Welcome to the Fifth International Workshop on Crowd-Based Requirements Engineering (CrowdRE'21)

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Abstract—**Welcome to the 5th International Workshop on Crowd-Based Requirements Engineering (CrowdRE'21), where scientists and representatives of industry meet to exchange ideas, experiences, and other contributions regarding the state of the art of Crowd-Based Requirements Engineering (CrowdRE). The discipline of CrowdRE seeks to address the challenges of traditional requirements engineering (RE) in scaling up to settings with thousands to millions of users of (software) products or (software-driven) services, who form a large and heterogeneous group that can be denoted as a 'crowd' [1],[3]. The user feedback generated by the crowd, such as texts or usage data, can be a valuable source of requirements, problems, wishes, and needs. Responding quickly, effectively, and iteratively to this feedback can greatly increase a product's success. CrowdRE comprises any approach that provides RE with suitable means for this crowd paradigm, especially by involving the crowd and by collecting, harmonizing, analyzing, and interpreting their user feedback.**

Index Terms—**Crowd-based requirements engineering, crowdsourcing, digital transformation, requirements engineering**

I. Contribution of CrowdRE'21

The CrowdRE workshop series has had a profound impact on the domain of RE. A year prior, the workshop had ventured out beyond its comfort zone and into new territories, exploring the role of CrowdRE in innovative settings including software ecosystems, smart homes, and smart cities. The increased emphasis on experience reports and case studies of practical applications of CrowdRE in research and business settings is a testament to the domain maturing, and the workshop operating at the forefront of science and practice. Before that, CrowdRE'19 saw a revised definition of CrowdRE by Glinz ([1]) that emphasized the need to identify concepts for bringing CrowdRE "into practice" with the right placement within the software product lifecycle. Particularly for this reason, this workshop was designed to emphasize on the following two main topics:

1. CrowdRE in the era of the COVID-19 pandemic. The pandemic has drastically changed our society. CrowdRE is a strong enabler for distributing RE activities, and for assuring that RE can still be performed successfully. We consequently solicited for works on approaches and technologies for applying CrowdRE remotely, or for raising the relevance to RE in the pandemic and the effect it has had on stakeholders.

2. Bridging the gap between CrowdRE and development. RE serves the purpose of preparing requirements that form the basis of subsequent stages in software engineering, including architecture, User Experience, software development, and testing. So far, there are few demonstrations of how CrowdRE analyses are adapted to support the (agile) development process. This is why we especially invited authors to present case studies that outline plans for or discuss lessons learned from involving CrowdRE in an organizational/development setting, or that describe the process of translating CrowdRE results into suitable RE and development artifacts.

CrowdRE'21 consequently brings experts, researchers, and practitioners with an interest in this topic together, and provides them with a platform to exchange ideas and contribute to CrowdRE. This time, it has a much more applied character than in previous years, when the CrowdRE among other things served to strengthen the relationship between CrowdRE and AI (CrowdRE@AIRE'18), establish a roadmap and shared resources for CrowdRE (CrowdRE'17), and unify the vision in the early days of this domain (CrowdRE'15 [2]). We hope it will inspire associated experts, researchers, and practitioners to move forward together through collaborations.

II. Goals of CrowdRE'21

The CrowdRE workshop seeks to reconsider the very foundations of RE for those contexts in which traditional forms of RE have been found to be ineffective, doing so by:

- Identifying and discussing the implications of Glinz' revised definition of CrowdRE [1], including opportunities for solutions to perform RE in settings with large groups of stakeholders, approaches for identifying unknown pitfalls, and ways of addressing known pitfalls.
- Obtaining a shared understanding of the status quo on CrowdRE, along with its benefits and limitations. Limitations may stem from the stakeholders' relative anonymity, threats to validity (e.g., a selection effect), the absence of direct interpersonal contact, and the increased difficulty to reconcile conflicting requirements with larger numbers of stakeholders.
- Understanding which practitioners and researchers are associated with which of the various streams within CrowdRE in order to stimulate collaborations.

- Defining the means to making CrowdRE increasingly suitable for industry settings, along with ways of evaluating the implementation of CrowdRE techniques in those applied settings.
- Growing the body of knowledge related to CrowdRE, exchanging ideas, and identifying open challenges and future avenues for research relevant for both academia and industry in order to focus and spawn research topics.

III. PROGRAM OF CROWDRE'21

To encourage a lively discussion on the current state of CrowdRE research, in addition to papers presenting technical solutions and experience reports (4–7 pages + 1 page for references), we also solicited shorter papers posing a problem statement or vision statement (2–3 pages) and for the first time, conference-first extended abstracts (1 page) of recent conference contributions that fit CrowdRE's themes and can benefit from increased diffusion within the community. Each paper was reviewed by four Program Committee members noted for their contributions to the field of RE, resulting in nine of 12 received submissions being accepted for presentation at the workshop.

In his keynote "On the Value of CrowdRE in Research and Practice", Dr. Fabiano Dalpiaz explores how the research value of CrowdRE can be translated into industry settings.

We then offer three paper sessions, each showcasing three works that explore CrowdRE in three exciting directions:

- Experiments on alternative user feedback sources such as product sub-forums, vision videos, and comments to YouTube videos;
- Case studies on bridging the gap between crowds, developers, and cultures;
- Solutions designing monitoring and feedback channels to improve the crowd's experience.

We conclude the workshop with a hands-on interactive session. We wish you a good time at the virtual CrowdRE'21 workshop!

IV. THE THEMES OF RE'21 AND CROWDRE'21

CrowdRE'21 is collocated with the 29th IEEE International Requirements Engineering Conference (RE'21), and is aligned with all its five research themes. The crowd is an important driver to "discover stakeholders' needs" (theme 1), and the analysis of user feedback is often performed at the intersection of "AI + RE" (theme 5). CrowdRE is a clear example of the use of an approach to make RE more suitable for "smart and connected" (theme 3) settings. Finally, the workshop's main topics described in Sec. I specifically addresses "societal challenges" (theme 2) and "Agile, DevOps, and Hybrid" (theme 4).

V. CROWDRE ORGANIZATION

A. Organizing Committee

- Muneera Bano, Deakin University (Australia)
- Eduard C. Groen, Fraunhofer IESE (Germany)
- Irit Hadar, University of Haifa (Israel)

- Norbert Seyff, FHNW University of Applied Sciences and Arts Northwestern Switzerland (Switzerland)

B. Program Committee

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- Raian Ali, Hamad Bin Khalifa University (Qatar)
- Chetan Arora, Deakin University (Australia)
- Travis D. Breaux, Carnegie Mellon University (USA)
- Sjaak Brinkkemper, Utrecht University (Netherlands)
- Fabiano Dalpiaz, Utrecht University (Netherlands)
- Farnaz Fotrousi, University of Hamburg (Germany)
- Davide Fucci, Blekinge Institute of Technology (Sweden)
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- Zhi Jin, Peking University (China)
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- Marc Oriol, Universitat Politècnica Catalunya (Spain)
- Kurt Schneider, Leibniz Universität Hannover (Germany)
- Zahra Shakeri, Calgary University (Canada)
- James Tizard, The University of Auckland (New Zealand)
- Chong Wang, Wuhan University (China)

VI. CONCLUSION

CrowdRE is a topic that is both highly relevant and strongly on the move. While on the one hand its scope broadens, on the other hand its application scenarios become more concrete. We look forward to an exciting workshop in which we hope to welcome you as well! We would like to express our gratitude to the members of the Program Committee for promoting the workshop and providing very constructive feedback to the submissions, and to Miroslav Tushev for his outstanding work managing our website and social media. We also thank the authors for their excellent contributions, and you, the audience, for letting yourself be inspired by this workshop and/or these proceedings! Best wishes from Muneera, Eddy, Irit, and Norbert.

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CrowdRE'21 Committees

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