Touché: Enhancing Touch Interaction on Humans, Screens, Liquids, and Everyday Objects

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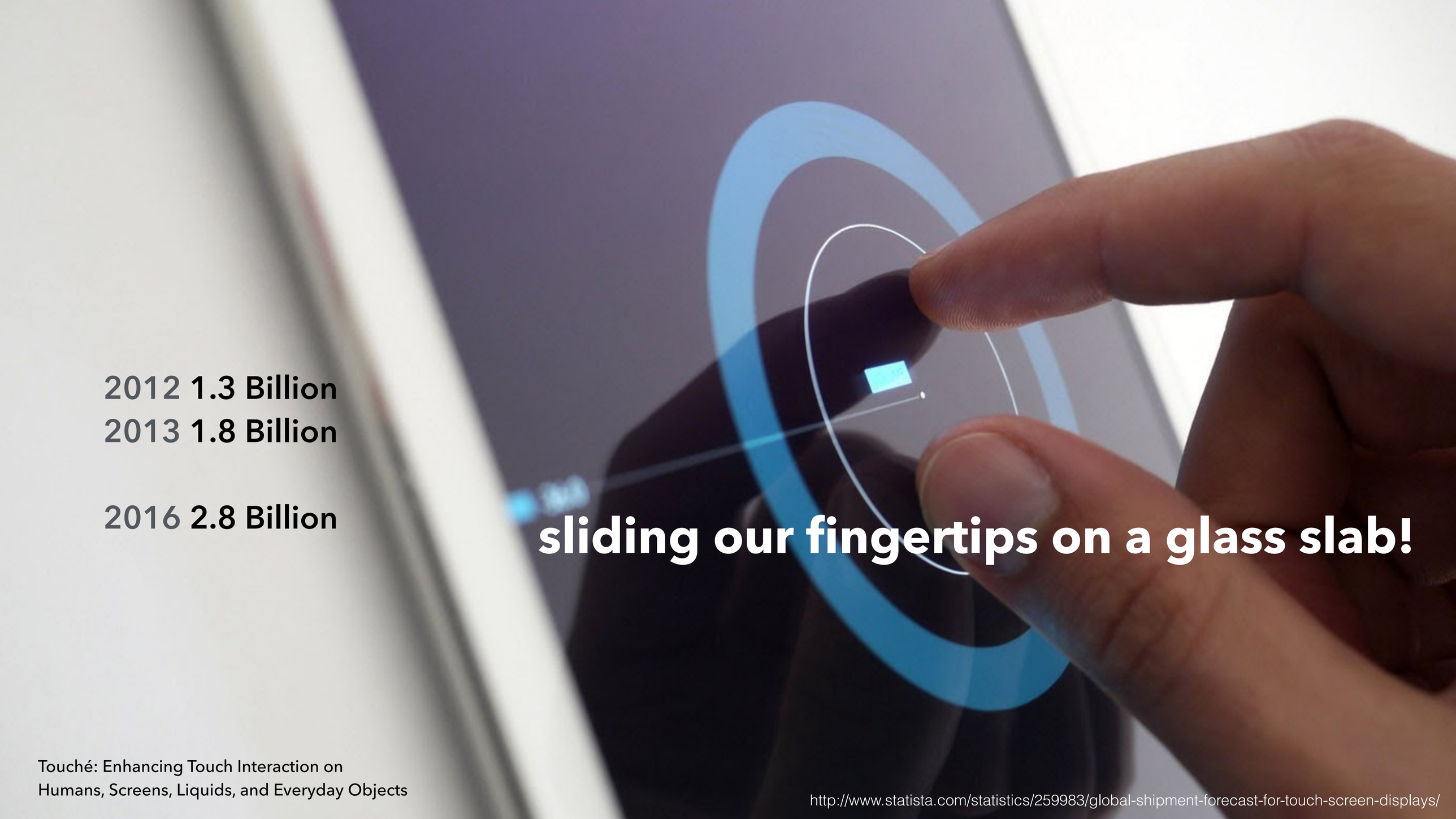
CHI 2012, May 5-10, 2012, Austin Texas, USA

Chinmay Parab
Interaction Design

Humans, Screens, Liquids, and Everyday Objects

Chinmay Parab
Interaction Design


2007



2012 1.3 Billion
2013 1.8 Billion

2016 2.8 Billion

sliding our fingertips on a glass slab!

Touché: Enhancing Touch Interaction on
Humans, Screens, Liquids, and Everyday Objects

http://www.statista.com/statistics/259983/global-shipment-forecast-for-touch-screen-displays/

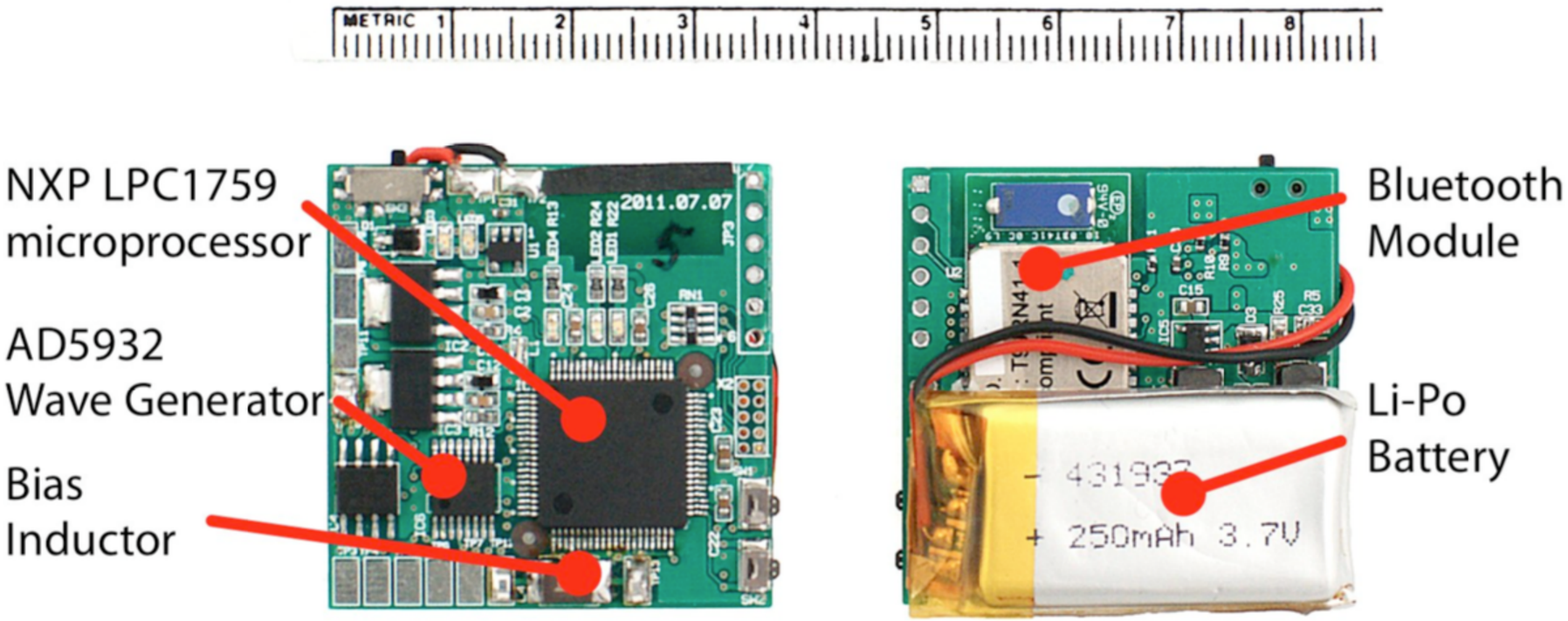
Everyday Objects

pencils, tables, chairs, doors, door knobs, mobile phones, etc

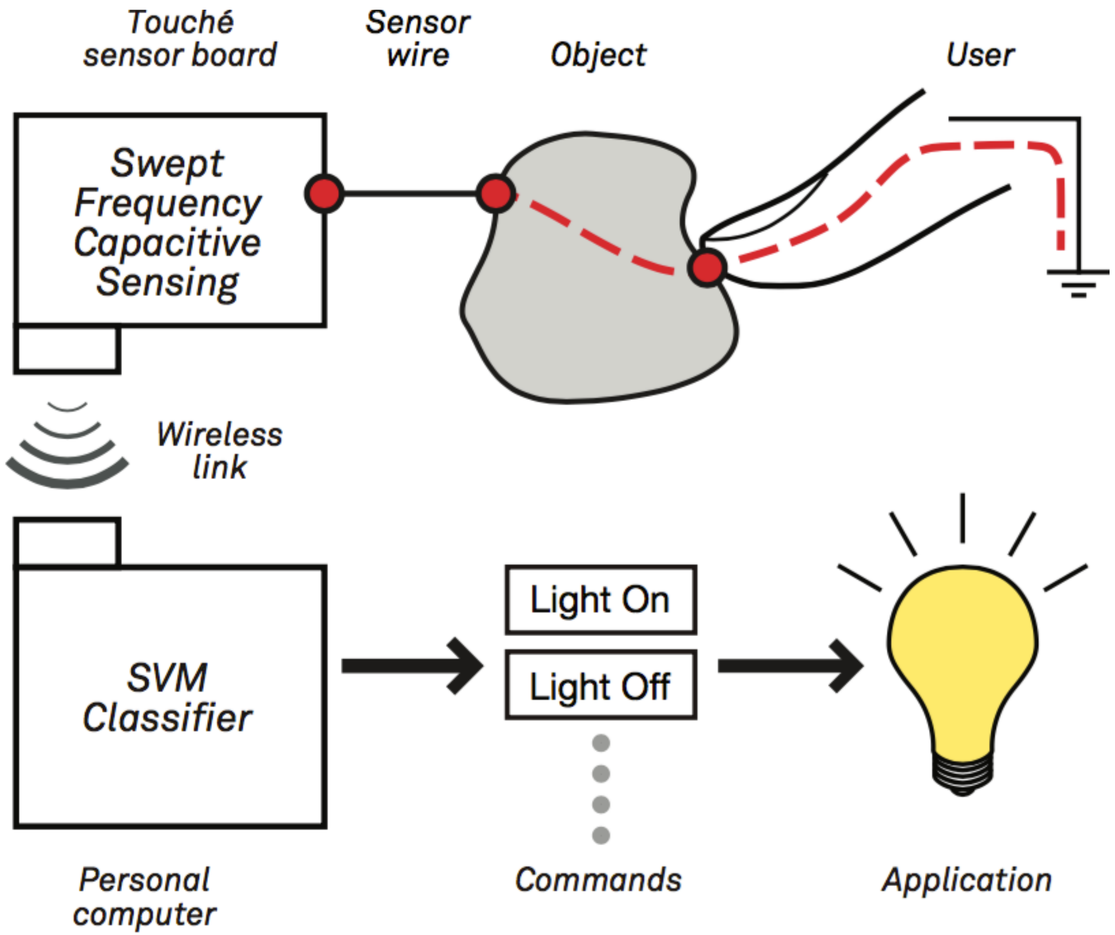
Everything is Capacitive, almost everything!

Touché is an add-on that can sense the change in capacitance and convert that info into machine language

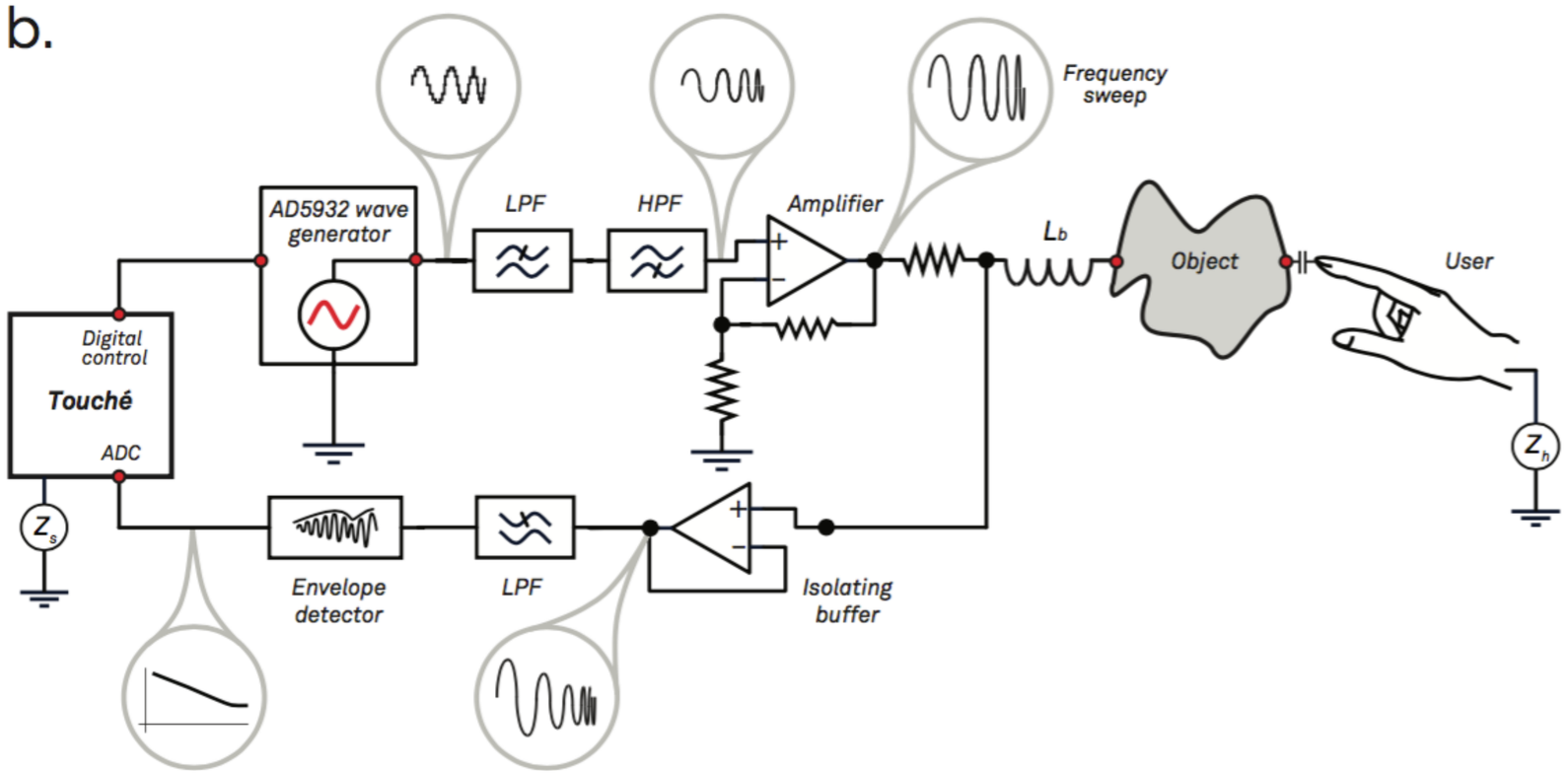
How it looks?



Touché sensing board


Touché sensor board
Sensor wire
Object
User
Swept Frequency Capacitive Sensing
Wireless link
SVM Classifier
Light On
Light Off
Personal computer
Commands
Application

How it works?

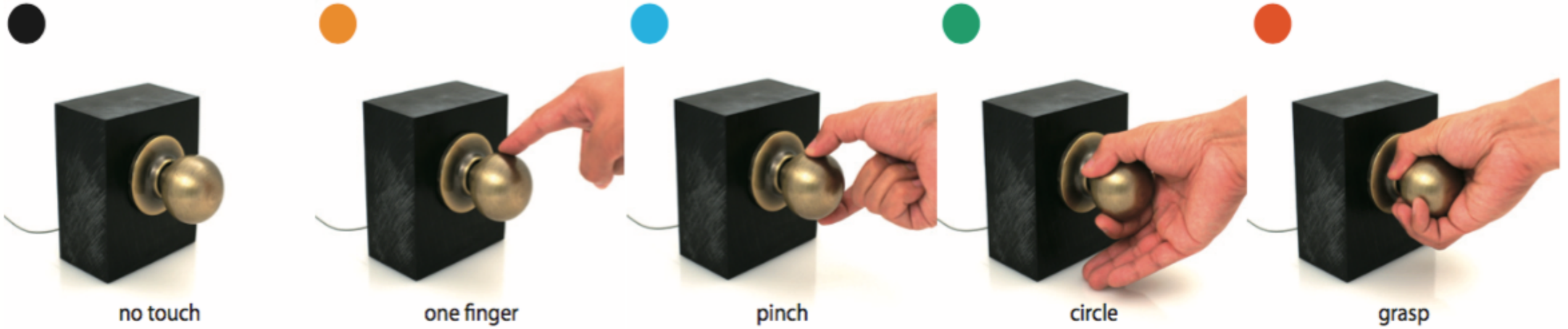

b.
Frequency sweep
AD5932 wave generator
LPF
HPF
Amplifier
L_b
Object
User
Digital control
Touché
ADC
Z_h
Z_s
Envelope detector
LPF
Isolating buffer

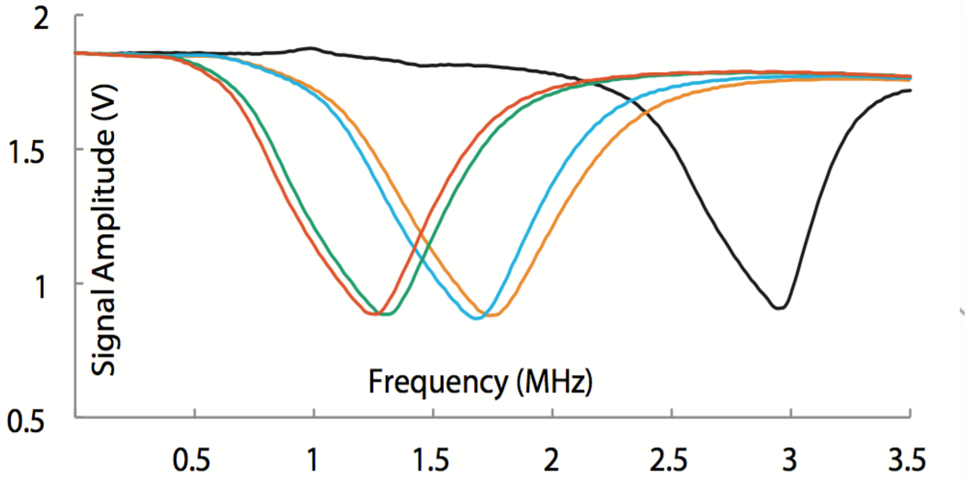
Details?

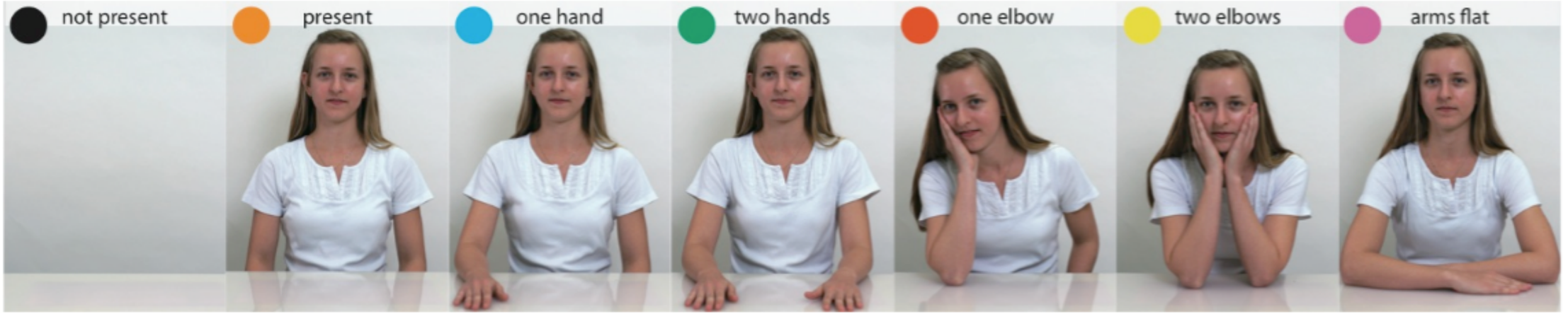
What it does?

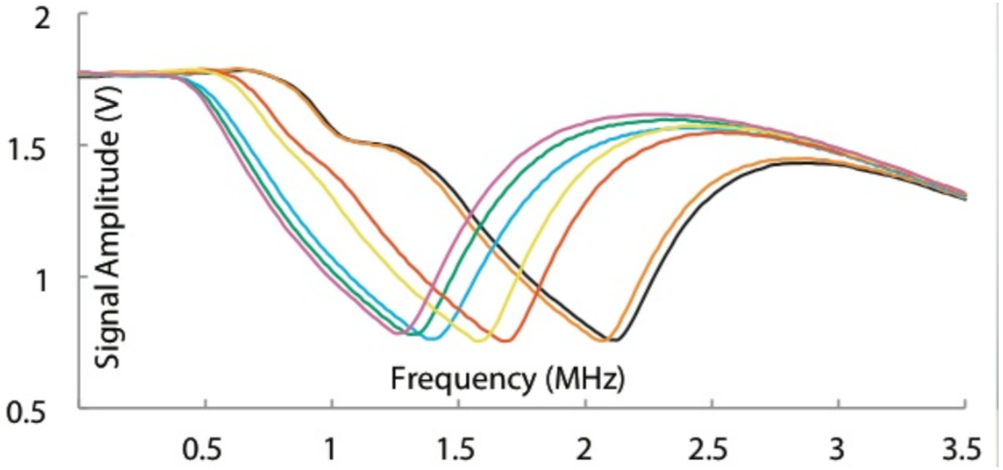
- Converts any object into Touch enabled interface
- Single electrode > Sensor > Controller
- Swept Frequency Capacitive Sensing Technique (SFCS)
- Provides unique contexts to touch
- Variety of Materials
- Works on digital as well as analog objects

Not only **if the action occurred,** but also **how** it occurred!

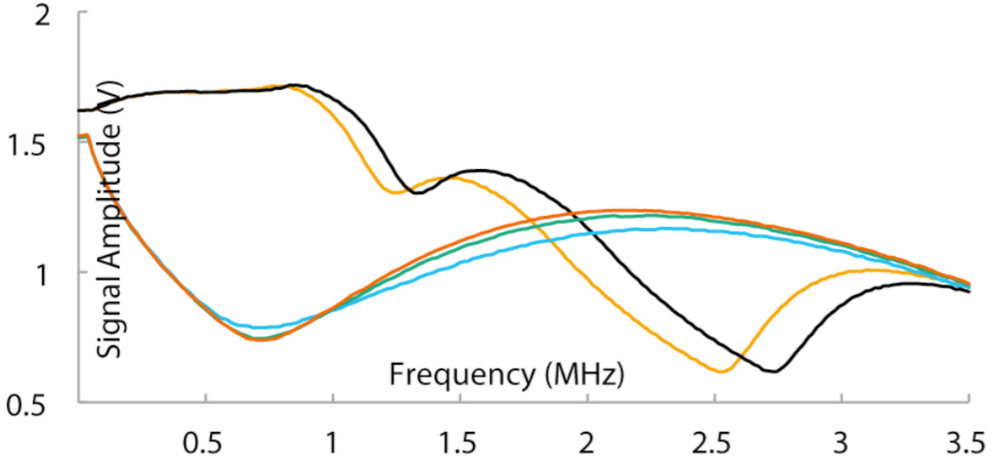

no touch
one finger
pinch
circle
grasp


2
1.5
1
0.5
Signal Amplitude (V)
Frequency (MHz)
0.5
1
1.5
2
2.5
3
3.5

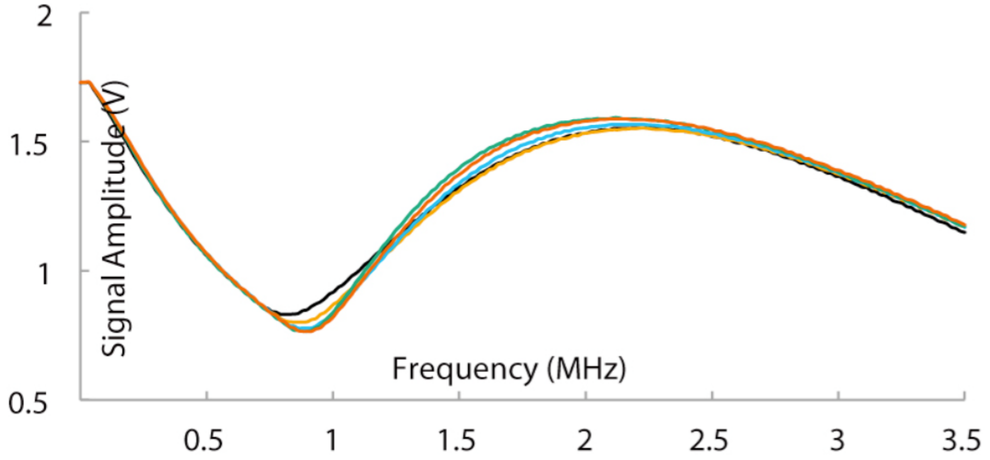

not present
present
one hand
two hands
one elbow
two elbows
arms flat

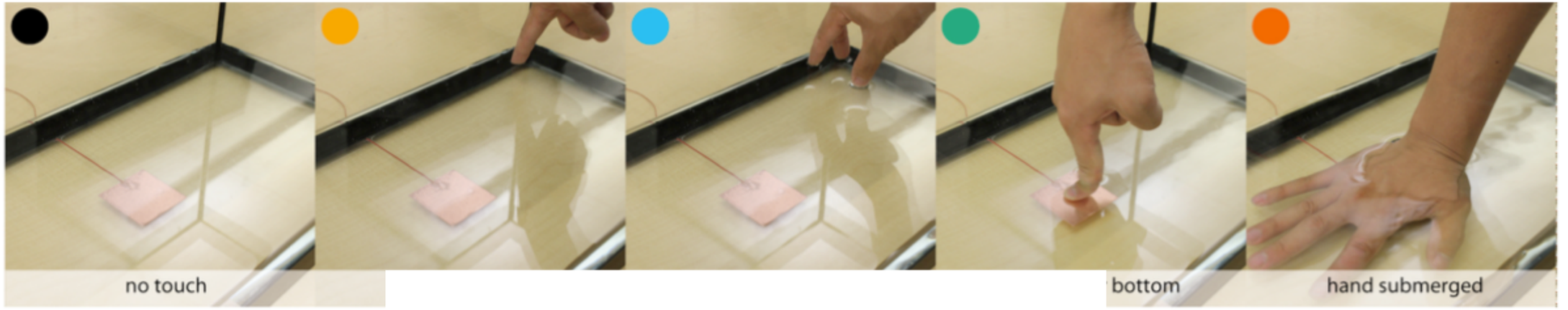

2
1.5
1
0.5
Signal Amplitude (V)
Frequency (MHz)
0.5
1
1.5
2
2.5
3
3.5

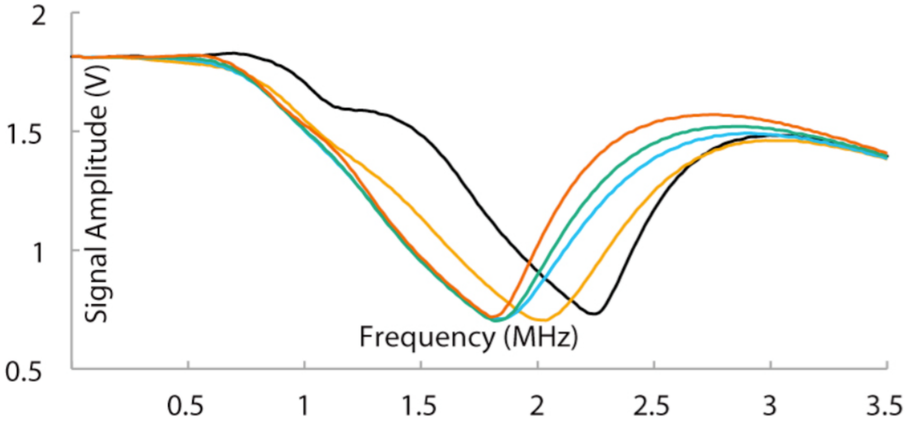

no touch
thumb
one finger pinch
two finger pinch
all finger pinch


2
1.5
1
0.5
Signal Amplitude (V)
Frequency (MHz)
0.5
1
1.5
2
2.5
3
3.5


no touch
one finger
five fingers
grasp
cover ears


2
1.5
1
0.5
Signal Amplitude (V)
Frequency (MHz)
0.5
1
1.5
2
2.5
3
3.5


no touch
bottom
hand submerged


2
1.5
1
0.5
Signal Amplitude (V)
Frequency (MHz)
0.5
1
1.5
2
2.5
3
3.5

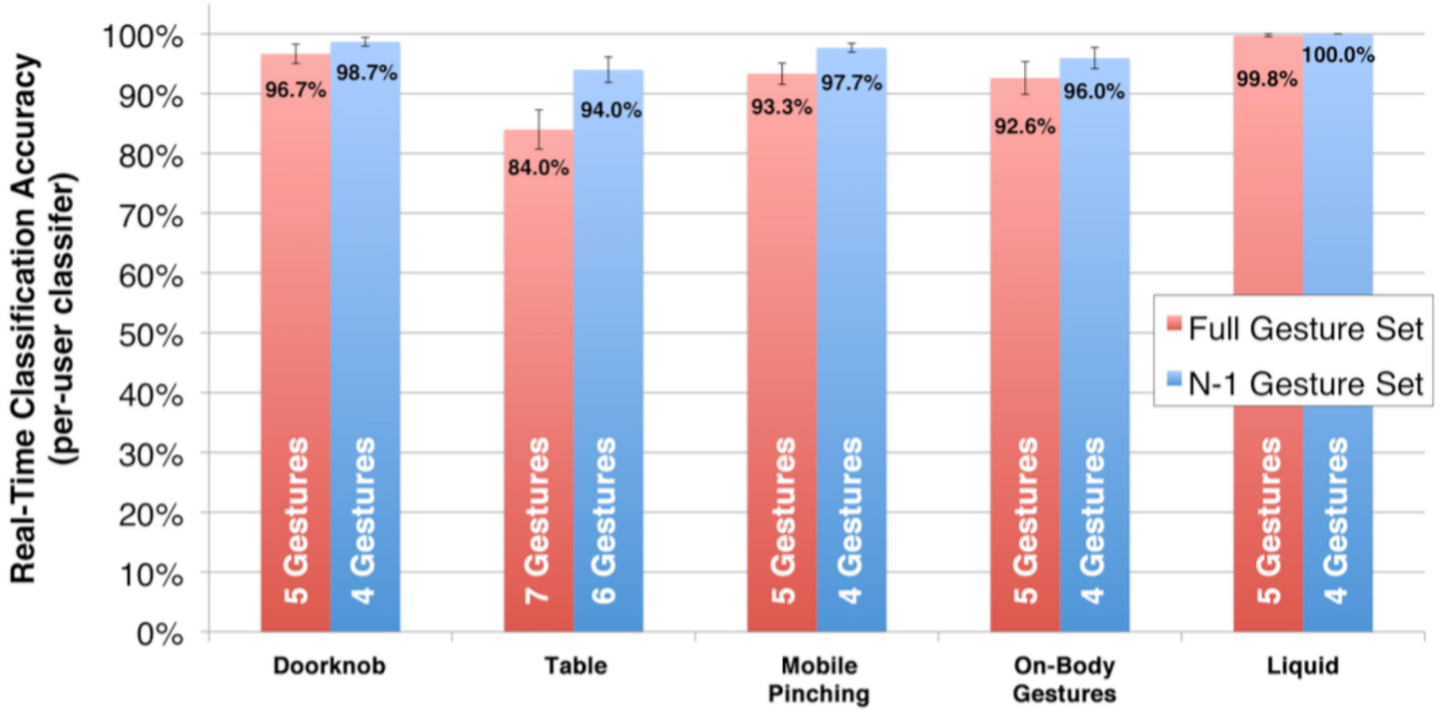
Evaluation goals

- Demonstrate possibilities
- Immediate Feasibility
- Explore potential richness of gesture library
- Baseline performance of Recognition Engine
- System level adaptability for user interactions

Evaluation process

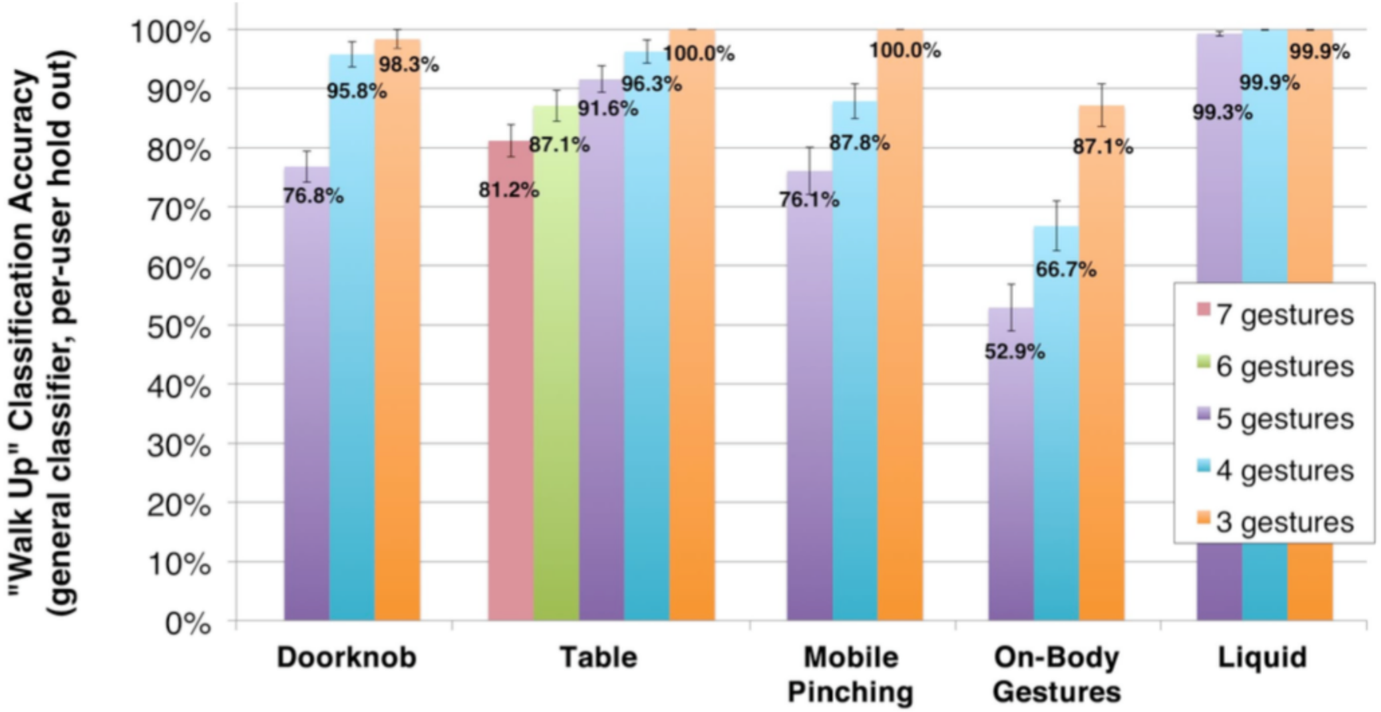
- Designed specifically to tax system's accuracy: this is to minimise the potential for ceiling effect
- Gesture sets for all 5 domains: All gestures and N-1 Gestures
- Two groups of 12 participants each
- Evaluation training followed by test of 60 min for 7 days
- First group of 12 participants were given studies for 1 to 4 domains with solid objects
- Second group of 12 participants were given liquid study

Evaluation Results



Real-time, per-user classification accuracy for five example application

Evaluation Results



Walk up classification accuracy for five example applications.

Thank you!