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A CHANNEL ALLOCATION SCHEME TO AVOID CHANNEL INTERFERENCE USING GENETIC ALGORITHM AND HEURISTIC APPROACH IN MOBILE NETWORKS

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ABSTRACT

Channel Interference is the major problem in mobile networks. The reasons for channel interference are improper frequency planning, weather conditions etc. The reproductive stage of Genetic Algorithm is used to avoid channel interference in dynamic mobile channel allocation. This algorithm combines sequential heuristic methods into a genetic algorithm that consists of three assignment strategies. The three strategies are regular interval assignment strategy, greedy assignment strategy which consists of node degree ordering and Frequency Exhaustive Assignment technique and Genetic Algorithm strategy which consists of selection, crossover and mutation.

Keywords: cellular networks, mobile host, mobile service station, genetic algorithm, channel interference.

INTRODUCTION

In mobile networks, the demarcated area of the earth is split into smaller region called cells. One Mobile Service Station and numerous Mobile Hosts allocate for each cell. MSS communicate with other MSS through wired links and MSS communicate with Mobile Host through wireless links. If one Mobile Host try to communicate to other Host, then it forward a request message to its own Mobile Service Station. The request can be accepted after it established wireless channel between MSS and Mobile Host for communication. Generally for channel allocation Centralized approach and Distributed approach are used. In a centralized approach there is only one MSS for the whole area. This leads to single point failure. Multiplexing is used to avoid interference. There are four types of multiplexing such as Space Division Multiplexing, Time Division Multiplexing., Code Division Multiplexing. Frequency Division Multiplexing.

RELATED WORK

In the centralized approach, there will be a central controller called MSC, which has information about all the channels. When a Mobile Host need to communicate with other Mobile Host it sends request to MSC. MSC process the request and allocates the channel. Limited channels are available in centralized approach, so they can be reused effectively If the channel is allocated at the same time by two cells which are within a threshold distance called the minimum channel reuse distance then it cause co-channel interference . The Disadvantage of this system is Single Point Failure. If MSC fails entire system fails. This reduces the Performance.

In [2] Abhijit Sharma *et al* present various schemes to avoid interference. Adaptive Load balancing with pre-emption uses online bandwidth management algorithms to avoid interference. iCAR scheme is used to share channels between cells by primary and secondary relaying. In the proposed system channels can be shared by two Mobile Hosts if the distance between them is greater than the threshold distance. In centralized approach, Selective Borrowing is used for Load Balancing. By measuring the degree of coldness here the cells are of two categories either hot cell or cold cell. Degree of coldness is the ratio of number of available channels to the number of channels allocated before in the cell.

In [1] Lutfi Mohammed Omer Khanbary *et al*, Genetic Algorithm is combined with the survival of the fittest technique. In this approach fitness function is the normal addition and subtraction. Here the number of generations is given as input. In each generation the time taken or the selection process is constant since the fitness function is simple mathematical calculation.

In [3] Seo-Jung Heo *et al*, Channel interference is considered only for generating initial population in genetic algorithm and channel interference is considered only for fixed cellular networks. Channel is assigned to only one confined cell. For the same type of channel, channel assignment doesn't occur. Genetic Algorithm is used only to improve the efficiency of channel allocation algorithm.

In [4] Sa Li *et. al*, for channel allocation genetic algorithm is used to avoid the benchmarking problem and to avoid the interference. In the encoding scheme, a p-bit binary string represents an individual with q fixed elements and the minimum separation between consecutive elements is represented by dmin.

PROPOSED SYSTEM

Proposed system is to reduce the channel interference. The three stage algorithm is used to reduce the channel interference.

Regular interval assignment

This stage is the first stage to assign channels to the Mobile Host. This stage is purely based on the distance. The Euclidean distance between the requested Mobile Host and channels are calculated. If the distance is greater than the specified distance and lesser than the other distances then the channel is allotted to the requested Mobile Host.

Greedy assignment

Constructing the Greedy region is the basic step. Largest degree Cell and its adjacent form the greedy region One Important condition to form the greedy region is that the Sum of Frequencies should be greater than its adjacent cells. This stage fails if the channels can't be assigned to the Mobile Host within the region. Then the greedy region is expanded by including all the other adjacent cells and it is preceded. If again the above mentioned condition fails Greedy Technique will be failed and it moves to Genetic Algorithm technique with the results from the first stage. This stage uses 2 techniques namely Node degree ordering and Frequency Exhaustive Assignment Strategy.

Node degree ordering

Cells are arranged according to the non-increasing values of the frequencies. Calculate the difficulty level of all the cells. Based on the difficulty level check whether the cells form a greedy region .If there is a greedy region the FEA strategy is used for allocating the channel. If no greedy region is formed the control is transferred to the next approach which is the genetic algorithm assignment.

Frequency exhaustive strategy

The list of cells arranged in the order of their respective difficulty levels is taken as the input to this method. In this approach channel is assigned to the cells based on the order in which they appear in the list.FEA strategy is efficient for allocating channels.

Genetic algorithm assignment

This step is the last step in the proposed system. The output from the FEA approach is taken as the initial population. This stage uses three steps.

a) Selection
b) Mutation
c) Crossover

Selection:

The list of blocked calls is randomly shuffled. Quality of each call is calculated. Based on this quality, the calls which have Quality value greater than the minimum value are selected for the next process.

Mutation

In this process the calls in the list mutate. Random call in the list is selected as a mutation rate. The calls neighbouring to this call swap their positions. The calls next to neighbouring calls also swap their positions. This list after mutation and the original call list are then taken as input to the Crossover phase of genetic algorithm.

Crossover

The two parent call lists are taken. One list is the list of blocked calls that is taken from the FEA approach. Another list of calls is the list that is got as the output of the mutation process. A binary vector is generated in random. Based on the generated binary vector a new call list is generated. First list contain the new call list of value 1 for the binary vector and the other values are filled from the second list. It is taken into account that there is no duplicate value for any call in the finally generated call list. The new list is the output of the genetic algorithm process. Channels are allocated for the calls in the order in which they appear in the list. This process takes place until all empty channels have been allocated to the requesting mobile hosts.

EXPERIMENTAL RESULTS

In the Figure-1 it can be seen that channels are allocated in all the three stages. After selecting the Mobile Host channels are allotted for some Mobile Host in the Regular Interval Assignment stage based on the distance calculation. Then a channel is allocated to the Mobile Host by using Greedy Technique where greedy region is formed. Then a channel is allocated to a Mobile Host by Genetic Algorithm Assignment. In this case all the three stages are executed.

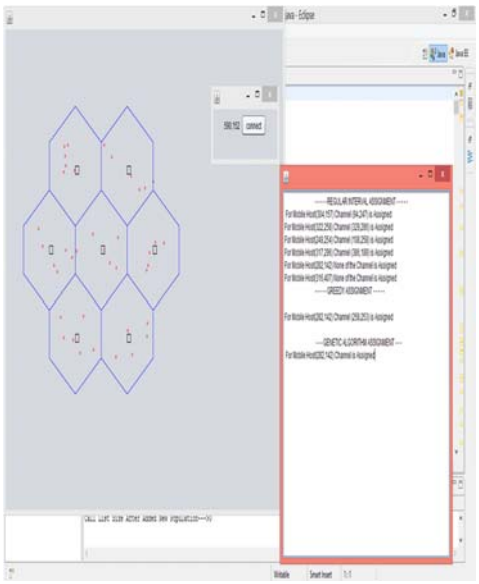

Figure-1. Results with the Greedy region.

In the Figure-2 it can be seen that channels are allocated in all the Regular Interval Assignment and Genetic Algorithm Assignment stage. After selecting the Mobile Host channels are allotted for some Mobile Host in the Regular Interval Assignment based on distance calculation. Then Greedy technique failed due to the failure in the expansion of the greedy region .Based on the results from the Regular Interval Assignment then a channel is allocated to all the remaining Mobile Host by Genetic Algorithm Assignment. In this case Greedy Assignment stage is not executed.

COMPARISON

In the existing centralized system there will be a single MSC which leads to single point failure if the MSC fails. But the proposed system there will be MSS in each cell which avoids single point failure. In the proposed system channel interference is avoided by proper frequency planning. The channel with a particular frequency can be reused by other Mobile Host if the distance between the particular Mobile Hosts are greater than the threshold distance. In the Figure-3 we can see that interference level is less in the proposed system than in the existing system.

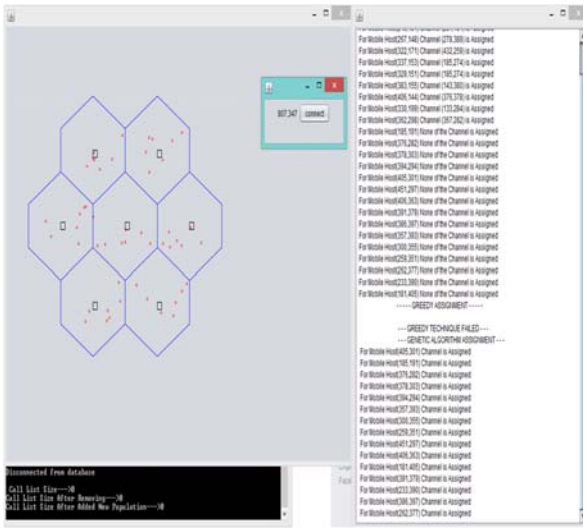

Figure-2. Results without Greedy region.

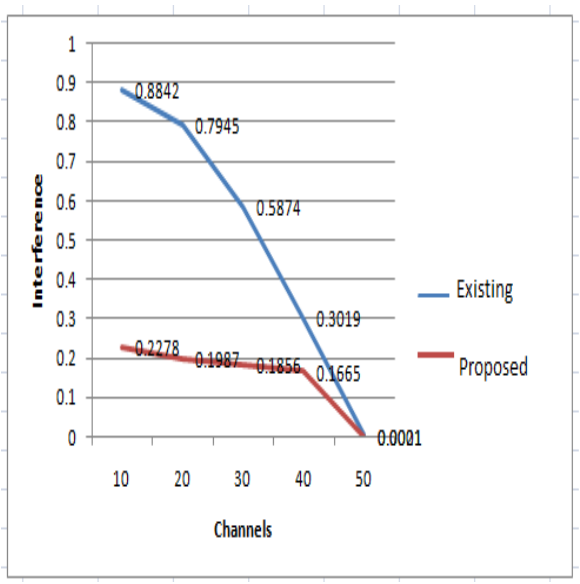

Figure-3. Comparative study.

CONCLUSION AND FUTURE WORK

The genetic algorithm approach to dynamic channel allocation has more advantages than the traditional centralized approach and other algorithm used for channel allocation. Channel interference is a major problem in previous channel allocation algorithm. Using the proposed system the problem of channel interference is removed. This approach is also more efficient than the previous algorithms. Hence it can be used in allocating channels for mobile networks.

In the Greedy Assignment stage of this proposed system, greedy region has to be formed and channel has to be allocated. If channels are not allocated the greedy region expands continuously and results in a large number of unsatisfied requests. If this happens the algorithm takes a long time to execute and go to the next stage of the algorithm. Instead of this stage some efficient channel allocation algorithms can be used which further reduces the searching time.

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