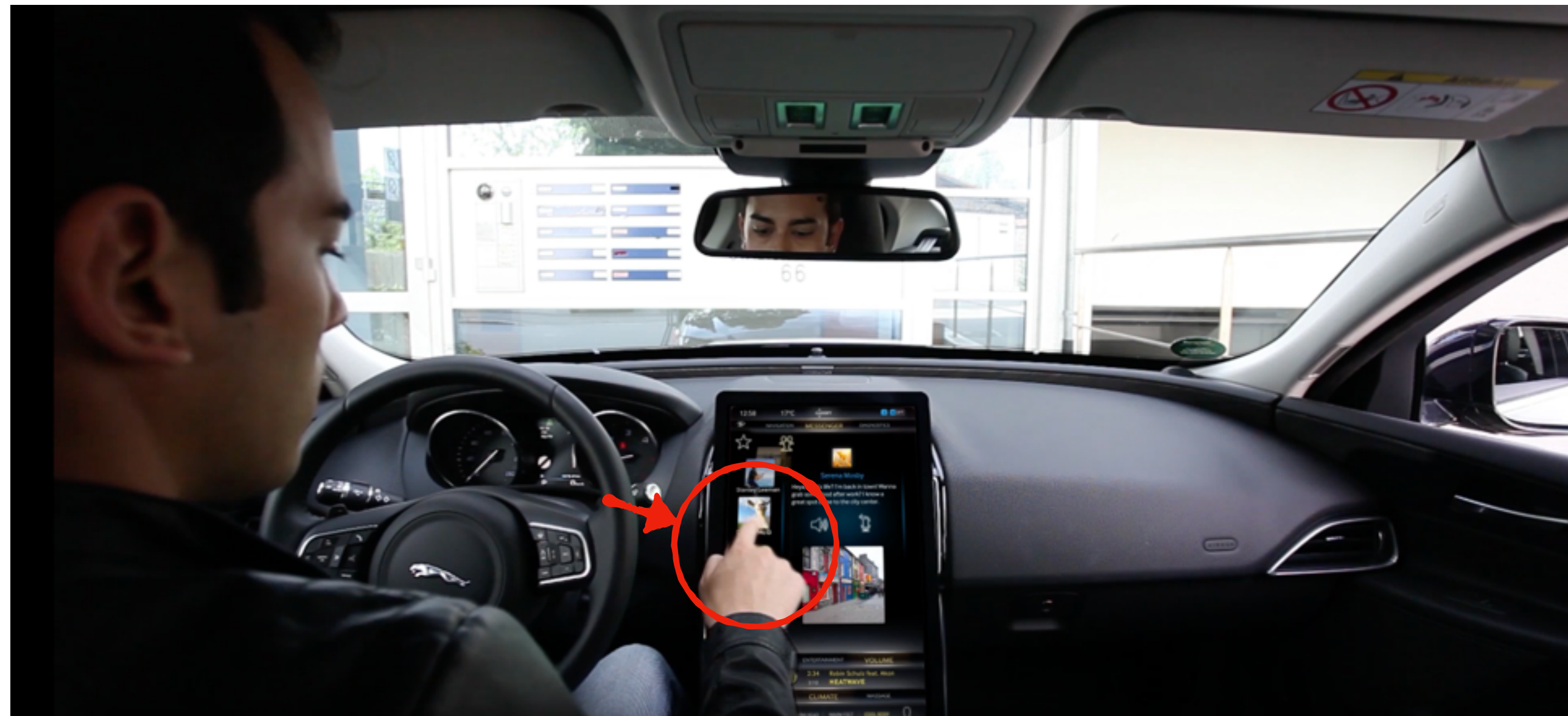


HMI Concept for an Intuitive Controller on Steering Wheel

——prototype design based on capacitive touch

Yang Li
05/07/2018

Why

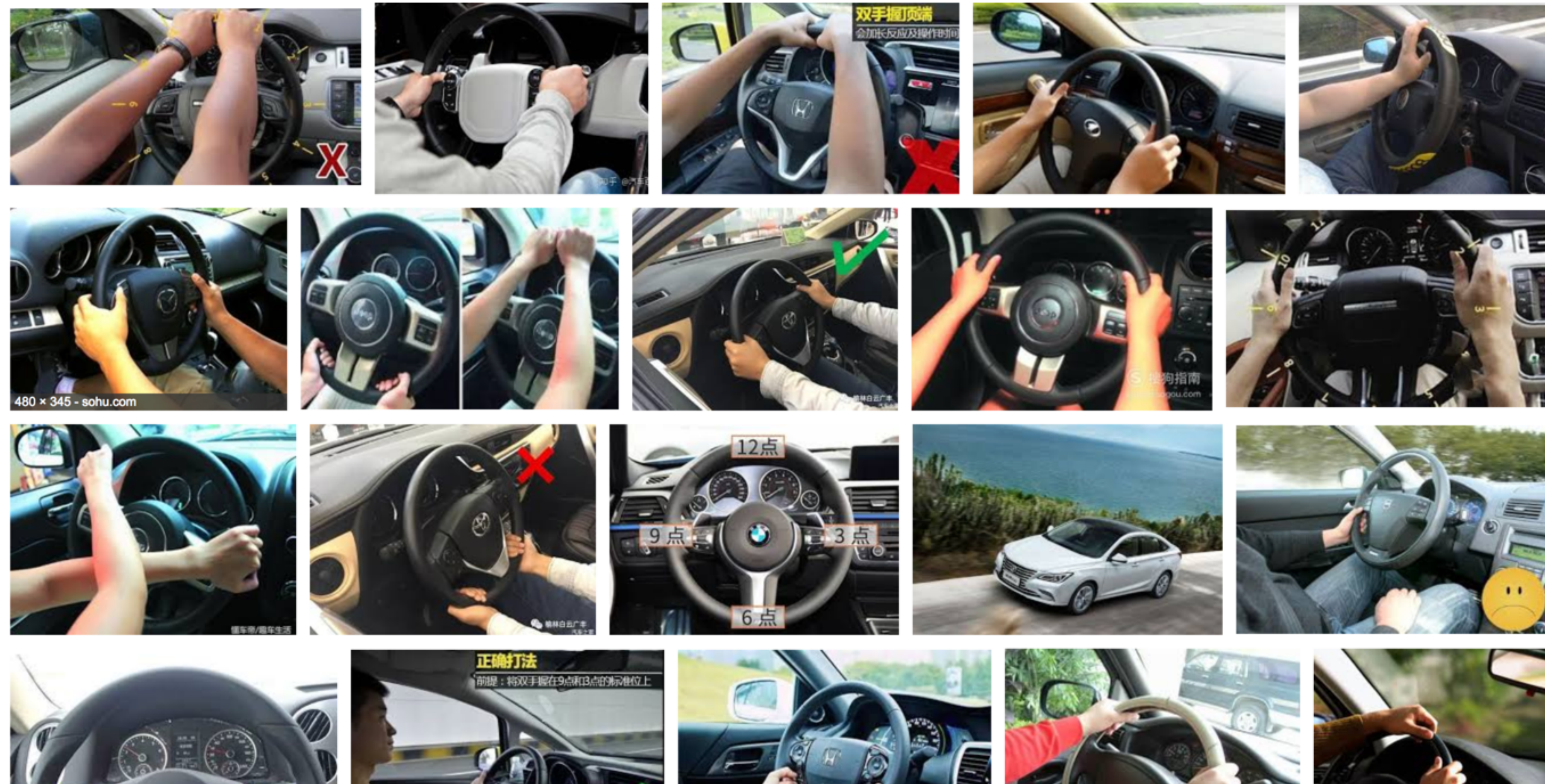


Hand-off while driving

Hands operations in vehicle

- Switches
- Levers
- Buttons
- **Knobs (Greater need for driver resources.对驾驶员资源消耗最大)**
- **Touch screens (Greater need for visual resources.对视觉资源需求较大)**
- misoperation (wiper&blinker)
- driving behaviour (take over between L2&L3)

Why



Bad hands behaviour on steering wheel

Why

Keele University psychological scientist James Hartley found that out of 230 drivers observed, only around 25% were actually **using two hands to grasp the wheel at the recommended 9 and 3 o'clock positions.**

The survey which has done by shows that British drivers are taking a hands off approach to making sure they're fully in control of a vehicle and multi-tasking seems to be a major culprit. Driving one-handed for whatever reason can be dangerous and in some cases can lead to criminal charges, so we'd **advise driver to keep their hands on the wheel and their eyes on the road.**"

What

“pressure sensitive sensor”

to do

- **Directly and safe inputs**
- **Hand-off detection & Driving behaviour correction**

Help

decrease distraction
safer & easier

How

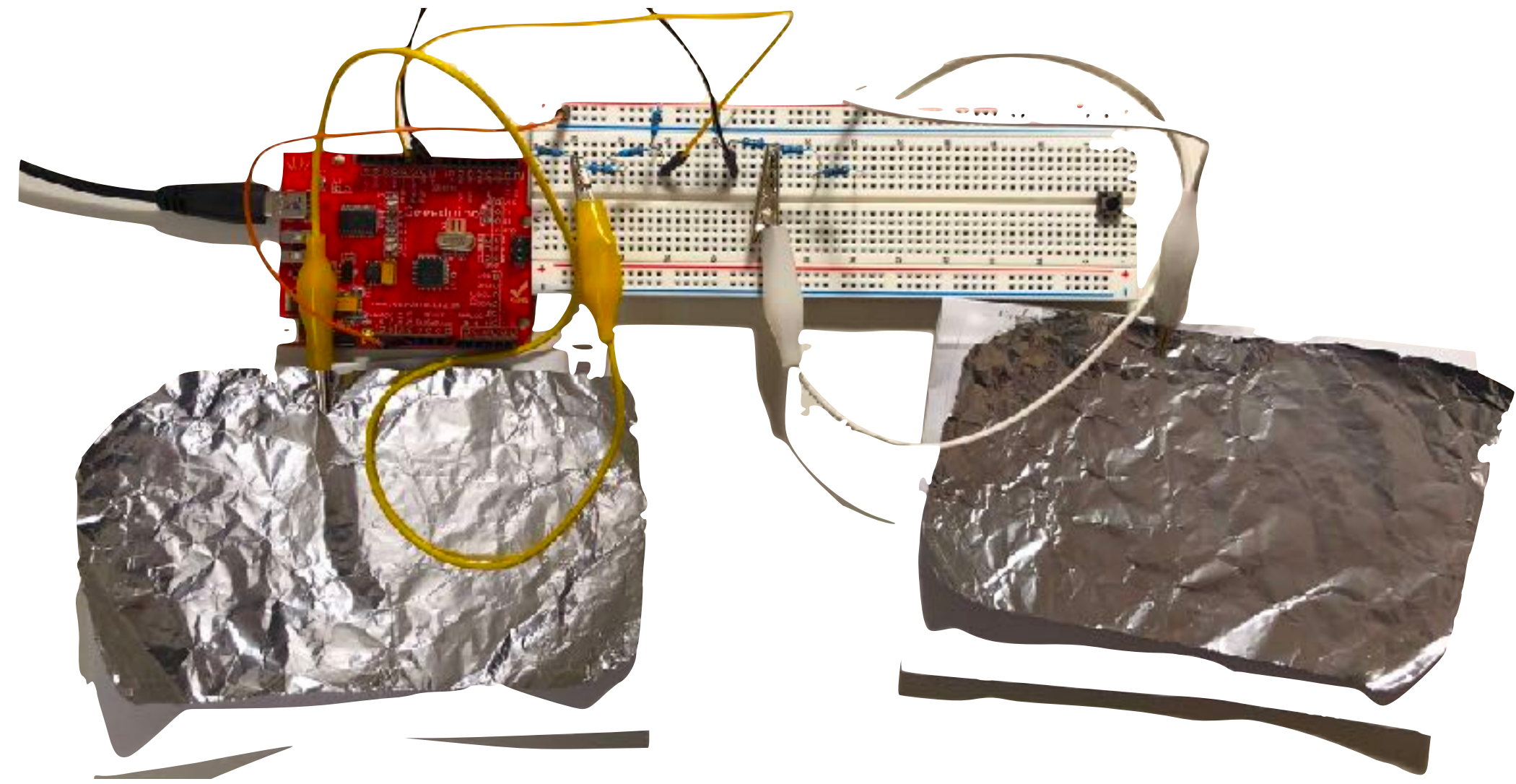
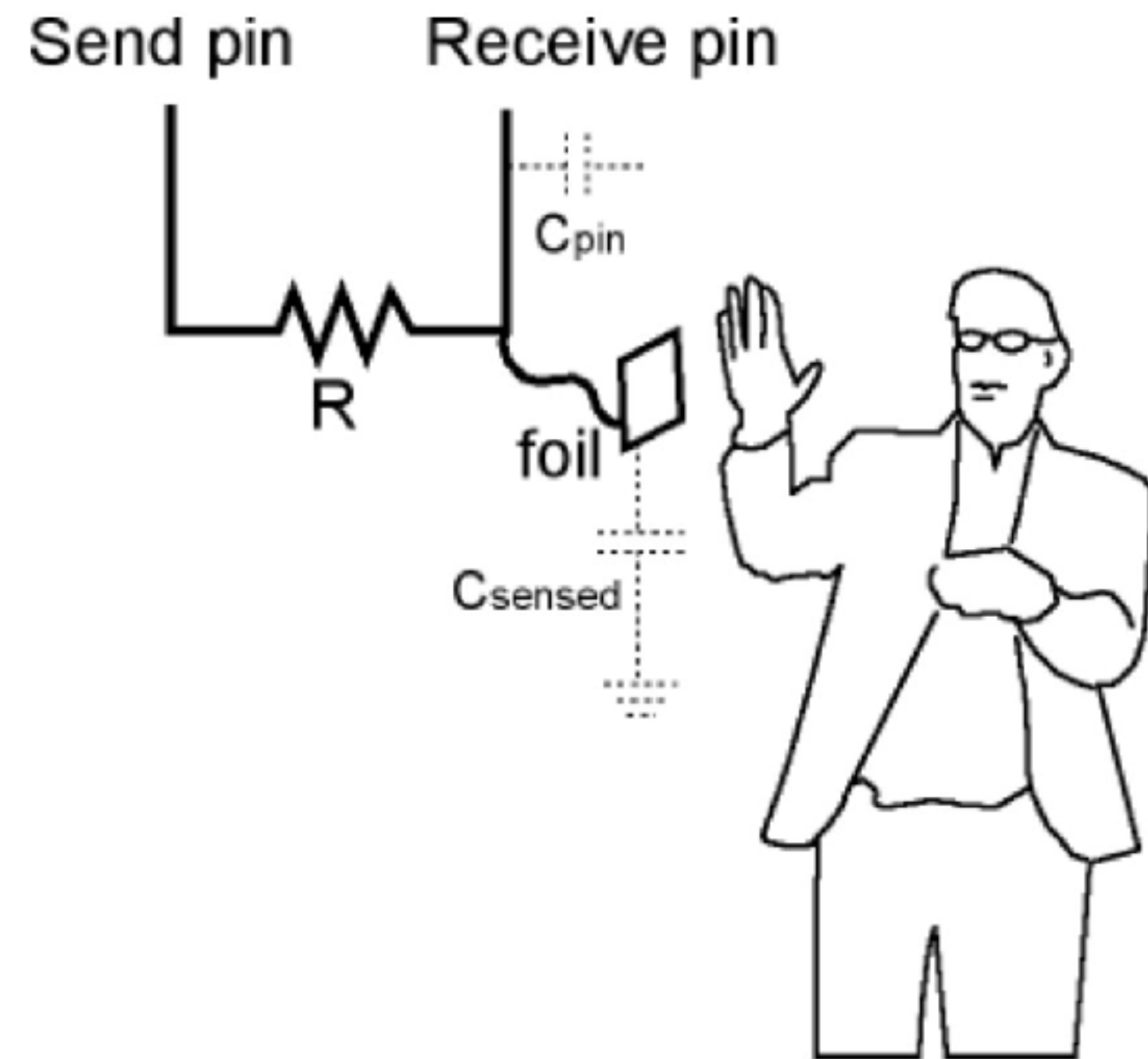
capacitive sensor

to detect

- **If the driver grasp the wheel at 9 and 3 o'clock positions**
- **The strength and position of gripping**

How

How it works



<https://playground.arduino.cc/Main/CapacitiveSensor?from=Main.CapSense>

How

hard grip with left hand



capacity sensor

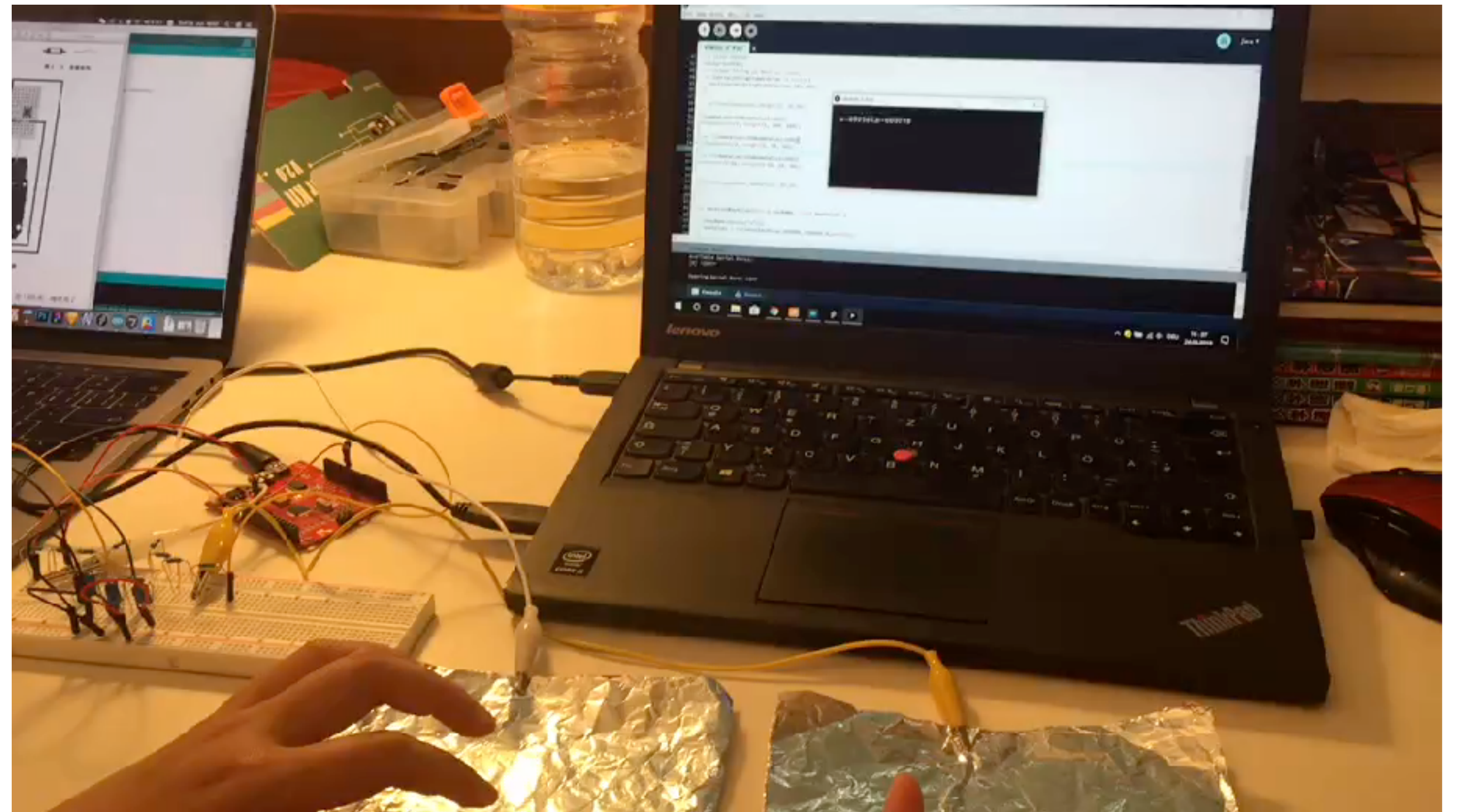
hard grip with right hand



Design — — Prototype

How

hard grip with both hands



What Prototype

Using
scenarios

Left turn
signal

Right turn
signal

Emergency
flasher

1

2

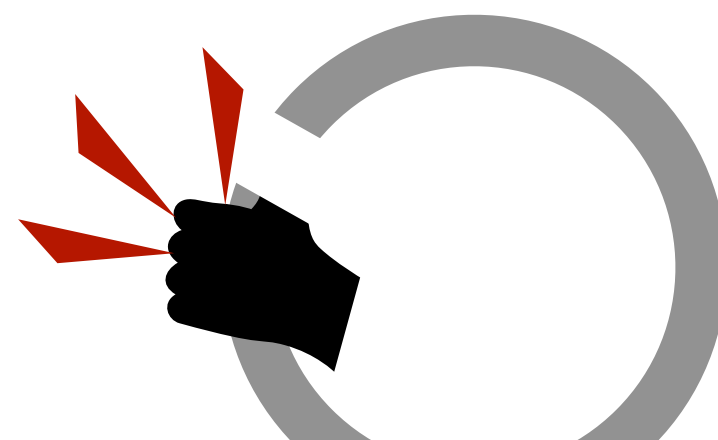
3

Display

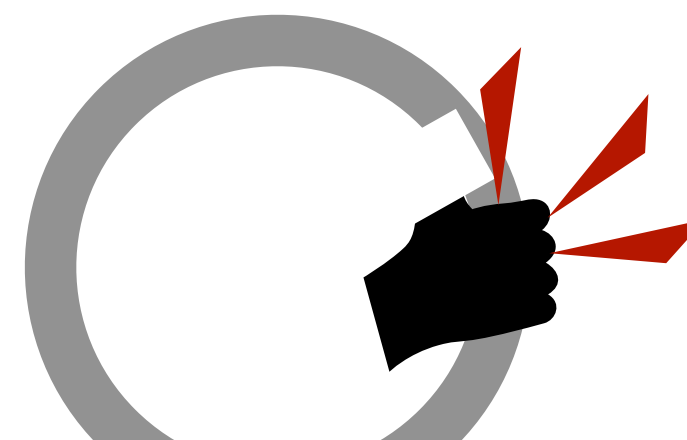


Gesture

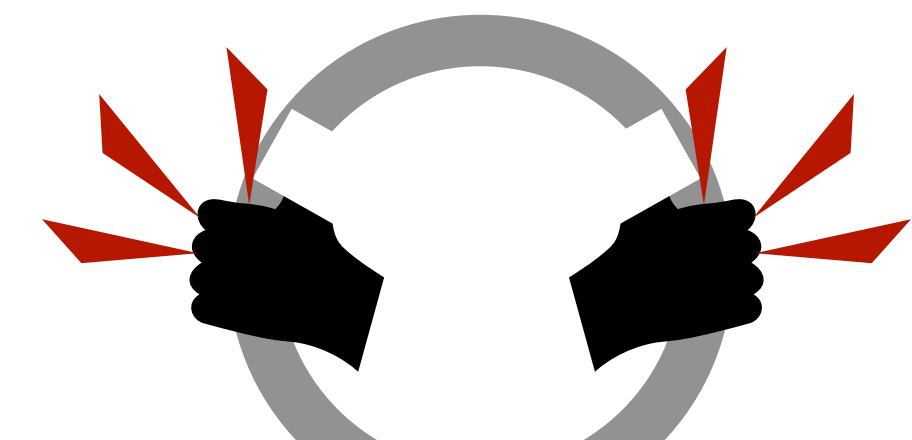
hard grip(L1) with
left hand



hard grip(L1) with
right hand



hard grip(L1) with
both hands



What Prototype

Using
scenarios

Horn

Wiper

.....

4

5

6

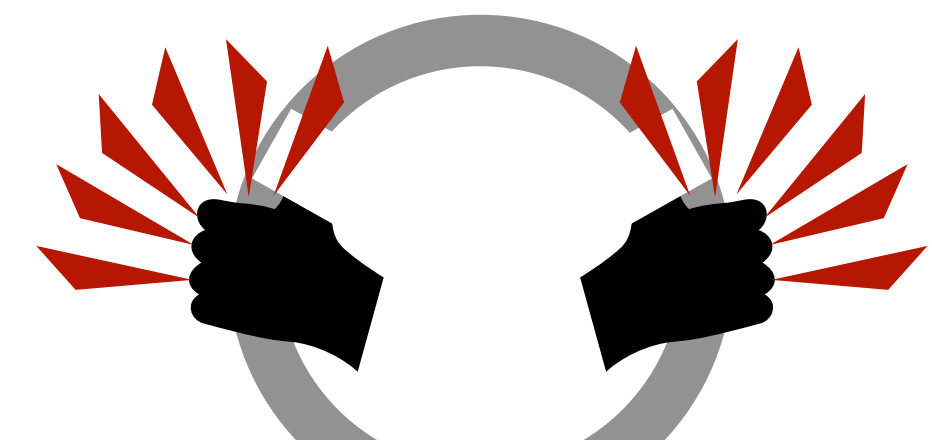
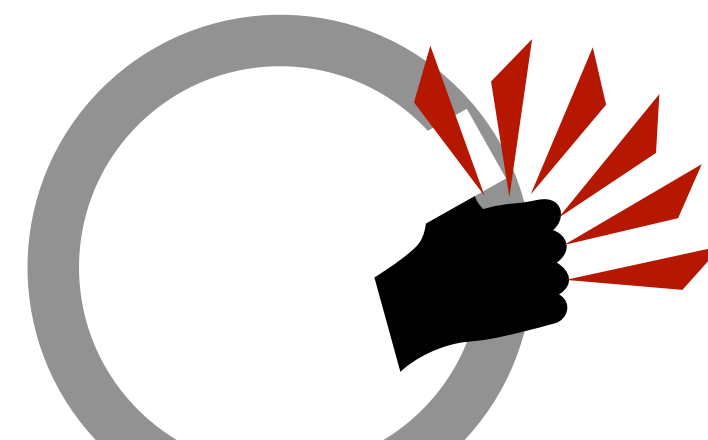
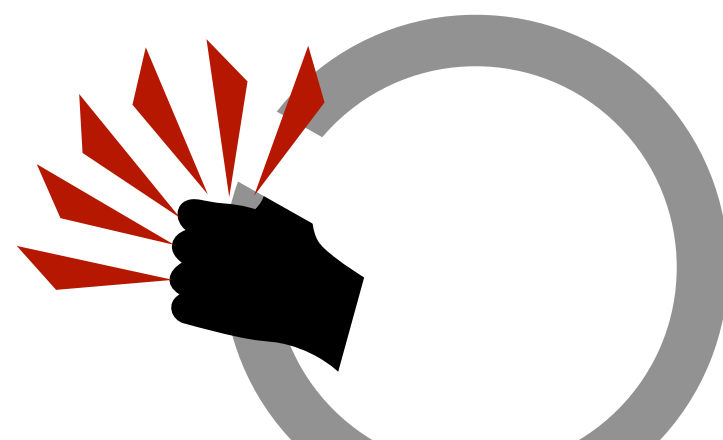
Display

Gesture

hard grip(L2) with
left hand

hard grip(L2) with
right hand

hard grip(L2) with
both hands



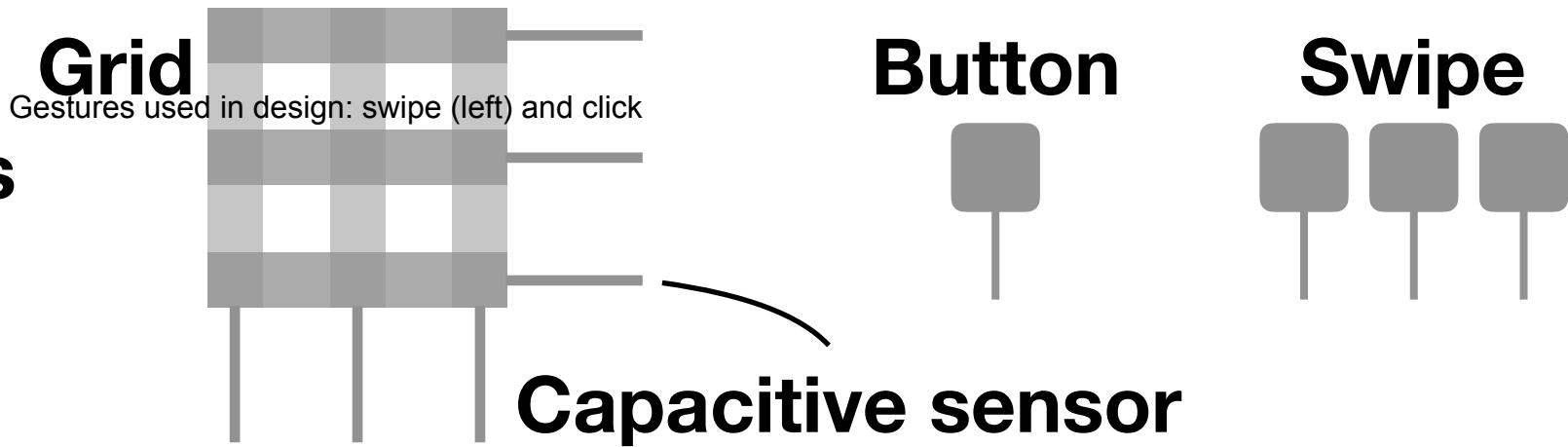
Gestures used in design: swipe (left) and click



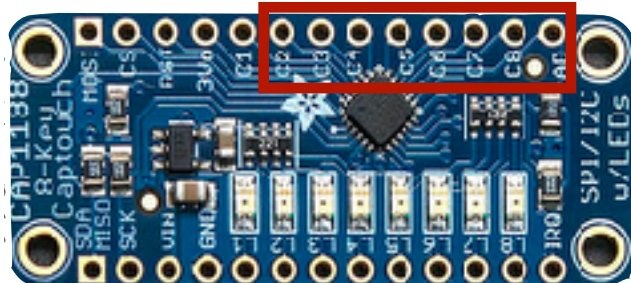
Layer 1: Surface



Layer 2: Sensors



Layer 3: Circuit



What

Driver also can define gestures based on their behaviour and custom.

Future Work

- **Test participants to invent intuitive gestures**
- **Test on driving scenario to know the help of this pressure sensitive cotroller**

Reference

1. Frederik Diederichs, Sven Bischoff, Harald Widloither, Patrice Reilhac, Katharina Hottelart, Julien Moizard. 2015. *New HMI Concept for an Intuitive Automated Driving Experience and Enhanced Transitions. Proceedings of AutomotiveUI'15 September 1-3, 2015, Nottingham, UK ACM 978-1-4503-3736-6*
2. Wai-Tat Fu, Wayne D. Gray. 1999. Redirecting Direct Manipulation or What Happens When the Goal is in Front of You but the Interface Says to Turn Left? *Late-breaking result, CHI 99 15-20. ACM ISBN: 1-58113-158-5*
3. Martelaro, N., Ju, W. WoZ Way: Enabling real-time remote interaction prototyping & observation in on-road vehicles. In *Proceedings of Computer-Supported Cooperative Work (CSCW'17)*. Feb 25-March 1, 2017
- Albrecht Schmidt. 2011. Touch-screen steering wheel keeps drivers focused on the road. <https://phys.org/news/2011-06-touch-screen-wheel-drivers-focused-road.html>
4. Basav Sen, John D. Smith, and Wassim G. Najm. 2003. Analysis of Lane Change Crashes. National Highway Traffic Safety Administration - NHTSA (ed.), Cambridge, MA, March 2003
5. Statistisches Bundesamt: Verkehr – Verkehrsunfälle 2014. Fachserie 8, Reihe 7. Wiesbaden 2016
6. Arduino play ground: Capacity sensing library. <https://playground.arduino.cc/Main/CapacitiveSensor?from=Main.CapSense>
7. Is Your Steering Wheel in Safe Hands?
8. <https://www.psychologicalscience.org/news/motr/is-your-steering-wheel-in-safe-hands.html>
9. <https://www.instructables.com/id/DIY-3D-Controller/>