

JewelryStudio: System for capturing/browsing pictures of jewelry from multiple viewpoints

Chiho Watanabe
Ochanomizu University
2-1-1 Otsuka Bunkyo-ku
Tokyo Japan
(+81)-3-5978-5703

watanabe.chiho@is.ocha.ac.jp

Koji Tsukada
JST PRESTO/Ochanomizu University
2-1-1 Otsuka Bunkyo-ku
Tokyo Japan
(+81)-3-5978-2571

tsuka@acm.org

Itiro Siio
Ochanomizu University
2-1-1 Otsuka Bunkyo-ku
Tokyo Japan
(+81)-3-5978-5703

siio@acm.org

ABSTRACT

Users often have difficulty taking pictures of jewelry as it requires advanced photographic techniques. We propose a system called "JewelryStudio" that helps users easily capture pictures of jewelry from multiple angles, and upload them to an online database for various web-based uses. In this paper, we explain the concept, implementation, and evaluation of the JewelryStudio.

Categories and Subject Descriptors

H5.m. Information interfaces and presentation (e.g., HCI):
Miscellaneous.

General Terms

Design, Human Factors

Keywords

Jewelry, pictures, multiple angles, web browser.

1. INTRODUCTION

Jewelry is a traditional tool to augment attractiveness of human bodies. Recently, the number of on-line jewelry shops has rapidly increased. Most of these shops present pictures of jewelry from various angles with proper lighting to attract consumers; that is, these pictures help consumers observe the details of jewelries. However, users often have difficulty taking such pictures themselves as this requires complicated processes based on jewelry type, such as finding an appropriate background, setting the jewelry at the proper angle, adjusting lighting and so on. Therefore, not only consumers but also jewelry shop staff often fail to capture the attractiveness of jewelry items due to a lack of photographic tools/techniques.

To solve this problem, we propose a system called "JewelryStudio" to help users easily capture pictures of jewelry from multiple angles, and upload them to an online database for various uses on the Web (Figure 1)

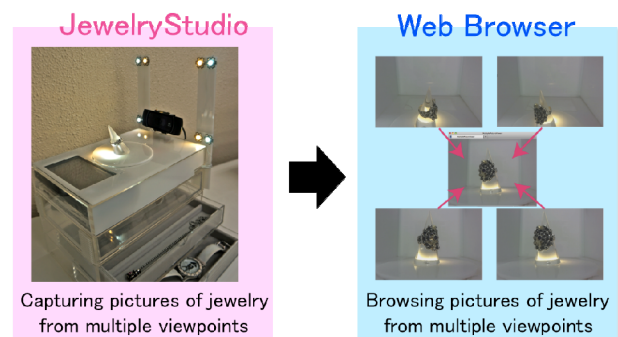


Figure 1. The concept of JewelryStudio.

2. JEWELRYSTUDIO

JewelryStudio helps users easily capture pictures of jewelry from multiple angles. The system can control jewelry angle, camera position, and lighting according to jewelry type. JewelryStudio basically consists of a moving camera, a rotary table, LED lights, an RFID reader to detect jewelry type, I/O modules and a PC to control the above devices.

Next, we explain the basic operation of JewelryStudio. First, a user attaches his/her jewelry to the jewelry stand equipped with an RFID tag and places them on the rotary table. Then, the system detects the jewelry type from the tag ID and takes multiple pictures as the camera moves and table rotates. At the same time, the system also controls LED lights to capture pictures of jewelry under various types of lighting (e.g., fluorescent/incandescent lights). Moreover, JewelryStudio automatically generates "multi-view pictures" by combining pictures with angle information, and uploads them to an online database. The multi-view pictures help users browse jewelry interactively from multiple angles on common web browsers.

Thus, users can easily create multi-view pictures of their jewelry just by placing them on the rotary table, and then use the pictures for various web services (e.g., web shops, blogs and auctions).

3. IMPLEMENTATION

Figure 2 shows the JewelryStudio prototype. As shown in Figure 2, we integrated a capture system in a ready-made jewelry box.

We used a four-tiered acrylic box (255mm x 170mm x 190mm, w/d/h). We installed devices into the top drawer and left the other drawers for jewelry storage. The prototype consists of a USB camera (Logicool HD Pro C910), an acrylic disk (10 cm in diameter) for the rotary table, an RFID reader (Texas Instruments S2000 micro reader) and antenna, LEDs, servomotors (two regular servomotors and a linear servomotor), I/O modules and a

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compact PC (VilivS5 by BRULE Inc.) to control the above devices. We attached a servomotor under the table and two servomotors (regular/linear) to the camera (Figure 3). The servomotors are controlled by the PC via a Phidget Servo



Figure 2. The JewelryStudio prototype.

Controller¹. We attached the rotary table on top of the jewelry box. We also attached the RFID antenna under the table, and RFID tags in the jewelry stands. We prepared four types of jewelry stands (watch/earring/ring/necklace) in the current prototype. Thus, the system can change capture settings (e.g., motion intervals of the table and the camera) according to jewelry type.

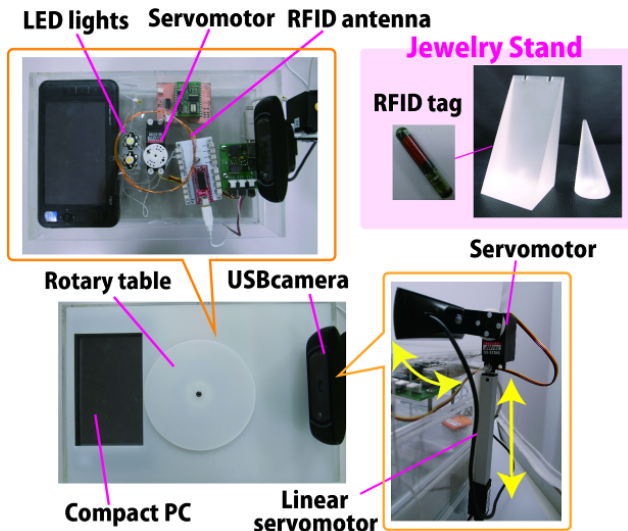


Figure 3. System configuration of the prototype

The USB camera (Logicool HD Pro C910) has relatively high resolution (1920 x 1080) and a quality lens. We attached the camera to the regular and linear servomotors sequentially with screws. We then set them together on the side of the jewelry box. Moreover, we used two types of white LEDs (incandescent and fluorescent, 3000/6500 kelvin) to provide different lighting. We attached these LEDs under the table and around the camera unit. These LEDs are controlled by the PC via Gainer I/O². We installed the PC, the I/O modules, and the RFID reader in the top drawer and covered it with acrylic boards to preserve the appearance.

¹ http://www.phidgets.com/products.php?product_id=1061

² <http://gainer.cc/>

Figures 4 and 5 show examples of pictures of jewelry captured by the JewelryStudio. The system uploads pictures with metadata (e.g., jewelry angle, camera angle, and jewelry type) to the online database.

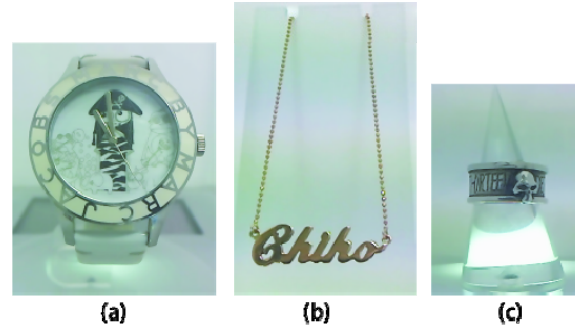


Figure 4. Examples of pictures captured by JewelryStudio: (a) watch, (b) necklace, and (c) ring.



Figure 5. Examples of pictures captured from multiple angles.

Users can browse these pictures on common web browsers through a web component implemented with Microsoft Silverlight. The system allows users to control the angle of pictures in proportion to the movement of the mouse cursor (Figure 6).

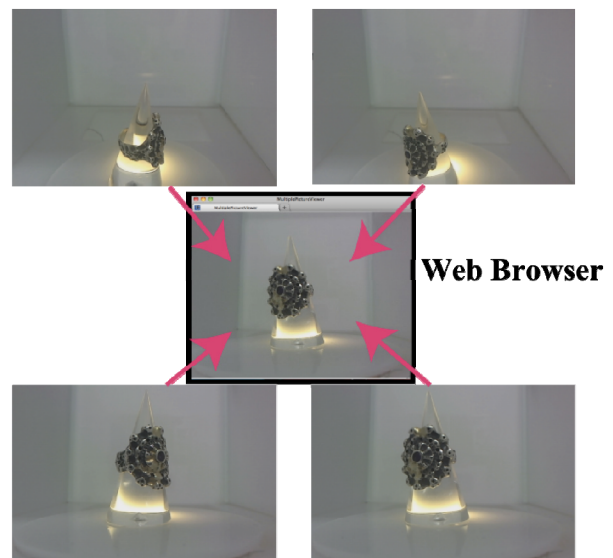


Figure 6. Screenshots of the JewelryViewer.

4. EVALUATION

We confirmed the basic performance of the JewelryStudio prototype through the evaluation.

4.1 Method

We selected 5 test subjects (5 females, their ages ranged between 23 and 26) and asked them to bring their own jewels (a ring, a necklace, a pierce, and a watch). First, the experimenter brought each subject in the laboratory and explained about the basic

function of the JewelryStudio (supporting users to capture/browse pictures of jewelry from multiple viewpoints) and its basic usage (attaching her jewelry to the jewelry stand and placing the stand on the rotary table in the right direction) for about 3 minutes. Next, the experimenter asked the subject take pictures of her jewels using the JewelryStudio. Most subjects repeated the capture process 4 times³. Next, the subject was asked to browse the pictures of her jewelry interactively from multiple viewpoints using the JewelryViewer. Finally, the experimenter obtained feedback from the subject through questionnaires in three aspects: (1) attributes of the subject, (2) easiness to control the JewelryStudio and (3) impressions of captured pictures. Finally, the experimenter obtained subjective feedback both by questionnaires and oral discussion.

4.2 Result and consideration

First, we attempted to characterize the subjects by asking them three questions: “(1) How many jewels do you have?”, “(2) How much are you interested in jewelry? (1: never interested - 5: very interested)”, “(3) How often do you use web services such as auctions, SNS and picture sharing? (1: not at all - 5: very frequently)”. For question (1), 3 of 5 subjects answered that they had more than 30 jewels and the others had about 10 jewels. For question (2), 4 of 5 subjects answered “5: very interested” or “4: rather interested”. For question (3), the answers of the subjects were split: 1 subject answered “5: very frequently”, another subject answered “1: not at all” and the others answered “3: sometimes”. The third group did not upload their activities (blogs or pictures) to web services; however, they browsed blogs/pictures of their friends and replied comments to them usually.

Next, we explain the results of the capturing process. We asked the subjects three questions: “(1) Could you easily attach your jewelry to the jewelry stand? (1: very complicated - 5: very easy)”, “(2) Could you take pictures of your jewelry easily? (1: very complicated - 5: very easy)”, “(3) Did you feel the waiting time was long? (1: very long - 5: very short)”. For question (1), 4 of 5 subjects answered “5: very easy” or “4: easy” (avg=4, s.d.=1.5). For question (2), all subjects answered “5: very easy” or “4: easy” (avg=4.6, s.d.=0.5). Moreover, the subjects mentioned that “It’s useful since I can take pictures of my jewelry just by putting it” and “I felt the operation was very easy since I need not adjust any parameters”. Thus, most subjects felt the operations of the JewelryStudio quite easy. In contrast, for question (3), 4 of 5 subjects answered “1: too long” or “2: long” (avg=2, s.d.=0.6). Since the current prototype needed about 5 minutes to take pictures of a jewel, the subjects felt the waiting time was quite long especially in the “just waiting” situation like the evaluation. However, since the JewelryStudio does not require users any operations after placing the jewelry, we think the waiting time may not affect the actual use in daily environment. In fact, a subject reported that “(Although I felt the waiting time was quite long), I can allow the waiting time if I can do other tasks during the period”. Moreover, we also plan to develop another solution: playing music whose length is matched to the waiting time while capturing jewelry pictures like the approach of CastOven [7].

Next, we explain the results of the browsing process. First, we set two questions to confirm the quality of the pictures as follows: “(1) How do you rate the quality of jewelry pictures? (1: very poor - 5: excellent)”, “(2) Could you recognize the detail of

jewelry enough? (1: never finely - 5: very finely)”. For question (1), all subjects answered “5: excellent” or “4: good” (avg=4.6, s.d.=0.5). For question (2), 4 of 5 subjects answered “5: very finely” or “4: finely” (avg=4.2, s.d.=0.7). From these results, the jewelry pictures had enough high quality and the subjects can recognize the jewelry details finely. In fact, a subject said that “The picture of my ring looks so fine. I can easily recognize its carving.”

Next, we confirmed the effectiveness of multiple lighting through two questions: “(3) Could you recognize the difference of pictures taken under incandescent lights and fluorescent lights? (1: almost same - 5: drastically different)” and “(4) Did you think the pictures in different lighting useful? (1: never useful - 5: very useful)”. For question (3), all subjects answered “5: drastically different” or “4: different” (avg=4.6, s.d.=0.5). For question (4), 4 of 5 subjects answered “5: very useful” or “4: useful” (avg=3.8, s.d.=1.0). Thus, most subjects could recognize the difference of pictures taken under the incandescent/fluorescent lights and felt them rather useful. In fact, a subject reported that “I found the multi-lighting function was quite useful. I would like to browse my jewelry pictures in different lighting after I took pictures”. In addition, the preferences of the subjects between incandescent/fluorescent lighting were split, since these pictures looked rather differently.

In contrast, for the question of “(5) Could you browse multiple pictures comfortably? (1: very uncomfortable - 5: very comfortable)”, 3 of 5 subjects answered “3: no preference” (avg=3.6, s.d.=0.8). Moreover, for the question of “(6) Did you feel the transitions between multi-angle pictures comfortably? (1: very uncomfortable - 5: very comfortable)”, 2 of 5 subjects answered “2: uncomfortable (avg=3.2, s.d.=1.0)”. From these results, most subjects felt the operation of the JewelryViewer not so comfortable because of the inaccurate transitions between multi-angle pictures. Especially, they seemed to feel uncomfortable at several pictures in similar angles. To solve this problem, we will adjust the parameters of movements of the camera more accurately. Moreover, we also plan to develop a new function to adjust these parameters automatically by attaching visual markers near the rotary table and detecting precise angle information.

In addition, we obtained miscellaneous comments as follows:

- “I enjoyed multi-angle pictures since I can easily check various aspects of my jewelry.”
- “I want to use multi-angle pictures when I watch jewelry pictures of my friends or online shops.”
- “I want to browse jewelry pictures in wider ranges of angles (e.g., above or bottom).”
- “I want to zoom in pictures of small jewelry.”

Finally, we summarize several challenges that were found by the experimenter in the evaluation as follows:

- The system occasionally failed to focus small jewelry (e.g., a small pierce with a diamond) accurately (Figure 9 bottom-left).
- The system could not take fine pictures of a pierce with long chains since it is often swung by the movements of the rotary table (Figure 9 bottom-right).
- The surrounding light is occasionally reflected on the jewelry parts (e.g., a watch glass as shown in Figure 7 left).
- Certain jewelry (e.g., a large pearl necklace) could not be attached to the jewelry stands because of the size issue.

³ one subject took only three pictures since she did not have pierces

We introduce examples of jewelry pictures taken in the evaluation as shown in Figure 7, 8, and 9. Each picture was selected by the owner (subject) as a best shot from multi-angle pictures. Based on these angle data, we plan to develop a new function to automatically select the best picture using machine learning techniques.



Figure 7. Examples of pictures of watches taken in the evaluation

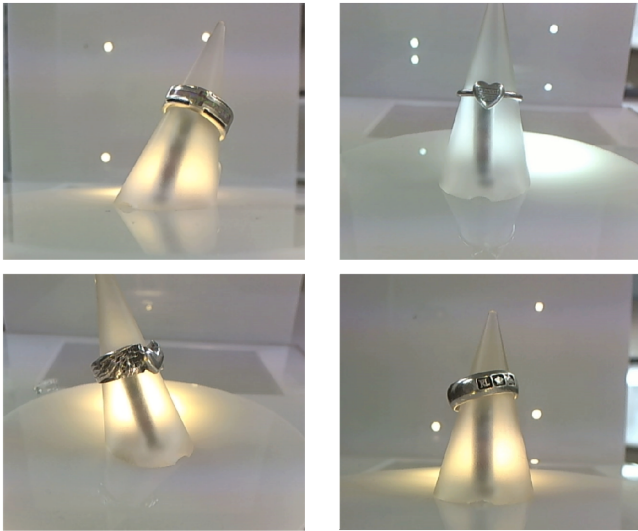


Figure 8. Examples of pictures of rings taken in the evaluation

5. RELATED WORK

The Complete Fashion Coordinator [4] helps users capture their clothes using TagTansu [5] and add annotations to the pictures just by hanging the clothes on a hook. The Countertop Responsive Mirror [2] can automatically record pictures while a user tries jewelry on in front of a mirror. DrawerFinder [3] can automatically take pictures of items in storage boxes without the need for users to perform any special operations. Magic Wardrobe [6] is a system which serves as a physical interface between the consumer and the on-line marketplace. Our system is unique in focusing on capturing pictures of jewelry just by placing the jewelry on a table. Using JewelryStudio, users can easily take pictures of jewelry from multiple angles and browse them on common web browsers.

There are several research projects and software that support users to create 3D models from multi-angle pictures [1]. We consider integrating the JewelryStudio with these systems for further use.



Figure 9. Examples of pictures of necklaces and pierces taken in the evaluation

6. CONCLUSION

We proposed a system called “JewelryStudio” to help users easily capture pictures of jewelry from multiple angles, and upload them to an online database for use in various web-based applications. We plan to develop additional functions for practical use, such as extracting the best picture from historical data during the browsing process.

7. ACKNOWLEDGMENTS

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