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AN INTELLIGENT TRAFFIC CONTROL SYSTEM FOR MODERN ERA USING RFID

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ABSTRACT

Vehicular traffic control at road crossings has always been a matter of concern for administrations in many modern cities around the world. It is often seen in today's automated traffic control systems that vehicles have to wait at a road crossing even though there is little or no traffic in the other direction. Congestion is often translated into lost time, missed opportunities, and delivery delays. To overcome these problems, in this paper, we propose a new method called intelligent traffic control system (ITCS) using radio frequency identification (RFID). The ITCS is comprised of RFID readers and a central computer system (CCS) to control them. The CCS in turn contains a central database processing system for processing vehicular data and a decision making section for controlling the traffic signals. The decision making section (DMS) contains a decision making algorithm that determines how the traffic lights are operated. The traffic signals are operated not only on the no of vehicles at a given instance but also on the priority assigned to each vehicle and also on the time of the day. This method facilitates tracking of stolen vehicles or vehicles booked for offences along with their time and direction of travel. Assigning differential priorities to vehicles facilitates efficient control of traffic. As the system is fully automated, it saves costly constant human involvement.

I.INTRODUCTION

Traffic control has always been an area of concern for many years. With the increasing vehicles many solutions have been proposed for effective control of traffic. Most of them are automated system with predetermined timings to operate the traffic signals. They are not efficient as they do not operate in accordance with the traffic at any particular instant. So the vehicles at the crossings have to wait irrespective of the traffic at the other end. As a result people waste their valuable time getting caught up in the congestion. Congestion often leads to missed opportunities, delivery delays etc. Traffic congestion can not only be recurring but also nonrecurring which arises due to traffic incidents like damaged vehicles, crashes, work areas, weather and special events. To solve this problem of nonrecurring congestion some sensor based systems were used. This was not effective as direct line of sight was required between sensors and vehicles. Moreover simultaneous multiple detections was also not possible.

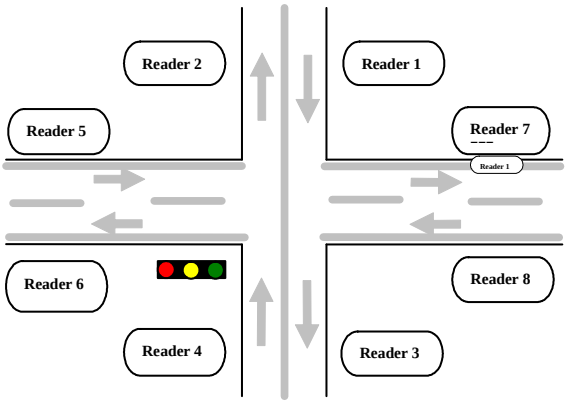
To overcome these problems we hereby propose a new method called the Intelligent Traffic Control System **(ITCS)** using radio frequency identification **(RFID)**.The basic principle behind this is the RFID tracking of vehicles.

II.ARCHITECTURE OF ITCS

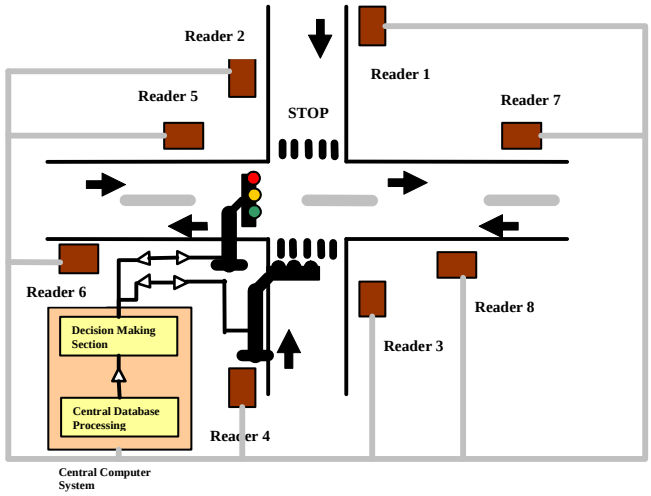
The ITCS comprises of RFID readers and Central Computer system **(CCS)** to control the

readers. The CCS in turn contains a Central Database Processing System **(CDPS)** and a decision making system **(DMS)**.

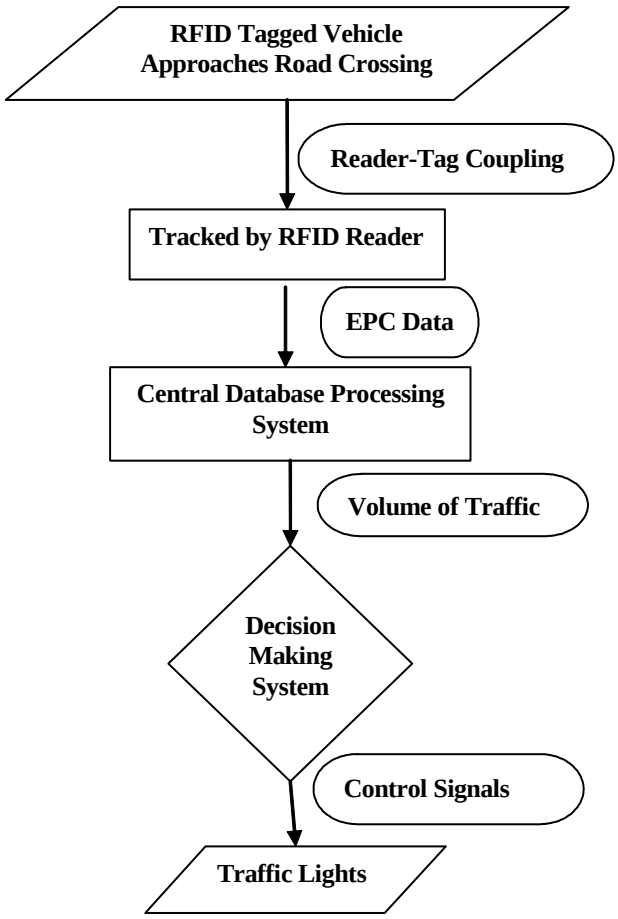
The figure below shows a road crossing with roads running in all the four directions.



A set of RFID readers separated by some distance is placed in each direction of road crossing. Each vehicle is attached with a RFID tag. As the vehicle passes by the reader it tracks the Vehicle with the help of its RFID tag and retrieves it electronic product code **(EPC)**.The EPC consists of an unique vehicular identification number **(VIN)**.The VIN can be used to obtain the various details of the vehicle such as the type, weight, length, registration, pollution control status along with the owner's identification.



The data thus obtained is then sent to the CCS through wired or wireless channels based on the convenience at the place. The central database processing data. Based on the processed results the DMS controls the traffic lights.



The flow chart of the system is shown above.

III.DYNAMIC DATABASE

The CDPS handles two types of databases, a dynamic database and a permanent database. The dynamic data base temporarily holds the details of the vehicles that are currently passing the crossing. The permanent database stores the records of all those vehicles that have passed the crossing.

The dynamic database arranges the EPC data of vehicles according to their time and direction of travel .Whenever the vehicle moves towards or away from the crossing it is detected by the readers and the details are transmitted to the CCS with a time gap between them. The direction of the vehicle is determined from the order of response of the two readers. The data regarding the vehicle is then stored in any one part of the database based on its direction of travel.

Once the vehicle has gone out of range of the readers the information regarding the vehicle including the time and direction of its travel is moved from the dynamic database to the permanent database.

IV.VOLUME OF TRAFFIC

The dynamic database can also be used to compute the volume of traffic at the given instant and the result of this is sent to the decision making system which then controls the traffic lights I.e the green light glows in the direction of maximum volume of traffic.

The volume of traffic is not just calculated by the number of vehicles .It has many predetermined factors given below:

*1)Type of the vehicle:*The type of the vehicle is the most important factor-whether it is a smaller vehicle like scooter, car etc or larger ones such as bus, lorry, trucks etc. There are special vehicles such as ambulances and those of VIPs which can have unrestricted passage.

*2)Priority assigned to the vehicle:*Each vehicle is assigned a priority based on the size, frequency of that vehicle at the crossing, time of the day and

various other factors.

*3)Priority assigned to the path:*This becomes essential when we have two roads intersecting at a crossing which are not of same importance such as a national highway and an ordinary road.

4)Time:The time of the day and also the day of the week is also taken into consideration.

The volume of traffic is determined by the priority assigned to the vehicle at that particular instant of time along with the priority assigned to the road it is travelling.

V.OPERATION OF TRAFFIC SIGNALS

The decision making section (DMS) contains a decision making algorithm which determines the control of traffic lights. It takes in to consideration the following factors:

- The volume of traffic-Green light is shown in the direction of maximum volume of traffic.

- As the volume of traffic fluctuates rapidly a constant time is set during which the signal remains the same irrespective of the traffic in other direction.

- The main aim of this system is to minimize the average waiting time. So a maximum time is set after which the signal changes automatically without taking into account the traffic in the other direction. This prevents the starvation of least priority vehicles.

- The algorithm also gives place for the interrupts to be incorporated so as to handle emergency situations such as accidents or failure of the system. A notification system attached to the interrupts calls for human intervention as such emergencies cannot be automated.

Based on the location we can have different decision making algorithms. The maximum and minimum time for each direction can be determined with the help of the statistical data. However using such a system for metropolitan cities requires a centralized system such as CCS. It also necessitates environment-specifics algorithms. Running too many algorithms seems to be quiet complex. But we can make use of parallel computing and distributed databases for optimizing the efficiency.

VI.ADVANTAGES

This system has numerous advantages over others which are listed below

1) The traffic signals are controlled in accordance with the current volume of traffic. This system differs from others especially in the way it calculates the volume of traffic.

We have differential priorities assigned to the vehicles.

a.Ambulances, VIP vehicles, fire brigades can be given unrestricted passage at any time of day

b.Scooters and cars can be given higher priority during school and office rush hours

c.Heavy vehicles can be given higher priorities at night

*2)*As the database holds the time as well as the direction of the vehicle, this system facilitates the tracking of stolen vehicles and those booked for

offences.

*3)*E-tolling of vehicles can be conducted and reliable traffic data can be generated for statistical purposes.

VII.FUTURE ENHANCEMENTS

When any one of the readers fails the system still works. In such cases, when the other reader in that path tracks a vehicle, the CDPS checks whether it has just crossed the readers in another path converging at the crossing or not. From this, the direction of travel can be obtained. For this, the CCS must regularly share hand-shaking acknowledgement signals with all the readers to find out whether or not they are working properly.

The readers are usually placed on opposite side of roads. If the road has to be broadened or maintenance work has to be done one of the readers can be temporarily removed and the system made to function on a single reader in that road. If any or both roads are two-way with pavement in between then the readers can be placed in the pavement.

If the tags are mass produced and employed in large scale, the cost would come down. The tags should be durable, impact resistant, water proof. The batteries should have a life span of more than ten years. Advanced security techniques should be developed to detect intentional tag removal or to ensure tags authenticity.

VIII.IMPLEMENTATION

ALGORITHM:

Decision making algorithm(m,n,t,t1,t2)

{

//v-no: of vehicles

//m-no: of small vehicles

//n-no: of heavy vehicles

//t-minimum time for green signal before computing the volume of traffic

//t1-maximum time for green signal before computing the volume of traffic

//t2-minimum time for green signal after computing the volume of traffic

If(time>8 and <10)

{

Small vehicles=∞;

Heavy vehicles=0;

Start1:

Max (waiting time);//direction with maximum waiting time is calculated

If (min (v))//checking if v is minimum

{

Green (t); //green signal glows for a time t

Computes traffic volume for other directions

}

Else

{

Green(t1);

}

If(m>n or m<n):

Green(t2);

For(i=1;i<5;i++)

{

Green(people);//green signal glows for the pedestrians

}

Goto start1;

}

Else If (time>20 and time<22)

{

Small vehicles=0;

Heavy vehicles=∞;

Start2:

Max (waiting time); //direction with maximum waiting time is calculated

If (min (v))//checking if v is minimum

{

Green (t); //green signal glows for a time t

Computes traffic volume for other directions

}

Else

{

Green (t1);

}

If (n>m or n<m):

Green (t2);

For (i=1;i<5;i++)

{

Green(people)//green signal glows for the pedestrians

}

Goto start2;

}

Else

{

Start3:

Max (waiting time);//direction with maximum waiting time is calculated

If (min (v))//checking if v is minimum

{

Green (t); //green signal glows for a time t

Computes traffic volume for other directions

}

Else

```
{
Green(t1);
}
For(i=1;i<5;i++)
{
Green(people)//green signal glows for the pedestrians
}
Goto start3;
}
}
```

IX.CONCLUSION

Thus an intelligent system based on a simple principle of RFID for controlling traffic is proposed. The advantages ITCS can provide were demonstrated in detail which vouches for its effectiveness in traffic management systems.

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