WatchLink: Enhancing Smartwatches with Sensor Add-Ons via ECG Interface

WatchLink uses the electrocardiogram (ECG) interface built into smartwatches to integrate various external wearable sensors, expanding the health monitoring capabilities of the smartwatch with minimal added power and cost requirements.

What is the Problem?

Current smartwatches are limited by their built-in sensors, restricting their ability to monitor a broad range of physiological metrics. Additionally, the lack of efficient data import methods means that many specialized health monitoring sensors, such as UV light sensors for outdoor workers or air quality sensors, must function independently of the smartwatch. This separation increases costs and complexity, as these sensors need their own systems for sensing, processing, storing, and communicating data. The main challenge is to bridge the gap between a smartwatch's data processing and visualization capabilities and the integration of these external sensors.

What is the Solution?

The solution lies in leveraging existing sensors on the smartwatch for low-cost and low-power communication. WatchLink employs the electrocardiogram (ECG) sensor built into commercial smartwatches as an interface to connect external sensors. The ECG sensor, designed to monitor heart activity by detecting small variations in electrical activity on the skin, is well-suited for picking up low-power signals. By transmitting voltage signals from the external sensor through the skin to the smartwatch's ECG sensor, WatchLink operates efficiently with only 50 microwatts of power.

What is the Competitive Advantage?

- Low Power Consumption: WatchLink operates with only 50 microwatts of power, making it highly energy-efficient and suitable for continuous monitoring without significantly draining the smartwatch's battery.

- Minimal Hardware Modifications: WatchLink's approach requires no changes to the existing smartwatch hardware, facilitating easy adoption and integration with current smartwatch models.

- Side-Channel Sensing: By utilizing the ECG sensor for communication, WatchLink leverages existing hardware to transmit data from external sensors, eliminating the need for additional

communication modules.

- Versatile Sensor Integration: The technology supports a wide range of external sensors, including those for monitoring UV light, air quality, and other niche health metrics, as well as multiplexing signals from multiple sensors.

- Seamless Data Transmission: The high gain of the pre-existing ECG sensors ensure reliable and accurate data transfer from even weak voltage signals to the smartwatch, maintaining the integrity of the collected data.

References

1. Anandghan Waghmare, Ishan Chatterjee, Vikram Iyer, Shwetak Patel(45576) , https://dl.acm.org/doi/10.1145/3654777.3676329, https://dl.acm.org/doi/proceedings/10.1145/3654777, 1-13