Complete Fashion Coordinator: A support system for capturing and selecting daily clothes with social networks

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ABSTRACT

For some people, selecting the clothes you wear is sometimes tedious, difficult and requires you to remember what you have previously worn. While there are many fashion SNS (Social Networking Services) sites and related research devoted to addressing certain aspects of this issue, there is no system that combines both the automated cataloguing of one's own clothes with near real-time recommendation by their social network. In this paper, we propose a novel system which allows users to easily organize and optimize their daily clothing selection based on historical data. By combining historical information about what the user has worn with several options such as the user's planned activities and the weather, it can help the user in coordinating what to wear. In order to simplify and automate the capture, storage and cataloging of image of the users clothing, we propose a system which allows for the automatic and standardized capturing of a person's clothes by simply hanging an item on a hook built into a cabinet. Furthermore, by utilizing the internet and common SNS sites, it allows friends, family living apart and/or romantic couples to seamlessly share the catalogued photos of their clothes, initiate conversation and help select what is appropriate to wear.

Categories and Subject Descriptors

H.5.2 **[Information Interfaces and Presentation]**: User Interfaces – input devices and strategies, user-centered design, prototyping.

General Terms

Design, Human Factors

Keywords

Fashion coordination, recommendation, social network, communication

1. INTRODUCTION

Selecting the clothes you wear is sometimes tedious, difficult and requires you to remember what you have previously worn. Many people have experienced situations where they can't decide which clothes to wear and end up being late to meetings. Similarly, one wants to wear a variety of clothes and be fashionable, yet end up wearing the same clothes combination since they don't know or are uncomfortable with their selection.

Recently, many websites for fashion-oriented people have appeared where people can easily obtain information about the latest fashion and clothing tips. For example, fashion SNS sites help people find friends with similar preferences for fashion, and communicate with them. Moreover, online auction services enable people to sell/buy their used clothes with each other. However, while these websites offer frameworks for publishing pictures and related information of users' own clothes, most people only browse/buy existing items and thus cannot describe the clothes they already own to others. Furthermore, there is no easy way to solicit and receive feedback on clothing combinations you personally own from remote friends and/or family.

There are several significant reasons behind the difficulty of capturing pictures of clothes and uploading them to a website for soliciting feedback. This involved process is outlined as follows: (1) finding a neutral background, (2) taking pictures of clothes with a digital camera, (3) transferring the pictures to a PC, (4) grouping the clothes using folders or annotations, (5) adjusting the size and cropping of the pictures using image-processing software, (6) uploading the pictures to a website using a web browser or a ftp client, (7) setting up a voting page for friends to "vote" on the best clothing combinations, (8) notifying the SNS and tallying the votes from the network.

We believe that we can help users publish pictures and related information of their clothes on a website by offering a system for capturing/uploading pictures of clothes quickly for both cataloguing and receiving recommendation from their social network. For these reasons, we propose a system called the "Complete Fashion Coordinator", which helps users easily take pictures of clothes by hanging each item on a hook, annotate the pictures, and automate fashion coordination feedback (voting page) through the user's social network.

2. DESIGN AND USAGE SCENARIOS

In this paper, we develop a "Complete Fashion Coordinator" system that can automate the process of capturing and selecting clothes via historical data, weather, situation and/or feedback from one's own social network. Figure 1 shows the concept of this system. This system utilizes the TagTansu system to facilitate taking full-length pictures of an ensemble worn by the user. Once the clothing picture is captured by TagTansu, the system allows users to easily organize and optimize their daily clothing selection by several criteria. This includes utilizing a historical clothing database and/or allowing the user to easily communicate with other people within their SNS network and receiving fashion advice based on their clothing database. When the Complete Fashion Coordinator system is utilized, the following scenarios can be envisioned.
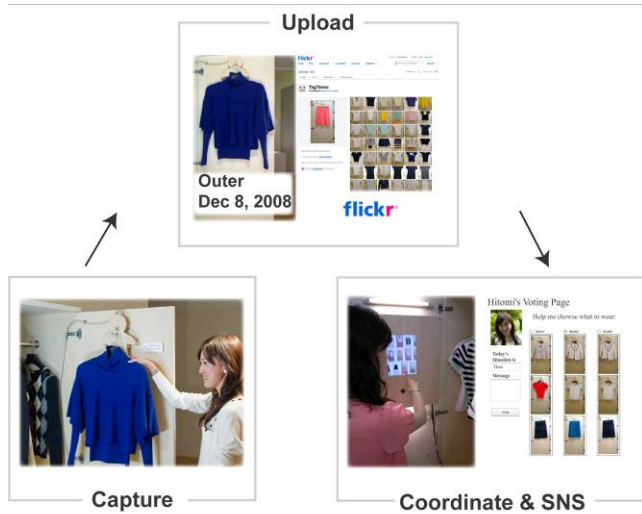

Figure 1. Concept of Complete Fashion Coordinator.

Scenario 1: Mary went shopping with her friends and bought autumn clothes. Using TagTansu, Mary can easily take pictures of her new clothes. Since it is very easy to use, this process becomes natural step whenever she buys new clothes.

Scenario 2: Having a comprehensive database of her own clothes accessible from anywhere, Mary can check which clothes she already owns and reduces the amount of clothes she buys which are similar in style.

Scenario 3: Utilizing the historical database, Mary reduces the amount of similar clothing combinations worn and is praised by her friends for her wide selection of clothes. Furthermore, Mary becomes aware of clothes that might have been forgotten in the past.

Scenario 4: Mary is having a hard time deciding what to wear for a date. She decides to ask her friends using the SNS function of the Complete Fashion Coordinator system. She then receives quick response on which clothes to wear as well as feedback from her friends on which clothes is more appealing to men. Mary's boyfriend, who usually doesn't pay attention about fashion, said "those clothes look cute on you!"

3. CAPTURING SYSTEM

Figure 2. TagTansu System Component.

In order to quickly and easily capture clothing images, we will utilize TagTansu - a novel capture and annotation system which can quickly capture pictures of clothes with simple annotations to support creating picture database of clothes. TagTansu mainly consists of sensors and capture components attached to the inside doors of a "tansu" (Japanese for wardrobe). We selected a wardrobe with double doors to utilize both door surfaces. As shown in figure 2, we attach hook sensors to one door and attach capture components - a camera, lights and an LCD - to the other door. We also attached a mirror and camera for taking a picture of the coordinated full body ensemble. By attaching these devices to an existing wardrobe, TagTansu has following advantages: 1) space-saving: TagTansu doesn't require additional space in the users' room, 2) sufficient focal distance: TagTansu can create enough distance between a camera and clothes by attaching them to separate sides of double doors and 3) consistent environment: TagTansu can easily keep capture environment (e.g. background and lighting) consistent and stable.

The usage of TagTansu is briefly described here. First, when a user opens the doors, the lights turn on automatically by detecting the opening of the door via an attached reed switch. Next, when the user hangs his/her clothes on a hook sensor, an image of the clothing is captured by the camera on the opposite door. Since TagTansu has multiple hook sensors, he/she can indicate the type of clothing by hanging it on different hooks (See next section for details). Moreover, hook sensors also detect estimated weight of clothes. Thus, TagTansu can capture types and estimated weight of clothes in addition to the picture itself. When the user closes the doors, the user's whole body ensemble is captured by the camera and is automatically tagged. Finally, the captured picture and associated tags are automatically uploaded to a web/file server (e.g. Flickr) via http/ftp.

3.1 Implementation

We developed TagTansu with the above features (Figure 2). The system consists of several hook sensors, a magnetic reed switch, two USB cameras for capturing images (inside clothes only and external full body ensemble), two fluorescent lights, an LCD display with touch screen and a host PC. There are three hook sensors attached on a human shaped wood plate (Figure 3). We embedded a pressure sensor to each hook for detecting the weight

of clothes hung on the hook. These sensors are controlled by the host PC via a Phidget Interface Kit. Two hooks are located at neck level, and one hook is located at waist level of the human shaped model. Based on which hook the clothes are hung from, different meta tags are automatically associated with the picture taken of the clothes such as a "tops" tag on the upper hooks and a "bottom" (i.e., pants, skirt) tag on the lower hook. Moreover, as shown in figure 3, each upper hook has different length. Users can add an "inner" (e.g., shirt) tag on the short (inner side) hook and an "outer" (e.g., jacket, coat) tag on the long (outer side). In this way, users can easily select types of their clothes using a natural mapping like human body. The magnet switch detects the open/closed states of the doors for turning the lights on/off.
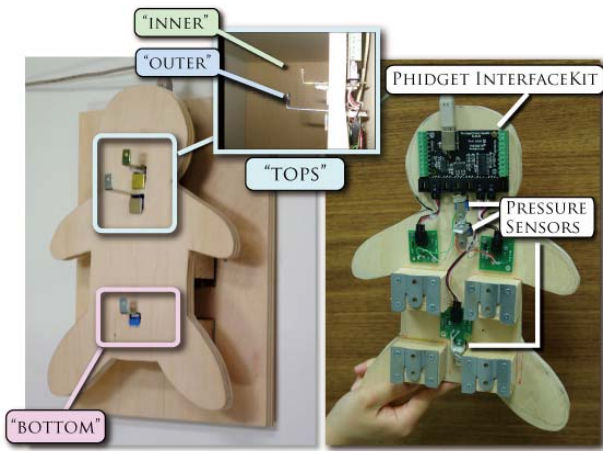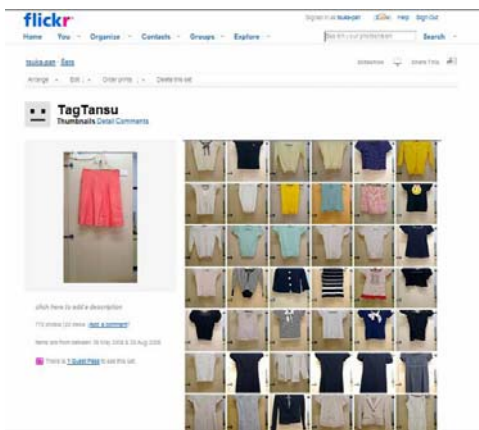

Figure 3. Hook Sensors.

Figure 4. Upload to Flickr.

Next, we explain the system procedures for taking pictures. First, when a user hangs his clothes on a hook, the pressure sensor detects weight of the clothes. Then, when the weight exceeds a certain threshold and remains over the threshold for a given amount of time (e.g. one second), the system begins countdown for capturing pictures. After a few seconds (three seconds in the current system), the system captures an image of the clothes with the USB camera and plays a shutter sound. The captured picture is displayed on the LCD and saved to the host PC in a JPEG format.

The system also adds three types of annotations: type of clothes (outer, inner, top, bottom), estimated weight of the clothes and a timestamp to the picture as EXIF information. Figure 4 shows example of pictures captured and uploaded to Flickr by TagTansu. These pictures are automatically uploaded to a website and categorized by types of clothes using a CGI program.

4. RECOMMENDATION SYSTEM

In this section, we describe the recommendation system which allows users to easily organize and optimize their daily clothing selection by utilizing the clothing database collected via the TagTansu system.

Currently, when we select what to wear, we need to know various pieces of information beforehand. For example, we may select a different clothing combination depending on the day's events and the type of people we would meet. Therefore, in order to find out the most important criteria for selecting clothes, we conducted a survey of 46 people via an online website survey. The multiple choice question "What factors do you consider most important when deciding what clothes to wear for the day?" was asked with the following choices: "Intuition", "Occasion", "Weather/Temperature", "Who they are meeting", "Lucky color", "Fortune/Horoscope" and "Other". About sixty percent answered "weather/temperature" and "who they are meeting" (more than one selection can be made). From this result, we consider that weather and the person they were meeting as very important factors when we select clothes.
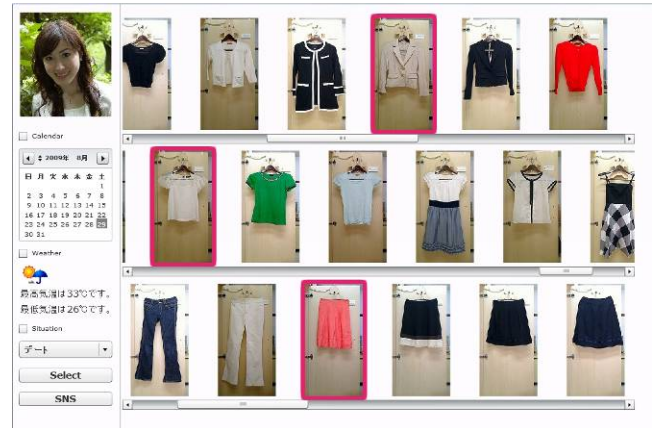

Figure 5. Screenshot of Recommendation System.

Based on this feedback, we developed a system which allows users to easily organize and optimize their daily clothing selection based on the person they are meeting, the weather of the day as well as historical wear data. The system displays all clothes in a scrollable thumbnail format. The thumbnails are stored on Flickr and are automatically downloaded with their associated category information. As seen in Fig.4, the system shows pictures of clothes classified under three categories ("outer", "inner", "bottom") based on the automatic classify in the TagTansu capture phase.

Utilizing this system, the user can select clothes more effectively. For example, this system will suggest users not to wear the same clothes in the same situations based on the historical data, or suggest proper clothes based on the day's weather.
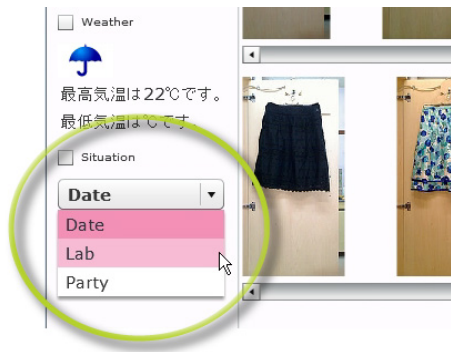
Figure 4. "Situation" Menu.

The recommendation system then displays all clothes in a scrollable thumbnail format, a calendar showing today's date, weather forecast for the day and a menu for selecting the type of setting (e.g., date, laboratory, work) the user will be in (fig. 4). The user can select the "Situation" such as going out on a "Date", studying at the "Laboratory", or going to "Work" via the drop-down menu. This is called the "Situation Menu" (fig. 5). Also, as seen in Fig. 4, the "Calendar", "Weather", and "Situation" options all have a checkbox displayed on the left. When this checkbox is selected, the pictures of inappropriate clothing based on that particular criterion will be dynamically blurred. For example, if the checkbox next to the "Calendar" option is selected, the clothing worn for the last several days (currently set to seven days) is blurred. Using this effect, the user can intuitively know which are "inappropriate" clothing. Similarly, when the checkbox is selected next to the "Situation" menu, the thumbnails of clothing in the past similar events (currently set to seven) where the user wore in the same situation is also blurred. These selections can be layered so that only the appropriate clothes for multiple criteria are displayed.

The blurred picture can also return to the original (unblurred) picture when a particular blurred thumbnail is selected. We considered various ways to display inappropriate clothing - for example, to not display the thumbnail at all - and eventually decided to use blurred effect because it can intuitively inform the ordering priority while still allowing the user to select potentially "inappropriate" clothes.
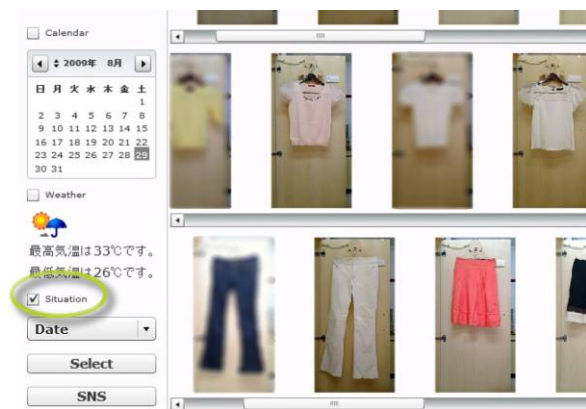

Figure 5. Inappropriate clothes are blurred.

After selecting the clothing combination for the day, the user will then press the "Select" button whereby the selections as well as other related data will be recorded to the system log. Finally, the calendar selector can be used to query the database/log on what was worn in the past. Likewise, one can enter/revise their selection if they forgot to use the system for that particular day and input their selection retroactively.

5. SNS

When selecting what to wear, we sometimes would like to ask for other people's recommendations. If we live with our family or friends, we can easily ask/show and get advice from them directly when we have a hard time deciding what to wear for the day. In addition, this action may start different conversations such as "What/where are you doing today?" However if we want to ask our remote friends opinion and feedback, we usually need to ask via a telephone call and/or email and describe our clothes to them verbally. For example, when a girl will have a romantic date, she may ask her close friends and family for clothing advice by sending them manually taken pictures of her clothes. Similarly, the husband who takes up a job in another city, leaving his family behind, may call his wife to ask about his clothing for the day in a similar manner.

If there is a system which the user can easily coordinate with their family, friends or romantic couples, we think it would also facilitate and promote additional communication with them after receiving the fashion advice.

Therefore, we propose the "SNS" function. This feature will allow the user to select multiple clothing candidates and request feedback from their social network (e.g. Twitter, Facebook). By selecting the candidate thumbnails and then selecting the "SNS" button, the system will create a page on a web server with only the candidate ensemble displayed. A link to this web page and a short message will then be sent to the user's social network about the pending query. When the user's friends receive the request, they are directed to a web page where they can easily vote for their recommendation and (optionally) leave comments. Figure 6 shows the system overview where the capture, tagging, database and log system integrate with the SNS and voting components.

This information (vote) is then automatically compiled and the system notifies the user of the network's recommendations in near real-time (fig. 7).

This system allows the user to easily and casually interact with their social network as well as allowing the voting friends to quickly take part by utilizing the informal communication properties of SNS' such as Twitter. The system also allows for getting valuable feedback from other people in the network, thus leading the motivation from both parties.

Finally, the voting friends will want to know what clothes the user had ultimately selected for that day. Therefore, after the user makes her final selection, the system takes whole body picture by the capture system. This is then uploaded and notifies the voting friends which ensemble was actually chosen. This information will be valuable for many friends who may not want to wear similar clothes with the user at the same party or function. Thus, they can avoid the faux pas of wearing the same clothes to the same event.
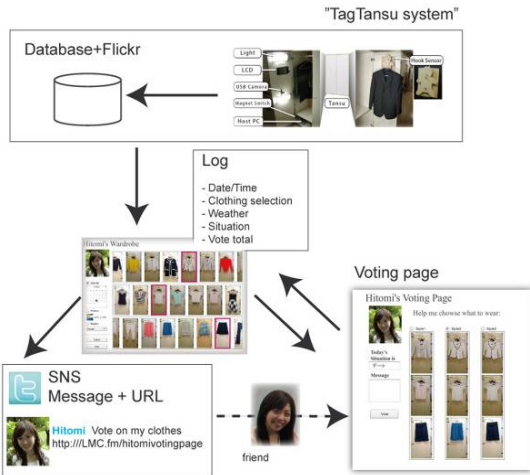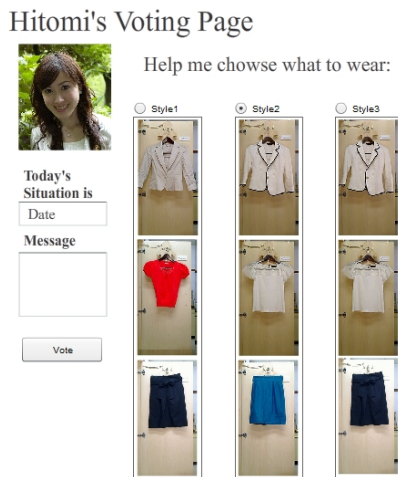
Figure 6. System Overview.

Figure 7. Screenshot of Voting Page.

6. EVALUATION

6.1 Evaluation of the capture and recommendation function

To determine the effectiveness of the system, we conducted a 20-day field test. The participant was a 27-year-old female (and one of the authors of this paper). During this time, the participant selected clothes every morning using the Complete Fashion Coordinator system. Before the field test began, the participant captured all her clothes using TagTansu and made an initial clothing database of about 100 items.

Based on this, the participant could figure out her clothing pattern (e.g. color, style) in one glance and found it useful during shopping trips since one can easily browse all her clothes in the system. For example, the participant thought she had many patterned skirts and colored skirts before using the system. However, she found that most were black and white skirts.

Therefore, she changed her buying habits and bought more patterned and colored skirts the next time she went shopping.

Other examples of changes in habit were that since clothing selection was taken care of by the system, it reduced the amount of time spent taking clothes in and out of the closet. Prior to using the system, the participant was apt to wear her favorite clothes many times. However, by using the calendar function to bring up historical trends, she avoided wearing the same clothes too often.

Before using the system, the participant didn't wear the clothes stored in the back of her closet as newer clothes pushed back older clothes. However, by using the system, the participant was surprised "I have such clothes!" by remembering the forgotten clothing and ended up actually wearing the clothes. Similarly, the participant became more conscious about not wearing the same clothes to her part time job.

6.2 Evaluation of the social network function

In addition, we conducted the following field test during a 10-day trial to determine the effectiveness of the SNS function. There were a number of unknowns that we wanted to evaluate in this test. This included how much time we should allow the network to provide feedback and how many people will actually reply. During the field test, the participant selected three candidate ensembles (styles 1-3) for the day and used a voting web page (fig. 7) to have her social network select the best ensemble to wear.

We used Twitter and Facebook for sending the URL of the voting site and message for that day. The number of people the message was sent to was about 180 people in the participants social network (removing overlap between the two social networks). Both Twitter and Facebook consisted of friends, co-workers or acquaintances. Table 1 shows the result of the voting system, voting time (the time that the participant asked for coordination advice) and decision time (the time which the participant closed the vote and selected which clothes to wear), votes (the number of votes submitted) and comments (the total number of comments received on that day).

The participant selected three candidate ensembles and selected the "SNS" button before getting ready (shower, make-up, etc…) After getting ready, the participant checked the voting results and feedback from her friends. This resulted in a number of occasions where the participant thought a certain ensemble was probably best for her, yet her social network selected something that was unanticipated. During these occasions, the participant felt it was a good opportunity to try the new style. Regardless, the participant always wore the selection that garnered the most votes.

Table 1. The result of voting system

Date	Voting Time	Decision Time	Votes	Comments
11/7	13:25	16:00	47	12
11/8	12:49	14:00	6	6
11/9	11:34	14:15	8	4
11/11	7:59	10:00	9	4
11/12	8:34	11:00	8	2
11/13	8:44	10:00	23	3
11/16	13:28	14:10	7	4

Furthermore, there was a space to provide feedback on the voting site. Many participants wrote various messages freely in this space. As seen from the table, as soon as the novelty wore off, comments were only left by certain core members. Some examples include helpful comments such as: "wear with gold accessories", "casual is best when meeting friends" and "the pink combination is best, but it should go with the shorter skirt". Some wrote the reasoning for their selection such as: "I like simple style, so I've voted 2" or "I like shorter skirts."

It was also noted that by using SNS' such as Twitter and Facebook, the voting and feedback was received very soon (several minutes) after the SNS request was sent out. Furthermore, due to the casual nature of this communication medium, votes from people who were not that close were also received.

After the selection is made, a full body picture of the selection is uploaded to the network. This sometimes led to friends enjoying a voting game with comments like "I win!" or "I lost" on Twitter. This even started conversations such as "I voted on your coordination system today" when they met later in the day. Several of the voting friends also mentioned that they wanted to see the votes being tallied in real time, to be able to see the clothing in finer detail (zoom) and to have an function to view how the ensemble would look on the participant (versus just the clothes themselves). We feel that developing these features would create a more interactive and fun environment for the voting participants as well.

7. RELATED WORKS

There are many fashion SNS sites and related research devoted to support for fashion coordination.

AVENUE7 [1], FashionMash [2], GirlSense [3] are fashion SNS sites where users can upload pictures of their clothing and connect with their friends. They can then comment and/or coordinate with each other as well as dress up their own avatar. StyleMob [5] is a site where one can vote on pictures of clothing and ensembles and get feedback on.

These services require the tiresome step taking pictures of clothes using a digital camera, transferring the pictures to a PC and uploading to a website.

The Webcam Social Shopper [6] is an augmented reality dressing room. Using a web camera and special marker, users can try on different clothes from an online shop with live video feed. However, the user needs to use a special positioning marker in order to adjust the overlay position of the clothes.

Magic Wardrobe [9] proposed a new wardrobe which serves as a physical interface for the online marketplace. For example, when a user picks up a jacket, the system would look for matching shirts from the online marketplace. What am I gonna wear? [7] is a fashion recommendation system which provides coordinate of clothes for users' purposes based on tags of the clothes. Although

these projects proposed interesting applications of fashion, users may feel troublesome to add tags to all their clothes manually.

Digital Decor [8] attached a camera and an LCD to a drawer to help users find lost items and communicate with friends in long distance.

Mystylist [4] is a fashion coordination based game. The user takes pictures of their clothes by using a special camera and the game provides recommendation. This system requires the user to find a clear background and to do manual tagging.

There is no system that combines both the cataloguing of one's own clothes with near real-time recommendation by their social network. Complete Fashion Coordinator is a system which can totally support for capturing and selecting clothes with the assistance of the social network.

8. CONCLUSION AND FUTURE WORK

We developed a novel system called the "Complete Fashion Coordinator" which allows users to easily capture, store and catalogue the images of clothing as well as make recommendations on their daily clothing selection based on a number of key factors or with the help of one's social network. In addition, we conducted a 20-day field test that evaluated the recommendation function based on criteria such as the day, weather and situation where the clothing would be worn. Finally, we conducted a 10-day field test utilizing two social networking sites in order to solicit both ensemble selection and feedback from the participant's actual social network of friends.

We are planning to expand the number of people who use this system in their daily life and get more findings. Currently, the user must manually select the clothes they wear for the historical database. We hope to automate this process using technologies like RFID tags. Finally, we are looking to support other key features of one's ensemble including shoes and accessories.

9. REFERENCES

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