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A Framework for Social Service Volunteers: A Social Network Representation

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Abstract: This Social network analysis is used to improve the performance of user-specific information dissemination in many internet-based applications like on-line viral marketing, on-line social service and recommendation network based applications. In this paper, we represent a social service framework using social network which is consisting of two layers; one layer comprising of service receivers and second one comprising of service providers. Service receivers have different type of demands. Depending on the requirement of receivers, the volunteers may approach some external sources. Since there are various communities of receivers with different requirements, we need to classify them properly to organize this system well. Here we are presenting a model which is efficient for such NGO dataset. After considering some benchmark research works, we can claim that our proposed algorithm with this model gives good result and it is helped us to improve NGO services since we are giving important to the receiver's feedback also.

Key Words and Phrases: component; Non-Governmental Organization (NGO), Service Receivers, Volunteers, Resource, Resource Allocation Graph.

1 Introduction

NGOs are nothing but a group of members who are active in the efforts of international growth and enhancing the benefit of helpless individuals in developing countries. Normally NGOs work in some ways, severally and beside symmetric aid authorities from developed nations, private-sector substructure operators, self-help tie-up, and local governments [1]. We can define NGOs as private organizations whose objective is humanitarian or helpful instead of commercial purposes. It pursues actions to relieve suffering, encourage the interests of the helpless, save the environment, provide basic social a bit of help, or attempts community development in developing countries. So in one word, NGOs are nonprofit community-based organization. The main goal of NGOs is sharing resources [2]. Resource means everything available with NGO which can be provided and used to satisfy receiver needs. It is technologically accessible, economically feasible and culturally acceptable. NGO have man-made resources. Needy people needs more resources [3]. Here, we are focused on the fair distribution of public resources like Educational fellowships for poor students, Medical apparatus for the ill child or old age, Shelter, food, dress, education for orphans, Needy apparatus for disabled, etc. A resource distribution has become essential for a sustained quality of life and satisfaction [4]. Otherwise, we may face the following major problems:

- Global ecological crises.
- Dissatisfaction of needy people.
- Development of weaker section of society.

Resource management and resource usage framework have been proposed by the author [5]. Resources can be brought off by the assigned agency. A user must interact for utilizing the resources for complete the process execution. Their protocol assured lawful order to get resources promoting social inclusion. The protocol protects resource rights and traceability of resource utilizations. In this proposed work we have presented a framework for interacting with different users and various agencies for managing resources. For surviving the needy people have to acquire the resources whereas for making a profit for personal growth a user must utilize his ability and capital for commercial usages. Usage of resources can be viewed as a process, which initiates the resource request first and secondly fulfilling of obligation for resource usage before the process terminates. Socially Responsive Resource Usage Protocol (SRRUP) has been proposed a protocol for obeying social ethics on resource utilization [6], and [7]. The main objective of this protocol is to empower the needy people for accessing the resources and come out from the impoverished environment. In

requests of the socially distanced individuals. A logical distance defined between a resource and its user is termed as a social distance of the user on the resource [8], [9], and 10]. A resource has three attributes: place, cost, and constraints having dominating effects on its usages. A location where the resources can be availed is called place. [11], and 12]. A user has to pay for availing the resources is specified as cost. A set of assertions and conditions used as pre- and post-conditions to a resource utilization are the constraints. These are the following contribution has been made in our proposed framework:

- To avail, the resources, socially disadvantaged people will get priority.
- Based on the financial and social statuses of an individual they have to service a resource. Further, a receiver in disadvantageous positions and located in a remote area have to avail public resources.

The rest of the present research paper has been organized model. In Section 3, it has shown the experimental result of the proposed model with a discussion. Finally, it has been concluded with section 4 points out the concluding remarks and future works associated with the proposed model.

2 Proposed Model

In this section, we discussed about our proposed model, algorithmic representation of proposed model, and mathematical representation of proposed model in details.

2.1 Concept of Proposed Model

In this article, we have presented a network consisting of two layers; one layer comprising of service receivers and the second one comprising of service providers. The service receivers are from the weaker portion of the society such as orphans, disabled, poor, old, etc. The service providers are from a voluntary organization formed for providing service to the above categories of the society. Here volunteers have executed two types of responsibilities: identification, an attraction of receivers for service and pooling up resources to support the requirement of the receivers. The services required vary from receiver to receiver. One may need financial help such as scholarship, education fees; disabled requires physical and medical help; poor need both financial and medical help and old needs physical as well as medical help. Volunteer also have different strengths. Some provide financial resources, some of them are good at environmental services, and some provide medical facilities.

many receivers at a time. At the same time, a receiver may need several services, and hence, more than one volunteer need to serve them. So the interaction is one-to-one, one-to-many, many-to-one. The system is supported by external sources. Depending on the requirements of receivers, the volunteers may approach these external sources. This may not directly come in the picture. We found some ground rules: volunteers do not extract more than what is required. The service purely needs to be based. Volunteers of particular services or attached to a specific group of receivers may interact with other volunteers whenever necessary. When a specific need or requirement is fulfilled, the corresponding volunteer may withdraw his service or corresponding receiver may leave the system.

2.2 Mathematical Representation of Proposed Model

We have denoted each receiver by x and volunteers by y with appropriate suffixes as and when required. If x has requirements then x(r1, r2, …, rk) denotes such a receiver with k requirements r1, r2, …, rk, to be fulfilled. y(s1, s2, …., sp) denotes a volunteer who can provide services s1, s2, …., sp. ri and si denotes direct quantities and are non-negative real numbers so that we may compare the requirements and supports to measure the strength of the system.

Since there are two categories of people with different requirements and services, we find many communities in this network based on the idea of community detection in social network analysis and classify them properly to organize the system well.

We have presented two approaches here:

Case I. Volunteer-wise categorization.

Case II. Receiver-wise categorization.

This can further be classified to get a clearer picture.

Case I: Assume that each volunteer has only one service to provide, but he can serve many. Then we attach good numbers of receivers to him.

Let y1(s1) denotes a volunteer with a quantum of service s1(Example: Scholarships, Medical services, etc.).

Let a group of receivers {x11, x12, …, x1k} are attached to y1 with requirements of r11, r12, …, r1k where x1i(r1i) denotes a typical member of this group.

We now have

(service quantum is more than sum of required)

In this case, either the organization or volunteer y1 himself looks for more receivers to add to this service. Now we can add x1k+1(r1k+1), x1k+2(r1k+2), …, x1p(r1p) where p>k and

$s1 \geq \sum^{p}_{j=1} r1j.$ (2)

This process continues till $\sum^{p}_{j=1} r1j \leq s1 < \sum^{p+1}_{j=1} r1j$ (3)

This reflects the ability of y1. A performance of y1 measured on this output i.e. number of x1j's.

Lemma 2: $s1 < \sum^{k}_{j=1} r1j$ (4)

In this case, the strength of y1 is not enough to meet the requirements of x1k's. So either the organization or the volunteer himself (y1) approaches another volunteer y2 of similar service as required by x1k's. Now we have two ways:

(a) if $\sum^{l}_{j=1} r1j \leq s1 < \sum^{k}_{j=1} r1j$ where $l < k$ (5)

We can detach those {x1l+1, x1l+2, …, x1k} from y1 and connect them to y2 directly. So here y2 is a direct volunteer of an organization.

or (b) we don't allow y2 to contact directly with x1i's. We linked up y2 to y1 so that,

$s1 + s2 \geq \sum^{k}_{j=1} r1j$ (6)

Where s1 is the strength of y1 and s2 is the strength of y2. Here either organization or volunteer y1 finds a donor or supporter from the society for the specific case, and this may be purely temporary.

Case II: Each xi has requirements in different directions, say, for example, scholarship, food, shelter, medical facilities, physical assistance, etc. and no single y could meet all these requirements. Hence each x is associated with a group of y's. We consider x1(r11, r12, …, r1k) and {y11(s11), y12(s12), …, y1k(s1k)}. We may assume $r1j \leq s1j$, where j=1, 2, …, k since otherwise the organization includes more y's to support x1.

Lemma 1: Suppose $r1j = s1j \ \forall \ j=1,2,\ldots k$ (7)

Here all the requirements of x1 are met, and x1 leaves the system after the requirements are fulfilled.

Lemma 2: Suppose $r1j < s1j$ for some $j= p \leq k$. (8)

Now the specific y1p(s1p) can support more than on 'x' and the system may utilize its services by attaching some x2 for which x2(r2p) is such that $r1p + r2p \leq s1p$ (9)

This way such y1p is attached to more x's. This process continues when $\sum^{k}_{j=1} r1j \leq s1j$. (10)

In this case, the performance of the system may be measured by some x's attached to each y and number of x's leaving the system after fulfilling their requirements.

2.3 Algorithmic Representation of Proposed Model

Here, we define all the terms which we have used in our proposed algorithm.
x ← Receiver
r← Requirement
x1j← r1j Receivers(x11, x12,.....x1j) with requirements(r11, r12,.....r1j)
y ← Volunteer
s ← Service
y ← s Volunteer (y) supports service(s)
y1 ← s1 Volunteer y1 supports s1 type service, y2 ← s2 Volunteer y2 supports s2 type service etc.

In our algorithm, our goal is to provide services(s) to a receiver(x) who have registered(x ← r) with requirements (r). Volunteer (y) supports service to receiver (x) to fulfill their services. In the first case, the system is strong while in the second case system needs support.

Algorithm 1: Algorithm for Case I

Begin
$x_{1j} \leftarrow r_{1j}, \forall j = 1, 2.., k$
$y_1 \leftarrow s_1$, $y_2 \leftarrow s_2$
if $s_1 > r_{11}$ **then**
  y_1 supports x_{11}
end
for $l = 2$ *to* k **do**
  if $s_1 > \sum_{j=1}^{l} r_{ij}$ **then**
    y_1 supports $\{x_{11},x_{12},...,x_{1l}\}$
  end
  if $\sum_{j=1}^{l} \leq s_1 < \sum_{j=1}^{l+1} r_{ij}$ **then**
    y_1 supports $\{x_{11},x_{12},...,x_{1l}\}$ but not x_{1l+1}
  end
end
Select $y_2(s_2)$ **such that**
$s_1 + s_2 \geq \sum_{j=1}^{k} r_{ij}$ or $s_2 \geq \sum_{j=1}^{k} r_{ij} - s_1$
Then $\{y_1, y_2\}$ support $\{x_{11}, x_{12}, ..., x_{1k}\}$
End

3 Experimental Result and Discussion

In this section, we discussed our experimental result. We gave a glance on innovative environment and nature of inputs and elaborated outputs for each and every input.

We have written a C program for the preliminary study, and executed it on an HP ProBook 4440s laptop with 2.80 GHz Intel(R) Core(TM) i5-3360M CPU 2.80GHz microprocessor and 8 GB RAM memory, running Windows 7 professionals with 64 bits operating system on Dev c++. In our experiment, the basic idea is to define the correlations using different types of interaction functions. An objective function is defined based on the service receiver and service providers. According to our observations, we could identify three kinds of interaction functions:

- One-to-one- This denotes the one provider is quite enough to provide to service to one receiver.
- One-to-many-This represents the dependency of providers to other claimants.
- Many-to-many- This represents the many receivers can serve by many providers.

The three interactions can be instantiated in different ways like System consists of receivers denoted by `x' and providers by `y'. The requirements by seekers are denoted by ri ,i=1,2,...,n and strengths of providers are denoted by sj, j=1,2,...,n. Table-1 shows the receiver requirements and Table-2 shows that how providers provide requirements to concern receiver.

Notation: x^i is a seeker (i=1 to n)
$x^1{}_{1000}$ is a seeker with single requirement r_1.
$x^2{}_{0100}$ is a seeker with single requirement r_2 .
$x^1{}_{1100} = x^2{}_{1100}$ is a seeker with two requirements r_1 and r_2 .
$x^1{}_{1110} = x^2{}_{1110} = x^3{}_{1110}$ = ...is a seeker with three requirements r_1 , r_2 and r_3.
$x^1{}_{1111} = x^2{}_{1111} = x^3{}_{1111} = x^4{}_{1111}$ .. . is a seeker with four requirements r_1 , r_2 , r_3 , and r_4.
$y_1{}^1$ is a provider with single resource r_1 for service s_1.
$y_2{}^1$ is a provider with single resource r_2 for service s_2.
$y_1{}^5{}_2{}^6$ is a provider with five resources r_1 for services s_1 and six resources r_3 for service s_3.
…….. ……
$y_i{}^j$ is a provider where i represents types of service and j accounts for some resources.

Simple Case: Suppose each seeker `x' has only one requirement of size`1'. That is $r_1=r_2=...=r_n=1$. Seekers with variable requirements: e.g. $x^1{}_{1000}(r_1)$ $r_1 \geq 1$. Thus,

Table 1. Receiver Requirement Table

Receiver/Requirement	r_1	r_2	r_3	.....	...	r_n

……	….	….	….	….	….	….
x^2_{1100}	1	1	0	0	0	0
x^2_{1010}	1	0	1	0	0	0
…..	…	…	…	…	….	…
x^3_{1110}	1	1	1	0	0	0
….	…	….	….	…	…	…
Sum of requirements	=4	=3	=	=	=	=
Total requirements =						

Table 2. Provider Strength Table

Provider/Strength	s_1	s_2	s_3	…	…	s_n
y_1^1	k_1	0	0	0	0	0
y_2^1	0	k_2	0	0	0	0
….	….	….	…..	…	…	….
$y_1^2 2^2$	p_1	p_2	0	0	0	0
$y_1^3 3^2$	p_1	0	p_3	0	0	0
…..	…	…	…	…	….	…
$y_1^5 2^4 3^3$	q_1	q_2	q_3	0	0	0
….	…	….	….	…	…	…
sum of strengths	=	=	=	=	=	=

3.2 Result For Different Interaction Function

In our program, we have taken inputs for all the three functions. For one-to-one interaction function we have made (Table 3.) x^1_{3000}, x^2_{0500}, and x^3_{0020} as the seeker and y_1^5, $y_1^5 2^6$, and y_3^8 as the provider. Here x^1 needs 3 resources of service s_1, x^2 needs 5 resources of service s_2, and x^3 needs 2 resources of service s_3 while (Table 4.) y_1, y_2, and y_3 have 5,(5 of s_1, 6 of s_2), and 8 resources respectively. So, y_1 gives 3 resources of s_1 to x^1, y_2 gives 5 resources of s_2 to x^2, and y_3 gives 2 resources of s_3 to x^3. Now, y_1 have 2, y_2 have (5 of s_1,1 of s_2), and y_3 have 6 resources.

Table 3. Receiver Requirement Table for one to one

Receiver/ Requirement	r_1	r_2	r_3	r_4
x^1_{3000}	3	0	0	0
x^2_{0500}	0	5	0	0
x^3_{0020}	0	0	2	0

Table 4. Provider Strength Table for one to one

Provider/	s_1	s_2	s_3

y_1^5	5	0	0
$y_1^5{}_2^6$	5	6	0
y_3^8	0	0	8

For one-to-many, we have taken (Table 5.) input as $x^4{}_{4020}$ as a receiver which requires 4 resources of service s_1, and 2 resources of s_3. Since (Table 6.) y_1 have only 2 resources of s_1, so y_1 will take help from another provider to fulfill the requirement. Here y_1, 2 resources, and y_2 will give 2 resources of s_1, and y_3 will give 2 resources of s_3.Now, y_1 has exhausted, y_2 have (3 of s_1, 1 of s_2), and y_3 have 4 resources.

Table 5. Receiver Requirement Table for one to many

Receiver/ Requirement	r_1	r_2	r_3	r_4
$x^4{}_{4020}$	4	0	2	0

Table 6. Provider Strength Table for one to many

Provider/ Strength		s_1	s_2	s_3
y_1^2		2	0	0
$y_1^5{}_2^1$		5	1	0
y_3^6		0	0	6

For many-to-many, we have taken (Table 7.) $x^5{}_{4080}$ and $x^6{}_{0605}$ as a seeker and also we have added two more providers $y_1^5{}_2^4{}_3^5{}_4^3$ and $y_1^5{}_2^5{}_3^5{}_4^5$. Here $x^5{}_{4080}$ requires 4 resources of s_1 and 8 resources of s_3 so (Table 8.) $y_1^3{}_2^1$ will give 3 resources of s_1, and $y_1^5{}_2^4{}_3^5{}_4^3$ will give 1 resource of s_1, and y_3^4 will give 4 resources of s_3 and $y_1^5{}_2^4{}_3^5{}_4^3$ will give 4 resources of s_3. Now, $y_1^3{}_2^1$ have y_2^1 only, y_3^6 has exhausted, and $y_1^5{}_2^4{}_3^5{}_4^3$ have $y_1^4{}_2^4{}_3^1{}_4^3$. Seeker $x^6{}_{0605}$ requires 6 resources of s_2 and 5 resources of s_4, but y_2^1 is not able to fulfill. So it will take help from $y_1^4{}_2^4{}_3^3{}_4^3$ and $y_1^5{}_2^5{}_3^5{}_4^5$. After providing the resources to $x^6{}_{0605}$, y_2^1 exhausted, $y_1^4{}_2^4{}_3^3{}_4^3$ have $y_1^4{}_3^1$ and $y_1^5{}_2^5{}_3^5{}_4^5$ have $y_1^5{}_2^4{}_3^5{}_4^3$.

Table 7. Receiver Requirement Table for many to many

Receiver/ Requirement	r_1	r_2	r_3	r_4
$x^5{}_{4080}$	4	0	8	0
$x^6{}_{0605}$	0	6	0	5

Table 8. Provider Strength Table for many to many

Provider/ Strength	s_1	s_2	s_3	s_4
y_1	exhausted	0	0	0
$y_1^3 2^1$	3	1	0	
y_3^4	0	0	4	0
$y_1^5 2^4 3^5 4^3$	5	4	5	3
$y_1^5 2^5 3^5 4^5$	5	5	5	5

The strength of an organization is estimated by the number of xi's coming in, and the number of xi's going out satisfied.

4 Conclusions and Future work

A social network representation is a key social service arena that requires a systematic methodology to improve its effectiveness and efficiency. Services have a broad range of latitude. This massive flexibility has brought challenges to the framework approaches to a service provider. In this paper, we formalize the how to provide the services from one network to another network (service providers to service receiver) to needy person as first come first serve basis and proposed an approach to providing the services. The author attempts to extend social network representation into a social service framework of the system. In this paper, the author proposes an interaction between two networks of maintaining principles that provide a cornerstone for a holistic approach to service needy people. There are two factors of providing services identify and fulfill the requirements. For identification either seeker has to approach or a volunteer will approach seeker. Service are providing using three interaction functions. Once the seeker fulfill his requirement then either he may leave the system or system may stop to provide the service. Both the cases seeker has to give feedback. If the seeker is satisfied with service, then the system is strong else system needs improvements. In our program we have also tried to assigning providers to receivers by choice of seekers or providers (preferential allotment in a prescribed order say, x^1 to y_1 like that.

For the extension of this paper, we need to consider receiver feedback system improvement. We have tried to how best we can utilize the resources of providers keeping none idle, exhausting none, and uniform utilization of resources. Apart from this, we have to find the closeness of among the

demands of the receivers e.g. x^1_{5000} denotes a receiver with requirement r_1=5. This is the case where x^1 is also a provider of other conditions out of the system but has no provision for r_1 in his system. For example, a system that provides night shelter to orphans but cannot provide food.

References

[1] Eric D. Werker and Faisal Z. Ahmed.: What do Non-Governmental Organization do?. Journal of Economic Perspectives, (2007).

[2] Rout, A.,: A UML Framework for Socially Responsive Resource Usage Protocol , IJCCT, Vol- 3, Issue-2. 0975 – 7449, (2012).

[3] Mohanty, H., "Socially responsive resource usage: a protocol." In International Conference on Distributed Computing and Internet Technology, pp. 243-254. Springer Berlin Heidelberg, (2011).

[4] Silberschatz, P. B. Galvin and G. Gagne, Operating System Priciples, WSE, Wiley India Pvt. Ltd, (2006).

[5] Bhattacharyya, D., Seth, S., and Tai-hoon K., "Social network analysis to detect inherent communities based on constraints." Appl. Math 8, no. 1L , 385-396. (2014).

[6] Seth, S., Bhattacharyya, D., and Tai-hoon K., "CBACCN: Constraint Based Community discovery in Complex Networks." International Journal of Applied Engineering Research 9, no. 23 18115-18127, (2014).

[7] Yamakami, T., "Servicenics approach: A social service engineering framework." In Digital Information Management (ICDIM), 2013 Eighth International Conference on, pp. 358-362. IEEE, (2013).

[8] Nepusz, T., A. Petróczi, and F. Bazsó. "Multigraph Approach to Social Network Analysis.", (2012).

[9] Yamakami, T., "A two-layer view model of service engineering: Implications based on service engineering in mobile social games in Japan." In Information Science and Digital Content Technology (ICIDT), 2012 8th International Conference on, vol. 3, pp. 562-566. IEEE, (2012).

[10] Fogg, B. J., Cathy S., David R. D., Leslie M., Julianne S., and Ellen R. T., "How do users evaluate the credibility of Web sites?: a study with over 2,500 participants."

user experiences, pp. 1-15. ACM, (2003).

[11] Barik, R. K., Dubey, H., Samaddar, A. B., Gupta, R. D., & Ray, P. K. FogGIS: Fog Computing for Geospatial Big Data Analytics. arXiv preprint arXiv:1701.02601, (2016).

[12] Goswami, V., and Misra C., "Discrete-time modelling for performance analysis and optimisation of uplink traffic in IEEE 802.16 networks." International Journal of Communication Networks and Distributed Systems 10, no. 3: 243-257, (2013).