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Intelligent Traffic Management System using RFID

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Abstract: Radio Frequency Identification (RFID) is a technology that provides a method of uniquely identifying objects at some distance without requiring the object to be present in line of sight. In this paper this concept is further extended to manage traffic in a cost effective and intelligent manner. Moreover, catching traffic violators and providing a fast passage for ambulances are the other functions of this type of traffic management system.
Keywords: RFID, Traffic

I. INTRODUCTION

With increasing population there is an urgent need of developing an intelligent management system to handle traffic present on our roads. An intelligent system will be a big help to the daily commuters and also it will also be effective in identifying traffic violators which is quite difficult in the current system. The system proposed in this paper is based on Internet of Things (IOT) and can be implemented anywhere. The traffic lights will be controlled dynamically and a path can also be created for ambulances during emergencies. Moreover traffic violators can be identified and their information can be sent to police authorities even during night time.

Every metropolitan city especially in the downtown areas, face congestion issues. Such cities can be converted into smart cities where problems due to traffic congestion will be minimum, and this realisation of smart cities will be made possible by the use of IOT. RFID is one such technology that can work wonders if used in traffic management.

The idea is to attach a RFID tag to each vehicle present on the road and to place RFID readers at strategical location near the traffic signal. This will provide unique identification to each vehicle and thus exact density of traffic can be calculated which can be used in turn to change the duration of traffic lights dynamically.

Moreover, traffic violators can be uniquely identified by their respective tag numbers and their information can be used by the police to charge adequate fines. Also for ambulances, whichever path they chose will be turned green immediately while rest of the signals will be turned red to provide emergency exit to them. Another advantage is that commuter can access the traffic density on various paths through online portal and decide accordingly.

II. LITERATURE REVIEW

A. Recent advancements in Wireless Sensor Network (WSN) have made intelligent traffic management a realistic possibility.[1]
B. The advancement of IOT and high availability of Cloud resources can help in better utilization of our present resources.[3]
C. Countries like Honkong and Singapore are currently managing traffic by using IOT and AI.
D. IoT devices [4] are used to acquire the traffic related on-line information quickly and further sent for processing at the Big data analytics [3] centres.

III. INFERENCE FROM LITERATURE

The currently used intelligent management of traffic have following shortcomings:

A. Inductive loop detection

Reliability may decrease due to improper connections or application [6] of a sealant on the road surface. This system will be highly unreliable in places where digging of roads is frequent and where roads have poor pavement

B. Infra-red sensors

The disadvantage of this method is that it will be affected by changes in the weather, such as smog. The sensors may operate using line of sight (LOS) detection. Thus, vehicles in the LOS system's blind spots will not get detected. Also, the cost of maintaining such a system is high

IV. PROPOSED ARCHITECTURE OF THE SYSTEM

The system consist of multiple RFID readers placed in each direction of a road crossing some distance apart from each other. These readers are all controlled by a Central Computer(CC).Whenever a vehicle comes into the range of a reader, it tracks the car through the tag (RFID) attached to it and retrieves the data stored in that tag. The main information stored in this tag is a unique Vehicular ID (VID) which is assigned to that particular vehicle. This VID is looked up in a table and matched against records of individual vehicles where information like VIN, priority, owner's information etc. are saved. The diagrammatic representation of traffic management system is shown in fig 1. The data retrieved is then immediately sent to the CC which contains a database processing system for processing data of vehicles and a Decision Making system (DMS) to control the traffic.

A. Decision Making System(DMS)

The DMS decides, how the traffic lights are operated and it works on a predefined algorithm. The algorithm takes into account the following factors:

1) The traffic volume that is supplied by the database. The lane with maximum volume is shown green light.

2) Fluctuations in the volume of traffic are very rapid, so based on this alone the signals can't be changed. Therefore a minimum time slot is decided after which there is a need to calculate the volume of traffic again.

3) A maximum signal time is also set after which traffic lights have to change .This ensures that no vehicle is waiting too long at the traffic signal.
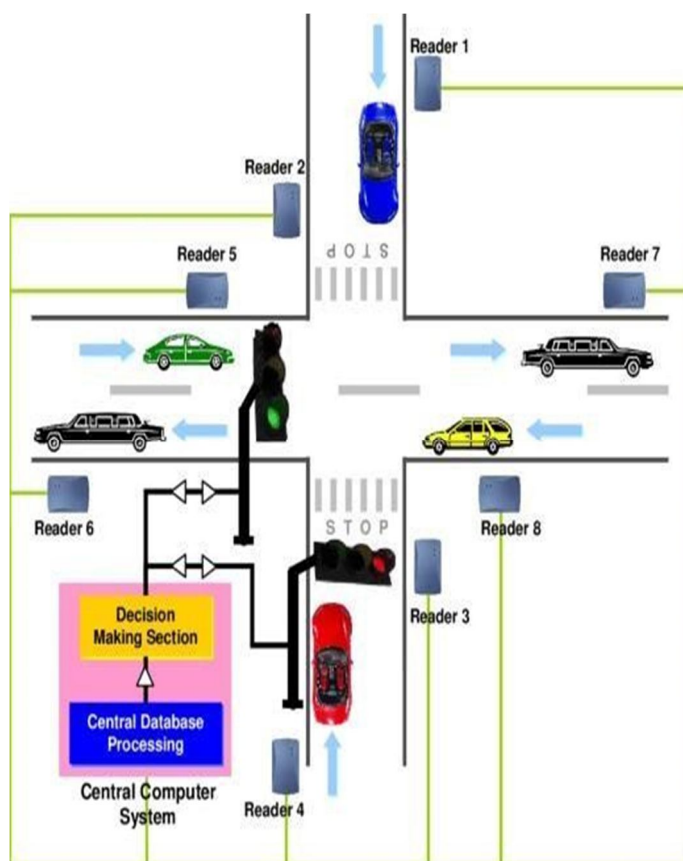

Fig 1. Diagrammatic representation of ITMS

B. Database Processing System

The database contains various parts and it takes the vehicle's data and arrange them according to parameters like travel direction, path etc. Whenever there is vehicular motion near the junction, the two readers convey that information to the central computer. This data comes with some time gap which is used to determine volume of traffic and the order in which readers are sending information, is used to determine the direction of travel. Once the vehicle is out of range, it's data is transferred from dynamic database to fixed database.
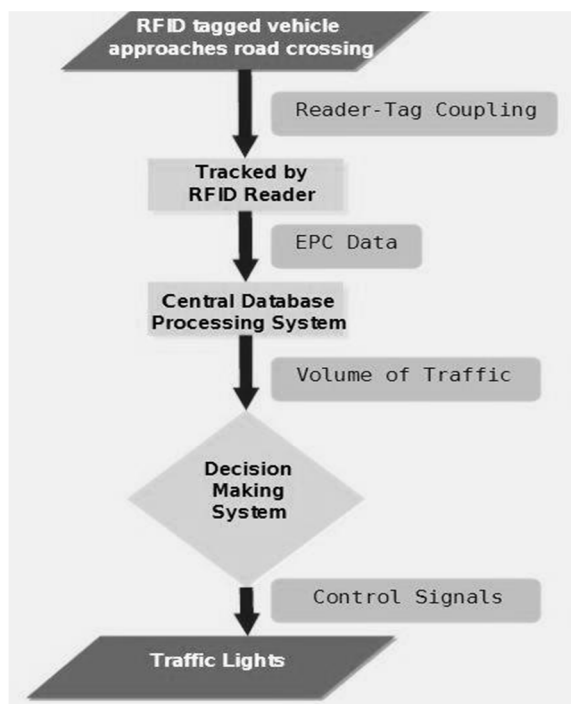
Fig 2. Flow chart representing decision making

V. ADVANTAGES OF ITMS

This system changes the traffic lights according to the need of the traffic and not according to some fixed schedule. There are many dynamic methods present in the world to manage traffic dynamically but the novelty of this system lies in the way the volume of traffic is calculated. The ITMS holds following advantages over other traffic management system:

A. Irrespective of the volume of traffic, ambulances, VIP vehicles etc. can be given emergency passage.
B. During rush hours school buses and cars can be given priorities.
C. Traffic violators can be uniquely identified even at night time. Also the time and direction of their motion at the time of violation can be used for statistical purposes.

VI. ENHANCEMENT POSSIBLE IN FUTURE

A few more features that can be added to the ITMS are as follows:

A. The system can also work if one of the readers present in a path fails. In such cases the working reader from that path sends the data to the computer, the system checks whether the vehicle has crossed any other reader which is present on a path that converges on our original path's intersection. This information can be used to know the direction of vehicle's travel. Handshaking acknowledgements can be used to share such information between readers and computer.
B. The initial cost of setup will come down definitely if the tags are mass produced in abundance. Also the tags must be durable and should have a larger life span. Moreover security techniques will also be required to prevent tag spooling etc.
C. The two readers on each path are placed such that they are on opposite sides. This will be useful if there is a need to broaden the roads. In such cases only one reader can be used to work the traffic.

VII. CONCLUSION

An architecture for designing an intelligent traffic management system is provided in this paper. The system is simple ,works on RFID tracking principle ,could operate easily in real time ,can improve traffic safety and flow and does not involve human intervention at most levels. Thus it saves cost involved in human resource and also prevents the possibility of human error. The advantages of ITMS heavily outnumber its disadvantage of having a high setup cost and also vouch for it's efficiency in managing traffic.

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