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Traffic lane controller using RFID and IoT

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Abstract

Traffic in urban areas is increasing day by day which leads to most critical issues of traffic management this paper proposes a smart and fully automatic traffic control system that will detect and control the congestion in real time, detect a stolen vehicle and also passes emergency vehicles smoothly with the use of passive RFID device. This effectively reduces travel delays and relieves congestion, it is necessary to control lane merge behaviors of freeway. Depending upon the count of vehicles green passage will be set dynamically and the proposed system provides special privileges for emergency vehicles like police vehicle, ambulance, VIP vehicles, etc.

Keywords*: RFID Tag, RFID reader, GSM, ZigBee, TICS*

1. Introduction

RFID tags placed at every 500m on road would be read by the RFID reader on the vehicle, and transmit the read tag id to the cloud. Traffic light posts are placed at the traffic junction. Traffic light set the green passageway for specific period of time which is not a complete systematic system as it cannot solve the traffic problems fully. The proposed system will have RFID readers at the vehicles that will read all the RFID tags attached on road coming towards the junction. RFID technology consists following components.

A. Radio-frequency-identification (RFID) tag

RFID tag uses small radio frequency identification and tracking purpose and track tags attached to objects automatically. The tags contain electronically saved information. It contain an integrated circuit and an antenna, which are used to transmit data to the RFID reader Passive tags gain energy from a nearby RFID reader's interrogating radio waves. Active tags have their own power source such as a battery and may operate at hundreds of meters from the RFID reader.

B. RFID reader

The purpose an RFID reader's is to identify RFID tags. A reader contains a Radio Frequency module, which acts as both a transmitter as well as receiver of radio frequency signals. To generate the carrier frequency, the transmitter contains of an oscillator. The receiver has a demodulator to extract the returned data and also for processing it contains an amplifier to strengthen the signal. A microprocessor forms the control system, memory to filter and store the data. The data is then ready to be sent to the network. RFID technology [1] uses digital data within RFID tag, which is made up of integrated circuits which contains a small antenna for transferring information to RFID readers. The greater part of RFID tags enclose as a minimum an integrated circuit for demodulating and modulating RF waves and an antenna. Frequency ranges differ from low frequencies of 125 to 134 kHz and 140 to 148.5 kHz, and high frequencies of 850 to 950 MHz and 2.4 to 2.5 GHz. Wavelengths in the 2.4 GHz range.

2. Existing System

A. Camera

There will be four cameras in one intersection for a junction road. A CPU will be connected with these cameras which will be used for video processing. The RFID will be positioned under the road for

detection of the car. The hardware's used: HD Camera [4], CPU (For video processing), Microprocessor (For traffic light controlling) and RFID Reader (For vehicle Detection) which will be besides the road. Then using Frame by frame Real-time video analysis through Developed algorithm, how much cars are present on the Road can be detected. Depending on the number of Detected vehicles implementation of a serial traffic Timer system is done. This information will be transmitted to CPU or the central database. According to this automatic traffic system, the traffic light ON/OFF will depend on the number of Vehicles on the Road. The CPU will detect each and every car and will Count the vehicle number in the road by using the Developed algorithm. It will also do the same thing with other side of the road by using another camera. CPU then compares vehicle number on adjacent roads. The road which has more vehicles will get the preference and green Light for that road will be set on and red signal will be displayed automatically to the other road. Traffic lights will be connected to the central system and intelligent System will control the traffic light system.

B. WSN

The work in proposed an approach to integrate Wireless Sensor Network (WSN) in the RFID Reader to implement Traffic controlling system where motion sensors are used to transmit signal to the RFID reader to enter in the read Area when it detects the RFID tag and then RFID Reader Reads the contents of RFID tag and pass this information to Host via IEEE 802.15.4/ZigBee standard, which reduces Cost and time required by eliminating the wired Installation of cable. Each intersection contains 8 RFID readers. The road is divided into two separate lanes. Each lane has its RFID Reader to track the vehicles passing through it. Each Intersection point has its separate database to store the Information regarding the vehicles that passed from junction. Every vehicle has a RFID enabled device that stores a vehicle identification number (VIN) [5]. The duty of the smart traffic controller is to compute the time of green signal specifically basis on the amount of vehicle and also solve the problem of starvation. This is recommended for object detection and contour tracing. After finding the edges then count objects as defined by the edges. RFID TAG must be installed in each and every vehicle that is being used. RFID READER placed at most critical spots on road would be read by the on the vehicle, and transmit the read tag id to the cloud. The Tag information table in cloud would fetch information regarding the Locality/Road/Lane [6]. The data base of the vehicle which is maintained by control room.

C. GPS system and ZigBee

This proposed system has three parts. First part contains Equipped with an RFID tag and reader at traffic junction. When it comes in the range of RFID reader, it will send the signal to the RFID reader which will track how many Vehicles have passed through the junction for a specific Period of time and determine the traffic congestion volume.

Accordingly, it sets the green passage for that particular path. Second part is for the emergency vehicle detection and clearance. Here, each emergency vehicle contains ZigBee transmitter and the ZigBee receiver will be present at the traffic junction. The buzzer will be turned ON when the vehicle is used for emergency. This will send the signal through the ZigBee transmitter to the Receiver. It will turn the traffic light to change to green. Once the ambulance passes through junction, the receiver no longer receives the ZigBee signal and the traffic light is switched to red. RFID and GPS based automatic traffic clearance system for ambulance.

The motivation of this job is to decrease the delay for the ambulance to reach to the hospital by automatically clearing the traffic lane, before it reaches the traffic signal. The third part is for detection of stolen vehicle. Here, when the RFID reader reads the RFID tag, it compares it to the registered stolen RFIDs and GPS are positioned together with the stolen automobile recognition module [2], so that the exact location of stolen vehicle is known. But when a equal is create, it transmits SMS toward control room of police, so that the vehicle is made to stop in the traffic junction and local police can take appropriate action.

3. Proposed System

In this paper we propose to install an intelligent tracking device on every vehicle. The reader would provide following features for controlling the Traffic in Highways,

- Ensures the Vehicles running on Highways follow lane discipline
- Identifies and Reports cause for Congestion in a fast track road.
- Enables automated deduction of violations and charges penalties or license cancellation etc.
- Helps in Reducing Bribery in the Traffic control mechanisms in avoiding Violations.

- Increases consciousness in vehicle operators.
- Creates ways to new Traffic prediction to reduce the influence of lane closure, this paper designs the control flow of Intelligent Lane Merge Control System (ILMCS) [3] with ITS techniques, and constructs Traffic Information Collection System, Traffic Information Process and Decision System and Traffic Information Release System of ILMCS.

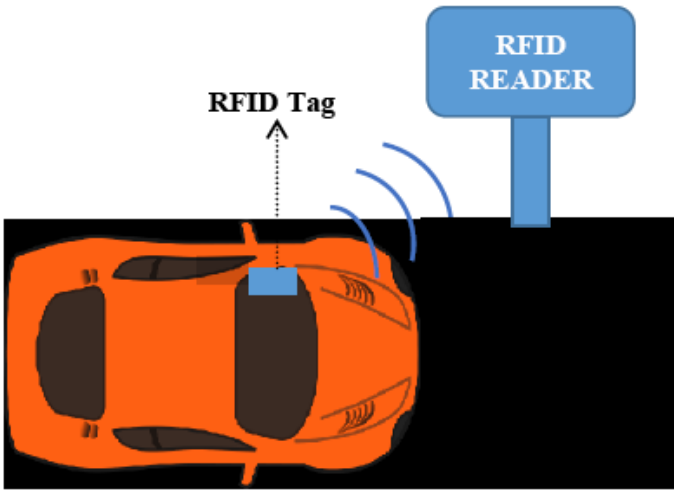

Fig.1. Design of proposed RFID tag system

The system identifies traffic states by analyzing real-time data collected by traffic detectors and then adopts adaptive lane merge control strategies by analyzing the extent of traffic congestion. At last, the paper evaluates ILMCS performances by simulation. The results show the performances of ILMCS exceed conventional merge controls, dynamic early merge control and dynamic late merge control, especially in improving freeway work zones safety and capacity.The main components of ILMCS are Traffic Information Collection System (TICS), Traffic Information Process and Decision System (TIPDS) and Traffic Information Release System (TIRS). TICS is the basis of ILMCS, using traffic detectors to collect data and transfer to TIPDS by communication network. TIPDS is the core component of ILMCS to decide which control strategy should be adopted. TIRS releases control strategy information to travelers by using a series of VMS, then to realize dynamic control of the lane merge. fig.1 shows the TICS, TIPDS and TIRS components and data flow.

Traffic state is detected by traffic volume, velocity and occupancy data. ILMCS triggers DEM when traffic volume is low and the system controls the first piece of VMS upstream to show “Left (or Right) Lane Do Not Pass/ When Flashing”. With the increasing of traffic volume, the upper VMS are triggered in sequences, until the final piece of VMS on upstream. If traffic volume continues to increase, when the queue diffuses to upstream of WZ and ILMCS transfers to DLM, where all VMS show the message of “Use Both Lanes to Merge Point/ When Flashing”. With the real-time change of traffic states, the control strategy of ILMCS also changes adaptively.

Traffic state is detected by comparing traffic data collected from TICS with the decision thresholds and the detection algorithms. Some traffic detectors are installed on VMS to monitor traffic density and congestion. When stopped vehicles are detected in the open lane next to a sign, a signal is transmitted to turn on the flashing strobes on the next sign upstream while automobiles are running once more, the strobes will shut off. In this way, the length of the no-passing zone is adapted to the length of congestion at any moment; thereby it can increase the capacity.

Finally the GSM module number is interfaced with IOT cloud which manage the database of vehicles and these are accessed by control room TICS act as IOT platform that collect the information and by using intelligence if any vehicle cross the speed limit of the Lane then vehicle details is noted in control room.

4. Conculsion

The previous systems work efficiently to manage to manage the traffic but does not provide quality of service for additional emergency and stolen vehicles and use Hardware like ZigBee etc. and complicate the system. The Proposed system works effectively and with higher accuracy in managing the traffic at junction with different priorities at different time.

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