> ## " NANO ELECTRONICS WILL ENABLE UBIQUITOUS ACCESS TO AFFORDABLE HEALTHCARE

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Santhosh Kumar Madathil, General Manager, Smart Devices, Wipro has over 23+ years of experience in embedded product design covering various industry domains. In his current role, he leads a team of researchers and technologists in next generation technology areas covering smart devices, IoT, and its applications across industry verticals. In an interaction with Dataquest, he talks about nano electronics and how it can be helpful in remote patient monitoring. Excerpts

Please throw some light on nano electronics. How is it used in the healthcare sector?

Nano electronics is defining the way we interact with day-to-day objects, people, and situations. Today, Nano electronics is making it possible to place the power of present day computers in the palms of our hands. Advances in semiconductor fabrication technologies have helped in the development of extremely small devices with a low energy footprint and a longer battery life that can measure various health parameters.

How does nano electronics help in remote patient monitoring?

Advances in nano electronics semiconductor fabrication has helped realize devices with not just a small form-fac-

tor but which are also non-intrusive, wearable, connected and intelligent and of medical grade. These devices can monitor vital health parameter such as ECG, heart rate, respiration, pulse oximetry, blood glucose, and body activity levels on a real-time basis. This when combined with back-end decision support systems and analytics can provide quality medical care at the convenience of both the patient and the physician.

This helps in early diagnosis, step-down monitoring, as well as post-operative care of patients. For instance, the fetal monitoring solution from Wipro helps assess fetal heart rate, maternal heart rate and Uterine Activity level on a real-time basis at a central monitoring station which can be accessed by the consulting physician through a mobile app for timely intervention and support. Remote monitoring has huge potential in chronic disease management such as the treatment of disorder such as diabetes, apart from geriatric care, drug adherence, and clinical trials.

What was the scenario before the adoption of this technology?

Traditionally, a patient had to visit the hospital for regular medical check-ups which can be both stressful and time intensive, especially in rural areas where medical facilities are not easily accessible.

Low doctor-to-patient ratio, lack of adequate hospital beds, large population and high costs in conventional healthcare models hinder long term and scalable improvements in current high CVD (cardiovascular disease) deaths, MMR (maternal mortality rate), and IMR (infant mortality rate). The traditional method of monitoring fetal heart rate and movements during the final trimester of pregnancy includes visits to clinic, belts, immobility and NST (Non Stress Test) techniques, creating needless anxiety to the expectant mother.

In terms of cardiac care, devices used currently such as ECG Holter monitors are bulky and constrict the patient's mobility to a great extent. They are standalone systems and do not come with any back-end real time decision support system and analytics.

How do nano electronics enabled remote monitoring solutions help patients?

The remote monitoring solution helps in monitoring the patient from the comfort of his/her home or work-place, thereby minimizing regular visits to a hospital or clinic.

Wipro's indigenously developed mhealth platform— Wipro Assure Health is a holistic solution for remote health monitoring and diagnosis using disruptive, next-gen, non-invasive wearable medical devices. These devices are built on advanced Body Area Network based mobility platforms, ubiquitous- cloud based clinical decision support systems and innovative business models to deliver affordable patient centric healthcare. Maternity and cardiac care are two such solutions that are built on this platform. Both these solutions come with light weight, non-intrusive wearable devices that are connected to the back-end cloud to monitor health parameters on a real-time basis and submit the data to hospitals on a central monitoring station. Physicians can then monitor this data on a mobile device, from any location.

How this technology can be helpful in other sectors?

Nano electronics will eventually enable new form-factors ensuring ubiquitous access to affordable healthcare. Some futuristic examples include tattoos and stickers with embedded sensors that can monitor body vitals such as temperature, heart rate, etc. Nano electronics will enable embedded electronics in fabrics and in consumable pills, which when swallowed will transmit internal body vital information.

Further advances in this field would also lead to self-sustaining and energy harvesting nodes, lab on a chip, biosensors, spectral microscopy, and new opto-electronics devices and sensors which would be much more efficient than conventional laser diodes.

Due to shrinking die sizes, the CPU and memory footprint would also reduce significantly. These collective advances have the potential to revolutionize a number of industry verticals such as manufacturing, energy, telecom, consumer and retail, apart from the healthcare sector.