

The final product was well-received and within a few weeks of launching the product, the company implemented its SmartRock sensor in various projects, from Ottawa's light rail to high-rise structures in Chicago.

Silicon Labs' Blue Gecko BGM111 Bluetooth Smart Module is the heart of the SmartRock sensor. Special modifications to the design of the enclosure made it possible to get a Bluetooth signal out of concrete, a solid, wet material. This allows for mobile-based data communication and analysis. Giatec worked closely with Silicon Labs engineers to design the final product with optimized properties and performance.

Giatec's first-generation smart sensors monitor the temperature of concrete, from its fresh, beginning stage through its hardened end stage. A mobile app analyzes the data to estimate the concrete's real-time compressive strength and evaluate its temperature history.

The business benefits of having this information readily available include being able to determine form-work removal time, optimize concrete curing, and allow loading on the structure.

Learn more about our wireless solutions at silabs.com/BGM111HERO





Tag Sensor

Label the sensor with the tag indicating its location both on the sensor and in the mobile app.



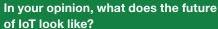
Pour Concrete

After installing the sensor in the formwork, pour concrete as usual.



Obtain Results

After concrete setting, wirelessly connect to the embedded sensor, and view the temperature and strength.



Soon IoT is going to be a natural part of our daily lives. In the construction industry, we are getting closer to designing completely smart concrete. This will involve adding a smart multisensor in the concrete at the batching plant, like an aggregate in every concrete truck that goes to the job site.

Customers won't have to install a sensor; they'll only have to download a mobile app. Smart concrete end-users will be able to obtain all the data on its quality, history, strength, etc. during delivery and pouring. They will also be able to monitor the properties of the hardened concrete over the service life of the structure. This will enable the end-user to report damages, corrosion, cracks, vibrations, etc.

The full cycles of IoT-based smart sensing with cloud communication will help us better evaluate the state of smart concrete infrastructure and ultimately address safety and sustainability issues in the concrete industry.

Aali Alizadeh
CEO and Founder Giatec





Rich Morris of BroodMinder is an electrical/systems engineer with more than 35 years of experience in product design. He spent the last five years of his career at an engineering development firm as VP of Operations and recently left after an acquisition, giving him some new time on his hands.

The inspiration for BroodMinder began eight years ago when he started raising bees as a hobby. He found that keeping a brood healthy and safe through a Wisconsin winter was very tricky. It is difficult to tell if bees are struggling unless the hive is opened, so the options were to either wait until the end of the season when it could be too late to save the bees or open the hive and put them at risk of the cold temperature. Being an electrical engineer and experienced product designer, Morris decided to do something about it.

The concept was to build a system that could accurately monitor temperature and humidity inside the hive without having to open it.

Declining bee populations is a big problem and threat to global agriculture. Awareness of this threat has brought beekeeping to the mainstream, and he saw proof of that through an IndieGoGo campaign by FlowHive. This startup out of Australia is building plastic taps that attach to a hive so honey will flow out the back. FlowHive was only trying to raise \$500,000 and they ended up raising \$12M. It was obvious then that a lot of people were concerned about the decline in bee population, and awareness had become pervasive even to urban areas. He knew this would be his target market and that a device for these concerned enthusiasts must have a very low barrier to entry.

To go about designing BroodMinder, Morris considered his target market and the technology he would need. He knew that Bluetooth low energy (BLE) would be critical so people could connect to their smart device easily. He also knew he needed to sell something affordable, on the order of tens of dollars (not the hundreds to thousands of dollars, like what was already on the market).

When choosing the technology that satisfied these criteria, he considered a variety of options. Morris knew his way around the industry since he had spent much of his career building embedded devices for clients and customers. He chose to build with the BLE113 module because of the simplicity of implementation and the impact it would make on his time-to-market. He wanted to have something pre-certified and stable to save development and debugging time. Plus, he had already worked with the technology before. He was very confident of the Bluetooth stack and because of previous experience, knew the quality of the product better than most.

Morris was fond of BlueGiga (now part of Silicon Labs) because its products scaled easily from small to large volume. As more units were sold, he didn't have to rewrite software when going from certified module to chip-on-board; this was more seamless and efficient, saving time and money in the future.

"The technology stack was precertified and reliable, which allowed me to focus on making my startup a success."



Rich Morris
Founder and Lead Drone
BroodMinder

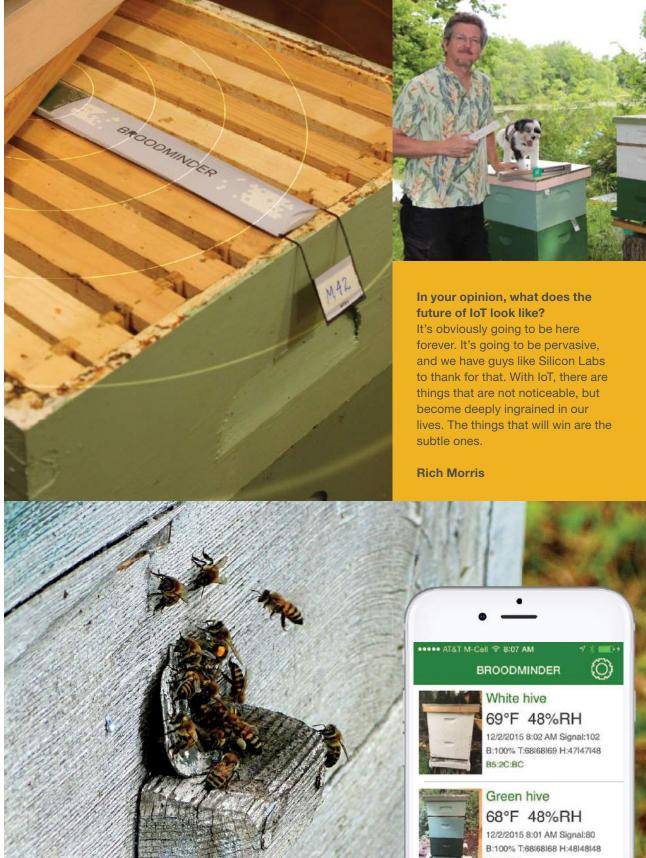
In Morris' experience, the biggest hurdle when starting up a new company and bringing a new device to the market was focusing on things other than hardware and firmware; in a startup there are many other factors to success. For example, even though it is a little more expensive to go with a module, the fact that it is reliable and proven took one major item off of his crowded plate. That left him available to solve the unexpected problems bound to arise whenever introducing a new product.

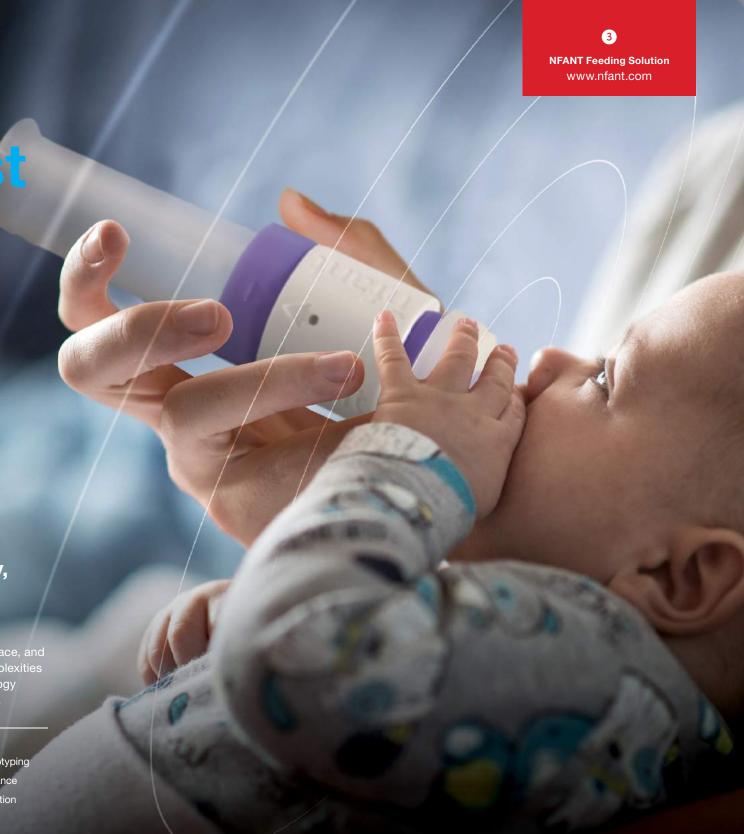
BroodMinder has been a great success, and Morris is already looking towards the next milestone on the horizon. While monitoring temperature and humidity is helpful for people fighting winter, his next device will be used for monitoring hive weight. With hive weight, there is the ability to see the brood build and grow in population. Additionally, as the honey flow comes in, it is possible to observe the hive weight jump in a matter of hours or days as honey is made. This helps to capture varieties of honey as different plants and flowers bloom, versus simply harvesting the bulk of what is produced at the end of the season. Currently people are DIY'ing this or paying thousands of dollars for a solution, but Broodminder is aiming for a target price of \$150, which will bring it into the realm of the 200,000 hobbyists. The key to solving this problem is getting it to mass production.

Bringing smart technology to beekeeping is a great example of the Internet of Things, and a lot of companies want to get into IoT. There are many niche, game-changing ideas and the ability to simply connect smart devices is powerful. In the case of BroodMinder, large quantities of data can be collected from the field- not just from specialists but also from enthusiasts, people who otherwise wouldn't connect and collect data. The power of data analysis is huge when it includes the masses.

Learn more about our wireless solutions at www.silabs.com/BLE113HERO







Solving the largest problems for the smallest patients with the loT

NFANT Labs, an emerging medical device company, had a concept for a breakthrough neonatal feeding solution and wanted to bring it to market quickly.

Based on clinical trials, they knew their device needed Bluetooth connectivity, a simple interface, and an affordable price. Being in a highly regulated industry, they also understood the many complexities beyond technical design involved in their road to success. They knew a pre-certified technology stack would reduce risk of technological roadblocks and help accelerate their time to market.

Our Solution

Smart Module

Application Medical Device

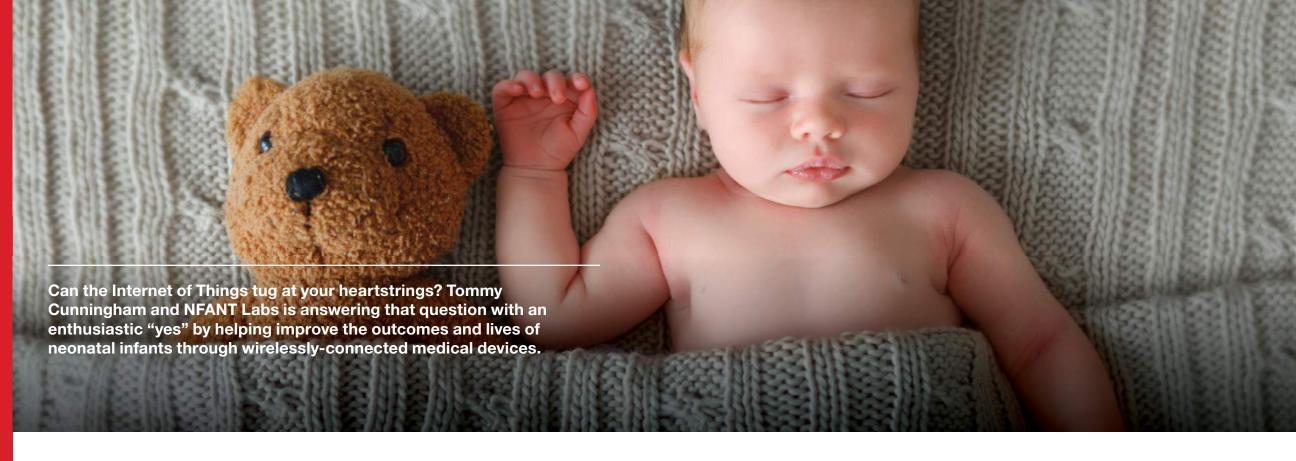
Customer Needs Pre-certified Technology Stack

Bluetooth Low Energy Affordable Bill of Materials BLE113 Bluetooth

Accelerated Prototyping

Rapid FDA Clearance

NICU Data Collection to Cloud



Tommy Cunningham is the co-founder and COO of NFANT Labs LLC, a company focused on improving the outcomes and lives of neonatal infants through wirelessly-connected medical devices. The organization was built from just two researchers and an idea, bootstrapping with next to nothing to start. In less than two years, NFANT Labs has performed clinical research, secured funding, designed and produced the product, brought on staff, and obtained FDA clearance.

Cunningham has a background in biomechanics and when he was working on his PhD, he would meet with clinicians that had great ideas but didn't know how to build anything. By the time he graduated, he had about 10 different projects under his belt and learned how to work on a low budget.

One of the project ideas came from eventual co-founder Dr. Gilson Capuluto, who proposed

creating a device to measure tongue strength during infant feeding. Currently, deciding exactly when it is safe to begin oral feeding and determining how to best advance an infant's feeding is based on a caregiver's professional experience and trial and error. The team set out to build a device that would help determine when NICU infants are ready to transition from tube feeding to bottle- or breastfeeding based on objective data. This was a very important step because babies can't leave the hospital until they demonstrate this feeding ability. Many infants might know how to feed, they just don't have the lingual strength and coordination to accomplish the task. The thought was to build a tool that could first diagnose strength and coordination deficiencies before clinicians intervene.

There was another device on the market that did something similar with a pacifier, but it was complex, costly, and cumbersome. After listening to feedback from doctors and nurses, Cunningham learned that the huge, wired machines that were currently being used were not targeting what the market wanted. What was needed was a small, wireless device that fit into the workflow of hospital clinicians and gave them bedside, actionable data during actual feeding.

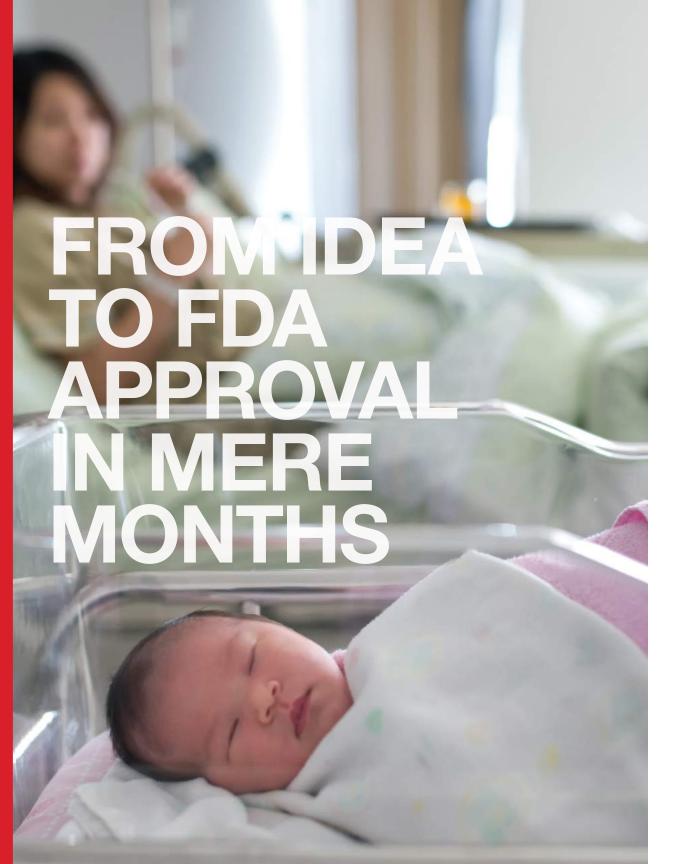
They also recognized an opportunity for connecting health metrics, specifically using the power of the cloud to make it happen. Nobody was actually doing this in the NICU and the company recognized that the way to bring medical technology into the future would be to make it smart and make it wireless. This means pushing physiological data to a mobile device and the cloud for analytics.

NFANT Labs started out unconventionally, giving its engineers a Bluetooth module and designing around it for a first prototype. They didn't want to be endlessly breadboarding with wires

hanging around because the NICU is already a very scary and stressful environment. The NICU is often dealing with life or death situations, and anything that looks intimidating is bad news. Designing initial prototypes for manufacturability from the start was risky, but it turned out to be critical to the company's rapid success on many fronts.

After reviewing available options, Silicon Labs' BLE113 was selected. Cunningham intentionally chose components and sensors that were both mass produced and cutting edge to get the best technology at an affordable price. This made their product less expensive to produce. They were able to launch at a fraction of the cost, and adopt a more flexible, analytics-driven business model that the industry had never seen.

The most intimidating factor and the biggest hurdle was that NFANT Labs was blazing a trail. They were bringing something entirely new to the



market in a highly regulated industry filled with entrenched practices, bureaucracy, complicated business processes, and painstaking evaluation practices. Despite the challenges, they pushed from concept to FDA submission in a matter of months, and emerged with clearance nine months later. EMC compliance testing was vigorous during this process.

The NFANT team is already seeing immediate value with the product at bedside with real-time biofeedback, and it is helping clinicians do the important work of navigating infants home safely and effectively. The long-term goal of the company is to build a connected NICU that will help medical professionals figure out how to iteratively improve treatments for their patients. Clinicians have to rely primarily on personal experience to know what to do. NFANT Labs is breaking down those silos and capturing many parameters to build predictive models to act on. Leveraging insights gained from the technology, clinicians will be able to enhance their daily medical practice with data-driven evidence.

"We kicked the tires on a lot of options, but finally went with the BLE113, which was proven and had a great reputation.



Tommy Cunningham Co-founder and COO NFANT Labs, LLC

As exemplified in the NFANT® Feeding Solution, IoT leverages great technologies, like lowenergy Bluetooth, to acquire data from a device, capture and push that information to the cloud, and then make sense of it. Today, people can capture data on just about anything they want. But to be useful, they need proper constructs or else they're just collecting data for the sake of it.

NFANT Labs set out to conquer an issue: an infant's inability to feed. They stream physiological data to a mobile app and capture clinical parameters surrounding that data to help create context. Aggregating and analyzing this data in the cloud and pushing it back down for clinical interpretation will shift the standards of modern medical technology.

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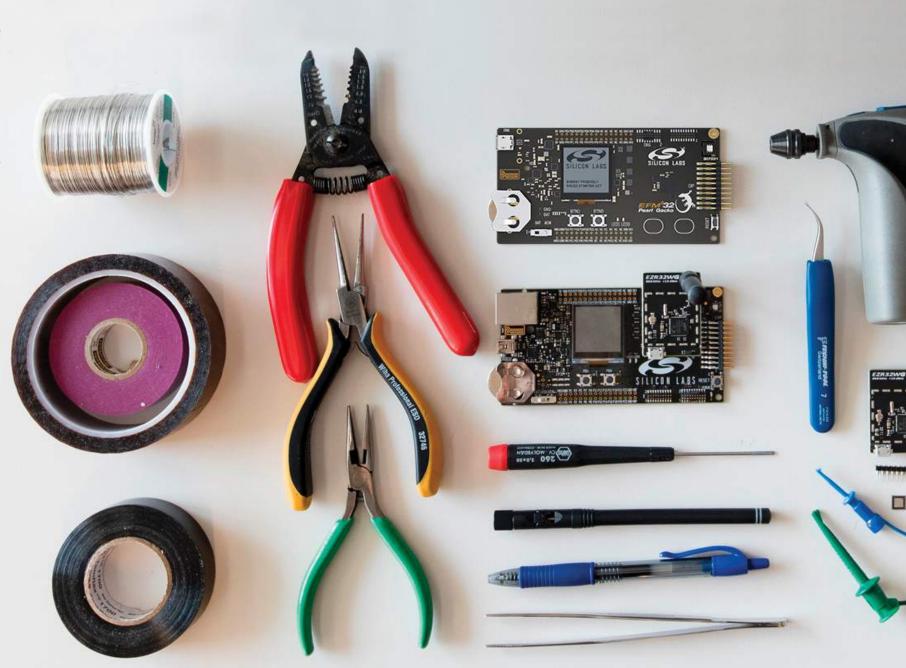
In your opinion, what does the future of IoT look like?

The more connected we are, the more patients we can help. By providing a means for data-driven decisions, we are empowering clinicians patients, and even payers; everyone will benefit This is the true essence of an evidence-based practice of medicine. We're providing just that.

Tommy Cunningham

Backed by our world-class team of hardware and software engineers with unsurpassed mixed-signal expertise, Silicon Labs gives you the tools and technologies you need to advance quickly and easily from initial idea to final product.

Silicon Labs is a leading provider of microcontroller, wireless connectivity, analog and sensor solutions for the Internet of Things (IoT). We transform industries by providing customers with significant advantages in performance, energy savings, system cost, time-to-market, and design simplicity.



Everything you need to create a more connected world.

Quickly Add Bluetooth Connectivity to Your Applications

From smart homes to wearables, Bluetooth functionality can be found virtually everywhere. Let us help introduce Bluetooth into your devices in a way that minimizes complexity and reduces time-to-market. We have the modules, software, and development tools to incorporate the connectivity you need to make the world a smarter, more connected place.

Meet more IoT Heroes at www.silabs.com/IoTHero



