**ABSTRACT**

The Controller Area Network (CAN) is a vehicle bus standard for over two decades. In recent times CAN finds application in industrial automation as well, CAN is mostly employed for safety critical applications where low response time is essential. With the advent of wireless technology, there is a possibility for CAN messages to be exchanged wirelessly; one can find several applications where wireless exchange of CAN messages is preferred. The primary goal of this thesis work is to evaluate the suitability of a WCAN scheme for the connection of the sensor and actuator nodes of a Fire and Gas safety system, which is a safety critical real-time application. This research work, in general, recommends stochastic response time analysis, which is a measure of the systems reliability, over worst case response time (WCRT) analysis, as the latter is pessimistic and leads to over designing and under usage of resources, the worst case when a message or system is unschedulable may not occur, while in specific cases with less tolerance, WCRT analysis is considered. WCAN modelled from wireless token ring protocol in a related work by Lun et al. (2012) is revisited, simulated using QualNet v5.0.2, compared with IEEE 802.11 and is found to outperform it. In safety critical applications, response time analysis is more essential than performance analysis, which is lacking in the related work. Hence the test results of constant bit rate and variable bit rate traffic of the related work are categorized as periodic and sporadic messages and validated using SAE benchmark. By WCRT analysis, the model fails to be schedulable, while by stochastic response time analysis, the probability of the system being reliable is 0.964. Encouraged by this result, WCAN is implemented using Freescale PowerPC MPC5567 with CAN interface, CAN messages are exchanged wirelessly using the radio protocol IEEE 802.15.4. The implementation is validated by WCRT analysis of the WCAN based Fire and Gas safety system, using CANoe v7.6 and the National fire protection association (NFPA) regulations of maximum allowable latency of 90s.