Modern Applied Science; Vol. 10, No. 5; 2016
ISSN 1913-1844 E-ISSN 1913-1852
Published by Canadian Center of Science and Education

A Social Cloud Computing: Employing a Bee Colony Algorithm for Sharing and Allocating Tourism Resources

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Received: December 10, 2015 Accepted: January 11, 2016 Online Published: April 25, 2016

doi:10.5539/mas.v10n5p177 URL: http://dx.doi.org/10.5539/mas.v10n5p177

Abstract

With the growth and development of social networks and emerging cloud computing networks, social network users will be able to share their intended data, in data centers from various places all over the worlds which belong to cloud, with one another and additionally use others data simultaneously. Since with the passage of time, sharing the services and data sources through social networks in Tourism industry would be more complex for clients, it could be possible to facilitate the usage and sharing the Tourism resources with designing a social cloud platform. Initially, social cloud in Tourism area collects clients' information their inter-connected relationships from social networks. Afterwards, with the utilization of artificial bee colony algorithm, it can make an adjustment and balance in Tourism resources that have been shared as of yet and the comments and friendly relationships obtained from social networks. Finally, implementing such a social cloud in Tourism field can lead to an increase in the level of satisfaction of users when they want to have an access to useful documents and can achieve progress in the Tourism industry and develop it within the country.

Keywords: social networks, cloud computing, social cloud, artificial bee colony

1. Introduction

New opportunities have been created for sharing information resources by emerging the innovation of Social Networks over the past few years which was unimaginable beforehand and have been welcomed greatly by users. State-of-the-art applications on Electronics economy and business have been introduced by the growth and development of Social Networks such as sharing images and multimedia software, exchanging of ideas among users all over the world and so. Social Networks could attract numerous users because of their special applications in various eras including Tourism industry, Electronics commerce, and education. Social Network users are confronted by various types of information and contents, consequently their decisions are influenced by these information and contents around the world (Haas et al., 2014).

As a result, Employing Social Networks in different areas for exchanging information among users would assist a lot in developing and progressing it. Social networks in practice have a kind of virtual dynamic structure in which the communications among friends is based on an inherent trust. Social cloud employs this trust for sharing the data and services among the members (Chard et al., 2010). In Social cloud efficient and practical Tourism resources which are more requested are offered to users employing the artificial bee colony algorithm in designing the social cloud, it brings about a considerable decrease in the time spending for executing the programs and increases the quality of allocated resources when compared with other similar algorithms.

2. Research Background

Many enterprises recently use Cloud Services because of the significant decrease in operational cost of software, hardware, and human effort. Now, Cloud Computing has become a powerful tool for servicing the clients. Nowadays, these two new technologies, Social Networks and Cloud Computing, collaborate with each other in various fields to achieve great goals.

Supporting lots of data traffic such as sending and uploading different types of files and movies, and establishing communication with peers is the main factor for utilizing Social Networks. With the assistance of Cloud Computing in Social Networks, it would be possible to define a Social Cloud Computing as follows: a Social

Cloud is a scalable computational model that provides information resource sharing between users and employ this information in supplying services to clients (Chard et al., 2012). In Cloud Computing model, distributed networks are used to provide users with services and resources including software, hardware and infrastructural facilities and they utilize such pre-prepared information based on their demands.

Mohaisen et al. [40] extended the definition of social cloud. They evaluated different designs of social compute cloud and extended multiple scheduling mechanisms developed for task assignments. The main factors of their approach to resource allocation problem included resource endowment and physical network structure. Their analysis involved simulation by multiple co-authorship and friendship networks as input to Social Cloud. Their proposed Social Cloud was based on variations in load, participation and graph structure.

Simiarly, Tan et al. [41] developed a concept for Social Cloud. Their concept was based on sharing and exchange of resources within a social network to solve Big Data problems. F2Box, a friend-to-friend cloud storage, such as dropbox via a social network, was developed by Gracia-Tinedo et al. [42]–[44]. Their solution was to retain a reliable service by providing storage resources from friends. However, quality of services provided by their pure friend-to-friend system was not comparable to traditional storage services. Their solution of this problem was to develop a hybrid approach in which reliability and availability could be improved by services such as Amazon's S3. Although this approach provides insights to social cloud, it is not necessarily used for the current setting.

Literature provides individual economic models for social cloud. There are different types of incentives in a social cloud to motivate participation of users; however, it is a challenging task to provide these incentives [45]-[46]. Members of a social cloud can cooperate to provide the required infrastructure [16]; the authors developed an economic model considering individual incentives and resource availability.

Kuada and Olesen [47] discussed the challenges and opportunities of an approach for providing and managing enterprise cloud resources; their approach, opportunistic cloud computing services (OCCS), was based on a governing platform for enterprise-level social networking platforms including interoperable cloud management tools for resources provided by the enterprise. Similarly, Diaspora,4 and My3 [48] are based on similar concepts to host social network by resources provided by the user.

2.1 Challenges

It is noteworthy that sharing information resources in Cloud is a considerable challenge at the present time because most users do not have trust to this sharing environment. Users need a platform to share their computational resources readily and based on mutual trust in social networks on the one hand and use shared resources of other users on the other hand. Grounded on such requirements, Cloud Computing created new approaches for offering Cloud services by interfering in and affecting Social Networks in which is called a Social Cloud (Ahuja & Moore, 2013, p.11; Bagci et al., 2013, p.11). Employing some special tools, a Social Cloud would be able to manage, authenticate, and pursue users' interests and needs and in this way, a Social Cloud use such information to present commercial services in different fields to clients. There are several usages of a Social Cloud technology and some methods to implement it but its architecture and design has been underestimated. In this paper, an optimal method and its architecture has been proposed to address the needs of design of a Social Cloud including scalability, availability, security, speed, and simplicity. In this paper, a model of a Social Cloud is used for allocating and sharing information resources in which can respond the requests of infinite users with acceptable speed and scalability simultaneously (Tran et al., 2011, pp.1-5)

2.2 A Social Cloud Architecture

A customized Social Cloud Platform is necessary to facilitate information resource sharing and allocation. Generally speaking, in the architecture of Social Cloud computing, Social Networks play a role of a media in which is responsible for creating interaction between users and a platform. These Social Networks create infrastructures that act as information resources in which these infrastructures interact with Social Cloud by user interfaces. The following necessary factors should be considered for the architecture of Social Cloud (Bubendorfer et al., 2013; Wu et al., 2010).

2.2.1 Social Cloud Platform

A Social Cloud platform is the central point in the system that has the responsibility for clients' information, their sharing settings, and providing them with resources and allocating them needed resources. Therefore, a Social Cloud platform needs two databases: first, for creating a social graph from users to identify their level of communications, and second, for identify users' priorities for allocating resources (Haas et al., 2014).

2.2.2 Social and Technical Adaptors

To determine sharing priorities, a Social Cloud needs to have an access to Social Networks. To achieve this goal, a Social Adaptor is used to collect information about clients form these Social Networks. A piece of Software is used to, specially designed for Social Network Analysis, gather information for a Social Cloud, or an API is employed for this purpose (Faruk et al., 2013). In this way, some practical information such as users' interests, relationships, and opinions for instance from Facebook or Twitter are collected. For this purpose, there are three methods that can be used separately or simultaneously (Punceva et al., 2013):

1. Ask from user's friends.
2. Use Social Network Analysis methods to detect relationships between users.
3. Use users' experience or comments made in Social Networks

2.2.3 A Social and Economy Model

A Social and Economy Model in Social Cloud computing is employed to how prioritize sharing information and adapt information resources for users. As a first step, demand and supply should be taken in to account (Mohaisen et al., 2011; Ali et al., 2012, pp. 160-166). In this paper, the execution of the social and economy model is done centrally. In other words, the demand and supply in sharing and allocation of information resources to clients is determined beforehand by clients themselves. As a result, by utilizing this method, more appropriate results would be obtained in comparison with information resources are not used centrally(Faruk et al., 2013).

3. The Proposed Social Cloud

In the proposed Social Cloud which is designed and implemented for Tourism industry, special tools are employed to manage and authenticate clients within the network. Grounded on the obtained records and information from users, it would be possible to facilitate the sharing process of Tourism information and facilities between users .Accordingly, it can be claimed that a virtual world is created along with our real world complementing each other, aiming at doing numerous Tourism activities(Akhmal binti Mohd Zulkefli & bin Baharudin, 2014, pp.1-6).

In the design and implementation of a Social Cloud in this paper, as a first step and input data, users' data which is related to their Tourism interests and relationships are collected from Social Networks such as Facebook (Sigala et al., 2012). As a second step, a web-based platform is designed and implemented for clients to log into it by their Social Cloud username and password. In this way, our customized Social Cloud platform would be able to have access to users' interests and wishes related to Tourism topic. As a third step which is the main step of Social Cloud design, a Bee Colony Algorithm is employed in a Social Cloud Computing. This algorithm detects users' needed information by repeating search steps and selecting optimal choices and making adaptation between two databases, one as Tourism resources and other friendly relationships between users (Vaishali et al., 2012, pp. 15-19).. As a result, the most appropriate information about the intended destination can be prepared for and delivered to Social Cloud users. As seen in Fig.1, in the left side of the figure as an input, user information such as their interests, relationships, and comments in Social Networks, such as Facebook and Twitter, are delivered to Social Network Analyst Software, like GEPHI, by using practical Social Network Analyst Software. Users' comments, about different Tourism topics, are classified and evaluated based on their Likes received from other users in Social Networks. Afterwards, collected information are adapted to select appropriate and optimal Tourism resources.

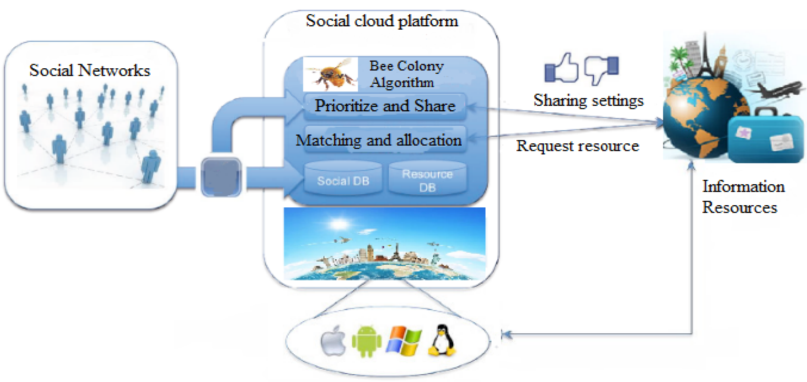

Figure 1. Social cloud computing and its main sectors

3.1The Proposed Bee Colony Algorithm

In the design of the proposed algorithm for a Social Network, several features are considered as key factors such as decreasing the computation time and optimizing answer for producing an adaptation between users' information and different information resources for sharing. Consequently, employing an appropriate algorithm in a Social Cloud for making adaptation and allocating optimal information resources, aiming at decreasing the program execution time, has received a lot of attention in Social Cloud(Huang & Gu, 2013). As a Bee Colony Algorithm is a group algorithm and based on an optimal search, it finds and collects information in an optimal manner, just like other Swarm Algorithms (Krishna, 2013, pp.2292-2303; Quijano & Passino, 2010, pp.845-561). Worker bees are responsible to extract information from information resources while supervisory bees discover information for users. As a result, it would be possible to allocate resources to Social Cloud users in an optimum fashion. As of yet, a Bee Colony Algorithm has not been employed in the design of Social Cloud platform to optimize and share information resources. Fig.2 shows the steps of Bee Colony Algorithm in a Social Cloud Computing in this paper. In the first step, after determining the number of bees, evaluation function will be delivered to bees based on the quality and score of each information resources. In the second step, bees use this function to make their decision and find optimal resources.

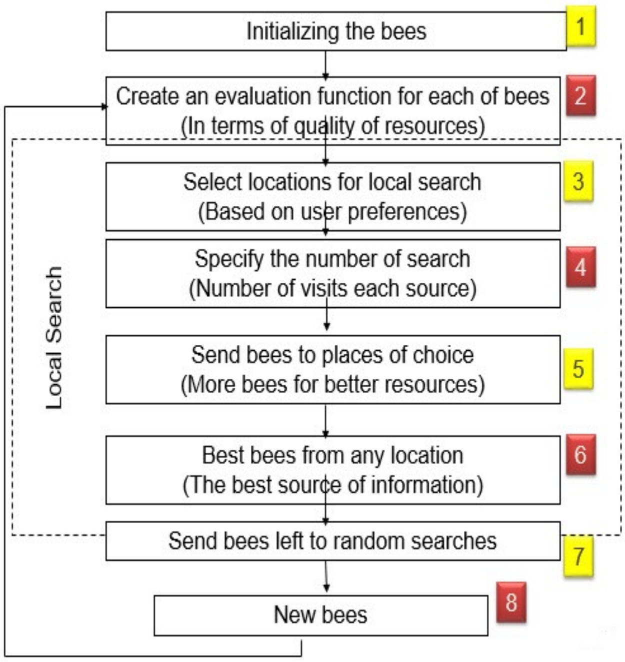

Figure 2. Bee colony algorithm proposed

In the third step, bees search through smaller areas and range among heap of shared information resources which are determined by platform priorities and find useful information in this step. In the fourth step and after extracting useful information from the previous step, again worker bees start to explore properly among these information resources based on the obtained information from Social Networks such as users' interest and comments made by their friends. Consequently, after an adaption which is occurred in the fifth and sixth steps, the most efficient and optimal information are allocated to users. In the seventh step, part of information that are obtained randomly can be compared with previous obtained information to substitute if necessary. Employing a Bee Colony Algorithm in searching through a Social Cloud would help decreasing the search and execution time of the data and program and increasing the quality of allocated information.

3.2 The Execution of the Proposed Social Cloud

In the first step, users' information are registered in the database of a Social Cloud (Social DB) based on their username. In the next step and as seen in Figure.1, the information resources are determined in the right side of the figure. These information resources are shared by users and are suitable to be employed in Bee Colony Algorithm. As a result, with an optimal search within these information resources by this algorithm, appropriate resources would be delivered to users. In the third step, the execution of the designed platform is done which is most weighty part in the design of a Social Cloud. Our designed website for this paper is "http://Abrgardeshgari.ir". After registering in the website, users can log into the website by their username in Social Networks such as Facebook. Immediately, Social Cloud can detect username and necessary information of users which are collected from Social Networks and this information would be delivered to Social Cloud in the long run. A Bee Colony Algorithm is executed in two phases. In the first phase, a Bee Colony Algorithm exploits useful and intended information from different information resources by worker bees (Quijano & Passino, 2010, pp.845- 561). These information are based on users' interests in a special field which are obtained from the platform priorities. In the second phase, this algorithm differentiate and adapt between obtained information about users' interests and their relationships which are attained from Social Networks form the first phase (Fig.1) and are stored in Social DB and the useful information resources acquired by worker bees and are stored in Resource DB. Accordingly, by repeating these algorithm steps and making necessary adaptation among useful information resources for users and their interests and attributes, users' necessary information are detected. As a result, the most appropriate and optimal information resources will be delivered to Social Cloud users based on their needs and requirements.

4. Results

In this paper, tourism information resources are considered in which they are implemented by different algorithms such as a Bee Colony Algorithm. Therefore, the most appropriate Tourism resources are allocated to users by using this method, Social Platform. In implementing of Social Cloud, by employing users' information and interests and their taste regarding Tourism topic, optimal resources allocate to users. It is noteworthy that all these information are gathered in Social Cloud Platform. By prioritizing these collected resources, useful information which have been shared in Social Networks are extracted from them. Then, intended information are extracted from these resources by executing different algorithms. In this step, gathered information from users in Social Networks are adapted related to requested information and useful Tourism information resources deliver to users.

As shown in Table.1, a sample of a Social Cloud execution for allocating to Tourism resources is demonstrated. These sample is obtained with the assistance of two algorithms, a Bee Colony and Genetics. Their execution time are compared based on the number of similar cycle and the number of variable chromosomes in the Genetics Algorithm and the number of variable bees in a Bee Colony Algorithm.

Table 1. Sample runtime social cloud

genetic algorithm execution time (s)	Bee algorithm execution time (s)	Number bees	Number chromosomes	Number of cycles
325	156	10	10	500
543	316	20	20	450
532	372	30	30	400
646	278	40	40	200
201	187	50	50	100
341	235	60	60	80
411	144	70	70	70
283	192	80	80	50
127	34	90	90	10
98	21	100	100	5

In the next step and by comparing these two algorithms and by keeping the cycle number or cycle repetition constant in each algorithm, the effect of increasing the number of bees and chromosomes on the program execution time is monitored and compared. After that, the number of cycles for the algorithm execution is kept constant while the program execution time which is based on the increase in the bee numbers in Bee Colony Algorithm and also is based on the number of chromosomes in Genetics Algorithm is compared with each other (Erdil & Ergin, 2006; Haas et al., 2013, pp.149-160; Wang et al., 1997). Shown in Table.1 and as some samples, the execution time of a Bee Colony Algorithm and a Genetics Algorithm are compared in the same conditions in a Social Cloud with the topic of Tourism for allocating optimal resources to users. The number of cycles are kept constant for both algorithms and in computing the execution time, the following results are obtained based on the number of chromosomes and bees. In Figure 3, a comparison is made between the execution time of a Bee

Colony Algorithm and a Genetics Algorithm in a same condition with similar data. The horizontal axis shows the cycle numbers in the number of chromosomes or bees while the vertical axis demonstrates the time execution of a Social Cloud in a Tourism field. The achieved results prove that the efficiency of the Bee Colony Algorithm is higher that a Genetics Algorithm in the execution time of a Social Cloud.

Figure 3 shows runtime in second versus different runs of each algorithm. The yellow scatter plot shows the runtime of the bee colony algrothim. The blue scatter plot shows the runtime of the genetic algorithm. In this simulation, 10 runs of the algorithms are considered as samples.

For different runs, conditions of the problem are the same. In the figure below, the conditions are shown in the form of 10×500 to 100×5 in which the left number implies the number of chromosoms in the genetic algorithm or the number of bees in the bee colony algorithm and the right number indicates the number of cycles of the algorithm.

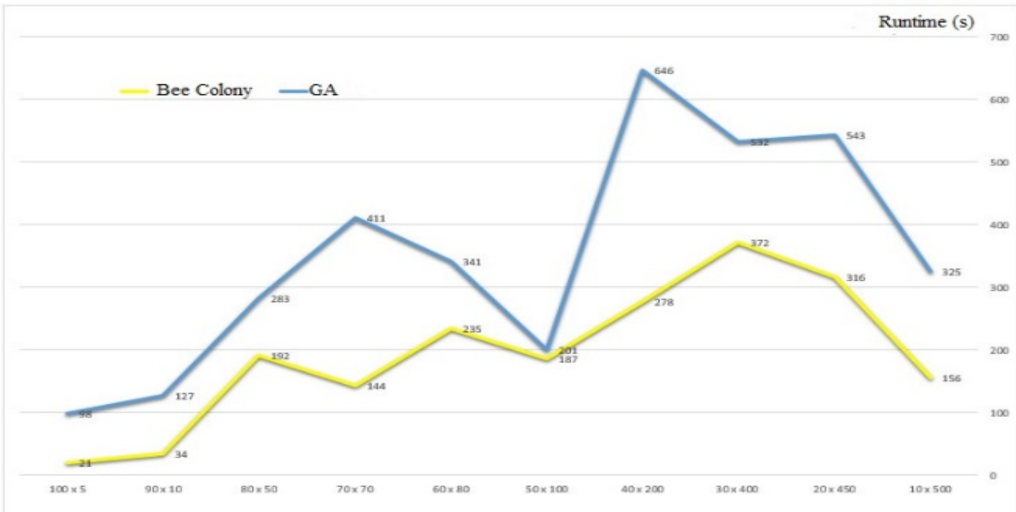

Figure 3. Compares the performance of social cloud

In our next evaluation, the cycles are kept constant while the numbers of bees and chromosomes have been increased and the results have been compared and shown in Figure 4. Results show that the increase in the number of chromosomes in the Genetics Algorithm and also bees in the Bee Colony Algorithm resulted in the increase in the execution time of the program. Nonetheless, an increase in the execution time of the program in the Bee Colony Algorithm is less than it when compared with the Genetics Algorithm. Generally, the Bee Colony Algorithm is more efficient than Genetics Algorithm when their program execution time is compared with each other, so better results have been achieved in the Social Cloud Computing by employing the Bee Colony Algorithm.

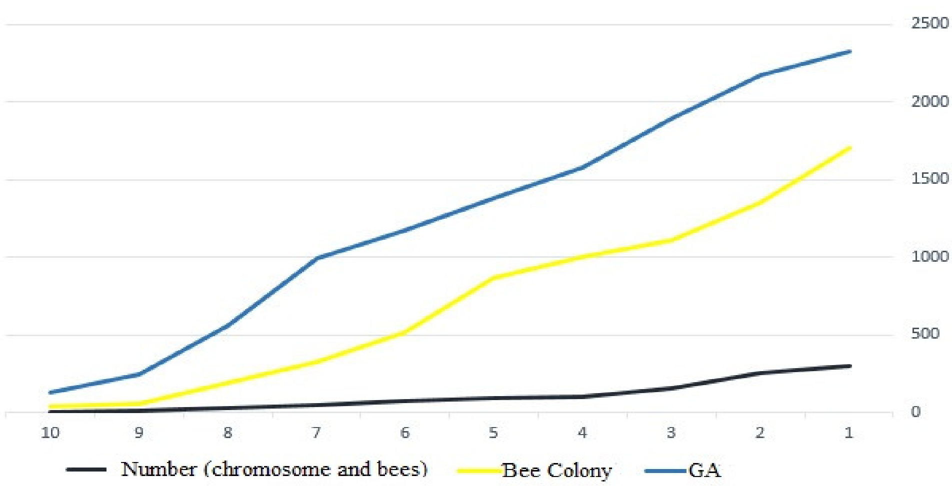

Figure 4. Compares runtime bee colony algorithm and genetic

By comparing Figure 4, it is clear that both increased number of chromosoms in the genetic algorithm and increased number of bees in the bee colony algorithm will increase runtime. However, the increased runtime is lower using bee colony algorithm than the genetic algorithm. Moreover, bee colony algorithm outperforms the genetic algorithm in terms of runtime. Bee colony algorithm provides better results in social cloud computations.

As shown in Figure 5, the Bee Colony Algorithm (BC) is compared with two other algorithms and the execution time of programs are compared with one another when the number of users have been increased. From the program execution time standpoint, the Bee Colony Algorithm is more efficient when compared with two base algorithms, namely DA and WO.

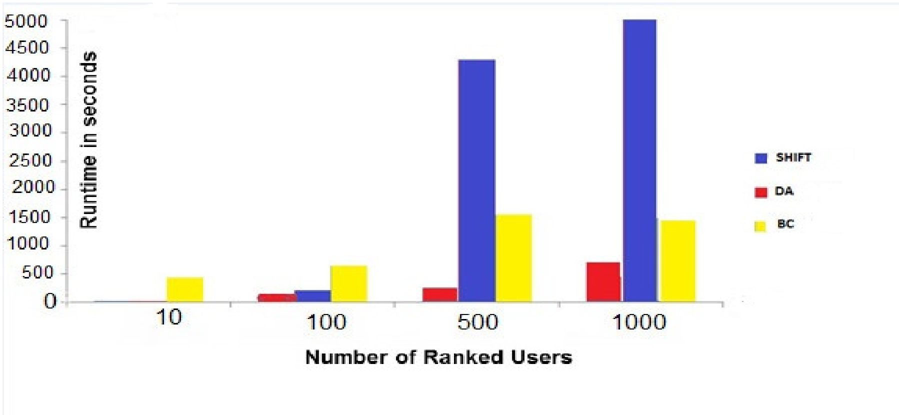

Figure 5. Compares runtime basic algorithms with bee colony algorithm

Additionally, as it is clear, the Bee Colony Algorithm has a better efficiency and least change when the number of users increase and also it has a better performance from execution time viewpoint when compared with other mentioned algorithms.

As a result, runtime of bee colony algorithm is better than similar algorithms for its simultaneous inquery by bees to find the most optimal way for sharing and allocation of information resources to users.

In general, extension of social cloud using bee colony algorithm in social cloud computations can be useful for higher access of users to tourism resources. Moreover, accurate selection of destination for users increases the level of satisfaction with social cloud, leading to growth and development of tourism industry.

5. Conclusion

With the development of Social Cloud Computing and considering the trust which is built up based on the users' relationships in Social Networks, it would be possible to employ this new emerging technology to provide clients with their necessary information and services. Social Cloud Computing can offer useful and efficient information in numerous and various fields to users whenever they wish. In the near future, Social Networks are going to develop and progress with the assistance of the Social Cloud. Consequently, with the aim of developing a Social Cloud and preparing the users with their necessary requirements, an efficient and feasible architecture for these networks is desired, being able to share information resources on the Cloud environment. Considering the architecture and design of a Social Cloud and proposing different models and procedures for optimizing the sharing process and facilitating users' access to the Social Cloud, a Social Cloud would develop and become widespread in next to no time. As a result, employing a Social Cloud in Tourism field could help increasing and absorbing the number of Tourists and having a considerable impact on this industry for each country. As a result, in this paper it is tried based on the assumptions and questions of research, investigate into the impact of the Bee Colony Algorithms on the optimal choice of a Tourism city and Tourism resources. In addition, it is necessary to conduct researches on the satisfaction level of tourists and tourist attraction.

Considering the significance of social cloud, this study presented a model designed for sharing and allocation of different tourist resources focusing on interests of users. Bee colony algorithm was used for computations of this social could.

Using bee colony algorithm, information was collected from users of social networks; by matching information resources as well as interests and requirements of users, the best useful information resources with higher quality are provided in less runtime compared to similar techniques.

A Social Cloud has the potential to be employed in other fields such as medicine, electronics business, marketing and other eras to allocate and share information resources to their special users. As future work, a Social Cloud simulator can be applied to different topics with higher states and algorithms. Other issues that can be considered in the future are lessening inconsistencies, deceasing overload and paralleling the Bee Colony Algorithm on the distribution devices. Other main concern about the design of a Social Cloud can be the issue of the trust and security in these networks.

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