Restoring amputees' natural functionality with brain-controlled interfaces

MIT student Eeshan Tripathii is working with his sister to engineer an intuitive brain-controlled interface for upper-limb prosthetics.

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When someone close to rising MIT junior Eeshan Tripathii and his sister, engineer Vini Tripathii, had their hand amputated, the siblings witnessed the challenges of living with a prosthetic. After a year of arguing with insurance companies to get their loved one a top-of-the-line prosthetic, they were dismayed that it failed to bring the loved one closer to the functionality needed for an independent life.

The device itself had strong mechanical dexterity. In practice, though, it was difficult to use, performed unreliably, and was limited by a poor control interface. Eeshan says it was "like giving someone the world's greatest computer, but with a broken keyboard and mouse."

Frustrated by how this exorbitantly expensive device could lack such basic functionality, he and his sister set out to find a better solution. While Eeshan, an electrical engineering and computer science major, initially wanted to build his own prosthetic, the siblings quickly realized that the true problem wasn't a lack of prosthetics; in fact, there were hundreds of people building new prosthetics. But no one was focused on making them easier to control.

By combining their understanding of amputees' struggles with Vini's technical background in neuroengineering and Eeshan's experience in computer engineering, the two knew they had an opportunity to help solve the true problem that prosthetic users face. Together, the siblings began working to develop a low-cost, non-invasive, brain-controlled interface that could improve the functionality of existing prosthetics limbs. Before long, they had designed a neuroprosthetic interface that couples electromyograph and electroencephalograph sensors with a proprietary algorithm to restore natural functionality to amputees.

"Simply put," Eeshan describes, "we're building a device that decodes your muscle and brain signals and translates them into commands that a prosthetic hand can use to make gestures and grasp objects. We aren't building the prosthetic hand; we're building the interface that controls the hand, and we're doing it completely non-invasively."

The Tripathiis decided that starting a company would help move their idea forward. In order to transform their concept from a research project to a product that could actually improve the lives of amputees, they knew that they needed advice on how to effectively prototype, scale, and bring their innovation to market. So they turned to the MIT Sandbox Innovation Fund Program for support and guidance.

The MIT Sandbox connected them with mentors who helped the siblings shape their long-term research and development strategy and craft a polished pitch. When the Covid-19 pandemic struck in 2020, eliminating critical access to labs at MIT and Cornell Tech, where Vini was a student, seed funding from MIT Sandbox allowed them to continue developing their product from their home in New Jersey.

Thus, Invictus BCI Incorporated was born.

Since then, Eeshan and Vini have made significant progress and are closer to their goal of bringing their technology to market as a solution for amputees. This summer, they are participating in the MIT delta v educational accelerator. And they are excited by the prospect of helping amputees and expanding the application of their noninvasive brain-computer interface for other forms of rehabilitative tech.

As the Tripathiis continue to fine-tune their device and business strategy, they remain steadfast and passionate. “I have found that the moment you start working on something that people need, rather than something people want, it becomes impossible to work purely for yourself,” Eeshan says. “Your motivation grows beyond a personal desire to create a solution.”