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Client:

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Abstract

Angiography is a medical imaging technique used to view blood vessels, specific organs, or tissues. Multiple liquids are used during angiography such as contrast agent and saline. A contrast agent is a substance injected to make blood vessels visible during imaging. Saline is used to prevent clots in the system and to remove any unwanted substances in the tubing. A manifold is the device that delivers these liquids into the patient. Currently, the manifold setup is cumbersome to use and the detection of air bubbles is difficult, increasing risk to the patient. A redesigned manifold and stand were developed to solve these issues. Results from several tests concluded that the prototype manifold is more efficient than the current manifold, can deliver precise amounts of fluid and withstand a pressures reaching 300 mm Hg. Further testing showed that the addition of an LED light effectively aids in monitoring saline flow. Following testing, the team determined what work needs to be completed in the future to improve the devices and run clinical trials.

Problem Definition

Motivation

- Angiography - commonly used procedure
- X-ray imaging
- Contrast injections via syringes, power injectors, or manifolds

Current Designs

- Manifold
- Medrad Avanta Fluid Management Injection System
- Saline Bags

Manifold



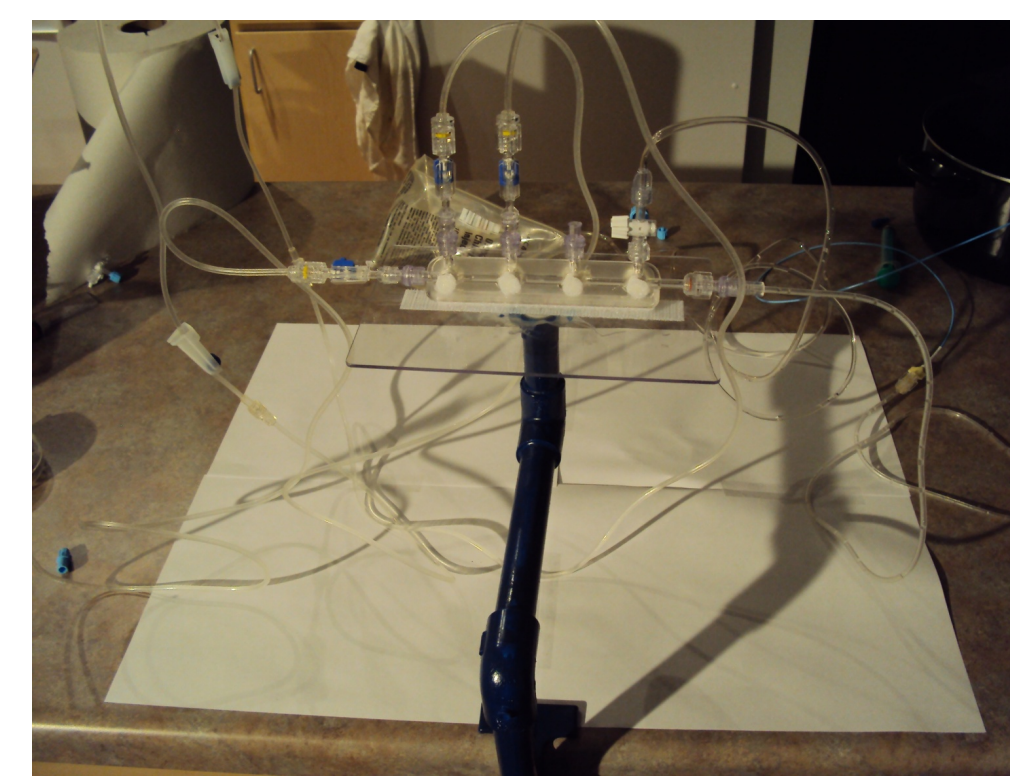
Problem Statement

- Inefficient work space
- Lengthy procedures
- Air bubble threat and blood contamination
- Constant need for saline
- Difficult to monitor reservoir levels

Design Criteria

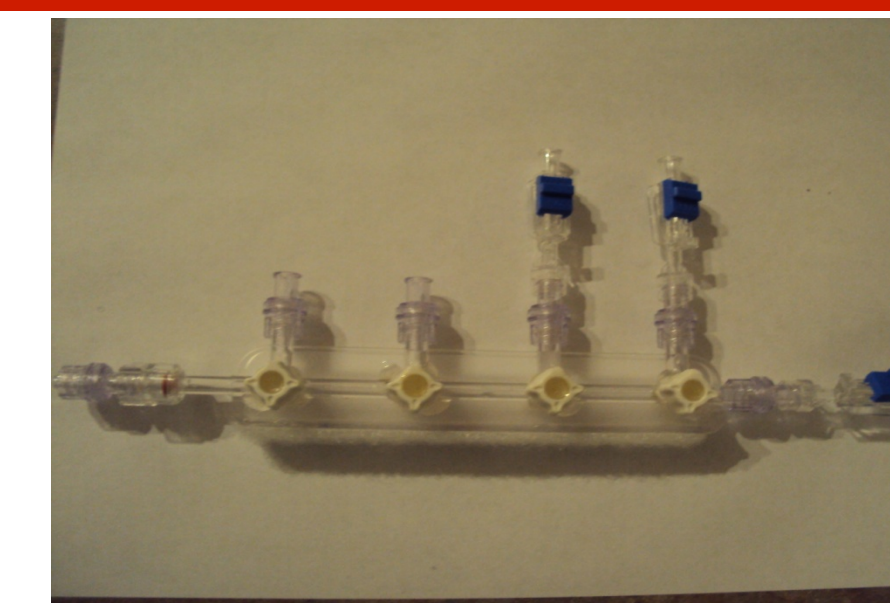
- Manifold
 - Improve procedure efficiency
 - Hand and power injector compatibility
 - Improve air bubble and blood detection
 - Disposable
- Stand
 - Should not obstruct manifold use
 - Maintain manifold visibility
 - Easy positioning
- Saline Detection Device
 - Simple to use
 - Indicate when bag is empty

Final Design

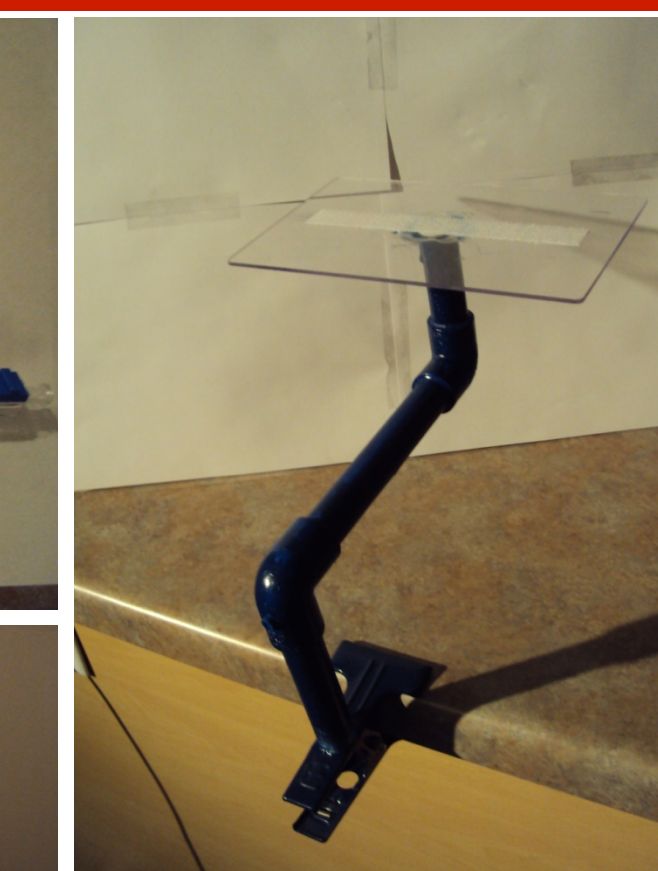


Assembled Manifold and Stand

- Manifold:
 - Modified manifold
 - Flow switches
 - One way valves
 - Velcro backing
- Manifold Stand:
 - Table clamp
 - PVC piping arm
 - Plexiglass platform
 - Velcro Patch
- LED Lights:
 - Attach to saline bag carousel
 - Positioned to illuminate saline spikes



Manifold



Manifold Stand



LED Light

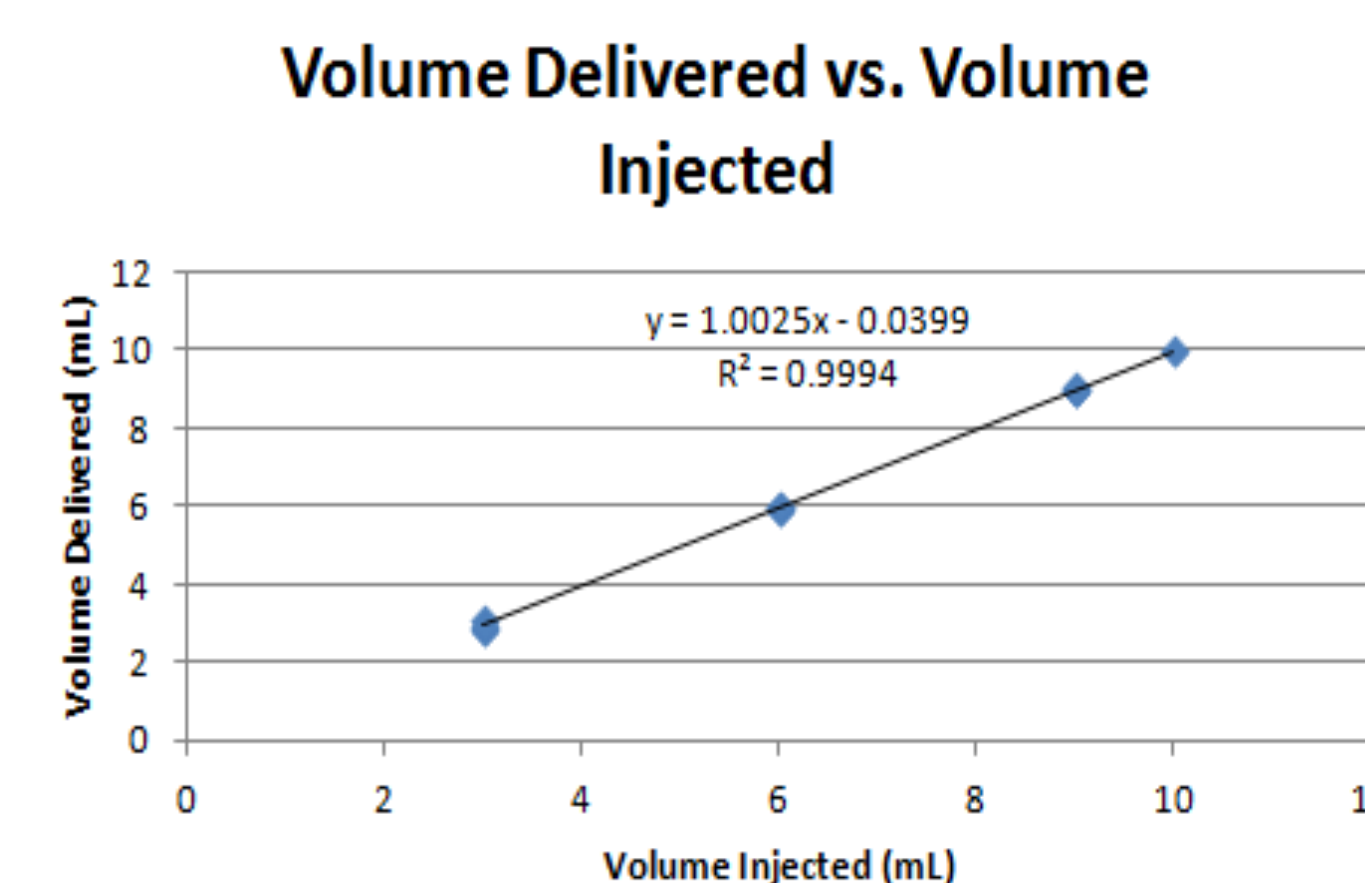
Testing and Calibration

Manifold Testing

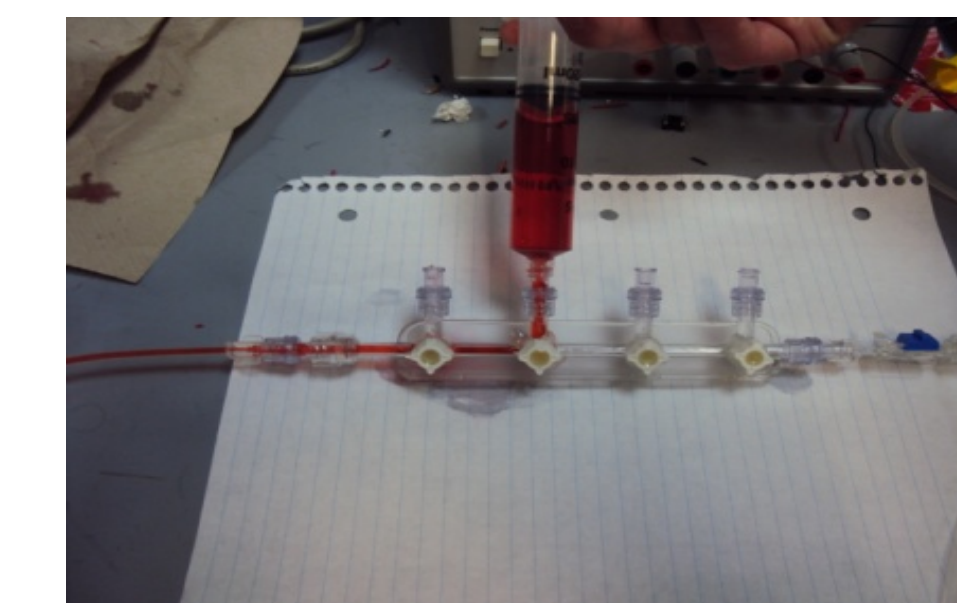
Blood Influx/Fluid Stoppage

Pressure (mmHg)	Valve Leakage?	Flow Switch Leakage?
40	No	No
80	No	No
120	No	No
160	No	No
200	No	No
240	No	No
280	No	No
300	No	No

Fluid Delivery



Fluid Flow



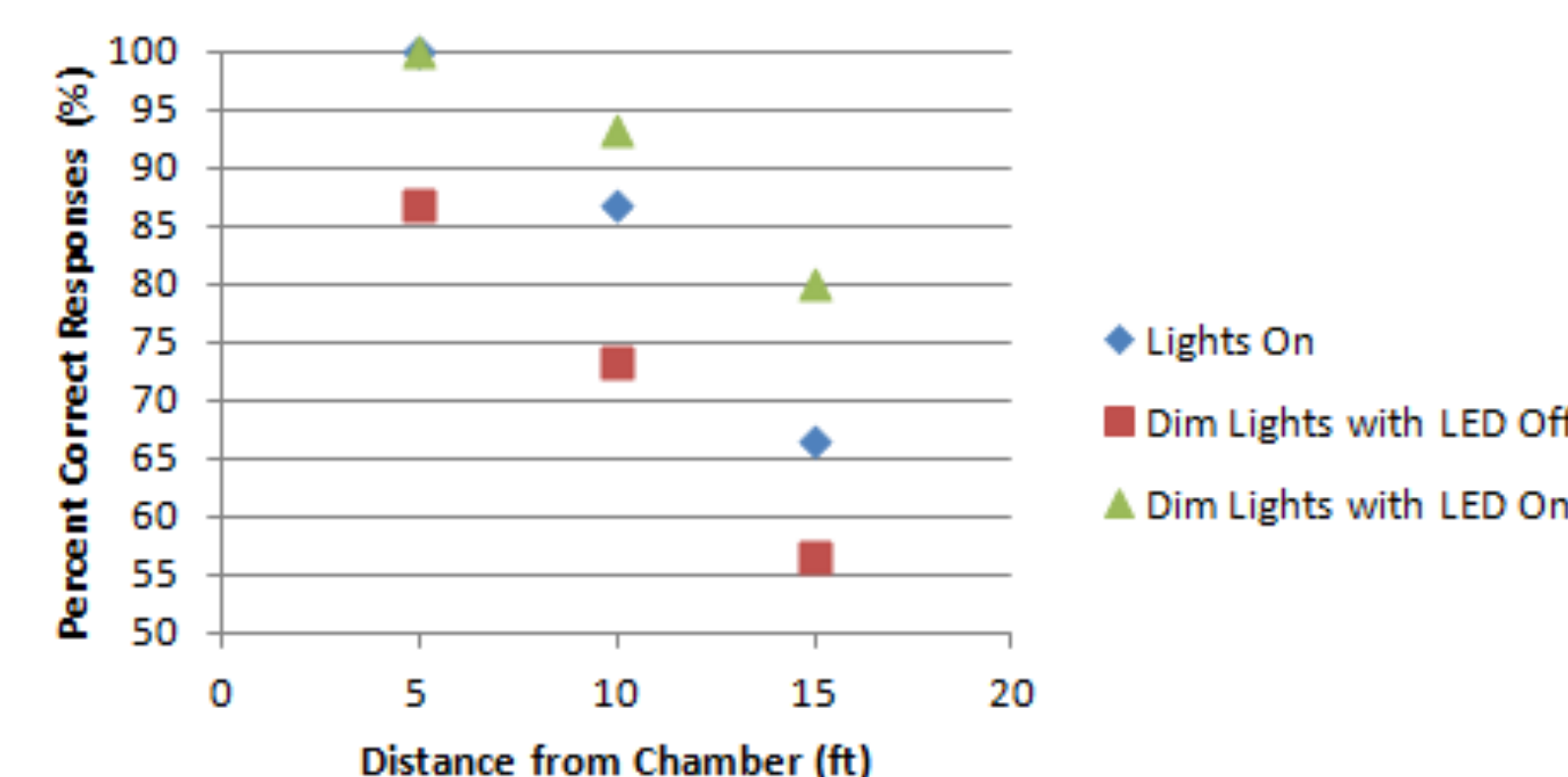
Fluid flow with saline flush off



Fluid flow with saline flush on

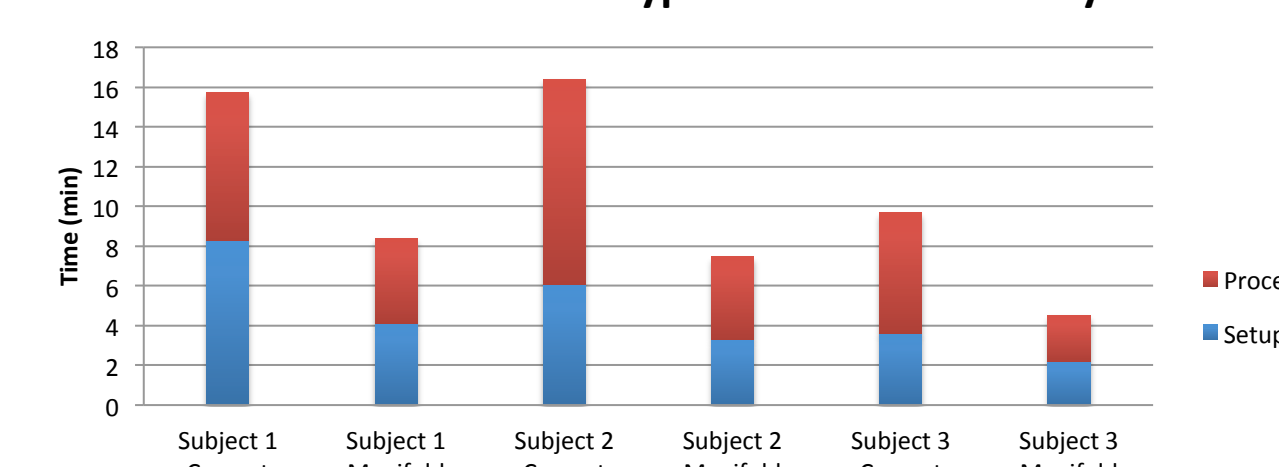
LED Spike Illumination

Saline Spike Chamber Visualization

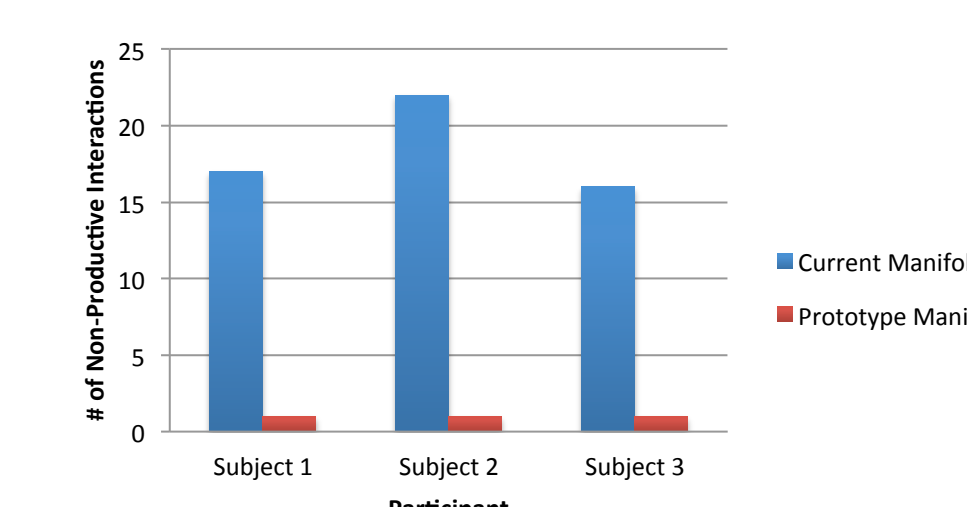


Efficiency Testing

Current vs. Prototype Manifold Efficiency



Current vs. Prototype Manifold Non-Productive Interactions



Parts List

- Manifold.....\$8.00
- One-Way Luer Check Valves.....\$6.75
- Flow Switches.....\$9.75
- Velcro.....\$5.99
- PVC Piping.....\$1.12
- PVC Joints.....\$0.56
- Plexiglass.....\$3.99
- Table Clamp.....\$8.99
- Epoxy Plastics Glue.....\$3.97
- LED Light.....\$10.99
- Total Cost.....\$60.11

Future Work

- Manifold
 - Replace current manifold with simple 5-port connection piece
 - Female to male connector for waste port
 - More flow switches
- Stand
 - Make device easily sterilized
 - Implement table angle variation mechanism
 - Improve mechanism of securing the manifold
 - Include swiveling for improved mobility
- LED Light
 - Reduce glare on spike
 - Softer light
 - Different colors for each reservoir
- Saline Bag Arrangement
 - Straight bar eliminating carousel
- Air Embolism Prevention
 - Prevent air from entering catheter

References

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