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Prototyping An Interactive Ambient Plant for Meditation

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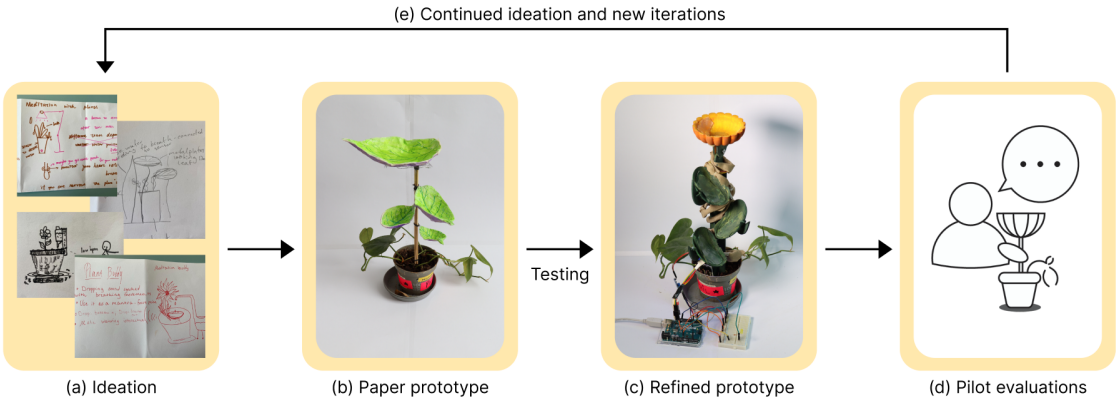

Figure 1: The ZenStem development process.

ABSTRACT

This paper introduces the ZenStem, an interactive prototype that facilitates meditation by visually guiding a user's breathing pattern. The ZenStem links users' breathing and heart rate to the irrigation of an indoor plant, as it will water the plant so long as the user can maintain a meditative state. Upon feedback from a pulse-sensing armband that the user's heart rate has risen, it will initialize its light-based breathing guide to help the user re-enter their meditative state. We describe the ideation and prototyping process of the ZenStem, followed by the initial impressions gained from pilot evaluations with potential users. Based on impressions pertaining to the appearance and functionality of the ZenStem, we end by proposing future research directions and design suggestions.

CCS CONCEPTS

• **Human-centered computing** → **Interaction design**.

KEYWORDS

Prototyping, Interactive Plant, Meditation Aid, Breathing Guide

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1 OVERVIEW

Neuroscientific research has associated mindfulness and meditation with mental and physiological benefits, such as better mental health, decreased feelings of loneliness, and improved social relationships [5]. Researchers have already studied various technologies to enhance meditation practices [2][4][6][8][10]. Moreover, other studies have compared plant exposure to meditation [1][9] demonstrating how exposure to indoor plants and guided meditation can both reduce task-induced cognitive fatigue and stress levels. These motivations, together with existing technological approaches have inspired the concept introduced in this paper: the ZenStem, an interactive prototype that facilitates meditation via plant care.

Connecting the irrigation needs of a plant to a meditation session, the proposed prototype (ZenStem) provides a light-based visual breathing guide that facilitates breathing meditation and thereby waters a plant based on how well a user can maintain their meditative state. Its pulsating lights provide users with a rhythm to adjust their breathing. Therefore, in this paper we contribute to the research community the following: (1) The design of a tangible prototype that supports an individual's health and well-being, thus proposing a novel interface that combines real plants with technology and mindfulness. (2) Initial impressions via a pilot user evaluation of the prototype, with suggestions for future research.

2 ZENSTEM PROTOTYPE

The idea of the ZenStem prototype is to promote interaction between humans and plants by turning the plant into a meditation companion. ZenStem provides a light-based breathing guide that doubles as an irrigation system, watering a plant based on how well a user can keep their pulse below a certain threshold while meditating. This is measured with a pulse-sensing armband, which is connected to a water release mechanism on the ZenStem that slowly waters the plant, unless the user's pulse rises past the threshold. The watering takes place drop-by-drop, so as not to overwater the plant. This causes lights on the device to pulsate to calmly guide the user's breathing so that they may lower their pulse and resume meditation, which would also resume the watering of the plant. The user can thereby meditate and care for their plant while their plant provides an incentive for them to calm down and supports their breathing if necessary. We took a rapid prototyping approach [3] to realize our design within an appropriate time frame. Due to the complexity of our desired functions, we focused on visualizing individual components rather than enabling full functionality. This section will describe the prototyping process in more detail.

Phase 1: Initial ideation In this phase, we brainstormed using the Crazy 8 method [7], sketched, and discussed different ways of promoting increased interaction between humans and plants (Figure 1a). After a few rounds of brainstorming, a main concept emerged: A light-based breathing guide that promotes calm by regulating meditation states via plant care (i.e., irrigation). Structurally, our idea consisted of a stem-like base with a flower-shaped water container at the top and leaf-shaped platforms from which the water would flow down. The water would be released slowly while the user maintains a calm, meditative state. The interaction between the device and the user would take place via the device's pulsating lights that guide breathing and the user's response by regulating their breathing and heart rate, which is passed to the device as feedback.

Phase 2: Mock-up Our first mock-up consisted of chicken-wire, tape, paper, wooden sticks, elastic bands, and aluminium foil (Figure 1b). We constructed the base stem using wooden sticks and elastic bands. Mock-ups of the leaf platforms and the water container were made using molded chicken-wire covered in aluminum foil and paper to create a smooth outside layer. This constituted a tangible mock-up to discuss considerations such as what mechanical parts would be necessary to highlight its functions, and what materials could be feasible to achieve these additions. It also provided the basis for the final overall shape and structure of our prototype, aiming for a plant-like appearance to blend in with a real plant.

Phase 3: Refined Mock-up In this step, we sought to make the prototype more robust and look closer to a usable artefact (Figure 1c). We used more robust materials like laser-cut MDF boards, 3D printed parts, and some electronic components. We made a base stem with a stand and 'branches' out of MDF board, and 3D printed open-source models for the water container at the top and the leaf platforms. The water container was attached to the stem using a hinge to tilt the container to simulate water pouring out of it, which we substituted with colored sand. For the light-based breathing guide, we used an Arduino board to program a pulsing pattern into LED lights that were attached under the leaves.

3 IMPRESSIONS AND DISCUSSION

We conducted pilot evaluation interviews with five university students who have experience in meditation. This was done after creating the refined prototype (Figure 1d). Of our mixed batch of bachelor's, master's and PhD student participants (P1-P5), three were female, with an age range of 22-33 years. All signed a form consenting to their anonymized data being used. The interviews were conducted using open-ended questions we designed to gather impressions on the four aspects of the prototype described below. The participants described varying meditation practices in terms of routine and technology used. All participants reported that they prefer meditating alone in their homes, under low light conditions.

Look and feel: Our prototype was praised for its attempt to blend in with a plant via its flower shaped container and leaf platforms, which participants thought would support a meditative ambience. However, it was also noted that our leaves looked too jagged, as a participant associated a meditation aiding device with softer shapes. Overall, the prototype appearance was less remarked on than its functionality, suggesting that impressions of appearance depend on individual mental models of meditation practice.

Pulse-triggered watering: The pulse bracelet-modulated watering system was not well-received. Some participants expressed that they prefer not wearing accessories while meditating. On irrigation, participants found that the sudden cessation and resumption of watering due to fluctuating heart rate may be distracting, due to a conscious dependence of plant on user. A participant found that this might make meditation into a performative act.

Lights guiding breathing: Opinions on the light-based breathing guide were conflicting. One participant said she would use the lights as her main breathing rhythm indicator, while another said that the rhythm of the lights may be confusing and distracting. Pulsating lights for breathing guidance in ZenStem should therefore be considered a customizable option rather than a standard feature.

Plant care as an incentive to meditate: Overall, participants found that a reminder to water their plant is a good incentive and reminder to meditate, as well as a way to establish and maintain a meditation routine. The only concerns pertaining to this were regarding over-watering and the amount of water that is deposited into the plant during a meditation session. This was noted as participants could not picture the slow speed at which small amounts of water would be released during meditation.

4 CONCLUSION

This paper introduced the ZenStem, our concept and prototype for an interactive light-based breathing guide that harnesses plant care as an incentive to meditate. Future work should entail a re-evaluation of the appearance of the prototype, as well as live testing of a functional prototype to assess (1) how it is used both by novice and veteran meditation users and (2) how the pulsating breathing guide lights and pulse-triggered watering are received in a real meditation context. It may be of interest to isolate these functions to independently test their reception. It is necessary to establish what amount of watering would support plant health and still allow for multiple meditation sessions within a short amount of time. As some plants require watering only once a month, the restriction of ZenStem use to only certain plant types must also be considered.

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REFERENCES

[1] Preyen Archary and Andrew Thatcher. 2022. Affective and cognitive restoration: comparing the restorative role of indoor plants and guided meditation. *Ergonomics* 65, 7 (2022), 933–942. https://doi.org/10.1080/00140139.2021.2003873

[2] Karen Cochrane, Lian Loke, Matthew Leete, Andrew Campbell, and Naseem Ahmadpour. 2021. Understanding the First Person Experience of Walking Mindfulness Meditation Facilitated by EEG Modulated Interactive Soundscape. https://doi.org/10.1145/3430524.3440637

[3] Julia Deneke, Darren Lehane, Kandler Alexandra, Tom Menchini, Mikael Laaksoharju, and Mohammad Obaid. 2017. Using Rapid Prototyping to Explore Design Implications for a Pill-Dispensing Social Agent. (10 2017), 53–59. https://doi.org/10.1145/3125739.3125754

[4] Alice C. Haynes, Annie Lywood, Emily M. Crowe, Jessica L. Fielding, Jonathan M. Rossiter, and Christopher Kent. 2022. A calming hug: Design and validation of a tactile aid to ease anxiety. *PLOS ONE* 17, 3 (03 2022), 1–26. https://doi.org/10.1371/journal.pone.0259838

[5] Aneeque Jamil, Sai Dheeraj Gutlapalli, Marya Ali, Mrinal J P Oble, Shamsun Nahar Sonia, Sherie George, Srushti R Shahi, Zahra Ali, Abdelrahman Abaza, and Lubna Mohammed. 2023. Meditation and its mental and physical health benefits in 2023. *Cureus* 15, 6 (June 2023), e40650. https://doi.org/10.7759/cureus.40650

[6] Yihang Jiang, Will Wang, Tim Scargill, Max Rothman, Jessilyn Dunn, and Maria Gorlatova. 2022. Digital biomarkers reflect stress reduction after augmented reality guided meditation: a feasibility study. In *Proceedings of the 2022 Workshop on Emerging Devices for Digital Biomarkers* (Portland, Oregon) *(DigiBiom '22)*. Association for Computing Machinery, New York, NY, USA, 29–34. https://doi.org/10.1145/3539494.3542754

[7] Martin Maguire. 2022. A Framework for User-Requirements Analysis and Development of Creative Design Concepts. In *HCI International 2022 - Late Breaking Papers. Design, User Experience and Interaction*, Masaaki Kurosu, Sakae Yamamoto, Hirohiko Mori, Marcelo M. Soares, Elizabeth Rosenzweig, Aaron Marcus, Pei-Luen Patrick Rau, Don Harris, and Wen-Chin Li (Eds.). Springer International Publishing, Cham, 97–113.

[8] Alison O'Daffer, Susannah F Colt, Akash R Wasil, and Nancy Lau. 2022. Efficacy and Conflicts of Interest in Randomized Controlled Trials Evaluating Headspace and Calm Apps: Systematic Review. *JMIR Ment Health* 9, 9 (20 Sep 2022), e40924. https://doi.org/10.2196/40924

[9] Sathishkumar S. and Beela G.K. 2023. Plant Meditation as Part of Horticultural Therapy Reduces Stress Levels in Adults. Volume 12 (03 2023), 195–199. https://doi.org/10.21275/SR23303143022

[10] Kavous Salehzadeh Niksirat, Chaklam Silpasuwanchai, Mahmoud Hussien, Peng Cheng, and Xiangshi Ren. 2017. A Framework for Interactive Mindfulness Meditation Using Attention-Regulation Process. https://doi.org/10.1145/3025453.3025914