HoverGames Challenge 3 Sustainable Food Ecosystems

Nitin Dahad ([00:00](#)):

This is a Smarter World Podcast, focusing on technology and issues behind today's connected world. I'm host Nitin Dahad, editor in chief of embedded.com and correspondent with EE Times. In this episode, we'll talk about the third installment of the HoverGames and how drones and rovers can make our food ecosystem more sustainable. Today, I'm joined by Iain Galloway, mobile robotics engineer at NXP Semiconductor. And Richard Fix, product portfolio manager at Bosch Sensortec. Welcome, thanks for joining.

Iain Galloway ([00:34](#)):

Thank you. Good to be here.

Richard Fix ([00:35](#)):

Hi Nitin.

Nitin Dahad ([00:34](#)):

So I'm going to turn first to Ian. Let's dive straight into it. There are going to be with listeners who haven't heard of the HoverGames before. Could you briefly tell us what the HoverGames are about and what's new this year?

Iain Galloway ([00:48](#)):

So HoverGames is a really interesting competition. It started being focused on mobile robotics drones, and in particular, a reference platform that NFB has called the HoverGames drone, which allows people to program and perform autonomy on this type of platform. And so even though it's a small drone, it's a fully open source platform that lets people get creative and do autonomous tasks. Really it's intended both as an introduction into this whole ecosystem, which is operating under Linux Foundation drone code, PX4 flight stack. And also the world of sensors and robotics and fusing the two. This is HoverGames 3, so we've had two beforehand. And at this point, what we're doing is I think, a big step up in its capabilities. And we're amazed at what everyone comes up with in the HoverGames, in terms of their project. So it's for engineers, programmers, developers, university students join. It's really quite an open competition and we try not to constrain it too much. We give the general themes of what we want to see happen and then go from there.

Nitin Dahad ([01:54](#)):

So you don't have to be a student, it could be anybody in any course of their career?

Iain Galloway ([01:58](#)):

That's right. In fact, it's not student specific, we have people working at companies, they're engineers in large companies, or they're startups that are even working in this field, as well as students or programmers that are just interested in the area. We're showing that there's applications of these small vehicles that are really innovative that pop out of the projects that are presented. So you do have to apply to be accepted for HoverGames and then when you apply or pass that, then you get highly discounted hardware and continue on from there.

Nitin Dahad (02:30):

Let's move to the challenges. The first two challenges focused on fighting fires with flyers and helping others during pandemics. This time, it's all about sustainable food ecosystems. Can you tell us how it's come to that?

Iain Galloway (02:42):

We were quite excited with the first two challenges and noticed the types of solutions that came out of these things. So fighting fires with flyers, one of the results stuck in my mind, were where people did amazing things with lightweight hardware. We're talking about drone platform that's several hundred dollars, not thousands and thousands of dollars. They're able to use it or amplify its capability by taking advantage of the low cost hardware. For example, developing a heat map, using a very low cost sensor. And then helping others during pandemics was involved with how can we use drones for betterment, for good, in a situation that's not so good? And we like to continue on that theme in terms of sustainability goals and helping others.

(03:27):

The title of our HoverGames 3 is about sustainable food ecosystems. And it's a little bit awkward in that, we don't want to pigeonhole it to be agriculture. It could be helping in the rainforest, it could be something to do with developing a test kit to farmers or soil test kits that help determine the insect loading in a certain area. So the trick we have, is to get the theme in place that lets the participants be very creative and come up with an innovative example. And in fact, this year with HoverGames 3, we're introducing the ability to use a buggy as well, or instead of the drone, because some people do have challenges flying a drone. So that lends itself to things like driving a buggy through tomato crops and checking for insects.

(04:18):

And an example of where the really exciting innovative work happens is where you can scale up a small solution, a several hundred dollar platform and maybe it's able to identify one thing at a time, one bug on a plant or a wilt on a leaf or something like that. But with a low cost product, like a drone or a rover, there's no reason you can't have a hundred of them in the field at the same time and doing it 24/7. And all of a sudden, even though it's only doing one little task at a certain pace, you can scale it up immensely and all of a sudden have acres and acres of land being covered, or lots and lots of animals being managed or tracked, so there's a lot of opportunity here.

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The third thing we're including with this year's HoverGames 3, is a new AI platform and an edge compute platform called NavQ plus. And that allows us to really step it up a notch in terms of the capability, because we've got a Linux companion computer, or applications co-processor with vision capability, with network connections on board, such as CAN and Ethernet. And itself, it has its own AI accelerator on board for more advanced tasks, like vision processing or identifying a tomato on a plant or trees that are in bloom. So there's a new push here with this particular challenge into the world of AI. And we're happy to include Bosch Sensortec in this year's challenge as well. We're happy they're joining us.

Nitin Dahad (05:44):
Richard, it's the first time that Bosch Sensortec is joining the HoverGames. Tell us a little bit more about your motivation to join and contribution to the competition.

Richard Fix (05:53):
Absolutely. First of all, we are excited to participate in this year's HoverGames and also to support it as a partner. Bosch Sensortec centers are known very well to support functions like gaming and mobile devices, to stabilize camera systems to have a good picture. But in fact, here we see the competition also as a great opportunity to tackle let's call it, real world problems. And that's not the first time for Bosch Sensortec. Another example is that our gas sensors are used to detect wild fires very early, which has also been at the first hand challenge, as you already mentioned, fighting fires with flyers, so that's one example for real world happens.

(06:25):
And of course, supplying the world was food is in fact a significant problem and we would like to contribute here. The important aspect here, is that if you want really to solve such problems, you need to have innovative solutions, where you can use cutting edge technology in order to address social and environment problems. So this is the motivation actually, and with respect to the contribution, it's twofold from our side. On the one hand, we have the special Bosch Sensortec sustainability award. And on the other hand, we provide really smart sensing solutions with cutting edge technology.

Nitin Dahad (06:55):
Tell us a little bit more about the special award that participants can win.

Richard Fix (06:59):
For sure. The motivation behind that as the name is already telling it, it's the sustainability award, is to show that innovation is really a driving factor in the fight against global topics like climate change and also for a more sustainable future, yeah? And this is also why we decided that the award shall go to the team with the most convincing sensor based solution, which really pursues sustainability goals. And the winner of the prize will be rewarded with a 500 Euro

voucher for the Autorion Official store. And we are really excited that our sensors are being in action for this and to see how they can help to tackle the challenge this year.

Nitin Dahad ([07:36](#)):

Elaborating a little bit on your involvement, Richard, what hardware and software are you offering for the competition that can be used for the sensor based solutions?

Richard Fix ([07:45](#)):

Yeah, it's really in fact, a combination of hardware and software. So on the hardware side of course, we have our integrated IMU, which is used. But the major part is the BME688, which is an environmental sensor combining temperature, pressure, humidity, and gas measurements in a tiny package. So this is a sensor which is already used to monitor for instance, air quality or to identify specific gases, to give warnings under certain conditions and which has many other applications. And this is the hardware part, but there is also a software part, so there is the BMEAI Studio software, which can be used to, as the name already says, you can train the sensor on specific applications.

([08:26](#)):

So for instance, I'm talking about a gas sensor, but also using temperature pressure and humidity data into account. And in the example I mentioned, initially you can train the sensor to specifically detect fire and especially in the smoldering phase, so very early. So this is one example how the sensor can be trained with software on a specific application. And I think this gives a huge opportunity to the challenge, to use the combination of hardware and AI based software to train the sensor on specific, important topics actually, in producing food. So this is why I'm pretty confident that this will be a significant contribution, and I'm really looking forward to the solutions which will be worked out.

Nitin Dahad ([09:04](#)):

You gave examples for the fire, can you give us an example for the food ecosystem where you can use this hardware and software combination?

Richard Fix ([09:12](#)):

Yeah, absolutely. What could be a very close solution, is to use not only one sensor, but we use a sensor network of dimension sensors in fields. First of all, to monitor the growth process for many different fruits. For instance, it's known that there are certain gases emitted, which give an indication about the ripeness of those specific food, and this is something which can be monitored. So it means, first of all, you can monitor that everything is growing well actually. Secondly, you can also use the sensor network to identify if there might be specific unusual situations in certain areas of the fields.

([09:49](#)):

And the cool thing is, if you combine that with the AI studio server software, the server can continuously collect the data from all the sensors in the field, from the sensor network. You can even retrain the algorithms to improve the performance. You can train your sensor system on the local conditions on the field, yeah? So it means that you will get a very early indication if something might not develop as it is expected or as it would be usual. And then for instance, you can use that to send a drone to that location and to do a much more local analysis of what might be the reason. So all in all, you can use the sensors in a sensor network to ensure that you will have the expected growth and the earnings from the food production.

Nitin Dahad ([10:31](#)):

A really good example. And that point Richard made earlier, the whole farm to fork ecosystem. So it could be monitoring to make sure there's no food waste in the logistics, for example.

Richard Fix ([10:43](#)):

Our sensors are already used today. So for instance, sensors like the BME688 are being designed into fridges to detect if food gets spoiled. So means at the end of the process, the sensors are already used let's say, in consumer products, of course during the whole process, until the food gets to your fork, as you said. And you can of course, also use the sensors to monitor that food does not get spoiled and this is about a very large amount of the same food. So if you detect it very early, you can make sure that you just use a very small part of the food you are going to transport, for instance, yeah? So answer is clearly yes, the sensor can fully bring benefits in the whole process until you have the food on your plate.

Nitin Dahad ([11:23](#)):

Sounds like the Bosch Sensortec sensors will enable participants to develop fascinating use cases. Besides the Bosch Sensortec sensors, how does the developer kit differ from the previous ones?

Iain Galloway ([11:33](#)):

So we've expanded the kit quite a bit this year. And I think the main theme we could say, is AI at the edge. The whole idea of moving these kinds of capabilities out to the edge means you can save power. You can multiply the processing capability and you're running at a much lower date. For example, as Richard mentioned, a sensor network that gets augmented by a vehicle that's able to go out to that area and then do more advanced processing in a specific area. So with this year's hardware, a new development board, we prepared called NAVQ plus, and that's an i.MX 8M plus processor from NXP is the part of that, which includes also an NTU on board, a neural net processing unit about 4.4 tops. So there's different levels of capability with each of these types of processors.

([12:28](#)):

So there's AI and the sensors that's able to operate a certain level and a certain power budget. And then you can go up another step. And now we can do vision processing for example, or take in multiple streams of data simultaneously and look at a larger neural net processing capability. So with that, we can do for example, camera processing, vision processing, where you may look at the leaves of a crop over time or in a particular area, to determine again, whether it's healthy or has succumbed to some kind of disease or pest. You can also of course, bring in other types of time division data and look for things like, let's go back to the more engineering side of it, vibration in a propeller indicating that a bearing is starting to go for example, or that there's a nick in a propeller, those are analysis that can also take place.

([13:18](#)):

But with the addition of this Linux based companion computer, we've got a demonstrator open to image, running Ros 2, and we've got all the tools within Ros 2 to really build quite a robust robotic system. And I think it's important that people realize, sometimes I get this comment when I'm walking down the hall with a small drone and they say, "Oh, you're having fun playing with the toys." They're not toys, they are real robots. And all of this hardware that's on board, scale to the smallest cost sensitive embedded sensor network, to very large vehicles that are out doing autonomous driving on the roads. And so the key thing with the hardware we're providing is that it's scalable that way and it does incorporate all the same CAN buses or CAN FD buses that are being used on autonomous vehicles.

([14:04](#)):

And two wire automotive ethernet is board and same secure elements that are used in passports and credit cards can be used to implicate that the pilot is allowed or authorized to fly in this area. So there's a lot of real world technology in a very small package. And the next big thing we've introduced here is the ability to use a buggy as an alternative to a drone. We know that in certain parts it's challenging to fly, and there's just as much that can be done on the ground as can be in the air. It's a different approach, but driving through windrows of crops or transporting across a desert or something like that can be done by ground as well as by air.

Nitin Dahad ([14:41](#)):

Before we close, I'd like to offer each of you the opportunity to give some advice to participants.

Richard Fix ([14:46](#)):

First of all, it's about having a good idea how you can really contribute to improve the situation. When it comes to using our sensors, then my advice is one of the first steps, just download the BMEAI studio software and play around with it, because it's very easy to be used. It also gives you a lot of ideas with examples in the documentation, how you can use it and I think that's a very good starting condition. I think everything else is pretty clear to the teams, which will apply to participate in the challenge. And usually, they are very well aware about how to combine hardware and software to come to a solution. But of course, gas sensing is a very special topic, but I think with our AI studio software, we made it as easy as possible to combine here new sensors with the power of artificial intelligence.

Nitin Dahad ([15:30](#)):

That's quite important, because the ability to play with software, to understand something you're capable of, then gives you the ability to have confidence to implement ideas as well. Iain, finally to you, any advice?

Iain Galloway ([15:43](#)):

My advice is to participate and not be intimidated by the scope of things. The concept here, is to get as close as possible to a working system, but proof of concept, talk about how something can be scaled, maybe you only have access to one of these, but it would scale well to a thousand of these. Don't be intimidated by the size and scope and thinking that everything has to be perfect. As we mentioned, it's about the idea, it's about how well you present it and document it. And then working with the software then learning something along the way, getting familiar with AI studio from Bosch or our software EIQ for the NavQ plus, there's a lot of areas that you can focus on and a lot of things that you can learn within this competition.

Nitin Dahad ([16:30](#)):

Iain and Richard, thank you very much. That was a Smarter World Podcast. I'm Nitin Dahad, thanks for listening and see you next time.