Agents Performance Analysis

by: MUSTAFA SHABBIR BHAVANAGARWALA

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EXECUTIVE SUMMARY

This report evaluates the effectiveness of four SuckyCorp robot vacuum models: Non-Sensing Sucky, Sensing Sucky, Memory Sucky, and Omniscient Sucky, under varying environmental conditions.

1) Non-Sensing Sucky: This basic model does not have any sensors, in all environments this model has the lowest scores among all models and consistently underperforms, making it less effective for comprehensive cleaning tasks. Its variance is lowest compared to other models, indicating consistently poor performance, depending on the environment. Its limited capability does not justify continued support.

2) Sensing Sucky: This agent is equipped with dirt and bump sensors, the model shows improved scores and performance over Non-Sensing sucky, especially in simpler environments. Its variance is higher than Non-sensing sucky, with performance dipping in simpler environments. However, lack of memory limits its effectiveness in complex settings, where its scores are less consistent.

3) Memory Sucky: With the help of a world model, this model demonstrates a significant improvement in scores and cleaning efficiency over Non-sensing and Sensing Sucky, across all environments. Its variance is higher than when compared to all other models, indicating consistently good performance, which depends on the environment. The added memory cost is justified by its amazing performance, specifically in complex and dirt-heavy areas. Adjusting battery capacity does have an effect on operational time, higher capacity is advantageous in larger environments, while lower capacity could be cost-effective in smaller spaces. Thus the optimal battery capacity for the Memory Sucky model should be perfectly calibrated depending on specific cleaning needs and environment size.

4) Omniscient Sucky: With complete environmental information, this agent has the highest scores and performs the best among all the models and in all environments. Its variance is slightly lower than that of Memory Sucky’s, indicating nice performance, in favorable environments. However, its market is limited to environments where maximum cleanliness is essential and justified by the investment.

SUPPORTING ANALYSIS

- Agents score comparisons in various environments. Percentage improvement comparison with Non Sensing Agent

Agents	Dirt / Wall	0.1 % better than 0.1 NoSense		0.1 % better than 0.3 NoSense		0.2 % better than 0.1 NoSense		0.2 % better than 0.3 NoSense		0.3 % better than 0.1 NoSense		0.3 % better than 0.3 NoSense	
Non-Sensing Sucky		18.3		8.4		34.2		17.2		49.6		25.9	
Omniscient Sucky		233.1	1174%	121.3	1344%	261.2	664%	131.2	663%	297.1	499%	139.6	439%
Sensing Sucky		69.9	282%	26.6	217%	138.6	305%	54.5	217%	193.8	291%	77	197%
Memory Sucky		107	485%	48.8	481%	202.4	492%	96.4	460%	292.3	489%	132.1	410%
Grand Total		**107.075**		**51.275**		**159.1**		**74.83**		**208.2**		**93.65**	

- Variance Comparison of the Agents

Agent	Variance	% compare to NoSense
Non-Sensing Sucky	169.48	
Omniscient Sucky	3618.69	2035%
Sensing Sucky	2743.68	-24%
Memory Sucky	5798.04	111%

- Overall percentage improvement comparison with Non Sensing Agent

Agent	% better than NoSense
Non-Sensing Sucky	
Omniscient Sucky	673%
Sensing Sucky	257%
Memory Sucky	475%

- Non-Sensing Sucky: The agent lacks any sensors. As the amount of dirt increases, its score also increases while as the amount of wall increases then the score decreases. As the battery capacity increases thus the performance also increases. Its scores are the lowest in all environments compared to other models. Its variance is lowest compared to other models, indicating consistently poor performance, depending on the environment. When compared to different environments, when the amount of dirt is the lowest and the amount of walls is highest then its score is lowest, while when the amount of dirt is highest and the amount of walls is lowest then its score is highest.

- Sensing Sucky: This agent performs well in environments where its sensors are useful, such as those with many obstacles. It is well-equipped with Dirt and Bump sensors. As the dirt increases, its score also increases while as the wall increases then the score decreases. As the battery capacity increases thus the performance also increases. In all environments, its scores are better than Non-Sensing Sucky's scores, but do not have better scores when compared to Memory Sucky and Omniscient Sucky

in any of the environments. Its variance is higher than Non-sensing sucky but less compared to other models, with performance dipping in simpler environments. When compared to different environments, when the amount of dirt is the lowest and the amount of walls is highest then its score is lowest, and performs 282% better than Non-sensing sucky, while when the amount of dirt is highest and the amount of walls is lowest then its score is highest, and performs 291% better than Non-sensing sucky. Overall it performs 257% better than Non-sensing sucky.

- Memory Sucky (formerly known as the World Model Agent): The ability to remember and model its environment allows for strong performance, especially in complex environments. This simple world model is based on their limited sensors. As the dirt increases, its score also increases while as the wall increases then the score decreases. While as the battery capacity increases thus the performance also increases. In all environments, its scores are better than Non-Sensing Sucky's and Sensing sucky's scores., but do not have better scores when compared to Omniscient Sucky in any of the environments. Its variance is higher than when compared to all other models, indicating consistently good performance, which depends on the environment. When compared to different environments, when the amount of dirt is the lowest and the amount of walls is highest then its score is lowest, and performs 481% better than Non-sensing sucky, while when the amount of dirt is highest and the amount of walls is lowest then its score is highest, and performs 489% better than Non-sensing sucky. Overall it performs 475% better than Non-sensing sucky.

  The extra memory in the Memory Sucky model is worth the cost in environments where high performance is critical, as it significantly improves effectiveness. However, in cost-sensitive markets, the Sensing Sucky might be a more suitable option due to its lower cost with acceptable performance. Thus, the value of the extra memory depends on the specific use case & customer needs.

- Omniscient Sucky: This agent delivers exceptional performance across all environments due to its complete environmental awareness. As the dirt increases, its score also increases while as the wall increases then the score decreases. As the battery capacity increases thus the performance also increases. In all environments, it has the best scores when compared to other models. Its variance is lower than that of Memory Sucky's, indicating nice performance, in favorable environments. When compared to different environments, when the amount of dirt is the lowest and the amount of walls is highest then its score is lowest, and performs 1344% better than Non-sensing sucky, while when the amount of dirt is highest and the amount of walls is lowest then its score is highest, and performs 499% better than Non-sensing sucky. Overall it performs 673% better than Non-sensing sucky and has best performance among all models.

  The Omniscient Sucky, with its high fixed cost for custom sensors, is likely only viable in niche markets where maintaining a completely dirt-free workplace is critical, such as in cleanrooms or highly regulated industries. For typical workplaces, the cost may outweigh the benefits, making it less attractive compared to other models. Therefore, the market for the Omniscient Sucky is limited to specialized environments where maximum cleanliness is essential.

- For the Memory Sucky Model, the effect of raising and lowering the battery capacity for the model does have an effect on its performance. The model has the lowest score when the capacity is lowest while the score increases as the capacity increases.

➢ Memory Sucky score comparisons in various environments with various battery levels.

	Battery	0						50 Tota	100						100 Total	150						150 Total
	Dirt	0.1		0.2		0.3			0.1		0.2		0.3			0.1		0.2		0.3		
Agent	Wall	0.:	0.3	0.1	0.3	0.1	0.3		0.1	0.3	0.1	0.3	0.1	0.3		0.1	0.3	0.1	0.3	0.1	0.3	
Memory Sucky		13.2	7.4	22	14	31	19	17.82	25.2	17	47.2	27	65.2	42	36.356	35.6	21	67.6	39.4	94.4	58	52.35555556

	Battery	200						200 Total	250						250 Total	300						300 Total
	Dirt	0.1		0.2		0.3			0.1		0.2		0.3			0.1		0.2		0.3		
Agent	Wall	0	0.3	0.1	0.3	0.1	0.3		0.1	0.3	0.1	0.3	0.1	0.3		0.1	0.3	0.1	0.3	0.1	0.3	
Memory Sucky		53.2	20	89.6	48	126	67	69.6	54.4	29	105	58.8	153.2	79	81.4222	71.8	40	130.6	73	173	96	97.46666667

	Battery	350						350 Total	400						400 Total	450						450 Total	Grand Total
	Dirt	0.1		0.2		0.3			0.1		0.2		0.3			0.1		0.2		0.3			
Agent	Wall	0	0.3	0.1	0.3	0.1	0.3		0.1	0.3	0.1	0.3	0.1	0.3		0.1	0.3	0.1	0.3	0.1	0.3		
Memory Sucky		75	36.8	157	69.2	203	116	110.71	101	41	169.6	81.8	239	116	125.533	91.6	51.4	195	95	242	141	137.956	81.0246914

When battery capacity is raised, the agent operates for longer durations of time without needing a recharge, this is advantageous in complex environments where more cleaning sessions are necessary to cover the full area. More time for cleaning can result in cleaner area and better performance as robot can clean more dirt in a single session without a break. In environments with high dirt density or significant obstacles that slow down cleaning progress, Memory Sucky can complete the task more thoroughly with more battery life.

However, the benefit of increased battery life is reduced in smaller environments where so much battery life is not required. In these cases, the additional cost of a larger battery may not be justified, as the extra capacity would go unused. This high cost may make it less friendly to cost-sensitive customers who do not require extended cleaning time. Lowering the battery capacity, on the other hand, reduces the cost of the Memory Sucky model, making it more affordable for a broader range of customers. However, due to low battery life, there is a trade-off with operational time, as the agent will have to be charged a number of times and this could disrupt the cleaning process. When the environments are larger or have more dirt, there would be many incomplete sessions leading to multiple cycles of charging and cleaning, thereby diminishing the robot's effectiveness.

Therefore, the optimal battery capacity for the Memory Sucky model should be perfectly calibrated depending on specific cleaning needs and environment size. While huge batteries can be beneficial in demanding environments, smaller batteries can prove to be cost effective in less challenging environments.

CONCLUSION

Based on the challenges of the environments and the models’s technological capabilities, the analysis of the SuckCorp’s four vacuum models reveal distinct performance variations. The Memory Sucky comes to be very effective and versatile option, as extra memory cost is justified with consistent high scores in all environments. The Sensing Sucky has adequate performance in simple settings, as it has no benefit from memory in complex environments. Omniscient Sucky, while gives amazing results, is limited by its high cost, making it suitable only for specific niche markets where maximum cleanliness is critical. Lastly, Non Sensing Sucky due to its primitive design, falls short in performance and should be phased out.

Some of the recommendations for the future can be firstly, the impact of integrating additional sensors into the Sensing and Memory Sucky models can be analyzed. This study could assess if incremental improvements in sensor technology could significantly increase the robots' effectiveness. Additionally, hybrid models can be tried out and analyzed that combine the strengths of Memory and Omniscient Sucky, to identify if there are new market opportunities. Finally, a market analysis where a customer is willing to pay for advanced features like those in Omniscient Sucky can guide strategic pricing and positioning.