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Identification of Trustworthy Sellers and Buyers in E-commerce

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ABSTRACT:Shopping through e-commerce websites has become an integral part of our routine and it is all but impossible to imagine a world without this. The success of these marketplaces is attributed not only to the ease that the buyers can have number of options available on a single click, but also to the fact of lesser time consumption. In spite of its cost effectiveness, e-commerce lacks the personal contact with the vendor. Hence for many people this rise of ecommerce was a surprise. How is it that strangers, who may be thousands of miles apart, are willing to trust each other? So the trust is undeniably the most critical factor when customers try to select proper e-commerce sellers for performing transactions online. At the same time Trustworthiness evaluation can't be assessed directly using some pre-defined metrics. It has to be perceived from various parameters including past history, reputation, website quality, and seller's response and customer support. However, these decisions are mainly dependent on the reviews that are posted by the post purchase user. In this paper, we have an approach for evaluating the feedbacks that can act as a decision support system, which can aid users to measure the trustworthiness of the user's opinion about a product or a service. In fact, the main part of the architecture lies in an intelligent layer that proposes three point questions from a collection of prefabricated feedbacks about the targeted product to each user who wants to provide his/her opinion. As a result of the user's selection, the proposed reputation algorithm generates better trust degree of the user, trust score of the feedback, global reputation score of the product and trustworthiness of the sellers.

KEYWORDS: Trustworthiness evaluation, reputation, trust degree, global reputation score.

I.INTRODUCTION

Internet nowadays has become the part and parcel of everyone's life, thanks to the invention of the 4G technology. The number of internet users is still increasing at a rapid rate every day. The online buying and selling has become a buzz word in today's world where a user can find anything, right from a small thing like pencil to the expensive product of cars and planes just on the press of the tip of finger. However, in this era of rapid growth of e-commerce, direct interaction between buyer and seller does not exist resulting in lack of mutual trust. But, users need to feel secure while purchasing a product or a service for the continuous development of e-commerce. Although cryptography and digital signatures and certificates assist users to make their transaction secure, they lack in the construction of a trustful reputation about a specific product or a service [1]. Hence, in order to perceive a trust for the product or service, additional information will be required to build a trust [2].

The trend observed today in e-commerce is that the buyers provide feedbacks and ratings to the products purchased online in lots of discussion forums. It's a very common practice that the users still wish to learn from other user's experiences and comments about a targeted product before buying it. Therefore ratings, feedbacks, recommendations and any other information given by users are very significant for the evaluation of trustworthiness. However, the honesty of this information needs to be verified before it is visible to the consumers. Here lies the significance of feedback evaluation system (TRS); so the analysis of trustworthiness of such feedbacks is the main topic of concern because while some factors like security or quality of services are subject to the direct metrics whereas the trustworthiness of the product in e-commerce cannot be measured easily by evaluating such direct parameters. Currently, the e-commerce jumbos like Amazon and flip kart have their own feedback evaluation systems but they don't provide the specifics about the trust score of feedback given by consumers and hence are less advantageous for buyers to make a buying decision. Therefore, we need a system, which can work as a tool that can help in recognizing

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naughty interruptions of the users, who may intentionally or unintentionally falsify the score associated to the product positively or negatively.

In the literature, there are many works such as [2, 3, 4, and 5] that propose algorithms for calculating a reputation or defining a specific set of possible reputations or ratings based on the semantic analysis of textual feedbacks. However, few of them such as [4, 6, and 7] have been devoted to the semantic analysis of textual feedbacks in order to generate a most trustful trust degree of the user. As opposed to these papers, the user's point of view towards specific prefabricated feedbacks which are stored in knowledge base is analysed. In fact, the user is going to give his opinion on a 2-scale button namely, Accept/Reject on those prefabricated feedbacks. The algorithm also checks whether the user's appreciation about the aspect of a product on a 5-star scale is in accordance with the review associated to it. The bottom line is that the proposed TRS algorithm is used to calculate the trust degree of the user based on the trustworthiness of his/her feedback. The algorithm also calculates trustful reputation score of a product using the trust degree of the user as a coefficient. At the end of the execution, the algorithm applies a trustworthiness degree to each feedback and seller.

The remainder of this paper is structured as: In section 2 we have thrown light on the related work in this area and discussed the terminology of trust and reputation systems. The architecture and flowchart of our system is reviewed in section 3. The next segment explores the minutiae of the proposed system which is followed by implementation details. Finally, we come up with some concluding remarks along with the future work.

II. RELATED WORK & LITERATURE SURVEY

Reputation and trust must be assigned closely to web content in order to estimate usefulness of web content and to use its trustworthiness. We need to create a social interaction, to develop further relations in order to collect more and more information and then filter them and decide about their reliability using TRS [1]. In our work, we have included the analysis of textual feedbacks obtained from the users for generating the reputation score of the various features of the product. However, we need to walk through some of the definitions of trust and reputation:

Definition 1:
The definition of Trust is closely related to the willingness to pay, in online markets such as Amazon, the actual selling price without taking an adequate reflection of the "underlying" trust of other buyers in the seller or even the product. [1] In e-commerce, being trustful is a quality which characterizes a product that a user promises to know from a past experience which is more trustful, or because other users say that it is a reliable product.
Definition 2:
Trust is also considered as a subjective evaluation of the potential outcomes and risks involved by relying on a partner. [1].
Definition 3:
Reputation is generally said or believed to be about a person's or things character or ranking. Related to products and services, it is the subjective opinion based on feelings, past experiences and the viewpoint of a circle of "trustful" people. Reputation is often used in the sense of the community's general reliability and trustworthiness evaluation of a service entity [12]. Therefore, this trust reputation needs to be gathered, collected and filtered so as to generate the most trustful reputation associated with a product, user and seller.

Hasnae RAHIMI, Hanan EL BAKKALI's [1] paper gives the basic idea of trustworthiness and also explains the use of prefabricated feedback asked to the user. The global reputation score of product is calculated with the help of user appreciation about the product and the trust degree of the feedback given by the user.Ankita Thakkar, Mrs. Deepali Vora [8] proposed a system which is feeded by the trust score of a product and trust weight of the person to get the decision of whether to buy a product or not that helps the user in decision making.The system proposed by Gatha kumar, Durai Raj Vincent PM [9] gives the factors which are responsible for gaining trust in online transactions that helps in calculating the trust degree about the contents of the online retailing site.

Xiuzhen Zhang, Lishan Cui [10] suggest in their paper the idea of calculation of trust factors considering the seller's on ecommerce web sites. They try to figure out and find solution to the famous "all good reputation" problem. The authors of [11] propose a method that uses subjective logic in order to analyse trust network (TNA-SL). Hence, this method aims to model in a simple way the relationship between different agents. A single arc means a single trust relationship

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between two nodes A and B [A; B] meaning that A trusts B. However, this trust should have degrees that can represent how much A trusts B. This issue is not taken into account in the paper. However, we should calculate the trust degree of the arc and also the trust degree of the nodes.

III. FLOWCHART OF PROPOSED SOLUTION

Here, the system is being developed that performs the semantic analysis of textual feedbacks given by users to calculate the trustful reputation score for the product and its seller. As soon as the feedback is submitted by the user, the system checks the feedback for its legitimacy and hence performs the concordance testing. If the user fails in this, then the feedback is discarded. This process is repeated for all features. If the user fails in maximum criteria, then he will be considered as a non-genuine rater and is blocked.

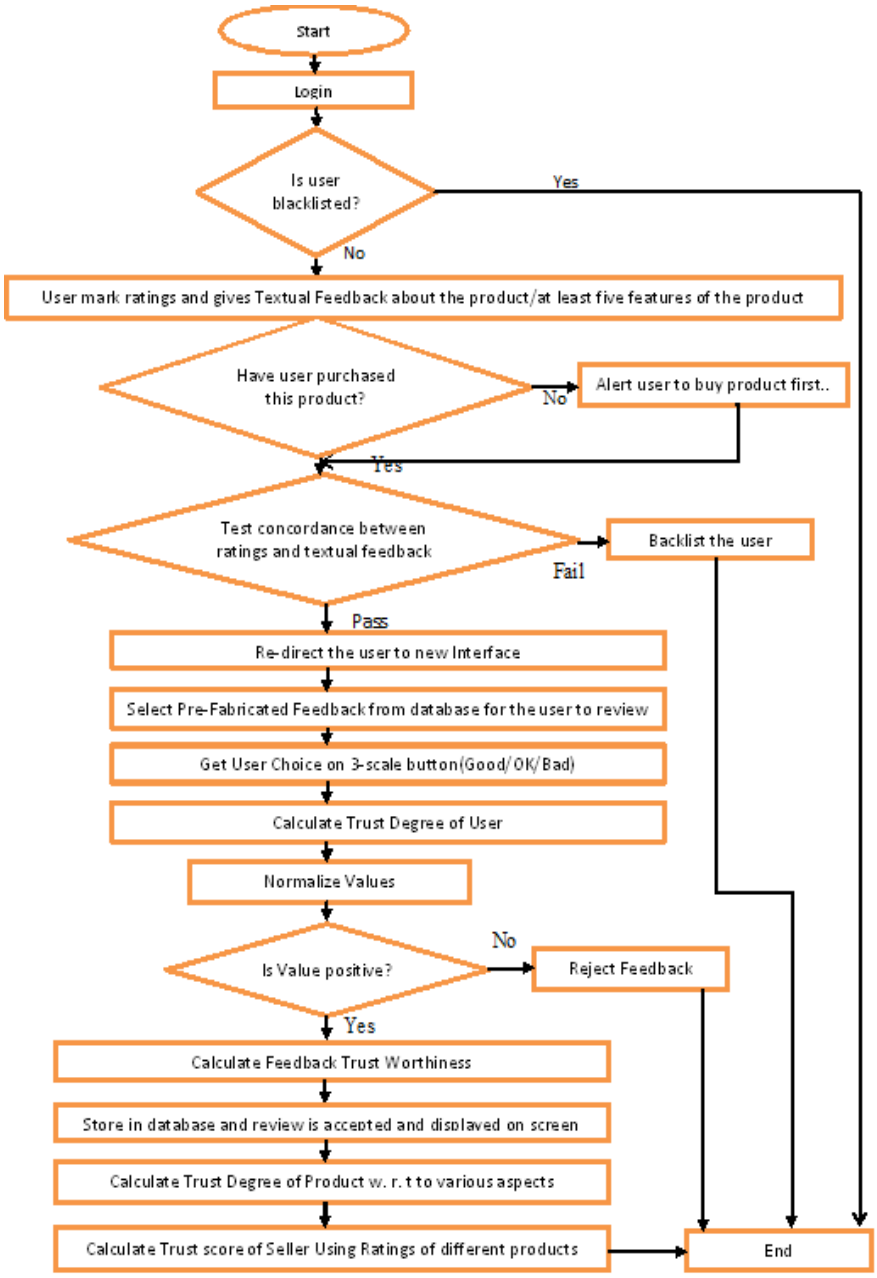

Fig. 1:Flowchart

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IV. WORKING OF ALGORITHM

Our system begins with the user logging into his account by verifying its password. Then a user can purchase the product of his wish and add it to a cart. Now an interface is provided for user to rate a particular product and provide his opinion. The user can select a way to rate a product, that is, he can either provide his review on the entire product or the enlisted features of the product. This rating given by the user is stored in raw database. Now, system checks the legitimacy of the feedback given by the user with the help of reputation algorithm. After receiving the user's feedback and ratings about the product, the concordance between them is verified in order to avoid and eliminate contradiction or malicious programs attacking our system.

A text mining algorithm analyses the textual feedback submitted by the user and calculates its score. For that the POS tagger technique is used, which checks the positive or negative polarity or inclination and evaluates the textual feedback. To do so, POS tagger tokenizes text input and identifies the nouns from the tokenized list. Then it finds out the adjective associated with each noun which is evaluated using SentiWordNet. The coefficient value for adverbs is differently stored in database file, which contains impact value for most commonly used adverbs. This coefficient value is multiplied with adjective that was found out and is assigned to the associated noun, which is provided back to reputation algorithm. Then this algorithm compares quantitative feedback score with this value. If it is aligned, then the feedback is stored in knowledge base. This process is repeated for all the ratings and textual feedback given by the user for the remaining features, which is used to calculate the concordance. If the concordance value is below the critical value, then the user is blacklisted otherwise then the user is considered as little trustworthy and taken to the next phase for further processing.
Actually, there are three types of feedbacks [2]:
1. Positive feedbacks: represent opinions that express a positive point of view about the product. Those corrective opinions contain a positive content concerning the product. Then, the adjective positive is referring to the nature of the content of the feedbacks not its trustworthiness. However, each feedback irrespective of its type can have either a positive trustworthiness or a negative trustworthiness.
2.Negative feedbacks: represent opinions talking negatively about the product. Logically, the users giving such opinions are not satisfied of the commented product. This feedback could be telling the truth or a part from the truth or could be far from the truth.
3.Mitigated feedbacks: represent feedbacks that are talking positively towards some aspects of the product and negatively towards other aspects of the product. They are also characterized by trustworthiness in a range of [-5,5].
Then we need to perform a semantic analysis algorithm to detect the contradiction in a specific content related to a product or its features.

In the next stage, the system updates the trustworthiness score of the product. In the redirected interface, several prefabricated feedbacks are displayed which were stored in the system and whose trust degree is already defined. However, not more than five feedbacks are to be reviewed by the user which will help to examine and evaluate user's view using provided feedbacks of different types. These reviews are randomly selected from the knowledge base and displayed before the user as a special form with the options of Correct/Incorrect. In fact, each of this feedback has trustworthiness score in a threshold range of -5 to 5. If the trustworthiness is closest to 5, the most trustworthy the feedback is. The feedback is very untrustworthy, if the trustworthiness is close to -5. Then the user is going to click on these buttons according to his/her view on each feedback. The user choices of either "accept" or "reject" is an important criterion to determine his trustworthiness.

After extracting the parameters, the trust degree of the user is calculated taking into consideration the type of the trustworthiness of the feedback compared with the user choice. The trust degree of the user can be updated if the user has already a trust degree. This value is updated by getting the previous trust degree of the user if he has been engaged in a transaction earlier or used an application before. Our proposed algorithm honors the user by increasing his trust degree if he agrees a trustworthy feedback or he disagree an untrustworthy one. The incrementing value is proportional to the value of the feedback trustworthiness. For example, when the user choice is a "accept" and the greatest is the feedback trustworthiness, then the honor would be greatest and vice versa. And when the user disagrees a feedback and the greatest is the untrustworthiness of the feedback then also the greatest the honor would be and vice versa. But, the final values needs to be in the range of -5 to 5 that is; the normalization of values is to be performed. So, if this value goes beyond -5, it is converged to -5 and for more than +5, it is taken as +5.

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if (0<feedtrustworth<=1.5) and (userchoice=”accept”)
Or (-1.5=<feedtrustworth<=0) and (userchoice=”reject”)
Degree_trust_user+=0.25
If (1.5<feedtrustworth<=2.5) and(userchoice=” accept”)
Or(-2.5=<feedtrustworth<-1.5) and (userchoice=” reject”)
Degree_trust_user+=0.5
If (2.5<feedtrustworth<=3.5) and (userchoice=” accept”)
Or(-3.5=<feedtrustworth<-2.5) and (userchoice=” reject”)
Degree_trust_user+=0.75
If (3.5<feedtrustworth<=5) and (userchoice=” accept”)
Or (-5=<feedtrustworth<-3.5) and (userchoice=” reject”)
Degree_trust_user+=1

After that, the global trust reputation score for the product is generated or updated using the user’s ratings and his calculated trust degree like the best possible example can be marks and coefficients. Similarly over here, the trust degree of the user is considered as a coefficient and his appreciation as a mark. Consequently, all the rating values multiplied by their respective coefficient are added and then the result of the summation is divided on the summation of all coefficients:
Where
X - Stored trust value in the database
Y- Recently calculated trust value
A - Summation of coefficient on feedbacks
B - Current User ratings

The “X” and “a” values are stored in different tables in the data base so that they can be found separately and above equation is calculated easily. Finally, a Global Trust Value for the product is updated and displayed on the site. Lastly, our proposed algorithm aims to calculate the user’s trust degree according to his attitude towards some fake and prefabricated feedbacks related to his targeted product.

V. WALKTHROUGH OF THE SYSTEM

Let us have a walkthrough of the trustworthiness reputation system developed by us as a user. Fig. 2 shows the snapshot of login page, which is used to authenticate user to ensure that only registered users can access the TRS.

Fig. 2: Login screen

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After the successful login into the system, the user is directed to the default screen, where user can browse through list of various products available on the left side of the screen. User can select any particular product to provide his feedback. By clicking on an image of that model, he will be forwarded to next screen wherein he has to provide the quantitative as well as textual feedback (Fig. 3).

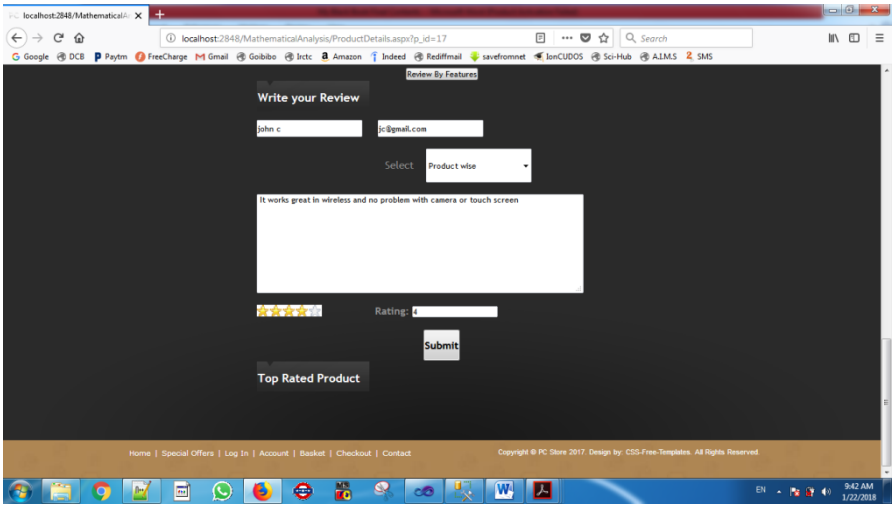

Fig. 3: User provides feedback.

Consider a scenario in which a user has recently bought a mobile and is willing to give feedback about the same model. He can select that model from the list and start giving review. If the user has not bought that product then system generates an alert saying that you cannot provide a feedback without purchasing the same model. The user can provide feedback either product wise or feature wise. Once user clicks on the submit button, the quantitative value of each feature on 5 star scale will be compared with the textual feedback value, which is obtained by performing semantic analysis of the textual feedback. If both values are aligned, i.e., either positively or negatively, but not contradicting, then they are stored in database temporary table.

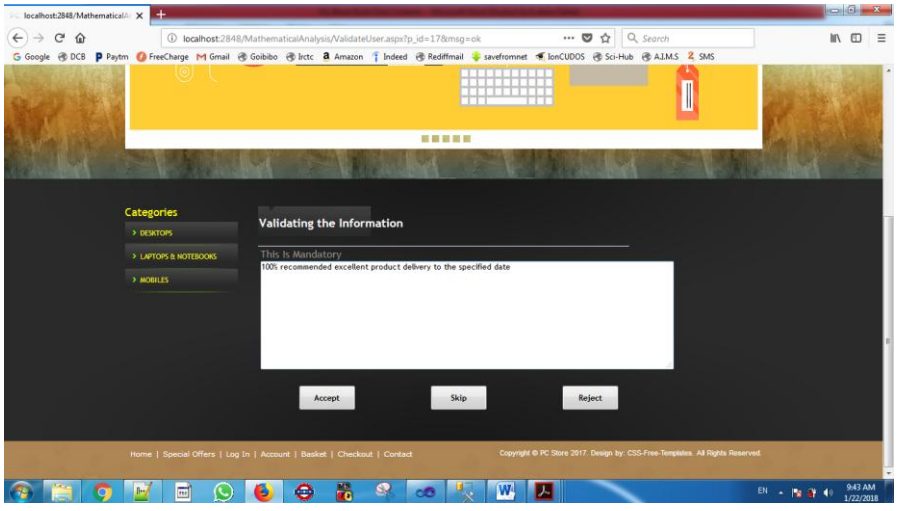

Fig. 4: Accept-Reject screen

Now, the reputation algorithm finds that both 5 star rating and textual feedback value submitted for each feature. If they are not matching then it is treated as non-concordance and the user will be considered as illegitimate user and is

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redirected to the login screen with thank you message and is blacklisted. Otherwise, he is considered as a legitimate rater and is redirected to the next interface, where he is shown randomly selected feedbacks provided by previous users, for his reviews of Agree or Reject (Fig. 4). These reviews are used to compute trust degree of user. The decision of the user's feedback whether accepted or rejected by the system is displayed using an alert message with the newly calculated global trust score of the product. If the feedback is trustworthy, it is accepted and displayed on the product screen for helping other users to buy this product which is shown below:

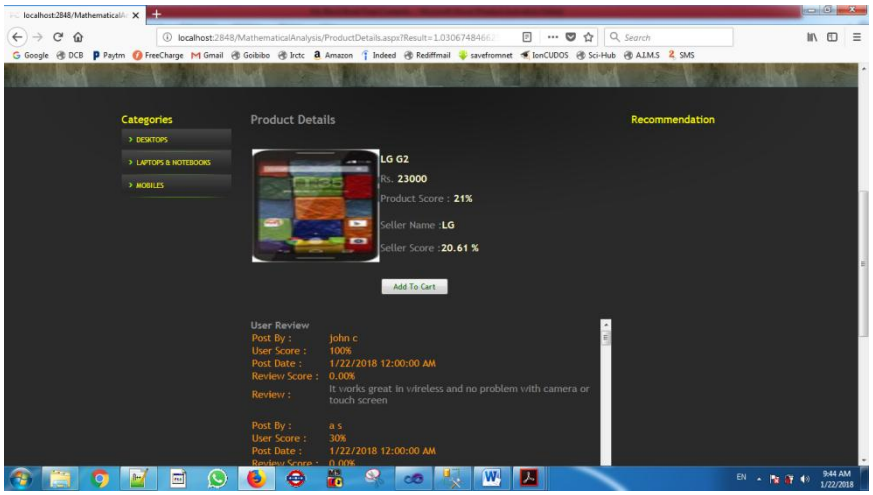

Fig. 5: Accepted Feedback Displayed.

VI.RESULTS AND DISCUSSIONS

The category of 'Mobile Phone' has been selected as a product with the facility to provide reviews on various features in order to implement and analyze this system. Observations have been calculated for six different mobile phone models so that analysis can be done efficiently and accurately. Hence data set with around 150 reviews from different users for different mobile phones is created. The main challenge was to collect the initial genuine feedbacks because it forms the base of our future trustworthiness score. For this, the reviews were collected from only those persons who were using that phone. Also, the user was supposed to rate the quality of different features of that phone on linear 5-point scale. Once the data set is prepared, it was used to calculate the future feedback provider's trustworthiness and seller's reputation score. The graph shows the result for six different phones. Fig. 6 shows the categorization of users based on their trustworthiness score. Fig. 7 shows the result of positive and negative feedbacks for each product along with its global trust degree.

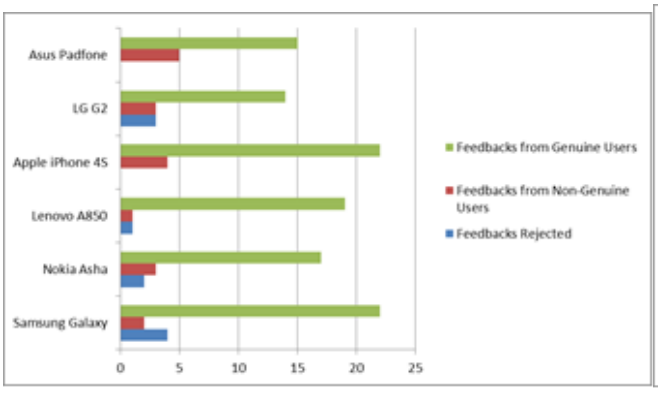

Fig. 6: Feedbacks from Genuine and Non-Genuine Users.

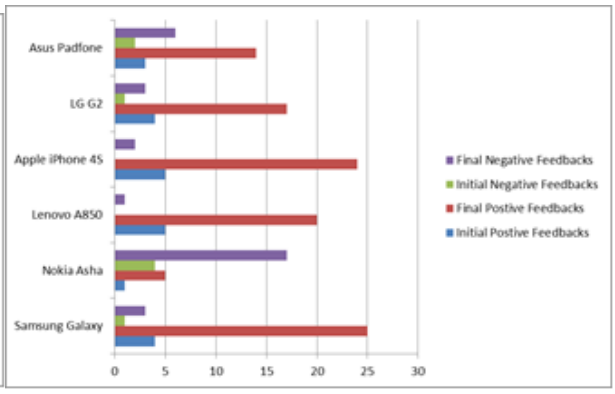

Fig. 7: Positive and Negative Feedbacks.

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CONCLUSION

Trust Evaluation System thus act as an efficient decision support system that aims at creating trust by calculating the trust degree of user, product and seller which in turn help users in taking an appropriate decision about relying on a specific feedback or going forward to perform transaction in e-commerce context.

In this system, a Trust Reputation System is designed based on the analysis of the user's attitude towards a collection of prefabricated textual feedbacks of previous users in the knowledge base. A Trust Reputation algorithm is proposed which attempts to calculate the trust degree of the user according to his subjective marking from three option buttons and the feedback trustworthiness. The proposed reputation algorithm also calculates the global trust reputation score of the product for its different aspects and generates the trustworthiness of the user's given feedback. Finally, the system generates the rating for the sellers based on its products. In our research, we used both markings and especially semantic feedbacks to calculate trust weight and to classify true and mitigated comments in order to inform the users about a product or a seller.

In future, the features of machine learning can be incorporated in our algorithm to make them more efficient, accurate and intelligent. We think that this would not only eliminate false user's feedback but also get rid of the widespread spamming happening in the internet world.

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