Hwa Chong Institution

Project Work

Category 3 Inventions Log Book

Title of Project: The Clo Thes Hanger
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Problem Finding

First of all, we have brainstormed and eventually arrived at two problems which we have encountered by ourselves.

1. Using a laundry stick to hang clothes onto a ceiling-mounted rack and dry them is tiring and time-consuming.

We feel that when we use a laundry stick, our arms will feel tired while holding the laundry stick and our necks will feel uncomfortable as we need to constantly look upwards.

2. Using multiple hangers to hang and dry clothes seems troublesome and tiring.

We feel that putting multiple hangers onto a rack to dry makes our wrists feel tired, and it takes time to hang many clothes hangers at once.

Now it comes to the stage where we decide our problem.

These are the criterias we used to choose our problem:

1.Validity of the problem.

If our opinion is not shared by other people, they disagree with our problem, then our problem will not be valid, as no one needs a solution for a nonexisting problem. Thus, we have done a survey to find out whether people have the same opinion as us about hanging clothes

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2.Whether the problem is solvable

When a problem is unsolvable, or difficult to be solved by secondary school students there will be no point of choosing this problem. We will not be able to come up with a solution, or to build an actual prototype to prove that our solution is realistic and applicable.

3.Lack of existing solution

When a problem has more existing solutions, it is very unlikely that our solution will be better than theirs. If other people's solution is better, no one will choose our solution

Problem Evaluation Grid

Considerations for Selection	Problems	
	Using a laundry stick to hang clothes onto a ceiling- mounted rack and dry them is tiring and time-consuming.	Using different types of hangers for different clothes is troublesome.
Validity of the problem	5	2
Whether the problem is solvable	4	4

Lack of existing solution	2	4
Total Score	11	10

Eventually we have chosen to solve the first problem, to solve the problem that using a laundry stick is tiring and time-consuming.

2.Defining the Problem

Now that the problem has been identified. we need to gather information to evaluate the usefulness of existing solutions based on *some criteria*. Thus ,we conducted a survey, to find out whether many people suffered deeply from this problem or not. Indeed, we have found out that 51% of the respondents uses laundry stick, and at least 68.2% of those who uses laundry stick feels tiring and time-consuming, with 15.4% of them **strongly agree.**

Comparing and contrasting existing solutions.

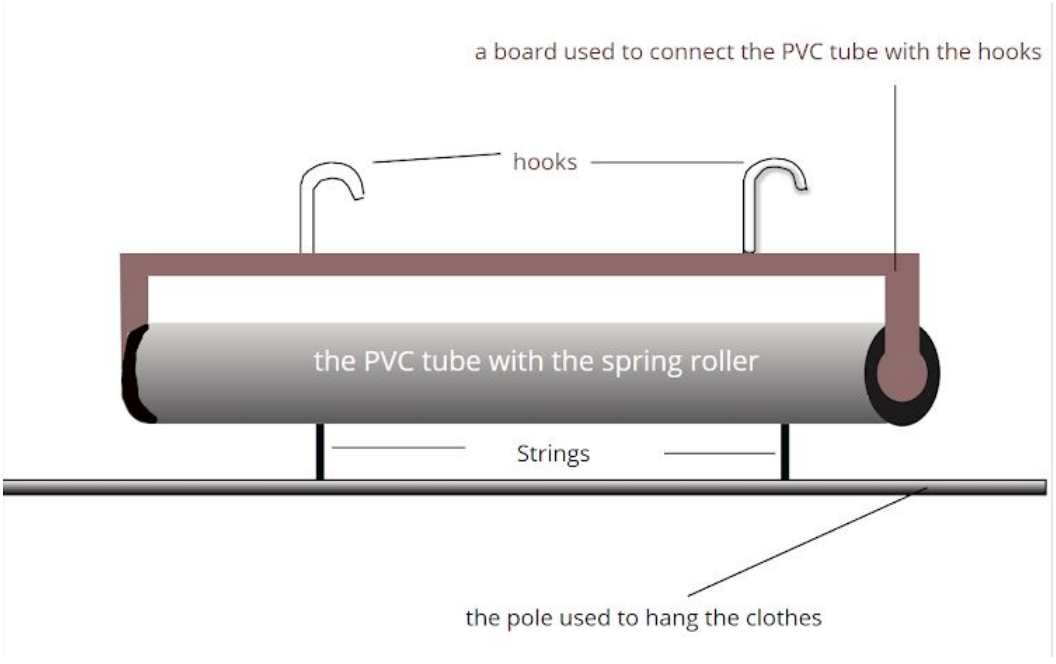
Pulley system: expensive, however easy to operate. It has to be mounted to ceiling, and also requires a wall to install the handle which is used to pull down the rack, meaning it is hard to install.

Ceiling-mounted Rack (using a winch) : Difficult to install as it requires the user to mount it onto the wall, and with a winch, the user will feel tired after rolling it repeatedly. However it costs less than other existing solutions.

Foldable Drying Rack: Easy to install as you just need to unfold the whole rack on the ground and assemble them. However, it is relatively expensive and it occupies space (it stays on the floor)

3.Our BIG idea

Our proposed solution, which is a new mechanism consists of mainly 3 parts: The mechanism itself, the 2 strings and the bar which is connected to the mechanism by the 2 strings.



Our proposed invention function similar to the manual projection screen. Using the spring roller system, once the pole has been pulled down to certain height, the bar will stop there for users to put their clothes on it. Then, simply pull down the bar using the cord again, and the bar will retract to its original position.

The purpose of our invention is to replace the laundry stick and shorten the time and effort taken to hang clothes for them to dry.

First of all, the other solutions need to be mounted to the ceiling. For family that already have a ceiling-mounted rack installed in their house even before they move in (The newer HDB) , it will be difficult for them to remove the rack and install a new system. For our invention, we just need to hang the Clo Thes Hangers onto the rack, instead of mounting directly to the ceiling.

Secondly, our invention has small size, relatively, thus it is easier to bring into the house and install.

Thirdly, our invention is cheaper than most existing solutions.

Most importantly, the idea of our invention is original and unique, we took 2 weeks to search online for similar products and found none.

However, since we are using the concept of a spring roller of the projection screen, we would need to fully understand the principle of it, and think of a way to simplify the design of the spring roller system in a projection screen, to one that is much smaller, but at the same time be able to hold the weight of the wet clothes.

4.Construction and modelling process

As we want our prototype to be constructed in its finest form, we have to select suitable materials for its important key parts, which includes

1.The case that contains and connects the spring roller with other parts.

For the case, we decided to use PVC tube, as it is light, thus the elastic force needed by the spring to recoil the pole will be reduced.

2. The spring roller that recoils the pole upwards.

For the spring roller, its length must not be too long, so that the user can carry it and install it easily, and its maximum elastic spring force cannot be too weak, thus we have chosen it to be 81.4 cm long.

1. Finding materials

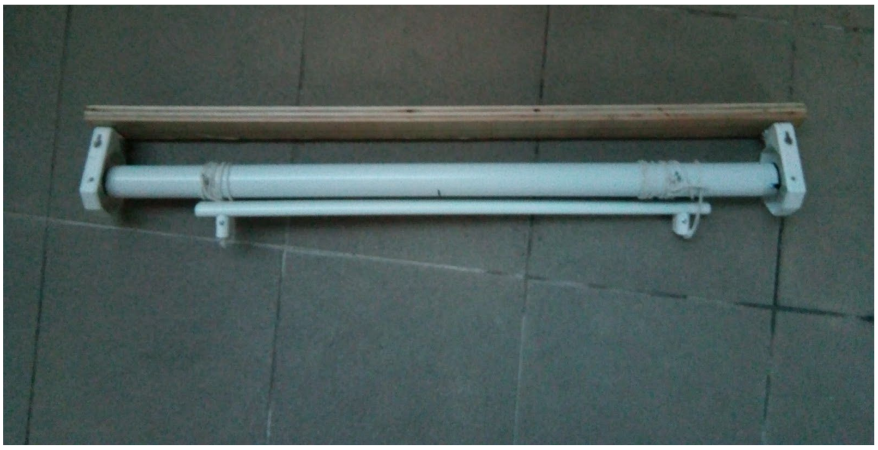
Except for the spring roller which we have obtained from online shops, everything else comes from the school's makerspace and SRC.

2. Construction

(the photo above is prototype 1)

We used a piece of wooden plank, a small spring roller to make the prototype.

Problems: 1 : Weak elastic spring force.
2 : The pole that was used to hang the clothes was not balanced.



(The photos above is our prototype 2)

We used a piece of wooden plank, PVC tube, spring rollers,hooks and strings to construct this prototype.

Solutions to the problems encountered when building the first prototype:

1: We made it greater in length to fit a longer spring roller for a greater elastic spring force.

2. We made the 2 strings that connect the pole and the mechanism together further apart from each other to make the prevent the pole from tilting when heavy clothes were hung on it.

5.Modification and Evaluation

After the construction of prototype

Test Iteration: 1 (Prototype 2)	Tick	Remarks

Test Date: 03/07/2018	Pass	Fail	Potential Failure	
Test Criteria 1: Security of structure	✓			It is strong enough to hold the mechanism without falling apart.
Test Criteria 2: Elastic spring force		✓		Unable to recoil when there are many clothes.
Test Criteria 3: Easiness of installation		✓		We were using a metal tube, and there is no hook yet.

Test Iteration: 2 (Prototype 2)	Tick			Remarks
Test Date: 07/07/2018	Pass	Fail	Potential Failure	
Test Criteria 1: Security of structure	✓			Strong enough to secure
Test Criteria 2: Elastic spring force		✓		The spring is unable to recoil much, it is stuck in the pvc tube.
Test Criteria 3: Easiness of installation	✓			It is light since we used a PVC pipe for the casing, and hooks added to hang the mechanism onto the rack.

From this point of time, we have notice another problem that lies within our prototype. When there is little or no clothes hung on the pole, the pole will recoil very fast will hit the tube, impacting the structure.

Test Iteration: 3 (Prototype 2)	Tick			Remarks
Test Date: 10/07/2018	Pass	Fail	Potential Failure	
Test Criteria 1: Security of structure	✓			Strong enough to secure
Test Criteria 2: Elastic spring force			✓	It can hang clothes, but only 5 pieces maximum.
Test Criteria 3: Easiness of installation	✓			It is not heavy since we used a PVC pipe for the casing.
Test Criteria 4: The collision between the pole and the PVC tube		✓		The pole hits the PVC tube and the clothes will drop.

Construction of final product:

The areas that we can improve on in our prototype:

1.The elastic spring force of the spring roller not strong enough.

(currently the spring roller can only function as we intended when a maximum number of 5 clothes are hung------ any way to make it stronger?)

Methods available	Accessibility of materials	Level of difficulty when constructing	Cost	Total
1. Longer spring	3	2	3	9
2. Add an additional spring	2	1	3	7
3. Increase the tension of the spring	5	3	5	13

(5 being the best and 1 being the worst)

After making the decision matrix, we decided to increase the tension of the spring.

2. The impact of the collision between the pole and the PVC tube is great when the string which connects both together retracts.

Methods	Accessibility of material	Level of difficulty when constructing	How much can it solve this problem	Total
1.Install decelerators	2	3	3	8
2.Install two rubber pads to reduce impact	3	4	5	12
3.Reduce the elastic spring force of the spring	4	4	1	9

we have installed gel padding to decrease the force of impact, and to stop the pole from recoiling further before it hits the PVC tube.

Test Iteration: 4 (Final product)	Tick			Remarks
Test Date: 10/07/2018	Pass	Fail	Potential Failure	
Test Criteria 1: Security of structure	✓			Strong enough to secure
Test Criteria 2: Elastic spring force	✓			It can hang clothes, but only 5 pieces maximum.
Test Criteria 3: Easiness of installation	✓			It is not heavy since we used a PVC pipe for the casing.
Test Criteria 4: The collision between the pole and the PVC tube	✓			The impact of the collision between the pole and the PVC tube reduced significantly by the gel padding

References

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