

UroScan: Real-Time Urine Monitoring System

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Mission Statement: We are a capstone team collaborating with GSE Biomedical to develop a wireless urine monitoring device that streamlines clinical workflows and minimizes human error. With a background in biomedical sciences, hardware design, and data acquisition systems, our team is committed to advancing patient care through thoughtful and user-centered engineering.

Clinical Need

Nurses currently rely on manual observation and documentation of urine output, a workflow that requires frequent handling of the drainage tubing and bag. This process is slow, labor intensive, and exposes staff to unnecessary contact with bodily fluids. These inefficiencies delay timely recognition of output changes and add avoidable steps to an already overloaded clinical workflow. A streamlined, automated approach greatly reduces interaction with urine, shortens monitoring time, and provides cleaner, faster, and more reliable data for clinical decision making.

For catheterized patients, current practice requires frequent room entries and visual inspection of urine bags, disrupting rest and potentially increasing agitation. Each manipulation of the drainage tubing or bag can cause discomfort, unintentional catheter tugging, and unnecessary handling of the collection system factors that elevate infection risk and compromise patient experience.

Product Architecture

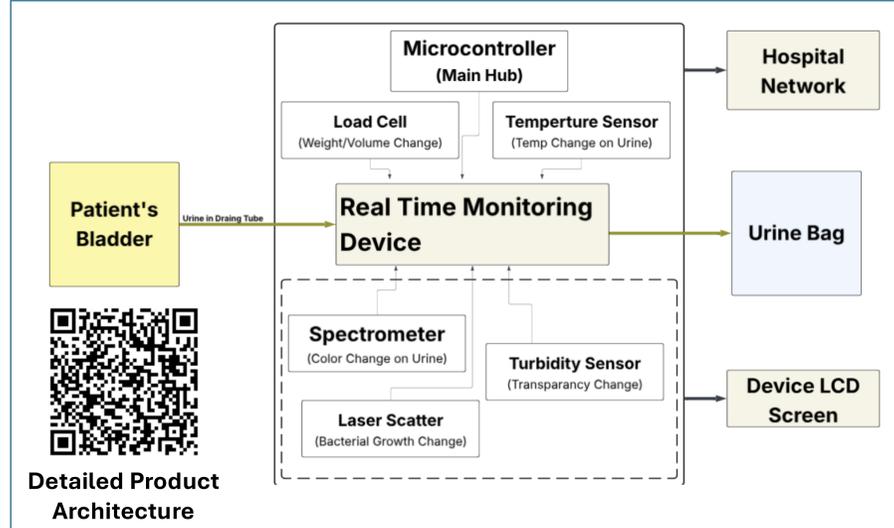
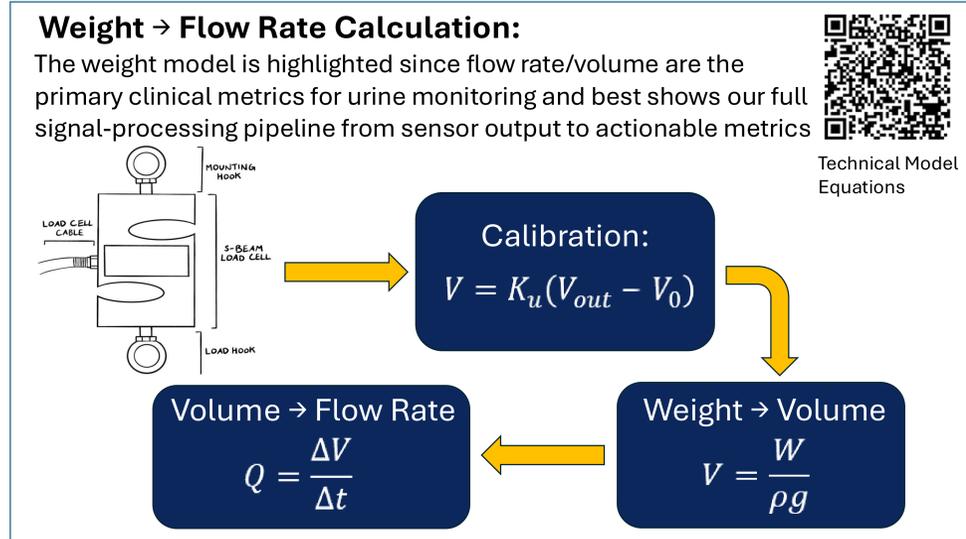
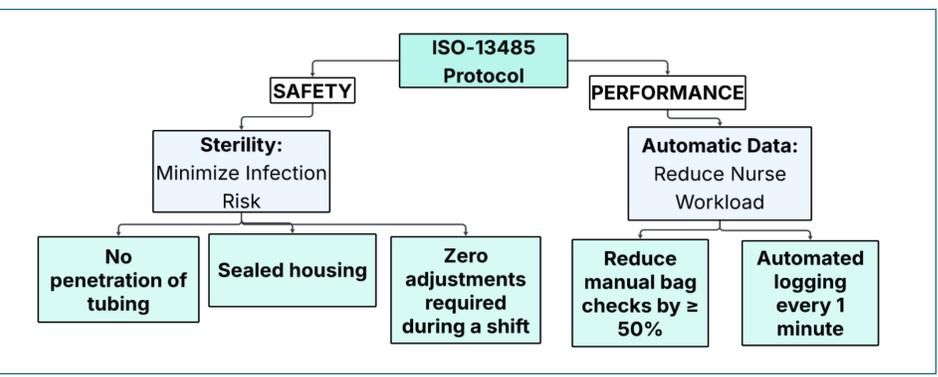


Diagram of the device architecture showing integrated optical, thermal, and weight-based subsystems for continuous urine monitoring. Optical sensors track color, turbidity, and spectral features, while the load cell measures volume and flow rate. Thermal sensing supports calibration stability. All data are processed by the onboard ESP32 and sent wirelessly to a clinical dashboard in real time.

Technical Model



Design Inputs



Design Manufacturing

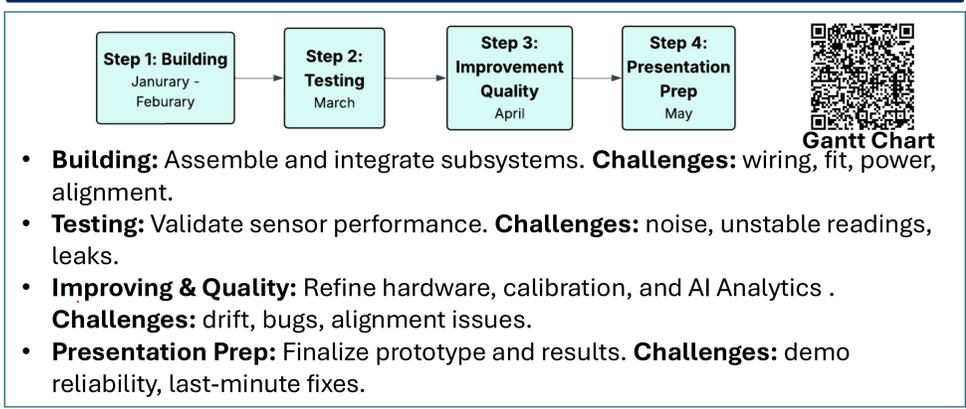
Component	Function	Importance	Est. Cost (USD)
Spectrometer (AS7343L)	Multi-spectral color / chemistry sensing	High	\$7-15
Turbidity Module (IR LED + Photodiode)	IR backscatter turbidity measurement	High	\$10-15
Nitrite / Laser Scatter Module (KY-008 + BPW34s)	Laser-based nitrite & particle detection	High	\$10-20
Temperature Sensor (NTC 102-AT2)	Activates sensing cycle + optical compensation	High	\$5-8
Weight Sensor (HX711 + Load Cell)	Bag weight → volume & flow rate	Critical	\$8-12
ESP32 Microcontroller	Data processing + wireless communication	Critical	\$8-12
Housing / Mounts (PC or PLA)	Aligns sensors + protects electronics	Moderate	\$8-15

Total Estimated Cost: ≈ \$65-75

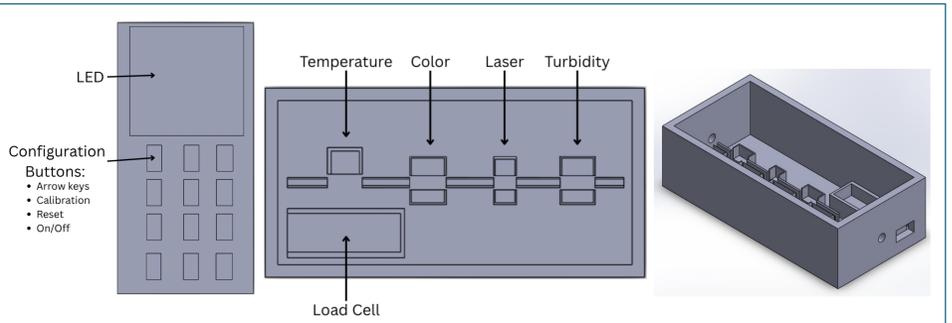
Final Product Specification

Critical Specifications: Continuous Monitoring Capability and Accurate Wireless Transmission.
Objective of the device is to lessen manual time required for recording medical data, these two criteria are the most prevalent when testing the product. The product must provide a real-time recording software but allow wireless transmission for lack of manual labor required.

Timeline & Future Work



Design Concept/Visualization



UroScan is a device that monitors urine output without touching the fluid. A lightweight clip-on module reads urine color, temperature, and turbidity through the drainage tube, while a non-contact weight cell measures volume and flow rate. All data is processed on a wireless hub and sent directly to a clinical dashboard. The live data will also be displayed on the LED display on the front panel. UroScan's device design reduces infection risk, eliminates manual bag checks, and works with any standard urine bag.

Acknowledgments and References

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References