Towards a Taxonomy of Augmented Reality-based Remote Service Business Models

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Abstract

- The use of Mobile Collaborative Augmented Reality (MCAR) in industrial service delivery is still new and enables new AR-based remote service business models for manufacturing companies. However, not all manufacturers are aiming at the same business model, since they address different use cases and customer demands.
- Focus group discussions with industry experts from various capital goods manufacturing companies have been conducted to investigate how business models for AR-based remote services in the capital goods industry can be designed.
- This poster presents design elements as an initial step towards a taxonomy for AR-based remote service business models.

Introduction

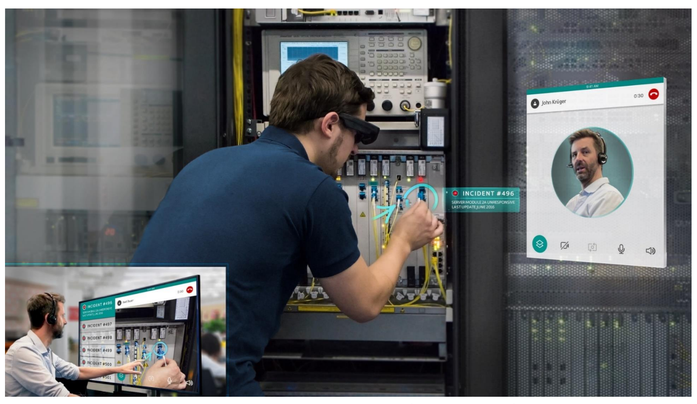


Figure 1. Remote expert and on-site technician using MCAR. Source: RE'FLEKT (www.re-flekt.com)

- Collaboration during complex maintenance tasks can help technicians make repairs more quickly and accurately. The value of collaboration has been empirically reported in several studies. [1]
- Using AR-enabled devices such as smartphones, tablets or head-mounted-displays improves the collaboration between on-site users and remote experts. This can improve the quality while reducing the cost of service delivery. [2]
- However, the operational use of AR-technology for service delivery purposes is quite rare in practice [3, 4].
- Companies that intend to adopt AR-technology for remote services face the challenge of creating a business model.
- The development of taxonomies contributes to a better understanding of business models [5] and thus to their development.

Research Gap

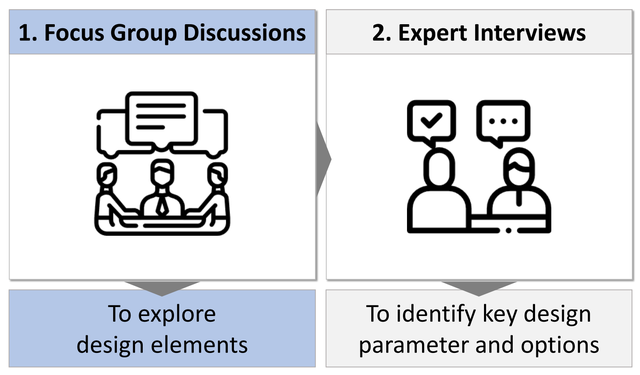
- Research focus in the body of existing literature is mainly on the development of AR systems or usability studies, mostly under laboratory conditions [5].
- Only a very few researchers took the business perspective and focused on business processes [6], use cases, enablers and barriers [7] and impacts on the business model [8, 9].

Research Aim

- Aim of this study is to explore design elements to develop a taxonomy including the key design parameter and design options of AR-based remote service business models .

Research Design

- Sequential two-step approach due to the unknown field of research.



- Results presented in this poster represent the results of the focus group discussions and form the basis of the individual expert interviews.

Data Collection*

- Four Focus group discussions with 19 participating industry experts from 12 internationally operating German capital goods manufacturing companies.
- Each focus group discussion lasted for one hour, was audio recorded and transcribed verbatim.
- Industry experts hold positions of strategic responsibility in company's service department.
- Because most companies do not yet use AR for remote service delivery, only those that had already tested or are currently testing AR-systems for this purposes participated.

Data Analysis

- Resulting transcripts were analysed according to the qualitative content analysis method of Mayring [10] using NVivo 12 software.
- Due to the unknown field of research, an inductive approach to category development was applied.
- Participants' statements referring to design elements were coded in categories.
- Exemplary statements (English translation) are listed below, each assigned to a different category.

> "You could say that there are two different prices, depending on whether you have your own hardware or buy an all-round package from us. *(Pricing Model)*

> "Customers usually ask if this can be done 24/7 on 365 days? So you always have to check whether the company is already set up so that you can provide this support around the clock. *(Service Hours)*

> "The head-mounted-display do not only have to be available to your own technicians. They can also be at the customer's site and be available for him for the telephone hotline. *(AR-Device User)*

Results

- Overall, 82 statements referring to design elements of AR-based remote service business models were coded in 20 subcategories and 4 main categories (Table 1).

Table 1. Coding categories of the focus group discussions.

Category	Subcategory	Sources	References
Pricing Model	Warranty Period Pricing	3	8
	Pay per Minute	2	7
	Flatrate	3	4
	AR-Device Pricing	1	3
	Higher Hourly Rate	1	3
	Resident Engineer	1	3
	Individual Pricing	1	1
AR-Device User	Customer's Personnel	3	6
	External Service Partner	3	5
	Third-Party Service Provider	3	5
	Own Service Technician	2	4
	Indipendent Service Technician	2	2
	Inexperienced Service Technician	2	2
Remote Service	24/7 Service Hours	4	8
	Remote Monitoring	2	5
	Multiple Softwares Solutions	1	1
Remote Experts	Remote Expert Skills	2	5
	Remote Expert Langauge	2	3
	Number of Remote Experts	1	3
	First Level Support (Help-Desk)	2	4
		Total	**82**

- The number of sources indicates in how many of the four focus groups the topic has been discussed.
- The number of references indicates how many participants' statements were coded to a subcategory.

Discussion

- **Pricing Model:** In addition to a suitable pricing model, there is also the question of the pricing of the AR-Device, in the case of handing it over to the customer. During the warranty period, the customer could be familiarised with the service free of charge.
- **AR-Device User:** Who is the person using the AR device to be guided by the remote expert? These do not necessarily have to be the company's own technician.
- **Remote Service:** The most discussed question is whether the company can even offer 24-hour support.
- **Remote Expert:** Which existing personnel can be employed as remote experts? First level help desk personnel, technical experts or former service technicians.

Conclusion

- A total of 20 design elements for AR-based remote service business models were identified in the focus group discussions.
- However, since the participants' statements were often more of an expectation, rather than an experience, the next step is to conduct individual expert interviews with companies that either already offer AR-based remote service or have at least developed a business model for this purpose.
- This allows to obtain the key design parameter and design options to develop a taxonomy of AR-based remote service business models.

*A detailed description of the focus group discussions conducted is given in the corresponding conference paper: Ohlig, S., Stegelmeyer, D., Mishra, R., & Müller, M. (Accepted/In press)

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