

IoT Partnership Supports Mission to Improve Neonatal Health Care Outcomes in Sub-Saharan Africa

When companies collaborate on a noble purpose, they can experience benefits far beyond boosted bottom lines. Their innovative work may even help save lives. Saving babies in sub-Saharan Africa is this brand of business success. That's what 3rd Stone Design and sister company Hadleigh Health Technologies work to do with their medical devices and custom Internet of Things (IoT) solutions in sub-Saharan Africa, where neonatal mortality rates are the highest globally.

- Sub-Saharan Africa has 27 deaths per 1000 live births, with 43% of global newborn deaths.
- A child born in sub-Saharan Africa is 10 times more likely to die in the first month than a child born in a high-income country,* due in part to a lack of access to medical devices.

To help combat these sobering statistics and end preventable newborn deaths in African hospitals, 3rd Stone Design became a founding partner of Newborn Essential Solutions and Technologies—the NEST360 Alliance. The organization's mission is to reduce neonatal deaths in sub-Saharan Africa by 50% during the next decade by collaborating with its partners and governments to strengthen health systems through innovative technology, education, and policy resources.

Read how 3rd Stone Design and Hadleigh Health Technologies teamed up with Monnit® to create an IoT solution to remotely monitor medical devices and climate conditions in neonatal hospital wards in sub-Saharan Africa.

Spoiler alert: The return on investment (ROI) is significant. Biomedical engineers, clinicians, and programs get the data they need to ensure critical neonatal equipment is used and any issues that arise are quickly corrected so the devices are ready to work, helping to save babies. It's all easily managed using cloud-based sensor management and monitoring software on mobile devices and computers. Plus, alerts via email, text, or voice call from various fast-install, easily configurable IoT sensors.

Challenges

As a privately held product design and development company, 3rd Stone Design and its sister company Hadleigh Health Technologies, create and manufacture medical devices to support newborn and pediatric health care in the global marketplace. The companies are known for popular neonatal medical devices, including:

- The Celsi Monitor—a continuous temperature monitoring device
- The BiliDx bilirubinometer—a total bilirubin concentration measurement tool
- The Pumani bubble CPAP—a Continuous Positive Airway Pressure (CPAP) device
- The Hadli Monitoring System—an automated wireless device remote monitoring system



*World Health Organization, Newborn Mortality Globally, Key Facts.

Fulfill the Mission of the NEST360 Alliance

Working with the NEST360 Alliance, 3rd Stone Design and Hadleigh Health Technologies help fulfill the organization's mission to support African governments to implement a package of care that includes:

- Deliver affordable, rugged, life-saving newborn care technologies.
- Prepare clinicians and biomedical technicians to use, maintain, and repair these devices.
- Transform how data is captured and used in health care facilities.
- Build a network of African engineers to design the next generation of medical devices.

"We work to design and build highly durable medical devices that will run for thousands of hours in hospitals and clinics in developing countries," says Robert Miros, founder and CEO of 3rd Stone Design and Hadleigh Health Technologies. "We also design our products to be easily repairable and even place spare parts inside some of them. Our goal is to give medical personnel and device technicians everything they need to keep these critical, life-saving products up and running strong for a long time."

Monitoring Medical Device Use and Performance

Even with the commitments to medical device design, reliability, and distribution through the NEST360 program, the companies faced a significant challenge to consistent product availability and use in sub-Saharan African health care facilities. During the initial stages of delivering on the strategies of the NEST360 Alliance mission, Miros and his team soon realized they needed a better way to track medical device use and performance.

The problem started well before the launch of the NEST360 Alliance. Historically, medical devices in sub-Saharan African clinics were under constant threat of entering a non-use cycle due to various factors.

"There are many different reasons medical practitioners don't use certain devices, ranging from insufficient training to incorrect infrastructure and outages preventing devices from getting continuous power," says Alexandra Brandt, product engineer at 3rd Stone Design. "Devices may also be broken, but nobody is aware, and therefore they're not available to fix them promptly."

Ultimately, many of these devices—radiant warmers, concentrators, CPAPs, and other life-saving devices—end up in "the local medical equipment graveyard," Brandt says.

Solution

Rather than continue to reach out to sub-Saharan African hospitals and clinics via phone calls for reports of neonatal medical device use, the NEST360 Alliance Team at 3rd Stone Design and Hadleigh Health Technologies sought a more automated approach.

They wanted a solution to help them know the availability, use, and performance of medical devices more immediately. After conducting additional research about medical device use patterns in these countries and exploring different monitoring possibilities, the team contacted Monnit.

Working with Monnit engineers, the companies designed various medical device power monitoring prototypes. They landed on developing a sensor prototype that featured the Monnit ALTA® Wireless 20-Amp Current Meter to remotely monitor whether a medical device was on or off and how often it was used.

In a test project, the collaborative partnership focused on monitoring lower-cost medical devices rather than devices with embedded or integrated monitoring technology, such as x-ray units and CT scanners. The team focused on monitoring:

- Neonatal phototherapy devices—blue lamps that treat jaundice
- Radiant warmers
- Oxygen (O₂) concentrators
- CPAP devices

The 20-amp current meter prototype proved its efficacy by providing real-time data. However, 3rd Stone Design decided to design a sensing device that features a custom ALTA 5-Amp Current Meter from Monnit Labs for its monitoring solution. They changed because the meter only monitors small, low-power medical devices in neonatal wards and neonatal intensive care units (NICUs). Hadleigh Health Technologies manufactures the sensor, now named the Hadli Device Monitor.

The IoT Components of the Hadleigh Health Monitoring System

The entire solution is the Hadli Monitoring System, an active, automated remote device monitoring system that captures and shares actionable IoT data enabling strategic support of medical devices. The Hadli Monitoring System includes:

- The Hadli Device Monitor with the custom ALTA 5-Amp Current Meter
- The Hadli Wireless Humidity Sensor, based on the ALTA Wireless Humidity Sensor, monitors the climate conditions, including the temperature where medical devices are used
- The Hadli Cellular Gateway, based on an ALTA International Cellular Gateway, aggregates, protects, and communicates data sent from the Hadli Device Monitor and Humidity Sensor
- The Hadli Dashboard—A cloud data monitoring dashboard that uses an API to retrieve data from iMonnit IoT Monitoring and Sensor Management Software automatically

The wireless Hadli Device Monitor can be easily attached to practically any medical device and includes a removable power cord. The Hadli Monitoring System remotely monitors the medical device power use, power outage frequency and duration, and ambient room temperature and humidity.

Results

Biomedical engineers can know what is happening with medical devices in their neonatal wards before they are alerted to issues by NICU staff. They can make plans to fix devices to ensure they're always ready and available for use.

When there are changes to user-configured Hadli Monitoring System sensing settings, notifications are sent to the cloud monitoring software. Managers of the NEST360 program receive texts, emails, or voice calls on their mobile devices and computers. Then, they can coordinate the dispatch of device technicians, if necessary, and communicate with medical and administrative personnel in the neonatal wards.

Using their comprehensive monitoring solution, 3rd Stone Design and Hadleigh Health can also:

- Help medical device technicians and personnel quickly install and seamlessly integrate the plug-and-play system.
- Empower informed, automated, and strategic support decisions with real-time data analysis of medical device performance trends and usage patterns.
- Maximize uptime and optimize neonatal medical device use processes with notifications about potential maintenance needs and hazardous environmental conditions.

Currently, through the NEST360 Alliance, the Hadli Monitoring System is in several neonatal hospital wards in four countries—Malawi, Kenya, Tanzania, and Nigeria. By the beginning of 2023, the IoT solution will be installed in 22 sites within those same countries, and by the end of next year, it will be in 70 locations.





Actionable Data is a Critical Benefit of the Hadli IoT System

Here are examples of the benefits of implementing the Hadli Monitoring System:

- Within the first week of installation at a hospital in Malawi, Hadli alerted a technician that a CPAP was not in use. The technician confirmed the machine needed maintenance, and they fixed it on the spot.
- Hadli sent an alert that oxygen concentrators were being used more than expected in a hospital in Kenya. Administrators found that walled oxygen was broken and that the concentrators provided backup at the perfect time.
- Hadli alerted that one phototherapy unit at a hospital in Tanzania was constantly in use, and one was not. Medical personnel reported that the one not being used was located where phototherapy is not frequently needed, so they moved that unit to the room where the need was greater.

ROI: The Hadli Monitoring System and the NEST360 Alliance are prime examples of improving health care equity in underserved regions of developing countries. At the critical point of preserving newborn lives, when neonatal clinics and hospital wards have the connected medical devices they need to deliver proper and equitable health care, vital outcomes and mortality rates improve.

“We’re monitoring medical devices critical to the quality of care for the most vulnerable babies immediately after their birth and within the first days of life,” says Miros. “It’s an honor to be part of this life-saving initiative of helping babies not only survive but thrive, and we’re grateful for our partnership with Monnit that helps make this happen.”

The Hadli Monitoring System Powered by Monnit Optimizes Medical Device Management



1

Hadli Device Monitor

Get alerts about medical device use to enable timely and strategic support services. Analyze power consumption and predict problems before they occur with the Hadli Device Monitor. Knowing current use by root mean square (RMS) average and amp hours helps you manage performance.

2

Hadli Humidity Sensor

Install the scientific-grade Hadli (ALTA) Humidity Sensor to remotely monitor relative humidity (RH) between 10–90%, temperature, and dew point in a neonatal ward, room, or NICU. Get alerts via text, email, or voice call so you can improve climate conditions by taking fast action.

3

Hadli Cellular Gateway

Connect your IoT sensor network to many of the world's leading and remote cellular networks. Hadli Cellular Gateways showcase the Monnit ALTA International Cellular Gateway platform. Quickly create an IoT network, even in remote locations around the globe, without Internet access.

4

Hadli Dashboard

Access real-time data anytime from anywhere on a web-based dashboard. View reports on device use trends and anomalies and receive alerts on a mobile device via text, email, or voice call about potential medical device maintenance and neonatal ward climate conditions.

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