Overview of PCAS
Software Engineering CSE435
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Project Overview

• System provides automatic braking for pedestrians

• Motivation for project
  – Address problem with accidents involving pedestrians
  – Facilitates collision avoidance
Background

• Pedestrian deaths account for 17% of vehicle crash fatalities

• Pedestrian Collision Factors:
  – Low visibility
  – Pedestrians are unpredictable, negligent
  – Alcohol consumption
  – Reaction time
Overview of Features

• System On/Off
  – Vehicle in Drive (D), system On
  – Vehicle in other gear, system off

• System Override
  – Button on dashboard screen

• Fail-Safe Sensor
  – Checks for system failures/vulnerabilities
  – Will engage Fail-Safe mode
Overview of Features

• Pedestrian Detection Sensor (PDS)
  – Detects the pedestrian within 35m ahead of the vehicle

• Pedestrian Collision Avoidance Algorithm (PCAA)
  – Calculates potential collisions

• Brake-by-Wire/ Acceleration-by-Wire
  – Acceleration-by-Wire: accelerates vehicle back to a steady state
  – Brake-by-Wire: decelerates vehicle to avoid collision
Domain Research

• Investigated
  – Existing pedestrian avoidance systems
  – Cybersecurity for vehicles

• Applied safety measures and design techniques to PCAS

• Project Constraints
  – PCAS sub-systems must be unobstructed and functional
    • Pedestrian Detection Sensor
    • Fail-Safe Sensor
    • The Acceleration-by-Wire & Brake-by-Wire systems
    • System Override Button
Model-based View of System
Decisions Considered

• Driver Interaction with PCAS On/Off
  – Originally On/Off performed manually by the driver
  – Replaced the now-implemented system override

• Driver warning via vibrating driver seat
Part III: Demonstration

Dashboard with buttons

Pedestrian

Vehicle
Scenario 1: No pedestrian, no effect
Scenario 2: Pedestrian moves in front of the vehicle and then stops
Scenario 3: Pedestrian is in front of the vehicle and moves out of the way
Scenario 4: Fail-Safe Mode Engaged
Scenario 5: Cyber Attack Prevented

System is being attacked
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