

Proposing Optimal Meeting Location Using NSGA-II

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ABSTRACT

In recent days use of smart phones has increased on large scale for day to day real life scenarios. These mobile devices contain many applications to provide location aware service to the users. We are considering a scenario where five people want to find the location to have an in person meeting. But the meeting location must be at most exact distance from all people's current location. Finding efficient and optimum meeting location is a crucial task. However, the meeting point decided through call or message may or may not be efficient to all users. In this paper, we aim to find a meeting location which should be optimum to all the users. Instead of using old strategy i.e. phone call or random deciding the place, we propose a method which will decide optimum location by considering all users current location parameter received from user's smart phone. To get the optimum location, proposed system uses Non Dominated Sorting Genetic Algorithm (NSGA-II) which is advanced version of genetic algorithm. Our result shows 99% optimum meet location.

Keyword : GPS, genetic algorithms, fitness function, multiobjective optimization, optimal solution, NSGA-II.

1. INTRODUCTION

The rapid growth of smartphones has increased in recent years. Android is much used operating system preferred by mobile phone users. Service provided by android OS is more usable and easy to use, because of this nature people are dependent on these gadgets and their provided services. Millions of mobile subscribers taking advantage of the innovative context-dependent services provided by service providers to obtain location specific information [1].

Mobile phone is carried everywhere by users so location aware services offers user more contextual information. Now many people work in organization and corporate offices and they need to attend business meetings frequently. Scheduling meeting is still a manual work in much organization. Time and date is more concentrated while scheduling meeting rather than efficient place. In such cases every employee must have to attend meeting in time irrespective of the place. Due to this pressure and workload on employee may get increased [2][3].

Determining suitable location for group of employees to reduce their workload and pressure to reach at meeting point on correct time. While deciding meeting point every user's location must be considered so that everyone should have same efforts to attend meeting. The location of employee can be tracked in smartphones using Global Positioning System (GPS) and Global System for Mobile Communication (GSM). GPS is easier to use and locate [4]. One of the functionality of GPS is providing spatial coordinates of user location. A spatial location can be represented by using latitude-longitude-altitude coordinate system [5]. Based on the location of each employee common place is decided using Google API to get optimized location [6].

The algorithms that have been emerged in recent years are Ant Colony Optimization (ACO), Particle Swarm Optimization (PSO), Bacterial Foraging Optimization (BFO), Artificial Bee Colony Optimization (ABC) etc. as shown in following figure. However NSGA-II works better than these following algorithms in optimal location finding application.

In proposed system meeting location is obtained by Non Dominated Sorting Genetic Algorithm (NSGA-II) algorithm [7]. The NSGA was one of the first Evolutionary Algorithm (EA). This algorithm work on domination theory, where each solution is compared with every other solution in the set of solutions to find if it is dominated.

This will require $O(MN)$ comparisons, where M is the number of objective and N is population size [8][9].

After scheduling the meeting location notifying every user is a relevant issue. Notification is done manually by one person it may be through call, message or email. However, again it will increase overhead of notifying. To reduce this overhead automatically notification should be sent to every user after scheduling meeting. Notification should include location, timing and any other requirement about meeting [10]. In android device notification can be sent like push notification. Push notification will directly show notification on notification bar of android device [11].

2. SCENARIOS

2.1 Business Meeting

Consider that a business meeting is planned by a company. The users will come from all over the world to attend the meeting. It is the company's responsibility about all expenditure of users to attend meeting. so the company wants to minimize the total expense of employee time and travel costs etc. users will either come through drive or fly at the meeting location. Some users already work at company where meeting is hosted so they don't need to travel. So which company should be considered as meeting location?

2.2 Friends Reunion

Group of pass out student wants to meet after BE completion but they are located at different locations, one is at swargate, second is at yervada, and other at kothrud and vishranwadi etc. So to go together they need to meet at some common place. For that some will come by own vehicle, some will by using public transportation etc. so in this scenario the common place to meet together will be decided by this proposed method.

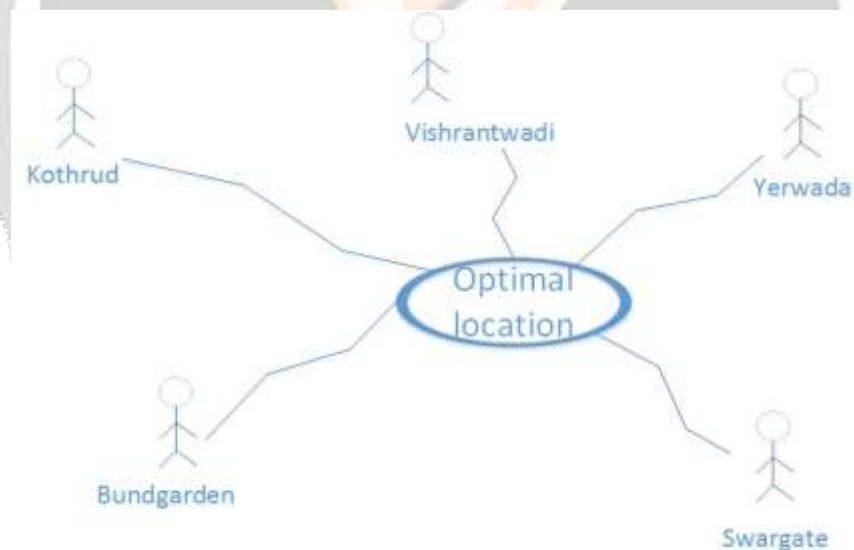


Fig -1: Meeting Scenarios

3. RELATED WORK

Igor Bilogrevic et, al. [1] proposed privacy-preserving algorithms for determining a meeting location for a group of users by using Fair Rendez-Vous Problem (FRVP) algorithm. The solution is based on homomorphic properties of well-known cryptosystems. This paper mainly addresses on the privacy of shared location rather than finding optimal meeting location.

Saniya H. Daruwale et, al.[2] This paper based on location sharing application to find center location for meeting. To secure the shared location this paper focuses on privacy preserving FRVP algorithm. It uses some encryption methods for security. This paper only focuses on idea of finding meeting location rather than optimum location.

Paulo Santos et, al. [3] this paper focuses on examine literature on meeting location decision making system by using FRVP algorithm. This system proposes a more comprehensive solution. This system is useful for constant value and it is complicated for dynamic users, system will fail with insufficient data.

Manav Singhal et, al. [4] proposed the implementation of Location based services through Google Web Services, APIs on Android Phones to give multiple services to the user based on their Location. This paper describes various parameters used to understand and use the GPS. This paper gives total theoretical idea about how GPS work and how we can use it by using Google services.

Pritam Kumar Tripathy et.al. [5] Presented paper that gives idea about working flow of our application. However this paper just considers privacy about location sharing and shows overall view of application rather than any algorithmic points. Finding meeting location is used as only example to show how location privacy can be preserved.

Kalyanmoy Deb et.al. [7] proposed multiobjective evolutionary Non-dominated Sorting Genetic Algorithm (NSGA-II). This paper gives comparison about working and result of NSGA-II with other two evolutionary algorithms named Pareto-archived evolution strategy (PAES) and strength Pareto EA (SPEA). This paper only focuses on working of NSGAII without how it can be used in different applications.

Adinovam H. M. Pimenta et, al. [8] Proposed the Non-dominated Sorting Genetic Algorithm Distance Oriented (NSGA-DO). This algorithm is used to find non-dominated solutions which balance the Pareto front with respect to optimization of the objectives. This paper focus on evolution of distribution of non-dominated solution as well as accuracy interpretability trade off. This algorithm is totally based on selection operator which is based on ideal points.

Malathi S Y et, al. [6] proposed on user location privacy using FRVP algorithm. This is Focused on real time location awareness. Privacy of a user's location or location preferences, with respect to other users and the third-party service provider, is a critical concern in such location-sharing-based applications.

Ankita Golchha et, al. [9] presents succinct overview of the application of NSGA-II. Describes how NSGA-II can be applied for solving number of optimization problems. This paper just gives survey with many authors view about NSGA-II and its steps. It just focuses on overview of NSGA-II rather than any implementation.

May H. Riadh et, al. [10] This paper introduce notification system using Android application. This paper introduces GCM service for instant notification and gives overall idea about implementation of it in different applications. However, to use GCM service we need a proper Google authentication.

Konglong Tang et, al. [11] This paper introduce MQTT (Message Queuing Telemetry Transport) protocol which is used to achieve instant messaging push notification. There was already the perfect push server in Apple's IOS but in android it was relatively hard to implement. However, MQTT protocol is complex to use as compared to GCM.

Sachith Abeyesundara et.al. [12] proposed genetic algorithm to solve the shortest path in road maps problem with its design and outline. GA covers all solution about problem and suggest many best solution. Main disadvantage of this strategy is it need to do relatively few assumptions about the problem that is being solved.

Da Yan et, al. [13] proposed a new baseline algorithm for the OMP query, which reduces the search space. This paper present two effective pruning techniques that further accelerate the baseline algorithm. An extremely efficient algorithm is proposed to find a high quality near optimal meeting point. This paper shows that finding the optimal location through queries is being complex.

4. PROPOSED SYSTEM

To overcome the drawback of existing system this system is proposed while deciding the meeting location and notifying about the same. Our proposed system is an android application. While deciding meeting location the term should be considered that everyone should get same distance for traveling. For that this proposed system will find such a meeting location which will be efficient to all its users.

To find the meeting points each user's current location will be considered by using GPS. GPS is easy to use and simple to locate the user. If user is offline that time we can't get his/her current location, in this situation we will use its home/default location. While registering app user will set its default /home location so that we can use it while user will be offline.

After deciding meeting point notifying to all the users is also tedious task. However this proposed system will automatically notify to all users, so less overhead will require for notification rather than existing system. Every person will get notified automatically about meeting location or venue and timing.so the person who arrange the meeting does not require to notify individually to every person.

4.1 System architecture

This section describes the architecture of proposed system. System consists number of users and a server to calculate the meeting point. Every user is using their android phone to use our system. Through android phone each user will login to our system. Each user will share location to find optimum location. Server will take care of finding meeting point and notifying all users about meeting.

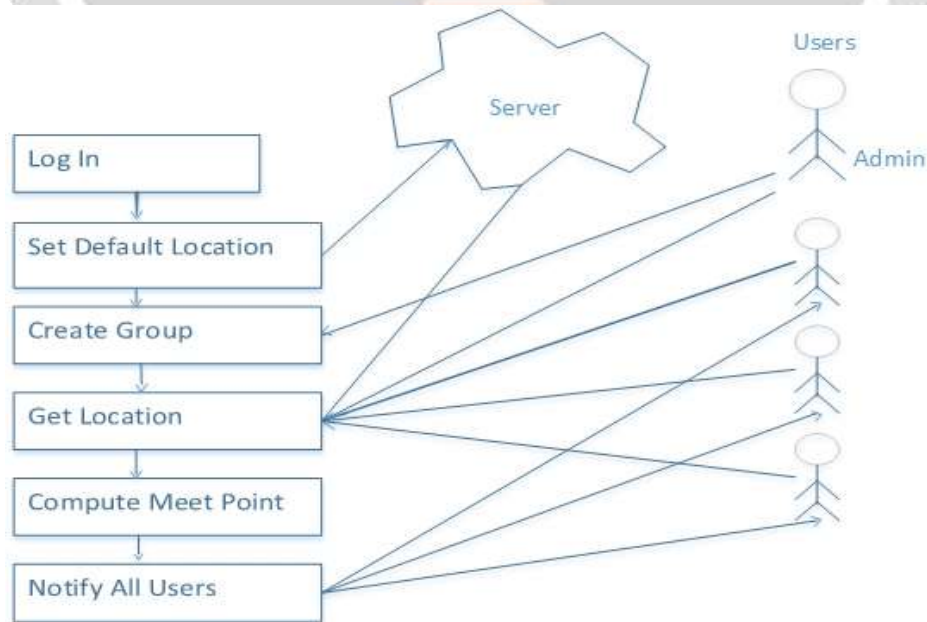


Fig -2: Proposed System Architecture

4.2 Algorithms used in System

Every user may be residing at different locations so to find optimal result we are using NSGA-II algorithm. NSGA-II algorithm will compute optimum meeting location. The NSGA-II algorithm uses a faster sorting procedure, an elitism preserving approach. This algorithm creates new solutions from present solutions. The working of algorithms is based on following steps:

4.2.1 Algorithm: Finding meeting points

Input: location of each users

Output: Finding optimal meeting location

1. Get location of each user
2. find no of meeting points(finding average points)
3. using nsga2 find optimal meet point
4. Notify all users about optimal meeting location.

5.2.2 Algorithm: NSGA-II to find optimal meet point

Input: Number of meeting points

Output: Finding optimal meeting point

1. No of meeting points(Parent Population)
2. select no of best meeting points(selection)
3. perform operation on two good meeting point and find new better meeting point(crossover)
4. perform some alteration in good meeting point and find a better meeting point(mutation)
5. select best meeting point which will be optimal (offspring)

In proposed system NSGA-II will initially find some locations as parent population. By performing selection, crossover and mutation it will create new solutions/offspring's. So that it will always drive towards a better solution by combining two good solutions. Like this NSGA-II will finally select optimal location which will be minimum to all the users.

6. CONCLUSIONS

This application can be used to schedule a meeting point which will be having same distance for all its participants. This application uses NSGA-II algorithm to find optimal meeting point from number of meeting points. To inform all users easily and quick this application will send automatic notification through mail, which is containing date and location of meeting.

In future scope, we can implement this application on different mobile operating system to increase its applicability.

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