

Smarty Pants

Urine desire detection system

SmartyPants is an affordable, comfortable & easy-to-use **bioimpedance-based** urine desire detection and alert system. It features unprecedented comfort with the use of **electrodes embedded** into the fabric of undergarments.

Urine desire is detected by approximating the volume of urine based on the impedance of the pubic region. **Impedance decreases as urine volume increases.** The alert system notifies the caregivers via a web interface when the patient experiences the first sensation of bladder fullness (~200 ml of urine detected)

Detect



Analyse

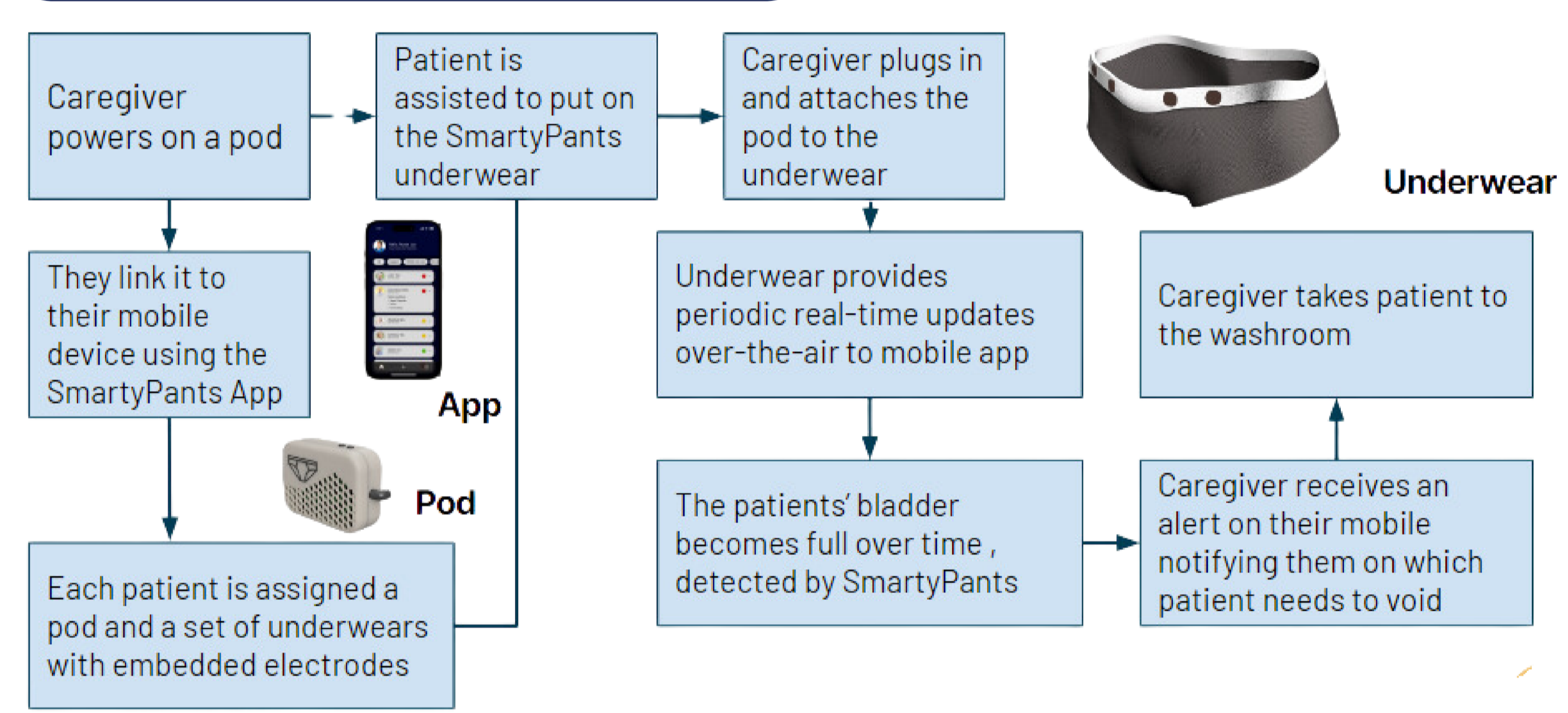


Alert

Clinical Problem

74% of dementia patients living in nursing homes suffer from **functional incontinence**. As a result, they are unable to communicate their needs to use the restroom. Patients are brought to the restroom at regular intervals, putting a strain on nursing staff. Current ultrasound-based products require tight contact with the skin, leading to **patient discomfort**. There is a need for a **comfortable and accurate urine desire detection system to reduce caregiver load**.

User Workflow



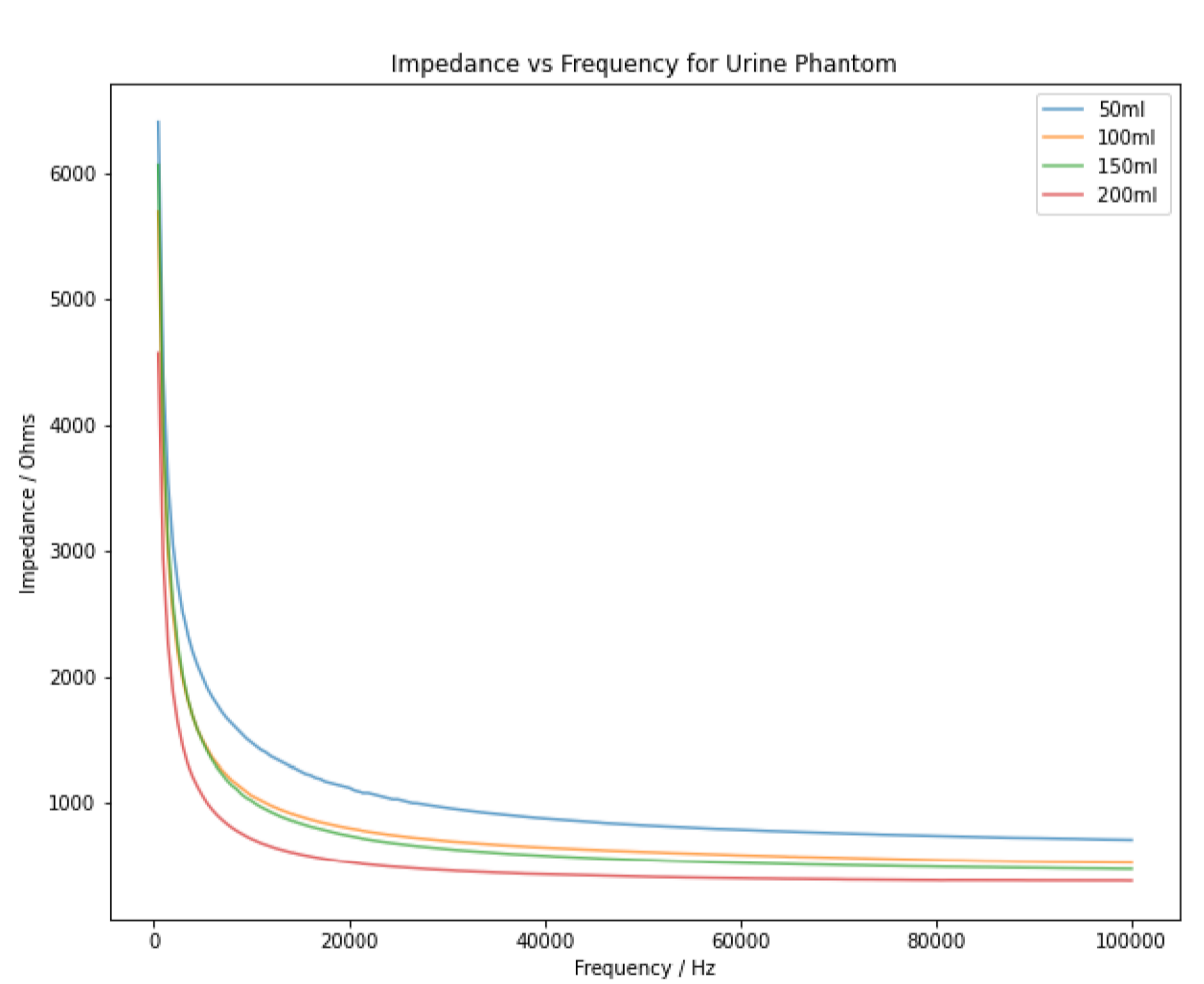
Product Features

- Electrical Bioimpedance**
Urine desire detection
 - Real-Time Alert system**
Application
 - Comfort Contact***
Between user application and skin
- ***Comfort Contact:** Sensor contact shall not significantly increase wearer discomfort beyond the level of normal contact between skin and clothing



Prototyping

A simple prototype was designed for proof of concept and tested with a tissue phantom of the pelvic region.

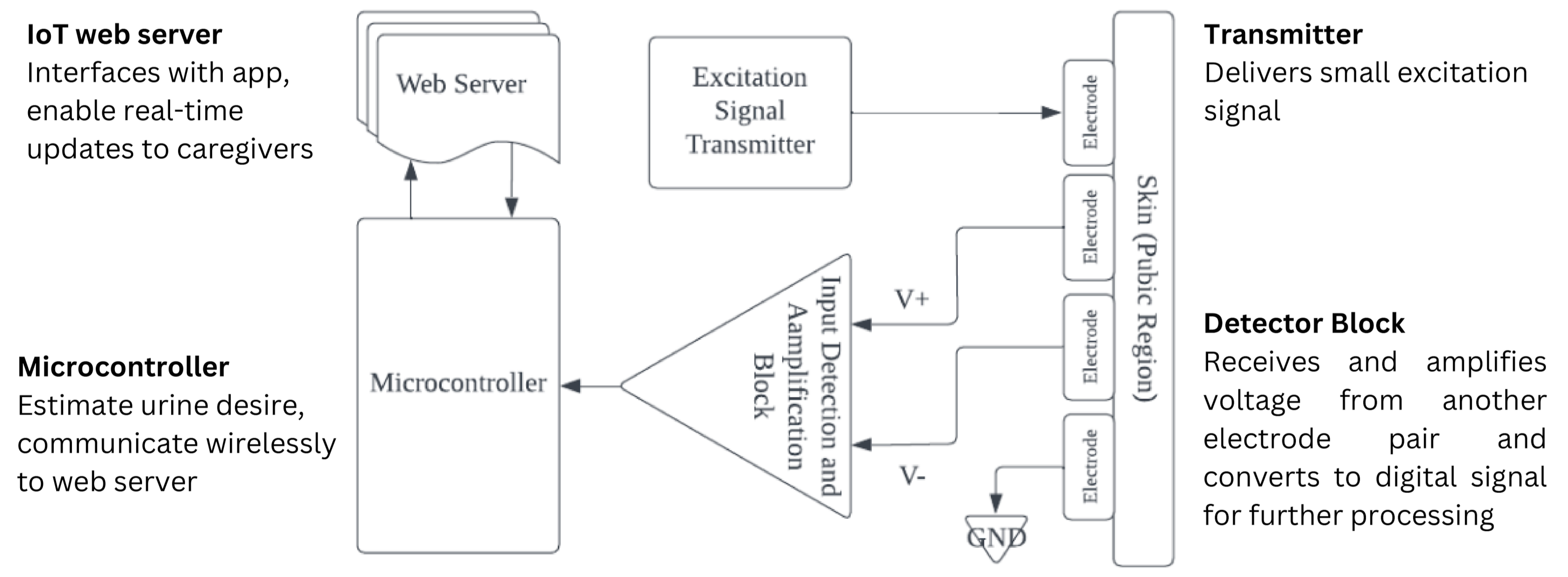


Multi-frequency impedance analysis using phantom bladder and urine

Inverse relationship between bioimpedance and urine volume
As urine is highly conductive, the impedance of the pelvic region decreases as the volume of urine increases. Tested with phantom urine, bladder and pelvic tissues

Working Principle

Functional Block Diagram



Key Results

- ✓ Detect **distinct changes in electrical properties of pelvic tissue** corresponding to different urine volume
- ✓ Trigger a warning **with 70% accuracy** at the first sensation of bladder fullness (~200 ml)
- ✓ Successfully **embedded electrodes** into the underwear for greater patient comfort