Student Innovation Challenge at the World Haptics Conference 2015: Teams Create Haptic Apps for the TPad Phone

Joe Mullenbach

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USE a variable-friction haptic smartphone to solve a real world problem. That was the challenge that student teams faced for the first ever Student Innovation Challenge at World Haptics 2015. Their responses ranged far and wide, from helping blind people take pictures to curing animal phobias. Twenty-five proposals were received from across the globe and nine teams were chosen as finalists, ultimately representing eight countries across four continents. The idea of running a student competition on a hardware platform with haptic feedback was conceived by Ed Colgate, Joe Mullenbach, and Hong Tan when the three took a bus to the airport after AsiaHaptics 2014. The event was organized by Joe Mullenbach of Northwestern University and received enthusiastic support from fellow student Craig Shultz, their advisor, Ed Colgate, and Arjmand Samuel, Jim Holbery, and Hong Tan from Microsoft. It was co-sponsored by Microsoft and the TPad Tablet Project.

Each finalist team was sent a TPad Phone (www.thetpadphone.com) along with programming tutorials. The TPad Phone, developed at Northwestern University and sold through Tanvas Inc., is a regular Android smartphone with a variable-friction haptic display created for academics and companies interested in researching and exploring the technology. The teams, some of whom had never programmed an Android app before, had just two months to develop their app before demonstrating it to a panel of judges at the 2015 IEEE World Haptics Conference (Fig. 3). The judges were Professor Sile O'Modhrain of the University of Michigan, Jim Holbery of Microsoft, and Greg Topel of Tanvas (formerly Tangible Haptics). Together, the winning teams received $3,000 in cash prizes and 12 Microsoft tablets, and every team got to keep their TPad Phone after the contest. Full descriptions of all the applications as well as one-minute videos are available at http://haptics2015.org/program/student-innovation-challenge.html. The winning submissions were:

First place—RoughSketch is a drawing application that presents a distinct feeling for each drawing tool (Fig. 1). For example, the paintbrush starts slippery, but gains texture as paint is removed from the brush. The pen tool has a constant rolling on paper feeling, while the eraser has the distinct sensation of rubbery bits wearing away as you erase. RoughSketch was created by Brenna Li, Gordon Minaker, Paul Bucci, and Oliver Schneider from the University of British Columbia, Canada.

Second place—HelloHapticWorld: A Haptic Educational Kit for Children. This application allows gesture-based teleoperation of small driving robots while providing haptic feedback that indicates the robot's surroundings such as road slope or obstacles ahead (Fig. 2). It was created by Dennis Babu, Daniel Gongora, Seonghwan Kim, and Shunya Sakata of Tohoku University, Japan.

Third place—Invisible Password is an application that allows eyes-free unlocking of your smartphone. Rather than tapping out numbers, users slide their finger randomly across the blank screen and count tactile lines up to the digit they want to enter. It was created by Gabriel Figueiredo, Matheus Tura, Bruno Cattelan, and Wagner Rampon of Universidade Federal do Rio Grande do Sul, Brazil.

People's choice—Remote Texture Renderer allows users to both record and display textures on their phone. Using a special tool to slide across a texture and capturing audio, acceleration, and image data, a texture model is created which can then be displayed on the TPad Phone or sent electronically. The tool and application were created by Matti Strese, Clemens Schuwerk, and Dmytro Bobkov of the Technical University of Munich, Germany.

Other applications include-

- *Tactile blind photography*—An application that is designed to assist visually impaired people in taking pictures. A texture is displayed over each face within the field of view in order to allow appropriate framing.
- *Haptic Physics - Eureka*—An application for learning physics through physical interaction. Objects on the screen exhibit forces due to gravity, friction, and spring force.
- *TacScore*—An application for reading music through touch. The musical stave is displayed in a spatial tactile map on the screen.

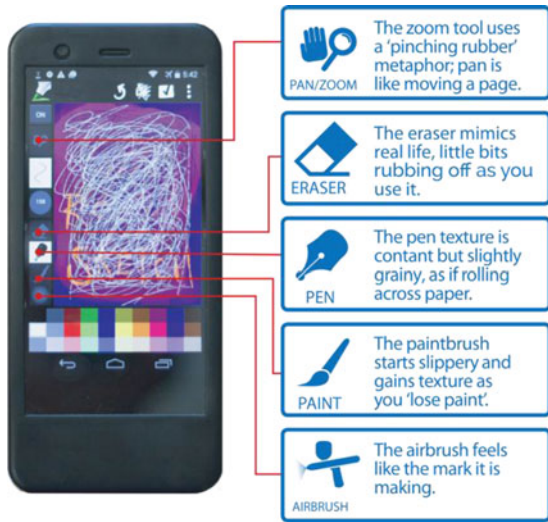- *The author is with the Northwestern University, Evanston, IL.*

Fig. 1. First place RoughSketch app.

Fig. 2. Person using the HelloHapticWorld app on the TPad phone.

- *Phoby therapy: Treatment of small animal phobia using a haptic augmented reality system*—This application first diagnoses your fear of small animals like snakes, spiders and cockroaches, and then asks you to touch them on the screen. As you progress through the therapy, the animals become more realistic, starting as nice feeling cartoons and ending by appearing on the table in front of you through augmented reality.
- *TeXecure: A secure input method using textures*—This application allows you to unlock your phone or input a PIN not typing in numbers, but by recognizing and choosing the correct textures.

Fig. 3. Participants of the student innovation challenge at World Haptics.