The Challenge of Continuous User Participation in eBayanihan: Digitizing Humanitarian Action in A Nationwide Web Mobile Participatory Disaster Management System

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Abstract—Disaster is a complex problem that needs to be addressed using a multidimensional and multiplatform framework in collecting information from disaster agents. Social media has been an additional source of information from the ground. eBayanihan is designed to add the human dimension by providing a mobile and web based reporting tool for citizen reporting aside from collecting information in social media. The system serves as a real time dashboard for government agencies assigned to monitor communities during disaster events. However, success of community based computing systems such as eBayanihan is measured by continuous participation from its users. Appropriate motivation is relevant assuring continuous participation. This paper presents a new method of designing a community based computing environment that uses motivation analysis in determining the most probable critical software features that will maximize continuous user participation. The features to be evaluated were extracted from the development team and an initial survey was conducted to determine user motivations based on the volunteer functions inventory. Initial factor analysis revealed three motivation types, namely: civic responsibility, career, and protection. A second survey evaluated the usefulness of each feature in usage scenarios based on the motivation types identified in the first survey. Results indicate that Posting Messages in an Open Forum, Reputation Rating by Peers and Event Notification via FB, Twitter or Text are affected by two factors, namely user motivation and scenario, further validated in usage statistics in eBayanihan.

I. CONTEXTUALIZING EBAYANIHAN

Developing applications for community-based computing systems is as complex, dynamic and unpredictable as the environment it mimics. The most critical aspect of the development process is choosing the right features to implement to ensure that the crowd participation - the lifeblood of the system - keeps flowing in order for the system to stay alive. This is doubly true when designing, creating and developing such applications in the context of disaster risk reduction and management.

Crowdsourcing [1] is the act of having a crowd participate in the performance of certain tasks such as translation, peer review or, in this case, submitting reports on events being witnessed. It is a portmanteau of "crowd" and "sourcing," and has now been associated with the act of using the internet to perform a previously unknown way of division of labor. Participants who take part in the performance of these tasks have varying motivations for their participation, but the question of maintaining continuous participation is often found difficult to answer. For example, is it a matter of providing extra services or rewards to motivate further participation? Are new features needed to entice users to continue their patronage of a system?

Motivations for user participation can offer the first clues about what kind of features will be most sought after in the application. Choices people make are motivated by their desire to improve themselves and to fulfil their psychological needs. These needs are in-born and form the basic requirements of psychological well-being [3].This theory also proposes that motivation is categorized into two types, intrinsic motivation which is defined as *doing something because it is inherently interesting or enjoyable* and extrinsic motivation which is defined as *something done for an expected and separable outcome* [4]. Crowdsourcing motivators showed that intrinsic motivators greatly outweighed extrinsic motivators such as monetary reward in determining the quality of the outsourced task especially when the extrinsic motivator was low [5].

To validate this new method, a project was chosen as the testbed for this study. Project eBayanihan is a two-year undertaking to design and develop a multi-platform

community-based computing system for disaster risk reduction and management. This system intends to use crowdsourced data and mold this into a visual representation that will allow its target users to see disaster reports vis-a-vis layers of data on risk, vulnerability, exposure, and disaster response planning. Its target users range from citizens living in the remote areas of the country to the leaders in local government units and the national government. For the project to succeed in gathering the data needed, the system used has to be in top form - addressing the nuances of disaster incident reporting, accurately parsing and visualizing the reports on the maps, successfully functioning in the manner by which it is expected to function in order to ensure that both types of users to continue using the system. Continuous participation is critical in generating social capital which is the resource for collective action in a virtual community which may lead to a broad range of individual or group outcomes [6].

The rising usage and affordability of ICT for management and mitigation of disaster has led to accessibility of disaster information to the general public. However, with disaster being a complex system that depends on the action and interaction of agents with and against environmental parameters, there is a need to create a system that can collect, analyze and model human behavior during a disaster. eBayanihan, with its root word coming from 1) bayanihan, a Filipino collectivist behavior of volunteering to help in a community, 2) bayani, which means hero, and 3) bayan which means nation or country, is nationwide ICT based participatory disaster management system, available on the web and mobile, designed to capture human experiences of ordinary citizens during a disaster. eBayanihan is designed to accommodate real time workflow environments of agency clusters and local government units.

This study focuses primarily on finding the critical application features that will drive the continuous participation of users in the system. It was therefore necessary to determine the motivation factors that ensures their continuous participation. The application features to choose from have already been applied in other systems, well-known or otherwise. Most of these involved forms of crowdsourcing. Various systems built on the world wide web in the past decade has demonstrated the power and effectiveness of crowdsourcing in problem solving. While highlighting new and interesting technical and social challenges, it is an emerging field that will drive development of more applications and structure, engaging even more users and solving increasingly complex problems [8]. Complex applications, however needs only a few critical features present that will draw users to the system. The problem is identifying these feature from the long list of possibilities drawn from many successful crowdsourcing applications.

II. LITERATURE REVIEW

Big and small organizations have expressed a common desire to use alternatives to traditional software development methodologies because of their inflexibility and pressure to produce more at lower costs [20]. Agile software development is considered to be one of these alternatives and has been around since the publishing of the Agile Manifesto in 2001 [21]. Lately however, new concepts in IT have emerged such as crowdsourcing. Derived from the terms "crowd" and "outsourcing", it depends on the collective effort of an often large community of disconnected individuals from which to derive extreme value and knowledge with little or no central management. Crowdsourcing application development has proven to be one of the most rewarding and challenging tasks in software engineering. Answers to questions that were previously thought to be out of reach have now become available with the right tools and implementation. This innovation however seems to require us to try newer software development methods to build successful applications. This section discusses different approaches for the development of a crowdsourcing application that is designed for continuous user participation.

A. Promote Continuous User Patronage

A successful crowdsourcing application requires a continuous flow of data from its users to remain relevant. It is important therefore to come up with design strategies such as choosing appropriate incentives and to provide users with incentives in the proper manner as well as to design right user interfaces in developing effective persuasive applications [23]. It can be said that any change applied to a programs existing features can receive varying degrees of acceptance. While current social incentive options being applied by various crowdsourcing applications today are monetary compensation, social facilitation and self-respect, it is also possible to simply just minimize the effort and cognitive load required to contribute to maintain continuous user participation [24]. Understanding user motivation then becomes a crucial feature in the design of the system.

B. User Motivations and Requirements Engineering

Interaction design is dependent on proper requirements engineering which is very crucial in identifying features for continuous user participation. Since agile methodologies also require their own testing techniques, one study has proposed ways of using failed testing in identifying hidden requirements early [32] that would have otherwise been discovered in later iterations. However, there is a need to discover the usage motivations that will drive the prospective community to participate. In the context of influencing factors that may determine participation, there is a striking difference between real-life communities and virtual on-line communities despite social science theories that suggest social dynamics of community life that promote the same instincts in a social setting [33]. Given this, there is a need to incorporate scenarios that mimic real life situations in order to obtain more accurate responses from the users.

C. Rationale for Structured Feature Identification Methods

While finding the right system requirements is obviously the most important part of any software engineering project, it is often the one with the least effort put into. Despite being the part of the project that determines the greatest cost that will be incurred if not done properly, it is performed in most cases

in an ad-hoc manner without any defined processes or methodology [34]. The method for identifying features in this paper could be likened to situational method engineering which focuses on the in-house construction of an organization-specific or project-specific methodological approach [35]. Though it has been a prevalent belief in recent years that no one method fits all project situations [12], this paper hopes to shed light on a method that can be reliably applied for disaster-related crowdsourcing applications. The following sections lists the most common features found in social networking applications which can serve as a basis for testing which set of features will lead to continuous participation.

1) On Twitter and Social Media Networks: Twitter is a microblogging application used by millions of users all over the world. Hence, it can be used for studying general online user behaviour. When posting tweets the primary user intentions are: Daily Chatter (primary), Conversations, Sharing Information/URLs, Reporting News. While the main categories of twitter users are: Information source, Friends, Information seeker [36]. It is then possible to predict user engagement from words used in tweets [37].

2) Open Forum Messaging: The use of hashtags ("#") is done to represent a connection to ideas that are passed along in the tweet which leads to a new form of sociality that is not based on reciprocity or notions of virtual community [38]. It has been demonstrated that Twitter can be used as a discussion forum when German politicians running for office in 2009 engaged with the electorate through the microblogging site [39]. It was their first time to become involved with social networking becoming their own "reputational entrepreneurs".

3) Reputation Rating by Peers: Perceiving content on Twitter usually means that one has subscribed to the updates of another. It is thus a prerequisite for a relationship bond on Twitter that user A has subscribed to user B"s tweets. After reading the messages of other users, the user may choose to amplify the messages by retweeting them or may choose to comment on the content by communicating with the original publisher [40]. A study on the possible models of retweeting behaviour found that people retweet because they share the same interests of the person being retweeted (47% probability), have been recently in contact with that person (28%), or retweet something in their current topic of interest (26%) [41].

4) Get Notified of Events via Facebook, Twitter or Text: Many people use Twitter to update others (e.g., friends, colleagues) about interesting things happening in their personal lives (e.g., whereabouts, interesting articles read, and thoughts). By staying aware of others ongoing updates, people are able to keep in touch with friends and maintain social relationships; this is especially important for contacts that are not part of their daily life or work activities [42].

5) News Alerts Allowing User Comments: As soon as a newsworthy event is tweeted, there is a brief significant correlation with people's subsequent tweets forming what is called a "transient news crowd" [43]. The correlation is weak although significant in terms of similarity between news articles that generate this crowd.

As this crowd disperses over time, parts of some crowds come together again around new newsworthy events. The most retweeted messages are often about persistent newsworthy events, making twitter a reliable source of news and has been seen to disseminate it faster than traditional mass media [44].

6) User-to-User instant messaging: Typing @username in a tweet is a process akin to replying to the last message by that user or calling out to that user hoping for a reply. The most general definition of this symbol is that it means the author of the post is telling a certain user that he thinks they would be interested in the content of the tweet [45]. The most often used method is to preface a tweet with @username (e.g., @Sammy wanna go to the park?). However, @username can appear at any point in the message. It can appear in the middle, if the author wants to address different sections of the tweet to multiple people (e.g., @sammy Ill be over tommorow @sally Ill fix it later).

III. FRAMEWORK

This study asserts that a successful community-based computing system requires continuous user participation. This can be attained if the system is able to maintain the interest of users within the community by understanding the motivations that drive them to participate in any online activity. This information in turn, determines the features the system should possess to achieve this goal. In software development projects, this is the objective of the requirements engineering stage. This study proposes to follow this method to systematically evaluate the user value of proposed features in a crowdsourcing system for disaster risk reduction and management.

A. User Engagement in the Software Development Process

There have been recent studies in software development methods that also used similar theoretical frameworks and methodologies. User motivation was a critical aspect in participatory software development based on a study in 2014. That study suggested an approach that involves engendering user engagement during development is a factor in improving project outcomes [46]. The involvement of users in a system's success is also cited by an empirical investigation via a systematic literature review that was performed in 2014. It concludes that user involvement does contribute positively to system success but may cause more problems than solutions if not managed carefully [15]. A 2011 study on the drivers of information exchange used surveys and online networks in the context of a major natural disaster. It called for socio-technical design principles to address the challenges of communication such as interoperability, authenticity, useability and reliability of citizen information generated during uncertain conditions [6].

B. Dimensions Of User Motivation Factors

Volunteerism motivation factors are the closest relevant factors that would motivate participation in this system context. The goal of this first step is to identify the motivation factors behind users of a disaster risk reduction system. Literature about the Volunteer Functions

Inventory provide insight into eight possible motivation factors, namely: Values, Search For Understanding And Awareness, Social, Career, Protective, Enhancement, Debt/Obligation and Civic Responsibility. The first six motivation factors are based on the volunteer functions inventory [47]. The latter two factors are provided by the Extended Volunteer Function Inventory [48].

C. Using Crowdsourcing For Development

Crowdsourcing can also be used in the process of software engineering [49]. After extracting the dimensions of user motivation factors, each dimension will be used as the context of scenarios for evaluating the value of features that can be implemented by the system. The source of data for all the required information will be from survey respondents who are at least familiar with social networking applications and spend a significant amount of time using these applications. They are the ones who are the most likely to participate in the crowdsourcing application that will be built.

IV. METHODOLOGY IN DERIVING A VARIATION OF THE AGILE METHOD

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A. Obtaining the motivation

The proposed method begins with user motivation analysis. From an original set of 80 candidate statements that underwent expert review, ten candidate statements for each of the six Volunteer Function Inventory motivation factors by Clary, et. al. [47] and two more in the Extended Volunteer Function Inventory factors by Hochstetler [48] were surveyed for their relevance as an indicator of motivation factor in online communities. A total of 34 respondents, 14 males with age range of 18 to 50 years old and 20 females with age range of 19 to 46 years old took this survey. Cronbach's Alpha scores and factor analysis was applied to reduce the list of statements to the most relevant ones per motivation factor.

B. Obtaining the features

An initial set of features which was extracted from studying most common online community based systems is enumerated.

1) Posting Messages in an Open Forum
2) User Reputation Rating by Peers
3) Mapping of Recent and Urgent Events
4) Directory of Site Partners and Groups
5) News Alerts Allowing User Comments
6) Invite and Follow Activities of Friends
7) Get Notified of Events via Facebook, Twitter or Text
8) Emergency last known location tracking
9) User-to-User instant messaging

C. Deriving Motivation on Simulated Scenarios

The study used a 3 x 45 factorial design with Motivation as the first factor and Scenario as the second factor. Motivation is operationally defined as emerging factors from the results of the first phase. Plausible scenarios of

user participation based on the motivation factors were listed based on personal experience and literature. The use of scenarios for evaluating possible features in this study also leans on the fact that as role-playing can be used as an effective teaching tool so that there is greater appreciation of the range of issues and problems in real world settings [50]. A total of fifteen scenarios per remaining motivation factor were included in the succeeding survey for evaluating proposed application features. A survey was then conducted on the perceived importance of each feature under different scenarios. This survey included demographic information such as age, gender, use of social networking and the frequency of use of social applications of the 64 respondents who joined the simulation.

1) Data Analysis: Analysis of variance were used per feature to measure main effects and interaction effects. Main effects will report whether Motivation or Scenario affect Feature score. Interaction effect reports whether both motivation and scenario will affect Feature score. The R statistical package was used to compute for the ANOVA Scores after the data was extracted and fed in CSV format from an automated survey form.

Fig. 1. Sample Survey Form

D. Automating The Survey Form

When the form for the feature-scenario evaluation survey was drafted, the number of items the respondents had to answer reached up to 405 given that there are nine features to be evaluated for 45 scenarios. At least five responses per item was deemed necessary to obtain a reliable evaluation dataset. An automated survey form was created to facilitate in responding to the survey items.

The automated form was coded using Java/Google Web Toolkit and used a PostgreSQL database. Please see the form process diagram at Figure 1. Potential respondents from the disaster response team of the institution were invited to participate via e-mail.

V. RESULTS

A. Motivation Analysis

After obtaining at least 30 respondents to the initial survey in determining the relevance of candidate statements to respective motivation types, Cronbach's Alpha score was 0.976. Factor analysis was used to reduce the number of statements to 69 remaining statements out of the original 81, falling under one of 8

dimensions as computed through Principal Component Analysis (PCA), Varimax rotation, Kaiser Normalization with coefficient values above 0.50. This resulted in only three main factors, namely: Values (10 items) and Civic Responsibility (7 items), Career (9 items), and Protective (7 items).

Table I summarizes the effects of motivation and scenario on each feature.

TABLE I. EFFECT OF MOTIVATION AND SCENARIO ON ONLINE FEATURES

Feature	Results
Posting Messages in an Open Forum*	Affected by Motivation
User Reputation Rating by Peers*	Affected by Motivation and Scenario
Mapping of Recent and Urgent Events	Not affected
Directory of Site Partners and Groups	Not affected
News Alerts Allowing User Comments	Not affected
Invite and Follow Activities of Friends	Not affected
Get Notified of Events via FB, Twitter or Text*	Affected by Scenario
Emergency last known location tracking	Not affected
User-to-User instant messaging	Not affected

B. Feature: Posting Messages in an Open Forum

The posting of free-form or semi-structured messages by users that can be viewed by all other users can be found on most social networking sites. Results show that Motivation has a significant effect on this feature's score (p = .0339) with resulting mean motivation scores as Civic Responsibility = 4.33, Career = 4.12, Protective = 4.02. The mean motivation score is high across the three motivation types indicating a solid pattern of importance among all respondents (5 is the highest possible score). This suggests that the feature will be sought after by the most motivated users of this system which should have a positive effect on their continuous participation.

C. Feature: User Reputation Rating by Peers

User Reputation Rating by Peers involve attaching a reputation rating for each user as they are rated by the fellow users. They may be rated by their responses to questions posted by other users and a scoreboard that is accessible to all shows their current rankings. Results show that there is an interaction effect between the two factors (Motivation and Scenario) on user reputation at p = .015. This means that increase in usage of this feature is contextually based on both the motivation and the scenario. For user reputation, civic responsibility scored 3.44, career scored 3.38 while protective scored 3.26. While not averaging as high as the previous feature, it still manages a consistent level of importance among all respondents. This suggests that the feature may still be a relevant feature that will encourage continuous participation in some scenarios.

D. Feature: Mapping of Recent and Urgent Events

Reported events by users are automatically plotted on a common map. This could represent events that have already been vetted by some process to ensure the reports are accurate and uses intelligent icons to quickly understand the meanings of each symbol that appears on the map. Results show no main effects and interaction effects thus, motivation and scenario does not affect use of this feature.

E. Feature: Directory of Site Partners and Groups

Provision of a directory of site partners and groups make it easier for users to locate and contact the site's partner organizations. While there is little direct benefit in terms of increasing user participation, having partner organizations can also attract new users to the system. Results however show no main effects and interaction effects. Motivation and scenario does not affect use of this feature.

F. Feature: News Alerts Allowing User Comments

More recently, news feeds in social media platforms allow its readers to provide direct and immediate feedback on the topic. In some cases, readers are even allowed to specifically indicate their emotional state after reading the article. Results however show no main effects nor interaction effects. This means that motivation and scenario does not affect use of this feature.

G. Feature: Invite and Follow Activities of Friends

With the implicit and explicit design of social networking platforms to provide seamless extension of networked communities, this feature makes it easier to bring friends and acquaintances from other sites into this community. Results however show no main effects and interaction effects. Motivation and scenario does not affect use of this feature.

H. Feature: Get Notified of Events via FB, Twitter or Text

In most cases, the features of an online community platform are directly driven by the user. This means that it is the user's action, through use of certain features, that drives the system to its next state. For example, if the user chooses to reply to a post, in the next state, the system will provide a reply box where the user can type in the comment. Provision of a notification service on the other hand allows for a system controlled scenario, wherein users are notified or alerted to interact with the system. For example, users can subscribe to a notification service that sends an alert via a chosen medium whenever a significant event is reported to the group. This keeps the user updated on the events happening in the community. Results show that Scenario has a main effect on notification (p = .0176). Use of the system because of civic responsiblity obtained a mean score of 3.82 while career obtained a mean score of 3.82. Use of the system to protect the person or community scored a 3.76. Notification feature manages a slightly better average score across all motivations than User Reputation Rating by Peers but with a smaller difference between them. This suggests that the feature will be find more usage in certain scenarios with a larger group of users composed of highly motivated and not-as-highly-motivated individuals.

I. Feature: Emergency last known location tracking

In disaster management systems, allowing users to be tracked using their mobile devices makes it easier to locate them if they ever need to be rescued. Though this seems to be a relevant feature, results however show no main effects and interaction effects. Motivation and scenario does not affect use of this feature.

J. Feature: User-to-User instant messaging

User-to-user instant messaging is a variation of messaging where the conversation is known only by the involved parties. It often acts as an alternate method of communication between users which makes visiting the site more appealing if there is a good chance that one will be able to converse with friends or other users in a more casual manner. Results however show no main effects and interaction effects. Motivation and scenario does not affect use of this feature.

In summary, three motivational factors that promote continuous participation include civic responsibility, career and protection. There are also three main features that can be incorporated in the design of the system to ensure continuous participation, namely: allowing users to post messages in public, user reputation by peers, and receiving notification for events.

VI. VALIDATION OF SIGNIFICANT FEATURES THROUGH EBAYANIHAN NATIONWIDE PARTICIPATORY DISASTER MANAGEMENT SYSTEM

After developing the design framework stemming from what motivates a user as well as what features influences continuous participation, there is a need to validate this on existing online platforms. For this study, we use ebayanihan, a nationwide participatory web and mobile disaster management system developed in the Philippines. eBayanihan is a system that addresses the gap in most disaster management systems which fails to directly measure human dimension and human movement during disaster. eBayanihan serves as a platform for information dissemination among agents during a disaster event. The system is divided into three major components: eHANDA (preparedness), eBAYANIHAN (response), and eULAT (report).
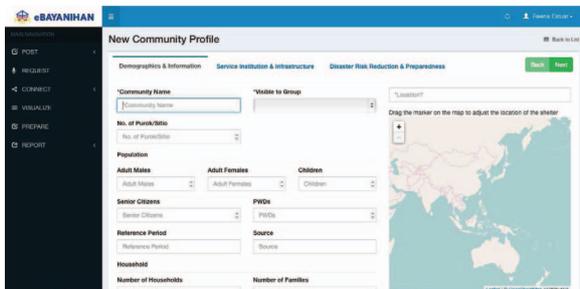
Fig. 2.   Community Profile

eHANDA allows users to upload basic community profile including information on demographics, service institutions as well as disaster risk and preparedness information. Figure 2 shows a screen shot of eHANDA. Providing basic community profile allows first responders to conduct a quick risk assessment especially in areas that will be affected by the path of the storm.

eBAYANIHAN allows users to post and view incidents, create volunteer requests, post shelter information pertaining to human security variables relevant to humanitarian agencies, and connect to social media using standard hashtags and keywords. Figure 3 shows screen shot of how the public can posts reports. Users of the system also receive a notification if there are posts
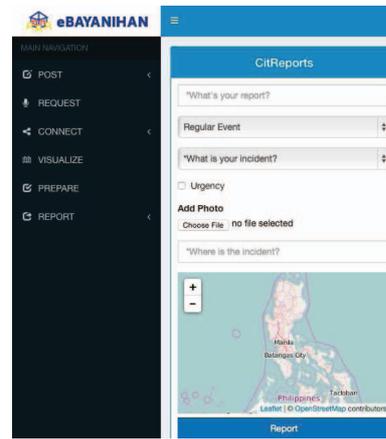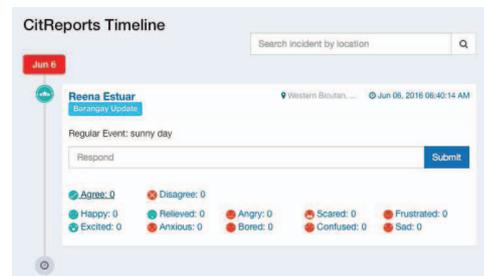
Fig. 3.   Citizen Reporting in eBayanihan

Fig. 4.   Rating user posts by approval or disapproval

related to the user's notification preferences as seen in Figure 5.

eULAT (report) allows users to produce real time reports and visualizations that serve as actionable information especially during critical moments when major decisions rely on relevant information that can be produced by the system.

Starting its launch in 2015, eBayanihan has 1344 users. Table II shows the usage statistics of the major features in eBayanihan. The events recorded actual tropical storms that occured in 2015. Except for Typhoon Lando, all other earlier tropical storm events, usage of the system was left to the public. However, during Typhoon Lando, eBayanihan made an explicit call to the public to volunteer and contribute by providing information in their areas as well as verify and plot reports coming from Twitter. It is in this event that we see that posting public messages, followed by user rating as well as notification to users of events validated the findings of this study.
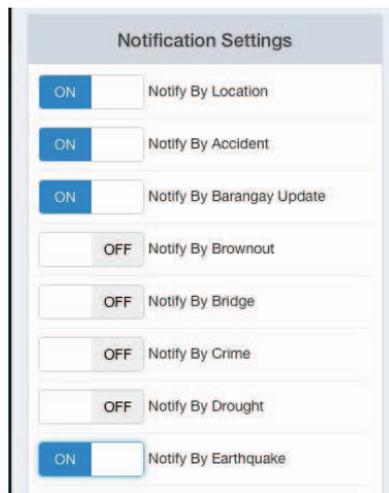
Fig. 5. User notification

VII. Discussion

The challenge in developing a community based computing system is ensuring its usability (so that users will find it easy to use as well as find it useful) but more so on its continuous engagement (so that users will be motivated to continue using the system). This study attempts to use motivation analysis and survey to identify system features for a real-world software development project. However, a different approach is needed when it comes to attempting to identify the best software features for continuous engagement for an extremely large community of users. An analysis of the crowd's motivation and preferences is a viable and probably more cost-effective procedure compared to other requirements engineering methods and tools.

Crowdsourcing can be a feasible development tool. The effort of conducting the experiments done by this study show that even a small team can perform crowdsourced studies for large projects at a reasonable cost. It is very important to find out what motivates users. The most motivated users are the ones who will most likely keep participating for the longest time. They are also most likely to deliver the best quality of participation. Community-based computing application users are often motivated by altruistic values as shown in this study where values and civic responsiblity motivations scored the most for this particular application. For continuous participation in crowdsourced systems such as eBayani-han, it is necessary to deliver the features that the most motivated of users find useful. Like all other social networking platforms that provide not only social connectivity but more so allow to capture and monitor behavior, it is always good to know that features will change over time depending on how people use the system as well as external factors that may influence different features to emerge.

VIII. Acknowledgments

References

[1] Jeff Howe. The Rise of Crowdsourcing. *Wired*. http://www.wired.com/2006/06/crowds/, 2016. Accessed: 2015.

[2] Jawed Siddiqi and M Chandra Shekaran. Requirements engineering: The emerging wisdom. *IEEE Software*, 13(2):15–19, 1996.

[3] Edward L Deci and Richard M Ryan. *Handbook of self-determination research*. University Rochester Press, 2002.

[4] Richard M Ryan and Edward L Deci. Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary educational psychology*, 25(1):54–67, 2000.

[5] Jakob Rogstadius, Vassilis Kostakos, Aniket Kittur, Boris Smus, Jim Laredo, and Maja Vukovic. An assessment of intrinsic and extrinsic motivation on task performance in crowdsourcing markets. In *ICWSM*, 2011.

[6] Yong Lu and Dan Yang. Information exchange in virtual communities under extreme disaster conditions. *Decision Support Systems*, 50(2):529–538, 2011.

[7] Torgeir Dingsøyr, Tore Dybå, N Brede Moe, T Dingsøyr, T Dybå, and N Brede Moe. Agile software development. *Agile Software Development: Current Research and Future Directions, ISBN 978-3-642-12574-4. Springer-Verlag Berlin Heidelberg, 2010*, 1, 2010.

[8] Anhai Doan, Raghu Ramakrishnan, and Alon Y Halevy. Crowdsourcing systems on the world-wide web. *Communications of the ACM*, 54(4):86–96, 2011.

[9] InnoCentive Inc. 5 examples of companies innovating with crowdsourcing. http://www.innocentive.com/blog/2013/10/18/5-examples-of-companies-innovating-with-crowdsourcing/, 2013. Accessed: 2014-02-07.

[10] Haoqi Zhang, Eric Horvitz, Rob C Miller, and David C Parkes. Crowdsourcing general computation. 2011.

[11] Ke Li, Junchao Xiao, Yongji Wang, and Qing Wang. Analysis of the key factors for software quality in crowdsourcing development: An empirical study on topcoder. com. In *COMPSAC*, pages 812–817, 2013.

[12] Omid Jafarinezhad and Raman Ramsin. Development of situational requirements engineering processes: A process factory approach. In *Computer Software and Applications Conference (COMPSAC), 2012 IEEE 36th Annual*, pages 279–288. IEEE, 2012.

[13] Tore Dybå and Torgeir Dingsøyr. Empirical studies of agile software development: A systematic review. *Information and software technology*, 50(9):833–859, 2008.

[14] Claes Wohlin, Martin Höst, and Kennet Henningsson. Empirical research methods in software engineering. In *Empirical methods and studies in software engineering*, pages 7–23. Springer, 2003.

[15] Muneera Bano and Didar Zowghi. A systematic review on the relationship between user involvement and system success. *Information and Software Technology*, 2014.

[16] Barbara Kitchenham, O Pearl Brereton, David Budgen, Mark Turner, John Bailey, and Stephen Linkman. Systematic literature reviews in software engineering–a systematic literature review. *Information and software technology*, 51(1):7–15, 2009.

[17] Barbara Kitchenham, Rialette Pretorius, David Budgen, O Pearl Brereton, Mark Turner, Mahmood Niazi, and Stephen Linkman. Systematic literature reviews in software engineering–a tertiary study. *Information and Software Technology*, 52(8):792–805, 2010.

[18] Julien Lemétayer. identifying the critical factors in software development methodology fit. 2010.

[19] Victor R Basili, Gianluigi Caldiera, and H Dieter Rombach. Experience factory. *Encyclopedia of software engineering*, 1994.

[20] Mikael Lindvall, Dirk Muthig, Aldo Dagnino, Christina Wallin, Michael Stupperich, David Kiefer, John May, and Tuomo Kahkonen. Agile software development in large organizations. *Computer*, 37(12):26–34, 2004.

[21] Martin Fowler and Jim Highsmith. The agile manifesto. *Software Development*, 9(8):28–35, 2001.

[22] Rick Kazman and Hong-Mei Chen. The metropolis model a new logic for development of crowdsourced systems. *Communications of the ACM*, 52(7):76–84, 2009.

[23] Hiroaki Kimura and Tatsuo Nakajima. Designing persuasive applications to motivate sustainable behavior in collectivist cultures. *PsychNology Journal*, 9(1):7–28, 2011.

[24] Mizuki Sakamoto, Hairihan Tong, Yefeng Liu, Tatsuo Nakajima, and Sayaka Akioka. Designing incentives for community-based mobile crowdsourcing service architecture. In *Database and Expert Systems Applications*, pages 17–33. Springer, 2014.

[25] Tsun Chow and Dac-Buu Cao. A survey study of critical success factors in agile software projects. *Journal of Systems and Software*, 81(6):961–971, 2008.

[26] Michail Lolidis. Kaizen definition & principles in brief - a concept & tool for employees involvement. http://www.michailolidis.gr/pdf/KAIZEN08.pdf, December 2006. Accessed September 8, 2014.

[27] Jagdeep Singh and Harwinder Singh. Kaizen philosophy: a review of literature. *The IUP Journal of Operations Management*, 8(2):51–72, 2009.

[28] VILJAN MAHNIC. Improving software development through combination of scrum and kanban.

[29] Patrick Wilson. Active story: A low fidelity prototyping and distributed usability testing tool for agile teams. *Univerity of Calgary, MSc Thesis August*, 2008.

[30] Pekka Abrahamsson, Juhani Warsta, Mikko T Siponen, and Jussi Ronkainen. New directions on agile methods: a comparative analysis. In *Software Engineering, 2003. Proceedings. 25th International Conference on*, pages 244–254. Ieee, 2003.

[31] Jennifer Ferreira. Interaction design and agile development: a real world perspective. 2008.

[32] Agustín Yagüe, Pilar Rodríguez, and Juan Garbajosa. Optimizing agile processes by early identification of hidden requirements. In *Agile Processes in Software Engineering and Extreme Programming*, pages 180–185. Springer, 2009.

[33] Manoj Parameswaran and Andrew B Whinston. Research issues in social computing. *Journal of the Association for Information Systems*, 8(6), 2007.

[34] Chad Raymond Coulin. *A situational approach and intelligent tool for collaborative requirements elicitation*. PhD thesis, Université Paul Sabatier (Toulouse III, 2007.

[35] Brian Henderson-Sellers and Jolita Ralyté. Situational method engineering: State-of-the-art review. *J. UCS*, 16(3):424–478, 2010.

[36] Akshay Java, Xiaodan Song, Tim Finin, and Belle Tseng. Why we twitter: understanding microblogging usage and communities. In *Proceedings of the 9th WebKDD and 1st SNA-KDD 2007 workshop on Web mining and social network analysis*, pages 56–65. ACM, 2007.

[37] Jalal Mahmud, Jilin Chen, and Jeffrey Nichols. Why are you more engaged? predicting social engagement from word use. *arXiv preprint arXiv:1402.6690*, 2014.

[38] Judith Enriquez-Gibson. Following hushtag (#) mooc: mobility of online courses on twitter.

[39] Thomas Plotkowiak and Katarina Stanoevska-Slabeva. German politicians and their twitter networks in the bundestag election 2009. *First Monday*, 18(5), 2013.

[40] Isabel Anger and Christian Kittl. Measuring influence on twitter. In *Proceedings of the 11th International Conference on Knowledge Management and Knowledge Technologies*, page 31. ACM, 2011.

[41] Sofus A Macskassy and Matthew Michelson. Why do people retweet? anti-homophily wins the day! In *ICWSM*, 2011.

[42] Dejin Zhao and Mary Beth Rosson. How and why people twitter: the role that micro-blogging plays in informal communication at work. In *Proceedings of the ACM 2009 international conference on Supporting group work*, pages 243–252. ACM, 2009.

[43] Janette Lehmann, Carlos Castillo, Mounia Lalmas, and Ethan Zuckerman. Transient news crowds in social media. In *ICWSM*, 2013.

[44] Haewoon Kwak, Changhyun Lee, Hosung Park, and Sue Moon. What is twitter, a social network or a news media? In *Proceedings of the 19th international conference on World wide web*, pages 591–600. ACM, 2010.

[45] Max Kaufmann and Jugal Kalita. Syntactic normalization of twitter messages. In *International conference on natural language processing, Kharagpur, India*, 2010.

[46] Peggy M Beranek, Gary Klein, and James J Jiang. Building user engagement for successful software projects: Meaningfulness, safety, and availability. *Pacific Asia Journal of the Association for Information Systems*, 6(3):1, 2014.

[47] E Gil Clary, Mark Snyder, Robert D Ridge, John Copeland, Arthur A Stukas, Julie Haugen, and Peter Miene. Understanding and assessing the motivations of volunteers: a functional approach. *Journal of personality and social psychology*, 74(6):1516, 1998.

[48] Jay J Hochstetler. *Revising the Volunteer Functions Inventory: An Exploratory Study of Additional Functions*. Northcentral University, 2014.

[49] Kathryn T Stolee and Sebastian Elbaum. Exploring the use of crowdsourcing to support empirical studies in software engineering. In *Proceedings of the 2010 ACM-IEEE International Symposium on Empirical Software Engineering and Measurement*, page 35. ACM, 2010.

[50] Didar Zowghi and Suresh Paryani. Teaching requirements engineering through role playing: Lessons learnt. In *Requirements Engineering Conference, 2003. Proceedings. 11th IEEE International*, pages 233–241. IEEE, 2003.

[51] Ather I Nawaz and Imran A Zualkernan. The role of agile practices in disaster management and recovery: a case study. In *Proceedings of the 2009 Conference of the Center for Advanced Studies on Collaborative Research*, pages 164–173. IBM Corp., 2009.

[52] Michael Tomasello and Amrisha Vaish. Origins of human cooperation and morality. *Annual review of psychology*, 64:231–255, 2013.

[53] Michael B Frisch and Meg Gerrard. Natural helping systems: A survey of red cross volunteers. *American Journal of Community Psychology*, 9(5):567–579, 1981.

[54] Ben MF Law, Daniel TL Shek, and Cecilia MS Ma. Exploration of the factorial structure of the revised personal functions of the volunteerism scale for chinese adolescents. *Social indicators research*, 100(3):517–537, 2011.