# HTML5 Based Email Client with Touch Enabled Advanced User Interface for Tabs and Tablets

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## Abstract

*The Internet has become as a very powerful platform that has changed the way we do business and the way we communicate. E-Mail is an essential tool for both cooperative world and individuals for communicating. Web-based e-mail systems have become more popular among the internet users with time. Internet and the devices that we use to access the internet are rapidly changing time to time. Among the recent evolutions the most significant of them is HTML5 incorporated mobile technology with hi-tech devices like tabs, iPads and tablets with touch sensitivity. However, the major problem occurs when different levels of resolutions arisewithmodern devices. Some devices support touch, multi-touch, gestures, keyboards and stylus. User-interface of email web clients hasnt improved in the way hi-tech devices evolved. Handling different types of interactions depends on the device and way that user handles it. We have developed HTML5 off-line supporting web-based UI for e-mail system to overcome this issue and to provide a highly user based interactive, responsive and efficient process even in slow network connections. Our approach is based on HTML5 features and client side on java-scripting. Our system is capable of running on a browser without installing any plug-ins. Depending on the device resolution and user interaction (one finger touch/ both hands or external keyboard) email client has provisions to transform the web UI to give better interaction for the user and email system.*

## Key Terms:

Graphical user interfaces, High resolution touching devices, Human computer interaction, HTML5 email client.

## 1. INTRODUCTION

Electronic mail is one of the most popular and reliable communication mechanisms in the modern world where most of the worlds population is familiar with. Many free email providers host their serves as web-based email systems. In Web-mail systems, the emails are accessed through a standard web browser. They are popular among users because they can be accessed by any computer and have advanced networking capabilities. We have noticed two issues mainly in designing UI for tablets. One is screen differentiation and second is how the user will interact with devices where tablet is the main option for the user to interact with.

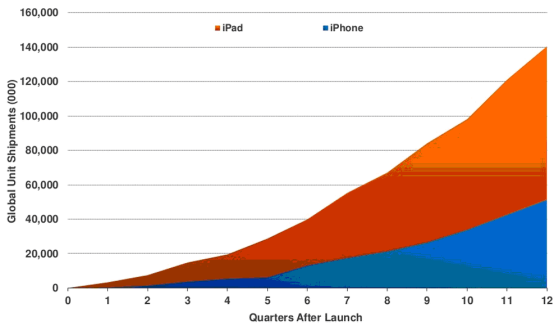


Figure 1: First 12 Quarters Cumulative Unit Shipments, iPhone vs. iPad presented in internettrends D11 conference on Apple, as of CQ1:13 (12 quarters post iPad launch)[1]

In modern devices such as iPads, tabs and tablets have different screen sizes, pixels per inch (PPI), aspect ratios and display resolutions. User's likelihood (multi-gestures) depends on operating system as well.

Touch devices are portable devices compared to notebooks where touch devices are more light weight and slim. According to the situation, users handle each device in different manners. Interactions can be identified as touching, multi-touching or devices with external support input devices such as keyword, mouse, or stylus.

However web mail client will have single user interface for all types of interactions. Same UI will be rendered for different resolution devices. Due to different resolutions this will reduce the responsiveness of the user interface. Web mail client will need network connection to function properly.

It is shown in the graph, the growth of trend for iPads (tablets) and it is more rapid than smart phones with iPad growth three times as compared to iPhone growth. International Data Corporation (IDC) as shown in Figure 1 the premier global provider of market intelligence and advisory services, has announced that they expect tablets to grow their share in the overall smart device market from 10.7% in 2012, to an estimated 16% by 2017 with a projected growth rate of 174.5% between 2012 and 2017 [1]. Growth of the tablet category has been mainly influenced by lot of researches to make their findings the best solution. Overall, worldwide shipments of smart connected devices has grown 29.1% year over year in 2012[1], and the entire market pushed past one billion units shipped. So people trend to use web based email in their tabs rather using PC or mobile. Tab will be the most nearest device for people to browser internet as well as emails.

Our solution contains mainly six web-components as shown in Table.2 and each component will have an interface to communicate with each other. Those can be rendered in client side browser with HTML5 support. Each component will have a unique task to be accomplished. Particular task will be the answer for every issue in the above mentioned points. The web scripting component will enable the touch web UI and other features. User interface is rendered and generated from the client-side script in offline mode as user interaction type changes.

Table 1: WEB COMPONENT AND TASK TO ACHIEVE

| Web Component | Task achieve | Solving issue |
|---|---|---|
| Responsive Component | Rendering UI for screen size and resolution | Different sizes for device screen |
| Template component | Give different template with consistence UI | Different type of interactions |
| Offline component | Offline support | Networking issues and performances |
| Gesturing component | Support for gesturing/multi-touching | Usability, less interactions |
| Theme component | Giving color scheme separately | Not easy to learn, less interactions |
| Controller component | Mapping data to UI | Interoperability |

## 2. RELATED WORK: WEB BASED EMAIL AND TABLETS

### *2.1 Exiting web based email clients and tabs in market*

Web based email system such as Gmail, yahoo, zohoo, live, hotmail are being popular with internet users. We have done a critical evaluation with iPad2 and Galaxy Tab on how they react in email systems tabulated in Table.**??**.

Table 2: WEB COMPONENT AND TASK TO ACHIEVE

| Email Client | Responsiveness | offline | Drag & drop | Gestures |
|---|---|---|---|---|
| Gmail | ✓ | ✓ | ✓ | |
| Yahoo | ✓ | | | |
| Live | ✓ | | | ✓ |
| Hotmail | ✓ | | | ✓ |
| Zohoo | | ✓ | | |

Majority of UIs in web based email systems works fine for the resolution 1024×768. But complete level of gesture support was not achieved by either of them. If user handles tablet from a one hand or keyboard [2], there will not be any UI changes through user interactions. But from OS level keyboard layout is disabled. There are lists of tablets and tabs that can be found with different screen sizes and resolutions, ppcm (PPI), aspect ratio and CSS pixel ratios.

User interfaces need to fit for all above specifications and it must perform smoothly. Web responsive component will have a grid layout to make web UI responsive for different screen sizes and resolutions as presented in table.3

Table 3: WEB COMPONENT AND TASK TO ACHIEVE

| Tablet | Resolution | size | ppcm | Aspect ratio |
|---|---|---|---|---|
| iPad2 | 1024×768 | 9.7’ | 64 | 4:3 |
| iPad3 | 2048×1536 | 9.7’ | 52 | 4:3 |
| iPad mini | 1024×768 | 7.9’ | 104 | 4:3 |
| Galaxy Tab–10.1 | 800×1280 | 10.1’ | 59 | 5:8 |
| Nexus 10 | 2560×1600 | 10.05’ | 120 | 16:10 |
| Surface | 1366×768 | 10.6’ | 58 | 4:3 |

### *2.2 Different input interactions for tablets*

Tablets are slim and lightweight devices that support touching, multi-touching, gestures and external devices. Therefore user can have different types of input mechanisms and some depends on the situation. For an example suppose user is using a tablet with both hands while user has a desk or standard location position for the tab. In office user can be using tablet with external mouse and keyboard rather than touch interactions. Here are the basic levels of interactions that user can handle in tablets or tabs.

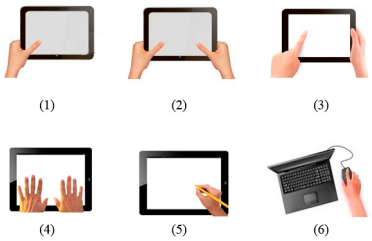


Figure 2: Six ways of interaction input models for tablets/tabs

Above six types of interactions are represented in fig.2 can be found for each user mainly depending on time and place of use. Finger count, finger type (movement), hands and external devices are important to identify them well.
According to fig.2.1 users interact with one hand and screen touching interaction will have only one finger. Sometimes tablet will interact with two hands for hold and interaction with touch will happen with two thumbs on each hand as given in fig.2.2. Figure.2.3 depicts one hand used to hold the tab and other full hand used for interact with the interface. If Tab contains a holder then user can use 10 fingers in both hands for interaction as in fig.2.4 [4]. Fifth way as in fig.2.5 shows external device stylus used for interacting with Tab interface. Last one, fig.2.6 uses external devices but not mainly on touch sense[5].

Each interaction has limitations for email functionality and keyboard layout. If UI component and level of interaction changes, it will make bettera interaction for user to performance his/her task.

### *2.3 Finger touch and movements*

Four of the interaction types given in Table IV mainly involve finger touches. Identifying the fingers and touching pitch of each finger are considered. The interaction touch angle of the finger has a great impact on the accuracy of the system. If

Table 4: FINGER AND SCREEN ANGEL IN DIFFERENT INTERACTIONS

| Finger angel | | Interaction type | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| 65° | $65^0$ | | | ☑ | |
| 45° | $45^0$ | | | ☑ | |
| 25° | $25^0$ | | ☑ | ☑ | ☑ |
| 15° | $15^0$ | ☑ | ☑ | | ☑ |

the angle of the finger [3] is large it has greater accuracy in touching pitch and getting low angle with screen will have low accuracy as well. 450 angles will be used in gestures. When

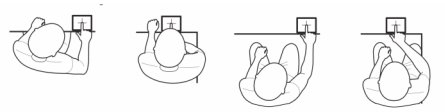

Figure 3: Head positioning when user uses tablet[3]

the user do not have standard tablet they try to make low angel in touch as it safe and prevent the device from slipping.

Touching will be effected with user head position against the device.Because of that finger may roll. It will be affected only in one interaction type. It is number four interaction. That is finger rolling and it is good to have gestures of that type of interaction.

### *2.4 Web applications and native apps*

Native applications are more interactive with user experiences regarding the web apps. Web apps can have native app level of interaction after identifying the interaction that native app allows users. Here are the basic gestures shown in fig.4 that touching device support[6] and those four are implemented in scripting in client browser.

Gesture component was improved by analyzing at existing emails apps and other top rate applications with above hand mentioned in Figure 4.

Gestures are also developed as application where it is

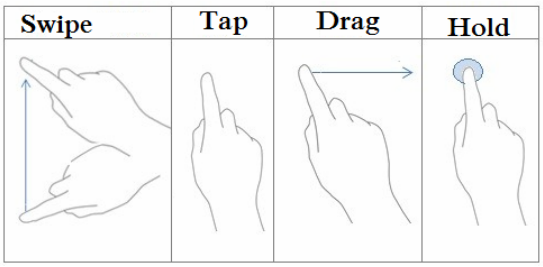


Figure 4: Simple gestures for touch tablet screen

familiar to the user rather than building such new applications. Gaming gestures are also considered in implementing gesture component.

There are some eventsand actions that occur in email frequently, such as compose email and view inbox. So those event triggering UI components have unique locations in web UI and also the finger, target and its pitch for touch.

## 3. SYSTEM DESIGN: WEB BASED EMAIL USER INTERFACE FOR TABLETS

Proposed system consist of HTML5 web based, multi-touch enabled user interface that supports different levels of interactions with consistence UI. System comprised of six components represented in fig.5 that can be run in front end of the browser as well as back end. From HTML5 storage [7] and cache will allow the script to run from the client side to improve system performances. Data will be mapped as json for each component and capture inter-operability among the components with 3rd party JavaScript libraries.

Responsive component handle UI for different screen size and resolution and Template component will provide best user interface depending on user interactions and user requests. Offline component will improve the performances of the system.

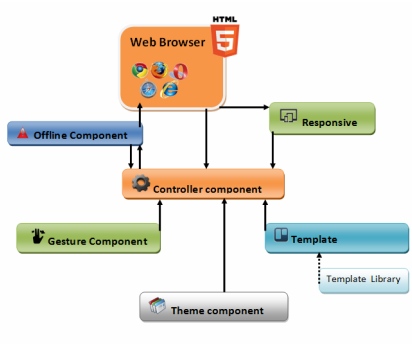


Figure 5: Components and component integration in the system

Gesturing component will give support gesturing /multi-touch. Theme component take care of the color scheme and controller component maps data to the UI template.

Responsive component[6], controller component and offline component get browser details from generated html page will direct offline component. This acts as a cache. Responsive component gets screen size and display details from browser and pass it to controller. Controller component then checks the user requested interaction type among six categories as it is predefined as in fig.3. Then controller passes details into gesture theme and template component the requested data. Template component has library of templates for email interface. Controller maps template and data (json/xml) into page output for browser in tablets.

### *3.1 Template component and template library*

There are six categories of user interaction for tablets. Template component will pick the user requested template to render the data. With the development of the technology, lot of new devices is introduced for tablets. If new level of interaction [8] come up for tablets, system can allow to add its template to the template library which leads to more user friendly and higher version of significance.

Template library contains six templates as their main three levels of interactions for tablets.

#### *3.1.1 One finger template*

This occurs when user is using tab with a single hand. Only thumb finger can capture the touch screen and only one side part of the tablet. All the important functionalities of email will be on right-hand side or left-hand side of the screen. Regarding sub functions of an email such as mark as, achieve, delete, move to, reply to, forward to, etc. will be on the top of the screen with leading button as angle of [3] thumb touch will be $25^0$ or $35^0$ degrees. System is reusing above UI components as

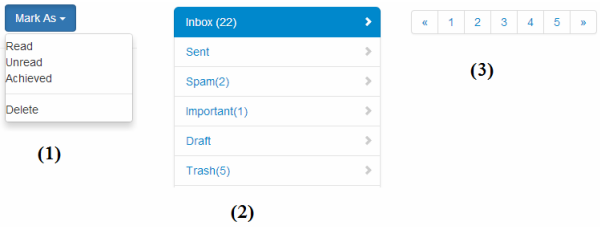


Figure 6: UI Components that is used in temples

given in fig.6.1 can be found in first two interaction modes in

right hand side and left hand side that can be easily controlled from thumb with fewer movements. Group button/list given in fig.6.2 can be found in all interactions with responsively to screen size. Pagination component as shown in fig.6.3 can be found for easy touching [4] pagination concept in bottom needs the thumb.

User will not able to handle keyboard layout with single hand But this template will capture quickly reply, forward functionality with predefined reply message. User can define his/her reply list and is able to send emails with predefined message list with single hand.

#### *3.1.2 Two thumb template*

This position can be seen when user is using tablet without desk or standard location position. Two thumbs have many movements, where hands will be moving along vertically with tablet side slider. In here, main buttons will be divided into both sides and much bigger size with the ease to pitch from the touch of thumbs.

For keyboard layout, splitting keyboard (iPad) concept is valid for this template. Logic behind splitting keyboard is also captured in this scenario.

#### *3.1.3 Two hands*

This template will have 4-5 finger interactions so it can have buttons or UI components over the screen. But it needs to think about the location of UI components and finger movements as well. Therefore diagonal movement of the index finger of distal/middle/proximal phalanx of finger can be considered in UI component separation.

In the template, drag and drop is supported as it is the main focus of the index finger. It will be 450 degrees angle of touch in this template where recent icon size can be found.

#### *3.1.4 Ten fingers (tab with standard)*

This template will have all fingers[9,10] interaction with screen. It is equal to normal UI experience but with multi-touch, gestures. With offline support it makes better performance and more interactive mode UI.

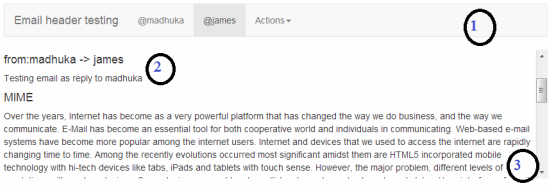


Figure 7: Advanced touch enabled email reading UI

Easy fast reading email UI depicted by fig.7 contains top navigation bar given in fig.7.1 that is touch move and it sync with side touch or mouse scroll as fig.7.3. Navigation easier to read email thread as represented in fig.7.2 quickly with less count of clicks or also less moving fingers and touches in big touch pitch in UI

#### *3.1.5 Keyboard and stylus (external device)*

When tablet is used with keyboard[10] people like to have more keyboard shortcuts [9,11,12] rather than touch screens. This UI supports multi-touch but mainly considered for keyboard shortcuts. There is tooltip helper for shortcuts over the UI.

When user uses stylus for tab, he can have more accuracy than fingers. Therefore we can get more details from the screen as tabs have much more resolutions. Keyboard layout disables as its OS supports handwriting characters.

### *3.2 HTML5 offline cache scripting*

On the first run of the system the server-side scripting is saved and kept on the long-run for offline access[7] . If one file gets updated in server only that file will get overwritten on the client side.

As there is lot of scripting operations occurring in system it is better to have it on offline in client side and it will improve the performances. Better interaction level with UI with more responsiveness for user events and for tablet display details is provided. The offline component [7] is responsible to store script in client side and to synchronize with the server if only there is an update of script file.

### *3.3 Gesture web component*

Native apps[8,4 ] are more interactive than web apps. Web apps have an issue regard to the network speed as all calls go to back end process and native app do all the processing onthe device itself. But with HTML5 we can achieve web app to act as native app. As all scripting files are stored in client side system do not need to send server calls for each operation. Store scripting file in client side will be excited in devices. Accordingly we can have multi-touch scripting functions in client side to get response for that event as native app.

There is simple canvas layout in email UI. That canvas can trigger events as shortcuts for touch, multi-touch and simple gestures. It will be used as scrolling sometimes while tabs are used by single hand[5] (one thumb)

## 4. DISCUSSION AND ANALYSIS

System was evaluated with existing email clients as given in Table V with six different interaction categories [13 , 7] Analysis was done for five main email functionalities compose email (CE), view inbox (VI), delete emails (DE), reply to email (RE) and labeling (LE). Below table will show above icons if it achieved target with particular context.

When user use a tablet with single hand with few fingers, proposed UI has being a tremendous improvement when compared with existing email clients. When user has both hands with five fingers, using tablet with both hands have nearly the same level of impact in performing a task. But analysis process noticed that existing email client have more user friendliness and usability.

Table 5: COMPARISON OF EXITING EMAIL CLIENTS AND PROPOSED UI

| Interaction level | Proposed UI | Gmail client | Yahoo |
|---|---|---|---|
| One thumb | VI, DE, RE | VI | VI |
| Two thumbs | CE, VI, DE, RE | VI, DE | VI |
| One hand | CI, VI, DE, RE, LE | CI, VI, DE, RE | CI, VI, DE, RE |
| Two Hands | CI, VI, DE, RE, LE | CI, VI, DE, RE, LE | CI, VI, DE, RE, LE |

Time that spent to perform such tasks was different and there was a 1 minute time gap between Gmail and the proposed UI, where they performed the same function equally.

System usability shown in Figure 8 was tested as providing

the UI for user without training and after training. Monitoring his performance, monitoring the task accomplished time and accomplishment level with different interactions levels were compared.

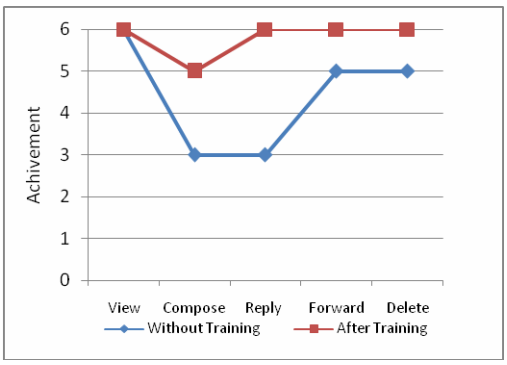


Figure 8: Usability testing with ad without training user

There were improvement regard to composed email and reply to email. As mentioned the concepts are novel to tablet web apps. After the training single finger template has not captured expected accuracy. Here user was using quick reply mode but identifying from correct word list mislead the user. Over roll usability test results were 96% as there was only one fail by user after training.

System was evaluated as Figure 9.By informing user to perform the all tasks in all interaction types reduced the time from 30 minutes to 5 minutes. Each task was trained equally as existing systems are much similar to user.

We count task completion against the time. We were able to notice there were tasks some user cannot perform in existing system so there is a gap between both charts. Both charts get reduced but existing system was reducing quickly than proposed system. Later we noticed user can perform frequent tasks quickly such as view inbox, reply and forward actions in new proposed UI.

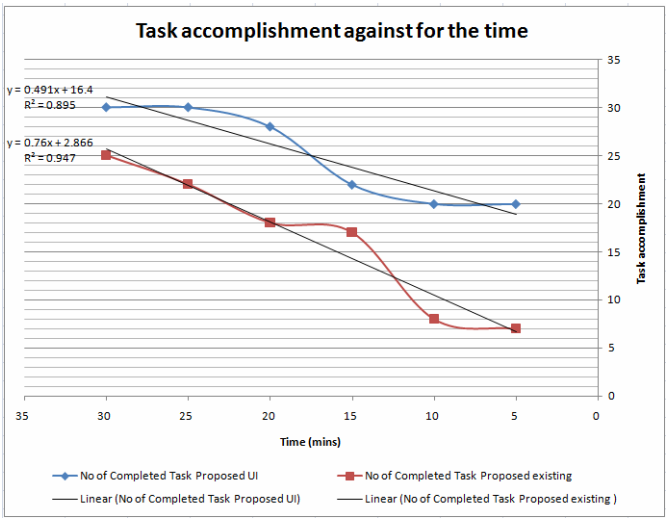


Figure 9: User recursive test on user performances with proposed UI and existing email client

## 5. CONCLUSION AND FUTURE WORK

Modern world lots of new devices are arising and among them touch devices such as tablets, tabs and iPadsclaim the top. It is predicted more applications and web pages developing are targeting those devices. There can be different ways of interaction as they are more portable and slim. Interaction can happen with different count of fingers and hands or external devices. User must be able to achieve his/her needs at all different interaction levels. As emails are the widely used application all over the world, proposing UI was developed for web based email client using HTML5 technology.

For this propose email client UI personalization was not added but themes (CSS files) are added. It is better if user can pick the gestures and touch level capabilities for user rather thansystem defines it for him/her. It is only the UI for email client and it is important to use this UI with existing emails system such as Gmail, yahoo, live, etc. With web components, system allows user to get his data from 3rd party email systems and change the data template as system needs and render the data into proposed systems.

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## References

[1] Liang Wu Mary Meeker, ”2013 Internet Trends - D11 CONFERENCE,” KPCB, New York, USA, 2013.

[2] F. Rajabiyazdi and T. Gedeon, ”Comparing User Performance on an iPad to a 17-inch BackPad,” in Complex, Intelligent and Software Intensive Systems (CISIS), 2012 Sixth International Conference, 2012, pp. 469,474.

[3] Patrick Baudisch Christian Holz, ”UNDERSTANDING TOUCH,” in In Proceedings of the 2011 annual conference on Human factors in computing systems (CHI ’11), Vancouver, BC, Canada, , 2011, pp. 25012510.

[4] Weidong Shi, Jun Yang, Yifei Jiang, Feng Yang, and Yingen Xiong, ”SenGuard: Passive user identification on smartphones using multiple sensors,” in Wireless and Mobile Computing, Networking and Communications (WiMob), 2011 IEEE 7th International Conference, 2011, pp. 141,148.

[5] Shumin Zhai Shiri Azenkot, ”Touch Behavior with Different Postures on Soft Smartphone Keyboards,” google, 2004.

[6] K., Mojahid, M., and Vigouroux, N. Bigkey Al Faraj, ”A virtual keyboard for mobile devices. In Human-Computer Interaction,” in Ambient, Ubiquitous and Intelligent Interaction, Berlin / Heidelberg, 2009, pp. 3-10.

[7] Gihan Dias et al., ”Database based and RESTful email system with offline web based email client,” in Advances in ICT for Emerging Regions (ICTer), 2011, pp. 127,127.

[8] P., Pierce, J., Whittaker, S., and Zhai, S. Bao, ”Smart phone use by non-mobile business users,” in In Proc. MobileHCI, 2011, pp. 445454.

[9] L., Bouraoui, J. L., and Vigouroux, N. Magnien, ”Mobile text input with soft keyboards: Optimization by means of visual clues.,” in In MobileHCI, Springer Berlin, 2004, pp. 197218.

[10] S., Hunter, M., and Smith, B. A. Zhai, ”The metropolis keyboard - an exploration of quantitative techniques for virtual keyboard design,” in In Pro. UIST, 2000, pp. 119128.

[11] N. Cooharojananone, A. Muadthong, R. Limniramol, K. Tetsuro, and O. Hitoshi, ”The evaluation of M-commerce interface on smart phone in Thailand,” in Advanced Communication Technology (ICACT), 2011 13th International Conference on , pp. 1428,1433.

[12] J. Walny, Bongshin Lee, P. Johns, N.H. Riche, and S. Carpendale, ”Understanding Pen and Touch Interaction for Data Exploration on Interactive Whiteboards,” in Visualization and Computer Graphics, IEEE Transactions, 2012, pp. vol.18, no.12, pp.2779,2788.

[13] W. Fikkert, P. van der Vet, and A. Nijholt, ”User-Evaluated Gestures for Touchless Interactions from a Distance,” in Multimedia (ISM), 2010 IEEE International Symposium , 2010, pp. vol., no., pp.153,160.