Collaboratec project

Needs, problems, challenges & opportunities: **Target industry report**

The Collaboratec project builds a collaboration model through which CIVIT research infrastructure and the know-how of new immersive technologies can be used effectively for companies' development needs.

This target industry report presents the needs, problems, challenges and opportunities of two company sectors: the creative digital industry and the work machine industry. Experts from these industries were interviewed to understand their views of the state of visual technologies. The aim is to utilize the key findings of this report in facilitating future industry-academia collaboration.

Created by the Collaboratec project team
www.tuni.fi/en/research/collaboratec

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Introduction

Collaboratec (Collaboration model for using immersive visual technologies in work machine and creative digital industries) is a project led by the Centre for Immersive Visual Technologies (CIVIT). CIVIT is a research infrastructure at Tampere University, providing research facilities and expertise in the sectors of visual content creation and representation of visual data, advanced displays, and immersive user experience. CIVIT is one of Tampere University's co-creation platforms, which means that it offers services and collaboration opportunities for companies, researchers, students and other organizations.

The specific objective of the Collaboratec project is to build a collaboration model through which the CIVIT research infrastructure and know-how of new immersive technologies can be used effectively as part of companies' development needs. This model reduces the gap between the academia and industry, allowing companies to experiment with CIVIT's unique equipment and novel research results.

To assist in the development of the collaboration model, this industry report presents an overview of the companies' technological landscape, focusing specifically on the opportunities, challenges, problems and needs related to immersive visual technologies. Additionally, the report addresses the roles of virtual reality (VR) and augmented reality (AR), along with insights into experiences of collaborating with CIVIT.

The project was funded by the European Regional Development Fund (ERDF).

Target industries

Two target groups were chosen for this project: the work machine industry and the creative digital industry. These industries were selected because they currently face technology and solution-related needs and challenges that align with what CIVIT offers. Both sectors already use visual technologies in their operations and stand to gain from further technological advancements in the near future. Additionally, it's worth noting that these industries are particularly strong in the Pirkanmaa area, and CIVIT has already established successful cooperation with them in the past.

The work machine industry aims to improve operation in safety-critical environments, where the work machine operator needs to be provided with information about the tasks and objectives. The operator of a forestry machine or crane can be relocated from potentially risky and physically demanding working conditions to ergonomic indoor control stations, which can either be situated near the worksite or at a remote geographical location. For these use cases, it is essential to build an easy-to-use and intuitive control interface that provides clear visual feedback from the work area and environment. Multi-level and multi-dimensional displays can seamlessly show several visual angles to the workpiece, supporting a wide field of view of the working environment. Further, depth perception enables precise and fast control. CIVIT has experience of developing such flexible platforms to experiment with complex maneuvers enabled by solutions for advanced data sensing, transmission and visualization.

The creative digital industries are finding it increasingly important to transform the methods of recording and delivering artistic performances to audiences. As the metaverse and web marketing advance, the demand for digitizing products and offering online viewing has become important to these industries. Through the full-size volumetric and motion capture studios, different cameras, and new forms of displays, CIVIT can support the development of creative applications.

Interviews

Interviews were chosen as the primary method of data collection because the aim was to understand the holistic view of the industry representatives. The interviews followed a semi-structured thematic approach, which allowed for flexibility in the order of questions while maintaining predefined themes and questions for guidance during the interview sessions. Additional follow-up questions were used during the interviews to clarify responses or ask for further details.

Participants for the interview were chosen by their industry, region, company, and role. The focus was on contacts who had been working with CIVIT before or were in some way aware of the operations of CIVIT. A total of 17 company and industry representatives were contacted through email. The interviews were implemented in Teams.

Each interview was based on a set of questions (please see Appendix A details) that was divided into two main parts: industry-related and CIVIT-related questions. In the first part, the aim was to understand the perceived role of visual technologies and especially VR and AR in the in companies' activities. This part also explored the challenges specific to the respondents' industries to identify possible challenges that could be addressed through visual technologies and collaboration.

In the second part, the respondents were asked to share their perceptions of CIVIT and its key technologies, role and contributions. Other topics covered in this part were challenges in company collaboration and potential benefits and drawbacks of collaborating with CIVIT.

The average length of a single session was approximately 40 minutes. The interviews were recorded and transcribed into text format. The participants were asked for permission to record the interviews.

Results

In total five interviews were conducted. In addition to two interviews with work machine industry and two with creative digital industry experts, one interview was conducted with a representative of the economic development agency of the Pirkanmaa region.

In the following sections the findings related to the specific industries are presented first. This is followed by an overview of common R&D needs, opportunities, challenges and problems.

Work machine industry

Needs and opportunities

Both interviewees stressed the importance of practical uses for VR/AR technologies. The companies were interested in leveraging these technologies, for example, for training, demoing, maintenance, and remote operation of machinery.

The work machine industry often requires advanced imaging techniques, such as 3D reconstruction and camera arrays, to enhance monitoring, analysis, and maintenance processes. Effective utilization of data is a priority for improving operational efficiency and decision-making.

Collaboration with research institutions and infrastructure units like CIVIT offers opportunities to access novel technologies, specialized knowledge, and skilled personnel for joint research and innovation. Short-term pilots or proof of concept (PoC) projects in collaboration with

CIVIT would allow companies to test new technologies without major financial risks. Also creating customized datasets using available resources can enable companies to fine-tune algorithms and models specific to their industry needs.

Challenges and problems

High costs and limited availability of VR/AR hardware pose challenges for adoption, especially for smaller companies. Especially ergonomic concerns, such as discomfort and weight, affect usability in industrial settings. Also, the lack of software expertise hinders the development and implementation of advanced technologies. These factors lead to challenges in aligning company needs with available technologies due to diverse operational requirements across different sectors within the work machine industry.

In terms of collaboration, companies and research institutions may have differing objectives. Academia seeks to share research findings publicly, whereas companies prioritize gaining a competitive edge, maintaining confidentiality and keeping certain findings proprietary. This was seen as a potential source of conflicts. Both interviews highlighted the importance of having sufficient resources, both in terms of funding and personnel, for successful collaboration between industry and academia.

Collaboration with CIVIT

The work machine industry can gain advantages from incorporating advanced imaging techniques, VR/AR applications and data-driven approaches. Collaboration provides opportunities for addressing challenges and leveraging the potential of these technologies. To maximize the benefits of collaboration, companies and research centers should work towards aligning their goals and addressing challenges related to hardware, software expertise, and data utilization. The development of tailored solutions, PoCs, and customized datasets can drive innovation, enhance operational efficiency, and contribute to the growth of the work machine industry.

Creative digital industry

Needs and opportunities

Both respondents recognized the growing importance of VR/AR technologies in their business development. VR/AR technologies were seen as a vital tool for enhancing customer experiences, storytelling, and visual effects. However, there are challenges related to the unfamiliarity of these technologies among the general public and the ongoing development of more accessible and compelling VR/AR solutions.

Both interviews emphasized the need for advancements in technology development in VR/AR technologies. Participants mentioned the lack of existing technology and the necessity for the evolution of hardware, such as VR glasses. One participant also highlighted the challenge of effectively utilizing visual technologies in content utilization for longer projects, such as TV programs and movies. Opportunities lie in exploring how to integrate these technologies into larger productions and finding the "killer app" that resonates with audiences.

Cross-disciplinary collaboration between creative industries and technology experts, as exemplified by CIVIT, could offer opportunities for innovative solutions and bridge the gap between technological capabilities and creative content.

Challenges and problems

According to interviewees the lack of established VR/AR technology poses a significant challenge, along with the uncertainty surrounding its rapid development. Technical hurdles, like battery technology, contribute to a slow adoption rate. There seems to be a lack of clear vision and understanding of how to harness VR/AR's potential, leading to short-term experimentation instead of comprehensive utilization.

The industry also faces challenges in securing substantial investments for research and development, resulting in small-scale projects and a reluctance to commit significant funds. Incorporating VR/AR technologies into existing content creation workflows remains a challenge because determining how to effectively merge these technologies with traditional media formats is not straightforward.

Collaboration with CIVIT

Both representatives had positive experiences of collaboration with CIVIT and highlighted the value of cross-industry partnerships. The interaction had been fruitful for technology exploration, especially in areas like volumetric capture.

The collaboration with Tampere University was thought to have facilitated knowledge exchange and resource sharing, making it easier to explore novel technologies and methodologies.

Future

Both respondents expressed interest in continued collaboration, test projects, and research partnerships that allow for exploring new technologies and their potential applications. The availability of funding and resources significantly influences the scope and success of any kind of collaborations and R&D projects. Also, both interviewees indicated the need for complete solutions, from technology testing to post-production, enabling seamless integration of VR/AR into content creation workflows.

Common needs, opportunities, challenges and problems

Most of the interviewed experts thought that the VR/AR industry is in constant development and has not yet reached its full potential. Many of the respondents stated that metaverse and many digital technologies are just beginning to be integrated into company operations.

The biggest common challenge in the industries was found to be the lack of technology development. The respondents thought that particularly VR/AR headsets are unnecessarily big and difficult to use. Also, the usage rates of current headsets are low, which means that the technology and software cannot be directed at consumers.

CIVIT is believed to be in a central role in developing the industry of digital technologies and VR/AR. Especially CIVIT’s volumetric capture studio earned praise from the respondents.

The interviews also delved into the center's role as a host for international guests and its important position at the forefront of the regional industry. Some respondents highlighted the influence of CIVIT-organized events in garnering attention for the industry, while also underscoring suggestions for a more focused approach to industry benefit.

A common challenge identified by interviewees was the requirement for substantial investments, particularly among startups and companies at large. The vast number of different technologies and their various applications was highlighted as a recurring challenge.

In terms of the technology available at CIVIT, the volumetric capture studio and various other camera systems emerged as the key components. The interview participants commented that CIVIT's expertise, particularly in piloting and refining beta versions, could hold considerable promise in addressing industry challenges in the future. This could extend also to the utilization of datasets, which are perceived as a basis for valuable collaborative opportunities for companies.

The relationship with the university was lauded for its role in facilitating access to knowledge and expertise. On the other hand, there were concerns over aligning academic and commercial interests, particularly regarding issues of intellectual property and research publication rights.

The identified common R&D needs, opportunities, challenges, and problems are presented below.

R&D Needs:

- **Integration into Industry-specific Applications:** Respondents highlighted the significance of integrating visual technologies into practical industry-specific applications. The ability to develop and identify such applications was seen as a key area for research and innovation.
- **Testing and Piloting:** There is a need for test projects and pilot studies to assess the feasibility and potential of visual technologies to understand the purpose and utility of technological advancements for future applications and collaborative opportunities.

Opportunities:

- **Visual Technology Utilization:** The possible future widespread adoption of technologies such as VR/AR and their specific applications was acknowledged as a pivotal opportunity that could lead to substantial growth and advancement across the industries.
- **Collaborative Problem-Solving:** The collaboration between industry and research institutions like CIVIT was underscored as a promising avenue for exploring innovative solutions and technological advancements in the visual technologies domain. This collaborative approach offers a fertile ground for mutual knowledge exchange and problem-solving.

Challenges:

- **Limited Awareness and Familiarity:** A recurring challenge was the limited awareness and familiarity with VR/AR technologies. This knowledge gap creates barriers to investment and impedes the search for suitable support mechanisms for VR/AR initiatives.
- **Technical Limitations:** Technical hurdles stemming from hardware-related issues, such as the availability and cost of technologies, were frequently mentioned. The experimental nature of many VR/AR applications also presents challenges, including limited software expertise and unclear developmental trajectories. The convergence of physical and digital components in VR/AR introduces further complexities.

Problems:

- **Uncertain Budget and Outcomes:** The interviewees expressed uncertainties surrounding project budgets, investments, and outcomes, particularly when dealing with novel technologies and innovative ideas. Concerns about costs, timeframes, intellectual property issues, and difficulties in aligning interests were acknowledged. Moreover, challenges in communication and a potential mismatch between short-term focus and university collaboration goals were recognized.

This analysis sheds light on the collective perspectives of industry stakeholders, giving opportunity to guide the development of the collaboration model created in the Collaboratec project. Furthermore, these findings can help in developing strategic recommendations for addressing the identified R&D needs, pursuing the highlighted opportunities, mitigating challenges, and devising effective solutions for industry-academia collaboration.

Conclusions

The main outcome of this report was to present the findings from interviews with industry experts from the work machine and creative digital industries as well as from the economic development agency of the Pirkanmaa region. The findings provide a view of the current visual technology landscape and related needs, opportunities, challenges and limitations.

The work machine industry has a clear demand for practical uses of visual and VR/AR technologies. These applications, ranging from training and maintenance to remote operation, have the potential to enhance operational efficiency and decision-making. However, the challenges associated with high costs, limited hardware availability, and software expertise hinder widespread adoption. Similarly, the creative digital industry recognizes the transformative potential of visual technologies in enhancing customer experiences and storytelling. Yet, the unfamiliarity with these technologies and the ongoing evolution of hardware present challenges. Further, the lack of established VR/AR technology, technical hurdles, and funding constraints impede full integration into content creation workflows.

For both target industries, collaborating with CIVIT offers a path to accessing cutting-edge technologies, skilled personnel, and joint innovation. Customized datasets and PoCs emerge as strategies to align industry needs with technological possibilities. This cross-disciplinary collaboration holds promise in bridging the gap between technological capabilities and creative content by providing a platform for knowledge exchange, resource sharing, and technology exploration. Decisions related to intellectual property rights and research publications need to be clear and mutually agreed before the start of collaboration.

Several trends emerged that illuminated the shared needs, opportunities, challenges, and problems within the technological R&D landscape. Integration into industry-specific applications, testing through pilot projects, utilization of visual technologies, and collaborative problem-solving stand out as common focal points. Limited awareness, technical limitations, uncertainties about budgets and outcomes, and communication challenges constitute the shared challenges and problems.

Appendix A: Interview questions

The industry-related questions covered the following:

1. What role do you think VR/AR technologies play in the development of companies?
2. What kind of challenges do you think the VR/AR industry has?
3. In your opinion, has CIVIT been involved in developing the needs or challenges of the AR/VR industry?
4. What are the biggest problems or challenges in your own industry?
5. How is visual technology used in your industry?
6. What are the biggest problems or challenges in the collaboration of companies?

The questions related to CIVIT were the following:

1. What image do you have of CIVIT?
    a. What are the most important technologies in CIVIT?
    b. Is there a technology in CIVIT that is or might be important in company collaborations in the future?
2. Do you see some cooperation opportunities where CIVIT could help solve problems or challenges in the industries or company operations?
3. What kind of cooperation is the most valuable for companies?
    a. Equipment rental
    b. Small pilot/proof of concept (1-2 months)
    c. Rental of CIVIT premises
    d. Collecting a custom dataset in CIVIT
    e. Longer research project with external funding
    f. Proposing the topic of the thesis to the student
    g. Participation in CIVIT events
4. What are the pros and cons of cooperating with the university?

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https://www.tuni.fi/en/research/collaboratec

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