S02E08: Fighting Electrical Fires With Smart Sensors

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Kyle Fox (00:25):

This is a Smarter World Podcast, focusing on breakthrough technologies that make our connected world better, safer, and more secure. I'm host Kyle Fox. Each episode we introduce bright minds in their approach to a more sustainable world. We discuss the opportunities and challenges they face and how technology can change the world for the better. Today we're talking safety and specifically keeping the people, animals and things you love, safe. Each year, electrical fires claim hundreds of lives and injure thousands. Property damage is estimated up to $1.5 billion per year. Today I'm joined by Bob Marshall, CEO and co-founder of Whisker Labs, a company who develops cutting edge sensor technologies to help protect homes and communities from electrical fires. Its flagship solution, Ting, draws on decades of electromagnetic and atmospheric sensor expertise combined with AI, to detect electrical faults in the home and on the grid. In short, imagine if you could know when hidden electrical fire hazards start to form, before they had a chance to evolve into a fire. This is an amazing device and I'm really excited to talk with Bob about the development and capabilities of Ting. Welcome, Bob.

Bob Marshall (01:40):

Great to be here.

Kyle Fox (01:41):

Before we dive in, so for full disclosure, I'm a current Ting user and I absolutely love the service. I am so super excited to have you on today and talk a little bit about where you're going with this and how people are getting involved with Ting and what the future looks like. So to get started, can you tell us a bit more about yourself and how you got involved in Whisker Labs?

Bob Marshall (02:01):

I'm one of the co-founders and CEO and I'm an engineer by background. I am a technologist and a data guy. In the prior company that I helped co-found, we did a global sensor network for weather and climate sensors, and then we came up with the idea for Ting, which unfortunately developed because of a terrible tragedy in my family. My sister-in-law's house burned down

several years ago. It was an electrical fire. They lost a pet, they lost everything, and it was really a terrible loss. I didn't know anything about electrical fires, but we had some great engineers and scientists and we set out to develop a product that would help prevent these things.

Kyle Fox (02:35):

Thank you for sharing that personal story with us. So this is born out of tragedy.

Bob Marshall (02:38):

It is, yeah. And sometimes that's a little serendipitous. Sometimes the best companies are born out of the need to solve a pressing problem. In our case, it was catalyzed by a loss and a terrible fire that impacted my family.

Kyle Fox (02:50):

And as a technologist and as you mentioned, a data guy, and your background doing sensor networks for weather, it does sound like it's just a natural extension to come into an idea behind a device like Ting. And your website uses terms like 'incredibly simple', 'super smart', and from my own personal experience using it, it's truly plug and play. You just pick it up and you move it around as you need to. And the data's so simple for me as a user to visualize and check up on my house, and what I never realized I was carrying was stress about what my electrical system at my house was doing. Because it's always been something behind a wall. It's not something I can touch or deal with. And this device suddenly opened it up and I had the sense that I understood what was happening behind those walls. And so we're talking a little bit about the mission statement; incredibly simple, super smart. I wonder if you could expand a little bit about that.

Bob Marshall (03:37):

The product itself from a customer's perspective is super simple. It's just a plug. You plug it in, connect it to your Wi-Fi, and one sensor monitors the whole house. And really what we're looking to detect, it's electrical arcing that occurs when you have damaged wires or loose connections. As you said, they can be inside of a wall. That's why electrical fires are often some of the worst fires that impact homes. They can start in the middle of the night when you're asleep. They can start when you're not home. They can develop for a long period of time and then it results in a fire, which is what happened at my sister-in-law's house. One of the things that's amazing about Ting is while it looks so simple on the outside and for you as a user, it is incredibly sophisticated inside.

(04:18):

The signal processing that we do with NXP silicon behind it, is incredibly sophisticated. It is taking 30 million electrical measurements every single second. We actually do machine learning and artificial intelligence on the device itself, and then we send the data up to the cloud where we do additional machine learning and AI in the cloud. So it is super sophisticated technology and data behind it. You never see that as a user, but we ultimately just prevent the fires.

Kyle Fox (04:44):

This idea behind edge processing, this is an absolute embodiment of it, where you're processing that locally and then you get the big heavy iron to do something a little more sophisticated up in the servers.

Bob Marshall (04:54):

And the sensor itself hardware wise, it's pretty straightforward, it's a plug. But again, when we set out to solve this problem, what we quickly learned is it was much, much harder than we thought. It required us to do very high speed digital signal processing and have the horsepower on the device, on the sensor itself, and frankly, there just wasn't a lot of great options out there. We discovered the NXP 4370 chip and there's just not many chips that have the kind of A to D capability that is built into that chip and the high speed digital signal processing capability. So it is really essential. We would not be able to solve this problem and particularly do it in an elegant and simple way, with one single sensor, without the kind of technology that NXP is providing.

Kyle Fox (05:36):

We see this so often in the high-tech industry is if you want simple, you're going to have to start with complex underneath, right? If you just want that simple statement of what's going to happen, there's a lot going on there, and I imagine if you're doing 30 million calculations a second, plus some neural net processing behind there, there's a lot going on inside that little device.

Bob Marshall (05:53):

It is a very busy device and it is literally taking across the fleet of sensors now, in the order of 20 gigabytes of data per second coming up to the cloud.

Kyle Fox (06:03):

Per second?

Bob Marshall (06:04):

Per second, coming up to the cloud. Obviously starting out at the device, and that's a tiny fraction of the data that each of the devices are producing, because at 30 million samples per second at the edge, it is massive amounts of data and that's the key behind solving this problem. It was a very difficult problem. It requires a lot of data. It's IOT at its finest, I would say.

Kyle Fox (06:23):

Just to tie this into the sustainability aspect of it, 20 gigabytes a second. If you're processing, and I'm going to make the number up, I don't know what it is, but 90% of this is being pre-processed locally, if this was just pure server-based stuff, the amount of data this thing would be shipping around through all the servers and the internet orders and orders of magnitude bigger than what is actually going up.

Bob Marshall (06:41):

In fact, it would just not be possible, Kyle. You could not send that amount of data to the cloud. You don't have the bandwidth and the connectivity in homes to do that, so you have to be able to do a substantial amount of edge processing in the device itself or else it just won't work.

Kyle Fox (06:56):

I never realized how much actual processing would be required, because when you look at the interface, it does come across simplistically and you think, oh, they're monitoring this couple of things. But there's a lot going on under there. And so when you think about electricity, we're absolutely dependent upon it and we're getting more dependent on it. We're connecting everything together. This rush to increase electrification, it clearly has its benefit as a civilization, but it can also be incredibly dangerous if not handled properly. So my question is, do you think that there's a need to educate the public like myself, because I don't know much about what happens with that electricity as it comes to my home. I just know when it's not there. Is there a need to educate the public on electrical fire safety? Is there something we should be doing more to help prepare them?

Bob Marshall (07:34):

I think it's well beyond electrical fire safety. Obviously, that's really what we're passionate about, preventing electrical fires and protecting our customers and saving lives every day. But the benefits of what we're doing go far beyond that. If you think about it, every home is an electrical grid in itself, and then you've got the utility grid. As we add solar and we add EV and we add storage, and we plug more and more things in, it creates incredible complexities not only within the home but on the grid. When you start to add that level of complexity, a lot of the electrical systems were not designed for this. They were not designed to have electricity flowing

backwards from the home, from solar panels or batteries, back to the grid. It just wasn't designed to do that.

(08:13):

And really the network of Ting sensors that we are deploying one, at a time, enables us to understand and monitor the grid at such high resolution. It's never been done before. We're detecting problems on the grid every single day that the utilities are just not aware of. They don't have sensor networks that are capable of doing the kind of stuff that Ting does.

Kyle Fox (08:35):

It was staring me in the face the entire time. I said the wire's behind the wall and I don't see what's going on. The reverse is true. My power company has no idea what's happening inside that house. It just sees electricity going here.

Bob Marshall (08:45):

I think the IOT sensor network that we are building, is going to be one of the most valuable sensor network that's ever been created. You talk about electrification and we're starting to see the ramifications of grid resilience. It's not just reliability: is the power on? Is the power safe? Is it high quality power? Because things get damaged, if the power from the utility and the grid is not safe and of high quality, then you damage equipment in the home. You can start fires in the home, and unfortunately, as we've seen recently, utility grids and poor grid resilience can result in really catastrophic wildfires that impact entire communities and towns and cities. And that's something that we also are very passionate about. We want to leverage the data that we're collecting from Ting sensors, to help utilities understand what's working, what's not working on the grid.

Bob Marshall (09:35)

A lot of the worst fires unfortunately are utility caused, because there's a lot of wildfires every year, but unless it's windy, they don't typically cause catastrophic damage, but it's the wind that really causes the problems. So when you start to have trees touching lines, that's when you get these sparks that cause some of these wildfires and then it's really already windy, so they really spread fast and become deadly. I think what's key is to leverage the kind of technology that we have with the NXP chip inside of Ting, monitor the electricity in ways that's never been done before, prevent fires inside the home, understand the resilience of the grid, help prevent wildfires. So it is really an incredible opportunity that we have to better society, save lives, and just make everything better.

Kyle Fox (10:20):

We've talked about the overall high level view of it. I want to unpack a little bit about the design itself, what's happening inside the signal processing. One of the things I love about the Ting that I use is how compact and out of the way the device is. To achieve that kind of design efficiency with all the stuff that you said you were doing inside that device, there had to have been challenges, and I'm wondering what are some of those challenges you encountered in building this?

Bob Marshall (10:41):

On the outside, very simple, but there is a lot packed in there. We've got to have a good Wi-Fi module in there, but the heart of it is the NXP 4370 chip that is the signal processing engine behind everything. And really within chip, we're able to take those 30 million measurements every second, but then not only just take the measurements themselves, but then actually do the machine learning. So I would say that the hardest part of Ting was not necessarily the hardware. Once you have the circuit board and the plug itself, it's straightforward. It's really having that capacity that we get from the NXP chip and doing the machine learning and the signal processing. The hardest part is how we work with the data and everybody's talking about ChatGPT and using transformer models, and that's all with the written word.

(11:27):

We're essentially doing the same thing. Instead of using the written word, we're using electrical measurements. We take electrical measurements and we throw them into a transformer model and do incredible things. It's just absolutely astonishing to me every single day, what our data science team does, and it's leveraging advanced machine learning and AI techniques and applying it to something that's going to help prevent fires. That capability didn't exist years ago. For this to work, it had to be in a small form factor. The Ting plug is just the size of a nightlight. We want our customers to just plug it in somewhere out of the way and let it do its job 24/7, taking those measurements every single second.

(12:04):

And for the customer, hopefully you don't hear from us, but we've saved now over 6,000 homes from what would've been potentially catastrophic fires. It's almost 15 per day now. Every day we will be working with a homeowner, identifying a problem, finding it, and fixing it before it can start a fire.

Kyle Fox (12:22):

You and your team must absolutely love your job to get that kind of positive feedback. I mentioned at the beginning of the podcast, what I love most about Ting is peace of mind. Just to be able to be aware of what's going on gives me a great feeling. Now, I have not encountered a

tragedy, but I got to assume that you have some incredible stories you've heard from your customers. Are there any you'd be willing to share with us?

Bob Marshall (12:42):

A lot of them are just like this one. The mother was out at a volleyball game with her daughter one evening. Ting had detected a big problem. We had notified our fire safety team. Then our fire safety team member, Sabrina, called her at the volleyball game. And she left the volleyball game immediately and came home to find smoke coming out of an extension cord in the basement right next to a bunch of stuff that would've ignited. We were able to stop that, but had she not taken the call from our fire safety team member, gone home, that could have been a catastrophic fire when she came home. And obviously she was just so thankful that Ting was there watching over her home, providing that notification to get it addressed before it can become a fire.

Kyle Fox (13:23):

That's building up so many emotions in me just listening to this story. Coming home to maybe a little bit of smoke damage versus a completely burned down house.

Bob Marshall (13:29):

Yeah, that's right. And had that in the middle of the night, they might've been sleeping when that happened. It is a concierge service that we provide our customers. All the technology, it's the plug, it's the machine learning, the data, the signal processing. But at that last step, if we know there's a problem in your home, you're going to get a phone call, a text, and an app notification from our fire safety team, and they will calmly work with you to do what we need to do to identify where that problem is, and find it and fix it before it can start a fire. We have an obligation to take care of our customers. We can't prevent 100% of fires. That is our objective, but we're very passionate about protecting our customers and their families and their homes, and it is incredibly rewarding when we do every day. That keeps us motivated. We're growing like crazy, expanding. We're in 400,000 homes. We just added 58,000 new homes in September alone.

Kyle Fox (14:18):

Now, I'd like to talk about how the grid factors into this, but more along the lines of, you mentioned solar, home batteries and generators, all these different technologies are coming into play.

Bob Marshall (14:28):

The grid has to be able to withstand the weather and climate conditions that it's going to face in the future, and it also has to be able to withstand those weather and climate conditions with the addition of solar and wind and batteries. So it is incredibly complex. We have a very meaningful role to play in monitoring the grid and proving the resilience, because we've got to be able to electrify. If we don't take the steps to decarbonize, then global warming is going to be worse, and the catastrophes associated with that, are going to be there. To get the grid where it needs to go to handle all this, you can't manage what you don't measure. So you've got to have sensors. You have to have data to understand all this. So I think that's an incredible opportunity for us to leverage the Ting sensors that we are installing and as the network grows.

(15:15):

And then I think the only other thing I'll say is that the IP, the technology behind Ting, is embedded in the NXP 4370 chip. So what other devices might that chip go into, beyond a standalone Ting sensor where you can get the benefits of all that great data and signal processing? If you put the NXP 4370 chip with our firmware and software and machine learning in it, in any device that's plugged into the grid anywhere, it does everything that Ting does.

Kyle Fox (15:45):

What you described is you absolutely can scale this.

Bob Marshall (15:48):

Oh yeah. No, there's no doubt. The scale opportunity here is tremendous, but our business model is largely based on partnering with insurance companies so homeowner customers largely get it for free.

Kyle Fox (15:58):

That's how I got mine.

Bob Marshall (15:59):

Companies like State Farm and Nationwide Insurance and Liberty Mutual and Erie Insurance, so they give away Ting for free to their customers because we prevent fires and take care of their customers. And that's good for insurance is predict and prevent versus repair and replace. So if we can prevent the losses, that's better for the customer and it's better for the insurance company.

Kyle Fox (16:20):

It's got to create a fiscal positive feedback loop to get more of this out there because it's in their best interest to do this. Besides the human aspect to this, from the business side of it, if you get them demanding it, then it's going to grow.

Bob Marshall (16:33):

I think there's a big flywheel effect and the value of the sensor network goes up actually with the number of sensors that you have. The data gets incredibly valuable. So as we continue to scale the network, the value of the data from the network gets better and better. So it enables us to provide that value to the utility companies, which then provides more value to the insurance companies, and everybody wants to go faster as the network grows.

Kyle Fox (16:57):

We're coming to the end of our time here, and it has been an absolute honor and pleasure talking with you today. Clearly, I'm a big fan of the work you're doing as I use a Ting device myself. We usually ask our guests a standard question. We ask, how do you envision a safer world 50 years from now, especially as it relates to technology? What do you see that world in 50 years?

Bob Marshall (17:17):

Well, in 50 years, I would say that the technology we have in Ting is going to be embedded in every single dwelling unit around the globe. But equally and importantly, we will have helped that transition to a more resilient grid, that is capable of handling the electrification that we need to have in society. We will be preventing some of the most devastating wildfires that are terribly impacting society and communities, and we should eliminate the worst of those as well. So it is leveraging the IOT, leveraging high-speed digital signal processing with the NXP chip, embedding that everywhere, and preventing fires and saving lives.

Kyle Fox (17:57):

Bob, it has been an absolute honor being with us. Thank you for sharing your vision, and I can't wait to see that world that you envision for the future. Thanks for being a part of the podcast.

Bob Marshall (18:06):

Kyle, great to be here and really appreciate our partnership with NXP for sure.

Kyle Fox (18:11):

Thanks for listening, and we'll see you on the next one.