

# StretchNode – Elastic sensor node

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## Introduction

The purpose of the demonstrator was to find out if conventional printing and SMD component assembly techniques can be used with elastic substrate materials. The use of elastic substrates would be useful in applications such as wearable electronics, where the conformability of the electronics is a desired feature. However, realization of such devices has been difficult due to applied stresses on electronic components and circuitry caused by stretching, compression and bending of the substrate.

## Manufacturing methods

The manufacturing methods utilized in this study have been widely used in the field of printed electronics. First, the electronic circuitry was designed and screen printed in roll to roll process. Then the components were assembled and secured in place with supporting adhesive. Stresses caused by stretching, compression and bending of the substrate were taken into account in component placement.



Figure 1. StretchNode stretched.

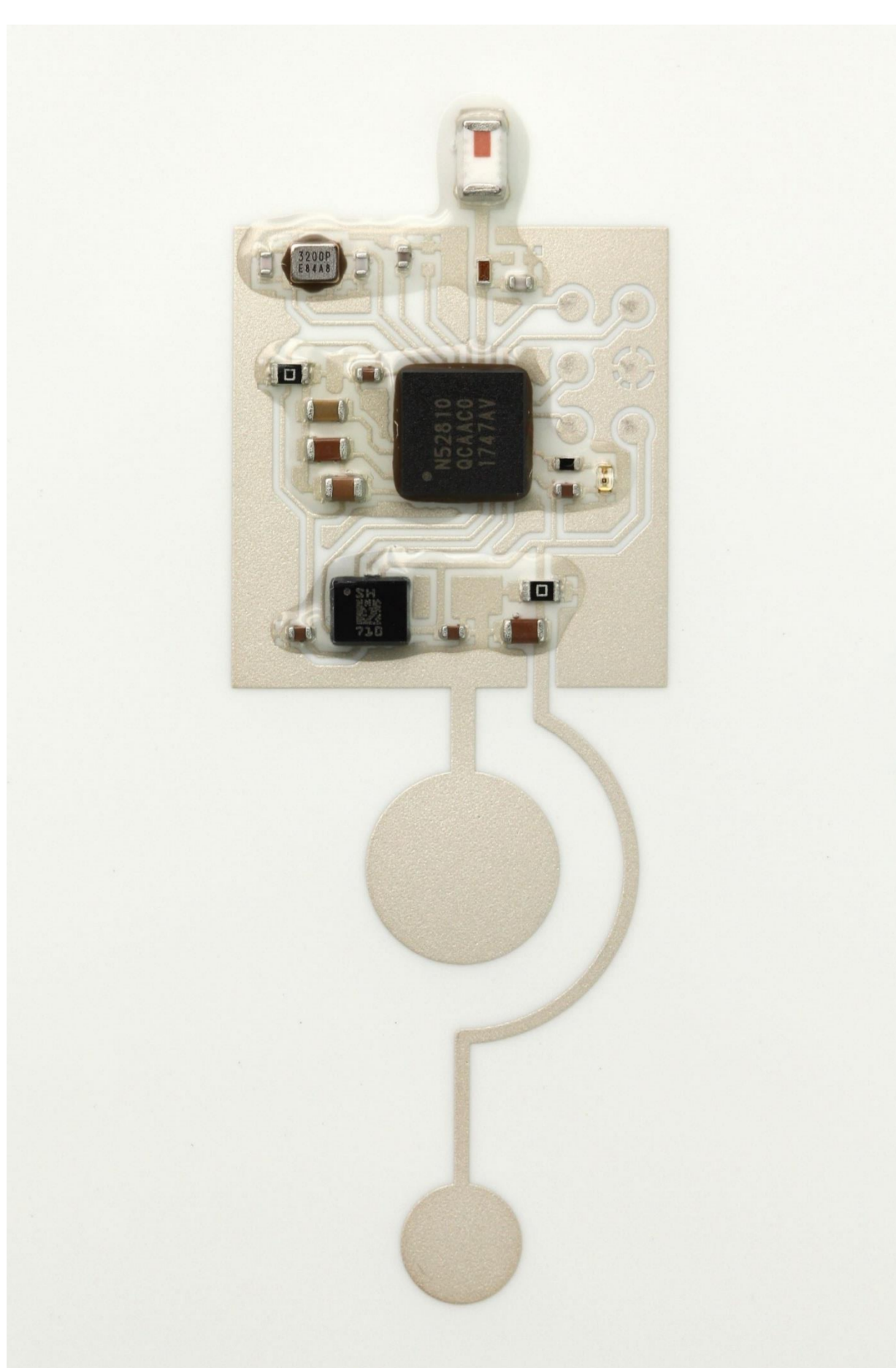


Figure 2. This version is coin cell battery powered with QFN packaged IC.

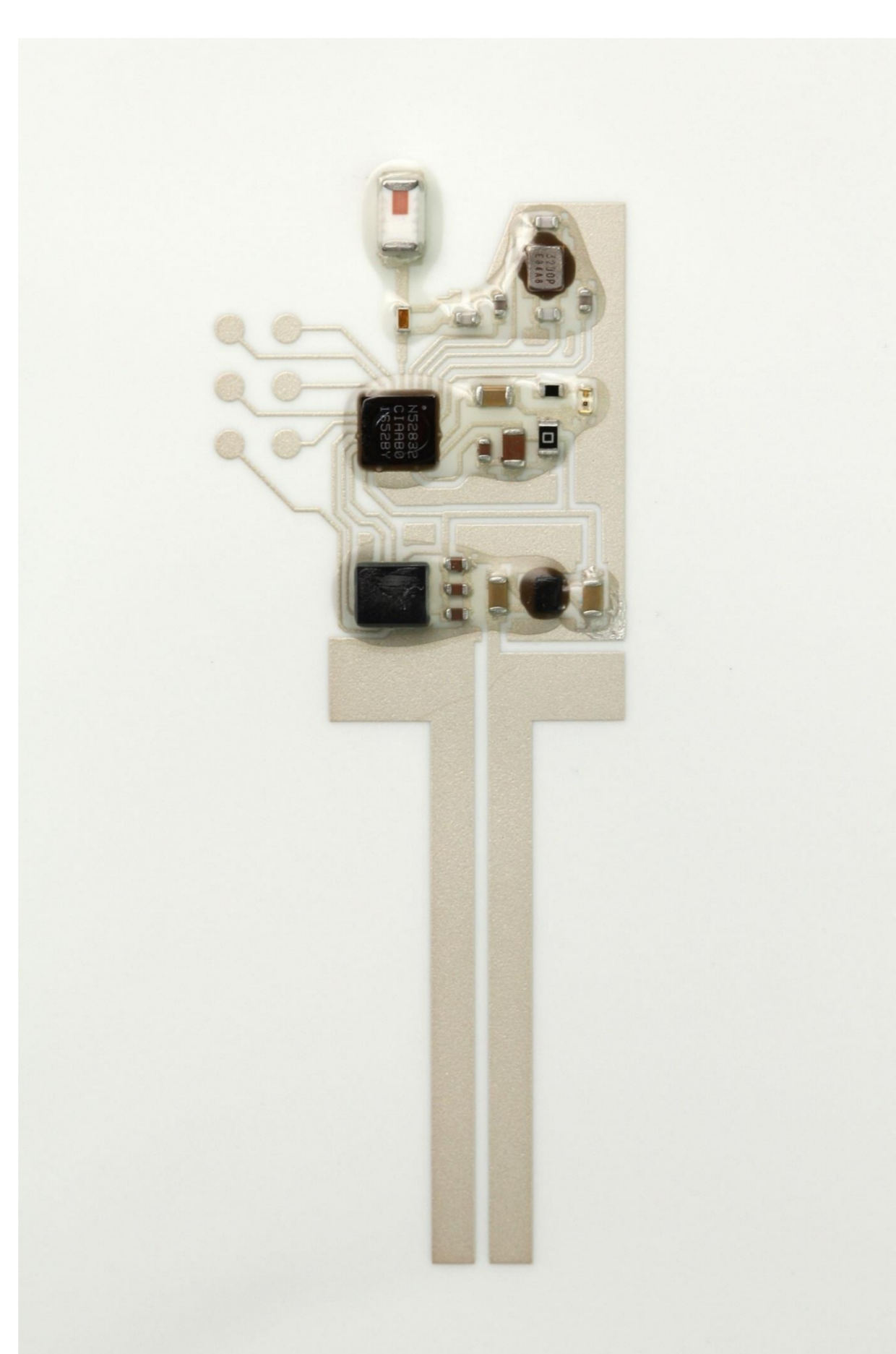


Figure 3. This version is LiPo-battery powered with WLCSP packaged IC.

## Results

The nodes were functional and they tolerated moderate stretching and bending. 40 devices in total were produced with four slightly different layouts. 20 pieces included Bluetooth microcontroller in small WLCSP-package, where the diameter and pitch of the solder bumps were 180 $\mu$ m and 400 $\mu$ m, respectively. Despite of the fine pitch, the assembly yield was 100%.

The electrical functionality of the devices was proofed: the 3-axis accelerometer data was successfully streamed over Bluetooth to an Android device (phone or tablet) as illustrated in Figure 4.

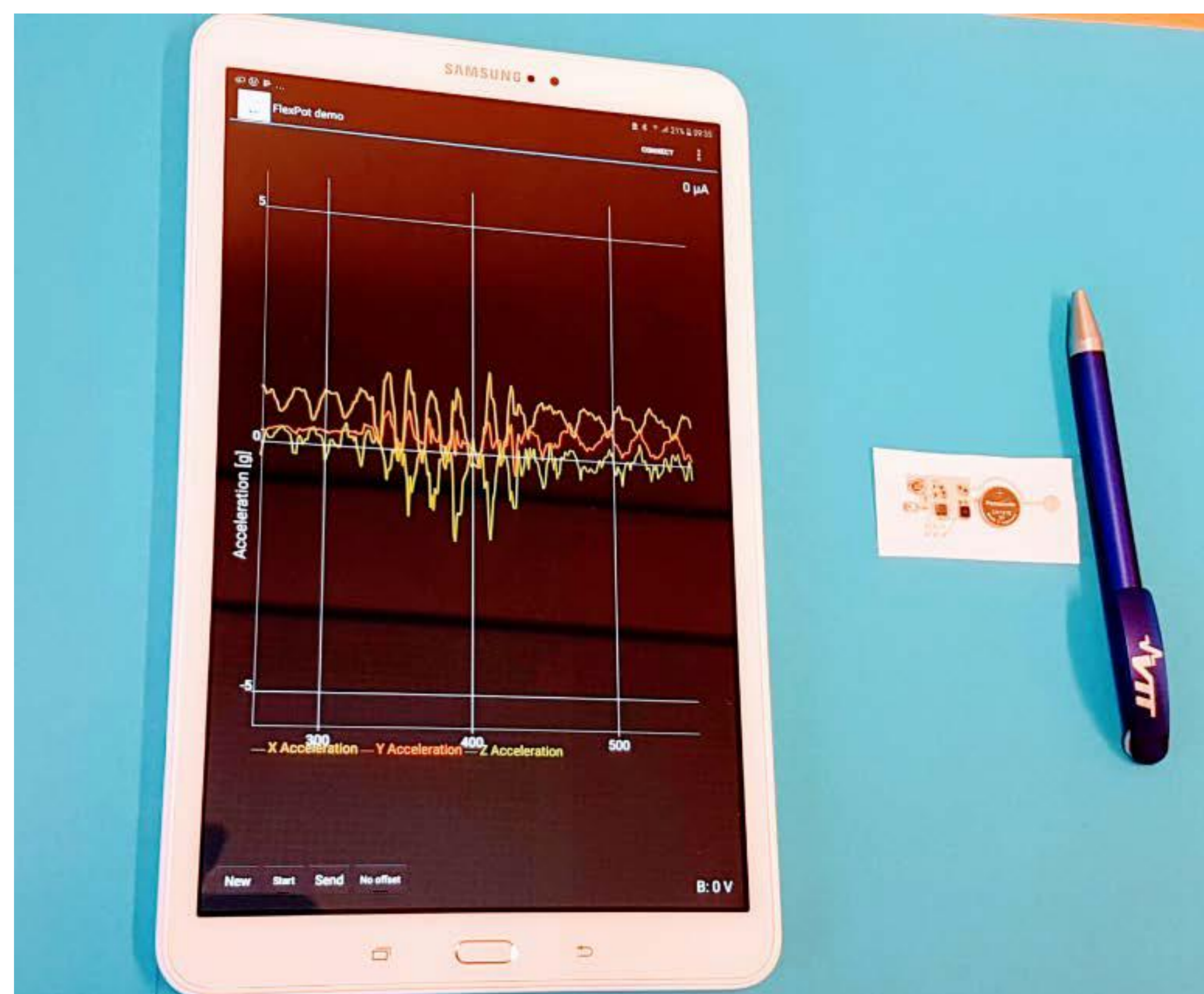


Figure 4. StretchNode streaming data to Android device.

## Summary and Key Metrics

- Wireless sensor node
- Stretchable, bendable
- Printed circuitry, SMD components, elastic substrate
- Low-cost R2R process
- Comfortable against skin

## Acknowledgements

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