Design Matrix Criteria

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	Design A*	**Design B***	**Design C***
Brief Description	**Prof. Webster's Design**	**Balloon Modification**	**Diaphragm Modification**
Dead Space Variability (15)	(3/5) 9 (or 15, testing required)	(5/5) 15	(4/5) 12
Ease of Fabrication (15)	(5/5) 15	(2/5) 6	(3/5) 9
Safety (10)	(5/5) 10	(5/5) 10	(5/5) 10
Weight (10)	(5/5) 10	(4/5) 8	(5/5) 10
Power Consumption (5)	(4/5) 4	(5/5) 5	(3/5) 3
Durability (15)	(5/5) 15	(3/5) 9	(3/5) 9
Comfort (15)	(5/5) 15	(5/5) 15	(5/5) 15
Cost (15)	(5/5) 15	(2/5) 6	(3/5) 9
Total Value	**93**	**71**	**77**

*All designs can be found at the bottom of the document.

Justification:

Dead Space Variability: One of the most important criteria for our design, this rates the ability of a device to have the fullest range of variation in dead space, ranging from the fixed dead space of the mask and central tube at minimum, to as close to the full volume of the container (1 liter) as possible. The balloon-based design guarantees the optimal range of volume. The diaphragm-based design has the potential to span the full range of volume, however, it may be difficult to implement it to occupy the maximal volume. The design team has doubts about whether or not the original design, using the blood pressure cuff, would have the proper elasticity required to fully occupy the entire volume of the container at full inflation, and it also would likely occupy the largest volume at minimal inflation, which is less important. These doubts will be the topic of a future group meeting to undertake testing of the blood pressure cuffs inflation.

Ease of Fabrication: In this criterion, Prof. Webster's design is far better than the others. Among the three designs the coding for the hotwire sensor and the manufacturing of the outer regions of the device will be fairly constant. However, the three designs differ when we look at them closer. While the balloon design would require three compartments to be made inside and three separate motors to be intricately hooked up to these balloons, and while the diaphragm design would require careful gluing of the diaphragm and a positive pressure valve, Prof. Webster's design would only require us to insert and secure the bladder from a sphygmomanometer.

Safety: All three of these designs will be fairly safe. They are very simple to use, and the coding (which is where we will deal with any potential safety issues) required for them to work properly will be constant among them, making safety a non-factor.

Weight: A lighter design works best for our client. Prof. Webster's design and the diaphragm modification are very lightweight. Aside from the mask, tubing, and container, the designs only differ by the mechanism used to vary deadspace. Both mechanisms - the bladder and the diaphragm - are not extremely heavy and the differences in weight are negligible. For this reason, these two designs received the same marks that also turned out to be the highest marks. The balloon modification, on the other hand, scored lowest because it requires three motors in its design instead of just one. The additional weight, although not an extreme negative, is the reason this design scored lower.

Power Consumption: Here, the balloon design would be the best as the smaller balloons would be more efficient and require less energy than both the bulky bladder of Prof. Webster's design and the diaphragm of that design.

Durability: The blood pressure cuff device is designed for repeated stress cycles, and due to the low elasticity of the cuff, it likely would hold up to wear well. In contrast, the balloon and diaphragm based designs feature highly ductile rubber undergoing frequent stress cycles with large degrees of strain at their maximal inflation/deflation. This would likely result in these rubber pieces being much more likely to fail prematurely, compared to the blood pressure cuff design.

Comfort: All of these design alternatives will be equally comfortable because they are all going to be built around some kind of 1.00L plastic bottle.

Cost: Prof. Webster's design would be the best in this criterion too. Since the other two designs are more intricate, they would necessarily cost more, as we would have to buy each individual part separately.

Overall: Based on our design matrix as well as our client's preferences, Professor Webster's original design seems that it would be the most effective at fulfilling all of the necessities and

many of the luxuries that we would like to fulfill. That said, there are some aspects of the other designs that we may consider for our final design, such as a pressure release valve to combat the change in volume in our product.

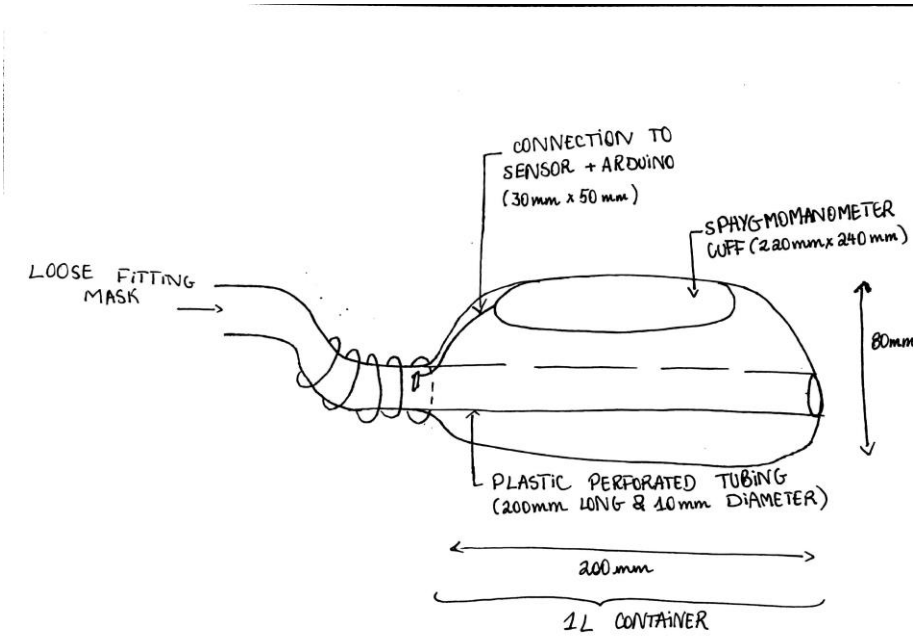

Figure 1 - Prof. Webster's Design

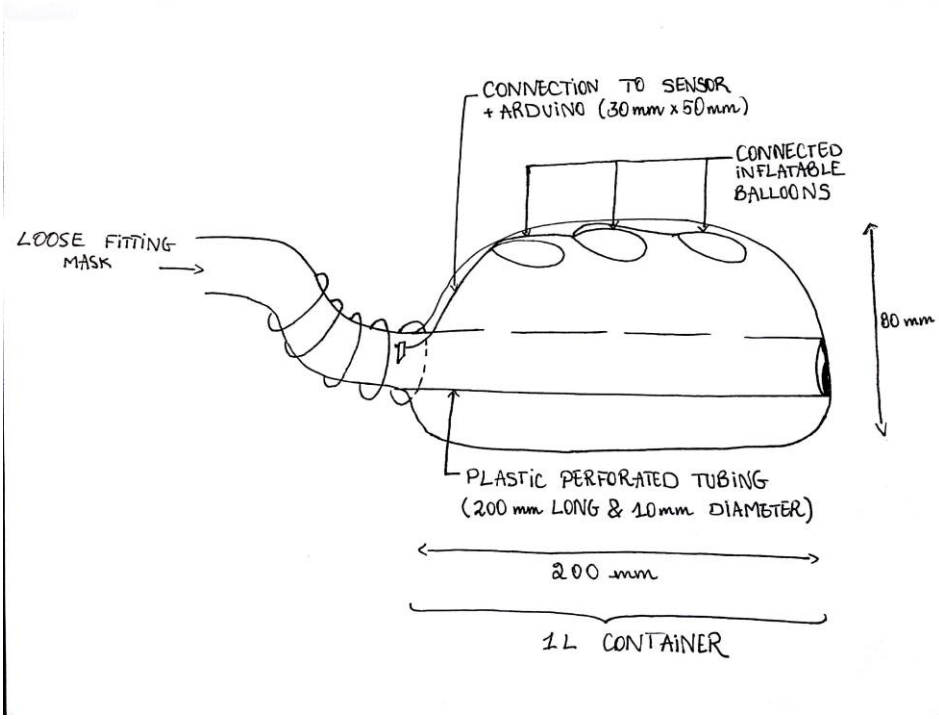

Figure 2 - Balloon Modification Design

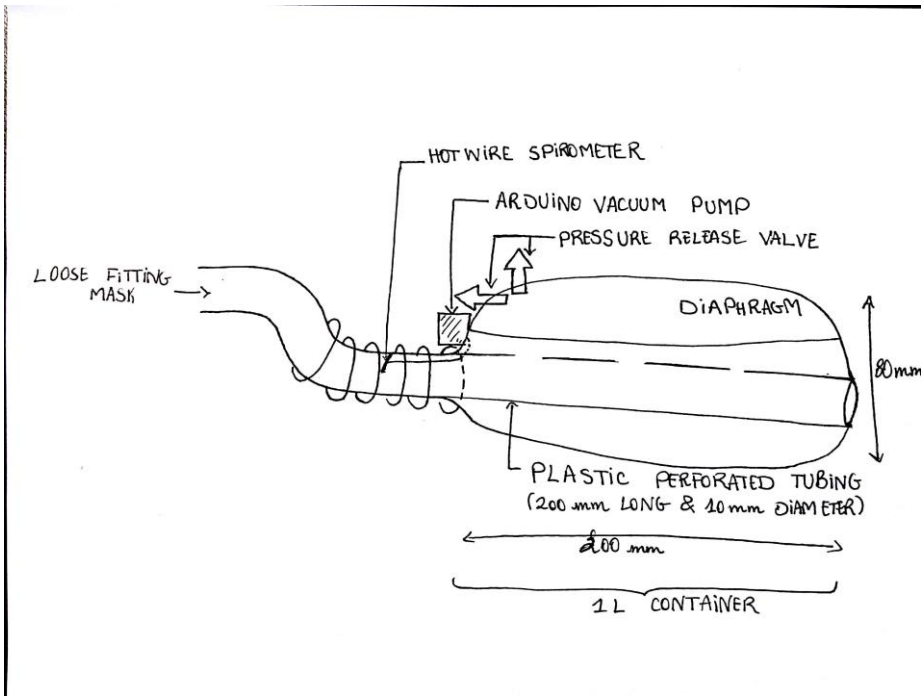

Figure 3 - Diaphragm Design