Transporting Goods using Cellular Automata

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1 Introduction

Our goal within the current project is to show the applicability of the cellular automata model in transporting goods within a two dimensional environment. In this sense we are trying to design a cellular automata that can perform this task. We would like to limit our goal to the design of this system, that could be further extended afterwards. The physical realism of the model will not be considered within the project, since our goal is to show that a self-organizing system can achieve such behavior.

Research question: How to transport objects over gaps in a cellular automata model of self-configurable robots?

1.1 Hypotheses

Our hypotheses are the following:

- The number of extra robots needed to push over a gap is independent of the gap size
- The number of reconfigurations is linearly dependent on the gap size.
- There is a linear correlation between the weight of the object that is transported and the minimum number of bots.

2 Literature

[1]

3 Model

2D cellular automa with gravity. Bots, obstacles and boxes. Pushing.

3.1 The world

Falling

Pushing

3.2 Cellular Automata

The bots move according to cellular automa rules.

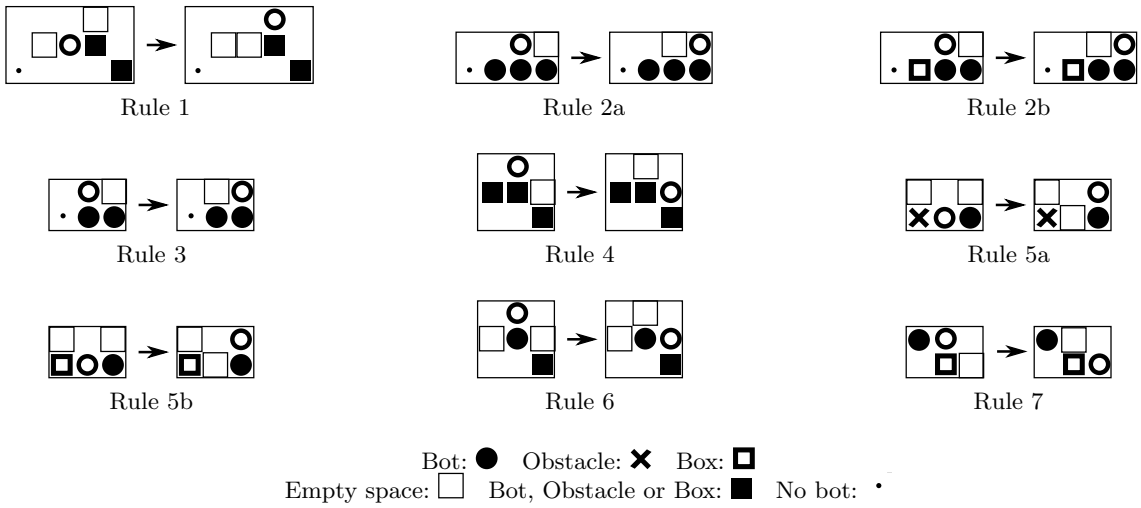

Fig. 1: Cellular automata rules for moving bots.

4 Implementation

5 Experiments

5.1 Experiment 1

5.2 Experiment 2

5.3 Experiment 3

In light of the model described in section 3, this experiment

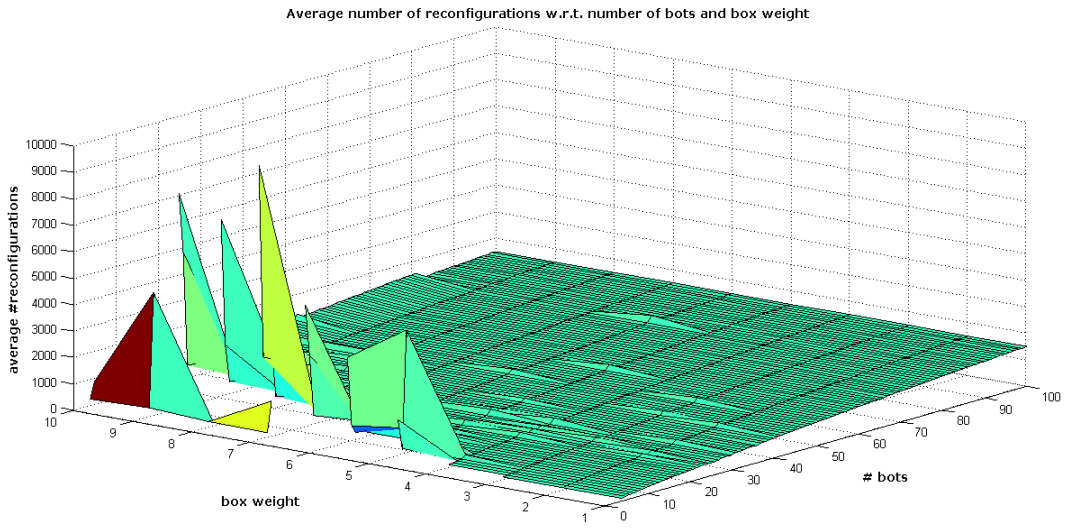

Fig. 2: The variation of the number of bots required to solve a specific configuration. We used one box of various weights that need to be pushed over a gap. The results are averaged over the different gap sizes within the $[0, 10]$ interval.

6 Conclusions

References

1. Butler, Z., Kotay, K., Rus, D., Tomita, K.: Generic decentralized control for a class of self-reconfigurable robots. In: Robotics and Automation, 2002. Proceedings. ICRA '02. IEEE International Conference on. vol. 1, pp. 809 – 816 vol.1 (2002)