

Tactograms for Vibro-tactile Route Guiding

Andreas Riener, Markus Straub, and Alois Ferscha

Johannes Kepler University Linz, Institute for Pervasive Computing,
Altenberger Str. 69, A-4040 Linz, Austria

Abstract. Research on vibro-tactile stimulation, particularly for application in navigational scenarios, has increased considerably in the last years. The bigger part of the reported work deals with outdoor navigation, mostly in combination with GPS position tracking. Outdoor route guiding operates sufficient accurate even if the feedback is imprecise and the update rate is low or delayed, as the distances to walk between way-points are great. With technology advances in both precise indoor position and orientation tracking and vibro-tactile feedback systems, directed and accurate indoor route guiding might come true. However, several problems have to be covered, for instance *(i)* the prevention or compensation of latency times or *(ii)* the definition of vibro-tactile notification patterns for precise route guiding.

In our studies, focused on precise and rapid haptic feedback for route guiding, we used the Intersense IS-900/Ubisense 7000 systems for person tracking on centimeter precision and a vibro-tactile waist belt composed of 8 C-2 tactor elements from EAI Technologies for providing navigational information to the wearer. Position and distance was encoded using combinations of *(i)* vibration intensity (attenuation in dB), *(ii)* vibration frequency, *(iii)* tactor position, and *(iv)* vibro-tactile pattern. First results showed that notification latency led to an increasing number of walking anomalies and consequently highly affects walking precision and speed. But in the case of ideal system parametrization (mainly determined by a low latency in the feedback loop), vibro-tactile cues alone allow for precise walking with an average failure of around $20cm$.

Keywords: Vibro-tactile guidance, Distance encoding, Tactograms.

Demonstration

As the utilized tracking systems are not portable we will use a position tracking simulator instead of in order to give an idea about the performance of our vibro-tactile waist belt. A volunteer (conference attendee) wears the tactor belt and follows the route information provided by the adviser via mouse traces. This way we can demonstrate that people are able to find completely invisible paths just by sensing and interpreting vibrations. A demo participant will be able to experience three different types of vibro-tactile guidance cues:

- (i)* Continuous vibration at fixed frequency of $250Hz$ and maximum amplitude.
- (ii)* Continuous vibration at both variable frequency ($200Hz - 300Hz$) and amplitude ($-24 - -0dB$).
- (iii)* Vibration patterns (“Tactograms”) at variable frequency ($250Hz - 320Hz$).