Observation of Variability in Car-Following Behavior

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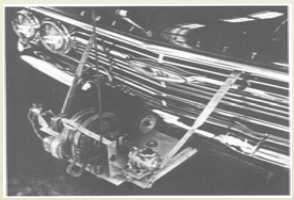
Problems and Limitations

• Past Experimental Studies and Biases

- Video recording or aerial film methods
  - Driving maneuvers that unfold over a greater distance cannot be captured by the stationary camera properly.
  - Difficult to capture various human characteristics.
- Wire-linked vehicles
  - The studies were conducted under observation and instructions to follow the lead vehicle at a safe distance.
  - Only one (or a few) members of a diverse population are represented.



Data collection system using wire and reel unit (1960')

• Causal Mechanisms

- Only a simple set of kinematic variables, such as relative speeds and spacings, etc., have been studied and formalized.
- Numerous other factors such as human characteristics, traffic and road, and environmental characteristics that may influence car-following behavior exist.

Several factors affecting car-following behavior

Research Motivation

- Most empirical work is several decades old.
- No real improvement in data collection methods or understanding.
- New high-fidelity data collection techniques.

New Data Collection System

- The instrumented test vehicle, which will be the lead vehicle, was designed to collect car-following on roadway traffic.
- It was equipped with three sets of measurement instrumentation, including infrared radar, DGPS/inertial Distance Measuring Instrument (DMI), and video camera.

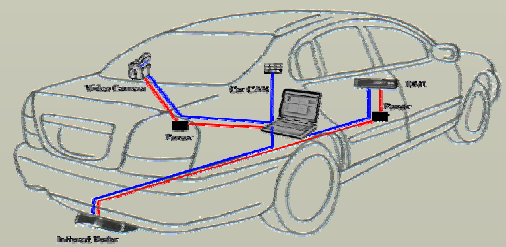
※ Test vehicle and infrared radar are donated by Nissan Technical Center North America, Inc.

Instrumented test vehicle apparatus

System Architecture

• Hardware

- Infrared radar: measure the distance and relative speed and curvature between the lead and following vehicle.
- Distance Measuring Instrument (DMI): predict the position and speed of the test vehicle, integrated with Differential Global System (DGPS) and inertial navigation.
- Video Camera: monitor the driving behavior of the following vehicle and additional information such as age, gender, and other visually noticeable conditions.
- Laptop Computer: stores the synchronized data collected from the different devices.

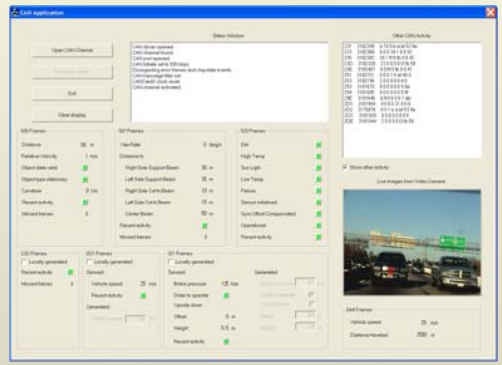


Connectivity Diagram of each measurement

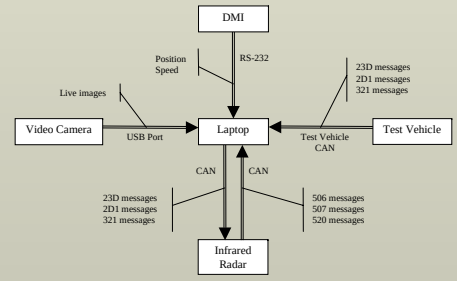
System Architecture (cont.)

• Software

- A synchronized user interface program (visual C++) has been developed to check the status of each device and concurrently store the information transferred from each device to the laptop computer.
- Since infrared sensor is a Controller-Area-Network (CAN) device, we have developed our own CAN application incorporated with two CAN networks: the one already in the car, and a separate, small one that consists only of our laptop computer and the infrared radar.



Main screen of user interface program



Block diagram of user interface program

Research Expectations

- Investigation of maneuvers that unfold over an interval of time.
- Identification of various critical factors that influence car-following behavior.
- Better understanding of the underlying processes and mechanisms in car-following behavior.