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ECC Cyber Emerging Tech Lab

Smart Transportation

2023

MAKING AN IMPACT THAT MATTERS since 1845

ECC CYBER EMERGING TECH LAB

Smart Transportation

Scenario

3D representation of a connected car prototype

Focused on both understanding of internal flows of information and detection of anomalies originated by cyber threats. It includes: key Electronic Control Units (Powertrain, power management and body control) as well as relevant interactive systems (steering wheel, dashboard, infotainment and navigation system)

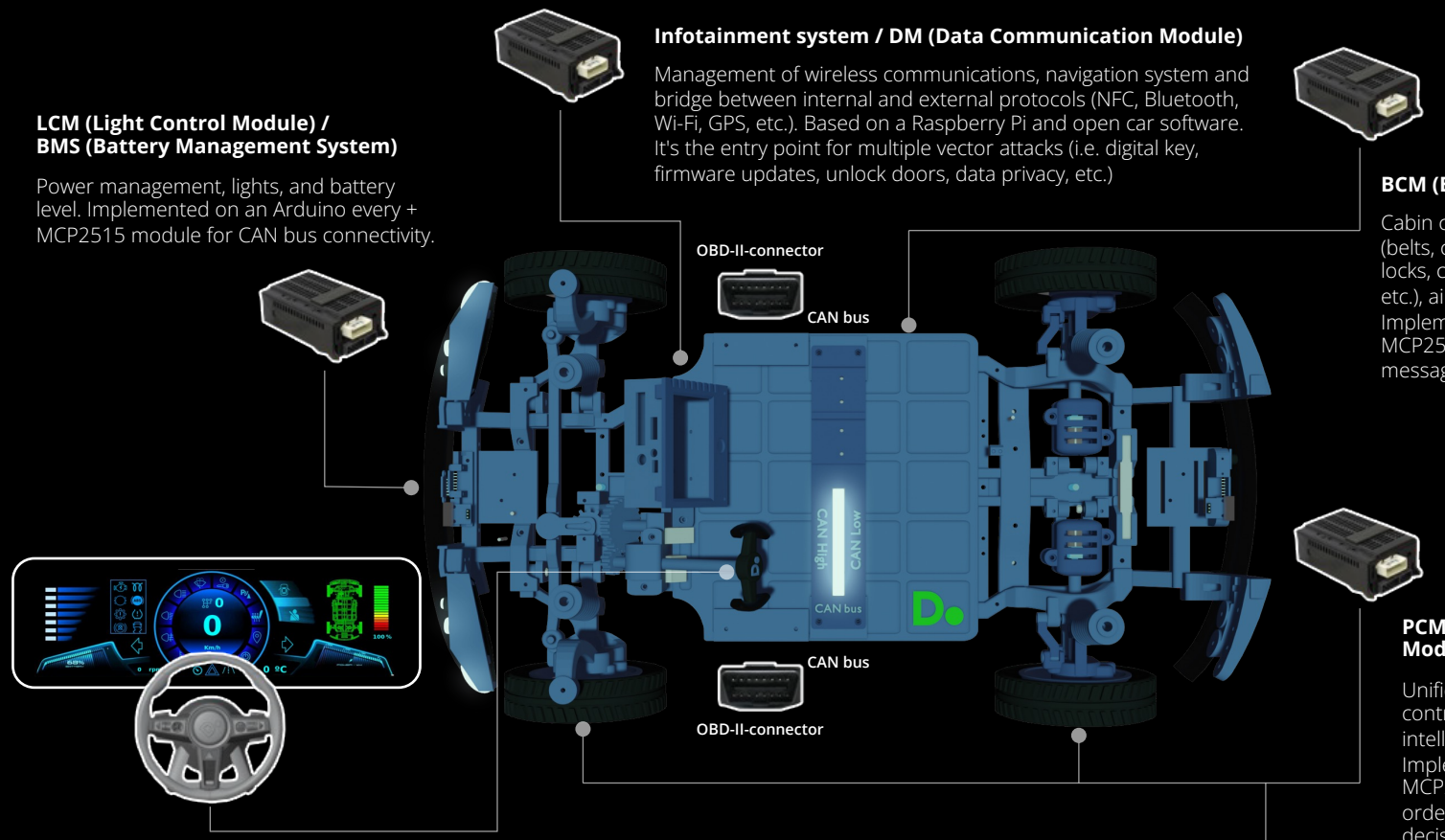
Connected vehicles are becoming on of the most trending topics of today for a large list of sectors and clients apart from vehicle vendors (assurance companies, OEMs, Transportation, fleets of vehicles, Smart cities, etc.).

Understanding Smart Transportation

The Deloitte Digital Twin

A printed 3D prototype scratched from zero (3D design, electronics, mechanics and software) reproducing the main existent functionalities, systems and protocols in a connected car for its understanding, security assessment, improvement and development of security capabilities

Development of vSOC capabilities extracting and analyzing every single inCar event in real time, identifying anomalies and reacting against real threats



Infotainment system / DM (Data Communication Module)

Management of wireless communications, navigation system and bridge between internal and external protocols (NFC, Bluetooth, Wi-Fi, GPS, etc.). Based on a Raspberry Pi and open car software. It's the entry point for multiple vector attacks (i.e. digital key, firmware updates, unlock doors, data privacy, etc.)

LCM (Light Control Module) / BMS (Battery Management System)

Power management, lights, and battery level. Implemented on an Arduino every + MCP2515 module for CAN bus connectivity.

BCM (Body Control Module)

Cabin control and management (belts, climate system, windows, door locks, crash detection, occupancy, etc.), airbags and car lock. Implementation on Arduino every + MCP2515 module for exchange of messages via CAN bus

PCM (Powertrain Control Module)

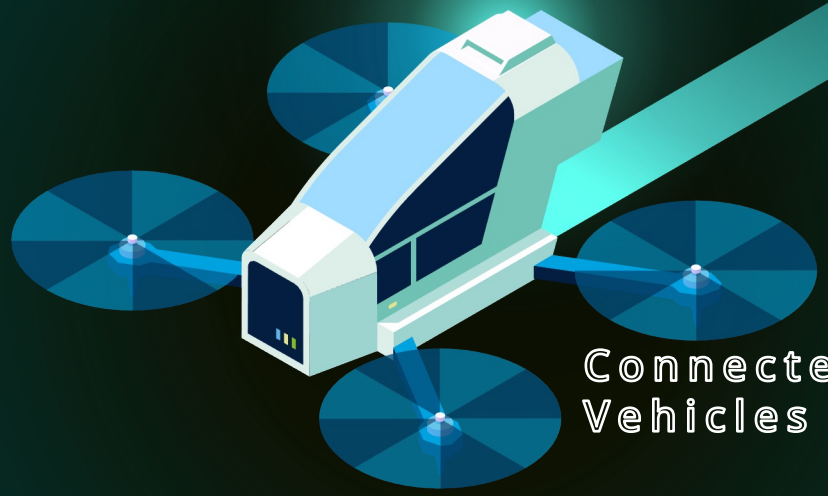
Unified transmission and driving control, including ABS, ESP and intelligent driving systems. Implemented on Arduino every + MCP2515 module, it receives orders and takes/communicates decisions via CAN bus (speed, slow down, direction, etc.), communicates with the engine subsystem thought LIN protocol managing temperatures, pressure, revolutions, and other parameters.

Steering controls

1. **Wheel** interface including acceleration, breaks, lights, Start/Stop, blinkers, direction, emergency, door lock, etc., based on Arduino Uno + MCP2515 module. It communicates with the rest of ECUS via CAN bus.
2. **Dashboard** representing in a graphical way the status of the main vehicle indicators (speed, revolutions, lights, power level, temperature, doors, errors, etc.) Based on Raspberry Pi + MCP2515 adapter it receives information from the rest of ECUS.

Smart Transportation

As a subset of processes in Smart Cities



Connected Vehicles

RECYCLING CLEANING SERVICES
- Smart infrastructures
- Route planner
- Geolocation

SAFETY & SURVEILLANCE
Anti-drone systems for critical infrastructures

SMART HIGHWAYS
- E-payment
- Route planner
- Traffic info

PUBLIC TRANSPORTATION
- Scheduling
- Tracking
- Route-planner
- E-payment
- Traffic info

AUTONOMOUS DRIVING & TRAFFIC CONTROL
- Inter-vehicles communication
- Smart traffic infrastructures
- Route planner

FLEETS MANAGEMENT
- Vehicle assignment
- Tracking & geolocation
- Route planner
- Park and charge
- Access control

PARCEL SHIPMENT
- Route planner
- Traffic info
- Tracking
- ETA
- Cost

EMERGENCY SERVICES
- Incident location
- Route planner
- Smart traffic
- Infrastructures

PORTS/AIRPORTS & LOGISTIC AREAS
- Geolocation
- E-payment
- Route planner
- ETA

CAR PARK
- Location
- Route planner
- E-payment

ELECTRIC CHARGE
- Geolocation
- E-payment
- Route planner
- ETA

TAXES/FINES & REGULATION COMPLIANCE
- E-payment
- Geolocation

ASSURANCE SERVICES
- Drive & risk assessment
- Tracking
- E-payment
- Support

Understanding Smart Transportation

Capabilities and risks based on existent technologies

Connected vehicles are the **core component** of smart transportation processes

Complex and heterogeneous ecosystem based on multiple factors.

- **Type of vehicles:** Cars, trucks, motorcycles, bikes, scooters, trains, plains, ships, drones…
- **Purpose:** private use, public, passengers, parcels, surveillance, defense, etc.
- **Engines:** Manual, automatic or autonomous drive. Electric, hybrid, fuel powered, …
- **Electronic systems & comms:** ECUs, CANbus, ISO 9141, J1850, OBD2, LIN, TCP-IP, Wi-Fi, BLE, NFC, 4G, 5G, …
- **Vendors:** …

Understanding and assessing security at the vehicle level will reduce dramatically risks to smart transportation processes

Deployment of digital twins for the understanding and assessment of connected vehicles as a first step toward secure transportation process

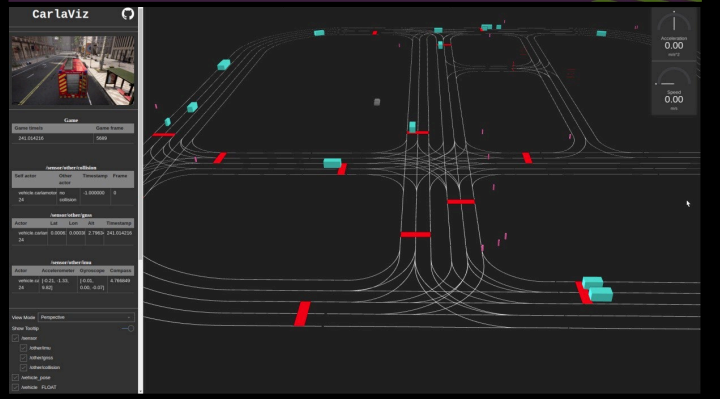
Understanding Smart Transportation

Extending the digital twin to the Smart City ecosystem

Integration with CARLA as a parametrized virtual world

Full analysis and assessment of **wireless communications and data flows:**

- **Geolocation**
- **Digital key processes**
- **Emergency services and SOS button**
- **Traffic integration**
- **Communication between vehicles**
- **Car parks and spots for electric charge**



Cybersecurity for Smart Transportation

Developing Cybersecurity capabilities

The understanding of smart infrastructures, services and protocols allow us to Identify new risks, to evaluate security solutions & to develop new effective security services:

Vehicle SOC

24x7 real time monitoring, identifying anomalies & threats against vehicles, discarding false positives & responding in the fastest way to reduce the impact of incidents & attacks

Smart Transportation Labs

A **collaborative space between vendors & clients for the analysis & test of technologies**, replicating complex infrastructures & processes through digital twins for the development of secure solutions

Smart Transportation / CP SOC*

24x7 real time integrated monitoring services for complex infrastructures combining IT, OT and IoT technologies addressed to detect and respond against Cyber Physical Security threats

** Cyber Physical Security Operation Center*

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