Pushing and Pulling

Computing push plans for disk-shaped robots and dynamic labelings for moving points

Dirk Gerrits

“I do Computer Science.”

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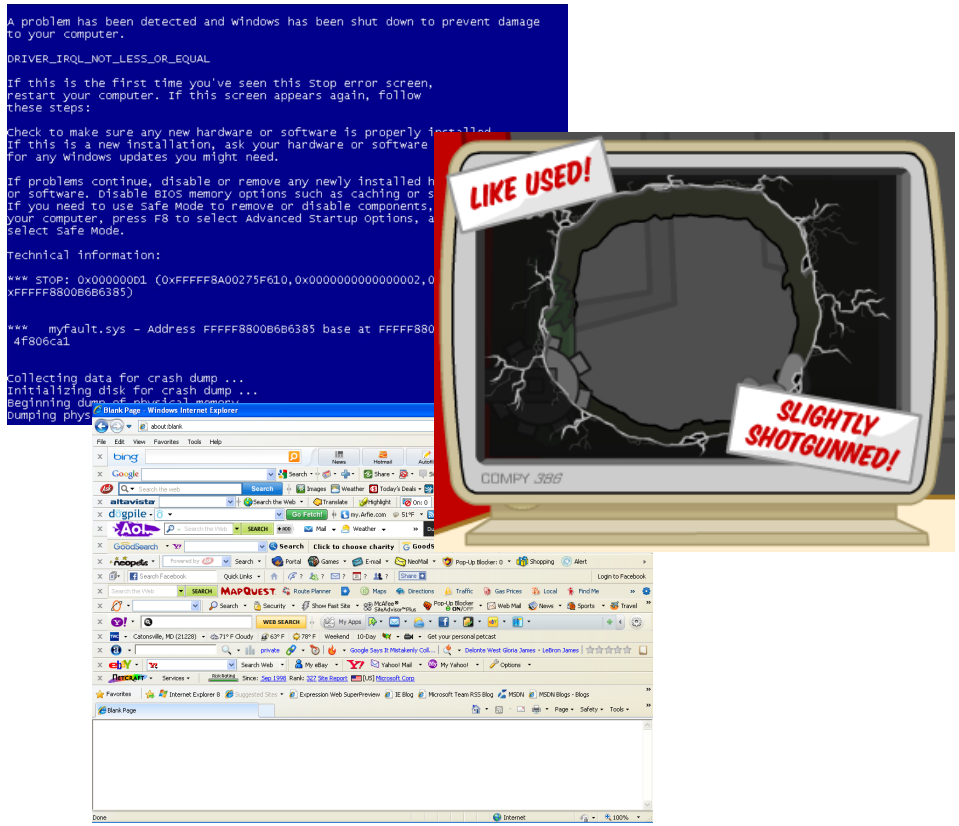
“Cool!”

“I do Computer Science.”

“Cool! So I have this problem with my computer. . .”



“I do Computer Science.”

Not: humans solving computer problems

But: computers solving human problems

“I do Computer Science.”

Not: humans solving computer problems

But: computers solving human problems

- What problems can they solve?
- How efficiently can they solve them?

Problem 1: Pushing Objects with Robots

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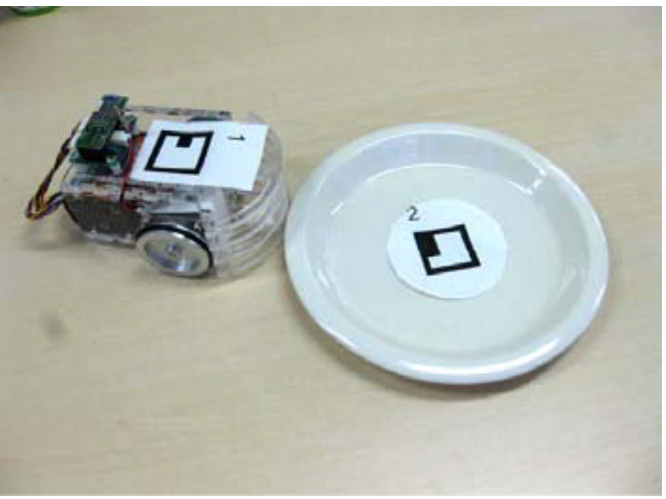
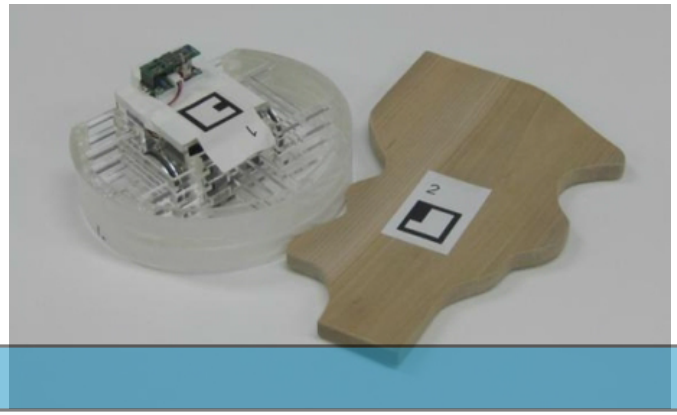
"How hard could it be?
A child can do it!"

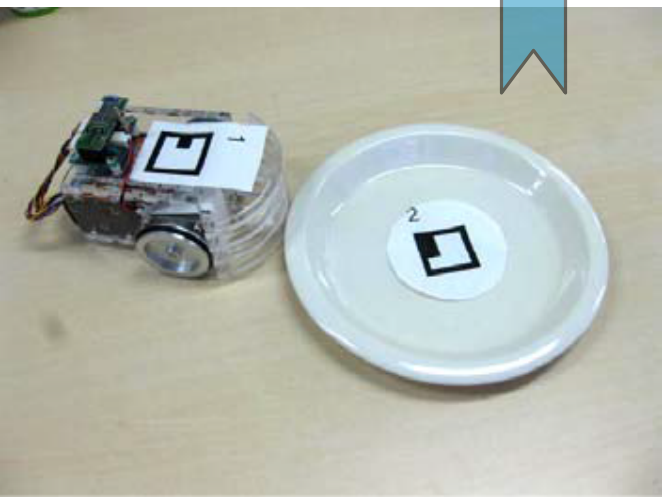
Baby Steps in Pushing



Baby Steps in Pushing

more complex shapes





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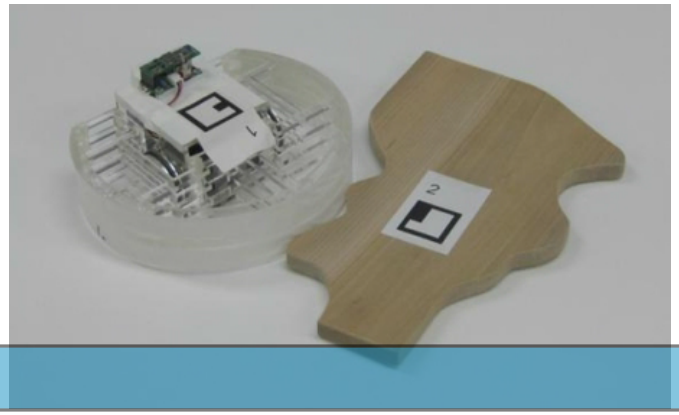

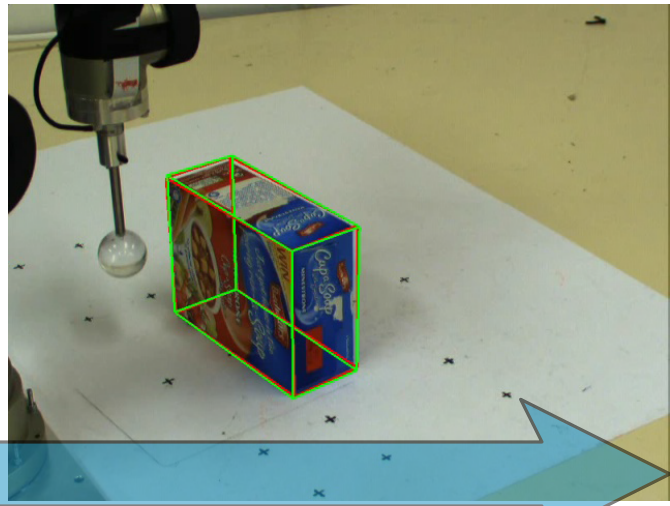

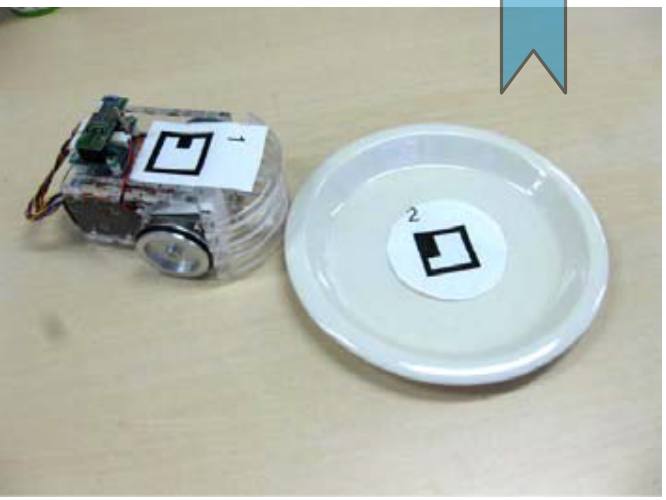

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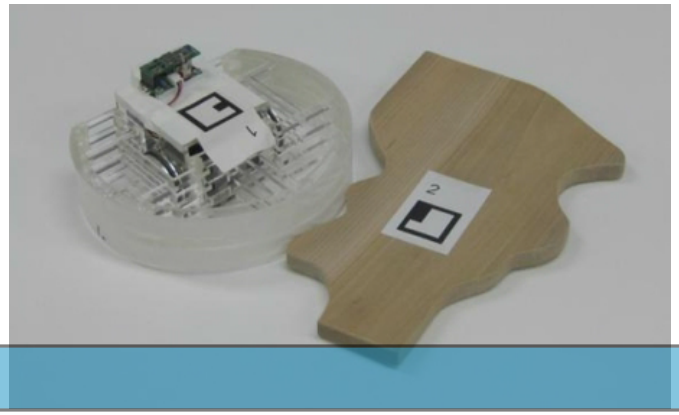
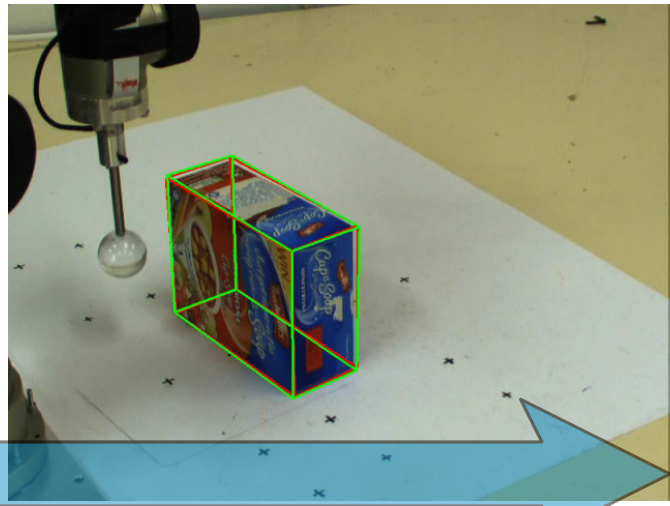
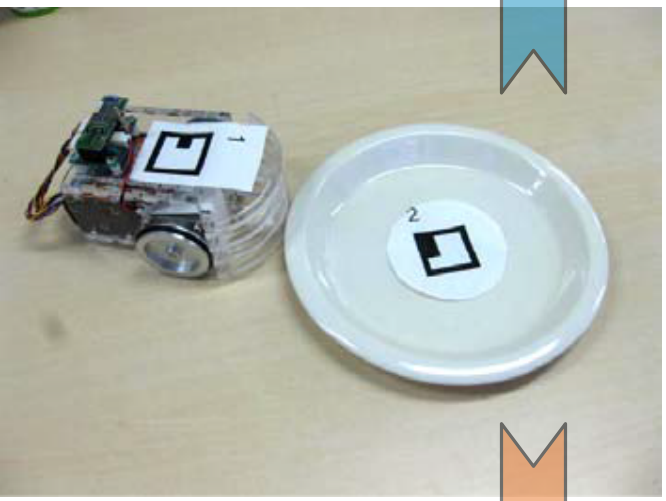
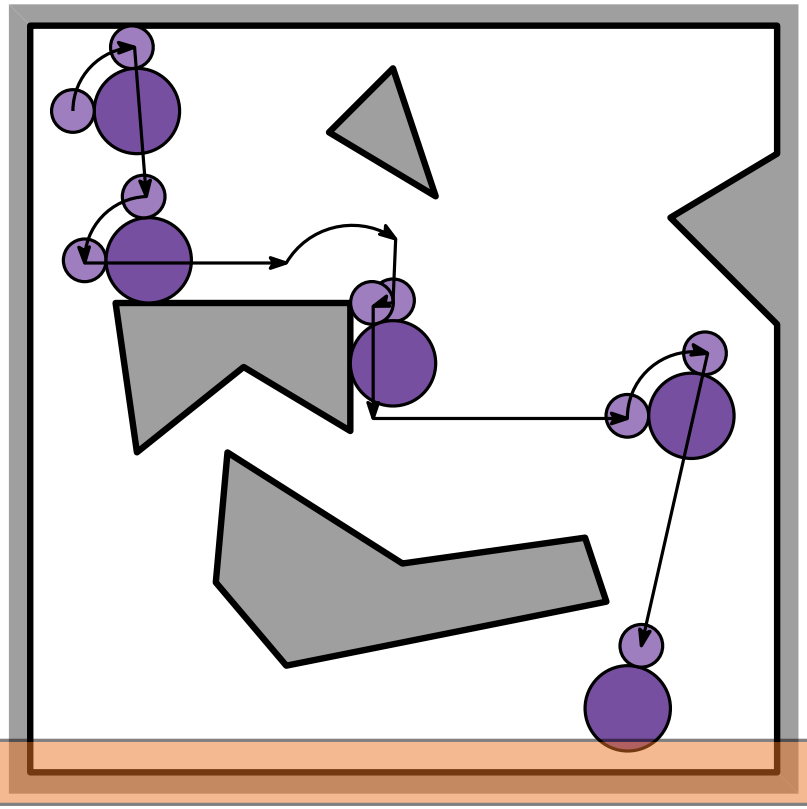






more complex pushing tasks



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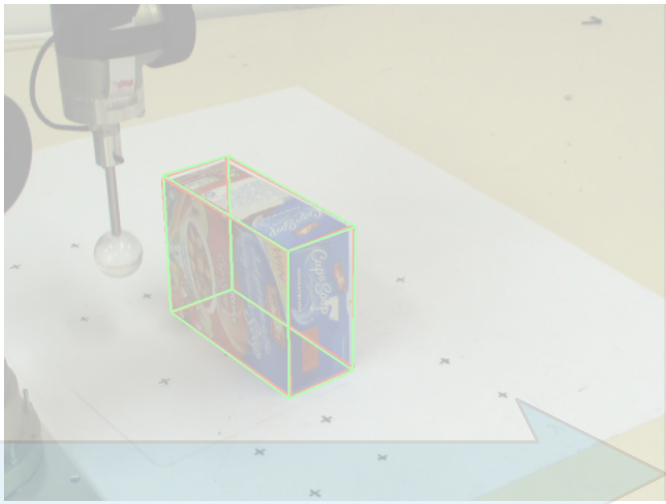
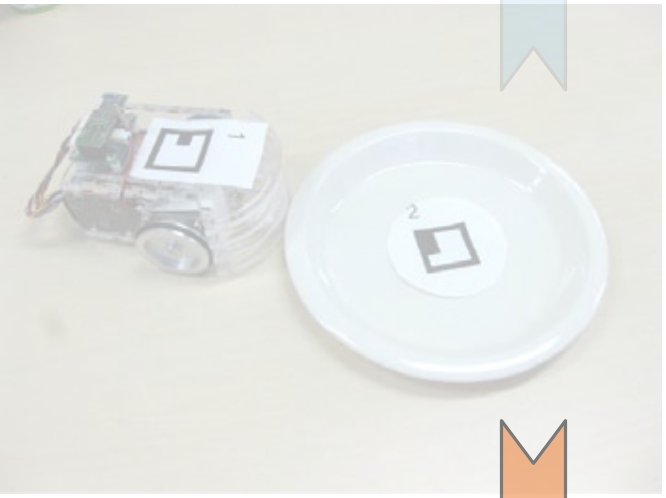
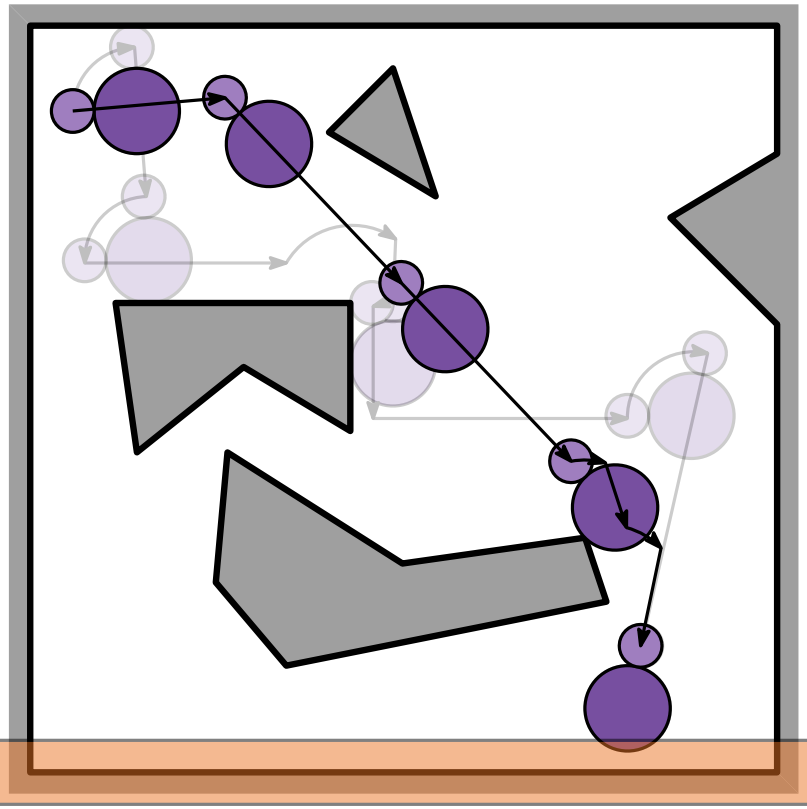
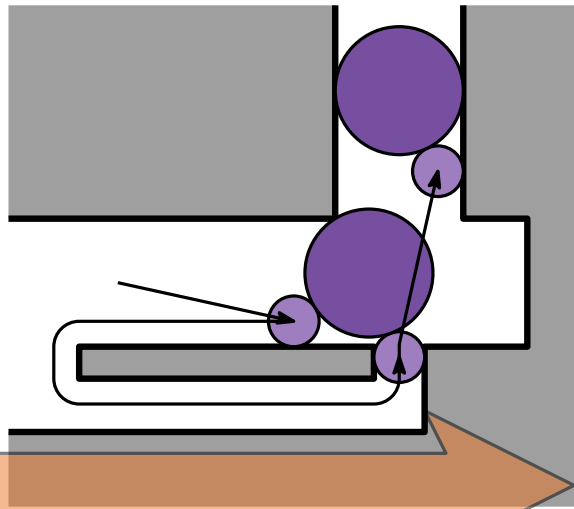


more complex shapes

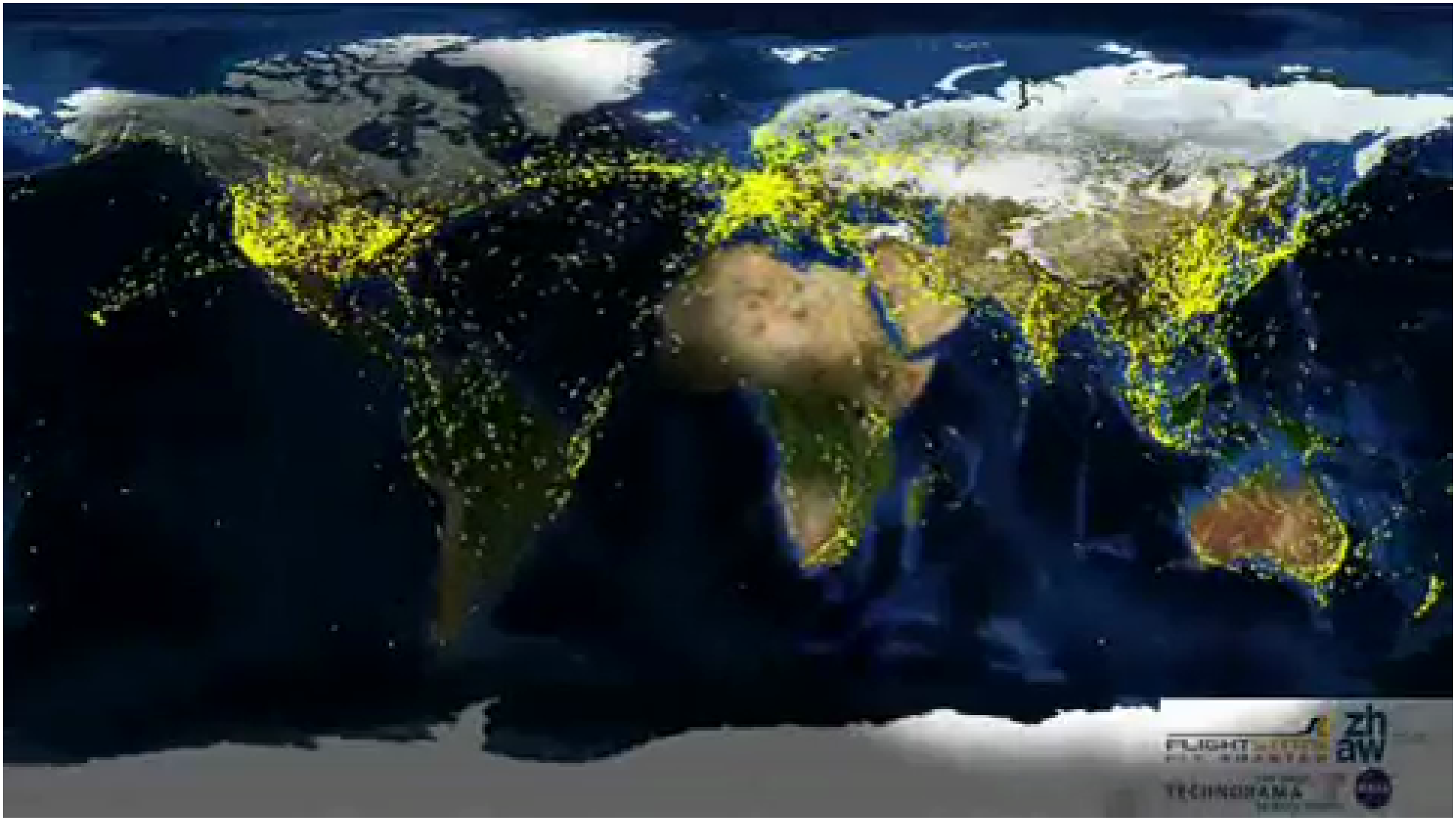






more complex pushing tasks

Intermezzo: Air-Traffic Control

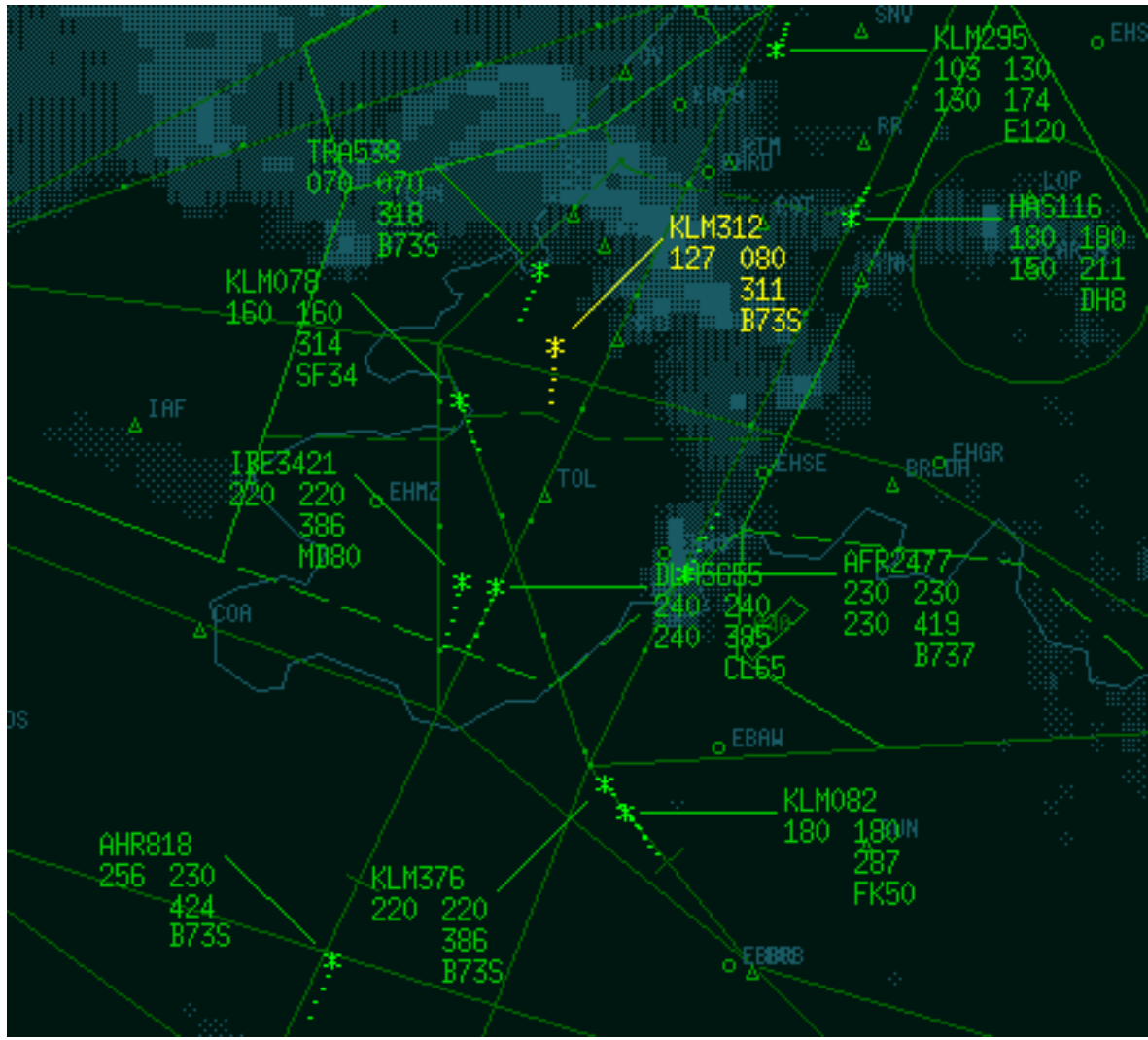


$\sim$100,000 flights/day, kept safe by air-traffic controllers.

Intermezzo: Air-Traffic Control

Airplanes $\rightarrow$ moving points + information labels

Watch for potential crashes



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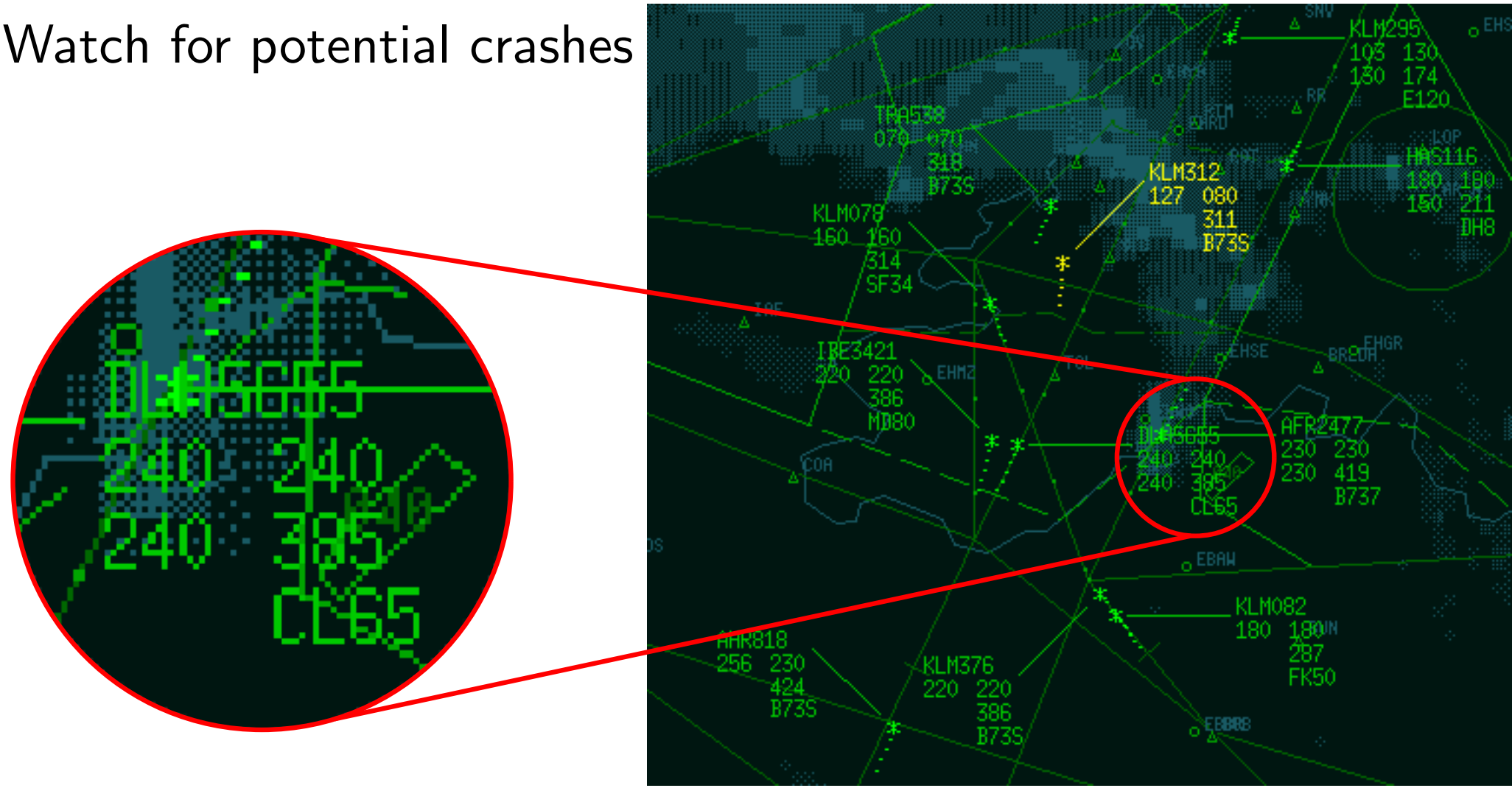
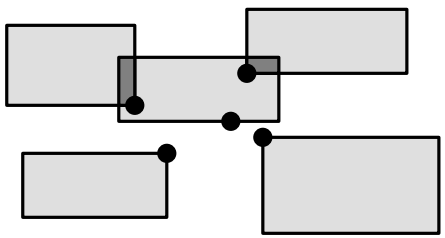


. . . while moving labels around for readability!

Problem 2: Labeling Moving Points

We want to:

- minimize overlap, labeling all points



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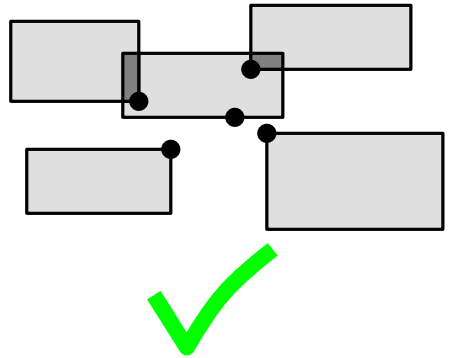

We don't want to:

- avoid overlap by only labeling some points

Problem 2: Labeling Moving Points

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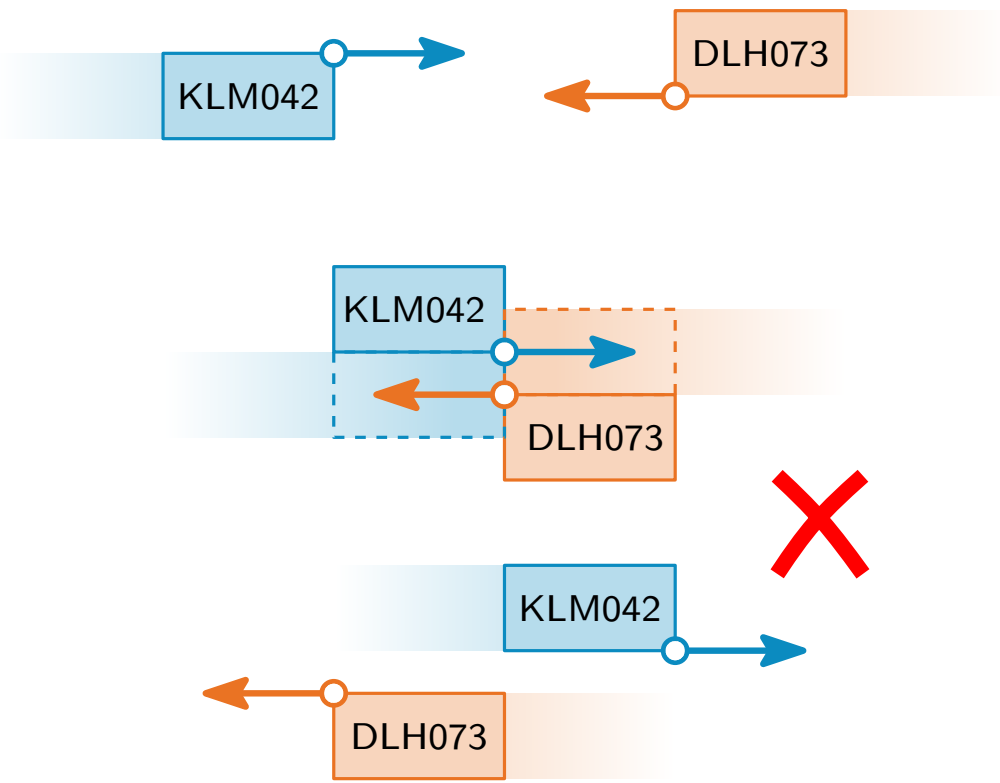
- minimize overlap, labeling all points

We don't want to:

- avoid overlap by only labeling some points
- relabel abruptly



Problem 2: Labeling Moving Points

We want to:

- minimize overlap, labeling all points
- move labels smoothly

We don't want to:

- avoid overlap by only labeling some points
- relabel abruptly