UBC Social Ecological Economic Development Studies (SEEDS) Student Report

An Investigation into Interactive and Non-interactive Displays in the New Student Union Building

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Abstract

In the new Student Union Building (SUB) scheduled to open in 2014, there will be a need for display boards to display information such as events and sustainable features of the new building. The purpose of this investigation is to find a combination of displays to effectively communicate the selected information with users of the SUB. Three different options for the arrangement of the display boards were considered: A) Have one large TV directly connected with small interactive displays, B) many small interactive displays, or C) a few small interactive displays with a separate large non-interactive display. The most effective option was found to be C). Suggestions regarding the location of the displays and the content that should be displayed on them are made. A triple bottom line analysis is conducted to examine the social, economic and environmental impacts of each display option. The paper concludes that light-emitting diode (LED) displays should be used for the large display boards, and a specific brand of industrial touch screen should be used for the interactive display boards.

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List of Abbreviations

AMOLED – active matrix organic light-emitting diode

CPU–central processing unit

DVT–digital vision touch

GHG – green house gas

ICI–Industrial Computer Inc.

LCD – liquid crystal display

LED – light-emitting diode

OLED – organic light-emitting diode

PC–personal computer

PMOLED – passive matrix organic light-emitting diode

SUB – Student Union Building

TV – television

1.0) Introduction

There are a few options regarding the number of boards. These options were proposed by team members as well as Chris Karu, the current Student Union Building (SUB) sustainability engagement coordinator. The following are the three proposed options:

- Option A: One large centralized display board partnered with a small interactive screen.
- Option B: Number of interactive small display boards accompanied with display properties.
- Option C: One large centralized display board along with multiple small interactive screens.

After investigating these three options, the team decided to pursue a design almost identical to option C. The decision was based mainly on social behaviour of students. A proper distribution of the interactive display boards would reduce the need for extended wait times. A large central display board would be necessary to address the demand of many students at once rather than the few who would be using the interactive display boards. A triple bottom line analysis was used to determine the type of central display board technology and the type of interactive screen suitable for the new SUB atrium.

1.1) Non-interactive Boards

The three types of television (TV) technologies that were considered in this report included liquid crystal display (LCD), light-emitting diode (LED) and organic light-emitting diode (OLED). Plasma technology was not considered even though it remains a fairly popular technology because it consumes too much power. Both LCD TVs and LED TVs refer to display technologies that use layers of polarized glass to either block or pass light to produce an image. LED TVs differ from traditional LCD TVs because they describe a subset of LCD TVs that use LEDs as a source of light rather than fluorescent lights and generally consume less power than LCDs (HowStuffWorks, n.d.). OLED is a display technology utilizing carbon-based compounds that has only just recently been added into consumer products such as smart phones and MP3 players. There are two major types of OLED displays: Active-Matrix (AMOLED) and Passive-Matrix (PMOLED). AMOLED displays are the ones used in television screens and because we are only considering television screens, they will simply be referred to as OLED displays throughout this report. AMOLED updates pixel-by-pixel instead of row by row. Each pixel is

activated with its own electrical current. Since each pixel is individually controlled, this makes AMOLED ideal for video playing (Freudenrich, 2011).

1.2) Interactive Boards

The smaller interactive display boards will be incorporated into a central location at the new SUB to increase traffic. The team opposed the idea of having a single interactive display board because that may cause people to wait to use the features on it. Multiple units will eliminate or decrease wait times and so that users will receive information promptly. The team wanted to present the display boards in a manner that allowed people to feel more comfortable to interact with the display boards and discover more about UBC.

The types of display boards that will be considered are of the touch screen variety. Our team has further identified that an industrial touch screen display board (such as those you find in your grocery store's self-checkout counter) is more suitable than a consumer grade touch-screen.

2.0) Non-interactive Boards

The non-interactive display board will be a large TV. The content that will be displayed on this large TV will be able to reach a large audience so it is a suitable method of increasing awareness of sustainability. A triple bottom line analysis will be used to help make a decision on the type of display to be used.

2.1) Social Analysis

In order to promote sustainability awareness, the following information should be presented on the main display board.

The large display boards will range from displaying a slide show with various types of information and short video clips to draw viewers' attention. The slide show can contain information such as sustainability tips of the day, power consumption differences between different UBC buildings, upcoming school events, and important school-wide messages. Video clips can relate to sustainability, such as a video walkthrough of the technologies utilized in the new SUB and short subtitled documentaries on environmental issues. The goal of these large display boards will be to fulfill the role of a central communication link between UBC and the student body, as emails do not always fit this purpose. The display board should be located on the side of the staircase so that anyone passing through the SUB atrium could see it. Because of the prime high-traffic location of these display boards, important messages will be easily seen by the majority of the UBC population. As well, the location will be a venue promoting sustainability to a large audience.

The slide show and video clips should take into consideration studies on green advertising. By targeting problems identified in this area of research, it will more likely create a sustainability awareness campaign that is effective in convincing students to incorporate more sustainable practices into their everyday habits.

Past research revealed several reasons why green campaigns have faced problems. The study by Straughan (1999) and Prakash (2002) show that people are not convinced that their daily habits can affect environmental change. People believe that the work of one individual is insignificant and unless they can see that everyone is willing to work together to become more sustainable, they refuse to be more sustainable themselves. McDonald & Oates (2006) show a related problem: there is a lack of agreement about which activities are effective and how much

effort is required to complete those activities. To tackle the first issue, the TVs should display UBC's plan to reduce green house gas (GHG) emissions. Patrons of the SUB will gain confidence that they will not be alone in their efforts when they know about UBC's attempt to be carbon neutral by 2050. It will help students realize that there is a general movement towards becoming more sustainable and it challenges the students to become involved and be more sustainable as well. The second issue can be solved by having the TVs display daily tasks and reminders such as turn down the heat and switch off the lights. These are tasks that many people should perceive as easy and are beneficial to the environment. The daily tasks and tips are aimed more at educating people on what is effective and to show that many simple tasks that do not require much effort can have a large positive impact on the environment. This whole process is aided by the TVs being located in a high traffic area. A large proportion of the UBC population will see these messages and that will hopefully translate into more agreement about which activities are easy to do and have significant positive effects for the environment.

Kim, Hong and Magerko (2010) found that displaying information about energy usage could promote change towards a more sustainable lifestyle. The group along with Holmes (2007) also found that images were the best way of convincing people to change their habits. Kim, Hong and Magerko (2010) found that iconic images were particularly useful in promoting change and Holmes (2007) found that thought-provoking and aesthetically pleasing images would aid in promoting change. Holmes (2007) also found that that a user often did not realize the amount of power their device was consuming because there is no real-time information that was presented to them. An image that most students would probably agree is both aesthetically pleasing and iconic is the rainforest. The current energy that is being used in the SUB atrium could be displayed as the health of the forest. If more energy is being used, the forest could begin to decay. If people were being more efficient and less energy was being used then the forest could look healthier and lusher. By planting these images into the minds of SUB patrons and letting them know that their actions can affect the environment, it should bring about positive changes as corroborated from previous study results.

2.2) Economic Analysis

Although OLED boasts an impressive list of technological advantages over its competitors, there is one major disadvantage that proves to be a major obstacle in preventing OLED from being a mainstream product: price. Even though this type of display is already

common in today's smartphones and other small handheld devices, such as the Samsung Galaxy S, it has only taken television form as early prototypes and as a result, suffers from high prices.

On average, LCD TVs are cheaper than LED TVs. The retail price of a 55" LCD TV (Best Buy, 2011a) is $1184.99. The retail price of a 55" LED TV (Best Buy, 2011b) from the same brand is 1667.99. The price of OLEDs proves to be a major obstacle in preventing them from becoming a mainstream product since a 25" OLED TV already costs $6100. The LED TV will only use a maximum of 166W (Sony, 2011a) while the LCD TV can consume up to 315W (Sony, 2011b). OLED TVs should consume the least amount of power because they do not require power to produce black. The LED TV is significantly more expensive than the LCD TV but the operational costs of the LCD are much higher. The OLED TV is by far the most expensive choice.

2.3) Environmental Analysis

The environmental considerations that are taken into account include the efficiency, power consumption and harm to the environment. The damage to the environment usually comes in the form of the materials that are used to create the displays.

These displays will be on for many hours each day so the amount of energy required to run them is an important factor in determining its environmental impact. For the two specific Sony models that were shown above the LED model used almost half the energy of the LCD model. In energy star mode the consumption of the LED model and LCD model was 85W (Sony, 2011a) and 166W (Sony, 2011b) respectively. The maximum consumption of LED model and LCD model was 166W (Sony, 2011a) and 315W (Sony, 2011b) respectively. The LED model consumes almost half the power of the LCD model. In general, LED TVs use about 40 percent less electricity than LCD TVs (Griffin, n.d.). One environmental advantage OLED displays have over traditional LCD and LED displays is that no power is needed to display black pixels; the "pixel", or more specifically the anode-cathode layer, is simply not supplied an electrical current which causes it to remain black in colour. This allows OLED screens to be incredibly efficient, as no power is used to display black (Wiley, 2011). Unfortunately, no direct comparison can be made at this time because current OLED TVs are either prototypes or profession-grade displays that are meant for very specific uses.

A major difference between the LCD TV and the LED/OLED TV is the source of the backlighting. The cold cathode fluorescent lamp (CCFL) that is used to provide the backlighting

in an LCD TV contains the heavy metal mercury. Mercury is an environmental hazard and when LCD TVs are thrown into landfills they can expose mercury from the CCFL to the environment (Griffin, n.d.).

3.0) Interactive Boards

The interactive display board has a touch screen and will have the ability to be more engaging for users because the user gets to determine what content is seen. A decision on which type of industrial touch screen should be used will be made by conducting a triple bottom line analysis of several types of touch screen displays.

3.1) Social Analysis

The interactive display boards are used to help students and visitors to find their way around campus. The boards contain 2-D and 3-D maps of campus, buildings and rooms in order to enhance the way-finding procedure. Students and visitors can easily type in the name of the place to which they want to go, and they will be guided to the fastest route to the desired destination. Another feature of the way-finding map can be location search based on "category" not "name". This feature allows users to find specific buildings without knowing the buildings' name. The buildings and rooms can be found based on the category to which they belong. Google Maps can be integrated into the interactive boards system to find locations that are not listed on the campus way-finding map as well as a direction function that the program will provide.

The display board will include a variety of advertisements. Examples of advertisements that could be used are; upcoming events whether they be for the SUB, University or Vancouver, local sustainable companies, and important information regarding UBC. These advertisements are recommended to run as slides on the display when its screen saver is active, as well as being displayed as traversing text as either a header or footer.

There will be a program in which users can input comments to be displayed on the large non-interactive display boards. This program will contain a filter in order to remove offensive and/or derogatory statements and terms. The users can also take advantage of a feedback program where users can enter, comments, concerns, and questions.

The interactive display boards can be used to promote sustainable practices. The boards can show sustainable tips while not in use. Messages, quotes and images can be used to inform people about sustainability. This approach can help to target people who are just passing by the boards, and not using the interactive boards' features. Examples of sustainable tips would be:

- Turning off lights in an empty room

- Change to fluorescent bulbs
- Hang your clothes to dry instead of using dryer
- Turn off your computer at night, don't put it to sleep
- Eat locally produced food
- Recycle and compose

Since one of the primary purposes of the interactive display boards is to help people to find their way around the campus, the strategic placing of the interactive display boards is crucial in order to maximize the boards' functionality. The interactive display boards should be located within the new SUB. Based on the number of display boards, at least one should be designated for each main entrance on the main floor. Due to the high volume of people in food courts, another interactive display board is recommended to be placed in or in close proximity to the food court. People who are visiting the university and students using this facility are likely targets for advertisement and way finding tools.

3.2) Economic Analysis

There are many different types of interactive computers that are used in stores, public centers and malls. The team found that there was a main distinction between many of the display boards, this being whether or not the boards were touch screen or not. The touch screen models seemed like the logical choice because there would be no issues with people tampering with the navigation hardware (keyboard and mouse), it uses less plastic, and a touch screen display is considered more technologically advanced.

The research showed that there were basically two types of touch screen displays; industrial and consumer based. The industrial based displays are ones like those used in self-checkouts, nursing stations and factories. These industrial displays have the characteristics of being able to withstand frequent usage and minor accidents such as spills etc. There is also a wide range of sizes and options available in the industrial based touch screen category. The consumer based touch screen displays are ones like those sold in Future Shop, which are used in navigation and display of personal/home computers. The choice was made towards the industrial based displays because their characteristics suited the needs of the interactive display board perfectly. Many different models of industrial based displays were looked through and these findings were produced:

- SMART Board 6052i interactive display (See Image 1 below): The interactive display board is designed to give access to digital material. The LCD display is integrated with DVT technology to give the user an engaging experience. The display can be operated by finger or designated pencil tool. The display board can support high definition, thus it can improve the visibility and impact of the display board content. (For specifications refer to appendix A)

Image 1.0- 6052i Smart Board

- Industrial Computers Inc. 17-inch Intel Atom Processor all-in-one touch screen computer (see Image 2 below): This interactive display board is made for use in a high volume area where people will be interacting with it on a regular basis. This board includes its own CPU that runs on Windows 7, and has an awesome viewing angle of 160 degrees which allows multiple viewers.

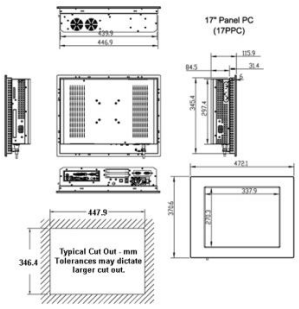

Image 2.0- ICI all-in-one computer specifications

- I-tech Company 17-inch touch screen all-in-one PC computer (see Image 3 below): This all-in-one computer works well in heavy usage areas, and has a design that makes is ideal for installing in a kiosk type

Image 3.0- I-tech all-in-one computer

- 3M Micro Touch Display C1500SS (see Image 4 below): The display board is designed for applications where compact touch integrated displays are needed. The display board is protected from damage by metal frame. The frame also provides stability.

Image 4.0- 3M Micro Touch display

After using the triple bottom line assessment on these displays we produced the following findings. Due to its size the Smart Board had an incredible power consumption of 290W and it also needed a PC because the board was just a display. The 3M Micro Touch display was also ruled out because it was expensive and would also need a PC to be purchased to run the programs that displayed our content. The final decision came between the Industrial Computers Inc all-in-one and the I-tech Company 17-inch all-in-one. We decided on the Industrial Computer Inc all-in-one as our recommendation because of a few main features. The display board had a built in CPU which would allow the content moderators to run the programs without having to purchase and attach a PC. The 17-inch screen was an ideal size because they are a common size among PC users and provide a comfortable feeling to the user. The specifications on the ICI all-in-one listed the price as $1549.00, unfortunately I-tech did not list a price and the attempt at contact with the company was unsuccessful. After looking at touch screen and PC combinations the team thought that the price of $1549.00 was quite reasonable for an all-in-one touch screen computer. The assumption was made that the I-tech and ICI all-in-ones were the same price, with this assumption team members were able to make a decision that economically

the ICI all-in-one was a better choice because it came with Windows 7 software where as with the I-tech all-in-one an operating system would need to be purchased

3.3) Environmental Analysis

The energy consumption of different interactive displays was compared to assess the impact the different displays had on the environment. The final decision came down to the power consumption between the ICI and I-tech displays. The ICI touch screen consumed 22W and the I-tech consumed 32W, therefore the ICI all-in-one touch screen display was recommended to install into the new SUB.

4.0) Conclusion and Recommendations

The recommended approach to display content is to use a large central display and several smaller distributed interactive screens (Option C). This option provides the best balance between the advantages and disadvantages of the large TV and the smaller interactive screens. The large central TV is able to communicate efficiently with a large amount of people and fully utilizes the high traffic that is expected in the SUB atrium. The small interactive screens would be more engaging with the users of the SUB so it is important to include them. Potential display boards for both the large TV and small interactive screens were investigated.

The three types of technologies that were considered for the large TV screen were LCD, LED, and OLED. The triple bottom line analysis showed that the LED technology would be suitable for the SUB atrium. OLED was the technology with the most advantages but is too expensive to justify its costs. LCD was the cheapest option but is worse for the environment and consumes more power. A display board that attempts to promote sustainability should be efficient or else the message could be seen as being insincere. LED is the recommended technology. As of right now, it is the TV technology that consumes the least power and is readily available at a large size. It is more expensive than the LCD model but is more energy efficient so the costs could be recuperated over time.

The large display itself should show a slideshow that features daily tips and tasks and small video clips that are related to sustainability. The display should be able to convince the UBC population that everyone should contribute to the sustainability movement and that UBC is fully committed to it. It should also be able to convince the population of tasks that are beneficial for the environment and require little effort to perform. The display should also provide a visual feedback mechanism where an image is used to represent the energy that is currently being consumed. Users will likely respond to perceived positive and negative changes to the image.

For the smaller interactive screens, different models have been assessed, and ICI all-in-one was recommended as the best option. The decision was made based on the power consumption and price of the interactive display boards. Regarding the content of the interactive display boards, the team has decided to include way-finding, advertisement, user input, and sustainability tips as features of the interactive display boards. The display boards are needed to be strategically located within the new SUB in order to maximise the functionality of the displays.

At least one interactive display board is dedicated to each main entrance of the new SUB. Any extra board can be located at places with the highest volume of people, such as the food court.

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Appendix

Interactive touchscreen note:

The interactive touchscreens that we recommended did not include a kiosk mount. There are a couple mounting options that were considered and they are as follows:

- Wall mount- This is where the computer is installed into the wall. A section of wall is cut out and the computer is inserted into this section. The advantages of this option are that it is relatively inexpensive and does not require intensive wiring needs for such things as power and CAT-5 cables. The disadvantage to this option is its location, because it is not out in the open but tucked off to the side.
- Plastic and metal mount- This is where a kiosk type mount is built to hold the computer and hide the connecting cables. This option has the price being in the mid-range and is quite simple. Its advantages are that it is isn't overly expensive and is able to be place in any location required that it can be wired in its position. It is also easy to access the innards of the kiosk to do repairs and maintenance. The disadvantages to this option is that it is doesn't appear too environmentally friendly because it is made out of plastics and metal as well it would be more of an intensive process to wire in.
- Wooden mount- This is where a kiosk is created out of wood to hold the computer and hide its connecting cables. This option would be a bit more expensive because a wood shop would be needed to build the kiosk to the proper specifications. Its advantages are that it would appear extremely environmentally friendly, there would be easy access to the innards of the kiosk and it would be able to be placed at any location. The disadvantages of this option are that the mount would require more upkeep than other versions, and the wiring would be more intensive than the wall mount option.

Interactive touchscreen information:

- Industrial Computers Inc all-in-one computer
  - Product info found at this address: <http://www.eindustrialcomputer.com/ProductCart/pc/viewPrd.asp?idproduct=697&idcategory=63>

- 3M Micro Touch Display C1500SS
  - Product info found at this address: <http://solutions.3m.com/wps/portal/3M/en_US/TouchSystems/TouchScreen/Solutions/TouchScreenDisplays/C1500SS/>

- I-tech Company all-in-one computer
  - Product info found at this address: <http://www.i-techcompany.com/intel-compact-panel-pc-chassisl-mount-lcd-wchc1700m1-i.html>

- SMART Board 6052i interactive display specifications:
  - Product size 50" W × 35 3/4" H × 7 1/4" D
  - Display/Interactive area: 52" diagonal, 16:9 format, 45 3/8" W × 25 3/8" H
  - Product weight: 132 lb. (60 kg)
  - Power consumption: Up to 290 W
  - Environmental compliance: EU RoHS, WEEE