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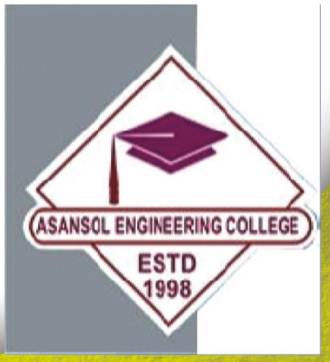

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Intelligent Traffic Control System using RFID

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***Abstract*— In this paper we propose a novel architecture for creating Intelligent Traffic Control Systems (ITCS) using Radio Frequency Identification (RFID) [1]. This architecture can be used in places where RFID tagging of vehicles is compulsory. The efficiency of our proposed system lies in the fact that this system operates traffic signals based on the current situation of vehicular volume in different directions of a road crossing and not on pre-assigned times.**

***Keywords*: Database Processing, RFID, Traffic Control, Vehicle Tracking.**

INTRODUCTION

Vehicular Traffic control at road crossings has always been a matter of concern for administrations. Several attempts have been made to design efficient automated systems to solve this problem. Most present day systems use pre-determined timing circuits to operate traffic signals. However these systems are inefficient because they do not operate according to the current volume of traffic at the crossing.

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. There are other problems as well, like ambulances getting caught up by a Red traffic signal and wasting valuable time. To solve these problems and to add further enhancements to the complex problem of vehicular traffic control at road crossings we propose the idea of "Intelligent Traffic Control Systems using RFID". Our idea is based on the principle of RFID tracking of vehicles, a topic on which many organizations are doing extensive research.

PROPOSED ARCHITECTURE OF ITCS

Let us consider the diagram of a road crossing as shown in Figure 1. Our idea is to place two RFID readers [2] (separated by some distance) in each direction of a road crossing and have a Central Computer System (CCS) to control them all. As a vehicle passes by a reader, it tracks the vehicle and retrieves its Electronic Product Code (EPC) data [3]. Currently available hardware can be used to monitor vehicles traveling at normal speed at a read distance of 10m (33 ft.) [4]. The data obtained is then sent immediately to the CCS by wireless [5] or wired channels (as found convenient at that location). The CCS contains a Central Database Processing System (CDPS) for processing vehicular data and a Decision Making Section (DMS) for controlling the traffic signals. A diagrammatic representation of the system is given in Figure 2.

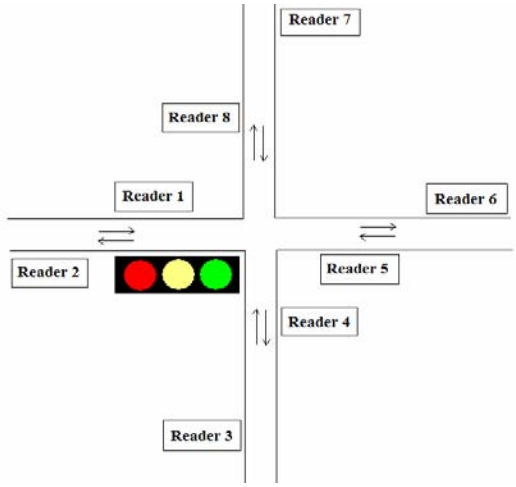


Fig. 1. A road crossing with RFID Readers

CENTRAL DATABASE PROCESSING SYSTEM

The CDPS consists of two parts:-

(1) A dynamic database where the records of vehicles currently passing the crossing are temporarily stored.

(2) A permanent database which stores the records of all vehicles that have passed the crossing.

The dynamic database is divided into a number of parts. It arranges the EPC data of vehicles according to their path and direction of travel. Whenever a vehicle moves towards or away from the crossing, the two readers in its path detect it and convey the obtained data to the CCS with some time gap in between. The order of response of the two readers determines the direction of travel of the vehicle (whether it is moving towards or away from the crossing). The vehicular data is then sent to any one part of the database corresponding to its path and direction of travel.

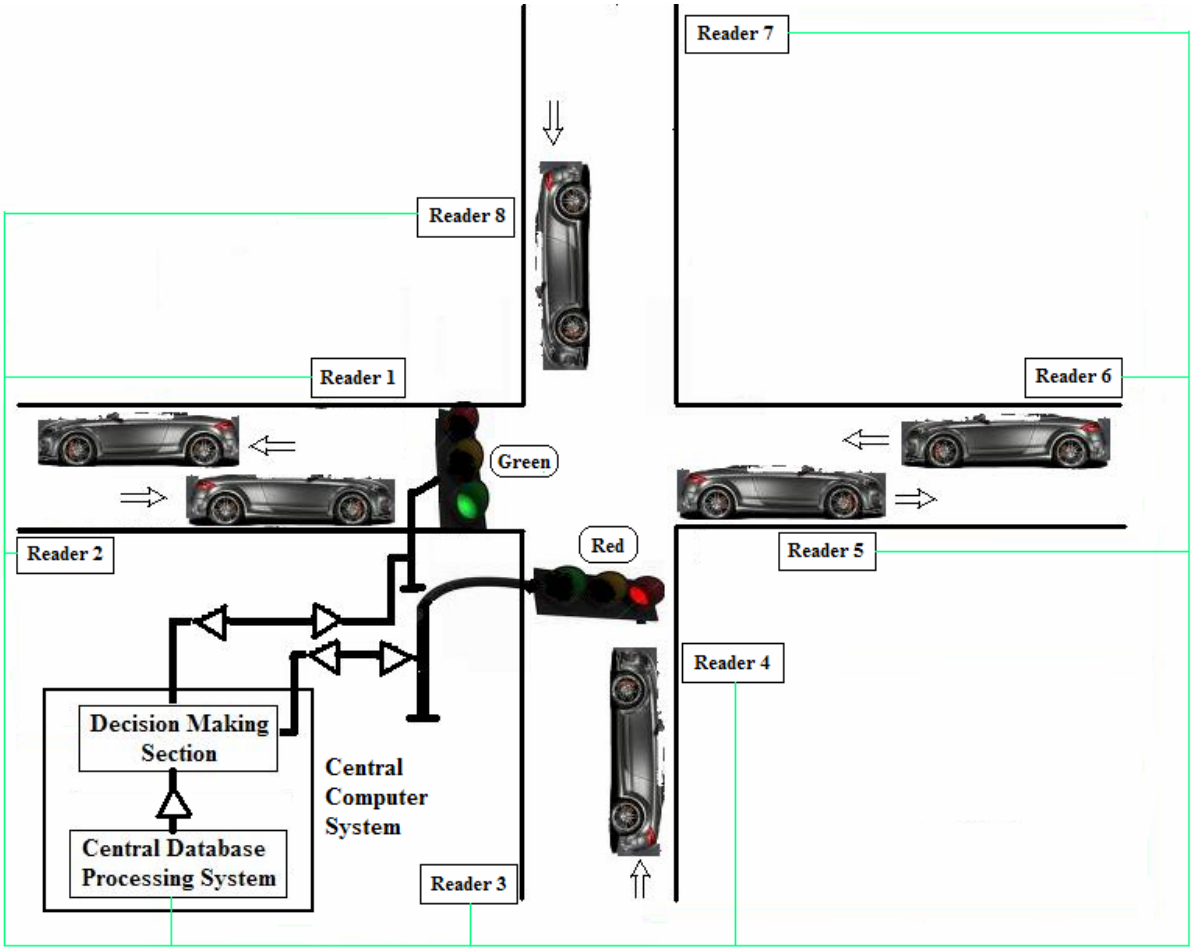


Fig. 2. Diagrammatic Representation of ITCS using RFID

At each instant, the CDPS checks the data in various parts of the dynamic database and computes the volume of traffic for both the roads intersecting at the crossing. It then sends the computed information to the Decision Making Section of the CCS which operates the traffic signals according to the current volume of traffic (showing the Green light in the direction of maximum traffic).

The volume of traffic is not calculated simply by the number of vehicles but by a complex set of equations which take into account pre-defined factors (obtained by research) like:–

(a) Type of vehicle (Whether it is a smaller vehicle like a scooter or a car, or a larger vehicle like a bus or a truck)
(b) Priority assigned to the vehicle (Each type of vehicle is assigned a specific priority based on its size, frequency of that vehicle at the crossing, time of the day etc.)
(c) Priority assigned to the path of travel (This factor becomes essential when both the roads intersecting at the crossing are not of the same importance. e.g.- Intersection of a national highway with an ordinary road.)
(d) Time (The time of the day, and day of the week)

So, the volume of traffic takes into account the priority assigned to each vehicle at the present time of the day and also the priority assigned to the two roads intersecting at the crossing.

Once a vehicle has passed the crossing (i.e. it has gone out of the range of the readers), its data is moved from the dynamic database to the permanent database where it is stored along with its direction of travel (both arrival and departure directions) and time.

Decision Making Section

The DMS contains a decision making algorithm which determines how the traffic lights are operated. The decision making algorithm takes care of the following factors:-

(1) The volume of traffic as received from the CDPS (Green light is shown in direction of maximum volume of traffic)

(2) Since volume of traffic can fluctuate very rapidly, it is not possible to alter traffic signals based only on this factor. So, a minimum time is set for which the traffic signals remain constant before checking for the volume of traffic again.

(3) A maximum time is set after which a constant traffic signal must change irrespective of volume of traffic. This is done to ensure that no vehicle has to wait too long at the crossing.

Each crossing should have a different decision making algorithm depending on the nature of the two intersecting roads. The various factors like maximum and minimum time for each direction must be determined by statistical analysis and research.

ADVANTAGES AND FEATURES OF ITCS

Our novel architecture provides the following advantages:-

(1) Traffic signals are operated according to the current volume of traffic.

(2) Differential priorities can be assigned to vehicles – (a) Ambulances, Fire Brigades and VIP vehicles can be given unrestricted passage irrespective of volume of traffic, (b) Scooters and cars can be given higher priorities during school and office rush hours, (c) Heavy vehicles can be given higher priority at night.

(3) Reportedly stolen vehicles, or vehicles booked for offence can be tracked and the time and direction of travel can be obtained.

(4) E-Tolling of vehicles can be done (for all directions or for any particular direction of travel).

(5) Reliable traffic data can be generated for statistical purposes.

Some other features that can be incorporated into the system are as follows:-

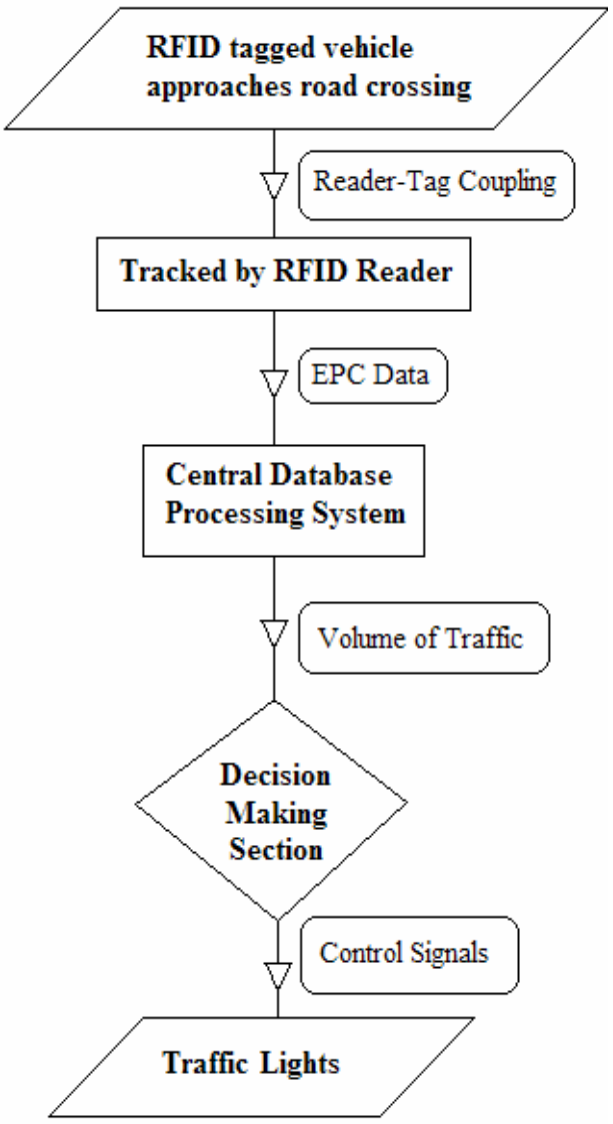
(a) If one of the readers in any path fails, the system can still work. In such cases, when the other reader in that path tracks a vehicle, the CDPS checks whether it has just crossed the readers in another path converging at the crossing or not. From this, the direction of travel can be obtained.

For this, the CCS must regularly share Handshaking Acknowledgement signals with all the readers to find out whether they are working properly or not.

(b) The two readers in each path are placed on opposite sides. If any road needs to be broadened or any other maintenance work needs to be done, then one of the readers can be temporarily removed and the system made to work on a single reader in that road.

If any or both of the roads are two-way with a pavement in-between, then the readers can be placed in the pavement.

FLOWCHART OF THE SYSTEM



CONCLUSION

We have proposed an architecture for creating Intelligent Systems for controlling road traffic. Our system is based on the principle of RFID tracking of vehicles. The effectiveness of our approach can be judged from the features and advantages it can provide (as stated in Section 5).

REFERENCES

[1] Patrick J.Sweeny II, "RFID for Dummies", by Wiley Publishing Inc.

[2] Klaus Finkenzeller, "RFID Handbook", by Wiley Publishing Inc., Second edition

[3] Bill Christensen, Technovelgy.com (2008, May 23). Electronic Number Plate keeps tabs on vehicles. [Online]. Available: http://www.technovelgy.com/ct/Science-Fiction-News.asp?NewsNum=195

[4] Roadtraffic-technology.com (2008, May 23). Tagmaster-Automatic Vehicle Identification (AVI) for hands-free vehicle access. [Online]. Available: http://www.roadtraffic-technology.com/contractors/access_control/tagmaster/

[5] Alan Benksy, "Short-range Wireless Communication", Communications Engineering Series, by Newnes, Elsevier Inc., Second edition