

Socio-Health with Personal Mental Health Records: Suicidal-Tendency Observation System on Facebook for Taiwanese Adolescents and Young Adults

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Abstract—Beginning in 2009 the second-leading cause of death for Taiwanese aged 15 to 24 has been suicide, accounting for 12.4% of deaths that year in this group and rising in the years since. The Taiwan Suicide Prevention Center (TSPC) provides a modest mental survey (MMS), also called the “feeling thermometer”, for evaluating individual psychological condition. The MMS has determined suicidal tendency with at least 85% precision. It has been observed that the most effective method for getting youth to take the MMS is to include it casually in various popular activities. In collaboration with the TSPC, the research team developed a suicidal-tendency observation system on some popular social web sites such as Facebook. Taiwan’s youth can simply participate in the MMS, and the results, with required personal information, are stored in the personal mental health records in the Clinical Document Architecture (CDA) standard international format. The service went online at the end of 2010. The TSPC can initiate contact with members of the high-risk group immediately via the system’s alerts. In addition, youth can be made self-aware through the MMS and so visit mental health physicians to obtain effective guidance.

Keywords- *social networks; suicidal-tendency observing; Facebook; personal mental health records; extensible markup language*

I. INTRODUCTION

Suicide has become one of the top ten causes of death in Taiwan and the public needs to be made more aware of this [15]. Also, the age at which people commit suicide is becoming younger year by year [16]. Evidence for this comes from the 2009 statistical analysis report for the major causes of death by age group from the Department of Health in Taiwan [15]. It is the second-leading cause of death of 15-24 year-olds [4]. In this age group in 2007 the suicide rate was 12.6 per million [15].

A definition of suicide from Rudd (2001) is death from injury, poisoning, or suffocation in which there is evidence (either implicit or explicit) that the injury was self-inflicted and that the deceased intended to kill himself or herself [10]. The generation of suicidal behavior is from suicidal ideation, which means any self-reported thoughts of engaging in suicide-related behavior [10]. Therefore, everyone who commits suicide will have suicidal ideation before s/he commits suicide, so suicidal ideation can be regarded as the motivation for suicide.

Based on the above, it is necessary to reduce the suicidal ideation in order to decrease the occurrence of suicide. In 1970, E. S. Shneidman proposed a three-level prevention model to do exactly that. The model is divided into three program response categories: prevention, intervention and postvention [i.e., post-intervention] [9]. Within this three-level prevention model, prevention is to increase the protection factor and decrease the risk factor. For example, schools can offer extracurricular courses such as life skills education. Intervention provides early counseling to the high-risk group. Postvention provides enhanced psychological counseling for those who have attempted suicide and their families and friends as well as for the families and friends of those who have committed suicide, and includes continuing observation to avoid the generation of knock-on effects.

This paper focuses on the second level, intervention, of the three-level prevention model and describes the attempt to zero in on the high-risk group so that early detection can lead to early treatment. Toward achieving this, Dr. M. B. Lee, et al. of National Taiwan University revised the Symptom Check List 90-R (SCL-90-R) into the Brief Symptom Rating Scale 50 (BSRS-50). However, they believed that even 50 is too many questions for the test to be effective. Hence through a series of screenings and tests, they reduced the number of questions to

five (BSRS-5), also known as the “feeling thermometer” (FT) [6].

Although to some extent the FT can help determine who is in the high-risk group, it depends on subjects actively answering the questionnaire. It is unlikely that all those at high risk will. Therefore, it is necessary to rely on people called gatekeepers to help identify high-risk individuals [5].

The broad role of the suicide prevention gatekeeper (SPG) is “to know how to identify suicidal tendencies and those at risk and to provide an appropriate response or referral.” Therefore, the SPG has an important role in early detection and early intervention [5]. The gatekeepers usually are school mentors, counselors, and classmates. However, a gatekeeper’s training relies on effective and available courses, which may not exist in some communities [11]. In addition, the gatekeeper is constrained by geographically and can affect only the people around him or her. Therefore, we utilize the Internet to overcome such constraints and generate the “Internet counselor” concept in order to expand the effects of the gatekeepers by networking.

The National Board for Certified Counselors (NBCC) defined the Internet counselor in 1998. It declares that counselors who are not in immediate proximity with clients must present those clients with local sources of care before establishing a continuing short- or long-term relationship with them. Counselors, however, can continue to communicate with clients via the Internet [8]. Note that the gatekeeper is not necessarily a counselor. He or she might not be able to solve a caller’s problem, but he or she can supply timely assistance, such as emotional comfort and referral. It has been determined in this study that Facebook is the most suitable social network to assist counselors to execute their tasks. The characteristics of Facebook are listed as below:

1) *High Utilization Rate in Taiwan*: There are 9.328 million Facebook users in Taiwan. Meanwhile, 14- to 24-year-olds accounted for about 39.9% of these, approximate 3.723 million youths in May 2011 [19]. Thus, Facebook is one of the major communication channels for Taiwanese young people.

2) *High Level Support for Third-party Program Development*: Facebook supports third-party program development, so tests such as BSRS-5 can be designed by using Facebook Application Programming Interface (API) and uploaded to Facebook as an application.

3) *High Accessibility for User E-mail*: Facebook API will query a user as to whether to let application fetch the user’s e-mail information before the user executes the specific application. If a counselor wants to contact the specific user, they can contact each other through e-mail.

4) *High Interactivity*: Compared to other network communication styles, social networking is highly interactive. For example, a user can leave a message, reply to a message, send a gift, and even poke another user. The more interaction among users, the more intimate the relationship that is developed.

The system developed here stores the users’ test results in extensible markup language (XML) format. As well, the data

for the high-risk group within the database is in XML format and is compatible for future integration with Health Level Seven (HL7) standards.

The goals of this application are to decrease the users’ suicidal ideation and actual incidence of suicide by (1) making the application widely and easily available soon, (2) ensuring the outcomes accurately reflect a user’s current status, (3) providing advice and/or referrals for assistance, and (4) letting the Taiwan Suicide Prevention Center (TSPC) monitor the high-risk group through the Facebook applications and suicidal tendency observation system.

II. METHODOLOGY

In order to decrease the suicide rate, the SPG concept, the Facebook social networking powers, a simple effective mental survey, also called the feeling thermometer (FT), and a series of applications to actively contact users have been adopted.

A. Suicide Prevention Gatekeeper

Based on a survey by the TSPC in Taiwan, 84.1% of the people believe that suicide can be prevented. Furthermore, 77.3% say that they want to assist in suicide prevention activities. As well, 70.4% say that suicide is a serious problem in Taiwan [18]. All of this shows that people have noticed the seriousness of suicide and want to reduce its incidence through a number of actions.

People who have suicidal ideation can be observed and prevented from actually committing suicide only by the other people in their immediate environment, such as teachers, relatives, and friends. However, the effectiveness of SPGs is limited; some aspects of suicidal ideation behavior are such that even a professional counselor might fail to observe them. Furthermore, some improper counseling methods actually increase the probability of the subject committing suicide. Therefore, our research team not only follows traditional methods to promote suicide prevention to the public, but also hopes to create a system to replace some of the functions of suicide prevention gatekeepers.

The Facebook application provides a simple psychological test and gives some useful comments with the results in order to accomplish two functions of a suicide prevention gatekeeper, early detection and early treatment. Through Facebook’s extensive networking, this test can be widely and rapidly deployed among test-takers. By repeating the test at regular intervals, a psychological profile of the test-taker is established, which assists in the early detection of suicidal ideation. Furthermore, the system automatically supplies all call-for-help channels to test-takers and provides some comments based on the test results to the counselors in order to achieve the early assistance function.

According to the TSPC, the formation of suicidal ideation does not occur in a short span of time, but results from the accumulation of stress over a relatively long time. With early discovery, counselors can not only assist people before the generation of suicidal ideation is completed, but also provide

readily available contacts for subsequent counseling. Thus, the causes of suicidal ideation formation will be reduced, so presumably suicide rates would be reduced, too.

B. Facebook Adoption

The founder of Facebook, Mark Zuckerberg, has said that “People want to share and stay connected with their friends and the people around them. If we give people control over what they share, they will want to share more. If people share more, the world will become more open and connected. And a world that’s more open and connected is a better world.” [20] This is Facebook’s core principles. The major differences between Facebook and other social networking sites are that Facebook integrates digital communication and publishing, which makes communication simple across time and space [3].

Furthermore, users can use Facebook to establish a profile, connect with friends and build their networks, communicate with other Facebook users, post photos, plan events, join groups, and even try out applications [3][21]. Such interactions will let users participate in social activities in the Internet. When users invite friends to join or recommend an application to friends, acceptance is based on the trust between friends. This trust extends to friends of friends, so the network of trust expands. Hence the uptake of the applications quickly increases, for instance Happy Farm, Restaurant City, and several humorous psychological tests. This is one of the factors in Facebook’s success.

Of special relevance to the suicide prevention system in question, Facebook has a special feature to allow third-party developers to utilize interfaces, such as OpenSocial [17] and Facebook API, to develop specific applications and to integrate them into users’ Facebook relationships [1]. Information security and personal privacy are serious problems with Facebook. Yet young people continue to utilize it. In 2008, as the Sheldon’s research findings said “socially anxious individuals are more likely to form relationships online.” [22] Therefore, it is a must for this suicidal-tendency observation system to be available on Facebook, but at the same time to avoid the loss of users’ personal information.

User data is composed of three types of information. Identity data describe who the user is in the social web. Social-graph data represent whom the user knows in the social web. Content data represent what information the user has posted on the social website [2]. In order to facilitate the statistical analysis of the data, without including the test-taker’s role in society in the results, it is necessary to get the test-taker’s identity data and a small part of his or her social-graph data.

C. Feeling Thermometer

Dr. M. B. Lee had simplified the BSRS-50 to the BSRS-5, also called the FT, which is shown in Table I. Dr. Lee utilized the mini international neuropsychiatric interview-plus model to establish that the FT has good reliability and validity. His research shows that by taking a score of five to six as an optimal cut-off point for the BSRS-5 among subjects admitted

for general health screening, the rate of classification accuracy reaches 82.2% [12]. Furthermore, he determined that a score of six points is the standard screening threshold [6].

TABLE I FEELING THERMOMETER TEST.

Question/Score	Non-existent	Mild	Moderate	Severe	Extreme
1. Feel nervous.	0	1	2	3	4
2. Feel upset or angry easily.	0	1	2	3	4
3. Feel worried and depressed.	0	1	2	3	4
4. Feel inferior to others.	0	1	2	3	4
5. Have sleep difficulties, such as difficulty falling asleep or waking up in the middle of the night or too early.	0	1	2	3	4

Some scholars further analyzed the suicide attempters’ FT scores and discovered that a repeat suicide attempter will obtain higher scores in all five facets (anxiety, hostility, depression, low self-esteem, and insomnia) of the FT. A higher score (\geq six points) is of clinical significance. Other data from the TSPC shows that the repeat suicide attempters are the most important target group of suicide prevention and require more intervention. In Taiwan, psychiatric counselors and nurses frequently utilize the FT. It can detect the psychological state of clinical patients. Then their treatment can be adjusted appropriately.

D. Suicidal-tendency Observation System

In order to utilize Facebook to promote the FT, the FT program had to be designed to be compatible with Facebook’s software. Fig. 1 shows the Facebook API-related functions and Fig. 2 shows the FT system functions.

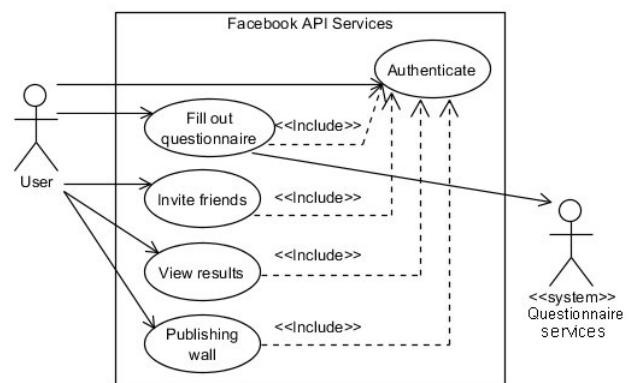


Fig. 1. Use case diagram for Facebook API services.

It is feasible to utilize the Facebook API to obtain the authorization, publish on the Facebook wall, and invite friends. This system can also display the FT results on Facebook, as shown in Fig. 3. The application lets the user utilize the system through Facebook and it is not necessary for the user to input any uniform resource locator (URL) in the browser.

The major functions of the questionnaire services include, as a minimum, a database connection and the Facebook API adoption. When a counselor wants to query all of the results of test-takers, he or she can log in to the system and browse data,

as shown in Fig. 4. If the counselor wants to browse the high-risk group, he or she must use a password in order to maintain the security of the data.

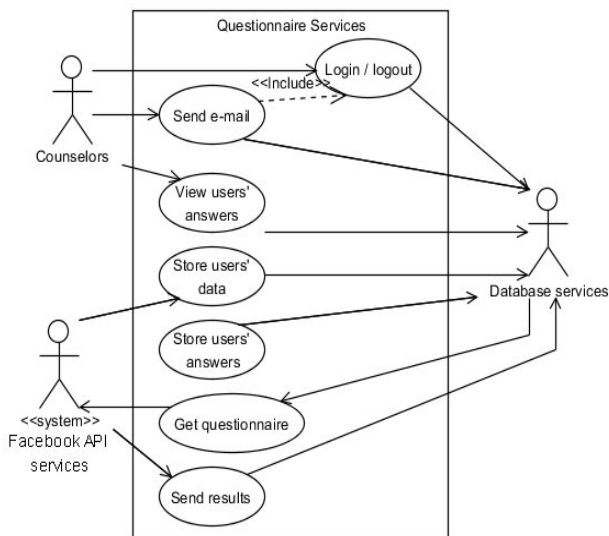


Fig. 2. Use case diagram for questionnaire services.

Please indicate the extent to which you felt distressed or worried last week.	
No	Questions and Options
1	Felt nervous <input type="radio"/> Nonexistent <input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe <input type="radio"/> Extreme
	Felt upset or angry easily <input type="radio"/> Nonexistent <input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe <input type="radio"/> Extreme
	Felt worried and depressed <input type="radio"/> Nonexistent <input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe <input type="radio"/> Extreme
	Felt inferior to others <input type="radio"/> Nonexistent <input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe <input type="radio"/> Extreme
	Had sleep difficulties, such as difficulty falling asleep or waking up in the middle of the night or too early. <input type="radio"/> Nonexistent <input type="radio"/> Mild <input type="radio"/> Moderate <input type="radio"/> Severe <input type="radio"/> Extreme
<input type="button" value="Submit"/>	

Fig. 3. Feeling thermometer of the suicidal-tendency observation system.

All Data Records

Gender	Birthday	Location	E-mail	Q1	Q2	Q3	Q4	Q5	Sum
male	10/24/1985	Kaohsiung, Taiwan	Send mail	0	2	3	4	2	11
male	10/24/1985	Kaohsiung, Taiwan	Send mail	1	2	1	3	0	7
male	10/24/1985	Kaohsiung, Taiwan	Send mail	4	3	3	3	4	17
female	08/19/1988	Taipei, Taiwan	Send mail	2	1	2	2	3	10
male	10/24/1985	Kaohsiung, Taiwan	Send mail	2	0	1	2	0	5
male	10/24/1985	Kaohsiung, Taiwan	Send mail	2	2	2	2	2	10
male	10/24/1985	Kaohsiung, Taiwan	Send mail	1	1	0	2	4	8
male	10/24/1985	Kaohsiung, Taiwan	Send mail	2	2	2	2	2	10
female	08/19/1981		Send mail	1	1	1	1	1	5
male	10/24/1985		Send mail	1	1	2	1	1	6
male	10/24/1985	Kaohsiung, Taiwan	Send mail	0	1	1	1	1	4
female	08/19/1988	Taipei, Taiwan	Send mail	1	2	1	1	0	5
female	08/19/1988	Taipei, Taiwan	Send mail	1	1	1	1	0	4
male	10/24/1985	Kaohsiung, Taiwan	Send mail	1	1	0	1	0	3
female	08/19/1988	Taipei, Taiwan	Send mail	1	1	1	1	0	4
male	10/24/1985	Kaohsiung, Taiwan	Send mail	0	1	1	1	0	3
female	08/19/1988	Taipei, Taiwan	Send mail	1	1	1	1	0	4
female	03/26/1984	Kaohsiung, Taiwan	Send mail	1	1	1	1	2	6
male	10/24/1985	Kaohsiung, Taiwan	Send mail	1	2	2	1	0	6

Fig. 4. Counselor can browse the test results of high-risk group.

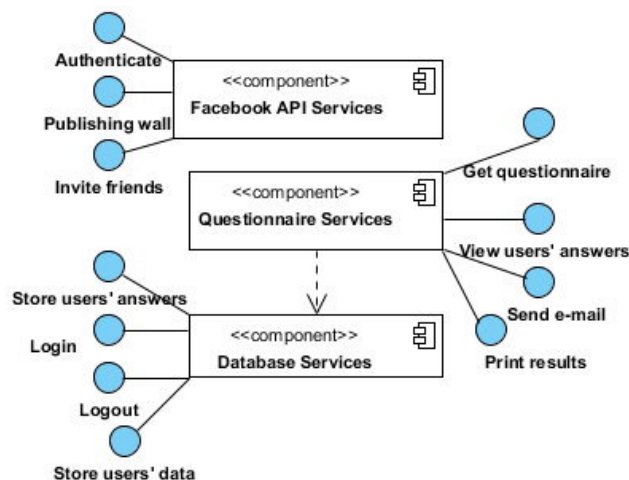


Fig. 5. Component diagram for suicidal-tendency observation system.

In Fig. 5, the component diagram shows that the system can be divided into three modules such as the Facebook API services, the questionnaire services, and database services. Commonly, this system can simply expand other services by append required functions in the future.

Test-takers can utilize the FT application and authorize by the system in order to access some of his or her personal information such as gender, age, and location. Then the application will save these authorized data to database. In case that psychological counselor or psychiatrist wants further contact with test-takers, the counselor can contact with the test-takers through e-mail.

Furthermore, the system utilizes World Wide Web Consortium (W3C) XML format to store related data in order to facilitate the system related modules as well as increase the reusability and maintainability. The system processing flow is defined in Fig. 6. That is, the XML document and related extensible stylesheet language (XSL) rules can be passed to XML parser for further parsing. After parsing by the stylesheet language transformation (XSLT), the final content can be adopted into various styles, such as display in the browser or print on the paper-style patient records, which are depended on the users' needs.

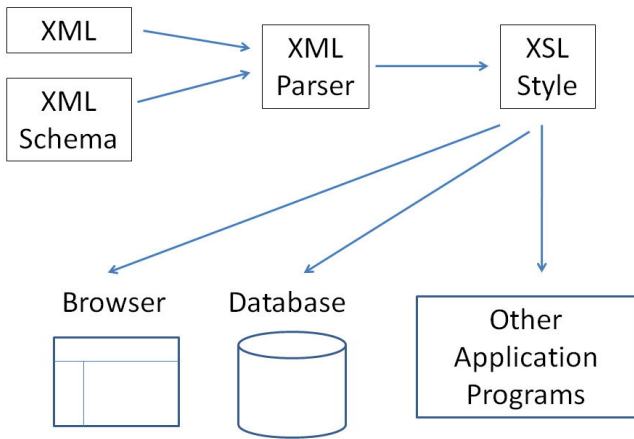


Fig. 6. Extensible markup language parsing architecture.

Another advantage for utilizing XML to store related data can let the system simply integrate with the personal health records (PHR) system by using the HL7 standards. Such an adoption can decrease the error possibility for data translation by revising the XSLT file only. That is, it is not necessary to revise all related web pages. Moreover, it also supports diverse browser compatibility for displaying our report with using different standards such as hyper text markup language (HTML) 5.0 and cascading style sheets (CSS).

III. RESULTS

The FT's results can be scored as four levels and the total score is from zero to twenty. These four levels are listed as follows. (1) 0-5 points means the user is in the general normal range, that is, he or she is in good physical and psychological adaption, (2) 6-9 points means the user is in mild emotional distress and it is recommended the user to find family or friends to talk as well express emotions, (3) 10-14 points means the user is in moderate emotional problems and it is recommended the user to seek psychological counseling or professional advice, and (4) more than 15 points means the user is in severe mood disturbance and needs high cares. Therefore, it is strongly recommended the user to seek professional counseling or psychiatric treatment.

Inside Facebook environment, the application must to obtain the authorization from the user online before the system wants to get user's personal information. After user finished the FT, the system will ask the user whether to publish his or her FT's results to the publishing wall and let his or her friends can understand his or her feeling. Of course, the user may choose to hide his or her FT's results for his or her eyes only. Anyway, the FT's results will be stored in the database. Meanwhile, the suicidal-tendency observation system will statistical filter out the high-risk group. The FT's total score which is larger than six will be assigned to the high-risk group.

The high-risk group can be selected form the MySQL database. Although it is not meant a person has suicidal ideation in case of participating the FT with higher score. However, it might present that he or she had accumulated

pressure for a while inside his or her psychological part. Therefore, it is necessary for counselor to intervention and tries to release patient's pressure. Moreover, the system utilizes XML schema definition (XSD) and XSLT to present FT's results on the screen and refers to the clinical document architecture (CDA) R2 standard as well as the related electronic medical records standards. The programmers can simply modify the XSLT part in case that electronic medical records (EMR) and PHR can be integrated each other and create a socio-health utility such as the personal mental health records (PMHR) in the near future.

Social workers and counselors can send e-mails to communicate with specific test-takers. If necessary, the test-taker and counselor can continuously execute counseling activity in the Internet. At last, the FT is only acting as self-detection tool and large-scale filtering test. Therefore, the FT's results are only for personal or physician references, not for other diagnosis purposes.

IV. DISCUSSION

Although the suicide-tendency observation system with Facebook meets the original goals briefly, there are some implicit reasons to truly across the gap and meet expects of the suicide prevention. At first, this application is verified with good reliability and validity [6], however, it is hard to find the incentive to let the users introduce our application to their friends. In comparison our application with other psychological tests, it is difficult to let the users to trust the FT's results. It might be the FT's results are too compendious. Therefore, it is necessary to focus on the FT's analysis part and supply more useful statements to the test-takers.

Secondly, the FT is a rough detection tool for psychological state. It is possible situation that the system analyzes the user psychological state without enough personal information and cannot obtain an effective conclusion. Therefore, it is necessary to consider increasing other measurement questions. In the meantime, the system can be designed to focus on the questions with high scored, to give further corresponding measurement questions, and to provide more accurate suggestions to test-takers.

At last, the FT is only for checking test-takers' psychological state. The test-takers who have worse psychological state will try to commit suicide themselves. Such a state might be temporary depression and can be restored over a period of time. It is undoubted that someone might be difficult to resolve his or her psychological pressure and then create the suicidal ideation. Therefore, it is necessary for counselors carefully conduct with test-takers in the Internet. Otherwise, the system should add more suicidal ideation questions in the questionnaire and let the high-risk group be discovered more accurate than before.

V. FUTURE WORKS

Based on the research results, the suicide-tendency observation system can be continuously developed as the following researching facets listed.

1) *Test Material*: If possible, it is necessary to develop the FT questionnaire with diverse descriptive formats. These formats will promote the accuracy of the psychological analysis, increase the user confidence, and arise the test-takers' interest.

2) *Test Result Analysis*: Although the system can roughly analyze test-takers' psychological facets which are based on the five questions in the FT, it can simulate the psychological test process to analyze test-takers' psychological state by means of presumable cases. For example, test-takers with different gender might have distinct difference on the test results, even the system can link other related psychological tests to obtain advanced psychological state from the test-takers.

3) *Physician Interface*: It is necessary to enhance both user and management interfaces, especially for the social workers to manage the related counseling processes. In order to protect the personal privacy of test-takers, a well-designed user interface can avoid social workers exclude the suicidal-tendency observation system.

4) *System Integration*: The suicidal-tendency observation system can integrate with other physical data such as medical records, health records, diet records, family history, and rehabilitation systems into a complete PHR system. That is, it can be another alternative to include an analysis abstract sheet inside the test-takers' PHR. Reality-related Technologies Adoption: the system can adopt virtual reality or augmented reality to let counselors discover the test-takers' problems easily.

VI. CONCLUSION

The much more increasing competitive society in the environment, the much more pressure will be added for the young people learning. Many adolescents and young adults have accumulated a lot of pressure and ignore it with senseless. The suicidal-tendency observation system lets all Facebook users who execute the FT application can understand self-psychological state and further resolve their psychological pressure which is based on the system's suggestions. In addition, it offers test-takers the call-for-help channels and let test-takers and psychological experts contact each other via the Internet. The proposed system wishes all test-takers can decrease their suicidal ideation in order to minimize the actual incidence of suicide.

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