CHIIoT 2

2nd Workshop on Computer Human Interaction in IoT Applications

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CHIIoT 2: 2nd Workshop on Computer Human Interaction in IoT Applications

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ABSTRACT

The CHIIoT workshop series brings together researchers and practitioners from human-computer interaction (HCI) design, computer science, and electrical engineering working on new challenges in industry and academia. In EICS 2021, This workshop will provide a platform for participants to review and discuss challenges and opportunities in the intersection of computer-human interaction and the internet of things, focusing on human-centered applications using emerging connectivity and sensing technologies. We aim to jointly develop a design space and identify opportunities for future research.

CCS CONCEPTS

• **Human-centered computing** → **Ubiquitous and mobile computing systems and tools**; • **Hardware** → **Emerging interfaces**; **Sensor applications and deployments**.

KEYWORDS

HCI, Internet of Things (IoT), Ubiquitous Computing, User Experience

1 INTRODUCTION

Computer-Human interaction (CHI) is a *"multidisciplinary field of study focusing on the design of computer technology and, in particular,*

the interaction between humans (the users) and computers. [1] *"* The CHI community gathers designers, researchers, and practitioners to create and investigate computing technology that works for people and society. In the light of ubiquitous connectivity and data, the development of Internet-of-Things (IoT) systems reshapes the relationship between humans and computers, as they embed computing in everyday objects and integrate it into people's everyday lives. As we are taking steps towards Weiser's Ubiquitous Computing vision [13], we research the systemic challenges that such technology embodies and introduces to end-users and contexts: for example, emerging psychological needs from the users' perspective, the role of data in design and engineering interactive systems, and the technological needs from the system's perspective.

We are looking at the intersection of IoT and CHI, where IoT platforms focus on human-centered applications and CHI studies the use of IoT solutions to build interactive environments. In this context, IoT devices need to sense and actuate following dynamic human behavior. This means that IoT networks need to both understand human behaviour as it is happening and adapt to changes in behavior and the environment. Edge computing, artificial intelligence and low latency IoT are becoming the cornerstones of building next-generation systems in which local networks are able to share computational loads to detect human gestures and emotions and then promptly set the IoT devices to interact with the environment in a meaningful way (e.g., produce audio-visual stimuli to keep emotional engagement, modify actuator to aid movements automatically, and drive recommendation and other interventions).

Until now, human users are not sufficiently involved in IoT systems. Although such systems increasingly replace traditional products and add complexity to everyday life, their new capabilities and potential roles are under-investigated and perhaps not appreciated. Also, the challenges of building both efficient embedded devices with enough intelligence to interact directly with the environment and cognitive networks able to infer and react to human behavior are still quite open. Finally, we need to build a body of knowledge around the risks and ethical boundaries that result from involving emerging technologies in end-user contexts. Therefore, our topic of interest can be summarized into two main directions: 1) The user-driven Computer-Human Interaction in IoT applications
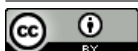
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[1]http://interaction-design.org

and 2) the system-driven IoT technologies in human-centered or human-directed applications, as shown in Table 1;

Regarding Computer-Human Interaction in IoT, we are interested in the human factors in Human-IoT systems, such as enabling the users' situational awareness by increasing the transparency of Human-IoT systems communication [3, 4] or empowering novice designers and engineers by providing them building blocks, tools and platforms to prototype novel IoT experiences [8, 9]. We are also interested in novel augmented reality user interface technologies that allow for rich and fluent Human-IoT interaction, and possibly maintenance-free user interface technologies for scalable deployment [10, 11].

Regarding IoT technologies in human-centered applications, we are interested in technological developments that enable new capabilities, such as edge computing and cognitive IoT [2]; and scalable deployment and ease of maintenance [12], such as battery-less, wireless, and self-sustained sensors [5] and platforms [6]. We are interested in the late-breaking work on remote sensing (e.g., LiDAR, mmWave, or acoustic sensors), and communication applications (e.g., LoRaWAN [7] and visible light systems [1]). We are also interested in the emerging 5G and beyond 5G studies for smart building and smart city scenarios.

Goal of the workshop. In this workshop, we will discuss the challenges and opportunities associated with emerging IoT technologies in human-centered applications. It will bring together an international and cross-disciplinary group of researchers from academia and industry to collaborate and explore the topic. We aim at building a community in which CHI and IoT researchers can exchange views and begin fruitful collaboration.

2 ORGANIZERS

The organising team combines expertise and interests from Computer-Human Interaction, Electrical Engineering and Computer Science.

Rong-Hao Liang is an Assistant Professor in Industrial Design Department and Electrical Engineering Department, Eindhoven University of Technology. He is also the co-founder of GaussToys Inc. He is interested in technical HCI research, focusing on sensing systems and rapid prototyping tools for applications in ubiquitous computing and human-computer interaction.

Alessandro Chiumento is an Assistant Professor in Computer Science in the Pervasive Systems research group at the University of Twente. His work is focused on the interaction between distributed dynamical systems and their environment, this includes the interplay between edge computing, sensing and machine learning for controlling IoT networks.

Marco Zuniga is an Associate Professor in Computer Science Department, Delft University of Technology. His research interests are broadly in the areas of the Internet of Things (IoT), visible light communication, pervasive computing, wireless networks and cyber physical systems (CPS). He is particularly interested in research problems that are amenable to both, simple mathematical analysis and system evaluation.

Przemysław Pawełczak is an Assistant Professor with the Embedded and Networked Systems Group, Delft University of Technology, The Netherlands. He received the MSc degree from the Wrocław University of Technology, Poland, in 2004 and the PhD degree from the Delft University of Technology, The Netherlands, in 2009. His research interests include wireless networking and intermittently-powered devices.

Mathias Funk is an Associate Professor in Industrial Design Department, Eindhoven University of Technology. He leads the Things Ecology lab. In addition, he is the co-founder of UXsuite GmbH, a high-tech spin-off of Eindhoven University of Technology (TU/e). He is interested in design theory and processes for systems, designing systems for musical expression, and designing with data.

Yaliang Chuang is an Assistant Professor in Industrial Design Department, Eindhoven University of Technology. His research focuses on exploring the applications and user experience of connected products or systems, such as Smart Home, utilizing LED light patterns and sounds for expressing easy-to-understand semantic meanings to facilitate natural and seamless interactions.

Joep Frens is an Assistant Professor in Industrial Design Department, Eindhoven University of Technology. He leads the Connecting Rich Interaction in Growing Systems (CRIGS) squad in TU Eindhoven. Frens is interested in the research question 'How can we design for rich interaction in growing systems?', which he explores in a hands-on, making approach together with his students.

3 TECHNICAL PROGRAM COMMITTEE

The technical program committee, formed by 8-10 members, also combines expertise and interests from Design / Computer-Human Interaction, Electrical Engineering and Computer Science.

4 EXPECTED SUBMISSIONS

We expect 10-12 submissions and will accept 6-8 (50%-66%) of them for oral presentation based on the quality of their position paper and on the basis of background and perspective. The rest of submissions will be invited to be presented as posters if relevant.

5 WORKSHOP FORMAT

The workshop will either be half-day workshop, which will be split into 3 sessions:

Session 1: Opening and CHIIoT 2 Best Paper Award. In the first session, we kick off the workshop with an introductory round and an overview of the grand challenges and opportunities in HCI and IoT researches. Then, the best paper award will give a 20 minute presentation including Q&As. Then, we put a coffee break with poster presentation stimulate networking and discussion.

- Introduction (10 minutes).
- Invited Keynote (20 minutes): 10-15 min presentation + 5-10 min Q&A / paper.
- Coffee break / Posters (10 minutes).

Session 2: Emerging IoT Technologies for Human-Centered Applications. In the second session, we arrange 3 paper presentations on the topics of emerging IoT technologies and systems for human-centered applications. Each presenter gives a 15 minute presentation including Q&As. Then, we put a coffee break with poster presentation stimulate networking and discussion.

- Paper presentations. 15 min (presentation + Q&A) / paper.

Table 1: Example Topics of interest.

Computer-Human Interaction in IoT Applications	IoT Technologies in Human-Centered Applications
Emotion recognition and affective computing in IoT	Edge computing for IoT and Cognitive IoT
Tools and platforms for prototyping Human-IoT experiences	Battery-less, wireless, self-sustained sensors and platforms
Embedded AI for CHI-IoT applications	Sensing and monitoring applications with LP-WAN technologies
Human-IoT Systems communication	Visible light systems for sensing and communication
Novel user interfaces for Human-IoT interaction	Remote sensing solutions based on LiDAR, mmWave, or acoustic sensors
Human Factors in Human-IoT systems	5G and Beyond-5G studies for indoor and city scenarios

Session 3: Posters. In the second session, we arrange 3-5 poster presentations on the topics of emerging IoT technologies and systems for human-centered applications. Each presenter gives a 3 minute pitch. Then, we put a coffee break with poster presentation stimulate networking and discussion.

- Paper presentations. 3 min (presentation + Q&A) / poster.
- Coffee break / Interactive Posters (20-30 minutes).

Session 4: Computer-Human Interaction in IoT Systems. In the third session, we arrange 3 paper presentations on the topics of CHI related research in IoT systems. Each presenter gives a 15-20 minute presentation and Q&As. Each presenter gives a 15 minute presentation including Q&As. Then, we put a coffee break with poster presentation stimulate networking and discussion.

- Paper presentations. 15 min (presentation + Q&A) / paper.
- Coffee break / Posters (20-30 minutes).

Session 5: Closing and CHIIoT 2 Best Talk Award. Then, we conclude the workshop and announce the CHIIoT 2 Best Talk Award. We will also announce an agenda for further events.

- Concluding remarks (10 minutes).

6 PUBLICITY PLAN

We will distribute a call for position papers in HCI (Human-computer interaction), computer science, electrical engineering communities. We will announce the Call for Participation in mailing lists and calendars and social media (e.g., IEEE Collaboratec, Linkedin, Twitter, Facebook). The calls and other details will be posted on the workshop website and publicised via the organizers' international network. Furthermore, we will directly contact researchers who are likely to be interested in the workshop and write to relevant institutions and companies. We will be promoting the workshop and getting in touch with potential participants during the period leading up to the position paper deadline. We have already made a list of 20 potential collaborators and attendees from industry and academia.

7 EQUIPMENT REQUIREMENT

CHIIoT 2 will be an on-line workshop.

- Presentation: Zoom Webinar
- Coffee break and Interactions: Discord Server

8 A DRAFT VERSION OF THE CALL FOR PAPERS

We invite position papers for the 2nd Workshop on Computer Human Interaction in IoT Applications (CHIIoT 2). This half-day workshop will offer a cross-disciplinary forum of discussion and knowledge exchange for researchers in the both fields. This workshop looking at the intersection of IoT and CHI, where IoT platforms focusing on human-centered applications and CHI studies using IoT solutions to build interactive environments.

Topics of interest include but are not limited to:

- Emotion recognition and affective computing in IoT
- Edge computing for IoT and Cognitive IoT
- Tools and platforms for prototyping Human-IoT experiences
- Battery-less, wireless, self-sustained sensors and platforms
- Embedded AI for CHI-IoT applications
- Sensing and monitoring applications with LP-WAN technologies
- Human-IoT systems communication
- Visible light systems for sensing and communication
- Novel user interface technology for Human-IoT interaction
- Remote sensing solutions based on LiDAR, mmWave, or acoustic sensors
- Human Factors in Human-IoT systems
- 5G and Beyond-5G studies for indoor and city scenarios

Researchers from both Computer-Human Interaction and IoT Systems are invited to submit a 2-6 pages position paper using the ACM Two-column SIGCHI Master template. This position paper should address one or more of the workshop's topics of interest or suggest another (we encourage visionary and provocative ideas). All submissions will be reviewed by the technical program committee. Paper accompanying demos are encouraged, and will be allocated time in the workshop agenda. Participants will be selected on the basis of the quality of their position paper and on the basis of background and perspective.

At least one author of each accepted paper must register for the workshop and for one day of the conference itself. Participants will be invited to present a position statement at the workshop and will actively engage in a discourse on the meaningful design space for researching computer-human interaction and human-centered applications in Internet of Things.

Important Dates:

- Abstract deadlines for position papers: May 5, 2021
- Submission deadline for position papers: May 12, 2021.
- Notification of acceptance: May 19, 2021.

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