IN4MATX 133: User Interface Software

Lecture 25:
Designing for Wearables

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Class notes

- Quiz 4 grades are posted
  - Average ~87%, no curve as a result
- Your quiz grade is based on the top 4 scores
  - No need to take Quiz 5 if you’re happy with your scores
  - Quiz 5 covers 11/19 lecture to 12/3 lecture (5 total)
- Assignment 3 grades will be posted in the next few days
  - Assignment 4 feedback hopefully not long after that

Class notes

- Course wrap up on Wednesday 12/5
- Class canceled Friday 12/7
  - I’m in a remote meeting from 4am to 9am on 12/7 and 12/8, I won’t be much fun
- There will likely be office hours on 12/11, but still TBD

Dec 2	Dec 3 **Designing for Augmented and Virtual Reality** 2:00-2:50 | DBH 1100 **Jamshir Office Hours** 5:00-7:00 | ICS 440	Dec 4 **Quiz** Device Resources, Databases, Visual Design, & Other Devices **Discussion** 7:00-7:50 | SH 134 **Discussion** 8:00-8:50 | SH 134	Dec 5 **Wrap-up** 2:00-2:50 | DBH 1100 **Professor Epstein Office Hours** 3:00-5:00 | DBH 6093	Dec 6	Dec 7 **Professor Epstein Away (CHI Committee Meeting), class canceled** **Simion Office Hours** 3:00-5:00 | ICS 440	Dec 8
Dec 9	Dec 10	Dec 11 **A5 Due** Improved Sleep Tracker in Ionic	Dec 12	Dec 13	Dec 14	Dec 15

Today's goals

By the end of today, you should be able to…

- Describe some of the history of wearable computing
- Explain key principles for designing a good experience on a wearable
- Describe novel areas of research within wearable computing

What is a wearable computer?

A MUCH More Diversified Market Than Investors Realize

CREDIT SUISSE

What is a wearable computer?

- A computer on the body that is:
  - Always on
  - Always accessible
  - Always connected
- Other actions:
  - It augments user actions
  - Is aware of the user and their surroundings

Rhodes, B.J. 1997. The wearable remembrance agent: a system for augmented memory. *Personal Technologies*, 1(4), 2018-224.

The ideal wearable

- Persists and provides constant access
  - Designed for everyday and continuous use over a lifetime
- Senses and models context
  - Models the user’s environment, mental state, and it’s own state
- Augments and mediates
  - Information support for the user in both physical and virtual realities
- Interacts seamlessly
  - Adapts input and output modalities to those most appropriate at the time

Starner, T.E. 1999. Wearable computing and contextual awareness. *Dissertation, MIT*

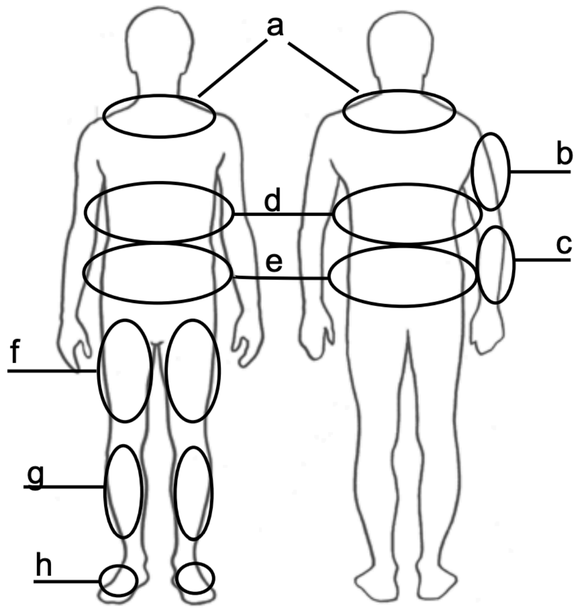
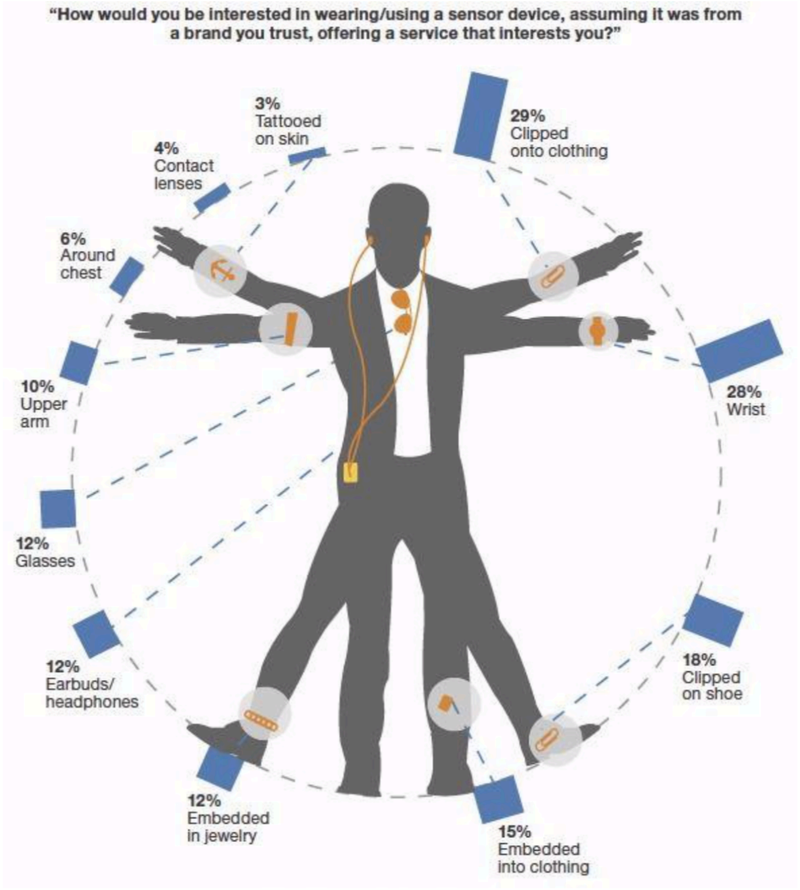


Fig. 1, The general areas we have found to be the most unobtrusive for wearable objects are: (a) collar area, (b) rear of the upper arm, (c) forearm, (d)rear, side, and front ribcage, (e) waist and hips, (f) thigh, (g) shin, and (h) top of the foot.

Gemperle, F. Kasabach, C., Stivoric, J. Bauer, M. Martin, R. Design for Wearability. ISWC 1998.



North American Technographics Consumer Technology Survey, 2013.

A very incomplete history of wearable computing

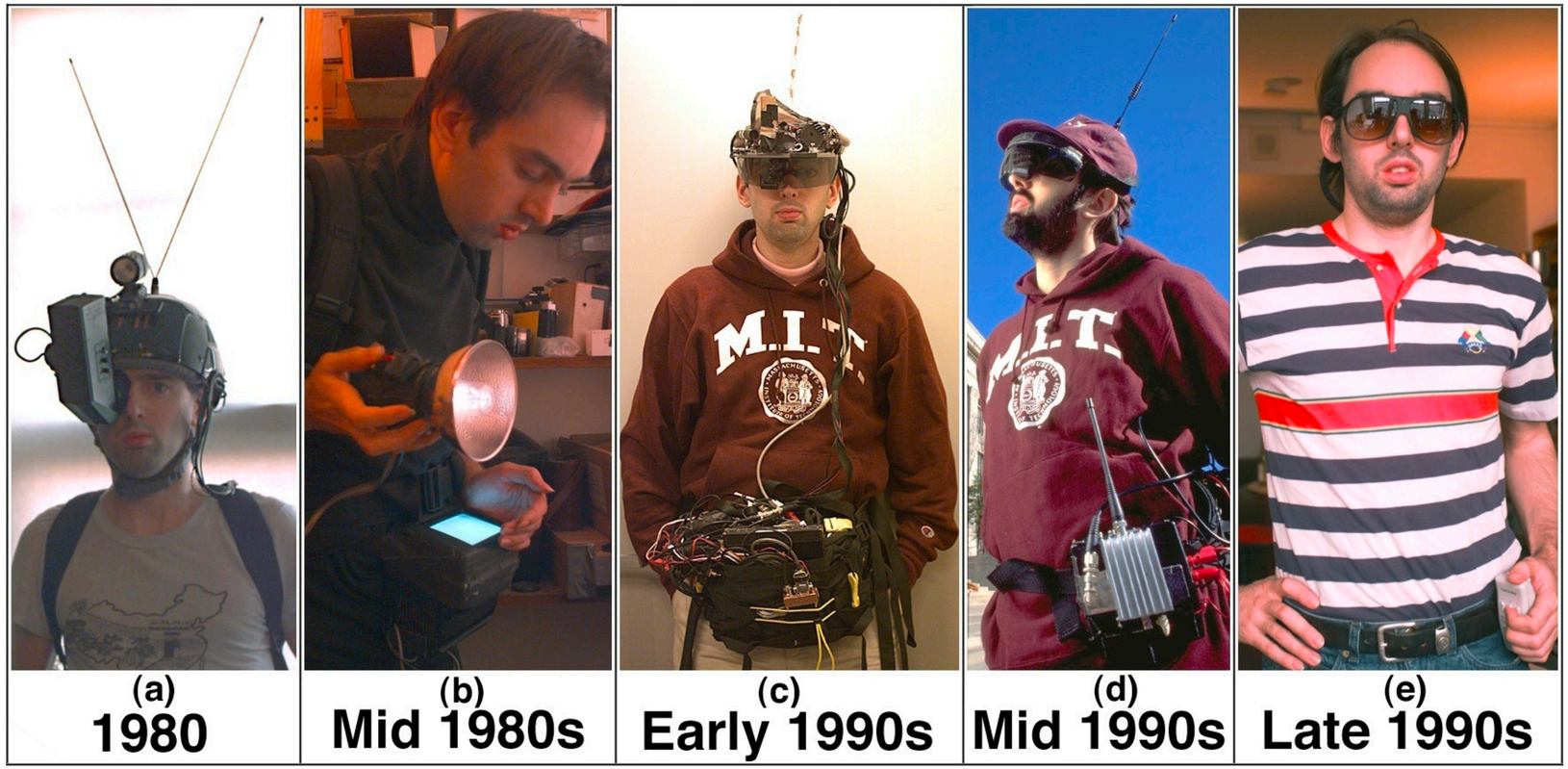
Body and head-mounted wearables

Blackjack card counting (Keith Taft, 1972)

- Belt computer
- Input in toe
- LED in glasses for feedback

https://gizmodo.com/casinos-and-con-men-the-hustler-origins-of-wearable-co-1718085809

Steve Mann (1980's)



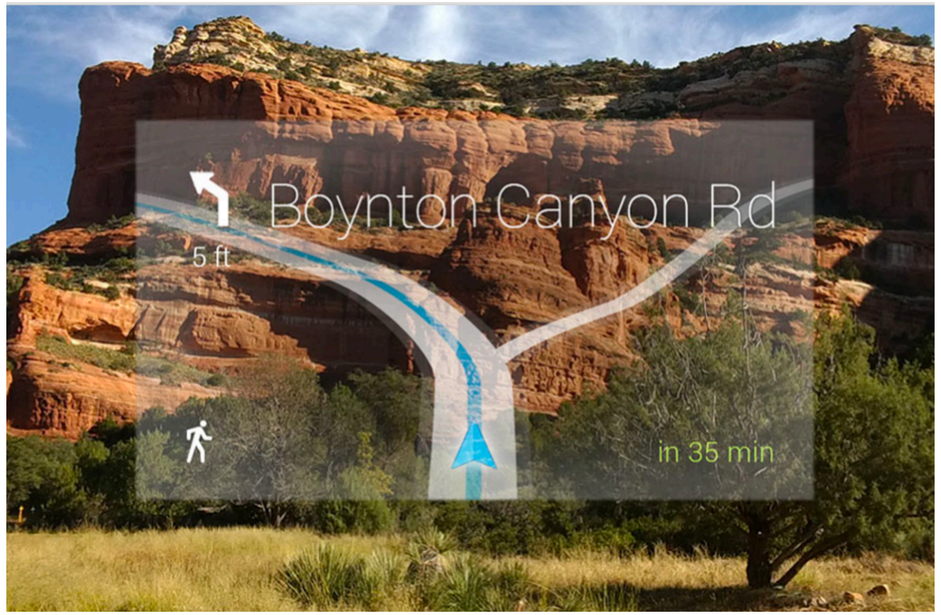
MIT Wearable Computing (1996)

Google glass

- Commercial smart glasses, released in 2013
  - Technology lead by Thad Starner, part of the MIT group
- Front-facing camera, rear-facing display
- Gyroscope/accelerometer/ magnometer
- Natural language input capabilities

https://www.x.company/glass/

Google glass



https://www.x.company/glass/

Google glass

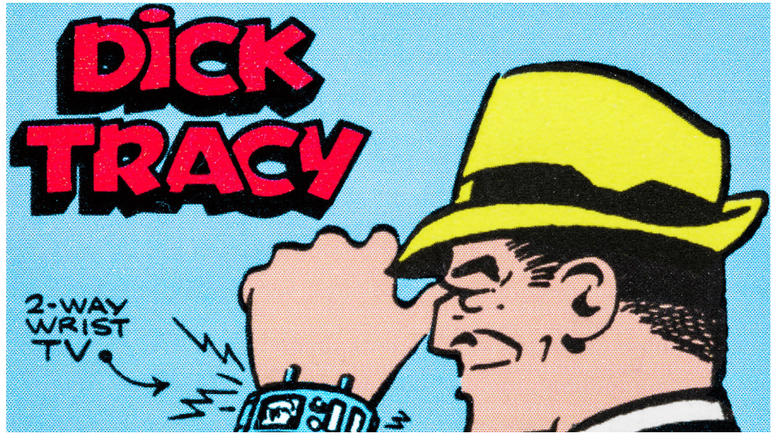
- Privacy and safety concerns prevented take-off in the consumer space
- Lives on in enterprise spaces
  - New version released in 2017
  - Used in manufacturing, healthcare

https://www.x.company/glass/

Wrist-worn wearables

An early vision: Dick Tracy

- Comic strip created in the ‘30s
  - Cartoonist: Chester Gould
  - A forensic detective with James Bond style gadgets
- Gould knew Al Gross, the inventor of walkie-talkies
  - Gross imagined making a watch-sized version
  - Gould asked to include it in the strip



Smartwatches

Fitbit (2011)

- One of the first commercially successful digital pedometers
- Early versions were hip-worn, now almost exclusively wrist-worn
- “Fitness-first” design
  - Activity prominently included on the home screen
  - Richer dashboard on the phone/ desktop

Pebble (2013)

- Arguably the first commercially successful smartwatch
  - Two of the most funded Kickstarter projects ever
- E-ink display led to high battery life (a week vs. a day)
- Paired with a phone via Bluetooth
  - Could retrieve email, control music, receive notifications, etc.
- Acquired by Fitbit in 2016

Apple Watch (2015)

- From the onset, it was intended to be a “second screen” companion to iOS devices
- Original versions could do almost nothing without pairing to an iOS device
- Apps add a secondary component to an existing iOS app

Wrist-worn wearables

- Early visions described communication purposes
- Commercial approaches examined sensing context
- Today’s technology aims to augment our experience

Design recommendations for wearables

Think minimal design

- High contrast
- Bright colors
- Sans-serif typography
- Large fonts

https://mayvendev.com/blog/10-tips-for-designing-for-wearables-and-watches

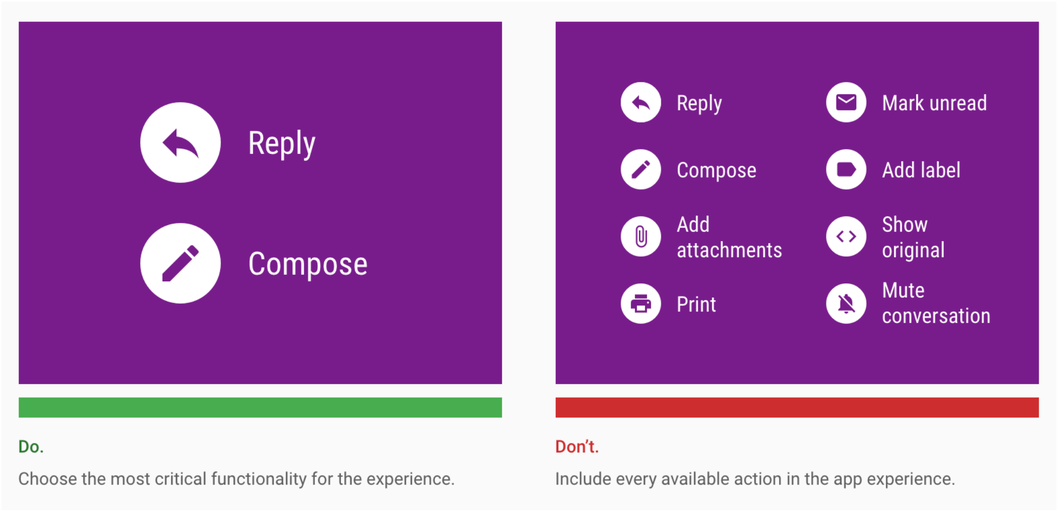
One visual thought per screen

- Real estate is extremely valuable on watches
- Shrinking a mobile or desktop app will create a bad experience
- Keep words and interactions to a minimum

https://mayvendev.com/blog/10-tips-for-designing-for-wearables-and-watches

Reduce input options

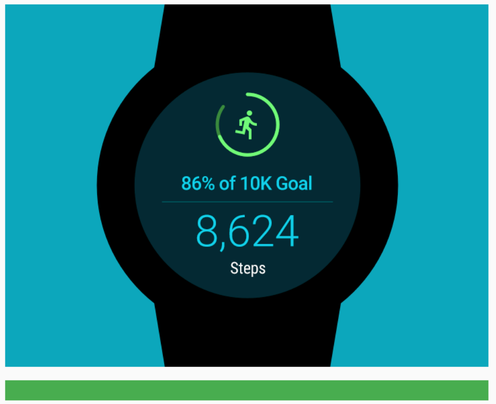
- Have only a couple of buttons per screen
- This may mean a watch app has fewer features than a mobile app
  - That’s okay!
  - The watch augments the experience
- Consider voice input when longer instruction is needed



https://designguidelines.withgoogle.com/wearos/wear-os-by-google/designing-for-watches.html

Some apps don’t need a watch interface

- For some apps, a watch app may not add to the experience
- Focus on use cases which make sense
  - Quick input
  - Glanceable feedback



Do.

Design experiences where tasks can be accomplished easily using the watch interface.

Don’t.

Complex, detailed apps that include items like spreadsheets may be difficult to edit and view on a watch.

https://designguidelines.withgoogle.com/wearos/wear-os-by-google/designing-for-watches.html

Question

These are all Apple Watch apps. Which have a compelling use case?

Pick whichever choice is closest to what you believe.

New York Times (news)
Dark Sky (weather)
Fandango (movie purchase)
RunKeeper (fitness)
OneNote (notetaking)

A. None of them have a compelling use case.

B. Dark Sky

C. Dark Sky, RunKeeper, Fandango

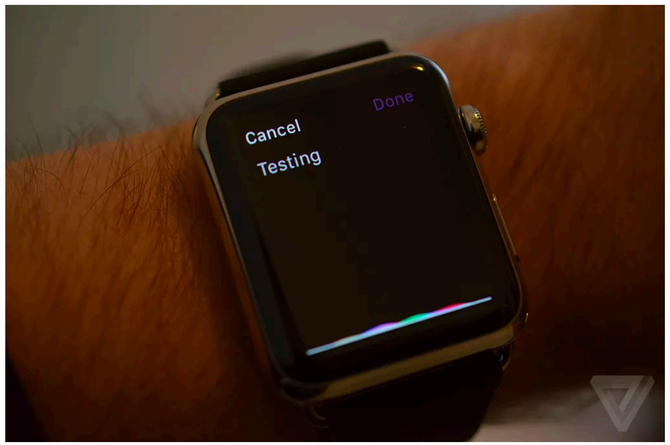
D. Dark Sky, RunKeeper, New York Times, OneNote

E. All of them have a compelling use case.

Microsoft apps for Apple Watch

Powerpoint remote

Skype messaging



OneNote voice memos

Are these compelling use cases?

https://www.theverge.com/2015/4/28/8508445/microsoft-apple-watch-apps-hands-on

Questions to consider

- Would a watch app add anything to my mobile app?
  - Is there timely information the app needs to provide?
  - Can it be shown in a very small format?
  - Are there simple controls to the app that would be added to a watch?
- Do I have the resources/time to do this?
  - Currently limited market impact, but growing
- What type of interaction do you want the user to have?

Research highlights

New input modalities

Ke Sun, Yuntao Wang, Chun Yu, Yukang Yan, Hongyi Wen, and Yuanchun Shi.
Float: One-Handed and Touch-Free Target Selection on Smartwatches. *CHI 2017*.

New input modalities

Robert Xiao, Gierad Laput, and Chris Harrison. Expanding the input expressivity of smartwatches with mechanical pan, twist, tilt and click. *CHI 2014*.

Leveraging quick interactions

Michael Nebeling, Alexandra To, Anhong Guo, Adrian A. de Freitas, Jaime Teevan, Steven P. Dow, and Jeffrey P. Bigham. WearWrite: Crowd-Assisted Writing from Smartwatches. *CHI 2016*.

Leveraging quick interactions

Tom Horak, Sriram Karthik Badam, Niklas Elmqvist, and Raimund Dachselt. 2018. When David Meets Goliath: Combining Smartwatches with a Large Vertical Display for Visual Data Exploration. *CHI 2018*.

New wearable sensors

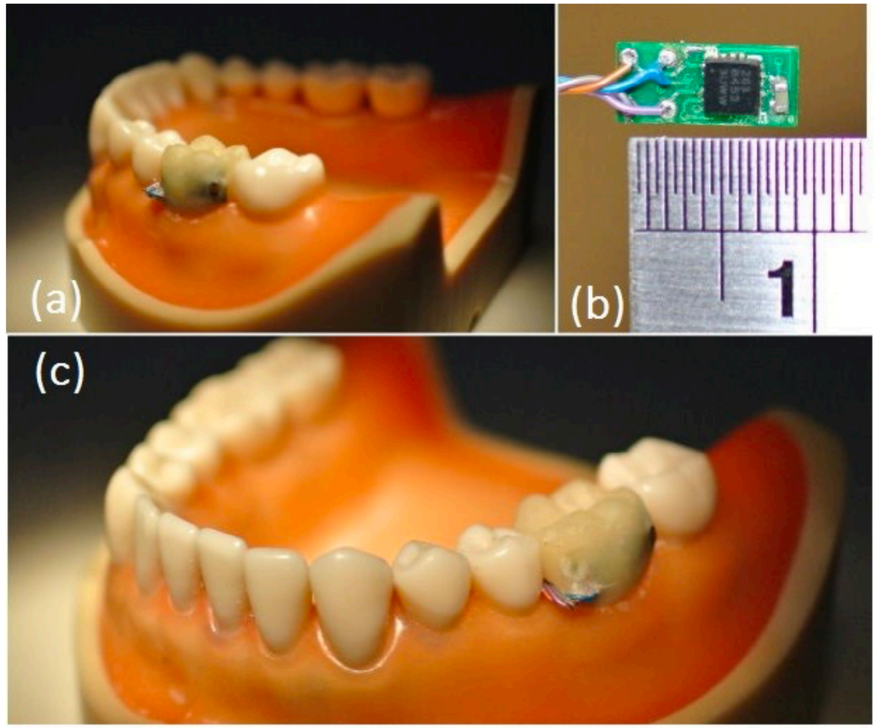


Figure 1. The breakout board with (b) tri-axial accelerometer and (a)(c) sensor embedded denture.

Cheng-Yuan Li, Yen-Chang Chen, Wei-Ju Chen, Polly Huang, and Hao-hua Chu. 2013. Sensor-embedded teeth for oral activity recognition. *ISWC 2013*.

New wearable sensors

Fig. 3. The three sensor mounts at different angles (0, 30, and 45) were prepared to account for the differences in neck postures among individuals. The second and third image show the front and the side view of the sensor on a subject. In our application, the distance *d* between the proximity sensor and jaw is measured as shown in the third image.

Keum San Chun, Sarnab Bhattacharya, and Edison Thomaz. Detecting Eating Episodes by Tracking Jawbone Movements with a Non-Contact Wearable Sensor. *IMWUT* 2, 1, Article 4 (March 2018).

New wearable sensors

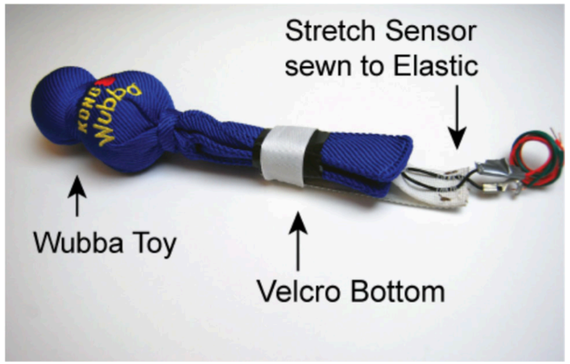


Fig. 7 Tug sensor showing variable resistor sewn into elastic

Fig. 8 Border collie activating tug sensor on-body

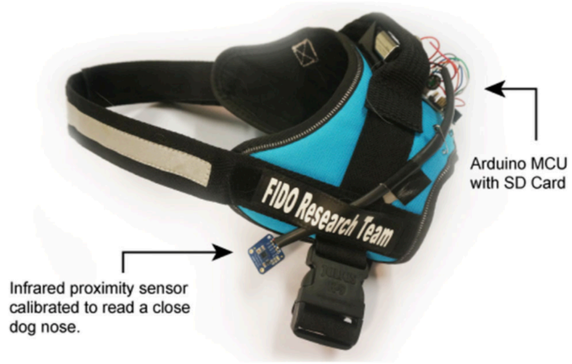


Fig. 14 Infrared proximity sensor on vest

Fig. 15 Border collie activating the infrared proximity sensor

Melody M. Jackson, Giancarlo Valentin, Larry Freil, Lily Burkeen, Clint Zeagler, Scott Gillibrand, Barbara Currier, Thad Starner. FIDO—Facilitating interactions for dogs with occupations: wearable communication interfaces for working dogs. *Personal and Ubiquitous Computing, 19 (1) January 2015.*

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