Morphological Image Processing of ℓ-HX Group of Vehicles -Traffic Light Control using Bipolar L-fuzzy logic

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Abstract:

Controlling and regulating traffic congestion at a four way junction, is one of the major problems in all cities because of ever increasing number of vehicles, overpopulation, poor traffic control system, and others. This traffic congestion causes people to lose time, money and good opportunities. In this paper we are going to adopt the morphological image processing technique instead of other electronic sensing devices which are already existing. Morphology image processing technique is based on the algebraic framework of complete lattices. In our proposed method we are considering the lattice ordered HX group of vehicles supposed to be at a four way traffic junction. Morphological image processing technique is used to classify the vehicles and detect emergency vehicles, as well, counting the number of vehicles on each of the four roads meeting the junction without any delay. It is also used for the removal of background noise, leading to the delivery of accurate data instantly. The aim is to control traffic signal lights using morphological image processing based on bipolar L-fuzzy membership values. The main tendency of this paper is display the green signal first in emergency vehicle road without considered any aspects and clear the traffic congestion immediately without any delay.

Keywords:

ℓ-HX group, bipolar L-fuzzy sub ℓ-HX group, Morphological image processing.

I. Introduction:

Normally, traditional systems are best utilized for managing the traffic congestion. Herein, the traffic police persons will utilize his or her physical hand with a white glove to signal depending on the density of the traffic at the four way junction. This system fails when the traffic is heavy. Today's traffic management system is the advancement of traditional systems, which follows a fixed time cycle, that is automated signaling. It provides a specific identical time interval to each signal, without considering the traffic congestion. Hence, unnecessary waiting for the next signal to appear in cycles will happen. In addition, this system does not give priority to emergency vehicles like ambulances, police vehicles, fire trucks and others. So, this kind of signaling system, the traffic leads to chaos, even get jammed for an unknown period and then it get resolved. To avoid this kind of frustrated situation, we plan to display green signal light based on priority. First priority is given to the emergency vehicle road without considering the projection time on other three roads. Next priority is given to the vehicle roads depending on the projection time. R. Muthuraj et.al.,[7] introduced the FHXSTR system and fuzzy HX water distribution system. C.

Gonzales Rafael[4] introduced Digital Image Processing. Alper pahsa[1] introduced the concept Morphological image processing with fuzzy logic. In our proposed method, we consider the lattice ordered HX group of vehicles is on the four roads and also we managing the traffic congestion using morphological image processing based on bipolar L-fuzzy logic.

II.Preliminaries:

Throughout this paper G=(G,*,≤) could be a lattice ordered group or a ℓ-group, e is that the identity of G.

Definition 2.1[9]

Let $2^G-\{\phi\}$ be a non empty set. ($\vartheta\subset 2^G-\{\phi\}$, ., ≤) is called as an ℓ-HX group or lattice ordered HX group on G, if the following conditions are satisfied.

i) (ϑ, .) is a HX group.
ii) (ϑ, ≤) is a lattice.

Definition 2.2[10]

Let α be a bipolar L-fuzzy subset defined on G. Let $\vartheta \subset 2^G-\{\phi\}$ be a ℓ-HX group on G. A bipolar L-fuzzy set ρ^α defined on ϑ is said to be a bipolar L-fuzzy sub ℓ-HX group on ϑ if for all P,Q∈ϑ.

i) $(\rho^\alpha)^+(PQ) \geq (\rho^\alpha)^+(P)\wedge(\rho^\alpha)^+(Q)$
ii) $(\rho^\alpha)^-(PQ) \leq (\rho^\alpha)^-(P)\vee(\rho^\alpha)^-(Q)$
iii) $(\rho^\alpha)^+(P) = (\rho^\alpha)^+(P^{-1})$
iv) $(\rho^\alpha)^-(P) = (\rho^\alpha)^-(P^{-1})$
v) $(\rho^\alpha)^+(P\vee Q) \geq (\rho^\alpha)^+(P)\wedge(\rho^\alpha)^+(Q)$
vi) $(\rho^\alpha)^-(P\vee Q) \leq (\rho^\alpha)^-(P)\vee(\rho^\alpha)^-(Q)$
vii) $(\rho^\alpha)^+(P\wedge Q) \geq (\rho^\alpha)^+(P)\wedge(\rho^\alpha)^+(Q)$
viii) $(\rho^\alpha)^-(P\wedge Q) \leq (\rho^\alpha)^-(P)\vee(\rho^\alpha)^-(Q)$

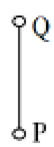
Where $(\rho^\alpha)^+(P) = \vee\{\alpha^+(m)/\text{for all } m\in P\subseteq G\}$ and
$(\rho^\alpha)^-(P) = \wedge\{\alpha^-(m)/\text{for all } m\in P\subseteq G\}$

Example 2.3[10]

Let $(G, ._8)=(\{1,3,5,7\},._8)$ be a group where G is the non-negative integer relatively prime to 8. Consider the partial order relation "Less than or equal to" on G. It gives the following Hasse Diagram.

Hasse Diagram

Clearly the poset (G, ≤) is a Lattice.
Hence $(G, ._8, \leq)$ is a Lattice ordered group.
Let $\vartheta\subset 2^G-\{\phi\}$ be a non-empty set. Let us consider ϑ={P,Q}={{1,3},{5,7}}
Clearly $(\vartheta, ._8)$ is a HX-group.
Consider the partial order relation P⊆Q iff p≤q for all p∈P and q∈Q on ϑ. It gives the following Hasse Diagram.



Hasse Diagram

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Clearly the poset $(\vartheta, \subseteq)$ is a Lattice.
Hence, $(\vartheta, \cdot_{\vartheta}, \subseteq)$ is a Lattice ordered HX-group.

2.4 Image processing:[1,4,11]

Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. Their main applications are to transform the contrast, brightness, resolution and noise level of an image. Contouring, image sharpening, blurring, embossing and edge detection are typical image processing functions.

2.5 Morphological image processing:[1,4,]

Morphological processing deals with tools for extracting image components that are useful in the representation and description of shape. Morphological operations apply a structuring element to an input image, creating an output image of the same size.

2.6 Pixel:[1,4]

The word "pixel" means a picture element. Every photograph, in digital form, is made up of pixels. They are the smallest unit of information that makes up a picture. Usually round or square, they are typically arranged in a 2-dimensional grid.

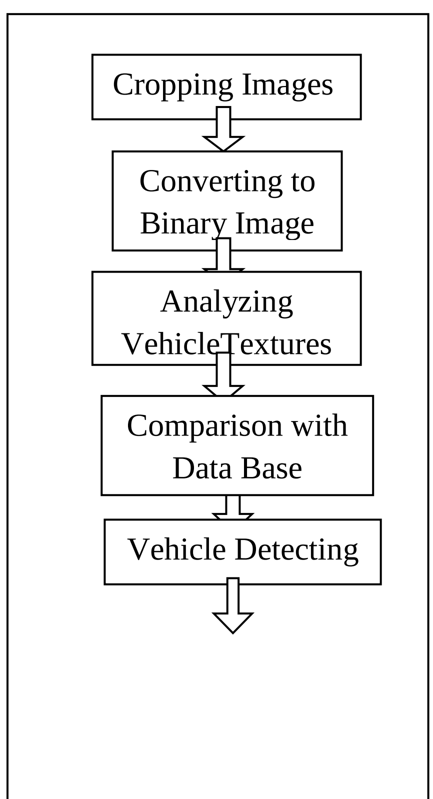
2.7 Morphological dilation and erosion:[1,4]

The most basic morphological operations are dilation and erosion. Dilation adds pixels to the boundaries of objects in an image, while erosion removes pixels on object boundaries. The number of pixels added or removed from the objects in an image depends on the size and shape of the structuring element used to process the image. Morphological dilation makes objects more visible and fills in small holes in objects.

III Proposed Traffic Signal Method:

3.1 Morphological image processing:

In this application, we are going to adopt the morphological image processing technique instead of other electronic sensing devices which are already existing. Morphological image processing technique is based on the algebraic framework of complete lattices which is used to classify the vehicles and detect emergency vehicles, as well, counting the number of vehicles on each of the four roads meeting the junction without any delay. It is also used for the removal of background noise, leading to the delivery of accurate data instantly. The following steps are utilizing in morphological image processing.



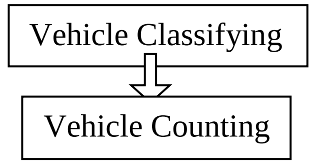


Figure 3.1 Block Diagram of Morphological Image Processing.

i. Converting to Binary Image

Cropped images are converted from RGB to gray scale image then, gray scale image are converted into binary image. Binary images are made up of pixels (picture elements) that is 0 and 1, where 0 indicate the background pixel value and 1 indicate the foreground pixel value.

ii. Analyzing Vehicle Textures

Image segmentation is done here. By using the image processing techniques we can extract the expected image. We can select the foreground pixels successfully as well as reject the background pixels effectively. Finally the shape and size of the extracted images will be analyzed.

iii. Comparison with Data Base

Extracted images are compared with stored images.

iv. Vehicle Detecting

After the edge detection, vehicle will be identified clearly.

v. Vehicle Classifying

Image enhancement is done here which is improving the quality of the vehicle. Morphological dilation helps vehicle will be visible clearly. Finally the detected vehicles will be classified and tracking.

vi. Vehicle Counting

Finally, each type of vehicle is on each road will be counted. So, that the morphological image processing technique is very useful to detect, classify and count the vehicles in very speed.

3.2 MATLAB Tool

MATLAB is an array-oriented programming language. This software is used as very effective tool in image processing. Morphological image processing is called as a toolbox which contains many MATLAB functions. In our project, by using this MATLAB code we can get the data of vehicle classification and vehicle counting. The ambulance is diagnosed very efficiently without using any other sensors. MATLAB tool is detecting the vehicles in very speed and counting accurately.

3.3 Assigning Bipolar L-Fuzzy membership values to the roads

First we identify the emergency vehicle road. if it is on the road, we assign the highest membership value 1 to that road without considering the projection time of other three roads. After moved all the vehicles in emergency vehicle road, we compare on the remaining three vehicle roads for assigning membership value based on projection time. Suppose if there is no emergency, we consider all the four roads are vehicle road then we can assign the membership value for the four roads according to their projection time from high to low.

3.4 Calculation for finding Bipolar L-Fuzzy Membership values

The projection time of each road is calculated by giving the different passing time to different vehicles. Assigning the membership value 1 for emergency vehicle road without considering the projection time. Membership values are given to the vehicle roads depending on the projection time of vehicle roads.

i. **Projection time for green signal light in each road**

Projection time of each road = sum of (Count of each type of vehicles on the each road × corresponding passing time of each vehicles on the each road) in seconds.

ii. **Bipolar L-Fuzzy membership value of vehicle road**

- Average projection time of VR= $\frac{\text{Sum of the projection time of all the VR}}{\text{Count of VR}}$,
  where VR is vehicle road.
- $(\rho^{\alpha})^{+}(VR) = \frac{\text{Projection time of VR}}{(1+\text{Maximum projection time of VR})}$,
  if projection time of VR ≥ average projection time of VR
  where, VR is vehicle road and
  $(\rho^{\alpha})^{+}(VR)$ is positive membership value of vehicle road.
- $(\rho^{\alpha})^{-}(VR) = \frac{\text{Projection time of VR}}{(1-\text{Maximum projection time of VR})}$,
  if projection time of VR < average projection time of VR.
  where, VR is vehicle road and
  $(\rho^{\alpha})^{-}(VR)$ is negative membership value of vehicle road.

Using the above formula, we can make a code for computing the positive membership values and negative membership values for high projection time of vehicle roads and low projection time of vehicle roads respectively.

3.5 Priority for displaying green signal light using Bipolar L-Fuzzy membership values

After finding the bipolar L-fuzzy membership values, The membership value is sorted in descending order. According to the descending order of membership values the projector will display the green signal light. First green signal light falls at the highest membership value of 1. Next green signal light falls on the next big membership value likewise green signal light falls for remaining roads.

IV. Example of Proposed Traffic Signal Method

In this section, we demonstrate the example of our proposed traffic signal method.

Consider the lattice ordered HX subgroup of vehicles waiting on the four roads. The digital camera is placed at each road alongside the traffic signal light. Camera has been programmed to capture only the image of vehicles are in the specified portion is on each road. The camera captures the image in sequence and sends it to the system. The cropped captured images are processed by morphological image processing. Then, we get the data of vehicle classification and count of vehicles on each road. We can make a code by using python program to compute the positive membership values and negative membership values for high projection time of vehicle roads and low projection time of vehicle roads respectively. First, we assign the membership value '1' to emergency vehicle road. Next we calculate the membership values for vehicle roads according to projection time of the road and then all the membership values are sorted to descending order. According to this order of membership values, we decide the priority of displaying green signal light of each road.

4.1 Proposed Method

Consider G be an lattice ordered group of vehicles waiting on the four roads and $G = \{v_1, v_2, v_3, ..., v_{13}, v_{14}\}$. Let us assume Road-1 consists of 4 vehicles, Road-2 consists of 2 vehicles, Road-3 consists of 5 vehicles and Road-4 consists of 3 vehicles. That is $R_1=\{v_1,v_2,v_3,v_4\}$, $R_2=\{v_1,v_2\}$, $R_3=\{v_1,v_2,v_3,v_4,v_5\}$ and $R_4=\{v_1,v_2,v_3\}$. Then we can clear the traffic congestion immediately by showing green signal light to every road based on bipolar
L-fuzzy membership values.

4.2 Lattice ordered HX group theory in four way road

Consider $G = \{v_1, v_2, v_3, ..., v_{13}, v_{14}\}$ be a lattice ordered group of vehicles waiting on the four roads $R_1=\{v_1,v_2,v_3,v_4\}$, $R_2=\{v_1,v_2\}$, $R_3=\{v_1,v_2,v_3,v_4,v_5\}$ and $R_4=\{v_1,v_2,v_3\}$. Let $\vartheta \subset 2^G - \{\phi\}$ be a HX group on G. So that $\vartheta = \{R_1, R_2, R_3, R_4\}$. We consider the partial order relation is "Priority". Our first priority is emergency vehicle road and then next priority is based on the projection time of vehicle road from high to low. So, we can compare each pair of roads according to priority. Thus, we consider ℓ-HX group of vehicles is on the four roads.

4.3 Implementation of Bipolar L-Fuzzy logic for showing green signal light

Consider G = { $v_1, v_2, v_3, ..., v_{13}, v_{14}$} be an lattice ordered group. Let ρ^α be a bipolar L-fuzzy subset in lattice ordered HX group ϑ and $\vartheta = \{R_1, R_2, R_3, R_4\}$. The mappings $(\rho^\alpha)^+ : \vartheta \to L^+$ and $(\rho^\alpha)^- : \vartheta \to L^-$ where, $L^+ = [0, 1]^n$ and $L^- = [-1, 0]^n$, for a positive integer n are defined as, $(\rho^\alpha)^+(R_1) = \vee\{\alpha^+(v_i)$/for all $i \in R_1 \subseteq G$, i = 1,2,3,….,14} and

$(\rho^\alpha)^-(R_1) = \wedge\{\alpha^-(v_i)$/for all $i \in R_1 \subseteq G$, i = 1,2,3,….,14}.

Assigning the highest membership value 1 for emergency vehicle road without considering the projection time. Next we consider the constraint is **Projection Time of Vehicle Road**. Assigning the positive membership value $(\rho^\alpha)^+(R_1)$ for vehicle road with high projection time, because it is satisfies the constraint. Assigning the negative membership value $(\rho^\alpha)^-(R_1)$ for vehicle road with low projection time, because it is counter-constraint.

4.4 The four roads captured by digital camera

The image given in figure 4.1 was cropped and captured by digital camera placed at each road alongside the traffic signal light. Camera has been programmed to capture the particular region of inside the marked line on the each road. Traffic density is continuously monitor by video processing.

Figure 4.1 Cropped Images

4.5. Data derived from Morphological Image Processing:

The cropped images shown in figure 4.1 are transmitted in to image processing. The images are analyzed by various techniques of image processing using MATLAB code. By using this process we can identify the vehicles clearly. We can detect the distinguish between ambulance and other vehicles. After the image processed, classified vehicles are obtained which is shown in figure 4.2.

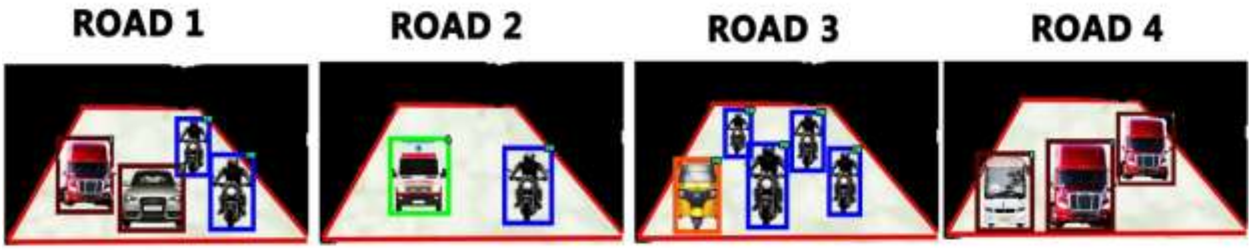


Figure 4.2 Classified vehicles

The name of detected vehicles in figure 4.2 are denoted by the single letter on the top of the specified box of each vehicle on each road. The name of the classified vehicles shown in figure 4.2 are 2W-Two wheeler, 3W-Three wheeler, C-Car, B-Bus, A-Ambulance and T-Truck.

After the image processed we got the following data of vehicles count and classification of vehicles on each road.

Road	Classification and their counts	Count of vehicles on each road
Road-1	Two wheeler-2 Car-1 Truck-1	4
Road-2	Ambulance-1 Two wheeler-1	2
Road-3	Two wheeler-4 Three wheeler-1	5
Road-4	Bus-1 Truck-2	3

Table 4.1

4.6. Program for projecting green signal light as well as staying time of that light

i. Input to the Program

In our proposed method, we consider that each vehicle takes different time to pass the road. we approximately take the passing time of each vehicle as follows, Two wheeler-4 sec, Three wheeler-5 sec, Car-7 sec, Bus-9 sec, Ambulance-6 sec, Truck-10 sec. The data given in table 4.1 and the passing time of each vehicle is given as input to the system. By using Python program, we can find the projection time and bipolar L-Fuzzy membership value for each road.

ii. Variable used in the program

Variable used in the program	Extension word
R_1, R_2, R_3, R_4	Road-1, Road-2, Road-3, Road-4
VR	Vehicle Road
EVR	Emergency Vehicle Road
AVR	Average projection time of Vehicle Road
SVR	Sum of projection time of all the Vehicle Road
CVR	Count of Vehicle Road
MVR	Maximum projection time of Vehicle Road
BLF value	Bipolar L-Fuzzy membership value
MIP	Morphological Image Processing

Table 4.2

iii. Code for ordering green signal light to roads and calculating green light duration

```
#List declaration and initialization.
induvidual_veh_count = []
time = []
veh_count = []
road_classi = {}
BLF = []
tot_time1 = 0
tot_time2 = 0
count1 = 0
#Initialing a dictionary for displaying traffic light.
traffic_light = {1:"colour", 2:"colour", 3:"colour", 4:"colour"}
#Receiving data from MIP
for i in range(0,4):
print("Road ",(i+1))
temp = []
for q in range(0,6):
        if(q==0):
temp.append(int(input("\tTwo Wheeler : ")))
        elif(q==1):
temp.append(int(input("\tThree Wheeler : ")))
        elif(q==2):
temp.append(int(input("\tCar : ")))
        elif(q==3):
temp.append(int(input("\tBus : ")))
        elif(q==4):
temp.append(int(input("\tTruck : ")))
        elif(q==5):
    temp.append(int(input("\tAmbulance : ")))
  tot_time1=(temp[0]*4)+(temp[1]*5)+(temp[2]*7)+(temp[3]*9)+
        temp[4]*10) +(temp[5]*6)
    if(temp[5]>0):
```

```
        road_classi[i+1] = "EVR"
if(temp[5]==0):
        road_classi[i+1] = "VR"
induvidual_veh_count.append(temp)
veh_count.append(sum(temp))
time.append(tot_time1)
print("\n")
#After the classification of road
print("Road classification ---> ",road_classi)
print("\n")
#Calculating AVR and MVR
for h in range (1,5):
        if(road_classi[h]!="EVR"):
                tot_time2 = tot_time2 + time[h-1]
                count1 = count1 + 1
AVR = tot_time2/count1
MVR = max(time)
#Calculating the BLF value
for j in range(1,5):
        if(road_classi[j]!="EVR"):
                if(time[j-1]>=AVR):
                val = round(time[j-1]/(1+MVR),3)
                BLF.append(val)
                else:
                val = round(time[j-1]/(1-MVR),3)
                BLF.append(val)
                else:
                        BLF.append(1)
#Finding the road  with emergency vehicle  and initializing BLF value to 1
for m in range (0, len(BLF)):
        if (BLF[m] == 1):
                print("Emergency in road ", (m+1))
                print("Stays Green for ---> ", time[m] , " sec")
                traffic_light[m+1] = "GREEN"
        else:
                traffic_light[m+1] = "RED"
#Displaying the traffic light after finding the emergency vehicle road.
print("Traffic light in the order --> ", traffic_light)
print("\n")
for k in range (0,4):
        if(BLF[k] == 1):
                BLF[k] = 0
        else:
                pass
#Displaying the final MIP details after removing the emergency vehicle road.
print("Remaining MIP feed with BLF value: ")
print(BLF)
dup_BPL_val = BLF
for g in range(0,4):
        if(dup_BPL_val[g]<0):
                dup_BPL_val[g] = -dup_BPL_val[g]
#Counting number of roads with vehicles.
count = 0
for val in BLF:
```

```
                if (val != 0):
                        count = count + 1
                else:
                        pass
        print("Number of roads with vehicle are : ", count)
        print("\n")
        traffic_light = {1:"RED", 2:"RED", 3:"RED", 4:"RED"}
        #While loop to determine which road to be opened first based on the BLF
       value.
        boolean = True
        while boolean:
                traffic_light = {1:"RED", 2:"RED", 3:"RED", 4:"RED"}
                if (len(BLF) == 0):
                        boolean = False
                else:
                  if(max(BLF) != 0):
                   maximum = max(BLF)
print("Road with highest projection time is : road-", BLF.
                         index(maximum)+1)
for e in range (0 , len(BLF)):
                            if(BLF[e] == maximum):
                                traffic_light[e+1] = "GREEN"
                                count = e
                                BLF[e] = 0;
                            else:
                                traffic_light[e+1] = "RED"
print("Stays green for ---> ", time[count] , " sec" )
print(traffic_light)
print("\n")
                            else:
                            break
        #Displaying the traffic light after all the vehicles moved out.
        print("\n")
        print("After clearing the vehicles in each road ----> ", traffic_light)
        print("\n")
```

iv. Program Result

- **Input**

Road 1:

Two Wheeler	:	2
Three Wheeler	:	0
Car	:	1
Bus	:	0
Truck	:	1
Ambulance	:	0

Road 2:

Two Wheeler	:	1
Three Wheeler	:	0
Car	:	0
Bus	:	0
Truck	:	0
Ambulance	:	1

Road 3:

Two Wheeler : 4
Three Wheeler : 1
Car : 0
Bus : 0
Truck : 0
Ambulance : 0

Road 4:

Two Wheeler : 0
Three Wheeler : 0
Car : 0
Bus : 1
Truck : 2
Ambulance : 0

- **Output:**

Road classification : {1:'VR', 2:'EVR', 3:'VR', 4:'VR'}

- **FIRST** green light road : **EVR-Road 2**
  Staying time of green light : 10 sec
  Traffic light order : {1: 'RED', 2: '**GREEN**', 3: 'RED', 4: 'RED'}
- **SECOND** green light road : **VR-Road 4**
  Staying time of Green light : 29 sec
  Traffic light order : {1: 'RED', 2: 'RED', 3: 'RED', 4: '**GREEN**'}
- **THIRD** green light road : **VR-Road 1**
  Staying time of Green light : 25 sec
  Traffic light order : {1: '**GREEN**', 2: 'RED', 3: 'RED', 4: 'RED'}
- **FOURTH** green light road : **VR- Road 3**
  Staying time of Green light : 21 sec
  Traffic light order : {1: 'RED', 2: 'RED', 3: '**GREEN**', 4: 'RED'}

At last the order of traffic light : {1: 'RED', 2: 'RED', 3: 'RED', 4: 'RED'}

4.7. Experimental result of proposed traffic signal method

Road	**Classification and count of each vehicle**	**Classification of road**	**Count of vehicles**	**Projection Time for green signal light (in seconds)**	**BipolarL-Fuzzy membership values**	**Priority road for green signal light**
Road-1	Two wheeler-2 Car-1 Truck-1	Vehicle road	4	25	0.83	III
Road-2	Ambulance-1 Two wheeler-1	Emergency Vehicle road	2	10	1	I
Road-3	Two wheeler-4 Three wheeler-1	Vehicle road	5	21	–0.75	IV
Road-4	Bus-1 Truck-2	Vehicle road	3	29	0.97	II

Total projection time for completing one cycle in proposed method is 85 seconds

Table 4.3

V. Proposed traffic signal method with current traffic signal method

In this section, We discuss simulation and comparison of proposed traffic signal method with current traffic signal method followed by most of the cities.

5.1 Simulation table

In current traffic signal method, we consider approximately, projection time of every road is 30 seconds. But in our proposed traffic signal method, projection time is differ on every road which is depend on the vehicle's type.

Road	Classification of road	Count of Vehicles	Priority road for display green signal light		Projection time for green signal light (in seconds)	
			Current Method	Proposed method	Current method	Proposed Method
Road-1	Vehicle road	4	I	III	30	25
Road-2	Emergency vehicle road	2	II	I	30	10
Road-3	Vehicle road	5	III	IV	30	21
Road-4	Vehicle road	3	IV	II	30	29
Total projection time for completing one cycle					**120**	**85**
Result : **Projection time difference for completing one cycle is 35 seconds**						

Table 5.1

5.2 Comparison table

Content	Current traffic signal method	Proposed traffic signal method
Priority	It does not prioritize emergency vehicles as well as projection time. Which is a round cycle system.	It gives first priority for emergency vehicle road and then next priority for highest projection time of the vehicle road. Which is a priority based system.
Projection time	It takes 120 seconds for completing one cycle and which is a fixed time system.	It takes 85 seconds for completing one cycle and which is a varying time system. Time variation is based on the vehicle's type of the road.

Table 5.2

VI. Conclusion:

In this project, Instead of density sensor and sound sensor we use the morphological image processing techniques. Hence, we get the data in very speed and accurate. In this method, we provide the first priority to emergency vehicle road so that to avoid confusion in the traffic road. we plan the projection time of the green signal light based on the vehicle's type of the road. So that we reducing the time for completion of one cycle and also avoid unnecessary waiting of public in the traffic. Hence, giving first priority to emergency vehicle road and clear the traffic congestion depending projection time[High to Low] are implemented in our proposed method. So that our proposed traffic signal method gives the best result compared to current traffic signal method.

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