KEVIN C. GALLOWAY

resume & portfolio

KEVIN C. GALLOWAY

EDUCATION

University of Pennsylvania School of Engineering and Applied Science, Philadelphia, PA
Candidate for Doctor of Philosophy: Mechanical Engineering | August 2010

Master of Science and Engineering: Mechanical Engineering | May 2006
GPA: 3.77

Bachelor of Science in Engineering: Mechanical Engineering | May 2004
Minor: Mathematics
Major GPA (20 courses): 3.82 GPA: 3.61

Honors: Magna Cum Laude, Dean's List 2001-2003, Pi Tau Sigma National Mechanical Engineering Honor Society

ENGINEERING EXPERIENCE

University of Pennsylvania Weiss Tech House, Philadelphia, PA | 2008-Present
- Advised student-initiated projects on product development topics including brainstorming, team dynamics, product development and intellectual property.

Traffic Safety Glove, Philadelphia, PA | 2007-2009
- Secured funding from Weiss Tech House ($1k) and received the GAPSA-Provost Award for Interdisciplinary Research ($6k) to develop an illuminated glove for the purpose of directing motor vehicle traffic.
- Directed focus groups with the University of Pennsylvania Police Department to establish functional requirements.
- Successfully demonstrated device function and operation through field tests conducted by Penn PD.
- Personally filed two provisional patents and a patent application (US Patent Application No.: 20080218996).

Sandbox Innovations LLC, Philadelphia, PA | Summer 2008
- Assembled and served as project director of a design team to build a six-legged, running robot.
- Established functional requirements and created mechanical design for robot final assembly.
- Directed manufacturing of all hardware components using aluminum and carbon fiber construction.
- Delivered on schedule the mechanical hardware for 10 robots on schedule.

Smart Motion Technologies LLC, Palo Alto, CA | 2005-2008
- Co-founded a smart materials actuation company based on electroactive polymers with a Penn bioengineering graduate student and two Wharton MBA students.
- Conceptualized designs, fabricated looks-like prototypes, and identified manufacturing techniques.
- Developed business plan, IP strategy, and co-authored a PTC application
- Patent Pending: Dielectric Elastomer Fiber Transducers (20090085444).

Jacob M. Abel Internship, Philadelphia, PA | Summer 2004
- Developed a parametric design architecture using Microsoft Excel, Visual Basic, and AutoCAD.
- The finished program successfully allowed a user to create geometric entities using specifications generated inde pendently of the CAD environment.

NSF Research Experience for Undergraduates, Philadelphia, PA | Summer 2003
- Conducted investigations into the optimization of a continuous helical zone melter.
- Results were presented in the 6th International Workshop on the Crystal Growth of Organic Materials at the University of Strathclyde, Glasgow, UK.

PRODUCT DESIGN AND CONSULTING EXPERIENCE

Snack Caddy LLC, West Chester, PA | 2008-Present
- Co-created a portable snack bar for outdoor entertaining, www.snackcaddy.com
- Currently licensed to Spectrum Imports, Inc.
- Patent Pending: Collapsible Stand (US Patent Application No.: 20090206211).

Lightning Packs LLC, Wayne, PA | Summer 2009 - Present
- Participated in brainstorming sessions to improve robustness of their patented suspended load backpack.
- Provided advice on material options and prototyped several compliant composite components.

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PRODUCT DESIGN AND CONSULTING EXPERIENCE (continued)

Clearly Art LLC, Tullytown, PA | **Summer 2007**
- Worked with sales department to laser engrave customer logos onto crystal glasses.

Living Arts Tattoo, New Hope, PA | **Fall 2006**
- Consulted on the design and development of tattoo machines.
- Developed CAD models, standardized dimensional requirements, and fabricated looks-like prototypes.

Redyns Medical LLC, Encino, CA | **2004-2005**
- Led early stage development of Prowick™, a post-arthroscopic medical wrap, www.redynsmedical.com.
- Conducted human factors research, developed prototypes and identified manufacturing methods.

AWARDS & HONORS

Traffic Safety Glove (2007-08)
- 1st Place, Second Best Idea SLAM
- GAPSA-Provost Award for Interdisciplinary Innovation ($6k)
- 2nd Place ($2500), PennVention

Snack Caddy LLC, QVC prize ($2500), PennVention (2008)

Radiosonde Recovery, Grand Prize ($5k), PennVention (2007)

Smart Motion Technologies LLC (2006)
- Grand Prize ($20k), Wharton Business Plan Competition
- 1st Place, Fortune Small Business Battle of the Business Plans
- Grand Prize ($5k), PennVention

Penn Prize for Excellence in Teaching ($500) (2006)

RoboTrikke, 3rd Place ($400), ASME Student Design Competition (2006)

Hugo Otto Wolf Memorial Prize, ($200) (2004)

PUBLICATIONS

A. Yasemin, **K. Galloway**, Y. Yazicioglu, D. Koditschek, "Modeling the Compliance of a Variable Stiffness C-Shaped Leg Using Castigliano's Theorem," ASME International Design Engineering Technical Conferences (IDETC), Montreal, Quebec, Canada, 2010.

K. Galloway, R. Jois, M. Yim, "Factory Floor: A Robotically Reconfigurable Construction Platform," International Conference on Robotics and Automation (ICRA), Anchorage, AK, 2010.

K. Galloway, J. Clark, D. Koditschek, "Design of a Tunable Stiffness Composite Leg for Dynamic Locomotion," ASME International Design Engineering Technical Conferences (IDETC), San Diego, CA, 2009.

K. Galloway, J. Clark, D. Koditschek, "Design of a Multi-Directional Variable Stiffness Leg for Dynamic Running," ASME International Mechanical Engineering Congress and Exposition (IMECE), Seattle, WA, 2007.

S. Chitta, M. Karabas, **K. Galloway**, V. Kumar, "RoboTrikke: Design, Modeling, and Experimentation with a Robotic Trikke," ASME IDETC/CIE. Philadelphia, PA, 2006.

SKILLS

Programs: AutoCAD, SolidWorks, Cosmos, WorkingModel 2D, FeatureCAM, Maple, and MATLAB
Computer languages: AutoLISP, WokingModel Script, Visual Basic with Applications, and C
Prototyping capabilities: Composites, CNC machining, Shape Deposition Manufacturing, LaserCAM

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DESIGN OF A COMPOSITE TUNABLE STIFFNESS LEG

OBJECTIVE AND ROLE

Animals can adjust their leg stiffness in response to changes in speed, payload, and terrain. If legged robots are to approach the speed and agility of the animal kingdom then research suggests that tunable leg stiffness must be a component of the design. A large portion of my doctoral research has centered on developing a robust, tunable stiffness leg for a class of dynamic running hexapedal robots (see page on XRHex for an example). As part of this effort, I have investigated all methods for mechanical spring stiffness adjustment, experimented with a number of materials (i.e. plastics, nitinol, and composites) and mastered several prototyping techniques including shape deposition manufacturing and composite manufacturing.

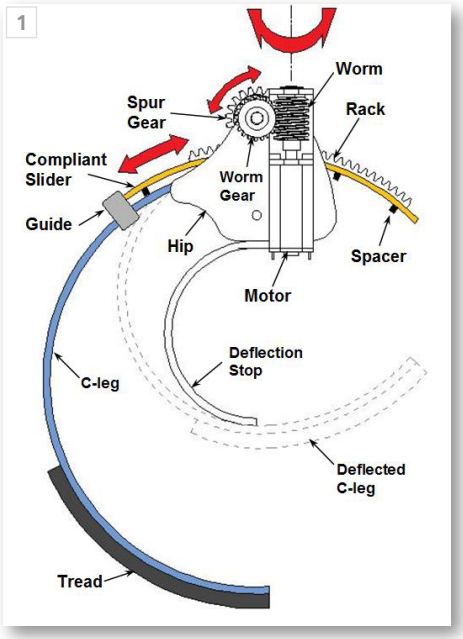
SOLUTION

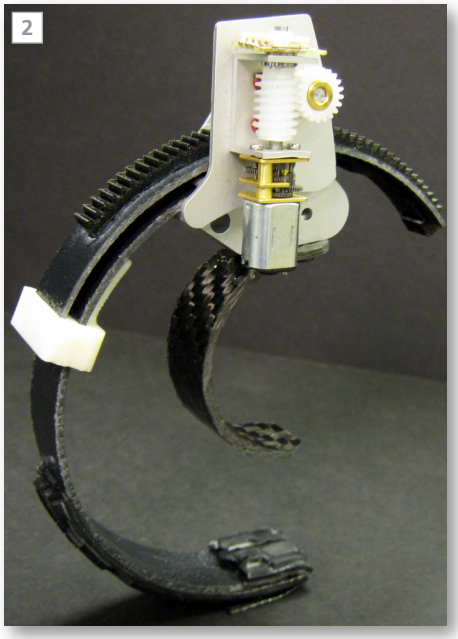
This tunable stiffness leg design uses the method of structure-controlled stiffness where the second moment of inertia of a C-shaped leg is adjusted with a compliant slider (see Figure 1). The leg shown in Figure 2 is constructed out of S2-6781 pre-preg fiberglass, which was selected for its high energy density, fracture toughness, and low damping. The position of the tuning element is controlled by a worm gear mechanism attached to the hip. The self-locking nature of the mechanism allows the leg to maintain a stiffness setting without consuming power. In my doctoral dissertation and defense, I will experimentally demonstrate that the design enables a wider range of energy efficient gaits than was previously possible with single stiffness leg designs.

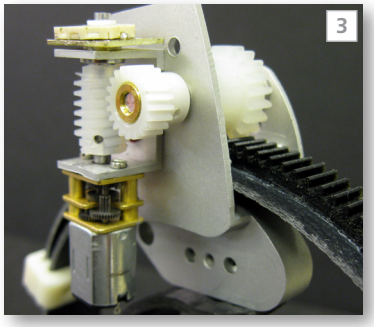
PAPERS AND CONFERENCE PRESENTATIONS

K. Galloway, J. Clark, D. Koditschek, "Design of a Tunable Stiffness Composite Leg for Dynamic Locomotion," ASME International Design Engineering Technical Conferences (IDETC), 2009.

K. Galloway, J. Clark, D. Koditschek, "Design of a Multi-Directional Variable Stiffness Leg for Dynamic Running," ASME International Mechanical Engineering Congress and Exposition (IMECE), 2007.







1 *Side view demonstrating leg stiffness adjustment*
2 *Finished prototype*
3 *Close-up of the worm gear mechanism*

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XRHEX

OBJECTIVE AND ROLE

During the summer of 2009, I led the mechanical design of XRHex, a next generation RHex robot. The mechanical design goals of the project where to increase the stiffness of the frame, improve robustness through composite materials, allow attachment of sensor payloads to the top, improve serviceability, and maintain overall weight under 9 kg.

OUTCOME

With the support of a mechanical engineering undergraduate, we developed a detailed 3D model of XRHex, CNC machined and molded all the components in just three months. The assembled robot met all the design goals and weighs only 8.2 kg.

TEAM

Dr. Clark Haynes, Electrical Systems Engineering (ESE) Post Doctoral Fellow
Berkay Deniz Ilhan, ESE PhD candidate
Aaron Johnson, ESE PhD candidate
Ryan Knopf, Mechanical Engineering Undergraduate
Goran Lynch, ESE PhD candidate
Ben Plotnick, ESE Undergraduate

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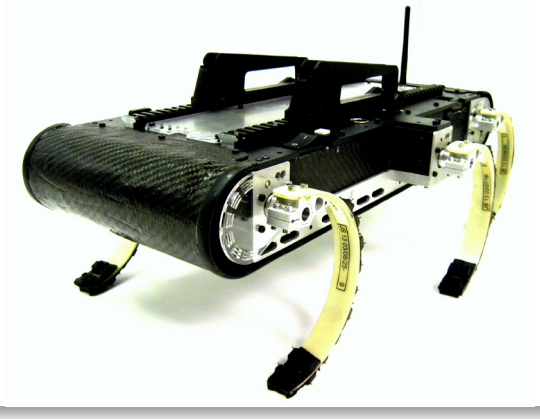

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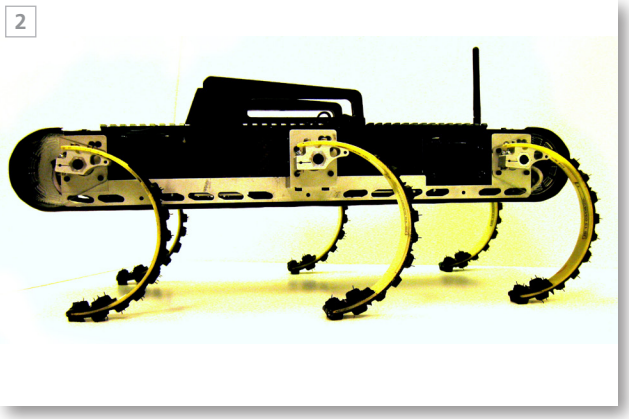

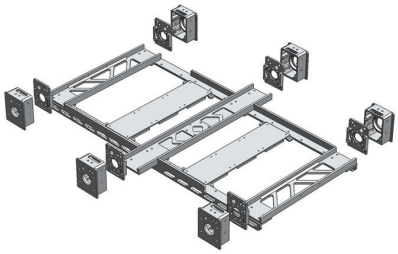

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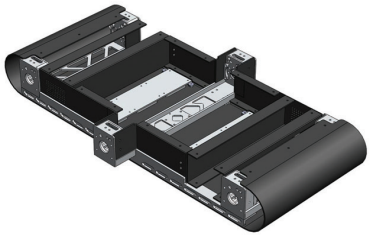

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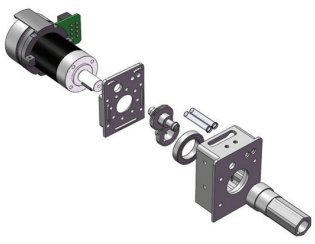

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1 XRHex; 2 Side view of XRHex; 3 Model of aluminum frame; 4 Composite components added to aluminum frame; 5 Exploded view of motor mount assembly

SANDBOX INNOVATIONS™

OBJECTIVE AND ROLE

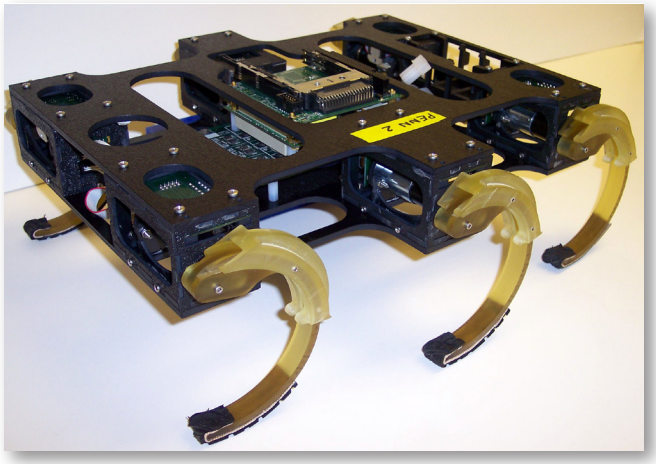
In the summer of 2008, Sandbox Innovations (www.sandboxinnovations.com), a start-up robotics company, contracted me to lead the mechanical design effort to morph Edubot, an educational legged robot platform, into a commercial product know as RespondBot Research and Development Kit (RDK).

OUTCOME

In just under three months, my design team, which consisted of two undergraduates, and I completely redesigned the Edubot body from a laser cut ABS construction to an aluminum chassis with a carbon fiber shell. All of the components were designed and CNC machined or molded in house. At the completion of the project, we delivered on schedule the mechanical hardware for 10 robots on schedule.

TEAM

Dr. Haldun Komsuoglu, Founder of Sandbox Innovations
Dan Meana, Mechanical Engineering Undergraduate
Matthew Nowicki, Mechanical Engineering Undergraduate



Edubot
(Before)

RespondBot Research and Development Kit
(After)

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FACTORY FLOOR

OBJECTIVE AND ROLE

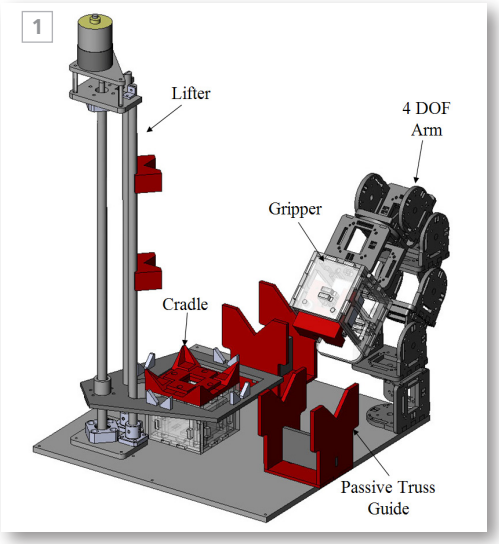
Working in collaboration with Dr. Daniela Rus from MIT, Dr. Hod Lipson from Cornell, and Dr. Eric Klavins from the University of Washington, we, at UPenn, are exploring building algorithms and the mechanical design of robotic systems capable of building passive structures. Enabling robots to build passive structures offers considerable utility as they can quickly adjust to changing functional requirements and resources at a level of sophistication that no human builder could match.

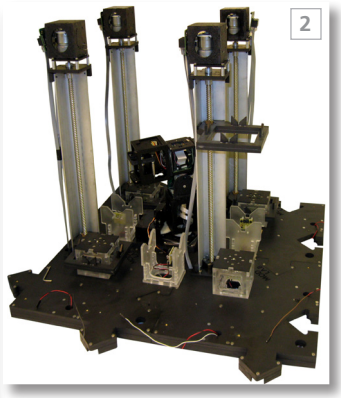
At present, we are pursuing the idea of the "factory floor," which can construct truss-like structures without climbing on them. Instead, the structure is, in essence, extruded out of the ground plane. The system is composed of tiles which consist of a building arm, an elevator, and passive structural guides. Each level is constructed on a ground plane using a truss and node configuration and is elevated to make room for the next level. This process is repeated to create 3D truss structures or reversed to decompose the structure for the next task.

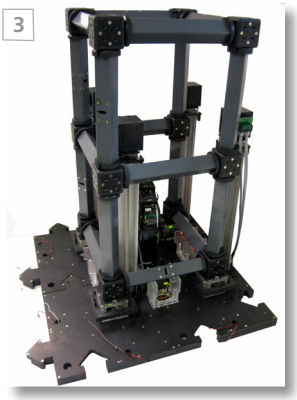
I have had the opportunity to play many roles in this project including identifying the functional requirements and constraints, determining the construction process, leading mechanical design investigations, and working with several undergraduates to build and test prototypes.

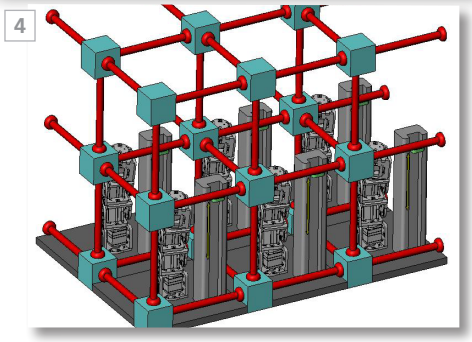
PAPER

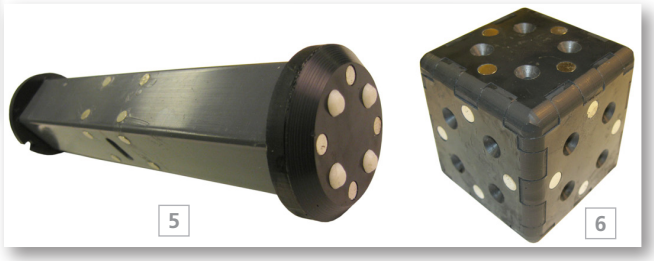
K. Galloway, R. Jois, M. Yim, "Factory Floor: A Robotically Reconfigurable Construction Platform," International Conference on Robotics and Automation (ICRA), Anchorage, AK, 2010.











1 Model of a single factory floor tile with a builder arm, elevator and passive structural guides. 2 A four tile factory floor prototype. 3 Prototype with structural members. 4 An early model of multiple tiles working together to build a truss structure. 5 A protoype of a truss with magnetic ends. 6 A prototype of a node with magnetic faces. 7 Sample truss structure.

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TRAFFIC SAFETY GLOVE

PROBLEM

While driving during a power outage on a rainy night, I witnessed officers directing traffic with flashlights. As drivers approached the intersection it was difficult for them to interpret the officer's commands (i.e. stop or go). Aside from posing a significant safety risk to the officer, this method of traffic control increased driver confusion and slowed the flow of traffic. I felt there had to be a safer and more effective way to direct traffic.

SOLUTION

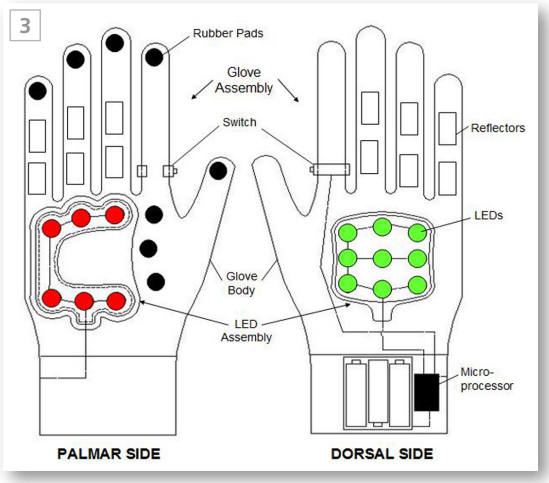
As a result of this experience, I designed a new traffic control device to increase the safety of traffic control personnel (TCP) and to improve communication between drivers and TCP. During the summer of 2007, I held focus groups with the University of Pennsylvania Police Department to identify the functional requirements and constraints. Their input led to a design of the Traffic Safety Glove which maps the color of traffic lights to standard traffic control hand motions. The design features two flexible LED assemblies mounted to the palmar and dorsal sides of each glove. The palmar side can illuminate in a red glow to signal "STOP" to one lane of traffic, while the dorsal side can illuminate in a green glow to signal "GO" to another lane of traffic. In the fall of 2007, the Penn PD graciously field tested the device and I was able to demonstrate its effectiveness. A patent application was filed for this invention.

AWARDS

2007 Second Best Idea SLAM, 1st Place
2007 GAPSA-Provost Award for Interdisciplinary Innovation ($6k)
2008 PennVention, 2nd Place ($2500)

TEAM/ADVISORS

Capt. Joseph Fischer, University of Pennsylvania Police Department
Dr. Vukan Vuchic, Electrical and Systems Engineering (ESE), University of Pennsylvania
Thomas Mather, ESE PhD candidate



1 Palm illuminated red; 2 Dorsal side illuminated green; 3 Proposed schematic for integration of light glove components

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MUSCLEMORPH

ROLE

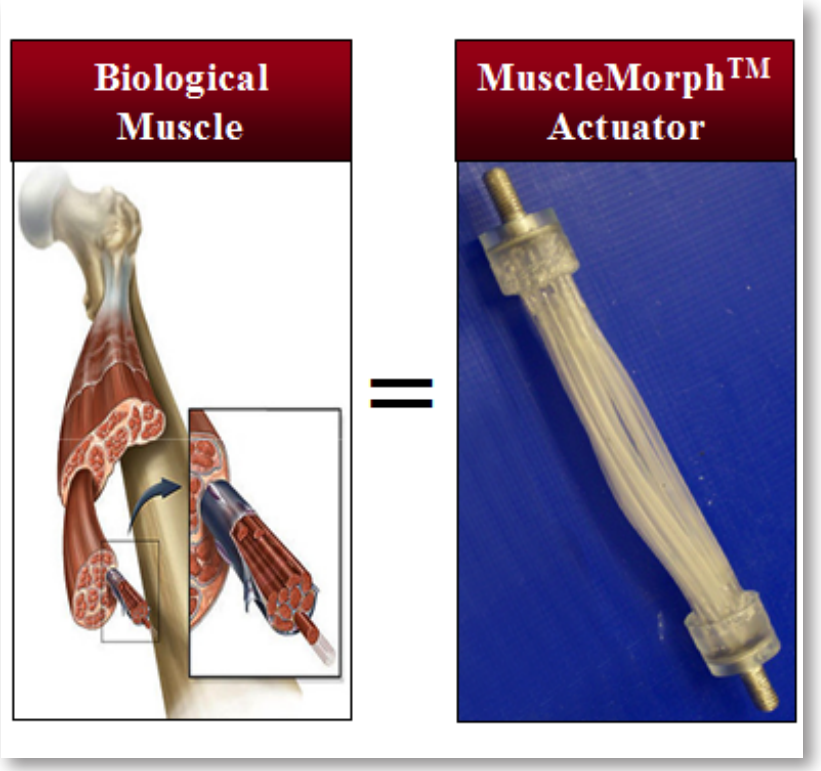
In fall of 2005, I co-founded a smart materials actuation start-up based on electroactive polymers with a University of Pennsylvania bioengineering graduate student and two Wharton MBA students. My roles included conceptualizing designs, fabricating looks-like prototypes, identifying manufacturing techniques, business plan development, and developing an IP strategy. The technology is patent pending.

AWARDS

2006 Wharton Business Plan Competition, Grand Prize ($20k)
2006 Fortune Small Business Battle of the Business Plans, 1st Place
2006 PennVention, Grand Prize ($5k)
Rang NASDAQ closing bell 8.8.2006

TEAM

Rodrigo Alvarez-Icaza, Bioengineering PhD candidate
Rahul Kothari, Wharton MBA candidate
Howard Katzenberg, Wharton MBA candidate



MuscleMorph
Enabling the Future of Motion

Rang NASDAQ closing bell, 8.8.2006

SNACK CADDY

PRODUCT DESCRIPTION

The Snack Caddy is the latest innovation in portable party gear. Designed for tailgaters, beach goers, BBQ'ers, and anyone else who enjoys entertaining outside (or inside), this lightweight snack bar features 17 pockets that can be stuffed with chips, dips, drinks and all your party favorites. Take it with you to start a party anywhere, and when it's over, fold it up and go.

ROLE

The idea for the Snack Caddy was born out of my business partner's frustration with serving food outside. Before becoming a partner, my initial involvement with this project was in a consulting capacity where I was responsible for defining functional requirements and developing prototypes for field testing.

OUTCOME

The Snack Caddy is currently licensed to Spectrum Imports Inc. and can be purchased at several websites including our own www.SnackCaddy.com. A patent is pending.

AWARD

2008 PennVention, QVC Prize ($2500)

PARTNER

Carrie Goodman

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RADIOSONDE RECOVERY

PROBLEM

Radiosondes are instruments used by weather services around the world to track and forecast weather conditions with roughly 550,000 launches yearly. Typically, radiosondes are attached to weather balloons and reach altitudes of 100,000 feet before the balloon bursts from the low air pressure. The instruments then parachute back to earth and land wherever the wind takes them. Unfortunately, these systems, which average $80-100 per unit, historically average a return rate of less than a 20%. For the U.S. alone this represents about an $8-12 million expense for an item that could be reused if recovered.

PROPOSED SOLUTION & ROLE

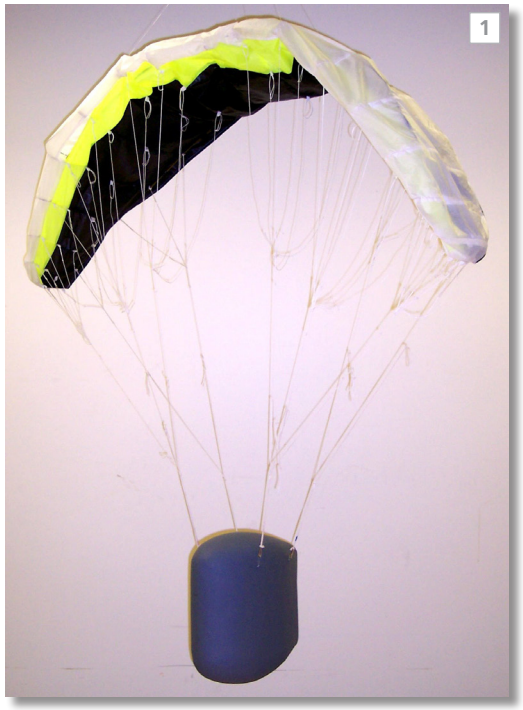
The team leader for this project originally had the idea for recovering radiosondes. The proposed solution called for the integration of a small, autonomous GPS based robot with each radiosonde that is capable of steering the parachute to designating landing sites for collection (see Figure 3). I was so intrigued by the proposition that I assembled a team to help refine the mechanical design and business model for submission to PennVention, the University of Pennsylvania's invention competition. This work, which included making the looks-like prototype shown in (Figure 1), enabled this idea to win PennVention and additional funding for further development.

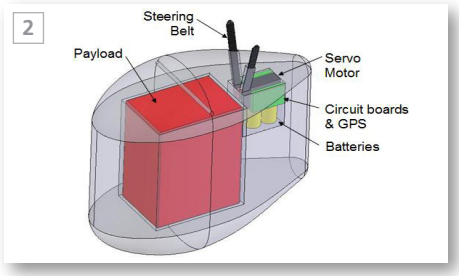
AWARD

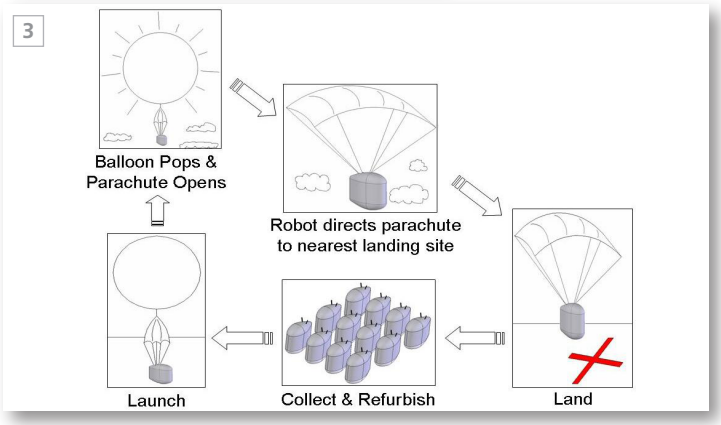
2007 PennVention, Grand Prize ($5k)

TEAM

Warren Jackson (Team Leader), Mechanical Engineering Masters Student
Thomas Mather, Electrical and Systems Engineering PhD candidate
Chris Thorne, Mechanical Engineering PhD candidate







1 *Looks like prototype*

2 *Proposed mechanical design*

3 *Storyboard of recovery process from launch to collection*

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ROBOTRIKKE

OBJECTIVE AND ROLE

The Trikke (Figure 1) is a three-wheeled human powered scooter produced by Trikke Tech Inc. and was the genesis of the robotic version (Figure 2) . The original Trikke is propelled by a single rider using a combination of swaying and cyclic inputs to the steering axis. RoboTrikke (Figure 2) is a scaled down robotic version of this novel under actuated, undulatory locomotion system. Motion is generated when a single servomotor drives the periodic motion of the front steering wheel. The reduction to a single actuator is one of the notable advantages of this system. As the lead designer on this project, I reduced the Trikke's compliant joint (see Figure 3), which is assembled from more than 10 different parts, to a compliant, monolithic, multi-material frame (see Figure 4) for RoboTrikke.

SOLUTION

The RoboTrikke frame was fabricated using the method of shape deposition manufacturing. This prototyping technique allowed me to embed components (i.e. no screws are used) and alter the compliance of select segments by choosing materials of different stiffnesses.

AWARD

ASME Design Competition, 3rd place ($400)

PAPER

Chitta, S., Mustafa, K., Galloway, K. and Kumar, V. "RoboTrikke: Design, Modeling and Experimentation with a Robotic Trikke", ASME International Design Engineering Technical Conferences (IDETC), 2006.

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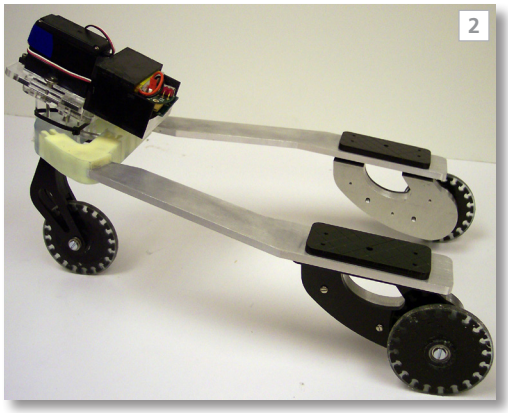

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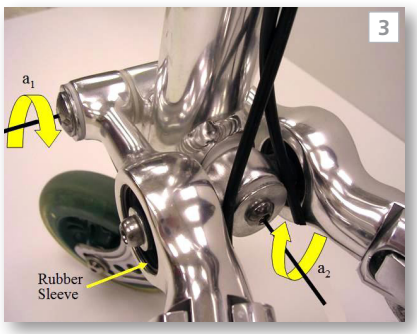

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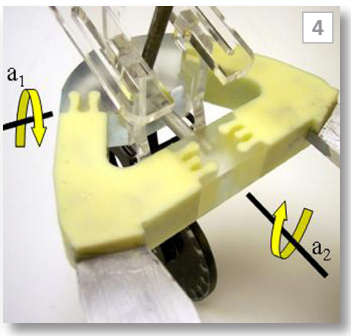

1 *Trikke*

2 *RoboTrikke*

3 *Trikke compliant joint*

4 *RoboTrikke multi-material compliant joint*

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PROWICK™ COLD WRAP

ROLE

In the fall of 2004, I consulted on the early development of a post-arthroscopic medical wrap, Prowick™, designed to wick fluids out of an incision. As part of this work, I conducted human factors research, developed prototypes, identified suitable hydrophobic and hydrophilic nonwoven materials, and explored manufacturing methods.

OUTCOME

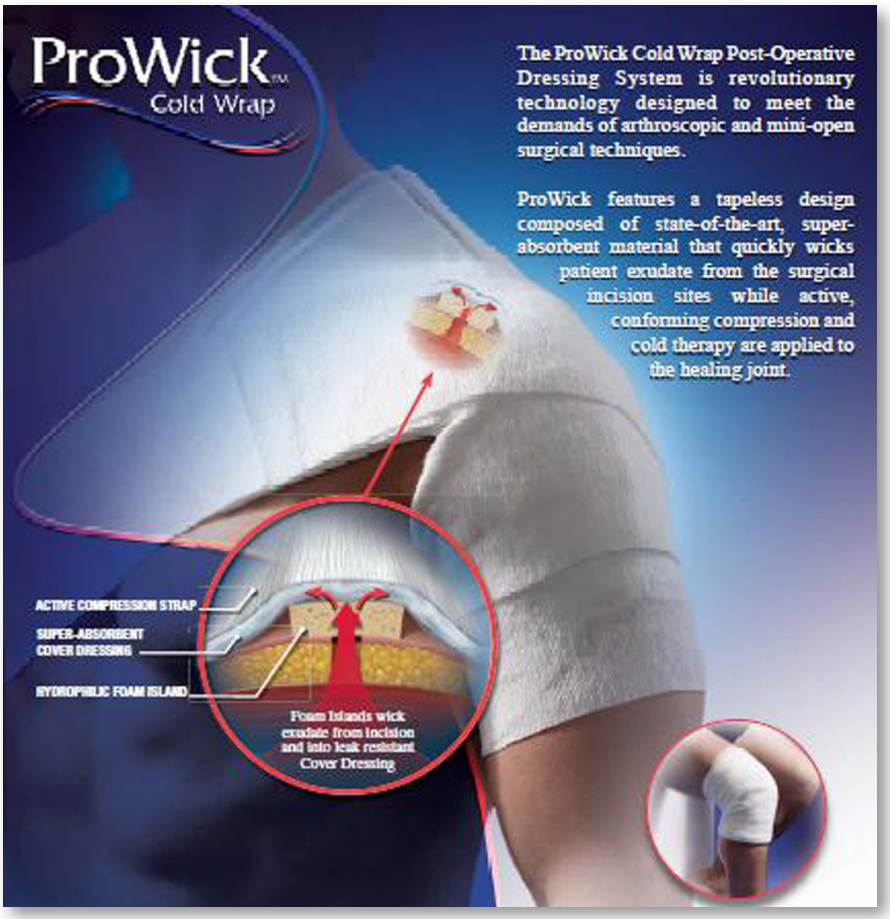
The Prowick™ shoulder wrap became the first product of Redyns Medical LLC (www.redynsmedical.com). The Prowick™ product line is currently distributed worldwide by Arthrex.

TEAM

Nate B. Snyder, Co-Founder, Redyns Medical LLC.

REDYNS MEDICAL

The Surgeon's Finishing Touch



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