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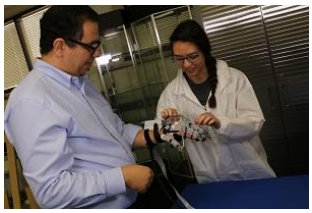
Biomedical Technologies

UTARI's Biomedical Technologies Division focuses on developing clinically relevant devices and systems that can be utilized by health care providers, as well as patients, to enhance diagnostics, treatment, rehabilitation, and preventive care.




REHABILITATION TECHNOLOGIES

REHAB GLOVE & UPPER EXTREMITY EXOSKELETON: Portable, programmable and feedback controlled exoskeleton systems capable of implementing prescribed motion therapy that are commonly used in hand and upper extremity rehabilitation after surgery, stroke, or spinal cord injury, as well as for conditions such as Cerebral Palsy. Additional applications include using as assistive devices for human performance augmentation.

WOUND HEALING TECHNOLOGIES

REHEAL GLOVE: The REHEAL Glove is an advanced hand wound care system that enables delivery of localized treatments including therapeutic drug delivery and Negative Pressure Wound Therapy (NPWT). The REHEAL glove is made with a flexible polymer to allow for motion therapy during healing in order to aid in functional restoration of the hand.

INJURY PREVENTION TECHNOLOGIES

SMART CUSHION & BED: These systems monitor and modulate pressure and shear between the body and a support surface. The smart cushion aims to reduce pressure injuries among wheelchair users, while the bed and shoe systems are designed to minimize the occurrence of facility acquired pressure injuries and diabetic foot ulcers, respectively.

IMPACT REDUCTION LINERS: An interconnected fluid-filled cell based liners for helmet and other protective gears for reducing force and acceleration transfer for reducing the effect of blunt impact. The main application include using as a helmet liner for reducing concussion in sports and military scenarios.

AFIRM — Armed Forces Institute of Regenerative Medicine

NSF

NIH National Institutes of Health

CDMRP Department of Defense

MTEC Medical Technology Enterprise Consortium

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REHAB Glove

Supporting Rehabilitation Contiuum

KEY FEATURES

Three Therapy Modes in One System

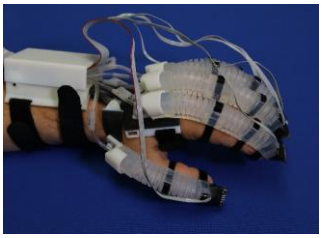
- Continuous Passive Motion
- Compensatory Assisted Motion
- Active Resistance Motion

Evidence Based Optimal Therapy

- Quantifiable diagnostics
- Progress monitoring
- Remote access and data logging

Affordable and Usable

- Light weight and portable
- Easy-to-use and safe
- Low-cost



ABOUT THE TECHNOLOGY

Motion therapies are widely used in post-surgical and post-stroke rehabilitation. The University of Texas at Arlington's patented soft robotic actuators enable the REHAB Glove to match anatomical motion within small joint sizes with the degree of control necessary for hand rehabilitation. The REHAB Glove achieves these goals with additional safety and less complexity while reducing cost compared to traditional rigid robotic systems.

The REHAB Glove is a portable feedback controlled, and programmable system capable of implementing prescribed therapeutic schemes developed by healthcare professionals. Each digit includes a state-of-the-art inertial measurement sensor to monitor the joint motion during flexion and extension. Applied torque and its resulting joint-angle motion provide data for progress monitoring and evaluation. Remote monitoring and adjustment enable therapists to prescribe, monitor, and evaluate therapy outside of the traditional clinical setting.

NSF

In collaboration with: University of North Texas Health Science Center

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Upper Extremity Exoskeleton

Supporting Rehabilitation Contiuum

KEY FEATURES

Two Therapy Modes in One System

- Continuous Passive Motion
- Compensatory Assisted Motion

Evidence Based Optimal Therapy

- Quantifiable diagnostics
- Progress monitoring
- Remote access and data logging

Affordable and Usable

- Light weight, wearable, and portable
- Easy-to-use and safe
- Low-cost

ABOUT THE TECHNOLOGY

Motion therapies are widely used in post-surgical, post-burn, and neurological rehabilitation. The University of Texas at Arlington's patent-pending Upper Extremity Exoskeleton provides motion therapy by assisting the well-coordinated movement of upper extremity joints. The exoskeleton built using soft robotic technology offers a higher degree of human compliance with improved safety at a reduced cost in comparison to traditional rigid robotic systems.

Upper Extremity Exoskeleton is a portable, feedback-controlled, and programmable system capable of assisting fingers, wrist, and elbow motion. The exoskeleton allows the implementation of prescribed therapeutic schemes developed by healthcare professionals. Control schemes implemented with the exoskeleton enable coordinated joint motion for training activities of daily living. Sensor-based applied torque and its resulting joint-angle motion provide data for progress monitoring and evaluation. Remote monitoring and adjustment enable therapists to prescribe, monitor, and evaluate therapy outside of the traditional clinical setting.

In collaboration with: University of North Texas Health Science Center

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REHEAL Glove

Advanced Wound Care System For Hand Trauma

KEY FEATURES

Function of the Glove

- Applies Negative Pressure Wound Therapy to the hand
- Allows drug and wound cleansing agent
- delivery
- Stabilizes skin grafts by conforming to the hand and applying uniform pressure

Benefits for Improved Patient Outcomes

- Allows early motion therapy during wound healing
- Non-adherent to new tissue growth
- Transparent for easy wound visualization

ABOUT THE TECHNOLOGY

The REHEAL Glove is an advanced hand wound care system that enables delivery of localized treatments including therapeutic drug delivery and Negative Pressure Wound Therapy (NPWT). This wound care system is comprised of a glove-shaped wound dressing and control unit that delivers the therapeutics and applies negative pressure. The flexible and transparent polymer-based glove is designed to fit the size and shape of an injured hand with strategically placed fluid exchange ports for NPWT, wound irrigation, and therapeutic delivery.

Current NPWT involves foam-based dressings which have significant limitations in their clinical utility for hand wounds including: poor fit to hands, difficulty achieving vacuum seal, and hand immobilization leading to stiffness. These foam dressings are adherent to new tissue growth, which is unintentionally removed during dressing changes. This is a critical factor in areas where the tissue mass is thin and multiple tissue types are involved in the injury. The REHEAL glove system is specifically designed to circumvent these issues by leveraging a flexible polymer substrate which prevents adhesion to the wound and allows motion during the application of NPWT.

MTEC Medical Technology Enterprise Consortium

NIH National Institutes of Health

CDMRP Department of Defense

In collaboration with: University of Washington Orthopaedics and Sports Medicine

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Smart Seat Cushion

Active Sitting Service for
Pressure Injury Prevention

KEY FEATURES

Real-time Pressure Sensing and Modulation

- Real-time pressure mapping and recording
- Data-driven pressure modulation including pressure redistribution and offloading

Benefits for improved patient care

- Redistribution of seating interface pressure to eliminate peak pressures
- Offloading pressure from already effected areas
- Continuous care for reduced burden of caregivers
- Remote access and data logging allow for retrospective analysis

ABOUT THE TECHNOLOGY

Current wheelchair cushion options do not provide real-time mapping enabled automated pressure modulation, and thus patients and caregivers are forced to find ways to manually relieve pressures by repositioning or body weight shifting. UTA's patented modulating air-cell technology, equipped with an array of sensors, enable the Smart Seat Cushion to actively monitor and create pressure maps of a seated person and actively modulate in real-time to redistribute pressure across the sitting interface to ensure that there is no peak pressure on vulnerable areas.

Additionally, the seat cushion allows users to offload pressure from already effected areas of the body completely, then redistribute the pressure across the remainder of the sitting interface to avoid mechanical loading on bony prominence and to facilitate blood reperfusion. The Smart Seat Cushion provides a new and more effective way to prevent pressure injuries while also reducing the burden on clinicians, therapists, and caregivers.

The Smart Seat Cushion will easily accommodate most any wheelchair, and is a portable, feedback controlled, and programmable system capable of adjusting pressure levels as prescribed by healthcare professionals. Remote monitoring and adjustment enable therapists to prescribe, monitor, and evaluate patients outside of the traditional clinical setting.

CDMRP Department of Defense

In collaboration with: University of Pittsburgh

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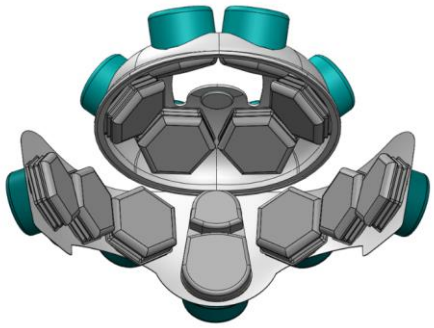
Interconnected Liner for Impact Reduction in Protective Sports Gear

KEY FEATURES

- Interconnected cell architectures allow one cell to undergo impact while the other cell aids in absorbing impact energy which reduces both force and acceleration transfer.
- Can be utilized across a variety of industries.
- Use of hyper elastic construction material for better impact absorption properties.
- Adjustable internal pressure of cells for customizing to different applications.
- Customizable arrangement into different configurations and variations of cell shape based on corresponding anatomical location.

ABOUT THE TECHNOLOGY

The inventors have developed an impact reduction liner concept which is based on fluid-filled interconnected cell architecture. This development can be configured for a helmet or protective body (chest) gear to prevent the occurrence of impact-related injuries. When cells are subjected to an external mechanical force, they deform, and fluid within the system moves into other cells which expand accordingly to accommodate incoming fluid. The efficient function of the invented construction is provided by the specifically designed geometries and connections of impact-receiving and impact-absorbing cells. Following an impact, the impact-receiving cell is compressed and deformed resulting in fluid within the system moving into the impact-absorbing cell. The fluid motion and the expansion of the impact-absorbing cell will reduce the direct force and acceleration transfer from the impact to the head or other protected body part. The geometry of the system is designed to reduce both linear and rotational acceleration due to an impact.



TECHNOLOGY NEED

While sports have become cornerstones of the world's pastimes, the safety gear that players use season after season has not changed in the last 30-40 years despite routinely poor safety evaluations for helmets on the market by a variety of professional leagues. In a world full of constant innovation and invention, safety technology needs to catch up. There is a noticeable lack of innovation in the underlying principles that allow sports helmets to function at optimal performance. While strong advocates like the National Football League (NFL) are pushing for more research into safety, there are issues with the current framework that many sports helmets are based upon. There are an estimated 1.6 - 3.8 million sports and recreation-related concussions that occur in the United States each year. The global smart helmet market size was valued at $372.4 million in 2018 and is expected to expand at a compound annual growth rate of 18.6% from 2019 to 2025. Strict road safety regulations established by the government, growing adoption of advanced wearable technology, and awareness regarding personal safety are expected to drive the demand for the advancement in protective gear.

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