Chapter 7

Conclusion and Future Scope

7.1 Summary and conclusion

In this thesis, the working principle of Electro-Optical tracking system, Tracking Radar system and Passive target tracking system was studied. Factors of measurement accuracy for all the three kinds of the tracking system are analyzed thoroughly. Criteria for prioritizing and eliminating erroneous EOS was established. Different models develpoed for the Electro-Optical tracking system, Tracking Radar system, Passive target tracking system, Multi-sensor track data generator and Real-time multi-channel visualisation system in this research work. A unique approach of prioritizing EOS using perpendicular distance is elaborated in a model. K-means clustering algorithm implemented in two different ways in EOS measurements for identifying and eliminating erroneous EOS to improve position measurement accuracy. Radar measurement accuracy factors and their impacts were analyzed. By using these factors radars were prioritized to calculate error boundary. A model was proposed for the successful elimination of erroneous radar using K-means clustering. A model is established on the passive target tracking system. This model shows the measurement error boundary. It prioritized the passive receivers so that the best combination of the receivers were identified. Considering the best four passive receivers most accurate position measurement was achieved. Integrated multi-sensor simulator developed for successful experimentation of all proposed techniques used in different models. A real-time remote visualization system was designed for monitoring and analysis of all tracking sensor performances.

7.2 Limitations

In this research, the electro-optical sensors are used to track target up to 100km of range. Our experimentation is limited with a maximum seven numbers of EOS at a time. Proposed models related to EOS are working well with two numbers of erroneous EOS out of maximum seven sensors. In this thesis, work is restricted to tracking radar system. Surveillance and other king of radar is not considered. Tracking radar is able to track a single target. Multi-target tracking radar is not focused on this thesis. For a passive target tracking system, time difference of arrival techniques is only used. Other algorithms like Time of Arrival (TOA), angle of Arrival (AOA) etc are not analyzed. Four numbers of passive receivers data are considered at a time for calculating the position of the target and the best result obtained for a target up to 100km of range. Multi-sensor track data generator can produce data within 100 milliseconds and it can be configured for a maximum of eighty numbers of sensors at a time. A real-time multichannel remote monitoring system can be operated a maximum of ten numbers of channels. The update rate of this system is one second and it can handle a maximum of fifty numbers of Display-on-Demand systems simultaneously.

7.3 Future Scope

In this thesis, prioritization is done with EOS or tracking radar or passive receivers. Research focused on intra-sensors. This work can be extended to prioritize all three types of sensors considering as a whole. Inter-sensor prioritization can be done in the future. K-means clustering algorithm is applied with the EOTS and TRS for time efficiency of computation as these data being processed for used in real-time applications. Further research can be carried out with other clustering algorithms so that computational time complexity is matched for real-time applications. K-means clustering approach applied with EOS and tracking radar but not on PTTS. This can be the subject matter for the future resesrch. There is no limit to increasing accuracy. So some new approach can be developed to improve the accuracy of the measurements of the target locations. Work on EOS is limited to seven numbers of sensors, further experimentation can be carried out to find the maximum capacity of the proposed model. Our proposed models for EOTS, TRS and PTTS can produce a good result for a target up to 100km of range. The study can be further extended for finding out the performance of all these models for the target beyond 100km of range. Our work focused on three different target tracking systems only, some other tracking systems can also be focused on prioritization and measurement accuracy can be improved.