Color Singer: Composing Music via the Construction of LEGO Blocks with Various Colors

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ABSTRACT

Explore the fusion of creativity, play, and music with our project, where LEGO blocks transform abstract music composition into a tangible, intuitive experience. Each color in the LEGO palette corresponds to a distinct musical note, offering the freedom to purposefully replicate sheet music or casually build, unveiling serendipitous musical surprises. We present Color Singer—a system crafted and programmed with LEGO Mindstorms, open-sourced for accessibility. Our video showcase not only explains the implementation of Color Singer but also features a charming LEGO stop-motion animation narrating the heartwarming story of the Color Singer saving love. Join us in this innovative journey, where the tangible world of LEGO meets the abstract realm of music composition.

CCS CONCEPTS

• **Human-centered computing** → **Interactive systems and tools**.

KEYWORDS

LEGO, Music Composition, DIY, Synaesthesia

1 INTRODUCTION

Creating music can be abstract and demand specific knowledge, prompting the development of tools to facilitate composition in previous research [4, 5]. In contrast, playing with LEGO blocks offers a tangible and intuitive experience [2]. Exploring the intersection of creativity, play, and music, this project delves into the abstract realm of music composition through tangible means—LEGO blocks. The concept involves translating LEGO builds into a musical language, where different colors represent distinct musical notes. Whether purposefully reproducing sheet music with LEGO blocks or casually creating structures, the outcome is a surprising and serendipitous musical experience. Beyond the LEGO-centric approach, another music composition method is introduced—drawing. This multifaceted system is aptly named Color Singer.

2 THE COLOR SINGER

The Color Singer is both constructed and programmed using LEGO Mindstorms, a programmable toy widely utilized in education [1, 3]. Furthermore, the entire Color Singer project is open-sourced, enhancing accessibility for a broader audience. Resources can be accessed in the supplementary material or on Github.

The physical platform of the Color Singer resembles a CNC platform. Its core components include two NXT Controllers, four stop (touch) sensors, one light (brightness) sensor, and two motors. We conducted tests on the light sensors of LEGO blocks in various colors and selected eight colors distributed evenly across reading ranges. These colors symbolize musical notes, ranging from rest, do to ti. Alternatively, drawn color blocks with corresponding brightness can represent notes. Music can be created through assembling LEGO blocks or by painting, ensuring color brightness aligns with desired sensor readings. Once the block music is prepared, place it in the Color Singer, activate the NXT controllers, and the sensor will follow an S path. The Singer plays a quarter note for each block the sensor reads. Even with limited music knowledge, casually building or drawing something can be a delightful experience. Give it a try, and you might be pleasantly surprised by the music created.

To assist anyone interested in the painting approach, please consult Table 1 for the approximate CMYK codes of the LEGO blocks we utilize. However, it's worth emphasizing that the light sensor reads brightness. When it comes to painting, you have the flexibility to select various colors for a given musical note, as long as the brightness reading remains within the specified range.
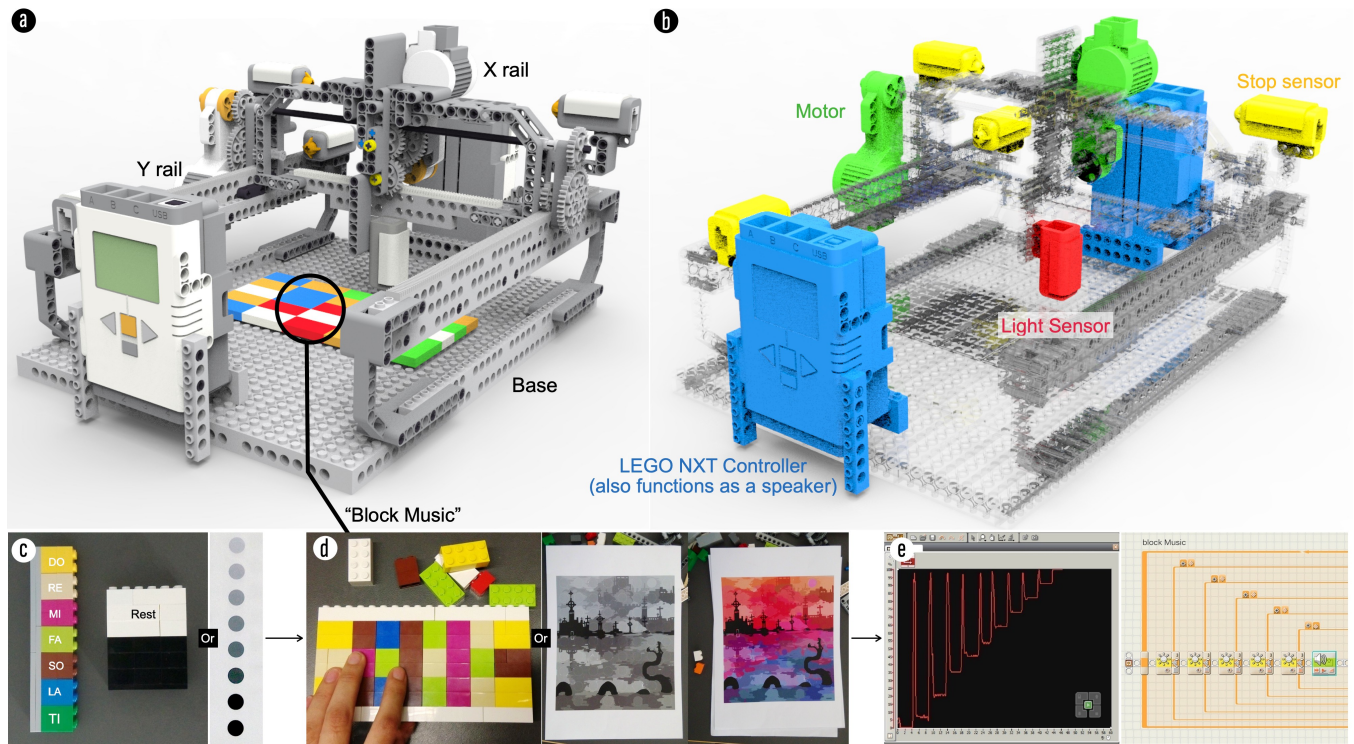
3 THE VIDEO SHOWCASE

The video showcase not only elucidates the implementation of Color Singer but also features a captivating LEGO stop-motion animation, narrating an endearing tale of the Color Singer saving love. Through

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Figure 1: a) Overview of the Color Singer. It is constructed and programmed using LEGO Mindstorms. b) Core components: Two LEGO NXT controllers, four stop (touch) sensors, one light (brightness) sensor, two motors. c) We utilize the light sensor to test LEGO blocks of various colors. After testing, we select 8 colors approximately evenly distributed across the reading ranges. These colors represent musical notes, spanning from rest, do to ti. Alternatively, one can use drawn color blocks with corresponding brightness to represent notes. d) Music can be built using LEGO blocks, termed "Block Music," or painted with different colors, ensuring the brightness matches the desired sensor readings. e) Once the block music is ready, place it in the Color Singer, activate the NXT controllers, and the sensor will move in an S path. The Singer will play a quarter note for each block the sensor reads. Here we provide an example of sensor reading results and the program for converting brightness to notes. And it can be a lot of fun to casually build or draw something even if you have limited knowledge of music. Just give it a try, and you might be pleasantly surprised by the music.

this innovative and playful approach to music creation, we invite individuals, regardless of their musical expertise, to embark on a journey where the tangible world of LEGO converges with the abstract realm of music composition.

Table 1: Block Colors and Corresponding Sensor Readings

LEGO	Musical Note	Approx. CMYK	Senser Reading
White	rest	0%, 0%, 0%, 0%	97-100
Yellow	do	0%, 13%, 69%, 8%	91-96
Beige	re	0%, 5%, 18%, 16%	78-90
Magenta	mi	0%, 59%, 28%, 22%	65-77
Light Green	fa	8%, 0%, 54%, 22%	45-64
Brown	so	0%, 26%, 35%, 47%	25-44
Blue	ra	76%, 27%, 0%, 24%	10-24
Green	ti	60%, 0%, 30%, 40%	0-10

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