

ChromoFiber: A Reprogrammable Multi-Color Fiber Based on Photochromic Dyes and Embedded LEDs

ANONYMOUS AUTHOR(S)

We present ChromoFiber, a reprogrammable multi-color fiber that can change its color locally in individual color segments. While prior work used external projectors to initiate the color change, ChromoFiber embeds UV and addressable RGB-LEDs inside the fiber, which enables color-changing capability on interactive wearable garments. ChromoFiber consists of a flexible PCB core embedded inside a silicone fiber that is coated with a color-changing photochromic silicone cladding. We use a reflective layer to diffuse the point light from the LEDs to more evenly saturate the photochromic dye along the fiber. The ChromoFiber design tool allows users to reprogram the pattern to be shown on a garment with integrated ChromoFibers. We present a technical evaluation on the color-changing properties of ChromoFiber which shows that a fiber can change color within 9.5 minutes. We demonstrate the usefulness of ChromoFiber with application scenarios on wearable passive data visualization and customizable clothing.

CCS Concepts: • **Human-centered computing** → **Human computer interaction (HCI)**.

Additional Key Words and Phrases: e-textiles; programmable textures; photochromic dyes.

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To address this issue, we developed ChromoFiber, a fiber that uses integrated LEDs as the light source to program the color of the photochromic dye. We accomplish this by manufacturing a flexible PCB as the fiber core that holds

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CCS Concepts: • **Human-centered computing** → **Human computer interaction (HCI)**.

Additional Key Words and Phrases: e-textiles; programmable textures; photochromic dyes.

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To address this issue, we developed ChromoFiber, a fiber that uses integrated LEDs as the light source to program the color of the photochromic dye. We accomplish this by manufacturing a flexible PCB as the fiber core that holds

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ChromoFiber: A Reprogrammable Multi-Color Fiber Based on Photochromic Dyes and Embedded LEDs

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We present ChromoFiber, a reprogrammable multi-color fiber that can change its color locally in individual color segments. While prior work used external projectors to initiate the color change, ChromoFiber embeds UV and addressable RGB-LEDs inside the fiber, which enables color-changing capability on interactive wearable garments. ChromoFiber consists of a flexible PCB core embedded inside a silicone fiber that is coated with a color-changing photochromic silicone cladding. We use a reflective layer to diffuse the point light from the LEDs to more evenly saturate the photochromic dye along the fiber. The ChromoFiber design tool allows users to reprogram the pattern to be shown on a garment with integrated ChromoFibers. We present a technical evaluation on the color-changing properties of ChromoFiber which shows that a fiber can change color within 9.5 minutes. We demonstrate the usefulness of ChromoFiber with application scenarios on wearable passive data visualization and customizable clothing.

CCS Concepts: • **Human-centered computing** → **Human computer interaction (HCI)**.

Additional Key Words and Phrases: e-textiles; programmable textures; photochromic dyes.

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1 INTRODUCTION

Being able to change the color of a physical object as easily as a digital model is an important part of the vision of a dynamic physical world (The Perfect Red [17]). Recent work on reprogramming the appearance of physical objects demonstrated the new opportunities for reprogramming the appearance of phone cases, cars, and shoes [19], or as a passive display, such as a mug that displays the user’s daily schedule [44]. One important application domain for reprogrammable color are textiles that can change their appearance based on user’s daily needs (Shimmering Flower [3]).

Researchers have developed different methods to reprogram colors, such as using electrochromic [18] and thermochromic [21] dyes. While these approaches only enable the transition between two colors, Photo-Chromeleon [19] proposed a method to achieve a large color gamut using photochromic dyes. By spraying a mixture of cyan, magenta, and yellow photochromic dyes on the object and using light patterns of specific wavelengths to saturate/desaturate individual color channels, researchers have shown that they can achieve high-resolution multi-color textures.

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