

BIG DATA ANALYTICS PROTECTING LIVES OF PREMATURE BABIES



PROJECT LEADER

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SYSTEM

NIMBUS

AREA OF SCIENCE

MEDICAL DATA ANALYTICS

APPLICATIONS USED

Artemis Platform

When visiting a neonatal ward, you might find paper records of the heart rate, blood oxygen, and respiratory rate of premature and ill children, taken at hourly intervals. When Dr Carolyn McGregor AM of the University of Ontario walks into a neonatal ward, she sees the phenomenal potential for revolutionary advancements in healthcare.

The data recorded on paper represents a fraction of what monitors read. What is not recorded simply disappears, risking infant's health and wellbeing; including the ability to predict infections such as Late Onset Neonatal Sepsis (LONS). Without these predictions, one in five low birth-weight babies can die from infection.

Dr. McGregor and the team at the University of Ontario Institute of Technology have developed the Artemis platform; a system that supports the acquisition and storage of patients' physiological data streams and clinical information for real-time analytics, retrospective analysis and data mining. In collaboration with the Pawsey Supercomputing Centre, the University of Technology Sydney and the Western Australia Department of Health, Dr McGregor is bringing her work to the Australian community for the betterment of society.

2018



THE CHALLENGE

In 2009, Artemis was deployed as a pilot research study to demonstrate how data collected by medical devices in hospital neonatal intensive care units (NICU) can be harnessed and utilized for new approaches to providing care to fragile premature and newborn infants.

“As a patient’s condition changes, initially it can be very subtle,” said Dr McGregor. “I realised that they didn’t have a platform that could take in all of this data and help them to watch, and that we could learn from all of that data – things that we haven’t learned before.”

Artemis has supported research students in the NICUs of The Hospital for Sick Children in Toronto, Ontario; Women and Infants Hospital in Providence, Rhode Island; and The Children’s Hospital of Fudan University in Shanghai, China. Now, the team behind Artemis are currently collaborating with the Department of Health and the Pawsey Supercomputing Centre to implement the system in Western Australia enabling Dr McGregor to bring

Artemis back to her homeland of Australia.

“Pawsey is a very large component in this work as we will be constantly streaming a lot of patient data from critical care monitors, analysing it in real-time and demonstrating the potential to provide the information back to the various healthcare workers in real-time,” said Dr McGregor. “The unique nature of the computing facilities at Pawsey are very important for my work.”

“Big data, stream computing and the internet of things (IoT) have the potential to bring about new game-changing approaches to healthcare,” said Dr McGregor. “We can’t expect healthcare facilities in urban let alone rural and remote communities to try and provide these new forms of healthcare and support all the technology.”

THE SOLUTION

Artemis doesn’t require any local installations at hospitals, urban and remote, to access this level of healthcare, as it runs entirely on a cloud-based system; which is where the Centre’s Nimbus cloud service comes in.

“Using cloud services and supercomputing, we can offer these new ways to analyse your current health state as a service,” said Dr McGregor, “and we can easily scale the service to accommodate all those that we need to monitor.”

As the research requires data streaming to be timely and accurate, it could not operate within the boundaries of typical supercomputers that experience down-times. With cloud computing services like Nimbus, the Centre can continue its focus on supporting research, and strengthen international collaborations through projects such as the Artemis Platform.

OUTCOME

Artemis has been ground-breaking in its monitoring of premature children in neonatal wards internationally. The Artemis Platform cloud service can connect to bedside monitors, allowing a live stream and analysis of around 1,256 data points per second, per patient, amounting to roughly 600MB per day (as of 2012).

Artemis has significantly reduced false-positive frequencies in data collection, can diagnose different types of neonatal apnoea with 98% accuracy, preventing babies from receiving too much oxygen and reducing the risk of permanent eye damage.

This research will improve healthcare services for some of the most vulnerable lives in Western Australia’s hospitals, and that’s only the beginning.

“While we are initially demonstrating the approach in neonatology, this will show the potential for holistic healthcare,” said Dr McGregor. “In my other collaborations, we are also working now to demonstrate how these same tools can be used for mental health as well, and also the management of physical health and wellness in space on long-range missions.

“I am demonstrating how this can be used for differential diagnosis through the use of new cognitive computing technologies.”

“I think in principle the intent for this project is to start with neonatal intensive care units, but technically you can deploy this kind of system to any hospital bed,” said Dr McGregor.

“Then, you start talking about a much larger system, which might, in the future, be something that needs to be developed.”