HYDRATION MONITORING SYSTEM: HYDROSTAT

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INTRODUCTION

Hospital staff face challenges in assessing dehydration, which can lead to negative effects on physical and cognitive performance. Current methods and their associated cons to assess for dehydration include the following:

- Urine tests; *unconventional*
- Blood samples; *invasive*
- Manual skin pinch; *inaccurate*
- Novel devices; *costly*

Figure 1: Skin Punch Test

Current methods lack a simple, effective, and accurate method to measure hydration. A method to evaluate hydration is by assessment of skin elasticity, which is the basis of commonly used manual skin turgor tests. Inspired by this technique, our proposed device, **The Hydrostat,** implements a negative pressure force to cause an elastic deformation of the skin.

CUSTOMER STATEMENT

The purpose of the Hydrostat is to eliminate the human error associated with the skin pinch test. The Hydrostat provides a quick, inexpensive, and non-invasive method to monitor hydration in patients.

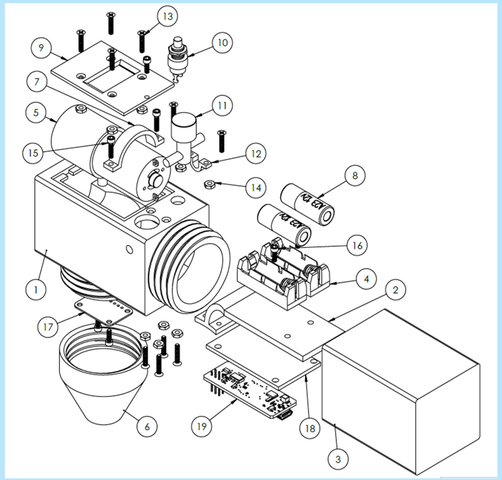
FUNCTIONAL SPECIFICATIONS

CUSTOMER REQUIREMENTS	FUCNTIONAL REQUIREMENTS
Portable	6 x 3 x 2 in
Non-invasive	Yes/No
Affordable	Cost < $500
Light	Weight < 5 oz
Results	< 30 sec.
User Friendly	< 3 steps

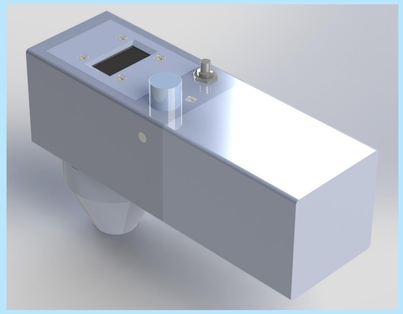
Table 1: Customer requirements and functional specifications

FINAL PRODUCT

a)



b)



ITEM NO.	PART NUMBER	DRAWING NUMBER	QTY.
1	CENTRAL BODY	C-2, C-2.1, & C-2.2	1
2	ELECTRICAL MOUNT	C-3	1
3	END CAP	C-4	1
4	BATTERY HOLDER	T-5	2
5	AIR PUMP	T-1	1
6	CHAMBER NOZZLE	C-1	1
7	PUMP CLAMP	C-6	1
8	A23 12V BATTERY	T-6	2
9	COVER PLATE	C-5	1
10	SWITCH BUTTON	T-8	1
11	PUSH STOP VALVE	T-	1
12	PUSH STOP VALVE CLAMP	C-7	1
17	VL6180 LIDAR SENSOR	T-2	1
19	ARDUINO NANO	T-3	1

Figure 2: Image of (a) exploded view of device, (b) Rendered view of the device.

TRACEABILITY MATRIX

	Quick Result Output	Lightweight	Portable	Simple software interphase	No pre-requirements for patients	Durable	< 3 steps for operator	lift and release skin	Patient Friendly	Repeatable Uses
Pump Performance					X	X	X	X	X	X
Assembly Performance		X	X			X		X	X	
Pressure Effect on Skin								X	X	X
Sensor Sensitivity Test	X	X		X			X	X		X
Endurance Test						X		X		X
Software Test				X	X		X			X
Survey of Nurses	X	X	X	X	X	X	X	X	X	X
Survey of Patients	X		X		X			X	X	X

Table 2: Traceability matrix allows us to determine the proper testing needed to ensure that the customer requirements are satisfied.

TESTING RESULTS

TR-04: Endurance Test

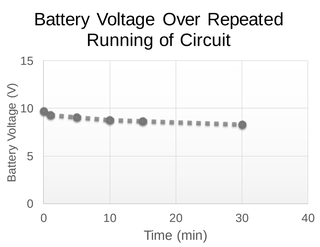


Figure 3: Endurance Test Results, battery life

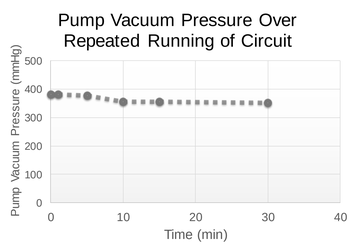


Figure 4: Endurance Test Results, changes in vacuum pressure over time

TR-01: Pump Performance Test

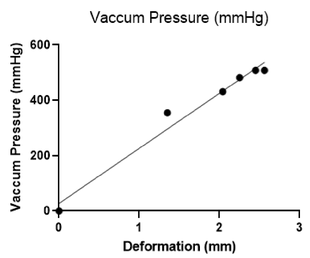


Figure 5: Pump Performance Test Results

PERSONNEL AND REPORTING

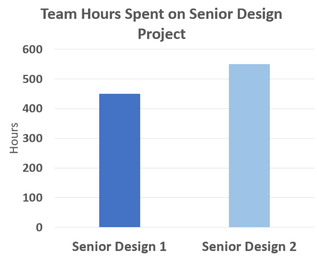


Figure 6: Hours Spent by M.I.Z.A. Tech Team on Hydrostat

MANUFACTURING COSTS

Total Prototype Cost: $150.00

CLAIMS

- Application of controlled, non-invasive suction to epidermal skin layer will elevate the skin.
- Resulting skin relaxation rate recorded by the LiDAR sensor will inform patient hydration.
- The Hydrostat can thus be used to accurately, rapidly and noninvasively assess patient hydration.

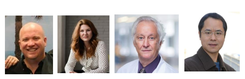
CONCLUSIONS

- Daily, 75% of Americans are dehydrated and 45% of all admitted patients develop dehydration, not including the already half a million admitted annually for dehydration.
- The goal is to quantify the widely known skin turgor test as a method to routinely assess patient's hydration status.
- The Hydrostat provides medical staff the ability to measure hydration in a simple point-of-care diagnostic test, with attractive features of portability, rapid results, and low cost.

TEAM MEMBERS & MENTORS

Team Members

Mentors



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