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A Case Study for Traffic Control Signal at Four-Way Intersection Road

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Abstract:

Traffic management is major problem of traffic department in busy lane/road inside of city in intersection of lane . Always we looking one traffic man can't handle to a many intersection lane traffic and large traffic area this research paper can be cover four way lane traffic handling without traffic man using light single. We try in this Research paper are describes how to sense the traffic and how to handle a large traffic in four way lane using fuzzy logic. We trying in this research paper to cover some technical device and feature to traffic management and this research is provides a detailed study of fuzzy logic controller for traffic.

Keywords **— Fuzzy logic controller, Fuzzy rule base database, Fuzzification, Membership function, Defuzzification.**

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I.   INTRODUCTION

Traffic signals are the most suitable method of controlling traffic in busy junction or lane .The monitoring and controlling of Road/lane traffic is a major problem in many country because Number of vehicles is increasing daily but highways developments have a lower phase then lead to traffic blocking problem or congestion problem. traffic overloading or congestion have a lot of factor are lead to like as the density of vehicles on the lane/road, human being lifestyle, public behavior and traffic light system are a major problem is payable to the traffic lights system that controls the traffic at junction/intersection. Traffic policeman are stand at a traffic intersection daily in order to overcome these congestion in peak hour then one of the roots are a problem is due to unsuccessful traffic light controllers. this paper are describe the implementation and structure of an intelligent traffic control system using fuzzy logic technology which has the capability of mimic human intelligence for controlling traffic lights.

Fuzzy logic technology allow the completion of real-life rules which is similar to human would think. Fuzzy logic is fitting for controlling and handling intersections lane because they are bright to follow the control logic of traffic police officers who at times put back traffic signal control when the intersection is packed.

Fixed time and traffic actuate control methods are used for controlling the secluded signalized intersections. If traffic capacity or number of vehicle are up and down moment in time of day then traffic actuated model are choose but if traffic volumes are fixed in time of day then fixed time control technique is used. Single red and green lights timings are a set the traffic moves efficiently in all directions without people jump in any one of the lane having to wait for an overly lengthy period for their turn round.

II.   DESIGN CRITERIA AND METHODOLOGY OF INTERSECTION OF FOUR WAY LANE

In a traffic lights control system have a following assumptions are usable for designing.

1. Four way junction where traffic are coming on the four directions. These directions are a north and west and south and east.
2. Where traffic is moves from north and south direction then traffic are stop from west and east direction.
3. Left and right side turns are not considered.
4. When East-west lane is assumed as the main approach or south-north lane is assumed as the main approach
5. Maximum and minimum time for green light are determine

Fuzzy logic controller is watching the north and south traffic is one side and west and east traffic as another side.

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III.   STRUCTURE OF TRAFFIC SIGNAL CONTROL

Basically two type of traffic lights control system are used in intersection junction. First traffic lights single control to system they are used a preset cycle time to change the light and second traffic lights control system are combine preset cycle time with sensor which can change the light according to time cycling. We are trying to show general Structure of traffic lights control system in a fig 1.
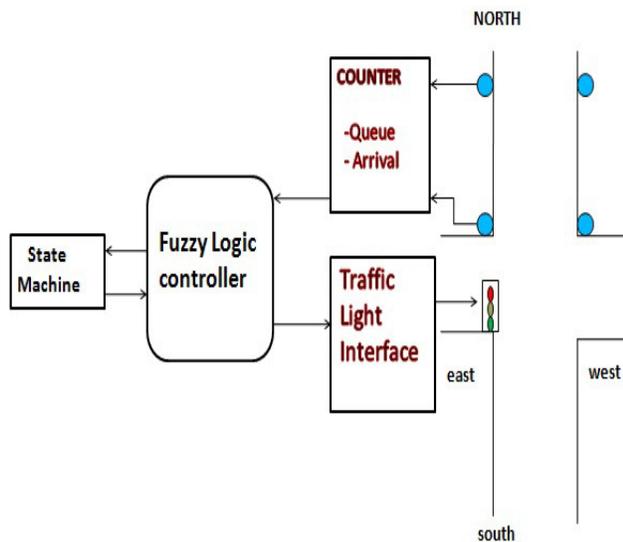

Fig.1- GENERAL STRUCTURE of Traffic signal control

Traffic lights control systems Structures have a following component.

1. Sensors:- The fuzzy traffic light control system are use two sets of inductive loop sensors on each approach to the intersection here two electromagnetic sensors located on the way for each lane.

this structure first sensor are situated in before intersection of The cross point of lane means first sensor behind each traffic lights single and its counts the number of cars passing the traffic lights Second sensor are situated in behind the first sensor and its count the quantity of cars coming to the intersection means second sensor predetermined space from the junction to high traffic numbers information.

2. Fuzzy logic controller:- This traffic statistics information will be used by the fuzzy logic controller for select the highest priority phase and determine whether to extend the current green light phase. The selected light phase information is going to the fuzzy logic controller for inputted to the PLC for actuation. Then traffic lights and sensors are attached to the Programmable Logic Controller (state machine) via the interface and protective devices.

So fuzzy logic controller is basically responsible for two things first are it is responsible for controlling the length of the green time according to the traffic condition it is taken in the two fuzzy inputs in sensor though arrival and queue variable and one fuzzy output though extension variable in traffic light are a second effects.

The fuzzy logic controller use for simulation and it determines sequence phase and whether to extend or terminate the current fuzzy rule for green light time. maximum degree of priority based queue length are analysis by fuzzy rules and waiting time after that it uses traffic data to selecting the phase and determine the duration of green phase extension.

3. State machine controls: - states machine control system responsible for the controlling in the sequence of states that the fuzzy traffic controller should cycle from elevation and wherever incoming traffic is identify then traffic state is generated for

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busy lane red single and no incoming traffic is detected then it generates to green light set state of fuzzy controller means State machine are responsible for generate to the single.

IV. FUZZY CONTROLLER DESIGN

We describe fuzzy logic controller for four lane traffic intersection of junction. We describe controller system for fuzzy controller and it's used for two input arrival and queue variables and one output Extension time variable First input Arrival variable are used for quantity of the traffic on the arrival side it quantity are given to the first sensor and Queue are another input variable they used for quantity of traffic on the queuing side it quantity are given is input by second sensor and if green single looking is north and south then time it side is a arrival side means it used arrival variable and west and east side have a traffic then time it is going to queuing side and if west and east face have a green single then time it side is a arrival side means it used arrival variable and north and south side have a traffic then time it is going to queuing side means it used queue variable.

Extension time is calculated by Output variable so controller are formulated the fuzzy rules and assign to using rules in output variable Extension and this rules are going current green light. We try to show general organization of fuzzy logic controller in a fig 2.
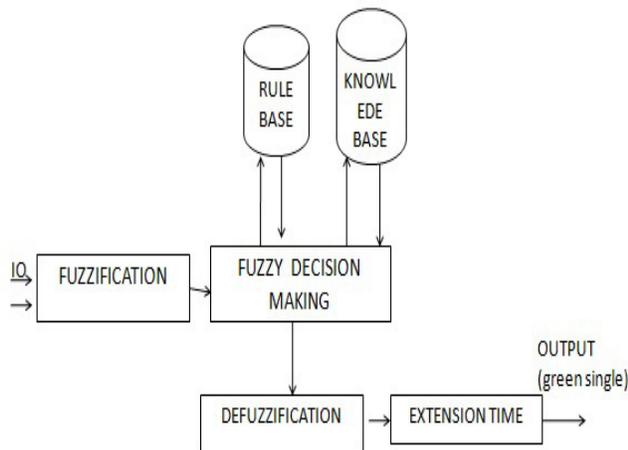

Fig.2- STRUCTURE OF Fuzzy Controller

Fuzzy logic controller organization has a following function.

1. Fuzzification: - fuzzification is process of convert the crisp input into fuzzy input means when we convert crisp set to a fuzzy set is called fuzzification and number of vehicle are counted by all sensor in increment order and send this count number to fuzzification system. Fuzzy set support numerical number between 0 to 1 and crisp set support any numerical number then is needed to convert crisp number to fuzzy number.

 Arrival, queue and extension are a Fuzzy variables they are used in traffic lights control system and these values of input and output variable are for all time between 0 to 1 means crisp value are convert to number of car is presents value to fuzzy value.

2. Fuzzy Decision Making: - fuzzy decision making system is take a arrival and queue fuzzy value from fuzzification after that take a decision using knowledge base and fuzzy rule base database after that result is transfer to fuzzification via output variable. Decision support system for fuzzy component are execute a operation based on rules and this rules are generated by using knowledge base and fuzzy rule base database and fuzzy inference system are used is method (max-min composition).

2.1 Knowledge Base: - main aim of knowledge base is determine the best policy for known input like reduces a number of vehicles in an intersection lane. The knowledge base is constructing using result of traffic simulation and it is complemented by rules and searching algorithm like a heuristics, hill clamming search. Knowledge base of fuzzy is defines an input and output variables as members of the universe of a discourse and defines degrees of membership functions

Knowledge base system designs a membership function for all fuzzy variable like a input or output. Traffic light control used four member ship function for each input and output fuzzy variable. This member ship variable is list out in Table-1 and this variable is very useful for design a membership function.

Table 1- Fuzzy Variable and Their Membership Function

Arrival	Queue	Extension
Almost-(AN)	Very Small-(VS)	Zero-(Z)
Few-(F)	Small-(S)	Short(S)
Many-(MY)	Medium-(M)	Medium(M)
Too Many-(TMY)	Large-(L)	Longer(L)

Most popular method of assigning in membership value algorithm approach is Intuition, logical reasoning, procedural method and Partitioning on input and output space.

Graphical representation of the relationship of membership function and fuzzy variable is presented in Fig.3 in this diagram degree of the membership of fuzzy variable show a y-axis and x-axis show as universe of discourse in an input variable for amount of vehicles as universe of discourse in a output variable used for extended time (second).
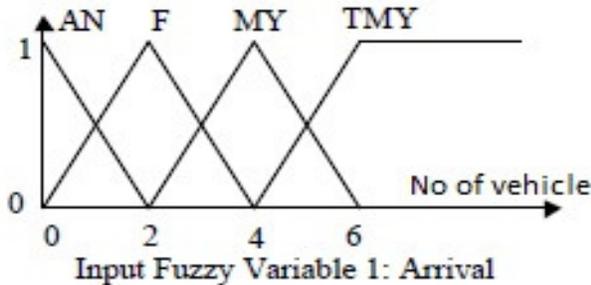

Fig:3.1- Membership functions Arrival vehicle

In fig 3.1 show as Member ship functions for number of vehicles for arrive at the intersection point of lane in traffic lights.
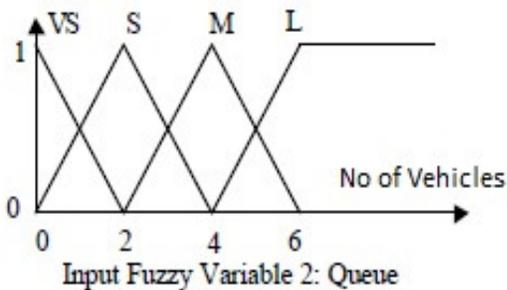

Fig.3.2- Membership function for Queueing vehicles

In fig 3.2 show as Member ship functions for number of vehicles for standing or queuing in the line at the traffic lights system.
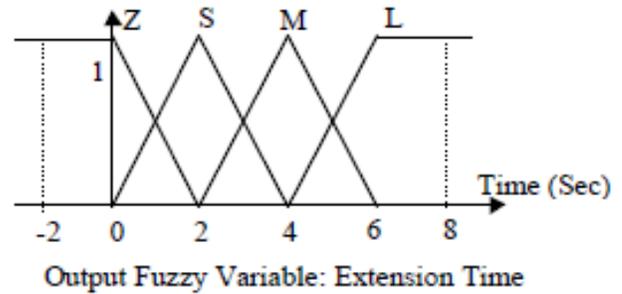

Output Fuzzy Variable: Extension Time

Fig:3.3-Membership function for Extention Time

In fig 3.3 show as Member ship functions for allocated time for extension time for green single.

2.2 Fuzzy Rule Base: - The inference machine in the fuzzy logic controller resembles the human reasoning process and this fuzzy logic technology is associated with artificial intelligence. This system is verify the overcrowding and warning details and their appropriate action same a human reasoning.

Fuzzy rule base have a lot of IF-THEN policy. The fundamental aim of fuzzy rule base is stand for the skilled knowledge in a form of IF-THEN rule and this structure are combined with AND/OR logical operator. For paradigm IF traffic from the north of the town is extra AND traffic from the west is fewer THEN allow movement of traffic from the north side.

fuzzy logic controller are Select to the input and output variable and define a membership function after that it gather a rules using a source input variable and expert knowledge/ intelligence decision/fuzzy rules are listed a matrix after that best rules a goes to output variable and generated a single and fuzzy rules are identical by basic various approaches. These fuzzy rules are listed by following metric Table-2.

Table-2 Fuzzy Control Rules

Queue(Q) / Arrival (A)	VS	S	M	L	VL
VS	D	D	D	D	C

S	D	D	D	C	C
M	D	D	C	C	I
L	D	C	C	I	I
VL	C	C	I	I	I

In this Table we use VS-very small, S-small, M-medium L-large, VL-very large D- decreases, C-constant, I- increases keyword.

VS, S, M, L, VL is a membership function for a input variable and D, C, I is a membership function for a output variable so D, C, I is a extension time for a green single time.

For example
• If middling amount of vehicle is queuing (Q) and the number of vehicles is arrival (A) is small then green light (T) decreases.
• If hefty (large) amount of vehicle is queuing (Q) and the number of vehicles is arrival (A) is small then green light (T) constant.
• If very huge amount of vehicle is queuing (Q) and the number of vehicles is arrival (A) is medium then green light (T) increases.

3. Defuzzification and Extension Time: -
Defuzzification is a process to convert the fuzzy output values of a fuzzy inference to actual crisp value means allocate the extension time in an mathematical number. defuzzification procedure get a fuzzy output value(extension variable) as of fuzzy decision making and converting in a crisp value so at last extension time a green single timing in a second means fuzzy value is converted in a second numerical value.

V. CONCLUSIONS
In this paper we have describe the fuzzy decision support system and component of fuzzy controller with fuzzy rule base that are currently implementing in four way road in city. Sensor is a basic equipment of controller and it's sans the traffic and this traffic information goes to fuzzy controller and fuzzy controller check rule base database and take a traffic conclusion. We obtainable to some fuzzy rule database according to traffic this database rules are an increase by traffic difficulty so goal key of this research paper is given

a fuzzy logic in the traffic signal control and a matter of fact is as follows-
• Improving of traffic security in the junction.
• Make the most of the ability of the junction.
• Minimize the waiting on vehicle.

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