# Human Interfaces In Information Systems Laboratory

## The Human-Computer Interaction Group

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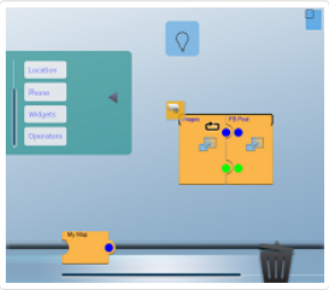
## Our Mission

Laboratory brochure | Laboratory presentation



The activities of our laboratory aim to address fundamental questions on the interaction between people and technologies. The underlying reason for this interest is the need to provide the highest number of people with satisfying access to applications for the largest number of purposes and in the broadest number of contexts. Our research activity is in methods and tools to support user interface designers, software developers, and end-users in obtaining systems that can be accessed from different contexts of use in such a way to improve usability, accessibility, and user experience. For this purpose, we design and evaluate solutions that take into account the available devices and objects, the users (in terms of tasks, abilities, cognitive and emotional state), the surrounding environments, and the social relations, and aim to allow users to improve their experience.

**The main goal** is to propose new solutions in basic and applied research in the field of human-computer interaction, specifically in user interface software and technologies, mainly under the aegis of national and international programmes and private sector R&D contracts. One of the first groups in Italy in the HCI area, we have become internationally well known, as demonstrated by participation in numerous European projects and in the programme committees of the most important HCI conferences, and publications in the main HCI and software engineering journals and conferences.

The **main research areas** concern: Context-Dependent Interactive Systems, End-User Development, Methods and Tools for Usability, Accessibility, and User Experience Evaluation, Human-Robot Interaction, Intelligent Interfaces, MultiModal User Interfaces, Accessibility, Emotion-based User Interfaces, Usability Engineering and Models for HCI. Such work has led to the development of several tools and applications, some of which are publicly available.

### News

Read all news...

**21-Jun-2022**

We have published the paper: End-user development in industrial contexts: the paper mill case study. The case study has been carried out in the paper district in the Lucca area in Tuscany. It can be interesting to understand issues and possibilities when introducing end-user configuration of automations in industrial contexts.

**14-Jun-2022**

We are looking for candidates for one three-year PhD scholarships that will be carried out at the at the Human Interfaces in Information Systems (HIIS) Laboratory at CNR-ISTI : The fellowship is associated with the PhD school at the Computer Science department of the University of Pisa in the Human-Computer Interaction area, with a preference for topics related to Adaptive Human-Computer Interaction. The HIIS Laboratory is a creative and multi-disciplinary interactive technologies research laboratory, with deep and extensive research collaborations, industrial partners, and a supportive working environment.

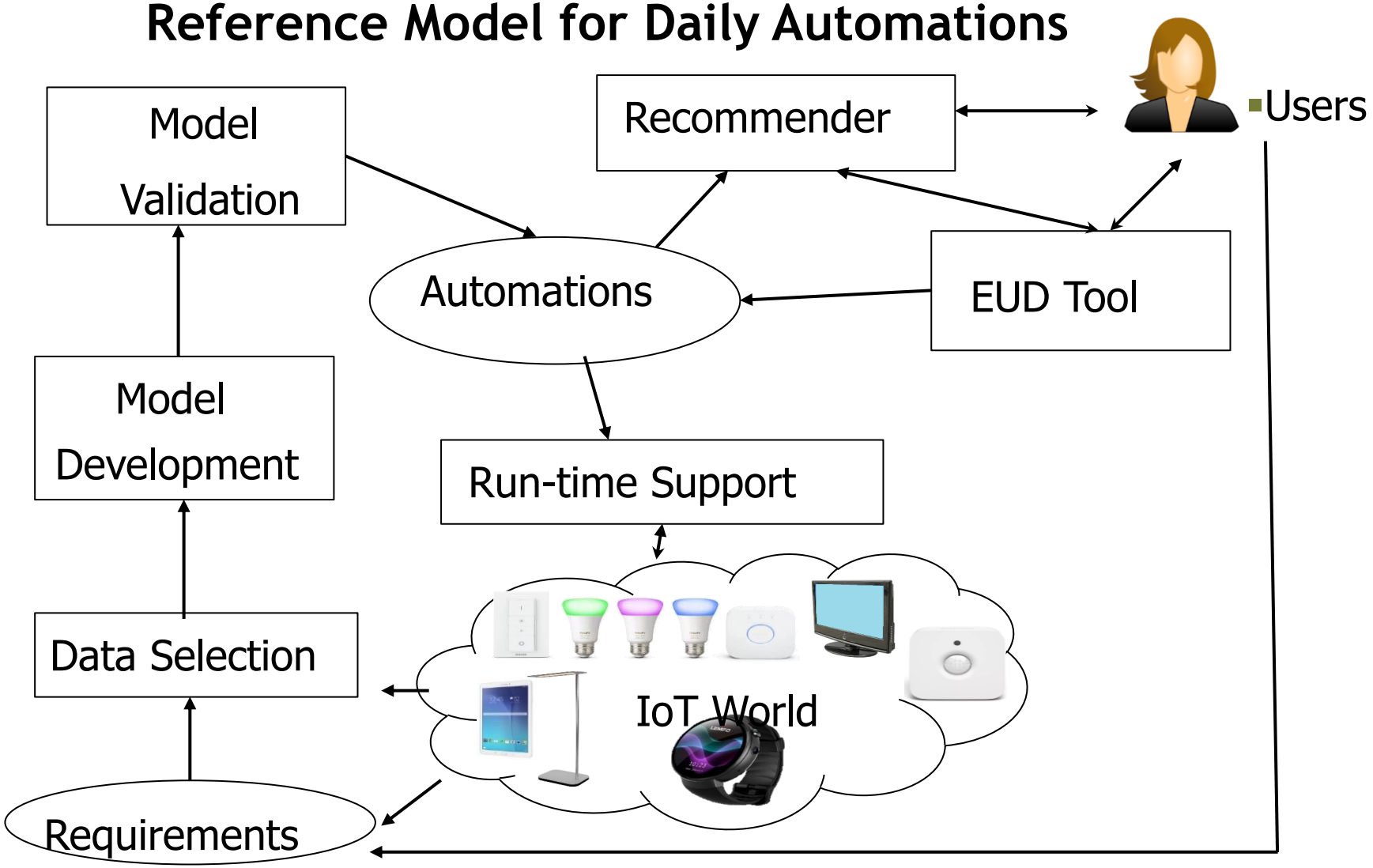
# Research Topics

- Interactive Smart Spaces
- Human-centred Artificial Intelligence
- End-User Development
- Human-Robot Interaction
- Multimodal User Interfaces
- Tools for Accessibility and Usability Evaluation
- Assistive Technologies and Accessibility

# Current Projects

- EMPATHY - Empowering People in Dealing with Internet of Things Ecosystems
- SERENI - SERious gamEs with a humanoid robot in a cogNItive training
- PNRR-AGID - Automatic Monitoring of Accessibility in Public Administration Web Sites
- Games for children with cognitive disorders in collaboration with PAIM and ASL

# Reference Model for Daily Automations



# Examples of possible daily automations

- In a store, automations for sending personalized ads to customers' smartphones based on the movements and interactions with store products
- In an older adult residence, automations for sending personalized messages to the older adult to promote healthy behaviour: for example, a warning on the preferred device (eg TV) to encourage them to exercise more, based on the activities detected in the morning
- In an industrial site, automations to activate safety alerts to workers on their smartwatch based on the dynamic presence of some potentially dangerous equipment
- In a smart home, automations to better control the activities according to user preferences, routines, devices and context, eg. if it is a day of week, from 9 to 17 and a sensor detects a certain movement, the application should flash red lights in the smartphone, with an image from the home webcam

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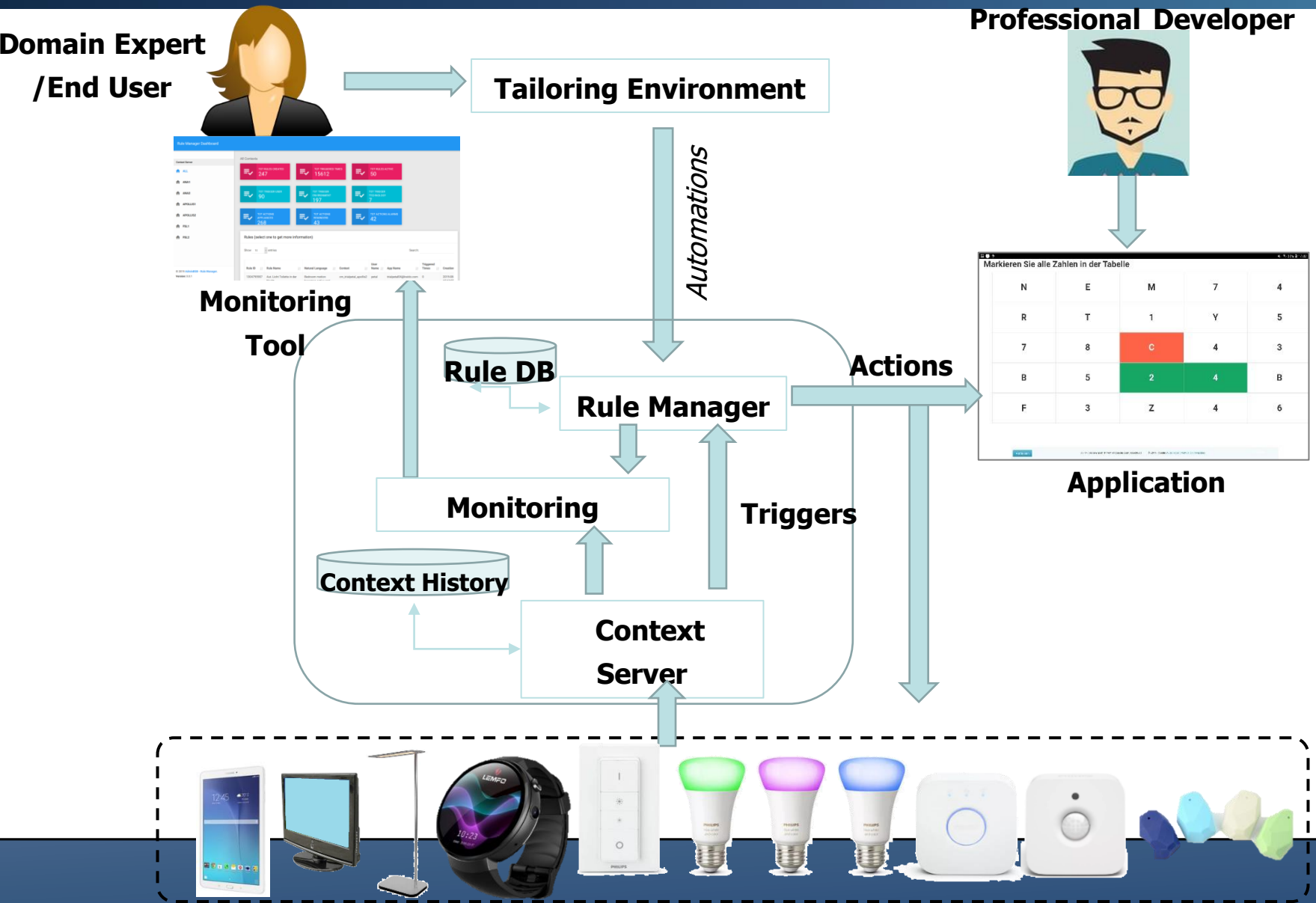
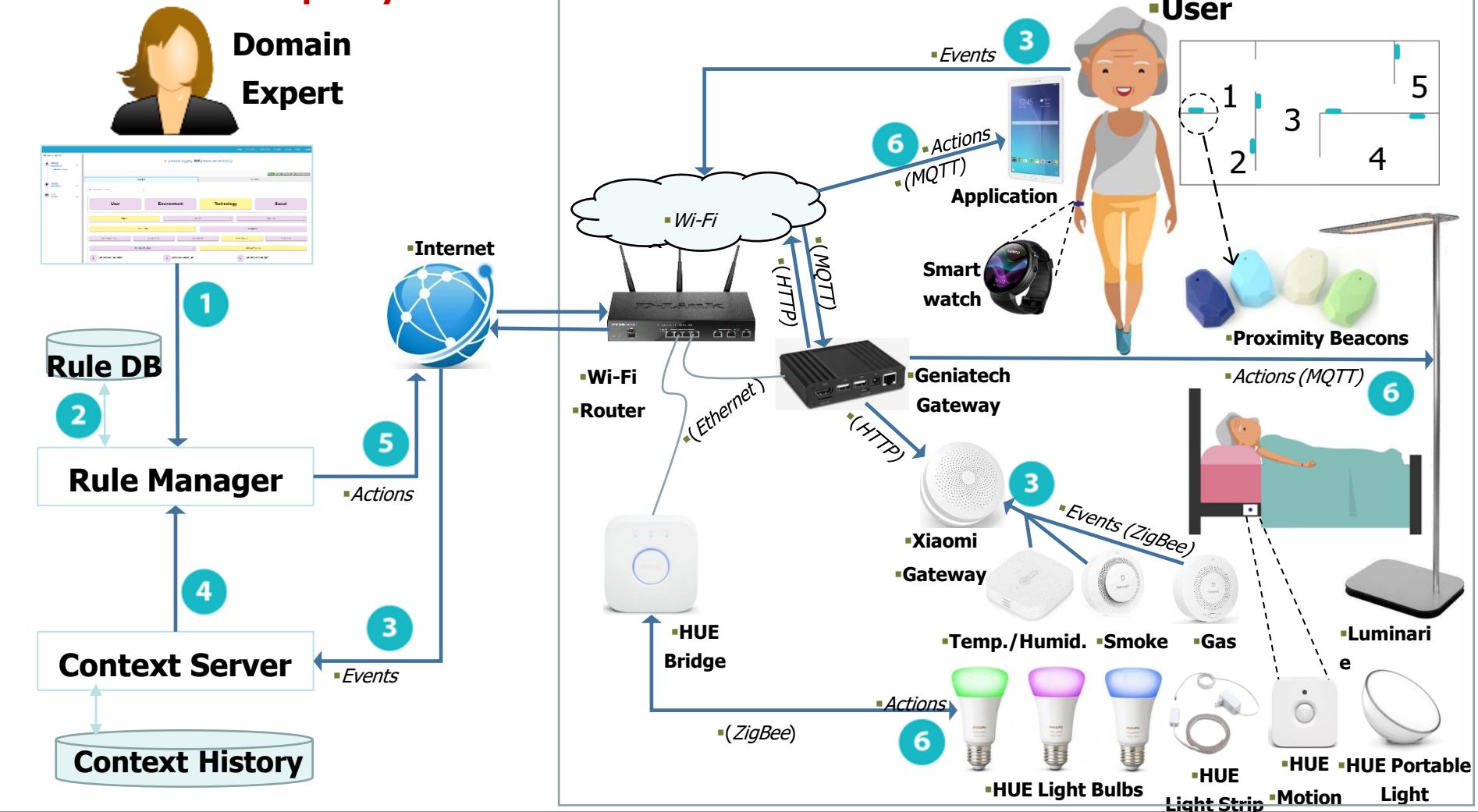


# Platform deployment



# Example Automations

- **Safety**. WHEN the user exits home and IF time is between 11 p.m. and 7 a.m.  DO send a text message to the caregiver
- **Comfort**. WHEN motion is detected in bedroom and IF time is between 11 p.m. and 6 a.m.  DO turn on lights to go to the bathroom
- **Wellbeing**. IF the training time is less than 30 minutes and WHEN the time is 6 p.m. DO send a reminder
- **Health**. WHEN NOT(taken medicine) between 08:00 and 09:00 , DO send one alarm by text to caregiver
- **Energy saving**. IF user is in bed AND time is between 11:00 p.m. and 06:00, DO turn off all lights in the bedroom
- **Socialization**. If tomorrow's forecast is good AND tomorrow's temperature is above 20 degrees, when it is 6 p.m. remind the user to call a friend to plan for a walk together tomorrow

# Approaches in Composition Paradigms

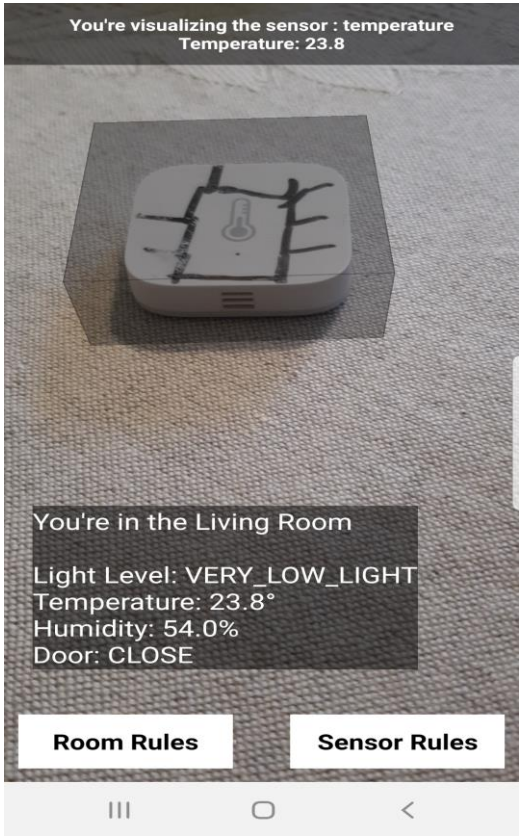
- Composition paradigm:
  - how they present the relevant concepts and interact with users
  - how they support the rule development process
- Data flow (representing how information goes through the various components)
- Visual Wizards (aiming to drive users by limiting their possible selections)
- Block-based (using the puzzle metaphor to suggest possible compositions)
- Conversational (exploiting natural language and AI to get user input, process it, and request clarifications)

# Possible Issues and Solutions

- Visual editors with conceptual representations of possible automation elements
- They tend to be large, comprehensive, static, abstract EUD tools detached from the user's real context
- It may not be straightforward to understand how to navigate the large number of elements
- Understanding the elements and to what real element they refer to sometimes requires technical knowledge
- Need for more narrowed, situated, dynamic representations associated with the physical objects available

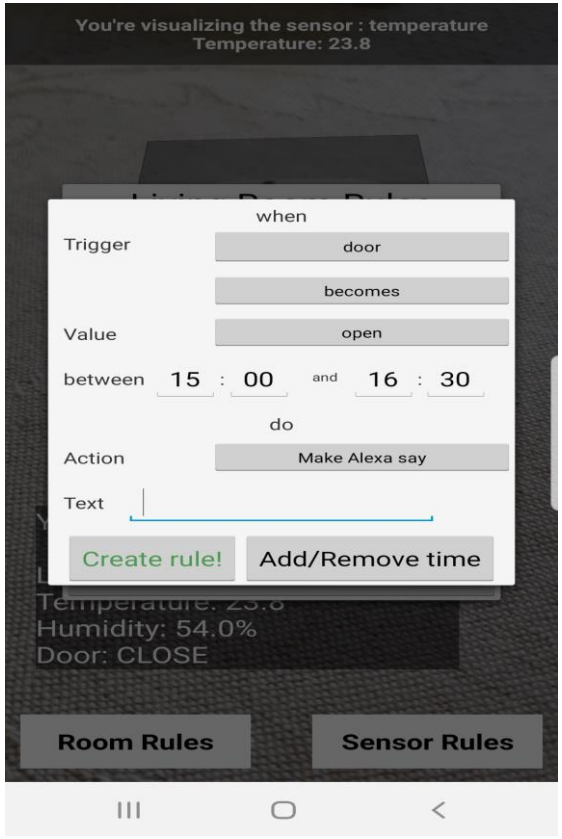
# Augmented reality support for automation control

- Avoid using special devices that many do not have
- Possibility of direct interaction with the object of interest
- Possibility of monitoring nearby automations while moving, also at different levels of granularity (object, room)
- Ability to select a real object directly and know the automations that involve it
- Ability to create new automations
- Ability to modify existing automations




Information on current room


Rules created for current room




Creation of new rules

# AR Rule Editor Prototype

## Augmented Reality in IoT

Goal: making easier the composition of automation and reasoning about TAP concepts

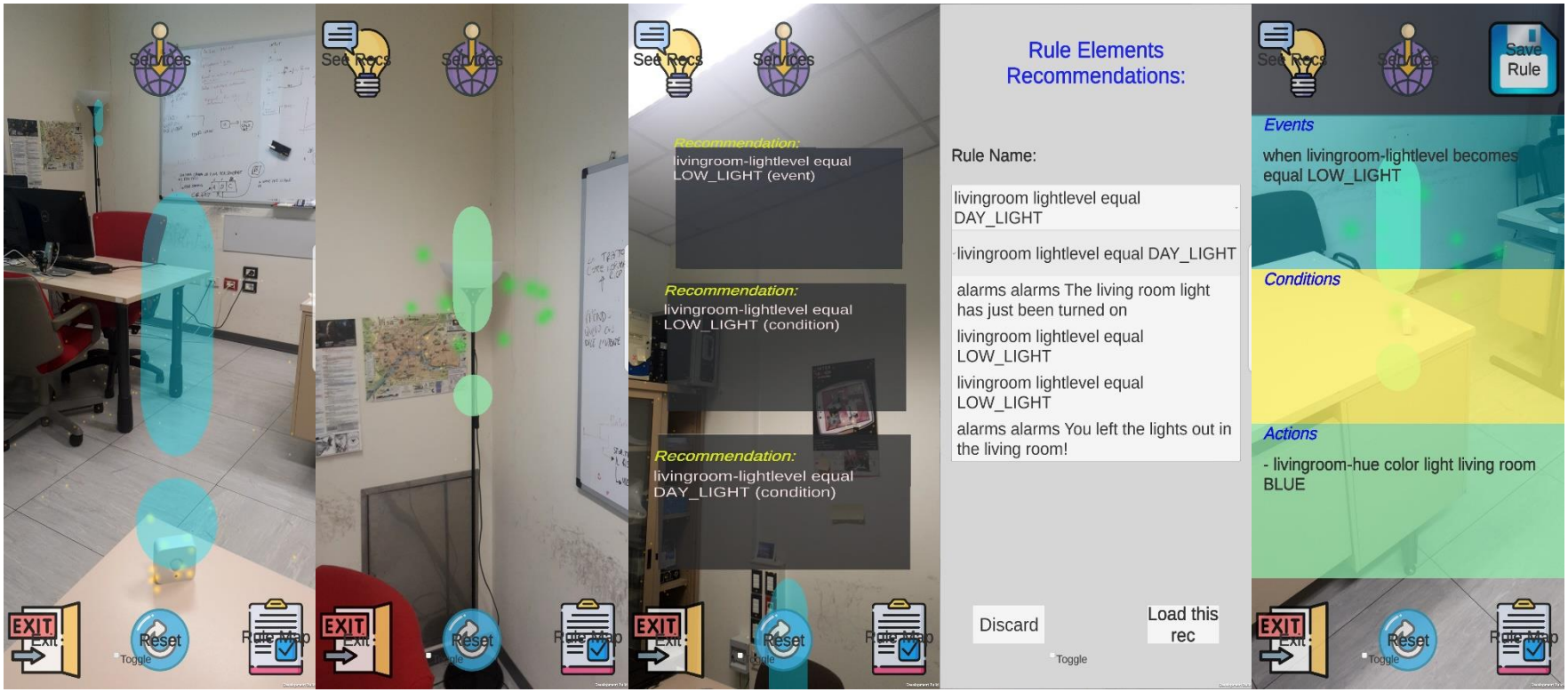
- Facilitating the mapping between the digital and real objects
- Narrowing the space of selection dynamically presented to users (hierarchical and abstract → plain and situated)
- Making TAP concepts more explicit

## Recommendations

- The goal is to provide rule elements suggestions coherent with user input
- Used a modified version of the Bounded Greedy algorithm
- First coarse utility measure: used word2vec to also capture semantics in input (understand that the vocal reminder "close the refrigerator door" refers to the "fridge" object)
- Precise greedy measures: lift for utility, cosine similarity between the representation of the new suggestions and the other recommendations for diversity. Also considering user-objects distance

## Further Developments

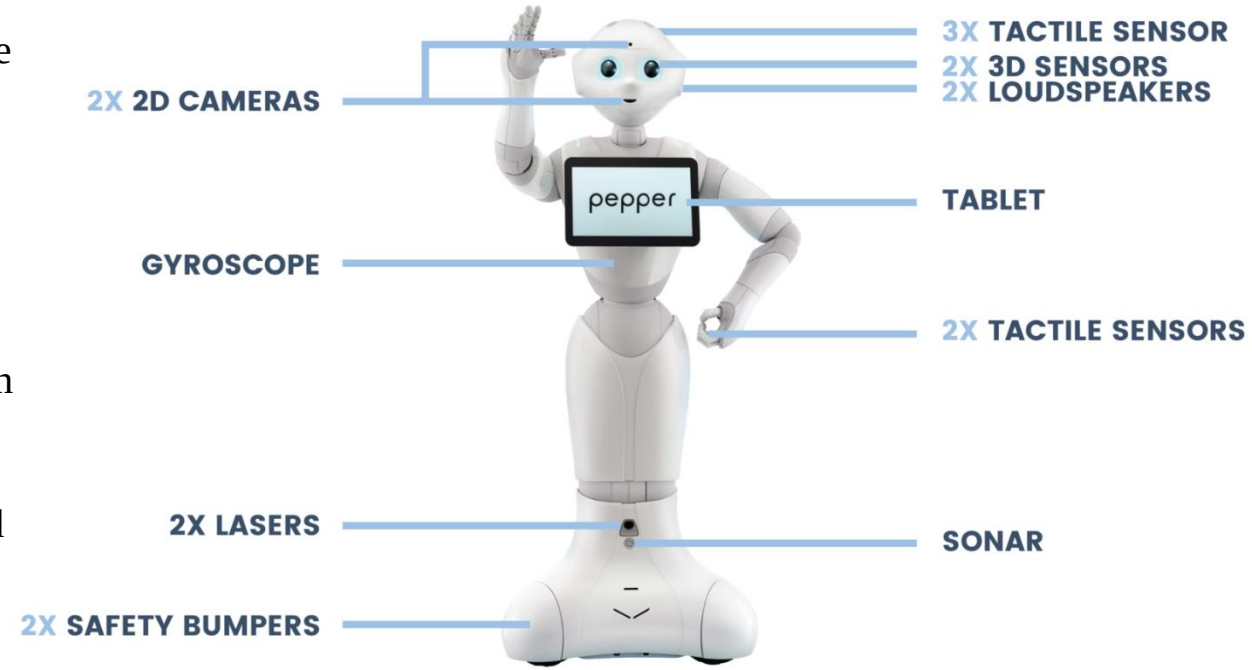
- User test with the current solution
- Supporting automation transparency to improve user control
- Integrate recommendations with a deeper understanding of the current state of the environment




*Editing an automation rule using AR Rule Editor: 1 exclamation marks indicate objects that can be interacted with; 2 after the configuration of a selected rule element, a particle effect is placed on it to show that is in use; 3 recommendations related to the inserted rule element are placed in the environment; 4 tapping on the "Lamp" icon show the complete list of recommendations; 5 the "Rule List" provides a summary of the current automation, also the "Floppy" icon indicates that the rule can be saved.*

# Pepper Robot

- Pepper is a 1.2m tall **humanoid robot**
- 17 joints for expressive body language
- 3 omnidirectional wheels
- 20 degrees of freedom for motion
- multi-modal interfaces
  - Touchscreen
  - Voice
  - Tactile head
  - Hands
  - Bumper
  - LEDs



# Human Interfaces In Information Systems Laboratory

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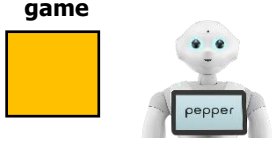
## BIOGRAPHY-BASED SERIOUS GAMES FOR COGNITIVE AND SOCIAL STIMULATION

- USER PERSONAL INFO & MEMORIES
- MEMORY
- ATTENTION
- EXECUTIVE FUNCTIONS
- SOCIAL SKILLS

AUTOMATIC ADAPTATION TO PERSONAL LEVEL

Chosen game



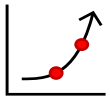

- SESSION DATA
  - Session duration
  - Abandonment rate
  - Frequency of use
- GAME DATA
  - Response time
  - Completion
  - Correct/wrong answers

GAME SESSION

EMOTIONAL INFO

COGNITIVE AND SOCIAL ASSESSMENT

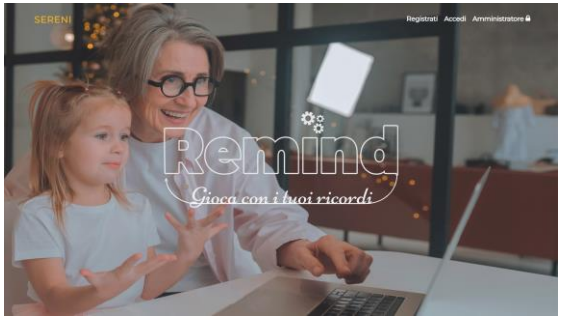
LEARNING CURVE



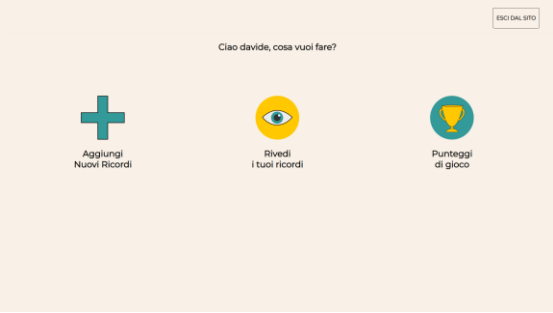
STORED USER DATA

- USER PERSONAL INFO&MEMORIES
- CHOSEN GAMES
- CHOSEN DIFFICULTY LEVELS
- SESSION DATA
- GAME DATA

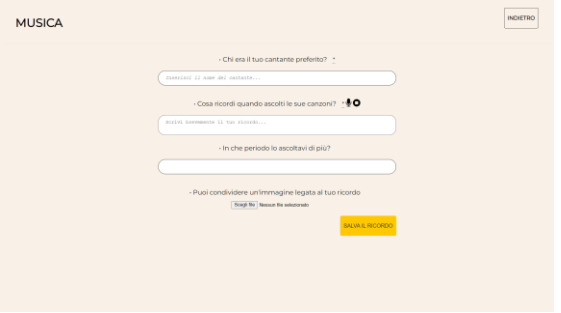
# Appweb




- Registrazione utente
- Login utente
- Aggiungi nuovi ricordi relativi all'utente loggato
- Rivedi i tuoi ricordi, visualizzazione, modifica e cancellazione dei ricordi caricati
- Punteggi di gioco, vedere le statistiche delle sessioni di gioco effettuate







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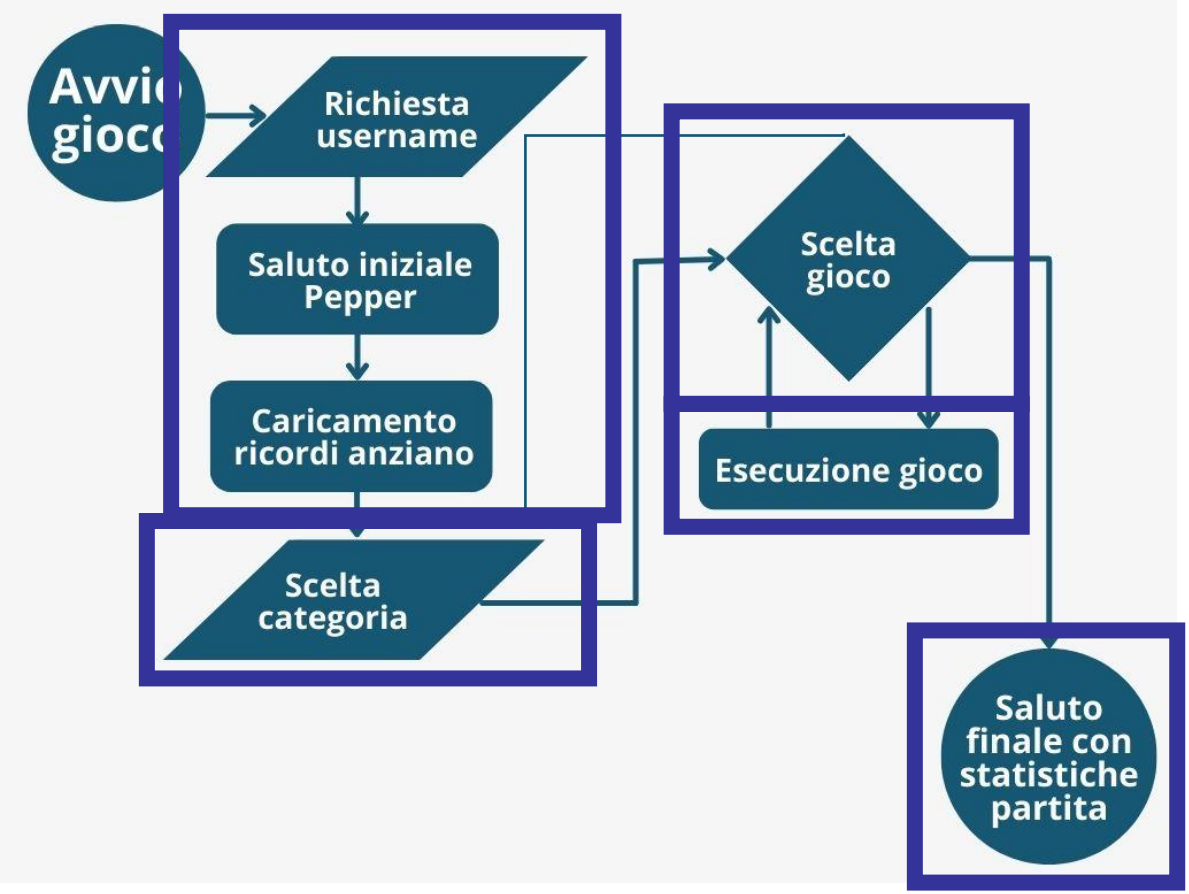


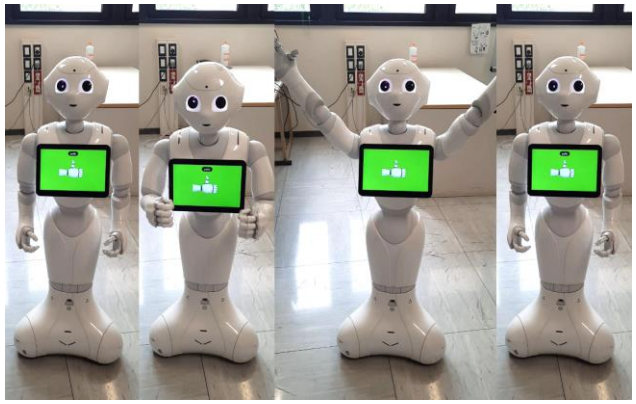

# Robot personality for older adults

## Personality

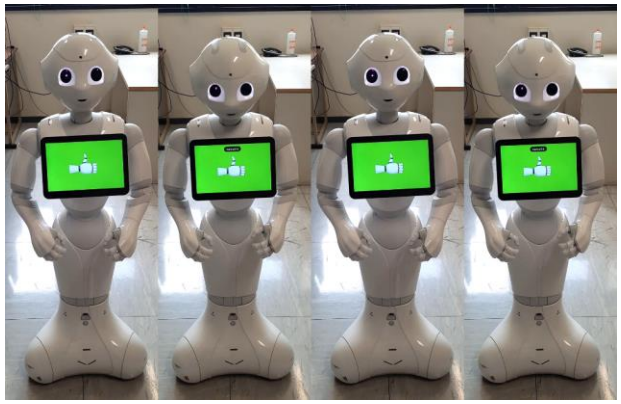
Manipulation verbal and non-verbal cues:

| Verbal | Non Verbal |
|---|---|
| *Pitch variation* | *Gesture* |
| *Volume* | *Speed Movements* |
| *Speech rate* | *Motors* |
| *Dialogue Style* | *Autonomous movements* |
| *Feedbacks* | *Motors distances* |
| *Tenses* | *Motors rotation* |
| *Sentences* | |

Extravert Animation



Introvert Animation

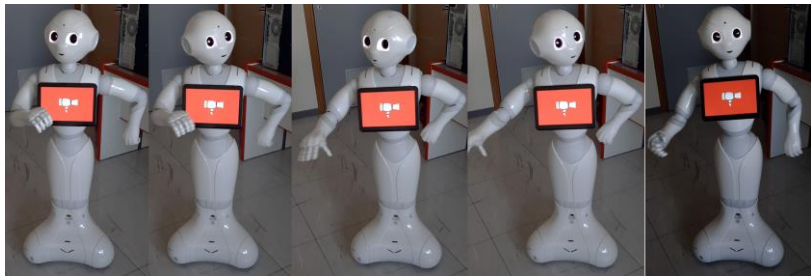


# Robot personality for older adults

## Personalities parameters in details

| | Extravert | Introvert |
|---|---|---|
| Pitch variation | 80% of maximum | 60% of maximum |
| Volume | 90% of maximum | 70% of maximum |
| Speech Rate | ~ 160wpm | ~ 140wpm |
| Dialogue style | More direct few pauses | Polite longer pauses |
| Tenses | present tenses | use past tense form |
| Sentences | shorter and direct sentences | longer and formal and hesitant sentences |
| Feedback | reinforcement and encouraging feedback | neutral feedback |
| Gesture | gesture with big angles more dynamic | gesture with smaller angles less dynamic |
| Speed movements | faster movements more dynamic | slower and longer movements less dynamic |
| Motors | omnidirectional movements, faster trajectory | backwards & forward movements slower trajectory |
| Motors distances | lateral & forward | backward |
| Motors Orientation | -15° to 20° degree rotation | 0°to 5° degree rotation |

Extravert Animation



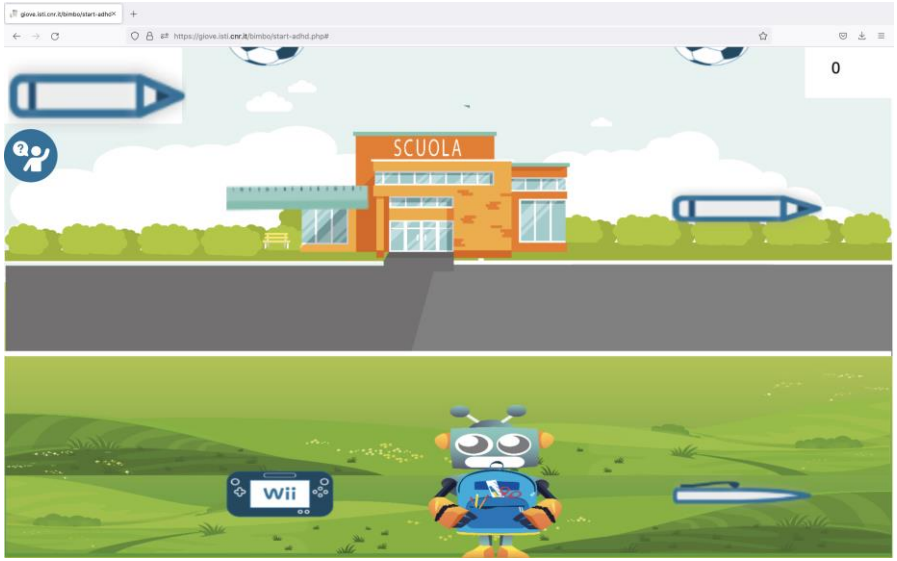
Introvert Animation

- Robot personality for older adults
  - Extravert

  - Introvert

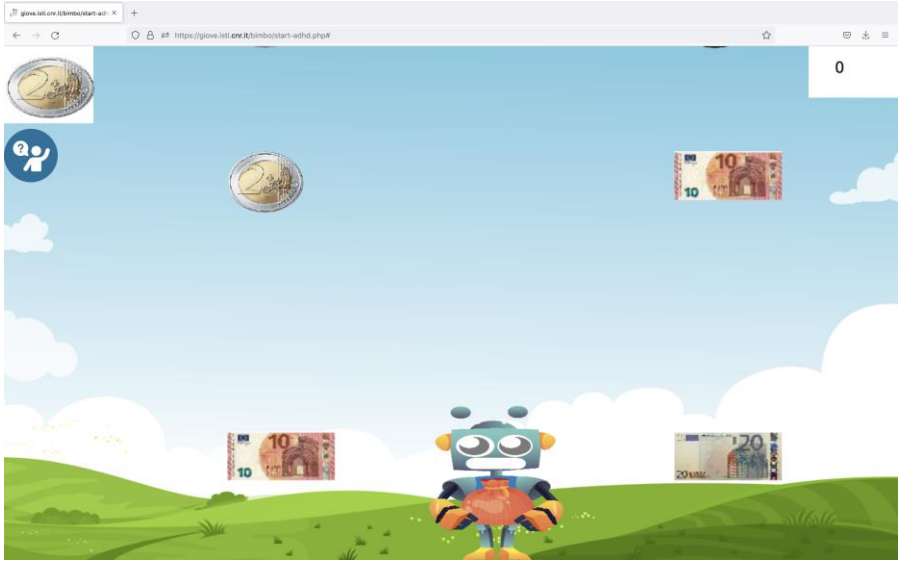
# PlayToPickUp: Serious Game for children with cognitive disorder

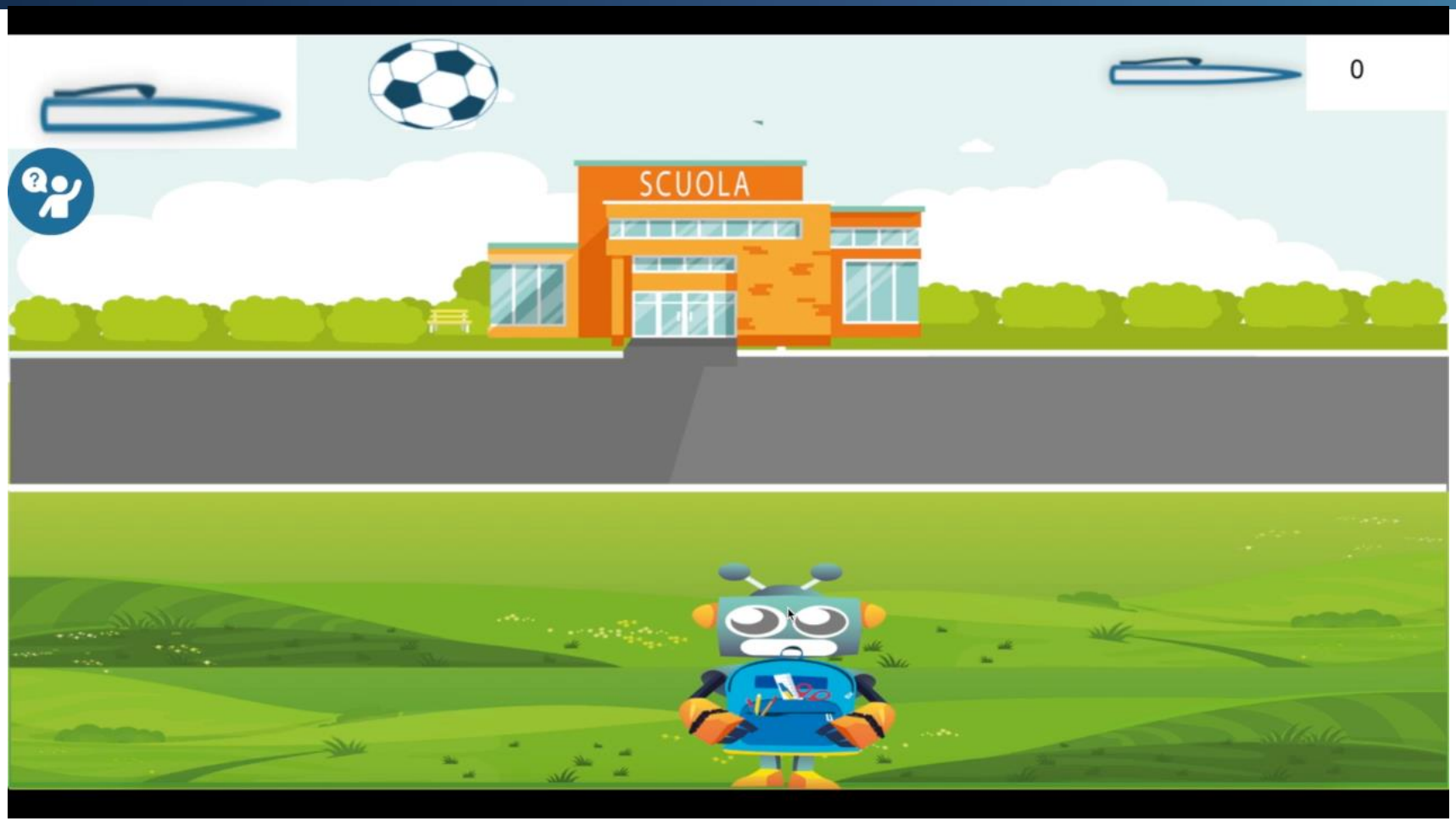
- Serious game for children 8-12 years old with adhd
- Serious game that aims to stimulate attention, planning tasks and error monitoring
- PlayToPickUp game has been designed to reproduce some scenarios that children may encounter in their daily life: preparing the backpack, recognizing money or emotion



# PlayToPickUp: Serious Game for children with cognitive disorder

- Depending on the characteristics of the child, the operator can customize the game by configuring some parameters, such as the falling speed of the elements, and the scenario
- We made two trials in collaboration with two organizations that support therapeutic activities of such kind of children in Tuscany (Italy): PAIM Social Cooperative of Pisa and ASL of Livorno.
- 48 children, aged between 8 and 12 years, participated in the study, 20 with cognitive disorder, 27 with ADHD and 1 with comorbidities ADHD and cognitive disorder.

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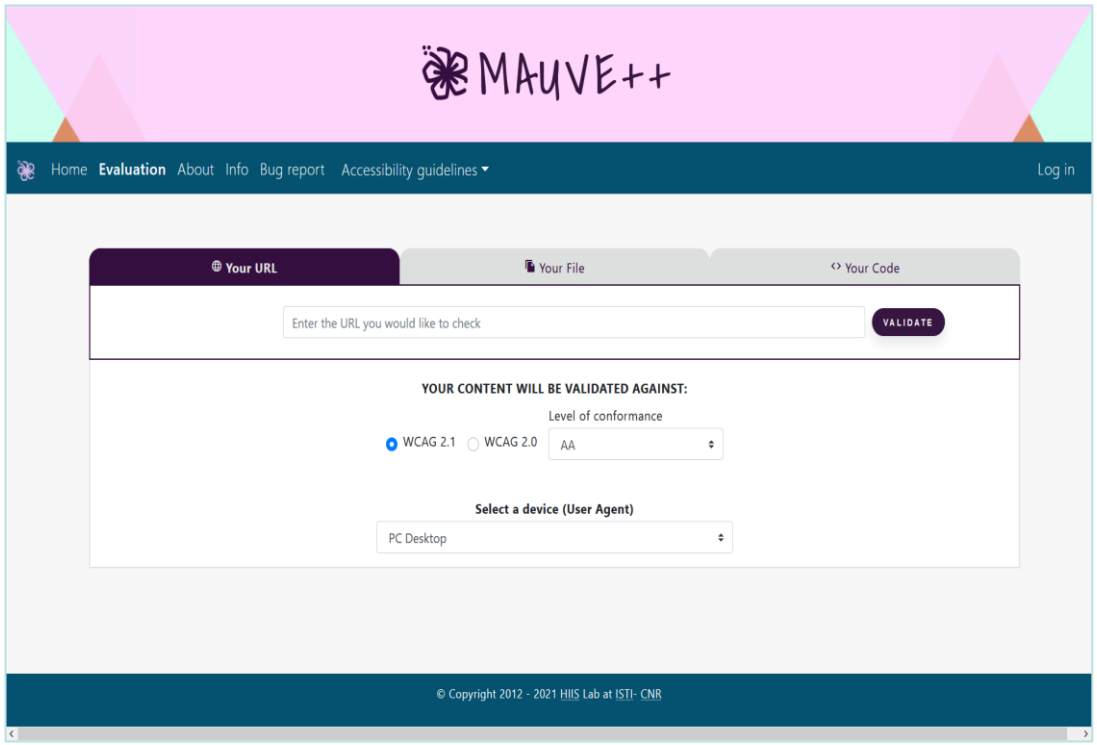
SCUOLA

# Automatic validator: MAUVE ++

https://mauve.isti.cnr.it/




- 2676 Utenti Registrati
- Progetto con Agid
- Stiamo finendo validazione di 2 milioni di pagine !

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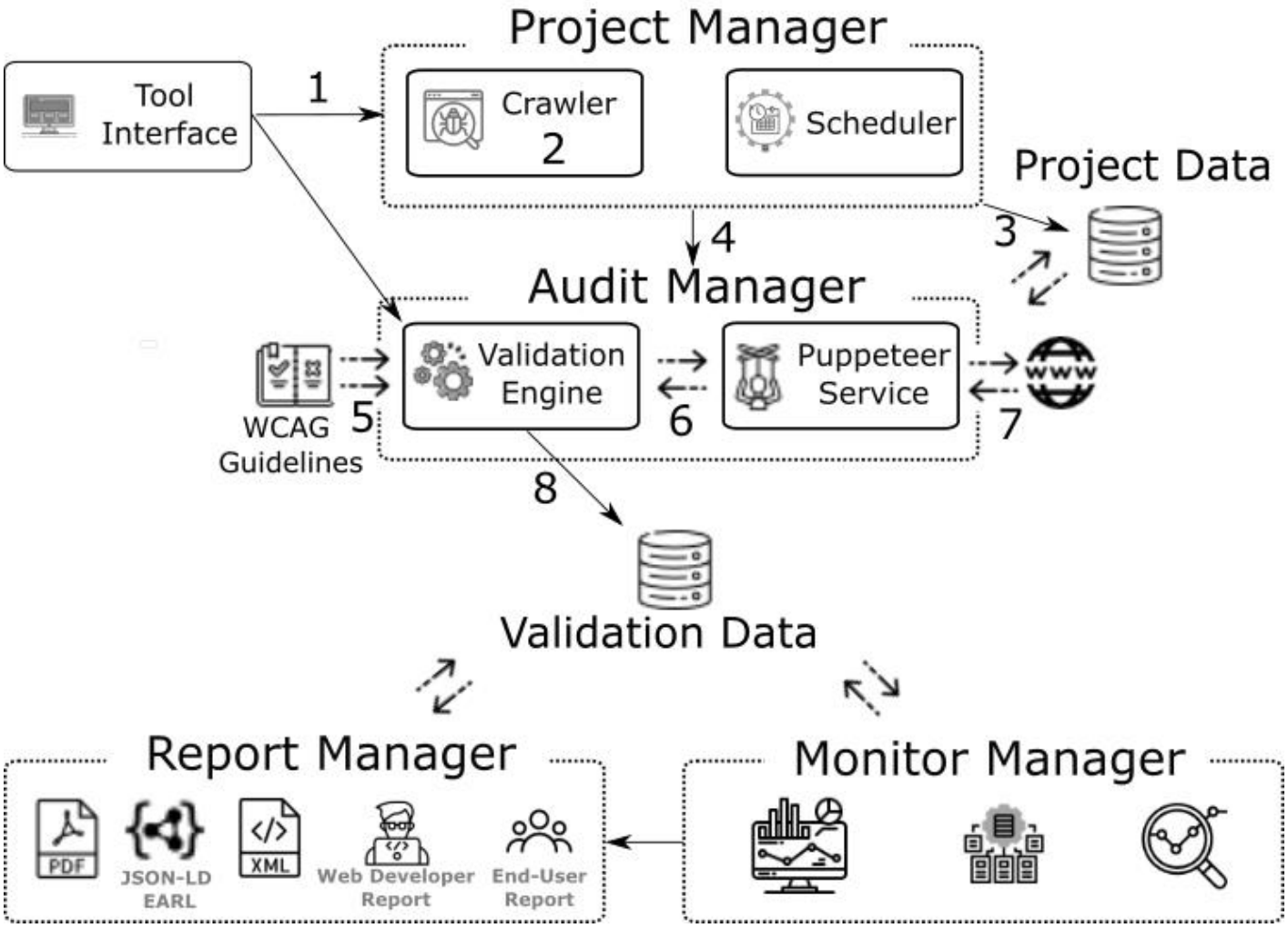

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- M Manca, V Palumbo, F Paternò, C Santoro, The Transparency of Automatic Web Accessibility Evaluation Tools: Design Criteria, State of the Art, and User Perception, ACM Transaction on Accessible Computing, ACM Press, 2022
- M Manca, F Paternò, C Santoro, End-user development in industrial contexts: the paper mill case study, Behaviour & Information Technology, Taylor&Francis, 2022, https://doi.org/10.1080/0144929X.2022.2089597
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- Manca, M., Paternò, F. & Santoro, C. Remote monitoring of end-user created automations in field trials. J Ambient Intell Human Comput (2021). https://doi.org/10.1007/s12652-021-03239-0
- A. Mattioli and F. Paternò, Recommendations for creating trigger-action rules in a block-based environment, Behaviour & Information Technology journal, 2021
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- P Fröhlich, M Baldauf, T Meneweger, M Tscheligi, B de Ruyter, F Paternó "Everyday automation experience: a research agenda", Personal and Ubiquitous Computing 24 (6), 725-734, 2020.
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- F. Paternò, M. Burnett, G. Fischer, M. Matera, B. A. Myers, A. Schmidt: Artificial Intelligence versus End-User Development: A Panel on What Are the Tradeoffs in Daily Automations? INTERACT (5) 2021: 340-343E. Zedda, M. Manca, F. Paternò: A Cooking Game for Cognitive Training of Older Adults Interacting with a Humanoid Robot. CHIRA 2021: 271-282
- Palumbo V., Paternò F., Micogito: a Serious Gamebook Based on Daily Life Scenarios to Cognitively Stimulate Older Adults, GoodIT '21: Proceedings of the Conference on Information Technology for Social Good, September 2021 Pages 163–168, ACM Press
- S. Gallo, M. Manca, A. Mattioli, F. Paternò, C. Santoro, Comparative Analysis of Composition Paradigms for Personalization Rules in IoT Settings, Limassol, Cyprus, IS-EUD 2021, Lecture Notes in Computer Science, vol 12724. Springer Verlag, pp.53-70, Springer Verlag
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