

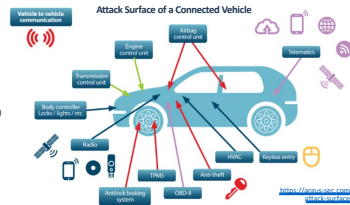
# PIVOT



## OPEN COMMUNITY PLATFORM FOR SHARING VEHICLE TELEMATICS DATA FOR RESEARCH AND INNOVATION

### MOTIVATION & NEED

- Internal Components
  - Telematics
  - Infotainment
  - Vehicle gateway
  - ECU port
  - Engine control unit
  - Transmission control unit
  - Body control unit
  - Instrument cluster
  - Steering control
  - Brake control unit
  - Airbag module
  - Safety (seaters, headlights, horn)
  - ADAS
  - Sensors (camera, radar, lidar)
  - GNSS receiver
  - Anti-theft
  - TPMS
  - Keyless entry
  - Bluetooth system
  - Wi-Fi hotspot
  - Radios



- Internal Basics
  - Controller Area Network (CAN)
  - Low Voltage Differential Signaling (LVDS)
  - Local Interconnect Network (LIN)
  - Media Oriented Systems Transport (MOST)
  - FlexRay
  - CAN FD
  - Automotive Ethernet
- Internal Interfaces
  - Software, OSes
  - Sensor interfaces
  - Hardware interfaces
- External Interfaces
  - Bluetooth
  - Cellular
  - Wi-Fi
  - Zigbee
  - Radios (terrestrial, satellite, RFID, DSRC)

**Need for High Quality, Real-life Automotive Datasets:** Needed by researchers advancing the state of the art in automotive and related systems, but such datasets tend to be ad hoc, hard to obtain, and have limited utility, which prevents (or slows) the researchers from growing the discipline

**Need for Community Infrastructure:** Needed to transform the ad-hoc, small-group endeavors for vehicle data curation into scientific body of work done by larger synergistic community

### FIVE PILLARS

**Platform:** Robust and reliable hardware and software upon which the system runs

**Data:** Curation and sharing of data and contextual information

**Tools:** Common software-based tools to collect, transform, combine, filter, and visualize the data

**Services:** Researcher-centric services for sharing, securing, and evaluating datasets, plus privacy services

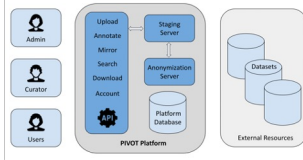
**Community:** Outreach and engagement to improve the data utility using design feedback mechanisms



### PLATFORM

Scalable, interactive platform to provide user services and access to data and tools

- The platform will host a web server, database, and microservices
- Robust security including firewall
- Hosted at Memphis
- Mirrored at partner institutions (e.g., Colorado State) for backup, redundancy, and seamless recovery



### DATASETS

**Community Datasets**

- Produced by others
- Not widely known
- PIVOT acts as clearinghouse
- E.g., ORNL ROAD, HCRL datasets, Bosch TruckCAN, CSU heavy truck datasets

**Geotab Telematics Devices and Fleet Data**

- Spindle: Small "fleet" for collecting high-fidelity telematics data for PIVOT researchers
- Altitude: Geotab global telematics network and analytics platform

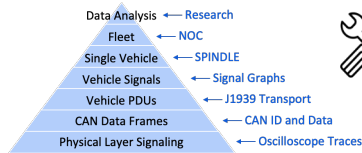
**PIVOT CAN Logger 4**

- Collect and store crowdsourced datasets from passenger cars and heavy trucks
- Based on CSU's CAN Logger 3



### TOOLS

- CAN log format converters
- Convert raw CAN into protocol data units
- Data decoding
- CAN data log slicing and filtering
- Others TBD based on community needs



### SERVICES

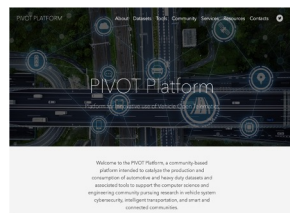
- Access to datasets and tools
  - Links to community datasets and tools
  - Access to and/or mirroring of PIVOT Spindle datasets
  - Access to Geotab datasets and analytical tools
  - Collection, storage, and mirroring of PIVOT crowdsourced CAN logger datasets
- Access to PIVOT tools
- Privacy support services and tools
  - E.g., using anonymization or privacy-enhanced technologies
- Internal Review Board (IRB) support



### COMMUNITY OUTREACH & ENGAGEMENT

Community engagement and outreach activities to raise awareness, encourage contributions and use, elicit input and requirements from broader community

- Publications
- Technical review articles
- Webinars
- Website content
- Social media
- Conferences and workshops
- PIVOT community workshops
- CyberAuto & CyberTruck challenges



**Community Workshops**

- November 2021:** focus on datasets and applications
  - 70 people from academia, industry, and govt
  - Materials: <https://bit.ly/auto-datasets-2021wkshp>
  - Report: <https://bit.ly/auto-datasets-2021wkshp-report>
- November 2022:** focus on CAN loggers and privacy
  - Materials: <https://bit.ly/auto-datasets-2022wkshp>
- April 4-5, 2024:** focus on beyond CAN
  - Materials: <https://bit.ly/auto-datasets-2024wkshp>



### BENEFITS & IMPACT

- Help coordinate existing isolated efforts
- Provide new crowdsourced CAN datasets
- Facilitate exchange of knowledge and resources
- Encourage, nurture, and sustain ongoing conversations
- Stimulate pre-competitive research collaborations
- Provide resources to educate the next generation of automotive cyber engineers
- Engage industry, including OEMs, suppliers, and other important partners
- Engage relevant standards bodies and applicable government organizations

**IMPACT:** Create robust ecosystem that works to develop and share community resources, including automotive research datasets and tools

➔ Enable researchers to address important problems, define high-quality research initiatives, and develop new, innovative applications

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