LEGO SORT-O-MATIC

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Introduction

Lego is my favourite thing to do! One of the big problems I always have is finding the pieces that I need. There are so many Lego pieces mixed in together that it is too hard! Mummy tells me that I should organise them all into the same colour and size so that I can find them easier, but that takes a long time! So I decided to make use of our Lego EV3 robotics kit to build a robot that would sort the bricks by colour and size for me! I called it Lego Sort-o-Matic.
Building the Sort-o-Matic

The Sort-o-Matic is built entirely from Lego, but contains advanced features such as the ability to identify both the size and colour of Lego bricks. It does this using three sensors:

1. A colour sensor, put at the end of the brick chute. It scans the brick colour to know where to put that brick.
2. A rotation sensor. It is used to scan the brick size to know where to put it.
3. An IR sensor. This tells the robot where the piles of bricks are, using the custom built tower to identify the first pile.

Process of building:
These are the parts needed for this project:

There were also a lot of instructions to follow. A sample of the instructions:
Once the Sort-o-Matic was built, I still needed to customise the program and install it on the robot. The program is used to tell the robot the commands it needs, and how to find the bricks, identify the colour and size of the brick and then sort the brick. It is, the brains of the robot. The program is coded using the Lego Mindstorm program, and is very visual making it easy to follow. Part of my program:

![Diagram of the program flow](image)

**Hypothesis**

I think that my robot will be able to sort the unsorted Lego bricks into correct colour piles accurately.

**Material**

- Lego Mindstorms EV3 Robotics Kit
- Unsorted Lego bricks in different sizes and colours (red, green, blue, white, grey)

**Experiment Design**

The variable that I am going to keep the same is the Lego bricks.

I will time how long it takes to sort the same number of bricks.

I also will repeat the experiment multiple times to ensure that the results are fair and conclusive.
**Procedure**

To make my Lego Sort-o-matic to sort a pile of Lego bricks into the correct piles by colour and size:

1. I had a total of 70 Lego bricks – both large and small
2. They were fed into the Lego Sort-o-Matic
3. The Lego Sort-o-Matic checked the colour and size of each brick and placed it into the appropriate pile.
4. Using a stopwatch, I time how long this took
5. When the Sort-o-Matic was finished, I reviewed the piles to see if any were wrong and determine accuracy.

I repeated this process 16 times, and recorded the results in a table.

**Results**

I recorded the results of the time taken and accuracy in the table.

**Lego Sort-o-Matic**

<table>
<thead>
<tr>
<th>Attempt #</th>
<th>Time Taken (seconds)</th>
<th>Accuracy (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>890</td>
<td>100%</td>
</tr>
<tr>
<td>2</td>
<td>922</td>
<td>100%</td>
</tr>
<tr>
<td>3</td>
<td>922</td>
<td>100%</td>
</tr>
<tr>
<td>4</td>
<td>922</td>
<td>100%</td>
</tr>
<tr>
<td>5</td>
<td>897</td>
<td>100%</td>
</tr>
<tr>
<td>6</td>
<td>914</td>
<td>100%</td>
</tr>
<tr>
<td>7</td>
<td>896</td>
<td>100%</td>
</tr>
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<td>8</td>
<td>927</td>
<td>100%</td>
</tr>
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<td>9</td>
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</tr>
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<td>10</td>
<td>926</td>
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</tr>
<tr>
<td>11</td>
<td>901</td>
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</tr>
<tr>
<td>12</td>
<td>876</td>
<td>100%</td>
</tr>
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<td>13</td>
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</tr>
<tr>
<td>14</td>
<td>915</td>
<td>100%</td>
</tr>
<tr>
<td>15</td>
<td>920</td>
<td>100%</td>
</tr>
<tr>
<td>16</td>
<td>909</td>
<td>100%</td>
</tr>
</tbody>
</table>

The Lego Sort-o-Matic which had an average time of 911 seconds, with an average accuracy of 100%.
**Discovery**

We wanted to see the time and accuracy of Lego by the Lego Sort-o-Matic. Here are some graphs to show the results.

![Lego Brick Sorting Time: Sort-o-Matic](image)

Lego Sort-o-Matic is very consistent, with the largest difference in time being 51 seconds.

When it comes to accuracy, the Lego Sort-o-Matic was 100% accurate every time. Being a machine, it will be more consistent than people.

However, whilst the accuracy for the Sort-o-Matic is great – the time taken is very longer.
Investigation

Machines are very good at performing the same task repeatedly in the same way. The Lego Sort-o-Matic, given bricks, can identify the colour and size and sort them into piles. They have a specific program they follow, and they will not deviate from this. In contrast, humans can be unpredictable. We are one of the most complex machines ever built, and we have the most powerful computers ever known to mankind – our brain!

Humans have an ability of spatial awareness. Robot does not have this ability. To identify where to place the bricks, Lego Sort-o-Matic had to use an identifying object as the starting point and calculate where the pile is from here. To make sure it doesn’t lose this spot, it would reset back to find this original spot after every 5 Lego bricks, meaning that the whole process was much slower.
Conclusion

I discovered that sorting Lego bricks into piles can be done by a machine.

I was so surprised at how much longer the Sort-o-Matic took – but after I learned more about it I started to understand why.

I successfully built a machine that can sort Lego, and I will keep on trying to find ways to make it faster so it can take over doing the job I don’t enjoy the most – having to sort through and organise all the Lego pieces I have at home!
Reference


Acknowledgements

A big thank you to Mummy and Daddy for the big help they gave me (and for letting me play with Lego!)

Thank you to Mummy helped me type up this project and for teaching me all about machines and the different parts that made the Sort-o-Matic.

Thank you to Daddy for helping me push those Lego pieces together that were just too hard, and for helping me graphs for my results.