**Description**  
The wristwatch has been an ever-present wearable technology since its inception in the early 1900s, and has undergone continuous technical refinement since that time. Researchers have long viewed the immediacy and ubiquity of the wristwatch as a vehicle for computation, pushing its capabilities to ever-greater heights. In 2000, IBM demonstrated the first watch running a full operating system.

One of the main reasons a wristwatch emerges as an attractive wearable device in the fact that a large fraction of the population is already accustomed to wearing wristwatches, thus favoring the learning curve for novice users. Furthermore, people generally keep watches on their wrists, and watches are less prone to be misplaced compared to phones and tablets. For example, a hip holster or pocket are not convenient places to keep a cellular phone while sitting in a car, and so people tend to keep them in the car seat and forget them when they leave the car in the parking lot. Another significant advantage of a wrist watch is that it is much more accessible than many of the other devices one may carry. It is often said that one of the reasons for the initial success of the Palm was its moving to an instant-on paradigm, i.e. eliminating the long boot up time associated with laptops. Wrist watches move users to the next step: an instantly-viewable paradigm.

From its beginnings, wearable devices have often faced a major challenge: user interface. An adequate smart phone user interface was missing for a long time. An adequate UI was the major success factor of the iPhone --the reason it was superior to all other approaches at that time. The same challenge is ahead for this new class of device: the *smartwatch*.

Unlike smartphones, which can be scaled to a variety of sizes, smartwatches must be small and unobtrusive in order to remain socially acceptable, which has long limited their practicality. The reduced size of the screen poses challenges to the possibilities and usability of multi-touch technology. One approach, followed by Google, is voice recognition. However, it does not appear to be socially acceptable to talk to a watch yet. In addition, in environments with strong noise pollution, its accuracy falls dramatically. This is particularly true of devices such as the Samsung Gear, as its michrophones are tuned to support surrounding noise for its video recording feature.  
  
Devices such as the Moto 360 and Apple Watch make use of a gyroscope to recognize when users turn their wrist to look at the device so as to lighten up the watchface. This feature provides the foundations for a technology which emulates the most intuitive movements we do with our hands and arms - touching and pointing to something.   
  
The User Interface design below aims to enhance the most important capabilities of existing smartwatches while eliminating aspects and features that proved to be an impediment for usability purposes.  
  
  
**Design**JLF Watch stays true to the timeless form of the classic wristwatch. A round design maximizes the display area, while ensuring a comfortable fit. Each material has been carefully chosen and meticulouoslyl crafted -from the stainless steel case to the interchangeable wrist bands, and scratch resistant glass. JLF Watch organizes your information by predicting what you need to see, when you need to see it, and displaying it before you even ask. Voice controls makes it easy to get things done, even when your harnds are full. Send texts, set a reminder, check the weather or communicate with devcices in your home, all with just your voice.   
  
It’s worth noting that when a smartwatch runs out of juice, you don’t lose just the smart functions. The display dies, and you lose the ability to even tell time. At this point, you really need to appreciate the shiny brushed metal, because you’re wearing nothing more than an expensive bracelet.

gyroscope

The approach we present complements contemporary smartwatch input mechanisms, namely touch, physical buttons and voice. Our approach does not hinder any of latter modalities, while simultaneously enabling new dimensions of input, which we view as a significant benefit. That being said, there are several drawbacks and limitations that should also be noted, which we now describe.

As with capacitive touch, buttons and voice, there is a danger of accidental input. This might occur by snagging on clothing or being “pushed” when e.g., the hands are resting on a table. Like other modalities, an “unlock” mechanism might have to be employed to reduce false activations. Indeed, a device could have one such mechanism shared by all input modalities.

When outside of a 10m radius of your attached phone, the watch will alert you to an incoming call, if you are unable to return to your phone to answer the call you will have an option to send a message to the caller informing them you will return their call soon.

These will look a lot like the cards in the Context Stream: short snippets of relevant information, with an optional photo backdrop. Again, you'll be able to swipe to the right to see expanded information. An action button will let you perform commands on your phone without actually touching it, usually via voice, though the full capability of these actions hasn't been revealed yet.

Nowadays, phones have much more power and memory so can easily support more complex prediction models, which greatly reduces the impact of ambiguity by taking the context of the words into account.

In our application, we have three kinds of feedback: visual feedback on the smartwatch display, audio feedback (e.g., a knocking sound when performing a virtual knock) and vibration in case of a notification.

Also for smartwatches, visual feedback remains the most common way of providing feedback to users. In order to keep the display contents easy to grasp, we only show information that is essential, following the recommendations of Kärkkäinen and Laarni [8].

However, the ambient light sensor makes a huge difference to the experience of using the Moto 360. With it enabled, the device adapts the light of the screen according to the environment you're in, saving you having to access the settings to increase or decrease the screen brightness whenever the lighting conditions change.

At it’s very core, a watch is there to provide you with the time. We have many variations of watches, some offer more, quite a few can tell you the date or the day of the week, or even the current altitude.

make smartwatches intuitive: voice, gesture, and contextual response.

Smart watches will have sensors and be close to our body to constantly measure our pulse and other body functions.

Rolling the crown causes a scrolling action when textual content is

**Usage Scenarios  
  
Office Use**

In office spaces, administrators interact both with eacth other and with varaious analog and digital devices in the offices, providing an interesting space to utilize smartwatches . The smartwatch’s interface could therefore not omit this kind of environments.  
  
As smart watches are normally worn on the wrist, there is a significant potential for them to digitally augment gestures performed in day-to-day contexts. The watch’s interface will include an application to assist office employees in easily locking and unlocking doors, in acquiriing information and notifying others when they want to enter their office.

The reduced size of the screen calls for fast interactions. The Office app of the watch implements two types of physical gestures to support the most imporant functionalities. First the application provides the opportunity to perform a virtual knowck with the same gesture as a real knock. Secondly, the interface supports opening/closing doors using the gesture of turning your wrist, just like turning a key to open a door.   
  
Knowledge workiers tend to drop by each other’s offices regularly, for example, to ask for assistance or quickly discuss something. Even with the door open, knocking on the door is a common gesture to politely indicate your presence and check whether you are not interrupting the person. Using the smartwatch, one could digitallyl augment these gerstures, which can provide a number of benifts. For example, when a person is not in his office, knowck gestures coulds till be recognized and transferred to that person’s smartwatch. This allows office workiers to keep a reacord of who came by and who they might have missed. Additionally, it is often incovenient to interrupt a phone or Skype call to tell the person knocking on the door that it is not a good time. Nevertheless, depending on who is knocking on the door, it might be important enough to interrupt the phone call. Using the smartwatch’s interface, the person in the call gets a notification about the virtual knock, and can choose to grant or deny their colleague access, without having to interrupt the call.   
  
Keys (or keycards) are commonly used to open doors in office buildings. However, they present several disadvantages: generic keys could still provide access to restricted rooms; they might be lost or forgotten (e.g. employees could lock themselves out); employees might forget to lock their door, which could lead to theft of personal belongings or sensitive information. The smartwatch matches the identity of its users to the door they have the rights to open to proved more fine-grained access control. Using the users’s identity, employees can be restricted access only to doors they are allowed to open. Employees do not have to remember to bring their keys with them, assuming they always have their smartwatch on their wrist. To prevent theft, doors could be automatically locked after a specific period of time and door entry and exit could be logged.

When doing gestures, it is difficult to see what is happening on the screen. During the development of our app, we noticed that when a gesture was performed, the device could have detected two different gestures in sequence. However, when the user looked at the screen, he only got feedback of the last gesture that was performed. To address this problem, we decided to add audio feedback and play a sound every time a gesture has been detected. Users should be able to immediately distinguish the performed gesture based on the sound they hear. For example, when a virtual knock gesture is performed, the device plays a real knocking sound. For the opening/closing gesture we decided to use a rattling keys sound  
  
  
Audio feedback will also be generated when someone needs to be notified, like receiving a virtual knock on his device. This is helpful because users might not look on their watch at all times. Vibrations are only used sparingly, as they can be annoying to the user. Vibrations are only used for notifications: for notifying the user when someone is knocking on their door, when they need to attend a meeting, in case of an error, or when the user tries to perform an action without the

right permissions (e.g. opening the boss’s office door).

**NFC**Near field communication, abbreviated NFC, is a form of contactless communication between devices such as smartphones or tablects. Contactless communication allows a user to wave the smartphone over a NFC compatible device to send information without needing to touch the devices together or go through multiple steps setting up a connection.  
  
With NFC, a new type of user interface emerges. It is not on the screen anymore, but deeply embedded in the real word. For smartphoens, such technology was so far of limited succes because it is conventient to control with the touchscreen. But for devices like a smart watch there will not be a screen of adequated size. Making contact with a NFC tag, which initiates a context-dependent action is the simplest thing to do, especially because the smartwatch is placed on the users’ wrist, and pointing to or touching something is one of the most intuitive human gestures to most groups. With NFC and smartwatches, this gesture has the potential to connect the real and the virtual world in a new and innovative way.   
  
Its NFC capability will allow users to share files, such as photos, videos, contacts, etc. by just having their phones in proximity.   
  
However, the potential uses of NFC go well beyond this. The NFC chip will let users purchase items just by reaching the phone close to a receiver at a cash register. In order to ensure the security of these transactions, each payment will require the user to swipe their finger through the fingerprint sensor, found on the side of the watch. This mechanism emulates the behavior of Apple Play on the iPhone 6 and iPhone 6 Plus.   
  
Users will also be able to use their rewards cards at different locations, or check in for their flights without the need to pull out their phones. The power will be   
  
  
Home Appliances  
Because of the small screen we wanted to make the interaction fast. We decided to implement three types of physical gestures to support the most important functionalities. First, we provide the opportunity to perform a virtual knock with the same gesture as a real knock. Secondly, we support opening/closing doors using the gesture of turning your wrist, just like turning a key to open a door. Finally, the last gesture we provide is swiping your arm to bring you back to the home screen with room scanning functionality.

**Rationale for Design**  
Smartwatches promise to bring enhanced convenience to common communication, creation and information retrieval tasks. Due to their prominent placement on the wrist, they must be small and otherwise unobtrusive, which limits the sophistication of interactions we can perform. This problem is particularly acute if the smartwatch relies on a touchscreen for input, as the display is small and our fingers are relatively large.

Principles of Good Wearable Design:

1. Glances, not stares: No smartwatch should ever command the attention, especially the eyesight, of a user for more than a few seconds at a time. Spending longer erodes any advantage over a smartphone

2. Interact once, display many times: Smartwatches should primarily provide displays of information and prompts for action rather than providing rich interactive elements, meaning they will show lots of information that is passively consumed.

3. Speed over accuracy: Consumer smartwatches should be flexible, fun, in-the-moment companions, which means they should make lots of ignorable suggestions rather than waiting to make a few suggestions that it deems perfectly right, as current predictive services do.

4. Pass the hallucination test: Smartwatch use can be perceived as novel behavior, but it can’t present like Bluetooth headsets, which make it impossible to know who is on the phone and who is screaming at an imaginary friend on the street.

The fashion-will-fix-smartwatches narrative is a really compelling story. It’s also completely wrong — or, at minimum, flies in the face of decades of study about how new technologies get adopted. As documented by Everett Rodgers in The Diffusion of Innovations, no fundamentally new product type succeeds solely based on the fact that it’s attractive; it succeeds because it does something genuinely useful at a price point low enough that people don’t consider it a luxury. And then it becomes normal and even attractive because it was first useful.

So if it’s not fashion, what is standing between today and the smartwatches-everywhere future? One thing: a great, unique interface that showcases how much better this new product type can perform both new and existing functions.

Eliminated some of the hardware at the table. Keep the online engagement to smaller bites and less intrusive manners.

Following requirements for navigation between screens on the watch:  
(i) a quick return to the watch face from any application,   
(ii) a time-out to the watch face from any function,

(iii) one touch deactivation of alarms,

(iv) direct access to the main list of applications,

(v) user programmable touch screen areas that could be used to acces the user’s most important applications

(vi) the ability to easy return to the previous screen (People are familiar with the browser model and the concepts of following hyperlinks and going back in the browser history stack. Therefore extending the concept of a browser back button to every watch face screen is desirable)

We wanted usage of the wrist watch computer to be obvious, and avoid the need for a thick user manual for the watch. We started with Human Computer Interaction (HCI) concepts from familiar computing environments such as web browsers, etc., and then employed a user-centered design process to tune the environment.   
  
  
  
**Usability Metric Forecast**

References