Augmented and Autonomous Vehicle Security

Kevin Gilbert, Christopher Haster, Gilberto Rodriguez III, Hao Chen, Young Chou, Joshua Bryant
University of Texas at Austin

Abstract

Our research project is focused on highlighting security concerns in augmented and autonomous vehicles. We have developed and built a robotics testbed and simulator on which we can measure and apply real-world data. We primarily focus on the two coupled weak points in augmented automotive cybersecurity: wireless transceiver entry points into an unsecured Controller Area Network (CAN).

Main Objectives

Our main objectives were to design and implement a testbed on which we could launch security exploits and defenses while providing a retrospective of current automotive cybersecurity. We wished to highlight the inherit dangers of an unsecured CAN bus and demonstrate the necessity of high speed, short-term encryption. Our goals were to create a secured CAN-like protocol within a FPGA coupled with hardware encryption on which we could pipe wireless packets through. We would test this device with a set of wireless transceivers at high speeds in moving vehicles and within our robotics testbed. The realworld data we generated could then be used within a simulator in which we could measure safety and implement a variety of network protocols.

Materials and Methods

Our primary modules were broken down into:

- FPGA -
  - CAN Bus
  - UART - CAN Packet Translation
  - PWM Generation
  - Hardware Encryption
- Wireless Transceivers -
  - Data Transmission
  - Software Encryption
- Robotics Testbed -
  - Data Measurement
- Embedded -
  - IMU Measurement
  - Motor Control (PID)
  - Laptop to CAN Bus Interface
  - Sensor Interface
- Simulator -
  - Network Timing Constraints

Measurements and Data

We will focus on modular specific system testing and timing constraints collected in this section. The following section will collect this data into a summary of our results.

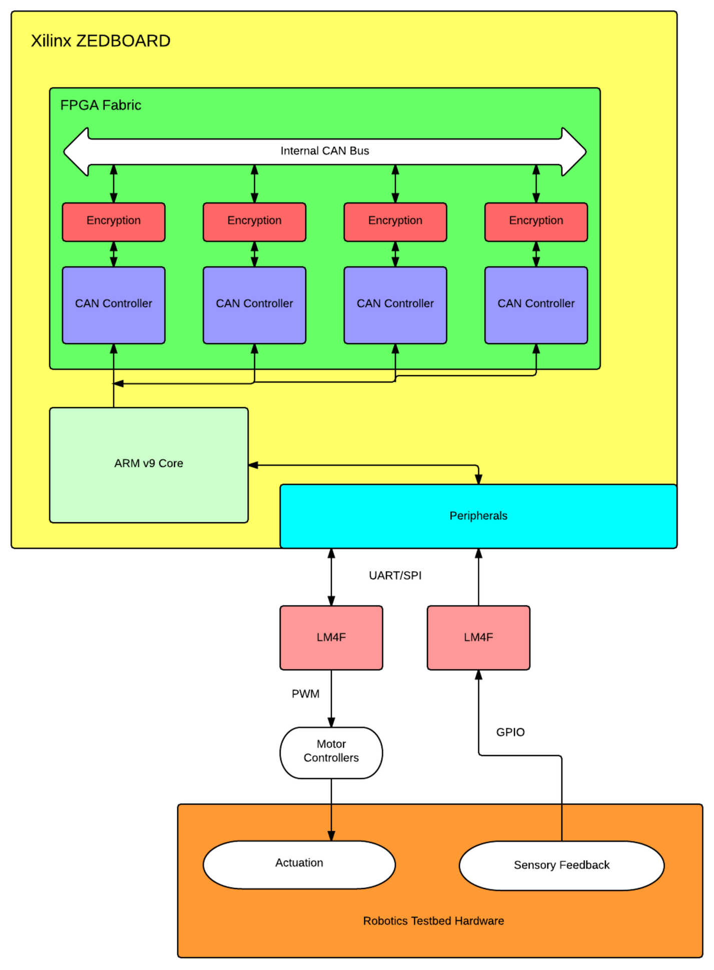


Figure 1. FPGA Layout

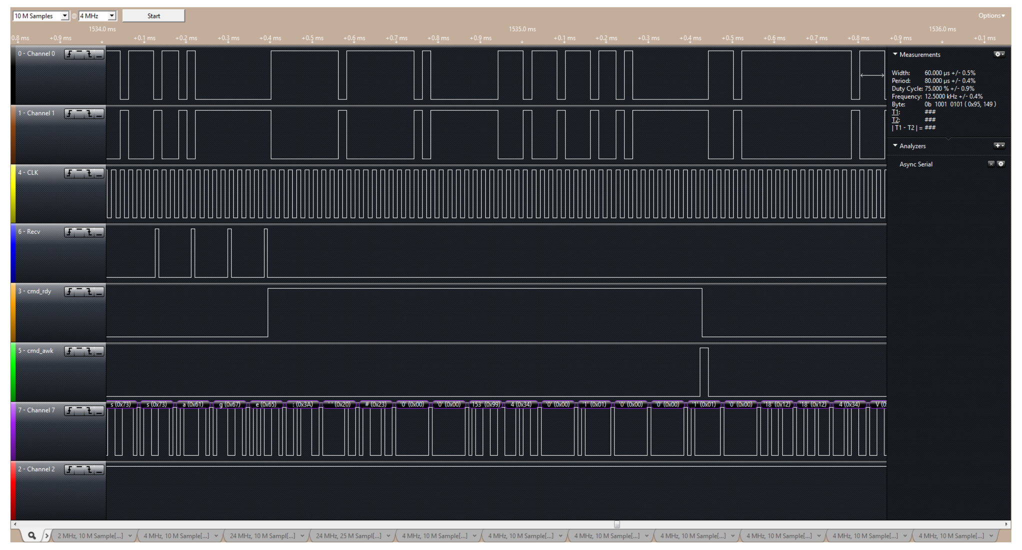
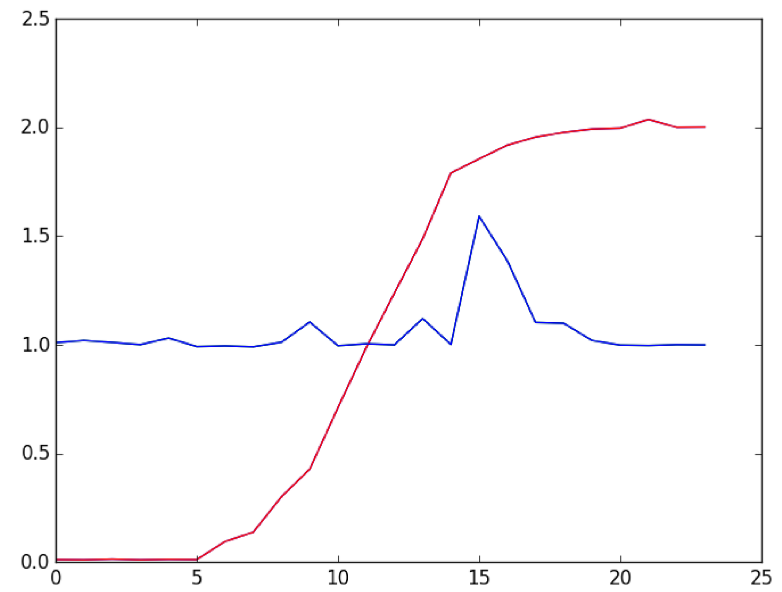
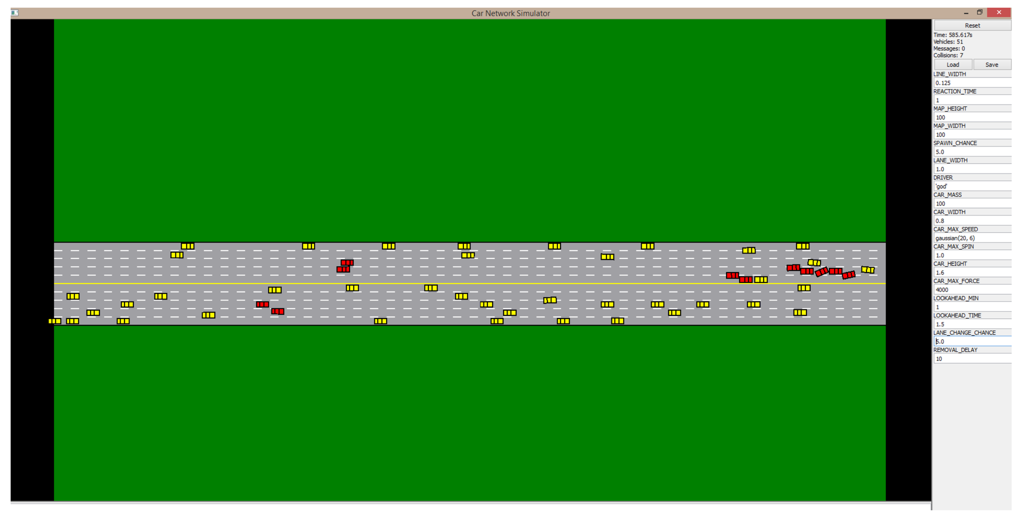


Figure 2. Hardware CAN Bus Capture





Results

Donec faucibus purus at tortor egestas eu fermentum dolor facilisis. Maecenas tempor dui eu neque fringilla rutrum. Mauris *lobortis* nisl accumsan. Aenean vitae risus ante. Pellentesque condimentum dui. Etiam sagittis purus non tellus tempor volutpat. Donec et dui non massa tristique adipiscing. Phasellus imperdiet, tortor vitae congue bibendum, felis enim sagittis lorem, et volutpat ante orci sagittis mi. Morbi rutrum laoreet semper. Morbi accumsan enim nec tortor consectetur non commodo nisi sollicitudin. Proin sollicitudin. Pellentesque eget orci eros. Fusce ultricies, tellus et pellentesque fringilla, ante massa luctus libero, quis tristique purus urna nec nibh.

Treatments	Response 1	Response 2
Treatment 1	0.0003262	0.562
Treatment 2	0.0015681	0.910
Treatment 3	0.0009271	0.296

Table 1: Table caption

Nulla ut porttitor enim. Suspendisse venenatis dui eget eros gravida tempor. Mauris feugiat elit et augue placerat ultrices. Morbi accumsan enim nec tortor consectetur non commodo. Pellentesque condimentum dui. Etiam sagittis purus non tellus tempor volutpat. Donec et dui non massa tristique adipiscing. Quisque vestibulum eros eu. Phasellus imperdiet, tortor vitae congue bibendum, felis enim sagittis lorem, et volutpat ante orci sagittis mi. Morbi rutrum laoreet semper. Morbi accumsan enim nec tortor consectetur non commodo nisi sollicitudin.

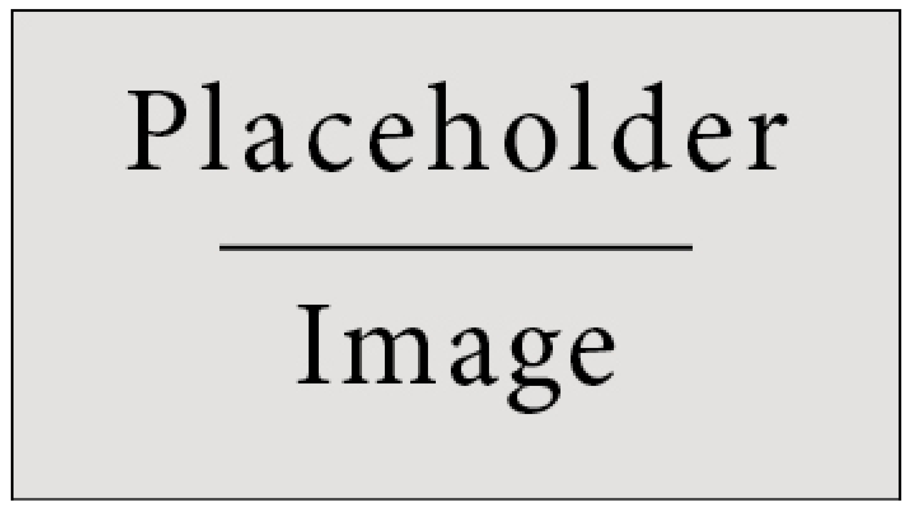


Figure 1: Figure caption

In hac habitasse platea dictumst. Etiam placerat, risus ac. Adipiscing lectus in magna blandit:

Treatments	Response 1	Response 2
Treatment 1	0.0003262	0.562
Treatment 2	0.0015681	0.910
Treatment 3	0.0009271	0.296

Table 2: Table caption

Vivamus sed nibh ac metus tristique tristique a vitae ante. Sed lobortis mi ut arcu fringilla et adipiscing ligula rutrum. Aenean turpis velit, placerat eget tincidunt nec, ornare in nisl. In placerat.

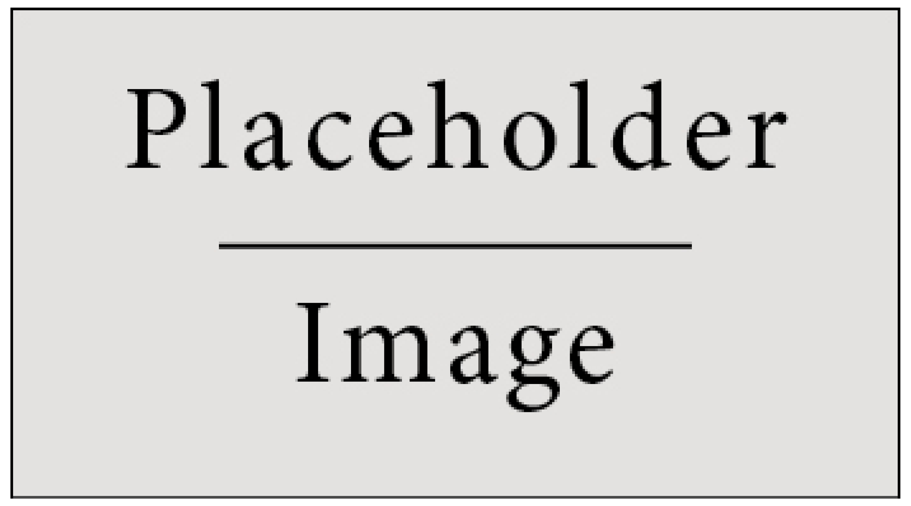


Figure 2: Figure caption

Conclusions

- **Pellentesque eget orci eros. Fusce ultricies, tellus et pellentesque fringilla, ante massa luctus libero, quis tristique purus urna nec nibh. Phasellus fermentum rutrum elementum. Nam quis justo lectus.**
- **Vestibulum sem ante, hendrerit a gravida ac, blandit quis magna.**
- **Donec sem metus, facilisis at condimentum eget, vehicula ut massa. Morbi consequat, diam sed convallis tincidunt, arcu nunc.**
- **Nunc at convallis urna. isus ante. Pellentesque condimentum dui. Etiam sagittis purus non tellus tempor volutpat. Donec et dui non massa tristique adipiscing.**

Future Research

Vivamus molestie, risus tempor vehicula mattis, libero arcu volutpat purus, sed blandit sem nibh eget turpis. Maecenas rutrum dui blandit lorem vulputate gravida. Praesent venenatis mi vel lorem tempor at varius diam sagittis. Nam eu leo id turpis interdum luctus a sed augue. Nam tellus.

Acknowledgements

Dr. Tiwari, TI, UT Austin, swiggity swaggity swoop