Friends Personalization of Trustworthiness for Privacy Perseverance in Social Networking

Manmeet Mahinderjit Singh, Liu Ban Chieng, Rohail Hassan, Zarul Fitri Zaaba

***Abstract*—Online Social Network (OSN) has become the most popular platform on the Internet that can provide an interesting and creative ways to communicate, sharing and meets with peoples. Trust concerns have been raised and the trustworthiness of social networking sites has been questioned. Currently, the trust in social networks is using the single- faceted approach, which is not well personalized, and doesn't account for the subjective views of trust according to each user, but only the general trust believes of a group of population. From our initial survey, we had found that most people can share their information without any doubts on OSN but they normally do not trust all their friends equally and think there is a need of trust management. By adopting the idea of multi-faceted trust model, a user-centric model that can personalize the comments/photos in social network with user's customized traits of trust is proposed. In this paper, the initial result is analyzed in determining the need to enhance the current trust model within the current social networking.**

***Keywords*---Online Social Network (OSN), Security, Privacy, Trust, Multi-Faceted Model, Trust Management,**

I. Introduction

ONLINE Social Network (OSN) can be defined as a free online platform, with high availability that serve as a digital representation of the users stay connected in the virtual environment that provide data sharing, semi- public profile creation, and messaging services [1,2,3,4]. Online Social Network (OSN) such as Facebook, Twitter and Myspace has experienced a bullet's speedy growth in recent years. Despite the social hierarchy, almost everyone, with an online device, will have at least one account in any of the social network sites.

A survey done by [1] has demonstrated that the users of social networking site from 2005 - 2012, consist of people from different age group, ranging from 18 to 65 and above. The number of ONSs users has increased in all age groups over the years. The main problem in the current OSN is the generalization of trust in OSN. Friends in a group are assumed to be trusted equally. Take for example, on Facebook and Twitter; they have grouped all friends under one level of the category in which they tend to trust them all the same. Although they can group friends into "Close Friends" and "Family" like in Facebook, the categorization is still in a big group but not personalized and specific. However, in real-life, it is impossible to do so as trustworthiness is context dependent [5,6] and need to personalized [5,6]. Some friends are likely to be more trustworthiness compared to the rest. This research aims to answer the questions of whether a multi-faceted model of trust that is personalisable and specialisable be welcomed in OSNs and would an application of the model satisfy user needs when expressing their subjective views on trust in the OSN environment.The main aim of this research paper is to tackle the lack of personalization in term of trustworthiness in the current OSN. The objectives is to explore various trust traits and users requirement that is essential to the users by the means of survey.

This paper is organized as follows; Section Two introduces the concept of OSN, the categorizations as well as a brief history of them. It provides an analysis of the state of the art in trust and its characteristics, and current trust mechanisms used in notable online social networks. Section Three concentrates on a survey designed to gather user opinions of current trust management approaches being used, and presents our findings as well as analysis of the results. Section 4 present discussion section based on the findings obtained in prior section. Finally, in section five, a conclusion featuring the original objectives and goals were achieved during this research project is presented.

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II. Related Works

A. Online Social Network (OSN)

Online Social Network not only serves as a communication tool but also act as an application source and online community builders [1,2,3]. Face to face interaction is eliminated in OSNs [4,7]. It was the most popular internet sites mushrooming in the past few years and today having billions of users with a wide demographic range. Nowadays, the users of OSNs are spread over all age groups despite their backgrounds. The first recognizable OSN is the SixDegrees.com with the initial purpose creates profiles and listing friends in 1997. OSN experienced various evolutions from 1997 until now, with the addition of function, improvement of the interface and the availability of OSN simultaneously with the increment of the popularity of OSNs [8].

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B. An example of OSN: Privacy issue with Facebook

Facebook was initially designed to support college networks only [8]. However, over the years, Facebook has increasingly adopted a wider range of users and the usage of Facebook has evolved over time [4]. Facebook has become the most popular and fast growing OSNs. [4] have reported that Facebook users had become more sociable after using Facebook, because of the transparency of the site itself as a social tool. Moreover, Facebook is adopting the open platform where advertisers can exploit social graph of users to recognized the potential customer effectively, developers is able to develop applications on the Facebook platform quickly, making profit, and it is available in many programming environments [9].

According to [9], privacy settings in Facebook are based on opt-in policy. In other word, user's profile is accessible to all by default. This could definitely create many privacy holes. [4] have also claimed that the friendship in Facebook is not well differentiate, and this might caused over accessibility, oversharing and too many friends in the contact lists despite age group but in global perspective. The settings itself are available, but is weak and a bit difficult for the older users than younger. Many users post personal information without realizing the risks of being attacked by the malicious users such as hackers [9]. However, [4] have recognized the problems generated from the transparency of Facebook in maintaining the sociability of the sites itself as shown in Table I.

TABLE I: THE PROBLEMS GENERATED FROM THE TRANSPARENCY OF FACEBOOK[4].

Design Principles	Description
Availability and Ease of Use	Privacy settings should be easy to use so that the users have no difficulty in controlling the settings. "Reminder before sharing" feature can be implemented.
Focus on Privacy Purpose	Should help users to understand the privacy settings.
Restriction on Friends	Friends' suggestion should be eliminated to limit open relationship.
Multiple Social Circles	Provides tool to organize the friend lists effectively.
Limit Oversharing	Provide tool for the user to know to whom the content is shared.
Restrict Default Settings	Default settings should be more restrictive to protect the new users.

To protect privacy in Facebook, [9] has suggested to implement a privacy-protection system (PPS) that can configure the privacy settings based on the user's data automatically into Facebook. The system consists of three components: profile information (PI), privacy manager (PM) and profile zoning (PZ). PI contains two types of information: personal and social information. However, PPS has taken personal information as the main core of the system as it is easy to be obtained. In PZ, the user's data are divided into two zones: one zone with information that is accessible by third party application while the other zone is inaccessible. On the other hand, PM performs the privacy configuration in two phases: Phase I employ the network sampling methods to reveal changes of data while phase II configures profile's data using computational methods which are: revelation matrix that applied statistical analysis and threshold matrix computing average probability of each data. [4] have also concluded that Facebook should be designed according to the six principles as stated in Table II, to balance the sociability and content sharing with the privacy.

TABLE 2: ILLUSTRATED THE FACEBOOK DESIGN PRINCIPLES

Problems	Consequences
Social Curiosity	Peoples tend to look through strangers' profile updates through Newsfeed because of curiosity. Unintentional disclosure of data in Facebook affects data privacy.
Social Tension	The openness of Facebook has made trust in Facebook to be complex. Who to believe is somehow complicated.
Too Many Friends	Friendship is not well differentiated. Hence, it is hard to control to whom and the amount of data to be exposed.
Self-Awareness	Peoples tend to show only parts of themselves in Facebook when they aware of the privacy threat, challenge the initial purpose of content sharing on Facebook.
Ease of Use of the Privacy Settings	Privacy settings in Facebook itself are confusing and difficult to use, often lead to unintentional leakage of data.

Another approach to tackle privacy issue within OSN such as Facebook is through the modification of the current trust adopted currently by these social network. Next section present some related information on trust mechanism in current OSN.

C. Trust Mechanism in Current OSN

Network in OSNs has become more and more diversify since social sites bring together people, often from different type of social ties; consisting of thick bonding and weak bonding [4] Hence, forming a different level of trust among "friends" in the social networking sites. "Thick trust" is formed among those sharing common interests in offline interaction while "thin trust" is formed across strangers [4]. They also claimed that mixing of social circles in OSN could gradually lead to social distrust. Hence, privacy management should be examined together with the trust model in OSNs. OSNs have been believed to generate many security and privacy issues, and thus, trustworthiness in social networks has been doubted after all. However, trust is an important concept in obtaining the user's heart to use the sites. This is because, a certain level of trust is needed in order to make the user

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willing to use the sites and share their private data on the sites. The characteristic of trust can be concluded as [1]:

i. Trust is asymmetric: Trust is not identical; A might trust B fully but A doesn't necessary to trust with the in the same way.
ii. Trust is transitive: A and B trusts each other well and B has a common friend C, that A might not know where A might trust C because of B. However, A might not trust D, a friend of C since their network linkage is getting far.
iii. Trust is context dependent: In other words, trust level towards an individual can be varied based on time, situation and experience. Depends on the context, people tend to trust each other differently.
iv. Trust is personalized: Which means trust is subjective. Two persons can have different opinions regarding the trust level towards a same person.

Currently, the trust model in social networking adopts the following characteristic:

a. *Single- faceted:* The current trust model focus only on one trust characteristic, which is an inadequate model of trust since the Internet environment is so broad and the population of users is wide. It is too general in term of trust beliefs and it has ignored a lot of other important trust concepts such as reputation in their model [5, 6]. Dishonesty can happen [6]. However, trust concepts are very useful in considering the relationship between peoples and it should not be unitary but diverse [5].
b. *Not personalized:* Trust model should be personalized and conjunction with the domain specific model [5,6]. However, current trust model itself does not inhibit a personalized concept, which take-in consideration of the subjective nature and the views of human's trust towards peoples across a large population [5]. In the real world, trust is context dependent and peoples tend to judge people differently with different weight of trust traits. For example, Abu might think that Ali has a high reputation but still he don't beliefs in him because Ali ever tells a lie to him. However, current social networking sites cannot specify the trust level based on the user's customized trust traits on specific individuals.
c. *Trust level cannot be annotated or calculated [5]*: Friendship is not well- categorized in the current social networking sites [1**]**. Hence, the trust level towards different individual cannot be explained in context and yet cannot be calculated accordingly [5]. Thus, the trust value on each "friend" is being uniformity with lists or category, but not differentiated according to percentage of trustiness and how the user weighted the importance of trust traits.

The Trust Management Model [6] such as the Marsh's trust model is one of the pioneers to introduce computational concepts of trust and has represented trust in scalar form while SECURE makes it in a range from including the measure of uncertainty. There are also some simple trust calculation in some of the online community like eBay and Amazon, to enable the members to understand the statements and guide them for purchasing and moreover send feedbacks. However, it is based on single-faceted approach and dishonesty can still happen as mostly they will tend to avoid negative comment [5,6]. Many other trust management systems such as REFEREE, SULTAN, Advogato and Film Trust applied the single-faceted approach, which means they do not inhibit the subjective nature of trust in their users [5].

The multi-faceted idea has utilized the subjectivity of trust nature and view found among the large population. The trust concept such as: honesty, reputation, competency, credibility, confidence, reliability, belief and faith are recognized as the core of this multi-faceted model. Besides that, multi-faceted model is able to support personalization and is context dependent. The multi-faceted of trust and the relationship between the trusts concepts are utilized to reflect the subjectivity of human being into the model [5].

Moreover, King et.al [10] have proposed a multi-faceted management interface that is applicable to both operational and contractual operations. The heterogeneous web services with different levels of capabilities and characteristics can be managed with this multi-faceted interface. Based on the information shared on the current trust mechanism in OSN, there is a need to understand the insight of users perceptions and awareness of the issue faced in OSN particularly facebook. The goal of this survey is to determine if adoption of a better trust model in facebook is required.

Next, the survey design and its findings are outlined.

III. Survey On Insight Of Trust In Online Social Network

To gain insight into different practices regarding trust in Online Social Network, the questionnaire groups participants into three categories as follows, people who are currently using OSNs, people who have used OSNs before but are no longer active, and people who have never signed up in any OSNs. In total, 200 people took part in answering the questionnaire. Among which, 58.5% were female, 41.5% were male. Mostly from age ranges from 21 to 30. Among all the 200 participants that contributed in this survey, there are 179 active OSN users, 12 people that are no longer active in OSNs and 9 people who never or will not sign up in any online social networks.

A. Survey Results and it Findings

Among the 179 respondents who are currently using OSNs, the majority of the profiles are set to be viewable by the friends that are directly linked through the users' networks. This indicated that the OSNs users are more comfortable to share their data to people that they know than exposed everything to the public. We then asked the question of whether these users are happy with the available ways of controlling access to their profiles. We found that most people are pleased with current access control methods; they can share their photos and other contents without doubts. Most of them think that the settings are automated with the previous settings and are easy to control too. Most of the users also think that their privacy is protected in OSN and feel safe when using current OSN. Similarly, most of the users believe that OSN

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will not use their information for other purpose. They feel safe using OSN for content sharing.

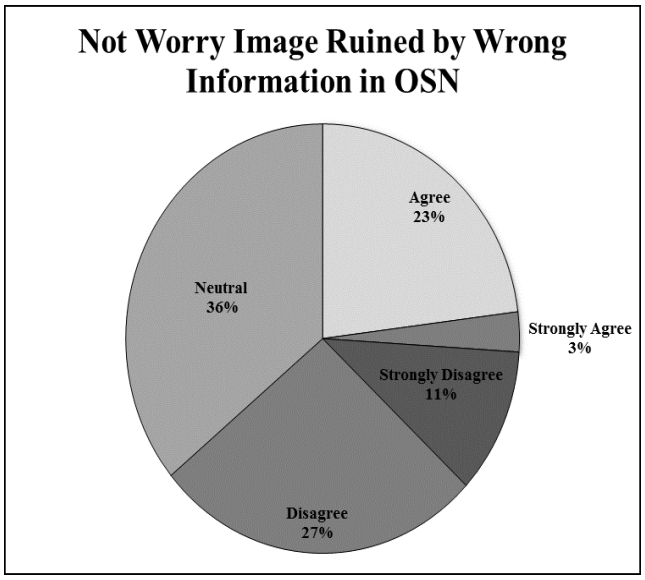

Fig. 1. User satisfaction towards current access control methods- Category One

As Fig. 1. implies, despite relying too much on OSNs, most of the people are worried about their image is being ruined by wrong information posted in OSN, while about 36% of the respondents stand neutral for it. Only approximately 25% of people are not worrying about it. Since most of the people are satisfied with the current access control methods, we asked the question of whether they trust random strangers to view their profiles, as well as the question of whether access control really is necessary. Result has indicated that only 10% of these people actually stated the fact that indeed, they do trust anyone and everyone, including random strangers, viewing their profiles. Most people however, claimed that they do not, while also a small portion of people are not bothered by it at the same time.

We have found a similar response regarding the necessity of access control in OSNs, only less than 10% of these people think it is not necessary, while most people, nearly 77% of the respondents believe that controlling access is necessary, and around 9% of people do not care about having control over their profiles. During their memberships of the 12 respondents who are no longer active in OSN, 75% of people had set their profiles accessible by directly linked networks, while only less than 10% allowed friends of a friend to access their profile. There are only 8% of peoples that set their accessibility to anyone or searchable by search engine. When asked about why you have stopped using OSNs, for instance, a lot of people lost interest in OSNs, mostly due to they are not really happy with the access settings. In our survey, 25% of people in this category have lost trust on OSNs most probably due to some unpleasant experiences during their membership. There are around 20% of people who don't dare to post their private data online, as they are doubt for the confidentiality of their data. When asked whether they think access controls of profiles are necessary in OSNs, this group of people had a similar response to category one. On the other hand, among 9 respondents that never signed up in any OSN, some had no interest, some dislike the idea of having private information on the Internet and none of them have never heard of OSNs.

B. Desired Trust Features and Opinions on the Proposed Solutions

In contrast, when we asked the 200 people the question whether they would trust all their directly linked friends to view all parts of their profiles, most of the respondents only trust some of their connected friends but not all. Most of the people also feel safe when sharing content but only applied to sometimes, while about 20% of them are doubt about the data confidentially and only less than 10% feel definitely comfortable on content sharing. There are only about 5% who don't really care about it. We have found a similar contradictive response regarding the necessity of considering the trust level when sharing contents in OSNs, only less than 10% of these people think it is not necessary, while most people, nearly 65% of the respondents believe that considering the trust level in OSN when sharing something is necessary, and around 29% of people do not care about having control over their profiles and remain neutral. We would like to find out if a multi-faceted model of trust that calculates a weighted average of the eight trusts attributes: credibility, honesty, reliability, reputation, competency, belief, faith and confidence, is to be integrated into OSNs, would that be welcomed?

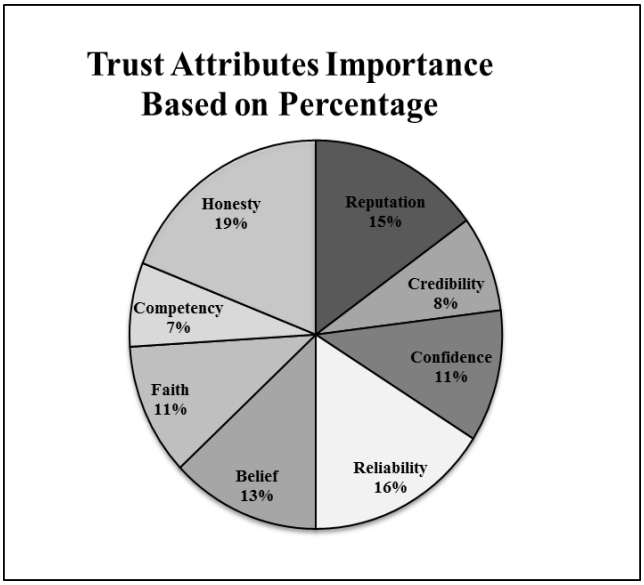

Figure 2: Importance of the 8 Trust Traits

We would like to know is ranking of the eight traits can represent the subjective views of trust in OSNs as well. To do so, we have asked 200 participants who of those eight attributes of trust are most important in their opinions, as shown in Figure 2; honesty appears to be the most important factor, closely followed by reliability and reputation as well as credibility. Many of them think that rating friends in OSNs seems cruel. However, since privacy is an issue they are willing to take the chance, if there is such setting.

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IV. Discussions

Several issues have been discovered during the survey, as discussed within this section:

i. *Current trust mechanisms need to be refined.*

We find out that, in current OSNs, a single faceted mechanism is used, where user can selectively set their profiles accessibility to anyone or specified groups. Even though the users trust each member in a specific group differently, they are not able to state the trust level for each friend separately. Although mostly they are satisfy with the current access settings in OSNs, a large number of peoples are worry for wrong information spread through OSNs about them. There should be a multi-faceted mechanism that allows users to express their various degrees of trust in a person, or a group of people context-specifically since the main problem in current system is that, users cannot express their subjective views on trust freely, and the fundamental trust characteristics mentioned in section 2.4 are not utilized in OSNs.

ii. Need of better control on the accessed of profiles

As our findings have contradictive found that, a large number of users do not trust anyone and everyone to view all parts of their profiles, and believe controls are indeed necessary in OSNs. This means that, existing trust mechanism in OSNs have not achieved user satisfaction, hence, refinement of trust management is needed in OSNs.

iii. Users are unsure about a multi-faceted model of trust with rating features.

Another contradictive findings in this survey is that, users think that trust level should be refined in OSNs, but on the other hand, users are not agree with the rating features. They find it hard to rate someone they know personally and being rated by others too. Such opinions could be the result of a lack of understanding regarding the proposed solution, as for a large percentage of candidates, since the word rating is so open to be interpreted, it would be very hard for them to simply imagine what ratings could be like without having the rough ideas of how it is going on.

iv. Ranking of Trust attributes may bias to sample size & background

The ranking of attributes within the multi-facet model is correlated based on sample size and their background. This may result to biased result and could not be accepted as valid. Without any means to analysed the result by using statistic tool, the current result showing honesty as the most important attribute to determine one's trustworthiness is a weak determinator.

v. Rating based on feedback is lack of reliability

Employing a single method such as feedback and recommender from a list of friends is not enough. There is a need to extend the current trust model within the OSN to adopt computational method based on mathematical or algorithms approach. Any new trust model proposed such as multi-facet trust model should include features in calculating trust computationally to increase the trustworthiness degree. A suggestion to adopt a hybrid trust model in which soft trust (feedback & recommender) is intergrated with hard trust (mathematic representation and algorithm based).

V. Conclusion

This paper discussed about the challenges faced in online social networks nowadays. Research has proved that the current issues can be classified into security and privacy which can give a negative impact on the trustworthiness and integrity of social networking sites. Current trust model in social networking sites using the single- faceted approach is said to be not well differentiate the categorization of friends and the trust value is not personalized and specified. Throughout the comparison and contrasts, a multi-faceted model of trust is proposed by adopting the idea from [29]. Based on the outcome of this research, we will extend our work in the future by evaluating and ranking all the eight trust traits. The ranked attributes will then be an input to designed a computational model within online social network.

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