Figure 1: (a) This blind user is playing a first-person shooter designed for sighted users. (b) The DualPanto bimanual force feedback device enables this. Its me handle allows users to move their avatar around the virtual space. Force feedback prevents users from crossing virtual walls. The it handle moves by itself. It allows users to feel where the current opponent is located and what direction it faces. Users aim using the haptic knob on the me handle; a foot pedal fires the gun.

As part of this project, the team you will create (1) a mobile version of the shown haptic device hardware and most of all (2) a software framework, API, and IDE around it.

The device that enables blind users to interact with spatial virtual environments that contain objects moving in real-time, as is the case in sports or shooter games. Users interact with DualPanto by operating its me handle with one hand and by holding on to its it handle with the other hand. Each handle is connected to a pantograph haptic input/output device. The key feature is that the two handles are spatially registered with respect to each other. When guiding their avatar through a virtual world using the me handle, spatial registration enables users to track moving objects by having the device guide the output hand. This allows blind players of a shooter game to aim at an opponent or dodge the opponent’s shots; it allows blind players of a 1-on-1 soccer game to race for the ball or evade an opponent. In our user study, blind participants reported very high enjoyment when using the device to play (6.5/7).

Software you will write & required skills
One team member will probably specialize on working on the hardware, while the others will focus on creating a software system around it.
Ideally, you have experience in 3D computer graphics, and in the design and implementation of software system. If you had taken HCI2 and enjoyed it, that would be nice, but is not mission critical.
**me handle** lets the user explore a virtual environment

**it handle** traces moving objects