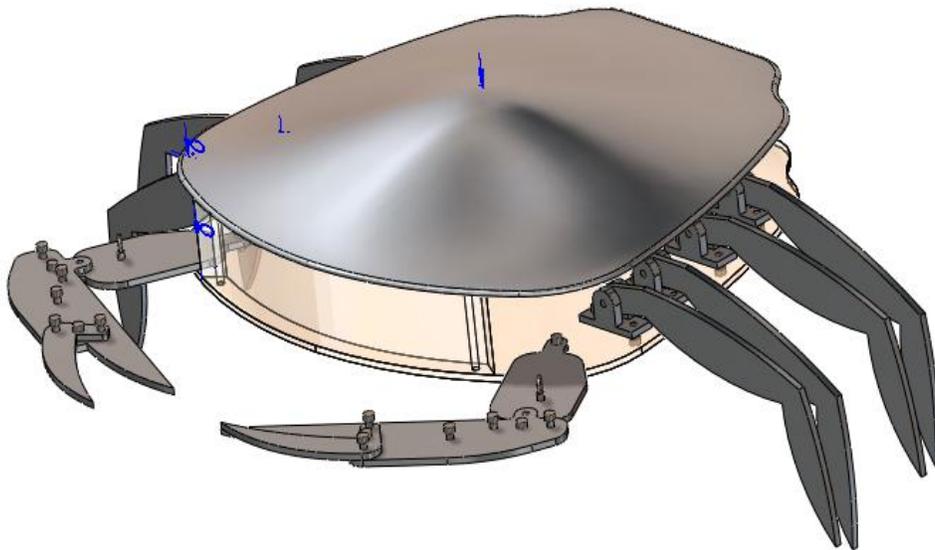


Biomimetic Crab

Senior Design Team P11029



TEAM:

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GUIDE:

William Nowak

CUSTOMER:

Dr. Lamkin-Kennard



MSD I Sponsorship

What are we doing (Team P011029)?

The goal of our project is to design and build a biomimetic crab showcasing the McKibben Muscle technology researched in Dr. Lamkin-Kennard's laboratory. Previous projects have involved a workbench to test a variety of muscles types (length, force output, deflection, etc...), and multiple generations of artificial limbs. Our team will now adapt previous design work to be able to operate in a submerged environment. The refined technology will be implemented into real world biomedical applications. Upon completion, the system will be showcased at the Imagine RIT Festival in May of 2011, for the education and entertainment of the public and most importantly, engineers of the future.

Benefit to Donor-Recognition at Imagine RIT.

Since 2007, The Rochester Institute of Technology has been the host of an innovation festival in early May known as *Imagine RIT*. The campus wide event is structured to showcase the creative spirit of RIT students, faculty and staff. Every year Imagine RIT has experienced growth and features the new ideas of students immersed our in technical and creative fields. Last year over 30,000 people attended to capture the enthusiasm that surrounds our innovative university. In past years the senior design projects have had a high visibility and offered great exposure for the sponsors involved. The reason senior design projects are so integral to this event is because they offer an interactive demonstration environment that the community members may participate in. Our project demonstrates that the greatest inspiration can be made when science and engineering comes to life.

Our Biomimetic Crab will be demonstrated at this year's 2011 Imagine RIT Festival. We believe our exhibit will be a big hit at the fair and will generate buzz over the senior design program that is unique to RIT. A sponsor that helps us achieve our goals will receive notoriety and share in the positive publicity.



Figure 1 - Biomimetic Hand Demonstration, 2010 Imagine RIT Festival



P11029 Design Team Needs

Our current budget is limiting the level of complexity in controls and fabrication our group is trying to accomplish hence we need a sponsor to provide \$1300 to address this.

Given this support, our team would pursue a more advanced control system by incorporating an electronic pressure transducer. This electronic pressure regulator would make it possible for the claw assembly to transition smoothly through its entire range of motion. These pressure transducers are widely available through any industry supply catalog at around \$300 each. Ideally we would incorporate two these into our design to control the right and left claw assembly.

Precision Electronic Air Regulators

Electronic regulators convert a current or voltage input signal into a proportional pressure output. As you increase your input signal, output pressure increases within the regulating range listed. Use with any sensor or source capable of producing the required input signal, or a programmable logic controller (PLC) for automatic setting adjustments.

Regulators are relieving style, which reduces downstream pressure through a vent port when your system is blocked. Mount vertically. Air inlet and outlet connections are NPT female.

Low Flow



Accuracy is $\pm 0.5\%$. All have a NEMA 4X enclosure suitable for washdown and outdoor applications. Body is aluminum. Gauge port is 1/4" NPT (gauge not included). Electric connection knockouts are 1/2" dia. Mounting bracket is included.

Pipe Size	Max. scfm @ 100 psi	Regulating Range, psi	Input Signal	Max. Temp.	Max. Pressure	Overall Size		Part #	Each
						Ht.	Wd.		
1/4"	12	1-17	4-20 mA	150° F	100 psi	4.25"	2.6"	4993K6	\$258.94
1/4"	12	2-60	4-20 mA	150° F	150 psi	4.25"	2.6"	4993K5	282.48
1/4"	12	3-15	4-20 mA	150° F	100 psi	4.25"	2.6"	4993K1	258.94
1/4"	12	3-27	4-20 mA	150° F	100 psi	4.25"	2.6"	4993K2	258.94
1/4"	12	3-120	4-20 mA	150° F	150 psi	4.25"	2.6"	4993K3	309.41
1/4"	12	3-120	0-10 VDC	150° F	150 psi	4.25"	2.6"	4993K4	309.41

Figure 2 - Pressure Regulators from McMaster Carr

The first iteration of our crab was constructed of 2-D aluminum cut-outs to give the impression of a crab in a top view profile. In order to satisfy the requirements of the customer a 3-D crab was necessary. To achieve a final product that aesthetically resembles a crab with limited artistic ability many options were considered and compared and Rapid Prototyping was the winner. The customer agreed with our choice and recommended Fine Line Prototyping. We are currently in the process of refining out design to incorporate these parts using complex geometries and curves to enhance the appearance of the crab. To manufacture this shell we need \$200. Additionally, we have received quotes for the claw, pincher and forearm parts ranging from \$35 to \$120. In order to cover the claw assembly parts we would need \$500.

Thank you

Thank you for taking an interest in our project. In order to achieve a truly biomimetic crab we have to blend the science, engineering and art. The artistic element of the project is the least relevant to our backgrounds as engineers however holds the greatest potential to impress and inspire. Through your support we can achieve a significantly higher level of innovation and inspiration.

Thanks again,
Team 11029

