DrawPetal: A Multisensory Flower Interface for Embodied Creativity and Emotional Expression

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Abstract—DrawPetal is a soft, flower-shaped interactive prototype designed to support embodied creativity through multisensory feedback. Users interact by drawing or pressing on its petals, triggering light, sound, and haptic responses that reflect the motion, rhythm, and pressure of their gestures. Rather than focusing on visual accuracy or screen-based drawing, DrawPetal emphasises embodied creativity, encouraging users to explore emotion, rhythm, and self-expression through physical gestures. The prototype blends capacitive and pressure-based sensing with soft electronics to create a reflective space for both children and adults, supporting emotional well-being, mindfulness, and playful exploration. Inspired by principles of calm technology and embodied interaction, DrawPetal offers a poetic and playful canvas for emotional self-expression, reflection, and well-being. This paper outlines the concept, design motivations, and future development plans, situating DrawPetal within the fields of creative technology, education, and sensory interaction design.

I. INTRODUCTION

In a world increasingly shaped by screens and abstract interfaces, there is a growing need for technologies that foster physical, creative, and emotional engagement. DrawPetal was developed as a response to this need - a soft, flower-shaped interactive surface that allows users to express themselves by drawing or pressing with their hands. As they interact, DrawPetal responds with calming light animations, natural soundscapes, and gentle haptic feedback, transforming tactile gestures into a multisensory experience.

This work builds upon the foundations of embodied interaction [1], multisensory learning [2], and calm technology [3]. It proposes that creativity does not need to be visual or screen-based alone, it can also emerge through the user's physical interaction, such as hand movement, pressure, rhythm, and touch. By translating these gestures into light, sound, and haptic feedback, DrawPetal creates a space for emotional reflection, sensory exploration, and mindful play. The project also responds to the growing interest in soft, inclusive technologies that are approachable for children, neurodiverse users, and anyone seeking gentle, low-pressure creative tools

II. RELATED WORK

DrawPetal builds on a rich body of literature in embodied interaction, emotional expression, and multisensory creativity. The foundational theory of embodied interaction

proposed by Dourish [1] suggests that we create meaning not just through abstract reasoning, but through physical action and engagement with the world. This idea is expanded in Gallagher's work on the body's role in shaping the mind [2], where cognition and emotion are inseparable from physical experience. By allowing users to engage in tactile drawing gestures and receive sensory feedback, DrawPetal makes space for meaning making through movement.

Participatory sense-making, as described by De Jaegher and Di Paolo [3], further positions interaction as a co-created process between user and system. In DrawPetal, the soft materiality and responsive multisensory output invite this kind of reciprocal meaning-making, turning the flower into an emotionally intelligent partner in expression.

In parallel, studies on multisensory learning show how combining sound, touch, and light enhances attention, memory, and emotional connection, especially for children and neurodiverse users [4][5]. DrawPetal's sensor-rich, hands-on design aligns with this, offering an accessible, expressive alternative to conventional creative tools.

DrawPetal also follows the philosophy of calm technology [6], where systems are designed to "inform without demanding attention." The device does not seek to instruct or entertain, but instead gently supports self-expression through light and tone. Affective interaction research [7] has shown that such systems, when emotionally responsive, can deepen reflection and foster connection. Sengers et al. propose the framework of reflective design [8], where interaction invites users to become aware of their own internal states. DrawPetal embodies this idea, functioning as a canvas for emotional introspection.

In the realm of therapeutic and educational tools, tactile and expressive technologies have shown promise in improving mental health and engagement [9][10]. Approaches like Montessori education [11] emphasise hands-on, sensory-rich learning, which DrawPetal aligns with. Devices like Wakayima [12] and Huggy Bear [13] have demonstrated the feasibility and value of embedding soft, expressive interfaces into child-facing tools. DrawPetal extends this line of work by offering an emotionally responsive, screen-free platform for embodied creativity and reflection, bridging learning, art, and affect.

III. IMAGINED PROTOTYPE DESIGN

A. Prototype Overview and Interaction Design

DrawPetal is a flower-shaped, soft interactive device that supports embodied creativity through multisensory feedback. Inspired by natural forms and emotional expression, the device is designed to invite playful and reflective engagement through physical gestures. The structure consists of a round central drawing surface surrounded by six plush fabric petals. This configuration offers a soft, cushion-like form that feels comforting to hold and encourages tactile interaction from children and adults alike.

Users engage with DrawPetal by drawing, tapping, or pressing on the central surface or the petals. The system responds in real time with coordinated light, sound, and haptic feedback, allowing users to express themselves rhythmically and emotionally. For instance, a slow swirl gesture triggers ambient wind sounds and a gradual bloom of light across the petals; tapping generates spark-like pulses and a twinkling chime; a firm press activates a deep hum and full-petal glow. The experience is less about drawing pictures and more about "drawing with feeling", using motion and touch as tools for emotional storytelling.

The interaction flow is illustrated below using a comic-strip storyboard that maps common gestures to their multisensory responses:
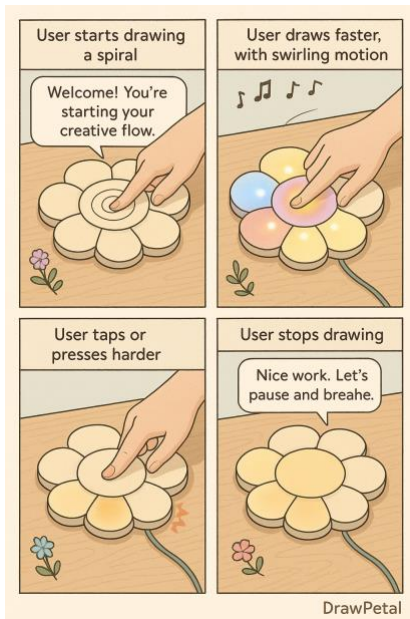

Fig 1: Comic strip storyboard of DrawPetal (Generated by ChatGPT)

DrawPetal can be used as a tool for creative exploration, mindfulness, or emotional reflection in a variety of contexts from educational workshops to therapeutic environments. Its soft form, intuitive feedback, and calming aesthetic make it particularly suitable for neurodiverse children and individuals seeking low-barrier, expressive technologies.

B. Technical Implementation and Fabrication

The prototype uses an Arduino Nano microcontroller to coordinate inputs and outputs. The capacitive touch pad is embedded under the central drawing area, allowing the user's finger gestures to be captured through the fabric. Capacitive touch sensing or force-sensitive resistors (FSRs)

are embedded to detect gesture dynamics such as position, pressure, and rhythm. A NeoPixel LED ring surrounds the central area, enabling colorful lighting effects in response to user input. Audio feedback is powered by a DFPlayer Mini module connected to a small speaker, which plays ambient nature sounds stored on a microSD card. A vibration motor provides gentle haptic feedback to reinforce emotional connection.

The electronics are housed in the lower portion of the flower or inside a central padded pocket. The wiring is routed discreetly through channels in the foam or stitched fabric. Materials include laser-cut felt or EVA foam for the petals, a soft mesh or fabric overlay for the touch surface, and stuffing for volume and comfort.

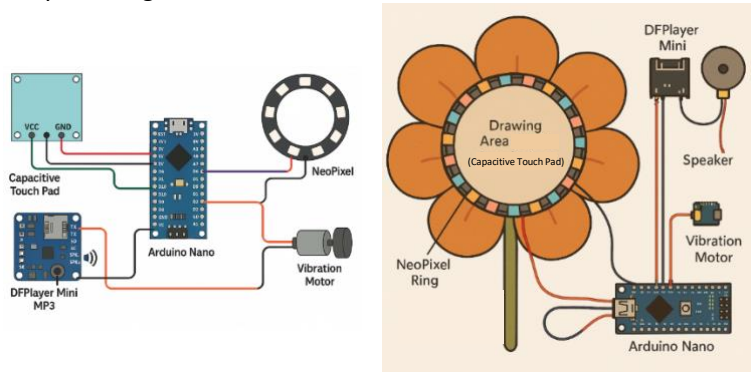Below is the current wiring diagram showing component layout using an Arduino Nano board:

Fig 2: DrawPetal wiring diagram with Arduino (ChatGPT generated)

Future iterations may include washable textile sensors, Bluetooth connectivity, and modular components for easier assembly and repair. For classroom deployment, a simplified version using a BBC micro:bit can be developed, leveraging its built-in accelerometer and easy programming interface.
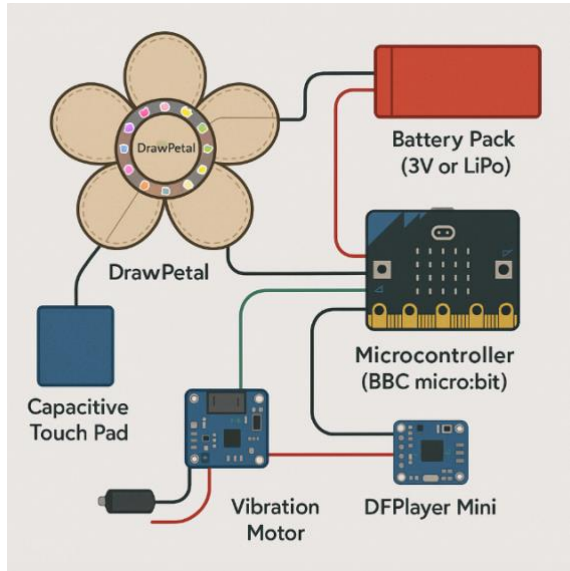

Fig 3: Draw Petal wiring diagram with Microbit (Generated by ChatGPT)

IV. RESPONSIBLE INNOVATION

DrawPetal is designed with an intentional focus on responsible innovation, particularly in terms of emotional well-being, accessibility, and sustainability.

From a societal perspective, the prototype addresses the growing need for gentle, non-verbal modes of creative expression, especially for children, neurodiverse users, and individuals experiencing anxiety or emotional overwhelm. By prioritising soft interaction and reflective engagement, DrawPetal moves away from screen-based technologies and toward slower, more embodied ways of connecting with oneself and the world.

The design also reflects an ethical commitment to low-barrier, inclusive interaction. Its form is intuitive and welcomes users of varied ages, abilities, and cultural backgrounds. The prototype can be used independently or with a facilitator (e.g., teacher, therapist), and its feedback mechanisms are designed to be non-intrusive, calming, and emotionally intelligent.

In terms of environmental sustainability, the current prototype favours low-power components (e.g., LEDs, DFPlayer Mini, vibration motors) and aims for a long lifespan through modular, repairable construction. Future iterations could further reduce environmental impact through:

- Recyclable or biodegradable materials for enclosures (e.g., felt from recycled fibers, compostable foam)

- Washable textile sensors to enable reuse

- A focus on repairability, with easy access to internal modules

DrawPetal also encourages slower tech practices, users are not "gamified" or nudged toward performance, but rather supported in slowing down, reflecting, and expressing. This aligns with values from calm design and humane technology.

As the project evolves, participatory design with target users, especially children and neurodiverse individuals will be central to ensuring that the system continues to support well-being in ways that are empathic, respectful, and meaningful.

In addition to its emotional and ecological goals, DrawPetal is designed to be cost-effective and easily replicable. It uses widely available, low-cost microcontrollers (such as Arduino Nano or BBC micro:bit), basic electronics (like NeoPixels, DFPlayer Mini), and affordable craft materials (felt, foam, thread), making it accessible for schools, community makerspaces, and grassroots therapy settings. The overall system can be built for under £30–£40, depending on components used. This affordability opens up opportunities for wider access, local repair, and customisation by children, educators, or parents in diverse contexts.

V. AUTHOR BIO(S) / EXPERIENCES

I am a PhD student in Human-Robot Interaction at Lancaster University, with a focus on explainability, child-robot interaction, and multimodal interaction. My academic journey began with a BSc in Physics in India, followed by a MSc in Robotics in the UK. I bring an interdisciplinary approach to my work, drawing on experience in education, interaction design, science and technology, and public engagement.

The motivation for DrawPetal stems from my interest in creating technologies that support emotional well-being, embodied learning, and expressive interaction, especially for children. As a classical dancer and poet, I am deeply inspired by non-verbal modes of communication. I believe in designing technology that speaks through movement, rhythm, and sensory feedback.

You can learn more about my work at LinkedIn and Google Scholar.

VII. REFERENCES FOR FORMATTING INSTRUCTIONS

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