Hwa Chong Institution
Project Work
Category 3 Inventions Log Book

Title of Project: Indoor Dryer for the Elderly
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1. Problem Finding

1 A List of Problems Found / How we found them

1. **No Strength ---> (related problems?) : trouble taking in clothes in flats/trouble cleaning and sweeping house**
    - Observation on Grandparents
2. **Eyesight problems?**
    - Elderly in general face this problem
3. **Difficulty going to the toilet? (Improvise) (SIT ON TOILET BOWL)**
    - Based on Observation on Grandparents
4. **Difficult to change their clothes. (Movement Problem)**
    - Based on observation at Nursing Home
5. **Difficulty remembering things that they wanted or were supposed to do. (Something like a reminder?)**
    - Side effects of common diseases amongst elderly like Dementia
6. **Unable to sleep well---> something that can lull them to sleep**
    - Observation on Grandparents
7. **Difficulty hanging clothes out to dry…> Indoor Dryer/**
    - Major Problem amongst the elderly
8. **Reaching for things in cupboard that is situated at higher level**
    - Based on Observation

1 B Considerations for Selecting our Problem

Current Solutions in the Market:

- We wanted to tackle a problem that had the least solutions in the market as it would allow our product to seem the most feasible and have more freedom to design our product such that it has minimal similarities to other existing solutions.

Feasibility of coming up with an invention to solve this problem:

- With the basic concept of a solution in our heads, we considered the feasibility of constructing a prototype of that solution
- We needed a sense of security (i.e. materials needed were not hard to source for)

Amount of People Facing this Problem:

- We wanted to choose a problem that would allow our product to possibly benefit the largest amount of people

1 C **Problem Evaluation Grid**

Considerations for Selection (1-4)	Problems			
	Reaching for things in cupboard that are situated at higher/lower levels	Difficulty going to the toilet	Difficulty remembering tasks	Difficulty hanging out clothes to dry
Feasibility of coming up with an invention to solve this problem	3	2	2	3
Amount of people facing the problem	3	4	4	4
Current solutions in the market	3	1	4	4
Total Score	9	7	10	11

2. Define the Problem

2 A **<u>Extent of problem</u>**

- Today, Singapore has an ageing population as a 13% of the population is made of people aged 65 years and above according to statistics published on the Ministry of Health's website (2017)
- The elderly are very vulnerable to falls and injuries when they are cleaning their house or trying to retrieve objects on the floor as they strain their backs easily and are weaker than youths.
- Common method of drying clothes in HDB flats now is by using long bamboo poles.
- However, the weight of the bamboo poles which is approximately **400g** coupled with the weight of the wet clothes, can become a hassle for the elderly
- Hence, our selected problem is: **Traditional Drying Methods is an inconvenience for the Elderly**

2 B Comparison of Existing Solutions

Product	Addis Easi Airer	DriBuddi	TiJUMP
	An ordinary indoor drying rack	Consists of a small motor that sucks in cooler air from outside and pushes out hot air onto the clothes above. There is a metal stand which supports 10kg of clothes which can be hung. Zip bag helps to retain the hot air	Portable dryer with 360 degrees circulating heat ventilation system and vapour removing motor
Pros	Little effort required to open and setup	Efficient drying with the use of hot air	Light and small, very portable
	Comes with 3 year guarantee	Some dryers without motors cost more	No need for ironing
	Good build quality with sturdy struts and joints	No need for ironing since the hot air prevents creases	Uses a remote control, making it very convenient
			Dries clothes very quickly due to 1000 watt heater
Cons	Quite costly considering it is just an ordinary rack with no unique features	Thick clothings took too long to dry	Increase in energy use, not environmentally friendly
		Assembly of stand was physically demanding	Very expensive
			Other dryers serve the same purpose but are much more affordable
Cost	$70	$120	Early Bird: $249.10 Retail: $354.54

3. Your BIG IDEA#

3 A **Proposed Invention Description**

- Our proposed solution consists of a bag made of high-quality plastic enclosing the clothes which are hung on a bar inside.
- A heater then heats up the air inside and the hot air rises to the top of the bag, where two fans blowing in the same direction will circulate the hot air in a somewhat cyclone-like manner.

Initial Solution:

- Telescopic main stand with holes and metal inserts that lock the desired height of the stand
- Foot of stand is expandable like a quadrapod
- Swivel, lockable wheels that are attached onto the feet for easy manoeuvrability
- Heater to be placed at the bottom of the stand
- Charcoal to be installed for dehumidification
- Three fans to be installed at the top (angled to the right for a tornado effect for better heat circulation)
- Wires for fans and heater to run through the main stand to maintain aesthetic tidiness

Revised Solution:

- Main stand has a twist-to-lock function to be adjusted to desired height
- Flat base with pre-attached swivel wheels for easy manoeuvrability
- Dehumidifier rod to be attached to main stand
- Perforated and collapsible metal container to store charcoal
- Two fans will be installed on the hangar

3 B **Purpose and Potential Benefits of Proposed Invention**

- Our proposed invention would allow the Elderly to conveniently dry their clothes **indoors**
- It would also be elderly friendly as it is **portable and easy to manoeuvre**
- It is **height adjustable** so users can adjust the main stand to the desired height
- Makes use of charcoal as it is a **natural dehumidifier**, and therefore making the drying process quicker without increasing the power usage

3 C **How is our product different/better than Existing Solutions**

- Our product would be better than current existing as we aim to make it as affordable for everyone, even for low-income families.
- Our product would also be portable, easy to manoeuvre and assemble, and compact, therefore it is space- saving when it is stored.

3 D **Problems we expect in the course of our proposed invention**

- Struggle with the wiring of the fans and heater
- Difficulty attaching the different parts of the prototype sturdily
- Sourcing for heavy duty heater coils in Singapore
- Liaising with dri-rod suppliers in Singapore
- Sourcing for suitable covers
- Stabilising the Main Stand
- Placing the hanger on top of the metal pipe without fixing it permanently

3 E **Project Timeline**

- 3 April: Proposal Evaluation
- 28th April - 2nd June: Sourcing of Materials/Components
- 5 June: Attached Base and Metal Container to Main Stand
- 26th June: Attachment of dehumidifier container and charcoal (Initial Solution)
- 8th July: Attachment of fans and heater and bag
- 9th July: Purchase/Attachment of Dehumidifier Rod
- 12th July: Mid-Term Evaluation
- 1st August: Initial Evaluation of Prototype
- 2nd August: Modifications made based on observations
- 11th - 13th August: Testing/Data Collection
- 14th August: Wiring/Cable Management
- 17th August: Final Evaluation

4. Construction or Modelling Process

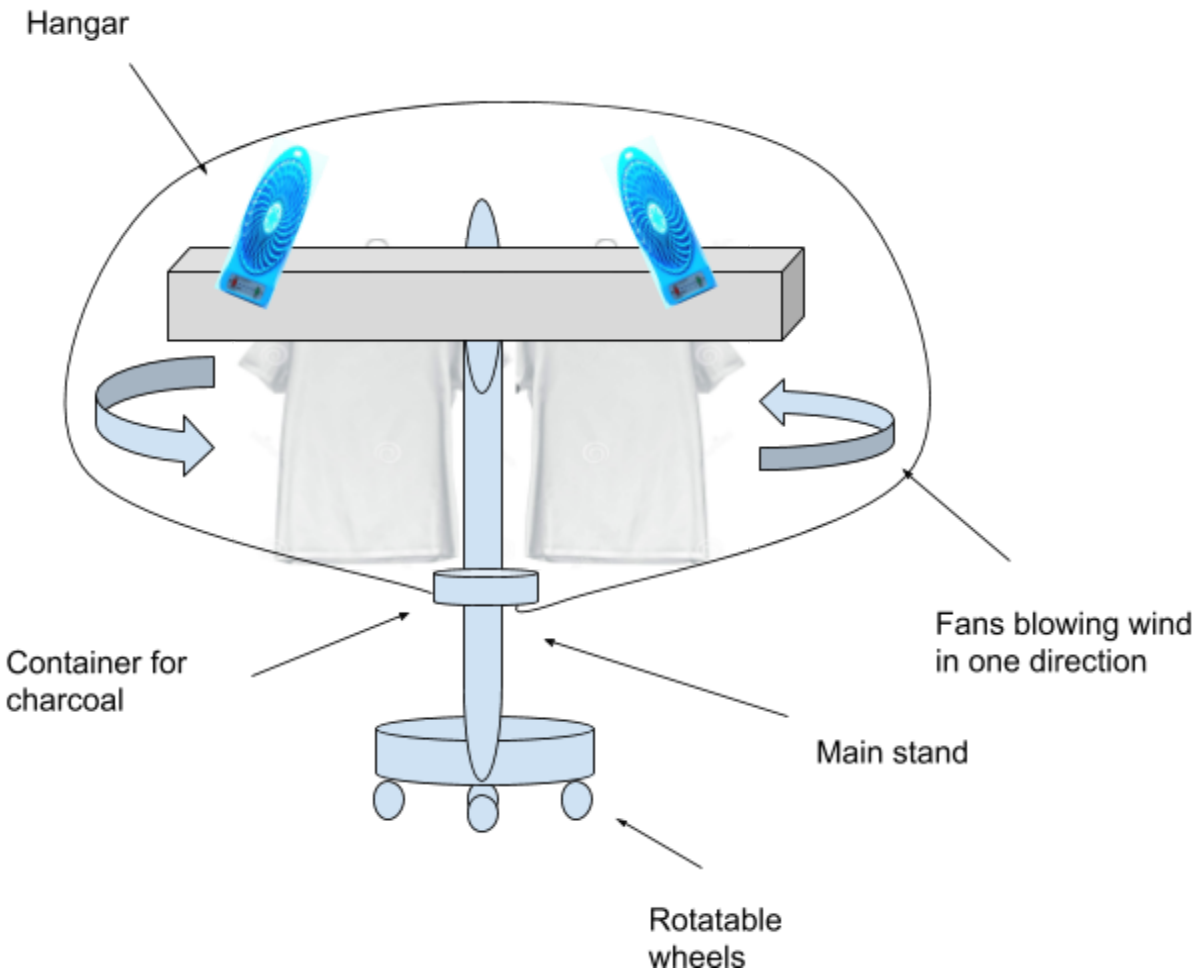
4 A Rationale of Materials Chosen for Prototype

- Main stand made of metal as the main stand needs to be strong to support the weight of the wet clothes
- Hangar made of plastic as plastic is light, cheap and waterproof
- Base made of plastic as plastic is light, cheap and durable

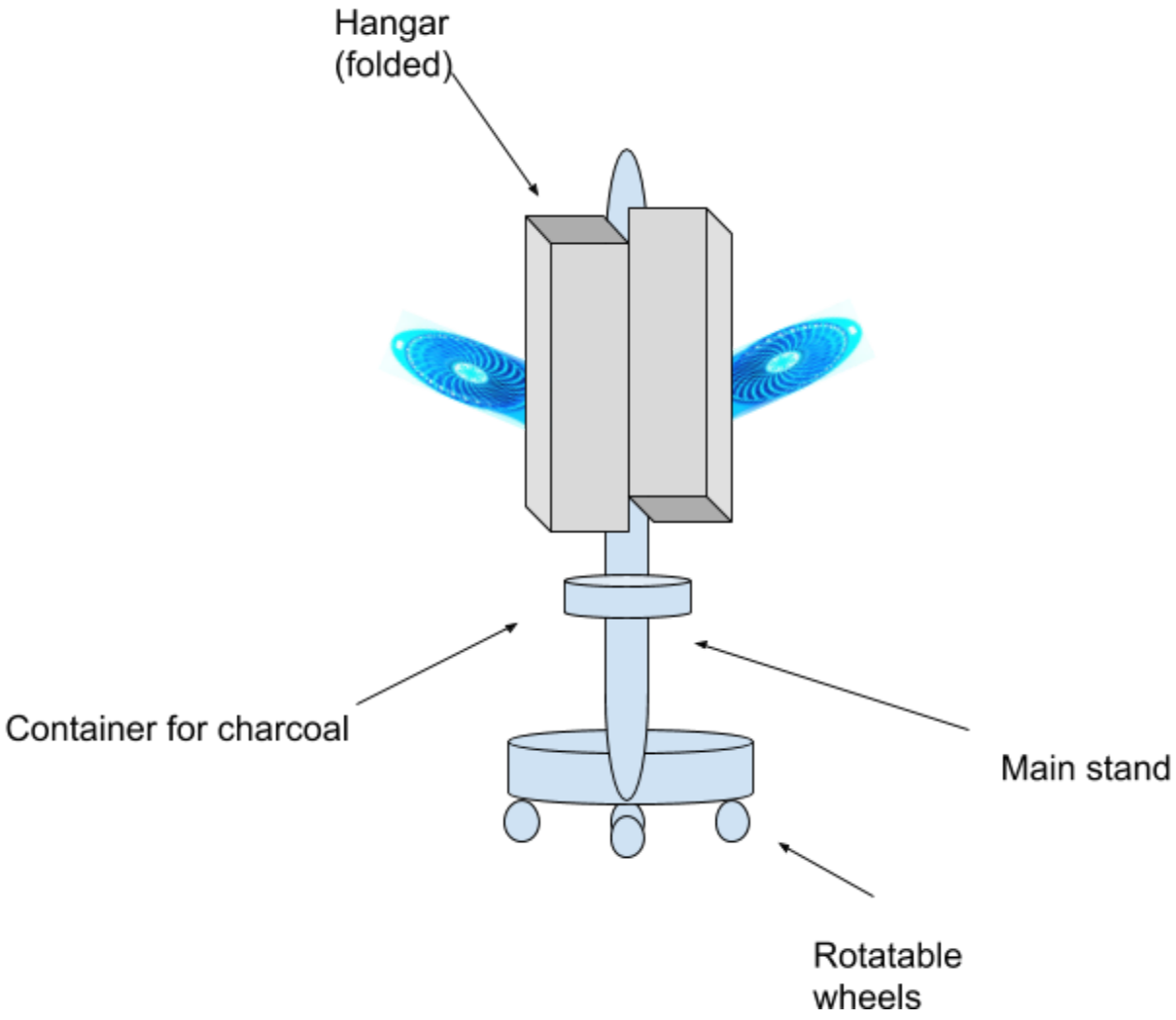
4 B Prototype Development Stages

- **Stage 1: Attachment of main stand to base**
  - Through drilling a 20mm hole in the base
  - Secured cable reel to base with industrial grade double-sided tape
  - Inserted stand into cable reel and base
  - Added hot glue to fill in gaps between the cable reel and stand
- **Stage 2: Attachment of metal container to main stand**
  - By inserting the main stand through a 20mm hole drilled in the middle of the metal container
  - Inserted container onto main stand
- **Stage 3: Attachment of hangar to main stand**
  - Sawed off the unnecessary sections of the hangar
  - Nailed a short wooden rod of 5cm into a longer wooden rod of 13cm, forming a T-shaped stopper.
  - Placed the horizontal end of the stopper into the hangar
  - Placed the other end of the stopper into the main stand
- **Stage 4: Attachment of fans to hangar**
  - Used industrial grade double sided tape to attach the fans to the hangar
  - Zip tied the fans to the metal supports for additional support
  - Angled at a 45 degree angle to create a tornado like effect
- **Stage 5: Attachment of heater to main stand**
  - With the adhesives that already came pre-attached

OPEN


Hangar
Fans blowing wind in one direction
Container for charcoal
Main stand
Rotatable wheels

CLOSED


Hangar
(folded)
Container for charcoal
Main stand
Rotatable
wheels

5. Modification and Evaluation

5 A Initial Evaluation and Modification

Observations

1. **Batteries in fans could not last long**
    a. When not in use, power would still drain from the batteries
    b. Batteries would have to be charged very frequently (Huge inconvenience)
2. **Actual charcoal pieces would disintegrate into carbon particles**
    a. May get trapped in clothing
    b. Develop a musty smell
3. **Bag did not have a good shape**
    a. Bag may get caught in the fans
    b. Does not promote good air circulation

Modifications

1. **Allowing fans to receive power from wall outlets**
    a. Less troublesome as power is constantly being supplied from the wall outlet instead of having to constantly charge batteries
2. **Replacing charcoal with dehumidifier beads**
    a. Dehumidifying beads are kept in a container with a filter, preventing any particles from escaping
3. **Replacing old bag with a newer bag**
    a. New bag is much sturdier, longer and will maintain a good shape at the top of the dryer

5 B Test Data

2 Cloth

Type of Data	Traditional	Invention
Original Weight	21g	21g
Weight When Wet	59g	59g
Weight of Cloth after 30 mins	52.43g	46.36g
Total Time to Dry	2h 44 mins	1h 20 mins

3 Shirts

Type of Data	Traditional	Invention
Original Weight	117g	117g
Weight When Wet	290g	290g
Weight of shirts after 30 mins	198g	138g
Total Time to Dry	1h 52 mins	1h 17 mins

2 Shorts

Type of Data	Traditional	Invention
Original Weight	153g	153g
Weight When Wet	358g	358g
Weight of shorts after 30 mins	294g	259g
Total Time to Dry	1h 36 mins	1h 2 mins

3 Shirts + 2 Shorts

Type of Data	Traditional	Invention
Original Weight	270g	270g
Weight When Wet	648g	648g
Weight after 30 mins	511g	428g
Total Time to Dry	2h 56 mins	1h 27 mins

6. References

Read http://www.bibme.org/citation-guide/apa/ on how to cite references.

6 A Cite the references you have used for your project work. Your source of reference should come from different types (eg books, magazine, websites, journal articles, interview, photographs, product brochure, reviews etc.)

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