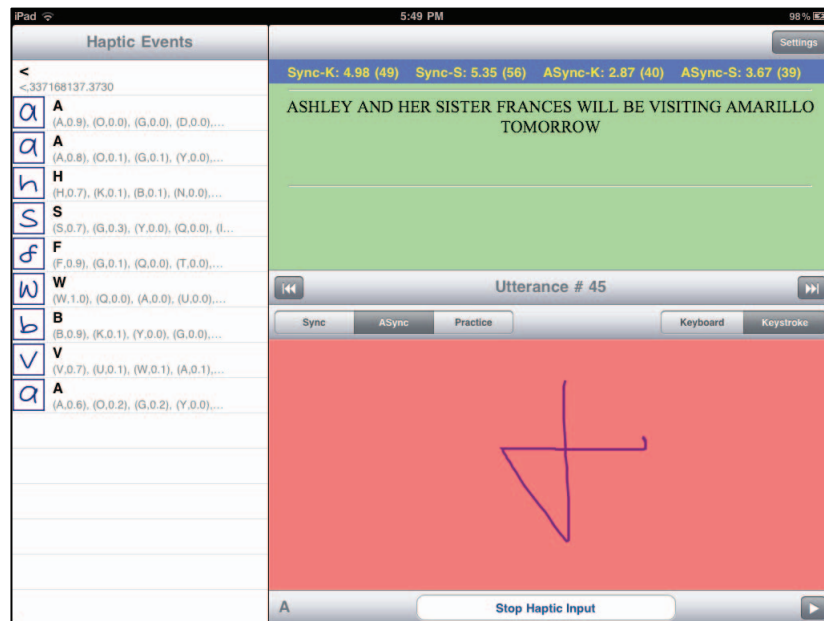


Figure 2: Screenshot of the HVR prototype iPad application using an onscreen scratchpad to input haptic events

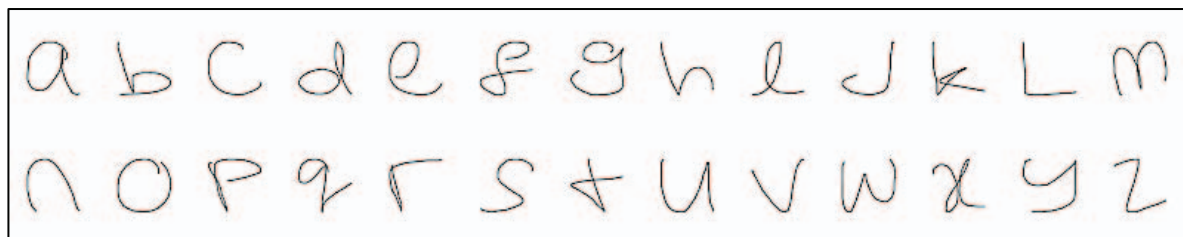


Figure 3: Examples of single-stroke letters recognised by the HVR prototype iPad application