Vehicle Autonomy: State of the art, opportunities and challenges for adaptation in Africa

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I. Abstract

Self-driving cars are projected to be ubiquitous in the future of transportation. In the years following *the* 2005 DARPA Grand Challenge, research into vehicle autonomy has garnered significant attention. Aside from the many social and economic breakthroughs self-driving technology may unlock, a key factor driving the proliferation of this field has been its potential to save lives. To reduce the 1.35 million lives lost globally to road accidents [1]. With 271,737 deaths in 2018 alone, the African region is the largest contributor to this fatality rate [1]. This single statistic shows the importance of Africa developing capability in self-driving research and development.

Developing autonomous vehicles to surpass human capabilities is not a trivial task. While the global number of crashes and fatalities are high, these incidences are relatively infrequent when compared to the number of miles people drive. The ability to make split second judgement calls, subtle nonverbal communication with other drivers and anticipate the actions of pedestrians comes naturally to humans. However, these crucial components of driving are mostly probabilistic and thus difficult to formalize as algorithmic solutions with high degrees of certainty. The complexity of the self-driving problem will be further intensified by the road quality, street signage and general lack of structured infrastructure that is characteristic of many road networks in Sub-Saharan Africa.

The cultural and environmental uniqueness of Sub-Saharan Africa necessitates that self-driving technology for our market be developed on the continent. In that regard, this research maps out the current space of self-driving technology, we give an overview of the two main approaches (Vision sensors + Deep learning vs Lidar + HD maps) and discuss their viability. We also present the typical architecture of a self-driving vehicle and discuss underlying technologies. More importantly we review the opportunities, challenges and possibilities in adapting this technology to the African region. We finally propose novel approaches, potential areas and implementational direction for developing autonomous vehicles capable of navigating African terrain and traffic.

Our work presents a collation of the state of the art in self driving, identifies gaps and challenges unique to the application of this technology on the African continent. This work is a pilot project which will further the discussion and knowledge on the adaptation of self-driving technology in Africa.

We have previously developed an affordable autonomous vehicle development platform [2] which combined with the knowledge and potential research direction proposed by this work would aid in the proliferation of self-driving research on the continent.

References

[1] World Health Organization, "Global status report on road safety 2018", WHO Press, Geneva, 2018.

[2] B. Quartey and G. Ayorkor Korsah, "Affordable Modular Autonomous Vehicle Development Platform," 2018 IEEE 7th International Conference on Adaptive Science & Technology (ICAST), Accra, 2018, pp. 1-8. URL: http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=8506757&isnumber=8506680