Cloud-based Real-time Bulletin Board Posting Using AngularJS Framework

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Abstract - Information dissemination on the internet or in any media is a vital foundation in the community which needs attention and proper management to build up better communication. This study aims to provide Cloud-based Real-time Bulletin Board integrated with AngularJS Framework and mobile application. The Rapid Software Prototyping was used in the development of electronically organized content management bulletin board system in relation to interviews, related literature and studies, and survey evaluation to evaluate the system's conformity level with regards to ISO 9126-1 standards. The study improved the real-time information dissemination, accurate bulletin posting as the data disseminated is filtered and validated before posting. The Data would be published in the bulletin and secures information dissemination once the credentials to access and manage the system is sent through an email address. Based on evaluation results, the Functionality and Usability obtained the highest weighted mean of 4.70 with interpretation being Highly Acceptable.

Keywords - Cloud-based, Cloud Computing, Real-time; Board Posting; AngularJS Framework; Rapid Software Prototyping

I. INTRODUCTION

Either on the internet or in any devices, information dissemination is a vital foundation in an organization, institutions or community which needs attention and be properly managed for better communication. Azodolmolky, Wieder, and Yahyapour stated that cloud computing has come into view and become known as a broadly acknowledged computing archetype build around foundation concepts such as virtualization, dispensation control, flexibility, allotment and connection integrated to offer the collection of information technology resources and distributed by means of abroad network.[1] In a few decades, social networking, for instance, Bloggers, Facebook, Twitter, Instagram, and others make people get used to sharing news and thoughts online. As explained on previous work done by Mishne, Tsagkias, Tatar, Hong that to discover the public sentiments and popularity recognition of various topics and issues offer high-quality resources [2][3][4][5].

Since this can take suitable procedures in time to avert the spreading of awful views that may harm images, the kind of aptitude is valuable to relevant authorities. The study lead to real-time and recognized sources of information disseminated in an institution or organization. The study of Zheng and Litvinov on real-time ex-post price marketing compared measured study and elaborate the importance of real-time dissemination of Information. Other deals to distinction in measure among the ex-post price and support price of individual resource current and definite response. [6] Similarity, displays are needed for a diversity of reasons like advertisements, announcements and others that are essential for dissemination of information purposes in some public spaces. Abridged expenses in contrast to printed media and adaptability in the hosting of manifold contents dynamically are advantages offered in using different digital devices are explained in www.bdigital.com.

A general and most important scheme of extending these displays is the utilization through of devoted equipment or microprocessor in communal spaces in collaboration through light-emitting diode or liquid crystal display monitor. Moreover, content management presentations play an essential task in disseminating the designed information for the community. It is the reason why people organized space to construct definition. Kang et al. studied a bulletin board innovative user interface to administer or control objects on its multimedia dynamic design. They have compared usage of fixed and dynamic layouts in a bulletin board's multimedia by developing a prototype.[7]

The study is concerned mainly on the problem in posting scheduled information being disseminated in Higher Education in the Province of Laguna, Philippines. Problems encountered are the presence of manpower interactions, location, and busy schedule of persons involved. Materials for creating or updating bulletin need to be planned depending on the design wanted to attain. Then, after planning the bulletin board budget for the design needs to be produced before the bulletin starts to be updated. There are also circumstances wherein persons concerned in updating the bulletin board are busy or not available when there is a need for immediate posting or revision. Furthermore, updating the bulletin board sometimes commits a typographical error which leads to miscommunication due to the misunderstanding in information posted. In addition, traditional bulletin board encounters problems such as scratches, destruction, and damage done by some undisciplined individuals.
In line with this, the objective of the study are the following: (1) to develop an electronically organized and easy management system of updating and publishing information on bulletin board specifically to develop an electronically organized and easy manageable process of adding and updating published information on bulletin board with accounts privileges on system users for validity option and review comments and message filtering regarding submitted post by staff or faculty members even when persons concerned are in the other places; (2) to create a content management for a more artistic design template or background and insert desired content such as news, activities, incoming events and other related updates for bulletin board with less manpower involvement; (3) to generate reports to know the effectiveness of the Cloud-based Real-time Bulletin Board in relation to number of times the system bulletin have viewed and feedback rate with regards to announcements from its viewers; (4) to integrate Angular JS Framework in the development of the system; (5) to develop a mobile application that will help users to easily manage posting and notification; and (6) to evaluate the system’s conformity level with regards to ISO 9126-1 standards.

The study is essential for the academic dissemination of important information like school activities or events, Dean's listers, schedules of examination and many more which are displayed or posted in LED Monitor as a medium for the electronic bulletin. The system can also save trees by reducing paper consumption and garbage from used materials in the traditional bulletin board. Nowadays posting and distribution of vital information is very critical for the reason that information should be validated, have been checked well and disseminated on-time. In addition, with the help of the system, only the legible persons are authorized to disseminate information; thus, reliability and validity of information will be assured. Also, posting and updating the bulletin board can be managed even the person in-charge is outside the vicinity thru mobile, tablet or computer, for as long as they have an internet connection. Lastly, the study also aimed to improve the previous dissemination of information which is more attractive and may get the attention of anyone who can see it.

II. REVIEW OF LITERATURE

A. Cloud Computing

According to Rahman and Devi's work, social networking sites build as static web pages along with brochures containing text and images. Nowadays, the internet has evolved to improve all the way with increased bandwidth compared to the past; online visitor's prospect or expectations are being changed. It is stated that old static web pages which provide user dissatisfactions experiences because of time-consuming on how pages load and respond to the users. Furthermore, expectations from the users to an improved company are known as real-time market updated and globalized technology especially as per viewing the company's websites in terms of responsiveness within the users.[8]. However, as cloud computing is known on its rapid growth in providing noticeably scalable and virtualized information technology resources that require new cloud security controls arise, from the reality or truth that the union of numerous in different industrialized areas, including virtualization and service-oriented structural design is considered cloud computing, as stated in the study of Faraz, Moghaddam et al.[9]. The static Hypertext Markup Language pages into dynamic innovation, user-interactive presentations have been mostly achieved through the foundation of scripting technologies. In addition, Chaves, Westphall, et al. said that one of the toughest and exigent issues in the internet clouds is to virtualized infrastructure and to simultaneously afford a suitable or appropriate level of security.[10] Definitely, each cloud individual user necessitates to have a reliable level(s) of security based on information defined of Standard Layered Approach. In cloud-based environments, there are numerous models that attempted to categorize the level of security. The categorizations were generally based on security constraints or define a security policy as stated in the study of Yildiz, Abawajy et al. [11]

Cloud computing represents the most exciting change in computing archetype. However, primary obstacles to its wide acceptance are superficial in terms of security and privacy. The security capabilities of the service provider, data sensitivity and cloud consumers requirements, in observation of isolation, elasticity and computing environment concepts in cloud must be based on policy management scheme as stated to the study of Moghaddam, Wieder et al. [12] The emails, health files, tax records, photo albums, financial dealings, and others by individuals and enterprises are required to be stored and exploited. Ren, Wang et al said that they are encouraged to outsource their local complex systems data management to the cloud owing to its better elasticity and cost-efficiency. However, once individuals or persons were no longer physically own their data its reliability and confidentiality prone to a threat. [13] Then, according to Chhetri et al work, the most universal solution for privacy protection of resources and to lessen or prevent manipulation on both sensitive and non-sensitive information is to characterize each cloud node’s security policies as declared requirements and sensitivity. [14] In relation to this, the researcher applies such ideas in order for have flexible and responsive database and secured management system of information dissemination to have an effective communications in a community or institutions.

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B. Real-time Bulletin Posting

According to Tsagkias et al., the information has been delivered and improved by using accurate textual information before publishing on various news media, using a two-stage binary classification method to analyze and predicting the volume of comments to classify articles which receive a possibility to earn a high number of comments. [3] Some reviewed papers like the project of e-Campus in the work of Storz et al., Santos et al. and MAGIC Broker Erbad et al implemented through dedicated machines their prevalent and interactive displays as servers to accumulate and illustrate contents with the application of Faculdade de Ciências e Tecnologia 4U (FCT4U)[15][16][17]. Then, Academic Information System using web services stated in work of Pandini et al. and MoCHA in work of Oat et al. used two systems to disseminate information correspondingly as a web server for contents hosting in a web browser and through a mobile application. [18][19] Compared to the devoted technology which spent on thousands of dollars, as web servers may arrive finally with cost-efficient maintenance such as electrical energy and Internet aloft using pre-existing computers as explained in www.wirespring.com. [20] Heroku pricing said that the another option is to employ to server host in cloud computing for cost per month of as low as $0 - $50 wherein in the study uses the cloud-based system in order to minimized cost and for the system to run efficiently.[21]

In addition, studying previous user engagement literature applications on mobile were chosen because of rapid adaptation by more and more countries on mobile.[22] The use of the Android platform was preferred for its built-in assimilation with the Chrome cast and market share in demand.[23] According to Song et al., App Quality Alliance set guidelines on June 2013 and became the foremost basis in the study of their application to portray the different application aspects based on roles defined in designing Android interfaces. [24][25]. Icons8’s Graphical resources were applied for the effectiveness of system interaction evaluation[26], In the study of Alt et al. [27], the use of site deployment for user acceptance test, animations were applied to a study of Osman et al. [28], questionnaires on Yong's worked [29] concentrate on essential parameters [25], and constrained usability tests for time were used on study of Hussain et al. [30] based on usability and effectiveness of mobile applications evaluation and communal displays [31]. The real-time or on-time posting of announcements such as news or incoming activities or events are important in all users in order for them to be attentively aware and prepare ahead or before of time.

C. AngularJS Framework

JavaScript is an essential piece of modern web development and programming language that used nowadays to build an assortment of systems through refined user interfaces. Mostly, it has been observed that the use of JavaScript incorporated with JavaScript frameworks and libraries resolved to face general problems in such like applications. Particularly, an innovative family of JavaScript frameworks arises along with the Model-View-Controller (MVC) structural design or pattern. Among from the examples AngularJS, Ember.js and Backbone.js; AngularJS are verified in AngularJS API documentation and worked of Ramos et al., which developed and managed by Google, is the most accepted framework [32].

Since 2013, the detail is a fact by differentiating the quantity of most in Google searches queried framework per month in Stack Overflow as shown and interpreted on one of the figures in the study of Ramos et al. [33] Moreover, the AngularJS framework was used in the development of the system. Angular is one of the most modern web frameworks which have been recently introduced with ReactJS, KnockoutJS, and polymers which are used for dynamic web application development discussed on Comparison of Javascript application frameworks (March 2016). These frameworks become popular by using data-binding concepts, templating, single-application pages attributes, MVC, routing and others. With these concepts, developers relieved from boiler-plate code writing thus, easing the JavaScript applications development which in need of rapid final product distribution to client or customer.

In addition, without javascript frameworks, it is a difficult challenge since there is an absence of static typing, type checking assembly and support Integrated Development Environment. Despite the speed at which they can be erudite and implemented in order for the final product or output needs to pass a level of definite quality assurance before it can be released for the end user [34]. The study used AngularJS as its framework on a host server accessible in a platform like in the different previous studies through mobile application or browsers of a computer, laptop or tablet. AngularJS framework was chosen for its responsive formula and fast or real-time updating in any changes intended on the cloud-based bulletin. In addition, AngularJS is uncomplicated SPA framework with additional javascript codes that provides the application’s data binding and responsive formula. AngularJS increases its usability, design visualization, user knowledge, and content development in designing the website or system wherein according to Mcleod and Schell (2001), the information is one of the five main types of resources [35]. As computer capabilities of businesses or institutions expand and become more complex, information management importance or necessity also increases.[36] Furthermore, AngularJS endow with the test-driven framework which reduces the developers extra time and effort for application testing, as stated in the study of Rahman and Devi that testing and evaluation comprise a high validity and reliability.[8] In connection to this, the researcher applies AngularJS Framework to improve the code reusability that supports
developers to reuse written code to save additional time and effort and to improve server performance in supporting caching and many other processes.

III. RESEARCH METHODOLOGY

A. System Architecture

The Rapid Prototype Software Development method to ensure the system met its specification and outcomes were in accordance with Nikunj Patel that Rapid Software Prototyping offers a quick and precise method to comprehend the potential of the product.[37] Fig. 1 shows the system model architecture of the proposed system wherein data or information has been saved or recorded in the cloud database server of the hosting site to conserve and secure storage which can also be accessed through mobile, laptop or other desktop PC as long as users supply a valid user credentials for updating layout design, submit works and posting of information to be announced or disseminated for different category of users. Any changes by users with regards to the bulletin will be reflected dynamically and real-time on LED screen. Posted announcements can be seen by a group of users. The system was constructed or developed with HTML5, CSS3, Javascript, Bootstrap and AngularJS use as front-end; PHP, MySQL, jQuery, and Apache as the back-end of the system. The AngularJS framework is used for a real-time response or access to content management when updating the bulletin.

B. Data Requirements

B1. Interview: The interviews were conducted to gather useful information and comprehend the entire procedures involved and utilized during the design, development, and evaluation of the system. In addition, the researcher prepared an interview guide to gather relevant data or information that would help in the system project. The preliminary or initial interview conducted to understand the problems, issues, and challenges faced by the respondents on previous bulletin posting of an announcement, news or other important information disseminated in institutions. Moreover, there were follow-up interviews conducted to make clear some procedures, or documents required in the study. After the interviews, the researcher transcribed the interviews and created a synopsis of the most important topics in the interview.

B2. Survey: The survey was conducted to exploit the respondents’ insights and point of view to the development of the proposed project in order to meet the requirements of its users. The survey was distributed to four hundred seventeen (417) respondents. In addition, the survey was explained well and disseminated personally to the respondents within the institution composed of four (4) types of respondents namely, (1) Academic Heads/Dean, (2) Faculty, and (3) Staff members having one to seven (1-7) years of work experience with age ranging from twenty-five to sixty (25-60) years of age and (4) group of students on both College and Senior High Department with age ranging from sixteen to thirty (16-30) years of age. Furthermore, the questions on the survey were answered based on Likert’s scale points ranges 1.0 as the lowest up to 5.0 as the highest and interpreted in the scale of Not Acceptable, Slightly Acceptable, Moderately Acceptable, Acceptable and Highly Acceptable.

B3. Observation: The researcher observed the effectiveness of information dissemination with the use of cloud-based real-time bulletin board posting integrated with AngularJS Framework and mobile application for the development of the real-time, secure, accurate and easy manageable content management system.

IV. RESULTS AND DISCUSSIONS

A. Cloud-based Real-time Bulletin Board Management System Module

Fig. 2 shows the electronic and easily manageable process of updating and publishing announcement or news on the bulletin board. This module can only be accessed by
the Administrator, staff, and faculty who are allowed for Bulletin posting and information dissemination. Additionally, the Administrator or Editor itself can also add or create an announcement to be posted in the bulletin. The administrator can also check the image or review the video, add comments or suggestions before approving or publishing into the bulletin. Furthermore, this account is responsible for creating or updating bulletin for each category users. The module has secured and organized content management with contents privileges for each user and can only be accessed by the Administrator, staff and faculty members who are allowed for Bulletin posting or dissemination of information. All the information posted and published in the bulletin are secured, filtered, validated and organized as compared to the traditional bulletin posting.

1) Adding and Updating Post Management Module with Review Comments for Publishing Approval:

Fig. 3 shows the add and update form posting management where the author can add of at least 1MB image and a video link along with their post for the bulletin to be submitted for approval. The authors or users who are allowed to post can also tag to mentions names such as business or username and select category of users where to address the announcement and news submitted.

Additionally, the system has a validity option that submitted post can only be approved by administrator accounts and any comments or suggestions by the editor are can only be view by the administrator and its authors, either comment received to inform for approval or the submitted announcement and news has been approved and posted in the bulletin. Then, Admin members are not allowed to update submitted works of the staff and faculty. Furthermore, this module prevents unauthorized posting of the announcement to validate the posted information disseminated by its authors regarding forged information, typographic and grammar errors, plagiarism and others.

B. Create and Assign Template Management

Fig. 4 shows the design management of the bulletin, wherein administrator members only are allowed to change the layout by assigning different templates for each user's bulletin and changing background through browsing and uploading desired type of at least 1MB images either created design images or selected from the computer files. In addition, administrator users or editor can also apply appropriate and the formal standard combination of fonts for the bulletin design defends on trends. Then, the system module has the capability to update slides effects or animation and transitions to caught and get more attention from its viewers. Furthermore, with this module, it will easily help to manage and update the desired design and template with less time and manpower interaction and to reduce garbage from used materials such as papers, glues, coloring materials, and others even when the person’s involved were not present in the vicinity or they are in the other places.
C. Optimal Times Engagement and Track Reaction Ratings for the Effectiveness of Cloud-based Real-time Bulletin Board Management System

C1. Tabular Summary Representation Report Module on Number of Views:

Fig. 5 shows the tabular summary report module of posted announcement or news in the bulletin with a specific summation of the number of views and visited. In addition, the module includes identification and categorization of the viewing process either it has been viewed through Mobile Application, Mobile Browser, Tablet and Personal Computer such as Desktop PC or Laptop.
C2. Overall and Specific Post Chart Representation

Fig. 6 shows the overall and specific post in daily, monthly and yearly chart representation summary report of the total number on how many times the announcement and news in the bulletin have been viewed or visited using a personal computer, tablet, mobile browsers, and mobile application. In addition, the module helps to identify optimal times for engagements when the bulletin audiences or visitors are most likely to visit and engage its contents and to know the devices mostly used by the audiences in visiting the bulletin. Moreover, the modules help administrator, staff and faculty members to modify and adapt strategy in disseminating information at the right time especially when audiences are most active.

C3. Tabular and Chart Report Module on Number of Ratings:

Fig. 7 shows the tabular presentation of the overall and specific chart presentation of announcement and news ratings by each user. The module helps to track and monitor the number of ratings or reactions regarding post and information disseminated in the bulletin and in order to determine whether audiences are interested in what is currently published that should help to inform authors the type of contents to share in the future.

D. AngularJS Framework Integration in System Development

AngularJS framework integration in system development to design a simple architecture that helps developers catch up and enhance features to any extent on what the client requires. In addition, AngularJS integration enhances the data binding ability of system testing wherein the decoupling of the data identification and manipulation such as request and displaying of data is very simple and easy to use. Then, AngularJS in system development improves the code reusability that supports developers to reuse the same chunk of written code before which saves time and additional effort that makes the AngularJS a unique from other frameworks. Furthermore, the AngularJS framework improves server performance in supporting caching and many other processes.

E. Developed Mobile Application Modules for Posting and Notifications

Fig. 8 shows the screenshot of a mobile application for easy and effective manageable posting and notification of information dissemination using cloud-based real-time bulletin board. In addition, because of its portability compared with the traditional bulletin board, Administrator...
members can also be easily notified by the staff and faculty. Their response regarding posted review and comments to the post they have submitted with the help of the mobile application. Any problems or any changes need to be applied regarding the published post can be easily managed with the help of mobile application in order to improve and develop more productive information dissemination to prevent miscommunication.

![Image 1](https://via.placeholder.com/150)

**VI. SYSTEM EVALUATION**

Table 1 presents the tabular summary of the ISO 9126 Software evaluation results of two categories of respondents which are an operational and technical group of users.

<table>
<thead>
<tr>
<th>Indicators/ Criterion</th>
<th>Overall Mean</th>
<th>Average Weighted Mean</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Operational</td>
<td>Technical</td>
<td></td>
</tr>
<tr>
<td>Functionality</td>
<td>4.49</td>
<td>4.91</td>
<td>4.70</td>
</tr>
<tr>
<td>Reliability</td>
<td>4.46</td>
<td>4.85</td>
<td>4.66</td>
</tr>
<tr>
<td>Usability</td>
<td>4.51</td>
<td>4.89</td>
<td>4.70</td>
</tr>
<tr>
<td>Efficiency</td>
<td>4.46</td>
<td>4.82</td>
<td>4.64</td>
</tr>
<tr>
<td>Maintainability</td>
<td>4.45</td>
<td>4.91</td>
<td>4.68</td>
</tr>
<tr>
<td>Portability</td>
<td>4.46</td>
<td>4.85</td>
<td>4.66</td>
</tr>
<tr>
<td>All Characteristics</td>
<td>4.47</td>
<td>4.73</td>
<td>4.60</td>
</tr>
<tr>
<td><strong>OVERALL MEAN</strong></td>
<td><strong>4.66</strong></td>
<td></td>
<td><strong>Highly Acceptable</strong></td>
</tr>
</tbody>
</table>

Amongst the main characteristics of ISO 9126 software evaluation standards, Functionality and Usability were obtained the highest weighted mean which is 4.70 with a verbal interpretation of Highly Acceptable. It simply denotes that under Functionality criterion, the software evaluation respondents strongly agreed that the system was able to include, execute and perform all the enumerated tasks and features for a specific user. In addition, the functionality the system was able to generate accurate results once executed wherein the system able to communicate or responds with other system components. Furthermore, both operational and non-technical respondents agreed that the system was able to connect the users from one link pages to another in order to continue a specific transaction. Lastly, the proposed system provided the least amount needed security like access to the authorized users or the users with approved account and privileges only. In Usability criterion, respondents were mostly agreed that the system was able to provide easy to follow processes or clear instructions user interface. Then, both operational and technical respondents agreed that the system was user-friendly and mostly applicable to any device whether computer, laptop, tablets or smartphones and possess formal or an almost standard uniformity in the interface. Furthermore, the system design and template and combination of colors and graphics are appropriate. On the other hand, the other main characteristics namely: Reliability, Efficiency, Maintainability, Portability, and Compliance of All Characteristics in Data Privacy was obtained Weighted Mean of 4.66, 4.64, 4.68, 4.66 and 4.60, respectively with a descriptive and interpretation of Highly Acceptable. Furthermore, the Overall Weighted Mean in all criterion of ISO-9126-1 has an Average Weighted Mean of 4.66 based on expected program result and interpreted in scale as Highly Acceptable.
VII. CONCLUSION

The proposed system was intended to secure, check and validate information before it will be approved for posting to prevent plagiarism, typographic and grammar errors and others. In addition, the system will not only lessen the number of paper usage, exerted time and excessive efforts of personnel just to update and improve the design of the bulletin but also includes modules to know the effectiveness of the bulletin with regards to the audience or viewer’s insights and interest to the information published and disseminated. Future researcher may improve the system by adding template features for different desired events. Then, researchers may focus on the development of the content management organization of submitted and published post with summary of review comments to monitor author’s development. Moreover, other researcher may also focus on the development of mobile application by adding some modules such as design and report management in order to become more responsive, effective and easy to use. The study proved and revealed the importance of real-time, accurate and secure information dissemination along with rapid growth of technology in order to have better and effective communications.

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