

RGBRIX: THE LEGO® COLOUR SORTER

OPPORTUNITY

Automatically sort LEGO by color to improve the sorting experience of ToroLUG members

OBJECTIVES

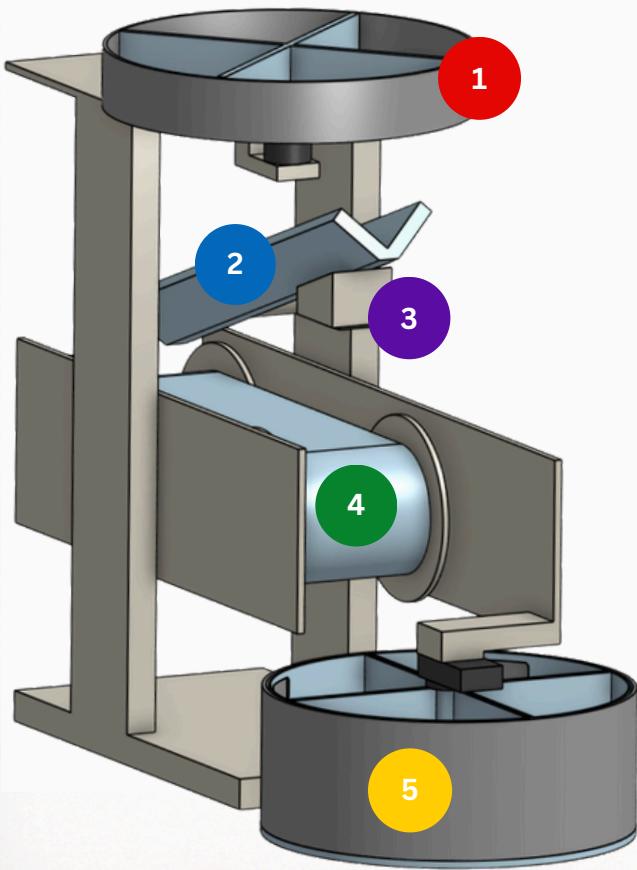
- Accurate colour sorting
- Time-efficient sorting
- Sustainable design
- Removable compartments

DESIGN HIGHLIGHTS

- Sorts by colour due to stakeholder preference
- Stacked layout for **compactness**
- $\leq 5\%$ jamming rate ensures time-efficiency and fewer malfunctions
- Sorts with an accuracy of **80%**

DESIGN OUTCOMES

The RGBRIX takes an initially unsorted batch of 2x4 LEGO pieces and sorts them into 4 categories: red, green, blue, and a miscellaneous compartment for other colours.



1 Carousel

Stepper Motor controlled rotating cross drops individual pieces through slot.

2 Ramp

Guides pieces down, orienting them correctly for scanning.

3 Colour Sensor

The TCS34725 reliably detects colour in varied lighting.

4 Conveyor Belt

360 Servo-automated conveyor belt moves a single filed line of LEGO under sensor.

5 Collection Plate

A 360 servo-driven plate rotates to align the correct compartment for pieces to fall into.

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TEAM VALUES & DFXs

- Responsibility and Design for User Experience & Safety:** Regarding community's preferences, our design implements a pause button if they choose to sort differently, and components have rounded edges for safety.
- Sustainability and Design for Sustainability:** Our prototype is created using scrap wood and reusable containers, maximizing sustainability.
- Efficiency and Design for Reliability:** Several iterations of research and proxy testing were conducted to ensure the design meets the sorting accuracy requirements.

DESIGN JUSTIFICATIONS

- LEGO Restrictions:** ToroLUG members have pre-existing sorting processes, so the inputted bricks will have similar dimensions (e.g. 2x4 bricks) to prevent malfunctions and jamming.
- Size and Volume Decisions:** ToroLUG's need to balance compactness and sortable volume led to our design to be maximized within requirement dimensions: 21.5" x 14.5" x 17.5".
- Material Considerations:** The use of light scrap wood and a reusable plastic container reduces load to optimize motor movement and counter frequent use of the device.

RESEARCH & TESTING

- Inspired by **Daniel West's Universal LEGO Sorting Machine**, our design uses similar conveyor belts and a V-shaped ramp to aid in piece separation.
- Ramp Slope Calculations:** Using the friction coefficient of plastic on wood, the slope of the ramp is around 30 degrees.
- Volume Calculations:** The volume of the carousel is equal to the volume of one collection container to prevent LEGO overflow.

NEXT STEPS

- Increasing **colour combinations** using AI, a mini-computer and wireless communication to produce a GUI menu.
- Enclosing design into a **transparent cage** to improve Design for Safety.
- Increasing **sorting speed** by adding additional colour sensors spanning the conveyor belt.
- Expanding sorting to **size and shape** by classifying by weight and using AI detection.