

Background & Market Research

Introduction

Gardening is a popular pastime within the Seven Hills community. This activity is a way for the clients to relax, unwind, and get much needed exercise. The clients in the Seven Hills community possess an array of different disabilities. These range from mild physical disabilities to debilitating mental illnesses, leaving most people dependent on on-site helpers. Despite the large amount of available resources, a great deal of hobbies that the general public enjoys, like carpentry or model-building, require fine motor skills and strength that some members of the Seven Hills community do not have. Gardening, let alone watering plants, is no exception. The clients at Seven Hills, despite their abilities, are not able to operate standard watering cans. Fortunately, new technology has been developed that enables people with physical and mental disabilities to become more independent in certain tasks, like watering a plant.

User

People that are disabled can have difficulties with some of the things most people take for granted. These activities range from brushing teeth to watering plants. There are two major problems with standard watering cans. They require a large range of wrist and arm motion and a large amount of strength.

Fine motor skills are physical abilities that everyone develops and exercises when one uses tweezers to pluck out hair or types fast using all fingers. Unfortunately, such skills can be impaired through the inception of a physical or mental disability, stripping the person of a lot of independence. Even tilting a milk jug can be a struggle for someone with aforementioned

disabilities. This problem has been addressed through the development of triggers which allow water flow, eliminating the need for the user to exercise more complex fine motor skills for a simple squeeze of a trigger. Normally, watering cans require users to be able to twist their arms in a large range of motion to be able to allow for water to begin to pour out the spout. However, if the spout was at the bottom of the can, gravity would be able to pull water out of the can. A stopping mechanism would be necessary, but this would require fewer motor skills than tilting the whole can. Trigger mechanisms will require some force, but using the principles of torque and how force applied translates to the shifting of a mechanism, the amount of force needed to operate a trigger can be reduced significantly.

The second problem with current watering cans is the strength required to lift the cans. Although the density of water is not something that can be altered, the material of the can, the amount of water, and the way the can is held can be changed. Different plastics have different densities, with some heavy duty plastics are more dense than others and vice versa. For example, PVC is more dense than water, while Polyethene is less dense than water. Although the least dense plastic can not just be used as it may break easily or be too weak, using a less dense plastic would allow for the can to weigh less (Plastic Reference Tables). Similarly, although watering cans all have a similar purpose, they can vary greatly in volume. Watering cans used for indoor uses can hold about half a gallon, while outdoors can hold about two gallons. The best watering cans according to The Wiring Cutter, holds 2.6 gallons. However, their indoor watering can of choice holds about half a gallon of water (“The Best Watering Can (Outdoor and Indoor)”).

Watering Cans

Watering cans have two major functions, to carry and release water. Typically, watering cans hold half a gallon to two gallons of water, based on use and necessity. Generally, watering cans for indoor plants hold less water, while watering cans that are used in outdoor settings hold more. The type of watering cans designed for the participants in the Seven Hills Community would be for indoor recreational purposes, meaning the cans need to hold about half a gallon to a gallon of water. Conventional watering cans also require fine motor skills to be able to pour the can, whereas new designs may require less motor skills.

Currently there are many different watering cans available to people that are disabled. One available design is a pressurized hose utilizing a trigger mechanism. This design requires a hose to be attached to a faucet and the water to be turned on, eliminating the need to tilt and carry a watering can. The pressurized water will also be able to reach areas that can not easily be walked to and therefore can better spread out the water (Thrive). However, the faucet acts as an anchor, restricting the independence of a watering can to a radius.

Another design for watering cans for people that are disabled is a large can with a control nozzle. This design is able to pour water similar to normal watering cans, but instead of relying on being upright to stop water flow it is controlled by a nozzle. This watering can is able to pour water rather well, but does not address the issue of being too heavy. The can is very large and for people that lack sufficient arm strength, it would be difficult to operate. However, the can is able to move water around easily and can pour. Also, the can is simple and easily to understand which would be a benefit to a person that possesses a mental disability. Simple watering cans may be

more beneficial to the people at Seven Hills. However, this watering can does suffer from being too heavy and requiring too much fine motor skills (Thrive).

A third available watering can is similar to the first. This design can be referred to as an extendable watering lance. This is a hose that is attached to a faucet. The pressurized hose is then attached to an extendable pole that is able to shoot water from the end and spray water on plants. The pole needs to be attached to a pressurised faucet so that it limits the mobility and versatility of the hose. For example, if the user moves too far away the hose, he or she is unable to move as easily and as smoothly. However, this product is able to easily shower the water on a large area and is able to pour onto plants that are far away. Better products may be more versatile in their usage and more easily maneuverable (Thrive).

Last year, a group tried to build and design a watering can for the Seven Hills Foundation. The product they produced is able to hold and pour water successfully. Their project addresses the strength issues by being small and light, and the fine motor skills by possessing a trigger mechanism. Despite their successes, their product does have some drawbacks. Last year's product was made of multiple materials, leaked a bit, and lacked in durability. One major desired change is making the product out of a plastic so that it is able to be pressed in a way that creates a desired product out of a vacuum press (Thrive).

These different watering cans try to address the needs of people that are disabled. They try to address different issues, but whenever they try to improve one aspect a different aspect of the watering can falls short. New designs have potential to address all of the needs of people that are disabled (Thrive).

Materials

One major desired feature is the watering can being made out of a single plastic. Last year's project was not able to reach the deliverable stage because the can was not made of a single plastic. The Seven Hills Foundation would like the watering can to be made out of a vacuum-formed body. There are multiple ways to develop a product out of plastic, the most common being injection molding, compression molding, and vacuum forming (Monsoff, 2005).

Injection molding is a very common molding process used by many different companies today. This molding method requires heating plastic and forcing it into a mold. In the mold, the plastic cools down and reaches a state where it is solid. Once the plastic has solidified the product can be removed from the mold. This plastic molding method has been used in mass production and works successfully. Injection molding is used for things from plastic caps on water bottles to phone stands. Injection molding uses Polymer Resin pellets which are heated and melted to make a mold. Then the mold has pressure applied to solidify the mold and eventually make the product. Then the plastic is cooled and hardened into the desired shape ("Injection Moulding").

A second method of plastic forming is using compression molding. This method is based around compressing plastic on a mold with a large amount of pressure and a very high temperature. The pressure forces the product to meet all points of contact with the mold. As the object contacts the mold, the product begins to solidify and reach the desired state. Compression molding is common with high strength, complex, objects. These objects are very solid and do not

bend or suffer easily from pressure applied. Compression molding is common with automotive parts because it works quickly and produces strong parts (“Plastic Moulding Techniques”).

A final method of plastic molding is vacuum forming. Instead of having pressure applied to the object to create the product, heated plastic is wrapped around the object and leftover air is sucked out using a vacuum, forming a plastic shell. Vacuum forming is able to create smaller details in a product and enables forming of plastics. Although on a larger scale, vacuum forming is common for making hot tubs, similar object that are able to hold liquid without leaking (“Vacuum and Pressure Forming”).

One particularly useful plastic for plastic molding is acrylonitrile-butadiene-styrene copolymer (ABS). This plastic is strong and easily flexible when heated. However, once it cools down it becomes much stronger and much more difficult to mold. This plastic is good for vacuum forming. When hot, the plastic is easily malleable and easy to manipulate. This means that as the vacuum pulls it into shape it will offer little resistance and will cooperate. Also, this plastic is relatively inexpensive at about twenty four dollars for two feet by eight feet. These qualities make the plastic a strong candidate for our final design. However, more inexpensive products may be available, but these may come at a cost in quality (“FAQs Frequently Asked Questions”).

Rotocasting is another possibility for plastic forming. This method uses the rotational properties of fluids and plastics to create a plastic. The plastic is based on a mold that is commonly made out of silicon or a similar substance. Then the plastic will be formed into the final needed material to create the desired design. This sort of method creates a semi-rigid plastic which is able to bend easily and not shatter. This formation is easier than the other methods and

requires less intense resources and machines. Rotocasting can be done using more simple and available materials. Rotocasting is an opportunity to create a semi rigid plastic formation that is able to be used to make a watering can (Systems, 2017).

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Conclusion

Watering cans are currently not suitable for the needs of people that are disabled. These cans lack accommodation and require strength and fine motor skills that clients at Seven Hills do not possess. The available products for people that are disabled require strength, and devices that are available overly convolute the process of watering a plant. One of the desired aspects of the watering can is making it out of plastic to create a smooth and aesthetic finish. Different plastic moulding techniques include, compression moulding, injection moulding and vacuum forming. Each of these techniques has pros and cons and some are more beneficial than others. Newly developed watering cans can be much better and can address the issues with current watering cans.

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