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Using a fuzzy inference mechanism for determining the optimum green time of a traffic light at a crossroad

Mukhamedieva Dilnoz Tulkunovna[1], Isroilov Ismoil Ergahs ogli[2]

[1] Doctor of Technical Sciences, Professor;
National Research University «Tashkent Institute of Irrigation and Agricultural Mechanization Engineers»; Republic of Uzbekistan

[2] trainee researcher;
Institute for the Development of Digital Technologies and Artificial Intelligence;
Republic of Uzbekistan

Analysis of flow characteristics, such as volume of traffic, speed, density, composition of vehicles and pedestrian behavior, allows identifying problem areas and developing appropriate measures to improve traffic safety and efficiency. For example, if a certain section of the road is experiencing frequent traffic jams or accidents, measures can be taken to regulate the flow, change the infrastructure, or introduce new technologies to improve the situation [1].

The construction of a fuzzy rule base for determining the optimal time for the green signal of a traffic light at an intersection is based on data obtained using a traffic detector. This requires the following steps:

Data collection: Use the traffic detector to obtain information about the traffic volume on each of the intersecting roads at different points in time. Gather data on the number of vehicles, speed and other parameters that can be important in determining the optimal green light timing [2].

Linguistic description of variables: Transform collected data into linguistic variables using linguistic terms. For example, traffic intensity can be described as "low", "medium", and "high". Other variables such as movement speed can be described in a similar way.

Rule definition: Build a fuzzy rule base that relates input variables (such as traffic volume) to an output variable (green light time). The rules are formulated on the basis of

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expert knowledge or data analysis and may be of the form "If the traffic is high, then the green time of the traffic light should be long".

Evaluating Rule Weights: For each rule, assign a weight to reflect its importance and influence in determining the optimal green light time. The weights can be assigned based on expert knowledge or using data-driven learning techniques.

Fuzzy Inference Engine: Use the fuzzy inference engine to combine input variables and apply rules to determine the optimal green light time. Fuzzy inference can use fuzzy logic operations such as fuzzy union and fuzzy intersection to obtain fuzzy output variable values.

Defuzzification : After obtaining fuzzy values of an output variable using a fuzzy inference engine, it is necessary to perform defuzzification to convert the fuzzy values into specific numerical values or actions. There are various defuzzification methods , such as the centroid method, the maximum method , and others, which can be applied depending on the specific requirements and task context.

Testing and optimization: The constructed fuzzy rule base can be tested on real data or simulation models to evaluate its effectiveness and compliance with the requirements. If necessary, you can optimize the rule base by making changes to the rules, weights, or linguistic descriptions of variables.

Integration into the traffic light control system: After the fuzzy rule base has been built and tested, it can be integrated into the traffic light control system at the intersection. This can be implemented using software or hardware components that will take input from the detectors and apply the control strategy defined by the fuzzy control rule base to set the optimal green light time.

It is important to note that building a fuzzy rule base and developing a traffic light control strategy are complex tasks that require expert knowledge and data analysis. When designing such a system, it is recommended to take into account local features, traffic specifics and safety requirements in order to achieve maximum efficiency and optimal traffic management at the intersection.

- If (X1 = small or very small) and (X 2 = large) and (g(X1) = large), then (green light time = reduce).
- If (X1 = small or very small) and (X2 = medium) and (g(X2) = small), then (green light time = increase).
- If (X1 =large or very large) and (X2 =small or very

small) and (g(X 1)= small), then (green light time=increase).

Here X1 is the number of North-South cars.

X2 - the number of cars West-East.

g(i) - green light time.

The classic fuzzy control module can be further integrated into a wider traffic control system, including other methods and algorithms. This allows you to create an intelligent transport system that is able to adapt to changing conditions.

References:

[1] Yakimov M.R. Mathematical modeling of the distribution of transport demand in the transport system of the city // Transport: science, technology, management. 2010. - No. 10. pp. 7-13.

[2] Trofimenko Yu.V., Yakimov M.R. Transport planning: formation of efficient transport systems of large cities: monograph / Yu.V. Trofimenko, M.R. Yakimov. - M.: Logos, 2013. 464 p.