Multisensory Floral Clock: Biophilic Timekeeping with Mechanical Blooms and Scent

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Abstract*—Multisensory Floral Clock is a biophilic timepiece that replaces sudden digital cues with the slow opening of twelve laser-cut mechanical flowers, each releasing a distinct fragrance aligned with natural blooming rhythms. Controlled by an Arduino real-time-clock module and low-noise servo motors, the clock blends visual and olfactory channels to nudge users toward a calmer, more intuitive perception of time and foster a connection to nature's rhythms. By combining low-cost plywood, organza fabric and modular 3D printed scent cartridges, the design can be reproduced for under £80, making this nature-inspired well-being technology suitable for offices, classrooms, and care setting.

I. Introduction / Background

Modern timekeeping systems often prioritize precision over presence, and constant awareness of the exact time can increase stress in work or caregiving environments. In contrast, biophilic design, a design approach that intentionally integrates humans' innate connection to nature into the built environment [1], has demonstrated significant benefits for emotional well-being, stress reduction, and attention restoration [2,3]. Within this domain, flowers are especially effective [4,5], and floral scents have been shown to reduce stress, enhance restoration, and alleviate anxiety [8]. Yet few devices translate these benefits into everyday awareness of time. Historical precedents, from East Asian incense clocks [6-8] to contemporary olfactory prototypes such as Patrick Palcic's Scent Clock [9,10], suggest that multisensory timekeeping can offer a softer, more ambient alternative by incorporating sensory cues beyond the visual and auditory. However, the integration of biophilic principles into such approaches remains largely unexplored.

This paper introduces the Multisensory Floral Clock, inspired by Carl Linnaeus's 18th-century floral clock. The device combines visual and olfactory elements to create a calming and immersive timekeeping experience that supports well-being. Each hour is marked by a different mechanical flower that opens and releases a corresponding scent, mirroring the natural blooming patterns of real flowers. By engaging multiple senses, the design fosters a deeper connection to nature and offers more effective well-being enhancement than unisensory approaches. This project draws on the principles of biophilic design and multisensory timekeeping, harnessing the natural rhythms of real flowers to promote emotional health. A visual-only prototype of the Floral Clock has already been fabricated and exhibited; during the Summer School, we will upgrade it with modular scent cartridges, creating a fully multisensory yet manufacturable product that ensures distinct, hour-aligned fragrance release throughout the day.

II. Related Work

Historical scent-based timekeeping. Incense clocks in 16th-century China and Japan marked the passage of time through the controlled burning of fragrant cords or spirals, with each section corresponding to a specific time interval [6–8]. These devices used scent (often from sandalwood) to create a calm, ambient sense of temporal progression, long before the advent of mechanical clocks.

Commercial devices. Febreze Scentstories attempted automated fragrance rotation [11, 12], but suffered from "nose blindness" and lacked any natural temporal mapping, which may have contributed to its limited commercial success [13]. Ode released food aromas three times daily to encourage meals among dementia patients still living at home, demonstrating the behavioural potential of scent-based time cues [14].

Research prototypes. SensaBubble delivered visual projections on scented bubbles, coupling transient visual imagery with lingering olfactory trails [15]. Patrick Palcic's Scent Clock released twelve hourly aromas from a wall-mounted array, inviting users to perceive time olfactorily rather than numerically [9, 10].

None of these systems combine the visual calm of blossoming forms with hour-specific fragrances aligned to natural blooming rhythms, nor do they offer a low-cost, modular pathway to small-batch manufacture. The Multisensory Floral Clock addresses this gap by synchronising mechanical flower movements with refillable scent cartridges within a low-cost bill of materials.

III. Imagined or Existing Prototype Sketches/Drawings/Photos

A. Overview of Existing Prototype

The current prototype of the visual-only floral clock consists of twelve mechanical flowers that mimic natural blooming patterns to represent the twelve hours of the day. Each flower opens at a designated hour using a synchronized system of Arduino-controlled servo motors and DS3231 Real-Time Clock module. The prototype has already been fully fabricated and publicly exhibited at the Machine Art Event, NYU Shanghai, and West Bund Art & Design FutureLab.

Fig 1 & 2. Each flower is connected to a dedicated servo motor and programmed to open and close based on local time.

B. Mechanical Design and Components

Each flower is composed of two petal layers: the outer petals are laser-cut 3mm plywood for structure and support. The inner petals are handmade from hard organza fabric, selected for its flexibility and shape retention. Each flower has its own unique color and petal geometry, referencing real botanical species based on Linnaeus's original flower clock.

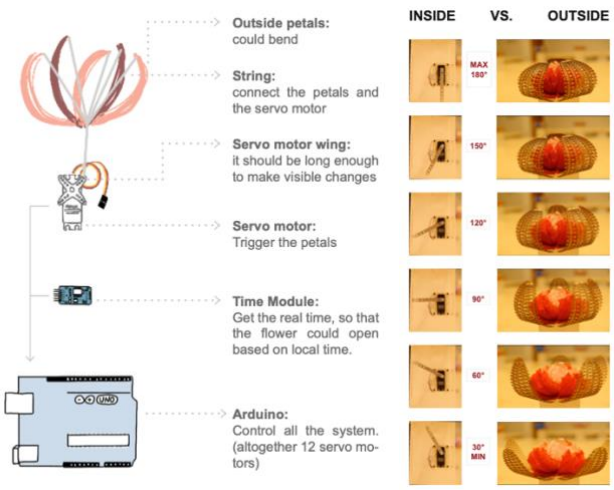

Fig 3. Sketch and picutres showing mechanical connections and how flower movement is triggered by servo rotation.

C. Electronics and Control

The prototype has two working modes, real-time mode (each flower opens/closes according to real-world hours), and performance mode (flowers animate dynamically in random sequences to demonstrate full blooming motion)

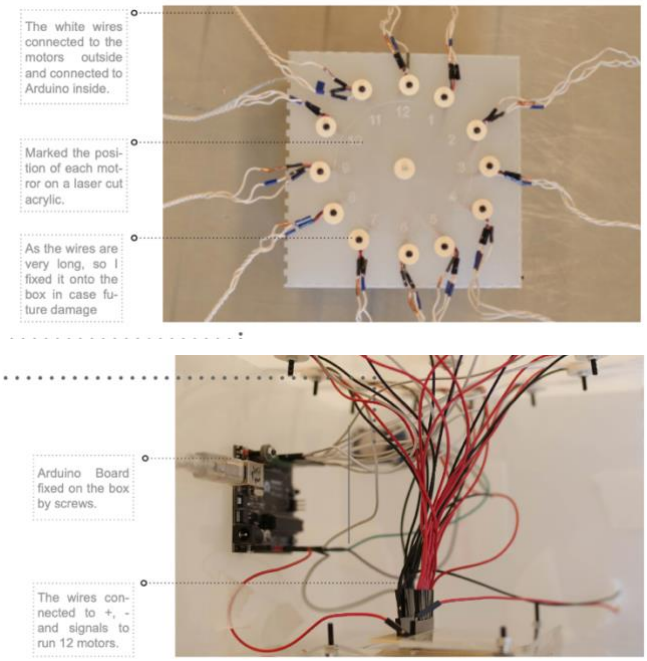

Fig 4 & 5. 12 motors are connected via long wires to an Arduino Uno mounted inside a custom electronics box.

D. Next steps in summer school

During the Pro^2 summer school, the project will be upgraded from a visual-only installation to a multisensory timekeeping device through the integration of modular scent cartridges. These cartridges will be mounted beneath each flower and controlled via additional Arduino-triggered components to release a unique fragrance for each hour. Each cartridge is designed to last at least two weeks under regular use, with a scent diffusion radius of approximately 0.5 meters. It would be ideal for small, personal indoor spaces such as desksides, bedside tables, or therapeutic environments. This extension will demonstrate not only a more immersive biophilic experience but also a low-cost, manufacturable framework for ambient scent and time interaction.

IV. RESPONSIBLE INNOVATION

The multisensory clock is designed with responsible innovation principles at its core. It aims to promote emotional well-being through biophilic, multisensory interaction, providing a calm alternative to conventional digital timekeeping. By reimagining how people experience time, the clock addresses rising concerns around workplace anxiety, sensory overload, and digital fatigue.

Environmentally, the clock is built using laser-cut plywood and organza fabric, both low-cost and readily available the modular scent cartridges are designed to be replaceable, enables ease of maintenance and long-term reuse.

In future iterations, we plan to evaluate the life cycle impact of scent materials and explore refillable scent delivery systems. The project also considers accessibility and inclusivity. Overall, the floral clock reflects a commitment to designing with empathy, sustainability and long-term societal value in mind.

V. Author Bio(s) / Experiences

Yang Gao is a researcher, interactive media artist, and designer currently pursuing a DPhil in Experimental Psychology at the University of Oxford, under the supervision of Professor Charles Spence, Asifa Majid, and Carlos Velasco. Her research explores how multisensory experience design, particularly through taste, smell, and touch, can enhance storytelling in film, VR, and interactive media. She holds an MArch in Design for Performance and Interaction from University College London and a BSc in Interactive Media Arts from NYU Shanghai, with a minor in Film and New Media. Her creative and academic work has been exhibited internationally in London, New York, Abu Dhabi, and Shanghai. Prior to her doctoral studies, she worked as a film director and UX designer for major television productions in China. She also has hands-on technical experience in laser cutting, 3D printing, circuit building, metal fabrication, Arduino programming, and 3D modeling. Yang is driven by a desire to explore how embodied, sensory-rich storytelling can reshape human perception of time, emotion, and interaction. The Multisensory Floral Clock continues this trajectory by merging poetic design with practical manufacture to create a scalable, biophilic alternative to conventional timekeeping, offering users a more grounded and restorative connection to the passing of time.

Professor Charles Spence is a prize-wining experimental psychologist who researches the factors that influence what we choose to eat and what we think about the experience with the likes of world-leading chefs. His focus in on applying the latest insights concerning the multisensory nature of perception to everyday life. He is the author of the 2014, Prose prize-winning "The perfect meal" with Betina Piqueras-Fiszman, the international bestseller "Gastrophysics: The new science of eating" (2017; Penguin Viking) – winner of the 2019 Le Grand Prix de la Culture Gastronomique from Académie Internationale de la Gastronomie, and Multisensory Packaging Design (2019; Palgrave MacMillan). His latest book 'Sensehacking" was published in 2021. He is a regular on TV and Radio, and has been profiled by The New Yorker (http://www.newyorker.com/magazine/2015/11/02/accounting-for-taste; see also Charles Spence – Sensploration (FoST 2016; https://vimeo.com/170509976).

Author Contribution(s)

Yang Gao: Conceptualization; Prototype Design; Hardware Fabrication; Electronics Implementation; Exhibition Preparation; Writing – original draft; Writing – review & editing.

Charles Spence: Conceptualization; Writing – original draft; Writing – review & editing.

Talks and Conferences Related to This Project:

Gao, Y. (2024, November). Multisensory Floral Clock: Enhanced Multisensory Timekeeping with Technological Design. 13th EAI International Conference: ArtsIT, Interactivity & Game Creation, New York University, Abu Dhabi, United Arab Emirates.
Gao, Y. (2024, April). Design considerations for a multisensory floral scent clock. Olfactory Cultural Studies Workshop, Copenhagen, Denmark.
Gao, Y. (2024, February). Flower clock: From digital to physical. Somerville MCR Symposium, Oxford, United Kingdom.

Other Publication:

Gao, Y., & Spence, C. (2025) Enhancing multisensory immersive experiences in virtual reality with touch and haptic feedback. Virtual Worlds.
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VII. Refernces

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