**ASSIGNMENT REPORT- 3**

**(*Task : Fuzzy logic based expert system to manage traffic lights*)**

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**Title :** Fuzzy logic based expert system to manage traffic lights

**Abstract :**

In the world of automation where everything can be implemented by using IOT or AI, traffic lights can also be programmed for dynamic working. Most of the traffic lights are statically programmed before setting them up. So this idea works on traffic light by checking the live status of the lanes. More the density of traffic, More time for Green signal it takes compared to other lane. In this era, Its not too complicated to get the live density of lanes. Machine Learning can easily do that. Following comes the main step of altering times of the lights based on all the situations. There can be many states and Fuzzy logic does the work here where it gives the output for different states that occur. These are very helpful in controlling the traffic in the larger cities.

**Introduction :**

Traffic control is one of the basic issues to be set out to work on the economy of any country. Because of increment of vehicles in the streets, public behaviour and fixed time-controlled traffic light frameworks have not given an answer for high traffic congestion. Traffic framework is more reliant upon boundaries like time, day, season, climate, and unusual circumstances. The difficulty and vulnerability of traffic stopping up made an extreme representation of such research.

L.A Zadeh proposed a fuzzy set theory to deal with uncertainties present in real world situations. This concept provides the possibilities which are not given by computers, but like the range of possibilities generated by humans. Fuzzy logic is the logic underlying approximate, rather than exact, modes of reasoning. It contains as special cases not only the classical two-value logic and multivalued logic systems, but also probabilistic logic. Fuzzy logic contains the multiple logical values and these values are the truth values of a variable or problem between 0 and 1. Fuzzy logic is a set of mathematical principles for knowledge representation and reasoning based on degrees of membership. There is a huge difference between the probability and fuzzy logic because probability deals with uncertainty an likelihood where as fuzzy logic deals with ambiguity an vagueness.

**Background (Fuzzy Control System):**

A fuzzy logic control system provides a better optimal solution for the fluctuating traffic system. Controlling the traffic flow system using fuzzy technology can convert human thinking process into an algorithm using some mathematical models. Implementation of real rules which are like the way that traffic policemen would think to manage traffic signal lights can be done by fuzzy if-then rules.

The inputs of fuzzy signal control system are generated by the help of an experience. Fuzzy rule-based system derives actions from given inputs by constructing if-then rules which represent the relation among the linguistic variables. In general, a fuzzy traffic signal controller will improve the traffic protection in the junction, usage of junction at its maximum level and minimize the delays.

**Design of Model :**

It is a four way junctions with roads moving in the direction N-S and E-W.

When vehicles move from N-S then there is no movement in the E-W direction and vice-versa.

The minimum time in any lane can be 10 sec and maximum can be 50 sec.

Diagram

Description automatically generated

**Working of the model :**

In the main system there will be a system to calculate the density of the lane. Next comes the work of fuzzy.

Whenever a green signal is on, system will stay still. Seconds before the green signal of a lane is going to end the system will calculate the density and the time for next iteration will be changed accordingly.

There can be many possible states to feed in the fuzzy logic. The different membership functions output are:

|  |  |  |
| --- | --- | --- |
| **Arrival** | **Queue** | **Extension** |
| Almost | Very small | Zero |
| Few | Small | Short |
| Many | Medium | Medium |
| Too many | Large | Larger |

In this model, I am using the two Fuzzy controllers one of it is for calculating the Density of the North-South and East-West lane and the other is for getting the extension value based on these two density values (NS and EW Lanes).

**First Fuzzy Controller :**

Input : Arrival and Queue values

Output : Density value

**Second Fuzzy Controller :**

Input : Density value of NS Lane and Density value of EW Lane

Output : Extension value

Here Density value signifies about the traffic of the lane and Extension value is the value of that extend the time of the Green signal based on the traffic of the lane.

**Conclusion :**

This Fuzzy logic traffic light controller performed better than the static controllers. This is flexible because it involves number of vehicles sensed at incoming junction and extension of the green time. In the static controller the green light time is not extended based on the traffic situation but Fuzzy controller does include it to enhance the system further. As we know that this problem is uncertain and may include more parameters into it based on experience. We can use it as a generalized or as an initial stage of the traffic control system using Fuzzy.

**References :**

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Paper-3 : [https://www.researchgate.net/](https://www.researchgate.net/profile/Mohan-Pradhan/post/In-implementation-of-Fuzzy-logic-in-Matlab-can-we-use-the-output-variable-to-decide-the-state-of-output/attachment/59d6281d79197b807798678f/AS%3A328703725850624%401455380483686/download/120953.pdf)

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