MOTIVATION GOALS

• Deepening penetration of battery vehicles (BVs) reduces funding of the transportation infrastructure because of the absence of gasoline tax collection from BVs.
• There are 3 key goals:
  – Design a secure and privacy-preserving tax collection model for BVs that uses mileage and location of the vehicle for tax computation.
  – Compute tax amount for each authority—county, state, federal—based on the miles driven in each region.
  – Ensure the auditability of the tax computation in case of challenge by any affected entity.

RESEARCH CHALLENGES

• Design of a system that preserves location privacy of the user but provides auditability of the tax amount.
• Development and incorporation of fail-safe mechanisms for situations such as car crashes, instrument malfunction/destruction, data unavailability, and hacking.
• Assurance of scalability, robustness, and cost-effectiveness for practically oriented system.
• Implementation of tamper-resistant mechanisms to protect the integrity of the system.

RESEARCH PLAN

• Preparation of documentation that discusses the key requirements of the system.
• Design of the system in conformance with the requirement specification.
• Implementation of the system on an open-source platform, and testing of it.

INFORMATION FLOW

MOTIVATION BEHIND ANDROID

• Car manufacturers are continuously introducing embedded functionalities—e.g., Ford Sync®, Mercedes-Benz’s mbrace®—similar to those of smartphones, such as navigation, traffic reports, and health status of car.
• Many ongoing efforts, such as AUTOSAR, OVERSEE, GENIVI, and AutoLinQ™, provide automotive platforms with API support to run third-party applications.
• OVERSEE aims for a secure platform for vehicles, with all the intra-vehicle communication regulated through the firewall.
• Software implementing all the above platforms is available only to the project partners or is proprietary.
• Open-source Android platform provides many key functionalities similar to those of automotive platforms along with excellent documentation.

KEY COMPONENTS’ INTERACTIONS

BROADER IMPACT

• The design can be ported to any automotive platform or smartphone platforms such as iOS, and can be deployed to Pay-As-You-Drive (PAYD) insurance schemes with minor modifications.
• The odometer simulator and GPS simulator can be used to develop other car applications.

FUTURE EFFORTS

• Development of all the applications on Android platform.
• Implementation of the tamper-resistant feature that explicitly corroborates the data collected from GPS, odometer, and accelerometer.
• Implementation of distinct levels of privacy and security for the viewer, and, if possible, test it with actual users.
• Comprehensive documentation to allow the portability of the application on a future automobile platform.