CSE 40484/60484: Networked Sensor Systems
Due: September 25, 2007

HOME WORK ASSIGNMENT #1

1. (25 pts) Sensor network to detect traffic congestion: Consider a sensor network to detect traffic jams. Assume that the system is deployed in an urban setting with roads and traffic lights. Once a traffic jam was detected, the system can directly control the traffic lights to reroute traffic to ease congestion (traffic lights directly act as the sensor gateway nodes). Note that rerouting means that a traffic light on the path leading to the congested areas will not turn GREEN while paths leading away from congestion turn GREEN. The drivers are free to wait on the particular traffic light that is RED rather than take the path that turned GREEN. However, assume that the drivers will always take the rerouted path. Also, assume the availability of sensors that can

A. detect metal objects in their vicinity, the signal strength was proportional to the product of the the mass of the object (m) and its proximity to the sensor (d) (i.e., m*d). You choose the detection range of these sensors

B. The sensors can detect motion based on analyzing the rate of signal change. However, the sensor cannot detect the direction of travel.

C. The sensor uses a peizo-electric mechanism that harvests energy from passing vehicles. Don't worry about the details, assume that the batteries are constantly replenished. The sensors can be buried in the road (like the reflector studs).

Describe the criteria that will be used to detect a traffic jam (refer to Section 5.1, pg 138), the specific algorithm that you will use to choose the cluster leader, and the tasking mechanism. How will these sensors be deployed (number and location on the road)? Also, describe a scenario under which your sensor system will fail to detect a traffic jam.

Describe all the assumptions that were required for the proper functioning of your system. Keep your assumptions simple (for example, you don't have to worry that the cars might disperse wireless communications or that snow pileup might reduce the energy replenishment efficiency)

2. (10 pts) Describe the challenges in simultaneously tracking multiple objects. Describe the challenges encountered in all aspects of the system (use all the chapters from the textbook).

3. (5 pts) In directed diffusion, describe why reinforcement does not direct **all** information along the best path.

4. (5 pts) In the leader election protocol (page 156), the discussion assumes that the signal of a target propagates isotrophically and attentuates monotonically with distance. Describe the implications of relaxing these constraints.

5. (5 pts) Consider geographic routing mechanisms. In the case that there was an obstacle between two nodes that prevent signals from reaching immediate neighbors, describe a mechanism (from the text book) that would allow you to still reach the destination.