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Education
Colorado State University (CSU)
M.S. Systems Engineering ‘21

The University of Tulsa (TU)
B.S. Mechanical Engineering ‘19

Engineering Projects
Student Cyber Truck Experience
2019 NASA Robotic Mining Competition
NASA Jet Propulsion Laboratory Intern
Current Project

Semi-Trailer Temperature Monitoring System

A scalable system capable of securely monitoring tire and brake temperature across trailers and dollies over heavy-duty vehicle networks as an early warning indicator for drivers.
Motivation

• For large trucks involved in crashes, tire and brake failure constitutes the majority of vehicle-related factors and violations recorded by the Federal Motor Carrier Safety Administration (FMCSA).

• Heavy vehicle drivers are at a disadvantage because they may not detect the symptoms of tire and brake failure such as vibration, noise, and reduced mileage that a passenger car driver would experience.

• Trailer and converter dollies are especially difficult
Objectives

System Objectives

- Scalable
- Inexpensive
- Secure
- Robust
- Retrofit
Existing System

System Topography

Telematics

J1939 Line

J1708 Circuit
J1939 Circuit

ECU

PLC Transceiver

Power Line

TRACTOR

TRACTOR TRAILER CONNECTOR

TRAILER
Approach
System Topography

- Telematics
- Driver Display
- J1939 Line
- ECU
  - J1708 Circuit
  - J1939 Circuit
- PLC Transceiver
- Power Line

TRACTOR

- TRAILER

- Brake Assembly
  - Temperature
  - Wheel Speed

- Sensor
  - Temperature
  - Wheel Speed

- System ECU
  - Amplifier/Transducer
  - Microcontroller
  - J1708 Circuit
  - PLC Transceiver

- Tractor Trailer Connector

Colorado State University
Approach

Semi-Trailer Temperature Monitoring System Topography

- **Temperature Sensor**
  - PT1000 RTDs

- **Wheel Speed Sensor**
  - HD Wheel Speed Sensor

- **Combined Sensor**
  - Trailer Wheel and Brake

- **Simple Concept Sketch**
  - Wheel Speed

- **Diagrams**
  - J1939 Line
  - Power Line
  - Amplifier/Transmitter
Approach

Semi-Trailer Temperature Monitoring System Topography

System ECU: J1708 Output Test

254E
9550
298
25°C
77 F

Amplifier/Transducer
Microcontroller
J1708 Circuit
PLC Transceiver

Iteration 3

System ECU

Temperature
Wheel Speed
Approach

Semi-Trailer Temperature Monitoring System Topography

- Current GUI is connected directly to ECU and used for testing purposes.
- Provides an interface to analyze and interact with incoming data from prototype ECU.
Security

The three attributes of a secure heavy vehicle network system are authentication, integrity, and nonrepudiation [2]. The methods that are being investigated to satisfy these attributes are:

- Cipher-based Message Authentication Code (CMAC)
- One-way hash of message ID and data
Thank you