From Print to AR: A Case Study of Fronius Inverter Installation using Augmented Reality

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Abstract

This paper presents the design and implementation of an AR quick start guide for installing a Fronius inverter. The AR application was created using Unity and Vuforia, and provides an interactive and immersive experience for users during the installation process. The application guides users through each step of the installation process, providing them with digital instructions, feedback, and multimedia resources in real-time. This paper describes the technical implementation of the AR application, as well as its potential impact on the installation process of Fronius inverters.

Index Terms: Human-centered computing—Human computer interaction (HCI)—interaction paradigms—Mixed / augmented reality;

1 Introduction

The installation process of a Fronius inverter can be a daunting task for many users, particularly those who are not familiar with the product. To improve the user experience and make the process more accessible and engaging, an Augmented Reality (AR) quick start guide was developed. The AR application provides users with a more interactive and immersive experience by guiding them through each step of the installation process, providing digital instructions, feedback, and multimedia resources in real-time. The AR application also demonstrates the potential of AR technology to enhance technical documentation and make it more accessible and enjoyable for users.

2 Technical Documentation and AR

Technical documentation must fulfill certain criteria, such as accuracy, completeness, and accessibility, to be effective. However, in today's digital age, technical documentation must also evolve to meet changing user expectations and keep pace with new technologies. Users now expect technical documentation to be more interactive, engaging, and accessible from multiple devices. For example, with the rise of smartphones, tablets, and other mobile devices, users want to access documentation anytime, anywhere. This requires technical documentation to be available in multiple formats, such as PDF, HTML, and e-books.

Augmented reality (AR) technology is one example of a new technology that can help technical documentation meet these evolving needs. By providing an even more interactive and immersive user experience, AR technology can help technical documentation be more engaging and accessible for users. AR technology overlays digital information onto the physical world, providing users with an enhanced view of their environment. This can help users visualize complex processes and procedures, making them easier to understand and follow. Another benefit of interactive documentation is that it can help ensure that users have read and understood important safety instructions or warnings.

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Figure 1: Start Screen

3 Implementation Overview

The AR application was built using Unity and Vuforia, which provided the necessary tools for building an AR experience. To display the 3D object on mobile devices, a significant amount of editing was necessary. Initially, the 3D model had over 50 million faces, making it difficult to run on standard computers. By transforming and reducing the model using Keyshot and Blender, it was possible to reduce the number of faces while still maintaining render quality. This enabled the user to display the Fronius inverter on the wall where the marker was placed.

3.1 Positioning and Distance Measuring

Figure 2: Minimum Distance Measuring

The next step in the installation process involved allowing the user to change the position of the inverter on the wall and check the distance between the inverter and other objects in the room. The inverter had to have a minimum distance from other objects, such as the wall or ceiling, which required checking. To facilitate this, the user could set a mark where another object was located. The application used a bounding box, a plane simulating the wall, and raycasts to draw a line, state the measured distance in text form, and visualize whether the distance was sufficient using the color of the line (see Fig. 2).

3.2 Mounting on the wall

Once the user had set the position of the inverter, it disappeared, leaving only the mounting bracket in place. The user was then provided with screen overlay illustrations and text to guide them through the process of mounting the bracket to the wall. After confirming the completion of the mounting step, the inverter was placed on the bracket with an animation following a specified path.

3.3 Installing the cables

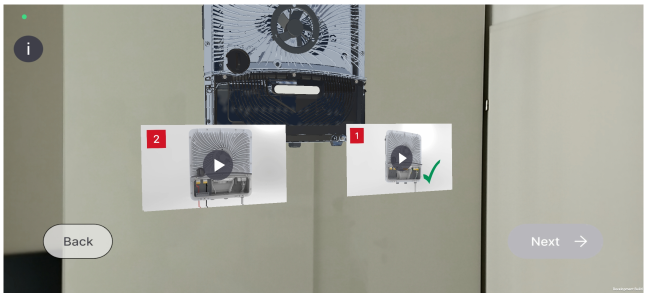

Figure 3: Including information with Multimedia

The final steps of the installation process involved providing users with multimedia resources to help them install the cables on the inverter (see Fig. 3). Two images were attached to the bottom of the inverter, allowing the user to access videos with detailed instructions on installing the cables. To achieve this, the AR application uses a raycast to detect when the user clicks on the image game object. Once the raycast hits the game object, it triggers a button that starts playing the instructional video (see Listing 1). Once the user had completed the cable installation process, they were guided through the final steps of the installation process with a screen overlay and a link to the app store to finish configuring the inverter in their network.

Listing 1: Raycast code

```
using UnityEngine;
using UnityEngine.EventSystems;
using UnityEngine.UI;
public class EnableVideoScript : MonoBehaviour
{
    public GameObject targetGameObject;
    public GameObject buttonGameObject;
    private void Update()
    {
        if (Input.touchCount > 0 && Input.GetTouch(0).
     phase == TouchPhase.Began)
        {
            CheckGameObjectClick(Input.GetTouch(0).
     position);
        }
        else if (Input.GetMouseButtonDown(0))
        {
            CheckGameObjectClick(Input.mousePosition);
        }
    }
    private void CheckGameObjectClick(Vector2
     screenPosition)
    {
        // Send a ray to the target (Image with Video-
     Thumbnail)
        Ray ray = Camera.main.ScreenPointToRay(
     screenPosition);
        if (Physics.Raycast(ray, out RaycastHit hit) &&
     hit.transform.gameObject == targetGameObject)
        {
            // Simulate the button click
            Button button = buttonGameObject.GetComponent
     <Button>();
            if (button != null)
            {
                button.onClick.Invoke();
            }
        }
    }
}
```

4 User Interface

To create a simple and visually appealing user interface, the AR application's interface was designed using Figma, a web-based design tool. A main criteria for the application was to match with Fronius's corporate design standards to ensure a consistent and seamless user experience across all Fronius products. The user interface design was optimized to be intuitive, user-friendly, and easy to use, making the installation process more accessible for all users.

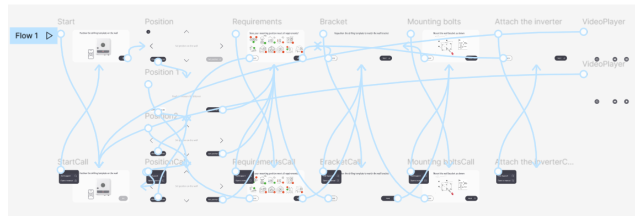

Figure 4: Figma Protoyp: Flow

Figma made it easy to mock up the interface and test it with clickdummy flows (see Fig. 4), which acted as a prototype for the application's interface. This approach facilitated the detection of any problems in the whole process before it was implemented in Unity, enabling early identification of any potential issues and ensuring a smooth implementation of the interface. The visual design of the interface elements was essential to enhance the user experience, providing clear and concise instructions to the user and guiding them through the installation process.

5 Outlook

The prototype project developed for the Fronius inverter installation is just the beginning of what is possible with augmented reality technology in technical documentation. In the future, computer vision technology could be integrated into AR applications to provide even more real-time feedback and guidance to users. For example, the AR application could use computer vision to check if the installation position meets all the minimum distances, and alert the user if it does not. Additionally, the AR application could provide users with even more detailed information and multimedia resources to help them with the installation process.

The possibilities for future applications of AR technology in technical documentation are endless and will likely revolutionize how we interact with all types of products and services.

6 Conclusion

The AR quick start guide for installing a Fronius inverter provides users with an interactive and engaging experience during the installation process. The AR application guides users through each step of the installation process, providing them with digital instructions, feedback, and multimedia resources in real-time. The implementation of the AR application required careful implementation and design to ensure functionality and a visually appealing user interface. The AR application also demonstrates the potential of AR technology to enhance technical documentation and make it more accessible and enjoyable for users. By providing users with a more user-friendly and intuitive installation process, Fronius can improve customer satisfaction and build a loyal customer base.