New, versatile sensor platform allows IoT organisations to accelerate time-to-market and focus on their data

IoT deployments involve significant challenges in terms of power supply, environmental factors and the need for connectivity coverage at the right cost for the use case. Bluetooth 5.2 is bringing in a new era of robust connectivity but organisations need hardware that gives them the flexibility to position connected sensors where they are needed and to ensure they are protected from moisture and able to operate at both high and low temperatures.

For mass-scale deployments bespoke hardware is a realistic prospect but for specialised, lower volume deployments that demand short time-to-market, this approach is unviable. Instead, deployment of a device that offers designed-in flexibility, pre-canned uses and the ability to add bespokely developed software, can deliver organisations with the best of both worlds.

Jonathan Kaye, the senior director of product management, and Chris Boorman, senior product manager, at Laird Connectivity explain to IoT Now managing editor George Malim how the company's new Sentrius BT610 offering provides an ideal device for rapid roll-out of sensor connectivity

George Malim: What are the challenges associated with planning IoT deployments? What typical constraints in terms of power and thermal efficiency need to be considered?

Chris Boorman: It very much depends on your app and there are different challenges for different apps. For a lot of customers, the challenges of getting power to the environment are substantial but this isn't necessarily about having devices in remote locations, it could just be having devices in awkward locations. This is one of the reasons that we started off this product series with a battery powered sensor platform.

Environmental conditions are also a significant concern with extreme weather and temperature cycles affecting device longevity. We've therefore designed our new Sentrius BT610 I/O sensor to address such concerns with a custom-designed, IP67 ruggedised, vented enclosure. Powered by a replaceable, large capacity, lithium thionyl chloride battery which will last up to 5 years. With an operating temperature range of –40ºC to 85ºC, this is vital for IoT applications that rely on having multiple sensors which remain operational in harsh environments.

Many IoT applications also rely on having multiple sensor types, each with a dedicated purpose, so finding single use/single input sensors each with the required operational performance quickly becomes extremely challenging and you end up with a store-room full of sensors from different manufacturers. We've therefore designed the Sentrius BT610 platform to support a wide range of sensor inputs.

This makes the BT610 versatile enough to be coupled with multiple off-the-shelf sensors for an array of use cases. For example, in a control hut application, sensing door open/closed, climatic conditions inside and out, AC current loading for HVAC systems and button press events etc. Creating a product that is versatile and configurable for the different challenges our customers face and simplifying their deployments. Customers can focus on digesting the data from the device rather than on integrating sensors and managing data they create. It enables customers to focus on the data rather than on its collection.

GM: How does the Sentrius BT610 help address organisations' deployment concerns and fit the needs of IoT environments for flexibility? ▶

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Jonathan Kaye
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"We can pitch the BT610 at many different levels"

CB: The versatility of the BT610 is a result of developing a platform which, at a hardware level, supports pretty much any industry standard external sensor through its range of interface options – from general purpose analogue inputs, digital I/Os, I2C and SPI. The generic I/O interface allows customers to wire in their own inputs from whatever item of kit or sensor they already have, connecting up to four, 4-20mA or 0-10VDC analogue inputs, two dry contact digital inputs, plus two digital outputs. Alternatively, we have our own pre-canned cable assembly options which are sold separately, allowing customers to connect thermistors, AC current sensors, pressure or ultrasonic sensors which are all supported out of the box. Lastly, customers also have the option of going down a development path and building their own application software on **Zephyr** to meet their operational needs utilising the SPI/I2C and UART interfaces available.

Combined, this flexibility allows us to position the BT610 so it's well placed to service many different customer applications.

We can pitch the BT610 at many different levels. We have the standard unit with off the shelf operation, or customers can do their own software application development utilising the documentation we make available, allowing them to go off and build their own dream.

GM: Are you seeing that customers want to do their own development, or do they want pre-canned options?

CB: It's still early days for the BT610 but through early engagements with customers we're seeing there are examples of both extremes. Some big players want solutions that are plug and play, they want us to give them something they can scale with. Then there are others with their own cloud platform that just need a hardware platform to provide the data.

We also see smaller companies and start-ups with developers in-house who again just need a platform to build on and have their own partners who complete the offering. There's a big mixture of use cases out there. From my perspective there are very limited rules in terms of customer behaviour. It just depends on their capabilities and their ambition. ▶

Jonathan Kaye: I think there are three factors that influence this – specific sensing requirements of the application, time to market and the capability of an organisation's engineering group. Our growing packaged products portfolio has been developed out of our embedded wireless modules, as the core wireless and compute engines that drive the packaged product variants.

We've found that customers' expectations and requirements for packaged products widely differ based on their internal capabilities and type of company it is. Some customers expect a product that they just power on and their data just gets to the cloud. Others want to tweak and optimise the product configurations, sensors, and data flow to match their requirements and specific cloud implementations.

Being everything to everybody is not realistic for real world IoT applications and we've endeavoured to achieve flexibility for all these different customer personas.

A big challenge for our engineering team is that it's almost too flexible. There are so many levers, variations, adjustment options and sensing interfaces we can accommodate that it has been an interesting design exercise for us to assess how we service all the different potential demands for the I/O sensing interfaces we have here.

We've tried not to make this product a Swiss Army knife because if you try to do that and serve everybody's specific needs you end up serving none of them. Instead, we've

focused on providing enormous flexibility and broadening the application use cases.

GM: Are you seeing industrial IoT organisations selecting Bluetooth 5.2 to address deployments that require long range support?

JK: We are seeing exactly this, and Bluetooth 5.2 was core to the design of this product. The core BL654 BLE module utilised in the BT610 design has silicon from Nordic Semiconductor, the nRF52840. That product has been out on the market for approximately three years and one key driver for that module itself has been support for Bluetooth 5 features sets, which are key industrial customer requirements.

We see customer demand for the LE Coded PHY feature for enabling the ability to punch through really poor RF environments. Sensing options generally do not happen in lovely pristine environments, they are normally buried down inside machines or they need to push to get as much range as possible in order to connect back to the gateway, then onto the cloud. LE Coded provides that option to address poor RF environments. The **Bluetooth SIG** marketing claims performance of four times that of Bluetooth v4, using LE Coded at both ends of the wireless connection.

In our own testing we've found that industrial customers see Bluetooth 5.2 as an advantage. Throughput goes down but the range does significantly increase and for most devices such as this, which involve communicating sensor info and state info, it ▶

is small pieces of data and being able to send that over longer range point-to-point or punch through poor RF environments that is something the industrial market is looking for.

GM: You mentioned the BT610's enclosure earlier but what are the important attributes device enclosures need for challenging environments?

CB: It would have been incredibly easy for us to have taken an off-the-shelf enclosure thrown the board in that and called it good but we didn't find one that we felt gave us the design we wanted. We wanted to make the BT610 as compact as possible, making it suitable for deployment in the widest range of applications we could. In many factory floors you have huge amounts of space, but this isn't always the case, in vehicles for example, space is extremely limited so we wanted to keep the BT610 small to maximise its applicability.

We've achieved this by making our own custom enclosure with an IP67 rating. We've also included a vent and four cable glands ports. When you're not using these inputs they can be capped to save having an unused cable gland protruding and potentially allowing moisture ingress without a fitted cable making the seal.

In addition, the vent allows pressure to pass through. With a sealed enclosure, as sunlight hits the unit or as the temperature rises, so does the pressure inside. If the pressure cannot escape stress is placed on the seals. Conversely as the temperature reduces, so does the pressure. Without a vent, the sealed enclosure will attempt to suck outside air/moisture in. Both of these scenarios are exacerbated in stormy weather with more sudden and rapid changes in the environment. The vent also aids cooling and helps prevent condensation. We've also tried to eliminate the problem when engineers access devices to initiate Bluetooth connections, unscrewing the lid and exposing the inside to the elements, by using a magnetic sensor on the side that triggers the device to go into a pairing state. This means you can connect to the BT610 from the mobile app which comes with it and the necessity to open the enclosure up is reduced.

We also have a tamper switch that pushes an event into the cloud if triggered, useful for security and maintenance purposes.

With the battery, as mentioned, we've gone for lithium thionyl chloride call. It was chosen because this chemistry has a long shelf life, meaning you can keep batteries in storage alongside the BT610 waiting for deployment, and a flat discharge curve in conjunction with a wide operating temperature range. So cold nights or deployment in freezers aren't a problem.

A lot of time and thought has gone into the design of the housing and the enclosure and the general configuration of the hardware to make it as versatile and user friendly as possible.

GM: Laird Connectivity has drawn on experience from previous product generations to make the BT610 as flexible as possible with many interface options. How have you approached this?

CB: We thought a great deal about how to interface the sensor

cable assemblies to the platform and we've certainly leant on lessons learnt there. For the BT610 sensor inputs we wanted to avoid the need for specific connectors to achieve the versatility we wanted to offer. This enables our customers to not only route cables through tight spaces without a big connector on the end but also have freedom to wire in their own pre-existing cable assemblies without the time and cost impact of needing to fit new connectors, both of these were important considerations.

Alongside the ease of installation lessons, I think the addition of a vent is another good example of drawing on experience to optimise the longevity of our new packaged products in harsh environments.

JK: The software interface is also important. In previous models we've had a binary software offering which did what we said it would do but in relatively confined ways. Now we want to serve many more use cases. We have pre-canned binary interfaces that will perform functions as we set them out, but using fairly standard tools, developers can make significant changes and customise software their own way. With **Nordic Semiconductor** silicon as the core of the product, there is a lot of developer expertise in the market and flexible tools so customers can develop their own applications using the Nordic nRF Connect SDK or Zephyr RTOS.

GM: What do you see as the typical use case for the BT610 and the associated cable assemblies?

CB: We're just finalising development of the BT610 and as you would expect from everything we've said, there are a large number of use cases that the product is suited for, ranging from monitoring electrical equipment, such as the HVAC units in control huts, discussed earlier, to AC current sensing for single or three-phase induction motor monitoring, which I think is a strong industrial application.

In addition to heavy industrial environments there are an endless number of applications in light industrial, smart building, healthcare, hospitality and other verticals, and the pre-canned cable assemblies we're launching alongside the BT610 are intended to cover are a reasonably wide range of these from day one. There is a raft of different environments where the pre-canned cable assembly combinations could be deployed. Thermistors specifically are commonly used for environmental monitoring, automotive applications, industrial process applications, aerospace and medical applications. AC current sensors can be used for automation, process control, safety, motor protection, preventative maintenance, load switching, failure monitoring and monitoring energy use. While pressure and ultrasonic sensors can be used for fluid or gas applications to measure flow, safe levels and pressure drops in a line for preventive maintenance as well as measuring fluid height or level in tanks – your imagination is the limit.

We've tried to make the platform as adaptable as possible, to support not only greenfield deployments but to also make it suitable for updating brownfield applications with wired sensors already deployed, which can be converted into battery-operated wireless nodes, providing robust messaging to the cloud via our BT610. ■

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