Older Driver Support System (ODSS) – Real-time Feedback on Driving Behaviors

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Driving and the Lifespan

Motor vehicle crash deaths per 100,000 people by age and gender, 2013

FARS, 2013
Older Driver Challenges

• Perceptual
  – Visual acuity, contrast sensitivity, depth and motion perception, visual fields, hearing

• Physical
  – Range of motion, strength, speed of movement

• Cognitive
  – Selective attention, processing speed, judgment/decision-making, working memory
Collecting Driving Data on a Smartphone App

Primary Variables
- Driver ID
- Date, Time
- GPS - Lat, Long, Alt
- GPS - Bearing
- GPS - Velocity
- IMU - g force X, Y, Z

Secondary/Calculated Variables
- Distance, Elapsed Time
- Lat, Long, Vert acceleration
- Accel/Decel point
- Accel/Decel rate
- Max Accel/Decel X, Y, Z
- Incline/Decline
- Variability in X, Y, Z
Smartphone App as a Driver Support System

• **Location-based information**
  – Speed limits
  – Intersections
  – Specific roadways/landmarks

• **Driving behaviors**
  – Speed relative to current speed limit
  – Longitudinal acceleration/deceleration
  – Lateral acceleration
CDRS Interviews

Older Driver Difficulties

- Lane keeping
- Maintaining appropriate speed
- Visual scanning & spatial awareness
- Anticipating intersections, driveways, exits
- Remembering roadway location, recent signs

CDRS Coaching

- Pre-drive reminders
  - Monitoring lane position
  - Mirror checking
  - Scanning whole road
- Reminders during drive
  - Preparing for turns or exits
  - Upcoming stop signs/lights
  - Navigation assistance
ODSS Development

• **Messages/Visuasls**
  - Roadway information
  - Warnings
  - Reminders

• **Triggers**
  - GPS location
  - Vehicle speed
  - Acceleration/deceleration
  - Timed/randomized
Pre-Drive Reminders

Stay centered in your lane.

Check your rear and side view mirrors.

Maintain a safe distance between vehicles.

FOLLOW SAFELY

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Pre-Drive Reminders

Check blind spots before changing lanes

Be aware of traffic around you
Speed Information & Warnings

- Most recent posted speed limit (display only)
- Excessive speed warnings (tone and verbal)
- Under-speed warning (verbal only)
Excessive Acceleration/Braking

- Buzzer Tone
- Display graphic
- Verbal:
  - “Please accelerate more slowly.”
  - “Braking too hard, brake earlier or more slowly.”
  - “Sharp turn, slow down prior to a turn or curve.”
Intersection Reminders

Traffic Light Ahead

Stop Sign Ahead
Location/Roadway Notification

- Verbal only: “Approaching Highway 47”
- Demo version identifies 2 major roads on approach
- Could be set to different levels of detail
Pilot Test/Demonstrations

- **Participants**
  - 3 older drivers
  - 2 CDRS

- **Demonstration drive**
  - Researcher drove test route
  - Participants observed ODSS feedback

- **Post-drive evaluation**
Participant Feedback

- **Roadway information**
  - Reduces uncertainty/stress
  - Improves confidence

- **Speed/acceleration warnings**
  - Alerts driver to unsafe behaviors
  - “Buzzer” alert tone is too harsh-sounding
  - Could be distracting if too frequent

- **Overall opinion**
  - ODSS could potentially benefit some older adults
  - Potential concerns: some drivers may rely too much on feedback
Future Possibilities

• Further assessment
  – Older drivers with identified driving challenges
  – Varying levels of feedback (types and frequency)

• More feedback types
  – Lane position, proximity alerts
  – Roadway conditions (work zones, slowed traffic)
  – More navigation information, current street displayed

• Collection of driver data for evaluation
  – Identify/validate driving metrics for normal vs unsafe driving
  – Use naturalistic driving data as diagnostic tool for older drivers
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Acknowledgement

This research project was supported by the Center for Advancing Transportation Leadership and Safety (ATLAS Center). The ATLAS Center is supported by a grant from the U.S. Department of Transportation, Office of the Assistant Secretary for Research and Transportation, University Transportation Centers Program (DTRT13-G-UTC54). The ATLAS Center is a collaboration between the University of Michigan Transportation Research Institute (UMTRI) and the Texas A&M Transportation Institute (TTI).
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