Computer Aided Design of Traffic Signals
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Abstract:
In olden days traffic flow is very complicated to control on the heavy traffic roads or in metro cites, so overcome this kind of problems we developed traffic light signals, in modern days these traffic light signals also could not control the traffic flow in peek hours and some important days of occasions, finally we overcome these kind of traffic problems here we proposed a computer aided design of traffic signals, this design is a dynamic control of the traffic during rush hours. In this proposed design the Traffic congestion is one of the major issues to be considered. Generally vehicular traffic intersects at the junctions of the road and controlled by the traffic signals. This traffic research is to optimize the flow of vehicular traffic and goods. The flows of a traffic constantly changes depending on the time of day, day of the week, and the time of year. With the ever increasing vehicles on the road and the number of road users, the limited resources provided by current infrastructure lead to ever increasing travelling times. The computer aided design of Traffic signals controller is playing more and more important roles in modern management and controls of urban traffic to reduce the accident and traffic jam in road. This is an automatic sequential process so that there is no possibility to collusion of vehicles. The device that involves counting the sequential in traffic lights controllers, timing and synchronization and flashing light synthesis sequence. This design is developed based on the IRC method for design of traffic signals using Computer aided design.

Key words: Traffic signals, smart traffic controller, IRC Method.

I. INTRODUCTION:
The traffic of our country is growing day by day, by that the management and management of traffic may be a major downside. The traffic volume is increasing often therefore dominant serious traffic is incredibly laborious for the traffic police and therefore the accident rate also are increasing at intersections. Therefore to beat the crises of skyrocketing traffic, style of traffic signals on squares of the cities are necessary. The light helps the vehicle to maneuver on sq. or intersections with safety and Ease. So the look of light is a vital a part of control in major cities, that tend to economical and safe technique for correct operation of vehicles at intersections. Traffic flow is that the study of interactions between vehicles, drivers, and infrastructure (including highways, signal, and control devices) [9], with the aim of understanding and developing an optimum road network with economical movement of traffic and nominal hold up downside. Traffic streams are represented by 3 variables: density (k), speed (v), and flow (q), measured severally in vehicles per lane per metric linear unit, metric linear unit per hour, and vehicles per lane per hour. At the megascopic level, these variables are outlined underneath stationary conditions at every purpose in area and time, and are connected by the identity letter of the alphabet = k × v. The serious concentration of population in a very few centers has resulted within the enlargement of cities in density yet as space. With the rise in population and economic activities the travel demand has accumulated several folds. Study of the fundamental traffic flow characteristics [5] like traffic volume is that the conditions for the effective designing, design, operation and management of route systems. Traffic in developing countries like Bharat is heterogeneous in nature consisting of vehicles of various classes with wide variable dimensional and operational characteristics. In Indian road traffic, the non-uniformity is of high degree with vehicles of wide variable static and dynamic characteristics. Underneath this condition, it becomes troublesome to create the vehicles to follow lane. The matter of activity volume of such heterogeneous traffic [2] has been addressed by changing the various styles of vehicles into equivalent traveler cars and expressing the degree in terms of car unit (PCU) per hour. The conflicts arising from movements of traffic in numerous directions are solved by sharing of the principle. The benefits of light embrace an orderly movement of traffic, an accumulated capability of the intersection and need solely easy geometric style. But the disadvantages of the signalized intersection are it affects larger stopped delays, and therefore the style needs advanced issues. Though the delay could also be lesser than a rotary for a high volume, a user is additional involved regarding the stopped delay [7]. Fig.1. shows the general traffic signal design.

Figure 1. Traffic signal design.
Background and motivation:
Traffic may be an important issue of transportation in most of all the cities of states. This is often very true for countries wherever population is increasing at higher rate. Traffic condition in Guntur town is as shown in fig 2. There’s extraordinary growth in vehicle population in recent years. As a result, several of the blood vessel roads and intersections are operational over the capability and average journey speeds on a number of the key roads within the central areas are not up to ten Km/h at the height hour. In a number of the most challenges are management of over 1,00,000 vehicles, annual growth of 7– 100% in traffic, roads operational at higher capability starting from one to four, travel speed but ten Km/h at some central areas in peak hours, inadequate or no parking lot for vehicles, restricted variety of policemen. Presently a video traffic police work and watching system commissioned in Guntur town. It involves a manual analysis of information by the traffic management team to see the traffic signal length in every of the junction. It’ll communicate an equivalent to the native law enforcement officials for the mandatory actions.

Figure 2. Traffic condition in Guntur city

Reinforcement learning for traffic signal management has initial been studied by Jim Thorpe he used a traffic light-based worth perform, and that we used an automotive primarily based one. Jim Thorpe used a neural network for the traffic-light primarily [3] based worth perform that predicts the waiting time for all cars standing at the junction. This suggests that Thorpe’s traffic signal controller got to cope with a large variety of states, wherever learning time and variance could also be quite massive.

II. METHODS:

The works reviewed during this paper were elite and analyzed supported the subsequent criteria:

a) Approaches accustomed build traffic routing and light-weight signal allocation selections. An example accommodative (learning) versus non-adaptive ways; offline versus real time strategies.

b) Variety and kinds of parameters/variables (input and output) used. we have a tendency to review systems that use single variables (e.g. traffic amount) and ones that use many variables (e.g. traffic quantity, waiting time, past and gift traffic knowledge knowledge) to create traffic routing selections.

c) Traffic knowledge assortment ways used and communication ways applied to transmit collected knowledge.

STCS that management traffic at an isolated junction or multiple intersection junctions or each [4].

Proposed style:
In our planned style we have a tendency to be used some traffic ways, shortly we have a tendency to mention in on top of section.

During this technique we have a tendency to set to allot the traffic signal signals routing and assortment of traffic knowledge.

Once completion of this work we have a tendency to opt for forms of parameter like input and output of traffic amount. In next step we have a tendency to opt for traffic knowledge assortment. this is often the terribly vital task in our style therefore we have a tendency to fastidiously collected knowledge from traffic junctions specifically space, from each direction of road we have a tendency to assembling knowledge like bikes, autos, buses, serious vehicles etc throughout all the day of traffic[1]. From that data we have a tendency to segregate the traffic density with relevancy time of day. Likewise we have a tendency to are assembling traffic knowledge, some explicit amount of days and analyze that data like hours and days additionally as peak hours and traditional hours. this whole method is taken by manually with facilitate of some man power and conjointly assembling traffic data from the users of traffic and a few reasonably suggestions associated with traffic, a way to scale back these abundant of traffic delays.

Here the fig.3. shows the traffic routing and signal placement on the traffic junction.

Figure 3. Design of traffic routing.

The entire collected traffic knowledge is regenerate into the shape of PCUs(Passenger Car Units). The all vehicles are takedown into one unit with the assistance of PCUs factors by the reference of IRC1985-93. The table 1 shows the PCU’s knowledge assortment of 4days and one week.

Table 1. PCU’s information (a). For 4 days (b). 1 week

(a)

(b)
Like, we have a tendency to convert the whole traffic data of explicit length [8], we have a tendency to opt for the Calculation of Peak hour supported PCU’s, the table 2 shows the peak hour calculations.

**Table. 2. Peak hour calculations of PCU’s**

<table>
<thead>
<tr>
<th>Peak Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00-9:00</td>
</tr>
<tr>
<td>9:00-10:00</td>
</tr>
<tr>
<td>10:00-11:00</td>
</tr>
<tr>
<td>11:00-12:00</td>
</tr>
<tr>
<td>12:00-1:00</td>
</tr>
<tr>
<td>1:00-2:00</td>
</tr>
<tr>
<td>2:00-3:00</td>
</tr>
<tr>
<td>3:00-4:00</td>
</tr>
<tr>
<td>4:00-5:00</td>
</tr>
<tr>
<td>5:00-6:00</td>
</tr>
<tr>
<td>6:00-7:00</td>
</tr>
</tbody>
</table>

IRC: 93-1985 Method:
The India Roads Congress (IRC) [10, 11] is that the oldest and most significant representative technical body of route engineers in India. The expansion of route engineering as a profession owes a lot of to the IRC that has completed 73 years of its existence. It will be claimed that the event of roads within the country has been considerably influenced by the wise counsels given by the IRC and has progressed in keeping with the policies enunciated by it.

**The Origin:**
The origin of the IRC will be derived back to the Indian Road Development committee (the Kayaker Committee) appointed by the govt of India in November, 1927. One in all the recommendations of this committee was that road conferences ought to be control sporadically to debate among different things, queries concerning building and maintenance. The Central Government, when consulting the state Governments, convened associate inaugural Governments convened associate inaugural meeting of route engineers at New Delhi in Gregorian calendar month, 1934. This meeting was attended by seventy three Engineers from all elements of the then Asian nation. Once the activities of the IRC dilated, it absolutely was registered as a society in 1937 beneath the Societies Registration Act of 1860. Beginning with a modest membership of seventy three in 1934, the IRC has currently concerning 13,500 members comprising of engineers of all ranks from Central and State Governments, Engineering Services of Army, Border Roads Organization, Road analysis Institutes, Engineering faculties, native Bodies and personal enterprises.

**III. OBJECTIVES:**
The IRC provides a National forum for sharing of information and pooling of expertise on the complete vary of subjects coping with the development and maintenance of roads and bridges, as well as technology, equipment, research, planning, finance, taxation, organization and everyone connected policy problems. in additional specific terms, the objectives of the IRC are:

1. To push and encourage the science and apply of building, operation and maintenance of roads.

2. To produce a channel for the expression of collective opinion of its members relating to roads.

3. To push the employment of ordinary specifications and to propose specifications.

4. To advise relating to education, experiment and analysis connected with roads.

5. To carry periodical conferences to debate technical queries relating to roads and therefore circularize technical data of experiences amongst route engineers.

6. To recommend legislation for the event, improvement and protections of roads.

7. To recommend improved strategies of administration, planning, design, construction, operation, use and maintenance of roads.

8. to determine, furnish and maintain libraries and museums for furthering the science of road creating.

9. To publish, or organize for the publication of proceedings, journals, periodicals, and different literature for the promotion of the objectives of the IRC.

The IRC has unrelentingly strived to realize these objectives and fulfill its charter. The tables 3, 4 information show the Manual Calculation of traffic signals for using the IRC method and sequence of calculations.

**IRC Method calculations:**

**Table.3. Calculation of IRC method**

<table>
<thead>
<tr>
<th>From</th>
<th>E</th>
<th>S</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td>To</td>
<td>S</td>
<td>W</td>
<td>W</td>
</tr>
<tr>
<td>PCUs/hr</td>
<td>348</td>
<td>606</td>
<td>747</td>
</tr>
</tbody>
</table>

The width of road = 16m
With a speed of walk = 1.2m/sec
Width of kerb = 1m
The width of the approach road from each direction is = (16-1)/2 = 7.5m
Saturation flow(S) = 525W= 525*7.5 = 3938

**Sequence of calculations:**

**Table.4. Sequence of calculations**

<table>
<thead>
<tr>
<th>From</th>
<th>E</th>
<th>S</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td>To</td>
<td>S</td>
<td>W</td>
<td>W</td>
</tr>
<tr>
<td>PCUs/hr</td>
<td>348</td>
<td>606</td>
<td>747</td>
</tr>
<tr>
<td>Total(s)</td>
<td>1044</td>
<td>575</td>
<td>507</td>
</tr>
<tr>
<td>Saturation flow(S)</td>
<td>3938</td>
<td>3938</td>
<td>3938</td>
</tr>
<tr>
<td>Y-μ/s</td>
<td>0.27</td>
<td>0.25</td>
<td>0.23</td>
</tr>
</tbody>
</table>

Provide amber time (a) of 2 seconds Starting delay per vehicular phase (I) = 2 seconds
Lost time \[ L = (3*2) + (3*2) = 12 \text{ seconds} \]

Optimum cycle time, \[ C_0 = \frac{(1.5*12) + 5}{1-0.75} = 92 \text{ seconds} \]

- Ges \[ = (0.27/0.75) \times 92 = 33 \text{ seconds} \]
- Gsw \[ = (0.25/0.75) \times 92 = 31 \text{ seconds} \]
- Gwe \[ = (0.23/0.75) \times 92 = 28 \text{ seconds} \]

From these calculations, the Fig.4 shows the timing diagram of traffic controller.

**Figure 4. Timing diagram**

The pedestrian inexperienced time needed for the most important and minor roads are calculated supported walking speed of 1.2 m/sec. and initial walking time of seven.0 seconds. These are the minimum inexperienced time needed for the vehicle traffic on the minor and major roads severally.

1. The inexperienced time needed for the vehicle traffic on the most important road is enhanced within the proportion to the traffic on the 2 approach roads.

2. The cycle time is calculated once permitting amber time of 2 seconds each.

3. The minimum inexperienced time needed for clearing vehicles inward throughout a cycle may be a determined for every lane of the approach road presumptuous that the primary vehicle can take 6 seconds, and therefore the ulterior vehicles (PCU) of the queue are cleared at a rate of 2 seconds. The minimum inexperienced time needed for the vehicle traffic on any of the approaches is proscribed to 33 seconds.

**Smart Traffic Controller Design for Android Application:**

In Parallel one Application was developed on golem OS. The program is meant in xml. The writing is programmed in JAVA. The appliance is developed supported cake (2.3.3) platform in android [6]. It works on all platforms ranging from 2.3.3 version to the newest version of android.

After completion of this application we would like to visualize that application is functioning properly or not therefore we have a tendency to be applying the all PCU’S peak hour knowledge to the current application [7, 8]. Supported the input data we have a tendency to get the Fig.5 shows the results of android application.

**Figure 5. Smart traffic controller for android app**

After giving inputs to the sensible traffic controller golem application beginning the analysis to determine the actual time declarations for every facet of traffic junction and generated temporal order cycle delays for that junction the Fig.6 shows the sensible traffic controller temporal order for every facet of junction.

**Figure 6. Smart traffic controller timing.**

After completion of manual work of temporal arrangement calculations results and robot application results, both are
compare, finally we got the equal results manually and android application. The table 5 shows the Comparison of traffic signal timings in manual design and computer design.

Table 5. The Comparison of traffic signal timings in manual design and computer design.

<table>
<thead>
<tr>
<th>Name of Phase</th>
<th>Computer programme</th>
<th>Manual calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-S &amp; E-W Phase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red time</td>
<td>65</td>
<td>65</td>
</tr>
<tr>
<td>Green time</td>
<td>33</td>
<td>33</td>
</tr>
<tr>
<td>Total cycle time</td>
<td>102</td>
<td>102</td>
</tr>
<tr>
<td>S-W &amp; S-E Phase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red time</td>
<td>69</td>
<td>68</td>
</tr>
<tr>
<td>Green time</td>
<td>31</td>
<td>31</td>
</tr>
<tr>
<td>Total cycle time</td>
<td>102</td>
<td>102</td>
</tr>
<tr>
<td>W-E &amp; W-S Phase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red time</td>
<td>74</td>
<td>75</td>
</tr>
<tr>
<td>Green time</td>
<td>28</td>
<td>27</td>
</tr>
<tr>
<td>Total cycle time</td>
<td>102</td>
<td>102</td>
</tr>
</tbody>
</table>

From this validation the signal timings are used for the traffic control and this will be act as smart traffic control system. According to smart traffic control system the calculated traffic signal timings will be useful for period of 6 to 12 months.

IV. CONCLUSION:

By finding out the road traffic of the town we have a tendency to analyze that the key accident cause is collision of vehicles at the intersections. The collision is also rear shunt on approach to junction, right angle collision, principle right flip collisions and pedestrian collision. These collisions are often avoided if correct style of signal is completed at the intersection in order that the most objective of the treatise is to supply higher and safer movement of traffic through signal style at the intersection of the Guntur town is glad. The signal is intended as per IRC tips in order that the signal will justify the correct movement of the traffic. The impact of the signal style are often seen in reduction of accident cause by that the reduction in fatal injuries at the intersection. Thus give a much better and safe movement of the traffic. The signal style may facilitate the pedestrian to cross the road safely. The signal temporal order plays a vital role in traffic movement. Therefore the temporal order of the signal should be such that it doesn't cause delay to the vehicles. If the temporal order is conflicting further delay to the vehicles than the driving force can decline the signal, leading to reason behind accident. Thus the signal temporal order ought to justify the movement of vehicles in order that further delay by the RED signal won't have an effect on the whole journey time. In future we have a tendency to employing a sensors for the installation into the roads can helps to gather the traffic information mechanically this good stoplight system will be reborn to automatic style of traffic signals.

V. REFERENCE:


