

Beam TelePresence Robot White Paper

What is it?

The [Beam TelePresence robot](#) is a mobile video conferencing device. Each unit consists of a video conferencing system mounted on a mobile robotic base. The system allows a host complete immersion in a remote location by connecting via traditional TelePresence. It also grants mobility, as the host is able to drive around in the environment, interacting with local participants. The system consists of both the physical robot (sensors and actuators) and the remote interface, at the host's location, used to pilot the unit.

How Does it Work?

The Beam telepresence robot stands 5' 2", and sports a 17" LCD screen, two wide-angle cameras, a six-microphone array, and a built-in speaker. During initial setup, the "Beam" is connected to wifi using a standard USB keyboard, which it uses to maintain a connection to the manufacturer's server. End-users download a dedicated control application (currently only available for Mac and Windows), and with a login and password connect to the manufacturer's server. They can see a list of devices they have access to, where they are physically located, and if they are available for use. If they are available, the user selects the device, and takes control of the Beam. Using the arrow keys on their keyboard, the end-user can drive the robot



See the Beam in action [here!](#)

at a maximum speed of three MPH. Two cameras provide the user with a downward-view, for driving, and a forward view, for interacting with people in the remote environment. The end-user's webcam and mic input are transmitted to the Beam, and vice-versa, allowing near real-time interaction. The Beam also allows the remote participant to share their own computer screen on the 17" LCD screen, in order to collaborate with local participants.

Use Cases at VT

There are several use cases for the Beam Robot. At Virginia Tech we have experienced or imagined the following uses:

- Remote Teaching: A faculty member is traveling and cannot be physically in class. The Beam robot is taken to the classroom and the professor logs in from the remote location and teaches class. Using the Beam, in lieu of having

an online only session, allows faculty to share their screen, move around the class, talk to specific students and feel more engaged. Dr. Joseph Tront (ECE) leveraged the Beam in this manner for his classes at the beginning of the fall 2013 semester. Dr. Tront had a GA present in the classroom and simultaneously hosted a WebEx session for sharing content on the larger projection screen.

- Remote Learner/Assistive Technology: A student is unable to attend class (illness, injury, sports) in person, but can attend and participate using the Beam robot.
- Course Sharing: A future planned course for fall 2014 includes a course with 2 instructors, one in the classroom at Virginia Tech and the other remote in Nicaragua. The class will consist of about 10 – 15 students in a flipped-style (highly interactive) course. The remote instructor will be able to move around the class to engage groups or individual students.
- Guest Speaker: Guest speakers can come to a class through the use of the Beam without physically attending. They can share a presentation and respond to questions.
- Employment Recruiter/ interviews: Many interviews consist of a meeting and also a tour of the work environ-

Use Cases (Cont'd)

ment, the Beam will allow for both to take place easily if the potential employee is unable to come in person.

- Meetings: Faculty, staff and administrators can participate in programs and meetings even if they are off site. The Beam gives them more capabilities to move around the event and look in the direction of different speakers. They can also share information from their computers.
- Tours: Groups from remote locations can get tours of specific areas at Virginia Tech, giving them flexibility of where they go and look.
- Promotional: The Beam is a great promotional tool for Virginia Tech, participating in functions for potential students.



What are the Downsides?

The limitations of the Beam robots in our initial testing arose in the broad areas of technical and physical functionality. From a technical perspective, the most serious limitation is that the robots are Wi-Fi dependent, and this is particularly complicated at VT because they can only be used in certain locations that have Wi-Fi specifically configured for their use. If the wireless goes down or the robot moves out of range it must be physically retrieved, which significantly limits usability. Video and sound can cut in and out, depending on the strength of the signal, which also impedes effective use. The Beam also features an automatic zoom out function, which is disconcerting when users move the robot slightly and must completely reconfigure their zoom settings.

From a physical perspective, the robots can only be used in locations they are physically able to maneuver. This means that they have limited mobility in classrooms that have steps, do not have aisles wide enough to accommodate the Beam, or which are otherwise not well configured for a machine that has no arms and cannot negotiate steps and (to some extent) uneven surfaces. Additionally, the full physical experience is

compromised by the limitations of the Beam camera - its range is limited (making text on a projection screen illegible, for example) and the camera has limited abilities to shift in angle, which means that the Beam must often be placed at a distance to capture objects in a room, which are then out of range to be captured in decent resolution by the camera. The initial presence of the Beam in a classroom or meeting appears to require an adjustment period for participants.

Where is it Going @ VT?

The combination of technical and physical limitations suggests that significantly expanded usage is not particularly feasible at present due to the wide variation in building and room setups at VT. However, the Beam robots certainly pose exciting possibilities for teaching, learning, and working synchronously at a distance while maintaining a unique form of physical presence. They may not be suited to usage at scale in a massive fleet, but make great sense if used as part of a suite of distance learning and working technologies, such as our enterprise versions of WebEx and lecture capture with Echo360.

Although enterprise-level expansion of the Beam robot program is probably not advisable, additional use cases may be worth compiling to determine whether adapting locations that are physically, but not technologically, feasible for the robots might make sense. If further testing demonstrates that additional use locations would be desirable, the robots will either need to be equipped with cellular data cards or made compatible with the standard VT wireless setup.

The Beam robots are available for use by anyone interested in trying them for Virginia Tech purposes. Please contact Tech Teams (tlos_techteams@vt.edu) if you are interested in taking the Beam for a spin.

<http://blogs.lt.vt.edu/techteams>