

PUBLIC TRANSPORT SECTOR DRIVER BEHAVIOUR:

Measuring recklessness using speed and acceleration

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Public Transport in sub-Saharan Africa

- Minibus taxi sector dominates the informal public transportation system
- South Africa has more than 200,000 minibus taxis
- Most available and affordable to public
- Accounts for 65% of all public transport in SA (14 million passengers every day)
- SSA has some of the world's highest road traffic fatalities
- 32 deaths per 100,000 population annually
- 9th leading cause of death in Africa

Safety – public transport is considered to be a dangerous option in SSA

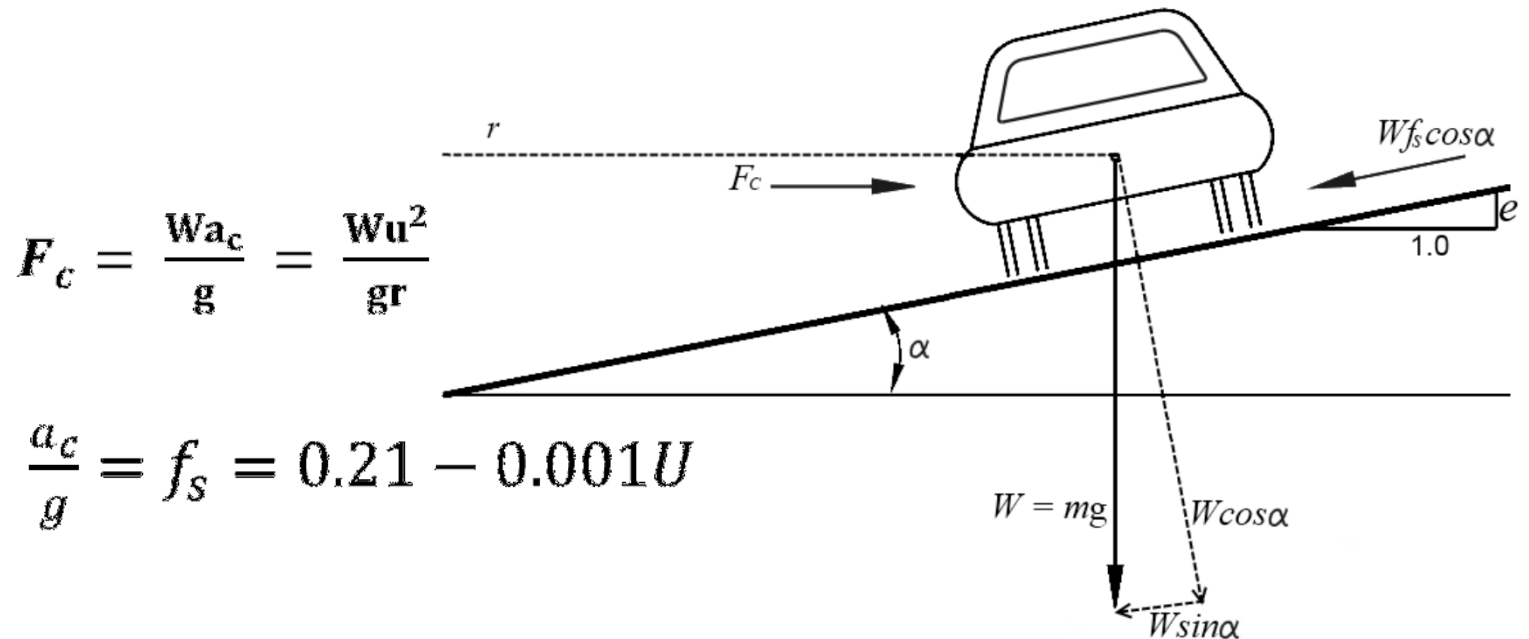


Reckless driving detection system

- Numerous studies completed on driving behaviour
 - Differences are in the specific application area and the sensing method employed
 - Shortcomings in the research field: the lack of an algorithm where relations between speed and acceleration are *simultaneously* taken to identify reckless driving
- Sudden changes of direction, travelling at high speed around curves, or braking and acceleration – results in forces acting on the vehicle
- High levels of acceleration associated with reckless events
- Accelerometer measures inertial g-force
- GPS device measures speed

Design of the reckless driving detection system

- Roads designed to optimize efficiency and safety, whilst minimizing cost and environmental damage
- Friction coefficient – relationship between vehicle's tyres and road surface
- Correlation between friction coefficient and in-vehicle inertial acceleration utilised to enable reckless driving detection
- Curve radius is key determinant of safeness of road curvature
- Centrifugal force countered by centripetal force



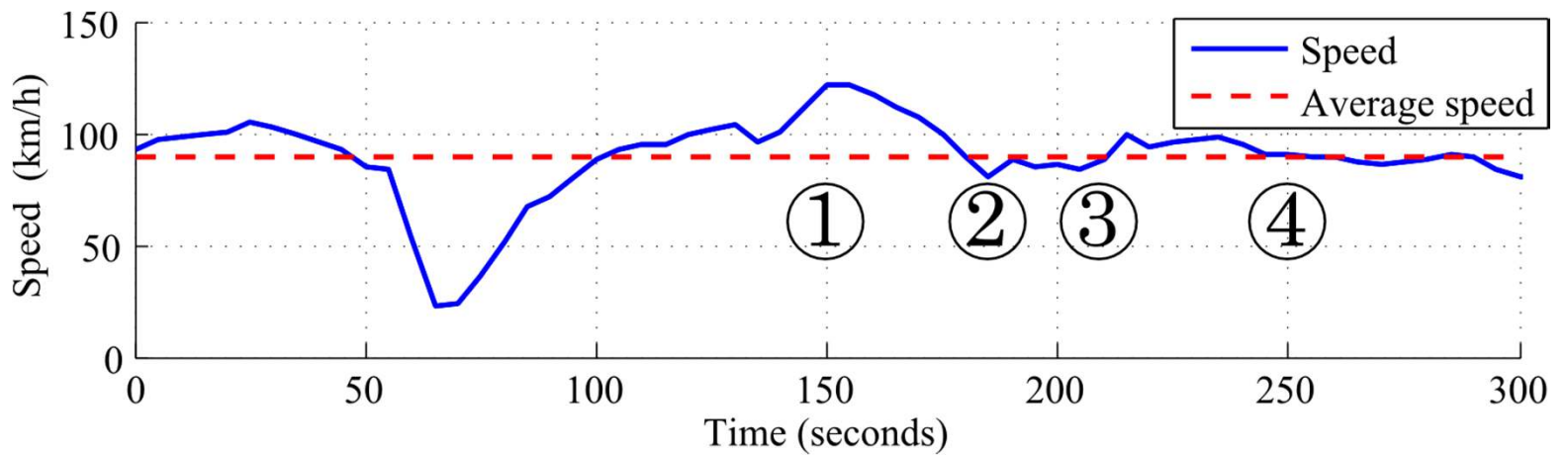


Results

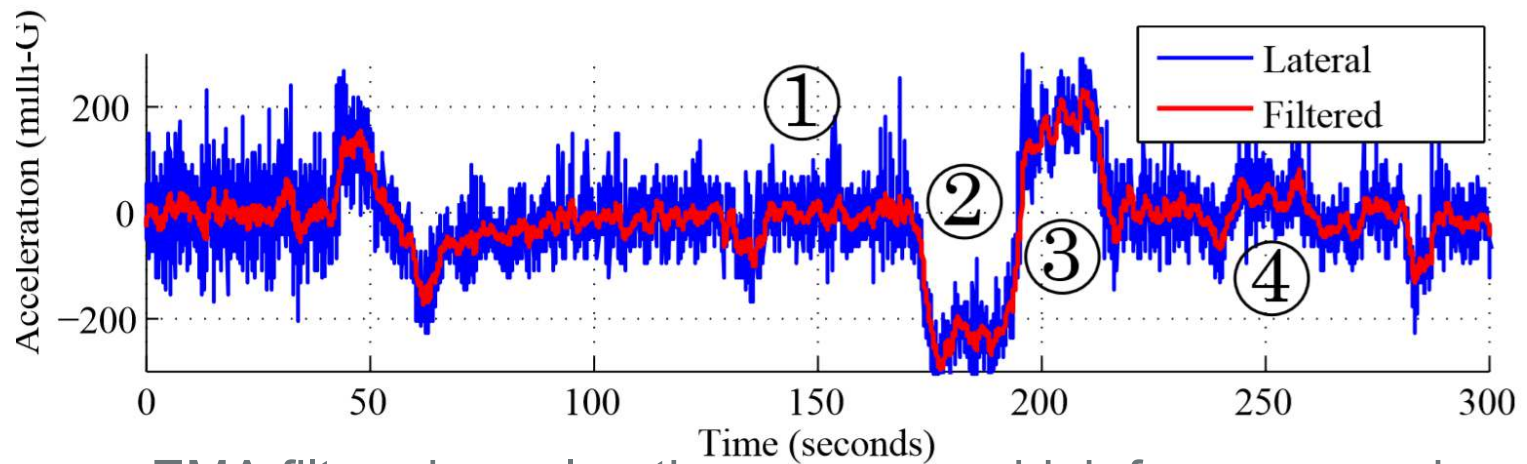
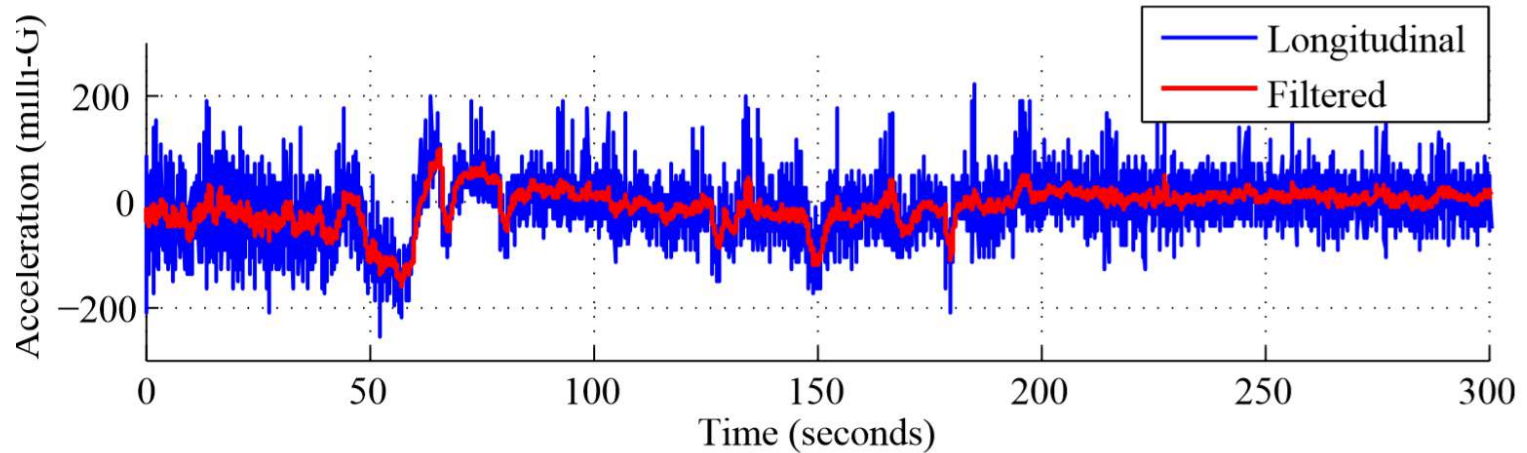
- Acceleration and speed data collected in minibus taxis in South Africa and Uganda
- More than 36 hours of data from, 41 different minibus taxis
- 25% Urban data, and 75% highway data



Results

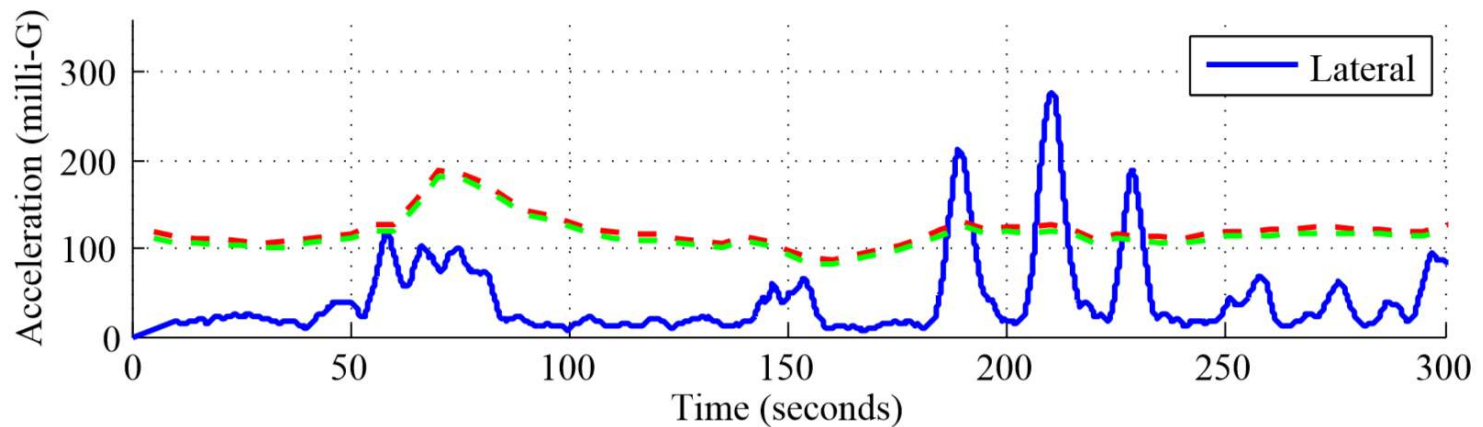
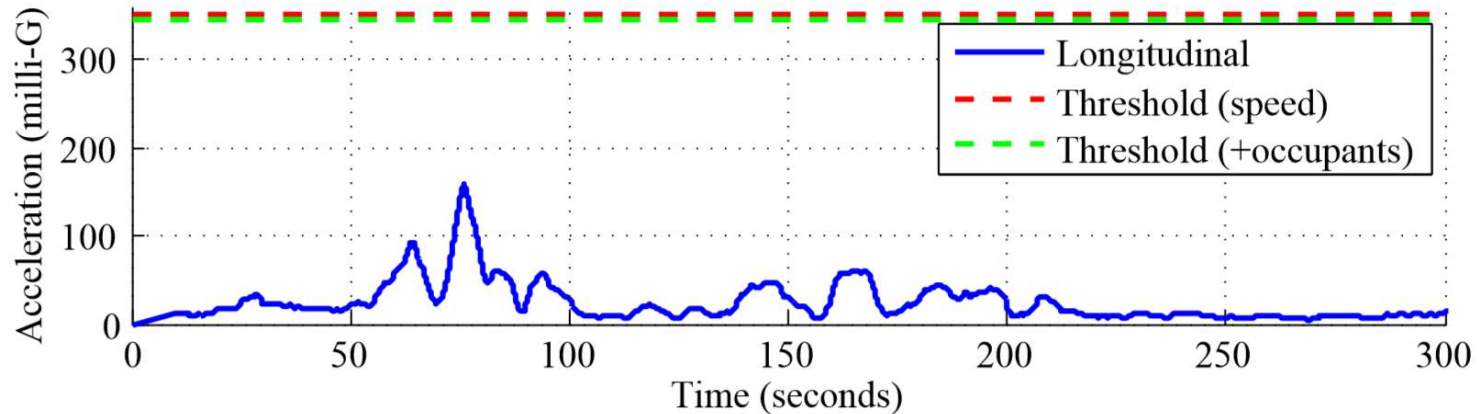


Results



- EMA filtered acceleration – removes high frequency noise
- Left turns – negative acceleration values
- Right turns – positive acceleration values

Results



- Determine rate of change of acceleration: Jerk
- Summation of jerk values
- High concentrations of acceleration relate to erratic events
- Measured acceleration compared to threshold (from road design principles)

Online platform



- Real-time information
- GSM network
- <http://smart.trintel.co.za>



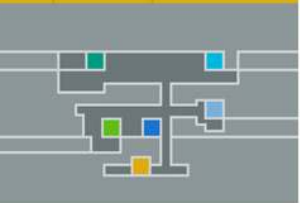
Conclusion

- Presented a reckless driving detection system, which was validated in minibus taxis on South African and Ugandan roads
- Acceleration and speed results are used as a measure of recklessness
- Augmenting acceleration data with vehicle speed information
- Designed model is based on principles used in road design
 - Relationship between a vehicle's tyres and the road surface
- Reckless driving detection system was successfully developed and tested
- Could be used to make public transport in Sub-Saharan Africa safer





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Thank you for your attention

