Statistical Simulation for Multi-Agent Scheduling under Uncertainty

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PROBLEM

Deterministic schedulers cannot adapt to **uncertainties**, leading to scheduling inefficiencies in stochastic systems.

SOLUTION

Statistical simulation creates a natural platform for quantifying uncertainty and can be used to supplement an adaptive scheduler.

APPLICATION: MAT SINKING

Figure 1. Current Mat Sinking operations

Water navigation causes riverbeds to erode. **Mat Sinking** is a process of laying concrete mats on the riverbed to protect it, and consists of these steps:
1) Lifting slabs from a Supply Barge
2) Placing them on a Mat Boat
3) Tying them together into "mats"
4) Pushing the mats onto the riverbed
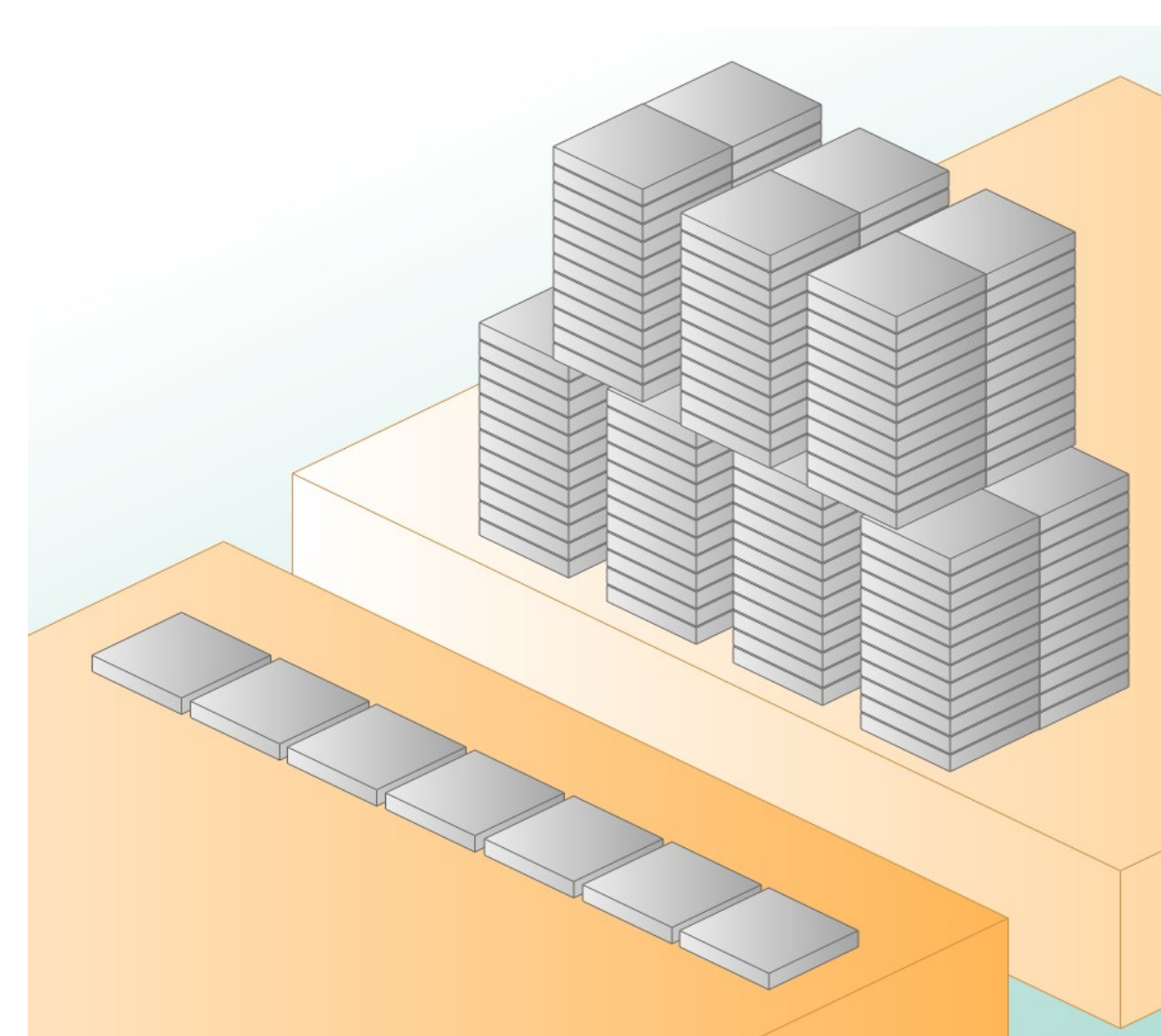
Figure 2. Illustration of supply barge, with concrete slabs stacked on top of each other, and the mat boat, where they are lined up and tied

SYSTEM ARCHITECTURE
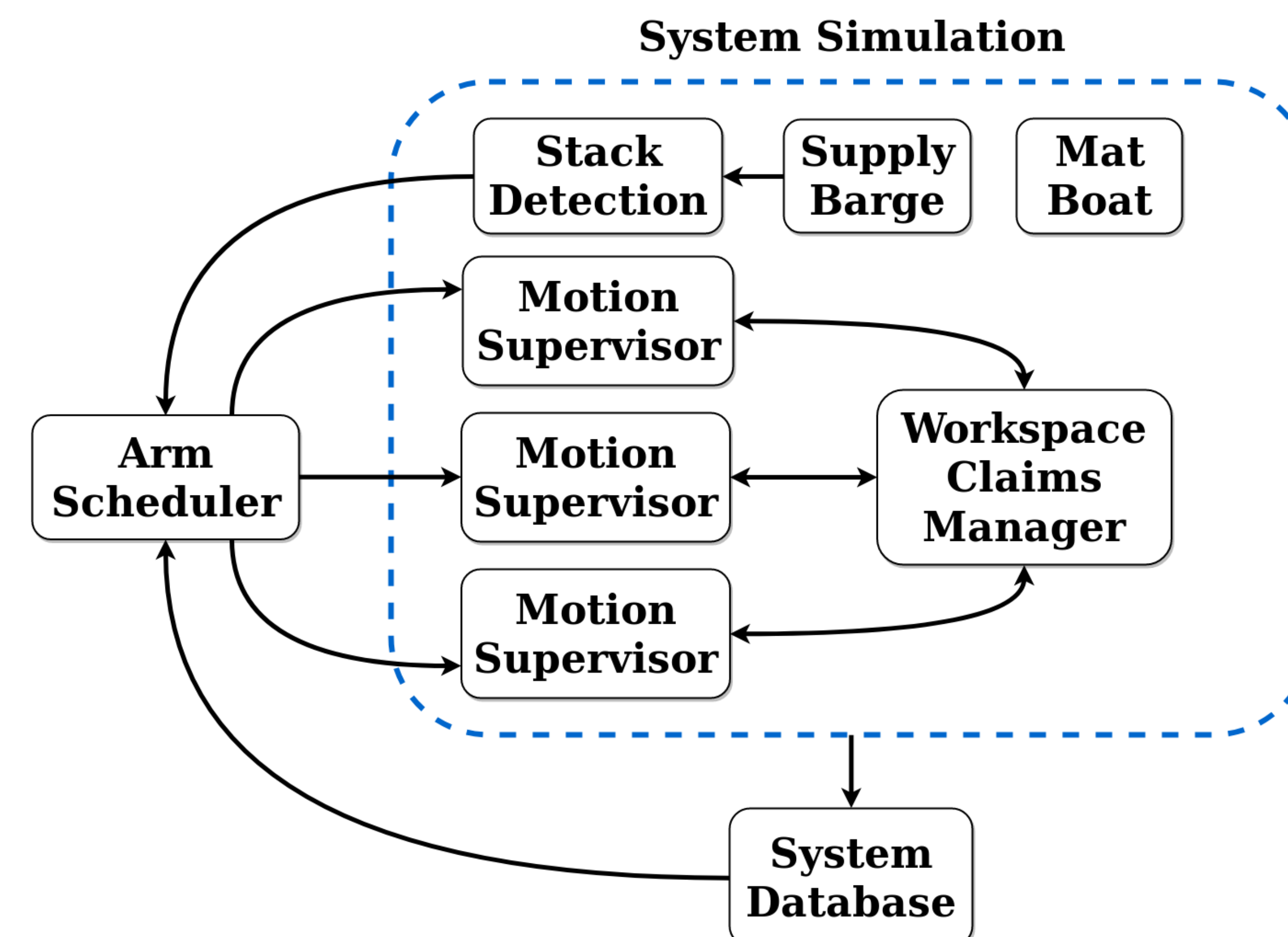
Figure 3. Simulation contains the Supply Barge and the Mat Boat, as well as the Mat Sinking robot and error checker (WCM). Simulation interacts with the scheduler and database.

EXPERIMENTAL SETUP

BASIC SCHEDULER:
PREDEFINED CLAIMED SPACE

■ Initial Arm Position
■ Step 1: Pick up squares
■ Step 2: Place 1st square
□ Step 3: Place 2nd square

GREEDY SCHEDULER:
DYNAMICALLY DEFINED CLAIMED SPACE

Figure 4. Top view of of the claimed space and steps taken in the two different schedulers

EXPECTED RESULTS

Greedy scheduler should be more efficient than base case: arm motion less constrained, and claimed space is dynamic.

FUTURE WORK

Vary parameters →
Estimate time taken →
Compare schedulers →
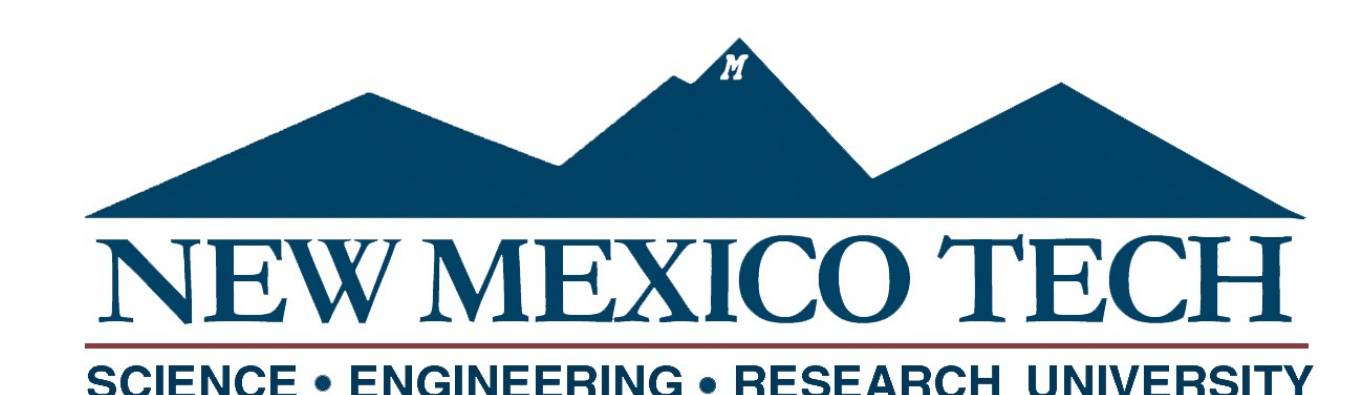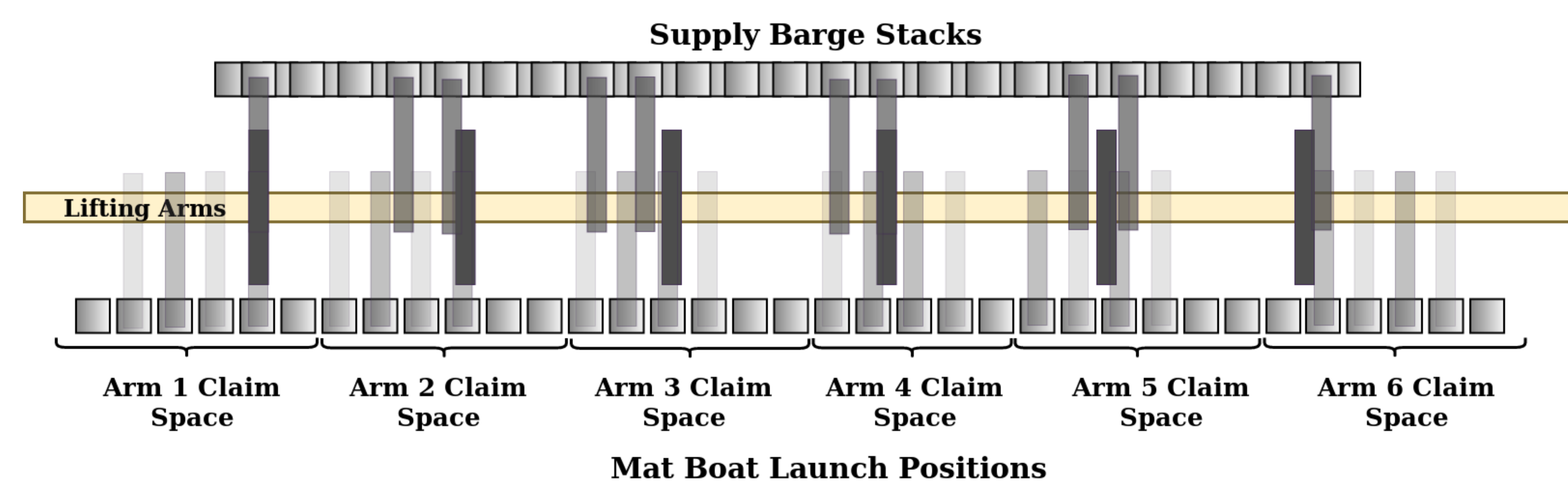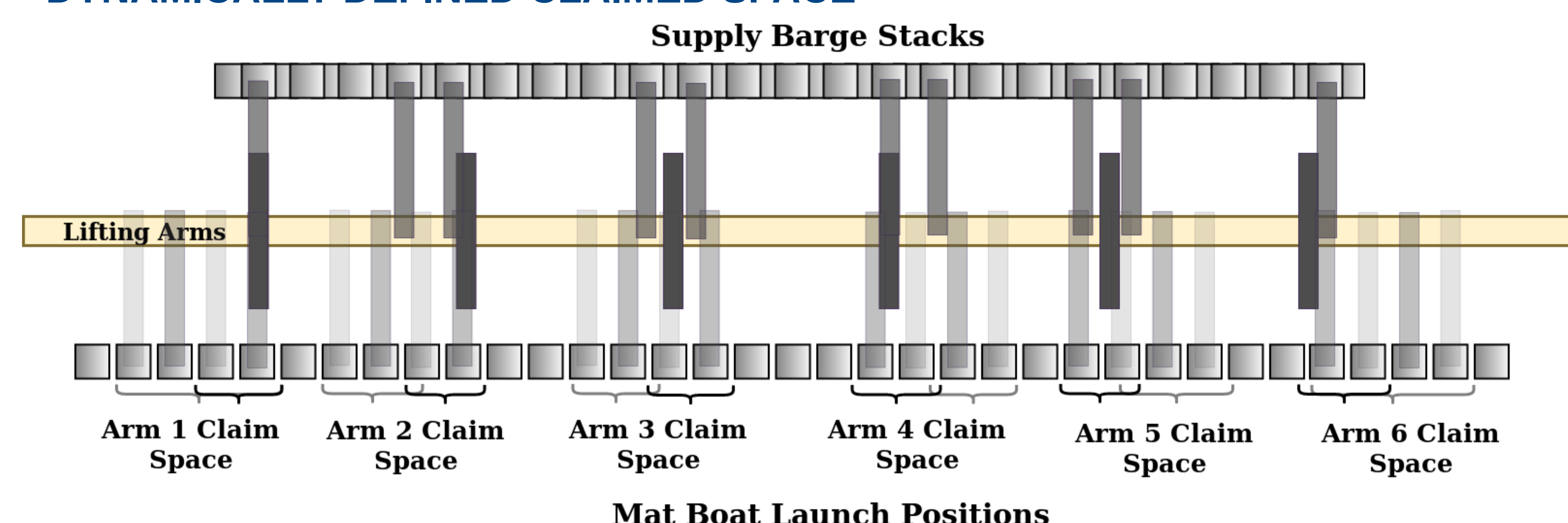Test scheduler on robot

Figure 5. Mat Sinking Robot in development

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