Advance Traffic Light System Based On Congestion Estimation Using Fuzzy Logic

Javed Alam¹, Prof. (Dr.) M. K. Pandey²
¹Research Scholar, Dept of CS, Mewar University, Rajasthan (INDIA)
²Director Computer Science & Applications, AIMCA, Haldwani UK (INDIA)

Abstract—Vehicular traffic is the major problem which every country faces because of the increase in number of vehicles throughout the world, especially in large urban areas. Therefore it is required to explore the options to better accommodate increasing demand of traffic control and one of them is to development of simulated model and optimization of traffic control. Fuzzy optimization deals with finding the values of input parameters of a complex simulated system which results in desired output. Traditional techniques may require an enormous amount of simulation run to evaluate the system. Fuzzy logic controller is used to execute fuzzy logic inference rules from a fuzzy rule base in determining the congestion parameters, getting the warning information and the appropriate action. Input variables and output variable are defined as members of the universe of discourse, having degrees of membership determined by membership functions. Describe the design and implementation of an advance traffic light system based on congestion estimation using fuzzy logic. To simulate the situation of an isolated traffic junction based on congestion estimation, we use MATLAB. The simulation results shows that the fuzzy logic controller has better performance and is more cost effective than fixed time controller.

Keyword — Simulation, Fuzzy logic, Advance Traffic light System, Queue, Arrival, Right-Turn, Left-Turn and Extension time.

I. INTRODUCTION

The monitoring and control of Road traffic is becoming a major problem in many countries. The increasing number of vehicles and the lower phase of highways developments have led to traffic congestion problem. There are many factors that lead to traffic congestion such as the density of vehicles on the roads, human habits, social behavior, and traffic light system. One major factor is due to the traffic light system that controls the traffic at junction. Traffic policeman are deployed at traffic intersection everyday in order to overcome these congestion during peak hour, thus one of the roots of the problem is due to ineffective traffic light controllers. With effective control the intersection, it is believed that the overall capacity and performance of urban traffic network could be resolve.

With the ever increasing number of vehicles on the road, the Monitoring authorities have to find new ways or measures of overcoming such a problem. Many solutions were proposed to solve the traffic jam. Most conventional traffic surveillance systems use intrusive sensors, including inductive loop detectors, micro-loop probes, and pneumatic road tubes. However, these sensors disrupt traffic during installation and repair, which leads to a high cost installation and maintenance. In addition, over the ground sensors like videos, radars, and ultrasonic were used. These systems are also high cost and their accuracy depends on environment condition [1, 2].

Conventional methods for traffic signal control based precise models fail to deal efficiently with the complex and varying traffic situations. They are modeled based on the preset cycle time to change the signal without any analysis of traffic situation. Due to fixed cycle time, such systems do not consider that which intersection has more load of traffic, so should kept green more or should terminate earlier then complete cycle time. In case of intersections, conventional control systems only consider waiting time of signals on different directions but not the vehicle directions. Such situations can be seen in various areas of Dehradun, India like Darshanlal-chowk, where traffic flow varies in different hours and heavy traffic flows in morning and evening timings because of large number of offices on that route. Also, in different intersections, traffic flow abruptly changes in schools timings then other daily hours. Preset Cycle Time Controllers fail in such scenarios because they could not get complete information of vehicles earlier. Also, sometimes situation arises, when some VIP movement is there, the traffic flow has to be diverted to other available intersections. In such situations, efficiency of human decision-making is unprecedented because decision making objectives are unclear [1, 2].

Fuzzy based controllers are proved to be well manager of traffic system in such scenarios. Fuzzy controllers have the ability to take decision even with incomplete information. More and more sophisticated controllers are being developed for traffic control [3, 4, 5, 6 and 7].
These algorithms are continually improving the safety and efficiency by reducing the waiting delay of vehicles on signals. This increases the tempo of travel and thus makes signals more effective and traffic flow smooth. The key motivation towards Fuzzy Logic in traffic signal control is the existence of uncertainties in signal control. Decisions are taken based on imprecise information and the effect of evaluation is not well known [8].

Lin Zhang and Honglong Li developed Fuzzy Traffic Controller for Oversaturated Intersections [8]. They designed an algorithm to control over-saturated intersections of two-way streets with left turning movements. Jee-Hyong Lee and Hyung Lee-Kwang also designed a Fuzzy Control Model. The goal of controller is to decrease the average time delay in the whole traffic network. They assumed that special establishments named right-turning lane in the intersection allow right-turning traffic flow to pass the intersection without disturbing the other traffic flows at the same intersection. Under this assumption, right-turning traffic flow is out of the consideration of fuzzy control [9].

In this paper we discuss the implementation of an advance traffic light system for isolated intersection using fuzzy logic technology which has the capability of mimicking human intelligence for controlling traffic light. To simulate the situation of an isolated traffic junction based on fuzzy logic using MATLAB. The control of the traffic light using both conventional fixed-time and fuzzy logic controllers can be simulated in the software. Analysis on the traffic light simulation such as waiting time, density, cost, etc. can also be made using the software. The software can also be used as an exercise for undergraduate and graduate students to understand the concept of fuzzy logic and its application to a real life environment. The rules and membership functions of the fuzzy logic controller can be selected and changed their outputs can be compared in terms of several different representations.

Fuzzy Logic works glowing when traffic flow in different directions is highly uneven as compared to Pretimed Controller. The beauty of fuzzy logic is that it allows vague terms and conditions such as “short”, “Medium”, and “long” to be quantized and understood by the computer [9].

II. LITERATURE REVIEW

In this section, we discuss different research work in the field of traffic light system. In other words this section concentrates on the use of fuzzy logic for traffic control. The first attempt made to design Fuzzy Traffic Controller was in 70s by Pappis and Mamdani [3]. After that Niittymaki, Kikuchi, Chui and other researchers [5] developed different algorithms and logic controllers to normalize traffic flow. Kelsey and Bisset also designed a simulator for signal controlling of an isolated intersection with one lane. Same work was also done by Niittymaki and Pursula [6]. They observed that Fuzzy Controller reduces the vehicle delay when traffic volume was heavy. Niittymaki and Kikuchi developed Fuzzy based algorithm for pedestrians, crossing the road.

Nakatsuyama, Nagahashi, and Nishizuka [7] applied fuzzy logic to control two adjacent intersections on an arterial with one-way movements. Fuzzy control rules were developed to determine whether to extend or terminate the green signal for the downstream intersection based on the upstream traffic. Chui was the first who uses Fuzzy Logic to control traffic in multiple intersections [5]. In this attempt, only two way streets are evaluated without considering any turnings.

In recent years, Lin Zhang and Honglong Li [8] also worked on designing Fuzzy Traffic Controller for Oversaturated intersections. Jee-Hyong Lee and Hyung Lee-Kwang [9] presented direction-varying traffic signal control but assume that right turn traffic flow do not disturb any other traffic flows in an intersection.

I. N. Askerzade (Askerbeyli), Mustafa Mahmood [4] discuss a paper entitled “Control the Extension Time of Traffic Light in Single Junction by Using Fuzzy Logic” In this paper discuss the implementation of an intelligent traffic lights control system using fuzzy logic technology which has the capability of mimicking human intelligence for controlling traffic lights. Software based on MATLAB has been developed to simulate an isolated traffic junction. Fuzzy logic technology allows the implementation of real-life rules similar to the way humans would think.
For example, humans would think in the following way to control traffic situation at a certain junction: if the traffic is heavier on the north or south lanes and the traffic on the west or east lanes is less, then the traffic lights should stay green longer for the north and south lanes. Such rules can now be easily accommodated in the fuzzy logic controller.

III. FUZZY LOGIC

The Fuzzy Logic tool was introduced in 1965, by Lotfali Askar Zadeh, better known as Lotfi A. Zadeh, is a mathematician, electrical engineer, computer scientist, artificial intelligence researcher and professor emeritus of computer science at the University of California, Berkeley. Fuzzy logic is a mathematical tool for dealing with uncertainty. It offers to a soft computing partnership, the important concept of computing with words. It provides a technique to deal with imprecision and information granularity. The fuzzy theory provides a mechanism for representing linguistic constructs such as “many,” “low,” “medium,” “often,” “few.” In general, the fuzzy logic provides an inference structure that enables appropriate human reasoning capabilities. On the contrary, the traditional binary set theory describes crisp events, events that either do or do not occur. It uses probability theory to explain if an event will occur, measuring the chance with which a given event is expected to occur. The theory of fuzzy logic is based upon the notion of relative graded membership and so are the functions of mentation and cognitive processes. The utility of fuzzy sets lies in their ability to model uncertain or ambiguous data. Applications of fuzzy logic occur in three primary categories: consumer products, industrial/commercial systems and decision support systems [1, 2].

IV. MATHEMATICAL CONCEPT FOR FUZZY LOGIC

A fuzzy set is defined as the extension of a crisp (classical) set which allows only full membership or no membership to its elements (Zadeh, 1965). In a classical set A the membership function define as-

\[ \mu_A(x) = \begin{cases} 1, & \text{True} \quad x \in A \\ 0, & \text{False} \quad x \notin A \end{cases} \]

Fuzzy set theory extends this concept by defining partial membership. A fuzzy set A on a universe of discourse \( U \) is characterized by a membership \( \mu_A \) that takes values in the interval \([0, 1]\).

The membership functions, both linear and non-linear, that are most commonly used in engineering can be classified into four types as follows:

a. Zadeh’s \( S : x \rightarrow [0,1] \) defined as

\[ S(x, \alpha, \sigma, \beta) = \begin{cases} 0, & \text{for } x < a \\ \frac{2x - \alpha}{\beta - \alpha}^2 & \text{for } a \leq x < b \\ 1 & \text{for } x \geq b \end{cases} \]

b. The function \( \Gamma : x \rightarrow [0,1] \) defined as

\[ \Gamma(x, \alpha, \beta) = \begin{cases} 0, & \text{for } x < a \\ \frac{x - a}{\beta - a} & \text{for } a \leq x < b \\ 1 & \text{for } x \geq b \end{cases} \]

c. The function \( L : x \rightarrow [0,1] \) defined as

\[ L(x, \alpha, \beta) = \begin{cases} 1, & \text{for } x < a \\ \frac{\beta - x}{\beta - a} & \text{for } a \leq x < b \\ 0 & \text{for } x \geq b \end{cases} \]
The frequent accidents caused by poor conditions of the highway, the state corresponds to electromagnetic sensors which only indicate the presence of cars. This provides the controller with traffic information instead of proximity sensors at the front of each traffic light and can only sense the presence of a car waiting at the junction, not the number of cars waiting at the traffic light. The distance between the two sensors S, is determined accordingly by the difference of the reading between the two sensors. This is in contrast to conventional control systems which place a proximity sensor at the front of each traffic light and can only sense the presence of a car waiting at the junction, not the number of cars waiting at the traffic light. The distance between the two sensors S, is determined accordingly following the traffic flow pattern at that particular intersection. The fuzzy logic controller is responsible for controlling the length of the green time according to the traffic conditions. The state machine controls the sequence of states that the fuzzy traffic controller should cycle through. There is one state for each phase of the traffic light. There is one default state which takes place when no incoming traffic is detected. This default state corresponds to the green time for a specific approach, usually to the main approach. In the sequence of states, a state can be skipped if there is no vehicle queues for the corresponding approach.

The general structure of a fuzzy advance traffic light system is illustrated as in Figure-6. There are two electromagnetic sensors placed on the road for each lane. The first sensor behind each traffic light counts the number of cars passing the traffic light, and the second sensor which is located behind the first sensor counts the number of cars coming to the intersection at distance S from the light. The number of cars at traffic light is determined by the difference of the reading between the two sensors. This is in contrast to conventional control systems which place a proximity sensor at the front of each traffic light and can only sense the presence of a car waiting at the junction, not the number of cars waiting at the traffic light. The distance between the two sensors S, is determined accordingly following the traffic flow pattern at that particular intersection. The fuzzy logic controller is responsible for controlling the length of the green time according to the traffic conditions. The state machine controls the sequence of states that the fuzzy traffic controller should cycle through. There is one state for each phase of the traffic light. There is one default state which takes place when no incoming traffic is detected. This default state corresponds to the green time for a specific approach, usually to the main approach. In the sequence of states, a state can be skipped if there is no vehicle queues for the corresponding approach.

Along the road of such an “intelligent” highway, alterable road signs posted on traffic sign gantries display speed limits for each lane and display non regular events such as road work, warnings for traffic back-ups, breakdowns, an accident, or dangerous weather conditions [1,2]. Fuzzy logic traffic light control is an alternative to conventional traffic light control which can be used for a wider array of traffic patterns at an intersection. A fuzzy logic controlled traffic light uses sensors that count cars instead of proximity sensors which only indicate the presence of cars. This provides the controller with traffic densities in the lanes and allows a better assessment of changing traffic patterns. As the traffic distributions fluctuate, the fuzzy controller can change the signal light accordingly.

The function $A : x \rightarrow [0,1]$ defined as

$$A(x, \alpha, \sigma, \beta) = \begin{cases} 0 & \text{for } x < \alpha \\ \frac{x-\alpha}{\sigma-\alpha} & \text{for } \alpha \leq x < \sigma \\ \frac{x-\sigma}{\beta-\sigma} & \text{for } \sigma \leq x < \beta \\ 1 & \text{for } x \geq \beta \end{cases}$$

Figure 5: An example of A-function

II. DESCRIPTION OF THE PROPOSED ADVANCE TRAFFIC LIGHT SYSTEM (ATLS)

The first traffic management systems used in Germany was implemented on roads with frequent accidents caused by fog or icy road conditions. Later, these systems were extended to detect and control traffic to increase the traffic capacity. These traffic control systems use several detection stations along the road. These stations employ magnetic sensors for traffic detection, as well as weather stations transmitting environmental data from road surface and the air layer near the ground. A central traffic control computer collects the data transmitted from the section stations. A control strategy derives an adequate speed limit for every section. The control objectives are:

- Keep traffic flowing in case of peak traffic
- Slow down traffic at the inflow to congestion
- Warn for bad weather conditions such as fog or ice

Along the road of such an “intelligent” highway, alterable road signs posted on traffic sign gantries display speed limits for each lane and display non regular events such as road work, warnings for traffic back-ups, breakdowns, an accident, or dangerous weather conditions [1,2]. Fuzzy logic traffic light control is an alternative to conventional traffic light control which can be used for a wider array of traffic patterns at an intersection. A fuzzy logic controlled traffic light uses sensors that count cars instead of proximity sensors which only indicate the presence of cars. This provides the controller with traffic densities in the lanes and allows a better assessment of changing traffic patterns. As the traffic distributions fluctuate, the fuzzy controller can change the signal light accordingly.

The general structure of a fuzzy advance traffic light system is illustrated as in Figure-6. There are two electromagnetic sensors placed on the road for each lane. The first sensor behind each traffic light counts the number of cars passing the traffic light, and the second sensor which is located behind the first sensor counts the number of cars coming to the intersection at distance S from the light. The number of cars at traffic light is determined by the difference of the reading between the two sensors. This is in contrast to conventional control systems which place a proximity sensor at the front of each traffic light and can only sense the presence of a car waiting at the junction, not the number of cars waiting at the traffic light. The distance between the two sensors S, is determined accordingly following the traffic flow pattern at that particular intersection. The fuzzy logic controller is responsible for controlling the length of the green time according to the traffic conditions. The state machine controls the sequence of states that the fuzzy traffic controller should cycle through. There is one state for each phase of the traffic light. There is one default state which takes place when no incoming traffic is detected. This default state corresponds to the green time for a specific approach, usually to the main approach. In the sequence of states, a state can be skipped if there is no vehicle queues for the corresponding approach.

In this research, the main goals of fuzzy logic in the traffic signal control, and a matter of fact, also in traffic signal control in general, are as follows:

- Improving of traffic safety in the intersection.
- Maximizing the capacity of the intersection.
- Minimizing the delays.
- Clarifying the traffic environment.
- Influencing the route choices.
III. METHODOLOGY

In the development of an advance traffic light system, the following assumptions are made:

- The junction is an isolated four-way junction with traffic coming from the east, west, north, and south directions, as shown in figure.
- When traffic from the east moves, traffic from the west, north, and south stops. In other words, traffic moves from one direction, other three directions traffic will stop.
- The fuzzy logic controller will observe the density of the east traffic as one side and the west, north and east traffic as another side.

![Figure 7: General Structure of 4-way intersection](image)

The flow diagram of a fuzzy logic controller is shown in figure 8. A fuzzy logic controller was designed for an isolated 4-lane traffic intersection: east, west, north and south as shown in Figure 7. In the traffic light controller, four fuzzy input variables are chosen: quantity of the traffic on arrival side (Arrival), quantity of the traffic on queueing side (Queue), quantity of the traffic on right side (Right-Turn) and quantity of the traffic on left side (Left-Turn).

![Figure 8: Fuzzy logic Controller for Traffic Signal](image)

If the north side is green, then this would be the Queue side while the south, west, and east side would be considered as the Arrival, Right-turn and Left-Turn side respectively, similarly consider for other direction. The output fuzzy variable (Extension) would be the extension time needed for the green light on the Queue side. Thus based on the current traffic conditions, the fuzzy rules can be formulated so that the output of the fuzzy controller will extend or not the current green light time. If there is no extension of the current green time, the state of the traffic light will immediately change to another state, allowing the traffic from the alternate phase to flow.

IV. FUZZY PARAMETERS AND THEIR MEMBERSHIP FUNCTIONS DESIGN

For the traffic light control, there are three membership functions for each of the input and there are four output fuzzy variable of the system. Table 1, shows the fuzzy input variables of Queue, Arrival, Left-Turn, and Right-Turn and output variable Extension time of the system.

<table>
<thead>
<tr>
<th>TABLE 1</th>
<th>Fuzzy Variables form for Advance traffic light system</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input Variables</strong></td>
<td><strong>Adjectives</strong></td>
</tr>
<tr>
<td>Queue</td>
<td>Arrival</td>
</tr>
<tr>
<td>Small</td>
<td>Small</td>
</tr>
<tr>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Large</td>
<td>Large</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

![Figure 9: Queue membership](image)

![Figure 10: Arrival membership](image)
V. Fuzzy Rules

The inference mechanism in the fuzzy logic controller resembles that of the human reasoning process. This is where fuzzy logic technology is associated with artificial intelligence. Humans unconsciously use rules in implementing their actions. For example, a traffic policeman manning a junction say, one from the north and one from the west; he would use his expert opinion in controlling the traffic more or less in the following way:

IF traffic from the north of the city is HEAVY AND traffic from the west is LESS THEN allow movement of traffic from the north LONGER

In Advance traffic light system 81 rules have been found. The some fuzzy rule uses in advance traffic light system shown in the figure 15.

VI. INFERENCE ENGINE AND DEFUZZIFICATION

The basic function of the inference engine is to compute level of belief in output fuzzy sets from the levels of belief in the input fuzzy sets. The output is a single belief value for each output fuzzy set. In this stage, the fuzzy operator is applied in order to gain a single number that represents the result of the antecedent for that rule. The procedure of converting each aggregated fuzzy output set into a single crisp value is called defuzzification. The defuzzification methods are Centroid method (also called; Center of Area-CoA / Center of Gravity-CoG), Max-membership principle, Weighted Average method, Mean–max membership, Centre of Sums, Centre of Largest Area, First of Maxima or Last of maxima. In advance traffic light system we use the center of gravity defuzzification technique. The center of gravity equation can be written as follows:

\[ y_{op} = \frac{\int_{y_{min}}^{y_{max}} y \mu_{agg}(y) \, dy}{\int_{y_{min}}^{y_{max}} \mu_{agg}(y) \, dy} \]

Where \( y_{op} \) is the output of the system and \( \mu_{agg} \) is the output of the fuzzy set from the aggregation phase, \( y_{min} \) and \( y_{max} \) are the minimum and the maximum value of the base variables respectively.

In the fuzzy logic controller once the appropriate rules are fired, the degree of membership of the output fuzzy variable i.e., Extension time, is determined by encoding the antecedent fuzzy subsets, in this case Queue, Arrival, Left-Turn and Right-Turn. In advance traffic light system using fuzzy control, the max-min implication technique is used. Using this technique, the final output membership function for each rule is the fuzzy set assigned to that output by clipping the degree of truth values of the membership functions of the associated antecedents.
Once the membership degree of each output fuzzy variable is determined, all of the rules that are being fired are then combined and the actual crisp output is obtained through defuzzification.

VII. SIMULATION RESULT AND DISCUSSION

After the advance traffic light system was carefully designed, we test the system and discuss the impact of the input variables on the output variable. The simulation we show the effect of the four inputs to resulted extension time. This system shows the slow growing in the time that will added to the cycle which make the traffic situation more stable. The simulation implemented in five stages. In each stage we test one of the inputs with other inputs and discuss their effect on the output extension.

TABLE 2
Extension time at different values of input variables Queue, Arrival, Left-Turn, and Right-Turn

<table>
<thead>
<tr>
<th>No. of Vehicles at Queue side (Max R=50)</th>
<th>No. of Vehicles at Arrival side (Max R=50)</th>
<th>No. of Vehicles at Left-turn side (Max R=20)</th>
<th>No. of Vehicles at Right-Turn side (Max R=20)</th>
<th>Extension time (Max R=40)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>26</td>
</tr>
<tr>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>29</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>26</td>
</tr>
<tr>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>29</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>26</td>
</tr>
<tr>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>29</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>26</td>
</tr>
<tr>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>29</td>
</tr>
</tbody>
</table>

As shown in figure 16, 17, 18 as well as in Table 2 with the different inputs, the extension time (z-axis) is small when the density of arrival (y-axis) is small and the density of the queue side (x-axis) is also small. Unlike the other method, here the external time grows slowly its being large only when the arrival side density, queue side density, Left and Right turn density is very large. In other words, the external time grows slowly its being large only when the arrival side density increases and the queue, Left and Right turn side density is constant. On the other hand if arrival, Left and Right turn side density being constant and the queue side density increases then extension time goes to medium to short.

If queue, arrival, and left side density being small (constant) and right turn side density increases then extension time grows small to medium. These are important differences between other methods.

VIII. CONCLUSION

The fuzzy logic traffic light controller performed better than the fixed time controller or even vehicle actuated controllers due to its flexibility. The flexibility involves the number of vehicles sensed at the incoming junction and the extension of the green time. In the fixed time controller, being an open loop system the green time is not extended whatever the density of car at the junction. In addition to the fuzzy variables as mentioned, the fuzzy controller also has an advantage of performing according to linguistics rules in the manner of how a human would use. In this paper a basic advance traffic light control system for isolated intersections using fuzzy logic was developed.
In this paper, advance traffic light control system, the extension time is not a fixed value. They are all fuzzy variables such as zero, small, medium and large. The numbers of vehicles sensed at the input of the fuzzy controller are also converted into fuzzy values, such as small, medium, large. In addition to the fuzzy variables as mentioned, the fuzzy controller also has an advantage of performing according to linguistic rules in the manner of how a human would use. The reasoning method in the fuzzy controller is also similar to that of the policeman handling the traffic flow at a typical junction.

It can be observed from the results that advance traffic light control system provides better performance in terms of total waiting time as well as total moving time. Less waiting time will not only reduce the fuel consumption but also reduce air and noise pollution. Overall, the simulation results indicated that ATLS has the potential to improve operations at intersections. It also shows that it can reduce the traffic congestion and avoids the time being wasted by a green light on an empty road.

REFERENCES


