**EPISODE 384**

[INTRODUCTION]

**[0:00:00.3] ADENA: "**Wearables are everywhere, in the medical field, they are transforming lives. Hayan Jung, innovation director at Microsoft Research created a wearable for a young graphic designer that developed Parkinson's. This wearable allows the Parkinson's patient to write and draw again. Hayan explained the research process and the technical aspects of how the wearable works. We also talk about the internet of things, the components of these systems and the technical challenges.**"**

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[INTERVIEW]

**[0:01:43.8] ADENA:** I'm here at Microsoft with Hayan Jung, innovation director at Microsoft Research. Hayan, welcome to Software Engineering Daily.

**[0:01:52.4] HJ:** Thanks Adena.

**[0:01:54.5] ADENA:** You designed a wearable that helps study the hand of a graphic designer that was diagnosed with Parkinson's at the age of 29 which is quite early. Explain how Parkinson's affects the human body?

**[0:02:10.8] HJ:** I'm definitely not a medical expert but I met Emma just over a year ago, I was participating in a TV show on the BBC, a documentary about sort of the power of engineering to solve real problems in the world so I met Emma and you know, she's doing so well in her career, she's a creative director in London but she was diagnosed with Parkinson's about three years earlier.

Parkinson's is a neurological disease, it's debilitating over time, it manifests in different ways in different people, there are multiple symptoms that people have to deal with day to day, they have to take a lot of medication so the main symptoms are, to do with kind of motor based function, though Emma herself, she has tremors.

She is basically constantly shaking when she performs an activity, the shaking can get worse. A lot of other people have freezing gate which is when they're walking down the road, they suddenly can't move their legs, their legs are frozen.

Some people have a slowness of movement and then they have also smaller movements, they find that they can't make exaggerated big physical movements. A lot of the symptoms are motor based and of course, you know, this also affects speech, they're stuttering and eventually it can affect sort of you know, internal organs as well. Yeah, it's a very challenging disease.

**[0:03:35.0] ADENA:** What does the device that you designed to help Emma with her work look like?

**[0:03:41.7] HJ:** You know, we met and her big challenge to me, is that there is one aspect of her symptoms that she wanted to overcome, she's a graphic designer by training, she works with kind of computing and also with the traditional sketching, drawing, she's also an artist in her own right and she found that you know, because she had this tremor, she was unable to use a pen to write and to draw.

 

She was constantly kind of shaking when she was trying to do these things. She wanted to find a solution, she wanted to find a way to overcome these symptoms. This is where I really went into this not knowing if I could solve this problem and in fact, afterwards, the producers of the show said that they actually didn't think that I would be able to come up with a solution.

**[0:04:31.2] ADENA:** Why do you think they thought that?

**[0:04:33.5] HJ:** They thought I would fail and then that would make for a great documentary I think.

**[0:04:38.2] ADENA:** Was there a particular reason that made them think that? As in, it was –

**[0:04:42.0] HJ:** There wasn't a solution, it didn't exist one and it was unclear if you know, there's been decades of research into Parkinson's symptoms and no one had found anything.

**[0:04:52.0] ADENA:** What was the timeframe that they gave you and as part of this challenge for those documentary?

**[0:04:56.8] HJ:** It took about six months. I really didn't know, you know, but I sort of leapt in and I said, "Okay, well, let's look at what we can do from an engineering perspective," so I tried out a number of different prototypes that were about kind of, how can we make the pen more steady, I was using magnets, you know, what if we have the writing stuff is magnetic and the pen has a magnet on it so the pen is kind of slightly stuck to the paper and it dampens her vibrations, her tremors.

Other things like using kind of different drawing apparatuses and then as a kind of very left afield, last minute prototype, I thought, "Well, I kind of have this idea, this hunch that maybe applying vibration to her hand will help her."

This really came about because I saw some other workarounds that people with Parkinson's use and it kind of gave me this idea of what might be the problem. To give you an example, people who have freezing gate so that when they're walking down the road, when they suddenly

stop and they can't move, sometimes they have a metronome which makes this ticking noise for musicians, it goes tick, tick, tick.

They carry one of these and they turn it on and they listen to it and this basically distracts their brain into focusing on something else and then they can walk again. I thought, well, this is interesting that there's this phenomenon in Parkinson's where you might be able to kind of focus your brain on something else, your brain is you know, at least, subconsciously focusing on something else. Maybe if we bring in vibrations.

Instead of sound, we have this physical metronome and we apply it to the limb that she's using as a hunch maybe it will work. You know, I tried it, I started to kind of testing it with other people with Parkinson's and you know, it seemed to have some positive effects. I went from there.

**[0:06:50.2] ADENA:** Can you describe what the device looks like?

**[0:06:54.2] HJ:** Yeah, I mean, I call it a watch, I guess it's kind of like a smart watch but it doesn't tell the time and it doesn't have a screen. We used an existing strap from another product and then we 3D printed a watch face case, we put the electronics in the case and on the strap and on the face of the watch, we engraved Emma because the watch is called The Emma, it's made for her. Yeah, that's what it looks like.

**[0:07:20.5] ADENA:** I saw a video where you show one of the first prototypes and this looks like a big circuit board with lots of cables, what were the technical challenges of making it into a small wearable watch looking device?

**[0:07:37.8] HJ:** Right, I mean, it's a huge hurdle to go from tinkering to making a custom PCB. PRI collaborated with a colleague of mine, Nicolas Villa, he is an electrical engineer and we sat down and we said, "Okay, well let's take this prototype, this kind of large development board.

Let's make a custom PCB that is also wireless and can recharge a battery and let's get it made." Basically, we designed a circuit board, it has Bluetooth connectivity, it takes a battery power supply and it also recharges via micro USB and we pretty much made the board, it's got a quite a powerful processor in it, it can do lot more but we pretty much made it agnostic.

How you program it is that there is an accompanying app on a windows tablet and Emma can program the pattern of vibration. Because we weren't sure exactly what kind of vibrations would help her so we had this kind of very agnostic UI.

**[0:08:41.9] ADENA:** You mentioned just now that the device connects to a mobile app, what can we learn from the data that is being sent from The Emma watch to the mobile app?

**[0:08:52.4] HJ:** This is interesting. I, since Emma received her watch and you know, we've been working together on this, we're actually kicking off a clinical study with a neuroscience team in London. This is where we sign a protocol, we have a number of tests and we bring in people with Parkinson's with possibly similar symptoms and they run through the test and we'll do an analysis, a dotter analysis, a statistically if they've made an improvement wearing the watch, not wearing the watch.

For this you know, we are capturing the tremor information on the wrist so the watch is not only administering the treatment but it's also capturing tremor information to feedback so that we can analyze that when the watch is on, does the tremor pattern actually change when the person is using it.

**[0:09:44.9] ADENA:** The duration of the vibrations like you said is customizable, right? through the app?

**[0:09:48.6] HJ:** That's correct. You know, for the purposes of our clinical study, we've had to identify one to two different settings so that we can test against.

**[0:09:58.7] ADENA:** What are other new opportunities that you have seen for devices that are improving people's disabilities and in the digital healthcare space?

**[0:10:09.1] HJ:** I think there is so much potential and opportunity for technology to play a role in improving people's lifestyles when they have chronic illness, debilitating kind of disabilities. At the moment, I'm continuing to work on this and thinking about – we're proposing that as we move further along in this research, can we use this idea of wearables to help with other parts of

the body or to start detecting symptoms and offering other kinds of interventions, not just to help with tremors but –

For example, in the last 550 years in Parkinson's research, the medication, on the chemical side of it has moved very slowly. Can we have, use technology to improve the efficacy of medication, these are other aspects we're looking at to improve overall lifestyle, not just kind of singular moments in someone's day.

This is where I think – this pattern, this idea can be applied to lots of other conditions, the idea of capturing data, bio medical signals and applying interventions when needed.

**[0:11:18.5] ADENA:** Another area where I think that data might be useful, I don't know how the ear devices work for people that have limited hearing, they must be adjustable right? Depending on the requirement?

**[0:11:28.7] HJ:** The hearing idea, yeah.

**[0:11:31.6] ADENA:** More data driven if you're in a quiet environment.

**[0:11:33.9] HJ:** No, that's great, exactly, this idea of feedback and contextual functionality is so important. I think you know, up until now, we do have existing technologies you know? You can buy a hearing aid but now, we have I think this is the potential for reactive technologies as well.

**[0:11:50.0] ADENA:** Yes.

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[INTERVIEW CONTINUED]

**[0:13:26.0] ADENA:** People are working on software to detect depression and other issues from smart phone data, do you find this type of work promising?

**[0:13:36.8] HJ:** I think there are a lot of signals in someone's life and someone's day to day that we can capture and use to deduce certain symptoms, certain problems perhaps, I think there is a lot of signals. The question is, you know, doing this kind of research, I think we need to be very careful in that, how we're picking these signals and how we're interpreting these signals.

Can we be sure that if you're doing certain things on your smart phone that this is an indicator of depression. But of course, you know, even if we have false positives, if we manage to help one person out of a handful of people then I think that's a plus. I think that is a win.

I have an intern at the moment who was working on project Emma and he is also you know, looking at signals in relation to Parkinson's. His PHD thesis is round capturing smart phone usage, daily digital activity to detect the progression of different symptoms.

**[0:14:39.8] ADENA:** As we've been talking about small devices that connect and send and receive data, this shows that you've worked in the Internet of Things field, how do define Internet of Things?

**[0:14:53.2] HJ:** I mean, it's such a broad term now, it's such an exciting field you know? It's also – I guess over used and over hyped as well. I'm very excited about the potential to now going

from the age of big room sized computers to desktops to laptops, to mobiles, to now think about new kinds of physical devices around us that might be imbued with smartness that might be connected to the cloud to be even smarter, to serve us in our day to day.

I think the potential for this kind of technology to think about as we're looking around on the desks, to see different gadgets, different objects, how can these things be imbued with smartness, I think that's how I think about the Internet of Things, this potential for new kinds of smartness with the innate objects around us.

**[0:15:47.8] ADENA:** In this space, what are some of the business applications that you've seen with Internet of Things?

**[0:15:54.6] HJ:** It's interesting that you know, the Internet of Things is already being applied in industrial settings in B to B.

**[0:16:01.2] ADENA:** What is B2B?

**[0:16:02.3] HJ:** Business to Business.

**[0:16:03.4] ADENA:** Okay.

**[0:16:04.0] HJ:** Areas where you might not see it yet but it's already having a huge impact on how people run their businesses. Things like supply chain providers that can track goods as they are shipped across the country. Can track a trucking company that can track their fleet and be able to optimize their business based on the data that is being generated. A factory that can monitor the equipment that they have and for servicing and maintenance.

To reduce their overhead cost, to reduce breakdowns. I think already this idea of sensing the environment and then talking with the cloud and doing analytics on that data is having a massive impact on business and as we progress in the next few years, I think we are going to see more of that in our everyday lifestyles.

 

**[0:16:56.3] ADENA:** And in addition to this business strategy, the Internet of Things is appearing in toys. Why do you think this is happening?

**[0:17:05.5] HJ:** So one of the aspects that I work on at Microsoft Research in Cambridge is around new kinds of place and scenarios and new kinds of toy technologies. I mean I could definitely go into a lot of the detail on this but you know something is happening with kids and with how they grow up. They are transitioning into the screen and digital games much earlier on. You know, playing with tablets, playing with VR holograms and perhaps coming off of toys.

So weaning off of toys earlier and earlier and I think there is an opportunity to think about well, I think there is a value in kids playing with physical toys but how can we imbue this physical toys with smartness so that the kids can still be attached to their toys but still have a rich digital experience as well.

**[0:18:02.7] ADENA:** And related to these toys, earlier this year I saw on the news there was this teddy bear, Internet of Things teddy bear that the information got leaked. What are the security risks with toys? Why is this very sensitive?

**[0:18:20.6] HJ:** Oh gosh, yeah. There is a dark side to the Internet of Things. If the objects around us are collecting data and uploading this to the cloud then we have to make sure that the data it's collecting and the people it's affecting is protected especially for the most vulnerable members of our society which is kids. You know I think there are some approaches to IOT and toys that are misguided which is thinking about "well, from the perspective of a business how can we collect information data from kids and improve our business."

This is where I think we need to, as technologist, we need to really focus in on how can we provide the best value for the user. How can we make the experience delightful and make any data that we are capturing actually relevant to whatever it is that they want to do with their teddy bear or with that devices.

**[0:19:17.0] ADENA:** Yeah and what happened with this teddy bear is you could send messages through the teddy bear to your parents or something and what I saw was that it had to do with not very highly enforced password restrictions and things like that. Is there may be some

miscommunication missing as in if you are going to set up an Internet of Things, these are the set of check points you need to make sure because what I think is there were some basic things there that were missed somehow. So do you think there's still a gap in teaching more people what this takes?

**[0:19:54.4] HJ:** This is a very naughty subject. I think consumers have an appetite for smart gadgets, smart door locks, smart drop cams, baby monitoring. There's definitely an appetite and interest so there is a market there and there's lots of companies entering into this market and perhaps not as much focused on the underlying infrastructure as you mentioned. Security, data security is a huge issue and because very quickly so many smaller players have entered into this market to launch products, there hasn't been this infrastructural layer being set up to accommodate, to account for the security but I think that is slowly coming in.

I think there is now with these incidents more of a focus on these issues. From a user experience perspective, you're right. I think there hasn't been any guidelines or design principles around how we make IOT devices, sometimes that's good because then people are able to innovate and think outside the box and sometimes that's not great because people can make products that have a huge gap.

A colleague was telling me who's setting up a smart energy system in his house and it took him hours. It took him a few hours and by the end of it, he still hadn't been able to set it up because it was so complex, you know connecting things to the Wi-Fi, setting up the app and how you access different lighting devices in your house and he said at the end of the day, he literally just – all he wanted to do was be able to turn on the heating.

So all he did was he went into the wall and he just took two wires and then just tied them together and he was able to achieve, he was able to turn on the heating instead of using this kind of smart home system.

**[0:21:41.6] ADENA:** So that's definitely where we are going to be seeing more improvements in this area in the next course.

**[0:21:45.8] HJ:** Well I think there will be lessons learned from a user experience perspective and I hope more designers share these experiences so we can all improve our design.

**[0:21:54.2] ADENA:** And you come from a more traditional software engineering background, what was the transition like to design and working on human experiences?

**[0:22:03.8] HJ:** I think I took an unusual route in that. I was a software engineer, I was working on a bio med company and I just found that I wanted to have more influence in terms of the kinds of products we were developing rather than focusing in on algorithms and system architecture. I mean I find that really fascinating to solve a problem about how do you architect the system and what pattern libraries you should use.

The coding in itself is just a really enjoyable craft but I found that I really wanted to also influence what are the features we should be developing. Why are we implementing this particular feature? Is it really going to benefit the surgeons of the end users? So that's when I started transitioning into design and innovation and I actually did a Master's Degree in Interaction Design which is about designing the interface between people and technology.

So I found that that helped me to reframe my thinking from software engineering perspective to a user perspective.

**[0:23:07.0] ADENA:** And in an interview you did on Channel Nine with Rob Fraser, you mentioned that democratizing technology helped you explore other fields. How did this help you?

**[0:23:20.4] HJ:** You know I would say in the last 10 years, we've seen this movement. Some people call it the maker movement which is about how do we make technologies accessible to amateurs and also this kind of belief that you should be able to take apart the technologies around you and to thoroughly understand it that some people say I don't own a thing unless I can take it apart and put it back it together and so I think there are so many great projects and great people working on making the activity of creating technology easy and understandable for everyone to use.

 

So things like making a webpage, it's so simple now to just make a website whereas before, I made my first website in 1993 and I was like hand coding HTML and nowadays, it's super simple. You can drag and drop and you can be very expressive with technology, with these tools that simplify the process of it and I really admire this entire movement so that you know, with the development of the out wiener board so that everybody can start tinkering with electronics, with making their own gadgets, I just think that these tools are great for kids or for anybody.

**[0:24:38.5] ADENA:** Well for small communities where other companies might not think to solving their problems but they get to solve –

**[0:24:44.2] HJ:** Yeah, exactly. There are so many problems in the world that might only affect to a small handful of people. Case and point being Emma and her particular symptom, obviously there are other people with Parkinson's with these particular symptoms but I think that the populations is sometimes it can be quite small and not big enough for big medical companies to invest the money that is needed to find solution.

**[0:25:09.7] ADENA:** Or like you mentioned at the beginning, part of the prototype was 3D printed. So if those technologies were not available, it would have been much harder to get a prototype but they're learning.

**[0:25:19.0] HJ:** Yeah, exactly.

**[0:25:20.3] ADENA:** You're working in Microsoft Research. How can work that comes from research and this maker's first movement be commercialized?

**[0:25:31.0] HJ:** This is one of the challenges that I am dealing with in some of the projects that I am working on which is how do we bridge the gap between great research and great solutions for a small handful of people to scaling up to helping maybe hundreds of people or thousands of people. I have a few different projects and they have different levels of ambition. We have some projects that are trying to scale up to may be helping hundreds of people.

And then other projects that are trying to go mass market and I think for each one, I'm trying to think through what is a bespoke go to market solution. I think it's different in every case and I

think we are leveraging lots of different tools like open sourcing, working with external partners in the specific industries so that they had to tap into their expertise. So there is no – I don't think that there is a silver bullet but I think if you have a team of people who are just very passionate and dedicated to getting this out, then we will find a way through it.

**[0:26:30.3] ADENA:** Last question, what technology are you most excited about in the next 10 years?

**[0:26:36.2] HJ:** There's so many exciting new research, new technology research that's happening. Things with bio, being able to manipulate DNA, organic materials and how that might replicate computational processes is so exciting. There's holographic and VR technologies. I think for me, to be selfish what I would love is for technology to adapt to my needs and what I want to do right at that moment because at the moment, I have to work around my day to use technology.

If I am texting, I have to take out my phone and I have to use my thumbs to text. You know, we have to bend ourselves to technology at the moment and I hope that in the next ten years technology will bend to us so that in the moment that we need it whether it's a personal assistant that we could just tell what we want to do and they'll do it for us or something more invisible that predicts what we want to do at that moment, I think this is what I am hoping.

That we as humans can just live and fulfill our potential creatively and that technology will work with us to do that rather than having us spend our day to day trying to sort of change ourselves to make technology work for us.

**[0:27:52.2] ADENA:** Or like you said earlier, a more reactive approach.

**[0:27:55.5] HJ:** Yeah, exactly and I think that is going to take a culmination of things like AI, things like new kinds of display technologies. Can we go from screens to just hologram around us? New kinds of sensing technologies to detect what it is that we are doing. So I think it will be a combination of things.

**[0:28:15.3] ADENA:** Hayan, thank you for taking the time to come on the show. It was great talking to you today.

**[0:28:21.1] HJ:** Thanks so much Adena, I really had a lot of fun. I love this podcast, thank you so much.

**[0:28:25.0] ADENA:** Thank you.

[END OF INTERVIEW]

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