화상 채팅의 음란성을 차단하기 위한 기술적 해결 방안

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요 약

본 논문에서는 화상 채팅에 대한 실태 분석, 접속 형태 분석 그리고 이의 음란성을 기술적으로 차단하기 위한 방법론을 제안하고자 한다. 현재 음란사이트를 차단하기 위한 기술적 방법은 있지만 화상 채팅에 있어 음란 행위를 선택적으로 차단하기 위한 기술적 해결 방안은 없는 실정이다. 기존의 음란사이트 차단 방법은 목록 기반과 단어 기반 방법인바 이는 그 내용이 처음부터 끝까지 무조건적으로 차단해야 하는 음란 사이트 차단에는 적합한 방법이다. 그러나 화상 채팅사이트는 개설되어 있는 채팅방중에 음란성을 가지는 즉, 문제가 되는 채팅방만 선택적으로 차단을 해야 하기 때문에 기존의 방법으로는 차단이 불가능하다. 따라서 본 논문에서는 기존의 음란사이트를 차단하기 위한 방법들 즉, 목록 기반 방법과 단어 기반 방법으로는 화상 채팅 사이트에서 이루어지고 있는 음란 행위를 차단할수 없으므로 이를 내용 기반으로 문제가 되는 채팅방만을 선택적으로 차단하기 위한 방법론을 제시함을 본 연구의 목적으로 한다. 최종적으로 본 연구는 내용 기반으로 화상 채팅방에서 문제가 되는 채팅방에 대해 영상 차단, 음향 신호 차단을 행하여 청소년들을 보호하는데 기여하고자 한다. 본 연구의 유용성을 입증하기 위해 불건전한 음란 장면과 음향에 대해 실험을 수행하였으며 실험 수행 결과 음란의 장면이 담긴 영상과 음향 신호를 정확히 차단할수 있었으며 이를 통해 화상 채팅방의 건전한 사용 및 이용을 유도할수 있을 것으로 여겨진다.

Technical Approaches for Blocking Obscenity in Internet Video Chatting

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ABSTRACT

In this paper an analysis of current video chatting situation and connection status is performed and a technical method to block the obscene contents is proposed. Methods to shut down socially degenerate Internet sites are well known, which are essentially directory or vocabulary based. For the video chatting sites, however, dynamic selectivity is required as the chatting groups in a sites are all different and even in a single group the contents of chatting may turn socially objectionable as time passes. The proposed method is based on the analysis of chatting contents and selectively blocks the sound and/or video data streams. To prove the effectiveness of the method the experiments are performed and the results are shown very satisfactioy.

키워드 : 화상채팅(Video Chatting), 음란성(Obscenity)

1. Introduction

As Internet has become a vital part of our day to day life, the negative use of it has grown proportionally, evidenced by the existence of suicide web sites, draft dodger web site, school dropout web sites, and etc. One of the fastest evolving Internet technology application area is the proliferation of various chatting sites[1-9]. Initially began with character type chatting, the service has progressed through voice chatting and now to video chatting. The format of chatting varies many forms of combinations such as one to one, one to many. Originally started as a convenient communication means, the Internet chatting has become one of the most vicious tools leading to many social problems and crimes. The biggest problem is that our under-aged society members are defenselessly exposed to obscene video chatting and enticing means leading them to offline delinquency and degeneration[10]. Further, the number of chatting participants are ever growing. This still remains as a technical problem. Only obscenity in video chatting has been noticed in the press. For the pornographic Internet sites, social issues have been raised and technical measures to block them are known, which are directory and vocabulary based. However, the same method can not be applied to the video chatting sites because the sites need to be blocked only when they turn obscene. The objective of this research

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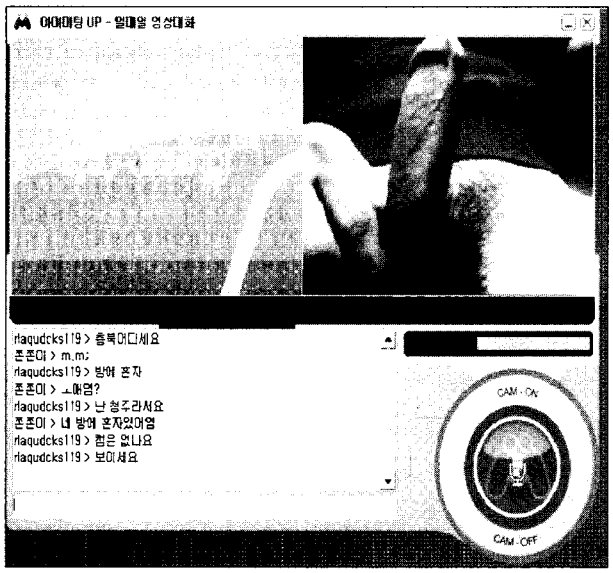
is to develop a technical measure to selectively turn the chatting room off only when it becomes obscene. We survey the chatting situation, analyze the technical aspect of chatting process, and propose measures to screen the chatting participants for their adulthood and the contents of chatting for their obscene nature.

2. Video Chatting Situation and Analysis of Related Works

The technical advance in chatting to the video form has caused the change of the nature in chatting. While video chatting is vital in exchange of useful information, it has also introduced proliferation of hardcore pornographic chatting sites. (Figure 1) shows only one of "moderate" contents currently exchanged in these chatting sites.



(Figure 1) An example of video chatting scene.

Others include video exchange of live sex acts, showing hardcore pornographs, coercively inducing live sex act, and etc. In these cases the chatting site operators are actively protecting the obscene chatting performance by forcing inactive or very passive group chatting participants out of the process. It seems that the chatting site operation is one of the very valuable cash cows in ISPs' business now. Our survey of randomly chosen 87 subjects on their 30's shows that wide spread exposure and participation of the their age group in pornographic video chatting <Table 1>.

<Table 1> Survey results of 87 participant on their 30's

Sex of Survey Participant	Male(55), Female(32)
Video Chatting Experience	Yes (45), No (42)
Connection Time	Mostly between 18 : 00 P.M and 23 : 00 P.M
Chatting Time	Below 1 hr.(24), 1 hr. ~ 3 hrs. (9), 3 hrs. ~ 5 hrs. (3), Over 5 hrs. (3)
Invitation to Offline Meeting	Yes (21), No (18)
Request for Sex	Yes (13), No (30)
Offline Meeting after Chatting	Yes (13), No (20)
Have Seen Pornographic Scene during Chatting	Yes (21), No (13)

Another survey <Table 2> reveals that some chatting sites are actively arranging offline meeting over the phone ("phoneting" - phone meeting).

<Table 2> Survey results on "phoneting"

	Category	Percentage(%)
Occupation	House Wife	44%
	Student	18%
	Salary Man	14%
	Entrepreneur	2%
	Others	22%
Age Group	Below 20	22%
	20~30	38%
	30~40	40%
Purpose of Chatting	Opposite Sex Socialization	34%
	To Spend Time	30%
	Curiosity	34%
	To Get Financial Benefits	8%

We found that 85% of the cases the entry point to this socially degenerative process is enticing spam mails[15]. Also in 88% of the cases the chatting site operators get the target spam mail address by using automatic email address extractors[16]. Therefore hindering spam mail operation by preventing email address extractors' working mechanism is a major step in blocking the entry point to the process.

3. Analysis of Related Works

Existing technical measures are for the obscene Internet sites, in which a whole site becomes inoperable if it is blocked due to verification that the site is pornographic based on the results of directory tracking and vocabulary examination of site contents posted. However,

these methods often fail when the Internet site operator updates the directory and posed site contents frequently to evade the measures. In case of chatting none of the methods used for the Internet sites are applicable, i.e., only socially objectionable chatting groups in a site should be shut down, leaving the other good chatting groups untouched. Therefore the techniques appropriate for the chatting sites should be contents based. Also as the techniques are contents based it becomes possible to selectively block the sound and/or video signals. (Figure 3) shows the comparisons between the existing methods and the proposed method.

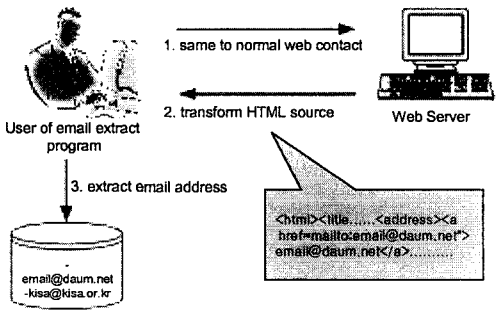
〈Table 3〉 Comparisons between the existing methods and the proposed method

Methods	gikimi 2.31	paros	i-boho	suhochunsa 2000	proposed method
distribution form	paid	paid	paid	paid	free
O.S	Win96, XP	Win98, XP	Win96, 2000, XP	Win98, 2000, XP	Win98, 2000, XP
Blocking Method	directory, vocabulary based	directory, vocabulary based	directory. vocabulary based	directory, vocabulary based	contents based
to be blocked	pornographic, violence,narcotics	pornographic, violence,narcotics	pornographic, violence,narcotics	pornographic,violence,narcotics	pornographic, video chatting
productor	interpia world	i top	ileart	plus tech.	academy

4. Obstructing Email Address Extractors' Operation

4.1 Obstructing Email Address Extractors' Operation

The basic mechanism of email address extraction is shown in (Figure 2).



(Figure 2) Example of Email Address Extractors' Operation

In this case an email address extractor program normally visits a web site asking the web server for web documents in HTML format. Then the web document is parsed to get email addresses by scanning "mail to" or "@" delimiters.

4.1.1 Operational Patterns of Email Address Extractor Programs

A simple email address extractor operation (eg. : Mail Sea, Email Hunter) is through the utilization of existing search engines such as Yahoo and Empas and extracting email addresses by scanning the listed link sites. Others (eg. : @Capturer and Email Spider) scan the email address extractor's own resident computer's temporary HTML files created when web pages are surfed. Since this method scans every page of web documents, surfing speed is slowed. Some are more systematic than other methods(eg. : Mail Sea, Email Hunter). The first web page entered is a root page and lower link nodes form level 1 and on making them a tree structure. In case of Email Spider, up to level 3 nodes are searched. Some email address extractors scavenge bulletin boards. Others are using agents as in web search engines.

4.1.2 Proposed Email Address Extraction Obstruction Measure

The method we propose here is not to present real email address at the first time when an email address request comes in through the hyperlink in web pages, and to have some testing period against the requester before giving out a real email address. A fake email address is given out initially and the client's response pattern is analyzed. Only when it becomes clear that the requester is not an email address extractor program, the real email address is presented. The process goes as follows :

- Step 1 : A generated fake email address, or id is presented when a request comes in. (Figure 3) shows an example fake id table.

H A R P S
I C O D B
E F G K L
M N Q T U
V W X Y Z

(Figure 3) An Example of Fake id Set

- Step 2 : The response of the client is analyzed. In case of email address extractor program the response has to be very quick compared to a human

computer user.

- Step 3 : To make sure that the requester is truly legitimate, another fake id may be given out and the response may be checked again.
- Step 4 : At this time the real email address is given out to the confirmed legitimate human user.

In the above cases a set of formulae given in (Figure 4) is used in generating a new fake id.

$$y_1 = 8x_1 + 6x_2 + 9x_3 + 5x_4$$
$$y_2 = 6x_1 + 9x_2 + 5x_3 + 10x_4$$
$$y_3 = 5x_1 + 8x_2 + 4x_3 + 9x_4$$
$$y_4 = 10x_1 + 6x_2 + 11x_3 + 4x_4$$

(Figure 4) First set of fake id generation formulae

In the (Figure 4), x1 through x4 are the characters of previous fake id and y1 through y4 are characters of newly generated fake id. When a new fake id is generated, the characters of the old fake id is recycled and another set of formulae is used as shown in (Figure 5).

$$x_1 = 23y_1 + 20y_2 + 5y_3 + y_4$$
$$x_2 = 2y_1 + 11y_2 + y_3 + y_4$$
$$x_3 = 2y_1 + 20y_2 + 6y_3 + 25y_4$$
$$x_4 = 25y_1 + 2y_2 + 22y_3 + 25y_4$$

(Figure 5) Set of true id generation formulae

In both cases modulo 26 operation is done to have alphabet characters. The fake id table may be periodically refreshed by generation of new character set through a random number generator, thereby tracing of the algorithm becomes impossible.

4.2 Screening Process of Video Contents

4.2.1 Segmentation

To partition an image into meaningful areas, the texture of an image is analyzed. To extract the genital area out of a naked body image, the proposed texture analysis is based on the combination of the two GLCM (Gray Level Co-occurrence Matrix) methods[17-19], i.e., the moments, which is very sensitive to any gray level value changes, and the homogeneity, which responds to homogeneous gray level value changes, producing the frequency distribution of gray levels. Then, the normalization of GLCM and homogeneity values using the gray level frequency distribution is performed. First, each G[i, j] of GLCM is the change vector value d = (dx, dy) and forms a pair of pixels with the brightness values of i and j and a distance of d between them. Now the total value of the GLCM frequencies is distributed to the GLCM elements, so that $\Sigma G[i, j]=1$, which is used to get the moment M,

$$M = \sum_{i=0}^{N-1} \sum_{j=0}^{N-1} (i-j)^2 G[i,j] \quad (1)$$

Now the normalized homogeneity H is defined as

$$H = \sum_{i=0}^{N-1} \sum_{j=0}^{N-1} \frac{255-|i-j|}{255} G[i,j] \quad (2)$$

where i, j are the coordinate values of M*N. Computation of H is successively done on a 4×4 window and the values computed are saved in the arrays of [A] and [B]. Then an OR operation is performed between [A] and [B] after the threshold value operation from the obtained M and H for extracting target regions is applied on both [A] and [B]. The result is the genital area extracted out of a naked body image, which is projected into Y-axis and the histogram formed is then analyzed.

4.2.2 Analysis of Histogram and Curve Fitting

As a result of previous operation([A] and [B]), we now have a histogram as x projection, which is to be further analyzed for the recognition of a naked body characteristic with the genital area exposed. As the genital area of a human body of either sexes can be represented into a quadratic curve, curve fitting operation is to be done for analyzing the x projection. Since we have M+1 variables of $\{(x_i, y_i) \mid i = 0, 1, \cdots, M\}$, the polynomial expression $P_n(x) = \sum_{k=0}^{n} a_k x^k$ can be fitted to Expression (3).

$$E = \sum_{i=0}^{M} (y_i - P(x_i))^2 \quad (3)$$

To have minimum values for $a_0, a_1, \cdots, a_n$, Expression (3) is expanded into Expression (4)

$$\begin{aligned} E &= \sum_{i=0}^{M} y_i^2 - 2\sum_{i=0}^{M} P(x_i) y_i + \sum_{i=0}^{M} (P(x_i))^2 \\ &= \sum_{i=0}^{M} y_i^2 - 2\sum_{i=0}^{M} \left(\sum_{j=0}^{n} a_j x_i^j\right) y_i + \sum_{i=0}^{M} \left(\sum_{j=0}^{n} a_j x_i^j\right)^2 \\ &= \sum_{i=0}^{M} y_i^2 - 2\sum_{j=0}^{n} a_j \left(\sum_{i=0}^{M} y_i x_i^j\right) + \sum_{j=0}^{n} \sum_{k=0}^{n} a_j a_k \left(\sum_{i=0}^{M} x_i^{j+k}\right) \end{aligned} \quad (4)$$

where x_i is X coordinate value and $P(x_i)$ is Y coor-

dinate value for the projection, and y_i is the data value. And a_j (j = 0, 1, ···, n) is the coefficients of the nth order in the curve fitting expression. To get the minimum value of the above E, we have Expression (5) for j = 0, 1, ···, n

$$\frac{\partial E}{\partial a_j} = (-2\sum_{i=0}^{M} y_i x_i^j) + 2\sum_{k=0}^{n} a_k \sum_{i=0}^{M} x_i^{j+k} = 0 \quad (5)$$

and we have Expression (6) for (n+1) unknowns of a_j

$$\sum_{k=0}^{n} a_k \sum_{i=0}^{M} x_i^{j+k} = \sum_{i=0}^{M} y_i x_i^j \quad (6)$$

which is further expanded to Expressions (7) through (9)

$$a_0 \sum_{i=0}^{M} x_i^0 + a_1 \sum_{i=0}^{M} x_i^1 + a_2 \sum_{i=0}^{M} x_i^2 = \sum_{i=0}^{M} y_i x_i^0 \quad (7)$$

$$a_0 \sum_{i=0}^{M} x_i^1 + a_1 \sum_{i=0}^{M} x_i^2 + a_2 \sum_{i=0}^{M} x_i^3 = \sum_{i=0}^{M} y_i x_i^1 \quad (8)$$

$$a_0 \sum_{i=0}^{M} x_i^2 + a_1 \sum_{i=0}^{M} x_i^3 + a_2 \sum_{i=0}^{M} x_i^4 = \sum_{i=0}^{M} y_i x_i^2 \quad (9)$$

Therefore the value of a_0 is obtained by

$$a_0 = \frac{\begin{vmatrix} \sum y_i x_i^0 & \sum x_i^1 & \sum x_i^2 \\ \sum y_i x_i^1 & \sum x_i^2 & \sum x_i^3 \\ \sum y_i x_i^2 & \sum x_i^3 & \sum x_i^4 \end{vmatrix}}{\begin{vmatrix} \sum x_i^0 & \sum x_i^1 & \sum x_i^2 \\ \sum x_i^1 & \sum x_i^2 & \sum x_i^3 \\ \sum x_i^2 & \sum x_i^3 & \sum x_i^4 \end{vmatrix}} = \frac{|D_0|}{|D|} \quad (10)$$

Similarly the values of a_1 and a_2 are obtained by

$$a_1 = \frac{|D_1|}{|D|} \quad (11)$$

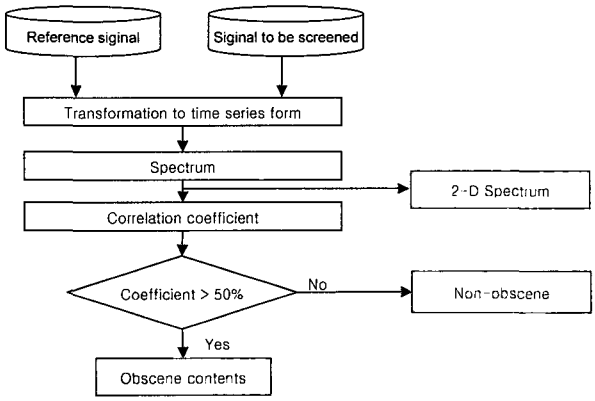
$$a_2 = \frac{|D_2|}{|D|} \quad (12)$$

Curve fitting to uniform distribution is done by arranging $y = a + bx$ to Expression (13)

$$\begin{bmatrix} a \\ b \end{bmatrix} = \frac{1}{M\sum x_k^2 - (\sum x_k)^2} \begin{bmatrix} \sum x_k^2 & -\sum x_k \\ -\sum x_k & M \end{bmatrix} \begin{bmatrix} \sum y_k \\ \sum x_k y_k \end{bmatrix} \quad (13)$$

4.3 Screening Process for Acoustic Contents

Obscenity is not only based on the video contents also includes the sound. In other words, another characteristic of obscene chatting is the various sound generated during sex related acts. Our proposal is to compare the features from 2-D spectrum of the acoustic data out of chatting site and the reference data prestored. The flow chart of the process is shown in (Figure 6).



(Figure 6) Screening process for obscene acoustic signal

Any acoustic signal to be analyzed should be transformed into a time series form and to a spectrum. For this process we used Praat free software package developed by and downloadable from Paul Boersma and David Weenink of the University of Amsterdam[20]. The features of two acoustic signals are compared by computing correlation coefficient using the following expression :

$$r = \frac{\sum_m \sum_n (Amn - \overline{A})(Bmn - \overline{B})}{\sqrt{(\sum_m \sum_n (Amn - \overline{A})^2)(\sum_m \sum_n (Bmn - \overline{B})^2)}}$$

where Amn and Bmn are reference signals and $\overline{A}$ and $\overline{B}$ are input acoustic signals.

5. Experimental Results and Observation

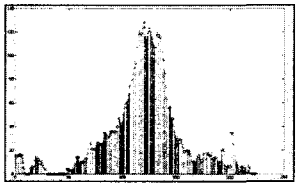
5.1 Image Contents

Experiments on video chatting images are performed using an IBM-PC with a C language program. (Figure 7) is a raw image of a female chatting participant with her genital focused. (Figure 8) and (Figure 9) are the results of area partition and histogram analysis. (Figure 10), (Figure 13) and (Figure 15) are original images from video chatting sites, and other matching figures are the results of corresponding area partition and histogram analysis. Obscene contents can be judged on the exposure of genitals and female breasts. The histogram through the curve fitting shows the quadratic curve. <Table 4> be-

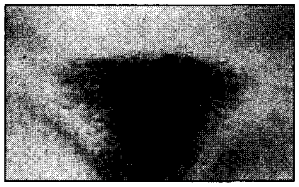
low clearly matches the results of the analysis. The experiments clearly show that the images of genital exposure can be correctly screened. However, in the case of Figure 16, our method fails to recognize obscenity. But the case like Figure 16 is controversial whether the images is obscene or not. The image was not recognized as obscene because the exposure of the female breast was not noticed even though the very act performed in chatting is masturbation and considered pornographic.

(Figure 7) An original video

(Figure 8) Result of segmentation chatting scene

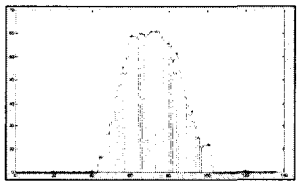


(Figure 9) Analysis of histogram

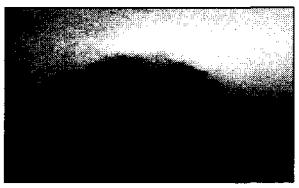


(Figure 10) An original video chatting scene

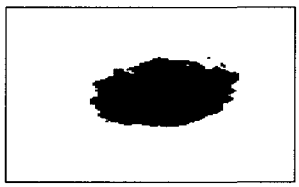
(Figure 11) Result of segmentation



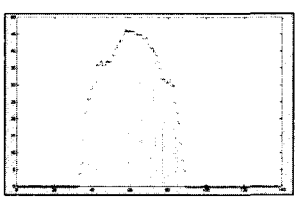
(Figure 12) Analysis of histogram



(Figure 13) An original video



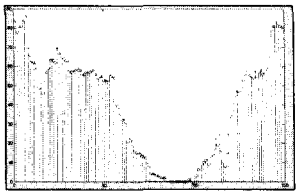
(Figure 14) Result of segmentation chatting scene



(Figure 15) Analysis of histogram

(Figure 16) An original video chatting scene

(Figure 17) Result of segmentation



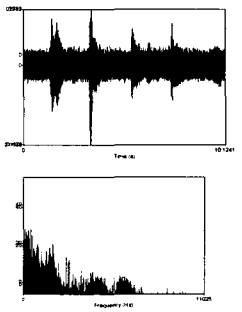
(Figure 18) Analysis of histogram

〈Table 4〉 Results of curve fitting

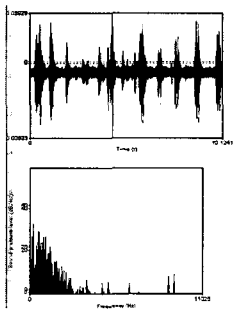
Video chatting scenes	Results of curve fitting
(Figure 7)	a=-0.0119, b=3.0304, c=-123.0598
(Figure 10)	a=-0.0687, b=9.8478, c=-293.2061
(Figure 13)	a=-0.0450, b=5.4630, c=-119.5912

5.2 Acoustic Contents of Video Chatting

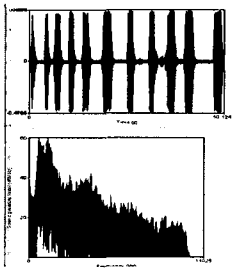
Experiments on acoustic chatting contents are performed using an IBM-PC with a program written in C++. Ten typical sound samples from Internet chatting sites are taken and transformed into wav file format. The matching pairs of each of (Figure 8) through (Figure 17) are acoustic signals and spectrums, for which previously mentioned software package Praat is used. Our experimental results in <Table 6> through <Table 8> show that there are high correlation between experimental samples and reference samples of similar nature. In the future we expect that more experiments with various samples and research in this area in search of systematic and established recognition methods.



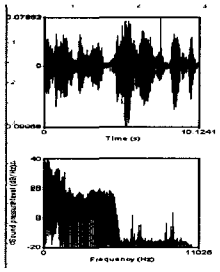
(Figure 8) Sample 1



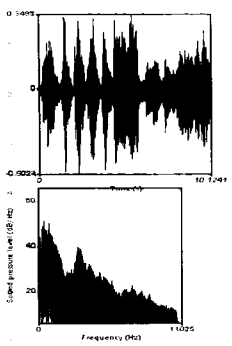
(Figure 9) Sample 2



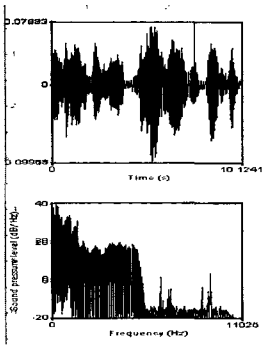
(Figure 10) Sample 3



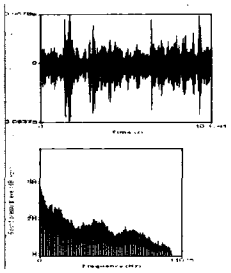
(Figure 11) Sample 4



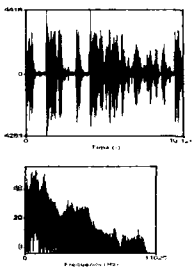
(Figure 12) Sample 5



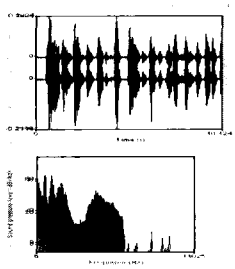
(Figure 13) Sample 6



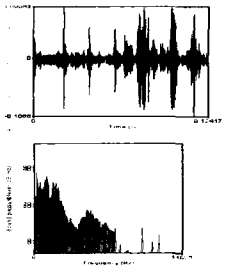
(Figure 14) Sample 7



(Figure 15) Sample 8



(Figure 16) Sample 9



(Figure 17) Sample 10

〈Table 6〉 Result of experiment(sample 6 & acoustic signal A)

	sample 6	acoustic signal A
sample 6	1.0000	0.5236
acoustic signal A	0.5236	1.000

〈Table 7〉 Result of experiment(sample 7 & acoustic signal B)

	sample 7	acoustic signal B
sample 7	1.0000	0.5660
acoustic signal B	0.5660	1.000

〈Table 8〉 Result of experiment(sample 3 & acoustic signal C)

	sample 3	acoustic signal C
sample 3	1.0000	0.9285
acoustic signal C	0.9285	1.0000

6. Conclusion

In this paper we discussed negative functions of Internet, specifically video chatting. We surveyed the current status of Internet chatting and analyzed the process of negative chatting functions. We proposed a measure to obstruct the function of email address extractor used by obscene chatting site operators. We also proposed screening mechanism for video images and acoustic signals from chatting sites. Our experiments show that chatting can be blocked by screening the contents of chatting. We consider our measures are only parts of a overall system to effectively control the access to harmful sites. We expect more research in this area so that good members of our society are effectively protected from the negative functions of convenient medium.

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