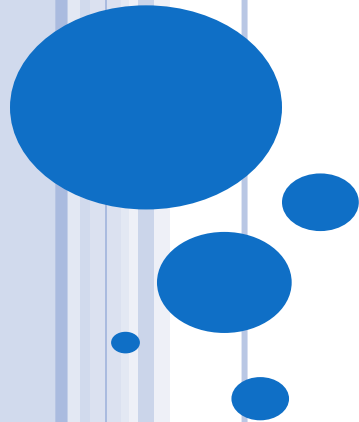


# VEHICLE-TO-VEHICLE COMMUNICATION

## TEAM #2



**Kimberly Leandre**  
**Dominic Eaton**  
**Diandra Prioleau**  
**Roberts Etumnu**



# PROBLEM AND MOTIVATION

- Approximately **1.3 million people** die due to road crashes [ASIRT] with an average of **3,287 deaths each day**
- It is predicted that by 2030 that road traffic crashes will be the fifth leading cause of death.
- Road crashes cost low and middle-income countries USD **\$65 billion annually**, exceeding the total amount received in developmental assistance

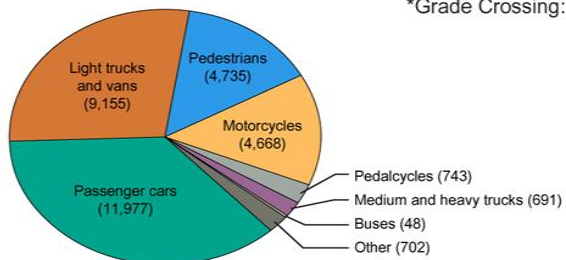




# NATIONAL TRANSPORTATION SAFETY BOARD

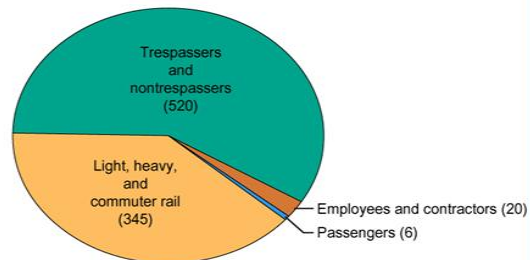
## 34,678 Transportation Fatalities In 2013

### Highway: 32,719

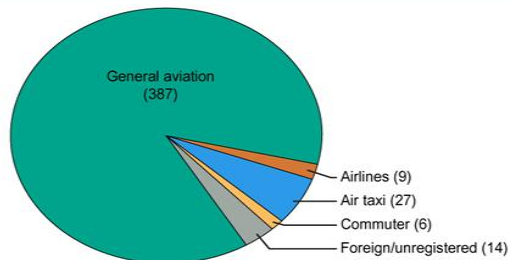


\*Grade Crossing: 231

### Rail: 891

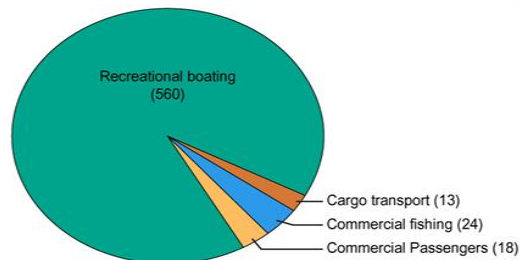


### Aviation: 443



### Pipeline: 10

### Marine: 615



**\*Note:** All data are preliminary estimates. Grade crossing fatalities are not included in the grand total because they were counted in the rail and highway categories, as appropriate. The pie charts are not drawn proportionately to each other. Aviation data are from the NTSB. Marine data are from the Department of Homeland Security. All other data are from the U.S. Department of Transportation.





**THE VERGE**

# BACKGROUND

- System designed to transmit safety information to vehicles to facilitate warnings to drivers concerning impending crashes
- Use short-range radio communication devices to transmit message about vehicle's speed, heading, brake status and other information to other vehicles and receive same information from the messages
- Longer detection distance
- Ability to see around corners and through other vehicles
  - Helps V2V-equipped vehicles to perceive some threats sooner than sensors, camera, or radar can



# PAST RESEARCH

- Connected Vehicle Safety Pilot Model Deployment
  - Sponsored by DOT - August 2012 to February 2014
  - Able to transmit and receive messages from one another
  - Mitigate and prevented potential crashes
  - Developed based on existing communication protocols found in consensus standards from SAE and IEEE



# CURRENT RESEARCH/CHALLENGES

- Wireless Spectrum
- Security and Communications Systems to support V2V
- Mitigate V2V Communication congestion
- Incorporating GPS positioning advancements to Improve V2V relative positioning
- Address false positive warning from V2V safety applications



# RELEVANT ENGINEERING PROBLEMS



# THE INTELLIGENCE SYSTEM

- Base System
  - Able to recognize vehicles within the perimeter of the host vehicle
  - Able to recognize if surrounding vehicles are too close to host vehicle
  - Able to recognize possible collisions and how likely a collision will be
  - Able to recognize and track movements/ other information of vehicles within surrounding radius of host vehicle
    - Other information: vehicle's size, velocity, acceleration, brake/ accelerator pedal status



# THE INTELLIGENCE SYSTEM (CONTINUED)

- Apply appropriate response to collision
- Able to distinguish vehicles from environment or objects in environment
- Able to differentiate between false and true collision conditions
- Host vehicle able to recognize its position in relation to surrounding vehicles/ environment
- Extended System
  - Able to calculate collision avoidance path
  - Able to take control vehicle in emergency collision situation



# THE COMMUNICATION SYSTEM

- Wireless system that is large enough to allow for vast number of devices to communicate on the system
- Vehicle identification system that will allow every vehicle in the system to have a unique identifier
- Put time stamp on data packets transmitted and received from device



# THE ALERT SYSTEM

- Includes a light (LED) based system which changes color depending on the likelihood of a collision
- Possible sound (beep) based system which increases in intensity depending on the likelihood of a collision
- Possible vocal response from system alerting of possible collision



# POTENTIAL SOLUTIONS

## ○ THE DEVICE

- After Market device
  - Installed after vehicle has been manufactured
- Product initially includes only the single portable/  
installable device
- Product can be upgraded to a package which includes  
installation of sensors on host vehicle
- Possible use of an inertial navigation system INS



# PROPOSAL

## ○ Ford OpenXC

- Connects to vehicle OBD-II(On-board diagnostics port II)
- Capable of collecting vehicle data
- Transmits data via android application



## ○ NovAtel Span-CPT

- GNSS and INS receiver
- 3D positioning, velocity, and also attitude
- Accuracy of centimeters
- Able to perform in rough environments



# SYSTEMS OVERVIEW

## ○ Positioning – Roberts

- Collect position data from other vehicles around host vehicle
- Capable of real time tracking of position and velocity
- GPS/ INS in each unit

## ○ Intelligence – Dominic

- Compute eminent collision from specific direction
- Levels of collision detection system
- Algorithm for collision response

## ○ Communication – Diandra

- Wireless
- Excellent in harsh conditions
- Should not interfere with other frequencies

## ○ Alert – Kimberly

- Notification if collision is eminent
- Display notification via LED/audible voice

