

The case study about building FRAM model for driving a car
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Today, the self-driving system is advanced rapidly. According to the survey in U.S[1]., however, many consumers fear the safety for self-driving car. To increase acceptance to self-driving cars from consumers, we are trying to conduct the safety analysis for a self-driving car in this research. This research is ongoing project and the authors show a FRAM model for “lane changing in driving a car” as a part of this project. Firstly, we identify the driver’s function in lane changing “check current positions (a)”, “consider object (b)”, “determine the empty space (c)”, “plan lane change (d)”, “adjust the speed and angle (e)” and “readjust speed and angle (f)” as shown in Figure 1. After the identifying the function, we defined six aspects for each functions. In the function (d), for example, input has “attempt to change lane”, precondition has “check has been made”, control has “current speed and position” and output has “plan of lane changing”. Finally, we characterized potential variability of each functions in terms of timing and accuracy. We have been challenging to define system requirements for lane changing in self-driving car from this FRAM model. For examples, “the system shall get positions of other cars (function b)”, “system shall calculate the space status and find the available space after get a current position and positions of other cars(function c)” and so on. And we also tried to define safety requirements by using actual car accidents. GM’s accident is an example of the accidents in lane change of self-driving cars [2]. This accidents was happened when the GM car attempt to move into another lane, causing the GM car to suspend its move and back to the previous lane. From this accident, we can find the new function in FRAM model. It is “give up changing lane and want to back to previous lane” which is input of function a, b, c and output of function e. Also, we can define a new requirement like “when system judged the system cannot change lane, the system shall start backing to previous lane”. As a result of this research, we found we can get system requirements by using FRAM model.

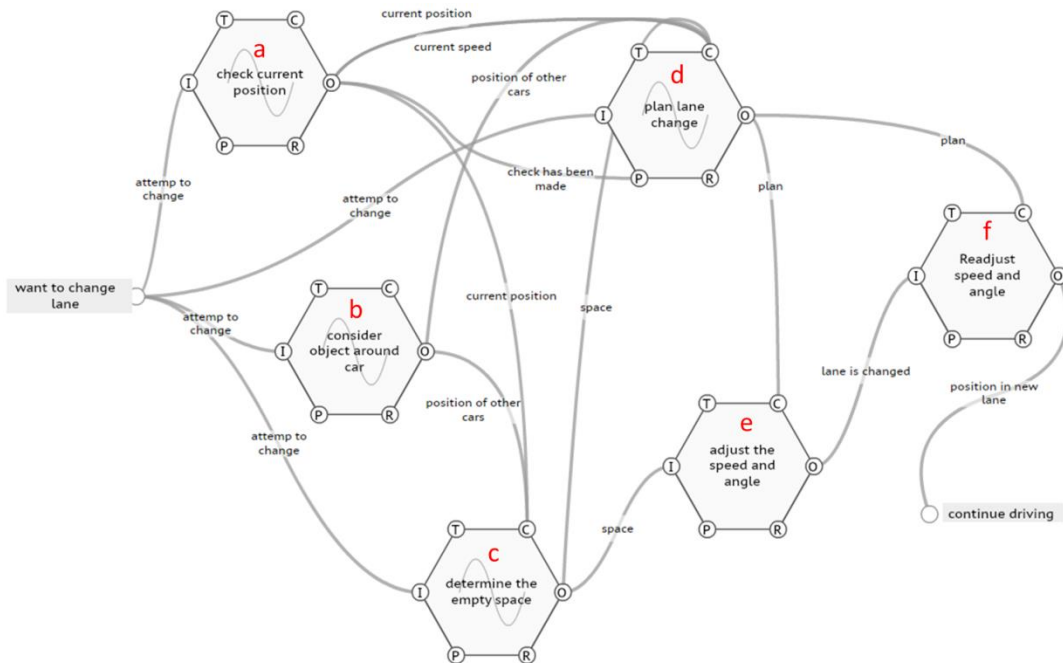


Figure 1. FRAM model for lane changing in driving a car

- [1] Erin Stepp, (2016) Three-Quarters of Americans “Afraid” to Ride in a Self-Driving Vehicle, <http://newsroom.aaa.com/2016/03/three-quarters-of-americans-afraid-to-ride-in-a-self-driving-vehicle>
 [2] Samuel Gibbs, (2018) GM sued by motorcyclist in first lawsuit to involve autonomous vehicle, <http://www.theguardian.com/technology/2018/jan/24/general-motors-sued-motorcyclist-first-lawsuit-in-volve-autonomous-vehicle>