Podcast Episode #9 - Commercializing the first robotic touch sensing that uses light, with Ákos Dömötör, OptoForce, Hungary

Bálint: I am very pleased to be able to bring Ákos Dömötör who is co-founder and CEO of OptoForce. Welcome Ákos to this Episode

Ákos: Thank you very much for having me here.

Bálint: We come from the same country, Hungary but whereas I live in Switzerland, Ákos, you live in Hungary where you made a name because of your unique technological solutions in robotic sensing that is already on the market.

Ákos: I think it is a little bit of exaggeration, I did not make the name myself maybe the company name made a name a little bit for itself but definitely not myself.

Balint: Yes, that is what I actually meant. The company made a name, you got a few awards. Ákos, can you tell us what your company does, your motivation for co-founding it and why you like being an entrepreneur?

Ákos: Sure. We actually build force-torque sensors for robots that means that we make robots able to feel how heavy an object is that they are lifting up, how hard they are pushing on something, we make them able to feel when they crash into you and all sorts of that really enable them to operate in an unstructured environment. What we actually do in this part is that we are building the hardware and we are building some parts of the software that enables robots to feel. I actually did not found the company or I am regarded as a co-founder now but I really joined them later. The company was founded by two of my colleagues, when they were doing their PhD so straight after their PhD studies. They felt that they needed someone more on the business side and that was the point when I joined.

Bálint: Did you join shortly after founding?

Ákos: Well it was roughly two years after so it was not that short.

Bálint: So that was your motivation for joining at an early stage?

Ákos: Right. Actually in my previous job I always felt that I could not learn more. I somehow felt that there was a limit to how I could progress professionally and personally. I wanted to move out of that. I was considering different options, I was considering moving more into marketing or sales, or product development and such. But I also felt that maybe working for a smaller organisation which was more agile, which wanted to hire and had more motivation what you can usually find in a multinational company was for me. So I was really thinking quite a lot about how I could start a company myself, I was talking to different people about different ideas and somehow

the team found me. When they wrote me an email asking whether I was interested in joining I was super happy and I told yes, that is exactly what I wanted to do. It was an easy decision.

Balint: Yes, I see. In the field of robotics how do you see, well the field of robotics and more specifically the field of sensing inside robotics how does the company position itself with respect to the competitors?

Ákos: There is quite a lot happening right now in robotics actually. Before I joined the company I did not even expect that. I have seen industrial robots used in factories before and I heard some news about all these walking robots at DARPA and such. But when I started to really dig into it I found that the industry is undergoing such a huge change right now. Earlier the standard was big industrial robots able to lift up 20-100 kg, sometimes up to a ton or more but now the industry is shifting towards the lightweight robots that can handle only a few kg of weight. That is roughly the same range what we humans can handle. You could put it also in the way that robots or these lightweight industrial robots are going to compete more and more head on head with human operators and that is also true to some extend. All you can rephrase it and say that these robots are collaborative meaning that they are built to work alongside humans. It is really the two sides of the same coin. That is where the industry is heading to. We will see a lot more jobs replaced by these lightweight industrial robots and that will free up operators to work on that requires the human much more. Where is the place where industrial robots currently add value, where they will be getting more value later and what is it that they will not be able to do in the sort term at least, well that is very much linked to the dexterity of the human hand. By dexterity I mean how well we can manipulate objects, how easily we can put a plug into a socket, how well we can assemble two parts. These tasks which required human sensing or tactile sensing has been super hard for robots, exactly because so far there was no sensing in them or if they had sensors that was quite limited. What we had seen already was a revolution in seeing, so camera systems, vision systems so really a lot has happened due to object recognition, robots can now detect a place where an object is and they get smarter and smarter. And this is a big trend and it is going to continue.

There is another trend which is just upcoming and that is where we operate. It is augmenting these visual information with tactile sensory input. So robots can now see well it can be better and will be better, but let us just put it simply that they can now see. Now we are also adding this sensing to them, this tactile feeling to them. That is where the industry is moving. Where we are in this is we are aiming to be the number 1 player in this field. There are startup companies but most of our competitors are also startups so it is a very nascent field and we have a very good chance of being able to win.

Balint: Ok. Regarding sensing you mentioned a couple of ways so tactile and also using visual methods, tools. How do you see yourself regarding tactile measurements with respect to the competitors?

Ákos: We have a quite unique way of measuring forces. But when I am talking about force measurements or force-torque and tactile sensing, it is basically the same thing, just looking at it from different angle. So when we are doing force sensing we do it in a very different method than what people usually do. There are two main established ways of measuring forces. One of them is with strain gauges which means very thin conductive layer glued on a metallic surface and then the other one is capacitive sensing when we move two metal flanges closer or further away from each other and you measure the difference in capacitance. Those are the two established ways. Strain gauges can be, not always, can be very precise but it takes up a lot of manual labor to actually build them and so it is not really scalable, also they are very rigid so they can be easily broken.
Capacity sensing is more cost-effective to build, but it is not as precise, by far. There were these two options and then we shall see what comes up next, but what we are doing is force-sensing based on optics. What I am mean, it does not sound very logical at first, but what we actually do is we track how the top player of the sensor deforms compared to the bottom layer. Force sensing is always deformation sensing also in strain gauges, also in capacitive sensing and also in optical. The way we build the sensors is that we have a silicon structure. As you can imagine the silicon is a quiet deformable material so we track how this structure is deformed. It has a couple of advantages and a couple of disadvantages, but where we position ourselves is that we actually have advantage in the lower end of the scale. So when we are talking about these lightweight robots that I was talking about, that is where we feel most comfortable, that is our range. If we go much higher up then the deformation of the silicon would be too high, but in this range our compliance, so the deformation of the silicon actually makes a lot of tasks easier to do. For example it helps a lot in assembly when we want to fit two parts together and then this small compliance actually helps, you do not need to program so precisely.

Balint: Regarding the third measurement that you mentioned, using optics, with this technique, are you the only one, because it sounded like the first two are the most dominant ones and the third is kind of coming up?

Ákos: There were some trials earlier as well. There are lot of different methods also in optics in how you want to do optical force measurement. What I can say now is that we are the only one who are building commercial products with optics. So there were others before and there are people who are using their own optical force-torque sensors inside their own products. Actually if you look at the 3D connection with the 3D mouse that is also somewhat similar concept. Also although that is only an input device not a force torque sensors which means it is far less precise, far less accurate. But the same kind of concept. So there are different kinds of people working on it and I can foresee that there will be other companies trying that as well but right now we are the only one who are actually selling force-torque sensors based on optics.

Balint: Ákos, you mentioned at the beginning that, still going back to that topic, the founding circumstances, you mentioned that you joined the company two years after founding. At what stage was the company then? Was it just like, let's say, a technologically interesting endeavour, that you had a solution with some maturity and you

joined when the validation started or it was even earlier when they had an idea and they had legally the company founded and you had to actually do also the innovation, the invention part?

Ákos: Right. The company is a university spin off. So this innovation part that you mentioned, the last one, was mostly done during the PhD studies of our founders. Straight afterwards they started with the legal process establishing the company and finding early venture capitalists to fund them. And then they started moving. This is a very technical innovation which means that the guys worked on a walking robot and for that robot they needed sensing for the feet of the robot. That is how they came up with the first prototype, the first prototype. It worked well and it was interesting for lot of other people working on similar robots but as you can imagine there are not a tons of these robots walking around now so it was quite far from what the market needed. Also the guys were more comfortable working on the project then talking to the customers. They went on, they started the company and found one or two very early customers, but they did not yet provide the stable revenue stream. So that was the point when they decided that they would like someone who works more on sales and looks more at the commercial part of the company and also helps them establish the right kind of vision that can actually help help the company grow as what is required from startups.
So that is pretty much when I joined. That time we already had a pretty mature product, we are constantly developing on it of course, but back then when I joined it was already technologically quite good and what they were missing at that time was really the market, which is of course, probably the most important thing in a startup, you need both, the market and the product. So we needed to establish the market so that is what we have been doing in the last two and a half years.

Balint: So you joined and looked at the business model as well, bringing together all the threads regarding customer development, talking with them what they need, getting their requirements and then doing some further iteration of the product technologically so that you satisfy those needs.

Ákos: Yes, exactly. We actually had a lot of ideas ourselves as well, which way to go. At some point we were also considering going into the way the 3D mouse went. So having less precise, less accurate sensor that is even cheaper to manufacture and then building hundreds of, thousands of, millions of them. That was one of the ways. We were also thinking whether we should move the company into a so-called design organisation where we would not manufacture anything but only design prototypes and then license the technologies to big corporations and then they would build it into their products the way they wanted and we would help them to customise. In the very beginning when I went out to the market and started to discuss with customers or find the first customers we found that it was quite easy to sell customised products. So someone wanted a force-torque sensor or force sensor and they needed something special that they could not buy at the market, there was quite a bit of demand for that. But that is of course not that scalable. We evaluated a lot of different options. We started out selling mostly to universities, of course, we did a lot of custom-development in order to gain market understanding and also to get first revenues. As we

learned more and more about what they needed we found that there was quite a lot interest also from the industry, for the industrial robots. That is where we are putting most of the efforts now to develop something very good for them. So we already came up or we already released the product last year that was specifically built for the industrial segment and we are constantly working on improving it.

Balint: What were the major hurdles, challenges that you encountered during this early phase? Specifically did you see some issues about some knowledge areas so like getting funding, hiring people, manufacturing or other topics?

Ákos: Actually we saw issues in all of those that you mentioned. I think the biggest one was actually finding the market and now I am very happy that it seems that we are on the right track in that. But I think if I had to name the number one that is definitely finding the right type of customers and also how finding out what is it what they really need, how can we best serve their needs. Related to that it was also a bit of a challenge to turn the focus of the organisation from the technical innovation to the market needs. Because when the company started it was a bunch of engineers. We had the two founders and they started working with other engineers as well and most of the people were engineer, either with a PhD or with at least a master so very technical focused. It took a while until we actually managed to to get them to listen to what the customers wanted. That was also a challenge. Also straight afterwards when we found the first customers who would actually buy in higher volumes we needed to fulfil these orders. Then we started having issues with how to organise the production. In the end we decided to keep some parts of the production, the most important parts of the production in house and outsource the more standard parts. We needed to learn how to handle the suppliers, we needed to learn how to produce stable quality in house. The people we started out with are very committed, very enthusiastic but they needed to learn about the topics, about how to run a productional organisation. It was quite helpful that I was working for a production company before, so I had some insights about that. Then we could together discuss on how to build up e.g. a quality management system, how to build up order management and so on. That actually took quite a lot of learning.

Balint: I see. So as fas as I could now get it, you do some in-house production, manufacturing but you outsource some other operations which I assume are not as critical. Do you do all these manufacturing activities in Hungary or outside of Hungary, maybe the outsourced one?

Ákos: Right. Actually most of it is done in Hungary, yes. But when we are talking about outsourced production, mostly talking about manufacturing of the metal flanges, the PCB productions and the PCBA. So the PCB is done I believe in Germany and then the PCBA, so the assembly of the PCB, putting the electronic components onto the PCB, the circuit board is done in Hungary then. It is quite beneficial to have the suppliers closed-by. If we need something fast they can react better and then also we tried to work together with organisations that are roughly the same size as ours, at least not too much bigger so that we also have bargaining power and it is also important for them to serve us because we represent a relatively hight stake in

their orders. That has been working quite well for us. We have been looking into whether to source part from China and at some point we did, we still buy some components from there, but I guess that will make more sense when we go bigger, when we really need to focus on the price of the products. Right now our biggest cost is related to the development and running the organisation, the wage of the people, working in the company and also in manufacturing. Compared to that whether we buy the metal parts from China or from Hungary is not so significant so we really want to make it easy for our people to run the organisation.

Balint: Ákos, I would like to move on to the so called ultrafast round of questions. So I will ask you four questions and it would be great if you could answer these relatively short. I'll go ahead. First question: if you could time travel like in Back to the Future movie, to the time when you were in your twenties, what notes would you take back from now so that you can give it to yourself?

Ákos: What notes? Well I guess first of all some winning combinations of the lottery. Seriously, I do not think I would have done anything differently. I am pretty satisfied with the way I lived my life so far. I am not saying that it was the best ever like I could not have things better but I just have not been thinking of it, there is not anything that I would do differently now so I think it was good, maybe I just would not talk to myself then, let my twenty year old myself develop the way he wanted. Maybe tell him to be more courageous in entrepreneurship and try out different stuff and just lose some money on it just for the sake of trying. But that is all.

Balint: Ok, experimenting more regarding your life and career. The second question: if you had to name one book which one had the biggest impact on your career?

Ákos: Yes, I know that one. That is Andrew S. Grove: High performance management. I do not know if you had read it.

Balint: It is high up on my list because the other one is "Only the paranoid survive" which is also on my list by Andy Grove, the founder of Intel. I know it is one of the best books on management.

Ákos: I actually read it when I was thirteen or so. And that is when I decided that I want to work in management. I just reread it couple of months ago and it is so insightful and so good that I could really recommend to everyone.

Balint: Evergreen contents. Third question: I am amazed by habits and how these can help us reach our goals and have an effect on our life. Do you have a routine, a morning routine or evening routine? Or any other work-related habit in your life?

Ákos: I could not agree more with you on this. I think habits really help determine whether you become successful or not. I have a few habits but I wish I had more of them. What I very much like doing in the morning when I first come to the office is to open my calendar and read through it what is it that I need to get done today and

then very much linked to it is the other habit. When I have something on my mind, I try write it down as fast as I can so it is out of my mind.

Balint: Brain-dumping?

Ákos: Right. I try to put everything into my calendar and find the time when I can handle it and when the time comes then I really sit down and take the time and go through but before that I just do not have it in my mind so I do not need to constantly think about it. I think that is the two main things that I find that works very well for me. But I think I will constantly try to develop because these habits do help a lot, I agree.

Balint: The fourth question: in your work, because you have to work sometimes across boarders, e.g. when you are looking for founding, what are some critical cultural differences that you could identify and you wish you knew about those before and how did you overcome those?

Ákos: Quite interesting. I used to live in a number of countries. I studied in Germany, I did an internship for 6 months in China, then I was in a management program where I worked in Czech Republic, in Hong Kong and afterwards I settled in Denmark for a while. Yes, you do see cultural differences and, I do not know, but probably what struck me the most...well in China I found it very hard to work with Chinese boss, because they wanted to detail every single step for me what I needed to do during the work and I just could not handle that. I felt that they were telling me too much in detail what I needed to do. I needed to tell to my boss that I just simply cannot work this way. So that was a main cultural difference that I found. Denmark was very interesting for me, coming from a Central-Eastern European country, it was very interesting for me to see how high level of trust they are using in their organisations. They do not control as much as we do. They just trust that people will do their jobs. Therefore they are actually saving a lot of time so that was also a major cultural difference. I hope I can learn from that, I hope I can implement some of that culture in OptoForce as well so we will be able to move faster. But generally about how to overcome cultural differences, we are coming from the same planet, there are cultural differences and sometimes they are big. But in the end we are all humans. If you are sensitive enough, or empathic enough, then you get through any situation in any culture. As an advice, I would like to give: when you are in a different culture, acknowledge it that they think differently and be sensitive to what they are saying and do not assume that you interpret their words correctly, maybe think twice what is it that they really wanted to say when they said so.

Balint: Thanks for this insight regarding empathy, so nurturing some more empathy towards other cultures.

Ákos: I think that helps the most.

Balint: So I would like to quickly wrap it up, the interview. It was great talking to you, Ákos about your business, also about the technological aspects, how you are different from competitors, and how you iterate it, different business models to come to

this current business model. I wish you all the best and I hope also you listener, liked this topic. It would be great to have your feedback. I have just one more question to you Ákos. It is regarding reachability, so are you reachable by email or by social media?

Ákos: I would prefer email. You can find my email on our website, so go for www.optoforce.com and you will find it there.

Balint: I will put this into the show notes. Thanks again!

Ákos: Thanks very much Balint, it was a pleasure talking to you!