Introduction to the Internet of Things

Licence 3 - Institut Galilée

Massinissa Hamidi

October 16th, 2019

Outline

- Organization
- Some IoT projects
- Hardware
- Software
- Resources
- Your projects

Organization

Moi même

Modaresi Sayed

Disponible à tout moment par mél! réponse rapide modulo nos deadlines (rédaction de papiers scientifiques, thèses, etc.)

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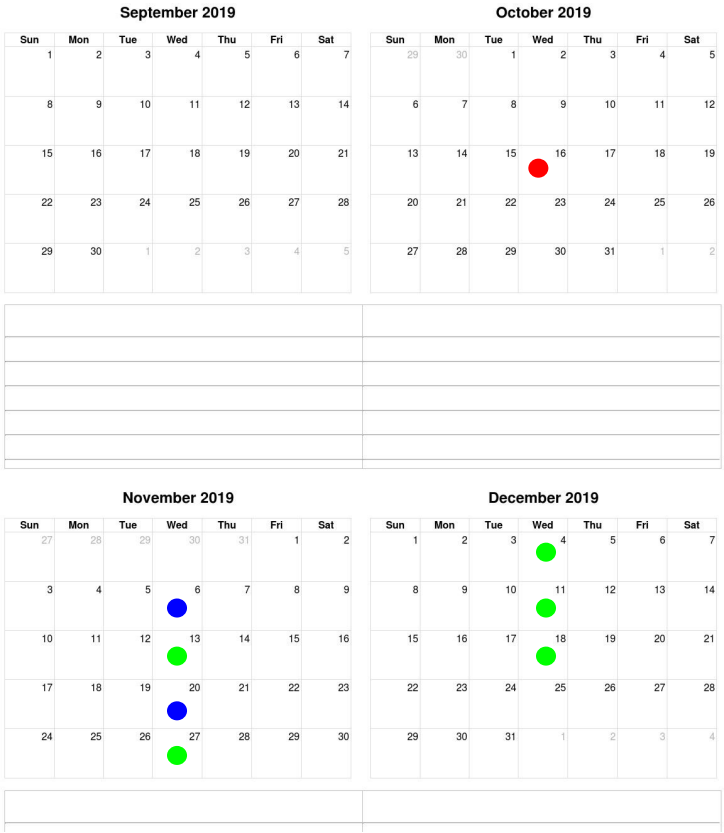
- modaresi@lipn.univ-paris13.fr

Organization (Cont'd)

- Courses
- Labs
- Projects



What about you?

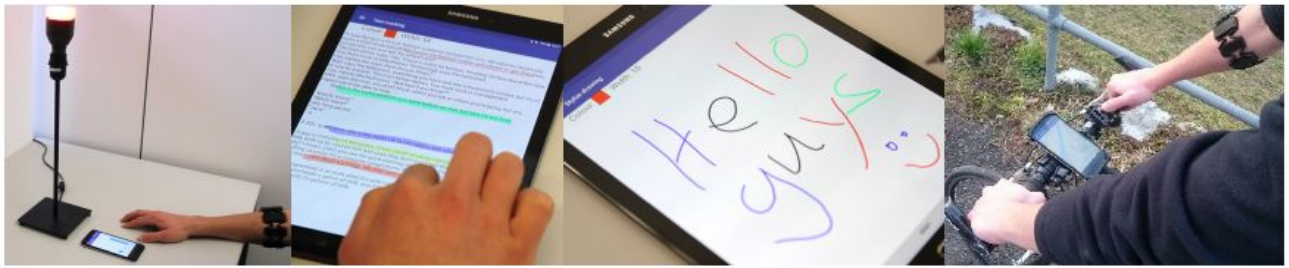
Vos attentes, vos domaines d’intérêt en informatique (sécurité, SI, web, compilation, intelligence artificielle, jeux, pourquoi pas IoT *o*, etc.)

Some research projects

TouchSense: Classifying Finger Touches and Measuring their Force with an Electromyography Armband

Vincent Becker, Pietro Oldrati, Liliana Barrios, Gábor Sörös
Department of Computer Science, ETH Zurich, Switzerland
{vbecker | oldratip | lilianab | soeroesg}@ethz.ch

"Enrich the interactions with devices"



(a) (b) (c) (d)

Figure 1: We propose a method that allows to determine the finger and the force applied in touches. We present several applications using this method to enrich the interaction with devices.

Some research projects (Cont'd)

PhysioHMD: A Conformable, Modular Toolkit for Collecting Physiological Data from Head-Mounted Displays

Guillermo Bernal*, Tao Yang+, Abhinandan Jain*, Pattie Maes*
MIT Media Lab, Cambridge, Massachusetts, USA*
Xi'an Jiaotong University, Xi'an, Shaanxi, China+
gbernal, yangtao, abyjain, maes@mit.edu

Figure 2: The image depicts every headset variation explored during this research. a) AR headset with flexible pcb & gold plated electrodes. b) VR headset with flexible PCB & gold plated electrodes. c) VR headset with hydrogel electrodes. d) VR headset with Ag/AgCI electrodes.

ABSTRACT

Virtual and augmented reality headsets are unique as they have access to our facial area: an area that presents an excellent opportunity for always-available input and insight into the user's state. Their position on the face makes it possible to capture bio-signals as well as facial expressions. This paper introduces the PhysioHMD, a software and hardware modular interface built for collecting affect and physiological data from users wearing a head-mounted display. The PhysioHMD platform is a flexible architecture enables researchers and developers to aggregate and interprets signals in real-time, and use those to develop novel, personalized interactions and evaluate virtual experiences. Offering an interface that is not only easy to extend but also is complemented by a suite of tools for testing and analysis. We hope that PhysioHMD can become a universal, publicly available testbed for VR and AR researchers.

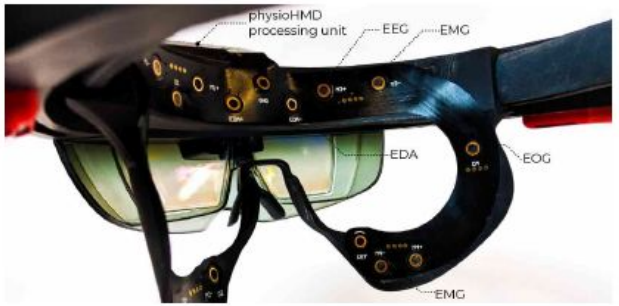


Figure 1: View of PhysioHMD hardware setup for AR experience. Gold plated electrodes and the flexible printed circuit board (PCB) record data through the contact with the skin.

Some research projects (Cont'd)

1D Eyewear: Peripheral, Hidden LEDs and Near-Eye Holographic Displays for Unobtrusive Augmentation

Alex Olwal **Bernard Kress***
Interaction Lab, Google Inc.
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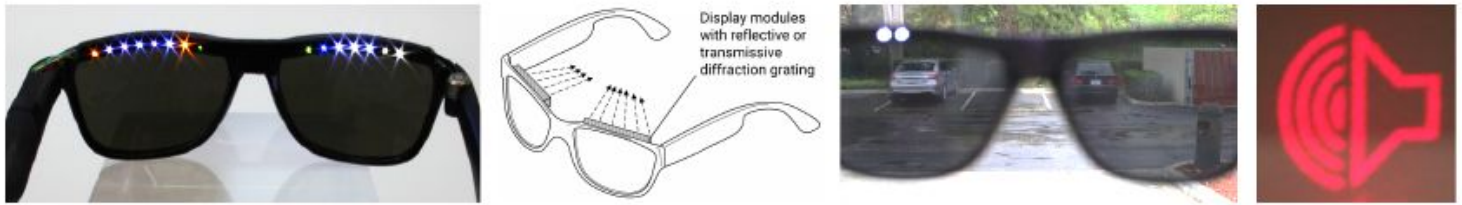

a) Wide-FOV, wireless LED glasses b) Embedded CGHs c) Perspective-correct rendering d) Hologram

Figure 1. 1D Eyewear uses 1D arrays of LEDs and pre-recorded holographic symbols for socially acceptable industrial design. We demonstrate near-eye optical designs using computer-generated holograms (CGHs) for compact presentation of symbology.

https://vimeo.com/295963543

Some research projects (Cont'd)

ABSTRACT

Order picking accounts for 55% of the annual $60 billion spent on warehouse operations in the United States. Reducing human-induced errors in the order fulfillment process can save warehouses and distributors significant costs. We investigate a radio-frequency identification (RFID)-based verification method wherein wearable RFID scanners, worn on the wrists, scan passive RFID tags mounted on an item's bin as the item is picked; this method is used in conjunction with a head-up display (HUD) to guide the user to the correct item. We compare this RFID verification method to pick-to-light with button verification, pick-to-paper with barcode verification, and pick-to-paper with no verification. We find that pick-to-HUD with

RF-Pick: Comparing Order Picking Using a HUD with Wearable RFID Verification to Traditional Pick Methods

Charu Thomas[1], Theodore Panagiotopoulos[1], Pramod Kotipalli[1], Malcolm Haynes[2], Thad Starner[1]

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[2]United States Military Academy
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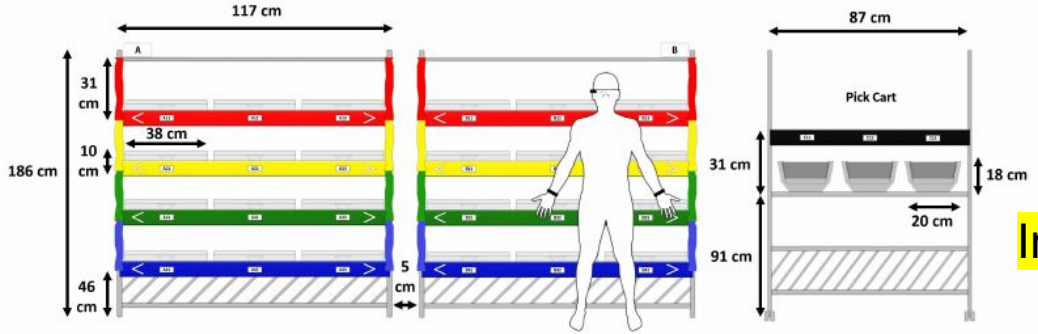
HUD - RFID | Paper - None



In an industrial context ...

Figure 6. Our experimental environment consists of two racks (named A and B) and a cart. Each rack has 12 source bins, and the cart has three receive bins (bottom row not used).

Some research projects (Cont'd)

SnapBand: a Flexible Multi-Location Touch Input Band

David Dobbelstein, Tobias Arnold, Enrico Rukzio
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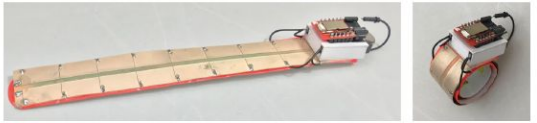

Figure 2. The *SnapBand*-prototype in a flat (left) and curled (right) configuration. A BLE Nano at the end of the band serves as a micro controller powered by a CR2032 coin cell battery.

ABSTRACT
The form factors of current wearable devices are designed and limited to be worn at specifically defined on-body locations (such as the wrist), which can limit the interaction capabilities based on physical constraints in body movement and positioning. We investigate the design of a multi-functional wearable input device that can be worn at various locations on the body and may as well get mounted onto objects in the environment. This allows users to adjust the device's location to different affordances of

By the way, you can contact the authors for more information or in order to get a prototype, who knows ...?

ulti-location; touch input device; on-body; off-body

ification Keywords
H.5.2. User Interfaces: Input devices and strategies

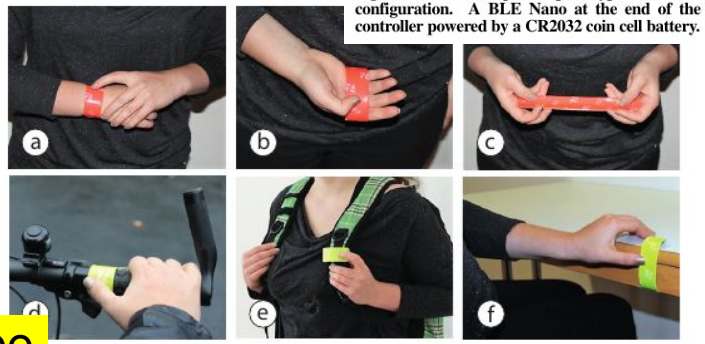

Figure 1. *SnapBand* **is a touch input device that can be snapped, worn and attached to multiple on- and off-body locations, such as onto the wrist similar to a smartwatch (a), as a one- or two-handed touch controller (b&c), attached to a handlebar on a bycicle (d), on a strap of a backback (e) or the edge of a table (f).**

Some research projects (Cont'd)

Empathy Amulet: A Wearable to Connect with Strangers

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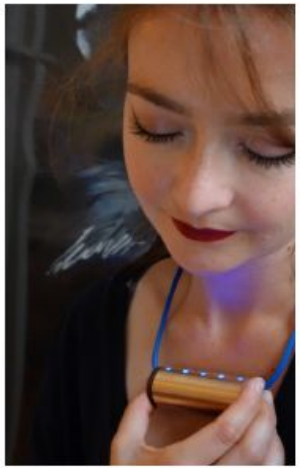


Figure 1: Empathy Amulet.

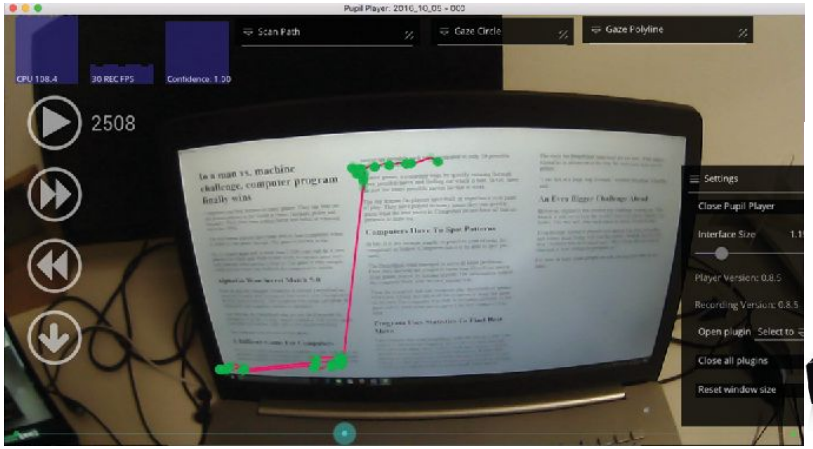
Figure 2: Grabbing handles to activate the Empathy Box.

Figure 4: Empathy Amulet.

Figure 5: Kapton heater on back of Empathy Amulet.

https://vimeo.com/194698949

Some research projects (Cont'd)



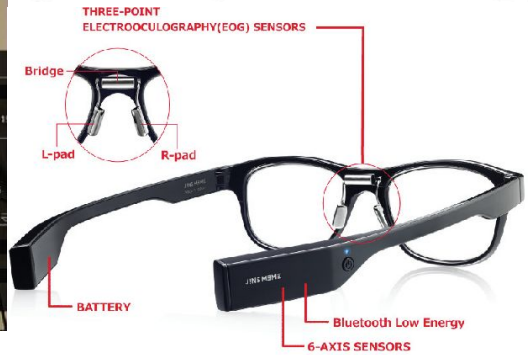
https://www.youtube.com/watch?v=7eOkTvC7UNc

Wordometer Systems for Everyday Life

OLIVIER AUGEREAU, CHARLES LIMA SANCHES, and KOICHI KISE, Osaka Prefecture University
KAI KUNZE, Keio University

We present in this paper a detailed comparison of different algorithms and devices to determine the number of words read in everyday life. We call our system the "Wordometer". We used three kinds of eye tracking systems in our experiment: mobile video-oculography (MVoG); stationary video-oculography (SVoG); and electro-oculography (EoG). By analyzing the movement of the eyes we were able to estimate the number of words that a user read. Recently, inexpensive eye trackers have appeared on the market. Thus, we undertook a large-scale experiment that compared three devices that can be used for daily reading on a screen: the Tobii Eye X SVoG; the JINS MEME EoG; and the Pupil MVoG. We found that the accuracy of the everyday life devices and professional devices was similar when used with the Wordometer. We analyzed the robustness of the systems for special reading behaviors: rereading and skipping.

With the MVoG, SVoG and EoG systems, we obtained estimation errors respectively, 7.2%, 13.0%, and 10.6% in our main experiment. In all our experiments, we obtained 300 recordings by 14 participants, which amounted to 109,097 read words.



(a) JINS MEME glasses.

(b) JINS MEME glasses as worn by a user.

Some research projects (Cont'd)

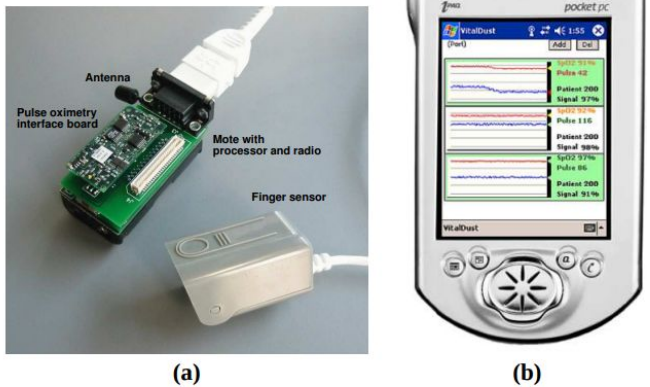


Figure 1: **(a) Our mote-based pulse oximeter. (b) The accompanying patient triage application.**

CodeBlue: An *Ad Hoc* Sensor Network Infrastructure for Emergency Medical Care

David Malan†, Thaddeus Fulford-Jones†, Matt Welsh†, and Steve Moulton‡
†Division of Engineering and Applied Sciences ‡School of Medicine
Harvard University Boston University

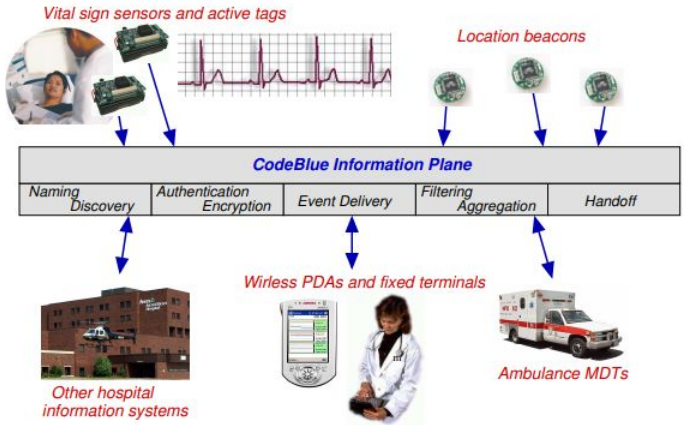


Figure 2: **The CodeBlue communication substrate.**

Some research projects (Cont'd)

Predicting Latent Narrative Mood using Audio and Physiologic Data

Tuka AlHanai and Mohammad Mahdi Ghassemi*
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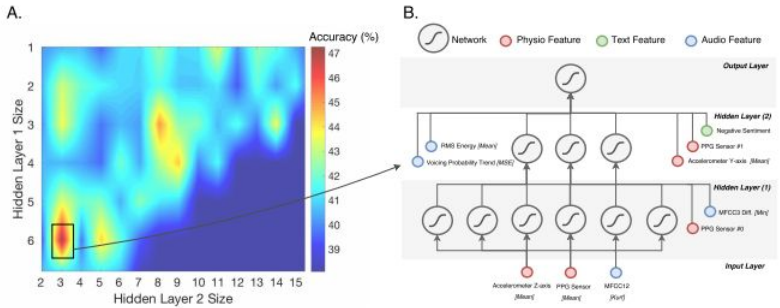


Figure 2: *(A) A heatmap of segment-level NN accuracy for a variety of topological settings. Hotter colors correspond to higher accuracy. (B) A depiction of the segment-level NN after optimization of feature location within the NN topology. Lower level features such as the accelerometer signal was placed in lower levels of the network while more abstract features, such as negative text sentiment, was placed higher in the network.*

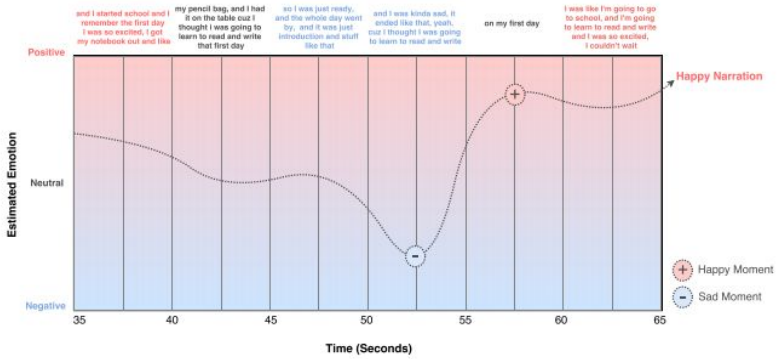
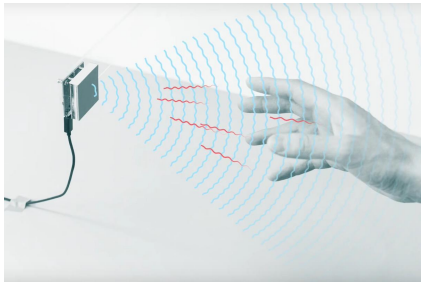


Figure 3: *Real-time estimation of the emotional content in 30 seconds of collected data, using our optimized NN. The color of the text at the top of the plot reflects the ground truth labels generated by the research assistant (blue for negative, red for positive, black for neutral). The predictions of the network (y-axis) reflect the underlying emotional state of the narrator.*

Mood-Predicting Wearables https://www.youtube.com/watch?v=ZZFcgg-7dlc

Some research projects (Cont'd)



BeyondTouch: Extending the Input Language with Built-in Sensors on Commodity Smartphones

Cheng Zhang, Anhong Guo, Dingtian Zhang, Caleb Southern, Rosa Arriaga, Gregory Abowd
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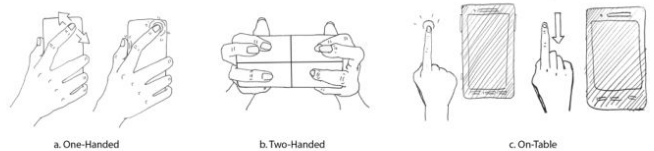
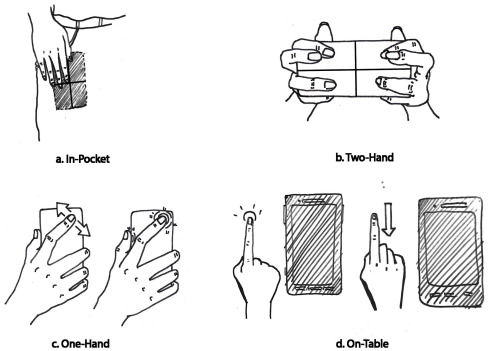


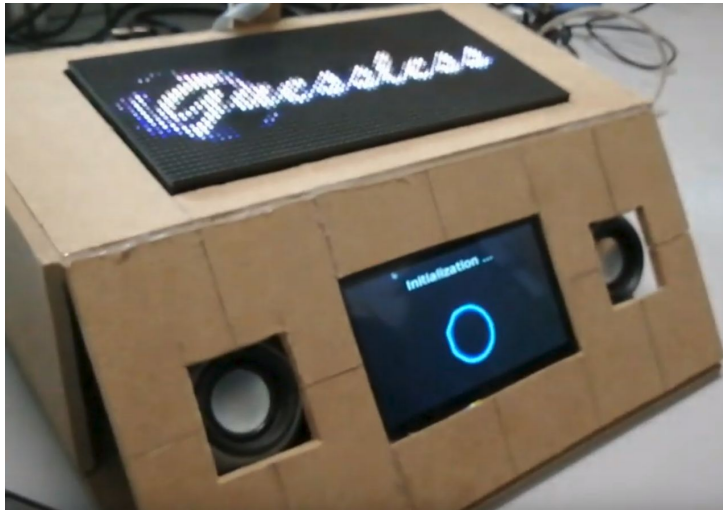


Google Pixel 4 Soli RADAR Gestures https://www.youtube.com/watch?v=hwEDIya5bx0
Welcome to Project Soli https://www.youtube.com/watch?v=0QNiZfSsPc0

Closer to you ...

Guessless

Authors: Maher LAAROUSSI, Aboubakr CHOUTTA, Hamid OUFKIR, Othmane MCHOUAT



Closer to you … (Cont'd)

Sapio Mirror

Authors: Pellier Bastien, Antoine Dombrecht, Pierre-Marie Frerot, Maxime Danguin

SocialMirror: Motivating Young Adults with Autism to Practice Life Skills in a Social World

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Abstract
In this video, we present *SocialMirror* [1], an interactive mirror connected to an online social network that allows young adults with autism to seek advice from a trusted and responsive network of family, friends and professionals. We depict three social scenarios that show the feasibility and applicability of SocialMirror.

Keywords
Autism, Social Networking, Collaborative Care

https://roboticsmind.github.io/project > smart-mirror

Gatech's SmartMirror https://www.youtube.com/watch?v=91-JnTg3MhA

Closer to you … (Cont’d)

Immersion 3.5D

Authors: Heba Kaddouh, Mohamed Ben Saad, Jessy Colombo, Khalid Barakat

Closer to you … (Cont'd)

Digiscript

Authors: Nicolas Dziurda, Guillaume Jobin, Thomas Arpin, Thomas Cornier, Steve Demeulemeester

Gatech - BrailleTouch Helps Visually Impaired Users https://www.youtube.com/watch?v=rIEO1bUFHsI
https://twitter.com/DigitalTrends/status/1111976370828181504

Closer to you … (Cont’d)

Eye Truck

Authors: Vincent Keller, Antoine Vo, Zhu Yongyi, Yixin Li

Closer to you … (Cont'd)

Platform for Assessment and Monitoring of Infant Comfort

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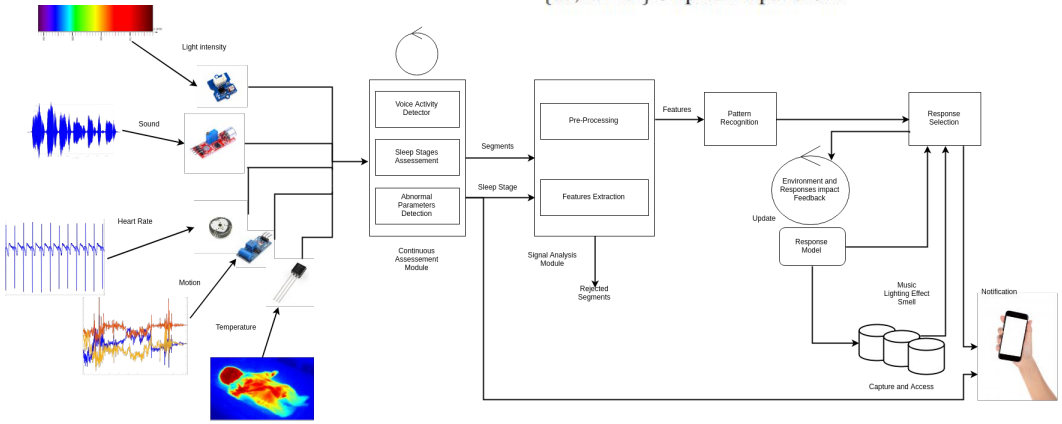


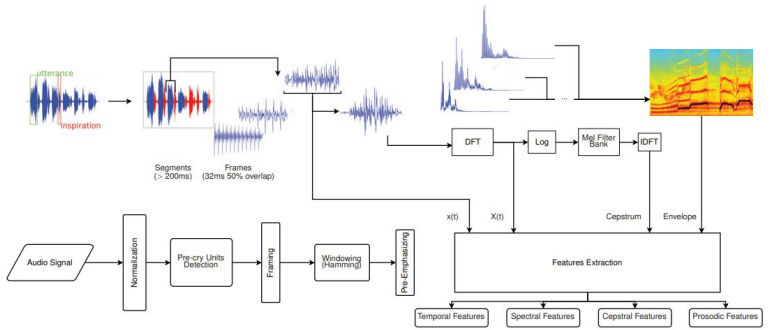
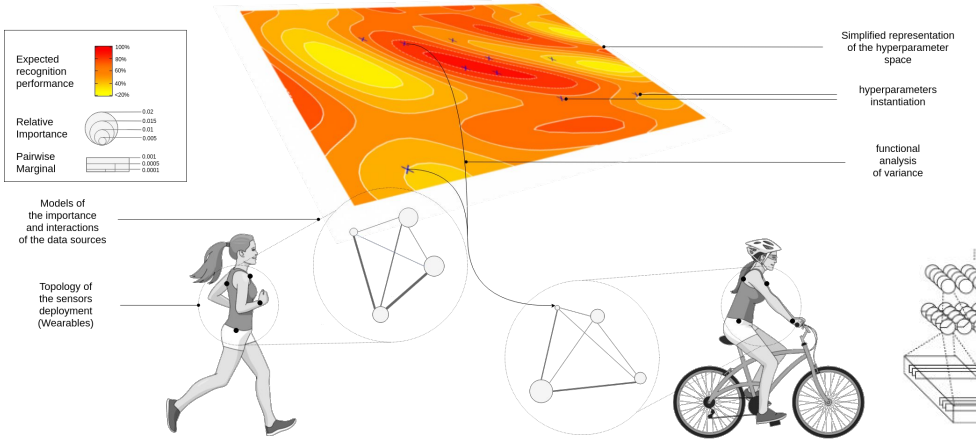


Figure 2: Block diagram of data preprocessing and features extraction

Closer to you … (Cont'd)



HAR Data Generation Model to Highly Reduce Learning Space

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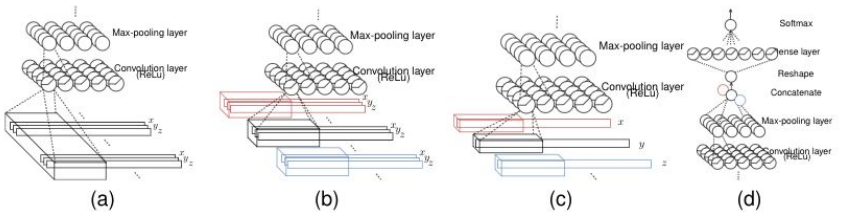
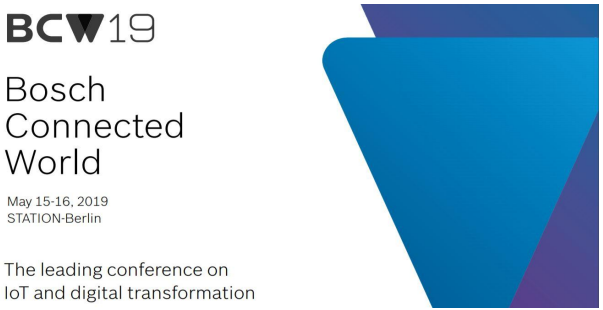


Figure 1: Schematic representation of the different *convolutional modes* of input data: (a) modalities are grouped together and convolved with the filters, (b) modalities are taken apart from each other, (c) Each channel is convolved alone. (d) Classification layer encompassing a set of convolutional layers followed by a dense layer. The features maps outputted from the last convolutional layer of each modality is concatenated and then reshaped to be fed into the dense layer.

International contests

- IoT world cup
- Bosch hackathon
- RoboCup (plus orienté robotique) more information with Lab instructor (he is the Technical Committee Head of the International Robocup Federation)



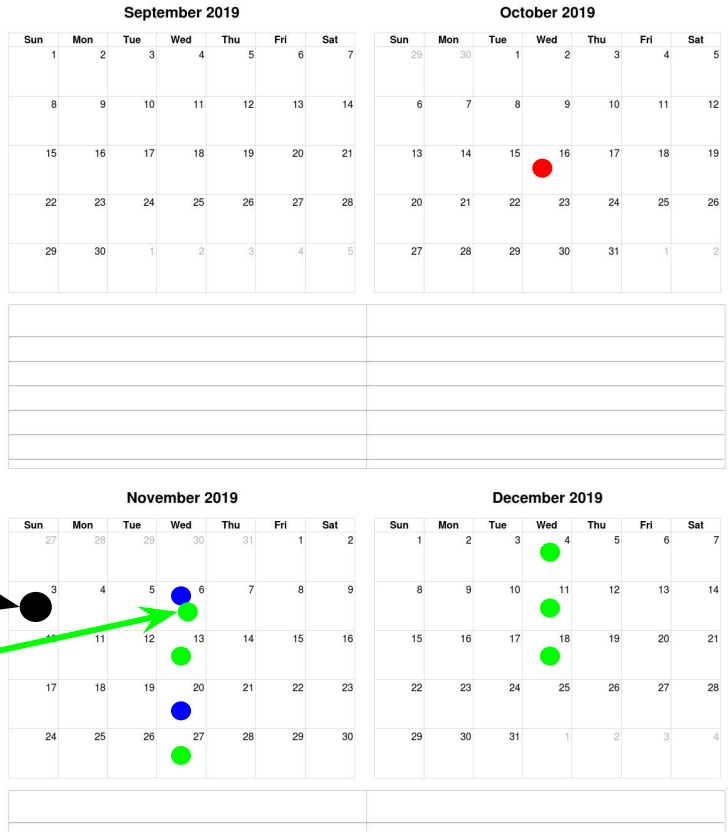
https://bosch-connected-world.com/hackathon/
https://bosch-connected-world.com/hackathon/recaping-bcx19/
https://viewpointsystem.com/en/applications/?branche=a-industry
https://www.innovationworldcup.com/11th-iot-wt-innovation-world-cup/

Back to organization

- Courses
- Labs
- Projects

1st deadline:

- Sunday 3rd November, 2019
- Project proposal: state-of-the-art, market study, norms and regulations, implementation planning
- Presentations

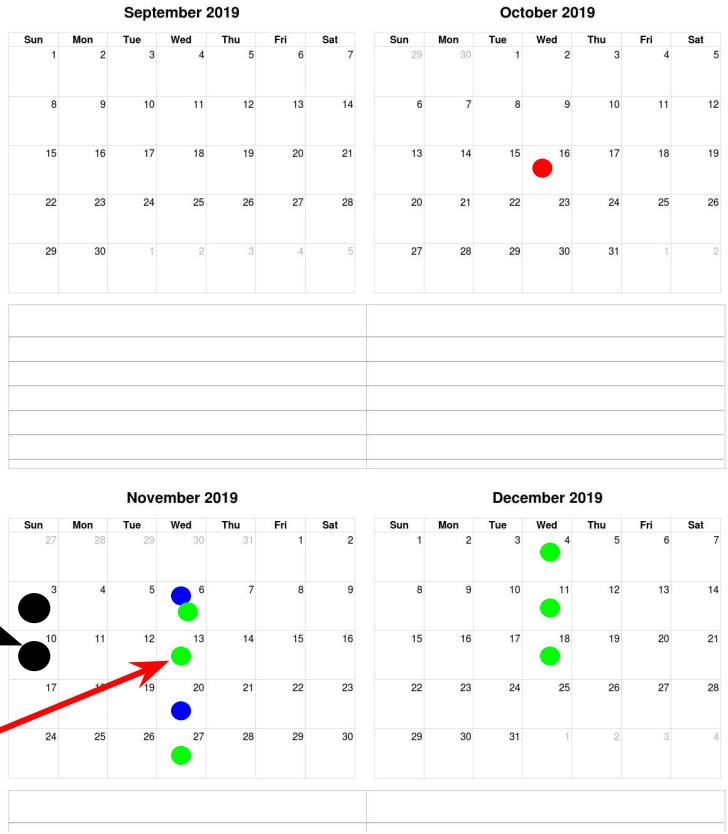


Back to organization (Cont'd)

- Courses
- Labs
- Projects

2nd deadline:

- Sunday 10th November, 2019
- Technical details: components list, software design (uml diagrams), hardware design, *etc.*
- Presentations and validation of the project … No major changes after that

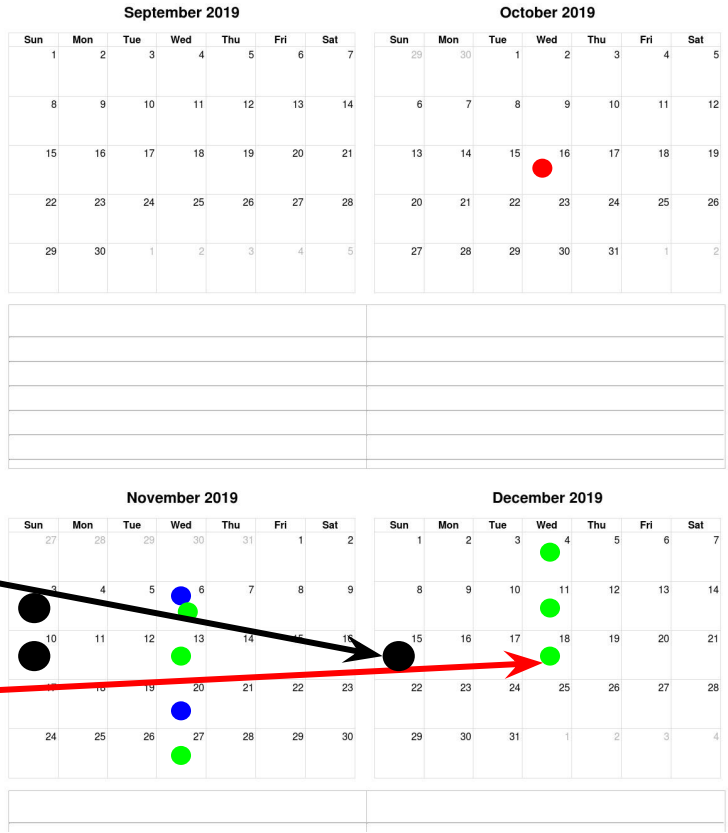


Back to organization (Cont'd)

- Courses
- Labs
- Projects

3rd deadline:

- Sunday 15th December, 2019
- What to submit: the final report, video, presentation;
- Final Presentations



Project-oriented course

At the end of the whole IoT-course, you have to submit:

1. a report;
2. a video;
3. mid-term presentations;
4. final presentation;

Report

Goals (a report? what to include?)

Your deliverables must include:

1. a clear description of the problem you tackle;
2. a comprehensive state-of-the-art around proposed solutions;
3. a description of your IoT-based solution and what makes it better than other solutions;
4. norms and regulations that apply in your specific case;
5. implementation planning in the form of Gantt diagram;
6. anything that would be of interest to your solution.

Video

Goals (a video? what to do? what not to do?)

Do’s

- 3 minutes NO MORE, NO LESS;
- Concise description of the Hardware and software;
- Demo of your product;
- Take a look at inspirational works around YouTube, Vimeo, etc.

don’ts

- More than 3 minutes;
- Less than 3 minutes;

Project proposal presentation

Presentation rules:

- Each group has 7 minutes to convince (followed by 3 min. questions);
- Each member of a group has to present, mainly, his part;

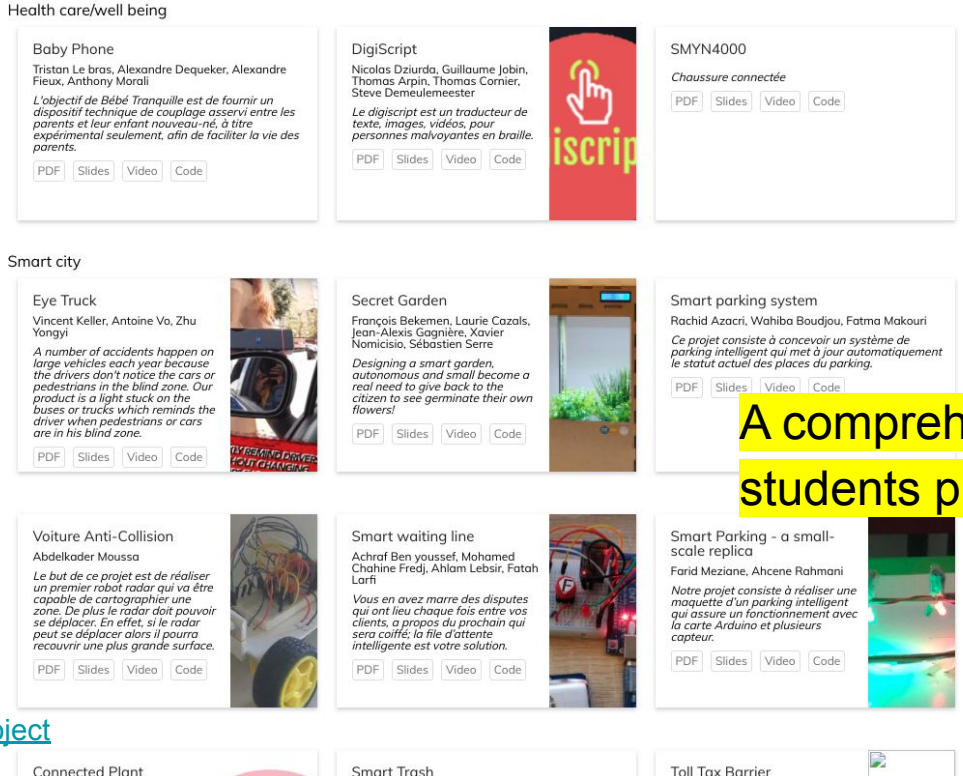
Evaluation:

- You have to evaluate each group, IN A CONSTRUCTIVE MANNER!;
- Check-out the evaluation spreadsheet (*);
- You have to send the evaluation to teachers and to the concerned group;

(*) https://docs.google.com/spreadsheets/d/1hkWVUlpps3B1EkdVFl21mFQUcTEXOgbCR7l0Lh8GIq0/edit?usp=sharing

IoT website

Objectifs (le site web? pourquoi faire?)



A comprehensive resource for students projects, eventually ...

https://roboticsmind.github.io/project

Evaluation

Sujet
[G] Difficulté
[G] Originalité
[P] Difficulté de la tâche

Présentation
[G] slides
[G] qualité générale
[P] Présentation personnelle
[P] Réponse aux questions
[G] Démo du travail effectué

Rapport
[G] Qualité présentation
[G] qualité état de l'art
[G] présentation de l'étude
[G] présentation de la solution
[G] aspects généraux
[P] Contribution personnelle

Vidéo
[P] Contribution personnelle
[G] qualité générale

Git [G]
activité en commits, issues, pull requests
pertinence des commits

Suivi lors des Tps
Présence
Engagement

Code
Aspects généraux
Fonctionnel?

Hardware
Aspects généraux

Time to create your GitHub accounts

Use usernames that correspond to your real names (easy for us to find out who is who!);

https://github.com

Time to team-up

- Based on personal affinities or shared interests;
- Flexible until the next course, no changes allowed after that;
- 3 members maximum, no singletons;

Even if you work in teams, final marks are individual!

Time to team-up (Cont'd)

- A GitHub repository will be created for each team;
- All your software developments will be done in GitHub (commits, issues, *etc.*) will be considered;
- All documents, reports, consulted resources, hardware designs, *etc.* have to be put in your respective project repository;
- A dedicated organization page, https://github.com/institut-galilee, will host your projects;
- You can find last years IoT projects in this organization page. You can also check the "sister" organization page, https://github.com/efrei-paris-sud.

Time to team-up (Cont'd)

- Team name;
- Team members:
  - GitHub username of each member;
- Description of your preliminary idea(s) (a small paragraph);

Send one email per group to

hamidi@lipn.univ-paris13.fr

cc: modaresi@lipn.univ-paris13.fr

cc: ao@lipn.univ-paris13.fr

Deadline to transmit all these pieces of information is today!