Novel Approach for Prediction of Traffic Flow

Prof. P. R. Patil
Assistant Professor at PICT, Pune.

Niranjan V. Kshirsagar
Student at PICT, Pune

Vishal S. Chaudhar
Student at PICT,Pune

AmolBhombe
Student at PICT, Pune

***Abstract*-Traffic flow prediction is an important technology in guiding traffic. For predicting this traffic flow intelligent transportation system is one of the important technologies. The predicted outcome should be accurate and it should give immediate results. This paper presents algorithm for prediction of short term traffic in urban network model. Road network model can be developed using matrix. In the given matrix links are connected with nodes which are of cross type. For collecting traffic data we simulated traffic flow using c language in graphics. The data obtained from the simulation is important factor in calculating traffic flow prediction. The obtained resultshows that the predicted traffic flow is nearly accurate.**

Keywords- Short-term Prediction, Network model, c-language.

I.PROBLEM IDENTIFIED

Now a day's cities are developing speedily. This increases number of vehicles. But the roads are not capable to carry heavy traffic. Due to this traffic jams occurs, which increases the travel time toreach Intelligent Traffic System(ITS) have key technology to solve the abovetraffic problems.

II.PROBLEM UNDERSTOOOD

In the recent years much more emphasis is given to solve the traffic problems such as AutoregressiveIntegrated Moving Average (ARlMA)[3][4], Kalman Filter[5], Neural Network based[6][7], Support Vector Machine[8][9], etc.These conventional methods give enough accuracy of traffic flow in only highway networks but not in urban networks. Because in city-like networks involves many factors which affects the traffic such as traffic signals, walkers and dwellers.

III.SOLUTION PROPESED

Shuet[8] has given a prevision model which is based on network structure. These methods achieve good results compared to microscopic simulation model. However this model contains many parameters which cannot be calculated on Indian roads, and that are contents of the link and waiting queue length, which are difficult to obtain in real time in actual road network.In this paper, to make the prediction model better to use the information we have obtained. Some terms are neglected which do not affect the result much. We have used historical data to get the prediction of traffic flow. So it is easy to implement this model using less resource.

IV.MATHEMATICAL MODEL

PREDICTION ALGORITHM

The prediction of Average Traffic Flow Rate is defined by,

$F_D(i, j, n) = \sum_{k\epsilon nTp} D_{out,D}(i, j, k) x 60/ T_p$ ____(1)

Where, $F_D(i, j, n)$: Average traffic flow rate

$D_{out,D}(i, j, k)$: Number of vehicles running out through the link

T_P : Prediction Period

Number of vehicles running out through the link can be represented as,

$D_{out,D}(i,j,k)=D_{Ds}(i,j,k)+D_{Dl}(i,j,k)+D_{Dr}(i,j,k)$____(2)

Where, $D_{Dt}(i,j,k)$: number of the vehicles that depart from the link turning t at time k.

$t \epsilon \{s, l, r\}$:Turning direction of traffic flow.

$$D_{Dt}(i, j, k) = \begin{cases} 0, \text{ if } g_{Dt}(i, j, k) = 0 \text{ or } Cog_{Dt}(i, j, k) = 0 \\ Min\{W_{Dt}(i, j, k) + Q_{Dt}(i,j,k), S_{Dt}(i, j) \times T\} \end{cases}$$ ________________(3)

$Cog_{Dt}(i, j, k) = 1$, if $V_{avg,D}(i_d, j_d, [k / T_p]) < V_D(i_d, j_d)$ _________________(4)

When avg speed of traffic flow is below $V_D(i_d, j_d)$ then the traffic flow is treated as congested. Where, $V_D(i, j)$: predefined traffic flow. $g_{Dt}(i,j,k)$: signal symbol for the vehicles turning t in the link (1 when the signal is green, 0 when the signal is red); $W_{Dt}(I, j, k)$ no of vehicles that wait in the link intending to turn t at time k can be computed as,

$W_{Dt}(i, j, k + 1) = W_{Dt}(i, j, k) + Q_{Dt}(i, j, k) - D_{Dt}(i, j, k)$ _________________(5)

At stop line of crossing , vehicle usually join diff waiting queue according to their turning direction,

$Q_{Dt}(i, j, k) = \gamma_{Dt}(i, j, k) x Q_{Dt}(i, j,k)$________(6)

Where,

$\gamma_{Dt}(i, j, k)$: ratio of the vehicles turning t at the stop line of the link attime k;

$Q_{Dt}(i, j, k)$ is the vehicle arriving at the tail of the waiting queue.is mainly determined by $\beta_D(i, j, k)$ the integer part of the time it takes when running from entering to tails

$Q_{Dt}(i, j, k) = ((T - \alpha_D(i, j, k)) / T) X D_{inD}(i, j, k - \beta_D(i, j, k) - \sigma_1) + \alpha_D(i, j, k)) / T) X D_{inD}(i, j, k - \beta_D(i, j, k) - 1 - \sigma_1)$ ________________(7)

Where, $\alpha_D(i, j, k)$ and $\beta_D(i, j, k)$ are the fractional and integral part of the time that the vehicles spend on travelling from the entrance of the link to the tail of the waiting queue at the stop line. They can be computed by (8) and (9). σ_1 is the constant parameter that represents the time during which the vehicles go through the joint.

$$\alpha_D(i, j, k) = mod\left\langle \frac{[C_D(i, j) - W_{Dt}(i, j, k)] \, x L_D(i, j)}{N_D(i, j) x V_{avg,D}(i, j, k-1) x T} \right\rangle$$

______________(8)

$$\beta_D(i , j , k) = \text{floor}\left(\frac{[C_D (i , j) - W_{Dt} (i , j , k)] \times L_D(i , j)}{N_D(i , j) \times V_{avg,D}(i , j , k - 1) \times T} \right) \qquad (9)$$

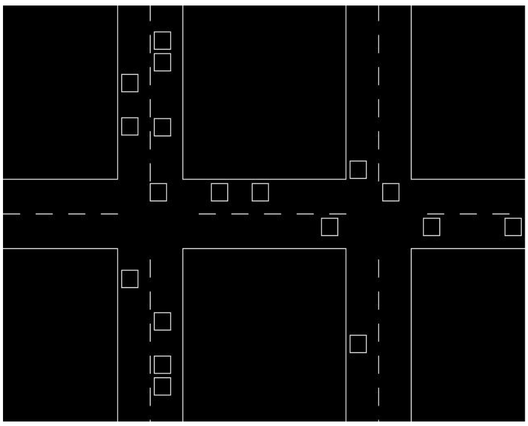
Where, C_D (i , j): capacity of the link expressed by vehicle numbers.

L_D(i , j): average length of the vehicles.

N_D(i , j): number of lanes of the link.

SOLUTION IMPLEMENTED

The solution is implemented using a road network model. This model consists of links and joints. These links and joints together forms network of roads.



There are source nodes from which vehicles can enter into the network. There are six source nodes in a network element as given in the figure. There are crosses in the network where vehicles decide whether to take left turn, right turn or go straight. This model consists of double lane traffic. This is shown using simulation in c-language graphics.

Following code is used to generate traffic data using simulation:

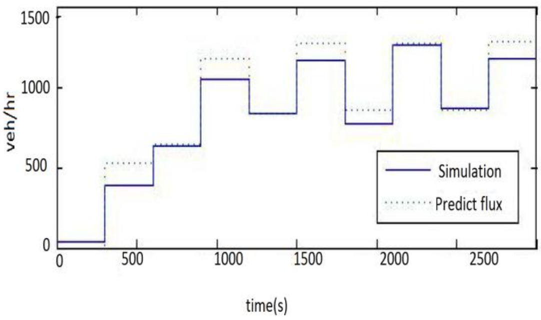
```
#include<stdlib.h>

#include<stdio.h>

#include<conio.h>

#include<dos.h>

#include<graphics.h>

#include<time.h>

struct car

{

struct car *link;

int c;

int d;

};

voidmoveit(struct car *head[6]);

struct car *create(struct car *head,int a[6],intb[6],int z);

void main()

{

int x=-40,y=-40;



struct car*head[6]={NULL,NULL,NULL,NULL,NULL,NULL};

int a[6]={185,0,145,425,619,465};

int b[6]={0,205,459,459,245,0};

intz,t=0;

struct car *temp;
```

```
intgdriver = DETECT, gmode, errorcode;
initgraph(&gdriver, &gmode, "c:\\tc\\bgi");
   /* request auto detection */
while(!kbhit())
   {
cleardevice();
    x=-40;
   y=-40;

if(t==25)
    {
    z=random(6);
//    printf("%d",z);
head[z]=create(head[z],a,b,z);
    t=0;
    }
moveit(head);
/*    increment(head);
    z=0;
while(z!=6)
 {
temp=head[z];
while(temp!=NULL)
  {
printf("%d%d,",temp->c,temp->d);
temp=temp->link;
  }
printf("\n");
z++;
 }*/
line(140,0,140,200);
line(0,200,140,200);
line(0,280,140,280);
line(140,280,140,479);
line(220,479,220,280);
line(220,280,420,280);
line(420,280,420,479);
line(500,479,500,280);
line(500,280,639,280);
line(220,0,220,200);
line(220,200,420,200);
line(420,200,420,0);
line(500,0,500,200);
line(500,200,639,200);
while(x<640)
   {
    x=x+40;
if((x>140&&x<220)||(x>420&&x<500))
    {
    }
else
line(x,240,x+20,240);

    }
```

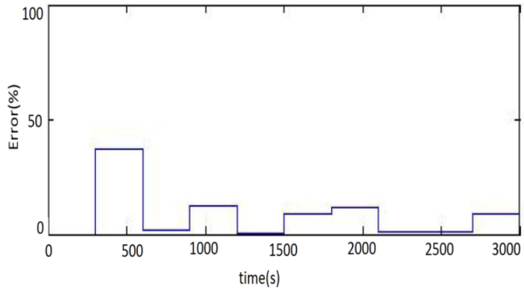
```
x=180;
while(x<600)
{

while(y<480)
{
y=y+37;
if(y>200&&y<280)
{
}
else
line(x,y,x,y+20);
}
x=x+280;
y=-40;
}
t++;
delay(50);
}
}

struct car *create(struct car *head,int a[6],int b[6],int z)
{
struct car *temp1;
struct car *temp=(struct car *)malloc(sizeof(struct car));
temp->link=NULL;
temp->c=a[z];
temp->d=b[z];
if(head==NULL)
head=temp;
else
{
temp1=head;
while(temp1->link!=NULL)
temp1=temp1->link;
temp1->link=temp;
}
return head;

}


voidmoveit(struct car *head[6])
{
struct car *temp;
int z=0;
while(z!=6)
{
temp=head[z];
while(temp!=NULL)
{
```

```
  rectangle(temp->c,temp->d,temp->c+20,temp->d+20);

if(z==0||z==5)

temp->d=temp->d+1;

else if(z==1)

temp->c=temp->c+1;

else if(z==2||z==3)

temp->d=temp->d-1;

else

temp->c=temp->c-1;

temp=temp->link;

 }

z++;

 }

 }
```

V.RESULT/CONCLUSION



The above figure shows the vehicle discharge rate as number of vehicles per hour and time in seconds. As the time increases the predict flux differs from simulation result. This states that the algorithm used for prediction of traffic flow gives good result for short period of time.



The above figure shows percentage error in simulation result and predict flux. Error in prediction increases as the time increases but gives nearly accurate result in case of short period of time.

In this paper we have studied and implemented the Short-Term Prediction algorithm. For practical applications this algorithm is more adaptive, because this does not include data from loop detectors which is not easy to obtain in engineering practice. This algorithm would give enough accuracy than the algorithms which were implemented before, because this algorithm mainly focuses on urban traffic model not the highway network model. For future practical applications proposed algorithm is promising.

	Qd	Wd			Fd
K=1 when red	24.99	11.24	8.99	24.75	0
K=2 when red	20.00	23.28	17.46	23.28	0
K=3 when green	24.99	0	0	0	4.99

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Authors Profile

P.R.Patilreceived the **B.E.** degree in computer science and technology from the Pune Institute of Computer Technology, Pune, University Of Pune, Maharashtra, India. Currently assistant prof. in PICT, Pune.

A.S.Bhombeis appearing **B.E.** degree in computer science and technology from the Pune Institute of Computer Technology, Pune, University Of Pune, Maharashtra, India

.

V.S.Chaudharis appearing **B.E.** degree in computer science and technology from the Pune Institute of Computer Technology, Pune, University Of Pune, Maharashtra, India

.

N.V.Kshirsagaris appearing **B.E.** degree in computer science and technology from the Pune Institute of Computer Technology, Pune, University Of Pune, Maharashtra, India

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