Second Skin: Emerging Technology Enablers

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SciTech Patent Art Contact (s)

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OBJECTIVE & SCOPE

- ✓ In Beauty Care there are several emerging innovation trends such as Personalized cosmetics, Beauty devices, Second Skin, Regenerative medicine, Holistic solutions, etc.

- ✓ Realizing these high-level concepts in commercial products/services will require several enabling technologies to fall in place. Further, these enabling technologies may come from outside of the cosmetics industry.

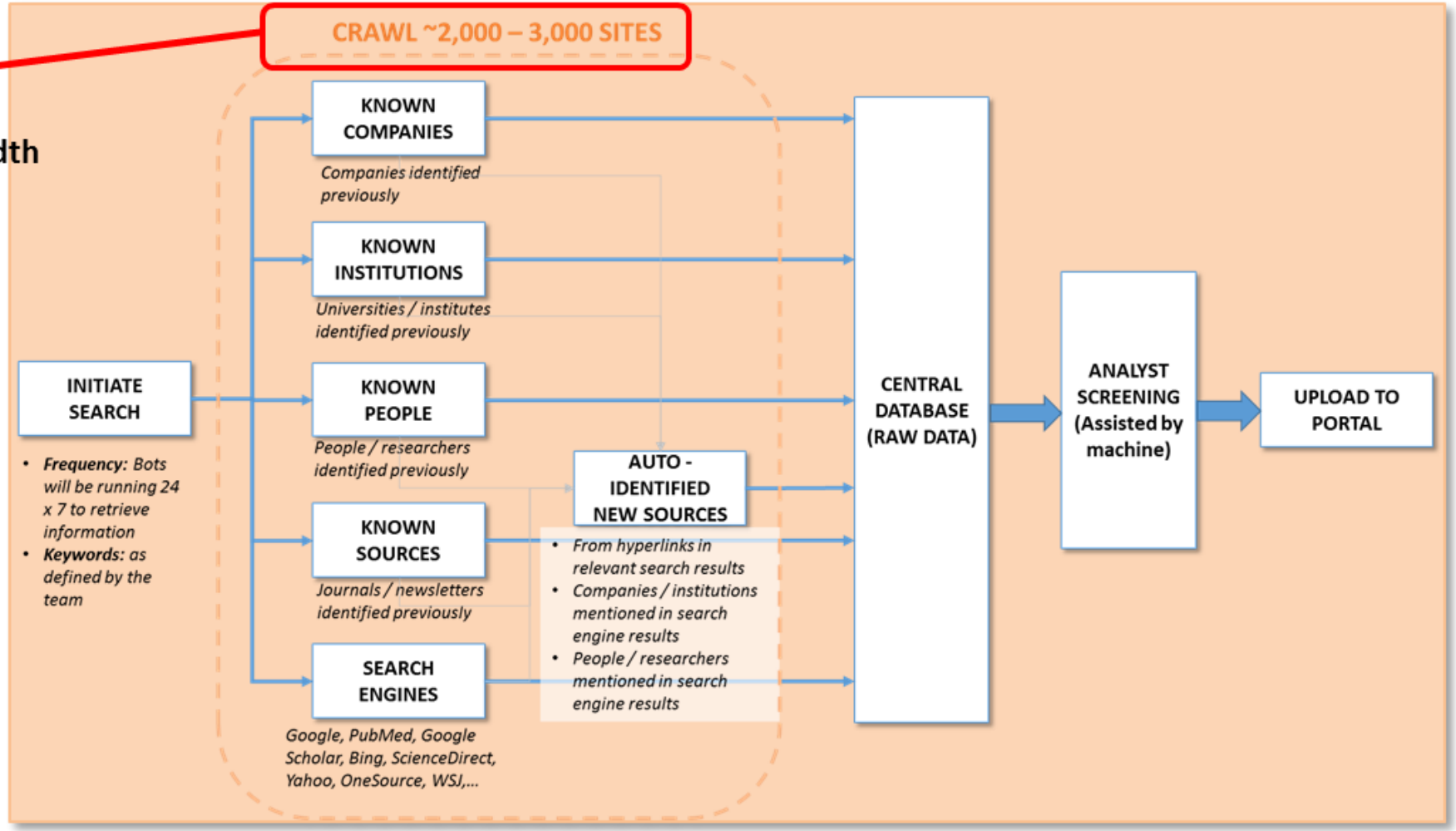
- ✓ Based on discussions with potential clients, SciTech Patent Art (SPA) has recently introduced a new service focused on identification of emerging & enabling technologies related to specific innovation trends.

- ✓ For an initial pilot, SPA selected "**Second Skin**" as an innovation trend. The search and analysis of emerging & enabling technologies for **"Second Skin"** involved deep web searching and AI-based concept screening.

- ✓ Following are the some of the concepts identified by SciTech Patent Art related to "***Second Skin***":
  - Material/polymers to provide thin and flexible films
  - Process to provide thin/flexible films
  - Materials to replicate physical properties (e.g., roughness, porosity, conductivity)
  - Materials to replicate appearance

SPA PROPRIETARY DEEP WEB / AI-BASED SEARCH PROCESS

EXAMPLE OF A CUSTOM CRAWLER**



** Designed by SPA analysts for a specific purpose. Analyst screening may involve proprietary AI techniques

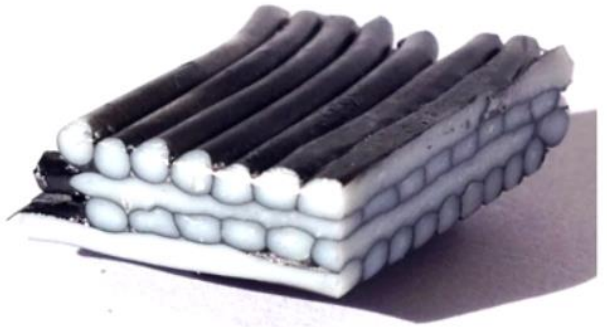
Technology: Carbon Nano Tubes Textile

Concept: Materials to replicate physical properties (e.g., roughness, porosity, conductivity)

EXAMPLE (NOT COMPREHENSIVE)

Carbon nanotube based smart skin electronics

Excerpts from the article:



- Researchers at the **University of Illinois at Urbana-Champaign** have synthesized thin carbon nanotube (CNT) textiles that exhibit both high electrical conductivity and toughness.
- This is the first study to apply the principles of fracture mechanics to design and study the toughness nano-architectured CNT textiles.
- Vertically aligned carbon nanotubes were synthesized via chemical vapor deposition.
- Self-driven capillary forces were used to staple the CNTs together.
- This new CNT textile, with simple flexible encapsulation in an elastomer matrix, can be used in smart textiles, smart skins, and a variety of flexible electronics.

SPA Comments:

- The CNT textiles maybe embedded with microcapsules filled with active cosmetic agents and are released on contact with the skin making the skin feel smoother, more elastic, and more youthful.
- The development of CNT textiles may explore new possibilities in beauty care industry for imparting various body and wellness functions to the wearer.

https://www.eletimes.com/wonder-material-carbon-nanotube-braces-thin-films-smart-skin-electronics

Technology: Smart gels

Concept: Material/polymers to provide thin and flexible films

EXAMPLE (NOT COMPREHENSIVE)

Smart gels

Excerpts from the article:

- Smart gels contain fluids (usually water) in a matrix of large, complex polymers. These polymers are special in that they respond to stimuli in an advanced way.
- Applications of smart gels permeate into many various fields including both medical and industrial.
- Development in smart gels' electrical properties could result in the future production of artificial muscles.
- With more development, these gels could become replacement muscles for patients. While this technology is only in its infancy, the manifestation would aid many who are in need of artificial muscles

SPA Comments:

- Smart gel based artificial muscles are suitable for use in muscle replacements for potential usage in cosmetic surgery.
- Smart gels can be used to make soft contact lenses.

https://web.stanford.edu/group/mota/education/Physics%2087N%20Final%20Projects/Group%20Delta/sg.html

Technology: Smart fabrics

Concept: Materials to replicate appearance

EXAMPLE (NOT COMPREHENSIVE)

Modern and smart fabrics

Excerpts from the article:

- Modern and smart fabrics are designed to maximize characteristics such as lightness, breathability, waterproofing etc, or to react to heat or light.
- Some key modern fabrics are Microfibre, Polar fleece, Gore-Tex, Micro-encapsulated, Heat sensitive, and Light sensitive.
- Heat sensitive fabrics uses thermochromic dye technology in which micro-encapsulated dye can change color in response to heat. These fabrics are used in children's clothes, sports clothing, firefighters' clothing, and wound dressings.
- Light sensitive fabrics uses photochromic dye technology in which smart pigments change color in response to sunlight. These fabrics are used in T-shirts military clothing.

SPA Comments:

- The above mentioned light-weight, breathable and waterproof smart fabrics may be used in cosmetic formulations that change color or odor depending on the surrounding environment.
- These smart fabrics may find applications in beauty products of facemask, wipes, and pads.
- These fabrics can also be considered under the category of "***Personal Shield***" for the concept 'Recommending actions based on surrounding environment'.
- Among many other companies**, Carre Technologies Inc (Hexoskin)** offers a line of cutting-edge smart clothings that include body sensors into comfortable garments for precise health tracking.

http://www.bbc.co.uk/schools/gcsebitesize/design/textiles/fabricsrev4.shtml

Technology: Gelatine-based skin

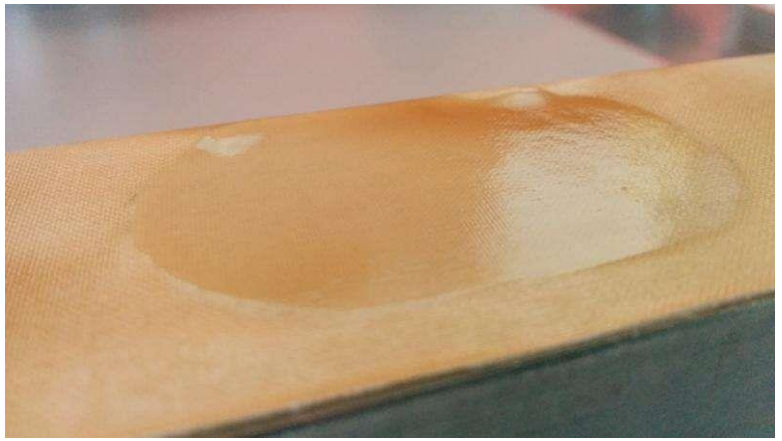
Concept: Material/polymers to provide thin and flexible films

EXAMPLE (NOT COMPREHENSIVE)

Artificial gelatine-based skin model

Excerpts from the article:

- Up to now, it has only been possible to determine the interaction between human skin and textiles by means of clinical trials on human subjects.
- Now, **Empa** researchers have developed an artificial gelatine-based skin model that simulates human skin almost perfectly.
- It will in future be possible to use the model to assist in the development of textiles, as well as other materials that may come into direct contact with human skin.
- Gelatine has similar characteristics to keratin, but is much cheaper



The Empa skin model: gelatine on a cotton substrate.

SPA Comments:

- This gelatin-based skin model may find applications in investigating innovative cosmetics.
- This model can be used in various in vitro tests such as irritancy test, phototoxicity test, and penetration assay in cosmetic products.

https://medicalxpress.com/news/2017-04-artificial-gelatine-based-skin-simulates-human.html

Technology: Wearable electronics

Concept: Material/polymers to provide thin and flexible films

EXAMPLE (NOT COMPREHENSIVE)

Biometric tattoos

Excerpts from the article:

- **Chaotic Moon, LLC** is developing electronic wearable "tattoos" made of components and conductive paint that use heart rate, hydration level and the composition of sweat to determine body temperature and detect stress in the wearer.
- The tattoo is temporary and washes off much like a temporary fashion tattoo.
- The devices upload health data using Bluetooth Low Energy or low-frequency mesh networks.

SPA Comments:

- These healthy tattoos may be used in cosmetics to monitor skin condition depending on the surrounding environment.
- These healthy tattoos can also be considered under the categories of "***Beauty device***" for the concept 'Portable diagnostic devices' and "***Personalized Cosmetics***" for the concept 'Process to customize cosmetic compositions'.

https://techcrunch.com/2015/11/23/chaotic-moon-explores-biometric-tattoos-for-medicine-and-the-military/
https://aabme.asme.org/posts/innovations-in-electronic-skin

Technology: Wearable electronics

Concept: Material/polymers to provide thin and flexible films

EXAMPLE (NOT COMPREHENSIVE)

Breathable nanoscale tech worn like a second skin

Excerpts from the article:

- Previously the technology required for skin monitoring has been bulky and impractical, restricting natural movement and changing the way skin interacts with environmental factors like air and moisture.
- Now, researchers at the **University of Tokyo** have developed a flexible, mesh-like structure of hollow, metallic nanofilament integrates with the skin on human fingers that allows for very precise, long-term monitoring, facilitating active, body-worn sensors for touch, temperature and pressure.
- Each nanofilament is about 300-500 nm in diameter and coated in a thin layer of gold.
- The mesh-like film structure sticks to the skin through an ultra-thin layer of polyvinyl alchohol (PVA)

Index finger with gold nanomesh conductor

SPA Comments:

- This invention has potential applications in external use, for example, monitoring of skin condition based on its interaction with various environmental factors.
- Another potential use of this technology could be under the category of "***Beauty devices***" such as for color-changing LED eye lashes.

https://medicalxpress.com/news/2017-04-artificial-gelatine-based-skin-simulates-human.html