Study on VGI Volunteers

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Abstract—Volunteered Geographic Information (VGI) is the phenomenon of geospatial information and services contribution by unpaid volunteers e.g. Wikimapia, Flikr, Cyclopath, OpenStreetMap etc. Study of geospatial volunteer demographics is critically needed for better design of future VGI projects and improvement of existing ones to achieve retention of experienced volunteers. This study aims to find out the leading and lagging motivational factors for VGI volunteers. Volunteers of two VGI organizations GISCorps and OpenStreetMap have been surveyed and the survey responses have helped identifying leading, moderate and lagging tiers of motivational factors.

Apart from the unified list, individual list of motivational factors based on the volunteer demographics have also been derived. These individual lists would serve as a point of reference while targeting specific volunteer demographic for any VGI organization or project. This work is novel in terms of motivation factors validated by experiments and inputs taken from geospatial volunteers only. The survey responses have reflected and have helped concluding important measures and suggestions for increasing the effectiveness of VGI as a whole and ultimately our society.

Keywords—Volunteer motivation; Volunteered Geographic Information; VGI; Geospatial data

I. INTRODUCTION

Due to rapid evolution of web, huge amount of user generated content is being collected and propagated. Volunteered Geographic Information (VGI) is geospatial information and services voluntarily provided by users. It is a georeferenced type of citizen science and is a growing area of information gathering. The content of VGI sites satisfies a variety of needs within industry, government and social networking communities. There is a need to study motivational factors of the VGI volunteers so that existing VGI projects benefit by eradicating volunteer motivation issues or problems.

In this paper, motivations of VGI volunteers have been identified by a survey conducted on them. Subsequent analysis and recommendations based on the results have been made. Related work on VGI motivational factors do not seem to be backed up by experimental validations. Volunteers of two VGI organizations namely GISCorps and OpenStreetMap have been surveyed to determine volunteer motivational factors. Understanding volunteer motivation will help in designing future VGI projects in a better and appealing way.

II. CONTRIBUTION

A. Limitations of Related Work

Goodchild’s [2]: This geojournal summarizes few factors underlying VGI volunteerism, like: “Self-promotion” (for non-anonymous projects only), “convenient way of making it available to friends and relations” and “Personal satisfaction” (for OpenStreetMap only).

It is unclear how the suggested factors have been arrived upon. Probably the outcomes are influenced by volunteer communities of Citizen Science projects. There is no mention of any kind of experimental approach backing up the findings.

Snyder et al [1]: The authors applied functionalist theory and hypothesized following 6 personal and social functions: Values, Understanding, Enhancement, Career, Social and Protective.

The volunteer subjects they studied were general social volunteers of unpaid helping activities in the community. We have come 11 years down the line. Changes in economic situation, availability of information and technology at volunteer’s disposal have resulted changes in motivational factors.

B. Contribution

- The motivation factors and their tiers have been determined by performing a survey on VGI volunteers.
- Number of motivational factors suggested is around double in number than those suggested by previous work. Some of the factors are completely new in comparison to the previous works.
• Individual motivation factor lists based on specific volunteer demographics have also been provided.

• Suggestions for improvements of VGI projects have also been included. This would help in the advancement of scientific studies and researches where VGI is used as research inputs.

C. Scope of Work

This work is limited to different aspects of motivational factors of the VGI project volunteers be it in creating new spatial data or updating the existing spatial data.

The following research questions are beyond the scope of this paper:

• Techniques to improve and ensure accuracy of contributed data and information.

• Statistical proofing and/or testing of the motivation factor. Efficient storage and retrieval techniques for these huge datasets.

• Insufficiency of existing spatial data types to represent varied types of data efficiently.

• Motivations factors behind general volunteers, Crowd sourcing volunteers and Citizen Science volunteers.

D. Outline

The rest of the paper is organized as follows. Section III presents the formal problem statement along with its significance. Section IV narrates the methodology applied in this work along with the experimental setup. Section V presents analysis and discussion of results obtained from surveys. Section VI discusses conclusion followed by future work. Survey questions are presented in Appendix at the end of paper.

III. PROBLEM STATEMENT

A. Problem Statement

Given:

• A set S, of VGI projects, P1, P2 …Pn.

• Sets of geospatial volunteers, V1, V2 …Vn for the projects, P1, P2 …Pn

Find:

• A list L, of motivation factors arranged in leading, lagging and moderate tiers.

• Measures to improve the VGI projects.

Example:

Volunteers of Cyclopath – a geowiki site form a candidate volunteer set.

Constraints:

During the study, access to the volunteers of only two organizations, OpenStreetMap and GISCorps was achieved. Hence the results and conclusions are based only on volunteers from these organizations.

Responses to the primarily important question of why people volunteer were collected in terms of 5-point likert scale. Likert scales are subject to distortion from several causes like central tendency bias of participants and social desirability bias. These two biases are constraints to this work.

Inferring human psychology is nontrivial; it is being assumed that the volunteers have been honest and truthful while responding to the survey.

Application:

This problem is applicable to all the projects and initiatives involving detailed locations update, urban and regional development to under-served developing communities, environmental analysis enhancement and fostering economic as well as community development.

B. Role and Significance of VGI in Advancing Science

Initial phases of VGI catered mostly to satisfy the intellectual curiosity of the common public, but nowadays volunteers contribute to the breadth and effectiveness of services [4]. Apart from their contribution to the growth and welfare of geowiki sites, they are considered an essential human resource for many organizations, dealing with geospatial data.

Doubts and uncertainty on the authenticity and validity of the information and services contributed through VGI can be answered well through methods and measures suggested by this paper.

VGI has proved to be a boon in managing disasters. Volunteers from various VGI organizations have contributed significantly during natural disasters like hurricane Katrina, Haiti and Chile earthquakes. In addition, volunteers from developed nations have shown their willingness to go and serve in developing nations which have very little and/or incorrect geospatial information, e.g. they provide position or attribute data for failing infrastructure (wastewater and potable water).
IV. APPLIED METHODOLOGY AND EXPERIMENTAL SETUP

A. Overall Methodology of the Study

- Survey questions were designed using Goodchild’s suggested factors and motivation functions of Snyder.
- The questions were revised after getting feedback from Prof. Francis Harvey and Dr. Thomas Dohm.
- Pilot Study of the survey was conducted on GISCorps director, Shoreh Elhami and her colleagues. Survey questions were revised based on their valuable comments.
- Few important questions which meant the same thing were rephrased and posed in the surveys repeatedly. This was done to validate each individual’s response repeatedly.
- The two VGI organizations are different in terms of the volunteered activities performed by their volunteers, the survey questions were customized accordingly and two separate surveys were sent to the corresponding organizations.
- The respective Surveys were launched to GISCorps and OpenStreetMap volunteers on April 01st 2010 and were kept open till April 12th 2010.
- Result analyses of both the surveys have leaded to the motivational factors. Apart from this, comparison and contrast between volunteers of non-VGI citizen science projects and VGI volunteers have also been done. Based on the survey responses; suggestions for improvements of VGI projects have been included as well.

B. Experimental Setup

**Number:** Overall 252 volunteers responded in the survey comprising of 134 out of 150 deployed GISCorps and 118 OpenStreetMap volunteers.

**Location:** Figure 1 shows the geographic location of the survey participants. Major participants were from USA, followed by Germany, United Kingdom and France.

**Organizations:** VGI projects like Open Street Map require volunteering for community geospatial information creation. Whereas in the VGI projects performed by organizations like GeoMentor and GISCorps; volunteering involves providing analytical services, presentations, teaching and documenting geospatial information. Following are few quick facts about both the organizations:

![GISCorps](image1)

**GISCorps**

Founded in 2003 at Atlanta, Georgia; GISCorps is a program initiated by the Urban and Regional Information Systems Association (URISA) that offers volunteer GIS services to under-served developing communities worldwide.

This volunteer based organization is headed by a team of professionals trained in urban and regional development. GISCorps has approximately 1,000 volunteers located in five continents and prepared to work on both domestic and international projects. Through their services highly specialized GIS expertise is provided to underprivileged communities; local capacity is strengthened by effective use of spatial information technologies; web-based interactive mapping applications are developed; and strategic planning of GIS systems and their implementation are done. E.g. They created an accurate base map for northwest Albania, developed several data layers including a detailed road network (on Open Street Map – OSM interface), damaged buildings, and various Points of Interests.

**OpenStreetMaps**

Founded in July 2004 by Steve Coast, OpenStreetMap is a collaborative project to create a free editable map of the world. The maps are created using worldwide data on roads, railways, rivers, forests, homes and everything else, what is commonly seen on maps from portable GPS devices, aerial photography, and other free sources or simply from local knowledge.

OpenStreetMap was inspired by collaborative sites such as Wikipedia. Registered users of OpenStreetMap can upload GPS track logs and edit the vector data using the given editing tools.
The initial map data was all built from scratch by volunteers performing systematic ground surveys using a handheld GPS unit and a notebook or a voice recorder, data which was then entered into the OpenStreetMap database. E.g.: During Haiti earthquake, OpenStreetMap used available satellite imagery to map the roads, buildings and refugee camps of Port-au-Prince.

Gender: Female participation was relatively low. Overall 22% and specifically 37% in GISCorps and only 4% in OpenStreetMap participated.

Occupation: Majority i.e. 74% of the survey participants and specifically 64% in OSM and 83% in GISCorps of the participants are professionals followed by students and academicians.
V. ANALYSIS AND DISCUSSION OF RESULTS

The answer to the main project question of why they volunteer at all was collected in term of likert scale. This figure represents the responses to various factors. The color coding chosen is symbolic as the shades of green represent strong agreement, yellow signifies moderate agreement and pink and red symbolize disagreement. We can see a clear trend being displayed from left to right, this made the tiering easy.

Other factors are reasons like adventure, fun of working on new projects, for demonstrating the benefits of spatial information technology during disaster situations and improving the use of geospatial techniques in local governments.

**Interesting Demographic Outcomes:**

**Female Participants:** As already mentioned female participation was found to be less. Out of 55 female survey participants 46 were professionals, 6 students and the rest 3 were academicians.

Hence we can safely infer that the female participants are majorly skilled and their contributions are accurate and reliable. Following bar chart shows the age distribution of female participants. Females belonging to age-group 30 and 40 are majorly involved in VGI.
Following table provides the factors tiered according to female participants:

<table>
<thead>
<tr>
<th>FACTORS</th>
<th>TIER</th>
</tr>
</thead>
<tbody>
<tr>
<td>To express humanitarian values (Altruism)</td>
<td>Leading</td>
</tr>
<tr>
<td>Personal Satisfaction</td>
<td>Leading</td>
</tr>
<tr>
<td>To increase understanding on the matter</td>
<td>Leading</td>
</tr>
<tr>
<td>To gain and improvise Geo-spatial knowledge</td>
<td>Leading</td>
</tr>
<tr>
<td>For improving professional skills</td>
<td>Moderate</td>
</tr>
<tr>
<td>To build your professional network</td>
<td>Moderate</td>
</tr>
<tr>
<td>For strengthening your social relationships</td>
<td>Moderate</td>
</tr>
<tr>
<td>For better utilization of your time</td>
<td>Lagging</td>
</tr>
<tr>
<td>For reducing personal stress</td>
<td>Lagging</td>
</tr>
<tr>
<td>To look for a new employment</td>
<td>Lagging</td>
</tr>
<tr>
<td>To remain busy and occupied</td>
<td>Lagging</td>
</tr>
<tr>
<td>Self-Promotion</td>
<td>Lagging</td>
</tr>
</tbody>
</table>

Female volunteers consider that altruism is the main motivating factor for them. Self-Promotion is the least preferred factor whereas it is the third-last factor in the unified table. The rest of the factors table does not have much of a difference from the first unified table.

**Other Outcomes:**

**Age:** It seems we need not worry much in terms of the age-group of the volunteers. Since participation from almost all age groups is there. People lying between the age of 20 to 50 years being the dominant ones.

**Occupation:** Group of professionals being dominant VGI volunteers is a good sign. Professionals having their area of work related to GIS can be considered more trustworthy in terms of data accuracy and reliability.

**Relation with GIS:** GISCOrps volunteers are highly skilled in GIS and they utilize their skills while volunteering. Whereas majority of OSM volunteers are less or unskilled in GIS and they volunteer as a hobby.

**Volunteering Frequency:** 46% of GISCOrps volunteers volunteer on an annual basis whereas 46% of the OSM volunteers do so, on a weekly basis.

**Volunteering Duration:** More than 60% of volunteers have been contributing for years or more.
On a unified scale, 69% of the volunteers have been contributing for more than years.

**Software Products Used:** Around 68% use commercial GIS software, but say they would prefer open source products.

**Places Marked:** Most volunteers mark streets and roads on maps. It can be inferred that the present commercial maps lack complete detail and accuracy for streets and roads.

**Contributed Data Type:** More stress is laid on spatial points, lines and polygons; the percentage contribution of you tube-, wiki-link and photographs is very low.

**Desire for Geospatial training:** 50% of GISCorps and 60% of OSM volunteers would undergo geospatial training only if it were free.

**Participation Incentives:** When asked what kind of participation incentive they desire the most, 25-58% replied they do not need any and a considerable 16-26% desired technical training.

**Social & Professional Network:** A majority of volunteers have at least one person in their social and professional networks who also contributes. Social networks may therefore represent a means to bring more new volunteers on board and retain existing ones.

**Important Suggestions for Advancement of VGI:**

**Centralised Community for Volunteers** belonging to a VGI organization/community/ project should be made where they can have knowledge sharing discussions.

**Intiatives to bring more volunteers**

- Publicity through media: Initiation of any kind of VGI project should be advertised sufficiently so that skilled people having desire to contribute can join.
- Ease of contributing: Tedious registration processes or long online registration forms should be done away with as they serve as road-blocks to the people who are eager to join.
- Easy documentation: Protocols and ground rules of the VGI project/organization should be documented or illustrated in simple ways so that the new joinees do not get scared of complex processes.

**Geospatial training** should be provided for free to the volunteers.

**Insufficiency of resources and infrastructure** [experienced by 54% of volunteers] should also be addressed in order to retain and attract volunteers.

**Appreciation of Contribution** is desired by most of the volunteers; small words like “Thank You” make a huge difference. They seemed to be tad sad by the indiffrence shown by the VGI organization for which they contribute.

**Encouragement from employers** is a huge improvement area. All organizations should allow for few days of give-back days to the community (might be paid leave to their employees) who want to contribute or volunteer.
VI. CONCLUSION AND FUTURE WORK

Initiatives to bring more volunteers (especially females) should be made. More number of volunteers would facilitate validating the geospatial information before making it available to rest of the world. Thus content accuracy would increase.

GISCorps volunteers are highly skilled in GIS and they utilize their skills while volunteering. Whereas majority of OSM volunteers are less or unskilled in GIS and they volunteer as a hobby. This is evident from the fact that majority of GISCorps volunteer’s professional work and areas of study are related to GIS. While for OpenStreetMap the opposite holds.

When asked what kind of participation incentive they desire the most, more than half of them replied they do not need any and a considerable portion desired technical training, followed by award, honor and recognition. No wonder we have personal satisfaction, altruism and desire to gain geo-spatial knowledge as the top factors.

More analysis would be done out of the survey results, like finding out motivation factors specifically for males, students, academicians etc. Studying rich sample size, varied geographies etc are the prospective candidates for future work.

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My sincere gratitude to Professor Shashi Shekhar for guiding me throughout this project. Special thanks to spatial database team at University of Minnesota and my colleagues for giving me additional inputs to make this project the best it can be.

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IX. APPENDIX

Survey Questions for GISCorps Volunteers

http://www.kwiksurveys.com/?s=KJEMIN_a24935a3

1. Your present location in terms of City, State and Country.
2. Your Gender
3. Your Age
4. Your Profession
5. Is your professional work / area of study related to maps or Geographic Information Systems (GIS)?
6. Please rate your Geographic Information System (GIS) knowledge. [Options were Poor, Fair, Good and Advance]
Survey Questions for OpenStreetMap Volunteers

http://www.kwiksurveys.com/?s=KJKEGF_dcdcb694

1. Your present location in terms of City, State and Country.
2. Your Gender
3. Your Age
4. Your Profession
5. Is your professional work / area of study related to maps or GIS?
6. Why do you contribute to spatial data? [Spatial Analysis, Conduct Research, Teaching, Hobby, Profession and Others]
7. Have you ever added any of these information to a map? [Photo, Wiki Link, You-tube Link, Spatial Point, Spatial Line, Spatial Polygon, GPS Coordinates and Others]
8. How would you rate information entered by other volunteers? [Not Accurate, Less Accurate, Moderately Accurate, Accurate and No Idea]
9. Please rate your GIS knowledge. [Poor, Fair, Good and Advance]
10. How long have you been volunteering?
11. How frequently do you volunteer?
12. What kind of places do you mark?
13. How many persons you know contribute to GIS/Geographic portal(s)?
14. Do you think sufficient infrastructure/resources are available to volunteer?
15. Would you like to undergo a geospatial training?
16. Would you contribute more if given any incentives? [Coupons, Cash, Technical Training, Employment, Award / Honor / Recognition and Others]
17. Please rank your motivation for volunteering on scale of 0 to 5, (0-low, 5-high). [Self Promotion, Self-Satisfaction, To look for a new employment, For reducing personal stress, For better utilization of your time, To remain busy and occupied and Others]
18. What kind of information have you corrected on maps? [Incorrect Geometries, Incorrect Roads, Incorrect Junctions, Incorrect Geometries and Others]
19. Do you contribute because you needed that kind of information in past? But did not get it in the past.
20. Do you wish to continue volunteering in the future?
21. Do you feel you would contribute more for city or state which has gone through a natural disaster like Haiti or Chile?
22. Did you ever volunteer because you found a new road/route missing in your GPS?
23. Did you ever volunteer because you found a geospatial location / information like new road, business etc missing in your Global Positioning System (GPS)?
24. Have you ever experienced insufficiency of infrastructure / resources for volunteering / contributing
25. How would you rate the contribution by other volunteers (might be your peers)? [Not Accurate, Less Accurate, Moderately Accurate, Accurate and I have no idea]
26. Please let us know about your additional comments on geographic / geospatial volunteers and volunteer organization. We would appreciate your suggestions for improvements which would lead to the betterment of these kind of volunteer activities and ultimately of our society.