Design and Fabrication of a Token for HCI Guests-of-Honour

2021 Group 11-01

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Abstract

Every year, Hwa Chong Institution hosts many distinguished Guests-of-Honour, and a common practice is to present them with tokens of appreciation to express the school's gratitude. However, a major problem stems from the fact that many tokens are mundane, common or do not serve functional purposes.

To solve this problem, this group's proposed solution involves the designing of a unique token which represents the school culture, while also serving as a sign of appreciation. The token would also serve functional purposes while reflecting the Hwa Chong values.

The Design Thinking Process was adopted in the designing of the token, and our group found that the proposed design is suitable for the use as a token of appreciation. However, there must be improvements made to increase the functionality of the token in order to make it more usable.

Improvements can still be made to the current proposed design, in order to make it an ideal token, which would have high functionality, usability and reflect the unique features of our school.

1. Introduction

1.1 Background Information

Institutions, corporations and organisations often invite distinguished Guests-of-Honour for special occasions and events. A common practice would be to present guests with tokens of appreciation to thank them for their valuable contributions and time. Research indicates that common tokens of appreciation include paintings, books, plaques and flower bouquets. Tokens of appreciation carry special significance and meaning, as they serve as a reminder of the institution's gratitude. It is of utmost importance that tokens of appreciation accurately reflect the values and significance of the institution.

Similar to many other organisations, Hwa Chong Institution hosts many Guests-of-Honour for various school events and celebrations. Past tokens include models of school buildings, paintings, plaques and more. The school has also given out 100th Anniversary-branded gifts to visitors and guests. For instance, PM Lee received a painting at the Centennial gala dinner (*Prime Minister's Office,* 2019).

Figure 1.1.1 Graduation Day 2020 Guest-of-Honour Associate Professor Kenneth Mak Receiving a Model School Building

Figure 1.1.2 Prime Minister Lee Hsien Loong Receiving a Painting at the Hwa Chong 100th Anniversary Dinner

1.2 Current Problems

While such tokens of appreciation may be aesthetically pleasing, they often lack functionality and uniqueness. Tokens are often of the wrong size. Larger tokens, such as paintings and flower bouquets are often oversized. This makes it harder for the recipient to transport, store and use the token. Smaller tokens may not serve a specific purpose, and are more likely to be misplaced, neglected or forgotten about. Furthermore, many tokens do not serve a functional purpose and are thus deemed to be of little value. Additionally, many tokens of appreciation are mundane and common.

1.3 Rationale and Goals for this Project

After identifying the current problems, our group had a clear understanding of how the ideal token of appreciation should be like. We aimed to design and produce a token that is unique, reflects on the features of our school, and can serve a functional purpose. This will allow the recipient to appreciate the token, as well as use the token regularly.

2. Proposed Solution

2.1 Concept

Our design would be modelled after a school building within the Hwa Chong Campus, which makes it distinct and unique to our school. Having a token modelled after a unique feature of our campus would establish “personal connections” between the recipient and the school.

The group decided on Kuo Chuan Art Gallery as the building of choice, due to its intricate architecture and symbolism. Furthermore, it would be unique as previous tokens were not inspired by this building.

Figure 2.1.1 The facade of Kuo Chuan Art Gallery

After further discussion, the group decided to make a terrarium modelled after the facade of Kuo Chuan Art Gallery, as well as the plants surrounding the building. The plants and shrubbery outside the actual building contribute to the remarkable look of Kuo Chuan Art Gallery, and our terrarium will present a miniature version of the building and its surroundings. Both the plants and model of the building would be key elements of the token.

2.2 Design

The terrarium would be a rectangular prism, with a 3D-printed base acting as the 'pot' to contain soil and plants. The backdrop of the terrarium would be a 3D-printed replica facade of Kuo Chuan Gallery, consisting of miniature windows and pillars. The other four sides of the terrarium would be enclosed by an acrylic shield.

The team documented the unique features of Kuo Chuan's architecture, such as the facade, its windows, pillars and door. Kuo Chuan Gallery has a very intricate facade. There is also a garden with unique plants and trees right outside the entrance of the building. We intended to replicate that look, by incorporating both the architectural and botanical elements of Kuo Chuan Gallery in the token.

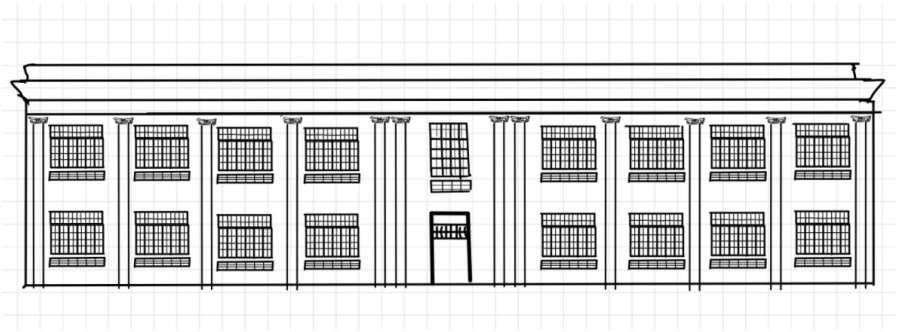

Figure 2.2.1 Rough Sketch of the Building's Facade for Visualisation

Terrariums are self-replenishing cycles, where the exchange of gases as well as the evaporation and condensation of water occurs within the terrarium environment. Thus, there is no need for large openings for ventilation and the exchange of gas. Furthermore, terrariums only require watering every few months, which reduces the care and maintenance required, while remaining visually appealing at the same time. This makes it an ideal gift as the recipient can use it as a piece of decoration without having to care for the plants inside.

2.3 Testing of 3D-Printing and Acrylic Materials

Due to the nature of terrariums, it is crucial that the materials used are waterproof and leak-proof. The team tested the feasibility of using various materials and glues.

Firstly, the team tested for potential leaks when acrylic and 3D-printed materials were glued together with acrylic glue. The two plates were held together sturdily, and no leakage occurred. It was decided that acrylic glue would be the adhesive of choice, and that glueing acrylic plates to 3D-Printed Plates would be feasible.

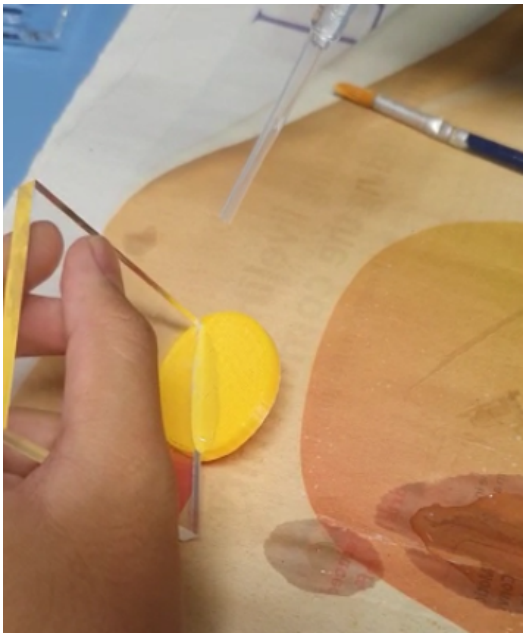

Figure 2.3.1 Testing for Potential Leaks Between Acrylic Plate and 3D Printed Plate

Next, the team explored the possibility of joining two acrylic plates together, for the outer covering of the terrarium. While no leakage occurred, it was found that the plates were not held firmly, resulting in increased risks of breakage. It was decided that acrylic would be a suitable material for the covering of the terrarium, but joining multiple acrylic plates with acrylic glue would not be a feasible option.

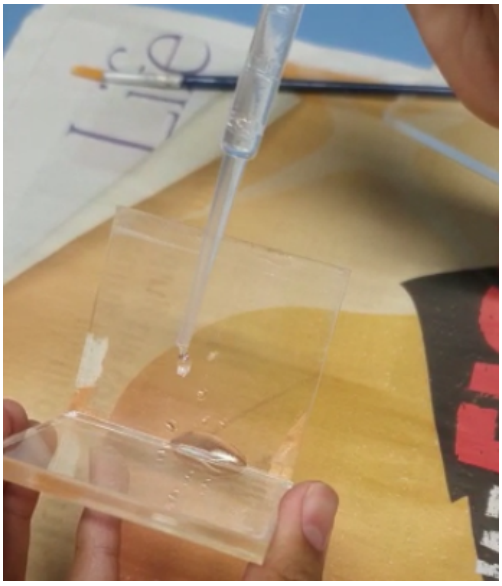

Figure 2.3.2 Testing for Potential Leaks Between Acrylic Plates

Thus, the team sourced for other methods of manufacturing a sturdy and leak-proof covering of the terrarium. In order to ensure that the 3D-Printed Base and Acrylic Covering maintained waterproofness and sturdiness, a single acrylic plate must be used. It was found that acrylic bending would be a feasible way to manufacture the covering of the terrarium. A single Acrylic Plate would be bent into the correct shape and attached to the 3D-Printed Base.

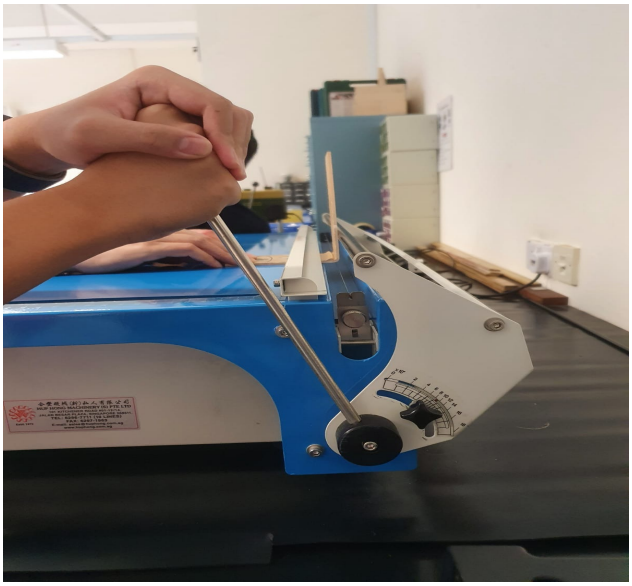

Figure 2.3.3 Testing of Acrylic Bender

2.4 Terrarium Materials

The terrarium plants, like the building facade, would be a main component of the token. We sourced for the correct types of plants, to ensure that minimal care is required and the plants can thrive in the terrarium environment.

Plants have vastly different preferences for soil types, and thus plants were chosen with similar soil preferences. The fact that the soil is in a terrarium also calls for some modifications and additions. After research, the soil and the order of materials are (from bottom up) rocks, charcoal, potting soil and then the actual plants and decoration.

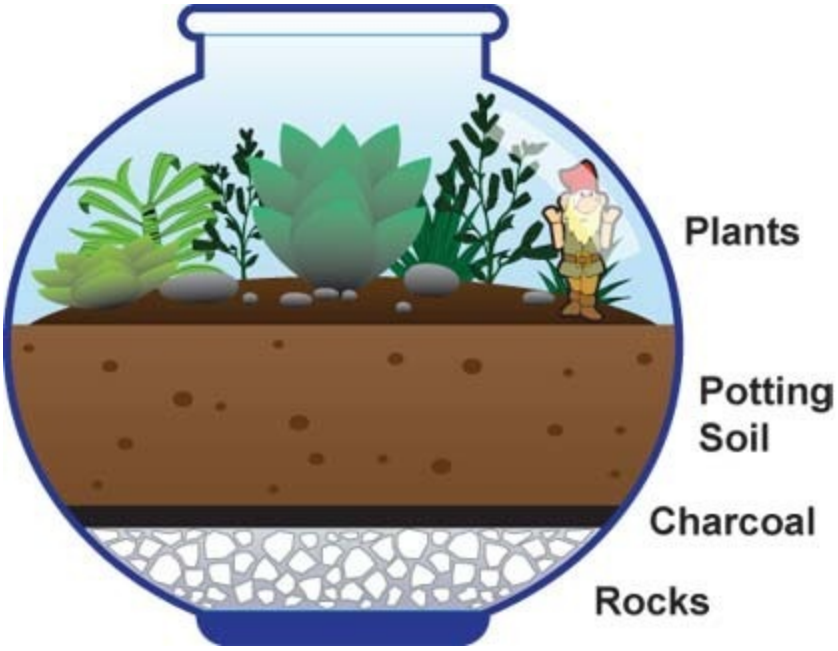

Figure 2.4.1 Proposed soil layers and order of layers (Terrarium shape in figure is not representative of token design)

The rocks and pebbles of the bottommost layer is used as a drainage system by removing unnecessary water from the terrarium's foundation to prevent rotting and root damage. Gravel can also be used. Charcoal, the second last soil layer, acts as toxin removal in the terrarium. It absorbs chemicals in the soil, water and air that can build up inside the terrarium over time and damage the plants. Live moss can also be used. Lastly, a thick layer of potting soil is also needed, due to live plants needing nutrients and water. The plants and the soil in the terrarium release water vapor, essentially recycling water. The vapor is then collected onto the walls of the vessel and trickles down to the soil. Terrariums are self-nourishing, making them ideal tokens as minimal care is needed for the plants. *(National Aeronautics and Space Agency (NASA) Climate Kids)*.

Plants are also essential in a terrarium. Through extensive research, the team has decided upon a few plants to be used, to replicate the life-sized plants in Kuo Chuan Art Gallery. From our research, we were able to identify and select terrarium plants which have similar shapes and looks to that of the actual plants surrounding the building.

Different mosses, nerve plants and lemon button ferns would be used. Such plants would be ideal for terrarium usage, as spike mosses thrive in terrarium environments with other plants *(The New York Botanical Garden, 2021)* and different types of mosses give terrariums more vibrancy while serving other purposes, such as removing toxins and retaining humidity *(Terrarium Tribe, 2019)*.

***Kuo Chuan* Plants**	**Terrarium Plants**	**Notes**
Grasses	Moss	A glamorous terrarium plant which adds vibrancy to the terrarium.
Red Flowers	Red Nerve Plants	Red nerve plants have a distinct red, mosaic design. Little care is needed for nerve plants, making them ideal for terrarium usage.
Bushes	Spike Moss	A green plant resembling the bushes. Thrives in a terrarium environment with other plants.
Trees	Lemon Button Fern	A fern with small, round leaves with a droopy look. Easily trimmed and thrives in terrarium environments.

Figure 2.4.2 Table of Terrarium Plants

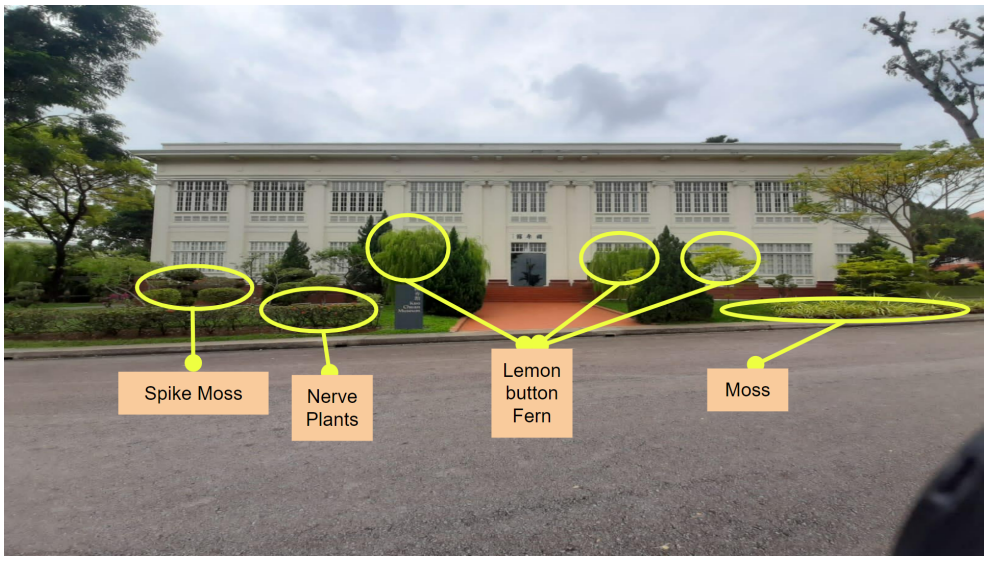

Figure 2.4.3 Illustration of Actual Plants and Terrarium Replications

Figure 2.4.4 Red Nerve Plants used to replicate Flowers

Figure 2.4.5 Spike Moss used to replicate Bushes

Figure 2.4.6 Lemon Button Fern used to replicate Trees and Shrubs

2.3 Prototyping

We incorporated other scientific and engineering methods in the design and fabrication of the token. 3D modelling and printing, as well as acrylic bending were used. We designed a replica of the windows of Kuo Chuan Gallery, which would serve as the backdrop of the terrarium.

Figure 2.3.1 Sample Digital Model of Terrarium Backdrop (Model Windows)

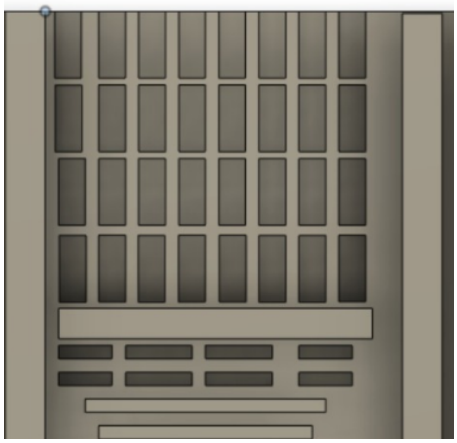

Figure 2.3.2 Close-up of Model Window

Figure 2.3.3 Print-Out of Model Windows

Additionally, in order to boost our understanding of concepts and skills used in this project, our group members participated in Massive Online Open Courses on 3D-Printing, Design Thinking and Engineering Project Management.

3. Results and Discussion

3.1 Findings and Observations

Using the Design Thinking Process, the group reviewed the design and proposed improvements. The group found that such a design would serve as a unique token, as it can be used as a piece of decoration. The minimal care needed for the terrarium also made it a suitable token. However, we understood that the recipient might be concerned regarding the care and maintenance of the plants inside the terrarium. On top of that, apart from its decorative purposes, the token has limited usability. We wanted the token to serve more purposes, making it a more feasible gift as the recipient can use it frequently.

3.2 Areas for Improvement and Future Work

As the terrarium contains unique components such as plants, the recipient may be concerned regarding the care and maintenance needed. We will explore ideas like designing an information sheet or pamphlet to provide information on the steps needed to care for the terrarium, as well as information pertaining to the types of plants used.

To increase the usability of the token, we plan to incorporate a stationery holder at the back of the terrarium. The terrarium can be used as a piece of decoration on a table and shelf, while other items like stationery and keys can be stored at the back.

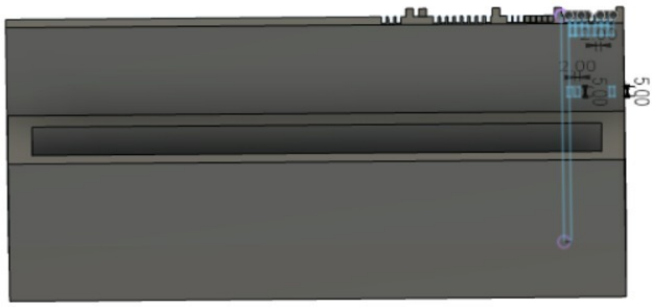

Figure 3.2.1 Design of Stationery Holder

We also identified some minor defects with the sample 3D-print, and decided to make improvements to the digital model. For future prints, we would print the windows as individual strips to reduce printing errors, and then paste them onto a 3D-printed backdrop.

4. Conclusion

The token developed is unique, usable and thus would not be stored away and forgotten, it is also of a convenient size to allow for easy displaying and using of the token, and finally it is not too expensive. More can be done to allow greater usability, and would serve its intended purpose as a functional and unique token.

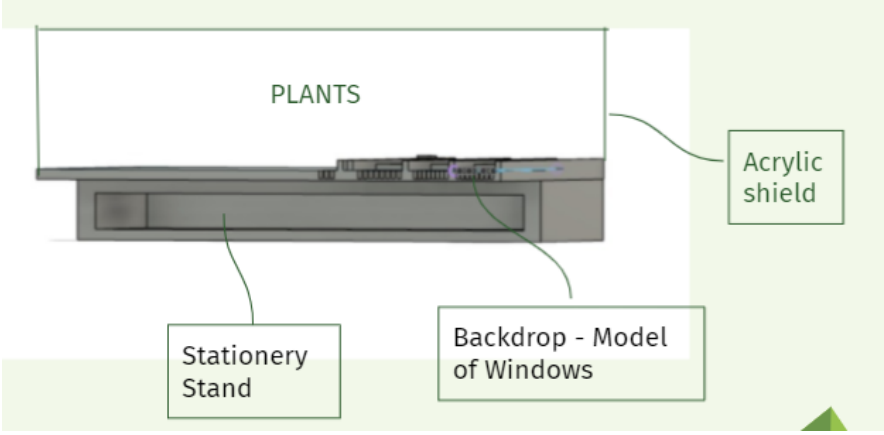

Figure 4.1 Aerial View Layout of the Improved Design

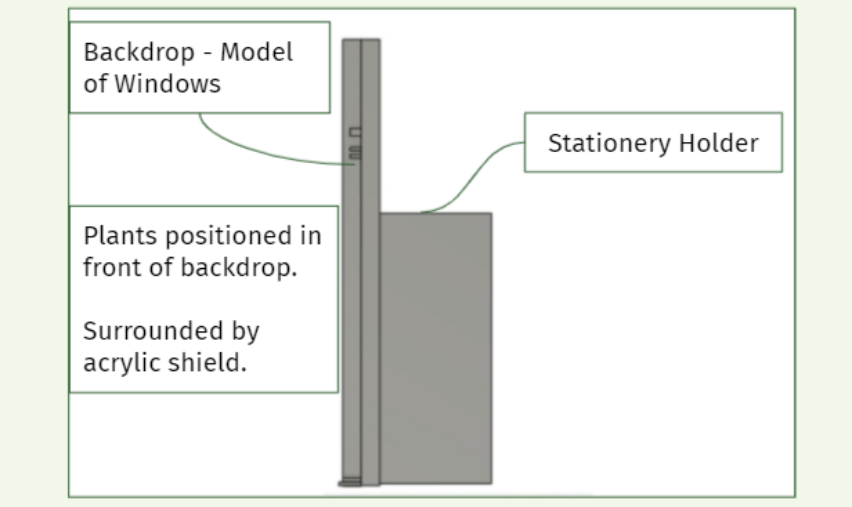

Figure 4.2 Side View Layout of the Improved Design

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6. Acknowledgements:

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