Kärcher + InOrbit: the Future of Autonomous Cleaning transcript

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Note, this webinar transcript has been edited for grammar and clarity

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Geoff:
Hi, everyone. Welcome one and all. Thank you so much for joining us here today. Today is going to be an exciting conversation. This InOrbit webinar is of course entitled **Kärcher + InOrbit, the Future of Autonomous Cleaning**. We really appreciate you joining us. My name is Geoff Chapman, I am the Content Marketing Manager at InOrbit, and I'll be your emcee setting things up for today. As we mentioned today we'll be looking at automation and its evolution in building services and the cleaning sector. Of course, some of the unique challenges to that space and the exciting moves that some of our partners especially are taking in the space. Of course, as I hinted at, we have some fantastic guest speakers with us here today. Our friends from Kärcher will be joining us.

So with that, we will be discussing a little bit about the recent InOrbit and Kärcher collaboration announcement. Now, if you're new to one of our InOrbit webinars I'd just like to give you a little bit of information about us: InOrbit offers a secure, cloud-based hardware agnostic, robot fleet and data management platform. We help robot makers and their customers develop, deploy and operate smart robots at global scale. Now, central to what we do is a dedication to effective RobOps or robot operations as we call it. It's central really to automation as it scales really in any sector.

A little bit of housekeeping for today before we get going, this webinar will be 45 minutes long. We will be recording it as well. So if you have any colleagues who weren't able to join us today, not to worry, we will send out a link with a VOD of today's webinar, that you can share with them as you wish, of course. and if you have any questions, please write them down in the chat. We will carve out the last 10 minutes or so of the webinar for your questions.

With that, I think we're about ready. I'd love to bring up our host for today, the co-founder and CEO of InOrbit, Mr. Florian Pestoni. If you could join us now. Florian of course comes to us with over 15 years of product experience at startups to enterprise companies managing, especially media products and SAAS products, from companies like Microsoft, Adobe, and Facebook. He has a wealth of knowledge and experience, and we are lucky to have him driving the vision and the ship here at InOrbit. Thank you very much for joining us.

Florian:

That was a very nice intro. Thank you so much. but let's turn the spotlight on our two great speakers that we have today. Let me start by introducing Marco Cardinale. He is the VP of Floor Care and Robotics at Kärcher. He has 14 years of experience in the cleaning technology industry, and he spent more than five years already working on autonomous cleaning solutions. At Kärcher and other places he's held various leadership positions in product development, product management, business development, corporate strategy, M&A. It sounds like Marco has done it all already. He has a Masters in International Economics from the University of Stuttgart.

And we're also joined by Felipe Garcia Lopez. He's the Head of Robotic Systems and Software Engineering at Kärcher. He has 10 years of experience in R&D working with AMRs, which are almost mobile robots in intralogistics, cleaning, and also an impressive academic background. He has a Master's in Mathematics and Computer Science and a PhD in Mobile Robotics, which I didn't know was a thing, from the University of Stuttgart.

Now, let me introduce Kärcher, the company, and I'll lean on Marco and Filipe to pronounce it correctly. I think there's the American pronunciation. '*car-sher*', versus the Käercher. You'll get it right for us, but for those of you who don't know it, it's a huge leading provider of cleaning technology. A worldwide 3 billion Euro a year, family-owned enterprise, with over 14,000 employees, across 80 countries, and 50,000 service centers, which is mind-boggling, in really all countries, to make sure that there's continuous and comprehensive supplies to customers around the world. So really it's a global enterprise. So again, we're super lucky to have these two fantastic speakers with us today. Maybe, would either of you want to add anything else to that intro? So, people can get a better sense for you?

Marco:

Thanks Florian. First of all, thanks for having us here and for inviting us - and, you were correct. We say Kärcher in English so we can stay with that. That's probably easier for all. Maybe what we can add is that Kärcher is indeed a B2B and a B2C business. And, this is also how we do robotics. For one and a half years now, we decided to also form a kind of a competent center when it comes to robotics and we do product development and also go-to-market for both consumer and the professional robots. The idea is to maximize the synergies in product development, and also enable us to use our resources in a fluid way where they are needed in the moment. I think that's worth adding.

Florian:

So let's just get right into it, Kärcher has a 80 year history, but now there's this thing about autonomous solutions, not just for Kärcher, but for the market in general. So has that changed anything? Have the expectations in the public around cleaning changed with the introduction of autonomous solutions?

Marco:

Yeah, definitely. I think the impact of autonomous solutions, especially when we talk about commercial cleaning, was quite significant. I would say so. And the reason is simple. When we talk about facility management companies, building service contractors, I think they all have the challenge, if not a pain point, that there is a huge lag or even shortage of labor. And this is also accelerated by the fact that they offer more and more services to their customers, and therefore the cleaning robots, or let's say autonomous solutions in general, address that point very well. There's also this tradition that the cleaning robots offer benefits such as the consistency of the cleaning quality and that’s what we talk about today. There’s lots of data that you can collect and where you can also create additional value for the customers. This has changed a lot in the last years and expectations towards this usage of data have increased.

Florian:

Yeah, you know, Marco, at a previous webinar, we had someone that I believe, you know well Buck Ward from Cyberclean. And, Buck has, as you know, an amazing history of 30 years trying to do autonomous cleaning. And he basically echoed what you mentioned, which is the tremendous change. We've seen an acceleration of pace in the last few years. I would say even the last three years have seen a lot of progress in that area. Now, I know it sounds like you can just wave the autonomous wand and then your machines start cleaning by themselves. But there's a lot of work that goes into that a lot of challenges. So maybe this one is, perhaps more for Felipe. What are some of the unique challenges that you've seen in cleaning robots in particular? I think we've all had some experience as consumers with like a Roomba, but we're talking about industrial

equipment and operations at scale. So it's quite different. So tell us what have you learned Felipe?

Felipe:

First of all, it’s a pleasure to be here. Thanks for the invitation also from my side Florian. In terms of what we do at Kärcher in terms of the robotics is we try to develop our own IP. Particularly for large floor care machines, and we try to avoid building from scratch. For example, it's about finding the right partnerships. It's about using the right off-the-shelf components in terms of hardware, sensor, CPUs, and even algorithms. So that's one of the things that we try to focus on. In that we use existing components in terms of software and hardware to have a good basis. And then we focus on application specific capabilities of the robot. Which we believe is a distinguishing factor, generating use piece for our product in our case for the cleaning application.

So for example: navigating really close to obstacles because we want to clean, and we don't want to avoid obstacles necessarily, but being able to recover from situations, and focusing on the user experience. So we want to have a product that is easy to deploy, and easy to use, even if there's changes in the environment. So that's our approach in a nutshell. Nonetheless, the robots we are talking about today are complex machines and they are deployed to a variety of complex environments. So also part of our approach is that this is a product or a robotic platform that is constantly evolving. And we need to learn from challenging situations in the field, so that's why we need to set up an elaborate remote operations ecosystem that enables us to monitor all of our robots. Because you know, we push them out of the door when we produce them. It's not like the robots that we have are pretty similar to AGVs with intralogistic concerns, where there's always people to maintain the robots. In our case, we need to be able to maintain them from remote. So that's also one of the reasons why we work with InOrbit in that regard.

Florian:

And I think that's kind of like an enlightened view Felipe, because we hear from a lot of companies in the robotic space without Kärchers experience where their idea is that they're gonna build a perfect robot in the lab and then when it's perfect they're going to send it to the field and it will continue being perfect. And I think that is a harsh reality that will hit those companies when they're out in the field. So I think this concept of continuous improvement as you were referring to is super critical for all companies in the robotic space to embrace.

Felipe:

Definitely. In my mind it's not possible to create a perfect robot in the lab. So you need to be out there. It definitely needs to have low incident rates. But you need to learn, because you can't test the variety of the different situations in the lab.

Marco:

That was for sure a big mindset change for us. Especially when you are a big global brand, that's the tough change that we needed to go through, but it was worth it in the end.

Florian:

And I was gonna say maybe continuing on what both of you just said at the end of day, for all the magic that goes into making a robot be autonomous the end users kind of don't care. They just want their floors to be clean. So I think there's a kind of like a slow evolution, and another big mindset change happening towards this idea of autonomous cleaning as a service. This idea that “I'm buying clean floors”, and not “I'm not buying a machine.” I’m so curious what you're seeing in the market?

Marco:

We can definitely confirm that. So we see automation as a driver of robotics as a service. Usually as Felipe said, we talk about complex machines and they go along usually with a real service agreement. And by saying this, the tendency also of the customers towards this kind of business models is much higher as compared to traditional machines and at Kärcher what we do is we promote robotics as a service, over the traditional purchase model. Also we founded our own financial solutions company, helping us to really push that idea into the market. As we see that (RaaS), as one of the key drivers for autonomous solutions and what helps us there is also that other industry sectors like as we mentioned with intralogistics, and the AGVs, they’re going the same way. So when we talk with these kinds of customers it helps us a lot, that they are used to these kinds of business models. When it comes to the building service contractors, I think there's still some work to be done. But I'm sure that this will change with autonomous cleaning getting more and more popular.

Florian:

Awesome. All right, so maybe, this is a good time to get a little geeky and technical. I'd love to ask Felipe to share a little bit about the Kira B 50, which is the product that launched at Interclean a couple of weeks ago in Amsterdam. It was really kind of the highlight of the show. I saw throngs of people waiting to hear from Felipe and from others about the new Kira. So tell us a little bit about it and just maybe look under the hood a little bit. Like what were the specific challenges that you were trying to address here? I'll tell you, at least from my perspective, one of the things that I saw that was really unique is how it can dock itself and empty the waste water and refill itself. It really

feels truly autonomous. It doesn't just drive around, but it also cleans autonomously. Talk about all the work that you needed to do around that. Not to steal your thunder, but go for it Felipe, the floor is yours.

Felipe:

Yeah. Well, first of all for a company like Kärcher this was a big decision to say that we want to create our own IP there in this market. Because it's a challenging task to produce such a robot, and we are actually pretty proud of it. So we're really happy that we started our market entry now and we are producing Kira. So this is actually starting now with all that we talked about with the after-sales concept period in place.

In terms of, what were the challenges there? It's really hard to pinpoint a specific situation. Robotics is hard in general. I think you know that, and probably most of the participants here also know that. But the way we set up our teams at Kärcher and with Marco. That success is due to his management, and we've been very lucky to work with talented engineers to build our robot.

So finding the right system architecture, and finding the right software, that wasn't actually the real issue. I mean it was hard, definitely but the problem is rather the industrialization process behind it. So turning a proof of concept robot into an actual robot. That's the hard part. That's industrializing your algorithms, industrializing your hardware and sensor setup, and industrializing also your mechanical design to suit the robotic capabilities. Additionally, the variety of environments such a robot is deployed to that's where the challenge is. And that's why we decided that this is an evolving product that has a strong baseline now, but one that will grow in terms of features and it will grow in terms of degrees of autonomy.

In terms of the capabilities we're talking about a scrubber dryer, a 50 liter machine. It has a multi-sense system. We have LIDAR on it. We have 3d cameras on it. We have ultrasonics on it. It is an IT-connected machine. We have a functionally safety-certified machine. So it's certified by a third-party agency so that our customers know this is safe to the latest standards. We could also say that this is the first machine that fulfills this whole range of new standards. In terms of the use piece, I talked about how we were focusing on ease of use in terms of deployment. So a user should be able to deploy that machine on his or her own even if the environment changes. If something has to be adapted a user should be able to do that and not a technical expert from Kärcher or one of our PSC or B2B contacts.

Yeah. And in terms of what is special about the cleaning, I think we're proud that the robot can drive very close to walls, while being still functionally safe. That's a real attribute there. We are able to recover from stuck situations and we provide a full

autonomy solution, combined with the docking station. So this robot can run for hours - all night long, all day long, combining routes, using dirt water and loading fresh water, and charging it's batteries. And like I also said, this machine comes with established remote operations installed using the InOrbit platform. Also Marco mentioned that we try to allocate data from these machines. We try to identify challenging situations and learn from all the experience that these machines have. Also in our headquarters and our R&D departments, to make that product better.

Florian:

I think Felipe, one thing that it took me a while to realize, and this is pretty obvious to you guys, but there's kind of like natural tension between the ideas of if you want to cover more space then you need a bigger machine with bigger tanks and everything, but then that machine usually can't go into tight spaces because it's big, versus a smaller machine. It can go in close to the wall, or go into an aisle, for example in a supermarket or in a warehouse, but then it will run out of water. So you've basically broken that trade off by saying, 'let's do both. Let's make a machine that's that small and nimble, that can get into tight spaces and can also go on forever by going back refilling and starting again.' I think that, to me as a non-cleaning expert, it seems like a game changer.

Felipe:

Yeah. Maybe Marco I don't know if you want to elaborate on that, but I think it was definitely the goal for this machine to work in a broad range of environments. So it is designed to be able to drive in supermarkets and at airports or in shopping malls, but also, that where we see our main target is: production warehouses, logistic environments. And coming with the docking station and the way we implemented it all, it's the full range of autonomy. Like I said, it can run for hours.

Marco:

With the high autonomy degree, I think you can get away from this typical argument about productivity in terms of area performance. When you think about the recommended robots to be used in these environments when there's not much traffic, because then you have the highest efficiency. So we talk about nights or maybe in let's say in the early morning or late evening. And then, because we have the charging option with a lithium-ion battery, the area performance is actually not that crucial anymore. But what is crucial is that most of the areas are covered and the customer returns and that's why we decided to go first with that kind of platform.

Florian:

Awesome. So maybe Marco while, while we're chatting, we got into, into the more technical aspects of it. But, I know from talking to you that there's a concept you call "dynamic cleaning" and I'd love to have you share that with the audience here.

Marco:

Yeah. It's a pleasure. I hope nobody's disappointed that I'm saying autonomous solutions are really key, but not everything to us. So we think it's key for the cleaning sector to have autonomous solutions. And they are for us as a global market leader, but what we see is that robotics is just an integral part of what we call a “dynamic cleaning”. We expect that the commercial cleaning will move more and more away from what we call standardized “fixed cleaning plans”, or “cleaning schedules”. The most typical example is always the restroom cleaning at airports. So in the past, and even I think nowadays, you can see this paper in the restrooms saying that it was cleaned every hour by a cleaner, and he or she has to sign that the restroom has been cleaned. And this is something that doesn't make sense to us because the cleaning happens independent from the frequency and also independent from the status of the cleanliness in that restroom.

So our idea is that we can use sensors in objects, in buildings, indicating the status of cleanliness or giving us at least indications about the true frequency of the people in the restroom, et cetera. And then this is also the reason why we went with a docking station. So assuming that you have a robot with a docking station, the sensor could trigger the cleaning, and then of course the cleaning happens, fully autonomously when you have the dock station involved. And then instead of, let's say, cleaning every hour, you might clean only three or four times a day, but you clean when it's really needed. And at the end of the day, what happens is you increase efficiency, but you also make sure that the customer's sustainability is improved. And that is our idea or understanding of what we call “dynamic cleaning”. And this is just an example, but we think this will be the direction the whole cleaning industry will move towards in the next few years.

Florian:

As you know, Marco, we work with tons of robotics companies in different verticals with different solutions. And I think if I can spot a couple of trends, one is that I would say if I think about the evolution of autonomous, mobile robots, not just for cleaning over the last, let's call it five years (maybe a little longer), initially a lot of focus was can I make a robot that move around without bumping into things. And that's fine, that's where you have to start, but I think now the industry is maturing and realizing some of the additional benefits of amrs. Robots are data machines in their own right. They collect a lot of information that can be used for more than just not bumping into things but navigation. But also they can be driven by data. So data flows both ways. And I think as you explain so well with “dynamic cleaning”, I think there's a lot of other dynamic things that need to be done: dynamic delivery and dynamic material handling, and so on.

Now what gets interesting is in a shared environment, where you have multiple of these tasks and you may have, for example, an airport. Obviously, it has to be cleaned and amazingly airports look pretty spotless usually, but there may also be a duty free shop where they need to take the tax-free booze to the gate or perfumes or whatever. I'd never buy stuff at duty free shops, but other people do. So, there's a lot of stuff that's moving around an airport, and now you have these different types of robots. It's the same thing in a warehouse. The main job in a warehouse is to move packages around, and pallets and so on. You have forklifts, and you have many different types of robots. You may have inventory robots. And there's people around, so you have to clean the space. So I think what we're going to see is as companies embrace autonomous machines more and more, they kind of need a way to make all of that work together. And starting with a peaceful coexistence, right? Not, not getting in each other's way and I can tell you we've seen through our data, things that I would say look hilarious to watch, but they're not good from an efficiency point of view. In a tight space having two autonomous robots coming at each other. We call it the robot dance because there are no roles. Wth people we developed all of these, social norms to pass each other safely but robots are not there yet. So I think there's this need for, coordination or orchestration, that we're starting to see as the industry matures.

Marco:

Absolutely. Absolutely. Maybe you can share also with us at some point the details about your incident management, because when we talk about the degree of autonomy, I think we all know that the worst thing is when the robot gets stuck or gets lost or whatever. So I think this topic is key and it both impacts the machine itself, but also the operating platform that InOrbit is offering. Can you share a few words with us on that?

Florian:

Yeah. I think I would tie it back to what Felipe said earlier, which I call an enlightened position, which is that you don't assume your robot will be perfect. Which as an engineer, it can be crushing. But it's the real world. So the way the conceptual model I have, and the numbers may vary, but if you can get your robot to be 90% autonomous, so 90% of the time it's fully autonomous, you're actually doing really well by industry standards. And some people will claim it's much higher, but some people really are much lower than that. So the interesting part is that getting that last 10% to work autonomously all the time is gonna be I would say 90% of the effort, but it's probably like 150% of the effort. So that last aspect of getting to full autonomy is really hard.

We've seen it with self-driving cars, for example, or autonomous vehicles. I think the realistic way of approaching that is to say there will be incidents. There will be things that happen in the real world that the robot will not be able to respond to on its own. So you build resilience into the operation of the robot and you don't need to do everything on the robot itself. By having a connection to the cloud, all of a sudden you open up

many more possibilities. You're also bringing data in. So there's a space that has done a lot over the years, which is the DevOps space in the cloud. Where you really plan for all of this, you build resilience.

So we're bringing in some of those best practices. And that way of thinking is part of what we want to do with InOrbit, we call it RobOps, for robot operations instead of DevOps, but it's some of the same ideas that like, you want the system to be working well most of the time, but you also want to be able to respond very rapidly. So a couple of things that people should measure are the, and these are well known metrics, but the "mean time to detection" and "mean time to resolution". That goes straight to incident management. We've seen cases, not with the Kira, but we've seen cases out there where you may have an autonomous forklift that was supposed to carry a pallet from one end of the warehouse to the other. Let's say it's not mislocalized, but couldn't navigate around an obstacle. And it was just sitting there maybe for hours until somebody at the warehouse notices.

Unless you have built in that resilience, you're not realizing the potential of the robot. So if you can turn that from hours to seconds, then you can see the impact. And then if instead of just notifying someone, you can actually have someone resolve the incident remotely, without having to walk around the warehouse, or around the airport, to resolve it well then you have the other metric, the mean time to resolution that also drops down to seconds. So obviously building the infrastructure for doing all of that, at scale is not easy. If you're a robot developer, if you're building a robot that it's already hard enough making it do its job. So, where we (InOrbit) tries to come in is to help with this infrastructure that augments what the robot can do on its own.

Marco:

Great. I mean, this was key to us. You mentioned that what the customer pays for is a clean floor at the end of the day, and therefore the uptime, the degree of autonomy, is key. No matter how you achieve it, to be honest at the end of the day. Yeah.

Florian:

Yeah. I think that in talking to founders of startups, they feel sometimes that it's kind of like it's cheating to do it that way because they think the robots should be able to, to deal with all of it. But as an end user I don't really care. I want my clean floors and I want them right now. And if I'm investing in an autonomous solution that's all I care about - that it does its job. So I think that's critical.

I know we're getting short on time. and Geoff, I believe we wanted to make some room for questions?

Geoff:

Hey, Florian. yeah this is a fascinating conversation guys, but we do have a few questions. I have one for Marco about how Kärcher is approaching labor. Have you guys experienced this as being problematic? I think with the labor shortage going on globally, it's maybe less of a concern about taking jobs. That sort of fear has kind of gone away a bit, but how do you guys work with human labor in conjunction with your automation?

Marco:

That's a big discussion in the cleaning industry, taking away jobs from cleaning stuff, but what we have experienced, when we approach the market with our robots, is that it is really not the case.

So what we see is that the shortage of labor is much higher. It's much more dramatic than maybe we all think, and it may differ from country to country, but in the end, what we see is that the automation, the cleaning robots, they will help so that human human labor can focus much more on valuable tasks. And as I said in the beginning, what we also see is that the facility management companies have now offered to the same customers many more services than they did five or ten years ago. Because there's a consolidation in that industry and therefore they need to free up time from their cleaning stuff for other jobs. So in the end, we have not experienced a single case where a robot of ours has substituted, or replaced human labor, Honestly. Yeah. We have not seen that yet. So I think this is a big discussion. It's an emotional discussion. I can understand it. But when we look at the facts and figures, I think it's probably not as big as it is treated.

Geoff:

Interesting. So can I ask, what about the approach to automation and considerations, as a service, in Europe versus America? Yu guys operate all over the place. Is it really varied as you look across the world or are people generally, especially with the pandemic, looking at automation in the same way in the cleaning space?

Marco:

I would say overall it accelerated a lot in the last three years and I think this is overall the case and in all the regions, but I would still say that for example, the US, and maybe also Japan, and Singapore, those three countries are a little bit ahead when it comes to commercial cleaning and automation. Ahead of Europe, I would say. You can also see it in the numbers being deployed in those markets. So there's not maybe a huge case in Europe that I know of where there's a huge fleet of robots being deployed. So we talk about hundreds of robots with the same customer. Yeah. This has just not happened yet. But we expect this to come (in Europe) in the next few years. So it is a little bit hot in the US, and I would say in Singapore, and Japan, but Europe will definitely also catch up.

Geoff:

Yeah. Interesting. Okay.

Felipe, I have one here for you. What should be the biggest consideration for companies moving into automation and what are you seeing people do wrong right now out there?

Felipe:

Well, I'm not sure if we should judge other companies, I could explain what we as Kärcher, think is important. I think we look at products in terms of these robots from a customer's perspective, like I said, by trying to focus on the customer's perspective in terms of their ease of use and ease of deployment. We see these as the use piece that we develop for our product, so I think that's one focus. I think what I see is that maybe other robotics companies try to make a perfect robot and also try to make a perfect robotic application rather than a custom experience. So we see a lot of the companies that have also cleaning robots that did need to have a deployment by technical experts. And that's something that we try to avoid. I would say that's one point and the other, is that Florian what you said. That's having a remote operation set up. It is considered something like cheating, but I don't see it that way, and I think you neither, so with that we're on the same page here. I think for us, and we're not talking about, for example, teleoperation here. So it's being able to identify challenging situations and then you need to have a set up for that. Otherwise you don't know what's going on with all your robots, and that's one thing you need. And then what you also said is about reducing response times in terms of incidents. And that is also not in terms of what we do here or what should be done. It is maybe some processes in your, in your algorithms are a bit discreet. So sometimes it's just the one way, or the other. Sometimes it is a not automated bridge between the two, and so sometimes it's not that bad to have someone look over and say, oh let's do that sequence of maybe motions or, or recovery strategies. And by doing that, by identifying the situations that happen, then you can automate that also. So you can make your robot better over time. So I think that's something that could be. I believe that robot operations is a key feature in deploying these robots. So I like the term also RobOps, and we have adopted it actually, so maybe that's yeah, to my two cents.

Florian:

Geoff, if I can chime in on this, on this question from the audience, I think one thing I would mention, and I think I tend to mention this in many of these webinars it is I think that you see a lot of people coming into robotics with a great passion for the technology. And at the risk of trivializing it they're like, 'let's go build a robot. What is it for? Who cares? It's a robot.' And then they go looking for a problem. And something that Felipe mentioned already, is to think about the solution, the end user, and what their needs are and start from there, and then work backwards towards the technology. Because, otherwise you end up with solutions that may be too complex, or you stayed in the lab for too long right? When you should have gotten out there and be a little

embarrassed, especially if you're a start up. If you wait for perfection, you're gonna run outta money. So, that's not a problem for Kärcher but we see it a lot across different industries.

The flip side of that is I think there's more and more competition right now. It's easier to build a robot than it was three years ago or ten years ago. So you see a lot of companies coming in, and what's going to be your differentiator? It is one of the things that Felipe you mentioned. How to make this machine very robust and industrialized. It's a harsh environment in which it operates. We've seen things like people on purpose running into robots because it's fun. We don't condone violence against robots, but people will do it anyway. So I think it's just thinking about how chaotic the world is, really is my recommendation for roboticists,

Geoff:

Right. Well, we're just about to hit our wall. But Marco. I'd love to give you the last word. Any lessons learned, any, any insight into what's on the horizon for Kärcher that you'd love to share or tease to the audience?

Marco:

I mean, what Florian mentioned, about different types of robots at the same facility, the same building, and if you combine that with our vision of “dynamic cleaning”, I think then you are very close to what we think will happen the next year. So this is for sure something that I recommend others to look into. This will definitely change things, because it will not happen that there is a customer side where you have just one robot from one manufacturer, as the automation takes place in every industry. So I think this is something really key for the future and we will for sure look into that.

Geoff:

Amazing, awesome. That's some fantastic insights guys. I really appreciate everyone's time today.

With that, we are out of time, unfortunately. I would really love to thank our special guests. You guys were amazing. And thank you so much to everyone for attending today's webinar. As a reminder, we'll send out the video of today's broadcast in a few days. So keep a lookout for that. And I hope everyone has a great rest of your day. We'll see you guys next time. So long everyone.

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