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Creating an Interactive Mirror Experience through Web technologies

Llogari Casas Cambra[*], Gerard Herrera Sagué[**]

[*] Technical Lead at Kaleidoscop Cartoons S.L.
[**] Creative Content Designer at Led Dream S.L.

Abstract- This research paper develops an Interactive Mirror Experience using Web-based technologies. Its main aim is to identify and list the perceptions and reactions of the users when they interact with it. Therefore, further evaluation from the User-Experience point of view is performed and analyzed in order to incentivize the usage of this new bright technology.

Index Terms- Human-Computer Interaction, Interactive Mirror, Software, User Experience, Web Development.

I. INTRODUCTION

Touchable screens have emerged in the market for the last decade or so, resulting touch-screens the most-common technology used for portable devices at the moment. In addition, convertible laptops are growing in sales number and are becoming the alternative for conventional computers, mostly due to the fact that include all tablet Human-Computer Interaction advantages, such as touchable displays and on-screen keyboards, and all computer advantages, like powerful processors and fast graphics cards.

In this particular case, a projected capacitive touchable screen has been used to perform the experiment. Capacitive screens consist of an insulator, normally represented as a glass coated with a transparent conductor, that becomes distorted when the human body touches its surface. Therefore, that alteration of the electricity in the sensor implies the detection of an input in the device. In most of the cases, the alteration is produced by the user's fingerprint as a tap gesture. In addition, this particular type of screen features an additional characteristic that turns deep black, normally represented in Web technologies with the hexadecimal color number ***#000***, into a reflective screen. In other words, deep black color turns a simple touchable screen into an interactive mirror. In order to be able to reproduce this characteristic, the screen must also include a reflective glass on the top of the capacitive display that transfers the electrical distortion to the touchable screen.

As a result, this research project will be focused in the technical aspects of the Web Application, improving the User Experience of the testers progressively in order to transform a desktop based WebApp application into a touchable WebApp.

II. RESEARCH ELABORATIONS

All the research performed in this project was later applied in real-world commercial projects. Therefore, no coding examples will be provided or disclosed in this paper. However, the whole research and testing process will be detailed explained in order to provide plausible and factual findings that can be later reproduced in further projects.

In order to develop an interactive mirror application several standardized Web technologies have been used. The key languages used were: HTML5, CSS3, JavaScript, jQuery and PHP. Each one of these technologies played an important and crucial role in a different way on this Software.

- HTML5 new features allowed the Website to become extremely interactive with the user through the usage of the **<*canvas*>** element. This HTML tag element allowed the development of a real-time video streaming from a Webcam that was later used to take pictures from the users. In addition, the same HTML element was adopted to create a hand-drawing applet that allowed the end-users to use their fingerprints to add color to a plain object at their own taste.

- CSS3 transitions and animations smoothed the User Interface of the application. Alongside with implementing the design of the WebApp through common Cascade Style Sheet rules, the ***animation*** and ***transform*** properties added visual feedback to the final end-user. In this particular case, all these rules were needed to be applied to WebKit engine based browsers. Therefore, the ***–webkit-*** prefix was used in all cases.

- JavaScript and jQuery technologies were used to capture the events triggered by the user. At the beginning of the research experiment, mostly ***onclick***, ***onmouseover*** and ***onmouseout*** were used. However, due to the fact that an interactive mirror is mostly controlled with touch events rather than mouse events, these events were later replaced with HTML5 touch listeners. These events were: ***touchstart***, ***touchend***, ***touchleave*** and ***touchmove***.

- PHP scripting language was used to perform server side requests needed to generate emails with the captured Webcam photos attached on it. Furthermore, **<*canvas*>** hand-drawings were saved into the database using JSON file format and managed with PHP and SQL queries.

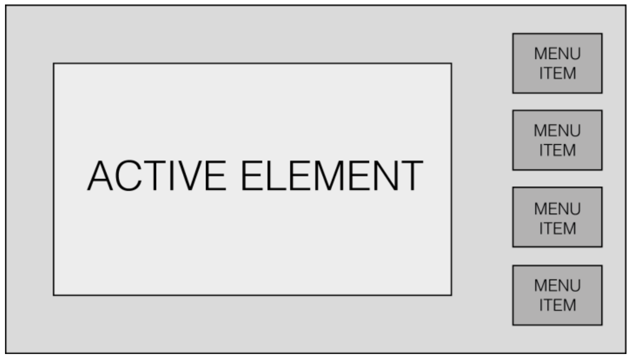

Figure 1. User Interface structure of the WebApp.

In addition, User Experience design has been taken into consideration in order to develop an easy and friendly interface to the user. The testing process has been done using a focus group with 10 testers on it. Research findings have stated that the menu should be placed on the right-hand side of the display in other to leave the main window on the left-hand side if the written language is from left-to-right. Otherwise, mostly for Arabian languages proposes, the structure of the WebApp should be mirrored from right-to-left. As it can be concluded and is broadly known, the User Interface design is dependent to the written language of each culture.

III. RESULTS AND FINDINGS

In order to test the application with final-end users, 10 people ranging from 20 to 60 years old interacted with the application. The testing process took about two weeks' time and the application was improved alongside with the testing findings from the users.

First reports from testing users stated that the triggering area of the buttons were far too small. The Human-Computer Interaction was working perfectly when a mouse was used. However, when the fingerprints were adopted as an interaction tool, the triggering area was too small for a correct usage. It was mainly caused by the fact that the size of the finger is considerably bigger than the dimension of the pointer of the mouse. Therefore, the size of all buttons were increased approximately four times its size. No further reports stated problems with the triggering area of the buttons.

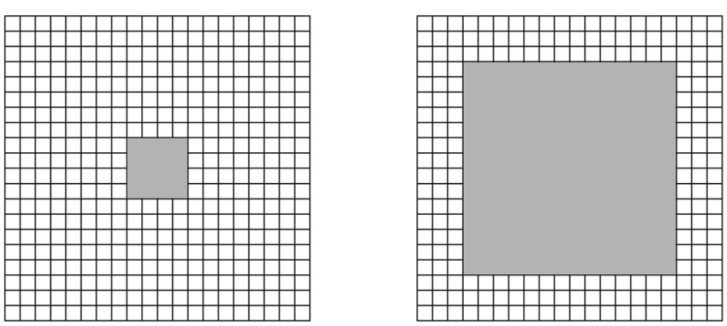

Figure 2. Comparison between the triggering area of a button.

Following the testing process, the users reported an increased satisfaction with the performance of the WebApp once the triggering areas of the buttons were fixed. However, the users faced new problems when they were pressing and releasing them. It was caused by the fact that the event listeners attached to them were referencing mouse events rather than touch events. Therefore, a conversion table was applied to the code in order to adapt event listeners to tap gestures.

Mouse Events	Touch Events
onclick *onmousedown* *onmouseover*	*touchstart*
onmouseout	*touchleave*
onmouseup	*touchend*
onmousemove	*touchmove*

Figure 3. Conversion table between mouse and touch events.

Once Human-Computer Interaction issues were solved, the users stated that the engagement level they perceived with the interactive mirror was higher than first evaluation. They spent about 5 minutes on average interacting with it, whereas on first attempts, they only reported an average time of interaction of approximately 30 seconds.

In addition, on the last stages of the inspection process, users stated that pop-up menus were displayed if a bad usage of the screen was performed (i.e. pressing for 5 seconds the screen or randomly pressing it). As a result, making usage of JavaScript and CSS rules, the cursor was hidden and the pop-up menus blocked. No further problems related to User-Experience or Human-Computer Interaction were reported.

This experiment reported high levels of engagement and positive feedback from all testing users and final-end customers. Reports stated that users were extremely engaged with the interactive mirror due to the fact that it was an innovative technology and they were feeling interested about testing it. Moreover, the fact that the interaction was taken place with the fingerprints and not with a mouse or a keyboard acted as an incentive for the users, no Human-Computer Interaction barrier was present.

IV. CONCLUSION

Taking the results and findings into consideration it becomes clear that Web Technologies are completely eligible to work perfectly outside of a typical browser scenario. New hardware devices allow Web Development scripting languages to be reused in different scenarios that can work on either a local or global network. However, as it has been seen in this experiment, a testing process alongside with testing users is crucial to achieve a good working result, as they interact in a mostly identical way as real-world users would do.

In addition, the fact that is considerably a bright new technology produced a good reception from the public. Most of them were willing to try the interactive mirror, mostly because they felt captivated from such a cutting-edge technology. Therefore, its usage is completely encouraged.

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AUTHORS

First Author – Llogari Casas Cambra, B.Sc. in Multimedia at Universitat Politècnica de Catalunya. M.Sc. in Computer Animation at Kingston University, Kaleidoscop Cartoons S.L. llogari92@gmail.com.

Second Author – Gerard Herrera Sagué, B.Sc. in Multimedia at Universitat Politècnica de Catalunya, Led Dream S.L. gerardherrerasague@gmail.com.

Correspondence Author – Llogari Casas Cambra, B.Sc. in Multimedia at Universitat Politècnica de Catalunya. M.Sc. in Computer Animation at Kingston University, Kaleidoscop Cartoons S.L. llogari92@gmail.com.