

A Study on Context-aware Forms with Smart Living Technology -Take Home Bathroom Space as an Example

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In the past few years, booming development of IT and CE industries drive the applications of touch and motion-sensing to smart living technology, making it become more and more closing to our life. The purpose of this paper is healing massage bathtub 《Fountainhead》, Touch screen controlled intelligent toilet 《Numi》, and intelligent mirror 《Cybertecture Mirror》 of bathroom products that are already sold on the market with equipment of smart living technology. In the assessing principle of interactive design theory, the research framework is developed by interview method and qualitative analysis to discuss the product performance affected by using context-aware technology, and its usage pattern under certain usage scenario. Finally, SWOT analysis is employed to evaluate the strength, weakness, opportunity, and threat of these smart living technology products. The result of this research will have profound impact on smart living technology product as design references for interactive design developer.

Key words: Smart Living Technology, Context-aware, Touch Device, Motion-sensing User Interface

1. Introduction

In recent years, due to the continuing development in both IT and CE technologies, they have tremendously improved the applications of telecommunication equipment. From iPhone to Windows 8 operating system, lots of touch screen technology related products have become very popular on handhelds after Apple introduced the iPhone in 2007. What is the design idea of these products? What kind of user's experience will be brought to the society? What are their affects in our future living behaviors? Would touch and control technology be dominant in the future? Or it would be replaced with other superior technologies? There are lots of unanswered questions for the time being. Therefore, the best way to see what is going to happen next, is to look for all kind of possibilities in our current world.

The purpose of this paper are to study the people using the smart living technology products at home through the interactive experience of daily living products, as well as to assess and analyze the usages of the smart living technology products and its relationship with the advancement of IT and CE technologies.

The purpose of this paper follows.

1. Investigate the relationship between the innovation of technologies and the product users, and look for the innovation opportunities among living, science and technologies.
2. Find out the characteristics of using the smart living products at home and bathroom areas, and propose recommendations for the design and development of the smart living technologies and products.

Whether just as what Bill Gates, former president of Microsoft, has prophesied like this: The touch interactive screen will be omnipresent in the future world! (The speech of CES opening ceremony 2008)

2. Research Method & Framework

This paper is with the qualitative methodology of interview method collecting and verification, via the interview method of the experts of relevant industries, draft the research object, research framework and adopting research methodology.

2.1 Research Framework

Assessment principle '3 e indicator' [1] that this paper structure puts forward with the interactive design theory and combining the interview method, interview the industry interactive expert: The executive director of new media interactive design, carry on the qualitative research, ponder over experience with the design of relevant experts, consult the basis as designing the developer's design interactively, finally analyse key elements as the advantage, inferior position, chance and threatening, etc.

2.2 Research Objects

These defending smart living technology products of relevant intelligent life of bath at home in order to already sold in the market, in order to as a Healing massage bathtub 《Fountainhead》 、Touch screen controlled intelligent toilet 《Numi》 and Intelligent mirror 《Cybertecture Mirror》 , as the main research objects.

2.2-1 Healing massage bathtub 《Fountainhead》 — Enjoyment of vision, hearing and touching

According to investigating, 3/4 of the American people use the smart phone in the lavatory. In order to the consumer whom will bring iPad in the lavatory. The bath company 《KOHLER》 VibrAcoustic introduce and defend the bath Intelligent products, the bathtub that will be shaken with the rhythm of the music 《Fountainhead》 , may known as ' treat and heal '. This product designs and combines acoustic massage and bathtub which accords with the human engineering perfectly, put the electric energy converter below the head of the bathtub ingeniously to assist, let user while taking a bath, not only can hear the wonderful musical sound but also let skin of every inches experienced the vibrations that the sound wave causes directly even more.

Fountainhead intimate technology :

- There are 6 pieces of music / vibrate changer, can utilize the blue tooth and connect to the personal electronic equipment to choose the most favorite music.
- The speaker surrounds the bathtub, and turn into a huge loudspeaker, vibration can cooperate with the rhythm of the music to change.
- Build ' quiet, relax, revive, detached ' 4 kinds of acoustic ways to preserve inside, it produces the resonance to combine different music melody, sound wave, spectrum, and each way is designed by the professional sound therapist.
- 4 led bulbs which around the bathtub, can show the light of 8 kinds of different colors at the same time.



Figure.1 《Fountainhead》 Healing massage bathtub leads you to come into the luxurious bathroom.
Combine the element which soak and music to relax the body and mind, enjoy SPA at home.

2.2-2 Controlled intelligent toilet 《Numi》 — Combine the new life with smart living technology gracefully.

《KOHLER》 Also have touch screen controlled intelligent toilet 『Numi』 . 4 major functions of the ballet type toilet cover of the original creation 、 illusion pad mirror designed 、 thermostatically seat cover and keeping foot warm 、 microwave infrared ray reaction, combine the touching type screen remote controller, wash and dry of the full-automatic on and off, also have built in MP3 broadcasts function, let you to listen to the music that you like while using toilet. With all intelligent LCD remote control, automatic seat cover and seat pad, the inductor starts and raises the toilet cover when nearing.

Fountainhead intimate technology :

- Gracefully ballet type automatic toilet cover (microwave infrared ray reaction)
- The novel and unique illusion pad mirror designed
- Foot warm air function
- The design inspiration come from the architecture right angle geometry idea, simple model of an organic whole .
- Curved metal clean body spray nozzle of the original creation, with ultraviolet ray disinfect.
- Multiple amusement function: Radio station and multimedia music broadcasting
- High efficiently with pair washing of intelligence electronic system, according to the state of using and wash by water automatically
- The novel and unique illusion pad mirror designed
- The high glass glaze: It is anti dirt antibiotic and easy to clear
- Foot reaction opening type seat circle
- The spray nozzle merges the warm air and night-light function in one
- 4.3 inches oversize touch pad LCD remote control
- Light detected and start LED at night
- Pulse type SPA massage function



Figure.2 《Numi》 With all new intelligent LCD remote control, demonstrate the smart living technology and fashion of the top sanitary equipment perfectly.

2.2-3 The stylish intelligent mirror in the house 《Cybertecture Mirror》

— Experienced the future life ahead

The Hong Kong designer James Law develop the intelligent mirror 《Cybertecture Mirror》, could realize the future life style in the science fiction film in an all-round way. The streamline appearance designed of the intellect mirror, cooperating continuously of digit information, may clean up and browse through community's websites in the same time, even watch TV. After utilizing the wireless network to link setting up with the computer, could offer a lot of information that you want to see on mirror, such as weather, stock market, facebook, etc., just use a simple remote control to operate it. Also with a weight scales, help you to measurement and record, watch your own body changing at any time.

Cybertecture Mirror's intimate technology :

- The mirror is made in order to resist the mist.
- Build in TV 、Stereo system 、 Wi-Fi function 、Grade P41 waterproof.
- Can operate by the smart phone.
- Suitable for the office, hospital, hotel and business company at the same time
- The mirror can incarnation become the display screen and broadcast the film 、music 、amusement files, etc.
- Through the outside sensor, Cybertecture Mirror can write down users' weight and control the health status.
- The built-in procedure guides users to various kinds of health and train the chain, and through Wi-Fi the data will be transfer to the computer, it is convenient to look over the exercise progress at home.



Figure.3 Cybertecture Mirror has weight scales and remote control , as to record the health status, will transfer the data to the computer through Wi-Fi.



Figure.4 The magic mirror is no longer only a fictitious thing in fairy tale Cybertecture Mirror
Cybertecture Mirror reflect the future life style in the dream or in the science fiction film in an all-round way.

2.3 Interactive experience and expression form of research objects

Table2 The interactive experience and expression form of research objects

	Healing massage bathtub 《Fountainhead》	Touch screen controlled intelligent toilet 《Numi》	intelligent mirror 《Cybertecture Mirror》
Interactive experience	There are 6 pieces of music / vibrate changer, can utilize the blue tooth and connect to the personal electronic equipment to choose the most favorite music.	The design inspiration come from the architecture right angle geometry idea, simple model of an organic whole .	Suitable for the office, hospital, hotel and business company at the same time
		Multiple amusement function: Radio station and multimedia music broadcasting	Can operate by the smart phone.
		High efficiently with pair washing of intelligence electronic system, according to the state of using and wash by water automatically	
		Pulse type SPA massage function	The built-in procedure guides users to various kinds of health and train the chain, and through Wi-Fi the data will be transfer to the computer, it is convenient to look over the exercise progress at home.
		Foot reaction opening type seat circle	
		The spray nozzle merges the warm air and night-light function in one	
		4.3 inches oversize touch pad LCD remote control	
		Light detected and start LED at nigh	
Manifestations	The speaker surrounds the bathtub, and turn into a huge loudspeaker, vibration can cooperate with the rhythm of the music to change.	Gracefully ballet type automatic toilet cover (microwave infrared ray reaction)	The mirror is made in order to resist the mist.
		The novel and unique illusion pad mirror designed	Build in TV 、Stereo system 、 Wi-Fi function 、 Grade P41 waterproof.
	Build ' quiet, relax, revive, detached ' 4 kinds of acoustic ways to preserve inside, it produces the resonance to combine different music melody, sound wave, spectrum, and each way is designed by the professional sound therapist.	Foot warm air function	
		Curved metal clean body spray nozzle of the original creation, with ultraviolet ray disinfect.	The mirror can incarnation become the display screen and broadcast the film 、 music 、 amusement files, etc.
		The novel and unique illusion pad mirror designed	
	4 led bulbs which around the bathtub, can show the light of 8 kinds of different colors at the same time.	The high glass glaze: It is anti dirt antibiotic and easy to clear	Through the outside sensor, Cybertecture Mirror can write down users' weight and control the health status.

3. Research results and Analysis

Assessment principle of '3 e indicator' that this research structure puts forward with the inter-dynamic design theory: Effective 、 Easy 、 Enjoyable, combining the interview method, interview the industry interactive expert, carry on the qualitative analysis, Finally, SWOT analysis is employed to evaluate the strength, weakness, opportunity, and threat of these smart living technology products.

3e indicator research objects as follow: Healing massage bathtub 《VibrAcoustic》 、 Touch screen controlled intelligent toilet 《Numi》 、 Intelligent mirror 《Cybertecture Mirror》 , form with analysis and interview.

3.1 Indicator 1: Effective

The user will go to use interactive products, there must be some problem that should be solved or the task that want to be finished. The minimum goal of interactive designed, just want to help the user of success, let them get the result they want. If the interactive design products can't help users to reach the goal and effectively, this interactive design that totally fails.

Besides " using " the effective index, also including " brand image " to effective index of recessive, not only handy but also match aesthetics and thought deeply, could succeed in expressing correct information to users. The must important thing is that should make the best of the language of designing, make clear orientation for the company and brand. The effective indicator and the expert's interview content as follow :



Figure.5 Healing massage bathtub 《Fountainhead》 、 Touch screen controlled intelligent toilet 《Numi》 and Intelligent mirror 《Cybertecture Mirror》

3.1-1 Effective— Interview content

Q1. What do you think of these three intelligent products: Healing massage bathtub 《Fountainhead》 、 Touch screen controlled intelligent toilet 《Numi》 、 Intelligent mirror 《Cybertecture Mirror》 , which possesses the effective indicator the most? and please explain.

A1. Healing massage bathtub 《Fountainhead》 has possessed the most effective indicator : That three products all have improved human life basically, help users to reach the goal of interactive design effectively, but 《Fountainhead》 help the mankind more, let user while taking a bath, not only can hear wonderful musical sound but also experienced the vibrations that the sound wave causes directly, and get the result of depth massage.

Q2. Products chosen according to the above question, propose one function that the most practical using of this product, and please explain.

A2. Music was the most practical function : The most people want to do to listen to the music while bathing, and let the body and mind abundant relaxing.

Q3. What do you think of these three intelligent products, which product possess the brand image and characteristic that aesthetics thought the most? and please explained.

A3. Healing massage bathtub 《Fountainhead》 has possessed brand image and characteristic that aesthetics thought the most, it design to the situation which the user will produce while using the bathtub, most people want to do to listen to the music while bathing. This product combine with people, psychological, physiological and science and technology, have reached the relaxed result that users needs.

3.2 Indicator 2: Easy

To reach the 'Easy' realm while designing the products, what the designer needs this kind of spirit: the user does not need to think but let me help you to think! The designer should get rid of all unnecessary interference in advance, let the user reach the purpose efficiently when they use the products, and get a happy use experienced. Such as the design idea which Apple Company adheres to: Prefer to reducing the function should insist on being easy and simple to handle [1].

To design the interactive products by simple and convenient, must help users to reduce the following 4 works :

1. Memory work: In operation and interaction, try best to reduce the thing that users need to remember.
2. Limbs work: The movements on the limbs. Push button, rotating the button, etc., all the limbs work that must be considered.
3. Vision work: Vision element pointing increase eyes and bearing.
4. Understanding work: Avoid the user to do the useless thinking.



Figure.6 《Fountainhead》 Operation interface 、《Numi》 Operation interface and 《Cybertecture Mirror》 Operation interface

3.2-1 Easy - Interview content

Q1. What do you think of these three intelligent products: Healing massage bathtub 《Fountainhead》 、 Touch screen controlled intelligent toilet 《Numi》 、 Intelligent mirror 《Cybertecture Mirror》 , which possesses the easy indicator the most? and please explain.

A1. Healing massage bathtub 《Fountainhead》 has possessed the most easy indicator : The interface is simple, the function is clear, and easy to use.

Q2. Products chosen according to the above question, propose one function that the most nature using of this product, and please explain.

A2. Healing massage bathtub 《Fountainhead》 can utilize the blue tooth to connect to the personal electronic equipment , choose the music you liked , It is simple and easy to operate .

Q3. What do you think of these three intelligent products, which product makes user reach the purpose to use products effectively, and get a happy use experience? please explained.

A3. Healing massage bathtub 《Fountainhead》 is relevant to use and design user's demand , has solved user's inconvenience in living .

Q4. What do you think of these three intelligent products, which product of operation mode let the user feel complicated? and please explained.

A4. The intelligent toilet 《Numi》 is individualized , do not need complicated and numerous functions , it is apt to increase user's pressure .

3.3 Indicator 3: Enjoyable

Effective and Easy indicator, will influence this indicator of Enjoyable directly. To improve the index of Enjoyable effectively, must also understand (Patrick W. Jordan) the master of product design theory: Designing the products can bring the user and mind joyful from such aspects as the physiology, the society, psychology, idea, etc. The following is the explanation of physiology, the society, psychology, idea aspect [3,4,5] :

1. Physio-pleasure: Come from the joyful sense of thinking intelligently, sense of touch 、 sense of taste 、 sense of hearing 、 sense of taste can all become and stimulate the happy source, will influence the use experience at the same time.
2. Socio-pleasure: Enjoy the symbol of the products on the social status or the personal image, can reflect the successful social images too.
3. Psycho-pleasure: Psychological aspect joyful is come from the interactive achievement that reaches.
4. Ideo-pleasure: Personal taste 、 aesthetic conceptions 、 values and expecting oneself, all belong to the joyful idea category.



Figure.7 Healing massage bathtub 《Fountainhead》 、 Touch screen controlled intelligent toilet 《Numi》 、 and Intelligent mirror 《Cybertecture Mirror》

3.3-1 Enjoyable - Interview content

Q1 What do you think of these three intelligent products: Healing massage bathtub 《Fountainhead》 、 Touch screen controlled intelligent toilet 《Numi》 、 Intelligent mirror 《Cybertecture Mirror》 , which possesses the Enjoyable indicator the most? and please explain.

A1. Intelligent attitude mirror 《Cybertecture Mirror》 has possessed the enjoyable indicator the most : The vision of all information experienced smart living technology for the joyful sense of people.

Q2. Products chosen according to the question A, put forward one function that this product lets users enjoy the most, and please explained.

A2. Record body's relevant information immediately, if personal information could be combined with life perfectly, the clouds concept and ubiquitous computing shall be kind of look of the science and technology in the future.

3.4 Overall comment of Smart living technology products of the interactive intelligent designed

The interactive designer's work is let the user can use the function of the product, want people and the products interactive in a kind of beautiful way. As to user to use the whole function of the product, it should be a kind of beautiful experienced that is worth enjoying. The master of product design (Patrick W. Jordan) has proposed 3 suggestions [3,4,5] :

1. Don't think of the function intuition only, but also think how to create a kind of enticement.
2. Don't think of the beautiful appearance only, but also think how to create interactive aesthetic feeling.
3. Don't think of the easy to use only, but also think how to let users make joyful.

Q1. Will you like to buy one of Healing massage bathtub 《Fountainhead》 、 Touch screen controlled intelligent toilet 《Numi》 、 Intelligent mirror 《Cybertecture Mirror》 , which product to use in the bathroom? and please explain.

A1. I would like to buy the Intelligent attitude mirror 《Cybertecture Mirror》 to use in the bathroom, because the personal health information is often easiest to neglect.

Q2. To the smart living technology products of intelligence in the future, what do you think in the bathroom, which kind of product will develop the most or the most potential? and please explain.

A2. Intelligent mirror 《Cybertecture Mirror》 will develop the most. The network world is coming, and the clouds will be a future trend, information will not be confined to the computer, it certainly will combine the clouds concept and ubiquitous computing in the future.

Q3. Could you please offer the suggestions of relevant development trends and development direction to the future smart living technology products of intelligence? and please explain.

A3. Transparent touch screen / Video shopping system : Can be bought the dresses that the protagonist wears while pressing a key. The finger detects the system. (LeapMotion)

4. Conclusion

Integrated environment development is observed at present, the environment of the network and development in smart living technology of relevant information are perfected 、ripely. The smart living technology to improve people's quality of the life is applied to the market and grown up fast, have already become the future potentiality field in which the whole world has attracted attention now, and attract all kinds of industry to put into and develop actively.

The smart living is incorporated that emphasizes ' smart and technology ', means user does not need to think how to operate, but the serving end can proactive perceptive the user's demand ability, providing convenient service. Besides applying to the relevant smart technology of living needs (ex. RFID 、wireless sensor network 、biomedical signal monitor, etc.) , need even more understanding and apply to the knowledge of various kinds services, could design the thing that users take (Human life applications), so science and technology should be with combination of the knowledge.

In the course of combining, the mastering of knowledge is more important than to develop science and technology, it meant that combine application do not really need the most advanced science and technology as long as mastering the demand and relevant knowledge, may only need to use the existing science and technology at present to come true.

While pursuing various kinds of smart living technologies to use in these years, find out there are a lot of questions, the subject matter is when the innovation uses intention served before entering the market, need adjustment at different stages, but the developer lacks the environment and user experiment, the development and application of innovation is very apt to fail. The following are this research conclusion and the smart living technology's SWOT. Research concluding remarks as follow :

- Intact system combination and back-end services are the key factor of success in the future life automation.
- The main developer has already begun to live automation extended use to various kinds of applications.
- The smart living technology automation our life, satisfy many kinds of application and improve its essential value.
- It will combine clouds concept and ubiquitous computing in the future.

Table 1 The SWOT analysis about Smart Living Technology.

Strength	Weakness
<ol style="list-style-type: none"> 1. To observe Integrated environment development, the environment of the network and development in science and technology of relevant information are perfected and ripely. ° 2. To pursuit of Smart Living Technologies could improve people's quality of life, and also develop relevant software and hardware innovate using and products, get additional value for the ICT industry. ° 3. The research and development of multifunction-sensor's software and hardware, and nergy monitoring module possession the competition advantage of our country. 	<ol style="list-style-type: none"> 1. Automation 、telecommunication 、digital home system are lack of the link platform, the system standard is mastered by the international main company. 2. When the innovation uses intention served before entering the market, need adjustment at different stages, but the developer lacks the environment and user to do experiment, the development and application of innovation is very apt to fail. °
Opportunity	Threat
<ol style="list-style-type: none"> 1. The use experience is leading interactive design 2. The mastering of knowledge is more important than to develop science and technology. ° 3. The consumption products of Hi-Tech in recent years, the main company all adopt the global arrangement, therefore the attention to Green Technology is relatively high. 4. The requisition for living environment quality increased. ° 5. Taiwan has increased the security 、energy saving and care service. 	<ol style="list-style-type: none"> 1. The product price is too expensive, the function of use is unable to do as consulting by normal people's life style. 2. Environmental consciousness resumes in recent years, consumers will not use some to endanger the electronic product to the environment or the health. 3. While Hi-Tech brings convenient and quality of the life, 、 what kind of role is acted with Hi-Tech civilization progress constantly in the future life blueprint?

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