



Pinetics

Delivering successful electronic products through
innovative engineering!



Innovation. Everyday

We are a leader in product design and development. With an unwavering commitment to excellence, we have built a global reputation for delivering agile and manufacturing-ready solutions to our esteemed clients. With over 20 years of industry experience, our talented team possesses an extensive wealth of knowledge and expertise that spans the entire product development life cycle.

We specialize in Electronics Hardware, Firmware Development, Embedded Operating Systems (OS), Internet of Things (IoT), Internet of Medical Things (IoMT), and Industrial Design, among others. Whether you're launching a new product, seeking to enhance existing offerings, or navigating the complexities of digital transformation, we have the expertise and resources to guide you every step of the way.

**Ideation | Product Design & Development | Testing |
Standards compliance | Ready to Manufacture |**



1. **Ideation**
2. **Product Design & Development**
3. **Testing**
4. **Standards compliance**
5. **Manufacture**

Product development life cycle



Electronics
Hardware



Firmware
Development



Embedded Operating
Systems (OS).



Internet of Things
(IoT).



Internet of Medical
Things (IoMT).



Industrial Design
& UI/UX Design

What we Offer

Solving Capacity Deficiency &
technical complications across the
world!

Capabilities Highlights

- Complex Embedded product development including high-end multimedia processors like NXP's i.MXRT, i.MX6, i.MX8 series, NVIDIA's Jetson Orin NX, ST's STM32F7/H7 series and entry level MCU's like Microchip PIC32MZx, ST STM32F0x, Nuvoton M480 series.
- Component Selection, Schematic design, Board Design, Multilayer and high-speed PCB Design.
- Writing Bare metal firmware, including bootloader, HAL (Hardware Abstraction Layer), peripheral drivers and application layer as per product requirements.
- LWIP stack with implementation of HTTPs, MQTTs and various protocols.
- Porting embedded OS like FreeRTOS, Zephyr, Yocto Linux, and Debian Linux to suitable processor platforms, including uboot, kernel, device driver customization and rootfs.
- Various industrial compliances like ISO, CE, UL.
- Various medical compliances like FDA, MDD/MDR, proven experience in getting FDA for a Medical product.
- Industrial Panel PC and BOX PC based on Intel ATOM and core-I processor.
- Industrial design of injection molds.
- RF-based product development with various technologies like ZigBee, 6 low-pan, Wi-Fi, Bluetooth, BLE, LoRA, GPS, GSM/GNSS, 2/3/4/5G, LTE-M and expertise in modules like CC3200, CC1121, WL1805, WL1835, SX-SDMAN-2830S-SP, NRF52XX, ESP32, SIM800, SIM7600E and NRF9160.





Case study

01

Wearable Sensor for incontinence management, patient movement and sleep posture tracing in geriatric care.



Wearable Sensor and system for incontinence management & patient posture and movement tracking in **Geriatric care**

We've engineered a state-of-the-art sensor, complemented by an advanced edge device, specifically designed to monitor incontinence events in geriatric care. This rechargeable wearable marvel not only tracks the location of patients across a custom-built mesh network but also aids in the prevention of pressure ulcers by meticulously monitoring minute body movements across three axes.

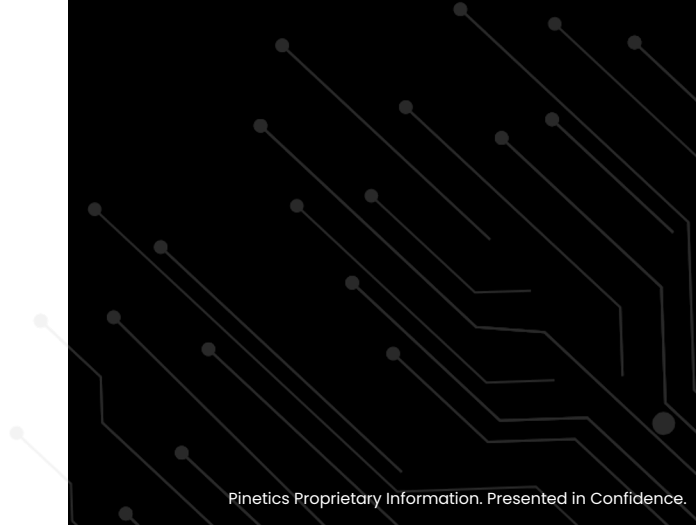
Our innovative technology empowers nursing staff with timely notifications and alerts via a bespoke mobile application, enabling them to provide superior care. This breakthrough in geriatric care technology significantly enhances the quality of life for the elderly, marking a new era in healthcare solutions.





Features of the Wearable sensor and system

- Inhouse sensor development for Urine saturation detection using impedance spectroscopy.
- Wearable device with battery management Unit with Li-Ion battery with a 48-hour cycle.
- Onboard IMU for patient position monitoring.
- Location tracking using BLE RSSI and triangulation methods.
- BLE to Wi-Fi gateway with multi-processor system including NRF52832/33 and ESP32 and also serves as a charging station for Wearables.
- Ethernet, Single band Wi-Fi and BLE 5.2
- Data communication over MQTTs and HTTPs protocols.
- OTA updates for all devices in the system.





Product Highlights



Hardware

- Modular design with 2 Unique PCBs
- 4 Layer board design, high component density, 4 mil T-T clearance
- Unique flex PCB sensor design
- High-density coin-size PCB for a low-power wearable
- In-house schematic, PCB layout, and CAD design
- Unique temperature-controlled simulator for urination and human position across 3-axis.



Firmware

- Bare-metal firmware for all devices.
- BLE stack with AES-128 secure connection and application layer for Nordic modules.
- Device drivers for accelerometer, gyroscope, magnetometer, battery gauge, analogue front end, and thermometer.
- Wi-Fi stack with MQTTs and HTTPs protocols and application layer for ESP32 modules.
- Different applications of launcher, updater and serializer on edge device.
- Self-constructing and self-healing mesh network.



Compliance

- Medical Device Regulation (MDR)
- IEC 60601-1,2, 3 & 11 EMI/EMC safety for medical devices.
- RF emission CISPR 11 Group-1, Class-B
- Comply with 14971 Risk Management standards
- ISO 13485 (21 CFR Part 820) Process Standard compliant
- HIPAA and Cyber Security Protocol compliant
- IEC 61233 Compliant battery
- SDLC compliant with IEC 62304
- Usability comply with IEC 62366 regulation standard




Cloud services

- AWS hosted backend
- Web interface for user management & device management
- Data Analysis & Cognitive services.
- Notification services
- AI & ML for impedance spectroscopy data analytics



Industrial design

- Usability, user Interface & User Experience
- Wearable and Simulator enclosure design
- Prototypes with 3D FDM printer
- Bio-Compatible
- Test rig design and setup



Case study

02

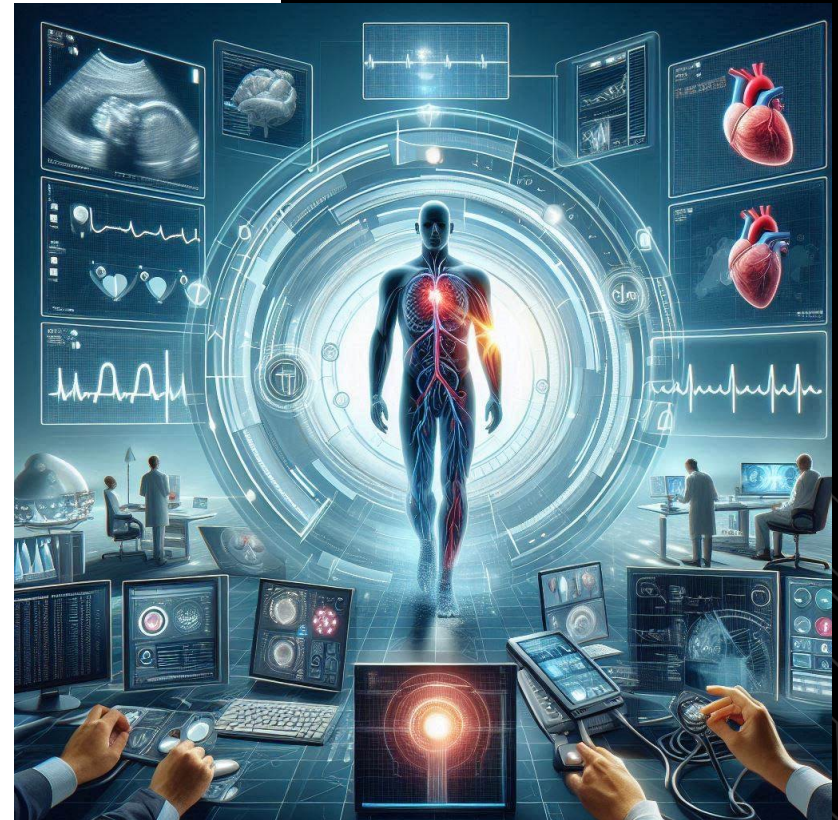
A one-of-a-kind device to measure cardiovascular health at a clinic, hospital or research institute.



Diagnostic, Screening and Research system for **Cardiovascular Health**

A ground-breaking and innovative healthcare system is designed to elevate patient's cardiovascular health and improve clinical outcomes through the integration of cutting-edge diagnostic technologies, including Pulse Wave Analysis (PWA), central blood pressure (cBP) assessment, pulse wave velocity (PWV) measurement, and Ankle-Brachial Index (ABI) evaluation. This comprehensive approach offers a sophisticated array of diagnostic markers, enabling a deeper and more insightful analysis for informed decision-making.

By enabling the early detection of potential abnormalities and facilitating more informed decisions regarding therapeutic interventions, our system not only enhances clinical outcomes but also empowers patients to lead healthier and more fulfilling lives.





Features of the Devices in system

- NXP iMXRT-based sensor device which handles pneumatic system, ultrasound and Photoplethysmography sensors.
- NXP iMX8MPlus-based Edge device runs multimodule application architecture based on modules developed in Qt, NodeJS and ReactJS.
- Nordic nRF52840 based PPG watch with Analog devices AFE to read photoplethysmography data.
- Fast Fourier Transform (FFT) computations on ultrasound signals to find different velocities in blood flow.
- Dual-band Wi-Fi and Bluetooth
- Data communication over MQTTs and HTTPs protocols.
- OTA updates for all devices in the system.



Product Highlights



Hardware

- Modular design with different pressure channels
- 6 Layer board design, blind vias, high component density, 0.4mm BGA, 3 mil T-T clearance for over-the-wrist wearable
- 4-layer high-speed design for edge device base board, including USB 3.0, HDMI and gigabit Ethernet interfaces
- In-house schematic, PCB layout, and CAD design
- 8-layer High-speed design for Doppler scanner, 4 PPG/pressure channels with a 4.3" capacitive touch TFT display



Firmware

- Complete in-house development of FreeRTOS-based firmware for sensor devices.
- Device drivers for PPG AFE, complete pneumatic system and ultrasound Doppler
- Complete in-house development of Zephyr based firmware for PPG watch.
- Multi-module architecture in Yocto Linux based on "Separation of concerns" design methodology
- Applications on embedded edge built on Qt framework, Node.js and React.js runtime environment and communicate over Dbus IPC



Compliance

- Medical Device Regulation (MDR) & US FDA Class-II regulation
- IEC 60601-1,2, 3 & 11 EMI/EMC safety for medical device
- RF emission CISPR 11 Group-1, Class-B.
- Comply with 14971 Risk Management standards
- ISO 13485 (21 CFR Part 820) process standards compliant
- HIPAA, GDPR and Cyber Security protocol compliant
- SDLC compliant with IEC 62304
- Usability comply with IEC 62366 regulation standards



Algorithms

- Blood pressure measurement using oscillometric, photo-plethysmography and ultrasound
- Blood flow velocity with PWV method using photo-plethysmography and ultrasound
- Blood flow spectrum recording and FFT analysis



Industrial design

- Usability, User Interface & User Experience
- Unique finger and wrist enclosure design
- Bio-Compatible
- Edge gateway enclosure
- Prototypes with 3D FDM printer



Case study

03

A body warmer to help patients recover from OT heat loss, generally post surgery.





Body warmer for Perioperative Hypothermia

A patient warming solution designed to support optimal recovery and improve clinical outcomes by restoring and maintaining normal body temperature, especially in the critical perioperative period. Using advanced disposable warming blankets, this system prevents and treats hypothermia before, during, and after surgery, helping patients return to a stable thermal state efficiently and comfortably.

These body warmers use convective heating technologies to deliver consistent, evenly distributed heat, creating a cocoon of warmth around the patient. The blankets are quick to set up and adaptable to various surgical positions and patient needs, suitable for both adults and children. By reducing heat loss by up to 80% and maintaining temperatures with a wide selectable range of 34°C to 43°C, these blankets significantly lower the risks of perioperative hypothermia, such as infection and postoperative complications.





Features of the system

- STM32-based heating controller.
- PID algorithm for accurate and stable temperature output.
- Controlled airflow to keep the blankets inflated with uniform distribution of heat.
- Selectable wide temperature range from ambient to 43 degrees Celsius.
- Selectable blower speed with HEPA air filter.
- Onboard self-diagnostics.
- Compliant to IEC 60601-2-35
- Intuitive LCD for audio and visual indications.



Product Highlights



Hardware

- Modular design with separate control board, power board and temperature sensor modules.
- 4-layer board design, blind vias, high component density.
- In-house schematic, PCB layout, and CAD design
- High current density power board is capable of handling 1000w power delivery to the heating element.



Firmware

- Complete in-house development of FreeRTOS-based firmware.
- Device drivers for the heating element with fail-safe PID algorithm.
- PWM-based speed control for BLDC fan.
- UI development in TouchGFX.
- Self-diagnostic running continuously in-situ



Compliance

- Medical Device Regulation (MDR) & US FDA Class-II regulation
- IEC 60601-1,2 EMI/EMC safety for medical devices
- IEC 60601-2-35 compliant
- RF emission CISPR 11 Group-1, Class-B.
- ISO 13485 process standards compliant
- SDLC compliant with IEC 62304
- Usability complies with IEC 62366 regulation standards



Algorithms

- PID for temperature control
- PWM based flow control
- Self Diagnostics



Industrial design

- Usability, User Interface & User Experience
- Unique portable enclosure for easy movement from patient to patient
- Bio-Compatible
- Prototypes with 3D FDM printer



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Thank you!

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