Intelligence Traffic Control Using Near field Communication

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Abstract :- Automotive technologies are gaining ground in road traffic-control systems today. There is a need for safety-critical traffic automation, and traffic engineering makes the dynamic or static analysis and the synthesis of automotive vehicle technologies possible. Taking the case study of manual toll tax collection system, we came to the conclusion that if the system is made completely automatic for collecting toll tax on the toll plazas by using of RFID that will save time, space and money. The goal of engineering is the planning and management of traffic systems.

The intelligence and cooperative set-up of actuation and its linkage to the central control system is vital for avoiding traffic jams and accidents. Moreover, environmental costs (eg pollution) can be decreased. The design of the traffic control system can be evaluated in two steps – synthesis and analysis. Several models and multiple control strategies exist, and engineers must decide between them using a priori knowledge of the real system.

Keywords- RFID-Radio frequency identification. TOD-Time of Day, ITCS –intelligence traffic control system.

Features:

- **Gives speedy transport without any obstruction**
- **Controlling pollution, To avoid loss of time, Loss of fuel**
- **Maintaining the congestion on roads**
- **Total Toll tax amount collected is publically transparent.**
- **Avoiding huge burden on Government and the citizens**

1. Introduction

Traffic control system is one of the various areas, where critical data about the well-being of the society is recorded and kept. Various aspects of a traffic system like vehicle accidents, traffic volumes and concentration are recorded at different levels. Intelligence traffic control system (ITCS) includes large numbers of RFID Reader that collect enormous quantities data in an attempt to provide information for the support and improvement of signal timing operations. Advanced forms of signal control, such as second and third generation control, are dependent on the sensor data supplied by ITCS. However, basic forms of control such as time-of-day (TOD), which is the prevalent signal control methodology used in this country, do not rely on the RFID data for operation. The RFID data is in fact capable of providing abundant amounts of information that can aid in the development of improved TOD signal timing plans by providing historical data for automatic plan development and maintenance and TOD interval identification. Data mining tools are necessary to exact the pertinent information from the data. [3] This paper describes research that is devising a procedure for developing, implementing and monitoring traffic signal timing plans using available data mining tools. The hypothesis premise of the research is that the data collected by signal control systems can be used to improve system design and operations for the current methods of traffic control.

The data-mining tool that serves as the foundation in this research for signal plan development is hierarchical cluster analysis, while classification may be used for monitoring plan effectiveness. This paper offers a background on signal timing plan development, with consideration of system state definitions and offering a procedure for improved traffic control through the use of hierarchical cluster analysis. The case study shows that the sensor data provided by ITCS holds valuable information regarding the behavior of traffic , capable of automatically generating TOD intervals for transitioning between timing plans as well as providing appropriate volume data for plan development during these automatically generated TOD intervals.[3] This paper is organized as follow: Section 2 describes the use of data mining in traffic management. In section 3 we describe how to collect data for this research. Section 5, 6 reports the way that are used for formulate the problem and the results of it.

2. THE USE OF DATA MINING IN TRAFFIC MANAGEMENT

There are many cities in our country which has a large population compared to their extension. Naturally these

People need a good transport system to cope with their needs like going to work, go shopping, etc. It should be done through city roads. The growth of population and the need of transportation system in one hand and the addition of transport vehicles on the other hand, we need a good city management all over the country. The addition of transport facilities in a town involves high financial and chronological expenses. These problems show the need of correct traffic management. As the traffic had bad effect on the air it has also undesired effects on human lives in different aspects, so it is necessary to investigate the ways to control and overcome

the difficulties in this field. One of the most important problems of traffic is taking a lot of time, so we can prevent undesired traffic effects. Today is the age of information increasing in any field; there are a large amount of traffic information in roads and cities. Traffic instruction has concrete characteristics. It means solving some parts of traffic problem may effect on the other ones. Traffic analysis requires using traffic rules based on the available information. We should consider two main materials get a reliable model and a right decision. First the information should be correct. Correct information represents a reliable model. Second the information should always be updated. The traffic information changes according to the rate of city changes, either change in population or in the construction. As this factor is important, it is impossible to do it easily.

Traffic is a changeable factor. It depends on the certain parts of the day or specific days. Intelligence ways are used to solve this problem but they have some faulty. Furthermore it relies up hardware facilities. We can mention a difference between data mining and modeling. One of the applications of data mining is to make series of patterns based on the phenomenon operations. Different traffic information is gathered regularly

Throughout a city and we can use of them to creating models for time-of-day signal control. Time-of-day (TOD) signal control is an example of a form of system control known as state-based control. A "state" is an abstract representation of the condition of that system at some point in time. The defined state serves as a sufficient statistic for the condition of the system. The concept of state based control is to use a set of established rules or policies to guide the selection of a control strategy for a system as the system transitions from one state to another. Many researches had be done about using data minig in urban traffic. First time [3] use clustering for managing urban trafic. After that [4] use GA for solved the problem of "unclean clusters" from resualts. Some other people useothe AI algorithms to change the answers. For example [2] used artificial immune clustering algorithm. Most of the researches are based on accidents alarms. By monitoring changes in signal data, they find risky times to become ready for helping pasengers. [1,5]

3. DATA COLLECTION

One of the most important factors in data mining is to collect the data and the needed information for data mining. The intelligence transportation system is an important way to control the traffics. In some junctions in Isfahan there are some sensors for determining the volume of vehicles traffics in order to control the lights in junctions. Each entry in junction has a sensor and it is enabling to count the number of entry vehicles. It can set the lights by the distinct orders. By considering the data collected by the system detectors in as high a resolution as possible, one can expect to better capture the nuances of the systems dynamic behavior.

Therefore, the state definition used for this case study is a vector of volume and occupancy measures for each

directional phase movement at each intersection. Not all intersections have system detectors located at every phase, so the state definition may vary from intersection to intersection depending on the availability of system

detectors. We have a table containing volume and occupancy measures for each directional phase movement at each junction in any time. This table contains the information of five junctions. This information is saved according to the name of junction in each 15 minutes for 2 months. The information consist of LV (volume of vehicles) and LO(vehicle occupancy) that recorded for different phases in junction. This table has a lot of zero fields

Data cleaning, also called data cleansing or crabbing, deals with detecting and removing errors and inconsistencies from data in order to improve the quality of data. Data quality problems are present in single data collections, such as files and databases, e.g., due to misspellings during data entry, missing information or other invalid data. For cleaning the available data, we choose junctions who have more complete information that others. These selected junctions don't have zero field and the sensors of these junctions have always been active. In the next stage, as the traffic in different days of the week differ, especially in weekends, we divided the weekend information from the others. So we have three tables. The first table contains the information of Saturday to Wednesday. The second one contains the Thursday's information and the last one for keeping the Friday information. The last stage is to writing the following query for each similar times of day:

SELECT Avg(l1v), Avg(l1o), Avg(l5v), Avg(l5o), Avg(l13v),
Avg(l13o) FROM [SHANBE-4]
WHERE (((Hour([Time]))=7) AND ((Minute([Time]))=30));

In this way, we calculate the average of LV and LO for each phase in similar times of day. Now, our information is ready for data mining.

5. PROBLEM FORMULATION

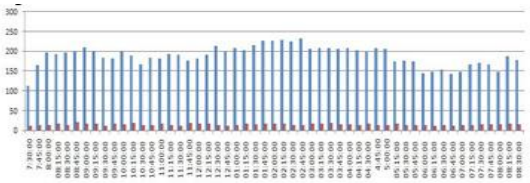

Figure 2. The clusters for business day

For weekends, Thursdays, we obtained the figure 3.

that is the cause of statistical fault as well as destruction of sensors, or making the sensors inactive by the traffic control center. If we want to apply data mining techniques on this information we will certainly get unreal models, so we should first clean this data.

4. DATA CLEANING

Clementine, a software system for data analysis, was the main tool used to implement data mining procedure,

clustering in particular, in this research. Also we used Microsoft excel to drawing charts for the clusters that were created by Clementine. The cluster analysis was done with the Clementine software using 15-minute volume and occupancy data supplied by the traffic control center. The purpose of cluster analysis is to place objects into groups or clusters suggested by the data, not defined a priori, such that objects in a given cluster tend to be similar to each other and objects in different clusters tend to be dissimilar. The case study was done on a data set consisting of approximately 3000 observations, where two months of data was extracted from two junctions. We clustered holidays and weekends separate from other days. These clusters were first tested in one phase of a junction, and then they were done on the other phases. We prepare the tables including (TOD) intervals as a result. For business days, from Saturday to Wednesday, we get figure 1.

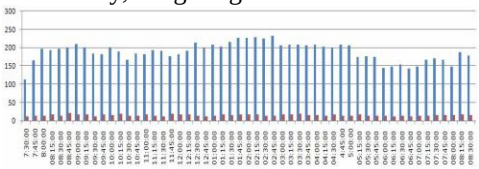

Figure 1. The diagram for business days.

These days are divided in to 4 clusters by using Clementine. The clusters are showed in figure 2.

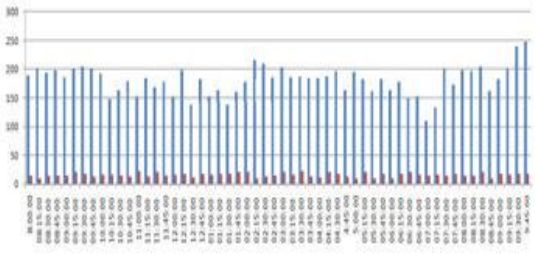

Figure 3. The diagram for Thursdays.

Thursday is divided to 4 clusters, too.

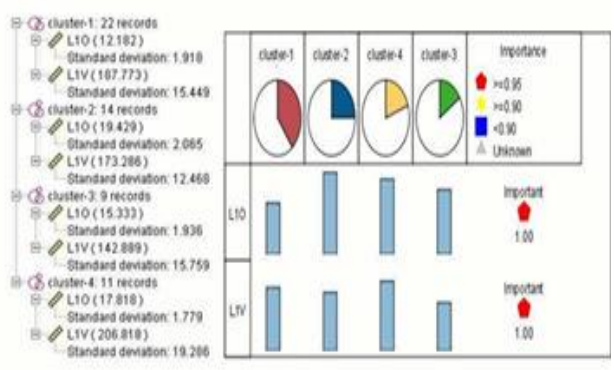

Figure 4. The clusters for Thursdays.

For holidays, we get figure 5.

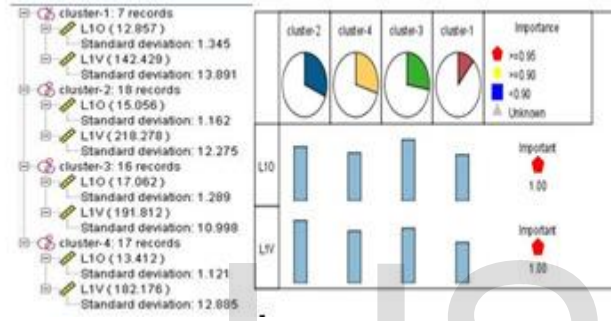

Figure 5. The diagram for holidays.

Holidays are divided in to 3 clusters by using Clementine.

The clusters are showed in figure 6

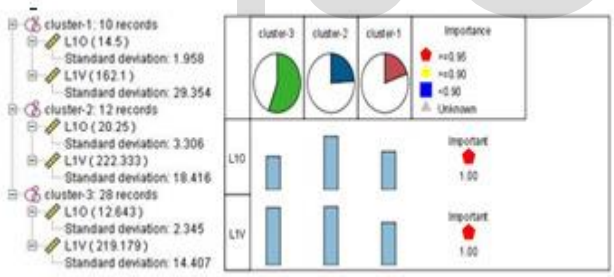

Figure 6. The clusters for holidays.

6. RESULTS

In this section we prepared the tables for TOD intervals based on the gained clusters in previous section. Table 1 identifies the cluster TOD intervals for weekend, table 2 identifies the cluster TOD intervals for holidays and table 3 identifies the cluster TOD intervals for business days ,from Saturday to Wednesday.

TABLE I. TOD INTERVALS FOR WEEKEND.

Cluster#	TOD Classification	TOD intervals
1	Off peak	22:00-08:00
2	AM , Evening	08:00-10:00 , 19:30-20:30
3	Post AM , PM	10:00-12:30 , 15:30-18:00
4	Mid day , Post PM	12:30-13:30 , 18:00-19:15
5	Pre-Off peak	14:00-15:30 , 21:00-21:45

TABLE II. TOD INTERVALS FOR HOLIDAYS.

Cluster#	TOD Classification	TOD intervals
1	Off peak	22:00-09:30
2	Post AM , Evening	09:30-10:30 , 18:30-21:30
3	Mid day	12:00-14:30
4	Post PM	14:30-18:30

TABLE III. TOD INTERVALS FOR BUSINESS DAYS.

Cluster#	TOD Classification	TOD intervals
1	Off peak	21:00-07:30
2	AM , PM	07:30-09:00 , 15:30-17:30
3	Post AM , Evening	09:00-12:30 , 19:00-21:00
4	Mid day	12:30-15:30
5	Post PM	17:30-19:00

7. AUTOMATED TOLL COLLECTION

Automated Toll Collection systems have really helped a lot in reducing the heavy congestion caused in the metropolitan cities of today. It is one of the easiest methods usedto organize the heavy flow of traffic. When the car moves through the toll gate on anyroad, it is indicated on the RFID reader that it has crossed the clearing. The need for manual toll based systems is completely reduced in this methods and the tolling system works through RFID.The system thus installed is quite expedient reducing the time andcost of travelers since the tag can be deciphered from a distance.

The people traveling through this transport medium do not need anything else to get on a highway, instead the RFID tag carried by their vehicle does every thing. A commutertraveling through this medium gets to know how much amount has been paid and how much money is left in the tag.

It does not require the person to carry cash with him to pay the toll tax all the time. The long queue waiting for their turn is reduced, which in-turn reduces the consumption of fuel. The RFID toll payment systems are really used in preventing trespassing on borders. The software solution developed can ensure a smooth running of vehicles without any need for further development. The software controlling these RFID tags and readers is easy to implement. Here Basic idea is to develop the automatic challan system that can check for signal break by any vehicle. The RFID Reader reads the information like vehicles numbers and automatically send a report to the owner of vehicles and simultaneously an information is given on the site itself through LCD.

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8. INTRODUCTION TO RFID

Radio-frequency identification (RFID) is an automatic identification method, relying on storing and remotely retrieving data using devices called RFID tags or transponders. The technology requires some extent of cooperation of an RFID reader and an RFID tag. An RFID tag is an object that can be applied to or incorporated into a product, animal, or erson for the purpose of identification and tracking using radio waves. Some tags can be read from several meters away and beyond the line of sight of the reader.

A basic RFID system consists of three components:

a) An antenna or coil.
b) A transceiver (with decoder).
c) A transponder (RF tag).

Electronically programmed with unique information. There are many different types of RFID systems out in the market. They are categorized according to their frequency ranges. Some of the most commonly used RFID kits are as follows:

1) Low-frequency (30 KHz to 500 KHz)
2) Mid-Frequency (900KHz to 1500MHz)
3) High Frequency (2.4GHz to 2.5GHz)

These frequency ranges mostly tell the RF ranges of the tags from low frequency tag ranging from 3m to 5m, mid-frequency ranging from 5m to 17m and high frequency ranging from 5ft to 90ft. The cost of the system is based according to there ranges with low-frequency.

9. PROPOSED SYSTEM OF TOLL COLLECTION

AUTOMATED COLLECTION SYSTEM (ACS) is an automatic collection system based on RFID i.e. RADIO FREQUENCY IDENTIFICATION where every vehicle will have a tag (RFID) with a unique tag identification number. This identification number will be associated with the complete information such as vehicle number, owner, etc. and also most importantly with a cost value. Whenever vehicle passes through toll booth, reader reads the information on tag associated with vehicle, deducts the toll and then account gets updated. This total communication takes place via Radio Waves and simultaneously all the information about this transaction is recorded at database server.

The tax value will be deducted automatically every time the vehicle passes the collection unit. No one will have to wait for time. This cost value can be recharged at the recharge center.

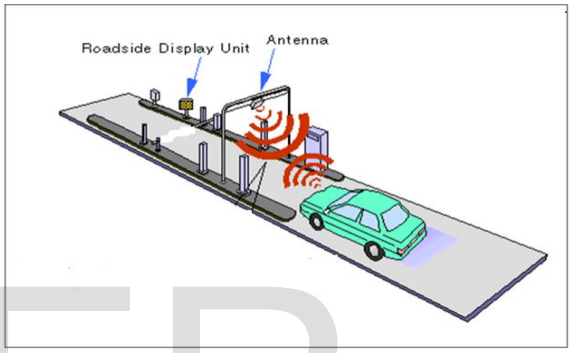

Fig. Structure of ACS

10. LOST VEHICLE TRACKING

Situation:

Today when a vehicle is lost then its entry is made in police station. Then search is made manually, i.e. suspects are searched and police traces the vehicle in the area where it was lost or misplaced. This search finishes and generally it is found that the lost vehicle is not recovered. So this system is not fruitful and not proving helpful.

Solution:

We are assuming that vehicles are placed with RFID tags. Radio Frequency Identification (RFID) devices consist of tags and readers that assist in the tracking ofgoods and vehicles. Tags are the devices that give identity to the vehicle and work like a wireless name plate. It transmits it identity to readers which are placed at strategic locations like entry/exit of Toll Booth. Readers pick up these signals and transmit them to the centralized data servers from where the information can be viewed or utilized any where.

Then This information related with stolen vehical will be send to data administrator through message and then it will be an administrator's responsibility to take necessary action.

11. CONCLUSIONS

The use of data mining tools to automatically generate TOD intervals and plans for signal plan development directly benefits transportation engineering, while the application of cluster analysis as a basis for real time control benefits the systems engineering field. From the research presented here, the timing plan development and maintenance process can be replicated and automated. The result of a through systems approach to problem solving is shown here to improve traffic performance through corridors with the ability to support. The tool evaluates the real time traffic data to constantly monitor the effectiveness of timing plans and alert traffic engineers of critical plans and variant traffic conditions.[3] This use of data mining tools on real time traffic data has proved to be beneficial to traffic signal control and development

Also this system can be effectively implemented on a highway or freeway, where vehicle with a RFID tag will be allowed to pass by deducting an amount from the tag balance. ACS is a toll tax collection implementation system that will save time, space and money.

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