iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 6 **Issue:** III **Month of publication:** March 2018

DOI: http://doi.org/10.22214/ijraset.2018.3539

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue III, March 2018- Available at www.ijraset.com

Survey on Implementing Vehicular Congestion Control System Using IR Sensors and Emergency Vehicle Clearance System Using RFID Technology

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Abstract: ***This paper presents an intelligent traffic control system to reduce the vehicular congestion and to clear path for emergency vehicles to travel smoothly. Each terminal in a junction consists of IR sensors, at specific distances from the traffic signal. The IR sensors are used to calculate the density of the vehicles at each terminal. By comparing the density of all the terminals at a junction, the system decides which terminal should be given green signal. Each emergency vehicle (ex. Ambulance, Fire engine) are equipped with special RFID tags(placed at a strategic location), which makes it impossible to remove or destroy. When an ambulance or a fire engine approaches the junction, the RFID reader placed at the junction detects them and clears the vehicular traffic of the terminal in which the emergency vehicle is approaching. RFID is used only when there is no internet connection or the network is poor. When the network is good, the ZigBee trans-receiver module is used to communicate between the emergency vehicle and the junction.***

Keywords: ***IR sensors, RFID tag, RFID reader, Zig Bee trans-receiver module, Traffic congestion, Emergency vehicle***

I. INTRODUCTION

INDIA is the second most populous Country in the World and is a fast growing economy. Road congestion is an ever growing problem as the number of vehicles is growing exponentially and the road infrastructure cannot be increased proportionally. This leads to increasing traffic congestion. It is seeing terrible road congestion problems in its cities. Infrastructure growth is slow as compared to the growth in number of vehicles, due to space and cost constraints [1]. Also, Indian traffic is non lane based and chaotic. It needs a traffic control solutions, which are different from the developed Countries [2].

Fig.1 traffic congestion at a signal

Traffic congestion occurs due to high volume of traffic or high vehicle density within a particular stretch of road. A vehicle may slow down owing to numerous reasons, leading to the subsequent slowing down of the following vehicles and hence causing traffic congestion. These reasons have been studied vastly and different technologies have been explored to detect and control traffic congestion. Most popular method of controlling traffic is a traffic signal which operates simply on timers. They are programmed to function in a specific manner irrespective of the traffic at a given time of the day. Inevitably, they fail to avoid congestion. However, these days detectors are commonly employed which use the most common technique of inductive loop. Other technologies include

GPS devices, Radar technology etc. But these technologies have several drawbacks for example they fail in certain situations, have installation and maintenance problems and cost limitations etc. [1].

Fig. 2 traffic congestion of vehicles waiting in signal

Intelligent management of traffic flows can reduce the negative impact of congestion. In recent years, wireless networks are widely used in the road transport as they provide more cost effective options [2]. In this paper, we propose a smart and fully automatic system that can detect congestion in real time, and subsequently manage it efficiently to ensure smooth traffic flow with the use of IR sensors.

To implement emergency vehicle clearance system we use RFID technology and ZIGBEE technology, An RFID i.e. Radio Frequency Identification system consists of two main components, the small transponder, more commonly known as a tag, which is attached to the item needing identification (here, vehicles) and the interrogator, or reader, which in some cases is used to both power the tag and read its data without contact. The RFID tag consists of all the information regarding the item to which it is attached and this can be wirelessly transmitted to the reader [2].

A. IR sensor

An infrared sensor is an electronic instrument which is used to sense certain characteristics of its surroundings by either emitting and/or detecting infrared radiation. Infrared sensors are also capable of measuring the heat being emitted by an object and detecting motion.

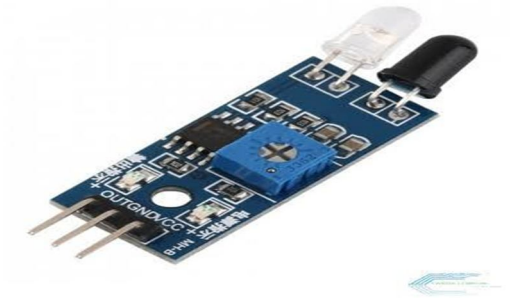

Fig. 3 Infrared sensor module

B. RFID Tag

A radio-frequency identification system uses tags, or labels attached to the objects to be identified. Two-way radio transmitter-receivers called interrogators or readers send a signal to the tag and read its response [3].RFID tags can be either passive, active or battery-assisted passive. An active tag has an on-board battery and periodically transmits its ID signal. A battery-assisted passive (BAP) has a small battery on board and is activated when in the presence of an RFID reader. A passive tag is cheaper and smaller because it has no battery; instead, the tag uses the radio energy transmitted by the reader. However, to operate a passive tag, it must be illuminated with a power level roughly a thousand times stronger than for signal transmission. That makes a difference in interference and in exposure to radiation [3]. Tags may either be read-only, having a factory-assigned serial number that is used as a key into a database, or may be read/write, where object-specific data can be written into the tag by the system user. Field

programmable tags may be writing once, read-multiple; "blank" tags may be written with an electronic product code by the user [3]. RFID tags contain at least three parts: an integrated circuit for storing and processing information
that modulates and demodulates a radio-frequency (RF) signals; a means of collecting DC power from the incident reader signal; and an antenna for receiving and transmitting the signal. The tag information is stored in a non-volatile memory. The RFID tag includes either fixed or programmable logic for processing the transmission and sensor data, respectively [3].
An RFID reader transmits an encoded radio signal to interrogate the tag. The RFID tag receives the message and then responds with its identification and other information. This may be only a unique tag serial number, or may be product-related information such as a stock number, lot or batch number, production date, or other specific information. Since tags have individual serial numbers, the RFID system design can discriminate among several tags that might be within the range of the RFID reader and read them simultaneously [3].

Fig. 4 RFID tag

C. RFID Reader

RFID systems can be classified by the type of tag and reader. A Passive Reader Active Tag (PRAT) system has a passive reader which only receives radio signals from active tags (battery operated, transmit only) [3]. An Active Reader Passive Tag (ARPT) system has an active reader, which transmits interrogator signals and also receives authentication replies from passive tags [3]. An Active Reader Active Tag (ARAT) system uses active tags awoken with an interrogator signal from the active reader. A variation of this system could also use a Battery-Assisted Passive (BAP) tag which acts like a passive tag but has a small battery to power the tag's return reporting signal [3]. Fixed readers are set up to create a specific interrogation zone which can be tightly controlled. This allows a highly defined reading area for when tags go in and out of the interrogation zone. Mobile readers may be hand-held or mounted on carts or vehicles [3].
Signaling between the reader and the tag is done in several different incompatible ways, depending on the frequency band used by the tag. Tags operating on LF and HF bands are, in terms of radio wavelength, very close to the reader antenna because they are only a small percentage of a wavelength away. In this near field region, the tag is closely coupled electrically with the transmitter in the reader. The tag can modulate the field produced by the reader by changing the electrical loading the tag represents. By switching between lower and higher relative loads, the tag produces a change that the reader can detect. At UHF and higher frequencies, the tag is more than one radio wavelength away from the reader, requiring a different approach. The tag can backscatter a signal. Active tags may contain functionally separated transmitters and receivers, and the tag need not respond on a frequency related to the reader's interrogation signal [3].

Fig. 5 RFID reader module

D. ZigBee

ZigBee is a cost and energy efficient wireless network standard used for exchange of information. Zigbee is an IEEE 802.15.4-based specification for a suite of high-level communication protocols used to create personal area networks with small, low-power digital radios, such as for home automation, medical device data collection, and other low-power low-bandwidth needs, designed for small scale projects which need wireless connection. Hence, Zigbee is a low-power, low data rate, and close proximity (i.e., personal area) wireless ad hoc network [3]. The technology defined by the Zigbee specification is intended to be simpler and less expensive than other wireless personal area networks (WPANs), such as Bluetooth or more general wireless networking such as Wi-Fi[3].Its low power consumption limits transmission distances to 10–100 meters line-of-sight, depending on power output and environmental characteristics. Zigbee is typically used in low data rate applications that require long battery life and secure networking [3].

Fig. 6 ZigBee trans-receiver module

II. EXISTING SYSTEM

Traffic congestion is a major problem in cities of developing Countries like India. Growth in urban population and the middle-class segment contribute significantly to the rising number of vehicles in the cities. Congestion on roads eventually results in slow moving traffic, which increases the time of travel, thus stands-out as one of the major issues in metropolitan cities [1].
In the current method, when an emergency vehicle is approaching a traffic signal, the traffic police have to manually clear the traffic and make way for the emergency vehicle. This is not so reliable as large traffic cannot be controlled manually, and also requires more time to clear the traffic.

A. Disadvantage of Existing system

1) Present Traffic lights works on timer based mode.
2) Doesn't analyze the traffic congestion.
3) More energy consuming.
4) Doesn't recognize emergency vehicle.
5) No proper centralized monitoring device.

III. PROPOSED SYSTEM

RFID technique deals with multivehicle, multilane, multi road junction areas. It provides an efficient time management scheme, in which, a dynamic time schedule is worked out in real time for the passage of each traffic column the focus of this work is to reduce the delay in arrival of the ambulance to the hospital by automatically clearing the lane, in which, ambulance is travelling, before it reaches the traffic signal. This can be achieved by turning the traffic signal, in the path of the ambulance, to green when the ambulance is at a certain distance from the traffic junction. The use of RFID distinguishes between the emergency and non-emergency cases, thus preventing unnecessary traffic congestion.

A. Advantages Of Proposed System

1) Better analysis of traffic using IR sensors.
2) Better device to device communication.
3) Emergency vehicle can be recognized using RFID tags.
4) Less energy consuming.
5) Better centralized analysis.

IV. ARCHITECTURE AND BLOCK DIAGRAM

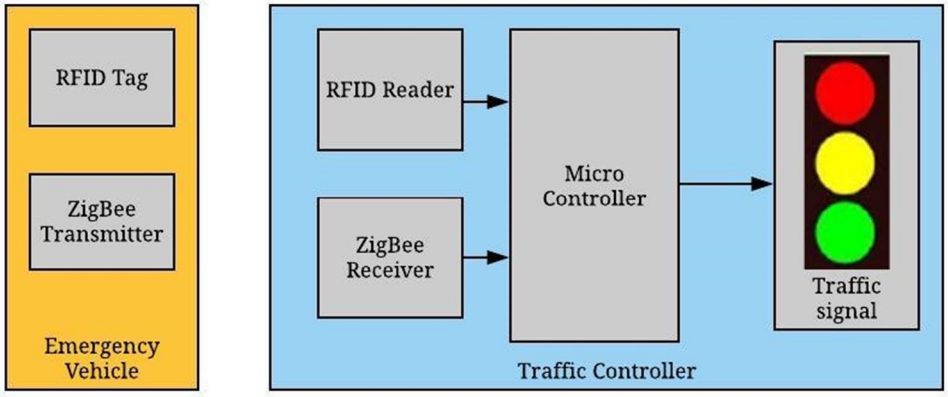

Fig. 7 Block diagram of proposed system using RFID and ZigBee

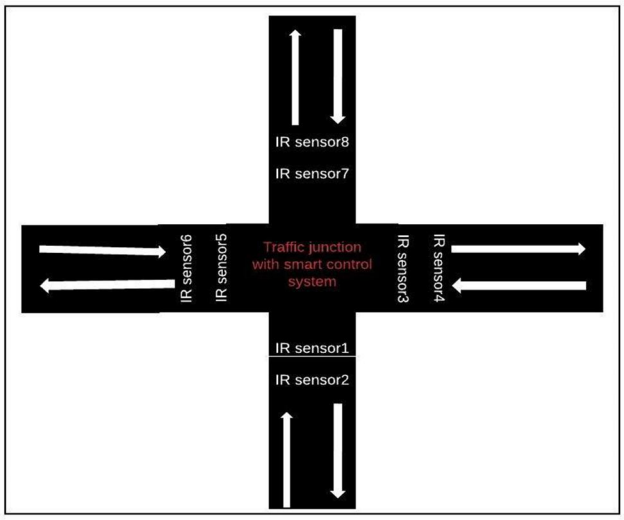

Fig. 8 Proposed system implementation model

V. FUTURE ENHANCEMENT

A. Stolen Vehicle Detection System

In this module, for testing purpose, we compare the unique RFID tag read by the RFID reader to the stolen RFIDs stored in the system. If a match is found, then the traffic signal is immediately turned to red for duration of 30 seconds.

VI. CONCLUSION

With automatic traffic signal control based on the traffic density in the route, the manual effort on the part of the traffic policeman is saved. As the entire system is automated, it requires very less human intervention. With stolen vehicle detection, the signal automatically turns to red, so that the police officer can take appropriate action, if he/she is present at the junction. Also SMS will be sent so that they can prepare to catch the stolen vehicle at the next possible junctions. Emergency vehicles like ambulance, fire trucks, need to reach their destinations at the earliest. If they spend a lot of time in traffic jams, precious lives of many people may be in danger. With emergency vehicle clearance, the traffic signal turns to green as long as the emergency vehicle is waiting in the traffic junction. The signal turns to red, only after the emergency vehicle passes through. Also GPS can be placed into the stolen vehicle detection module, so that the exact location of stolen vehicle is known[1].

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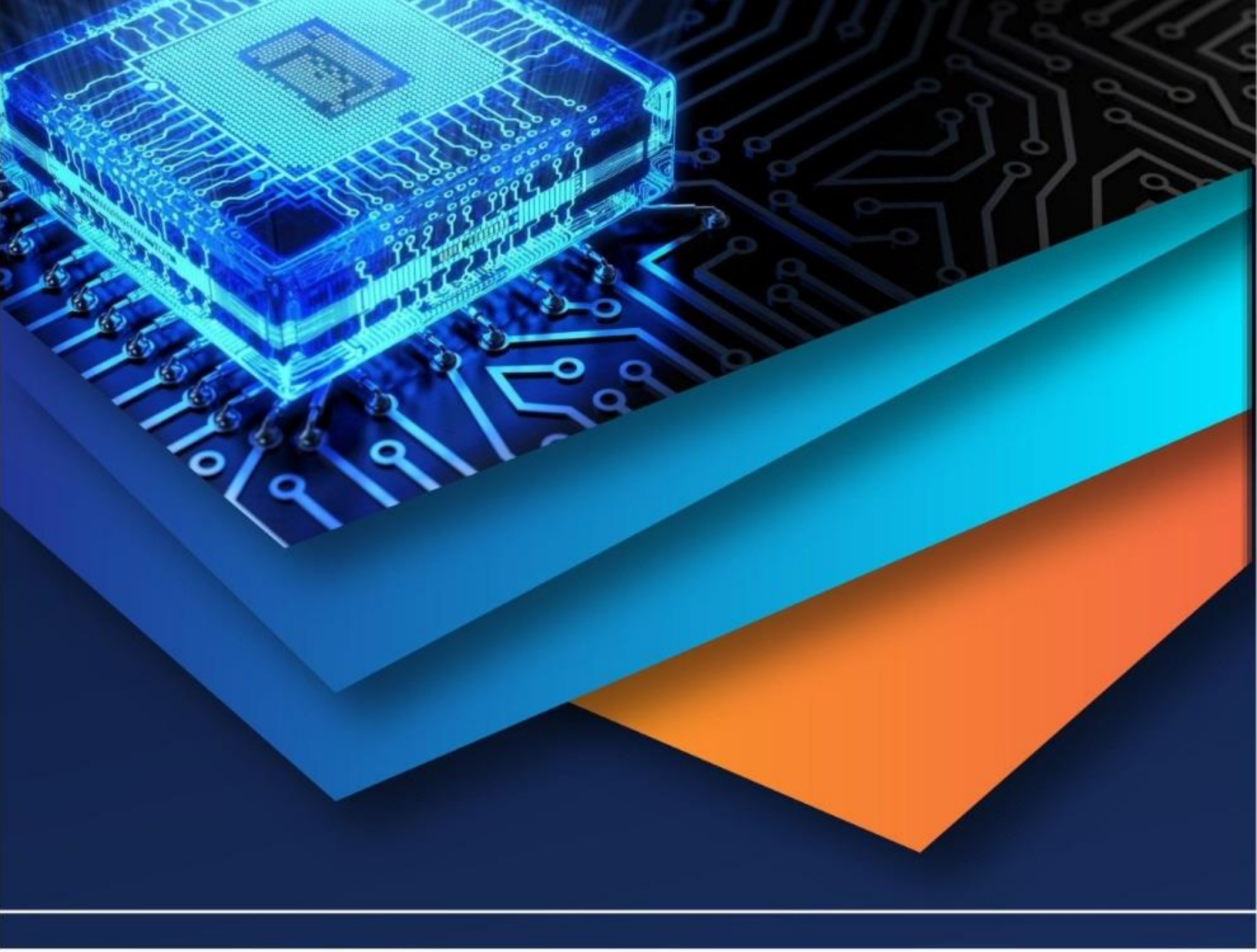

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