SENTRYSOLE

Reimagining nighttime mobility for seniors through intelligent, unobtrusive design. Our smart slippers blend seamless safety features with familiar comfort, addressing the crucial 15-second window where most falls occur - because dignity and independence shouldn't end at sunset.

Background Research

FALLS ARE A GROWING BURDEN

*48% of nighttime falls occur during bathroom visits

Top types Of falls that lead to serious injury and death

36% Falls on the same level (slipping, tripping / stumbling)

Falls involving furniture

5.5% Falls on stairs

DESIGN CHALLENGE

How to enhance night-time mobility for seniors while preserving their dignity and independence, particularly during vulnerable moments like bathroom visits?

Key Design Requirement

Intuitive activation

Zero learning curve, Auto-response to natural movement

Adaptive support

Environment-responsive features, Multi-surface capability

Seamless integration

Fits existing routines, Natural form factor

Scenario Analysis

Nighttime crutch dependency increases fall risk by 40%, with 65% of hip fractures occurring during darkness hours while using mobility aids.

Crutches

82% of nighttime strains and injuries occur during unplanned movements, with reduced visibility amplifying risk of serious accidents by 3x.

Moving objects

Dark conditions reduce spatial awareness by 60%, making wheelchair navigation particularly hazardous with 73% reporting near-miss incidents.

Push the wheelchair

48% of nighttime falls occur during bathroom visits, with 80% of serious injuries happening during transitions between surfaces.

Trip to the toilet

Critical nighttime fall factors

Physical State During Night Hours

Medication effects, stiffness, and impaired coordination upon waking increase fall risk.

Environmental Challenges

Darkness alters familiar spaces, compromising depth perception and creating misleading shadows.

Cognitive Impact

Semi-conscious state impairs spatial processing and hazard recognition, causing delayed safety awareness.

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- Guirguis-Blake, J.M., Perdue, L.A., Coppola, E.L. and Bean, S.I. (2024). Interventions to Prevent Falls in Older Adults. JAMA, 332(1). doi:https://doi.org/10.1001/jama.2024.4166.
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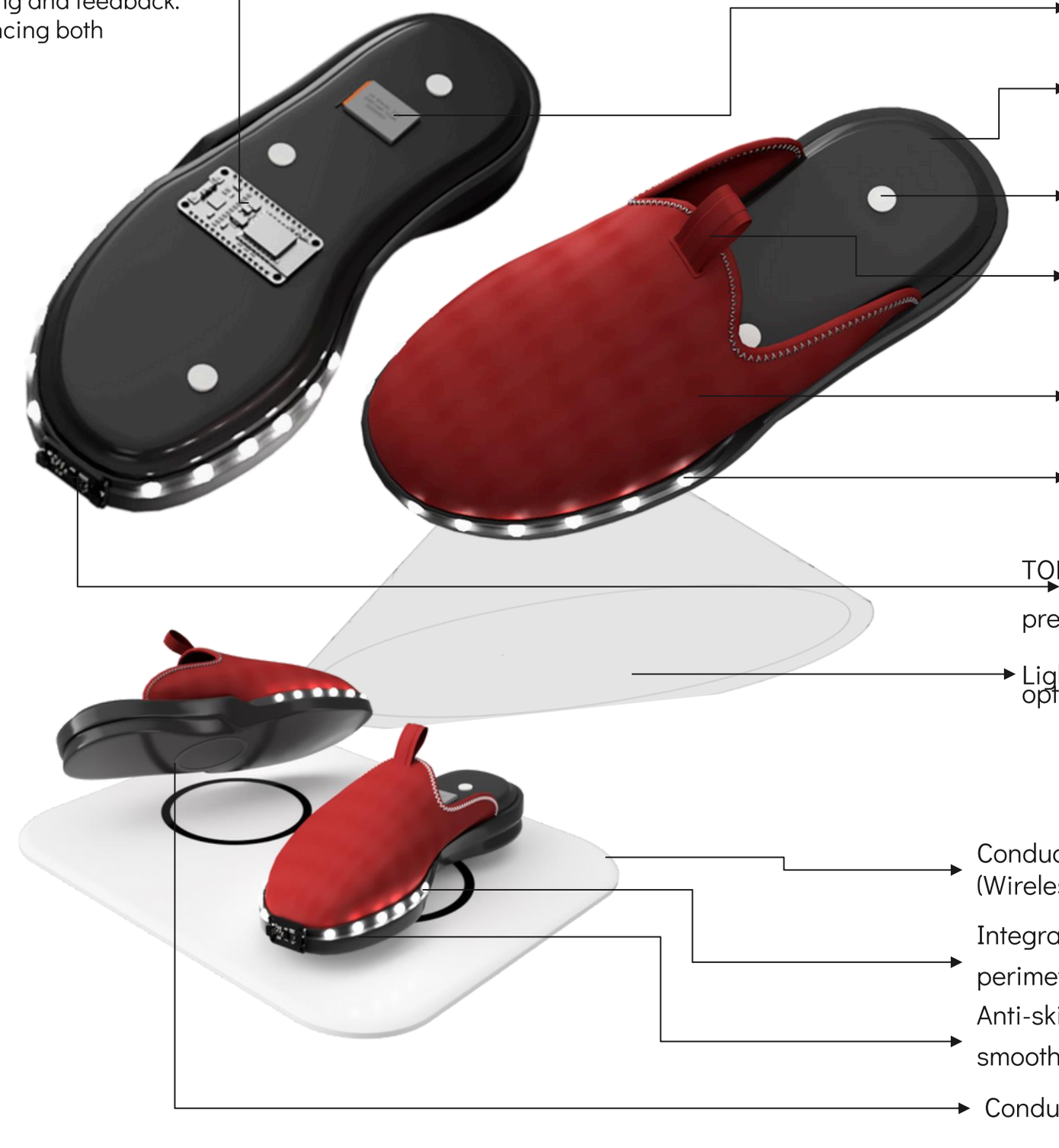
Product Breakdown

Moisture-wicking mesh upper with antimicrobial treatment, balancing breathability with structured night support.

High-grip rubber with smooth surface ensuring consistent traction across dry and wet surfaces

Dual-density EVA foam providing targeted cushioning and stability through strategic pressure mapping

Design Evolution:
The accompanying sketches demonstrate the iterative development process, showing how the final form emerged from extensive user testing and feedback. Each refinement focused on enhancing both functionality and user dignity.



ESP 32

Battery

EVA Memory Foam providing personalized comfort and pressure distribution

Pressure sensors strategically placed for balance monitoring

Ergonomic pull tab for easy donning/doffing

Breathable textile with structured support seaming for comfort and stability

Guiding LEDs

TOF (Time of Flight) sensor for precise obstacle detection

Light dispersion area designed for optimal pathway visibility

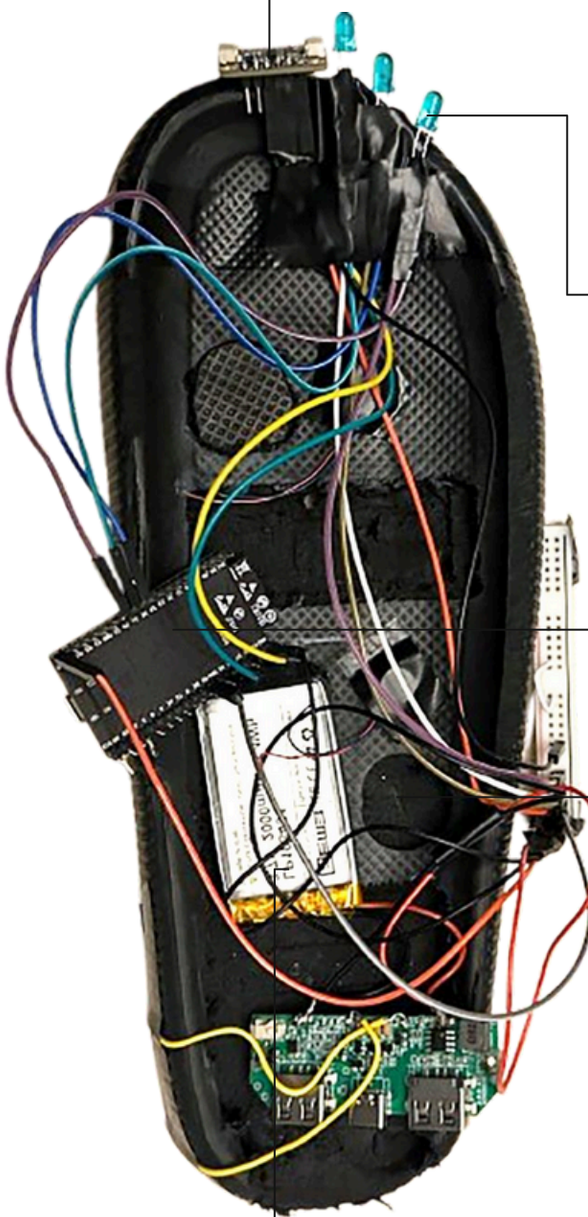
Conduction mat with coil (Wireless charging)

Integrated guiding LEDs along perimeter

Anti-skid Rubber base- smooth outsole for best grip

Conducting coil

Technology and Features



TOF (Time of Flight) Sensor

Forward-facing environmental scanner providing 20cm-30cm obstacle detection range, sampling 20 times per second with automatic calibration for varying light conditions.

Strategic LED Array

Three high-efficiency LEDs positioned along slipper perimeter providing adaptive pathway illumination (10-30% brightness) with color-shift hazard indication from white to amber to red.

ESP32 Controller

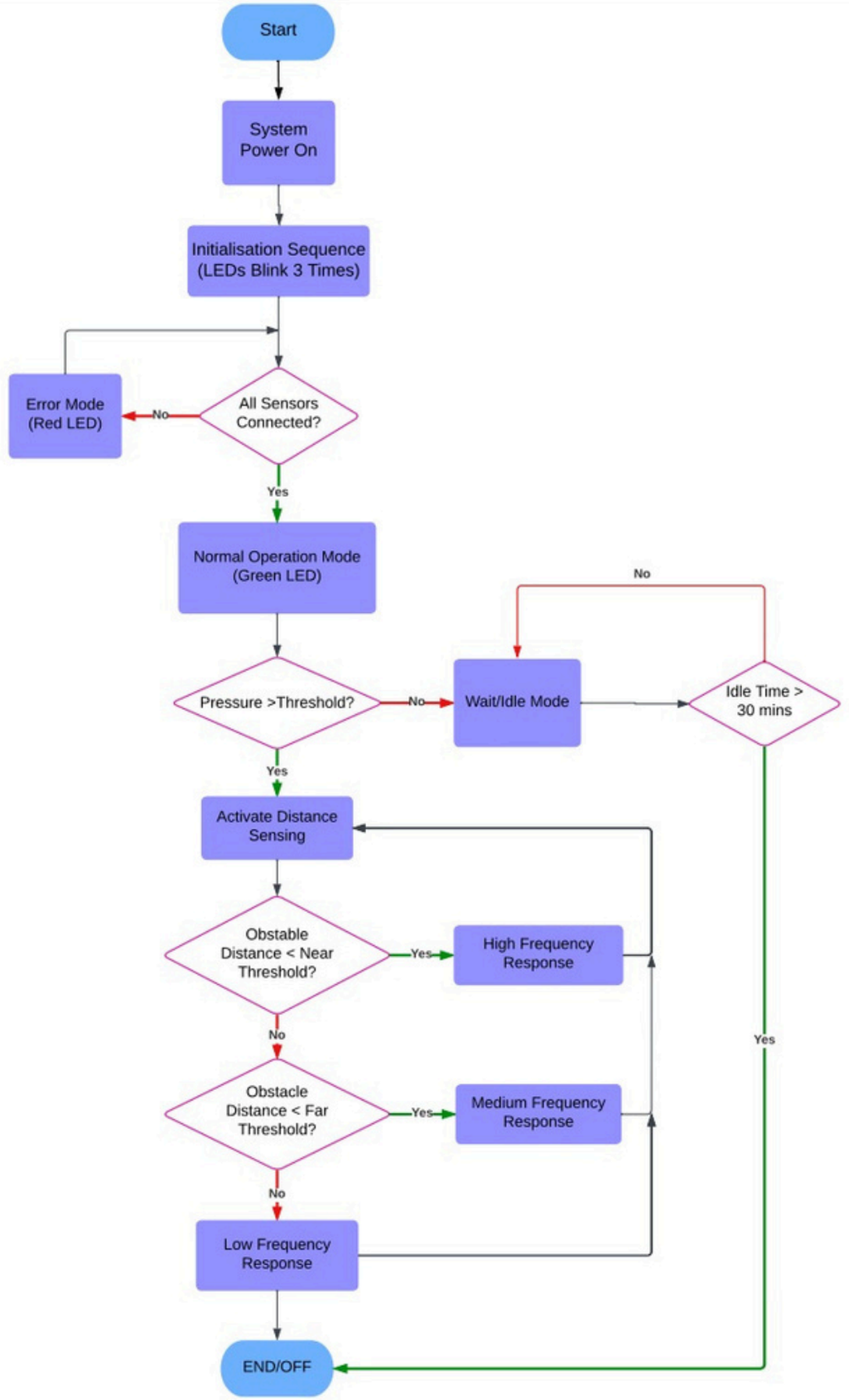
Central processing unit managing sensor fusion, power optimization, and real-time response, operating at 240MHz with deep-sleep capability of <0.1mA for extended battery life.

Precision Pressure Sensor

Located between the metatarsal and heel of the foot, detecting >2.5N pressure threshold, calibrated for immediate activation and balance monitoring with real-time weight distribution analysis.

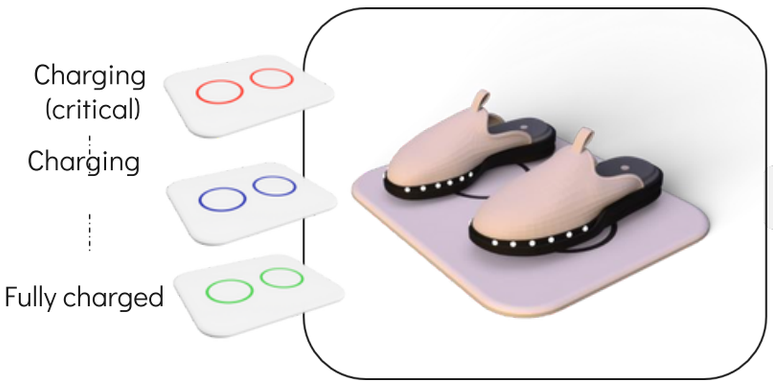
Power Management System

Rechargeable lithium battery delivering 12+ hours of active use, with wireless charging capability and intelligent power states transitioning between sleep (<0.1mA) and active (50mA) modes.



User Experience and Interface

Initial Setup (One time)



Placed beside bed frame, slippers charge wirelessly with LED rim indicating battery status. Magnetic alignment ensures optimal charging position. Sleep mode (<0.1mA) activates automatically when idle, with triple vibration alert at 5% battery

Waking Moment

Three-point pressure detection system activates upon sensing movement. System performs rapid environmental scan while gently illuminating floor area at 10% brightness, maintaining night vision adaptation. Temperature and humidity sensors establish baseline.

Initial Contact

Correct pressure detection (>2.5N) triggers gradual LED activation. Memory foam adapts to nighttime foot morphology while heel guide ensures proper alignment. Single soft vibration (0.5 seconds) confirms system engagement

Return Journey

Full monitoring maintains during return with familiar path lighting. Smart power management optimizes sensor activity based on movement patterns. Gentle vibration confirms proper charging position, system returns to sleep mode when stationary

Obstacle detection

Vibration intensity scales with obstacle proximity (20cm: gentle pulse, 10cm: stronger warning). LED transitions from white to amber to red based on hazard level. Side LEDs indicate obstacle direction, with distinct patterns for static obstacles versus wet surfaces.

Active Use

TOF sensor scans environment 20 times per second while three pressure points monitor balance. LED pathway illumination adjusts dynamically, increasing brightness with detected instability. Real-time surface condition monitoring adapts grip response.