Research that Reaches Out Podcast

Episode 12: Permission to Tinker with Dr. Anthony Choi

Hannah Nabi: Hello, and welcome to the Research that Reaches Out podcast from Mercer University. I'm your host, Hannah Vann Nabi. Research that Reaches Out is an initiative at Mercer University in Macon, GA that was launched in 2015 as part of Mercer's Quality Enhancement Plan, or QEP. We work with faculty and students to help them integrate service and research to address real-world problems affecting our communities at the local, regional, national, and global levels.

Today we are welcoming Mercer professor Dr. Anthony Choi, who teaches in the Department of Electrical and Computer Engineering in the School of Engineering. Dr. Choi earned his B.S. in Electrical Engineering from George Washington University and his M.S. and Ph.D. in Electrical Engineering from University of Florida. In addition to teaching, Dr. Choi serves as Director of Machine Intelligence & Robotics Laboratory in the Department of Electrical and Computer Engineering and was awarded an ASEE Summer Faculty Fellowship to work at the Naval Surface Warfare Center, Panama City Division on Mine Counter Measures using Unmanned Underwater Vehicles.

If you can't tell, Dr. Choi does a lot of really cool stuff, but today I want talk about two different initiatives he runs in his capacity as Director of the Robotics Laboratory at Mercer. First is the open robotics lab model that Dr. Choi has developed, which is open every day and available to all Mercer students and faculty, not just engineering. They have a ton of equipment for students to learn on, including a 3D printer, a laser cutter, solder rework stations, computer-aided design workstations and various electronics. There was actually a great feature article about the open robotics lab and student-led projects in The Den back in March, and we'll provide a link to that article in the episode description. But in addition to that, I also want to learn more about the Mercer Robotics Club and their work as mentors to local public school robotics teams. All of this is under the supervision and guidance of Dr. Choi, and I'm thrilled to get to dive into this today. So welcome, Dr. Choi!

Anthony Choi: Well thank you so much for that great introduction.

Hannah Nabi: So first, let's talk a little bit about your background. Tell us, how did you come to electrical engineering as a career and what brought you to Mercer specifically?

Anthony Choi: Well, even though my undergraduate degree says electrical engineering, if you look more carefully, it's actually electrical engineering with computer engineering option. During that time, they really didn't have a computer engineering program because it was early enough where computer science existed and electrical engineering existed, but there wasn't this major that bridge both the Computer Science and Electrical Engineering together. But that was where I was really interested.

I was interested in both the software aspects of it and also the hardware aspects. And then when I went to grad school, I chose to actually specialize in robotics. And during that exposure to robotics, I was also exposed to artificial intelligence as well. And so those were the two key components, I guess, the pillars of my interest, and that brought me together. And I really enjoyed that aspect of artificial intelligence and robotics because rather than it being just purely technical in nature, as some people might think, it actually brings in a lot of natural sciences as well. During my Ph.D. I did a ton of research in entomology, behavioral sciences. I actually read quite a bit of papers from psychology, behavioral sciences as well. Mainly because in order to be able to fully understand the capabilities of what you can create artificially, you probably want to have a pretty good understanding of how the real biological systems operate in certain situations. So that divergence really solidified my love of, interest in artificial intelligence because I realized that it wasn't just something purely artificial that we were creating, trying to mimic life. In a sense, we were trying to duplicate life in a computer digital world, and once I saw that linkage of that two togethe, I saw a great benefit and potential of where things could head. And so my dissertation for my Ph.D. was to actually recreate the fundamental learning process of how low-level, insect-level intelligence or low-level mammal type intelligence come about naturally as they're born and they interact with their environments. So, you know, my research focused on how an artificial intelligent robot or AI device would understand and learn from their initial interaction with the environment itself, and then be able to say, okay, this is how I'm going to model the world, and on top of that model, then you actually create the actual programming on top of it.

Hannah Nabi: That is so, okay, so here's maybe a dumb question. I have a five-year-old and he watches this cartoon called Handy Andy on YouTube. And just yesterday there was an episode, and Handy Andy is like this handyman mechanic superhero dude who works with, I don't even know what all it does. But, but they have this robot that Handy Andy had programmed that could learn, and so that, it was going around observing. They have two pots of flowers and one is dead and one is alive. And it says, the machine sees, registers that there's water going into the alive flower. And so when it looks at the dead flower, it, it learns that water is the missing component. Is that possible?

Anthony Choi: Oh, that is absolutely possible.

Hannah Nabi: (laughing) You say that like it's like no big deal.

Anthony Choi: Well, that that is actually not a very big deal. So artificial intelligence is a very, very broad field. And I think that a lot of the people who are not familiar with the technology doesn't quite understand what artificial intelligence is, but there's a certain part of artificial intelligence that's actually quite easy. And the limiting factor is the amount of computing power you can throw at it. And the more computing power you throw at it, the better it becomes. The more data you throw at it, the better it becomes. So as you know, computing power doubles every like 1.52 years, and we've gotten to a point where the computing capability and the power at that level is catching up to the needs of the programmer in terms of artificial intelligence engineers as well. That's the big shift that's been happening. And I'm not sure if you heard the term deep learning?

Hannah Nabi: Mmm mmm.

Anthony Choi: Deep learning is basically an artificial neural network. And what that means is, our human brain is a neural network, is a biological neural network system. You have all these neurons all interconnected, and somehow they fire. And those firing mechanisms understand images, understand thought, understand concepts, understand logic, understand how to solve problems that they haven't ever seen. So the idea was, can you can create that similar type of a system artificially. So what they did was they took individual neuron cells and then modeled it into artificial neurons, and then took thousands of, well initially tens, maybe hundreds of artificial neurons, interconnected them, and they saw some amazing results out of it. A problem was they couldn't put more than, like, few hundred and actually get it to learn. But about eight years ago, there was a huge breakthrough in two things. One, the ability to back propagate the learning outcomes to a very deep layer of neurons, meaning instead of just scale to go maybe one, two, three layers of neurons, you could actually go hundred layers deep. And then that neuron that was, like, so far away from the output can even still learn at that level.

Second thing was use of graphics cards. The graphics cards really exponentially increase the capability of processing, and actually doing all those neurons simulations, so that you can get results much faster. So something that would have taken months to run was running only taking days. And then instead of taking days, it was taking hours. And instead of taking hours, it was taking minutes. So you can see that over the past eight years, this huge increase of computing capability by integrating in large amounts of high bandwidth graphics, high-end graphics cards, plus this new way of back propagating learning. So basically errors to assign each of the neuron to say, hey, you were wrong this amount of time and you were wrong this much. And then each of the neurons themselves will self correct themselves. And that's how the learning actually takes place. They just make a guess initially, and then they produce an output and you say, you are wrong. And then you back propagate the error. Each of the neurons fix themselves. But now we're using neural networks that have hundreds of layers, meaning that we're talking about millions and millions of connections. So that is the breakthrough that has happened in the past about eight years. That's what deep learning is, and everybody is looking at deep learning for just about all the solutions right now. It is the central push, why many of the nations have identified artificial intelligence as a national strategic perspective. So like China, Russia, Japan, multiple countries. Even the United States is shifting to allow their research focus and research funding into this area. And so that's what's happening, and what we're seeing is problems that we thought could not be solved with this is being solved. Which is amazing. We're no longer seeing a barrier that we used to. Before, there was a certain class of problems you can solve with artificial intelligence. And a certain class which you'd think should be solvable, but we couldn't solve it. But now we're, it's basically solving just about every single problem being thrown at right now.

Hannah Nabi: So your students are entering a very different professional world with very different possibilities than even just, you know, five and ten years ago, it sounds like.

Anthony Choi: Absolutely. Yes.

Hannah Nabi: So then let's segue, then, into talking about the open robotics lab. You've been through a few different models of rules and accessibility over the years, and you've you've ended up with this open door policy, open access model. Talk to us about how that works and why you've arrived at the open model that you're currently in.

Anthony Choi: When I first came to Mercer, beyond just the teaching and my normal duties, one of the things I wanted to do was create an environment where students can tinker, meaning just get their hands dirty. Mess up, burn things up. I don't mean to, like, burn down buildings or anything like that, but maybe burn some circuits up, maybe a chip. You know, they'll fry a circuit here and there, but not be so paranoid about breaking things that they're not learning. I am a firm believer that you do not learn from your successes. You learn from your failures if you use the failure as a, you know, a springboard to understanding what it is you're missing. And what it is that world does not yet know. And that is a, that's an amazing opportunity to identify when something fails, it means that you either had an incorrect model of the real world, or a problem that your understanding, or the procedures that you were using was incorrect. Or maybe there just isn't a solution. That doesn't exist. So that's, you know, that's something that I thought was very absent in my undergraduate education. My undergraduate education was very theoretically focused. I mean, yes, they taught you the theory. I can solve problems. I did the math. I can set up problems and solve it through mathematically-run computer simulations and all that. But the amount of hands on activity that I had in terms of creating something real, something that you can actually interact with and see that it's actually working in this part of a real world process was very much lacking in my undergraduate education.

And as I got my Ph.D. and as I was, you know, looking at my opportunities and becoming a faculty, there was a shift to something called problem-based learning. And this is something that's very, why, not just in engineering or technical areas. A lot of other disciplines have learned or shifted to this problem-based learning. The idea is, rather than trying to learn a theory based upon how to understand the theory, understand that theory by applying the theory to a problem and by solving it, you will have a much deeper understanding of the theory. And in so doing, you're also getting your hands dirty, getting things done and that level of understanding does not come from a book, does not come from a clinical problem-solving on a physical paper. It does not work the same way. So I, and you can see that as clear as day. Certain students who are extremely bright, extremely book smart, but you put them into the lab and they are non-functional because they've never dealt with that aspect of it. And I felt that, especially in today's age where so much of it is driven by application of what we know to problems and solving problems, that students needed that hands-on approach. So in order to promote that, I was looking for different paradigms to, how can I actually promote this, you know, beyond just my classes. So a lot of my classes are very lab based. They're very project based, obviously. But beyond just the students that take my class, I wanted to expand that to School of Engineering and also Mercer as a whole. And so that's where I came up with this open robotics laboratory concept.

Now, when I first got it, I had a strong support from the School of Engineering, which I really appreciate, and I also had a strong support from NASA. So leveraging both the support from School of Engineering and NASA grants that I've accumulated over the years, and, you know, got funded for, I've been able to build up the infrastructure. It was very hard. It took me about four years before I actually got the lab up and running, you know, with limited resources and so forth. But I had strong support from both School of Engineering and the Provost's Office actually, and also the NASA funding. So those two things came together, and once I started seeding the lab properly and giving the opportunities, students came. I mean, students really came. And the students had this pent up energy, pent up desire to do things, but they never had an outlet to do so. And once I opened up the lab, you saw all these students come and they're, like, saying, yes! And it was an amazing experience.

Now, during that process, like you said, we went through various different models. One was, we tried to regiment it. We tried to keep everything organized. We tried to do all of the things that you think is necessary, where it was a little bit too much micromanaged. And what we realized was that, yes, there's, that is a model, but there's problems with that model. One, it takes a lot of work to micromanage things. So the amount of time, the amount of administrative time that is necessary to micromanage things at that level was just getting unwieldy. And also it wasn't fun for the students or myself. Second was, because the micromanagement, you saw that students were hesitant to jump in because there's all these rules, and they didn't know how they fit into the rules and how rules applied. So I saw that, two aspects of it. So what we did was, we started to liberalize and get rid of a lot of the things and just create some sort of a just open lab. Where anything goes type of a situation. So we went from one extreme, not one extreme, but kind of like a orbit strip organized cycle management system to, like, just like anything goes wild west type of overlap. Well, too much freedom is also not good. Because it was incoherent. Students were doing things, they would work on a project for, like, you know, a couple months and then just leave it and we have no idea what project is what. Whether it's something that's being worked on. The lab was in just constant chaotic mess, and that wasn't actually working out as well. So, and another problem that caused was things started to walk away in the lab because you weren't assigned to a particular project, and no, there was no micromanagement. Things were just disappearing. Now, things happen. And I don't think any of the students purposely or willfully stole things, but it's just that sometimes they take care of a project and they're working on it and they get busy on their exams and they put it away in a drawer and they forget that they have it. And I'm sure that's the reason why it happened, but unfortunately those things happen.

So the compromise that we finally settled upon was some, kind of like a membership bar. So what they have to do is, they have to attend certain number of workshops, be certified to use certain number of equipment. Once they get certain certifications in using the lab, then they had full access to the lab. So that's the the open lab mechanism. Now, when the door is open, any student can still come in. It is truly, it's still an open lab. But the students who have personal access, 24-hour access, because my lab is actually key-coded. They're given a personal key-code access to the lab. So they can come there, two o'clock in the morning, work on their project anytime they want. They can work on their homework there together and various other things. But it is, for those students who can just freely access the lab, there is a bar that we have. And then there's the open policy where, if anybody's there who has access to the lab, they are requested to keep the lab doors open, meaning anyone can walk in during open times. And usually my lab is open from nine to five. Actually far longer than just nine to five. So, you know, during the Covid time, it's not as widely utilized, mainly because we have put restrictions on how many students can be in the lab. So there's actually a limit barrier.

But during pre-Covid times, you would walk by my lab, two o'clock, one o'clock in the morning, and there'll be students in there working on projects and doing all sorts of different things. In fact, I found one student on a makeshift bed of cardboard boxes sleeping on the floor. And I said, What are you doing on the floor? And he was like, "Yeah I'm printing this thing out, and it's going to finish in about, you know, one hour. I didn't want to go to my dorm and come back for it. I just wanted to be here when it finishes because I'm really excited. So, but I do need some sleep. So I want to, you know, that's why I was, I got some of these cardboard boxes." And he was sleeping on the floor. I said, You can't do that. You know, and then I immediately told him, I said, Go out, find me a couch, I'll by a couch and we'll put a couch in the lab so that anyone who really needs to like, sleep there, at least you have a couch to sleep on. But so we actually have a couch in the lab. And that's the true story as to why I actually spent lab funds to actually buy a couch, because I really felt that it was necessary equipment, because of the way the students were using the, utilizing the lab.

Hannah Nabi: You're so excited and animated when you talk about this stuff. It's really infectious. Like, I can't wait to go, I'm going to wait until Covid is done, but I cannot wait to go and see it. How does it feel to see this lab that you've put so much work in and invested so much time in over the years really take off and energize and engage students in this way?

Anthony Choi: I think you hit it right on the spot. My most proud achievement at Mercer is this lab, by far. By far, this is my most proudest achievement. This lab has met all my dreams of expectations and beyond. So it really, really worked out well. And one thing I did not mention is this: I have amazing, amazing help from the students. I cannot have done this alone. Yes, I had the vision. Yes, I had what I wanted to do. But I alone cannot have made this lab happen. And so very early on, I was fortunate to be able to identify students who have similar visions, who have similar interests, who have similar, not only the smarts and, you know, the desire but also the desire to help other students. And that was the key is that if you look at my lab, when a student walks in for help, they get help. People are willing to help out anyone that walks in with whatever they need help with. Now, sometimes we can't help them. Maybe not. A lot of times we can because we have so many capabilities. I'm in the electrical and computer engineering department. Specifically, I'm in the computer engineering department. However, the students that are manning the labs, the officers, they come from mechanical engineering, biomedical engineering. They come from electrical. They come from computer, industrial. The lab is truly an interdisciplinary lab. It is not a computer engineering lab, and so that, you know, that really is an amazing thing.

And also the lab has become so well, I guess, oiled, and we have instituted various mechanisms so that if one group of, like, core students graduate. Things, sometimes in a group, you know, in a student-run group, when there's like a core group that was really active, and they're kind of like in the same cohort, and all of them somehow leaves, the club kind of just really takes a nosedive, you know. And we, I've actually experienced that in my lab. So we've also developed mechanisms to prevent that from occurring. So, for example, in our lab we have officers, but the officers are actually selected in the spring to become officer-elect positions for the coming fall. So we already have the next set of officers already in line. They're already learning about all the mechanisms and all the things that they need to do. Each of the officers are required to keep a transition letter that they receive at the very beginning of their term. Plus, if there's any information that needs to change or any information that needs to be added, any context of relevance for that particular officer's position is added to that transition letter. And that transition letter's then given to the next officer that gets elected. And so there's this overlap, a one semester overlap, between the current officers and the newly elected officers that really solidifies the transition. Because every year there was always this, like this havoc, uncertainty about how this year is going to go.

Once we developed that mechanism, the transitions became much more fluid. I mean, I do not worry about the next coming school year because I already know who the officers are ahead of time. We don't do elections in the fall, all the elections are done already. And they've been, already been trained to run the lab properly and they have received the proper information, proper guidance, proper mentorship, to be able to carry on their position already. So that, that's, you know, but it's really the students, right, it's really the students. I really allow the students to make a lot of decisions. I only guide them when, if I feel that there really needs to be guidance, but I really let the students try different things. And we don't mind experimenting. And we don't mind doing things differently, even though things are working well, because you never improve unless you try different things. But at the same time, if something doesn't work, something doesn't work, we'll go back to what's a known mechanism.

And this lab is truly self sustaining, and I almost feel like I don't even, I'm not even needed anymore. Which is kind of a scary thought. I think students can just run the lab without me. You know, all they need me for is to bring in more funding. As long as I just bring in the funding and fund the lab and buy their equipment and buy the tools that they want, they, they could care less whether I'm around or anything.

Hannah Nabi: Well, that's a sign of a good leader, right, that when they leave things continue to run smoothly. So you mentioned officers, and so you work really closely with the robotics, Mercer Robotics Club student organization with, I believe you founded, actually, a few years ago, is that correct?

Anthony Choi: Yes.

Hannah Nabi: Okay.

Anthony Choi: So basically, when I first formed the machine intelligence robotics laboratory, I also helped found the student group called Mercer Robotics Club. The two are two faces of the lab exposure. So Machine Intelligence Robotics Laboratory, it is a more of a scientific research arm of my lab, meaning they do the research, they do writing papers, experiments, and various other things. Mercer Robotics Club is the public face of the lab that allows the recruitment of students into the lab. Exposures. They also run robotics workshops. So basically the Mercer Robotics Club is the one that actually does the outreach activities to educate Mercer students, and anyone who wants to, in 3D printing. If they want to this understand how 3-D printing works, they can sign up for a workshop and then come and learn laser cutter, soldering, and throughout the year we run multiple, multiple workshops. During the Covid, I think it's a little bit less. We're not running it as often, and we're, instead of running, like, one large workshop in a week, we'll split it up into, like, two or three or four workshops where it's small groups of students that can come considering the constraints of the size. Because we do want them to get hands-on experience and physically see how things work.

So that's where the Mercer Robotics Club came in, is the, it is the public outreach component of where things happen. So they attend Bear Fair, they recruit students, they let other students know that this facility is available. Because if we actually have, sometimes you have a great research lab at Mercer.

A lot of people just don't know about it. It just doesn't exist, right. Unless you're somehow connected with it, you just don't know the opportunity that exists in that lab. You know, early on, I realized that you can't just create something great. You have to create something great and you have to let people know, and you have to let people know constantly because there's a constant rotation of students coming in. And then to, you know, fix that and to address that issue, that's why Mercer Robotics Club was founded. It is one of the most active labs, active student groups at Mercer. I mean, the amount of activity, amount of fundraising, amount of all the stuff that we do, it's a very, very activelab, and it's shown by the strong support that student government gives to Mercer Robotics Club.

Hannah Nabi: Now, in addition to the peer education and on campus outreach, so the students who are members of the robotics club also do mentoring of robotics teams in the public school system. And they have coached these teams to regional and national success in robotics competitions. How, tell us how did, how long have they been doing that? How did that relationship start, and how does it work?

Anthony Choi: Sure, um, our vision was initially when the lab and Mercer Robotics Club was founded, we were focused on establishing the lab internally, establishing it's, creating a strong infrastructure and the mechanism to keep the lab going. Once we got that level of, I guess, organization, kind of solidified, then we started looking for areas to make our impact felt beyond what we know, what little set corner we created. So there's two aspects that actually happened at that point. I purposely reached out to other faculty and other areas where we might partner with School of Engineering and Art, School of Engineering and other, like computer science, School of Engineering and mathematics, School of Engineering and Business. So the idea was to say, okay, so we have these types of capabilities, and I know that some of your other departments do not have these type of capabilities. Are there ways where some of your students can also benefit from something like that? So we've had our students, we've had to go in business students, pharmacy students come to the lab and become regular lab members, and then they are able to merge two different worlds together to really enhance their education, really enhance their experience as well. And so that's something that we want to do internally at Mercer is to not only be something that's in the School of Engineering and within the school of engineering, remember we're a very interdisciplinary lab, but not just stop at school of engineering, but let's say go out to Mercer. Now obviously our reach out to Mercer hasn't been that successful as in school of engineering, but we have had success stories.

Now, second part of that was now that we had all these capabilities and infrastructure, how are we going to make a difference in our community. The very first thing that I identified was First Robotics Competition. So FRC. It's a nationwide, one of the largest robotics competitions for high school students. Sometimes college students attend, but it's primarily geared toward K-12 type of a robotics competition. And it is one of the highly successful, I mean, it's very, very successful - huge attendance. In fact, this past year, well this year, we were supposed to actually host the Georgia championships at Mercer before the Covid thing hit. So that was the only reason that actually got canceled. So we were able to draw the state championships to Mercer, which was great. So, when looking at that, Georgia Tech does a really amazing job of mentorship and running workshops for FRC. There's a huge demand by public school systems and private schools for how to get their teams more educated and then, you know, attend workshops to find more things to expand the capabilities, expand their ideas and concepts. Well, a lot of Middle Georgia and South Georgia, North Georgia where Georgia Tech is, is too far away because they'll usually have it during afternoon sessions where, after school gets out. So in the metro Atlanta area, they're able to kind of drive, attend workshops, and come back. Whereas when you're talking about Middle Georgia and South Georgia, it's just too far, right, and logistically, it's very hard for them to attend. So they were being left out of this amazing educational opportunity that Georgia Tech has offered for many years, and they do an amazing job.

So what I chose to do was, I said okay, I want to create something very similar so that I have, I can open up the opportunities for K-12 robotics teams who are interested in competing in FRC or currently competing at FRC to be, understand better and bring it to Middle Georgia. That aspects of it. So I work with Connie Haynes, she's the director of FRC in Georgia. So she's the head person. So I made contact with her and we kind of laid out a plan and my vision of what I wanted to do, and once she heard, she said, You get that anywhere off the ground, I will support you 100% because that is something that we definitely know is a huge void in Georgia. Because, she said, you know Georgia Tech does a great job, but it's only like metro Atlanta schools have attended, and you have this rest of the Georgia, rural Georgia, south Georgia, Middle Georgia where most of the schools are not able to take advantage of that. And she said that whatever you need, we will help. And so I had strong support there. I talked to my dean at the time, Dean Shaw. And he said, Yes, that's great. And then I talked to my students and they said, oh, yes, that is awesome. You know, and considering that my lab is a robotics lab, a lot of them were actually FRC participants, team members during their high school years. So they said yes, that's awesome. You know, I would love to give back. I was looking for opportunities to give back. And so I had a buy-in from everybody from FRC to the dean of School of Engineering from the students in my lab, and so forth.

So one summer, we actually got the idea and then started to run workshops on FRC. So basically we went through one workshop based every Saturday throughout the whole summer. We would run workshops on safety, electrical systems, mechanical systems, programming, and various other aspects of, even fundraising in fact, we even covered that, to be able to teach teams about, you know, proper procedures, know how, and how to approach things. And the, the demand and participation was amazing. In one of the labs, I believe 17 different teams showed up at Mercer. We filled up that, you know that SEB 201, that auditorium style classroom in the new engineering building?

Hannah Nabi: Yes, it has 100-person capacity.

Anthony Choi: We almost filled that with participants. We had parents, mentors, students show up from all around Middle and South Georgia come attend that. During that time, I also worked with Bibb County and, you know, I helped them because there was an interest. And I think when I pushed it really kindled their interest into action. Bibb County, after those workshops, decided, Yes we are going to have an FRC team. So that's the first year they actually had an FRC team. One of the things that we did was, we took the Bibb County FRC team, it's called RoboBibb, we took them under our arms because it was their very first year. They didn't have equipment. They didn't have understanding that, they never competed. They don't know what was going on. So we spent hundreds, hundreds of hours with that team, mentoring that team. My students, every like afternoon, when their, their team members, high school students would meet for the robotics team meeting, we would pack up our tools and our lab tools. We pack our bags of lab tools, get into our cars, drive over there, and open up because they didn't have any tools or anything, and they needed to create a fully functional robot. And we would be the mentors, we would be, you know, tell them how to do the mechanicals, electricals, the programming, and all sorts of stuff. And we really, you know, worked hard that very first year. And it worked out beautifully because RoboBibb won Rookie All Star Honors the very first year of their existence, meaning they went to, they were good enough to make it to state competition. At the state, they performed well enough to actually receive Rookie All Honors. If you receive Rookie All Honors, you actually go to the international competition. Very first year, they made it to the international competition. So we were very, very proud of that. And then after that, they started getting more infrastructure and other mentors. So my students graduated, but students that were mentoring them, they graduated, got jobs at Robins Air Force Base, and they continued as mentors to that team, even after their graduation.

So this is how dedicated some of our students were. And then, I believe, two years ago or so, or three years ago, RoboBibb won Georgia championship outright. I mean, they weren't just Rookie All Star honorable mention type of stuff. They actually won and there was actually, following that, they have this FRC convention, kind of like, kind of like a kickoff. And one of the presentation was, how did RoboBibb do it? Because typically it's, the teams that win FRC are coming out of north metro Atlanta, where there's a huge infrastructural support, both financially and historically, so they have mentors with a lot of engineering companies that really have a very strong infrastructure support. And those are the teams that typically win Georgia. And you suddenly have a team out of Middle Georgia win Georgia outright. And so people are going, how did they do it. What happened, you know, where did this come from. And so, you know, they actually had a whole section on how RoboBibb did it.

And no, I did not have a part in how that happened. But I had a part in setting up the infrastructure so they could grow into that point. And like you said, you know, good leadership is shown by the fact that after the leader leaves, the system continues on after. And that's something I can say about RoboBibb, right. They continued on. We set up the infrastructure, and we slowly withdrew support, and we stayed with them for about two, three years. But as they were growing up, and they became more independent, we slowly withdrew our suppor. Now some of my old students are continuing to be mentors, but they became much more independent. And for them to not just, you know, go off a cliff or just be so-so, but to actually increase from where they were to actually win state outright, that is awesome. So that's one.

Another is the FTC, First Tech Challenge. So FTC is a another segment of FRC, so it's a different type of a robotics competition where the brains of the competition is controlled by a phone. So you actually put a mobile phone as your computer, and you still have a little bit of smaller robot, but similar types of events. And with this one, the idea actually came from, not me, but from a student. One of the students who was involved in FTC during his high school wanted to actually create a sponsorship program at Mercer for an FTC team where his, what he wanted to do was, again, look for opportunities where we can make a difference. And where he identified was, identify private schools or public schools or homeschool students who did not have access to a robotics team opportunity. And so this team was specifically formed for that purpose. And this was basically anybody who wanted to come, but obviously you have to be geographically near, so Jones County, Bibb County, Houston County, and so forth. But so, we had private school students. We had ACE students because they're not, they're technically public but they're not technically public because they’re charter. So ACE students having access to RoboBibb is kind of uncharted territory, it is, so technically they don't have access to a full blown robotics team. And then homeschool students, right, a homeschool students, you have a fair number of homeschool students in Middle Georgia, and they don't get to compete in these type of things.

So when the student kind of explained what he had a vision for, I said, Yes, that's an area where we did not actually do an outreach and where there is a need. So we're always looking for places where there is a need. Not just saying, we're just going to do outreach. But I want to really see where we're going to make a really big impact. And with that impact truly create opportunity where there wasn't any before we actually started participating. So we actually created a FTC team. It's for high school students of those private schools, public schools, and homeschool students who can come together. Last year was the second year of that team. First year, the team did okay. Second year, they actually went to state last year, and this year because of Covid they chose not to compete in the competition instead Of, because everything was virtual, so we couldn't figure out exactly what was going on. They decided to just run workshops this year to get the team ready for the next full year’s competition.

So those are the two types of outreach things, but we do also other types of outreach. So you know, I've done, we've done workshops where we brought in middle school teachers and then teach them how to fly weather balloons. So because they want to put experimental packages on, fly it, and collect data and so forth. There was a fair amount of interest in that. We run a robotics workshop for K-12 teachers to integrate robotics into their curriculum, to meet some of the things and to really increase the interest in STEM is how we see it.

And then we also have multiple NASA sponsored projects where we do outreach, and one of the outreach is that we have a high altitude payload platform, HARP is what we call it. And so basically what it is, is schools, K-12, other universities, can submit experiments. We'll load it up onto our balloon payload system, and then we'll launch it and will allow them to have real time access to data, real time control to their experiments while it's in the air. And we will recover their payloads once it actually lands. They get basically about 20 miles up into space or higher, and not in space, but near space. So basically near space conditions. So, when you get up there, you get a lot of those same type of freezing conditions, very low atmosphere. You also get high levels of radiation and all sorts of stuff, so. But then, because we can do it so economically, you could really open it up to K-12 and because they don't have to pay for any of those infrastructure, NASA pays for all that, so all they have to do is deliver us an experimental payload and then we will put it in and then we'll fire it for them. We'll launch it for them. We do a lot more other stuff. But those are some of the stuff.

Hannah Nabi: That's amazing. I'm really sad to say that our time is coming to an end. This is fascinating. I could sit here and listen to you talk about all these projects for hours. But before we close, I always like to ask our guests to sort of finish out by telling us your thoughts on why your work with robotics and the work on campus and out in the community is Research That Reaches Out.

Anthony Choi: Well, I think, simply, I've always had the vision, and fortunately my students also had the vision of helping fellow students, helping the community. Right. So we were always looking for opportunities where we can make a difference, not just for ourselves internally. We're always looking for where we can make a difference for the community as a whole. And some part of it is community within the Mercer community, some part of it is community within the actual community itself, that we actually live in. And some of the students that we recruit, these are students that were from North Georgia where they had excellent schools. They have had established robotics programs and so forth. And when they come here and they look around, and when I introduce them to some of the infrastructures and opportunities that exist in Middle Georgia, they realize, I didn't know that it was so special, what we had up there, and I didn't know going to Georgia Tech and attending workshops is such a hard thing. I just thought everyone did it. So when they realized that, they said, Yeah, I would love to give back. I would love to make sure that goes out in other communities in Middle Georgia, other communities in Georgia. Middle Georgia and rural Georgia has the same opportunities that you would have in Atlanta. And so you can see that, because of what we thought was important, because we felt mentorship and really expanding the knowledge and the experience to everybody that we can touch, especially where there is a void, I think kind of explains why, you know, what we do really is Research That Reaches Out. And we learn a lot, and we publish papers accordingly, too as well. So it is research.

Hannah Nabi: Well, thank you so much, Dr. Anthony Choi, for talking to us today.

And thank you to our listeners for tuning in to this episode of the Research That Reaches Out Podcast at Mercer University. You can check us out on our website at QEP.mercer.edu and subscribe to our show at SoundCloud.com.