

The development of concepts for cleaning bouldering mats

This assignment explores the problems with chalk in climbing gyms and proposes some concepts to address them.

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The Assignment

This assignment was carried out for *Radium Boulders*, an indoor bouldering gym. Indoor bouldering is a discipline of climbing without a rope belay on artificial climbing walls (Figure 1). The climbers use chalk (Magnesium Hydroxide Carbonate), a white powder they apply to their hands to improve grip. Chalk consists of fine particles which become airborne and spread widely throughout the gym facilities, requiring daily cleaning. Much chalk collects on mats placed in front of the climbing walls to cushion falls (Figure 2). There is no cost-effective method available to clean these mats. Thus the research question: *How can the cleaning costs for the mats be reduced while maintaining the current cleaning standard?*



Figure 1 Bouldering facilities



Figure 2 Chalk dust on fall mats

The Approach

This research went through multiple cycles of analysis and idea generation to determine a suitable way to reduce cleaning costs. Two solution directions were pursued for reducing the costs: 1. *Improving the ergonomics and efficiency of the cleaning so that less expensive amateurs could do the cleaning in a shorter time*, 2. *Preventing the chalk dust from collecting on the mats in the first place so that cleaning is not required anymore*. For the first solution direction, the cleaning method of the gym was analysed on ergonomics and efficiency. For the second solution direction, the chalk transport pattern near the climbing wall was analysed and represented in a schematic overview (Figure 3).

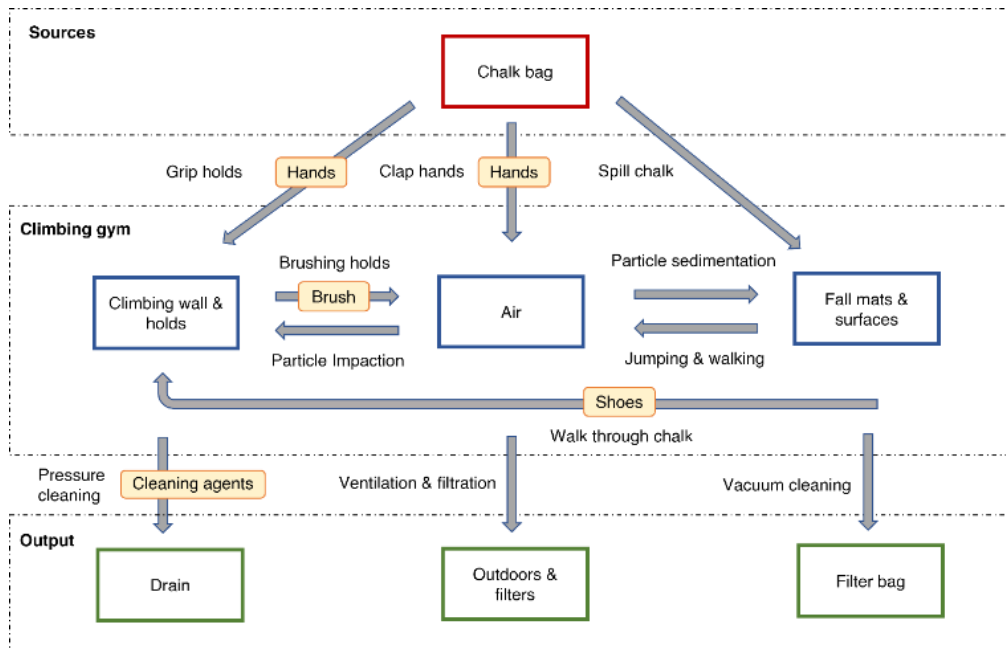


Figure 3 Chalk transport near the climbing walls

Conclusions & Recommendations

This research proposes to use **capture methods**, which are techniques to collect chalk dust before it gets on the mats. These methods improve air quality, reduce the facility's cleaning costs, and lead to a visually cleaner gym. The proposed ways to capture chalk include additional air cleaning measures to remove fine chalk particles from the air, innovative methods to remove chalk dust from the chalk cycle, and source control measures to capture dust before it spreads into gym facilities. Since capture methods cannot stop chalk from collecting on the mats, the suggestion is to **vacuum clean** them. A cost effective vacuum cleaner must be ergonomic and efficient in this environment. Based on a list of requirements, the market was analysed for suitable tools. It was found that no tool on the market can meet these needs while cleaning the mats to the standards of the gym. Thus the suggestion was made to develop a specialized vacuum cleaner. Two concept directions were proposed: **1. An automated concept, 2. An ergonomic and efficient concept to be used by the cleaning staff.** This research concludes that automation is the most cost-effective and feasible way to clean mats out of these two concept directions. Although some concept ideas were developed, more research about technical aspects is required to design a working product. The most promising idea developed for this report relies as much as possible on existing components to achieve both low running and investment costs (Figure 4).

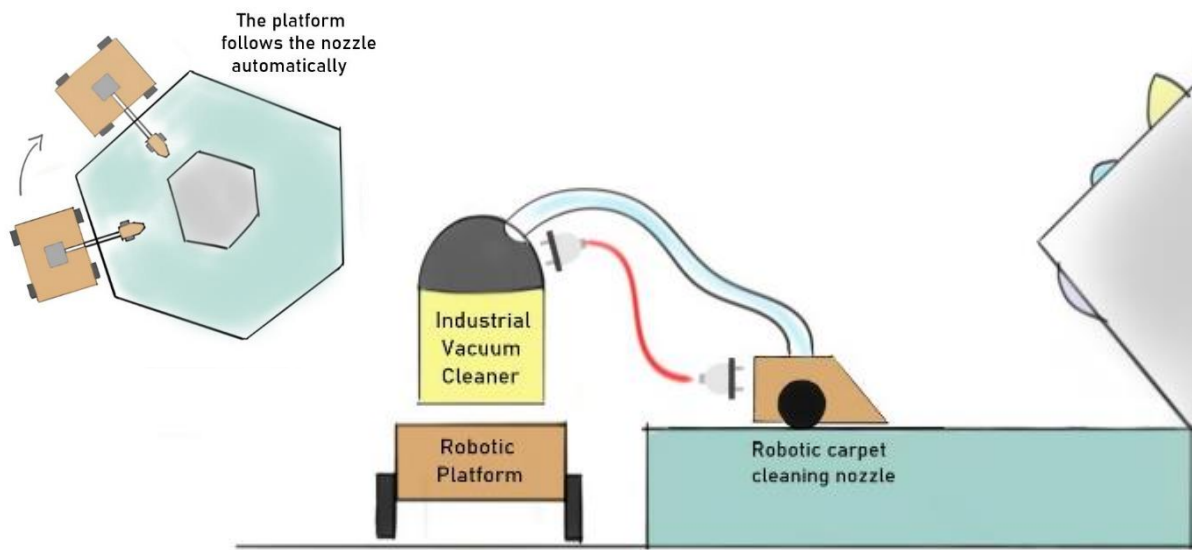


Figure 4 The automated concept direction