Risk-based decision making to prevent road accidents using fuzzy logic

Business, Management

This capstone project “ risk-based decision making to prevent road accidents using fuzzy logic” was started after viewing the recent Humboldt crash accident and an increase of urbanization in the Alberta region. The report is divided into three sections, the first section represents a predictive analysis, using linear regression to understand the impact of population on accidents rate. The second represents as prescriptive analysis, where I used fuzzy logic concepts to estimate the road driving risk, because certain causes, such as human behavior, weather are difficult to quantify in terms of numeric value. So, I used linguistic variables to express their intensity and impact, then converted that linguistic variable into a single output, which is known as defuzzification. Overall, the process goes by defining the root causes of Humboldt accidents using Fault tree analysis: Environment, vehicle parts, human behavior. Then, I estimate the individual risk for each cause, define the membership function for each subsystem parts, further, defining the output, then linking the input to the output using the Mamdani or Sugeno Inference system, using If-Then rules. Hence, in the end, I combined all the risk values, form the rules, and got the approximate value of 67/ 100, which is quite high or dangerous. In another word, the driver should abort the driving and first reduce the risk causes, as much as he can. Moreover, the car control system should understand the risk and prevent the accidents. The last part of the project deals with a layer of protection analysis integrated with vision zero quality management strategy, aiming to reduce accidents to zero. The aim of this was to change the human driving nature from resilient to proactive; your government should continuously experiment

and resolve the existing problem fast and efficiently. Below, are some of my suggestion based on this report and future:

a.) Past belongs to IC and diesel engine, presents belongs to electric, hydrogen, hybrid, and future belongs to autonomous combined with all propulsion. Major companies, such as Google, General Motors, Kia have all started. But, the major concern for these vehicles is the lack of safety and risk management. Companies claim that their vehicle is safe to drive, however, vehicle safety is not dependent on its operation, it equally depends on human behavior. So, it is important to estimate the human nature quantitatively and its impact on risk driving.

b.) At every moment, my vehicle should understand my nature and environment. This is possible, as I constructed the road driving interface or app, which record the risk in every scenario. Further, it will form a block or memory of risk, which can be retrieved from the vehicle control unit, and can divert the accidents, this process is commonly known as the blockchain or smart driving. The key point to remember the model which I presented is just a base or formed to develop an Idea. Otherwise, it requires a lot of programming experience and capital.

c.) No matter how brilliant and advanced the technology becomes, we cannot change and decipher human nature. However, we can control it, by developing strong and visible policy, rules, and road safety culture. This depends on the government of any country, if this to happens, require dynamic team management and leadership. Drivers should understand that driving is not complacent in nature; they have to take the transition from

resilient nature to proactive. It means they have to be flexible and understandable even if they are following traffic rules properly, others may not.

To conclude, the risk model formed using Simulink can be utilized in any other field, with multiple factors affecting it. At last, driving, and drivers will remain forever, living is not reversible, so it becomes the responsibility of every single person to educate themselves and others, for making better and sustainable driving conditions.