Living on the Electric Vehicle and Cloud Era: A Study of Cyber Vulnerabilities, Potential Impacts, and Possible Strategies

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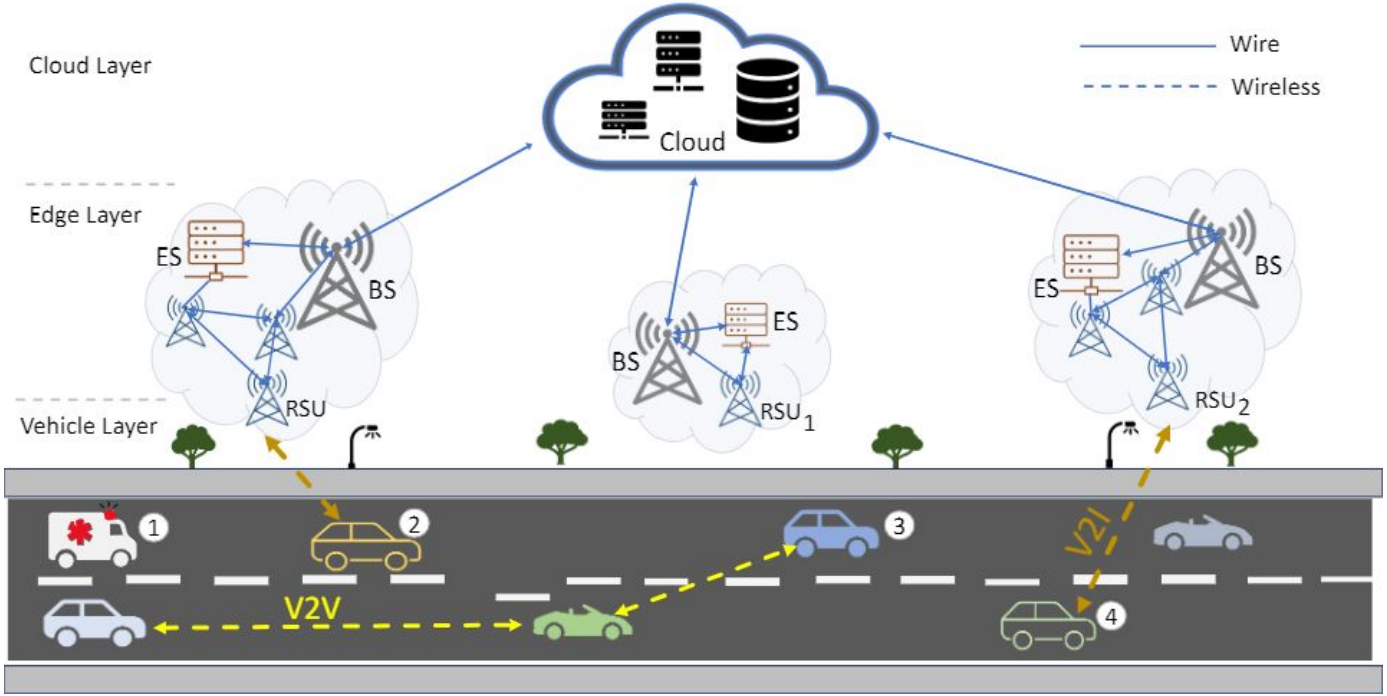
OUTLINE

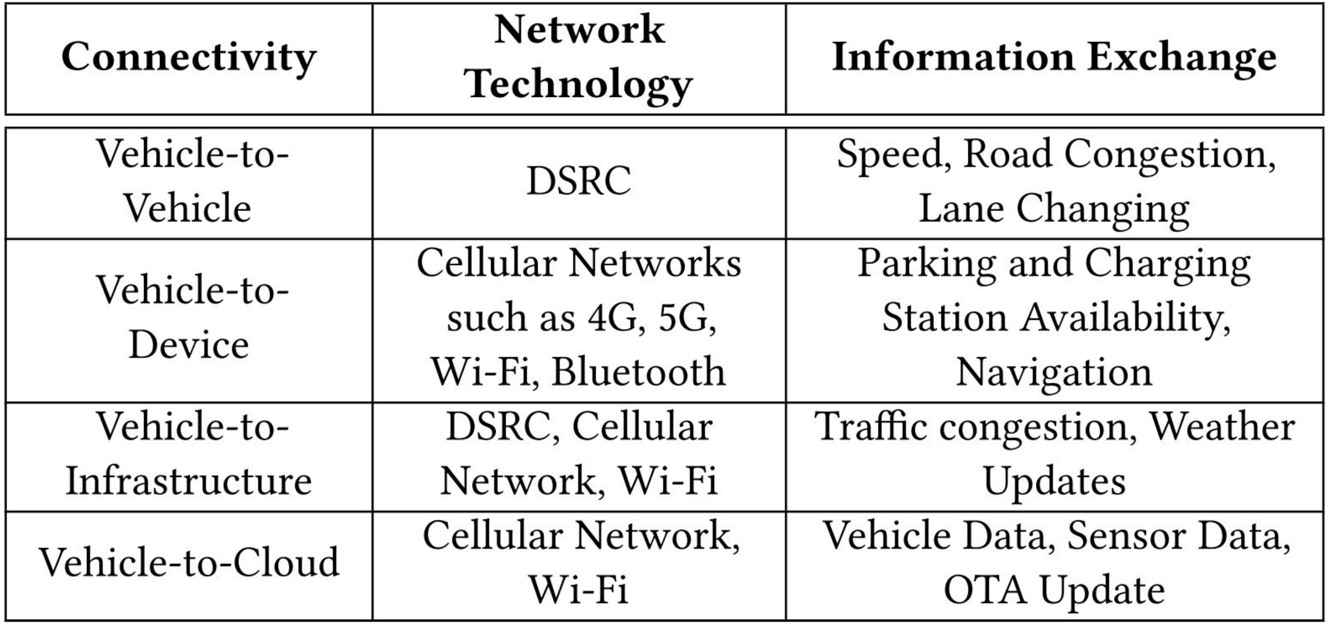
1. The Connection between EVs & Outside World
2. EV Cyber Vulnerabilities & Impacts
3. Security Strategies
4. Current Limitations & Future Research Directions
5. Conclusion

The Connection between EVs & Outside World



3 Layers of Communication

The Connection between EVs & Outside World



Connectivity	Network Technology	Information Exchange
Vehicle-to-Vehicle	DSRC	Speed, Road Congestion, Lane Changing
Vehicle-to-Device	Cellular Networks such as 4G, 5G, Wi-Fi, Bluetooth	Parking and Charging Station Availability, Navigation
Vehicle-to-Infrastructure	DSRC, Cellular Network, Wi-Fi	Traffic congestion, Weather Updates
Vehicle-to-Cloud	Cellular Network, Wi-Fi	Vehicle Data, Sensor Data, OTA Update

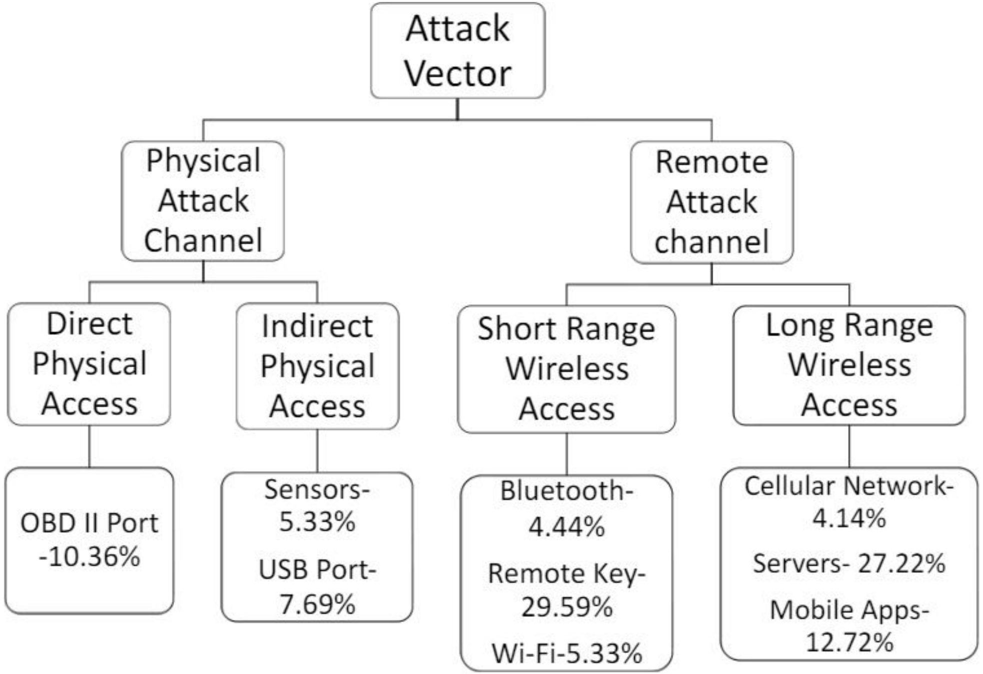
Types of V2X Connectivity, Technology and Data

Overview of This Research

- We scrutinize the **potential attack vectors** that EVs are vulnerable to and the **consequential impact** on vehicle operations
- We outline both **general and specific strategies** aimed at thwarting these cyberattacks
- We **anticipate future developments** aimed at enhancing EV performance and reducing security risks

EV Cyber Vulnerabilities & Impacts

EV Cyber Vulnerabilities



Common Attack Vectors on EV System

Types of EV Attacks

Eavesdropping

Jamming

Message Spoofing/Forgery

Replay Attack

Man-in-the-Middle

Sybil Attack

Fake Attack

Denial-of-Service

Malware

Tracking

Impacts of Attack on EVs

Loss of Mobility

Data Leakage

Remote Control & Safety Risks

Financial Losses & Reputation Damage

Security Strategies

Strategies Against Attacks

Software Update

Restrict In-vehicle Wireless Services

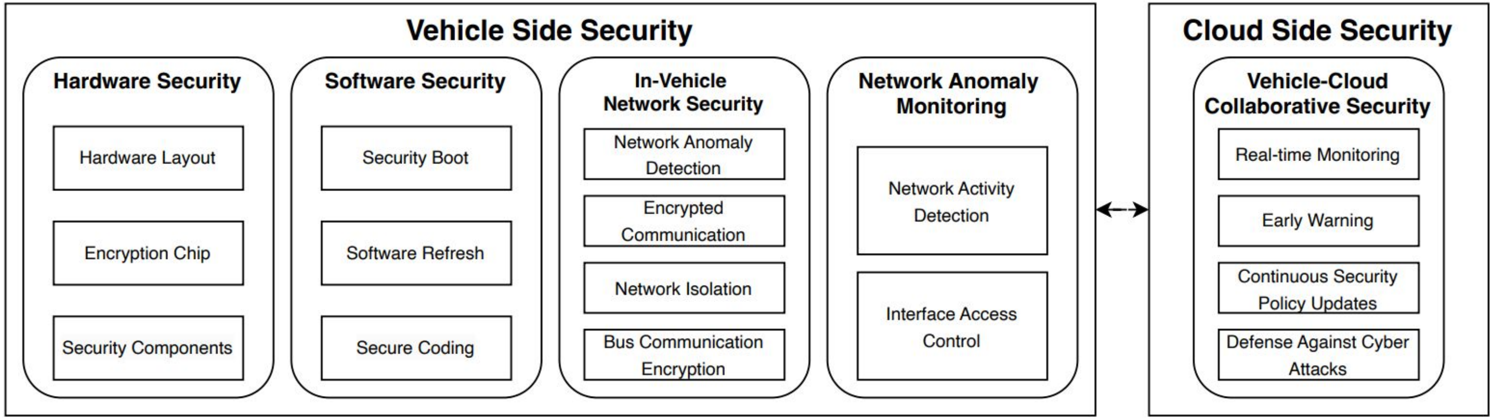
Avoid Untrusted Apps and Services

Other Measurements

EV Cyber Security Defense Lines

- **Vehicle side:**
  - Security software and hardware architecture design
  - In-vehicle network security architecture
- **Cloud side:**
  - Vehicle-cloud collaborative security
  - Up-to-date security policies

Security Strategies



Security Architecture Design Components

Current Limitations & Future Research Directions

- **EV Charging Infrastructure**
  - Limited station availability; vulnerable to cyberattacks
    -> need secure protocols and intrusion systems
- **Safety and Privacy**
  - Increased cyber-attack risk for connected EVs
    -> need better privacy techniques and cyber-security protocols.
- **Vehicle and Grid Interaction**
  - V2G/G2V needs secure cloud platforms
    -> focus on *security and privacy in data transactions*

Conclusions

- **Adoption and Benefits of EVs**
  - EV are gaining popularity due to multiple benefits (lower emissions, reduced noise, higher efficiency, superior technology)
- **This Research**
  - explores the integration of EVs with cloud connectivity and identifies potential cybersecurity threats; assesses the impacts and proposes strategies to mitigate these risks.
- **Contribution**
  - examine the potential attack vectors that EVs might be susceptible to and the resulting impact on the vehicle.
  - a valuable resource for researchers interested in EV platforms and cybersecurity issues related to EVs

Thank You!