ABSTRACT

Wireless Sensor Networks (WSNs) are fast emerging as the new network sensing models, based on a large number of tiny sensor nodes. Wireless networks deliver a lower bandwidth than wired networks; the mobility of hosts which causes topological changes of the underlying network also increases the network information. The effect of channel conditions on the wireless network performance should be overcome, and there is a need to provide a robust, flexible protocol that consistently gives high performance for a variety of network environments.

In a WSN, when nodes are densely distributed the application produces a high packet flow near the sink due to the convergent nature of the upstream traffic. Congestion in a WSN causes packet loss; due to this, the throughput may be lowered and latency gets increased, and also, the congestion leads to excessive energy consumption. Therefore, congestion has to be controlled to prolong the sensor node’s lifetime, in terms of the throughput and packet loss ratio, along with the packet delay, and control overhead.

From various studies, it is learnt that issues like the bit error rate, route recomputation, network partitions, multipath routing, latency, and overhead rate, have to be resolved, when the application is used in wireless networks. To address the above mentioned issues, the aid of a dynamic mechanism like an agent system is necessary. An intelligent agent is an autonomous entity that observes and acts upon an environment, and directs its activity towards achieving goals. Intelligent agents may also learn or
use knowledge to achieve their goals. The main focus of this thesis is to explore the performance improvement of upstream congestion control in WSNs.

This thesis describes an agent based upstream congestion control protocol, named Agent-based Congestion Control Protocol (ACCP) for wireless sensor networks. An important multi agent system considered in this design is the REusable Task-based System of Intelligent Networked Agent (RETSINA), representing a distributed cooperative scheme. The RETSINA is a cooperative multi-agent system that consists of three classes of agents: the interface, the task, and the information agent. In the RETSINA, the agents are distributed and are executed in parallel.

In this context, the methods of designing an agent based system to improve the performance of the mobile network in terms of end-to-end delivery, latency and control overhead in a computationally feasible time, using the multi agent system RETSINA are explored. The WSN has the ability to adapt to situations that differ from the ones for which it was originally designed. The Multi Agent System (MAS) is designed with reasonably low delays and low link error rates. In such cases, data is seldom lost or corrupted due to link errors, and the main cause of packet loss is the data being discarded in congested routers.

The rate traffic analysis on each node is based on the priority index and the congestion degree of the node. In addition, evaluated the performance of congestion control with multi agent platforms as technology choices comprehensively and investigated their throughput, latency and control overhead in a number of cases. The results obtained from various
network scenarios demonstrate that the agent based upstream stream congestion control in general, can greatly improve the network performance.

The simulations obtained with the multi agent can increase the throughput and the latency, and the control overhead gets reduced as the simulation time steps in. The average throughput of the proposed routing protocol in delivering data to the sink from the three scenarios is 92 to 93 percent. The average delay in the initiation of packets by a source node and the receipt of the receiver node is seen to be 1.55 seconds. The average protocol overhead received by the source node per delivered data is obtained around 3 MB. Thus, the ACCP reduces the congestion in an efficient way and is more energy-efficient than the existing techniques.