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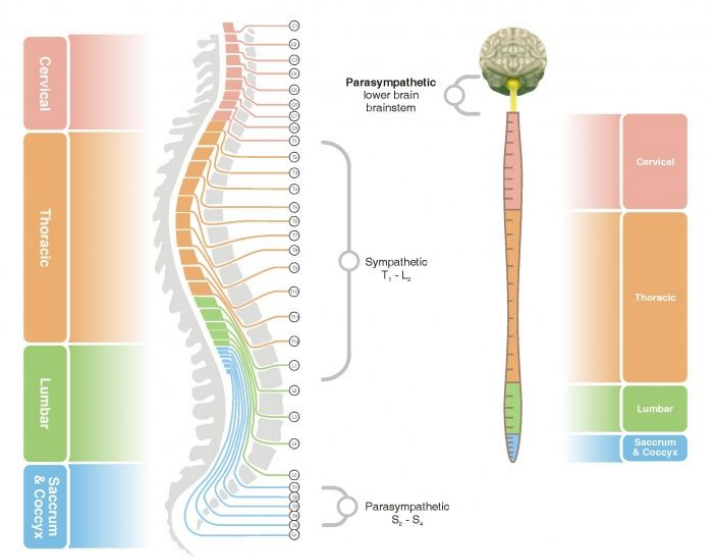
Spinal

14th February 2017



Project goal

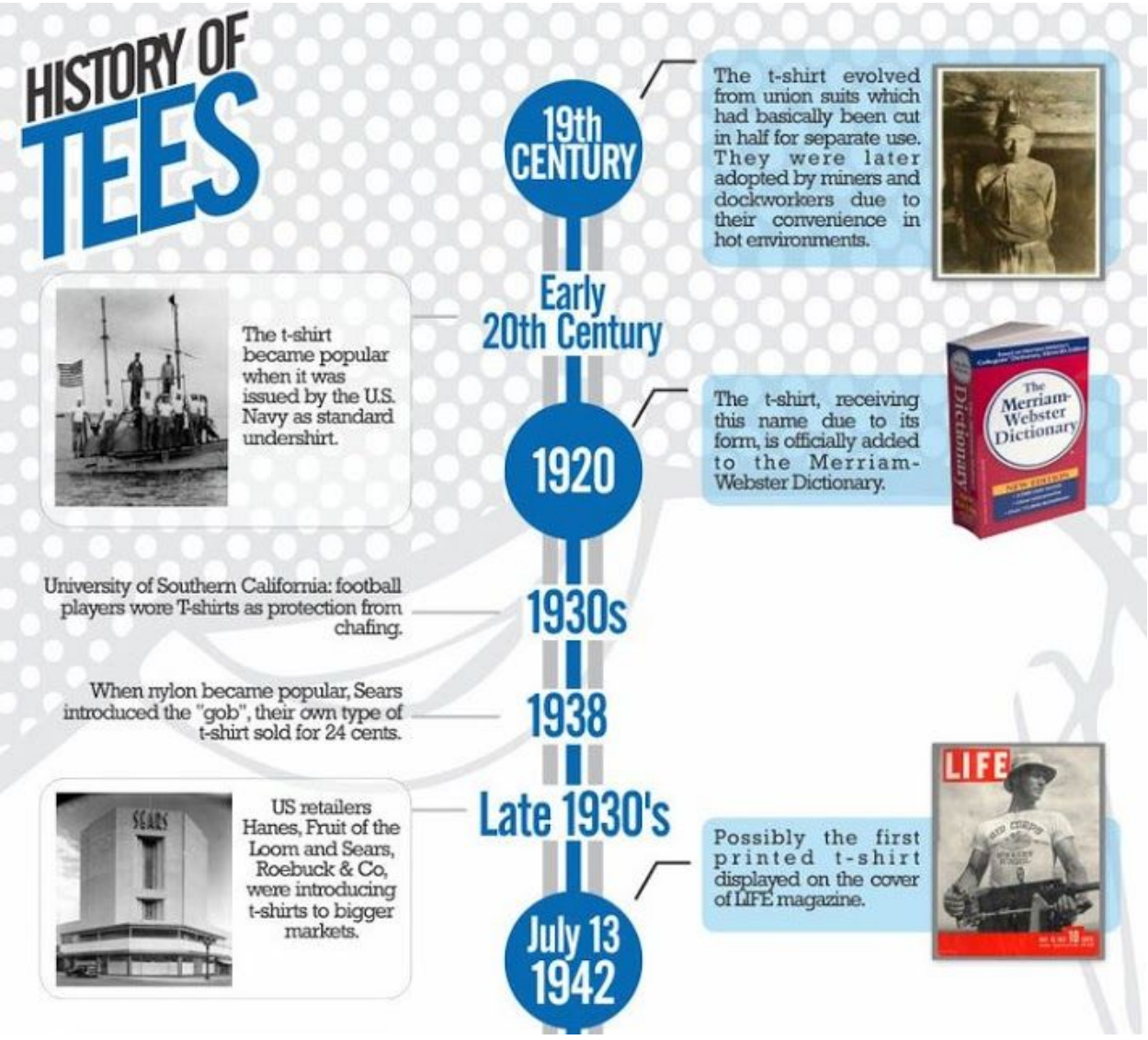
Thus far, we have explored the material, social and technological possibilities of fashion, technology and design. This project aims to investigate one specific body-based artifact and explore how technology can enhance, transform, help, inspire or entertain. The design focus (fun, serious, medical, useful, ironic) and applied technologies (physical computing, VR, AR, embodied game interfaces etc.) will be of your choice. However, the project must integrate and consider physicality, wearability and innovation in interaction as core goals of your material and conceptual research.

My keyword for the wearable item is “T-shirt”.

GENERAL REQUIREMENTS

I. Historical research: map out the history of the object
II. Technological research: map out technologies active around this object (10 examples)
III. Proposal: what is your idea? 250 words
IV. Illustration: visualization of project (collage, hand or digital drawing)
V. Schematics: technical drawing of the proposed design & system (include circuit layout)
VI. Materials: List of materials and tools needed to execute project

HISTORICAL RESEARCH

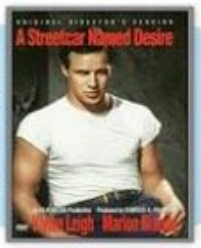


The U.S. Army and the U.S. Navy used t-shirts as standard issue with their uniforms.

World War 2

1951

Not until Marlon Brando appears in "A streetcar Named Desire" does the t-shirt become mainstream as a regular garment. So far it had always been considered undewear.



In the movie "Rebel without a cause" James Dean follows suit to Marlon Brando, helping popularize the t-shirt even more.

1955

Late 1950s

Printed t-shirts become more popular, as designs ranged anywhere from Disney characters to slogans for presidential campaigns.

Plastisol, a new type of flexible ink that allows new types of designs, opens a new market of possibilities.

Early 1960s

1969

Rit die kits were originally used to die linens and drapes until Don Rice had the idea to market them to hippies. The real breakthrough came when he gave away hundreds of tie-dye shirts at woodstock.

Malls offered clients a means to print t-shirts on the sport. Iconic designs such as I Heart NY and the Smiley emerged. Rock bands began selling shirts at concerts with their logos and slogans.

1970s

1980s

New methods of mass production were invented as well as new means of printing the shirts. T-shirts made of a blend of cotton and polyester emerged, branded as "wrinkle free".

A prototype for the first programmable T-shirt has been invented: tshirtOS. It has a LCD screen that allows you to display Facebook statuses, Tweets and Instagram snapshots.

2012

TODAY

T-shirt have evolved from their basic form into a lot more. You can now find such variations as raglans, ringers and tank tops, all becoming popular in their own right.

Today the T-shirt business is not only brick and mortar, but also virtual. New communication developments allow for constant growth. Online transactions all over the world have become faster and cheaper. The T-shirt industry is in its heyday and it will keep growing.

Presented By

idakoos.com

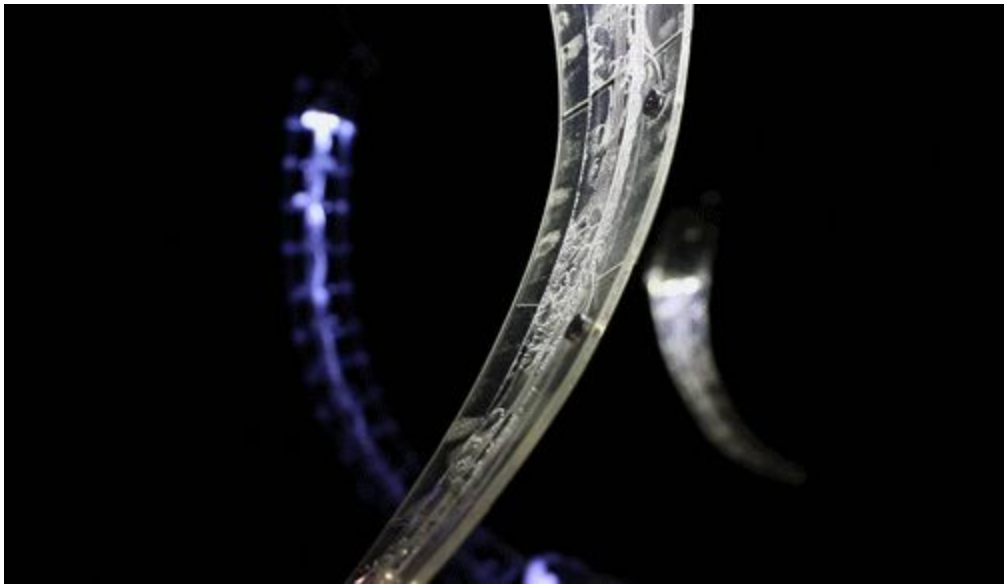
TECHNOLOGICAL RESEARCH

1. Assessment of spinal shape

“The purpose of this project is to use the Vicon 3-dimensional motion tracking system to estimate trunk and neck flexion angles as well as intervertebral angles in the neck and low back. This method would provide researchers with data beyond that provided by the electrogoniometers and could provide information regarding intervertebral motion in bending.”

http://www.skhs.queensu.ca/ergbio/research-spine_flex.html

2. Instrumented Bodies

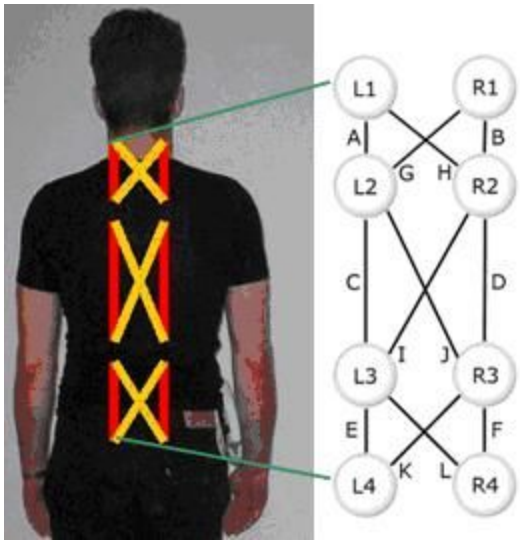


“Researchers at the Input Devices and Music Interaction Lab at McGill University recently released a video documentary on the design and fabrication of “prosthetic digital instruments” for music and dance. These instruments are the culmination of a three-year long project in which the designers worked closely with dancers, musicians, composers and a choreographer. The goal of the project was to develop instruments that are visually striking, utilize advanced sensing technologies, and are rugged enough for extensive use in performance.

The complex, transparent shapes are lit from within, and include articulated spines, curved visors and ribcages. Unlike most computer music control interfaces, they function both as hand-held, manipulable controllers and as wearable, movement-tracking extensions to the body. Further, since the performers can smoothly attach and detach the objects, these new instruments deliberately blur the line between the performers’ bodies and the instrument being played.”

http://idmil.org/news/press_release_instrumented_bodies?rev=1374118923

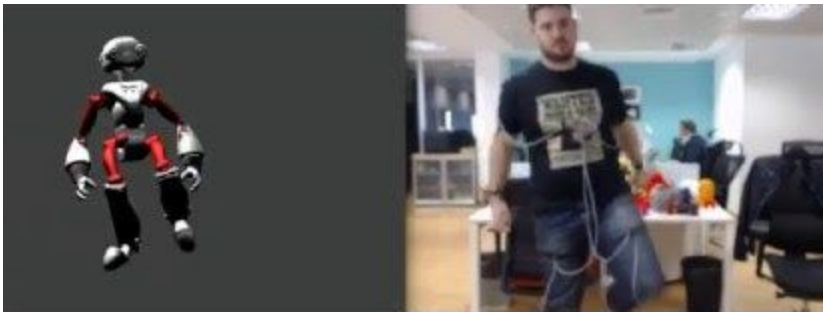
3. Evaluation Of Long-Term Seating Comfort Through Simulation Of Driver Movement



“Using highly accurate ultrasonic motion capture sensor technology, such as the sonoSensÂ® system available from Friendly Sensors AG, attached directly to the skin, this method provides many hours of data for regions of the body normally obscured by traditional optical motion capture technologies.”

http://www.lokvani.com/lokvani/article.php?article_id=3492

4. MotioSuit



“This full body suit has been developed in bq's Innovation and Robotics Department.

The suit reads the angles at which each of the user's limbs are oriented and sends them over bluetooth to the computer, where the model is updated in Blender to follow the movement.

The original intent for this project was to develop a full-body game controller, but other uses can be animating 3D models with natural movements and in a fraction of the time or even controlling a humanoid robot!”

https://hackaday.io/project/9266-motiosuit

Comment: It is a great project illustrating the high accuracy of the these tracking sensors which can literally be binded to a 3d virtual entity motions.

5. TRUPOSTURE

“We get an extremely accurate measure of the shape of the two major curves of your spine by placing an array of five miniature measuring devices – called nano-accelerometers – at strategic points along your back. We get an extremely accurate measure of the shape of the two major curves of your spine by placing an array of five miniature measuring devices – called nano-accelerometers – at strategic points along your back.”

https://www.truposture.com/NewSite/learn-more/

Comment: It amazes me that I found this very similar project concept to mine. However, this is a speculative design project which can be seen by a passed pre-order date and the whole website’s style. Moreover, it has very different user interactions to mines and it is not embedded into a compressing t-shirt. Therefore, I’m not sure if it affords its usability for daily usage by the general public.

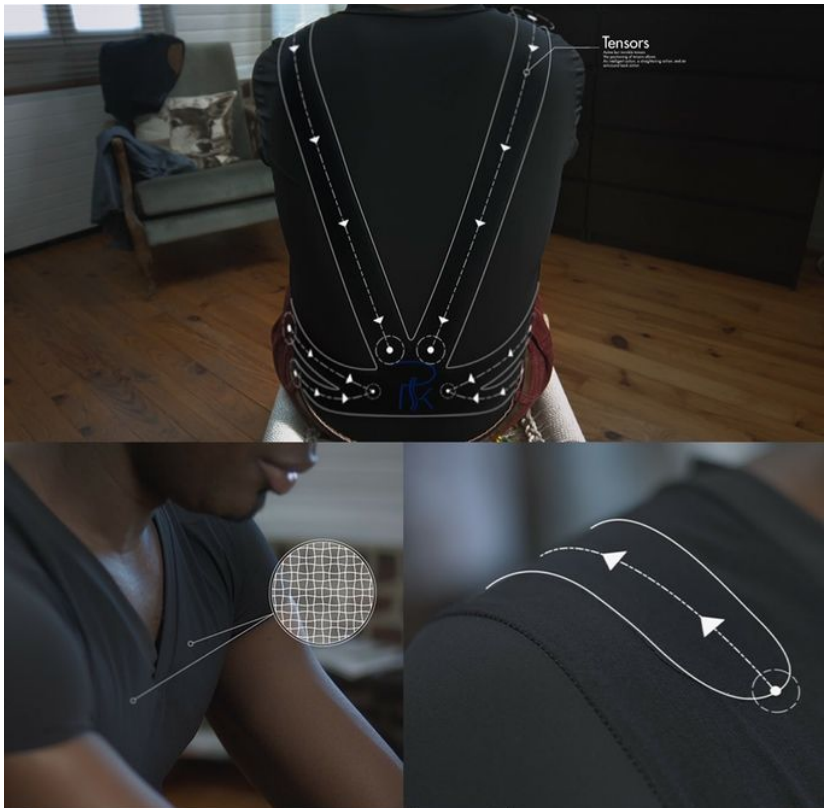
6. BetterBack

“BetterBack allows you to effortlessly sit in perfect posture, easing back pain. Even if you don’t have back pain, wearing it for just 15 minutes a day can retrain your default posture, so when you stand or sit without BetterBack, your posture is greatly improved. Good posture boosts your mood, confidence, motivation and overall health.”

https://www.kickstarter.com/projects/1123408990/betterback-perfect-posture-effortlessly

Comment: This is a more of an aggressive way to force you to keep a good posture. Due to many upper back vertebrae present in a spine, it won’t track the upper parts of your back which are also plays crucial roles in your spine.

7. Percko



“The Percko is an undershirt lined with tensors in the shape of your back with the idea of good posture in mind. When you’re sitting up straight, you don’t feel a thing. But when you hunch, slouch or move in any way that’s bad for your back, you’ll feel a slight stimulation in the right direction, letting you know you’ve got to re-adjust. It does this all without any electronics, **you don't even need a mobile app.** The sleek design aligns to the natural shape of the back, which prevents restriction but allows users to move around as they would throughout the day.The best thing about The Percko is that it is designed for you to continue to maintain your already existing life style. So if you commute to work, work from home or are simple going to the grocery store,The Percko is right there, and it has your back, helping you improve your posture.”

https://www.kickstarter.com/projects/778002582/percko-wear-it-and-get-perfect-posture

Comment: This is the most interesting project because it challenges the electronics embedding typical way of thinking. Instead it provides you with “smart” fabric which is build to teach you a certain behavior. However, I do wonder how much accurate and flexible this is device is for a variety of different people with different conditions.

8. Prime4orm

“Garmatex Technologies had developed a posture shirt that incorporated their fabrics and techniques. This shirt (called Prime4orm) had helped many early adopters and Garmatex wanted to get the shirt into the hands of more people who struggled with posture issues. They also wanted to provide more exposure for Prime4orm to increase corporate partnership opportunities.”

http://agency.media/work/prime4orm/

9. Smart wearable body sensors for patient self-assessment and monitoring

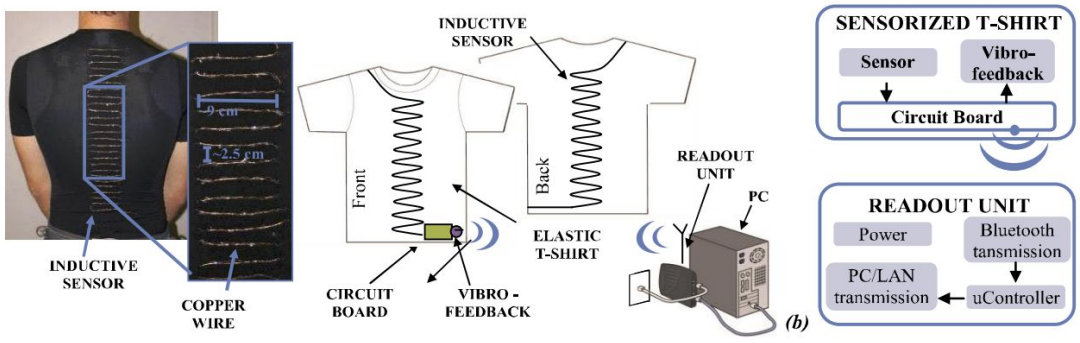


Fig. 2. (a) Posture monitoring system. (b) Block diagram.

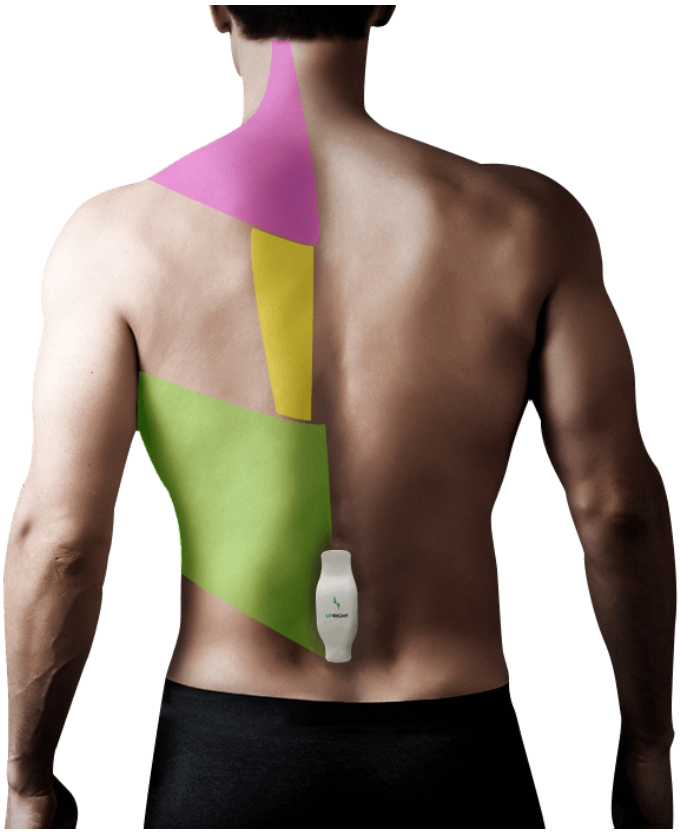
Image source[1]

"The monitoring of any human physiological parameters during rehabilitation exercises requires noninvasive sensors for the patient. This paper describes a wireless wearable T-shirt for posture monitoring during rehabilitation or reinforcement exercises. The subject posture is measured through a sensorized T-shirt using an inductive sensor sewn directly on the fabric. The wireless wearable T-shirt design specifications are the following: independence from the remote unit, easy to use, lightweight and comfort of wearing. This paper reports the conceptual framework, the fabricated device description, and the adopted experimental setup. The instrumented T-shirt's output data are compared with the data obtained via an optical system, as a gold standard, that measures the marker positions over the patient's back and chest. The trials performed on four subjects obtained on different days demonstrate that the wireless wearable sensor described in this paper is capable of producing reliable data compared with the data obtained with the optical system. The constitutive sensor simplicity that includes only a copper wire and a separable circuit board allows achieving the objectives of simplicity, ease of use, and noninvasiveness. The sensorized T-shirt, integrated with designed conditioning and transmission electronics for remote communication, could be used as a support tool for postural monitoring during rehabilitation exercises."

http://mauro-serpelloni.unibs.it/wp-content/uploads/2015/09/Wireless-wearable-t-shirt-for-posture-monitoring-during-rehabilitation-exercises.pdf

1 Appelboom G, Camacho E, Abraham ME, et al. Smart wearable body sensors for patient self-assessment and monitoring. Archives of Public Health. 2014;72(1):28. doi:10.1186/2049-3258-72-28.

10. UpRight: Bio-Feedback Posture Tracker / Wearable



“To use UpRight, you attach it to your lower back via single-use adhesive pads. When you slouch, UpRight gently vibrates, reminding you to straighten up. Sounds simple, but according to Cohen, the results have been outsized. “We hoped to begin to train people to sit up straight in about six to eight weeks. But within a week, all our beta testers reported that their awareness of their own posture increased, and within three weeks, they all reported being able to maintain an upright posture almost unconsciously,” explains Cohen. The best part: UpRight is only meant to be worn for about five minutes to an hour a day. (Check out 15 GIFs Every Fitness Tracker Addict Can Relate To.)”

http://www.uprightpose.com/

http://www.shape.com/lifestyle/workout-clothes-gear/new-wearable-technology-could-replace-your-old-fitness-tracker

PROPOSAL

In the context of the Computation Arts program held in the Concordia University, I want to create an artistic project critically engaged with the human technological wearables. The realization of this project is supervised by my teacher Valerie Lamontagne for the Project Studio II (CART 412) class. By the means of this project, I want to stress the importance of the human spine using the wearable technology medium called Spinal.

Spinal helps you to “hear” your spine condition. This wearable technology serves as an amplifying interface for the spine. Your spine allows you to move and feel due to its major role in the nervous system. This project aims to raise awareness about your spine by creating a shape-shifting interface of communication which can adapt to any spine. The latter will help your spine to manifest its condition in order to prevent an ongoing deterioration. Once this deterioration reaches a certain level such as a spinal disc herniation condition, there are only few possible treatments involving severe operations which may cause an uncomfort and reduce mobility for the rest of your life.

Spinal uses the arts to explore a fashion of smart wearable with a bio-technological interface.

The system will interpret the data and directly interact with its user through a meaningful output. Each spine is unique. Therefore, the starting point would be to position your spine into a proper posture (with a help of chiropractician if needed) and hit memorise using a haptic switch. From this point, the interaction will use vibration actuators. The user will be able to use built-in modes of interactions supporting various timeframes, intensities and positions. For instance, there will be a reminder and calibration modes. The reminder mode will remind every n time units using a vibration intensity from 1 to 5 set by the user about its spine incorrect positions. Whereas the calibration mode will vibrate on incorrect spine alignment points using a user-defined intensity until the user takes a proper position. The spine modes will be extendable and programmable to suit each user’s specific needs.

The core advantage will be in its shape-shifting nature which will allow it to adapt to various human spine dynamics. The latter will help the user to be aware about its life-essential living friend, your spine.

The interpretation of the data is processed directly in the built-in “Spinal” compressible t-shirt. Why connecting something to the Internet if there is no necessity? By keeping everything embedded not only we mitigate the possible privacy issues related to data personal data leakage but we are enabling a transparent interface closely merged to the human body.

It will feel natural and pleasant for an everyday healthy sitting life.

TECHNICAL

ILLUSTRATIONS

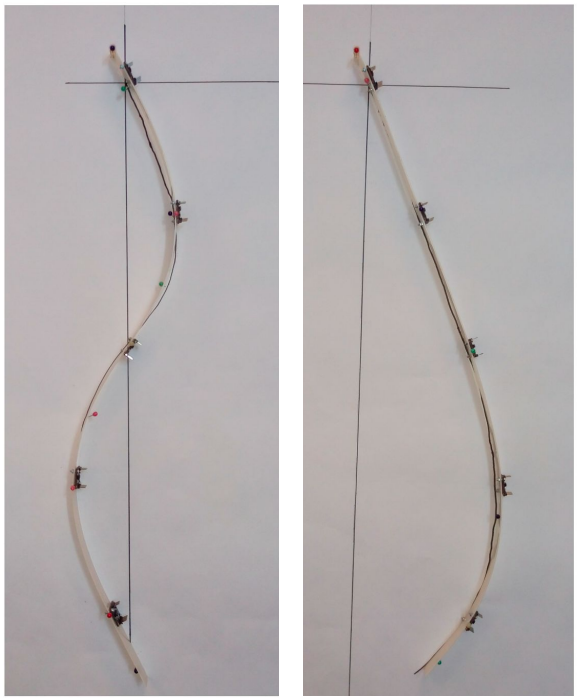
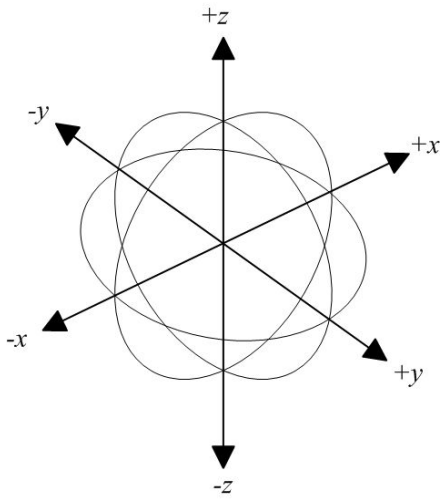


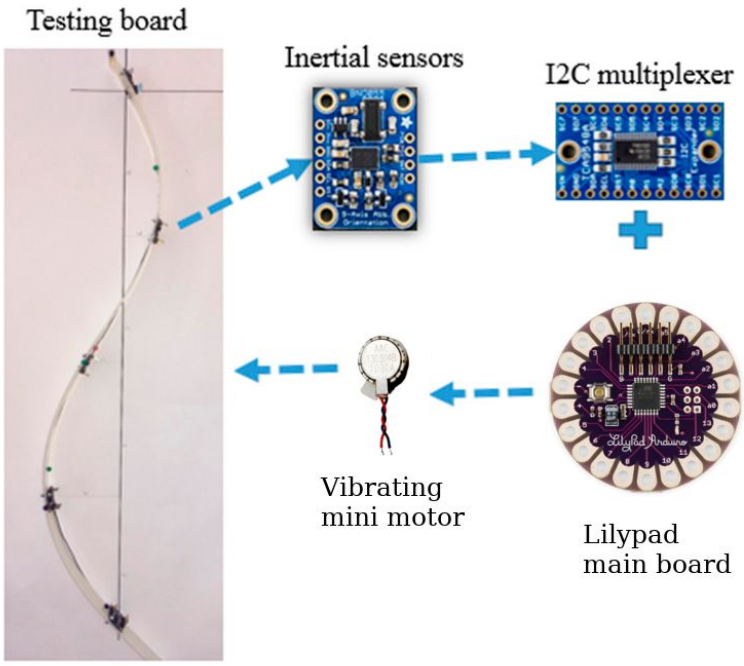
Image source[2]

2 Voinea, G.-D.; Butnariu, S.; Mogan, G. Measurement and Geometric Modelling of Human Spine Posture for Medical Rehabilitation Purposes Using a Wearable Monitoring System Based on Inertial Sensors. Sensors 2017, 17, 0003

SCHEMATICS

Note: Doe to a complex circuit nature, an exact schematic will be produced once I understand exactly how to bind the I2C multiplexer with the 5 IMU sensors. However, here is a visualisation of the communication logic:





MATERIALS

HARDWARE / MATERIAL	PRICE
Compressed (adjustable) t-shirt	To be determined
Isolating tissue	To be determined
Stainless Medium Conductive Thread - 3 ply - 18 meter/60 ft	$9.37
LilyPad Arduino 328 Main Board	$27.93
2472-ADA Adafruit 9-DOF Absolute Orientation IMU Fusion Breakout – BNO055	$244.65 ($48.93 * 5)
Vibrating Mini Motor Disc	$13.65 ($2.73 * 5)
TOTAL	$500~

Note: the budget will be updated as the project evolves.

CONCLUSION

This is very interesting project that may evolve in a variety of directions. For the moment, I'm primarily thinking about an everyday device to enhance people's health. However, there is a captivating tangent to the Spinal project in the gaming industry. The latter will depend on the resources and the available timeframe.

REFERENCES

[1] Appelboom G, Camacho E, Abraham ME, et al. Smart wearable body sensors for patient self-assessment and monitoring. Archives of Public Health. 2014;72(1):28. doi:10.1186/2049-3258-72-28., online, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4166023/

[2] Voinea, G.-D.; Butnariu, S.; Mogan, G. Measurement and Geometric Modelling of Human Spine Posture for Medical Rehabilitation Purposes Using a Wearable Monitoring System Based on Inertial Sensors. Sensors 2017, 17, 0003, online, http://www.mdpi.com/1424-8220/17/1/0003