World Academy of Science, Engineering and Technology
International Journal of Mechanical and Mechatronics Engineering
Vol:7, No:2, 2013

Traffic Violation Detection System based on RFID

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***Abstract*—**Road Traffic Accidents are a major cause of disability and death throughout the world. The control of intelligent vehicles in order to reduce human error and boost ease congestion is not accomplished solely by the aid of human resources. The present article is an attempt to introduce an intelligent control system based on RFID technology. By the help of RFID technology, vehicles are connected to computerized systems, intelligent light poles and other available hardware along the way. In this project, intelligent control system is capable of tracking all vehicles, crisis management and control, traffic guidance and recording Driving offences along the highway.

***Keywords*—**RFID, Intelligent highway, Traffic violation

I. Introduction

THE main types of Traffic Violations are 'Moving Violations' and 'Non-Moving Traffic Violations'. Driving offences involving fatalities are 'dangerous driving' and 'careless or inconsiderate driving'. A moving violation can only be issued if the car is in motion. A person drives dangerously when the way they drive falls far below the minimum acceptable standard expected of a competent and careful driver; and it would be obvious to a competent and careful driver that driving in that way would be dangerous [1].

Some typical examples from court cases of dangerous driving are:

- Speeding, Racing, Weaving
- Ignoring traffic lights, road signs
- Overtaking dangerously
- Knowing the vehicle has a dangerous fault or an unsafe load
- Permitting to drive without valid license
- Drove on wrong side of divided highway

A person drives carelessly or inconsiderately when the way they drive falls below the minimum acceptable standard expected of a competent and careful driver. Some examples of careless driving are:

- Overtaking on the inside
- Driving through a red light by mistake
- Cut across driveway to make turn
- Parked in No Parking area
- Leaving vehicle in dangerous position
- Speed under minimum

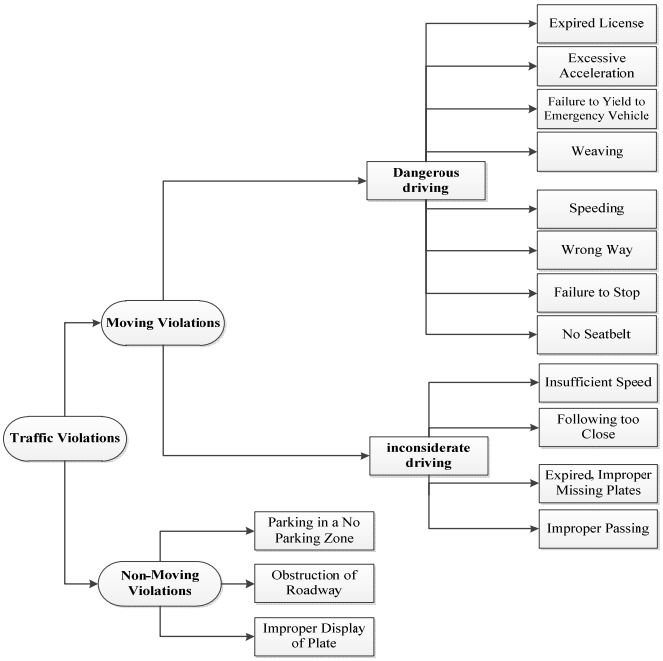

Fig. 1 Traffic violation types

II. The RFID System

RFID is an electronic method of exchanging data over radio frequency waves. An RFID system is comprised of several components including:

- Antennas: Linear or Circular polarized.
- Readers: This is sometimes referred to as an interrogator.
- Tags: This is sometimes referred to as a transponder.
- Software: This may also be referred as middleware.

Antenna: The antenna emits radio signals to activate the tag and read and write data to it. Antennas are available in a variety of shapes and sizes; they can be built into a doorframe to receive tag data from persons or things passing through the door, or mounted on an interstate tollbooth to monitor traffic passing by on a freeway. Antennas can also be mounted on mobile devices and under print heads.

Readers: Often the antenna is packaged with the transceiver and decoder to become a reader, which can be configured either as a handheld or a fixed-mount device. The reader emits radio waves in ranges of anywhere from one inch to 100 feet

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or more, depending upon its power output and the radio frequency used. When an RFID tag passes through the electromagnetic zone, it detects the reader's activation signal. The reader decodes the data encoded in the tag's integrated circuit (silicon chip) and the data is passed to the host computer for processing.

Tags: There are a variety of RFID tag types. Selecting the correct tag will be imperative to ensure a proper functioning system.

A tag is comprised of:

- Silicon chip: Integrated circuit (IC chip) that contains the data.
- Antenna: An antenna is attached to the chip in order to receive and transmit its data.
- Substrate: This is the paper or plastic film or housing that the chip and antenna are mounted on.

RFID tags can be active, semi-passive (semi-active) or passive [2].

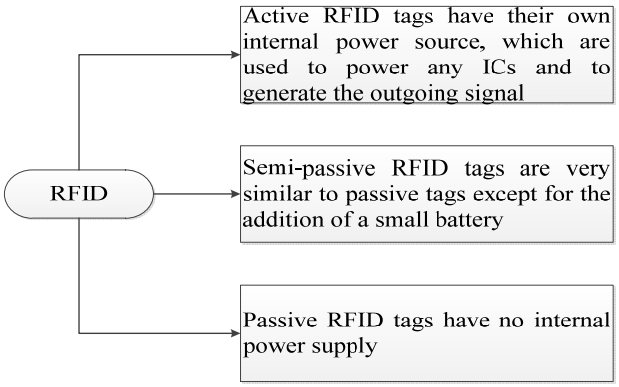

Fig. 2 RFID types

- Passive RFID tags have no internal power supply. The minute electrical current induced in the antenna by the incoming radio frequency signal provides just enough power for the CMOS integrated circuit (IC) in the tag to power up and transmit a response. Most passive tags signal by backscattering the carrier signal from the reader. This means that the antenna has to be designed to both collect powers from the incoming signal and to transmit the outbound backscatter signal.
- Semi-passive RFID tags are very similar to passive tags except for the addition of a small battery. This battery allows the tag IC to be constantly powered. This removes necessity the aerial to collect power from the incoming signal. Therefore, Aerials can be optimized for the backscattering signal. Semi-passive RFID tags are faster in response and therefore stronger in reading ratio compared to passive tags.
- Active RFID tags or beacons, on the other hand, have their own internal power source, which are used to power any ICs and to generate the outgoing signal. They may have longer range and larger memories than passive tags, as well as the ability to store additional information sent by the transceiver. To economize power consumption, many beacon concepts are operated at fixed intervals [3].

Software: A consistent intelligent system requires consistent components such as intelligent software for crisis management, reporting and training the system for different conditions. Therefore, genetic algorithm plays a significant role. In this project, the genetic algorithm of artificial intelligence or feedback is used. Genetic algorithms are one of the best ways to solve a problem for which little is known. They are a very general algorithm and so will work well in any search space. All you need to know is what you need the solution to be able to do well, and a genetic algorithm will be able to create a high quality solution. Genetic algorithms use the principles of selection and evolution to produce several solutions to a given problem [4].

III. Methodology Employed

A. Intelligent Highway with RFID

The general process of the system is as the following: in the mentioned system, all the vehicles are equipped with RFID. Along the highway, intelligent light poles which are equipped with RFID Reader, Solar Cells, etc. are used. In the entry and exit points on highway, road sign readers are used for activating/emitting record through local and global networks with wireless technology to the central computer. Light poles whose energy is provided through solar cells cover both sides of the highway in the form of every three poles [5].

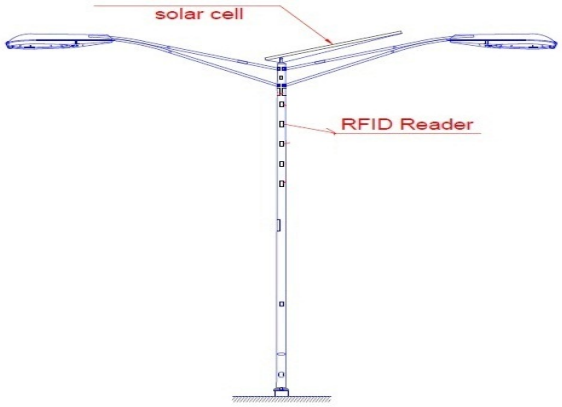

Fig. 3 Intelligent light pole

Cars and intelligent light poles sensors communicate with together by Short Range Communications protocol. RFID and wireless technologies allow vehicles to send and receive information to intelligent light poles sensors on the highway. Signals from vehicles will carry data such as car ID , position, etc. on the other hand; signal from intelligent light poles, will carry Data such as information about traffic conditions, accidents, the weather, etc. For example if one car stops suddenly or move in wrong direction, data center can send information to intelligent light poles on the road [6], [7].

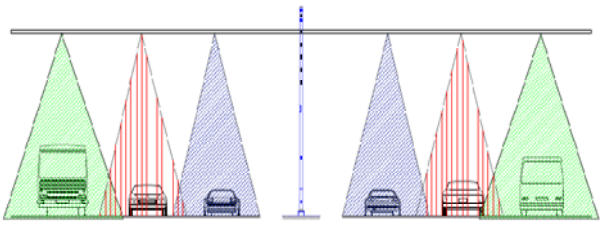

Fig. 4 Lane detection

The operations conducted by the components of the system are as the following:

- Recording information on the vehicle's tag while entering the highway;
- emitting signals through RFID to the intelligent light poles along the highway;
- disseminating information such as traffic guidance and warning through the intelligent light poles to the cars along the highway;
- collecting the information of the cars along the way in the particular installed places and disseminating them to the central computer;
- Removing the information off the vehicle's tag while leaving the highway and recording it in the vehicle's records.

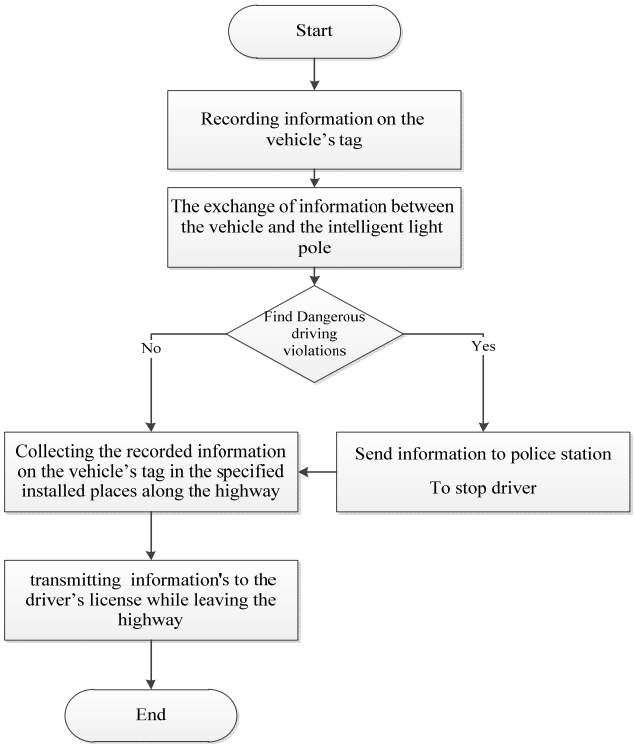

Fig. 5 Flowchart of system steps

In the first phase, all the vehicles that tend to move along the highway pass under the installed readers on the road lines, by which the vehicle is reported to the data center. Due to the vehicle user type, either private or public, the following operations are done:

After analyzing the mentioned factors, if there is a problem with the vehicle, it is guided to a suitable exit. While moving along the highway, the vehicle constantly reports itself through using communicative signals between the tags and the present readers in the intelligent light poles.

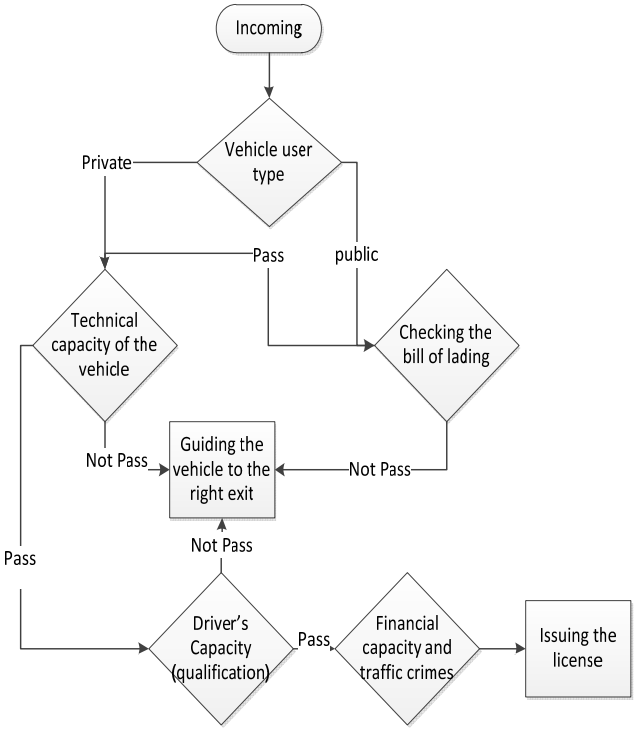

Fig. 6 Mechanism of system

B. *Driving offences detection*

The vehicle may fall under the following circumstances:

1. Stop mode

Detect: Parking in a No Parking Zone / Stop / Accident

If a signal is sent to an intelligent light pole from an area out of parking space, a warning in a specified time will be sent to the patrol units using software. Now if this stop has taken place in the main lines of the road, or more than one signal is emitted from the same area, the signal will be subsequently sent to the emergency vehicles and the area police.

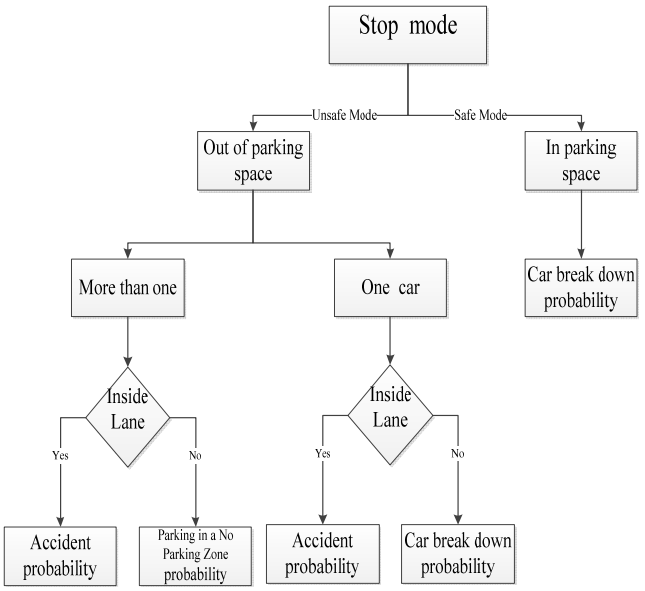

Fig. 7 Detect Parking in a No Parking Zone / Stop / Accident

2. Horizontally: moving along one lane

Detect: Speeding / Speed under minimum / wrong way

In this case, the vehicle may fall under two situations [8]:

- Moving along the right direction and in one lane
- Moving along the counter direction: the reverse light pole numbers appear on the tag.

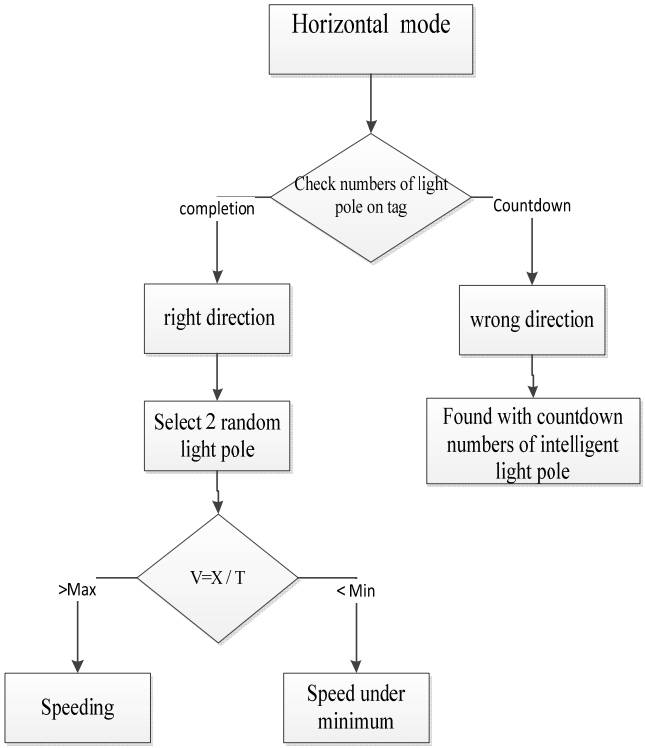

Fig. 8 Speeding / Speed under minimum / wrong way

IV. Conclusion

Conducting the above project, the following data is being sent to the data center:

- The exact place of the vehicle and its direction
- The vehicle's just in time speed
- Time and place of the accident
- The exact place of the traffic congestion
- Driver's status
- The capacity of analyzing the data for the crisis stations
- The capacity of recording the data history (as the input feedback in the software)

The key point at stake in the correct analysis and documented conclusion is the comprehensive and flawless data in the decision making centers. According to the above mentioned elements, two significant actions can be conducted.

A) Just in Time (JIT) decision making:

The just in time statistics and information makes any kind of programming and altering method possible for the sake of optimizing system.

B) Today, in most parts of the world, anticipating the future and pre-programming leads to the augmentation of the efficiency and placing the necessary equipment in the necessary places. With paying little attention, it becomes known that this method has less delay in comparison to JIT method. For this purpose, through using the history of the past and locating, the most of the future events can be predicted. Consequently, by decreasing the time of delay, the efficiency will certainly increase.

Some of the advantages of using this system are as the following:

- Increasing traffic's safety
- Decreasing the cost: such as traffic fatalities, financial damages and fossil fuels
- Decreasing delay time while entering and leaving the highway
- Decreasing traffic crimes

References

[1] A. Aitouche and S. Hayat. Multiagent model using coloured petri nets for the regulation traffic of an automatedhighway. Journal of Intelligent Transportation Systems, IEEE, 1:37–42, 2003.

[2] Syed Ahson, Mohammad Ilyas, RFID handbook : applications, technology, security, and privacy,Taylor & Francis Group ,2008

[3] S.Hajeb, P.Parvizi, F.Norouzi Fard, "Safe Lines to Transit in Tehran's BRT," International Journal of Science and Engineering Investigations, vol. 1, issue 1, pp. 113-118, February 2012.

[4] G. Kotusevski, K.A. Hawick, "A Review of Traffc Simulation Software," in Conf. Information and Mathematical Sciences, New Zealand, July 23, 2009.

[5] P.Parvizi, P.Parvizi, "Tehran-Tabriz Intelligent Highway," International Journal of Science and Engineering Investigations, vol. 1, issue 1, pp. 58-61, February 2.

[6] S. Wenchao X. Jianmin Y. Feng, "An Intelligent Transportation Simulation System Based on RFID Orientation Technology," CNKI:SUN:JTJS.0.2009-01-031.

[7] W. Hongjian, T. Yuelin, L. Zhi, " RFID Technology Applied in Highway Traffic Management (Periodical style)," Conference on Optoelectronics and Image Processing, vol. 2, pp. 348-351, November 2010.

[8] Zhang Yan, "Modeling Automated Highway Systems with VeriJ," No1, September 2011.