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A Smart Congestion Tracker in a Four Way Lane through RFID

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Abstract*: *A smart congestion tracker through Radio Frequency Identification using Bluetooth for a four way intersection can be one of the best way to track and clear the congestion. The main objective of this paper is to track the congestion in a lane using Radio Frequency Identification and transferring the collected data through Bluetooth to an android mobile. If the RFID tag belongs to a vehicle which has been stolen, in that case a notification is sent to the mobile app using Bluetooth transmitter. Each vehicle has a special RFID tag, placed at a strategic location so that it will be difficult to remove or destroy it. By using a RFID reader we can read the RFID tags, count the no of vehicles and also to find the URGENT vehicles and transfer details to the pic controller which in turn transmits the data through Bluetooth transmitter to android mobile. Also an alert message is sent to android mobile using the same Bluetooth mobile application.

Keywords: Traffic controller, Radio Frequency Identification, Congestion tracker, RFID tag, pic microcontroller

I. INTRODUCTION

As we know that India is becoming the most populous Country in the World and growth in infrastructure is bit slow as compared to the growth in the number of vehicles. So we require a smart management of congestion flow that can minimize the negative impact of congestion in the roadside traffic. To overcome this we have proposed a congestion tracker through RFID using Bluetooth. This involves the usage of technology called "Radio Frequency Identification" where no line of sight exists. We can use a RFID automatically to identify and track the tags attached to the vehicles. These tags can collect energy through radio waves from a nearby RFID reader. Active Tags have battery as a power source and the tags need not to be within the line of sight of the reader and it can be integrated in the tracked object.

Many industries like automobile manufacturing are using RFID tags to track the progress of automobile during its production phase. RFID microchip/tags can be embedded in cash, cloths or can be implanted in animals and people.

In the existing system, automation in traffic lights using IR sensors is already present but the problem is green light duration that cannot be modified dynamically. In addition to this, line of sight is required in case of infra-red signals. Also there is delay of data transmission in IR and only applicable for minimum range and also Interruption is high. Existing system also involves Zigbee technology which is quite expensive. Using Zigbee the connection is not secured and most of the systems are confined only to a single lane.

Here, we use a master slave concept that enables the use of more than one transmitter-receiver called readers. It sends a signal to the tag and in turn it reads the response from it. Also a system to track the congestion, clear the traffic for the urgent vehicles and to detect the stolen vehicle has been effectively used.

II. RELATED WORK

[1]Smart traffic control system for Emergency vehicle clearance by Veeravenkatesh & Nazneen Syed Deals with managing the traffic using camera where the images captured in it are analysed using various edge detection and object counting methods. However capturing images involves a relatively higher cost. [2]Implementation and comparison of the improved traffic congestion control scenario which uses a traffic control system where sensors are present in the road to monitor traffic and also the vehicles can get information about the traffic which will then report to the wireless traffic light (WTL).WTL has its own server which processes the data and broadcasts the information to all the vehicles to avoid traffic. Determination of predictive models for traffic congestion in Lagos metropolis is another approach proposed by Olusina, J.O. and Samson[3].In this paper the peak congestion period is found and the collected data are analysed in GIS environment and conclusion were raised to reduce the amount of traffic.

Detecting urban traffic congestion with single vehicle is another technique proposed by Chenqiwang[4].This paper follows a novel approach where only a single vehicle is used to track the current traffic status. Only a less number of vehicles are used but the efficiency is of no compromise. In addition to it, machine learning mechanisms are also utilized.

Next approach is a Distributed vehicular traffic congestion detection algorithm for urban environments. Here a new V2V Congestion detection algorithm which is based on IEEE 802.11p Standard is used. The vehicle knows the information about the traffic in the road and according to status it performs congestion detection where the detection is done with the help of cooperation of other vehicles and monitoring the speed.

Another approach is Neural Networks for Real-Time Traffic Signal Control[6].Here a multi agent approach is used where every agent acts as a controller for particular intersection in road traffic.

Yet another approach which is an Assessment of Traffic Congestion and Its Effect on Productivity in Urban Ghana[7]in which various effects due to congestion are discussed and its negative impact on society are highlighted. [8] Traffic Congestion in Major Cities of Nigeria by Joseph. O. Ukpata, AndersonA. Etika in which some remedies to improve congestion like broadening of road, public transport system, road maintenance was proposed.

Finally, an approach for Measuring Urban Traffic Congestion – A Review [9] in which various congestion detection techniques like Dual loop detector, Travel time estimation, and shortest path first have been proposed. But it doesn't include any ways to track and reduce congestion.

III. PROPOSED SYSTEM

We propose a smart congestion tracking system to solve the traffic problems. Our system consists of three divisions such as auto signal tracking system, looted vehicle detection system and urgent vehicle detection. We use Bluetooth application to display the status of the traffic in Android mobile. Latest technologies like Zigbee can also be used but instead of Zigbee, choosing Bluetooth has various positive reasons. Bluetooth has a very large range i.e 100m whereas Zigbee has range in terms of 20-30 m. In auto signal tracking system, each vehicle is provided a unique RFID tag. This is similar to vehicle registration number .But the difference is RFID tag cannot be removed or destroyed. Even if we change the vehicle, t is equipped with new RFID tag. All the information about the vehicle is stored in the PIC16F877A micro controller. If vehicle comes under the range of RFID reader, then the vehicle communicates with the reader by sending a signal to it. Then the reader will check the number of vehicles which has passed above its pre-defined limit. According to the traffic status, time period of the green light can be changed. For example, in case of hectic traffic, signal duration can be changed to 90 from 60 seconds. Second is an urgent vehicle detection system. As we know emergency vehicle like ambulance needs their way to reach the destination point at the earliest, so in that case if an urgent vehicle is stuck in traffic, particular lane of the traffic road signal time can be changed and colour of the light is moved from red to green colour. Thus it requires less human intervention and the manual effort on the part of a traffic police is mitigated. Last is the looted vehicle detection system where the PIC16F877A controller plays a major role as the complete information about all the RFID tag equipped vehicle information is stored. When the looted vehicle comes under the range of RFID reader, it scans and compares the list of information stored with the vehicle information. If the data matches, then the information is sent to the traffic police via Bluetooth application to his android mobile phone. The main advantage of this system is that no line of sight exists, cost effective and also applicable for four way road intersection. Fig. 1 shows the overall block diagram of smart congestion tracker through RFID reader.

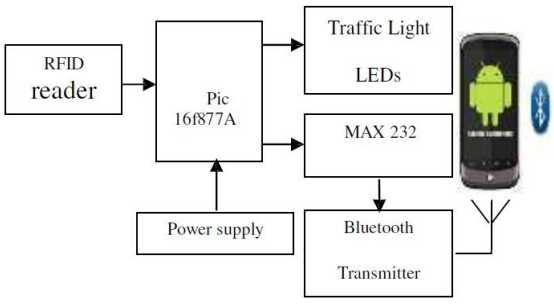

Fig.1Block diagram of smart congestion tracker through RFID reader

IV. MODULES

This system comprises of four main modules namely: Congestion tracking through RFID tags and Developing Bluetooth mobile application, stolen vehicle detection and Congestion clearance for urgent vehicles. All this four modules are involved in implementing an efficient congestion tracking and clearance system.

A. Congestion Tracking Through Rfid Tags

All the data received by the controller are transmitted to the android mobile application through Bluetooth Android is chosen because it is open source, freely available to all. In fact the cheapest android mobile in the world, FREEDOM '251' is been developed by India. Hence the output of our work like the number of vehicles, theft vehicle information can be sent as a chat message through Bluetooth mobile application to the android mobile. Based on the number of vehicles on a particular lane, the duration of the traffic light can be altered.

The RFID tag is a unique tag with its own number and it includes information about the vehicle. Vehicular information's like registration number, Engine number, Vehicle type, Model number and name will be present in the tag. RFID reader acts like a sensor. It is similar to that of bar code scanner. If the barcode scanner scans the barcode present in a particular object it gives a complete detail about the object. Similarly the RFID reader holds all the information of the vehicles by scanning the RFID tag.Fig. 2 shows how RFID reader scans the tags and stores information into the database and Fig.3 is the RFID reader setup.

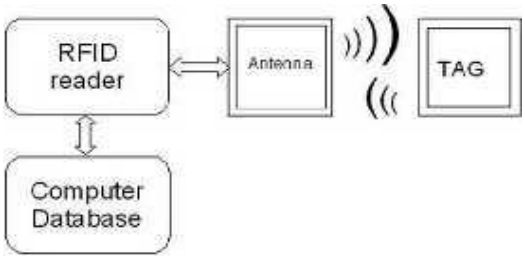

Fig.2 Relationship between RFID tags and reader

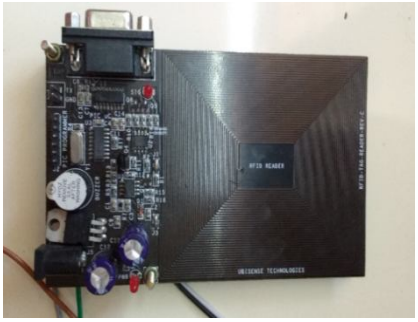

Fig.3RFID Reader

Fig.4 show the entire setup of congestion tracker where the RFID reader, PIC microcontroller and traffic LED's being interfaced.

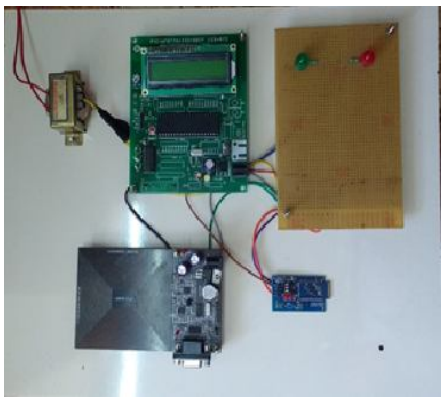

Fig.4Entire congestion tracker set up

Finally the mobile application through android mobile is interfaced with the setup by turning on Bluetooth.Fig.5 Shows congestion tracker connected to traffic monitoring system application and signal status gets updated and Red light is switched on indicating traffic congestion.

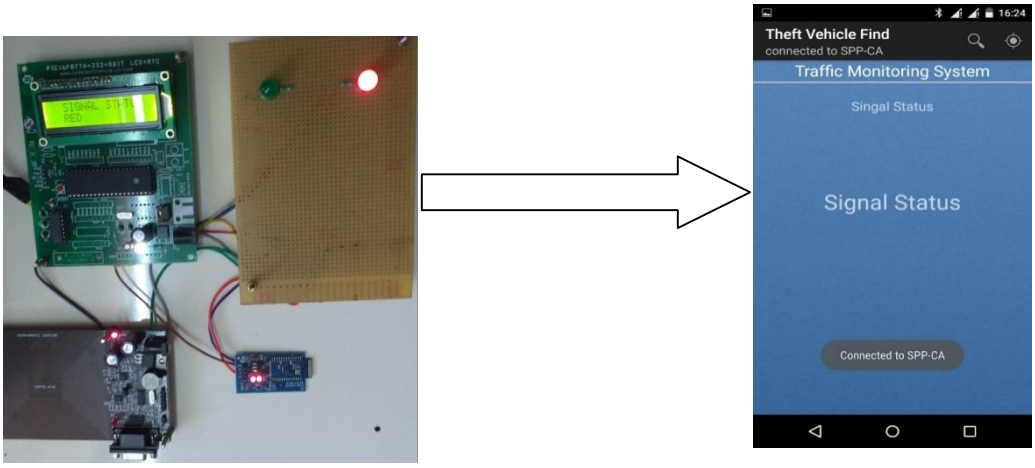

Fig.5 After interfacing congestion tracker Kit and mobile application

B. Stolen Vehicle Detection

Bluetooth is used as a wireless protocol for transmitting and receiving data between two or more devices. Here we use RN-42 which is a class 2 Bluetooth module consisting of UART and USB interface. It works on the principle of Master – Slave concept. Fig.6 shows the interface between PIC 16f877A and Bluetooth module.

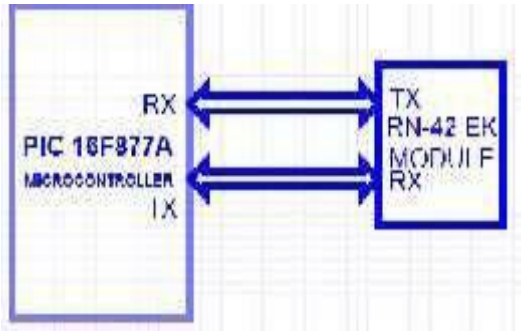

Fig.6 Bluetooth interfacing with pic micro controller

The microcontroller we use is PIC 16f877A. It is an 8 bit microcontroller with 40 pins. It has 256 bytes of Electrically Erasable Programmable Read Only Memory along with eight channels of ten bit analog to digital computer. When a stolen vehicle RFID comes under the range of the reader, an alert message is transmitted through Bluetooth to the android mobile specifying theft vehicle have been found.

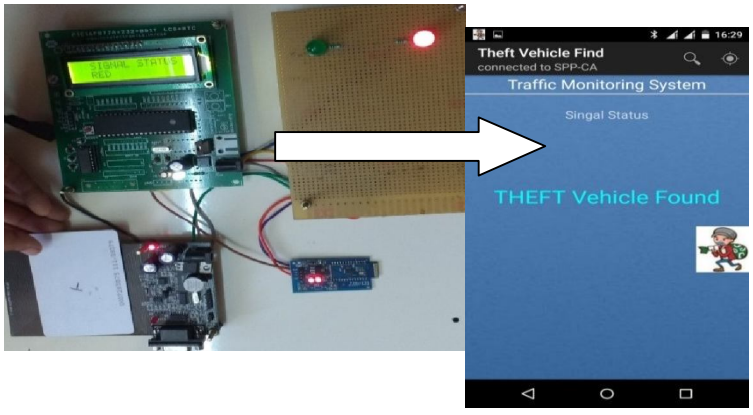

Fig.7Theft Vehicle Detection and notification about theft vehicle

Fig7. Shows the detection of theft vehicle and a notification message sent to mobile indicating vehicle found and signal status specifying blinking of Red LED light.

C. Congestion Clearance For Urgent Vehicles

As URGENT vehicles reachlane junction, it thereby communicates to the congestion tracker and traffic controller system in the junction. The RFID reader counts the number of vehicles and also finds the URGENT vehicles and finally it transfers the details to the pic controller which in turn transmits the data through Bluetooth transmitter to the android mobile

When an urgent vehicle such as ambulance, fire engine and VVIP vehicle, get struck in the huge traffic then the congestion tracker system after collecting the details through RFID reader alters the red light to the green light which indicates the clearance of the congestion for the emergency vehicle.Fig.8 indicates signal status turned green which shows the clearance of traffic for emergency vehicles.

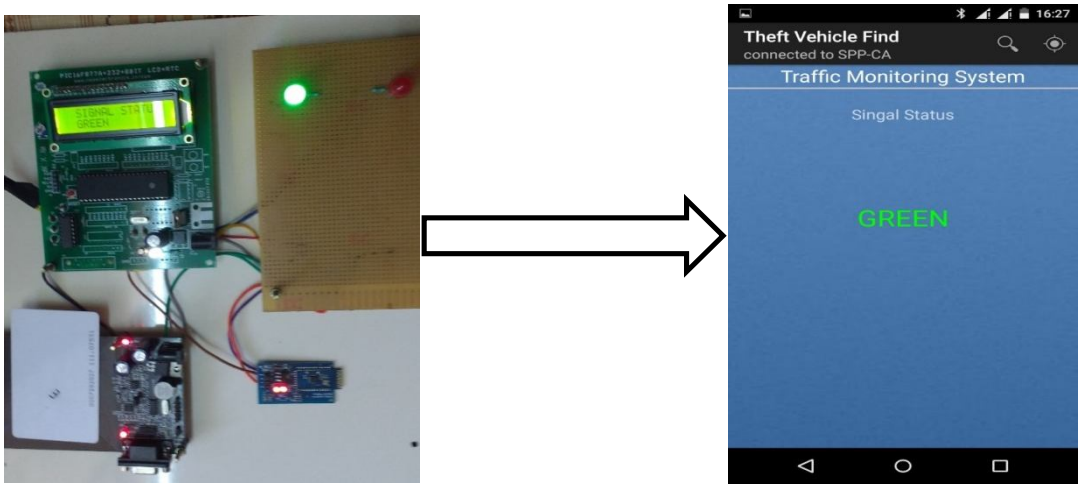

Fig.8 Congestion and Emergency vehicle clearance

V. CONCLUSION AND FUTURE WORK

Thus the smart congestion tracker through RFID helps to reduce the manual work. There is no need for the traffic patrol to be present at the four way intersection. It is cost effective and requires very less human intervention and stolen vehicle can also be detected. Emergency vehicles like ambulance, fire trucks can be made to reach the destination quickly. The idea can be extended in such a way that the green and red light time period can be controlled using an android mobile application. Also, the details about the congestion in a particular area can be broadcasted in such a way that before reaching the particular place, the traffic in that place can be made known.

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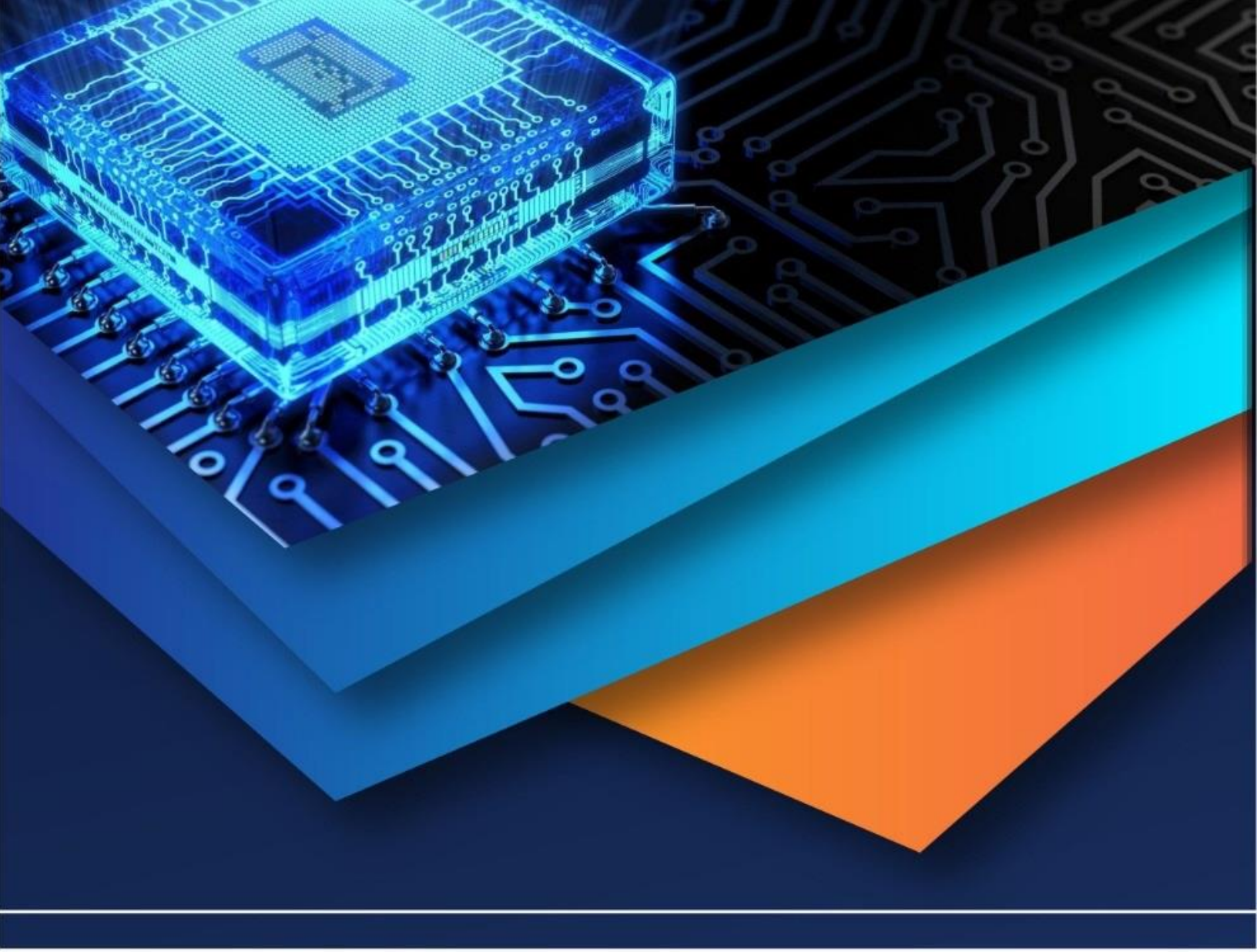

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