**LS RESEARCH**
WIRELESS PRODUCT DEVELOPMENT

Left hand controls

Batteries, processors and radio
are in arms of headset

Tactile control buttons with
capacitive touch ring

Cap-touch slider

OLED Display
Capacitive Touch

Ambient Light Meter

2 Cameras
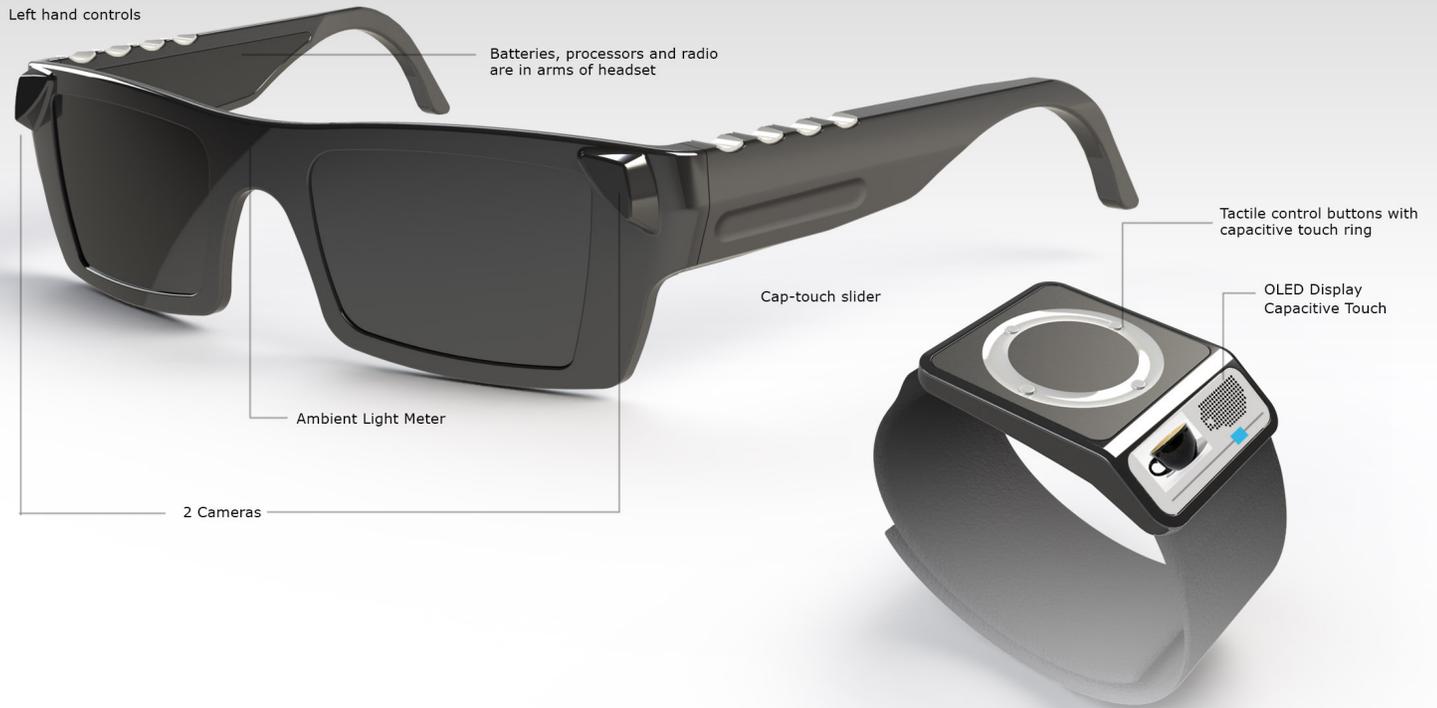
# Wearable Technology Design
## The Hidden Pitfall in your Design Plans

Richard Walters
Director of Industrial Design

# INTRODUCTION

The Wearable Technology industry, incorporating embedded electronics with clothing and other body-worn accessories, is producing arguably the biggest buzz this year in the consumer electronic, health, and wellness industries. Bluetooth-based accessories are once again on a dramatic rise, with applications broadening far beyond simply transferring phone audio to an ear bud. Designers are dreaming up new ways to harness the power of the consumer's smartphone to transmit information to and from locations on the human body, seeking to expand the usefulness of the smartphone beyond the inherent constraints caused by its form factor.

## Consumers are Left Wanting More

Whether you realize it or not, that beautiful new Samsung or iPhone's sexy shape is actually keeping you from doing more. It is becoming a pocket computer that may someday stay in your pocket or eventually "disappear" altogether, as it is integrated onto our bodies or into the things we wear. This trend towards a better, more natural user experience has been slow in coming to fruition; after all, mobile phones have been around for over 20 years and we still primarily grip them in our hands and hold them to our faces.  That being said, this trend will keep marching forward as consumers crave better solutions in terms of usability.

So the market is opening before your eyes!  Your company may be looking to leverage this trend and add a unique differentiator to your products or to improve your product's performance.  Sounds simple enough, right?  Reality is, the product-to-market roadside is quickly becoming littered with failed or abandoned Wearable Tech products. These products may perform technically but are housed in a design that you wouldn't be caught dead walking out of the house wearing.  On the other hand, other flawed concepts may look and sound good in theory, but simply don't have the performance or reliability the user expects.  I can have the sleekest looking tip calculator on the planet, but if it doesn't correctly multiply my dinner bill by 20%, I won't be carrying it around for very long.

In a nutshell, products such as these have only ensured their hammock is securely tied to one tree, not both.

## Tying Your Wearable Tech "Hammock" to Two Trees

So what ultimately makes a successful product concept for the Wearable Technology space?  We find it easiest to think of a Wearable Tech product as a hammock which must be secured to two strong, sturdy trees. After all, a hammock tied up on only one end won't offer a very enjoyable nap!

To ensure your Wearable Tech is something the end user will ultimately value, purchase, and use, it's helpful to think of two "Must Have's" for product success.  These are the "trees" that you must be securely tied to:

- Makes the consumer react with, *"That looks like something I would wear, it looks useful and makes my life easier!"*
- Intuitively and reliably performs the function(s) I expect it to.  In other words, *the technology works!*
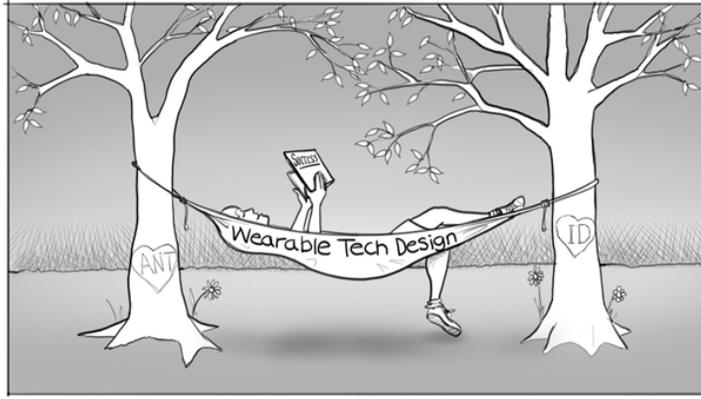


 It sounds straight-forward enough.  So why are so many products destined to end up joining the ranks of Wearable Tech products that missed the mark?  Commonly, the development team either fails to realize, or realizes too late, that when bringing the person and their technology closer and closer together, the two key design elements, namely Industrial Design and Wireless Design, are interdependent and must be approached holistically.  The following example will hopefully shed more light on this point:

**"The key for success in designing Wearable Tech is to approach both the Industrial and Wireless Technology Design methodologies holistically."**

## Holistic Approach to Industrial and Wireless Design

At the heart of the performance of nearly every product that incorporates wireless communication is the antenna.  A well-designed antenna ensures the best possible range and data throughput possible for the system.  However, the antenna does not exist in a vacuum, it lives right here in the real world.  And everything from the composition, shape, and size of the enclosure it's placed inside of, to the proximity it has to the human body dramatically impacts the effectiveness of that antenna.  In other words, if the form factor and design of the physical product are decided independently of your wireless design, you may have painted your RF/Antenna designer into a corner and the only way out is a complete re-design.

- Multiple design and prototype iterations
- Product development deadlines broken and budgets overrun
- A product that your customers simply don't want

## Real World Example: MEMI product development program at LS Research

Most companies gaining traction in the Wearable Tech space are doing so by focusing on specific problems, deeply understanding the needs and preferences of their target customer, and by being careful not to overload the individual with extra features that could complicate and dilute the real value of the product. LS Research has had the exciting opportunity to partner with the dynamic team at MEMI (www.hellomemi.com) to bring an innovative wearable product concept to reality. MEMI is creating a solution that helps women *be* connected without *looking* connected. Their fashionable, jewelry-like bracelet device stays wirelessly connected to a smartphone in order to alert the user through vibration when she receives a text or call from an important contact.

Due to the MEMI's proximity to the body and the materials used, both the industrial design of the piece and the design of the antenna were looked at collectively by the team to ensure a winning design. The combination of collaboration and expertise here at LS Research has enabled the development of MEMI to move forward quickly and clearly.

For this project, the requirement that the design incorporates metal in order to be jewelry-like in appearance strongly impacted the antenna design. Early on in the development process, the Industrial Designers and Antenna Designers sat down to collaborate on potential viable options. The team developed multiple concepts using different antenna topologies. The one that rose to the top was the "external antenna". With this design, two of the outer metal bracelet parts actually function as part of the antenna, and design changes to minimize the metal on the inside of the bracelet further improved the antenna performance. If the team had not worked collaboratively to find an optimal solution, there may have been unnecessary sacrifices made in the aesthetics or the antenna performance, or both. In the end, MEMI had a product they feel will hit the mark with their customers because the team ensured the "hammock" was tied securely on both ends!
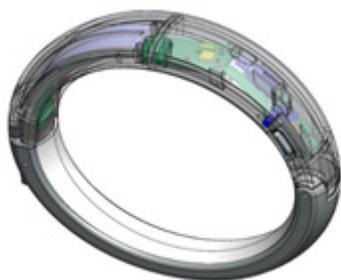
A Wearable Tech product that truly exceeds your customer's expectations not only requires a strong form factor, but at its core it is a product that must perform its function well. So as you set out to develop such a product, you will discover there are a lot of technical challenges to solve in doing so, as well. So if your organization is looking to embark on capitalizing on the Wearable Tech trend, it is critical to ask and answer the following question: "Do we have strong technical competence under our roof in both Industrial Design and Antenna/RF Design to ensure a collaborative product development approach?" If not, the recipe for success likely will lead you partnering with specialists who can deliver that approach.

> **IN ADDITION TO HAVING THE RIGHT EXPERTISE IN YOUR ORGANIZATION, YOU MUST ALSO ASSESS THE TOOLS AND EQUIPMENT, INCLUDING:**
> - 3D CAD, Modeling and Rendering software (such as SolidWorks)
> - 3D Antenna design software (such as CST Microwave Studio)
> - An Anechoic Chamber and Network Analyzer for antenna testing & certification

Hopefully, this example of an integrated design process where Industrial and Wireless Design were approached holistically has given you some food for thought. Although the product development of a wearable product can be deceptively complex, we encourage you to be courageous in creating your solutions and taking advantage of the many benefits wearable wireless products can deliver if done well. The following list of Do's and Don'ts may be helpful in your efforts.

## Wearable Tech Product Design | DO's & DONT's

| DO's: | DON'Ts |
|---|---|
| **Use an integrated team** with expertise in both wearables and antenna design | **Don't be everything to everybody**. Know your end user and stay focused on the key value your solution offers. |
| **Have a plan** for the antenna as soon as possible. Explore more than one option, as first ideas are not always the best. Remember, the performance of the antenna is directly related to other design decisions in the product, such as materials used. | **Don't just copy what others have done**. There may be better solutions, and will go a long way in creating differentiation in the marketplace by offering a unique design. |
| **Prototype and test often** and as accurately as possible, to ensure best possible technical performance.Remeber the body is soft and curvy, and location and poximity to the body can make huge performance differences. Explore flexible PCBs, formable antennas, and sewn goods if appropriate. | **Don't keep your Industrial designers isolated** from the RF/antenna designers. If so, there will be missed opportunities, budgets spent and corners to design yourself out of. |

**Want to learn more about successful product development approaches for Wearable Tech?**

LS Research is a global leader in enabling advanced wireless technology platforms including Wi-Fi®, Bluetooth®, BLE, Cellular, RFID, NFC, 802.15.4, DECT, and ZigBee®. LSR is the only wireless product development company providing turnkey M2M System Solutions with Design Services, on-site FCC / IC / CE Testing and Certification, and a broad line of RF modules.

Explore the benefits of partnering with LS Research. Visit www.lsr.com to learn more and request a follow up from your account manager.

**WANT TO LEARN MORE?** Download and watch our latest webinar from LS Research, "Designing for Success: Collaborative ID and Antenna strategies for Wearable Technologies". This webinar dives deeper into some of the technical challenges faced with Wearable Tech and how they can be overcome.