Speaker 1:
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.

Speaker 1:
It's not often that one gets to talk about their job being rocket science and truly mean it. Yet, our next guest did exactly that when she first started her career. She has since moved on to studying about and building robots with emotional intelligence to better interact with humans and greatly improve our quality of life. Dr. Ayanna Howard is a roboticist, educator, author and entrepreneur. She's the dean of the College of Engineering at the Ohio State University, and the first woman to hold that position. She has a slew of awards and accolades from being featured in the MIT Tech Review: Top 100 Innovators, to being named in Forbes America's Top 50 Women in Technology and has over 250 peer reviewed publications. Ayanna, welcome to *ACM ByteCast*.

Dr. Ayanna Howard:
Thank you, I'm excited about this conversation.

Speaker 1:
As excited as we are, I'm sure. I'd love to lead with a simple question that I ask all my guests, Ayanna, if you could please introduce yourself and talk about what you currently do, as well as give us some insight into what drew you into the field of computing.

Dr. Ayanna Howard:
So at the end of the day, I consider myself a roboticist. I think irrespective of my "position or title", I will always be a roboticist. So right now, [inaudible 00:01:50] dean of the College of Engineering at Ohio State University, and in that regard, looking at how do we engage students for the next generation of engineering and computer science, and do it so we do it responsibly. In my own personal work I focus on primarily looking at robotics, both in healthcare, but also looking at the bias that we have embedded in our AI robotic systems, and how do we mitigate that? Which has been exciting, especially nowadays, even though when I started it was because of the healthcare robotics field and now it becomes much more important around that.

Dr. Ayanna Howard:
So a little bit about how I got involved in this, as a roboticist, I wanted to be a roboticist since the sixth grade, which has been a long, long, long time ago, maybe two years ago. But it was because I was fascinated by science fiction, science fantasy, and I wanted to build the things that I saw in the movies and the television shows. Specifically, I wanted to build a bionic woman, which was my dream goal as a 12 year old child. And so that was sort of my path was, how do we design robots to really interact with people? And of course that's evolved of what that really means, but fundamentally it's about designing robots for really enhancing our quality of life and pushing that forward so that we are better because of the technology versus despite the technology.

Speaker 1:
It's amazing that you say that, I don't remember watching Bionic Woman, but I do remember watching a show called Small Wonder where a little girl was a robot, I think, and integrated into that family, and I was fascinated by it. Of course, I didn't end up going down the path of pursuing robotics as you did, but still as a young child, it felt like it was a different world altogether. But I'd love to understand, Ayanna, who were some of your influences to even get into computing? Was that a common thing in the school that you were in? How did you get inspired?

Dr. Ayanna Howard:
No, it was not a common thing. I was a product of, honestly, a public school system, so computing was not a thing, but my dad was, is an engineer. And so very early on, I remember in the third grade he brought home a computer that they were given away from his job, I think it was an old something. And he brought it home and he was like, "Hey, I want to teach you this kind of stuff." And he brought me a book, it was BASIC, BASIC as the language, not basic as a computer. And I remember just sitting there kind of going through and teaching myself how to program. And I didn't think it was something novel, it was just

something my dad brought home. I was, again, into these gadgets, even at that young age. And I just basically taught myself how to program BASIC from the book, from the manual.

Dr. Ayanna Howard:
And so I never really thought of myself as a computer scientist until I was much older. I programmed, it was one of my tool sets, I was good at it. But I didn't realize that I was computational and that, that was a label, it was just what I did. It was like reading, you just did it. It's like, "Oh yeah, here's another language. Okay, what can I do with this? Oh, that was fascinating. Okay, what's the next language?" So it was more like a language, like reading, than anything that I would have defined as, oh, you're a computer scientist.

Speaker 1:
And how did that translate into getting into robotics? I know your first job was literally being a rocket scientist at NASA JPL, what was that experience like?

Dr. Ayanna Howard:
Oh, that was fascinating. But I will tell you, my real first job was as a database administrator back in the day at Caltech. Because I was really good at computers, when I was in high school, this was after my senior year, I was looking for a summer job, the county basically had just brought in these mainframes computers. And they were like, "Oh, this is interesting, is there anyone out there that can help us do this translation of all of our spreadsheets into this computing platform?" And one of my teachers recommended me. And that was actually my very first job was basically a backend database administrator for an accounting unit at Caltech. And the way I got to JPL and NASA was my supervisor at Caltech, when I was like, "I want a real robotics job." And when I went to college, introduced me to a manager at JPL. And that's how I got to get involved in the robotics world at NASA from very early on.

Dr. Ayanna Howard:
My first summer position was after my freshman year in college where I was working on, believe it or not, neural networks to do some planning algorithms around things, putting it on areas [inaudible 00:06:39] and things like that. So it was fascinating being around really, really, really smart people that just got it. You would call us nerds or geeks, but when you're a nerd and geek and when you're around nerds and geeks, it's just like feeling like family.

Speaker 1:
You sound like an absolute trailblazer, Ayanna. I mean, going into a place like NASA JPL, was it intimidating at all?

Dr. Ayanna Howard:
It wasn't, and I think a lot of this is hindsight, but back then you were valued for your intelligence. And because I was pretty well versed in computer science when it wasn't a thing, computer science was really not a thing when I was going through as an undergrad, and I was good at it. And by the time I started at NASA, I had Pascal under my belt, I had BASIC under my belt, I had Fortran, these are languages that, "Oh, you know all three languages?" And again, I learned them like you would learn a new language, like a written and physical and verbal language. And so people just were like, "Oh, you're a smart kid."

Dr. Ayanna Howard:
So I never really felt intimidated until I was older and in my classes, but in the work environment, which is why I always encourage students, get some job experience early on, because when you're working, you are valued and you are evaluated by your output of how well you do your task in your job, you're not necessarily evaluated on how well you do on a task, which people can game tasks. And so I didn't feel intimidated when I was at NASA, I felt intimidated in my classrooms and in my engineering classrooms, for sure, but not in the work, not at NASA.

Speaker 1:
I think that's wonderful to hear that. And like you said, I think irrespective of our years of experience, we each bring something into the workplace and we are peers, and so that helps empower us in some ways. I mean, there may be things that we don't know, but we certainly add value with the things that we do. I'm wondering if you could talk a little bit about a memorable project from those times that still stays with you and you still look back on with pride?

Dr. Ayanna Howard:
So I will tell you about... Actually, I'm going to tell you about two. So one was the first research robotics project that I worked on, it was actually as an undergrad student. I had found a faculty member that did robotics and was like, "Hey, I know how to do stuff, because I've been at NASA." And he was like, "Sure." And my task at the time was to figure out how do I get a manipulator robot arm to basically identify an object? And so what I thought about was through touch. And so I remember programming the robot so that it would approach... And it had these sensors that the robot arm would approach an object and gently touch it, and then it would trace the outline using the sensor input, so it was this whole feedback loop.

Dr. Ayanna Howard:
And why I remember that is because, one, the robot arm was huge, right? And I remember it would take so long to get this robot to move because it had to be so gentle and just so compliant. And why I remember that is, when I went and started my PhD and my thesis, it was dealing with robot manipulators and deformable objects. And I think the reason why I was attracted to that as a project was because of that undergrad experience and working with the faculty member and the grad students in a research lab where I was like, "Oh, this is what research is in the academic environment." Which I, again, didn't experience until my junior year of college, so that's one.

Dr. Ayanna Howard:
In terms of the other project that really resonates with me was at NASA, it was the first project that I was leading as a technical manager, and that was looking at... So at the time, we had already launched the first Rover, Sojourner. So, Sojourner had happened, which was in the early '90s. And the whole thought was, how do we do longer range traversal on Mars? And so I was leading a research team to think about the possible. And the way that I approached it was to try to get the humans, so the human scientists, to try to figure out how do we take their knowledge and take their experience in the field and translate that to the rovers, right? So how do you design an expert system from the experts? And it was my first foray, at least with respect to rovers and human-robot interaction, all of that wasn't a word back then, on this blending of the human power and the human strength, human expertise with the robotic expertise.

Dr. Ayanna Howard:
And I remember that because it allowed me to one, explore the power that you have when you blend in the human and the robot, and capitalize on it as a system that's together versus a, okay, the robot's going to do something separate and the human's going to do something separate and the human's just the user. But really thinking about it as, it's a system and the symbiotic system of humans and robots working together. And that was, I think, the first time I realized that this could be done in the real world.

Speaker 1:
It almost sounds like that was a pivotal moment for you to sort of move into the next part of your career, which is really around adding human cognition into systems. But the other thing I was interested in finding out also, was you also made the switch from being in an industry setting into academia, what motivated that?

Dr. Ayanna Howard:
Yes, so that was because of the world and what happened. I thought I was going to be a lifer. So one of the things, traditionally, when you go into government work, most people are lifers, they start and they retire. And I really did think I was going to be a lifer, I loved my job, I loved working with NASA, I loved doing the Mars stuff. But what happened was we had the second shuttle accident, and the result of the accident was that almost immediately funding for research was dried up, it was basically halted, it was stopped. And because of that... So back then you didn't go on furloughs and things like that and stop, but you would come to work and the projects were basically, okay, yeah, you can come to work, but yeah, you're really not doing anything because these missions may not happen and we might not actually get this to be done and financed and funded because everything was halted.

Dr. Ayanna Howard:
And so at the time I was like, "Okay, do I weather this through? Do I just wait? Do I sit? Or do I see what's out there?" And I decided that it was time to see what else was out there. And unfortunately, there wasn't a lot going on in terms of industry research, so I was like, "Well, I can't go to industry." AT&T wasn't a thing anymore. The only place you could still do really good

robotics research was in academia. So I decided, well, let me see what happens. Let me go out, put out my CV, talk to a couple people and maybe that's something I could do. And I thought I was going to do it temporarily, like, "Oh, I'll do it for a few years until NASA comes back in terms of doing robotics research." And that was 16 years ago.

Speaker 1:
That's great. Certainly, NASA's loss. And I believe that that was your switch, and you moved to Georgia Tech at that point?

Dr. Ayanna Howard:
I did, I moved to Georgia Tech. And Georgia Tech because one, they were starting to think about growing robotics really as a discipline across multiple departments, they had been talking about, "We think we want to do a PhD program. We think we want to do a robotics institute." And the conversations were happening, and I was like, "Oh, I want to be on the ground floor of that."

Dr. Ayanna Howard:
And the other thing is, when I came and interviewed at Georgia Tech, I just felt comfortable. I felt at home, the faculty were like, "Oh, you are awesome. You are great. You could be part of the team." And I felt it was so much more about collaboration, even though this was an academic environment and things that I'd heard was, "Yeah, as an academic, you basically work by yourself and you're siloed." That's what I'd heard, but when I visited Georgia Tech, it didn't feel like that. And so that was the reason why Georgia Tech, and why I said yes.

Speaker 1:
That's great. I mean, I think that, I feel at least, all that you hear, as well as my own experiences, innovation really comes when you collaborate, when you have those diverse opinions that are clashing together and not always in agreement, but that's when you sort of really think about what can be done that might not have been done before. One of the things that I also read around that, Ayanna, was the fact that at one point we were always looking at robots for very mechanical or repetitive tasks, working in a factory, and you actually had a very defined set of movements that the robots would sort of do. And that started to change, and you started to work more in terms of saying, "How do we actually build more intelligence and add more human sort of thought process into robots?" Could you talk to us a little bit about that?

Dr. Ayanna Howard:
Yeah. So one of the things is, even when I was working at NASA, when I would go out talking to the public about robotics, I mean, every time there would be at least one person to ask the question about, "Well, you work on robots, you're taking away jobs." I mean, this was twenty-something years ago, because you had a lot of these industrial manufacturing robotic systems coming into car factories and other types of manufacturing environments and taking people's jobs. And I remember at the time that my mindset was, "Well, those aren't the robots that I work with." I don't want to be in a position where I'm designing technology that makes the human condition worse. And I decided that a long time ago, a lot of it because of my background and my parents and things like that, my role and my responsibility is to enhance as much as possible with my mind the human condition.

Dr. Ayanna Howard:
And so when I think about robots and I think about the role that robots could play and should play, the reason why we have technology is to enhance our quality of life.And if we're designing robots that aren't doing that as a positive, like sometimes there might be some negatives, but if the overall positive is not for enhancing our quality of life, enhancing the human condition, then we really should not be doing period, even if we can, we shouldn't be doing it. And so that is my philosophy, and therefore, it's why I work on robotics projects that really focus on this human and this robot through a symbiotic relationship, because I believe that that is the way that robots enhance our quality of life and aren't as detrimental as they could be.

Speaker 1:
Got it. But one question I do have, Ayanna, is, is it mostly so folks who are working in this space, I'm sure you know many of your colleagues, or even across the world, is it mostly our own sort of moral compass that keeps us responsible towards that goal of making sure that we're enhancing human capabilities, but not taking away from the opportunities that we may have otherwise had? How is that in some ways regulated?

Dr. Ayanna Howard:

So it is a moral compass right now, but I think like with anything, morality is learned, right? It's just the fact, if you notice when you have little kids, I want something, I take it. And parents and teachers are like, "No, no, no, you don't just take something, you ask or you pay." Right? We learn the right and wrongs and morality from the very beginning.

Dr. Ayanna Howard:

And so I think this aspect of, how should we use technology? What do we do that's good with computer science and robotics and AI? We, as academics, as instructors, as teachers really do have to embed that quality of values in our students, because it's just like with anything else, it has to be taught. And I do think it is a responsibility. It's a responsibility of technologists. It's also a responsibility of society to push back, which in some cases they're not because they're reliant, but it's also the responsibility of technologists to ask these questions and to ask about the pros and the cons whenever we're designing a new robotic application.

Dr. Ayanna Howard:

And I will tell you, in my own research, we've designed technology where I'm like, "Yeah, maybe we shouldn't do this. Maybe we shouldn't create a system, a robotics system that gives advice about how you look." Maybe that's not a good idea, because this aspect of how you look is going to be based on my group's perception of what is a good way to look and what's a bad way to look, so maybe that's not a good thing to do. But healthcare robotics, which my group works on, that's a positive whichever way you look at it, because it means that people can improve their health. There's no argument that that's very helpful, even if you're telling someone how to do this.

Dr. Ayanna Howard:

And so this morality thing, it is a responsibility and currently is not regulated very well. There's some rules and regulations that are being considered in the EU, for example, right now there are some in the United States around... I've seen a couple of bills that are flying through that have some aspects of regulations around AI, around ethics, around robotics, but there's nothing that is confirmed and final around this aspect of, what is the morality or what are the values that we should have in terms of designing the next generation of robotics, AI systems that are used by people?

Speaker 1:

Understood, and very well put. The point that you make about both teaching and learning, as humans, we are obviously capable of that, and having somebody to guide us while we make these decisions is super crucial. How does that translate to robots, as they are being built to make a lot of decisions for us? How do you see that you're able to teach robots to see between right and wrong?

Dr. Ayanna Howard:

Yeah. So one is, there are some grounded, I would say, outcomes that we can measure. So an easy one is, if I make a decision one, we need to make sure that that decision is equal irrespective of gender, irrespective of race, ethnicity, religion, that's an easy one, right? So if I'm a healthcare robotic system and I'm making a medical diagnosis, is it different, or is it a more negative outcome if it's a female patient versus a male patient? That's an easy one that a robotic system can look through the data, do some changes of parameters and see are the same outcomes coming out. I think that robotic systems, AI systems should be doing this. They don't traditionally do this, especially if they're being deployed in the field, but that's a simple one.

Dr. Ayanna Howard:

Now, other things in terms of what is right and wrong absolute, that's harder because it is tightly linked to the environment from which the robotic system or the AI system is deployed. So my whole philosophy is you need to give the users the choice to decide. So if I have a robotic system, for example, that's deployed in the United States in a rural community versus, say, somewhere in North America or South America in a predominantly, say, urban environment, you should be able to give the community the ability to change the parameters based on their culture and value system. It shouldn't be up to me as a technologist to infer or to force a default condition based on my own personal value system, because it's going to be different. And so how do you decide between right or wrong? I think we need to provide the ability to give people the autonomy to incorporate that in terms of their robotic platforms when they adopt them.

Speaker 1:

Right, and that also means building these systems with that level of flexibility to be able to take in those inputs and adapt to the environment that they are deployed in. What are some of the technology challenges that you are seeing, Ayanna, with this field? I mean, when we're going back to what we were talking about earlier, robots are no longer in sort of a constrained environment, right? So what are some of the challenges that you're facing as you're building these new systems?

Dr. Ayanna Howard:
Well, there's a bunch of challenges. So one challenge is this aspect of adaptation. We don't do that so well, just in general, and I can give you an example, if I'm creating a healthcare diagnosis system on my robotic system to do something interesting, I will collect some data from different target demographics to try to teach the robot what to do, what's the proper right way to do. And what happens then is if the system gets deployed in society, there's no way that it could have been trained on all the possible conditions, but giving the robot the ability to recognize when it's wrong or when it's in a novel environment is still an open-ended problem, because every environment that you consider novel, the parameters are going to change and shift, right? So that is an unanswered problem right now, which is interesting as a researcher, because it means that you could still have research and still publish papers, but that's one difficulty.

Dr. Ayanna Howard:
The other difficulty is when you're deploying in the real world environment, how do you translate from the lab into these, deployed, very dynamic, sometimes uncertain environments? This process as a researcher at an academic institution, I don't assume that my nice lab, proof of concept trained algorithm is going to be deployed in society, but we're seeing this accelerating. So you're seeing things that are done in the lab in terms of algorithm development. They're tested, they're validated, but then they're quickly deployed into the billions of people who you know that are on Earth.

Dr. Ayanna Howard:
And we're using basically the humans as our test conditions and then saying, "Oh, that didn't work. Oh, this group was disenfranchised, okay, let's train on it." For toy problems, that's fine, but when you have things like facial recognition algorithms that are using surveillance, that's an issue. When you have facial recognition used in your phone to unlock it, okay, maybe a little bit of a problem, but not so much. But that's a problem is that we're deploying these systems in real world scenarios that could be detrimental, and we as researchers haven't provided the scaffolds for these systems to adapt in real time.

Speaker 1:
Yeah, no, that's an excellent point. But I wonder, Ayanna, how would we do this better? I mean, actually deploying these systems in the real world is a good way for us to actually... It would be hard to simulate, or like you mentioned, all of the various sort of influences, in a lab situation, right? So it almost feels like it's a catch 22, you have to deploy in the real world to actually get enough material to learn and improve, and yet, there are some significant risks. So what is it that we can do to actually do these trials, but do it in a way where we're not sort of making it very, very risky?

Dr. Ayanna Howard:
So I actually have some ideas. Now, whether they will work in the real world is uncertain, but they have definitely worked in my own research in my lab. So one is giving the ability for people to tell the system when it's wrong, and using that as input. And so if you think about learning it's how do you design systems that have a core learning algorithm, and then as you're collecting very small in-samples, it can retrain and we learn, and identify that. So it works in the research lab, it doesn't work in the real world, I'm sure.

Dr. Ayanna Howard:
So basically what that means is, and I'll use my phone that has sometimes problems unlocking because of various, my tilting of my face and things like that. So wouldn't it be nice if every time it messes up, and I know when it messes up, right? I can put it and it will click, and that means, okay, we need to retrain this angle of my face. And I can click it and click it and click it, and therefore I have the ability that after a while it's like, oh my gosh, 10 out of the 20 times, this phone did not recognize my face, let's look at the data and see why. And half the time is because it's the angle that I'm holding it, because I like to sit back in my chair and things like that.

Dr. Ayanna Howard:

So that's one way, is putting as part of the system where it can personalize the learning based on me and my behaviors and my attributes in designing it. I know it works in the research lab. We've tried it in my own group in the algorithms we deploy, whether it works on a commercially available platform, not sure.

Dr. Ayanna Howard:
The other is, and this deals with this aspect of setting your parameters from the beginning. A lot of times, if you bring out a new robot or bring out an AI algorithm, there's these default settings. I would argue, let's not have default settings, let's create a system such that the default is based on the human input. And so we do this with respect to setting up a new computer. It comes on, it says, "What time zone are you in?" Right? And then it asks you these parameters, "What kind of background do you want to have?" And it doesn't assume anything. We should do the same thing in our robotic AI systems. Come up and saying, "The parameters used this algorithm," say healthcare, "is gender. What gender do you identify with? What ethnicity do you identify with?" From the beginning, versus just assuming that I've learned everything about every human that's out there, which is of course a hundred percent incorrect and wrong, and so don't have default settings have settings that by default are selected by the humans.

Dr. Ayanna Howard:
We've tried it again in my lab environment, and it works fairly well in terms of then is very customized at the very beginning, because healthcare should be a personalized application, whether it works on commercially available platforms that are deployed in the wild, who knows?

Speaker 1:
That's great. No, thank you for sharing that, that actually makes a lot of sense. One of the other things, moving in another direction, Ayanna, I also read that the pandemic and the situation that we're in today has changed our way of life and actually has been somewhat of a boon for robotics. How true is that statement?

Dr. Ayanna Howard:
It is true. It's one of these mixed blessings because as a roboticist I've become cooler, right? So it's like, "Oh my gosh, I thought it was cool before, but now everyone knows this." Because it's increased in terms of the acceleration and the adaptation and adoption in the real world, so that is true.

Dr. Ayanna Howard:
Now the mixed part is that there are still errors, there are still some disparate impacts in terms of different groups. And so the negative is that these systems don't necessarily work the same for everyone, and we don't yet have the algorithms to fix them real time in the real world. So they're being used or deployed, and we can clearly see that there's differences sometimes in the decisions depending on who's using the robot, who's using the AI system.

Speaker 1:
Got it. And so what are sort of the most common applications you're seeing that's being adopted more? I mean, other than my robotic vacuum cleaner, which has become an absolute treasure in our home, what else are people using, especially during the pandemic?

Dr. Ayanna Howard:
Yeah, so in terms of, I will say there's the physical platform like robotics with hardware, and then there's the virtual platform, so robotics in the virtual world. So in terms of the physical, it's mostly around things related to cleaning in the hospital, safety. So a lot of the linkages and adoptions have been, how do you design robots or how do you bring in robots so that we can do the cleaning of the floors, either in the hospital or in a retail environment, faster and safer? In those aspects, how can you do some of the handling? How can you do those things that have traditionally been based on human people doing labor have been transferred to the robots. The warehousing has increased as well because everyone's been shopping online, and so they've increased the number of robots that are deployed in the warehouse and logistics and things like that. So that's definitely in the physical space.

Dr. Ayanna Howard:

In the virtual space, it's everything from chatbots that are used in customer service, that are used for moderation online, for things related to say hate speech and targeting aspects in terms of filtering, advertisement, marketing, so all of the things that are in the virtual space that deals with our human interaction around language, primarily around language. And then the other is around healthcare. There's been an acceleration of the use of AI, specifically on the algorithm side, in terms of healthcare. In fact, there's some stories that have started to come out, which as an AI person you are aware of, but it's now coming out in the public around the use of AI for the COVID and for accelerating the vaccine, and how AI was used in that. And even how AI has been used in terms of figuring out how to do the logistics of disbursements and those aspects across the different states and countries in the use of AI. And so in healthcare there's been an acceleration as well.

Speaker 1:
I have to start off by saying thank you for the incredible work that you do, because what you're seeing really tells us how important it is, how valuable this has been to help protect the folks who would have otherwise had to do these roles in person, right? Especially when you talk about a cleaning crew at hospitals, et cetera, who would have been at such high risk if not for having these innovations that are able to sort of handle these things without putting the overall population at greater risk. It's amazing that that technology was already available for us to actually start using in this way. The other thing I read, Ayanna was also around robots providing support for human and emotional needs. How true is that? And how effective is it?

Dr. Ayanna Howard:
That is true as well. So this has both been in the physical and virtual space as well. So on the physical space, there has been an increase in the number of physical robots that have been used primarily in nursing homes, in places with older adults, because as you know, the very first lockdown, those were the most highly vulnerable. And so there was an increase in these pet-like, animal-like robots that was done.

Dr. Ayanna Howard:
In terms of the virtual, there has also been an increase in companionship types of apps, in terms of interacting with virtual agents. Also in mental health, there has been an increase in the use of automated AI systems got help with not only diagnosis, but also conversation, early detection of depression and things like that. In the healthcare space, primarily again, to address the loneliness, to address the depression that has increased during this time because of the isolation of different individuals.

Dr. Ayanna Howard:
So yes, it has helped, it's been a positive. And one of the reasons why I say it's been a positive is because the alternative is nothing, right? It's not like the alternative is, well, we're replacing humans, there is no alternative, and that's what we've seen. And so in this case, the adoption has enabled people to connect or feel connected, even though they may not be connecting to necessarily another human in the physical space, but they are being connected through conversation, through emotional connection. What happens as we get to the other side of what stays and what changes, that is still uncertain. But I think a lot of the things that we've become used to and accustomed to will stay. I mean, other things might adopt, but I think we're going to have a hybrid in terms of what's been adopted, what stays, and what's like, "Okay, I'm done with that. No more."

Speaker 1:
I have to emphasize what you just said, which the alternative is nothing, and I absolutely agree with you. There's always a fear that, if robots are going to take over the human, emotional connections that we have, the social interactions, then is that really the right thing for us? But as it stands today, we aren't able to have those connections. And I know many of us who have family further away, or family that's older and living alone would love for something like this, for them to not feel lonely, because there's a part of this, there's the physical aspect of dealing with COVID, but certainly there's a lot of mental strain from just the isolation. So yeah, your point is well noted. I'd love to also talk about your company, Zyrobotics. I know you do a lot of work of products that include therapy and educational products for children, could you talk about that? And what was the motivation? What drew you into that field?

Dr. Ayanna Howard:
Yeah, so Zyrobotics focuses on educational products primarily, but they also can be used for therapy, primarily for children with diverse learning needs. So the software adapts in terms of personalization. So it has parameters that can be personalized to the needs of the child, whether it's a sensory processing disorder, whether it's things about speed and all these variations where there's

a norm traditionally thought of in terms of, even games, right? There's a default setting that applies, but with the software that's created through Zyrobotics, there is no assumption of default, it's based on the child that's using the application.

Dr. Ayanna Howard:
And the reason Zyrobotics came about and why it developed software and technology in the space was because of the research I was doing at Georgia Tech working in healthcare robotics. Because I was working with children with special needs, primarily children with motor disabilities, what I saw very early on was that when you saw what was out there, when you saw what was available, it was very much in this, I would say medical space. And so when kids were interacting with tablets or games, if they had a special need, the kinds of things they were working on were, I would say, not the newest, not the greatest, not the [inaudible 00:37:37], like, "Oh my gosh, this is so cool." And it was much more of a old school, like, "Oh yeah, this is functional, but it's not fun and engaging."

Dr. Ayanna Howard:
And I just thought that this was a disservice, and as a technologist, I was like, "Wait, we could still make these very functional applications that are designed for children with special needs, we can make them fun and engaging so that all kids will want to interact with it." As an academic, of course, though, that's not a research problem necessarily, and so Zyrobotics took that on, was to take these very functional, what's cause and effect, how do you address sensory processing disorders, how do you do learning in the space, and making it fun and engaging, so all kids would engage in and want to engage with these applications, and it's customizable to the needs of every child. And so it makes it so that it's not a, you have a disability, it's a, everyone has a different need, everyone learns differently and therefore these applications, and this software, and technology basically works with any child's needs.

Speaker 1:
That sounds like wonderful work. Are you seeing a good amount of adoption of the products that you're putting out?

Dr. Ayanna Howard:
Yeah, so currently, well, as the last note that I was given in terms of report, we had about 800,000 users of either the software or the hardware, mostly in the United States though. I would say 90% of that is in the United States.

Speaker 1:
No, that's great. And it's certainly an area that needs a lot of innovation, and I'm so grateful that you're actually working in that space. The other thing I wanted to talk about, Ayanna, was also that you recently authored a book called Sex, Race and Robots, what inspired you to write that? Are you seeing biases in the field that are specifically concerning to you?

Dr. Ayanna Howard:
Yeah, so the reason I wrote this was because... Well, a couple of things, one is that I was starting to get frustrated at all of the, I would say negative things that are coming out in the media, but also the things that were coming out of companies in terms of language. There was language models that were spewing out racist statements when they redeploy, there was facial recognition algorithms that weren't recognizing people in terms of their passport photos. And you would have these things come out from these companies and apps that would basically undress women. And you could download any one woman's app and you can have them naked on your iPhone, and it was just frustrating me.

Dr. Ayanna Howard:
And then I would see people out in the media saying, "Oh, but we can't do anything about it." So I wanted to one, basically peel back the onion of why this was happening, what was going on with the technology, what was going on with the algorithms? [inaudible 00:40:21] was hard, but also give kind of some hope for how do we change this, how do we fix this, both as a technologist, but also as a consumer of these technologies. And so I just wanted to basically lay it out as one, identifying what it was, what are the problems without all of the media hype, but also what power we have to really ensure that we change this and we have a better future with it.

Dr. Ayanna Howard:

And so that was the motivation of it. And I didn't expect to see how well or how well people navigated or gravitated towards the message in that. And weaved throughout is also the story of being a Black female growing up in this technology world of robotics and AI, and just some of the challenges personally I faced, but also linking it to the challenges we also have with the technology, so it also tried to put a human face to technologists as well.

Speaker 1:
That's great. Well, we'll definitely link it in our show notes for our listeners. But do you have any advice, Ayanna around the same topic for professionals who are in the field? Work that you'd like for us to pursue? As well as anybody new was entering the field of robotics, or students who are aspiring to become roboticists around this specific topic?

Dr. Ayanna Howard:
Yeah, so the one thing to the technologists, and I say this over and over again, is it is our responsibility, because frankly it's also our fault, right? A lot of times I think as technologists we're like, "Well, the ethicist will take care of it. The ethics board, they'll check it off it's good or if it's bad, they'll send it back." Or, "Well, people are going to use it, it's their fault if they believe this stuff and use it." And I'm of the philosophy that, no, we're designing it, we're building it, we are also responsible to mitigate the evils. And if we don't know how, it's our responsibility to learn how. Because at the end of the day, if we don't, the technology will come after us. It's just like, I think about some of the old tales where we create, if you think about Frankenstein, we create these things and if we're not careful, our own technology will destroy the creator.

Dr. Ayanna Howard:
And so when it's a selfish reason, i.e. I don't want the technology that I love and just really lean into, to come back and be detrimental to me as a creator, but also it's a responsibility. If we're creating these things, we're creating it, the public doesn't know how to fix it. We're the only ones that know how to fix it, because we are so embedded in the algorithm. And therefore, we have to do what's right for not only our field, but also for the world.

Speaker 1:
A powerful message, Ayanna, thank you so much. We have to own what we create and we have to be accountable for it. I think that's definitely something we could all take a leaf out of your book. For our final byte, I'd love to know what are you most excited about in the field of robotics, maybe over the next five years?

Dr. Ayanna Howard:
I'm most excited, I mean, maybe this is my little ego, selfishness, but I'm most excited about the acceleration of the adoption of robotics and AI, honestly, in terms of like real world applications. Again, even though there are some issues, I think that the enhanced quality, the enhanced benefit to humanity is a positive, and so I'm really excited about that. It becomes pervasive, so we always talk about the internet is pervasive and the cell phone is now pervasive. I feel like robotics and AI will be, in the next five years, maybe 10, will be pervasive. It'll just be part of our environment. It will be part of our DNA. It will just be an accepted norm. Like, "Of course I have my personal AI agent, what did you do back in the 2000s?" Right? That's what I'm hopeful for and excited about.

Speaker 1:
Oh, I think the vision that you paint is definitely exciting to all of us as well. This has been such a riveting conversation, thank you so much for taking the time to speak with us at *ACM ByteCast*.

Dr. Ayanna Howard:
Thank you.

Speaker 1:
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