Demonstration on Areca Catechu Tree Reuse with Supporting of Information Technology

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Abstract. Areca catechu can be commonly found in Taiwan and Asia. By the restriction of agriculture policy, often the tree is chopped down and left in the wild and became an extra burden on the local environment. In this study, reuse design cases and opportunities were collected as Blog, so that people can access more easily. To enhance the user’s awareness and information access it included the facets of its biology, culture history and reuse cases. Furthermore, we proposed demonstration supported with information technology. A blog can collect facts and examples with capabilities of multiple tags. This ability makes information search more accessible. The proposed approach combines both physical samples and visual elements in Blog which can be view by mobile phone. From the survey, Blog performs better than a regular internet search. Most people feel interesting, and some people were able to have own idea. Demonstration designs gather both elements will help to form a positive communication to the society with sustainable thinking.

1. Introduction
Areca catechu [1], often known as betel nut tree, can be commonly found in Taiwan around the rural or agricultural regions. It forms part of the unique scenery and culture memory. Though the specific ways consumption of its fruit, the betel nut [2], has been part of the local social history for years, the recent founding of its cancer-causing characteristic has resulted in its reduced consumption. By the agriculture policy, often the tree is chopped down and left in the wild. Part of the trunk fell into the river, also impede the smooth flow of stormwater and became an extra burden on the local environment (figure 1). Its plantation is also known to have a negative impact on the soil and water preservation. By identifying more about it, sometimes we found a different perspective. Though this is indeed true due to the tree’s shallow root, however, it is not as bad as how the media portraits it. Recent years the government had been promoting to plant coffee trees along with areca trees to preserve the soil conservation. By utilizing the specific properties or trait of catechu, it can be turned a burden into resources. Many products were designed using different parts of Areca catechu [3]. Recently, a facile synthesis of gold nanoparticles (GNPs) using the aqueous extracts of the aerial roots of Rhaphidophora areca intertwined over Areca catechu was carried out under different conditions, namely room temperature, higher temperature, solar irradiation and pH variation [4]. Apart from reducing waste, we can also get to know more about its unique growth pattern, and its close relationship with our ancestors.
Figure 1. Areca catechu and burden to the local environment (a) only head and leave cut-off, (b) trunk cut-off near the root, (c) section view of the trunk, from inside to outside, the outside made of hard Xylem and inner being vascular structure.

The primary intentions of the paper (figure 2) are: (1) collect knowledge related to the Areca catechu, (2) build a E-book Blog of Areca catechu, so that people can access more freely, (3) collect reuse cases (indicated by static demo in figure 2) related to the Areca catechu to promote designer to generate new design, (4) proposed a demonstration approach with both physical samples and visual elements to extend the impact to youth groups.

Figure 2. Main elements and intentions, physical display, acrylic tube contain samples and reuse design.

2. Collection of reuse designs
Our ancestor had a harmonic relationship with nature, plant and the soil. Areca catechu tree’s unique composite material structure and its mechanism of transporting water are also an interesting phenomenon. While you find reuse opportunities, we can form a multi-faceted channel to pass information to our students and people. The E-book Blog and demonstration design discussed below, hoping that not only discovers reusability opportunities but also considers enhancing communication by providing the facets of its biology, culture history and sustainable facts. Design supported with information technology can extend the audience in a different location; cooperate to collect the idea and cases. The demonstration is undoubtedly helpful acquiring knowledge, experience, and feedback. That will support to form a positive communication loop with the society.

The areca catechu is broken down into four parts:
Leave: sheath, body and buds,
Fruit: ripe and unripe,
Trunk: from inside to outside, the outside made of hard Xylem and inner being vascular structure,
Root: radiant like; root body is round and there are enlarged nodes at the bending regions.
The design considerations included three facets. To better display different parts of the plant, we use a transparent acrylic pipe (figure 3). Different parts of the plant can show inside this pipe. The significant parts’ characteristics are listed below (figure 4):

Leave sheath and body: Sheath reuse examples: fans, flip-flops and food plates. By extracting recycled sheath inner surface’s fibers, it can form translucent stripes, which can be weaved into translucent films. The surface of a unripe nut is green. After cutting the nut it is edible. This is placed at the top of the acrylic pipe.

3. Physical samples design

Ripe nut gradually grows to a larger size. Its outermost layer becomes a hard, resistant fibers layer, and the middle core is a hard shell. By breaking the shell one can obtain the seed, which can employ as a dye. The central part of the acrylic tube displays products that made using this dye. The trunk can be as tall as 20 meters. Its nodes are where the sheath is attached. The closer to the root of the stem the more it turns into xylem and phloem. The inside of the main trunk has the vascular bundle. Its xylem’s texture is different to the one from ordinary trees. Each year it grows 3 or 4 extended rings. It is unique in that the vascular bundle growths in an oblique fashion. The slices made using a planer placed in the upper middle section so that one can observe that gradual change. The cross-section of the trunk can be used to show its transition from hard to soft. We can join each acrylic pipe with a vascular bundle to demonstrate the water transferring behavior. The root grows downward in an umbrella-like shape. A cross-section is made (added coloring) and placed in the acrylic pipe outer regions. The main trunk and the root reused as a substrate for flowers, or as unique patterned plates attaching to the ground.
Figure 3. Samples of visual demonstration in Blog, (a) leading pages and corresponding tags (articles) on right side, (b) physical display, and (c) overall display mode.
Figure 4. Reuse cases of the different parts of the plant [5, 6], where (a) the carpet from unripe fruit (by T S Su), (b) the flip-flops (J L Lu) from portion of leave sheath, (c) light design (S Y Du) also by using leave sheath, (d) woven structure which collect from inner surface of sheath (S L Huang).

4. Demonstration supported with information technology

Scientific demonstration focus on information display which attracts people to further exploration. Knowledge-based society demands different attitudes than in the past regarding learning [7]. It is essential to develop, evaluate, and improve design using an iterative design-based research approach [8]. The idea is not only to give a representation of the facts, but the intention involves users in an interaction as part of the information access process.

Mobile devices extend the learning environment beyond classroom walls [9]. Mobile learning provided a new delivery mechanism to overcome traditional learning [10]. The concept of context-aware learning was identified as a learning environment that appropriate content can provide at the right time and in the right place [11]. By proper organize the physical and information design, it is possible to improve the possibilities of “provide at the right time and in the right place”. Contextual information in the physical world and the adaptation accordingly to user action may provide customized learning content through mobile devices in response to situations. The trade-off between devices still needs to consider user’s affordance.

We use Blog to describe the growth of the tree, the reuse procedure and reuse design details (interactive demo). The physical samples also included (static demo) to extend user's experience. When people see the physical display, they often request the information related to display examples.
**Figure 5.** Communication design: upper part: e-book blog, lower part: physical facilities.

The Blog gives the visual demonstration, and acrylic tube display offers a physical presence. In the beginning, the audiences choose the part on the Blog that he or she wants to look. Within the Blog, everything saved in List with picture and text, and index points to different facet information such as cultural, plant structure, reuse and so on (refer lower part of figure 5). As Blog is demonstrating, the user likes to find corresponding on physical display, allowing the user to engage further. When the user is interested in a particular part of the material, he or she can search using the tags and trigger picture or text (refer upper part of figure 5).

E-book App was development firstly by choosing MIT App Inventor as the prototyping tool. The List structure utilized mostly for sequencing facts display, including picture/ text. The list index was organized as follow: 01-09 culture, 10-19 leave, 20-29 fruit, 30-39 trunk, 40-49 reuse of leave, 50-59 reuse of fruit, and 60-69 reuse of trunk. Depending on the collected data, the App will extend gradually.

Some difficulties were found with E-book App. There is no search ability, while the cases growth users cannot see what they want. MIT App Inventor has constraints on pages swap control and data retrieval with simple Tiny Database. Consequently, we shift our design from E-book App to E-book Blog.

The Google-supported blog application is Blogspot. It has become one of the top destinations on the internet to start a blog which is accessible with a Google account. Blogspot search engine that helps the user to find information focuses on the internal of the blog. The platform can collect facts and cases with capabilities of multiple tags. This ability makes information search much more comfortable.

### 5. Preliminary survey

Articles related to areca catechu tree are limited. We compared the user perceived depth on information regarding betel, between only use Google search to acquire knowledge of the subject, and experiencing our demonstrating design. Google search used as a reference baseline, where users conduct 15 minutes search and then answers a questionnaire. The facets of the questionnaire survey include:

- A: I think the betel nut tree re-use design is interesting.
- B: I acquired lots knowledge within 15 minutes using Blog.
- C: Sustainable design needs to understand a wide range of knowledge.
• D: Reuse design in different regions is similar.
• E: I can have ideas about reuse of betel nut trees.

![Figure 6. Histogram results of question (a) A: re-use design is interesting and (b)E: have ideas about reuse, where vertical axis is the accumulated count.](image)

The survey conducted on 20 users of Blog, it performs better than an internet search. Physical design supported with information technology extends positive communication with the society. Although internet search can provide a vast amount of information, they can often repeat. On the other hand, by using Blog, the audience can acquire facts through tags and systematic information structure within the Blogs. The averages (based on 5 point scale) of question A-E are 4.0, 3.7, 4.2, 3.3, and 3.15. By the message inspired, most people feel interesting. Some people have been able to provide an idea (figure 6). The demonstration approach with both physical samples and visual elements extended the impact to youth groups, and promote designer willing to generate a new idea.

6. Conclusion
Areca catechu is chopped down and left in the wild and became an extra burden on the environment. Re-look the Areca catechu can get an insight of reuse opportunities. People’s awareness of its biology, culture history and scientific facts inspire personal intent of creating. The outcomes of the paper are: (1) collect knowledge related to the Areca catechu and build an E-book Blog of Areca catechu so that people can access more freely, (2) collect reuse cases related to the Areca catechu to promote designer to generate new design. From the preliminary survey, the Blog performs better than an internet search. The main demonstration elements collect diversify knowledge of the Areca catechu within the support of the extendable Blog. The collected reuse cases respire and promote designer to generate more new design. The demonstration approach with both physical samples and visual elements extended the impact of youth groups which gather local people participating in related events.

7. References
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