Remote Texture Exploration

Imagine you are using your mobile device to browse the Internet for new furniture, home decoration or clothes. Today's systems provide us only with information about the look of the products, but how does their surface feel when touched? For the future, we imagine systems that allow us to remotely enjoy the look and feel of products. The impact of such technology could be enormous, especially for E-Commerce. Tangible example applications are product customization, selection of materials, product browsing or virtual product showcases.

Surface textures can be represented by acceleration signals, which are recorded during stroking of the object surface with a rigid tool. A convincing texture display for end user devices, however, is currently still lacking. We believe that the TPad Phone can fill this gap. Friction and roughness of a surface are two of the main dimensions in texture perception, which we want to recreate using the variable friction display. The information about the surface roughness – both macroscopic and microscopic - can be extracted using the smartphone sensors (IMU, camera, microphone) and used to create texture models enabling the display of a wide variety of textures on the TPad Phone.

Fig. 1 below illustrates the envisioned system that enables the remote touch of textures. Conceptually, the texture models can be retrieved from a prestored database or obtained from live recordings as shown below. Our primary focus in this project is on the convincing display of texture models (Fig. 2). To increase the realism, the tactile feedback is accompanied with images and sound. In the demo app, these textures will demonstrate the capability of the TPad Phone and our texture rendering algorithms. We further foresee the integration of live recordings and model creation as a demo on the TPad Phone.

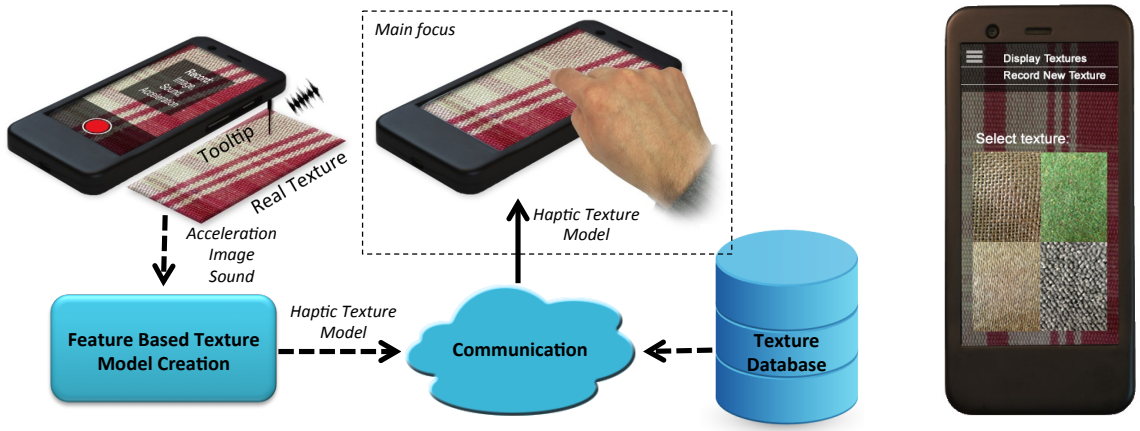

Figure 1: Left: *Overview of a distributed texture recording and display system. In this project we want to primarily focus on the feature based texture model creation to achieve a convincing texture display with the TPad Phone.* Right: *The Android prototype app serves as a demo to illustrate the texture rendering.*

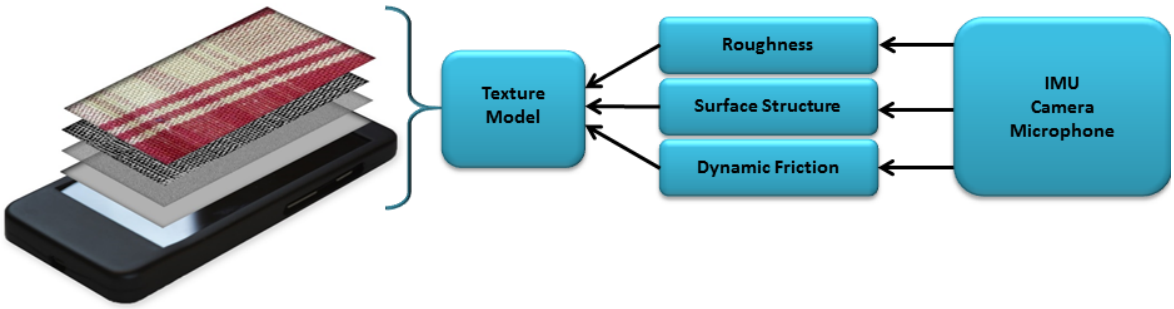

Figure 2: The haptic texture displayed with the TPad Phone uses a dynamic friction map, which is created by fusing the texture surface information recorded with the IMU, camera and microphone of the TPad Phone. The sensor fusion is important to create a realistic texture model, which is – in our opinion - not possible with images only.

Student Team: Our team consists of three PhD students with complementary research background. All skills required for the completion of the proposed application are available.

Matti Strese (haptic texture recognition, retrieval and synthesis, signal processing, Java, C++)
Clemens Schuwerk (haptic rendering, haptic communication, distributed systems, Java, C++)
Dmytro Bobkov (sensor fusion, image processing, machine learning, Android development, Java, C++)

Project Advisor: Prof. Eckehard Steinbach, Chair of Media Technology, TU Munich, Germany (for example projects in the area of haptics see http://www.lmt.ei.tum.de/en/prohaptics.html)