CRII: SaTC: Cyber Resilient Localization and Navigation for Autonomous Vehicles
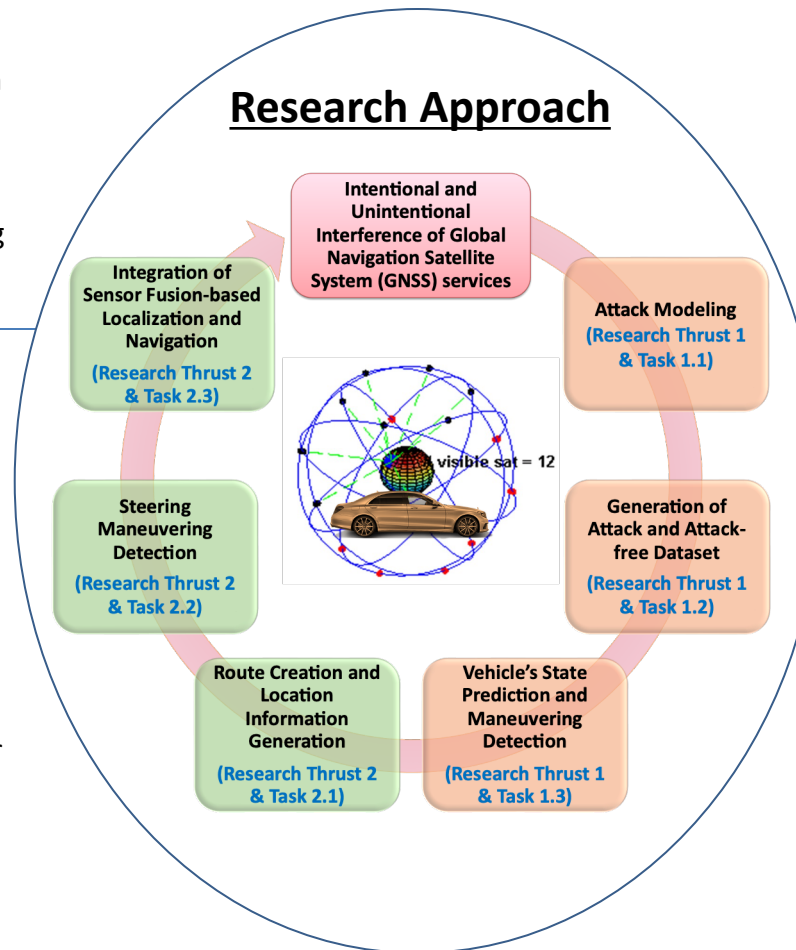
Challenges

- Detect unintentional and intentional Global Navigation Satellite System (GNSS) interference
- Generate location information (latitude and longitude) in a GNSS-denied environment
- Guide an autonomous vehicle (AV) to a destination for a long duration in a GNSS denied environment

Solutions

- **Research Thrust 1:** Investigate and develop an approach to detect intentional and unintentional interference of GNSS services using low-cost in-vehicle sensors (e.g., gyroscope, accelerometer, and steering angle sensor)
- **Research Thrust 2:** Investigate and develop an integrated cyber resilient system using data from in-vehicle sensors and on-board Geographical Information System (GIS) to navigate an AV for a long duration towards its desired destination in a GNSS-denied environment

Research Approach

Intentional and Unintentional Interference of Global Navigation Satellite System (GNSS) services

Attack Modeling **(Research Thrust 1 & Task 1.1)**

Generation of Attack and Attack-free Dataset **(Research Thrust 1 & Task 1.2)**

Vehicle's State Prediction and Maneuvering Detection **(Research Thrust 1 & Task 1.3)**

Route Creation and Location Information Generation **(Research Thrust 2 & Task 2.1)**

Steering Maneuvering Detection **(Research Thrust 2 & Task 2.2)**

Integration of Sensor Fusion-based Localization and Navigation **(Research Thrust 2 & Task 2.3)**

visible sat = 12

Scientific Impacts

- Enable a new paradigm of GNSS security solutions only using low cost in-vehicle sensors;
- Integrate in-vehicle sensor fusion and on-board GIS to generate localization information (latitude and longitude) in a GNSS-denied environment
- Enable an AV to navigate for a long duration between an origin and a destination in a GPS-denied environment

Broader Impacts and Broader Participation

- Extendable to other future automated vehicles (e.g., drones, flying vehicles) fields
- Improve AV safety, operation and user acceptance
- Involve K-12 students into lab research related to AV security
- Increase the number of female and ethnic minorities participation in AV security
- Develop graduate, undergraduate, creative inquiry relevant courses