



Implementing Intelligent Traffic Control System for Ambulance Clearance

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Abstract - Indian traffic is nonlane based and chaotic. It needs a traffic control solutions, which are different from the developed Countries. 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. Technologies like ZigBee, RFID and GSM can be used in traffic control to provide cost effective solutions. RFID is a wireless technology that uses radio frequency electromagnetic energy to carry information between the RFID tag and RFID reader. A GSM modem is a specialized type of modem, which accepts a SIM card and operates over a subscription to a mobile operator, just like a mobile phone. AT commands are used to control modems.

Index Terms—AT89C52, MAX232, RF Transmitter & Reciver, ambulance vehicle, traffic junction.

1. INTRODUCTION

INTRODUCTION INDIA is the second most populous Country in the World and is a fast growing economy. 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. Also, Indian traffic is nonlane based and chaotic. It needs a traffic control solutions, which are different from the developed Countries. 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. Technologies like ZigBee, RFID and GSM can be used in traffic control to provide cost effective solutions. RFID is a wireless technology that uses radio frequency electromagnetic energy to carry information between the RFID tag and RFID reader. Some RFID systems will only work within the range inches or centimeters, while others may work for 100 meters (300 feet) or more. A GSM

modem is a specialized type of modem, which accepts a SIM card and operates over a subscription to a mobile operator, just like a mobile phone. AT commands are used to control modems. These commands come from Hayes commands that were used by the Hayes smart modems. The ZigBee operates at low-power and can be used at all the levels of work configurations to perform predefined tasks. It operates in ISM bands (868 MHz in Europe, 915 MHz in USA and Australia, 2.4 GHz in rest of the world). Data transmission rates vary from 20 Kilobits/second in the 868 MHz frequency band to 250 Kilobits/second in the 2.4 GHz frequency band. The ZigBee uses 11 channels in case of 868/915 MHz radio frequency and 16 channels in case of 2.4 GHz radio frequency. It also uses 2 channel configurations, CSMA/CA and slotted CSMA/CA .

The whole paper is grouped into 5 parts. Sections II talks about the literature survey. Section III discusses about the current problems that exist in making way to an ambulance and other vehicles. It also talks of how the proposed model will overcome the problems faced in developing Countries as well as developed countries. Section IV gives the implementation details of the proposed model. Section V presents the enhancement of this work.

2. LITERATURE SURVEY:

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. Green wave system was discussed, which was used to provide clearance to any emergency vehicle by turning all the red lights to green on the path of the emergency vehicle, hence providing a complete green wave to the desired vehicle. A „green wave“ is the synchronization of the green phase of traffic signals. With a



„green wave“ setup, a vehicle passing through a green signal will continue to receive green signals as it travels down the road. In addition to the green wave path, the system will track a stolen vehicle when it passes through a traffic light. Advantage of the system is that GPS inside the vehicle does not require additional power. The biggest disadvantage of green waves is that, when the wave is disturbed, the disturbance can cause traffic problems that can be exacerbated by the synchronization.

The use of RFID traffic control to avoid problems that usually arise with standard traffic control systems, especially those related to image processing and beam interruption techniques are discussed. This 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 real-time operation of the system emulates the judgment of a traffic policeman on duty. The number of vehicles in each column and the routing are proprieties, upon which the calculations and the judgments are done. The disadvantage of this work is that it does not discuss what methods are used for communication between the emergency vehicle and the traffic signal controller. It proposed a RFID and GPS based automatic lane clearance system for ambulance. 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 asignal, 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. The communication between the ambulance and traffic signal post is done through the transceivers and GPS. The system is fully automated and requires no human intervention at the traffic junctions. The disadvantage of this system is it needs all the information about the starting point, end point of the travel. It may not work, if the ambulance needs to take another route for some reasons or if the starting point is not known in advance.

Traffic is a critical issue of transportation system in most of all the cities of Countries. This is especially true for Countries like India and China, where the population is increasing at higher rate as show in figure 1. For example, Bangalore city, has witnessed a phenomenal growth in vehicle population in recent years. As a result, many of the arterial roads and intersections are operating over the capacity (i.e., v/c is more than 1) and average journey speeds on some of the key roads in the central areas are lower than 10 Km/h at the peak hour. Some of the main challenges are management of more than 36,00,000 vehicles, annual growth of 7–10% in traffic, roads operating at higher capacity ranging from 1 to 4, travel speed less than 10 Km/h at some central areas in peak hours, insufficient or no

parking space for vehicles, limited number of policemen. Currently a video traffic surveillance and monitoring system commissioned in Bangalore city. It involves a manual analysis of data by the traffic management team to determine the traffic light duration in each of the junction. It will communicate the same to the local police officers for the necessary actions.

3. PROPOSED MODEL

From the current problem section, it can be seen that, existing technologies are insufficient to handle the problems of congestion control, emergency vehicle clearance, stolen vehicle detection, etc. To solve these problems, we propose to implement our Intelligent Traffic Control System. It mainly consists of three parts. First part contains automatic signal control system. Here, each vehicle is equipped with an RFID tag. When it comes in the range of RFID reader, it will send the signal to the RFID reader. The RFID reader will track how many vehicles have passed through for a specific period and determines the congestion volume. Accordingly, it sets the green light duration for that path. Second part is for the emergency vehicle clearance.

RFID Reader–125 kHz–TTL

Radio Frequency Identification (RFID) is an IT system that transmits signals without the presence of physical gadgets in wireless communication. It is categorized under automatic identification technology, which is well established protocol. The working of an RFID system is very simple. The system utilizes tags that are attached to various components to be tracked. The tags store data and information concerning the details of the product of things to be traced. The reader reads the radio frequency and identifies the tags. The antenna provides the means for the integrated circuit to transmit its information to the reader. There are two types of RFID categories, active and passive tags. The tags that do not utilize power are referred to as passive and they are driven by an antenna that enables the tag to receive electromagnetic waves from a reader. On the contrary, active tags rely on power and they have inbuilt power sources that enable it to send and receive signals from RFID reader. RFID range depends on transmit power, receive sensitivity and efficiency, antenna, frequency, tag orientations, surroundings. Typically, the RFID range is from a few centimeters to over hundred meters. RFID reader uses frequency 125 KHz with a range of 10 cm.



Fig 1.RFID Reader



RF transmitter and receiver:

In general, the function of a radio frequency (RF) transmitter is to modulate, up convert, and amplify signals for transmission into free space. An RF transmitter generally includes a modulator that modulates an input signal and a radio frequency power amplifier that is coupled to the modulator to amplify the modulated input signal. The radio frequency power amplifier is coupled to an antenna that transmits the amplified modulated input signal. Power amplifiers are required in radio telecommunication systems to amplify signals before transmitting, because a radio signal attenuates on the radio path. For efficiency, the amplifier is often a non-linear amplifier operated near its peak capacity. To avoid distortion of the transmitted signals due to the non-linearity, the signals are pre-distorted by a predistorter before they are transmitted.

The predistortion is required to prevent transmitter from transmitting signals on channel bands other than the band assigned to the transmitter. Digital predistortion may be performed by multiplying the modulated signals prepared for transmission by a set of predistortion values. The predistortion values are chosen such that the product values entering the power amplifier will be distorted by the power amplifier to return to a substantially linear amplification of the modulated signals. A direct conversion transmitter system to produce a transmission signal is generally comprised of a low oscillator (LO), a phase locked loop (PLL), a quadrature generator, a modulator, a power amplifier (PA), and one or more filters. The low oscillator, coupled to the PLL, produces a signal with a frequency that is substantially equal to the frequency of a desired RF transmission signal. The quadrature generator is coupled to the low oscillator and the modulator. The PA is coupled to the quadrature generator, and receives the transmission signal and amplifies it.

The amplified signal may go through a filter to reduce noise or spurious outputs outside of the transmission band. High quality RF transmitters typically include band pass filters, such as surface acoustic wave (SAW) filters provide excellent performance. A typical cell phone may employ a band pass filter following the power amplifier to reduce undesired noise present at the antenna in different portion of RF spectrum to meet various standards' regulations and specifications. The optimal functioning of a transmitter in a telecommunications system depends upon the suitability of the bandwidth of the transmitted signal to its data rate and modulation type. Cellular phones are designed to operate within the environment of one of several mobile communications networks. Transmitters and receivers for communication systems generally are designed such that they are tuned to transmit and receive one of a multiplicity of signals having widely varying bandwidths and which may fall within a particular frequency range.



Fig.2 RF receiver



Fig.3 RF transmitter

AT89S52 Microcontroller:

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the Industry-standard 80C51 instruction set and pin out.



Fig 4 AT89s52 Microcontroller



The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the Industry-standard 80C51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications. The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset.

IV. WORKING MODEL

In this model, there are mainly 2 modules as follows.

A. Automatic Signal Control System

In this module, for experiment purpose, we have used passive RFID tags and RFID reader with frequency 125 KHz. RFID tag, when vehicle comes in the range of the receiver will transmit the unique RFID to the reader. The microcontroller connected to the RFID reader will count the RFID tags read in 2 minute duration. For testing purpose, if the count is more than 10, the green light duration is set to 30 seconds, if count is between 5 and 9, the green light duration is set to 20 seconds. If the count is less than 5, the

green light duration is set to 10 seconds. The red light duration will be for 10 seconds and orange light duration will be for 2 seconds. Implementation for automatic signal control.

B. Automatic ambulance clearance

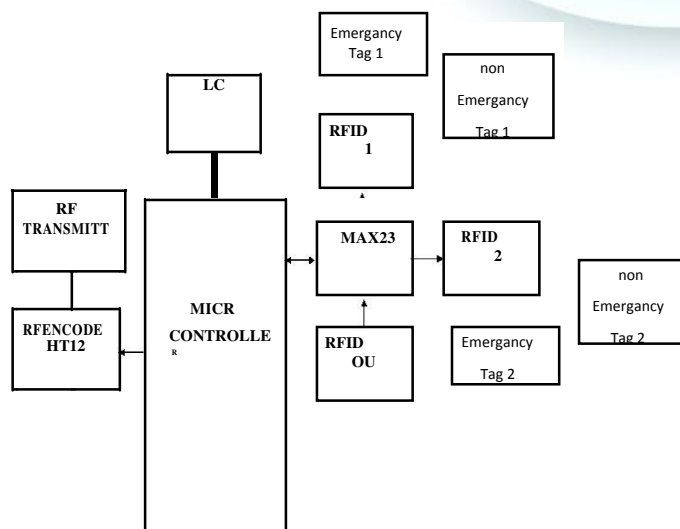
Two tags are used: one is for normal ambulance, second is for emergency ambulance. In every vehicle RF tag is provided and in every signal RF receiver is provided. Whenever the RF signal is detected by the receiver depending on the information given in the tag. The operations will be carried out. If the emergency tag is read then the signal will immediately change to green and the ambulance need not wait for the signal. If two ambulance are arriving at the same time depending on the ambulance arrived, the path is free to send the ambulances.

V. CONCLUSION AND ENHANCEMENTS

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. Further enhancements can be done to the prototype by testing it with longer range RFID readers. Also GPS can be placed into the stolen vehicle detection module, so that the exact location of stolen vehicle is known. Currently, we have implemented system by considering one road of the traffic junction. It can be improved by extending to all the roads in a multi-road junction.

REFERENCES

- [1] G. Varaprasad and R. S. D. Wahidabanu, "Flexible routing algorithm for vehicular area networks," in *Proc. IEEE Conf. Intell. Transp. Syst. Telecommun.*, Osaka, Japan, 2010, pp.30-38.
- [2] B. P. Gokulan and D. Srinivasan, "Distributed geometric fuzzy multiagent urban traffic signal control," *IEEE Trans. Intell. Transp. Syst.*, vol. 11, no. 3, pp. 714-727, Sep. 2010.
- [3] K. Sridharamurthy, A. P. Govinda, J. D. Gopal, and G. Varaprasad, "Violation detection method for vehicular ad hoc networking," *Security Commun. Netw.*, to be published. [Online]. Available: <http://onlinelibrary.wiley.com/doi/10.1002/sec.427/abstract>





- [4] M. Abdoos, N. Mozayani, and A. L. C. Bazzan, "Traffic light control in non-stationary environments based on multi agent Q-learning," in *Proc. 14th Int. IEEE Conf. Intell. Transp. Syst.*, Oct. 2011, pp. 580– 1585.
- [5] *ZigBee Specifications*, ZigBee Alliance IEEE Standard 802.15.4k2013, 2014. [Online]. Available: <http://www.zigbee.org/Specifications.aspx>
- [6] *Traffic Congestion in Bangalore—A Rising Concern*. [Online]. Available: <http://www.commonfloor.com/guide/traffic-congestion-in-bangalore-arising-concern-27238.html>, accessed 2013.
- [7] A. K. Mittal and D. Bhandari, "A novel approach to implement green wave system and detection of stolen vehicles," in *Proc. IEEE 3rd Int. Adv. Comput.*, Feb. 2013, pp.1055–1059.
- [8] S. Sharma, A. Pithora, G. Gupta, M. Goel, and M. Sinha, "Traffic light priority control for emergency vehicle using RFID," *Int. J. Innov. Eng. Technol.*, vol. 2, no. 2, pp. 363–366, 2013.
- [9] R. Hegde, R. R. Sali, and M. S. Indira, "RFID and GPS based automatic lane clearance system for ambulance," *Int. J. Adv. Elect. Electron. Eng.*, vol. 2, no. 3, pp. 102–107, 2013.
- [10] P. Sood. *Bangalore Traffic Police-Preparing for the Future*. [Online]. Available: <http://www.intranse.in/its1/sites/default/files/D1-S2->, accessed 2011.
- [11] *Traffic Management Centre*. [Online]. Available: http://www.bangaloretrafficpolice.gov.in/index.php?option=com_content&view=article&id=87&btp=87, accessed 2014.

