
Workshop on Personal and Pervasive Fabrication (PerFab 2013)

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Abstract

Recently, technologies for fabricating real-world objects and products that can be designed and built directly by the end-user have decreased in costs and are increasingly common. These technologies are expected to have a great impact on society and the personal fabrication concept has been described as the “new or third industrial revolution”. However, there is a great need to explore many novel research challenges and issues before the idea of personal fabrication becomes truly pervasive and applicable to the wider public.

PerFab is a workshop for providing a forum to bring together researchers from various disciplines working in this area. We intend to identify, explore and contribute to the research challenges that will allow personal fabrication to be pervasive. We will invite paper submissions to our workshop, review the submissions with a peer review process, and include the accepted papers in the ACM Digital Library. The long-term goal is to gather a community of researchers and establish this workshop as a leading forum for research dissemination in the area.

Author Keywords

Personal Fabrication; Geometric Modeling; User Interfaces; User-generated Design; Rapid Prototyping; Customization

ACM Classification Keywords

H.5 [Information Interfaces and Presentation (HCI)];
I.3 [Computer Graphics]; J.6 [Computer-Aided
Engineering]

Topic of Workshop

The focus of the workshop is on personal fabrication and the challenges that need to be overcome to make it pervasive. Personal fabrication is in contrast to mass production. Instead of buying pre-designed and pre-built products (as in mass production), individuals are empowered with the ability to design, customize, and fabricate personalized products by themselves and in their own home. This personal fabrication concept [1,2] has been described as the “new or third industrial revolution” [3,4]. It can transform multiple industries and lead to major paradigm shifts in the way products are designed, manufactured, stored, transported, and consumed.

Rapid prototyping technologies such as 3D printers and laser cutters are becoming more common and accessible. Their costs have been gradually decreasing such that a *MakerBot* 3D printer, for example, is affordable to the average consumer for use at home. However, for the concept of personal fabrication to be fully realized and be truly pervasive in reaching and impacting the life of a layperson, many research topics and issues need to be explored.

Research from various disciplines are applicable to our workshop, including (but not limited to): graphics and visualization, geometry modeling, human-computer interaction, user interfaces, computational design, fabrication, and rapid prototyping.

A more specific list of topics of interest includes, but are not limited to:

- user interfaces for designing fabricatable objects
- geometric modeling tools for fabrication
- fabrication-aware analysis of 3D models
- computational design of objects that takes fabrication constraints into account
- rapid prototyping technologies that are novel and low-cost
- application of personal fabrication for specific domains (e.g. designing and/or building furniture, jewelry)
- new materials for fabrication
- crowd sourcing for designing fabricatable objects
- representation and visualization of physically realizable objects
- simulation of physically realizable objects

Rationale of Workshop

Fabricating real-world objects with prototyping technologies such as 3D printers and laser cutters has recently attracted the attention of researchers from various academic communities. In addition, the concept of personal fabrication is expected to have a significant societal impact in the near future. We discuss both the academic and societal impacts of potential research work in fabrication, and thereby the need to organize this workshop to bring together researchers and consolidate work done in this area.

We also discuss the relevance of our topic to the UbiComp conference.

Academic Impact

There have recently been many strong and interesting publications related to fabrication in various research communities. Such publications have appeared in the computer graphics community [5-10], human-computer interaction community [11-14], tangible user interfaces community [15-17], and computational design community [18-20]. These publications are only a subset of examples, and it is evident that more work is currently being performed and will continue to appear in these communities in the near future. While the work in these different research communities may sometimes overlap, the researchers in these fields may not be aware of each other's work. Hence there is a need to consolidate these research areas and bring together researchers in different communities with our proposed workshop.

Societal Impact

The development of personal fabrication as a field will have an impact on multiple industries and the wider public. The 3D/CAD (computer-aided design) modeling software industries will benefit, for example, if more user interfaces and modeling tools that a non-technical person can use are available. The rapid prototyping and fabrication industries can benefit with a better understanding of the end-user's needs and preferences in the use of fabrication technologies. As the design and manufacturing of products can become fundamentally different, the transport and energy sectors will be affected. The ultimate beneficiary is the wider public. Personalized products are customized to fit with each individual, and the utility and enjoyment

from using such products are higher. The goal of our workshop from the societal point of view is to apply fabrication technologies and tools to everyday real-world scenarios, and bring such technologies from research labs/offices into people's homes.

Soliciting Research Contributions

Based on these academic and societal impacts, we will organize this workshop to provide a forum for sharing research in this area. We solicit original research contributions for inclusion in the ACM Digital Library and the supplemental proceedings of the conference. We have a peer-review process for the submitted papers by a committee of international experts. The workshop itself is open to all who wish to attend, and there is no limit in the workshop attendance.

Relevance of Workshop Topic to UbiComp Conference

Prototyping technologies such as 3D printers and laser cutters are gradually decreasing in prices and are increasingly common in research labs/offices. However, they are still not commonly used in people's homes. This may be because such technologies are difficult to use, in particular for those with no computing or technical background. Potential users may not know what products to design and fabricate, and how to design them. An underlying theme of the list of topics in the first section is to allow such technologies to become common and ubiquitous to an end-user's daily life. In this sense, our workshop topic is relevant to and will enrich the UbiComp conference.

Objectives of Workshop

The objectives of our proposed workshop are:

- to bring together researchers from various disciplines who work in and/or are interested in the personal fabrication area
- to consolidate research among separate disciplines and provide one forum for research dissemination
- to identify major research challenges in personal fabrication and in allowing it to be pervasive
- to generate useful results and discussions to move the field forward
- to establish a community of researchers, and potential links for future collaborations

Organizers' Background

Manfred Lau is an Assistant Professor (Lecturer in UK) in the School of Computing and Communications at Lancaster University, United Kingdom. His research interests include computer graphics, sketch-based modeling, and tangible user interfaces. Manfred received his PhD degree in Computer Science from Carnegie Mellon University.

Christian Weichel is a PhD student at the School of Computing and Communications at Lancaster University UK, under the supervision of Hans Gellersen. His research interests lie at the intersection of personal fabrication and human computer interaction, particularly tangible user interfaces and computational design. Christian received his Bachelor of Science from Hochschule Furtwangen University, Germany.

Nicolas Villar is a researcher at Microsoft Research, based in Cambridge, UK. His involvement in the area

of personal fabrication includes the development of .NET Gadgeteer – a toolkit that combines modular hardware, object-oriented software and CAD modeling to enable the rapid development of embedded devices. More generally, his research interests include tangible and embedded interaction, and the use of embedded and sensing technologies to enable novel interactive experiences. He is on the steering committee of the ACM TEI series of conferences.

Detailed Plan

Submissions

The submissions can either be short papers with a maximum length of four pages or full papers with a maximum length of eight pages. We encourage submissions of research papers, work-in-progress papers with interesting preliminary results that can lead to more future work, and position papers. All submissions should be in the SIGCHI archival format (double column, PDF).

All submitted papers are reviewed by at least two members of the program committee. If authors would like to cite their previous research in their submissions, they should do so by referring to themselves in the third person. Submissions should not contain any proprietary or confidential information at the time of publication. Submitted papers cannot be previously published or be under simultaneous review for other conferences, journals, or workshops.

Accepted papers are published in the ACM Digital Library and the UbiComp 2013 conference supplemental proceedings, if at least one of the authors registers for the conference and attends the workshop to present the paper.

Pre-Workshop Approximate Timeline:

- April 19: Distribution of Call for Papers, publicize workshop with CFP via UbiComp website and email, and encourage potential participants to submit papers
- June 1: Paper submission deadline
- June 19: Notification of accepted papers
- June 30: Camera-ready version of workshop papers due

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- September 9: Day of workshop

Post-Workshop Follow Up

- Thank participants for attending workshop through mailing list (established during workshop), and keep them aware of mailing list which will continue to exist after workshop
- Add list of workshop attendees to website
- Add presentations and slides to website, and add links to papers in ACM Digital Library

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