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FACTSHEET: SMART SELF-DRIVING PERSONAL MOBILITY DEVICE (PMD)

The objective of this research project is to allow a fleet of Autonomous Vehicles (AVs) to provide Mobility-on-Demand (MoD) which will complement the existing transportation system, so as to reduce the overall commuting time by solving the "first-and-last-mile" problem; and in the case of the Personal Mobility Device (PMD), the first first-mile and last last-mile problem. This solution will thus reduce the traveling time from the start location (for example, commuter's house) to the start of the transportation network (for example, MRT station) and reduce the traveling time from the end of the transportation network to the final destination (for example, commuter's workplace).

The research integrates existing technologies with fresh methodologies to allow driverless vehicles to intelligently provide MoD, with the goal of making this future transportation paradigm a reality. Multiple classes of vehicles are used in tandem to provide pervasive access to the MoD service not just over the typical road network (with cars), but even extended to difficult to reach areas, such as inside parks (with self-driving buggies), or even inside buildings (with a self-driving PMD).

The AV is a collaborative project between the Singapore-MIT Alliance for Research and Technology (SMART), the Massachusetts Institute of Technology (MIT), and the National University of Singapore (NUS). SMART's self-driving car has been operational since January 2014, while similar challenges have been tested on self-driving golf buggies on NUS campus since 2011. The latest vehicle developed is a self-driving personal mobility scooter, which was launched at the MIT Open House on 23 April 2016.

SMART's self-driving car was also one of the first autonomous vehicles to be given permission to drive on public roads in Singapore alongside human traffic. This permission to test drive at the One-North business district was given by the Singapore Land Transport Authority (LTA) in Sep 2015.

Besides solving the "first-and-last-mile" problem, AVs offer the following benefits:

Safety - Traffic accidents are the leading cause of death in road users of the 20-30 age group. Most accidents occur due to human errors. Automated vehicles have the following advantages:

1. Quicker reaction time
2. Shorter braking time
3. Wider field of view
4. Not distracted
5. Not affected by fatigue
6. Non-aggressive behaviour
7. Bad behaviours can be easily corrected

Accessibility - Provide mobility to people who cannot, should not, or prefer not to drive (for instance, the elderly, youth and disabled).

Productivity - "Commodity" driving is a chore that absorbs a large fraction of people's time, which could be better used.

Efficiency/Throughput - Automated vehicles can cooperate to minimise the effects of congestion. Routes can also be planned to minimise energy wastage, such as unnecessary braking or acceleration.

Environment - Automated driving can reduce emissions by 20 to 50 per cent, and efficiently interfaces with smart power grids.

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Better User Experience

1. Routes can be planned to make the ride smoother
2. Users can be doing other things and not worry about road conditions
3. Possible location aware services

Self-driving PMD features:

1. Dimensions: 0.93m (Length) x 0.485m (Width) x 1.97m (Height)
2. Weight: ~50kg
3. Turning Radius: 1m
4. Max. autonomous speed: 6 km/h; or 1 metre per second (as with walking speed)
5. Vehicle localisation using laser sensors, and not dependent on GPS
6. Vehicle works well in poor lighting, both indoors and outdoors
7. Obstacle detection using laser sensors(detects obstacles up to 2.5m in front and slows down; at the sides, lidars have sensitivity of 10cm before it comes to a stop)
8. Dynamic safety zone to adjust speed
9. Real-time route re-planning for obstructed path

For more, please see:

- FM Autonomy YouTube channel - www.youtube.com/user/FMAUTONOMY
- FM Autonomy Facebook - www.facebook.com/fmautonomy