Fluid Packs for Pediatrics Intravenous Fluids

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Project Goal: We aim to employ empathic engineering to give pediatric patients mobility and freedom from the constraints of their IV pole. Our product offers a compact and portable alternative to standard infusion systems while maintaining complete compatibility with current hospital IV infusion systems. With PEDS-PAK, pediatric patients can seamlessly transition between treatment and playtime, while enhancing their recovery.

Background

- Intravenous (IV) fluid delivery limits pediatric patients' mobility [1].
- Breaks in IV lines posel dangers to patients: tripping and infection [2].
- There are currently no wearable inpatient fluid infusion systems specifically designed for pediatric patients [3].
- **Solution**: Create a lightweight, wearable infusion system that maximizes pediatric patient mobility while receiving IV treatments.

Fig. 1. Pediatric patient walking with IV pole [4]

Project Design, Verification, and Validation Plans

Essential Features:

- Maximum **comfort**
  - Compact
  - Lightweight with equal distribution
- **Safety** features
  - Bubble detection
  - Flow rate guardrails
  - Alarm system
  - Quick chest access
- 6+ hours of **battery life**

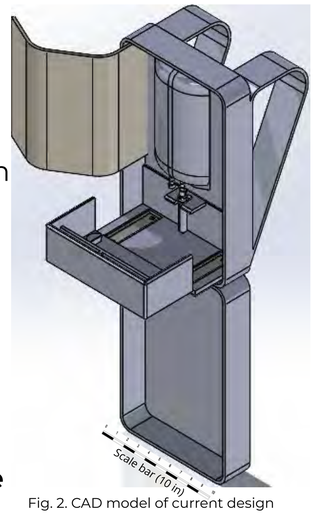


Fig. 2. CAD model of current design

- Clinicians, nurses, and parents **ease of use**
  - Hospital PC Unit system integration
  - Excess IV line storage
  - Data collection

Design Verification and Validation:

- Verification and validation of **IV circuit** in SolidWorks:
  - Verify critical diameter for IV line to prevent kinking
  - Fatigue/failure testing for drip chamber, IV bag support, and circuit housing slots
- Verification and validation of **flow controller** software:
  - Validate flow rate readouts and outputs
  - Test alarms function when IV line kinks, bubbles form, or flow is otherwise disrupted/inaccurate
- Verification and validation of **design intuitivity**:
  - Unassisted setup trials with pediatric nurses

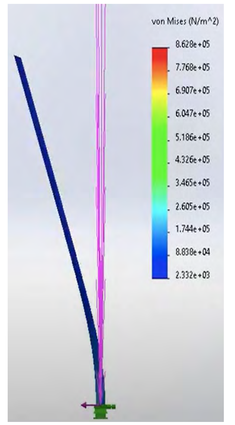
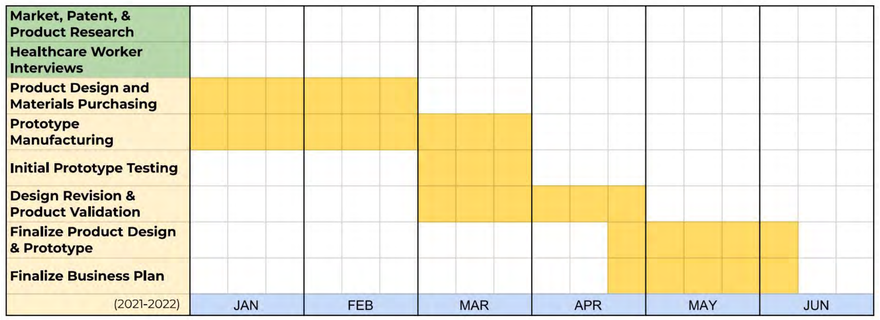


Fig. 3. Static stress testing of PVC IV tubing

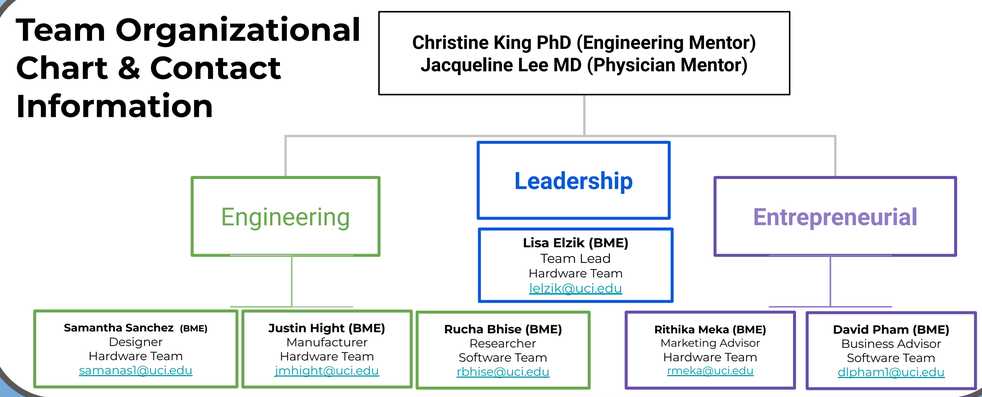
Corresponding Standards:

- **ISO 10993 (Biocompatibility)**: Sterile line with no breaks
- **ISO 14971 (Risk Management of Medical Devices)**: Safety features like bubble detection, flow rate guardrails, functional alarms
- **EC 60601 (Medical Electronic Safety)**: Minimal current/voltage in electronic components
- **ASTM F04.15 (Material Test Methods)**: Fatigue, materials, and software/alarm testing

Timeline



Team Organizational Chart & Contact Information



References

[1] Cochran, E. B., Phelps, S. J., & Helms, R. A. (1988). Parenteral nutrition in pediatric patients. *Clinical pharmacy*, 7(5), 351–366.

[2] Ray-Barruel, G., Xu, H., Marsh, N., Cooke, M., & Rickard, C. M. (2019). Effectiveness of insertion and maintenance bundles in preventing peripheral intravenous catheter-related complications and bloodstream infection in hospital patients. *Infection, disease & health*, 24(3), 152–168.

[3] Intravenous Infusion Pumps Market Share Report, 2021-2028. (n.d.). Retrieved from http://www.grandviewresearch.com/industry-analysis/intravenous-infusion-pump-market

[4] Home. (2017, October 4). ACCO. https://www.acco.org/