

# A multisensory (visual, auditory, and olfactory) and teaching application concerning the history and production process of coffee

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**Abstract**—This project presents a multisensory (visual, auditory, and olfactory) and innovative teaching application concerning the history and production process of a beverage that influences pleasures, habits, interactions with family and friends, and work: coffee. The users are immersed in a virtual reality farm from the 19<sup>th</sup> century to experience harvesting, roasting, and coffee preparation, and to learn historical facts. The setup uses an olfactory display that allows the coffee aroma to be part of the user’s experience. This multisensory experience is innovative and astonishing, and it brings users closer to the traditional coffee production process. This project has been presented at the Major Novaes Museum, in Cruzeiro, SP, and has been demonstrated to be a very interesting experience to the users. They feel like in reality.

**Index Terms**—Visual Sensing, Auditory Sensing, Olfactory Sensing, Multimodal Virtual Reality Interface

## I. INTRODUCTION

The environment developed transports the visitor to a traditional coffee farm in São Paulo state, Brazil, from the 19th century, where the user experiences the process of coffee production, from harvesting to the cup, in real-time.

The user is free to move around and interact with the 3D elements; users can, for example, view a coffee grinder from any angle. In addition to visual and auditory stimuli, which are part of most virtual reality applications, users also experience olfactory stimuli.

The coffee aroma is emitted when the user enters the kitchen where coffee beans are being roasted, grounded, and offered for tasting. Although the sense of smell is essential to humans, it is not commonly used in immersive virtual environments.

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Additional videos and audio describing each coffee production phase were distributed throughout the route, offering the tour an informative and pedagogical character.

## II. OBJECTIVE

This environment aims to assist and teach the history of the traditional production process of coffee, from the 19<sup>th</sup> century [1]. The main idea is to give to the user a real sense of reality inside a virtual interface, including coffee aroma and the other several variables involved in the process.

## III. MATERIALS AND METHODS

The project has started in 2020 with a historical study of the traditional coffee production process [1]. At the same time, we defined the 3D content, videos, sounds, and images. We also bought the electronic components used to build the olfactory display.

Next, we created the application and its content, including 3D objects and videos. We also started to create the aroma system, which can be seen in a video (<https://youtu.be/7wzERQGHaUM>). These components were integrated into the application using a microprocessor Raspberry Pi 3 [2].

The 3D farm was developed using the Unity Game engine. During development, we tested each element individually. Next, we performed an integration test.

Then, we created the display using elements that are associated with traditional coffee manufacturing (e.g., the cup, coffee grinder, and manual roaster) and a table with a tailored compartment to hold the olfactory displays.

The project website was also created, which can be seen at <https://www.aromadocafevirtual.com.br/>. Moreover, a backdrop was developed, including items such as banners, elements related to the coffee production process, and a table to support

the projection system and hide the electronic components of the olfactory display.

#### IV. CONCLUSIONS

The developed environment consists of an educational and multisensorial virtual reality experience concerning the coffee production process, including harvesting, drying, grinding, roasting, and preparation.

Coffee aroma is part of this innovative experience. Furthermore, videos and audios with historical facts are available in the environment. This project has already been exhibited at the Major Novaes' Historical and Pedagogical Museum (Cruzeiro, SP, Brazil) [3]. This is a historical city where part of the traditional coffee history took place in the past.

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