［論　文］

キネティックアニメーションによる電子投影システムの提案

A Proposal of Electric Projection System by Kinetic Animation

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Abstract

This research proposes a projecting display system that applies kinetic animation engine. We have developed a set of motions of letters as kinetic animation which is operated by kinetic engine software on browser. Our research team confirmed that our kinetic animation engine could improve recognition of letters or images on a rough surface of wall when an electric projector is used. This mechanism could provide a flexible message casting mechanism, which are available many different situations with projecting variety of information from Internet. Examples of such message casting are electric advertisement, electric bulletin board at disaster-stricken districts, and electric sign system projecting on a rough surface such as building wall or floor and so forth. Moreover, we evaluated the efficiency of recognition using kinetic animation by making inquires show the result is effective.

1. Introduction

Kinetic animation is proposed based on kinetic typography proposed by Ishizaki et.al.[1]. Kinetic typography is proposed as the effective method using moving characters on display. By using this method, the messages can be shown effectively. From this point of view we propose the method of kinetic animation as the communication method using not only moving characters but also moving graphics. The purpose of the use of this method is mainly improvement of the recognition of the message and/or graphics. Especially, this method is effective for image projection on a rough screen such as a wall of building. Our research team has been working on this project a couple of years and explored possibilities about how the kinetic typography could effectively apply to computer graphic devices. The result are shown in [2,3,4,5].

The common approach to express kinetic typography, namely to show the characters and graphics on browser is to use Java Applet. We define a set of motions of the letters by the software and developed them into so-called "kinetic engine". As a result, kinetic typography can be operated by any personal computer when message projection is required. The message can be transferred from anywhere on the Internet. The purpose of this paper is to propose this electric projection system with kinetic animation. The evaluation will be given especially in the situation where the walls of building are not very smooth and screen are uneven.

2. Concept Of Kinetic Projection System

Image projection on a rough screen could be very difficult since pictures or letters are sometimes partly hidden or are disturbed by some parts of the shape or the texture of the wall. In this section, moving the projection image helps a lot to improve readers' recognition of the message. In other words, the kinetic animation could improve recognition of letters in disturbing surface.

The kinetic projection system (K.P.S) equipped by kinetic engine software could provide the projecting information on building surface with improved readability of message. The system will be connected to Internet, so that it offers an opportunity for the public to be able to get the network information easily even in emergent situations such as earth quake.

Table.1 The mean value of the readability in the case which letters are fixed

	three letters word				ten letters word				a sentence			
	Grid X0	Grid X1	Grid X2	Grid X3	Grid X0	Grid X1	Grid X2	Grid X3	Grid X0	Grid X1	Grid X2	Grid X3
10pt	2.76	2.05	1.12	1.46	2.74	2.49	1.41	1.74	2.70	1.81	1.38	2.41
18pt	2.71	1.75	1.06	1.36	2.46	2.28	1.41	1.81	2.43	2.65	1.44	2.23
58pt	2.60	2.99	1.94	1.94	2.91	2.83	1.31	1.85	2.75	2.25	1.86	2.06
72pt	2.96	2.96	2.37	1.18	2.93	2.77	1.79	1.79	2.86	2.42	2.33	1.58

Table2. Differential of readability between the size of letters in the case which letters are fixed
=significant

10p-18p	0.04	0.30	0.06	0.10	0.28	0.21	0.00	-0.07	0.26	-0.84	-0.06	0.17
-58p	0.16	-0.94	-0.82	-0.48	-0.18	-0.35	0.10	-0.12	-0.06	-0.44	-0.48	0.35
-72p	-0.19	-0.91	-1.25	0.28	-0.19	-0.28	-0.38	-0.06	-0.16	-0.61	-0.96	0.83
18p-58p	0.12	-1.24	-0.88	-0.58	-0.46	-0.56	0.10	-0.04	-0.32	0.41	-0.42	0.17
-72p	-0.24	-1.21	-1.31	0.18	-0.47	-0.49	-0.38	0.02	-0.42	0.23	-0.90	0.65
58p-72p	-0.36	0.03	-0.43	0.76	-0.15	0.07	-0.49	0.06	-0.10	-0.17	-0.48	0.48

Table 3. The mean value of the readability in the case which letters are moving

	three letters word				ten letters word				a sentence			
	Grid X0	Grid X1	Grid X2	Grid X3	Grid X0	Grid X1	Grid X2	Grid X3	Grid X0	Grid X1	Grid X2	Grid X3
10pt	2.84	2.97	2.97	2.97	2.41	2.91	2.93	2.96	2.54	2.42	2.87	2.80
18pt	2.87	2.93	2.96	2.94	2.79	2.93	2.99	2.94	2.71	2.73	2.93	2.91
58pt	2.91	2.97	2.94	2.94	2.93	2.90	2.90	2.93	2.90	2.75	2.86	2.77
72pt	2.93	2.96	2.96	2.97	2.97	2.97	2.96	2.94	2.90	2.83	2.83	2.81

Table4. Differential of readability between the size of letters in the case which letters are moving

10p-18p	-0.03	0.05	0.02	0.03	-0.38	-0.02	-0.06	0.02	-0.17	-0.30	-0.06	-0.12
-58p	-0.08	0.00	0.03	0.03	-0.52	0.02	0.03	0.03	-0.36	-0.33	0.01	0.03
-72p	-0.09	0.02	0.02	0.00	-0.56	-0.06	-0.03	0.02	-0.36	-0.41	0.04	-0.01
18p-58p	-0.05	-0.05	0.02	0.00	-0.13	0.03	0.09	0.02	-0.19	-0.03	0.07	0.15
-72p	-0.06	-0.03	0.00	-0.03	-0.18	-0.04	0.03	0.00	-0.19	-0.10	0.10	0.10
58p-72p	-0.02	0.02	-0.02	-0.03	-0.04	-0.07	-0.06	-0.02	0.00	-0.07	0.03	-0.04

3. Improvement Readability by K.A.

The evaluation have been carried out to confirm the improvement readability by kinetic animation with the helps of seventy-five college students at Miyagi University, Japan. They marked statistics about capability or recognizing that are overlapped by

arrays of square on a CRT display(Fig. 1).

In this experimentation, subject evaluate readability of given letters on the CRT display into 3 grade (readable, almost readable unreadable). The four factors which depend on the readability are as follows:

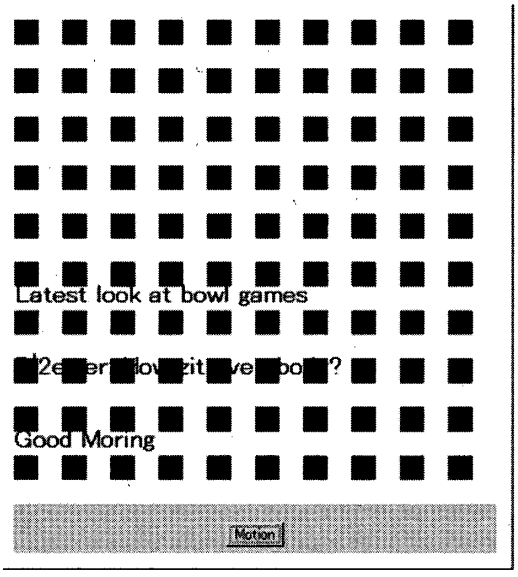

Fig.1 Sample letters on screen at experiment.

i) size of letter (four levels: 10pt, 18pt, 58pt, and 72pt),

ii) thickness of the grid (4 levels: 10pt, 18pt, 58pt, and 72pt),

iii) the number of letters in a sentence (3 levels: 3 letters, 10 letters, and a sentence),

and

iv) motion of letters (2 levels: fixed, and move).

We represent the grid having obstacles of 10pt to X0, similarly we denote the grid having obstacles of 18pt, 58pt, and 72pt to X1, X2, and X3 respectively. The plan of experimentation is within-subject factor since subjects are evaluated the readability of sentence which are combination of the four factors mentioned above. The evaluation was done by using fixed factor since the number of factor is too many to evaluate, and evaluation taking into account of all of correlation

At first, to evaluate the effectiveness of motion of letters, we compare the readability of fixed letters and moving letters (see table1, 2, 3, and 4). As shown in table 1 and 3, motion of letters improves the readability from the result that the readability when letters are moving is 2.99 to 2.41 and readability when letters are not moving is 2.99 to 1.06. Tables 2 and 4 shows the difference of readability between moving letters and fixed letters. The shadowed item in the figures are significant. When letters are moving, there are few dependence of readability on the size of letters compared with fixed case.

Next, we evaluate the fact that whether readability implies motion of letters or not. As shown in table 1, the low readability condition of fixed letters are a word consist of three letters on the grid X2 and X3, a sentence consisting of ten letters ont the grid X2 and X3, and a long sentence on the grid X2.

In those conditions, we carried out two factors analysis for the size of letters and motion. Consequently, there was a significant interaction among three cases, those are viewing the three letters word on grid X2 and X3, viewing the word consisting ten letters on grid X2, and viewing the sentence on grid X2. Namely, in any condition, when letters are moving, we obtained the result that readability is high and does not depend on the size of letters although readability depends on the size of letters in fixed case. Moreover, when viewing the letters on the gird X3, readability only depends on the motion of the letters and does not depends on the size of letters.

To obtain the condition of the motion which increase the readability, we carried out two factor analysis between the size of letters and the grids when letters are moving. Consequently, main effect of the size of obstacles are significant when three letters are moving, and readability makes low when viewing three letters on the grid X0. In two cases where a word consisting of ten letters and a sentence are moving, significant of the size of letters and the grid was significant. From the result of post hoc analysis, we

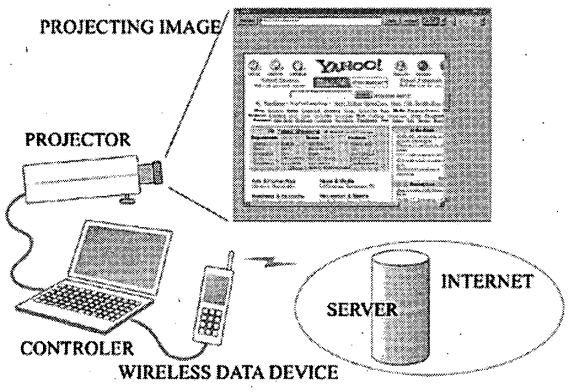

Fig.2 Model of K.P.S.

Fig.3 Demonstration of K.P.S.

get the result that most unreadable situation is motion of a word of ten letters with the size 10pt on the grid X0. Moreover, we observed that If the size of letters changes 10pt to 18pt, readability makes higher but there are no improvement of readability if we change the size of letter to 58pt or 72pt. The case where the sentence is moving on the grid X0, readability depends on the size of letters. Namely we observed that the readability makes higher if the size of letters becomes larger, but we could not observe the difference of readability between 58pt and 72pt. And the case where the sentence is moving on the grid X1,we can get the result that the readability does not depends on

the size of letters, if the size of letters exceed 58pt. From the result above, we can conclude that the motion of letters improves readability in any cases compared with fixed letters, moreover the moving letters hardly influenced the size of letters and the kind of grids, Moving sentences could help recognition the unreadable sentences. It means kinetic motion can be effective on increasing readability of unreadable projected images on a rough surface. This is a main reason of the key technology applying kinetic animation principle for the new electric projection system.

4. Model of Kinetic Projection System

On the basis on the readability test, setting the system outline as follows.

-It will be an unstable device for projecting on a rough surface at indoor or outdoor.

-The system needs wireless data communication equipment for projecting the network information.

-The projecting images require HTML data format for using a browser equipped the kinetic animation engine.

Figure 2 shows the outline of the system. The system consists of a projector, a controller and a wireless data device. The controller receives network data through the wireless data device, and has a control panel for operating the motion levels of the projecting image. It is a software for selecting motion types which are vertical, horizontal, round and random motion, and for controlling speed if the motion in order to the best condition against the rough surface. And it has a window for being put into a World Wide Web (WWW) address of projecting data.

Demonstration of K.P.S..

A demonstration of K.P.S. presents an effective projecting image, depending on electricity of the projector,

could be confirmed especially at night, even at daytime under the cloudy sky or at a shadow surface surrounded by tall buildings. The samples of image are projected as exhibition information and a commercial advertisement. They are composited by some figures and sentences.

Condition of a Rough Surface

Most surface of building wall is usually rough condition for building materials, window sashes, tiles, bricks and stucco. Those have different colors and different reflected condition which prevent the readability of a projecting message. Some parts of

surface overlap the parts of projecting letters. Kinetic animation moves the unreadable parts of letters to readable places on the surface. Black mirror curtain wall is not appropriate screen for projecting since its absorption of light rays.

Letters on Projected Image

Small size of letter is not best for projecting. Size using as title will be good. Color of letter requires complementary to the color of the surface. High saturation of letter will be preferable.

Motion for Readability

Quick motion is not appropriate for readable. Slow motion kind like the motion taking ten seconds per a round movement is good for reading the letters. Some building materials have stripe patterns as vertical or horizontal. The readability of image improves by perpendicular motion against the stripe direction. The round and random motion is appropriate to any kinds of stripe because it has both vertical and horizontal motion.

View Angle

The angle from floor to projector beam within 30 degrees will be kept for good readability in our demonstration. We have to check more about the angle at various conditions.

5. Conclusion

This K.P.S. could be applicable commercial equipments. A personal computer equipped the kinetic animation engine, an electric projector, and a network device, can operate the service. Most effective service using this system will be commercial advertisements. And an electric bulletin board at disaster-striken districts could be useful. Our research team will try to apply the K.P.S. for commercial use.

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