Improvements on the smartwatch

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Abstract:
The smartwatch can be improved in many aspects, battery, user interface, affordability, and physical characteristics. My paper will discuss how to improve on each category.

Introduction: Smartwatches are getting better every year but there is always room for improvement. My objective is to improve the smartwatch in which it lacks. I plan on fixing all these problems by tackling each problem one by one researching the best technology in each

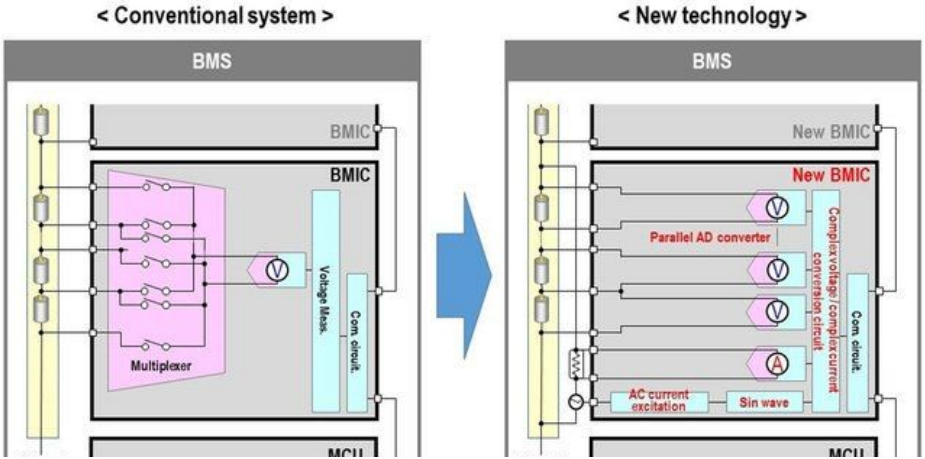
problem. I will be researching the best battery, the best software, and the best style to make the best smartwatch. First, increased battery life is the number-one improvement needed. Having a single charge lasting many days. Second, is the user interface and user experience known as UI/UX. A design that is easy to navigate and is simple will make using the smartwatch less frustrating. It has to be easy to use and pleasurable for the user. Third, is the cost of a smartwatch, in order to get a decent quality smartwatch with good battery life and high quality while having many functions can be costly. Lastly, the physical design of the smartwatch which is the size, comfort, and style of the smartwatch. The smartwatch can not be uncomfortable, heavy, and needs to look appealing.

Outline of methods: My research will be using improvement in technology that can be implemented into a smartwatch.

Batteries:

Smartwatches are growing and advancing more than ever but the limiting factor is the limited power. Batteries have not advanced that much overall but that is soon to change. Here are a few ways to better improve battery life on a smartwatch.

[Fig.1] Schematic diagram of BMS and BMIC



The Panasonic battery management system (seen on the right), working with Professor Masahiro Fukui of Ritsumeikan University has found “a new battery management technology that will make it a lot easier monitor batteries and determine the residual value of lithium-ion in them” [2]. It can now easily determine when those batteries have reached the end of their life.

Asymmetric temperature modulation which allows extreme fast charging. This is met for electric vehicles but if this technology can probably be implemented into any battery. The issue with charging is the lithium plating in the battery so with the asymmetric temperature modulation method it can charge at increased temperature to reduce plating.

Capturing energy from Wi-Fi. The wireless charging currently available is inductive charging but being able to charge with wifi could be the new way to charge smartwatch batteries. In development is a molybdenum disulfide-based rectenna which is basically a radio wave harvesting antenna, which is multiple atoms think and flexible. The rectenna collects AC power from the Wi-Fi in the air and converts it to DC to recharge a battery.

Energy harvested from the wearer. The source of power comes from the wearer, using TENG - triboelectric nanogenerator, “a power harvesting technology which captures the electric current generated through contact of two materials.” [2] The application of this technology can be endless, a smartwatch would not have to be connected to a cable to charge.

UI/UX:

UI and UX or user interface and user experience respectfully is an important part of a smartwatch. It how the user accesses their apps, read the time and overall how the smartwatch appears to the wearer. If the watch is sloppy and messy people will be frustrated and won’t buy the product. To improve the UX of a smartwatch we can start with *Learn 6 fundamental UX Smartwatch lessons that Apple learned the hard way.* Apple taking a huge portion of the smartwatch market, we can learn from their mistakes. “Best practice tip: To design for the

device, you must build your smartwatch app around this key idea of the essence. It needs to be fast, focused and delightful.” [1]

First is increased speed. The first Apple Watch would load apps slowly. It needs to be quick.

Second is being direct. “All your user experiences for smartwatch design revolve around getting to the core purpose of your app. To achieve this, you need to be direct.” [1] If it takes several clicks and screens to achieve an action that’s incorrect. The user should get to what’s most important instead of wasting time clicking around.

Two features/examples of directness from the Apple Watch is “[t]he Dock which keeps users recent and favorite apps stored in an easy-to-access spot where they are kept in their frozen state from when you last used them.”[1] This is super direct for the user getting straight into the app. The Apple Watch also has apps that can launch straight from the watch face like Workout, Music and Messages apps. The second feature is the Complications feature which is directly allowing the user to get straight to your app and arrive at a specific place within the app and also lets the user put any app on the watch face. Keeping the screen to an absolute minimum and to the most important.

Third is the apps, which needs to be purpose-built to help the user on specific needs. Apps need to be responsive to the user and offer a personalized experience. The app needs to change depending on the user, gathering data in order to make the best user experience.

Fourth is the glances and notifications, the main part of a watch that needs to provide live data. This is important to creating a smooth smartwatch experience. A rule is the two-second rule which the user should only have to at max stare at the smartwatch for two seconds. Any longer and that will be too long for the user just looking at nothing. And for notifications the biofeedback

which is when the smartwatch vibrates from a message or call while the user could be doing anything from running or driving. Make sure to craft this system simple and understandable.

Fifth is the complications being a big part of WatchOS 3's which increase customization and personalization. This is important because the user could have different tastes and would want

different layouts, colors, styles and such.

Sixth is holistic which means you can customize your watch on your smartphone not limiting the experience to your small smartwatch screen which is limiting.

Usually, the user interface can be fixed and improved with software updates and has been improving with newer generations still some smartwatches can be a hassle to navigate. These six steps can help improve the overall experience of a smartwatch.

COST:

The most recent Apple Watch, the Apple Watch Series 5 starting price is $399. That's the same price as a smartphone. That price is pretty steep. The Apple Watch Sport costs $83.70 to make where Apple Watch may cost consumers $349 and more. "In a teardown of a 38mm Apple Watch Sport, the research firm IHS said it costs an estimated $83.70 to build. That's only about 24% of the watch's retail cost." [4] and "IHS estimates that the most expensive part in the watch is the OLED display with Ion-X cover glass, made by Korean electronics company LG, at $20.50. The second priciest part is Apple's A1 processor, coming in at an estimated $10.20."

Apple takes a huge position which is why it may cost so much. The development, like the design and software, could make for the cost too.

Comfort/Style:

Use comfortable and light materials, which isn't heavy, and also have a good watch size.

Cool features:

Find my device: Locates your device which makes the device make noise using Bluetooth. I have used this feature so many times when I have misplaced my smartphone and I think is a mandatary on any smartwatch.

Messaging: Getting messages and being able to reply using your smartwatch is a major time saver and also making easier to see the message without having to look at your device.

Find my watch: I have misplaced my watch a few times and I think being able to find it using any device would be a big help.

Fitness tracker: If your walking or running, knowing how much excise is down in a day can provide data to the user making it easier to know how much the user have done. Being able to see the user's heart rate, with a heart rate sensor or how far or how much you have run with a built-in GPS can provide massive amount of data to the user letting use the data however needed.

Trade-Offs:

There are always going to be trade-offs for every watch depending on what the user wants and needs are. The cost is everything in picking the right smartwatch. Here is an example of two smartwatches that are completely different.

Price: $26.80 Pros: Long battery life about 20 days, low cost Cons: Black and white, bad UI, minimal functionality	Price: $199 Pros: Color, Many functionalities, great UI Cons: Short battery life about 18 hours, high cost
	

The future is bright for smartwatches and they will keep getting better. Someday the perfect smartwatch will be

A smartwatch that can last a week without charge,

a user interface that's clean and easy to navigate,

that's comfortable & stylish

While being affordable.

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