

Rashmi Mohan: This is ACM ByteCast, a podcast series from the Association for Computing Machinery, the world's largest educational and scientific computing society. We talk to researchers, practitioners, and innovators who are at the intersection of computing research and practice. They share their experiences, the lessons they've learned, and their own visions for the future of computing. I am your host, Rashmi Mohan.

Oftentimes these days when we think about building tech, we are thinking building an app. The next new Subway Surfers or the app that will deliver me a pizza in 10 minutes. It's not often that our thoughts meld to germinate ideas way beyond our daily problem spaces, especially not when we are 18. But our next guests have gone where few others dare to tread. Team V Bionic has combined their love for robotics, artificial intelligence, and a genuine desire to help humanity into an award-winning product. This young team of four individuals are the most recent world champions of the Microsoft Imagine Cup. Featuring a dream team for the very first time on our show, welcome to Zain Samdani, Faria Zubair, Ramin Udash, and Asfia Jabeen to ACM ByteCast.

Zain Samdani: Hello, Rashmi. It is a pleasure to join you on this amazing podcast.

Rashmi Mohan: Wonderful. It's entirely my pleasure to have all of you. I'd like to begin the way in which I always begin my podcast, which is to ask each of you to introduce yourself, and tell me what you currently do, as well as what drew you into the field of computing and technology. Zain, would you like to begin?

Zain Samdani: Yeah, absolutely. My name is Zain Ahmed Samdani. I'm a robotic student at Jacobs University, Germany. And I'm the CEO and founder of Exoheal. With Exoheal, we help paralyzed patients regain their movement through robots. I describe myself as a change making enthusiast and an expressive artist on a mission to aid humanity by turning fiction into reality. My journey with robotics and tech in general started at the age of five. I remember running up to my mother and telling her how I'd make a robot that would do all of her household chores for her. And since then, I've been making robots to achieve that goal one day.

Rashmi Mohan: That's phenomenal. Do we have that household tour robot? Because I would definitely be your first customer.

Zain Samdani: It's still in the works. Although you'd have to be the second, because my mom gets first for this one.

Rashmi Mohan: I think that's fair. I'm okay with second.

Zain Samdani: I'll put you on the list.

Rashmi Mohan: Okay. Thank you, Zain. I'd love to ask a Faria, would you like to go next?

Faria Zubair: Hi, I'm Faria from Saudi Arabia. I'm interested in arts and design, and I'm passionate about fashion design. And one day want to have my own brand. Currently, I'm pursuing my degree in VA. Well, my interest in technology started with studying robotics in my high school. That was when I initially spark my interest in technology. As my upbringing was in a modern city, it made me realize the positive impact technology can have on society. On my trips to India, I found ways through which even simple technologies can help marginalized groups. I have always been keen on fashion designing since a really long time. And since then, was determined to incorporate fashion design with STEM, to create visually appealing change making solutions.

Rashmi Mohan: That sounds phenomenal, Faria. And it's not often that you hear of the blend of fashion design and technology. I would know because my daughter has actually just started her undergraduate degree in fashion design, so I'm very curious to know how you bring those two worlds together. But welcome to the show.

Faria Zubair: Thank you.

Rashmi Mohan: Ramin, what about you?

Ramin Udash: First off, Rashmi, thank you so much for having us. My name is Ramin Udash. I am 19 years old. And I'm a computer science student at Jacobs University, Bremen. Professionally, I am a mobile application developer and a software designer. I am mostly responsible for majority of the software side of things at Exoheal, which mostly includes the mobile app and the web dashboards for patients and doctors. I currently serve as the chief technology officer at Exoheal. I was introduced to coding for the first time at the age of 12. And I think I built my first mobile app at the age of 15. And that was when I first realized the impact one could create through coding, and that I could build something that's needed in the world, and create an actual impact. And I have been doing it since then.

Rashmi Mohan: That's amazing, Ramin. And I think my introduction was probably ideal for you. I mean, typically, you tend to think of app developers, especially when they're so young working on something that's more entertaining than something that will genuinely be a huge change in the world. So props to you for taking this journey on.

Ramin Udash: Thank you so much, Rashmi.

Rashmi Mohan: Of course. And Asfia, the last person on our list, but definitely not the least. Yeah, we'd love to welcome you to the show and know what your journey has been like.

Asfia Jabeen: Well, thank you, Rashmi. Well, I'm Asfia joining you from Saudi Arabia. I'm doing my masters of education from University of the People. And I have given a gap though after my degree, but so excited to do my master's here. And I was raised

in Hyderabad, India, and I was brought up in a family that values empathy and human life. Growing up in a multi-talented family allowed me to explore and experience various disciplines in arts, sports, and sciences. My father was a very good sportsman, he used to play football. And my uncles, and me, and my kids are good at [inaudible 00:05:59]. Well, however, I found fulfillment in helping others through social work and explore tech solutions. I'm greatly thankful to almighty God for what we have we were able to achieve till now. And I'm hoping for much more in coming years. And I wish you a very good luck for our team and all the people out there doing something to work for humanity. Thank you for having us on your wonderful platform, Rashmi.

Rashmi Mohan: So it's wonderful to hear about all of your introductions and how you all started on this journey. But Zain, I'm going to post my first question to you. Robotics has definitely been a strong interest for you from the time that you were little and you saw the need for it when your mom was doing household chores. Have you worked on any other projects before this one that you think are significant enough to talk about?

Zain Samdani: That's a fantastic question, Rashmi. So throughout my life I've tried making robots that could make the tasks that I do easier. So for instance, around the very first robots I had made was a painting robot that could create these amazing floral patterns within my paintings on the side, and I could focus more on the main part of the painting. So that allowed me to use my creativity in different ways. But one of the more significant projects I had worked on before this one was called the [Idesh 00:07:23] Robotic Hand, wherein on one of my trips, I had interacted with a lot of patients that had lost their hands or were born without one. And that got me thinking on how I can utilize this robotics technology to help them out. So I was primarily involved in the development of affordable prosthetics. And that is what I was working on for approximately three years before starting Exoheal.

I made the switch to Exoheal on a family vacation, when I met my uncle for the very first time. My uncle, to my shock, was paralyzed. He had difficulty doing the most basic of tasks, such as picking up a glass of water, changing the channel with the TV remote, or even brushing his teeth. And that again, got me thinking on, "Hey, we definitely have solutions for paralyzed patients. Why aren't these accessible to my uncle?" And when I researched a bit more on them, I realized that the same problem persisted for paralysis patients as well, that these robotics technologies were really expensive for the everyday consumer. And were mostly available to the elite or if your insurance was that good. And that just felt unfair to me, and that's the moment when I decided that, hey, okay, I'm going to make all of my research on prosthetics open source and switch over to developing exoskeletons so that I can help my uncle recover faster.

Rashmi Mohan: Wow, that's amazing. I mean, it's nice to hear about how the basic idea for Exoheal began with one, your previous experience already having built using robotics for building prosthetics and also applying it to this very specific use

case. I mean, it makes it so much more real when you're actually working with somebody whom you care deeply about and you really want to improve the quality of life that they have. But now that you've mentioned Exoheal, I'd love to understand if you could describe Exoheal to our users, what does it look like? How is it used? Ramin, I'm wondering if you could help us with that.

Ramin Udash:

Yeah, sure, Rashmi. Exoheal, as the name goes, refers to healing paralysis on the hand with the help of an exoskeleton. So initially, we have a robotic exoskeleton that can be worn in the paralyzed hand of a patient. And the exoskeleton makes movements in the paralyzed hand using server motors to perform specific exercises that help patients recover from hand paralysis. So in addition to the exoskeleton that's fixated on the paralyzed hand, we also have a sensory glove. The sensory glove has several flex and force sensors that detects the movement in the paralyzed hand. The flex sensors specifically, they record the curl factor of the fingers and the force sensors. They monitor the force that the user device when a patient tries to grab something. So it's like we use the sensory glove to measure how much the patient has recovered over time. So we fit it in a paralyzed hand and give the user the freedom to use it, and make movements in the hand. And it records the tiniest of sensations to know how they're performing as they exercise over time.

But as we developed this, we realized that just giving a robotic device to a paralyzed patient, or let's say just to an average person, and then expecting them to know how to use it was a bit... It did not connect well. So we felt the need to incorporate something that eases the process of everything that lets them use this convoluted device in the best way possible. So we built a mobile app that connects to this exoskeleton and lets the users control and operate this exoskeleton using the app. Using the app, patients can perform several exercises that include movements of curling the fingers, haptic exercises, fingertip exercises, and grabbing exercises, of course. In addition to just being a mode of recovery, we try to make it more interesting, so that it helps patients in the process of recovery, so that to make the whole process of recovery seem less like a chore.

So in addition to that, we integrated several elements of gamification within the app, such as levels and reward points so that patients feel motivated to put in the right amount of effort. In addition to serving as a form of assistance, patients can also connect to a physiotherapist if they have one using the app so that they can share the recovery data. The physiotherapist can review it and suggest exercise or the training programs that they could do. This reduces the travel time, and helps provide remote therapy, and makes the whole process really easy. This several system of hardware and software entities make up a faster, portable, and affordable recovery solution that we call Exoheal.

Rashmi Mohan:

That's fascinating to me. Your sensory glove is not only collecting data for you to better understand how to improve your product, it's also giving you a way to

basically motivate your patients or the users of your product to help them along that journey.

Ramin Udash: Right.

Rashmi Mohan: It's quite phenomenal to think about it that way. So what would you say, Ramin, just continuing along this a little bit deeper. What would you say were the biggest computing challenges as you were building this?

Ramin Udash: I think the biggest challenges that we face technically, of course, included getting these two separate ecosystems to function together. The app and the robot they're completely isolated systems and we needed to figure out a way that it streams realtime data between the two, and communication happens in the most efficient manner possible. And I think that was the most technically challenging task with Exoheal for Imagine Cup, of course. And we eventually solved this using Azure's IoT Hub, which helps get sensory data in real time across several ecosystems of devices such as not just robotics, but web and mobile app dashboards as well.

In addition to that, I think the second most I would say challenging aspect of this was... And it's more towards the practicality and real life aspect of how things work, and it was that we really had a hard time fitting our prototype into different hand sizes. And that was a really big problem because hand sizes seem to differ across almost every single person. So we needed to figure out a way that it works for all of us. So in the final prototype, we built it in a modular fashion. Meaning that the base of the palm stays the same, but the fingers can be fixated later with the motors so that according to the needs and the finger size of the patient. So those were the technical parts of it. But I think the most challenging ones we still yet to discover because it mostly happens when we are trying to incorporate the system in the real world. So the real life logistical challenges is what I think calls a bigger significant challenge for us.

Rashmi Mohan: Yeah, no, absolutely. I mean, first of all, that's very clever designing. I mean, it's amazing that you were able to think of building this in a modular fashion. But absolutely, as you think about how do you scale this and how do you actually take it into the real world, and think about adoption, and the varied problems that might come from that. So yeah, you guys have a very, very exciting journey ahead. But even from that very, very first idea that came upon you, the prototype that you built to what has now been refined to a much, much more sophisticated prototype, if you will, or even a first level, a minimal viable product, that journey must have been a very interesting one. Definitely from both a computing challenge, but also from a design perspective. And I know, Faria, the design is something that is super important to you. Would you like to talk a little bit about that? How were you first introduced to the product? What did you think about the design and how you re-envisioned it?

Faria Zubair: Well, me and Zain were in the same school. And I had realized that the initial prototypes were quite robotic in nature, having a protruding design. Through my expertise in STEM and fashion design, I was able to transform the latest prototypes design, to make it less protruding and fit all sizes of hands. We were also selected as global finalists in Google Science Fair and Diamond Challenge. So that's how I came in the team.

Rashmi Mohan: That's very amazing. I mean, you obviously had a lot of exposure working towards these really competitive forums where you kind of have to rethink your design and work closely towards improving it. But I mean, speaking of the Imagine Cup, how did you hear about it? What inspired you to participate in it?

Faria Zubair: Well, we had been looking to include Azure in our devices for the past year, and the Imagine Cup was right around the corner when we started incorporating Azure Technologies. The platform provided the team with the unique opportunity to take up the challenge and take the leap towards the digitalization of rehabilitation therapy. Through Imagine Cup, we get access to invaluable resources such as mentorship, quarries, resolution, Azure tech, et cetera. Through which we are able to speed up the development process and refine our go-to market strategy. Last, but certainly among the most impactful, Imagine Cups prizes would enable us to establish a production facility, bringing us one step closer to helping these patients recover faster, get back to their daily tasks, and lead normal lives.

Rashmi Mohan: Yeah, no, absolutely. I can imagine. I mean in the sense pun unintended, but the kind of resources, the potential mentorship, the ideas that you get from participating in an event like this is significant, can significantly change the course and direction of your idea and your product. So it's great that you guys were able to put yourself up for that challenge. But you were talking very... And I think this is what makes it real, is really talking about the patients. You're building something of this magnitude, and it's used in healthcare. And to heal patients, you have to keep the accuracy of what you're building in mind, and that's paramount. You need to build something that works and works well.

So I was just wondering how did you think about that portion of your design in terms of saying, "Hey, I can think about building a product for somebody else. But unless I engage deeply with that community and understand what the real pain points are, my design won't be true to nature. It won't really be something that I think will finally be useful to that community." Asfia, I was wondering if you talk a little bit more about did you feel the need to engage with people who would eventually be the users of your product?

Asfia Jabeen: Yeah, actually as my interest was to help the community since the beginning, it was like for me, I'm able to convince people easily. And when I met a few in my relatives as well, suffering from the same disability or the pain of paralysis, now I was able to figure out how I can help them. I was just looking for the opportunities, and Exoheal gave me the one. Then I just got into the designer

and saw that it has the potential, the therapy. Basically, Exoheal is just not a device, it's a complete therapy. It has a total rehabilitation routine and exercises. So when I studied deep about it, I got the intuition that it will help paralyzed patients. And when I talk to the doctors, they ask the patients regarding Exoheal and this robotic device. Because it also looks so eye-catching when you see the device and people get excited with new technology.

And they got the hope, and I instill in them that they can recover because the first thing, what we have to instill in patients and even the doctors, is hope. Because when there will be a hope, everything is possible what I believe. So that way, I was able to convince the doctors and the patients. And when they use it, they felt the sensation. Actually the first time when Zain's uncle used it, he felt the sensation in his paralyzed hand. So that gave us more confidence to bring this technology in healthcare to help these patients. We have high hopes to spread it.

Rashmi Mohan: Yeah, I mean that sounds amazing. I mean, one is really attractive design that makes people want to use it, which is amazing. And then a product that actually gives them hope, and that's paired with you working with them, and helping them understand why this was crucial, as well as why it will actually work. And I'm a hundred percent with you. I think having that positive attitude and being willing to try a new product, or a new device, or a new way of therapy is probably the most important thing in this entire journey. Did you at all, Asfia, when you were working with, let's say physical therapist or doctor, did you feel any resistance? Were they confused by it? Did they feel like, "Hey, I don't know if this would definitely work?" I know you said that when Zain's uncle tried it and felt sensation, I mean that must have been an amazing moment because then it validates all of these theories that you've been working with. But what was the reaction from the doctors? Are they receptive to this mode of rehabilitation?

Asfia Jabeen: Yeah, actually they were quite enthusiastic about the therapy device when we first introduced them. And when we explained them about the procedure and the therapy, how it goes, they were very much willing to take it. And even their patients, and when I talk to them, they were like... Even when just before using, when I just explain them and talk to them, they said they felt like they are empowered just by listening to how it can help them. So that brought a very big hope in us as well to take this project to the level it can reach.

Rashmi Mohan: Yeah, that's, I mean, amazing, positive reinforcement. And a very encouraging for somebody who's working on a brand new idea. So that's great to hear.

Asfia Jabeen: And even when we told them that they can use it at the comfort of their home, they felt more interested.

Rashmi Mohan: Yeah, no, absolutely. I can imagine that. I mean just the convenience of being able to... I mean you not having to go towards your therapy, but your therapy

coming to you is phenomenal. Thank you for bringing that up. I think that's a very key part of this entire solution.

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But I want to go back to something that, Zain, you said early on. I think when you first were introducing the product, you said one of your primary goals was to keep the costs down. And hearing you all describe the product, and the amount of effort, and work that went into building it, especially when you're talking about something that's a physical device. I'm very curious to know how you do that.

Zain Samdani: That's a fantastic question. So in order to keep the cost down, we realize that current technologies out there mostly utilize really bulky and expensive technologies such as hydraulic systems and motors. And in order to counter that, we gradually shifted towards utilizing micro server motors and in-house really available components, so that we were able to keep put the costs down, and also make it as portable as possible. One of the issues that we realized that paralyzed patients faced was with portability and having to travel regularly for the rehabilitation sessions. And trust me, majority of these patients, they dreaded going to the rehabilitation center or the hospital. And so, we realized that it was really important to make the product as affordable and also as portable as possible as well.

And another way in which we tackle this is by the use of a mobile application, as Ramin was talking about earlier. And by doing this, we are able to digitalize rehabilitation, and take it from the rehabilitation center, and bring it to these patients homes, so that they're able to undergo therapy at the comfort of their homes. Another point regarding keeping rehabilitation costs down is that through the application, we are also able to ensure that a single doctor is able to monitor multiple patients progress remotely. And the patients get realtime feedback on their exercises, on their progress, and are then able to use this to perform better exercises curated for their needs. With all this combined, we are able to bring down the cost of these exoskeletons from the most affordable one in the industry right now is \$15,000. And we are able to bring down that cost from \$15,000 to less than a \$1,000.

Rashmi Mohan: My goodness, that is absolutely mind-blowing to see that kind of cost savings. Because I see two things right from what you said. One is, when you bring the cost down to that extent, you are suddenly making your product available to so many more people. And the fact that you're saying a single doctor can one, monitor more people and can do it remotely, means that the reach of this product is immense. Especially when you think about rural parts in many parts of the world, it's always hard to get healthcare to people who are not in urban areas where you don't have the latest of technology as well as facilities



available. So it's quite amazing that you were able to achieve that. But I want to dig a little bit deeper, Zain, in terms of the device itself or the product itself. How is it powered? And what do you do about energy considerations? What were the first things that you thought of when you were thinking about how this thing was going to work?

Zain Samdani: So early on, I knew that we wanted to incorporate a battery within the product itself. However, we decided to use regular power banks instead because power banks, it not only gave us the university to charge a multiple power banks and use them simultaneously within the tests, it also allowed us to use a power source, which was generally considered as say, for patients as well. Moving forward, we are expanding our team at the moment and are looking forward towards making better use of better power sources so that we can make the device a lot more portable than it currently is, and ensure that these patients have a more comfortable rehabilitation experience.

Rashmi Mohan: That's great with very innovative thought, and creative use of power banks, and meeting the energy needs that you have product on the device. But I do have to ask though, all of you are relatively early in your careers. And some of you are still in your journey of seeking education. But a lot of these problems that you're trying to solve require a level of expertise and knowledge that might be slightly beyond what you have been exposed to. So have you been actively seeking out mentors whom you run your design and ideas by, or you get reviews of your application design? And Ramin, I'd love to pose this question to you. Where do you get your expert knowledge from?

Ramin Udash: We have been in touch with one of our mentors who was our early mentor for the Microsoft Imagining Cup. He goes by the name George [Vesmedes 00:27:47]. Initially practiced our pitch for our Imagining Cup journey with him. But as we scheduled more meetings with him and we realized that he was someone who could really give great insight on the products we were building. A prime example of this would be the use of gold and hard storage, to keep backups of data. So this was a suggestion that he had given us while we were building the product for the Imagine Cup. And I think that was something that is immensely important.

In addition to that, we are still in touch with some of our other mentors from the Imagine Cup itself, Gwyneth. And Gwyneth is a cloud computing engineer at... She has a YouTube channel, I believe. She's a cloud computing consultant and she's been in the industry for five years. And then we have Maxim as well. And we are constantly in touch with them. So whenever we run into a challenge or if we want to review something, we generally send them an email. But if we just look for advice in terms of UI, we just do it with our closest people or the friends because it's really good to have different perspective, user's perspective. So yeah, that was it.

Rashmi Mohan: That's great. I mean, sounds like the Imagine Cup opened a whole bunch of doors for you, gave you access to these mentors who are crucial in your journey, especially when you are early on building a product or starting a company. And it's great that you are doing such an amazing job of leveraging those resources and you're using them to the best of your abilities to further your ideas. I'd love to hear from you in terms of what is next? I mean, are you at the stage where you feel the product is ready for an expansion in terms of either reaching out to more patients? Or do you feel like, "Hey, Imagine Cup is done and now we really need to look at Exoheal, and look at version 2.0?" And maybe Faria, I'd love to start with you is, do you feel like the design is where you'd like it to be? Or do you feel like there's more that can be done to improve it?

Faria Zubair: Yes. Well, I feel like there's always a scope of improving. We could change the design furthermore. Well, I have this vision that I would like to change the design and make it more fashionable so that people look at more like an accessory rather than a health device.

Rashmi Mohan: Yeah, no, that's an amazing insight. Have you spoken to anybody at all of area who uses the product and resonates with that idea of, "Hey, if this was a little bit more fashionable, I'd probably be more motivated to use it?"

Faria Zubair: Not yet, exactly. But that's just something which I had in mind.

Rashmi Mohan: Got it. Okay. Yeah, no, that's good. Because I personally think so as well. I mean a simple example is like I have to wear shoes that are wider toe box, and it's very difficult to find fashionable shoes that are also comfortable. And so, I know for a fact that a lot of us do care about how we look and our presentation to the world, and so I think that it might be an area of further exploration. But yeah, I was wondering if any of you were... Anybody else, whether it was Zain, or Ramin, or Asfia, wanted to talk a little bit more about where do you see this going? Do you feel like more users would be beneficial at this point? Or do you feel like re-looking at the design? Or is there a specific area that you want to focus on right now?

Zain Samdani: Yeah, I have something to say about this. This is something that we recently realized. I think at this point we have to take design alongside with user testing. And user testing, I mean it explicitly on when it comes to testing our AI models. So something that we currently realize is that as we have more users as just let's say a particular user keep using our device for a particular set of time, let's say three months, we would have ample amount of data to use this to better the process of recovery. So let's say for an example, a user uses our device for three months. We have data for the recovery, for the progress. So the recovery round within our device, it's going to be like how we're going to have to track how the sensations that we received in each of the fingers, the growth factor in addition to how much they're grasping power, let's say, is recorded in course of time as they complete exercises.

So we have access to this data that coincides or let's say relates to which particular exercises they do, and the recovery level that they attain after a certain period of time. And this is not true just for one user, but it's going to be for many users across a region or across a particular set of time. So we could leverage this data to improve the user experience for any new patient that might be starting. So let's say a new patient runs a sensory module. And then and the device detects that the way they grasp objects with their paralyzed hand is less intensive as it should have been. So the AI model could suggest the set of exercises that previous users have done that helped them gain recovery for the grasping feature much better. So I think as of now, we are working on getting... Combining this AI model within the robotic device and testing out with 50 plus patients for our next clinical trials. So that we can get an overview of how we could improve the recovery solution using or leveraging the patient data that we have.

And basically to add on to that as well. So after the Imagine Cup, we realized how we needed to backtrack and plan out our trajectory up until production and launch. So another thing that we are focusing on right now, as Ramin suggested through our clinical trials, we are going to be gathering data, which would eventually help us provide automatic assistance to these patients. Now, this is about most importance because this will enable these patients to put in the right amount of effort as they are going through the rehabilitation. And this basically makes sure that the patients are adequately challenged at each stage of the rehabilitation, so that they know that they're able to do more with each step and can see the benefits for themselves in real time. And in addition to this, we are also looking forward to incorporating additional technologies before launch into the actual product, such as the ability to control the device and the exercises via voice navigation. And the other thing that we are really looking forward to in the upcoming years, would be something along the lines of incorporating virtual reality or even augmented reality.

Rashmi Mohan: I love that idea. I mean, I love the idea of the realtime feedback because I think that's extremely powerful, really helps to get the maximum out of the device for the patient. And I think you guys are absolutely on the right track in terms of the other technologies that you want to incorporate into the product. So I heard a few times, Zain, you mentioned that it seems like there is a pathway to launch. What does that look like to you? I know you described what you'd like to do between now and launch, but when is launch?

Zain Samdani: We are currently scheduled for launch in the third quarter of 2024. Up until that point in time, we are going to be perfecting the prototypes and making sure it's ready for manufacturing and simultaneously. But also in the midst of acquiring all the necessary certifications so that we make sure that the device is safe for patients, it is easily usable by patients. Through our clinical trials, we are going to be gathering data so that we can provide this automated rehabilitation for these patients. And also with all of this going on, another reason why we are backtracking is so that we can truly dial in for what these patients actually need

for the rehabilitation. Since we realized that at different stages of the rehabilitation, their responses and their needs change over time as well.

So we want to make sure that we are addressing those to the best of our ability as possible. We are incredibly excited to launch this product. We've been receiving hundreds of emails or Instagram DM's from patients who want to use the device, who are a hoozy hope in using Exoheal and recovering. And it pains me to tell them every single time that, "Hey, we are trying to get this as soon as possible within your hands." And all of our efforts are going into achieving the same. And hopefully, 2024 is launch date.

Rashmi Mohan: That's very, very exciting. And I think you're absolutely on the right path in terms of gathering as much user feedback as possible to refine your product and put it out in the best possible way. It's absolutely the right strategy. And I hear you. I mean, I think that's validation enough when you hear from patients saying, "I want this product today." Especially when you talk about a product within the healthcare domain, I can understand that there is a lot of considerations that you want to keep in mind, as well as certifications and clearances that you need in order for it to be a viable product in the market. Curious to know, Zain, what is your clinical trial strategy? So for example, if there was say a clinic somewhere, or a set of patients, or a doctor who wanted to experiment with this. How could they reach out to you and say, "Hey, I'd like to be a part of your clinical trials?"

Zain Samdani: Oh, yes, that's an interesting question. We will be opening our applications for clinical trials in the next few months. We would recommend anyone to get in touch before that or check out our website, [exoheal.co](http://exoheal.co), or our Instagram handle [@exoheal](https://www.instagram.com/exoheal) to get in touch with us. And we'll keep them up to date on when we'll be launching applications for clinical trials. And apart from that, we are also really welcoming to any doctors or neuroscientists that want to get involved. We would appreciate any feedback that we can get for the product and get it in the hands of people that need it most.

Rashmi Mohan: Excellent. Yeah, we'll make sure to have all of those details in our transcript for this podcast as well. I think all four of you, when you talk about your journey, the passion and the enthusiasm that you have for solving this problem comes through in such a strong way that it is very inspirational to me as I listen to this. But I can imagine this was not a walk in the park by any means. So I'd love to hear from each of you, what has been the one most exhilarating moment of this journey? As well as what has been one of the biggest challenges that you've been able to overcome? So Asfia, can I start with you?

Asfia Jabeen: Yes, Rashmi. It was a phenomenal experience actually competing and Imagine Care provided us with the mentorship and experiences to propel our idea and project to the next level actually. We prepared for the Imagine Cup by taking part in other competitions and incubators to better develop our startup. And we used our learnings from interacting with doctors and patients to better focus on

impacting the end user, the patients. Helping them have a more comfortable rehabilitation accessor experience, by utilizing Exoheal while at the comfort of their homes. And what I feel is we must have faith. Actually, whether the idea is big or small, it doesn't matter. If it is having the capacity to make a change in the world for betterment, then we must definitely work on it and believe one day it'll be successful.

Rashmi Mohan: Oh, that's such a great piece of advice, Asfia, to have faith in your idea. Because when you're solving a problem, even if you're solving it for one person, it makes such a difference in the life of that one person. So thank you for that. I really appreciate it. Ramin, would you like to go next?

Ramin Udash: Yeah, sure. I think the accelerating challenge that we're talking about was during the Imagine Cup journey, was relaying the right idea to a bigger audience. Because oftentimes it's really easy to get hung up with technicalities as a person in tech, and not realize that we need to build a system that everybody can understand, and everybody can use. And this is something that we realized during our pitches for the Imagine Cup. So I think the exhilarating challenge, exhilarating in a sense that something that we did not get it directly. The challenge would be that to keep things simple while doing something that's convoluted or let's say sophisticated

Rashmi Mohan: For sure. I mean, I think that's a wonderful lesson for all of us. I mean, you're solving an incredibly challenging problem, something that obviously, patients have suffered for so long. And you're disrupting a space that probably hasn't really been disrupted in a while in the way that you are doing it. And to keep it simple and to keep that philosophy in mind is so crucial because I think that'll really help you, both in terms of continuing to build your product with confidence, but also in terms of adoption. So that's great advice. Thank you, Ramin. Faria, what about you?

Faria Zubair: Well, So the challenge that I faced was since the start of Exoheal, we have gone through almost four prototypes to finally come to this simpler design. So the biggest challenge was basically to going through all of these designs, thinking about every single part, that how can I make this part much more simpler, much more easily movable? So yeah, that was pretty much the problem for me.

Rashmi Mohan: Yeah, no, I can imagine that. Especially when you are not the target user, you're trying to put yourself in the shoes of somebody else while building this product. And being critical of your own design, that's not an easy thing to go through. And so, I must commend you all for having that maturity to be able to relocate your design in a million different ways to improve it for the patients. So thank you, Faria. That's great advice as well. And Zain, what about you?

Zain Samdani: So in my eyes, the primary challenge was coming up with the rehabilitation routine itself. I remember that we had to work with neuroscientists, patients, physiotherapists for approximately 1.5 years until we figured out a way through

which we can help these patients recover faster. So the primary challenge was to switch fields from robotics and learn more about neuroscience for that period of time. I was incredibly fascinated by neuroplasticity specifically, and how we are able to impact patient's lives by utilizing its various concepts right now. And the one rewarding feature throughout the journey would definitely have to be the patient's reactions when we see them making progress, when we hear from them that, "Hey, what you're doing gives us hope," and seeing them recover from paralysis, that would have to be the number one rewarding experience from all of this.

Rashmi Mohan: I can almost feel it myself through the passion with which you speak, Zain. And I must commend each of you for taking on this incredible challenge, and going at it, and moving forward with such great clarity, and vision, and with that thirst, and enthusiasm to learn more. Because clearly, there are some of these fields quite out of your lane, if you will, in terms of, I mean robotics, or computing, or fashion, or any field of arts. And yet you are solving a problem that you have to leverage the knowledge and the deep expertise from various other fields. I think it's remarkable what you've set out to achieve.

I think this has been an amazing conversation. I would really like to thank all of you for taking the time to be here today and share your journey. I hope that this is an inspiration to all our young achievers out there who are listening to this podcast. And I wish you the very best for your journey ahead. I think it's a phenomenal path that you have carved out for yourself. And I wish only the best of experience for you. So thank you all for joining us today at ACM ByteCast.

Ramin Udash: Thank you, Rashmi.

Faria Zubair: Thank you.

Asfia Jabeen: Thank you, Rashmi. It was wonderful.

Rashmi Mohan: ACM ByteCast is a production of the Association for Computing Machinery Practitioners Board. To learn more about ACM and its activities, visit [acm.org](http://acm.org). For more information about this and other episodes, please visit our website at [learning.acm.org/bytecast](http://learning.acm.org/bytecast). Slash. That's [learning.acm.org/bytecast](http://learning.acm.org/bytecast).