

The Establishment of an AR-based Interactive Digital Artworks

GJCST Computing Classification
I.3.7

Min-Chai Hsieh¹ Hao-Chiang Koong Lin² Jin-Wei Lin³ Mei-Chi Chen⁴

Abstract-This work attempts to declare the background of personal contemporary state through an immersion of “digital vacancy”. The work is stacked on the identical digital space with concurrent portrait and enjoyment. Moreover, the work describes the doubt and depression in life, combining with humor of predicament and absurdities of senses. We employ augmented reality to create digital artworks to present interactive poem. This work is established where the digital poem is generated via the interaction between a video film and a text-based poem. After establishing the digital artwork, we exhibited the digital work at Digital Art Center (DAC), Taipei, Taiwan. The audiences can interactive with digital poem in real time. In comparison to the other AR equipment, the cost of this work is quite low. In the future, some usability evaluation will be performed on this work.

Keywords- Augmented reality, Digital artworks, Interactive poem.

I. INTRODUCTION

In the past, the artists present the creation of domain and private space. The most artworks are based on non-interactive visual creative expression. With the progress of information technology development, people can create art by using the digital multimedia rather than just doing in a traditional manner. That is, the way of art-creating has changed dramatically. Thus, the digital art creation becomes more lively and interesting. Furthermore, these materials/technologies enhance the artists’ creativity. Artists are able to create artworks via technology and multimedia; that is to say, they can create artworks with the multimedia besides the traditional way of creating arts, so they can create in more fashions to express their thoughts. Today, the ideas of artists can be implemented in real time via the powerful computation abilities of various computers.

The process of artworks creation is charmingly. Because it no longer a phenomenon of the slice, but a manifestation of the experience. Interaction has been considered as an important characteristic of digital artworks. But the evolution of the aesthetic point of view is seldom mentioned. Participate in the experience during the construction is the significance of create all of the works. It formed the “interactive aesthetics” gradually. These are important concepts in new media art [1][2].

In “The End of Art”, Arthur C. Danto said/mentioned that the function of art imitation and reappear has already

disappeared. From now emphasizing that the verisimilitude imitation is also redefined in the art history [3]. The text should be opened to and created by the readers. The meaning of text is interpreted by the readers instead of the author. This is the well-known “writable text” concept [4].

In this work, we will employ Augmented Reality (AR) technology to create digital artworks to present a series of interactive poem. The audience can interact with the digital poem via pre-designed postcards. Notice that the postcard is real object, while the digital poem is virtual sight. Interestingly, the real lies in the virtual; vice versa, virtual scenes render in the real environment. Therefore, audience can feel themselves in an environment, both virtual and real.

II. RELATEDWORK

In recent years, many scholars and institutes have been carrying out the research on Augmented Reality, one of the techniques of computer vision application. AR is also called Mixed Reality (MR), the extension of Virtual Reality (VR). By setting up the scene via Computer Graphics, VR can simulate objects in the real world and create the environment where users can interact with the simulated objects. AR is the images, objects or scenes generated by the computer that blend into the real environment to strengthen our visual feelings. In sum, it adds virtual objects to our real environment. The technology has to possess three qualities, the combination of virtual objects and the real world, real time interaction, 3D space only.

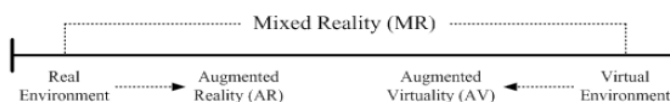


Fig.1. Reality and Virtuality(RV) continuum

Milgram et al. [5] treats the real environment and the virtual one as a closed union. We can find it in Fig 1. On the left side is merely real environment while on the right side is only virtual environment. VR is inclined to take place of the real world; AR is to augment the virtual image produced by the computer to the real environment. Presently, AR is being applied very extensively to such as education, medical technology, military training, engineering, industrial design, art, entertainment and so on [6][7][8][9][10][11][12].

AR combines virtual objects with the real environment and displays the virtual object generated by computers in front of users’ eyes. Milgram et al. [5] defines two displaying ways of AR. One is See-Through AR. Users can directly see the surrounding environment through the monitor and the monitor also display the virtual image in it. Accordingly, the

About-¹ Dept. of Information and Learning Technology, National University of Tainan, Tainan, Taiwan.

(telephone: +886-6-2133111#771 email: shiehminchai@gmail.com)

About-²Dept. of Information and Learning Technology, National University of Tainan, Tainan, Taiwan.

(telephone: +886-6-2133111#771 email: koonglin@gmail.com)

effect of augmented environment can be the greatest via See-through AR. The other is Monitor Based AR. The computer combines the images captured by the webcam with the virtual images. The final image after combination will show up on Head Mounted Display (HMD) or computer monitor. There are two kinds of HMD, one is pure HMD and the other is HMD with a small webcam. The former has small volume and can be equipped with the head mounted tracking instrument, which can track the present angle as well as direction ahead of user's head. It is more suitable for research and application of AR. The latter has immersion effect.

III. CONCEPT OF WORK

This work attempts to declare the background of personal contemporary state through an immersion of "digital vacancy," the work is stacked on the identical digital space with concurrent portrait and enjoyment. The author allows the audience to generate engagement of ideas from past created videos and poetry using interactive media, which further pushes the audience to wonder what they are expecting and the kind of attention they involve in while waiting. Such as life, the crowd passes each other in the city, alternating and switching consciousness and predicament. Perhaps the image of dust generally contains an ingenious meaning due to naturally-born vision and wisdom; while the condensation of air, image and signs symbolize the endless vacancy. Perhaps the audience has fallen into a conventional mindset. Often times, the audience needs to think again before understanding the definition to his or herself.

Our thinking can be both naive and profound. Therefore, this work attempts to expand fragments of a series of identify from the phenomenology of inconspicuous things. The work describes the doubt and depression in life, combining with humor of predicament and absurdities of senses. We are the city wanderers who observe various surrounding symbols through constantly muttering without probing into its significance.

After we enter the kingdom of other dimension, we often start immersing in the beauty of ambiguity while thinking about the multilevel of possibility. Such pattern forms cognitive approach to reflect the nature and details of things, while estimating the length and scale of seemingly familiar yet strange surrounding sceneries, giving a little taste of such inspiration. As Claude Levi-Strauss said, "Our eyes have lost the ability to distinguish and we no longer know how to treat things." Subjective regularity helps us gain insight to streamer and freeze in true cleverness. Our creation no longer belongs to part of theories and we can unlimitedly slow down our pace.

IV. DIGITAL POEM

A system (written in the Processing programming language) is established where the digital poem is generated via the interaction between a video film and a text-based poem. In other words, the system acquires two kinds of inputs: (1) a video file which was produced by the artist before, and (2) a modern poem which was written by the artist. The poem consists of a sequence of Chinese characters. Fig. 2 is the transformation program written in Processing.

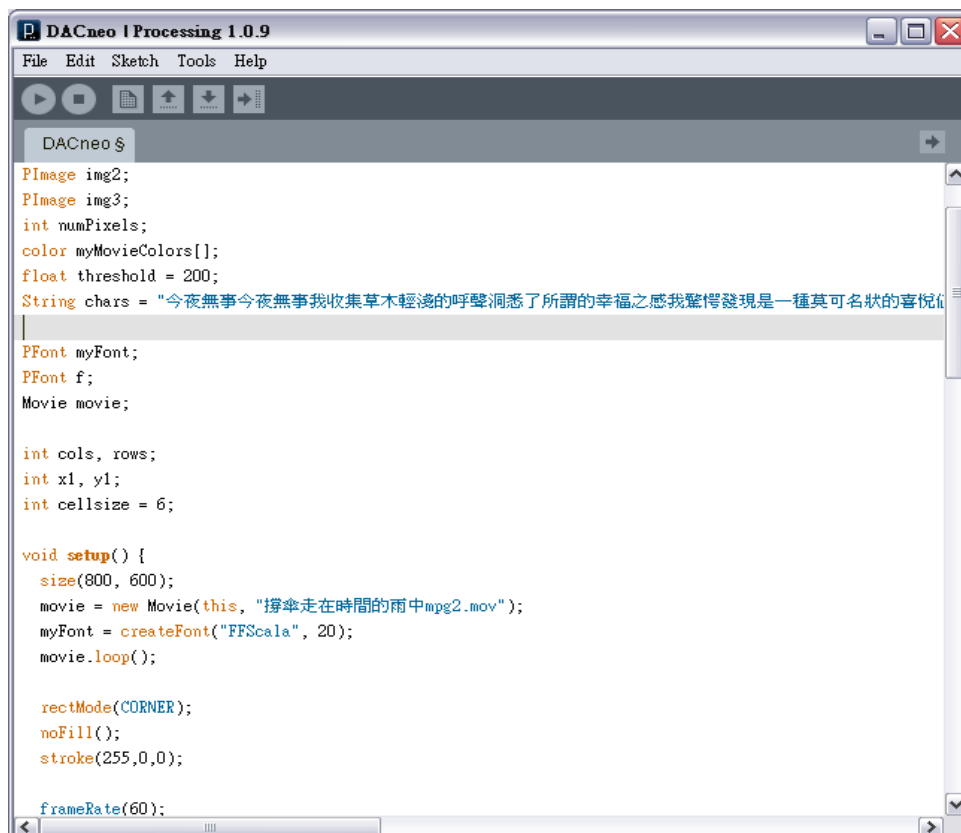


Fig.2. The transformation program written in Processing.

After these two inputs are fed to the system, each frame in the video is transformed to an image constructed by texts. The transformation process is depicted as follows. A “cell size” is defined in the program, and each cell contains several pixels, for example, four pixels. The number of the cell size determines the style of the resulting image. For each cell in the frame, we replace the content by the character in the poem. The orders for the characters to be applied depend on their positions in the poem. Moreover, the color of the character is based on the color of the cell on the same position. Notice that the font size of the

character can also be defined by the designer. Therefore, if the font size is larger than the cell size, characters on the image may overlap with each other's so that the colors will blur to embellish the frame to be “draw-like”.

When all the frames are generated and be filled with colors via the above process, an interactive “digital poem” with a video form is thus produced. Fig. 3 is the video file before transformation, play with Quick Time. And Fig. 4 is the frame after transformation



Fig.3. The video file before transformation.

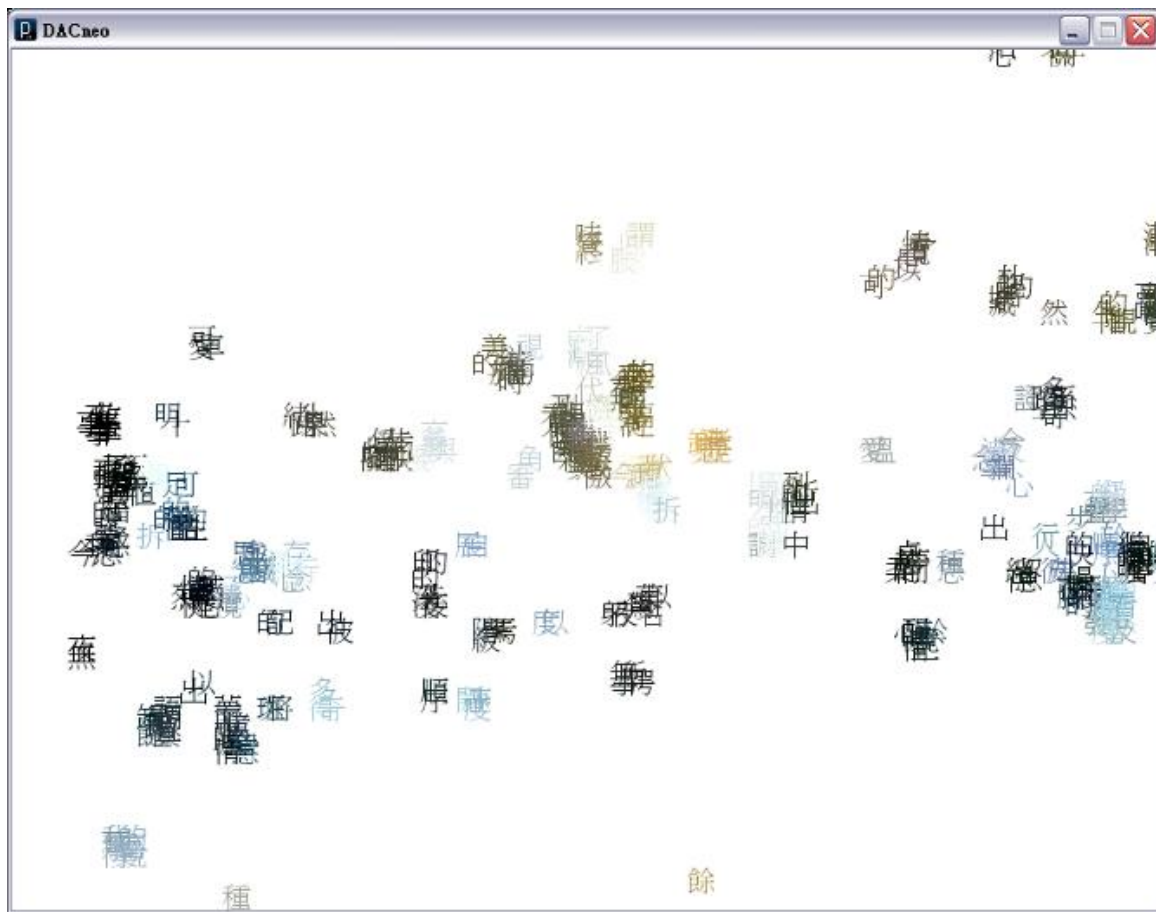


Fig.4. The frame after transformation (Pixels in this frame were replaced by texts in poem).

V. IMPLEMENTATION

We create digital artworks to present interactive poem by taking advantage of the Augmented Reality technology.

This work is implemented in Processing programming language and developed based on ARToolKit [13]. Figure 5 depicts the flowchart of digital poem presentation.

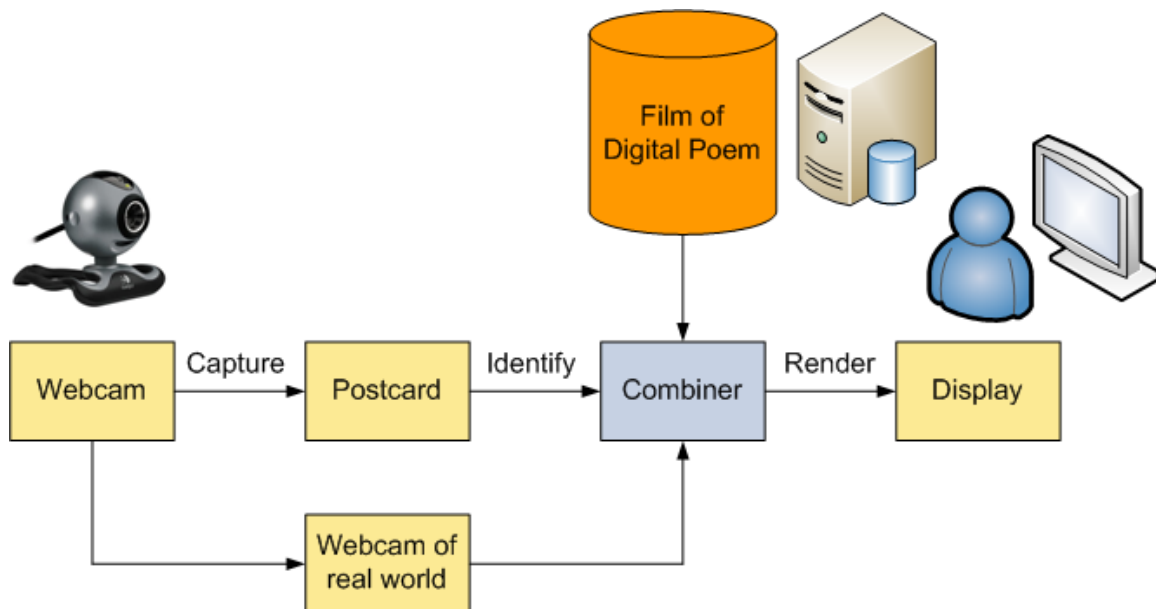


Fig.5. The flowchart of digital poem presentation

The webcam captures video of the real world and sends it to the computer. The system searches through each video frame for any square shapes of black color. If a square is found, the system uses some mathematics to calculate the position of the webcam relative to the black square. Once the position of the webcam is determined, a film of digital poem is drawn from that same position. This film of digital poem is drawn on top of the video of the real world and so appears stuck on the square marker. The final output is shown back, and displayed via the projector. Therefore,

when the audience looks through the display they see film of digital poem overlaid on the real world.

Figure 6 shows the digital poem presentation based on our system written in Processing language. We create image textures and corresponding vertices. Then, the four vertexes of film will match the four ones of Image Texture and film will be drawn on the Image Texture. There are four vertices in Image Texture. They are expressed as vertex (x, y, u, v). The x is coordinate of the vertex, the y is coordinate of the vertex, the u is horizontal coordinate for the texture mapping and the v is vertical coordinate for the texture mapping.

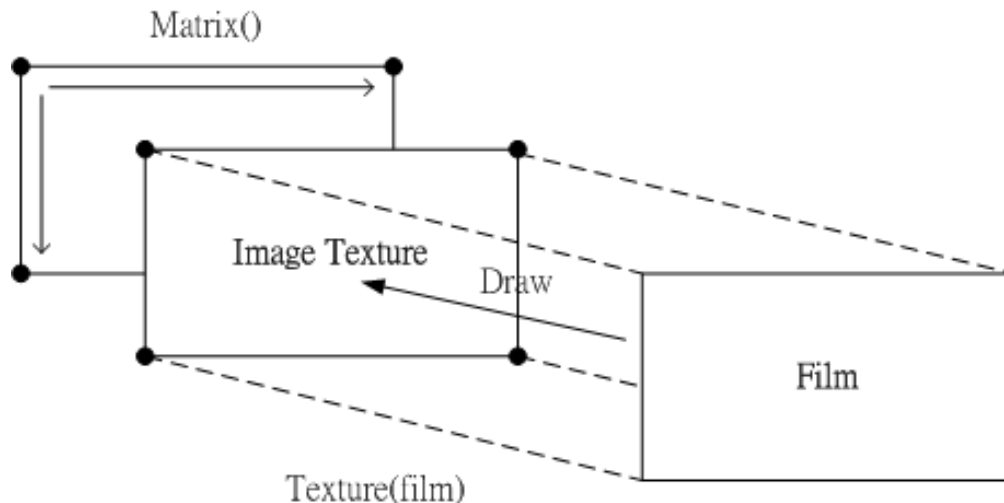


Fig.6. The film draws on image texture.

About the development environment, we use a PC with Pentium(R) Dual-Core 2.6GHz CPU, Logitech Orbit as the webcam, which captures 30 frames per second. The frame size is 640×480. The distance between the webcam and the postcard is 50 centimeters. The AR marker on postcard is 4.55 cm in length and width respectively.

The interactive content of the work contains video. Each poem from postcard matches a virtual digital poem. Then, the audience can interact with postcard by directly manipulating it. Figure 7 is the example of postcard. Each postcard corresponds to a video of digital poem. The total numbers of postcards and videos are both 12. Shown in figure 8 are all of the 12 postcards.



Fig.2. (1) The postcard of back is AR marker. (2) The postcard of front is poem



這只是我在弱勢團體中的一種姿態罷了

——我們彼此相識、交臂切後意圖沉默。
——路無聲地閉止。
——城市的子民們啊，然後我們在沉默下睡著。——

你還記得那晚。
（離你的可是那陽光。）
（像那樣的空間。）
「人口不斷膨脹及變異法這筆話
是否導致你當時地地愛上那點微光？」
「不，只是那兒某次無法理解及變異，並且忽然不
再。」
「那麼，你的世界似乎不該用這種方式不安。」
（像那樣的空間。）

路上行人來往多麼匆匆
彼此間只建立有
腳步的碎碎聲印的深深交疊發生的先後順序，瞬間
自遠處的幽暗美夢。

於高山峻嶺時髦的響亮角聲，輸入，以及
繼續呼吸。

自此靜靜耳聲。
懷舊中漸漸，輕輕地變換以變幻於，
風華絕代對世中與動了統一風格的美麗體系，
我繼續靜靜且，靜靜地睡。



第二天上演的情節

保持這種姿態。
我們都清楚如何繼續
繼續地讓這件即離當不經意流露自於眼下的早晨
以及能滿足對明的遠處
持續記住我沒有為誰的憂我們都有著看不見

但，但都市變遷淪陷的氣味一再稀薄
關於真實能力 給我性冷淡。
保持這份安靜沒人說明如何繼續絕對於沈默與
增進的臨界於是無聊的陽光和我都不明白
不明白為何沈默的身姿總是浮現在砂黃面於是我們只好，
時常微笑



無從界定

我所面對的，只有真誠。
「因為界定的本身已然落入一種思維的框架，」
從未親見的推論權利。

曾經擔心所謂爭執所謂的細心經營
是否正是向著所謂的 事實 一種不自量力的執著？
或者所謂談話變換變換變換
所謂知識所謂教育所謂所謂所謂判斷
甚至無從堅持 雖然在陽光依舊空襲時
不得不悄悄地遠離危險？

於此我放棄。

不該煽

情



不該煽情

有些眼神，藏匿於解構後的心懷中
無從重組。
所以夜色的身姿總是有些呆滯
所以翻不開的書頁 有寂寞的破綻聲。

無力掩藏思念的圖騰。
所以拼湊出的所謂零碎
所以析辨出的所謂落寞
俱不足採信。

字句中的結構面容
不時為雙情所吸引
選擇我們的虛構。折疊我們的憔悴
將喧鬧。緩緩疊疊的光陰
追逐冷冽的無形無對的氣息
夢囈式的抒情。

所以不該。



適可而止

景物一再變換姿態。迅速移動的光影令人發狂因循。
你的神情。於冥冥中。

「優美因子被光解構。所以我們有種有光榮。」
你是這般說的嗎？
然而我看到了景物一再變換姿態。迅速移動的光影令人發狂因循。

遠方的山嵐漸次逼近。大霧交織的聲響。不斷結糾。不斷結糾。
難以描繪的情緒。錯亂而至。
是呵。轟轟雲霧中。所以我終於看到了你的神情。
那是我聽到的最後一句話。

從你堅定炯炯的雙眸中。我終於聽到了這句話：

「對於所謂公平對於所謂真理的追求。是否何妨。適可而止。」

我，
以及其他



我，以及其他

這陣陣於一夜風雨解構的結局中。
（其實不必對自己表達秘密而有所刻意的歌。）

「一個人嗎？」
句法及語意皆過於嚴謹。一時令我啞然無從回答。
「一個人嗎？」
口氣的佈局顯然鬆動。我張口大笑
所有感覺都和我背道而馳。
是孤單罷。我想。

所以面談。關於一切優柔寡斷及其他等等。
而忘了防範：夢遺後
虛德與光榮紛紛跌落我頭髮糾結的思維中。
而彼此排擠。

我們只能這麼說了。心扉角隅一隅
優越與其突變的折等基因
錯這雙眸在意識的側面
我只能這麼說了
無涼麗相本質及無法為心情命名。
並且風雨驟變。
如此而已。



不修邊幅

我甚至連對睡眠相後的呼吸節奏都如此輕忽
其實並非漫視自己。
清靜的睡自後之後的習慣付諸。
決意將關心與那全對準這道牆。

即便十分認真地收藏了一輩子所有的遺憾與心碎
儘管安時總是如此地給亂翻書。

緣結是否不修邊幅
於焉就不重要。



停格之二

我的夢境。從內心的觀形到顯達不可見的完整結構
諸多真誠而又模糊的懸念
終於看見。轉瞬於潔淨山徑中的芳蹤。
你來了。

「然在此我仍尚未理清與昨日種種無關緊要的往事
究竟牽扯著什麼或該追求的懸念時。」(註一)
我靜待自己的睿智的覺醒。

所以我在這裏
所以你在那裏

(註一)：改編自田漢與詩人之「生生：世世」。



中傷我吧

以嬌俏的言語勾引你：
中傷我吧。
俾身而出的姿態是否與天氣有關。不用管
中傷我吧。

中傷我吧
藉此我揮灑心機
釋放難耐的憤恨與憂傷。
中傷我吧
因為感動是不需要的。傷感是不需要的
因為回憶是不需要的。珍惜是不需要的
釋放所有難結吧
可以如同他們般。轉瞬堅固的流光歲月。

而殘酷的詠與不該
當它們深深咬噬不及待想見識你的歡意不斷你的過於晶瑩的夢
那麼將情何以堪。

所以，還是中傷我吧



Fig. 8. The total postcards

The element of presentation includes the webcam embedded to the lamp, reading-desk, projector and white wall in exhibition. Figure 9 is the presentation of artworks. There are several postcards on reading-desk and the lamp is installed at a higher position in order to present a broader view. The audience “read” the content of these poem by manipulating the postcards, so that the digital films “hidden” behind the AR markers will be displayed. The installation of this artwork is show in figure 10.



Fig.9. The presentation of artworks



Fig.10. The audience interacts with AR digital poem..

VI. CONCLUSION

In this work, we employ augmented reality technologies to create digital artworks to present interactive poem. This artwork was exhibited in Digital Art Center, Taipei, Taiwan, and the exhibition duration is from March 6, 2010 to April 11, 2010. We will extend this work so that the audiences can interact with the AR digital poem via internet. The artwork

setting and operation is easy. Audiences only need to set up a webcam, with no additional hardware requirement. In comparison to other AR equipment, the cost of this work is quite low. In the future, some usability evaluation will be performed on this work.

III. REFERENCES

- 1) Lev, M. (2001). *The Language of New Media*. Massachusetts: MIT Press.
- 2) Kirk, V., and Gopnik, A. (1990). *High and Low: Modern Art and Popular Culture*. New York: Museum of Modern Art.
- 3) Oliver, G. (2003). *Virtual Art*. Massachusetts: MIT Press.
- 4) Zucker, S. D. (1997). The Arts of Interaction: Interactivity, Performativity and Computers, *Journal of Aesthetics and Art Criticism* (Special Issue on Art and Technology), 55(2), 17-127.
- 5) Milgram, P., and Kishino, F. (1994). A Taxonomy of Mixed Reality Visual Displays. *IEICE Trans. Information Systems*, E77-D(12), 1321-1329.
- 6) Azuma, R. (1997). A Survey of Augmented Reality. *Presence: Teleoperators and Virtual Environments*, 6, 355-385.
- 7) Azuma, R., Baillot, Y., and Behringer, R. (2001). Recent advances in augmented reality. *IEEE Computers and Graphic*, 21, 34-47.
- 8) Dünser, A., and Hornecker, E. (2007). Lessons from an AR book study. In: *Proceedings of the First International Conference on Tangible and Embedded Interaction*, 179-182.
- 9) Liarokapis, F., Petridis, P., Lister P.F., and White, M. (2002). Multimedia Augmented Reality Interface for E-learning (MARIE). *World Trans. on Engineering and Technology Education*, 1(2), 173-176.
- 10) Billinghurst, M., Kato, H., and Poupyrev, I. (2001). The MagicBook: A transitional AR interface. *Computer and Graphic*, 25, 745-753.
- 11) Kirner, C., and Zorzal, E.R. (2005). Educational applications of augmented reality collaborative environments. *Proceedings of sixteenth Brazilian Symposium on Informatics in Education*, 114-124.
- 12) Hsieh, M.C., and Lee, J.S. (2008). AR marker capacity increasing for kindergarten English learning. *International Multiconference of Engineerings and Computer Scientists*, 663-666.
- 13) Kato, H., Billinghurst, M., Blanding, B., and May, R. (1999). *ARToolKit*. Technical Report (Hiroshima City University).