SMART TEXTILES AND WEARABLE CLOTHING

COMPiled BY HOWIE BAUM
People and textiles have come a long way!

- Cotton hand-picking
- Hand spinning
- Backstrap-weaving
Where would you like to go today?
APPLICATIONS

HEALTH AND SAFETY MONITORING

EMERGENCY RESPONDERS – FIRE, RESCUE, POLICE

ATHLETES

ASSISTING PERSONS WHO ARE DISABLED

NEW FASHION DESIGN

ASSISTING PEOPLE AT WORK WITH TECHNICAL INFORMATION RESOURCES

MILITARY

PERSONAL COMMUNICATION, COMPUTING, AND SECURITY

EXTEND A USER’S SENSES AND PROVIDE METHODS TO EXPERIENCE ALTERNATE REALITIES

LIFE-LOGGING

WAYFINDING ASSISTANCE
Smart Clothing

- Conductive textiles and inks print electrically active patterns directly onto fabrics
- Sensors based on fabric
  - e.g., monitor pulse, blood pressure, body temperature
- Invisible collar microphones
- Kidswear with a game console on the sleeve
- Integrated GPS-driven locators
- Integrated small cameras
Textiles Materials Properties for Every Need

- Optimized moisture management
- Better heat flow control
- Improved thermal insulation
- Breathability
- High performance in hazard protection
- Environmentally friendly

- Increased abrasion resistance
- Health control and healing aid
- Body control
- Easy care
- High aesthetic appeal
- Enhanced handle
- High/low visibility
5.1 Demands of the body.
ACCORDING TO HOW THEY REACT, SMART / INTERACTIVE TEXTILES (SIT) CAN BE DIVIDED INTO

✦ PASSIVE SMART MATERIALS, which can only sense the environmental condition or stimuli

✦ ACTIVE SMART MATERIALS, which sense and react to the condition or stimuli

✦ VERY SMART MATERIALS, which can sense, react and adapt themselves accordingly

✦ INTELLIGENT MATERIALS, which are those capable of responding or activated to perform a function in a manual or pre-programmed manner
THE SENSATEX “SMARTSHIRT”

Sensatex developed a SmartShirt™ System specifically for the protection of public safety personnel, namely firefighters, police officers, and rescue teams.

It can also monitor vital signs for persons with medical conditions:

Heart Rate, Breathing, Body Temperature

The SmartShirt™ can monitor the health and safety of public safety personnel/victims trapped in a building or underneath rubble with the ability to detect the exact location of victims through positioning capability.

it also offers two-way voice communication with a microphone and speaker.
It can also include a miniaturized GPS circuit so a missing person can be located.
Researchers from the University of Washington developed a single-chip solution for a low-power, encrypted-signal wearable electrocardiography (ECG) system that enables secure cardiac monitoring on mobile devices such as smartphones or tablets.

The chip is integrated into a form-fitting “smart shirt” that incorporates flexible electrodes, batteries and an antenna that interfaces with a clinical-standard 12-lead ECG to encrypt and wirelessly transmit the patient’s cardiac data via an on-chip radio and flexible antenna, using less than 1 milli-watt (less than a thousandth of a watt).
FLEXIBLE SOLAR PANELS
Pauline van Dongen designed a beautiful Solar Shirt that can also charge your phone.

Functioning as a fashion garment as an embodied interface, the shirt combines solar panels and flexible electronics.
Protection e-Textiles aiming at:

- Fires
- Earthquakes
- Floods
- Terrorist incidents
- Major transportation accidents
- Major industrial accidents
- Chemical incidents
- Nuclear incidents
Engineered Textiles

Engineered textiles are materials that are developed and/or designed for a special need or application where a very high performance is required.

Engineered textiles may combine fabrics with glass, ceramics, metal, or carbon to produce lightweight hybrids with incredible properties.

Sophisticated finishes, such as silicone coatings and holographic laminates, transform color, texture, and even form.

Safe from the pouring rain in a Gore-tex jacket, an aviation boatswain's mate keeps a watchful eye on the activities on the flight deck aboard USS Ronald Reagan

Gore-tex membrane structure
Light Reflective Technology

A technology has been created to convert proprietary materials into miniature reflectors that, when imbedded into fabric by the millions, reflect oncoming light, such as automobile headlights.

The reflectors are smaller than a grain of sand and finer than a human hair. They can be imbedded into the weave of almost any fabric.

During the day, the treated fabrics are indistinguishable from untreated fabrics.
Microbes Begone!

An anti-microbial technology has been developed by which it embeds AgION™, a silver-based inorganic zeolite, in a solution-dyed polyester Fossfibre® bicomponent fiber.

The bicomponent fibers in Fossfibre are specially designed so that AgION is found only on the sheath, providing controlled release for optimum exposure to the destructive bacteria.

The silver ions from the ceramic compound are released at a slow and steady rate. Ambient moisture in the air causes low-level release that effectively maintains an anti-microbial surface. As the humidity increases and the environment becomes ideal for bacteria growth, more silver is released.
SmartSkin hydrogel is a new technology that absorbs cold water that has flushed into the suit and expands to close openings at the hands, feet, and neck, preventing more water from entering.

Water trapped inside the suit heats up upon body contact. If the water warms up past a transition temperature determined by the proportion of hydrophilic (water-loving) to hydrophobic (water-hating) components, the hydrogel releases water and contracts, allowing more water to flush through the suit.

This passive system constantly regulates the internal temperature — no batteries or mechanical action are needed.
Nano Technology

Nano-particles are permanently attached to cotton or synthetic fibers. The change occurs at the molecular level, and the particles can be configured to imbue the fabric with various attributes. Nano-technology combines the performance characteristics associated with synthetics with the hand and feel of cotton.

Nano-fibers 1/1000 the size of a typical cotton fiber are attached to the individual fibers. The changes to the fibers are undetectable and do not affect the natural hand and breathability of the fabric.
nanotechnology textiles

- self-cleaning capability
- smart textiles
- smart textiles LEED
- anti-bacteria
- stain repellent
- structural colour
- self-repairing
- flame resistance
- ultra-strength
- UV protective

Illustrations Kenneth buddha Jeans
**Electroluminescent wire (EL wire)** is a thin copper wire coated in a phosphor which glows when an alternating current is applied to it. It can be used in a wide variety of applications - vehicle and/or structure decoration, safety and emergency lighting, toys, clothing etc - much as rope light or Christmas lights are often used.

Unlike these types of strand lights, EL wire is not a series of points but produces a 360 degree unbroken line of visible light. Its thin diameter makes it flexible and ideal for use in a variety of applications such as clothing or costumes.
Just like mood rings, the Bubelle Dress changes colors with your mood. The dress is made up of two layers: the inner layer contains biometric sensors that pick up a person's emotions and projects them in colors onto the second layer.

The Bubelle dress was designed by Philips and works by monitoring physical changes associated with different feelings. Emotions like stress, arousal, or fear affect the body's temperature and sweat levels and these generate the light that changes the pattern and color on the dress.
BEAUTIFUL LED TOPS AND GOWNS
EMOTIONAL AND AROMATIC DRESS
The project ‘Scentient Beings’ by Jenny Tillotson implants smell technology into multi-sensorial clothing and turns the living dress into a sensitive Smart Second Skin.

The dress mimics the body’s circulation system, the senses and scent glands. The interactive fabric emits a selection of scents depending on your mood.
• **Luminex** a fabric that gives off its own light.

• Tiny, flexible optical fibers, developed for high-energy physics experiments, are woven into fabric and powered by an ordinary battery sewn into the cloth. A smart chip can make it glow in flashing patterns.

• Used in stage costumes, handbags and curtains as well as clothing. DKNY offering a line of silver Luminex pillows.
DISCO DOG!
THIS BED COMFORTER USES NITINOL MEMORY WIRE TO MAKE ITSELF, AFTER YOU WAKE UP!!
Wired/-less fabric keyboards
Shape Memory Alloys (SMA) are novel, superelastic materials that are able to return to a predetermined shape when heated.

SMA gold thread was incorporated into a self-ironing shirt created by the GZE Company.

- The sleeves were programmed to shorten immediately when room temperatures became a few degree hotter.

The fabric can be screwed up into a ball, pleated and creased - then just by the flow of hot air (such as from a hairdryer) and can revert back automatically to its former shape.
Warning and Signaling

A combination of sensors and small flexible light emitting displays (FLED) can receive and respond to stimuli from the body, enabling a warning signal to be displayed or sent.

The sensors can monitor EKG, heart rate, respiration, temperature, and pulse readings.

If vital signals were below critical values, a FLED would automatically display, for example, a flashing red light, and a wireless communication system could send a distress signal to a remote location.
The LilyPad Arduino is a microcontroller board designed for wearables and e-textiles. It can be sewn to fabric and similarly mounted power supplies, sensors and actuators with conductive thread. The clothing item can be hand washed without causing any problems to the board.

The LilyPad Arduino was designed and developed by Leah Buechley and SparkFun Electronics.
THIS JACKET HAS BEEN DESIGNED WITH THE LILYPAD CIRCUIT (CIRCLE IN THE CENTER) FOR PROGRAMMING A RIGHT OR LEFT TURN SIGNAL WITH LED’S, FOR PERSONS RIDING ON A MOTORCYCLE OR BIKE.
Wearable Biosensors – Wound Healing

• Monitoring Wound Healing

• Optical sensors for evaluation, but no tool for real-time monitoring!

• Continuous monitoring of wound healing progress

• Severe burnt patients, chronic wounds (e.g. ulcers)

• Target parameters: pH of body fluid, stage of wound healing, infection type, acute and/or infections.

• Integration of health monitoring tools into textiles, for safety and comfort

• Remote diagnostics to improve early illness detection
Kate Hudson looked incredible in a gorgeously designed, 3D printed inspired Bridal gown worn to the 2016 Met Gala.

The annual gala’s theme was “technology”, and the 3D gown designed by Atelier Versace, definitely fit that description.

The futuristic design made Kate look like she was floating.
A BEAUTIFUL 3D PRINTED DRESS

https://www.youtube.com/watch?v=wdRswasftfl
Made of durable nylon, the dress was 3D printed via **selective laser sintering** – an additive manufacturing technique in which a laser is used to convert powdered material into a solid or porous mass.
Massachusetts design studio **Nervous System** has revealed a dress made from 1,600 rigid pieces of nylon fabricated using a technique referred to as 4D printing.

The garment consists of small, rounded pieces whose shapes were inspired by petals, feathers and scales.

The pieces are attached to a framework of tessellated triangular panels that connect with moving joints. Each interlocking panel is rigid, but together they behave as a continuous textile.

https://www.youtube.com/watch?v=3DoeYtd0fyY
At the 2016 Rio de Janeiro Paralympic Games opening ceremony, snowboarder Amy Purdy’s running blades weren’t the only high-tech element of her performance.

Purdy, wore a 3-D-printed dress created by Israeli fashion designer Danit Peleg. The dance was conceived to explore the relationship between humans and technology, so it’s fitting that the dress was printed using a desktop printer.
WarmX is a manufacturer and distributor of heated knitted underwear system. The company has an own worldwide-patented technology for heating textiles called warmX-technology and “know how” and partners in both textiles and electronics.

The underwear is knitted with silver coated fibers in the trunk and neck areas and a battery mounted on the waist supplies the power.
Anti-Aging Clothes

The Nano Dew shirts and blankets contain vitamin E and special enzymes to reduce signs of aging and protect the wearer's skin from ultraviolet rays.
Hug Shirts

The hug shirt allows people to exchange the physical sensation of being hugged over distance, through sensors and actuators embedded in the textile. The hugs arrive thanks to the mobile network, since the shirt is a Bluetooth accessory for mobile phones.