e-Reklamo: An e-Government Portal for Citizens' Complaints in Government Services using Web Crawling

Asia Pacific Journal of Multidisciplinary Research
Vol. 6 No.4, 58-66
November 2018
P-ISSN 2350-7756
E-ISSN 2350-8442
www.apjmr.com
CHED Recognized Journal
ASEAN Citation Index

Shirley D. Moraga[1], Albert A. Vinluan[2]
[1]College of Computer Studies and Systems/Graduate School, University of the East, Manila, Philippines; [2]College of Computer Studies, New Era University, Quezon City, Philippines
shirley.moraga@ue.edu.ph[1], sbssmoraga@yahoo.com[1], aavinluan@neu.edu.ph[2]

Date Received: March 12, 2018; Date Revised: August 18, 2018

Abstract – *Most government organizations now have their own space on the web permitting citizen to find information and progressively participate in e-government. There are only few studies on e-government adoption and address the concern of the citizens in the different government services in the developing countries like Philippines. This study focuses on the development of government portal that solicits public feedbacks and complaints with the help of different ICT tools: web crawling, tag cloud, topic modelling and social media networking sites.*

The system can help to reveal the citizens' needs and expectations in the government services through e-government platform. Also, it uses web crawling technology to crawl the news, articles, updates, complaints of the top 10 most complaints government agencies' websites. The user can give feedbacks and comments to selected websites and it will be extracted to produce text visualization using the tag cloud and topic modelling. The information gathered will be sent to the respective government agencies for them to be aware of the different citizens' complaints and make some necessary actions. In addition, agile approach was also utilized for the software development.

The system helps citizens to empower and be informed of which government agency needs to improve their services. Moreover, it provides the government with more opportunities to better fulfil its responsibilities. Thus, it is recommended that the developed system be implemented as innovative modes of communication which can improve the transparency of the government and encourage citizen to participate in the government's decision making process.

Keywords – *Philippine government, e-Government, web crawling, website, tag cloud, topic modeling*

INTRODUCTION

In the recent years, increasing use of online media, such as websites, blogs, and social networking sites, by the government for various public relations purposes have witnessed. These channels are often observed to promote democratic values and public trust in government by helping the government provide the public with information and respond to citizen inquires [1]. Many online service provisions proliferate throughout the world, in which government try to improve the way to offer their services. The study shows that ICT can be more effective with the integration of existing technology for building citizen-oriented and empowering governance.

Government is moving to another idea of giving broad access of government services electronically from gadgets like PC, portable PC, smart mobile phones and other handheld gadgets, which are a great deal more incorporated into every day human lift [2]. E-government is as of now being executed around the world. E-Government can help creating country cities go up against the difficulties and enhance government services [3]. Most government organizations now have their own space on the web, along these lines permitting citizen to find information and, progressively, to participate in e-government supported services [4]. Citizens are experiencing different concerns to the government services which must be taking into

consideration. The government should deliver satisfactions which must start to the barangay or small government unit [5] to its citizen through the utilization of ICTs as incident report tool to hear and identify the issues, concerns and needs of citizen to enhance the activities of public sector [6].

One innovation that can be used to get more extensive information to all government service delivery is the Web Crawling also called web spider or web robot is software for downloading pages from the Web automatically. According to Singh, Bal and Varnica [7], web crawling is an important method for collecting data on, and keeping up with, the rapidly expanding Internet. Moreover, Catanese, De Meo, Ferrara, Fiumara, and Provetti [8], has used crawlers on the social networking site i.e., facebook. Likewise, Shkapenyuk and Suel [9], gave the design and implementation of the distributed web crawler. The utilization of information and communication technology (ICTs) in government has significantly expanded in the most recent couple of decades. Countries around the world are presently receiving systems for better utilization of these advances with altogether different objectives: noteworthy efficiency, transparency, higher service quality, and more engaged citizen participation [10].

In the Philippines, new complaints hotline 8888 was established last August 1, 2016 headed by Civil Service Commission (CSC), in which received 11,347 calls, or an average of 232 calls a day. Complaints are then forwarded to concerned agencies for immediate action. By creating a channel where citizens can air their specific grievances regarding government services, the CSC gets agencies and offices to respond to citizen complaints. The top 3 complaints reported to 8888 are related to slow processes, failure to act on requests, and unclear procedures (Feraren, Raffler.com, October 09, 2016). The Social Security System (SSS) has achieved the highest feedback resolution rate of 91.33 percent based on the 1st Quarter 2017 Citizen Hotline 8888 Report by the Civil Service Commission (CSC). Ranking second is Home Development Mutual Fund, with 82.94 percent, followed by Government Insurance System, with 72.37 percent. Also in the list are Bureau of Internal Revenue (with 66.77 percent), Department of Foreign Affairs (65.95 percent) Philippine Statistics Authority (59.05 percent), Commission on Elections (55.77 percent), Philippine Postal Corporation (50 percent), Land Transportation Office (42.83 percent) and National Bureau of Investigation (37.61 percent). The CSC's Citizen Hotline 8888 is a government feedback mechanism that enables the public to lodge queries and other concerns for immediate action. Currently, the hotline receives daily an average of 253 queries, 144 complaints, 66 requests for assistance, four suggestions, and three commendations/appreciation. [11].

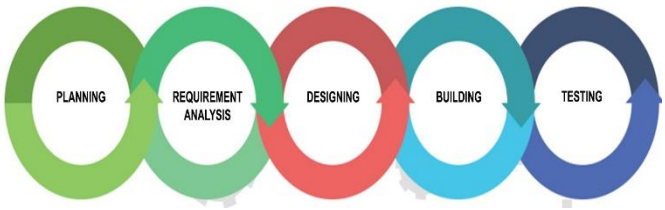
Indeed, the government must provide services to address the concerns of the citizens not just receiving call but also handling complaints and reports in different governments' websites to identify the government agencies that need to improve their services. Moreover, for the developing countries like Philippines, there are only few studies which explain e-government adoption [12,13]. Consequently, this study aims to reveal the citizens needs and expectation in the government services through e-government platform to voice out citizens' concerns, needs, complaints and issues to prompts the responses of different government agencies to external demands. Thus, the study intended to develop a government portal that could help community to easily browse announcements/news and post comments.

MATERIALS AND METHODS

The study e-Reklamo uses developmental approach research for the development of the solution. Developmental research, as opposed to simple instructional development, has been defined as the systematic study of designing, developing, and evaluating instructional programs, processes, and products that must meet criteria of internal consistency and effectiveness.

Software Development Model

Fig. 1. Agile Software Development Model



The agile model was used to develop the system as shown in figure 1 which the process iteration to ensure fulfillment of each module required by the study. Iteration includes Planning, Requirement Analysis, Designing, Building and Testing. The development of e-Portal starts with the planning phase which includes defining the required tasks, activities needed to accomplish with timeframe and different resources. Next is analysis of the identified requirements for defining user expectations that may be new or modified. Identifying the possible functionality, system behaviour,

information required by the portal is valuable for designing. Defining the overall architecture, modules, system interfaces, required data, processed data, and possible integrations to fulfill the requirements are done in designing phase. All these components were assembled in the building phase. Firebase Realtime Database, AngularJS, Node.js, npm (Node Package Manager), Facebook SDK for PHP and Facebook Graph API Explorer were all utilized for the progress of e-Portal. Lastly, the testing phase which ensures that all artifacts required by the solution are produced based on the defined requirements. Also, each functionality fulfill its purpose and provide the expected results. This model is dynamic in the cycle since it guarantees the quality of the developed e-portal.

Prototype Development Process

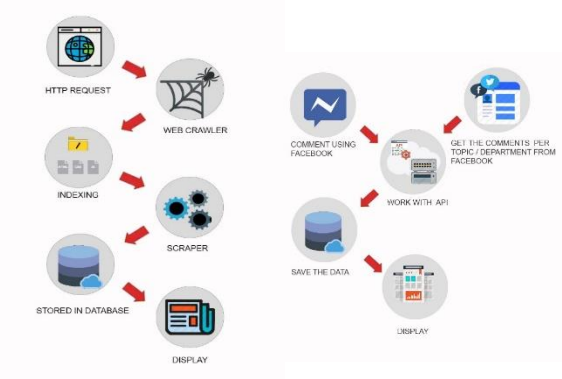
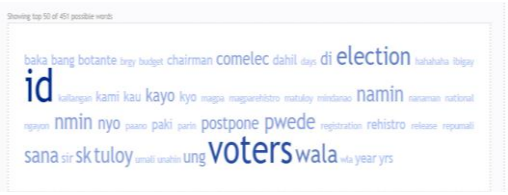


Fig. 2. Web Crawling Process and Facebook API

Figure 2 presents the web crawling process and Facebook API of e-Reklamo. The crawler begins with one or more URLs that constitute a seed set. It picks a URL from this seed set, then fetches the web page at that URL. The URL will work with the web crawler for indexing, Web crawler consumes resources on the systems they visit and often visit sites without approval. Issues of schedule, load, and "politeness" come into play when large collections of pages are accessed. It picks a URL from the comment section and suggestion are composed of Facebook API to write a comment using Facebook account to lessen the process and make it easy and fast. Facebook Graph API to be specific is the primary way to get data out of, and put data into, Facebook's platform. It's a low-level HTTP-based API that you can use to programmatically query data, post new stories, manage ads, upload photos, and perform a variety of other tasks that an app might implement. Using API the proponent will also get the comments that relates to existing agencies in the web page and display it in the main frame using tag cloud. Tag cloud is a visual depiction of user-generated tags attached to online content and copy it into database and used it as own Tag Cloud which shown in Figure 3, sample tag cloud from the extracted comments in Facebook.



Tag Cloud

According to Rivadeneria, Gruen, Muller and Millen [14] the tasks supported by tag clouds are: searching, browsing, impression formation, and recognition/matching.

Tag clouds capture the essential information through the representation of the most relevant tags [14]. In addition, tag clouds assist users whose search terms are not clearly defined but they can recognize them from a set of possible queries represented by the tags [15].

Tag cloud is usually sorted alphabetically and center-aligned but they can also be sorted by tag weight or random order. Sample tag cloud is shown in Figure 4. In most cases the tags are shown using HTML representation and are rounded in link anchor. To get the tag cloud we need to calculate the parameters: sc - the smallest count (or occurrence). tgc - the count of the tag being computed. lc - the largest count. sfs - the smallest font-size. lfs = the largest font-size.

Formula:

$$tag\_font\_size = (((tgs - sgc) * (lfs - sfs)) / (lc-sc))$$

There are ten (10) different presentation styles are therefore adopted in this study to display the keywords or tags in a Variable Tag Cloud. It also used different shades of one type of colour which is blue to avoid too many classes and colours on display. Light text shadow is applied from style 5 onwards as they have higher weights.

Latent Dirichlet Allocation (LDA)

The LDA model is the typical representative of topic models. LDA is a generative probabilistic model for collections of discrete data such as text corpora [16].

Documents are represented as random mixtures over latent topics, and each topic is then characterized by a distribution over words. The text generative model describes the generative process of words through documents based on latent variable and simple probabilistic sampling rules, and probabilistic topic models have been used to analyze the topic structure of given texts and the implication of each word [17]. The LDA model is also considered a bag-of-words model with three levels [16, 18, 19].

The System: E-Reklamo

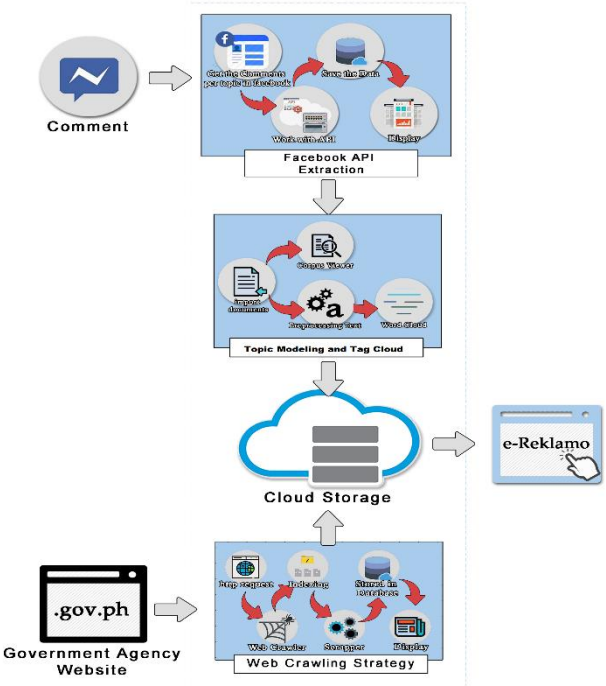


Fig. 4. E-Reklamo: System Architecture

Figure 4 illustrates the proposed conceptual framework for the study. Comments from Facebook Page of 10 government agencies were extracted using the API extraction. API is known as Application Program Interface which is a set of routines, protocols, and tools for building software application. It also specifies how software components should interact. Extracting comments from Facebook page begins in getting comments per topic, users must log-in to his Facebook account to view or post comments in selected government agency. After working with API, extracted data were stored in the cloud storage ready for tag clouding and topic modeling process. Next to Facebook API extraction are tag cloud and topic modeling, these techniques were utilized to visualize the sentiments of the netizens. The output will be stored in cloud storage then display the ranking and percentage of the most used words for every government agency's comments. Web crawling strategy was utilized to amass news, updates, and announcements of the 10 government agencies. It starts with Hyper Text Transfer Protocol (HTTP) request, followed by web crawler or also known as a web spider or web robot which is a program or an automated script which browses the World Wide Web (WWW) in a methodical, automated manner. After which, indexing that will collect, parse and store data to facilitate the scrapping routine. Scrapping is used for web harvesting for extracting data from 10 government agencies' websites. The result of the web crawling strategy will also store in the cloud storage then display in the developed e-Reklamo website. Thus, these general steps describe how the proposed system works that would help the community to give their concerns and issues in various governments service delivery.

RESULTS AND DISCUSSION

The purpose of this research is to voice out the feedbacks and concerns of the citizen to the government services using the developed e-Reklamo portal, the system are summarized in three aspects (i) government website web crawling (ii) text extraction from comments and feedbacks using social media (Facebook) (iii) generate tag cloud and topic modeling from the extracted information. This enables administrators and policy makers provide governmental support system to improve government to citizen relationship and services.

In this section it will present the different tools and techniques of E-Reklamo Application such as web crawling, facebook extraction, tag cloud, and topic modeling.

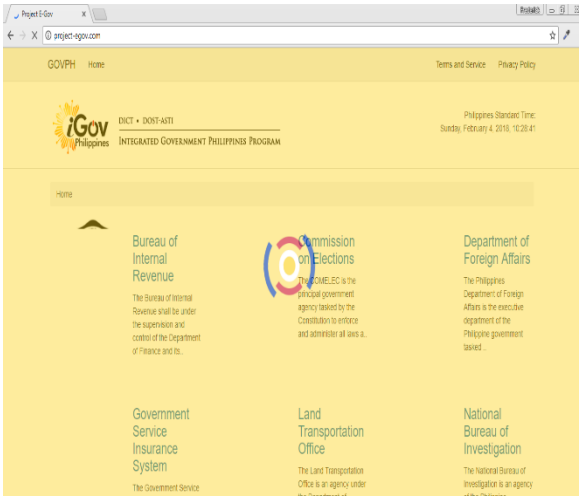


Fig. 5. Home Page-Crawling Process in Action

The web crawling shown in figure 5 shows the Home page of the system in which upon loading it crawl the selected website in the system. The government websites are top complaint agencies such Social Security System (SSS), Government Insurance System (GSIS), Home Development Mutual Fund (PAG-IBIG), Department of Foreign Affairs (DFA), Philippine Statistics Authority (PSA), Commission on Elections, Philippine Postal Corporation, Land Transportation Office (LTO) and National Bureau of Investigation (NBI).

Table 1. Keyword Identifiers in Different Government Agencies

Government Agency	KEYWORD IDENTIFIERS
SSS	*www.sss.gov.ph* , FBID: 102761037867
Pag-Ibig	*www.pagibigfund.gov.ph* FBID: 135568203131389
GSIS	*www.gsis.gov.ph* FBID: 1420751694846699
BIR	*www.bir.gov.ph* FBID: 313721258793029
DFA	*www.dfa.gov.ph* FBID: 138743156280527
NBI	*www.nbi.gov.ph* FBID: 126270541206019
COMELEC	*www.comelec.gov.ph* FBID: 1124813047530288
PHILPOST	*www.phlpost.gov.ph* FBID: 179127968875260
LTO	*www.lto.gov.ph* FBID: 8159545285433770
PSA	*www.psa.gov.ph* FBID: 567231098098751

Table 1 presents the keyword identifiers in ten (10) different government agencies that were used for the collection of documents. These keyword identifiers were utilized and applied as document categorisation and summarisation.

Table 2. Experimental Results of Webpage Extraction

WEBSITE	PRECISION	RECALL	F-MEASURE
www.sss.gov.ph	0.988329	0.8508842	0.914471
www.pagibigfund.gov.ph	0.547619	0.9279539	0.68877
www.gsis.gov.ph	0.90301	0.8023774	0.849725
www.bir.gov.ph	0.657005	0.8242424	0.731183
www.dfa.gov.ph	0.941474	0.8548799	0.89609
www.nbi.gov.ph	0.622842	0.8184991	0.707391
www.comelec.gov.ph	0.895628	0.8172458	0.854643
www.phlpost.gov.ph	0.95389	0.817284	0.880319
www.lto.gov.ph	0.262425	0.804878	0.395802
www.psa.gov.ph	0.946357	0.8508842	0.896085

To assess the performance of the proposed technique which is web crawling, Table 2 shows the experimental results of webpage extraction. It reveals that the government agency SSS has the highest precision of 0.988 while LTO government agency takes the lowest with 0.262 precision. It also discloses that PAG-IBIG government agency has the highest recall which is 0.805 whereas the GSIS is the lowest having 0.802 recall. Moreover, SSS government agency also got the highest f-measure with a value of 0.914 and LTO is the lowest with 0.396 f-measure value.

The users (citizen) can access the articles, news or updates in the selected government website wherein they can able to give comments and suggestions using Facebook account through the Facebook API to be connected to the government social media account to get all comments of the citizen. In line with this, all the comments/feedback will be collected by the system to extract information. Using API it collect the comments that relates to existing agencies in the web page and display it in the main frame using tag cloud. In figure 4, once you click a website, it will display all the crawled News and Updates of the agency. The users can read articles and give comments to the selected article/update shown in figure 6.

Figure 6. Government Website List of Articles

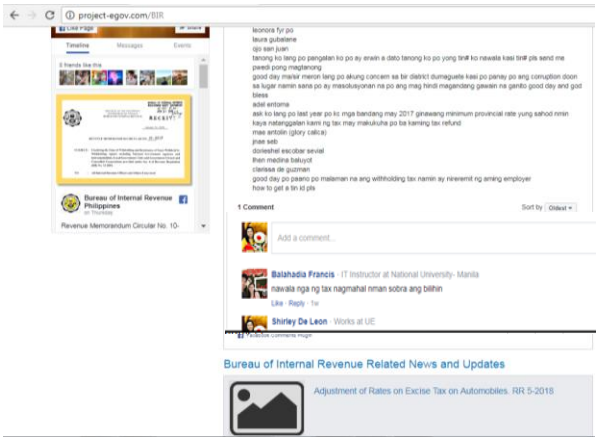


Fig. 7. List of comments from BIR's FB Page

In figure 7 shows the system which all collected comments from social media (Facebook) to produce tag cloud or group of words from citizen complaints and filtered the stopping words from the Facebook graph application. The system will link to the database of comments to construct topic modeling that will be basis for sending report to the government agencies for further action.

Fig. 8. List of comments from BIR's FB Page

Figure 8 represent the tag cloud produced from the comments, feedback or concerns of the community in the government agency.

The system gives the collected comments through tag cloud and topic modeling with graphical representation of the frequently used words from the citizen complaints in the selected government website that can be used to send to the government website for them to inform to the citizen's concerns.

The system used LDA Topic modeling to analyze the data on the government agency's Facebook page account, then it followed several steps such as construct database (corpus) for the system, clean data with removal of repeated messages, pre-process data with stemming, removal of stop words, and lastly generate hyper-parameters and Dirichlet Distribution to construct data frames with LDA. The results gathered by the system shows that in Bureau of Internal Revenue the most words/complaints focus on "voters" and "ID". The size of the circles represents the engagement rate of the topics. The color represents the co-occurrence of the topics. For each document in dataset, it identifies the topic index for which the probability is the largest for example the main topic. Grouping by the topic index, counting, and sorting results in the counts of documents per topics plotted shown in figure 9.

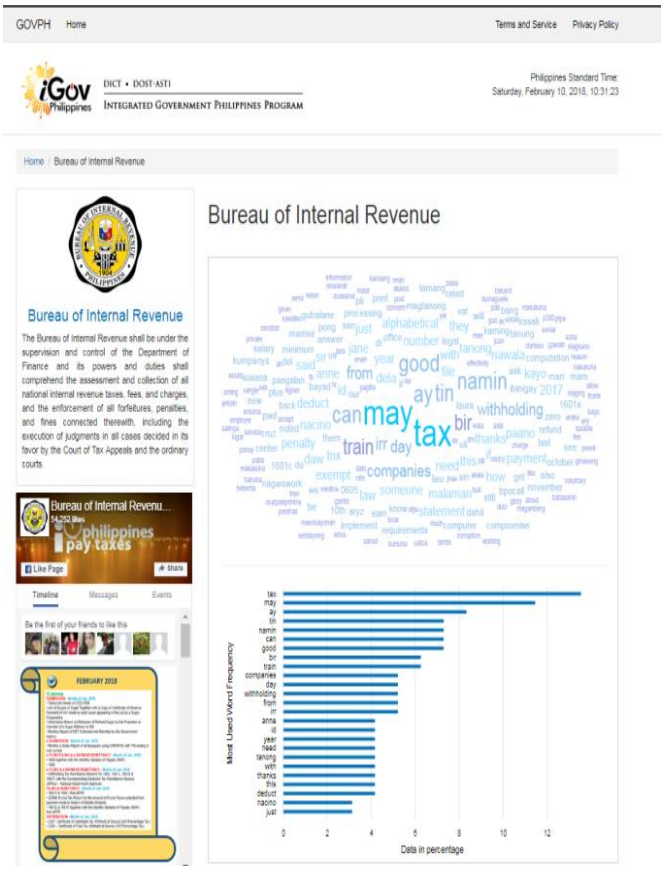


Fig. 9. Tag Cloud Results for Commission on Elections

Here are the results of collected and extracted comments in the FB Pages of the different government agencies. In the page of SSS Government Agency, "SSS" is the most used word with 57.03% followed by "loan" which is 23.94% while "maternity" and "day" are the least with 12.59% and 10.54% respectively as shown in Table 3. This implies that most of the comments and/or complaints are associated with these words. SSS government agency should take necessary actions on how to improve their services.

Table 3. Most Frequently Used Words in SSS Government Agency's Comments

Words	Percentage
sss	57.03%
loan	23.94%
good	18.86%
ask	18.41%
may	16.61%
wala	15.21%
hulog	13.12%
contribution	12.75%
maternity	12.59%
day	10.54%

Table 4. Most Frequently Used Words in PAG-IBIG Government Agency's Comments

Words	Percentage
loan	50.46%
ibig	26.29%
pagibig	25.29%
wala	24.29%
may	15.17%
good	12.53%
ask	11.97%
housing	10.89%
number	10.60%
member	10.28%

Table 4 reveals that the most used words in PAG-IBIG Government Agency's comments is "loan" with 50.46% whereas "member" is the least that got 10.28%. PAG-IBIG should now focus on their services especially if "loan" is concerned.

Table 5. Most Frequently Used Words in BIR Government Agency's Comments

Words	Percentage
may	11.95%
tax	10.69%
tin	9.43%
id	5.66%
good	5.66%
train	5.66%
this	5.03%
ay	5.03%
2551m	4.40%
if	4.40%

As shown in Table 5, the words "may" and "tax" have the highest percentage in the most used words in BIR Government Agency's comments with 11.95% and 10.69% respectively. Both "2551m" and "if" got 4.40% which are landed at the bottom. Result revealed that citizens are very much aware and want to share their opinions about tax, tin and the TRAIN law.

Table 6. Most Frequently Used Words in DFA Government Agency's Comments

Words	Percentage
passport	44.72%
dfa	18.70%
appointment	17.07%
may	12.60%
slot	12.20%
wala	10.57%
we	10.16%
have	6.91%
if	6.50%
email	6.50%

Table 6 presents the most used words in DFA Government Agency's comments, it reveals that netizens talked about "passport" as it gained 44.72% whereas; the least are "email" and "if" with 6.50%. DFA may take a necessary action on how to improve their services specifically on appointment for passport applications.

The most used words in NBI Government Agency's comments are "nbi" with 50.96% and "online" with 18.74% while the word "wala" is the least with 4.82% as presented in Table 7. Based on the result presented, NBI may assess their online services and releasing of clearance and/or ID.

Table 7. Most Frequently Used Words in NBI Government Agency's Comments

Words	Percentage
nbi	50.96%
online	18.74%
clearance	18.65%
may	9.00%
paano	7.10%
ask	7.01%
kumuha	6.82%
pano	5.46%
id	5.37%
wala	4.82%

It reveals in Table 8 that the most used words in COMELEC Government Agency's comments are "id" and "voters" having 30.72% and 20.43% respectively. The word "sk" is the least with 8.31%. With this, citizens mostly discussed are about ID, voters and election. COMELEC must re-evaluate their services especially if these most frequently used words are concerned.

Table 8. Most Frequently Used Words in COMELEC Government Agency's Comments

Words	Percentage
id	30.72%
voters	20.43%
election	19.87%
wala	14.82%
tuloy	13.58%
may	13.13%
comelec	12.01%
barangay	11.79%
namin	8.87%
sk	8.31%

"it" and "package" are the top 2 most used words in PHLPOST Government Agency's comments having 25.19% and 25.04% as presented in Table 9. It also shows that the word "tracking" is the least with 11.70%. This helps the PHLPOST agency of which of their

services might have problem and to provide appropriate solutions.

Table 9. Most Frequently Used Words in PHLPOST Government Agency's Comments

Words	Percentage
it	25.19%
package	25.04%
reply	16.00%
phlpost	14.82%
office	14.08%
this	13.93%
post	13.19%
have	12.74%
from	12.00%
tracking	11.70%

Netizens usually talked about "license" as it reveals in the Table 10 having 13.18% followed by "lto" that has 7.26%, then "card" with 6.25%. "id" and "plaka" are also part of the discussion in their comments with 3.89% and 3.55% respectively. Issues regarding license, renew, card, id and *plaka* were the priorities of LTO to improve their services.

Table 10. Most Frequently Used Words in LTO Government Agency's Comments

Words	Percentage
license	13.18%
lto	7.26%
may	6.25%
card	6.25%
sm	5.41%
wala	5.24%
renew	4.56%
id	3.89%
plaka	3.55%
sir	3.38%

CONCLUSION AND RECOMMENDATION

This study aimed to develop "e-Reklamo": An E-Government Portal for Citizens' Complaints in Government Services using Web Crawling Application. The system applied E-government applications in which allow citizen, and government sectors to access to available government information and will reduced costs in term of communication and other process, increase the transparency and services for citizens in providing a tool for good governance. The study used of e-government systems will can be used to improve the performance of government agencies and deliver the public service effectively and efficiently for all customers with the used of different Information Communication and Technology (ICT) tools such web crawling, social media, tag cloud and topic modeling. These technologies help in building trust between governments and citizens because it can use to voice out feedback and suggestion to the government services, also an essential factor in good governance by using internet-based strategies to involve citizens in formulation appropriate action based on the citizen complaints, transparency, accountability and to empower people.

Also, the agile model was used in the development of the system that allows client to interact and work with functioning software at the end of each iteration and provide feedback on it. In this approach, software is developed and released incrementally in the iterations. This gives more importance to collaboration with the client and responding to chance and delivering working software. In agile way of working, each feature is completed in terms of design, development, code, testing and rework, before the feature is called done.

The system has it limits, government websites are not easily access by its public domain due to its strong portal security that is why not all the contents of the selected website cannot be crawled and getting all contents causes storage and memory issues in the system. Additionally, the government social media accounts are not active, comments and posts are few so that extracting of text might not give expected output.

Future research should pay more attention to government-public interactions, including those through government websites and social media. Further inquiries are practical for demonstrating how such a growth would change the government-public relationships. There are many possible factors that may affect public participation in government which the study deals with individual's personal experience with government websites and social media. Given that the government-public relationship is not an immediate outcome of a single communication program, there is a need for a longitudinal study and continuous efforts concerning the government-citizen relationships.

REFERENCES

[1] Hong, H. (2013). Government websites and social media's influence on government-public relationships. *Public Relations Review*, *39*(4), 346-356.

[2] Second Administrative Reforms Commission. (2008). Promoting e-Governance. Retrieved from http://arc.gov.in/11threp/ARC_11th_report.htm

[3] Dwivedi, P., & Sahu, G. P. (2014). Challenges of E-government Implementation in India. *New Delhi: International Journal of E-Government & Policy*.

[4] Pieterson, W., Ebbers, W., & van Dijk, J. (2007). Personalization in the public sector: An inventory of organizational and user obstacles towards personalization of electronic services in the public sector. *Government Information Quarterly*, *24*(1), 148–164.

[5] Balahadia, F., Fabito, B., & Fernando, M.C. (2015). *E-Participation: Incident Mapping Portal for Local Government Units*. Conference Proceeding in 8th IEEE International Conference Humanoid, Nanotechnology, Information Technology Communication and Control, Environment and Management (HNICEM).

[6] Balahadia, F. Molino, W., Bawica, J., Juanatas, I., Balmeo, H., & Ballera, M. *E-Participation: Community Involvement Level Related to Different Services of Local Government Unit Officials*. International Journal of Computing Sciences Research Vol. 1, No. 2, pp. 10-20 doi: 10.25147/ijcsr.2017.001.1.07

[7] Ahuja, M., Bal, J. and Varnica (2014). Web Crawler: Extracting the Web Data. International Journal of Computer Trends and Technology (IJCTT) – volume 13 number 3 – Jul 2014. pg 132-136. ISSN: 2231-2803

[8] Catanese, S. A., De Meo, P., Ferrara, E., Fiumara, G., & Provetti, A. (2011, May). Crawling facebook for social network analysis purposes. In *Proceedings of the international conference on web intelligence, mining and semantics* (p. 52). ACM.

[9] Shkapenyuk, V., & Suel, T. (2002). Design and implementation of a high-performance distributed web crawler. In *Data Engineering, 2002. Proceedings. 18th International Conference on* (pp. 357-368). IEEE.

[10] Sandoval-Almazan, R., & Gil-Garcia, J. R. (2012). Are government internet portals evolving towards more interaction, participation, and collaboration? Revisiting the rhetoric of e-government among municipalities. *Government Information Quarterly*, *29*, S72-S81.

[11] PNP (2017). SSS tops agencies with highest 8888 resolution rate. Retrieved from: www.remate.ph/2017/07/sss-tops-agencies-with-highest-8888-resolution-rate/

[12] Al Hujran, O., Aloudat, A., & Altarawneh, I. (2013). Factors influencing citizen adoption of e-government in developing countries: The case of Jordan. *International Journal of Technology and Human Interaction (IJTHI)*, *9*(2), 1-19.

[13] Lin, F., Fofanah, S. S., & Liang, D. (2011). Assessing citizen adoption of e-Government initiatives in Gambia: A validation of the technology acceptance model in information systems success. *Government Information Quarterly*, *28*(2), 271-279.

[14] Rivadeneira, A. W., Gruen, D. M., Muller, M. J., & Millen, D. R. (2007, April). Getting our head in the clouds: toward evaluation studies of tagclouds. In *Proceedings of the SIGCHI conference on Human factors in computing systems* (pp. 995-998). ACM.

[15] Montero, Y. H., Herrero-Solana, V., & Guerrero-Bote, V. (2010). Usabilidad de los tag-clouds: estudio mediante eye-tracking. *Scire: representación y organización del conocimiento*, *16*(1), 15-33.

[16] Blei, D. M., Ng, A. Y., & Jordan, M. I. (2003). Latent dirichlet allocation. *Journal of machine Learning research*, *3*(Jan), 993-1022.

[17] Liu, Q. (2016). Employing Latent Dirichlet Allocation Model for Topic Extraction of Chinese Text. *International Journal of Database Theory and Application* Vol.9, No.7 (2016), pp.51-66.

[18] Liu, Q. (2012). An Efficient Adaptive Focused Crawler Based on LDA and Domain Ontology. *Journal of Computational Information Systems*, vol. 8, no. 5.

[19] An, W. & Liu, Q. (2013). Hierarchical Text Classification based on LDA and Domain Ontology. *Applied Mechanics and Materials*, vol. 414, no. 10.

COPYRIGHTS