Measuring Fluid Temperature Inside of a Syringe

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Introduction

Computerized tomography (CT) scans are a widely used imaging technique used for

- Diagnosis, monitoring, preemptively detect dangerous conditions
- The procedure involves the injection of up to 200 ml of contrast media that allows better visualization of structures within the body.

Temperature is important because it has an effect on the viscosity of the fluid.

- If the fluid is too hot or too cold, then it can lead to complications stemming from patient discomfort, or pressure levels.
- The sensor we developed resolves these issues by giving accurate real time temperature readings that ensures the safety of the patient.

Methods

- Initial experiments were performed to determine the optimal thickness of the insulating material.
- Experiments were performed to obtain an equation relating the temperature of the fluid in the syringe to the temperature of the surface of the syringe.

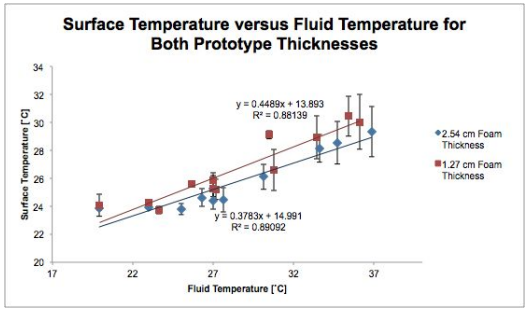

Figure 1: Comparison of the effectiveness of insulating materials of different thickness. High density, rigid polyurethane foam was used as the insulating material.

Results

1. **The temperature sensor contains an insulative casing that limits the effects of heat transfer from ambient conditions.**

In figures 2 and 3 below, the prototype design of the sensor is made using high density foam for insulation and styrene plastic to hold the sensor in place.

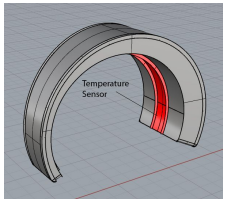

Figure 2: CAD model of the temperature sensor

Figure 3: Final design of the prototype attached to the syringe

2. There is a linear relationship between the temperature of the surface of the syringe and the temperature of the fluid.

In Figure 4 below, the prototype design is used to determine a linear relationship with a slope of 0.731 and an intercept of 6.1782.

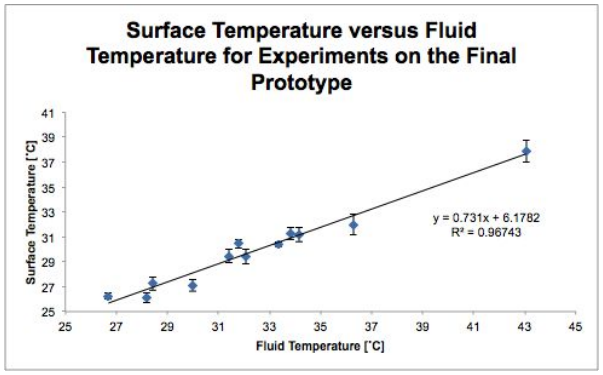

Figure 4: Comparison of fluid temperature versus surface temperature detected by a thin low mass temperature sensor.

Figure 5: Medrad Stellant injector system

Conclusion

We were able to design a sensor that helps improve patient safety and accountability. Our system is an improvement over the previous iteration that combined a heating element with a sensor. The improvements include the following:

- More accurate
- More responsive
- Allows for real time altering of the heating element
- Accounts for the difference between fluid and surface temperature

Future Work

- Combine the temperature sensor and existing heat maintainer technology into one attachment.
- Integrate calibration equation into existing monitors.
- Find more low-cost alternatives.

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