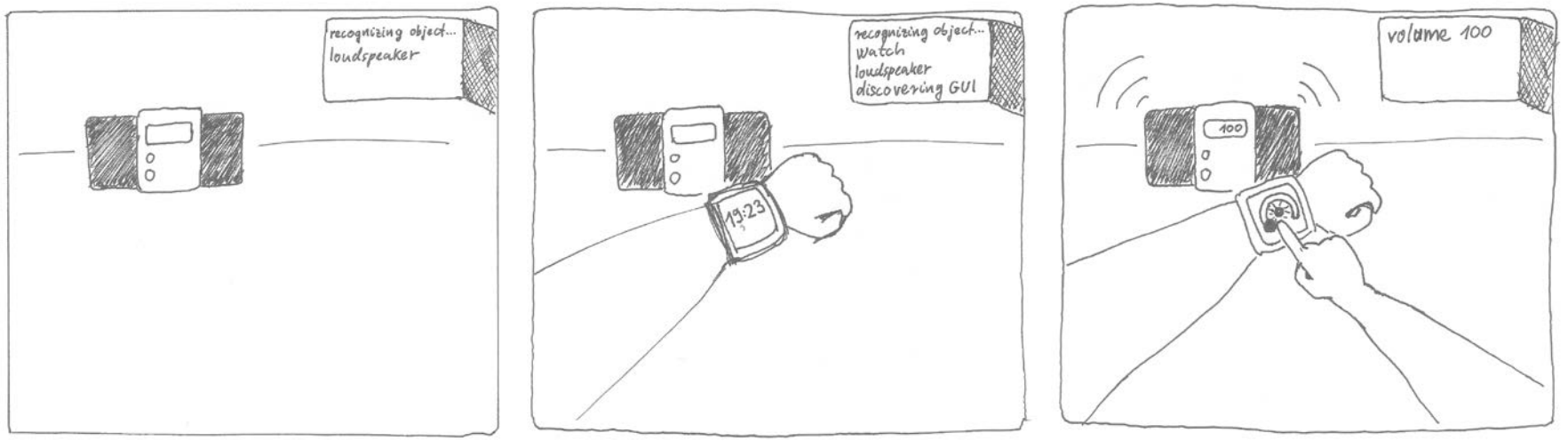


User Interface Beaming

Seamless Interaction with Smart Things using Personal Wearable Computers

Simon Mayer, Gábor Sörös

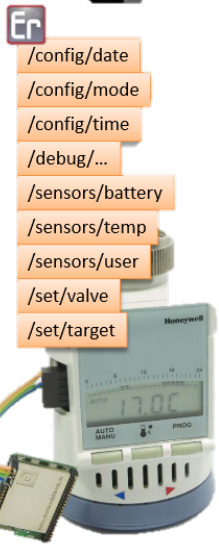
Glass and Eyewear Computing 2014, Zürich, Switzerland

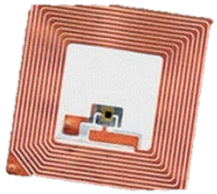
Turn it On

chumby

nest
72

57°

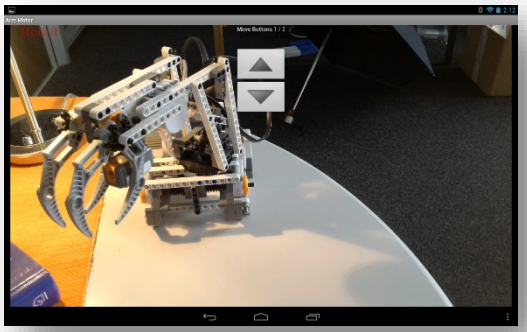

/config/date
/config/mode
/config/time
/debug/...
/sensors/battery
/sensors/temp
/sensors/user
/set/valve
/set/target
Honeywell



CEILING FAN
LIGHTS
SPRINKLERS
SECURITY
DOORS
HVAC
MULTI-ZONE AUDIO
HDTV

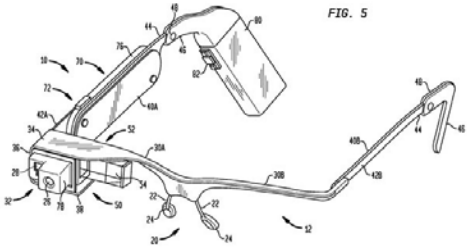
Interaction with Smart Things

- **Select** devices using object recognition technologies
- **Interact** with devices using appropriate user interfaces

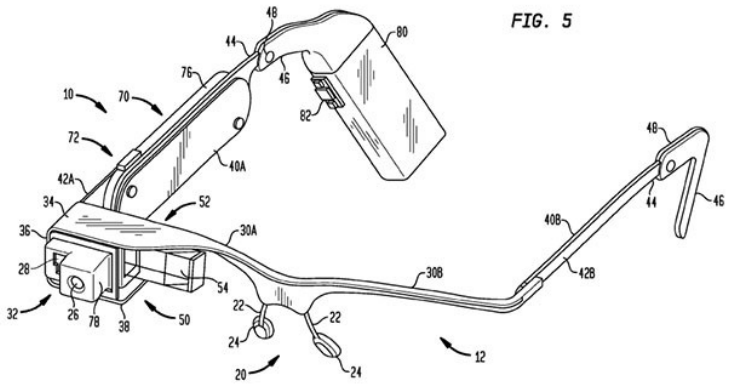


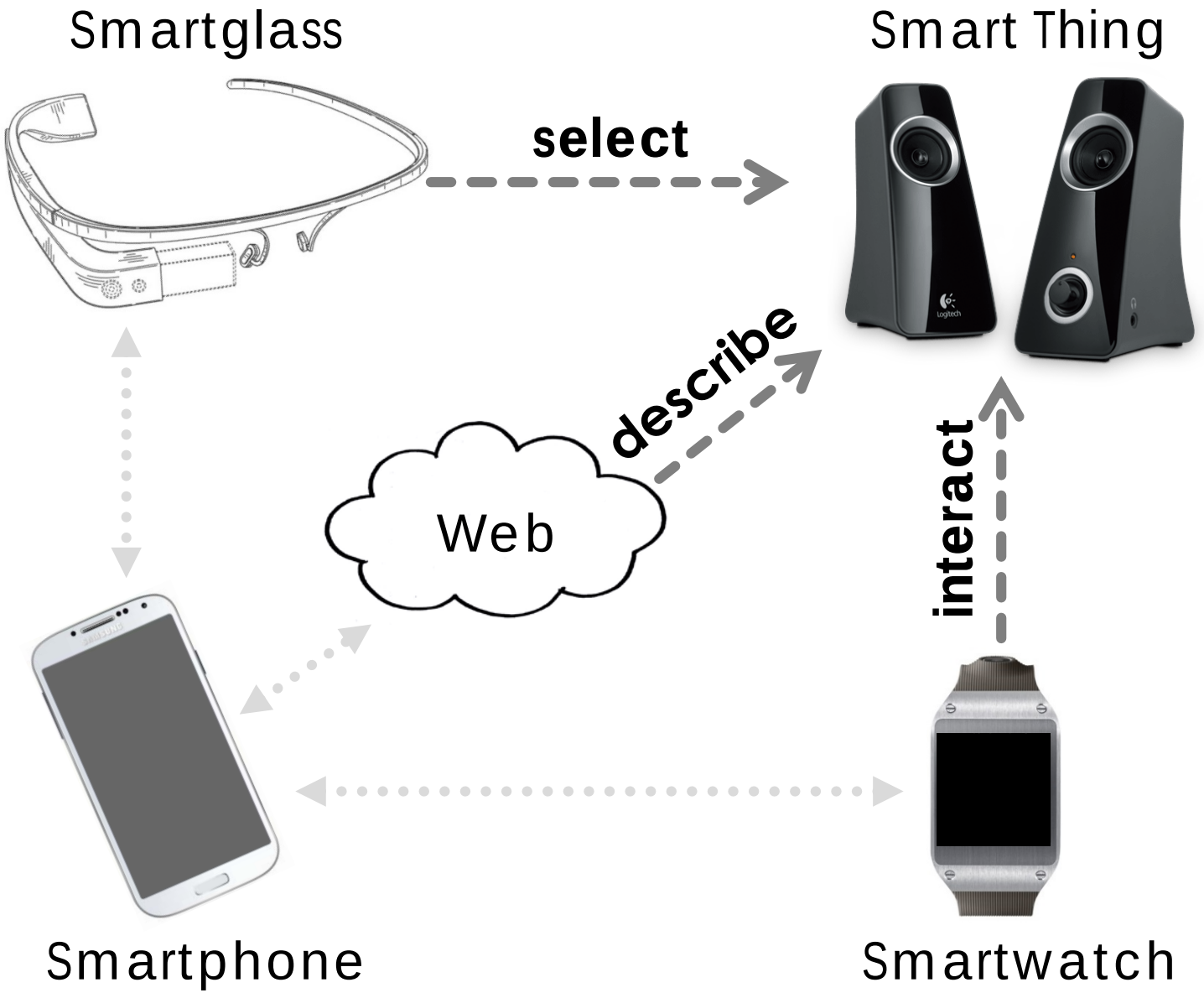
Simon Mayer, Markus Schalch, Marian George, Gábor Sörös: *Device Recognition for Intuitive Interaction with the Web of Things*. UbiComp 2013

- **Combine personal wearables** for convenient interaction

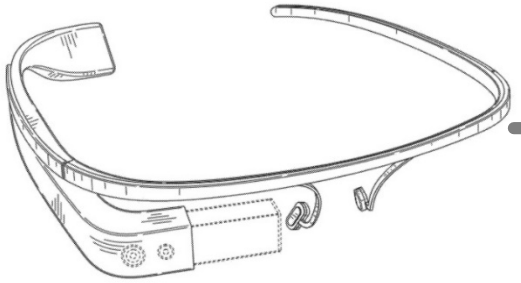


Combining Personal Wearables




Smartglass
Smart Thing
select
describe
Web
interact
Smartphone
Smartwatch

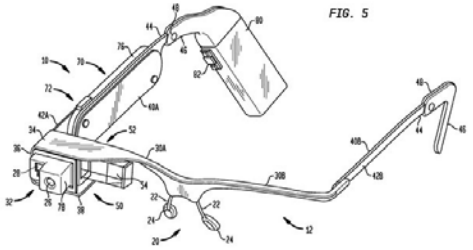
Smartglass



select

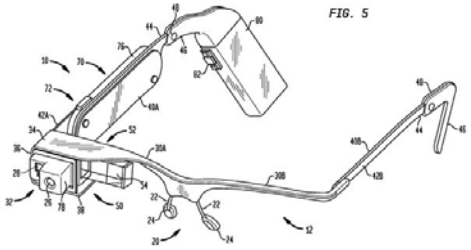
Smart Thing

Interaction with Smart Things: Selection



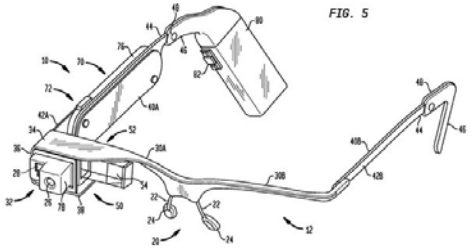
- Glass: Same viewpoint as user!
- Visual object recognition
  - About 10 snapshots per device, can differentiate 8 devices
  - No tagging/fiducial markers required!
- Classification
  - SURF feature detection + description

Interaction with Smart Things: Selection



- Glass: Same viewpoint as user!
- Visual object recognition
  - About 10 snapshots per device, can differentiate 8 devices
  - No tagging/fiducial markers required!
- Classification
  - SURF feature detection + description
  - Bag of Words + one binary SVM per device
  - About 80% per-frame accuracy

Interaction with Smart Things: Selection



Smart Thing

describe

Web

Smartphone

Interaction with Smart Things: Interaction

```
<span itemscope itemprop="interaction">You can
  <span itemprop="name">scale</span> this resource within
      a range of
  <span itemprop="type-range">[0,100]</span>
  <span itemprop="type-unit">percent</span> (values are
     of type
  <span itemprop="type-name">int</span>).
</span>
```

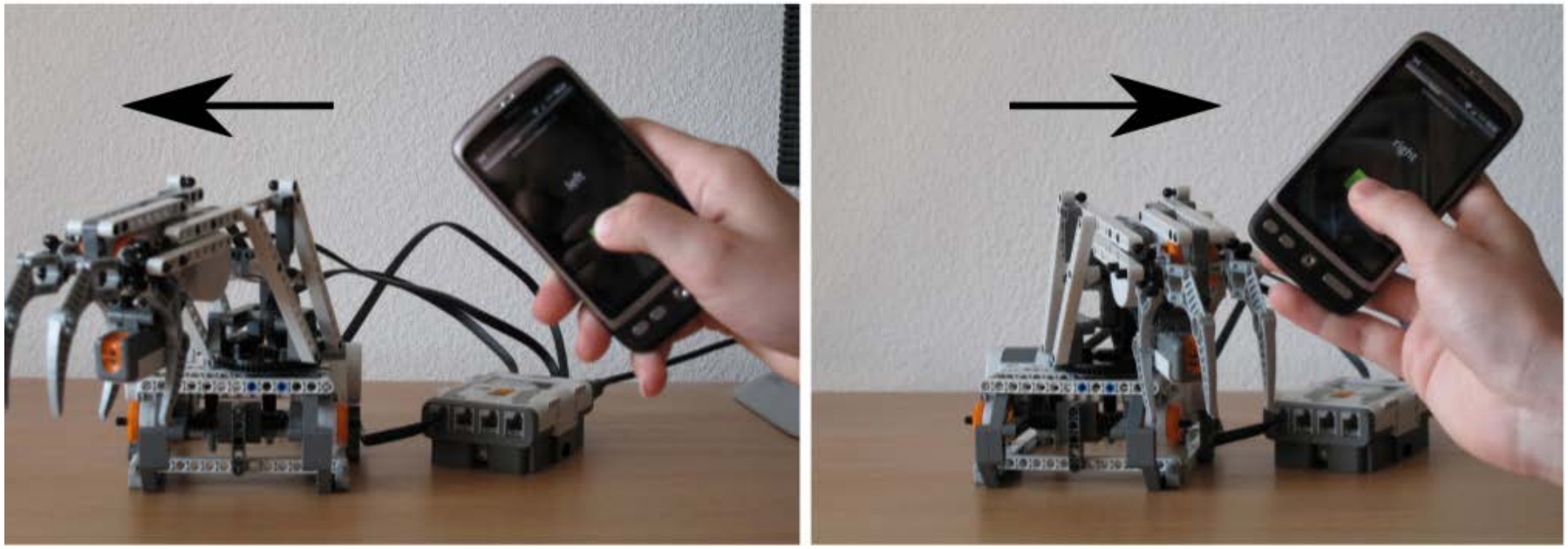
Human- and machine-readable volume controller interaction markup.

S. Mayer, A. Tschofen, A.K. Dey, F. Mattern: *User Interfaces for Smart Things. A Generative Approach with Semantic Interaction Descriptions*. ACM ToCHI 21(2), 2014

Haptic / Accelerometer

Smart Plugs

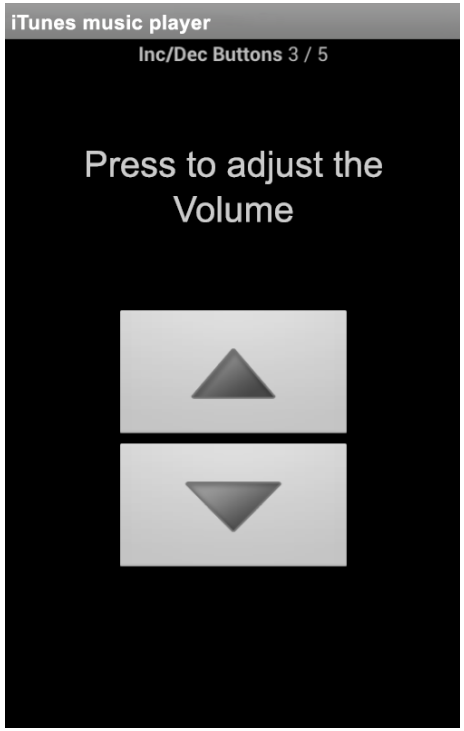
Speech



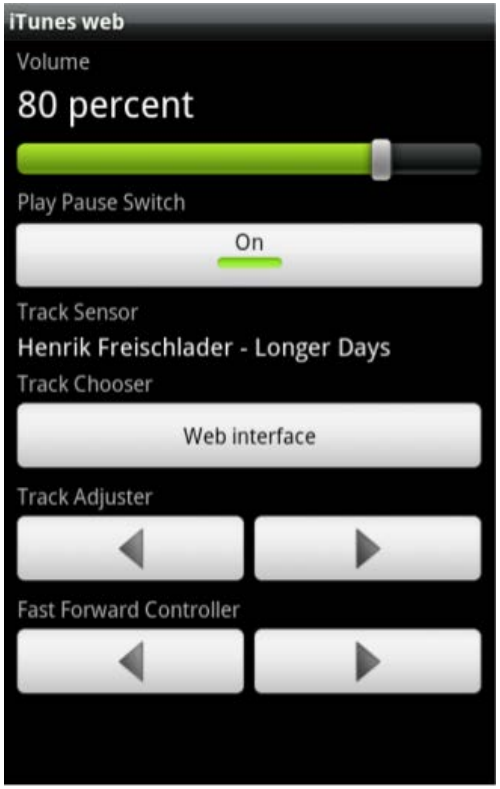
Toy Robot

Haptic / Gyroscope

GUI / Gyroscope



iTunes Application



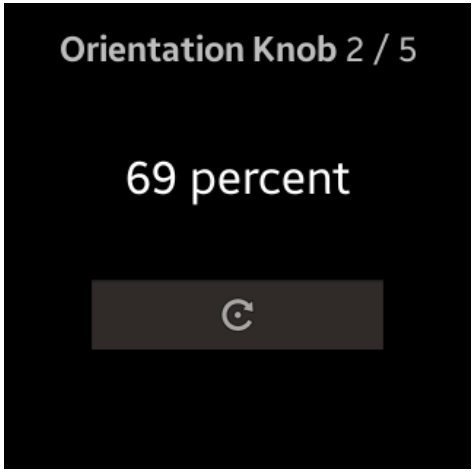
Composite UI

Smart Thing

interact

Smartwatch

Interaction with Smart Things: Interaction

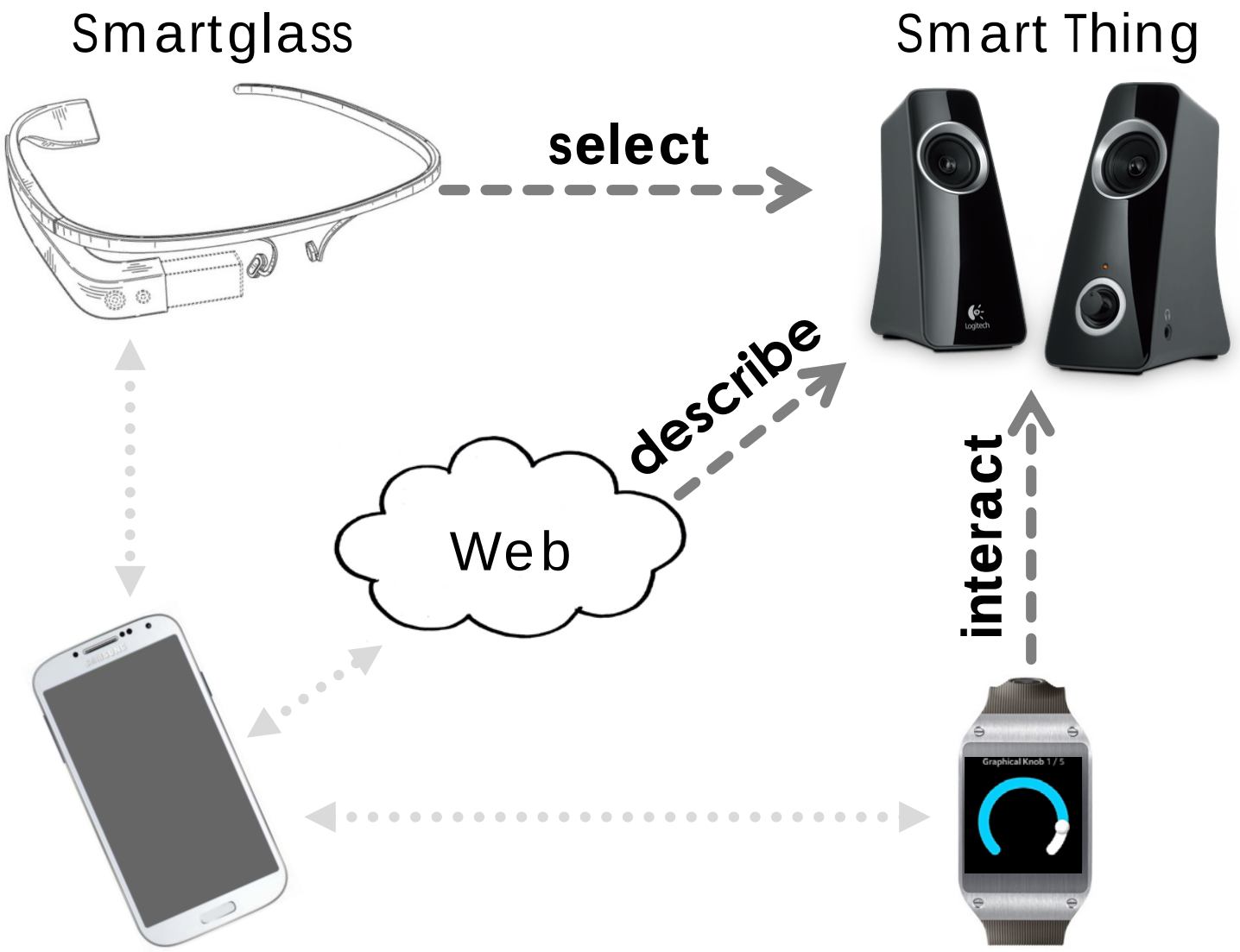


Smart Thing

interact

Smartphone

Smartwatch


Smartglass
Smart Thing
select
describe
Web
interact
Graphical Knob 1 / 5
Smartphone
Smartwatch

ETH zürich

Reviewer Comments

Why should I wear a smartphone, smartwatch, and smartglasses **just** to control my stereo set?

Our approach can help to do much more! Plus, you'll be wearing these devices in any case…

Our approach can help to do much more! Plus, you'll be carrying these devices in any case ;-)

Why are you **rejecting speech** recognition as «cumbersome to use»?

Why is noone using it? Our guess is:

a) Non-perfect recognition

b) Privacy issues and embarrassment

«Beaming» is **not a new concept**!
How about Ubi-Finger, for instance.

We refer to the seamless transition of a UI between two interaction devices as «Beaming»
UIDLs are much much older of course!

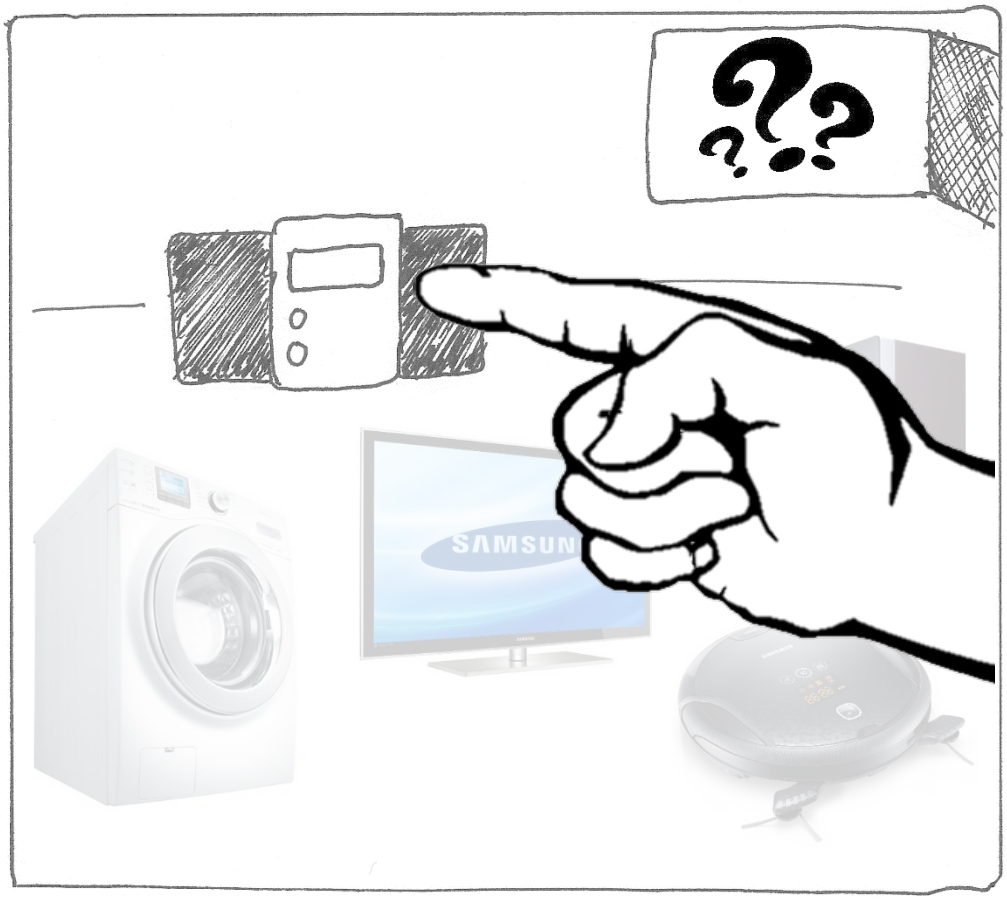
Limitations and potential problems with the system could be discussed more.

Indeed!

What if there are **6 devices** in the users field of view that can be controlled?

How about combining our idea with gesture recognition?

How about combining our idea with gesture recognition?



How about combining our idea with gesture recognition?

What about the **selection** phase? 80% frame on frame is not too good, is it?

That’s correct! Our experiments with BRISK/SURF and ORB/SIFT features look promising!

Can you really render user interfaces for **every device** on this planet?

Perhaps not. However, we haven't encountered a device that is not covered by the UIDL…

What were your «**legal problems**»
with using Google Glass?

Well…

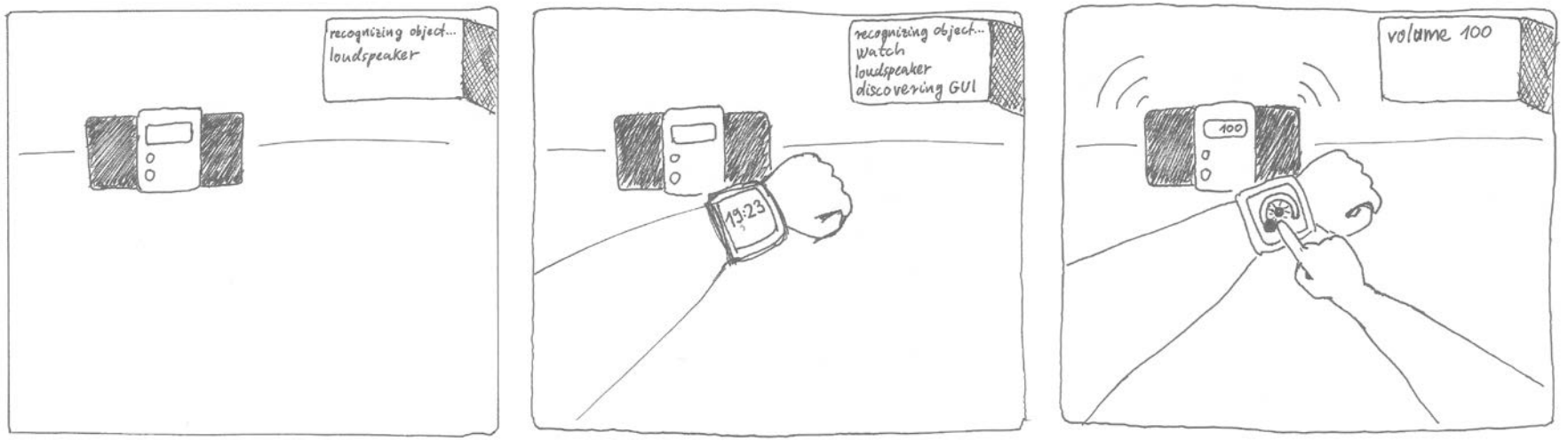
Limitations & Challenges

Objective	Limitations	Way out?
Select	- Multi-object scenarios - Accuracy - Number of devices	- e.g., gestures - e.g., better features - e.g., context-awareness
Describe	- Descriptions must be provided	- Simplify describing device interfaces
Interact	- Legal issues	- Get our own Glass…

Credits

- Marian George
- Andreas Tschofen
- Markus Schalch

FONDS NATIONAL SUISSE
SCHWEIZERISCHER NATIONALFONDS
FONDO NAZIONALE SVIZZERO
SWISS NATIONAL SCIENCE FOUNDATION



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