Animating Information Dissemination Through a Gamified Online Forum

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Abstract— **Various online forums aim to facilitate information dissemination within particular knowledge domains. A successful forum needs active participation and contributions from individuals. Just like common information systems, most online forum systems were designed without consideration of motivating users. Gamification works of an online forum is presented in this article. The gamification work provides several game mechanisms motivating users to participate and contribute more actively, which eventually leads to a more effective platform for information sharing and opinions exchanging. The completed gamification work verified the feasibility of gamifying an open-sourced online forum system. In addition, a preliminary qualitative evaluation shows that diverse mechanisms brought different effectiveness and experiences to users.**

Keywords - Forum; information dissemination; motive; gamification; servlet.

I. INTRODUCTION

In the age of Internet, online forums have being deployed widely for people in similar knowledge domains or with close interests to share information and exchange opinions. Both professionals and amateurs expect to swiftly acquire knowledge and experiences via browsing contents in various online forums, or they will spend much more time to accumulate the same stuff by themselves. Obviously, to serve as an effective platform for information dissemination, an online forum needs active participation and contributions from its users. Many online forums gradually withered due to decreasing participation and contributions from users. Unfortunately, the presence of these gradually withered online forums will be further deteriorated by many search engines favoring Web sites with up-to-date and intensively-referred materials [1]. Even worse, the lack of participation/contribution and deteriorated search engine visibility will form a vicious circle. Accordingly, motivating users is a critical task for successfully operating an effective online forum.

There are many options for people who are looking for an online forum system, and many of them even come with free licenses. However, these online forum systems were designed by people who applied conventional software system development procedure and principles, which results in a system with complete and correct functions, but their users likely to have no strong motive to actively use these functions.

In light of the significance of an animating online forum system and the lack of relevant works, this work tried to renovate an online forum system: JForum [2], through gamifying it. The anticipated benefit is motivating its users to participate and contribute more actively.

The remaining parts of this article are organized as follows: Section II briefs prior works regarding the gamification and its applications in information systems; Section III describes the analysis and design works of gamifying the JForum; Section IV describes the corresponding implementation details; and the concluding remarks and future directions were provided in Section V.

II. REVIEW OF PRIOR WORKS

Just like the mentioned online forum systems, most information systems were designed without consideration of motivating users, because the traditional design philosophy only takes functionality and accountability into account, but ignore the role that user's motive play in an individual's overall performance. As a result, the so-called well-designed information systems offer complete functions that enable users to accomplish their assigned tasks correctly, but did not equip any mechanisms to motivate users to perform tasks more actively or even enthusiastically.

The routine tasks bore people; prior study indicated that employee's working quality will degrade if they experience boredom [3]. In highly informationized working environments, people heavily rely on various information systems to complete their routine tasks. Consequently, designers need to take user's motive into account while they are developing an information system. To create a more animating working environment in the age of informationization, gamification of information systems properly emerges as a popular approach.

Usually, gamification refers to embedding game mechanisms into a non-game environment, such as information system [4, 5]. The original idea is planting users' engagement and addiction that could be found while they are playing various games into their working environments. Its purpose is to strengthen users' motivation, i.e., it makes users perform tasks with more fun, stronger motive, and deeper engagement. Once each individual is well motivated, the overall performance of an organization could be improved consequently.

With widely recognition of its effects, gamification has been applied by enterprises to animate their employees, i.e.,

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users of their information systems. According to a report from Gartner, over 70% of global 2000 enterprises have used gamification to renovate their information system before 2014 [6]. Among many successful cases, Starbucks gamified one of their supply chain management systems by ranking suppliers in a leaderboard according to their on-time delivery records. The operations of the gamified system motivated suppliers in the supply chain to fulfill orders on time, thus earned better ranks meaning better efficiency and administration. The consequence brought to Starbucks were higher percentage of on-time delivery of supplies, lower logistics cost, and more profits [7]. Delta airlines successfully used a mobile application (APP) with a number of game mechanisms to enhance its public recognition, customer loyalty, and revenue [8]. Not only in traditional manufacturing and service industries, gamification also was adopted by software developers, who integrated gamification components into software development process, and the preliminary results indicated that improved quality of software and corresponding documents [9].

Including the mentioned cases, the success of many prior experiences [10]-[13] collectively point out an important fact: successful gamification of an information system does not necessarily rely on complex game mechanisms. By contrast, the key factors are identifying the parts that do need motivating users, and then embed proper game mechanisms to increase users' motivation and engagement, which usually lead to better performance and outcomes [14].

III. PROCESS OF GAMIFYING AN ONLINE FORUM

The JForum, an online forum system with Berkeley Software Distribution (BSD) license terms, was selected to gamify due to its openness and popularity. The gamification implies renovating an existing information system rather than creating a new one from scratch, thus openness is critical. Generally speaking, a gamification process comprises the following key activities before embedding game mechanisms into the existing system: understanding the users, setting missions, identifying motivations, and selecting effective game mechanisms accordingly [15]. This section delineates the particular process of gamifying the JForum in this work.

A. Users and Missions Analysis

Rationally, target users of an online forum share a common profile: they are willing to acquire knowledge during the course of interacting with others, so they likely to be socializers, explorers, and achievers according to the Bartle's player type categorization [16]. Socializers enjoy the interactions with peers in the forum, explorers are happy to find new information that they never know, and achievers can feel satisfaction by observing peers responded or recognized the helpful information that they provided.

Obviously, reasonable target business outcomes of a gamified online forum include more active participation and more productive contributions from users. Consequently, the missions of a gamification work should be to encourage people to join the forum, participate the discussions, and contribute (raise issues or provide information) more valuable contents.

B. Motivational Drivers Identification

With clear missions, then we need to identify factors that are able to drive people perform what we intend them to do. A number of motivational drivers [14] that suits with target users are described as follows:

1) Collecting: For a long time, people enjoy collecting of either physical or abstract things such as coins or number of friends on social networks, which are meaningful to the collectors, in terms of value, security, or social status. Furthermore, once a collection starts, people tend to complete it, so if a collection could be infinite, the collecting activities will keep going.

2) Connecting: Connecting with people, especially those who share common interests or characteristics with us, makes our life enjoyable. This explains the foundation of various associations, clubs, fellowships, etc. Although being a member of a forum itself is making connections with other people, users still have motivation to expand the connections with people outside of the forum.

3) Achievement: People get great satisfication from achievement, which usually means successfully dealing with challenges. The positive psychological feedback makes us be willing to rise to the same challenge repeatedly, even we know that we probably fail sometimes.

4) Feedback: The feedback means acknowledgement, recognition, or just response to initiators' actions or messages. Feedback enhances the sense of being noticed, so not receiving feedback is extremely demotivating to anyone. Providing feedback is very important to encourage continuous participation and contributions in a forum.

5) Autonomy: Just like average people, members of a forum does not want the contents quality or atmosphere of the forum they join shift to a situation that they dislike to see but unable to restrain it. Therefore, if there is a trigger available, they tend to take necessary actions when they encounter any latency leading to these situations, such as offensive or inappropriate contents.

6) Fear of punishment: Members in a forum, just like most members in a society, tend to avoid speech and behaviors leading to punishment, this tendency gradually develops social norms or the corresponding regulations in written. Unlike the other motivational drivers that stimulate people to do something, this factor prevents members from doing things that are improper in a particular circumstance.

After setting missions and identifying motivation drivers, the next step is to embed proper game mechanisms that are able to motivate the users.

C. Selecting A Set of Suitable Game Mechanims

A game mechanism refers to a component with which users interact during the process of playing games. Besides its visible part displaying on the user interface, a mechanism

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also includes a set of rules that govern how this mechanism works. To realize the mentioned missions for encouraging users' participation and meaningful contributions, the following 5 game mechanisms were selected to embed into the JForum. Each mechanism's characteristics and the motivational drivers it offers were described as follows:

1) Points: The most popular mechanism in various games and have been widely applied in commercial contexts to reward customers' loyalty. Points motivate users due to humans' intrinsic desire to collect things such as money, stamps, antiques, etc. Besides, awarding points to users for her/his participation and contributions is a rational approach to recognizing their activities in the forum. In this work, points will be awarded to encourage certain types of actions including login, raise new topic, post new message, reply a message; as well as will be deducted to discourage other types of actions such as posting inappropriate contents, abusive reporting, etc.

2) Leaderboard: This mechanism ranks users according to their achievements within a specific context, which usually be representable in the form of points. It forms a competitive atmosphere, which encourages those who dislike following behind peers to engage the forum more actively.

3) Badges: To award memebrs accumelating a certain amount of points, specific types of badges will be granted. Usually, there are multiple types of badges honoring achievements in different levels of difficulty, or with different types of works. In the latter case, collecting badges will motivate some members.

4) Facebook likes: To use the plugins Application Programming Interface (API) of the Facebook, members' messages could be exposed on the largest social network. This allows memebrs to make connections with other friends who are not in the same forum, as well as receive feedbacks of relevance from friends on Facebook.

5) Report of inappropriate contents: This mechanism echos members' motivations in two facets; one is autonomy and another is fear of punishment. The former one drives members to control the quality of contents or the atmosphere of the forum through supressing inappropriate contents. The latter one holds back members from posting contents that are evidently not sutiable in a particular forum. To avoid abusive reporting, the reported contents will be sent to administrators for judging whether they are really inappropriate or not. After judgement, the reported contents will be sustained or removed, and the point of the member who posted inappropriate contents or the member who abusively reported will be deducted accordingly.

IV. IMPLEMENTATION DETAILS

The JForum is a Java servlet application being able to run on Apache Tomcat. Its design generally complies with the Model-View-Controller (MVC) architectural pattern [17], it has the 3-tier structure. Accordingly, planting game mechanisms needs to deal with components in different tiers. The gamification work needs to deal with a number of key components in each tier for accommodating the selected game mechanisms.

To minimize the interrelationship (coupling) between the original parts in JForum and the newly parts due to the gamification, the works were conducted with a loosely-coupled style, as Figure 1 shows. User identifiers were taken to serve as foreign keys of the data tables persisting mechanisms' status and records when it is rational. Besides, all gaming rules were collectively defined in a new package: "game". Doing so, it will make it easy to expand the gamification work, as well as to maintain either the original or the new gamification works.

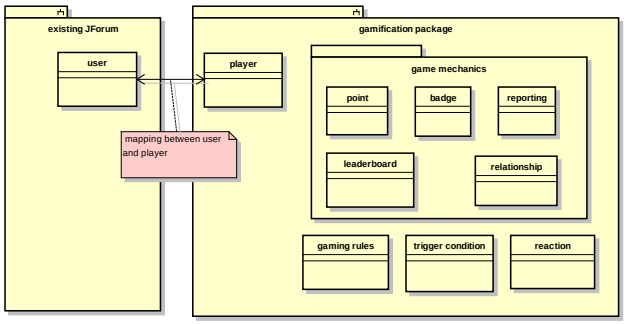

Figure 1. Loosely-coupled Architecture

Figure 2 illustrates the major components that need to be added and updated for gamifying the JForum, and each component is described as follows.

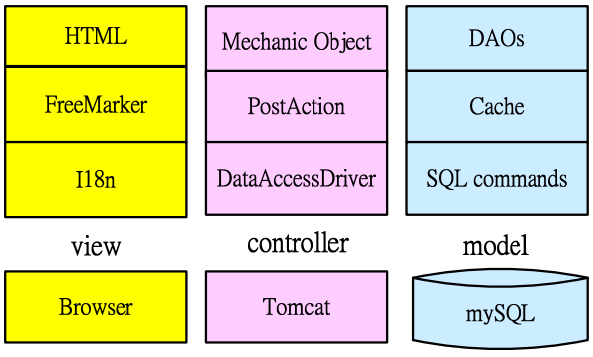

Figure 2. Key Components of the Gamification Work

A. User Interface (View)

The JForum uses the FreeMarker package [18] as a tool to separate Web pages design (view) and business logic programming (controller) works. The FreeMarker engine generates textual contents based on a template that contains HTML and FreeMarker Template (FTL) tags for dynamic Web contents, as well as a data model specifying data sources. Consequently, to embed a new game mechanism that will bring some new messages and graphics dynamically,

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it is necessary to update both the template and the data model of correspondence; the template decides the visual effect and format of the new components, and the data model tells where the displayed data come from dynamically when a particular page being accessed.

In addition, the JForum uses the I18 internationalization package for global users. For that reason, all new textual messages for embedding game mechanisms need to be added into the property file listing messages for a particular language (locale).

Figure 3 shows a FreeMarker fragment in a HTML file, which will display a message consisting of the word "point" in a default locale and the numeric value of the points earned by a non-administrator user.

```
<#if post.userId != 1>
    ${I18n.getMessage("Point.userPoint")}: ${point.totalPoints}
</#if>
<br />
```

Figure 3. A FreeMarker fragment

B. Game Objects and Corresponding Rules (Controller)

When thinking in the object-oriented way, each game mechanism obviously needs an object for holding its attributes and defining how it works. For example, to realize the "point" mechanism, a corresponding "Point" class will be defined; the attribute "userID" will bind it with a particular user, and the attribute "totalPoints" keeps track of the points being accumulated by the particular user. A method "changePoint" will be defined in the class to adjust the amount of points according to what that user did.

The PostAction object handles all actions for managing topics and posts, such as creating new topics or posting new messages, replying, deleting messages, etc. In other words, it deals with most major actions that the gamification work should focus on. So that, it needs linkage with some new game mechanisms. For example, when a user post a new message, the action of awarding points will be initiated by this object.

The DataAccessDriver abstract class defines the interface for linking the game mechanism and the persisting of the added game objects. Thus, all game mechanisms except the Facebook connection need to rely on one of its realization. Generally, the attributes of game objects will be fetched or stored via one of the corresponding concrete classes.

Since the servlet is the container for the JForum application, all business logics of the online forum systems and the new gaming rules were administrated and executed here.

C. Persistence (Model)

Taking flexibility of persistent storage into account, Data Access Object (DAO) design pattern was applied to separate the objects and its underlying storage mechanism. Thus, the object codes do not need to be changed due to switching to different data sources or APIs. DAOs provide abstraction and encapsulate all details for accessing the data source, which might be relational database, cloud storage, Lightweight Directory Access Protocol (LDAP), mainframe file systems, etc. The DAOs manage making connections with the data sources, as well as to fetch and store data. In the JForum system, each object was further divided into two layers of DAO for more flexibility, one is entity specific DAO, another is the generic DAO.

Cache mechanism in the JForum speeds up the object access operations through storing copies of object contents in Java virtual machine. So, many access operations do not need to access the database unless it is necessary to do so. To make contents of the persistent game mechanisms cacheable, addition of all persistent mechanisms needs the corresponding update in the cache mechanism.

All game mechanisms needing persistence require the corresponding tables in the database. Besides the properties of game mechanism objects, many gaming rules could also be encoded and then persisted in the database for more flexibility and maintainability. For example, the amount of points for awarding users should depend on the type of action they performed. However, the point amount for awarding a particular action could fluctuate rather than being constant for the sake of flexibility. Thus, these dynamics had better be encoded and persisted in the database, instead of being hardcoded in methods of mechanism class.

In summary, to illustrate the hierarchical operation of a game mechanism, the UML (Unified Modeling Language) [19] sequence diagram in Figure 4 shows the process of how components collaboratively worked to display the point of a user.

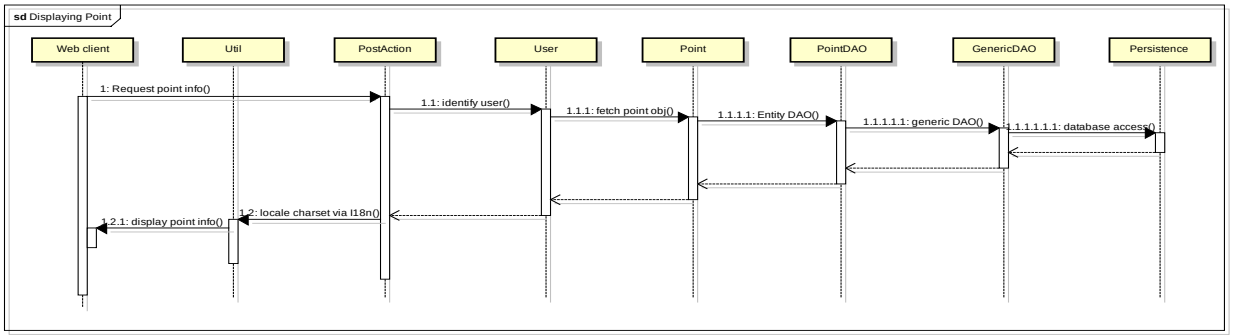

Figure 4. Working Process of the Point Mechanism

V. DISCUSSION AND CONCLUSION

The success of games relies on the proper application of motivational drivers that make players like and then be addicted to the game. Aiming to borrow the attractive features of various games, gamification techniques were used to improve users' experiences and engagement in non-game contexts for working, learning, or commercial purposes. The embedding of game mechanisms into an online forum system makes the system more engaging to users, who will feel animating while they are interacting and sharing knowledge with peers.

This article described the work of gamifying a JForum system realizing an online forum, including the work's motivation, process, and outcome illustrations. Besides, the present work shows the feasibility of gamifying an open-sourced software system by embedding 5 popular game mechanisms into the original code base with a loosely-coupled approach. A preliminary qualitative evaluation was conducted via interviewing with 8 users. They are computer science majored college students and usually spend a lot of time on visiting online forums to acquire information for completing their homework and projects. The responses from these target users of online forums indicated that the most significant impact brought by the present gamification on users is that they can observe the aspiring and competitive atmosphere, which was shaped by the badges and leaderboard and to some extent encouraged them to play more active roles in the information exchanging platform. The Facebook connections enable users to spread forum contents to their own social networks where there might be some constructive feedbacks regarding the topics in the forum. The mechanic of reporting inappropriate contents enable users to collectively maintain the quality of forum, which is important to the sustainable operation of a forum. By contrast, rewarding points made little difference due to the lack of redeeming mechanism enabling users to consume what they earned.

Besides studying how to embed other types of game mechanisms into an online forum, to better understand the effectiveness of particular game mechanisms in the context of online information sharing, the works being worthy of further investigations include the quantitative analysis of users' perceptions or satisfaction toward specific game mechanisms, and the quantitative evaluation of performance and productivity impact after particular gamification mechanisms being deployed.

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