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February 1st, 2014
Homework #3.A
Time: 2 hrs

Response to:
R. Tatchikou, S. Biswas, and F. Dion, Cooperative vehicle collision avoidance using inter-vehicle packet forwarding, Proceedings of the IEEE Global Telecommunications Conference (GLOBECOM), 2005.

Summary

In an effort to reduce chained traffic accidents, a protocol was developed that could be implemented between cars to notify the entire chain that an incident is occuring, and that preventative or evasive manuvers should be taken. The protocol is designed to work within one lane populated by a platoon, or a series of cars that are spaced within listening distance of the cars ahead and behind.

Goal

Develop a routing protocol that can relay messages to cars behind from events that may happen ahead, and prevent exessive packet generation due to overlapping transmission areas. The protocol must send a message contains the minimum data needed for incident identification: origin car, unique identifier, and other minor position, speed and acceleration information.

Done

Two methods were compared to a baseline consisting of purely visual reactions: naïve broadcast (NB), and intelligent broadcast with implicit acknowledgement (I-BIA). Both protocol will get their receive direction from a phased antenna. Naive broadcast will simply wait for a packet from ahead, and once received, start broadcasting its own message. If a message comes from behind, it is ignored. The inherent problem with this protocol is addressed by I-BIA: as the more cars start broadcasting, less messages get through, increasing packet delay. If a message is received from behind then the message-propogation will be left to that trailing car, so as to reduce the total amount of traffic in the system. If the message from the front has not been received before, and no messages from behind, then the car will continue with its broadcast.

Findings

It was found that using I-BIA on 70mph cars travelling with 0.9s distances between cars can reduce the number of collisions down to about 20% of the chain length, compared to 48% by NB, and 100% with only visual queues. In the future, when this research team uses a protocol for a collision avoidance system, they will choose I-BIA for its superior dense-network low latency.

Field Impact

At the time (2005), I believe the idea of smart collision avoidance was relatively new. Since then, many automanufactures have included systems like this in their new vehicles. The idea of having cars that communicate can have tremendous impact on road safety, something everyone can agree is a good goal. This extends the sensor field into the automotive world; a huge industry. That affects most American daily; the effects of safer cars can benefit the entire community of people.

Discussion

Reading this paper brought up a few technical questions that were clearly outside the scope of the paper, but still within the problem scope. One assumption made was the automatic braking during an emergency: what mechasism will brake the car? How are emergencies detected? Only by intense braking? How would this protocol fair for non-emergency situations? What if there are brief emergencies that resolve without stopping traffic? Is there a cancellation policy? Im sure many of these questions are asked in their other papers... this one seems like a subset of the entire work done.