**Modelling and Analysis of GPS Based Traffic Alert and Collision Avoidance System (TCAS) Using ‘Uppaal’**

Abstract

The Traffic alert and Collision Avoidance System (TCAS) is a collision avoidance system designed to reduce the incidence of mid-air collisions between aircrafts. TCAS monitors the airspace around an aircraft for other aircraft equipped with a corresponding active transponder and warns pilots of the presence of other transponderequipped aircraft which may present a threat of mid-air collision (MAC).

In this paper, we present a design and analysis of GPS based TCAS to proffer solutions to some of the challenges like possibility of horizontal resolution, reversal logic and time based representation of traffic.

Unlike existing TCAS systems, our model handles a situation where it has been shown that one of the two aircraft does not comply with the advisory given earlier by the TCAS and reversal logic is activated. Current version TCAS II can only support vertical separation advisories whereas more complex traffic conflict scenarios may be more easily and efficiently remedied by also making use of lateral resolution manoeuvres which is addressed in our proposed GPS based TCAS.

UPPAAL, a performance analysis tool based on timed automata, is used in the design and analysis of our proposed TCAS. Results of our analysis show that the time delay is minimal in modelling of a GPS based TCAS than transponder equipped TCAS. We note, however, that timed automata notation allows only one level of parallel composition and many numbers of states are covered in the TCAS modelling which prolongs early termination and reachability analysis of the timed systems as potential limitation of our proposed TCAS.