CHAPTER VI

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Limited processing capability in terrestrial and satellite systems has prompted researchers to seek a new alternative method for delivery of wireless mobile communication services. HAP is the most promising candidate because it has many advantages over existing wireless technology. This doctoral work has concluded the research investigation under present work with recommendations on HAP based techniques and algorithms for enhancing QoS. The indicator parameters of QoS namely CINR, INR, RSS, hand-off rate, delay and bandwidth utilization etc. have been significantly improved by using the proposed techniques.

This chapter provides a summary of the thesis and the conclusions from the research carried out. Moreover, limitations and avenues for future research are discussed.

6.1. Summary

The aim of this research is to enhance QoS by using HAP as a support technology in heterogeneous mobile networks. The results are compiled, compared, and analyzed in detail to make a significant contribution in terms of study, test plan, testing methodology and implementation. It is established that efficient use of HAP provides both the advantages of terrestrial and satellite systems. These features make HAP as an alternative technology for mobile wireless communication technologies. A comprehensive overview of QoS and it's enhanced techniques and parameters for advanced mobile wireless communication technologies have been presented in Chapter 1.

The literature review, supported by critical analysis, is presented in Chapter 2. It identifies gaps in previous studies and explores new avenues, so that the research aim, objectives can be addressed effectively. Several studies in the literature discuss hand-off technique, channel reservation technique and CAC technique, and their parameters that are used to enhance QoS such as operating frequency, bandwidth, data rate, coverage, power, interference, delay, jitter, latency, packet loss. Some of the previous studies concern research on an individual technology as an independent entity, while little if any research has been done. Some of the studies were limited to link advanced mobile wireless technologies and it performance only. However, none of the previous studies include systematically all issues QoS requirements in HAP based wireless deployment networks. It was established that there is a scarcity of research in the area of QoS requirements for HAP based communication networks. The chapters 1 and 2 meet the first objective of this research: ***—to study and compare, technologies and parameters of QoS and their use for enhanced QoS in advance wireless***

communication technology which can be used also to enhance QoS in HAP supporting communication networks.

Coexistence and the cellular deployment, hand-off concept and classification, HAP movement and antenna radiation patterns, were described and discussed in detail in chapter 3. This chapter also gives a comprehensive description of ANN. Subsequently, Path loss, RSS, Traffic intensity, distance and location, time advance technique and MUSIC algorithm, were also discussed with details. This achieves the second research objective: ***—to enhance QoS in HAP using an intelligent hand-off technique***. Results show that the unnecessary hand-off is reduced as well as hand-off rate is improved when traffic intensity and mean arrival rate increase.

Channel allocation, reservation channel and probability of blocking and dropping call were described and discussed in detail in chapter 4. Procedure and analytical model for the proposed channel reservation for new and hand-off requested calls fixed and dynamically, were also discussed. This achieves the third research objective: ***—to enhance QoS in HAP using channel reservation technique***. The results show that the Pcb and Pcd have been improved when channel reservation for hand-off and permanent channel is increased. Therefore, for QoS enhancement, if the number of users inside the HAP cell is very high, then the HAP cell will also require to increase the number of reserved channel for new calls vice-versa for hand-off.

CAC, bandwidth reservation and bandwidth degradation were described and discussed in detail in chapter 5. The performance is evaluated by introducing an analytical model, which is based on the Markov chain model. Based on Markov chain model, the probabilities of call blocking and dropping as well as bandwidth

utilization were calculated. This achieves the fourth research objective: ***—to enhance QoS in HAP using an efficient bandwidth CAC technique***. Result is shown that the Pcd and Pcb have improved but the bandwidth utilization has the excellent and significant improved.

Finally, based on the findings of the investigation, a set of future scopes were derived and proposed for enhance QoS in HAP based communication networks. This fulfills the fifth and final objective of this research.

6.2. Summary of the Existing Techniques for Improving QoS

Summary of the techniques used for improving QoS and their importance are shown in Figure 6.1.

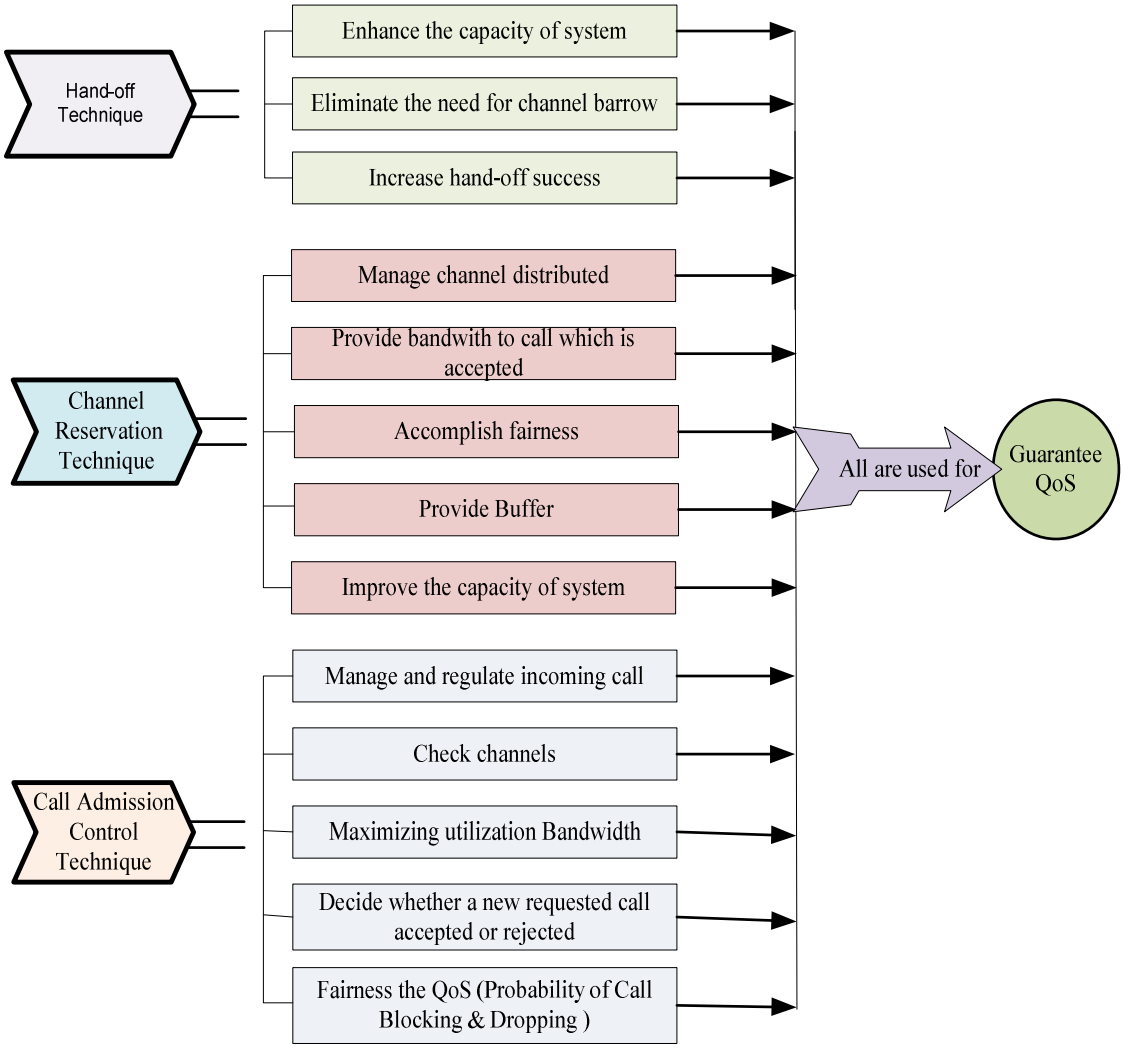

Figure 6.1 Existing Techniques for Improving QoS

6.3. Conclusion

Following conclusions have been drawn from the investigations carried out in the present work:

- Better decision making during hand-off procedures can be obtained by using intelligent hand-off techniques such as by using ANNs and multiple parameters e.g. RSS, traffic intensity, direction, distance etc. This result in reducing unnecessary hand-offs and hand-off rate is improved.
- The proposed CAC technique provides bandwidth guarantee to all service classes and delay guarantee. The priority of different types of calls and the service classes are maintained during the bandwidth allocation stage.
- Probability of call blocking and the probability of call dropping of the service classes and bandwidth utilization were considered for the performance of system.
- Efficient utilization of the scarce bandwidth has been achieved in the proposed techniques.

6.4. Future Scope of the Work

Finally, based on constrains and limitations of the present study, the potential future scope of the presented work can be extended to the following sections.

- In the present work, the proposed an intelligent hand-off for minimized number of hand-off and improve hand-off rate is done by using ANN.
  - Further work can be done on extended can be developed by using fuzzy logic and pattern recognition.
- In the present work, the Propose of the optimization parameter of channel allocation shows that it is possible to deliver fairness by varying the reserved channel according to requested call.
  - Selecting the right parameters would be better if it was done using analytical technique rather than numerical one.
  - In future this proposed technique can be tested that how it performs for both dynamic and fixed channel allocation for HAP cellular in a practical environment. Further work can be done on this technique in non uniform conditions of traffic.
- The proposed CAC technique has further extended to consider the fairness among the different types of calls i.e. the new requested calls in same cell and the hand-off requested calls. In our proposed technique hand-off calls are always given strict priority over new requested calls. Therefore, it is not ideal proposition when the network is lightly traffic inside cell.
  - Further work can be done on extended CAC technique to CAC technique with fairness. The fairness is achieved by making a proper tradeoff between the probability of call blocking and probability of call dropping.