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# HappinessCounter: Smile-Encouraging Appliance to Increase Positive Mood

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## Abstract

As William James stated, and confirmed by several psychological studies, the act of smiling positively affects on our mental status -- we become happier when we laugh. In this paper, we propose a new digital appliance that naturally encourages the act of smiling in our daily lives. This system is designed mainly for people living alone, who may have difficulty realizing when they are in low spirits and/or difficulty in making themselves smile. Our HappinessCounter combines visual smile recognition, user feedback, and network communication. We installed this system in a home with a single occupant, and the system had positive effects on the user's mood.

**Keywords:** Smile, Happiness, Mental mood, Health, Communication, Daily life

**ACM Classification Keywords:** H.5.m.  
Information interfaces and presentation (e.g., HCI):  
Miscellaneous.

**General Terms:** Design, Human Factors

## Introduction

William James said, "We don't laugh because we're happy – we're happy because we laugh" [2]. His theory, called the James–Lange theory of emotion, states that

life experiences produce a direct physiological response via the human autonomic nervous system, such as increased muscle tone and heart rate, perspiration, and dryness of the mouth. Emotions thus come about as a result of these physiological changes, rather than being their cause. Tomkins mentions that facial movement can influence one's emotional experience [11][12]. For example, an individual who feels compelled to smile during a social event will actually come to find the event more enjoyable. Kleinke *et al.* [3] conducted an experiment on the influence of facial expressions on mood. They found that the participants experienced an increase in positive moods when they created positive facial expressions and a decrease in positive moods when they created negative facial expressions, even when the facial expressions were just mimicked. Kleinke *et al.* also found that these effects were enhanced when participants viewed themselves in a mirror. From these results, we think that putting a smile on one's face, even when one is not in a good mood, may lead to a more positive disposition.

On the other hand, many people are living alone due to various reasons, including social situations, age, and diseases such as autism and depression. There are more than 31 million one-person households in the U.S., representing roughly 27% of all households [15]. For those people, it may sometimes be difficult to realize when they are in low spirits and do not have a smile on their faces. Without positive reinforcement, this condition could lead to more serious mental health problems. Medication might be one treatment option, but there are often side effects that should be considered.

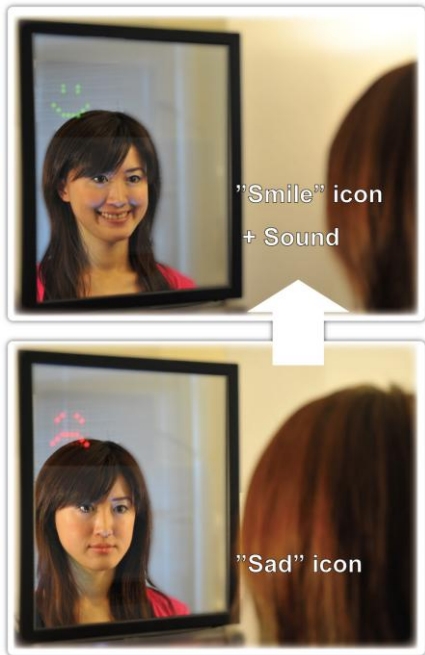


**Figure 1.** The HappinessCounter encourages users to smile in their daily lives by providing feedback about their smile and combining other reinforcing tools. The system detects a user's smile using the smile-recognition engine, and displays the smile icon as visual feedback in the corner of a mirror.

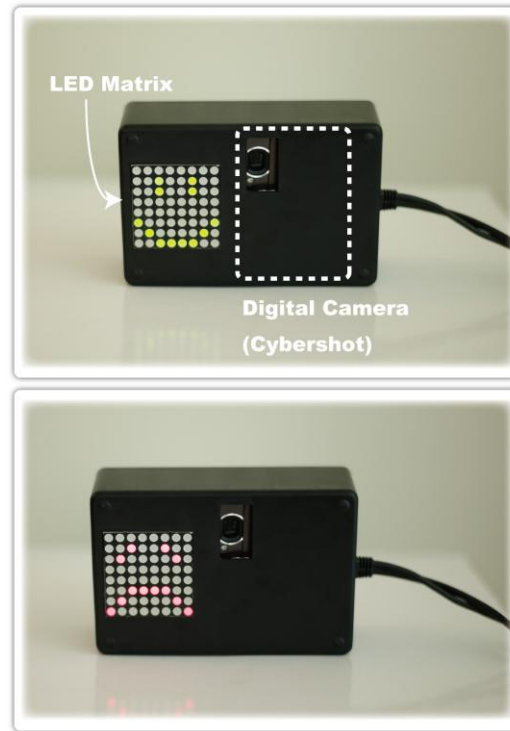
To address these problems, we propose a new system called the HappinessCounter. This device facilitates the act of smiling in one's daily life and thus promotes a more positive mood. By providing feedback to users about their smile in combination with other tools (e.g., communication tools, social networking services (SNS), or applications), the system makes it easy for users to smile and thus leads to happiness.

### **HappinessCounter**

The HappinessCounter detects a user's smile, counts the number of smiles, and records the user's mental state. After detecting a smile, the system displays visual feedback in the corner of a mirror, as seen in Figure 1. If users do not smile regularly, the system notifies them.



**Figure 3.** If the user has not recorded many smiles, the system displays a "sad" icon. When a user smiles, they system displays a "smile" icon accompanied by a happy sound. Note that the mirror is half-silvered; the camera attached behind the mirror can see through it for facial recognition.



**Figure 2.** The HappinessCounter Box consists of a digital camera, LED matrix display, and light sensor.

As previously mentioned, Kleinke [3] pointed out that the effects were enhanced when participants viewed their smile in a mirror. We think that if users are provided with feedback about their smile, they will be able to understand their feelings better. In other words, users will realize what is making them feel bad or good based on their corresponding smile response.

We developed the "HappinessCounter Box" for this purpose. We enclosed a digital camera, an LED matrix display, and a light sensor inside the box. These devices enable the system to detect a user's smile and provide the necessary visual feedback, as seen in Figure 2. Moreover, we attached the HappinessCounter box behind a one-way mirror, as seen in Figure 3, in order to detect the user's smile throughout his or her daily life. By incorporating the tools that most people use on a daily basis, such as a vanity mirror, we established an environment in which the system would be used in a natural and sustained manner, thus encouraging the user to smile regularly. However, depending on the user's mental state, he or she may not smile positively when provided with only visual feedback. Combining the system with other tools, therefore, encourages the user to smile more frequently and helps the user to be happier. We can think of several applications that can be combined with the HappinessCounter system.

We use this system in two modes. The first mode, called "Smile Awareness," simply recognizes and acknowledges when people smile to increase their awareness of smiling. The second mode, called "Smile Gateway," promotes a user's smile more actively. The system lightly limits certain routine actions in daily life, such as opening a door or turning on a TV, until the system detects the user's smile.

### **Smile Awareness**

In the Smile Awareness mode, we propose a supportive method that encourages smiles. Positioning the HappinessCounter in a commonly used location, such as a vanity mirror, and combining it with the following applications, leads to a natural and sustained use of the

## Hitomi's SmileCalendar

### January

Sun	Mon	Tue	Wed	Thu	Fry	Sat
						1 😊
2 😊	3 😊	4 😊	5 😊	6 😊	7 😐	8 😊
9 😊	10 😊	11 😊	12 😊	13 😐	14 😊	15 😊
16 🟡	17 🟡	18 🟡	19 🟡	20 🟡	21 🟡	22 🟡
23 🟡	24 🟡	25 🟡	26 🟡	27 🟡	28 🟡	29 🟡
30 🟡	31 🟡					

**Figure 4.** Screen shot of the smile calendar. Users can use their smile icon to keep track of how many times they have smiled.

system. This, in turn, will encourage the user to smile regularly.

#### *Sound feedback:*

When the system detects a user's smile and displays the smile icon, the system will provide sound feedback in the form of a happy piece of music. This cheerful music, combined with the visual feedback, may make the user feel better and happier. The music player can be set up to play the user's favorite music only when a smile is registered. Encouraging smiling through the use of sound feedback may cause the user to actively produce more smiles.

#### *Send the smile picture to a digital photo frame:*

The second application is to connect other communication tools and automatically send out a picture of the user smiling. When the user tallies enough smiles, the system will take a picture of their smiling face and automatically send it to family members' digital picture frame and/or e-mail. Since the system does not require complex operations, even elderly people living alone who are unfamiliar with a PC can send their pictures to their family just by smiling. The system also enables their family to monitor their activity or mental health easily. After such a picture is sent, it may prompt other forms of contact, such as a telephone call. Thus, the elderly have an incentive to smile because it will encourage communication with their family members. Young people living apart from their parents may feel that it is a bother to contact them too frequently. At the same time, parents worry about their children and "wonder if they are staying healthy." By using this system, children can inform their parents about their well-being without much hassle, and their parents will feel relieved.

#### *Display the smile results on a calendar:*

After recording the user's smile and the number of actual smiles per day, we can display the result on a Web-based calendar application, as seen in Figure 4. The user's smiles are represented with three icons—happy, normal, or unhappy—depending on the number of smiles counted on a particular day. In addition, when the icon is clicked, the user can see the particular smiles taken that day. By viewing his smile results on the calendar, the user (and potentially his social network) can easily understand how often he smiles, and how he felt on a given day compared to the prior day, week, and/or month. This organized feedback-based trend line may also lead the user to a more positive self-assessment.

#### *Post on SNS (e.g., Twitter):*

Connecting the system to an SNS will enhance interaction, and a user can easily share their feelings and emotional state with family or friends. The HappinessCounter system will automatically check the number of smiles for the day/week. For example, the system could automatically post a tweet such as, "Alice laughed 20 times today!" If the user does not have enough smiles recorded for the week, the system could automatically post a tweet such as, "Alice seems to be feeling blue." When family members or friends read such a message, they can call or send a message to the user. When this sort of encouragement is provided by another person, the user may feel better and be able to smile under conditions in which she could not smile by herself. Furthermore, the user could compare their number of smiles to that of a friend. Thus, the system may motivate the user to smile more. The system may also lead to a new form of communication through smiles. For example, for elderly people living alone, the ease with which they can share this information with people

around them may lead to reducing the burden on all individuals, thus leading to a more effective treatment in which the elderly can ultimately feel more reassured.

### **Smile Gateway**

In the Smile Gateway mode, we propose a method to forcibly limit access to something. Depending on the individual or his mental state, he may not positively make smiles under normal situations. Therefore, by creating an inconvenient situation, we believe the system may prompt smiling more effectively. Thus, we focus on the following method.

#### *Disallowing use of a daily appliance or piece of furniture without first smiling:*

To create an inconvenient situation, we focused on the daily appliances and furniture that people use frequently in their daily lives. The user is notified of a shortage of smiles by making furniture and other appliances more difficult to use. We assume that the user will smile more positively when provided with not only visual feedback but also a sense of force. As examples of daily appliances, we propose a door, refrigerator, cabinet, TV, and an electric pot. These are crucial items in our daily lives, and the system can make them harder to use when there is no smile registered. For example, the system can make it slightly harder to open items such as doors, refrigerators, and cabinets as well as making it harder to turn on the TV. The system controls them for a while, and when the user makes a smile, the system returns them to their normal state (Figure 5). Obviously, the system does not go so far as to make these things completely unusable, as that could actually make the user feel sadder or even angry. In this type of inconvenient situation, when the user can use the desired items smoothly, she feels lucky or happier;

conversely, when the users cannot use these items easily, they will be made aware of their feelings and that they are not smiling enough on their own.

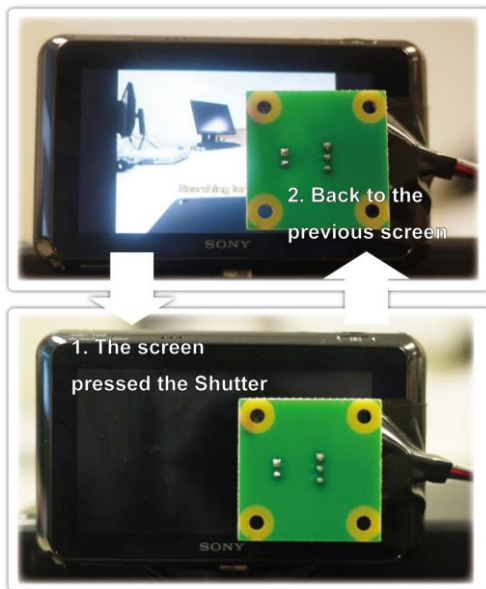


**Figure 5.** We combined the HappinessCounter Box with an electric magnet and attached it to the refrigerator door.

We can think of several applications that can be connected with the HappinessCounter system beyond the ones mentioned above. Along these lines, this research will try to determine the best method to use to generate as many smiles as possible by determining when rate-limiting and -encouraging applications should be used and what order and frequency the stimuli should be applied.

### **Usage Scenario**

When this system is utilized, the following scenarios can be envisioned.



**Figure 6.** For facial recognition, we attached a light sensor to a camera's monitor screen. When the camera detects a smile and automatically triggers a shutter, the brightness of the monitor screen also changes, and this change can be detected by the light sensor.

Scenario 1: A grandmother living apart from her family. She notices that she has not smiled recently based on the icon displayed on the mirror. When she tries to make a smile, the system automatically detects her smile and sends her smile picture to her family to be displayed on their digital photo frame. When the family sees it, they feel happier because her smile looked good. Afterward, they call her and have a conversation. The grandmother feels happier because she was able to communicate with her grandchild.

Scenario 2: A wife had only a little time due to housework. She was very busy and did not know she looked like cranky. When she tried to open the refrigerator, she could not open it smoothly. At that time, she noticed that she had not smiled. She woke herself out of her trance and made a smile. At that time, she could then open the refrigerator smoothly. After making a smile, she felt better than before. Minutes later, she met her husband, who had just come home. He said, "Did you have a good day today? You look great." When she heard that, she felt happy.

### Implementation

We developed the HappinessCounter system to detect a user's smile in daily life and make it easier for the user to smile regularly. The HappinessCounter system consists of two components – the "Smile Awareness" system and the "Smile Gateway" system, which control an appliance and/or a door using an electric magnet.

### Smile Awareness System

We developed the HappinessCounter Box for detecting a user's smile and provide visual feedback. We enclosed a digital camera, an LED matrix display, and a light sensor inside the box. We enclosed a Sony Cyber Shot digital

camera<sup>1</sup> in the box because it has a built-in smile-recognition engine. In addition, we enclosed an LED matrix display<sup>2</sup> to show the happy or sad icon. This LED matrix is connected to a computer via an Arduino<sup>3</sup>. We used a light sensor to detect when the system takes a picture in real time. Thus sensors are connected to a computer via a Phidgets Interface Kit<sup>4</sup>. By attaching the sensor behind the camera display, we can monitor the brightness of the camera's display (Figure 6). We put the CyberShot digital camera in the "smile shutter mode," where the camera automatically takes a picture when a smile is recognized. Thus, we can detect when it takes a picture or not because the brightness of the camera's display changes significantly after the shutter is pressed, as seen in Figure7. Using this function, when the system detects a user's smile, the system displays the smile icon on the LED matrix and also plays a happy sound. Moreover, using an Eye-fi card<sup>5</sup>, the system automatically takes a picture and transmits the image wirelessly to a PC. The system counts the user's smile for the day and after a certain number at the end of the day, the system uploads these states to a Web server. The system logs user's smile status while the other applications refer to the state on the Web server.

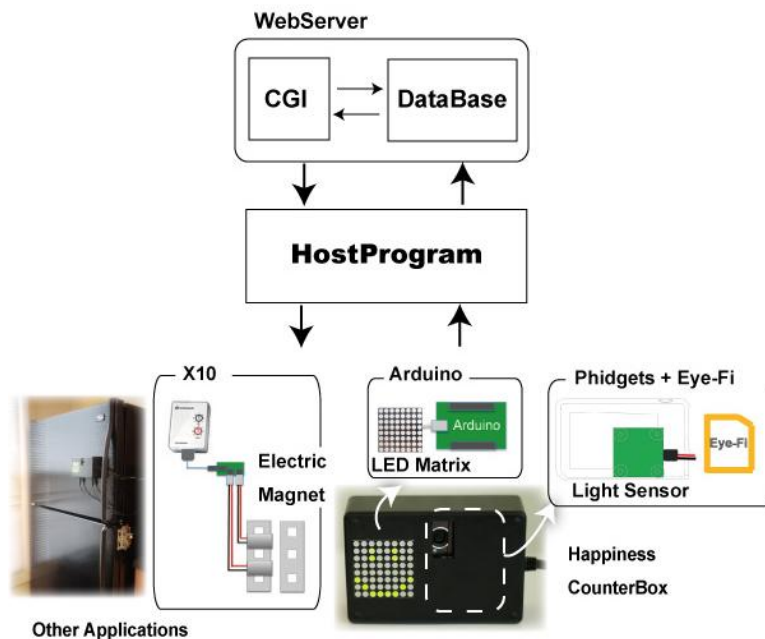
<sup>1</sup> Sony Cyber-Shot DSC-T99

<sup>2</sup> <http://www.sparkfun.com/products/759>

<sup>3</sup> <http://www.arduino.cc/>

<sup>4</sup> <http://www.phidgets.com/>

<sup>5</sup> <http://www.eye.fi/>



**Figure 7.** Overview of the HappinessCounter components.

### Smile Gateway System

As an example of a method by which we can limit access to something, we developed a system that can control the refrigerator door using an electric magnet. If the user does not have enough smiles, the system makes the refrigerator door harder to open by using an electric magnet to hold down the door. An X10<sup>6</sup> controller is used in this device. The X10 uses the power line as a means of communications and can easily control AC powered devices. Given that the X10 uses the power line as a means of communication, any electrical device

<sup>6</sup> <http://www.smarthome.com/2000.html>  
POWERLINC SERIAL/TW523

within a residence can be conveniently controlled through this method. Likewise, other devices such as room lights, fans, and air filters can be potentially controlled using this method. The host program monitors the Web server state. By smiling, the user unlocks the refrigerator door, allowing it to be opened smoothly.

### Pilot Field Test

To determine the effectiveness of the system, we conducted a preliminary field test and chose an application that limited access. We wanted to know how the system was received and how it changed the user's behavior by limiting access. We attached the HappinessCounter Box and an electric magnet to a refrigerator door. In this scenario, if the user did not smile at the box, the refrigerator door became somewhat harder to open. It only became possible to open the door normally when the user smiled, at which point they also see the smile icon and hear the smile chime.

In this field test, we installed this system in a home with one occupant (a participant), who is a 39-year-old male. He used the system for two days in his home. During this time, the participant used the refrigerator naturally several times a day.

### Findings:

During the field test, the number of recognized smiles totaled 33, with an average of 16.5 smiles per day in front of the refrigerator door. The participant cooked on both days and used the refrigerator most often in the morning and evening.

First, he was surprised by the number of smiles because he thought he usually did not smile that often. After the test, he stated that it was a good exercise of his facial

expression. He tried to make more smiles than usual because he felt happy when he heard the smile sound and saw the smile icon after making a smile.

However, sometimes the system took a little longer to recognize his smile, and thus he had to wait before seeing the smile icon and hearing the chime. During these times, he felt a little stressed by this delay. Furthermore, he did not want to give up until his smile was detected. Based on this finding, we need to improve the detecting technology using other tools and/or methods. It is very important to detect the user's smile immediately. For this experiment, we adjusted the force of an electric magnet and tested it with a female participant. She felt there was enough force to make the door harder to open. However, the participant mentioned, "While it was slightly harder to open the refrigerator door, the difference was not noticeable at times and should have been stronger." We need to consider the level of resistance and the method depending on the user.

Although our pilot test was very small in scale and duration, we think the idea of facilitating smiles in daily life has potential. This is our first trial based on our proposed concept, and we expect that we will test many design alternatives to make this system more effective. For example, when users are having a very sad experience, they may not make smiles and the system may lead to the user feeling worse. In this situation, it might be more appropriate to assist the user by, for example, having the refrigerator door open automatically. We are currently planning to carry out a long-term experiment in everyday life with multiple people using several different settings.

## **Discussion**

This system architecture will enable us to create various kinds of smile-inducing appliances. The following are some examples of interactions that are connected with existing products based on this architecture.

### *Built-in HappinessCounter system into a digital photo frame or Chumby-like device:*

By attaching a camera to a digital photo frame or Chumby device and installing the HappinessCounter system, a user can easily send smile pictures to the digital picture frames of remote family or friends, and/or a remote Chumby device, by just making a smile. Users can exchange their daily feeling and may inform others of their health and mental state through the picture of their smile.

### *Using the camera on a tablet or mobile phone:*

By using the existing camera on a tablet or mobile phone, the HappinessCounter system can control access to phone calls or e-mail with a "smile gateway." For example, only the user is required to smile before being allowed to call another person. In addition, when the user does not smile enough, e-mail they send or receive may be delayed. Conversely, when the user smiles a lot, they are allowed to send/receive e-mail normally.

### *PC based interaction:*

The HappinessCounter system installed on a user's PC will use the PC's Web camera to monitor the number of smiles the user makes while using the computer. If the number of smiles the user makes is below normal or not enough, the system can alert the user or force another action. For example, if the smile count is below normal, applications can become noticeably slower. This type of feedback system is not only useful at home but also

within the work place. Increasing the number of smiles in the workplace will enhance the atmosphere for everyone. Conversely, if someone is irritated or bothered by something, slowing the system down will allow the user to calm down and reconsider before doing something they might regret later. By making the user smile in this situation, it will help overcome whatever made the user angry in the first place.

### **Related Work**

There are many research projects related to detecting smiles [5][16]. We used the built-in smile-recognition engine from the camera mentioned in this paper, but in the future we will use these technologies and believe we can install and combine several applications without a special camera. McDuf *et al.* [7] proposed a system that could measure health indicators just by putting a person in front of a low-cost camera. Relax to Win [6] is a game that measures the player's galvanic skin response and uses the data during the playing of the game. Emotional Flowers [8] also harnesses the player's emotions. Within the game, the player's facial expression or emotion is used to control the growth of a flower. We try to enhance mental happiness by encouraging users to smile in daily life.

EyeCatcher [14] is a system that helps photographers capture a variety of natural-looking facial expressions of subjects by presenting images or videos on the display attached to the front of the camera. Cheese Cam [4] uses a camera that can induce unconscious facial reactions in a photography subject by displaying a small facial expression icon on Cheese Cam's screen. Based on this research, Samsung released a digital camera (DualView TL225) [10]. These studies aimed to make several natural facial expressions when the user takes

pictures by using several previously displayed images or icons. We focused on increasing smiles in daily life to increase happiness.

Several researchers have focused on monitoring the activities of the elderly for the benefit of their family. Digital Family Portrait [9] is an electronic picture frame that can display the daily activities of an elderly person who lives far from his/her family. I-pot [17] is an electric pot that sends an e-mail to family members when the power switch is turned on or the water is being poured. Family Planter [1] is a pair of artificial flowerpots with sensors, lights, and actuators that indicate the proximity of people in houses that are located far apart. SocialMedicineBox [13] is a communication system for the elderly that uses a medicine chest and notifies family members of the status of the elderly person taking medicines, as well as sending pictures to the family. These devices use e-mail to inform the family members of an elderly person as to his or her behavior or activity. Our research used the "smile" as a trigger and led to an enhancement of other communication.

### **Conclusion and Future Plan**

In this paper, we proposed a system called the "HappinessCounter" that facilitates smiling and improves mental health. After detecting the user's smile, it provides visual and auditory feedback. In addition, the system can be connected to other applications that can prompt the user to make a smile. Currently, we can only detect a user's smile in front of a mirror. Through a preliminary field test, we also discussed various potential applications for the system. In the future, we would like to detect smiles nonintrusively and automatically. We are planning to carry out a long-term experiment using multiple people in everyday life.

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