Leveraging Augmented Reality for Enhanced Smart and Connected Product Design: An Experimental Approach

CHACON ACUNA Pedro[1], ALZEIN Khansaa[1], JEAN Camille[2], LOU Ruding[1]

[1] Arts et Métiers Institute of Technology, LISPEN, F-71100, Chalon-sur-Saône, France
[2] Arts et Métiers Institute of Technology, LCPI, F-75013 Paris, France

Abstract. The Internet of Things (IoT) is transforming all sectors by enabling traditional products to become smart and connected, capable of collecting, analyzing, and exchanging data. In parallel, Augmented Reality (AR) has emerged as a promising technology to support product design by offering immersive and interactive ways to visualize and iterate ideas. This paper presents an AR-based application developed to assist designers during the early ideation phase of IoT product conception. The system enables visualization of virtual objects and interaction with 14 sensor capability cards and 12 user experience elements. An experimental study involving 14 undergraduate engineering students was conducted to compare the proposed AR tool with a traditional 2D paper-based method, using two design cases: a connected bicycle and a smart window. Quantitative results from NASA-TLX and SUS questionnaires indicate that the AR method maintained or reduced perceived workload, particularly in terms of complexity and time pressure, while achieving usability scores comparable to or better than the traditional approach. These findings demonstrate the potential of AR as an effective and cognitively sustainable tool for enhancing creativity in early-stage product design.

Keywords: Smart and Connected Product design, Augmented Reality, Sensors, User experience.

1 Introduction

The rapid advancement of the Internet of Things (IoT) has ushered in a new era where traditional products are being transformed into smart and connected products. These devices communicate with other devices, collect and analyze data, and provide enhanced functionalities, significantly improving user experiences across various sectors. The integration of IoT into everyday objects, from household appliances to industrial machinery, is revolutionizing how we interact with technology, making our lives more efficient, convenient, and informed.

In parallel, Augmented Reality (AR) has emerged as a revolutionary technology in product design. AR overlays digital content onto the physical world, providing designers with innovative ways to visualize, iterate, and collaborate on their projects [13]. By enabling real-time visualization and interaction with virtual prototypes, AR facilitates a more dynamic and flexible interactive design process. This is particularly valuable in the early stages of product development, where creativity and rapid iteration are crucial.

This paper explores the integration of AR in the creativity phase of smart and connected product design, proposing an innovative application to support designers in upgrading traditional products. By leveraging AR, designers can bypass the limitations of physical prototypes, allowing for more efficient and collaborative brainstorming and ideation.

This article is structured as follows: Section 2 provides a background on smart and connected product design, along with an overview of related work in AR applications. Section 3 details the proposed AR application, including its technical specifications and functionalities. Section 4 presents the developed prototype of the AR application. Section 5 describes the experimental setup, methodology, and results of testing the AR application prototype with participants. Finally, Section 6 discusses the findings, implications, and future directions for research and development in this area.

2 Background

2.1 Smart and connected product design

Smart and connected products are typically equipped with sensors, actuators, and connectivity technologies. These components allow the products to collect data from their environment or from the product itself. Common sensors measure parameters such as temperature, motion, light, humidity, and pressure. The data collected by these sensors is transmitted to computers or mobile devices via Wi-Fi, Bluetooth, or cellular networks (e.g., 4G, 5G). This data is then processed and analyzed to provide valuable insights or to trigger actuators to perform specific actions, thereby enhancing the functionality and user experience of the product.

Applications of smart and connected products span several domains [19]. In smart homes, these products enhance convenience, security, and energy efficiency. In the health and fitness sectors, fitness trackers and smartwatches monitor health metrics and provide actionable insights. In industry, smart and connected products enable predictive maintenance, automation, and process optimization, increasing efficiency and reducing downtime. In smart cities, they support traffic, waste, and energy management, contributing to urban sustainability. These diverse applications demonstrate the transformative potential of smart and connected products in enhancing both product functionality and user experience across multiple sectors.

However, designing smart and connected products entails significant challenges across methodological, financial, environmental, and ethical dimensions [21][22]. Through a literature review, a workshop with academics and a campaign of industrial interviews, Briard et al. (2023) [20] confirm this point and emphasize the lack of a structured methodological framework for designing such products, which hinders designers from fully harnessing the potential of the involved technologies.

2.2 Sensor capabilities creativity tool

Within the process design domain, the exploration and integration of data and sensor potential represents a promising area of research, as it opens significant opportunities for innovation in product design. The literature presents various methods proposing frameworks or tools for sensor selection and choice, including sensor kits [24], card games [25], analytical approaches, financial and technical evaluations [26], as well as technical abacuses [27]. Despite these methods, it is essential to recognize that sensor selection and choice are frequently conducted empirically by designers [28]. Moreover, the frameworks discussed for sensor selection do not adopt a holistic perspective for value creation based on captured data. They tend to focus on solutions addressing technical problems or user needs. Similarly, the selection approaches primarily consider sensor characteristics (performance, costs, integration into the product, etc.) without evaluating their roles within the entire system.

In response, we proposed previously an innovative method for identifying potential value creation through the integration of captured data into the creative phases of design [23]. They introduced a sensors capabilities creativity tool that represents the main data that can be collected by embedded sensors. This identification was accomplished by examining the technical specifications of sensors from five major companies in the sector: Bosch Sensortec, Infineon Technologies, NXP Semiconductors, STMicroelectronics, and Murata Manufacturing. By representing the detection capabilities of embedded sensors rather than the sensors themselves, the tool bypasses the technical aspects of the sensors. This ensures that expertise is not a limiting factor, allowing all designers to engage in creative discussions about potential value creations related to captured data for the product. While the list of detection capabilities is not exhaustive, its systematic construction is expected to represent most capabilities (figure 1). In real life practice these sensors take the form of physical cards (Fig. 2a) that can be used to show the place of the sensor on the product and share the idea (Fig 2b). Each card represents physical phenomena and quantities that can be measured using sensors.

Figure 1: The 14 detection capabilities in the form of cards [Briard'24)].

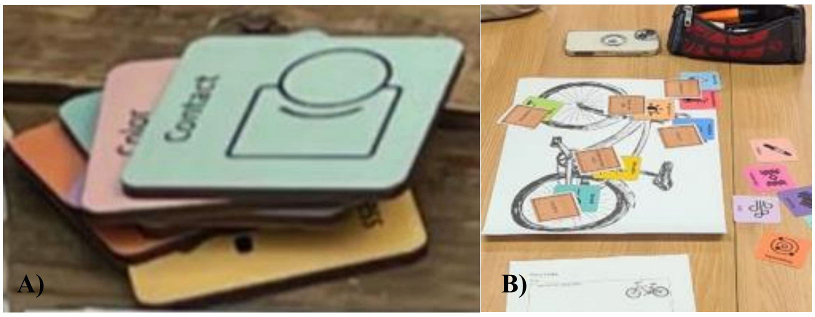

Figure 2: Physical cards and cubes manufactured in reality [23]

To use this tool, Briard et al. (2024) [23] propose a method that considers each phase of the product life cycle individually to initiate creative reflections on how detection capabilities can contribute to potential value creation. In their case study, they focus on user experience value creation by utilizing a list of 12 keywords to describe the user experience, based on the findings of Law et al. (2014) [29]. These selected keywords represent measurable experiential qualities (Figure 2).

Figure 3 : The 12 keywords of the user experience [Briard'24)]

This approach was tested in a case study with a shared bicycle company. The experimental results indicate that the tool significantly enhances the generation of novel and higher-quality concepts compared to traditional ideation methods. Additionally, participants expressed a high level of appreciation for the tool, noting that it significantly enhanced creative exploration and collaboration.

However, while this creativity tool based on physical cards [1][2] facilitates tangible interaction, it also presents important limitations. For instance, the physical manipulation of cards may slow down ideation, reduce the possibility of remote collaboration, and complicate the systematic recording of ideas generated during sessions. In contrast, digital and virtual tools—particularly Augmented Reality—can accelerate iteration cycles, support distributed teams, and ensure automatic saving of ideas for future reuse. This motivates the exploration of AR as a medium to extend the benefits of the physical tool while addressing its limitations.

2.3 Leveraging Augmented Reality (AR) to enhance the sensor capabilities creativity tool

Augmented Reality (AR) is revolutionizing design practices across various industries by offering new ways to visualize, interact with, and test designs in real-time and within real-world contexts. There is a growing demand for AR applications to support various stages of the design process, as noted by Giunta [3]. Beyond product design, AR technologies are extensively utilized throughout different phases of product development, from initial concept ideas to final manufacturing stages [4]

The integration of AR into design processes has opened new possibilities for creativity, collaboration, and efficiency. Especially there are needs of AR applications to support various stages of the design process [3]. Besides product design, AR technologies are also largely used in various stages of product development, from initial design ideas to final product manufacturing [4]. For the sake of considering the end-user experience in early product design stages AR technologies can facilitate involvement of end-user in the design creativity workshops. Thanks to the AR application end-users can manipulate and modify virtual prototypes of designed products in real-time. This helps users to express their ideas and feedback in the early design stage. The participation of users in the design process can efficiently reach optimal product design solution that meets user requirements accurately. [5]. The comparison between classical design activities in real environment and the one in virtual environment has been made for novice designers' education. Designers' creativity and idea generation are largely stimulated by the virtual condition thanks to AR technologies [6].

AR aided 3D sketching interface is devised to designed digitalized the traditional sketching tools and mediums. Mobile devices serve as sketching platforms and use AR techniques to support on-site 3D virtual shapes authoring and visualization directly within a physical environment. In addition, these systems propose interactive and intuitive manipulation of the virtual geometric models to enhance the designer's creativity and ability to express ideas in the mixed world with virtual and physical elements [7] [8] [9] [10].

AR can also enhance collaborative and real-time product design process by facilitating collaboration among team members and improving collaborative interaction with 3D virtual models and simultaneous design modifications [11]. In the education domain, collaborative product design within a learning factory environment uses cloud-based AR technologies to improve learning experience and facilitate understanding and engagement of learners by allowing users to see how design solutions in a physical space and improving spatial awareness and design accuracy [12]. In the specific Additive Manufacturing (AM) area, AR can help designers to better explore all the opportunities of AM during early design stage [13]. In addition, a farmwork combining AR, AM and Digital Twin (DT) technologies can share and visualize in real-time the manufacturing data for various product innovation stakeholders and support them in decision-making [14]. Virtual reality (VR) technology emerged early then AR and is also used in collaborative product design for enabling multi-disciplines product visualization. Completely immerged in the virtual environment where the product is used, the users can see and interact with the virtual product representations according to their interest/discipline [15] [16].

Despite the research there's few works directly address the ideation phase of product design, where creativity and rapid exploration are most critical. This gap emphasizes the need for AR-based tools explicitly designed to support early-stage brainstorming and concept generation, rather than only focusing on later prototyping or manufacturing stages. Our work addresses precisely this missing link.

Based on the current state of the art, our literature review did not identify any research that integrates Augmented Reality (AR) for the exploration and integration of data and sensors to support IoT product design activities. This gap in the literature highlights an unexplored intersection of AR technology and creative design tools aimed at enhancing design processes. Consequently, the objective of this study is to introduce an AR application designed to leverage AR to enhance creativity for sensor capabilities integration and to evaluate its impact on creativity and collaboration within design teams. By doing so, this study seeks to provide empirical evidence on the effectiveness of AR-enhanced creativity tools in the product design process.

3 Proposed approach

After having reviewed the current physical support for IoT product design and the virtual technologies used in design creativity, this paper aims to propose an innovative augmented reality (AR) application paradigm for assisting IoT product design activities. The main objective is to provide designers with a digital tool in which they can visualize the 3D virtual mockup of the product in the real world and express their design ideas (sensors capabilities and user experience) directly on the virtual product.

Users can penetrate the virtual representation of a product to gain a comprehensive understanding of its internal structure. This immersive capability allows for a detailed examination of each component and their interactions within the product. Real-time 3D rendering will enable users to visualize fluently the 3D mockup of the product embedded in any real environment and illusion of interacting with real product in the environment. The virtual prototyping function will allow users to quickly generate ideas. Designers can add and interact with virtual sensors capabilities onto the products offering a detailed perspective on how these sensors would be positioned spatially on the product. In addition, designers can also attach user experience value creation. Once all the design ideas have been expressed the application saves the work that means the added sensors capabilities with user experiences. So that for a new creativity session designers can load the previously saved design solutions. It is possible to save several design solutions that the designers can compare to find an optimal one.

This AR app will facilitate creative brainstorming for generating design ideas. Figure 4 illustrates the workflow of using an AR aided IoT design activities.

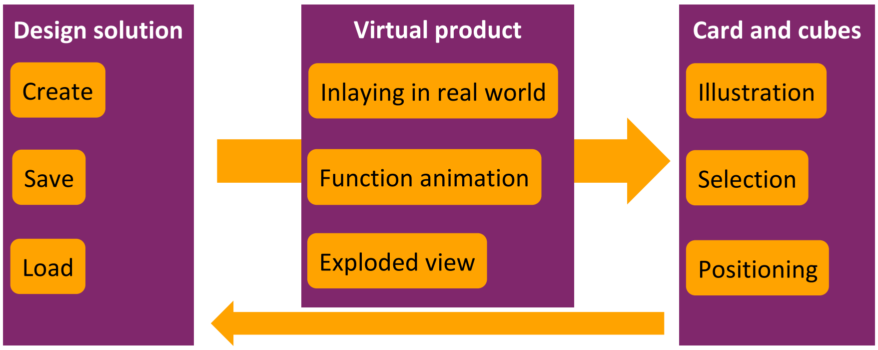

Figure 4 : General approach for AR aided IoT Design

This paradigm will meet following requirements that are defined to answers the first needs:

- Visualization and interaction with virtual mock-up of the product that is embedded naturally in the real environment.
- Interactive animation of the virtual mock-up for helping designers to better understand how the product works and what are internal components through exploded view.
- Presentation, explanation and examples illustration for the various cards of detection capabilities in IoT technologies. Possibility of adding and positioning them onto the virtual product.
- Presentation, explanation and examples illustration for the various cubes for keywords of user experience. Possibility of adding and positioning them onto the virtual product.
- Creation, saving and opening a design project that contains all the design ideas. Each idea correspond to a card, a cube and a comment as well as their spatial position. When opening an existing design solution all the cards, cubes and comments will appear and positioned relative to the virtual product.
- Online team work sessions through network connection to allow a collaborative design creativity workshop where each designer can express their ideas through his/her device.
- Demonstration of new functional features of the upgraded product with new detection capabilities. For example when a position detection capacity is added to bike, its trajectory can be visualized on a smartphone.

In this study, the 3D mock-ups used within the AR application were derived from existing product models, either adapted from CAD files or openly available 3D assets (e.g., bicycles, windows). This approach allowed us to focus on the integration of sensors and user experience elements into recognizable product shapes. For the design of completely new products, future work could integrate AR-based sketching or rapid 3D modeling techniques, enabling designers to generate initial product geometries before applying sensor capability and user experience elements but today's proposal relies on the addition of well-designed 3D models or the use of the ones available in the application.

4 Prototyped AR application

According to the ambitions declared in the previous chapter, preliminary proof of concept (POC) has been developed and proposed in this paper. This POC corresponds to an AR application that allows designers to generate IoT ideas directly on the virtual product visualized in the real environment. The essential functions have been prototyped so that experimentation has been conducted with participants (chapter 5).

4.1 Technical specifications

The proposed AR application has been prototyped by using the game engine Unity. It is one of the most popular and powerful platforms for 3D development due to numerous benefits. Unity allows developers to build applications for a wide range of platforms, including Windows, macOS, Linux, Android, etc. from a single codebase. Unity provides an intuitive graphic interface so that developers can add and configure 3D mockups easily. Its powerful computation core enables rapid prototyping, allowing developers real-time editing. Changes can be made in real-time within the editor during run time, providing immediate feedback and reducing development time.

In terms of AR the technology markerless AR is adopted because it does not rely on predefined visual markers. Instead, it uses the environment's natural features to determine the position and orientation of virtual objects in the real world. Unity's AR Foundation provides a unified framework to develop markerless AR applications that work across different AR platforms like ARCore (Android) and ARKit (iOS). Therefore, the developed AR application can analyze real environment to detect planes, estimate light source position so that the virtual mockup can have correct illumination and plausible position relative to the real environment.

4.2 Functions for designers

The home page of the prototyped AR application is illustrated in figure 5.a. It allows designers to select 3D models of products to upgrade, insert sensor capability, user experience and add comments for each design idea. Other buttons on the top correspond to “go back”, “options” and “quit”. A quick overview of the main steps involved in using the application is illustrated in figures 5.a-d: importing and positioning the virtual model in the real environment, inserting sensor capabilities and user experiences attached to the various product components, and adding comments to finalize the design idea.

Figure 5. AR application function: insertion of a 3D mock-up.

When the designer clicks on the button “Models" (fig. 5.a) a scrollable list of available product models will appear on the right side of the screen (fig. 5.e). Once a model is selected, the 3D mockup will appear in the real environment, eg. a bike on the table (fig.5.b) and the position, orientation and size of the 3D mockup can be adjusted with designers' fingers. Then designers can approve to fix the model. It is possible to click on the model to enable its adjustment.

When clicking on the model, there is a function available that allows the user to watch an exploded view of the product. A slider appears to adjust the distance for separating components (fig 6). Depending on the model to evaluate, in this case a bike, this can be seen as a major advantage compared to complex real objects and certainly 2D pictures printed on paper.

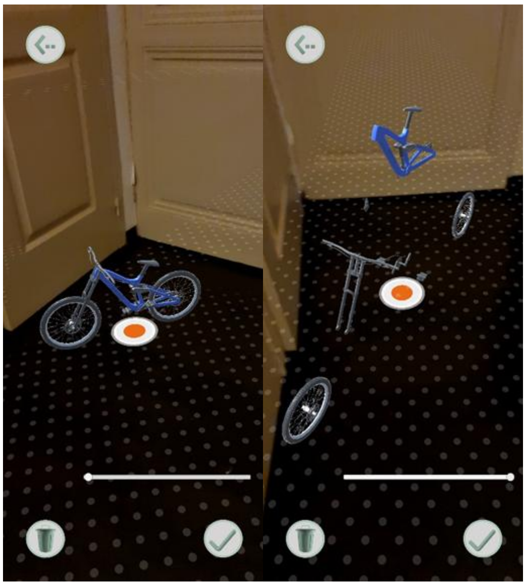

Figure 6. AR application function: Exploded view of a 3D mock-up.

Also, once the virtual product (eg. bike) is inserted and fixed somewhere in the real environment, the designer can click on the cards button (fig.5.a) a scrollable vertical list of 14 sensor capabilities appears on the right of the screen (fig.5.f). It is also possible to add a user experience cube by clicking on the cubes button (fig.5.a) a scrollable horizontal list of 12 experiences appears on the top of the screen (fig.5.g). The chosen sensors capability or user experience is a 3D object embedded in the real environment (fig.5.c) and its position, orientation and size can be adjusted by designers. It is also possible to attach the couples (card + cube) onto the 3D product (fig.5.d). Designers can also add various comments (fig.5.h) on to the designed product (fig.5.d).

5 Experimentation

For the sake of compare the proposed AR aided IoT Design application and a traditional method frequently used, an experimental study was conducted with **14** Bachelor **students** (12 male, 2 female) major in **Mechanical Engineering and product** Design. Participants were divided into two groups and worked on two predefined IoT-related design study cases: a smart **bicycle** and a smart **window**. The main idea was to face a Traditional Method (TM) design based on picture of product printed on paper and the

Augmented Reality (AR) aided design tool allowing visualization and exploded views of the objects in augmented reality.

For each group the session lasted approximately **two hours** and organized as two distinct phases:

- **Phase 1:** Participants performed brainstorming based idea generation using the **TM** tool for one design study case.
- **Phase 2:** Participants focused on another design study case and used the **AR** tool for ideation task.

The participants were asked to express their design concepts using both methods (TM & AR), onto **individual idea sheets** describing context, sensor, and user experience component choice (fig. 7).

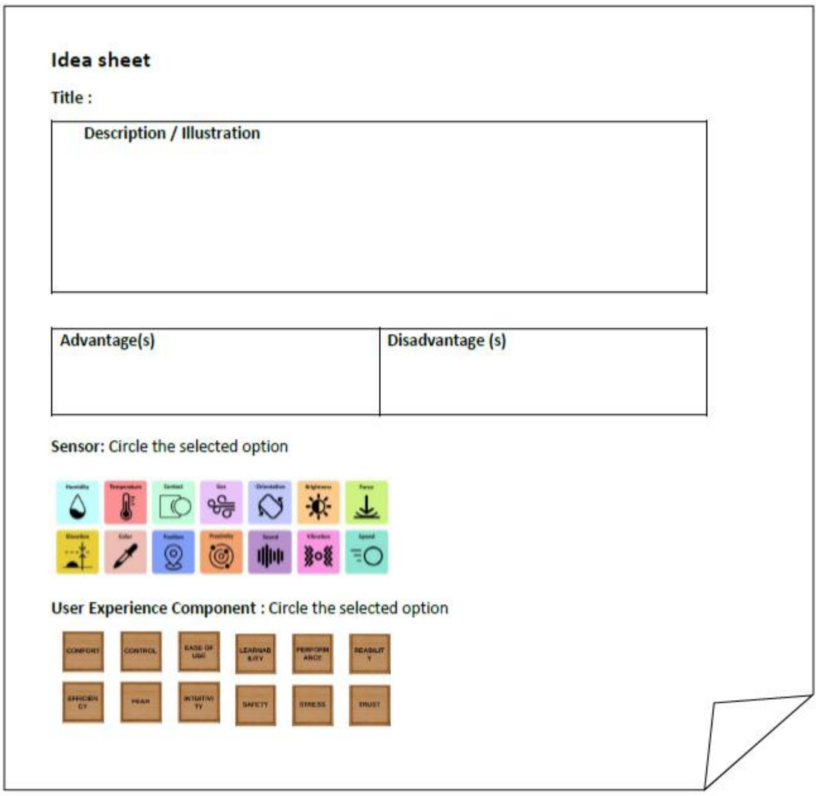

Figure 7. Ideas sheets.

5.1 Evaluation Tools

To assess the usability and cognitive load of each method, two standard questionnaires in the literature were used:

- **System Usability Scale (SUS)** [17]**:** A 10-item questionnaire evaluating perceived ease of use, learnability, integration, and user confidence.
- **NASA-TLX [18]:** A 6-item workload assessment covering mental and physical demand, time pressure, perceived complexity, stress, and distraction.

Participants answered both questionnaires at the end of each phase.

Figure 8. Briefing with participants.

5.2 Experimental Procedure

- **Briefing** (10 minutes): presentation of the Internet of Things (IoT) concept, product design followed by an explanation of design aim and tasks using 14 sensors and 12 user experiences. (fig. 8)
- **First Design** creativity sessions using **TM** tool (35 minutes): Presentation of a different use cases for each team and providing an A2 paper printed with the product to use as a support for placing sensors and user experiences as shown in figure 9.

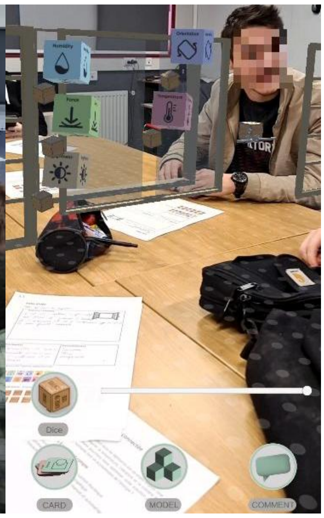

Figure 9. Phase Traditional Method

Figure 10. Phase AR Method.

- User experience **feedback** for **TM** (5 minutes): Experiment feedback through questionnaires based on SUS and NASA TLX.
- Explanation and training of the AR app's interface and functionalities to the participants.
- **Second Design** creativity session using **AR** tool (35 minutes): Exchanges of use cases between groups to now generate ideas by using AR application as support for the design process (fig. 10).
- User experience **feedback** for **AR** (5 minutes): Experiment feedback through questionnaires based on SUS and NASA TLX.

5.3 Results Analysis

The first measurable and significant aspect of the experiment lies in the number of ideas generated by each method, to define the level of production. It is necessary to mention that there are certain factors that influence this data, and the analysis must take them into account, as well as improve the quality of the data collected in future sessions.

The two working groups were very close to each other, as shown in Figure 9. They were on opposite sides of the same table, which allowed them to communicate with each other and share information about their use cases to be evaluated, and the ideas generated during the first session (TM). This first session generated a total of 15 idea cards between the two groups, bearing in mind that each group had a different topic.

At the beginning of the second session, both groups were predisposed to the “new” use case due to their prior knowledge of it, which led to some ideas being repeated or prevented other participants from expressing their ideas because “the previous group had already done so”. Fatigue due to the long duration of the session was also noticeable, generating disinterest among the students. In the end, the AR method generated 10 idea cards, 5 fewer than those generated in the first session by TM. That is why it is important to know the students' opinion regarding the usability and workload of the methods, which will be our main source of data for making the corresponding comparisons.

To evaluate the cognitive workload and perceived usability of the two design supports — paper-based traditional method (TM) and Augmented Reality (AR) tool—we analyzed the participants’ responses to the NASA-TLX and SUS questionnaires. The data were collected from 14 participants who completed both evaluations after using each method.

Cognitive Workload – NASA TLX

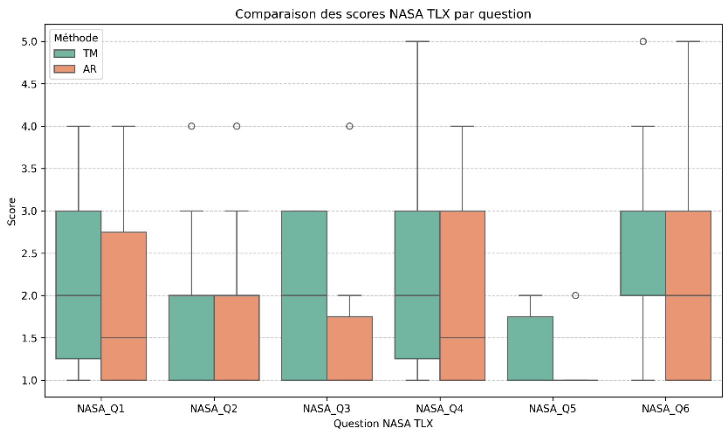

Figure 11. NASA TLX comparison (lower is better)

Figure 11 illustrates the comparison of average scores for each NASA TLX dimension across the two methods. Overall, the AR method did not increase the cognitive load compared to the traditional approach. In particular:

- **Mental Demand (Q1)** and **Perceived Complexity (Q4)** show slightly lower median values for AR, suggesting that participants experienced the AR method as more cognitively manageable.
- **Time Pressure (Q3)** was also perceived as slightly less demanding with AR, potentially due to the dynamic visualization aiding quicker decision-making.

- **Physical Demand (Q2)** remained low and nearly identical for both methods, as expected in a product design ideation task.
- **Stress/Anxiety (Q5)** and **Distraction (Q6)** scores were similar across both methods, with a slightly larger variance observed in the TM method.

These findings suggest that the AR-based tool maintained a comparable or reduced level of mental and temporal demand, while not introducing additional stress or distraction. This supports its feasibility as an ergonomic alternative in the ideation phase of IoT design.

Usability – System Usability Scale (SUS)

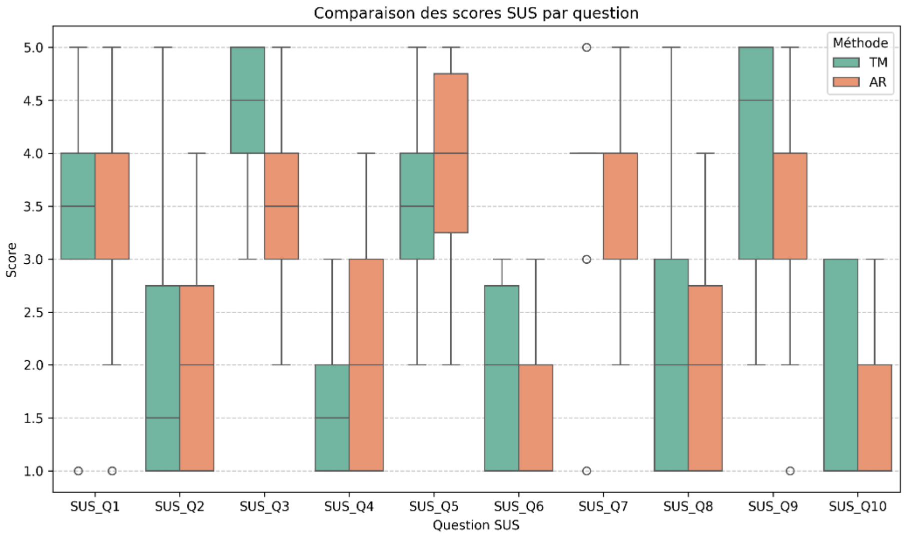

Figure 12. SUS comparison (higher is better)

The usability assessment results are depicted in Figure 12. Both methods received relatively positive scores, with a few distinguishing trends:

- Participants reported comparable levels of **perceived ease of use** (Q3), **integration of functionalities** (Q5), and **learnability** (Q7) for both methods.
- The AR method scored **higher** in **perceived efficiency** (Q8), with participants indicating it was less cumbersome than the traditional method.
- However, TM had a slight advantage in **initial confidence** (Q1) and **lack of need for technical support** (Q4), likely due to its simplicity and familiarity.
- **Q10 (need to learn many things)** indicated a slightly higher learning curve for AR, although the variance was not substantial.

Despite a minor increase in perceived learning effort, the AR system was well accepted by participants and scored similarly—or higher—than the traditional method (TM) in most aspects of usability. The results suggest that the AR tool provides a user-friendly and engaging platform that does not compromise efficiency or clarity.

5.4 Discussion

The results of this study provide meaningful insights into the comparative effectiveness of Augmented Reality (AR) as a support tool during the ideation phase of IoT design. Although traditional methods (TM) remain widely used due to their simplicity and familiarity, the findings suggest that AR-based tools can offer added value without increasing cognitive load or compromising usability.

In terms of workload, participants did not report greater mental effort, stress, or distraction when using AR. On the contrary, AR was perceived as slightly less complex and more time-efficient, likely due to the interactive and immersive nature of the interface. These observations align with prior work highlighting the potential of AR to reduce cognitive overload in early design tasks by making abstract systems more tangible.

From a usability perspective, the AR tool achieved levels of user satisfaction comparable to the traditional paper-based method. It was particularly well rated in terms of ease of interaction, integration of features, and overall user engagement. Despite a slightly higher initial learning curve, users quickly adapted to the system, suggesting strong learnability and low technical resistance.

Interestingly, the positive reception of the AR tool did not depend on prior experience with similar systems. This observation reinforces the idea that properly designed AR applications can be intuitive and accessible even for novice users, opening new avenues for integration into educational and creative contexts.

It should be noted that the experimental protocol always followed the same sequence (TM first, AR second). This fixed order may have introduced learning bias or fatigue effects that could partly influence the results, that's the main reason why we can observe a better performance in TM session, we were able to see it in the amount of ideas generated and, as well, in the details exposed in the idea cards, the latest registered in the AR session were barely described compared to the first ones in the TM session.

Future studies should counterbalance the order of conditions to better isolate the impact of the tool.

Another observed limitation was that the study did not assess the quality of the ideas generated, but only their number and the participants' perceptions of usability and workload. Evaluating idea quality, for instance, in terms of novelty, feasibility, or relevance, would provide a more complete picture of the contribution of AR in early-stage product design.

Finally, while questionnaires provided structured feedback, complementary qualitative insights from interviews or observational notes could enrich the interpretation of user experience with the AR tool. In any case, even without a qualitative survey, we did observed some interesting behaviors like, students taking the bicycle's size to a real scale to "get on it" and also to take a better look of all the pieces in the exploded view; during the phase of onboarding to the application, they were interested in understanding every functionality in the application, sharing some good opinions about the activity the were doing.

6 Conclusion and Perspectives

In this paper, an innovative AR aided design tool has been proposed and prototyped. This can overcome the absence of the physical product during IoT product design creativity workshop, and designers can interact intuitively with 3D virtual product using AR tool whereas it is not possible when using 2D picture. An experiment with 14 participants has been conducted to compare 2D and 3D methods.

This experimental study aimed to assess the feasibility and benefits of an AR-based application for supporting creativity and ideation in the context of IoT product design. By comparing it with a traditional method in a controlled setting involving undergraduate students, the study highlights several advantages of AR:

- Comparable or lower cognitive workload, especially in terms of complexity and time pressure.
- Almost equal usability perceptions, including ease of use, feature integration, and engagement.
- Rapid user adaptation, even in the presence of a slightly steeper learning curve.

These findings support the integration of Augmented Reality tools in early-stage product design processes, particularly within Design Thinking frameworks where ideation, creativity, and user experience are central.

Future work consists of technical development of the AR tool as well as scientific issues. Technically the aspect of networking can be a game changer allowing to creativity, design, and team work to get to the next level with coop sessions in which everybody can look, participate and shared his ideas with the other no matter where they are. Another interesting feature could be saving and loading projects that will allow the users to recover the last point of work easily and keep track of different versions and gain time in between.

In terms of scientifical issue it would focus on scaling the experiment with a larger and more diverse participant base, as well as on longitudinal studies to evaluate the impact of AR on idea quality and design outcomes. The latest experiences also showed a guideline to follow to avoid the influence of external agents within the design process.

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