

Using your arm as a smartwatch touchscreen

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Credit: lumiwatch

Smartwatches as devices for messaging and search are far eclipsed by the desktop, laptop, tablet and phones, for obvious reasons, namely their tiny touchscreens. In tech parlance, the smartwatch "input-output bottleneck" is lamentable, as it is a headache trying to work with such a small space.

As Andrew Liszewski quipped in *Gizmodo*, "human fingers aren't getting any smaller, and interacting with a tiny touchscreen has proven a major disincentive for many would-be adopters of the [technology](#)."

But what if you can sport a smartwatch and just use your arm as a touchscreen? Researchers at Carnegie Mellon University have come up with a prototype that is a smartwatch with built-in projector to accomplish just that.

"Our custom smartwatch hardware consists of five primary components," the team said. The components are logic board, projector, depth-sensing array, metal enclosure and battery.

Should their prototype ever progress into a real product, its usefulness would be easily appreciated, as one might consider what a smartwatch is especially good for—and compiling a movie script is not included; it serves other purposes.

Liszewski in *Gizmodo* remarked, "Projectors have always been the most convenient way to create a temporary but large screen, which makes them the ideal way to improve the functionality of smartwatches where you only occasionally want a larger touchscreen. Most of the time I only want to see the time or who's texting me when I glance down at my Apple Watch."

The team is calling their prototype LumiWatch.

Wearables with "projected, on-skin touch interfaces have been a long-standing yet elusive goal, largely written off as science fiction," said [Robert Xiao](#), one of the team.

They have a prototype that is a functional and self-contained projection smartwatch. What do they mean by describing their watch as self-contained? It performs an independent operation—no tether to a smartphone or computer. The smartwatch offers roughly 40 square centimeters of interact area, around five times that of a typical smartwatch.

Wearable said the combined hardware and software could deliver the 1024 x 600-pixel resolution touchscreen display offering up an interactive surface on the arm. "From that touchscreen, you can [tap](#) and swipe to help replicate the kind of gesture support you'd get on a smartphone."

The display is bright enough to be seen outside as well as indoors. "You swipe left to unlock the [watch](#), and apps are then displayed along your arm," said *The Verge*.

Their watch logic board design involved a

Qualcomm APQ8026 system-on-chip, which integrates a 1.2GHz quad-core CPU, 450MHz GPU, and Bluetooth 4.0 and WiFi controller. They added 768MB of RAM, 4GB flash memory, inertial measurement unit (IMU) and ambient light sensor. The smartwatch runs on Android 5.1.

— Robert Xiao et al. LumiWatch, *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems - CHI '18* (2018). DOI: [10.1145/3173574.3173669](https://doi.org/10.1145/3173574.3173669)

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The team's paper on their work is titled "LumiWatch: On-Arm Projected Graphics and Touch Input." The author affiliations are Carnegie Mellon Human-Computer Interaction Institute and the ASU Tech Co. in Beijing.

The prototype is powered from a 740mAh, 3.8 V (2.8Wh) [lithium ion battery](#). Battery life depends on whether the use is intermittent or continuous. The authors reported on both situations. "Under average use conditions, we obtain over one hour of continuous projection (with CPU, GPU, WiFi, and Bluetooth all active). In more typical smartwatch usage, where the projection would only be active intermittently, we expect our battery to last roughly one day."

The authors tackled the challenge of heat dissipation; the small size of smartwatches limits their heat dissipation capability. "Vents and fans are a common solution to this problem, but cumbersome in a small and energy-limited form factor," they said.

They said that their current design "dissipates very little heat at the watch-skin interface, as we placed the battery at the bottom of the watch body." They noted future design possibilities: "A future design could incorporate a metallic case thermally coupled to the logic board and projector, which could dissipate some heat to the wearer. A second, more radical possibility is to redesign the watch as a wristband, with hot components better distributed, and also using the watch and straps as heat sinks."

All in all, *Gizmodo* said, "the LumiWatch is the first [smartwatch](#) to integrate a fully-functional laser projector and sensor array, allowing a screen projected on a user's skin to be poked, tapped, and swiped just like a traditional touchscreen."

More information: —

www.robertxiao.ca/research/lumiwatch/

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