

AFFORDABLE INSULIN PUMP

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Background

Individuals with Type I diabetes need to maintain their blood sugar at a consistent level to maintain a healthy lifestyle. One of the ways they do that is with an insulin pump. However, most insulin pumps on the market are expensive. Even with health insurance, it can cost several hundreds of dollars to purchase an insulin pump. Our aim is to reduce the cost of an insulin pump by developing an assembly kit that can be customized by the user. The benefit is that any part that breaks can easily be replaced, without the cost of replacing the entire pump.

Objective

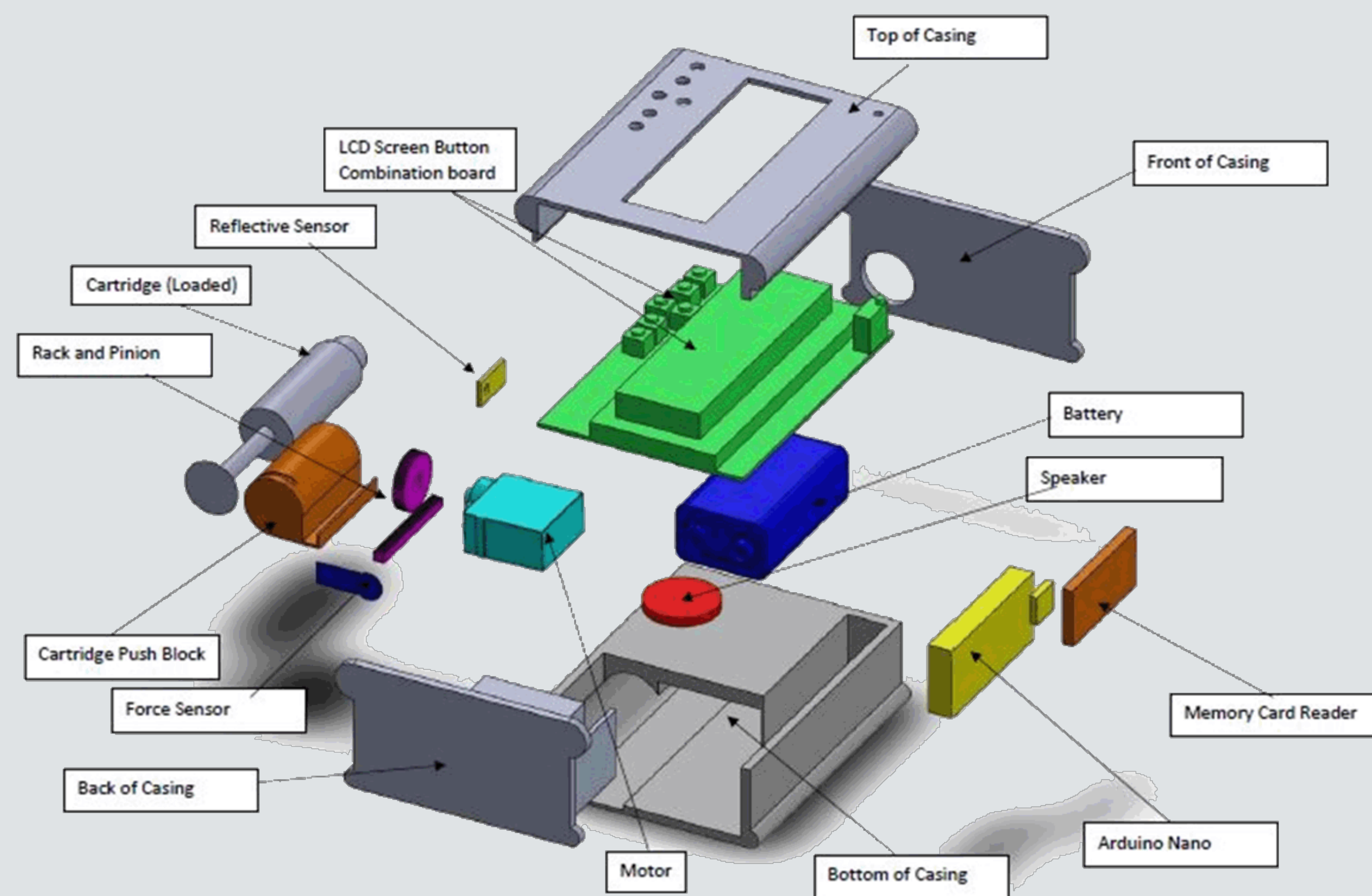
- Construct a model for less than \$500
- Deliver the insulin within a margin of error of 1 unit of insulin
- Design an intuitive user interface for controllability
- Design a customizable system for user satisfaction

Specifications

Metric	Units	Ideal Value	Margin	Actual
Safely and Accurately Deliver Medical Fluid	Units	± .5	± 1	± 0.87
Accuracy of Force Sensor	Grams	± 2	± 5	± 2.54
Reflective Sensor Able to Compute Error	Yes/No	Yes	-	Yes
Accuracy of Motor	Degree	± 1	± 5	± 1
Length of Battery Life	Hours	24	>6	6.2
Design Creates a Feeling of Control and Confidence	-	8<x>10	>6	8
Easy to Travel with and Non Obtrusive to Everyday Life	mm^3	185,000	<230,000	226,302
Price of Assembly Kit	\$	\$400	<\$550	\$250

Design Features

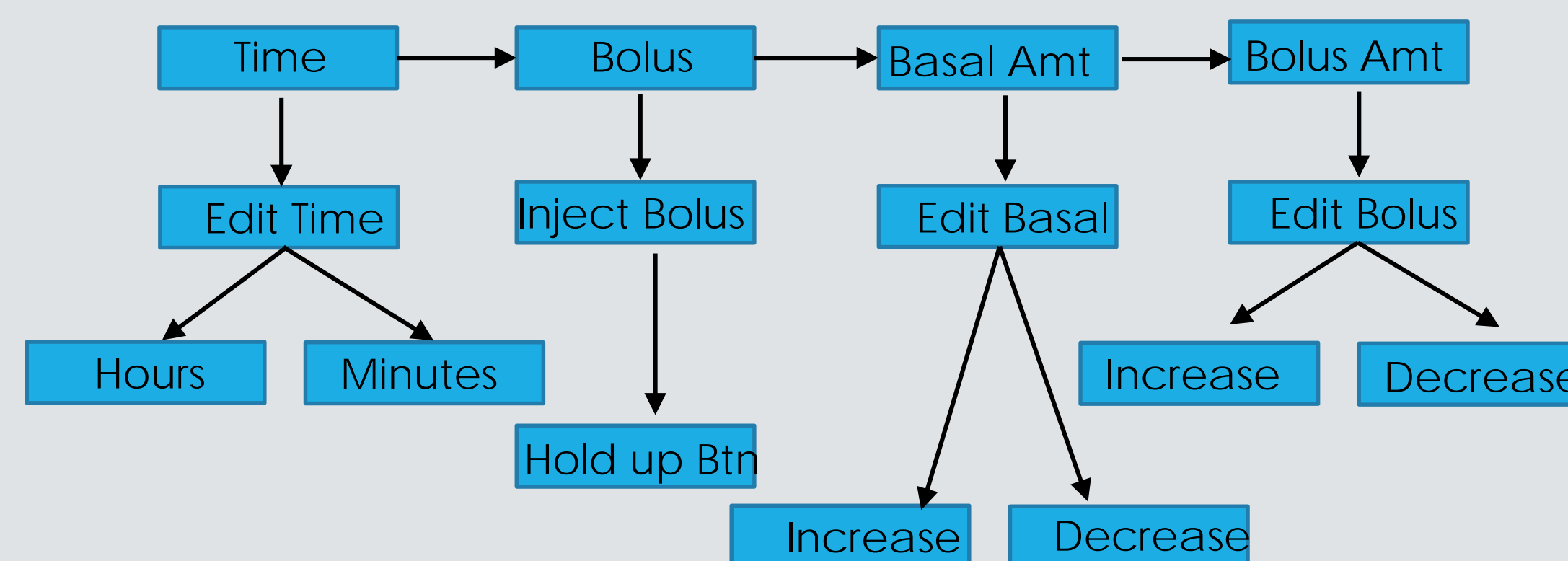
- Customizable parts and case
- Programmable features
- Replace parts if they break
- Interactive and intuitive LCD screen and button control
- Sensors for accuracy/error



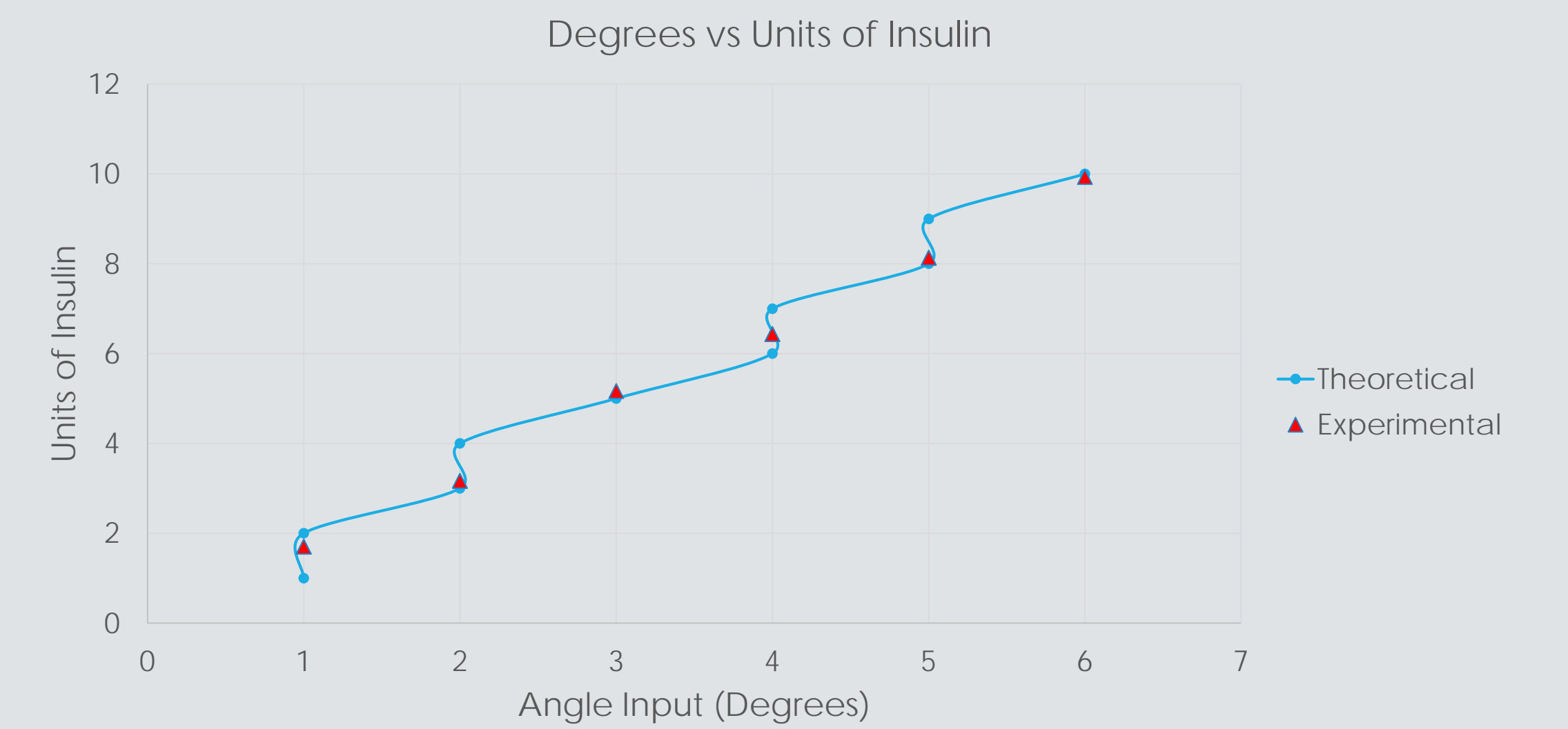
Casing Design and Components



Interface Flow Chart



Testing Resulting



Motor Accuracy

Theo Angle	Test 1		Test 2		Test 3		Avg. Error	Std. Dev
	Angle	Error	Angle	Error	Angle	Error		
20	21	5%	20	0%	21	5%	3%	0.47
60	60	0%	58	3%	59	2%	2%	0.82
100	99	1%	101	1%	99	1%	1%	0.94
140	140	0%	141	1%	140	0%	0%	0.47
180	177	2%	178	1%	178	1%	1%	0.47
Avg.							1.4%	0.61

Future Improvement

- Improve battery life
- Make customized microcontroller
 - Use less battery life
 - Exactly what we need and nothing extra
- Reduce size
- Customizable silicone cover
 - Water proofing
 - Reduce damage if dropped

Conclusion

The Affordable Insulin Pump does safely and accurately deliver insulin to the customer to control their blood sugar. The Affordable Insulin Pump would only cost the customer \$250, meeting the specification for affordability. However, the casing was too large and the battery dies too quickly. By customizing the LCD screen and microcontroller, the size would be reduced and would allow a smaller battery.