PROJECT SMOOTH
SMART MOBILE OPERATION: THE OHIO STATE UNIVERSITY TRANSPORTATION HUB
ON DEMAND AUTOMATED SHUTTLES

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OTEC: Ohio Transportation Engineering Conference
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• Smart, Sustainable and Green Mobility is an important part of a Smart City.

• Passengers should have access to all choices of transportation (buses, trains, subway etc.)

• In the U.S. the first mile (access to transportation choice) and the last mile (from transportation station to final destination) form the weakest link in smart mobility.
Most people in the US do not live or work close to a transportation stop (bus, train, metro), hence the first mile problem. How do you reach the bus stop to start mobility in a smart city?

Transportation stops are usually not close to the last point of interest like a shopping area, grocery store, pharmacy or work, hence the last mile problem. How do you reach your final destination after you get off the bus?
• While walking may be a solution it does not apply to everybody (elderly people, handicapped people, people with luggage).

• Note for instance that elderly people are expected to become 20% of the entire US population in 25 years.

• Automated shuttles will also help visitors who may not have too much time.
• Automated shuttles within selected zones to reach a bus stop will also help an important mobility problem for a future smart city of Columbus.
• On demand automated shuttles can be used for the first or last mile of mobility or for mobility within a selected zone.

• Smartphone apps can be used for reserving space in an automated shuttle, checking the timing of the shuttle and ordering shuttle service.

• Shuttle timing has to be coordinated with the bus arrival and departure.

• Connected Vehicle technology (intersection safety, cooperative driving) has to be utilized for optimum results.
• The National Institute of Standards and Technology (NIST) launched the Global City Teams Challenge (GCTC) on September 29-30, 2014.

• NSF accepted EArly-concept Grants for Exploratory Research (EAGER) proposals to support NSF researchers in participating in the NIST GCTC teams.

• Our NSF-EAGER proposal AVOID to support project SMOOTH was accepted.
KEY INNOVATIVE CONTRIBUTIONS

• Development of a unifying theoretical framework for sensing and tracking in densely crowded situations involving vehicles with different levels of communication capability and autonomy;
• Socially acceptable automated driving within pedestrian zones;
• Evasive road maneuvering to avoid colliding with conventional human driven vehicles.

KEY DISTINGUISHING AND CHALLENGING CHARACTERISTIC

Focus on dense pedestrian environments with erratic moving “obstacles”. Vehicles and a high number of mobile obstacles moving at similar speeds are under consideration.
EAGER: A Unified Solution of Mixed Traffic Sensing, Tracking and Socially Acceptable Active Accident Avoidance for on Demand Automated Shuttles in a Smart City

The NSF EAGER project concentrates on the following fundamental research problems:

- **Elastic Band theory** will be developed and used for **collision avoidance of automated shuttles in dense traffic environments** with moving and stationary obstacles.

- **Socially acceptable automated shuttle paths** will be determined using elastic band theory **within pedestrian zones**.

- **Pedestrian motion models** will be investigated and developed.

Success, future acceptance and widespread use require the solution of the fundamental research problems related to sensing/tracking in densely crowded situations, driving in pedestrian areas using a socially acceptable distance, and safely avoiding collisions. Project **AVOID** will provide data for Global City Teams Challenge project **SMOOTH**.
ON DEMAND AUTOMATED VEHICLES
• **Features:** Request an immediate pickup, Schedule a future pickup, Real-time autonomous vehicle status information, Administrator view for system status information, User authentication, Geo-location for pick up location, Map view provided by MapBox/ OpenStreetMap, Real-time OSU CABS bus information, Mobile compatible layout for easy viewing on a smartphone or tablet
Road types:
- Driveway
- Bike trail
- Parking lot
- Parking lot driveway
SMOOTH PHASE 2 ROUTES - MID CAMPUS TEST ROUTE
VIDEO DEMO OF ON DEMAND AUTOMATED SHUTTLES
The GCTC Festival took place on June 1, 2015 and the GCTC Workshop took place on June 2, 2015 in Washington DC, located at the National Building Museum. Prof. Bilin Aksun Guvenc is seen presenting the SMOOTH project in the Figure, followed by an introduction by Mr. Paul Carlson of the city of Columbus.
Flyers, postcards and other promotional material were distributed in the shared booth. Videos of the route demonstration were shown to the visitors of the booth.

A snapshot of the shared booth at the GCTC Festival, with Bilin Aksun Guvenc, Arda Kurt and Paul Carlson.
Just after the GCTC the city of Columbus was selected as the Intelligent Community of the Year.

The Ohio State University and city of Columbus team is proud to have presented the SMOOTH project in the last site visit before the final decision.
The title was earned after a year-long evaluation that included a quantitative analysis of extensive data, site inspections by the Intelligent Community Forum and votes from an international jury made up of experts from around the world. The Ohio State University and city of Columbus team is proud to have presented the SMOOTH project in the last site visit before the final decision.
The city of Columbus made a giant leap toward being a smart city by being chosen the intelligent community of the year 2015 and the SMOOTH team is glad to have made a contribution.
GCTC 2016 Kick-off Conference registration is now open.

Initial teambuilding workshop for the next round of the Global City Teams Challenge will take place November 12-13, 2015, at NIST's Gaithersburg, Md., Campus.
As the technology for autonomous vehicles continues to develop, it may be necessary for state and municipal governments to address the potential impacts of these vehicles on the road.

Source: http://www.ncsl.org/
Nevada was the first state to authorize the operation of autonomous vehicles in 2011. Since then, five other states—California, Florida, Michigan, North Dakota and Tennessee—and Washington D.C. have passed legislation related to autonomous vehicles.

Source: http://www.ncsl.org/
Sixteen states introduced legislation related to autonomous vehicles in 2015, up from 12 states in 2014, nine states and D.C. in 2013, and six states in 2012. I hope that in a very near future the State of Ohio will be among the states introducing legislation related to autonomous vehicles.

Source: http://www.ncsl.org/
THE END OF PRESENTATION!