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Priority Management of Emergency Vehicles Using IOT Approach

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Abstract: In the present world, with the growing number of vehicles, traffic has increased to a very greater extent. This mainly has a major impact on the vehicles dealing with an emergency situation. The system employs assistance to such emergency vehicles without any human effort. Conventional technologies use the manual or semi manual systems. Manual system uses the manpower. The semi manual methods use the fixed interval traffic light and image processing which do not distinguish between the emergency and other vehicles. The paper presents a wise traffic control system to pass emergency vehicles smoothly utilizing RFID and Internet of Things (IoT) applications. The system uses ARM7 controller (lpc2148), RFID reader to detect the RFID tags fixed to the vehicle. This module uses ZigBee module CC2500. The total system can be monitored through IoT.

Keywords: ambulance, ARM, GSM SIM300, Internet of Things, RFID, traffic light, ZigBee

I. INTRODUCTION

In today's world, traffic jams during rush hours is one of the major concerns. During rush hours, emergency vehicles like ambulances, police cars and fire brigade trucks get stuck in jams. Neither manual control by police officers nor using predefined timers has proved effective, but they are still being used in many places. Due to this, these emergency vehicles are not able to reach their destinations in time, resulting in a loss . Providing a green wave will give clearance of way 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. Often criminal or terrorist vehicles have to be identified. 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 huge. 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 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.

Hegde et al [1] the author has discussed about RFID and GPS based automatic lane clearance system for ambulance to be used. 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 the ambulance is travelling, before it reaches the traffic signal. This can be achieved by switching the traffic signal green in the path of the ambulance 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 unknown.

Sharma et al [2] the author discuss 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. Video traffic surveillance and monitoring system commissioned currently 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 junctions. It will communicate the same to the local police officers for necessary actions [3].

Khaleed Al Khateeb et al [4] the author compared RFID with image processing techniques, states problems related to it like beam interruption techniques, false acceptance

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rates (FAR), false rejection rate (FRR). And normally in case of jammed traffic, the computer vision results in erroneous detection. It uses RFID for traffic congestion and doesn't utilize its feature to store information.

Arunmozhi et al [5] the author has discussed about automatic ambulance rescue system using shortest path finding algorithm that has been used. The ambulance is controlled by the central unit which furnishes the most scant route to the ambulance and also controls the traffic light. Sreelekha et al [6] discuss references making use of RFID. But here they do not use any GSM. GSM is not used to update the database. Instead the data to the controller is directly updated to the database.

Sreemana data et al [7] the author talks about different categories, fixed time and traffic response strategies. Making use of RFID based system as priority has been considered for different vehicles and also density of the traffic by installing RF reader on the road intersections. This paper doesn't describe any means of communication between the vehicle and the traffic junction. Rajeshwari Sundar et al [8] explains about the green wave system, which helps to provide clear way to any crisis vehicle by switching the red lights to green on the way of the crisis vehicle, which provides a complete clear way to the crisis vehicle Pavitra et al [9] describes the system used for detection of emergency vehicles and providing a green wave using RFID technique. But to maintain database for vehicles, it is done by using GSM o manually updated GSM. P Bellavista et al [10] discusses about Ubiquitous smart environments, equipped with low-cost and easy-deployable wireless sensor networks (WSNs) and widespread mobile ad hoc networks (MANETs), are opening brand new opportunities in wide-scale urban monitoring. Indeed, MANET and WSN convergence paves the way for the development of brand new Internet of Things (IoT) communication platforms with a high potential for a wide range of applications in different domains.

II. SYSTEM OVERVIEW

From the current problem section, it can be seen that, existing technologies are inefficient to handle the problems of emergency vehicle clearance, stolen vehicle detection, etc. To solve the problems, the system implements the Intelligent Traffic 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 vehicles that have passed determines the priority. Accordingly, it sets the green light duration for that path. The basic block diagram of the system is illustrated in figure 1. The system comprises a RFID reader and a RFID tag or transponder. The system uses a reader which will provide respective ranges to the system depending on their frequency. During the manufacturing of vehicles, passive tag or transponders are embedded inside the dash board of the vehicle such that it is not easily removable. During the registration of the vehicle, each vehicle gets a unique license plate number. The system defines three categories for this system namely Emergency vehicle, Stolen Vehicle and a Normal Vehicle. A Column of priority is also added in table, in which three levels are defined-low, high and highest. However, as per the demand of the user, more levels and categories can be added easily. Readers are installed at every junction of the city, on top of the roads.

This RFID data is being sent to the junction through the ZigBee transmitter to the ZigBee receiver. It will make the traffic light to switch to green. Once the ambulance passes through, the receiver no longer receives the ZigBee signal and the traffic light operates normally. The second part is stolen vehicle detection. Here, when the RFID reader reads the RFID tag, it compares it to the list of stolen RFIDs. If a match is found, it sends SMS to the police control room and switches the traffic light to red, so that the vehicle is made to stop in the traffic junction and local police can take appropriate action.

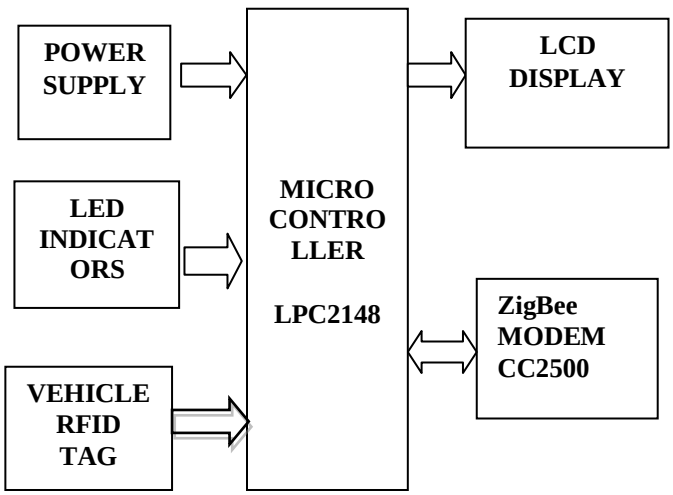

Figure 1 Vehicle section

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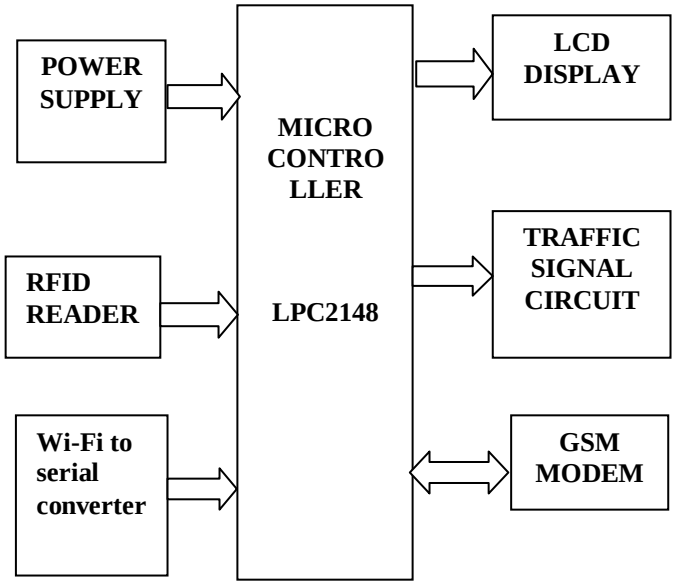

Figure 2 Monitor section

List of components used in the experiment are CC2500 ZigBee module, ARM7 (lpc2148), RFID Reader–125KHz, SIM300 GSM module and ESP8266 Wi-Fi module.

The figure 1 and figure 2 shown depicts the block diagram of vehicle and monitor section in the prototype, where the ARM controller LPC2148 which is a 32 bit controller is used. The peripherals contain the passive RFID tag which stores the information of the vehicle like owner details and other vehicle details. The system uses LCD to display the ID of the tag. The information, collected by RFID reader, is sent to the controller by ZigBee module CC2500 whose range is 10 meters.

Figure 2 shows the monitor section which receives the data from the vehicle section and provides a green wave. The ZigBee receives the information of the tag and sends to the controller. If the ID belongs to emergency or stolen vehicles then a message is being sent to the respective departments and by GSM module and also is monitored at server by the Wi-Fi module ESP8266.

III. SYSTEM HARDWARE

A. ZigBee Module CC2500

The CC2500 is a RF module and has transceiver which provides an easy way to use RF communication at 2.4 GHz Every CC2500 is equipped with the microcontroller (LPC2148). One of the most important features is serial communication without any extra hardware and no extra coding. Hence, it is a transceiver as it provides communication in both directions, but only in one direction. The microcontroller and CC2500 always communicate with the microcontroller via serial communication. Rx pin of CC2500 is connected to Tx of microcontroller and Tx pin of CC2500 is connected to Rx pin of microcontroller. Other two pins are used to energize transceiver. It is used to transmit and receive the data at 9600 baud rate. Here, system uses CC2500 ZigBee module which has transmission range of 10 metres.

B. RFID Readers

High frequency RFID readers can be fixed along the roads at every traffic signal system in all the directions in such a way that it covers the entire area under the reader.

C. RFID Transponders/Tags

Passive RFID transponders/Tags are embedded inside every vehicle at the time of manufacturing. These RFID tags consist of unique Identification number. When the vehicle is registered and gets the license plate number, the total data of the vehicle is stored in the database along with their category like, whether the vehicle is ‘Normal’ or ‘Emergency’. Thereafter the category may be changed from the one category to another.

D. GSM Module SIM 300

Here, a GSM modem is connected with the microcontroller. This allows the computer to use the GSM modem to communicate over the mobile network. These GSM modems are most frequently used to provide mobile Internet connectivity, many of them can also be used for sending and receiving SMS and MMS messages.

GSM modem must support an “extended AT command set” for sending/receiving SMS messages. It works on frequencies EGSM 900 MHz, DCS 1800 MHz and PCS 1900 MHz. SIM300 features GPRS multi-slot class 10/ class 8 (optional) and supports the GPRS coding schemes. This GSM modem is a highly flexible plug and play quad band GSM modem, interface to RS232, it supports features like voice, data, SMS, GPRS and integrated TCP/IP stack. It is controlled via AT commands. It uses AC – DC power adaptor with DC voltage ratings of 12V/1A.

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E. ESP8266

The ESP8266 is a low cost, high performance System on Chip Wi-Fi to serial module, part of Espressif System's 'Smart Connectivity Platform' that aims to provide mobile platform designers to innovate systems with embedded Wi-Fi Capabilities at the lowest cost with the greatest functionality. The various features include number of GPIO pins, presence of shield, antenna, type of package (Through-hole or Surface mount), memory and handling external analog signals, consist of 2 GPIO pins, UART communication, low powered 32-bit CPU and a PCB antenna.

FLOWCHART OF SYSTEM SOFTWARE

The flowchart figure 3 shows the sequence in which the working operation takes place.

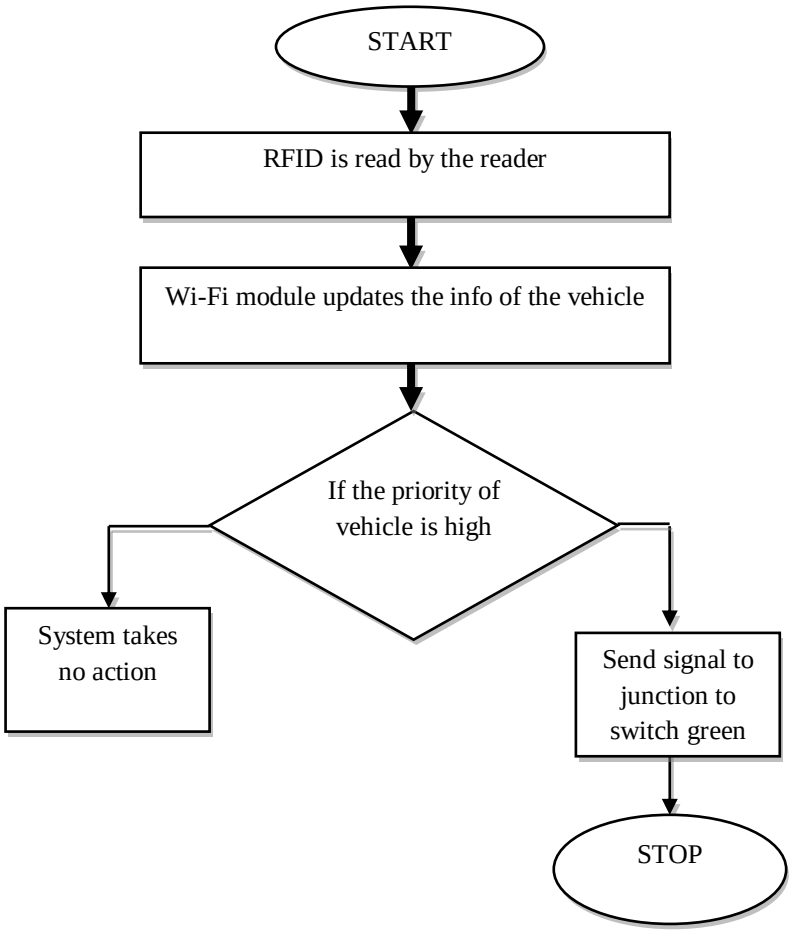

Figure 3 Flowchart

IV. RESULTS

The manual effort on the part of the traffic policeman is saved by using IoT applications. Human intervention is minimized because the entire system is automated. The vehicle section and the monitoring section is shown in figure 4 and figure 5. Figure 5 gets the interrupt from RFID reader in figure 4 to manage the signal accordingly. Fig 6 shows the Wi-Fi module output which can be seen with the static IP address of the Wi-Fi module. When an emergency vehicle approaches this reader, it is successfully detected by the system as an emergency vehicle and traffic light switching is activated. On the other hand, if any stolen vehicle is detected, it is displayed on the LCD and the server page. This prototype presents an approach to solution to implement the concept of greenwave in urban cities. The overall system is cost effective and has various advantages over the conventional technologies. The webpage displaying the output of the ESP8266 can be seen by using the static IP of the module. The same can be seen in the LCD display and server webpage. The page displays "INTERNET OF THINGS USING ESP8266 WORKING KA05VJM108 HIGH__S". The message displays the vehicle priority and the direction in which it is approaching. It displays a high priority vehicle from the south direction. This data can be seen from anywhere accessible by the internet. And hence monitoring and decision making is simplified

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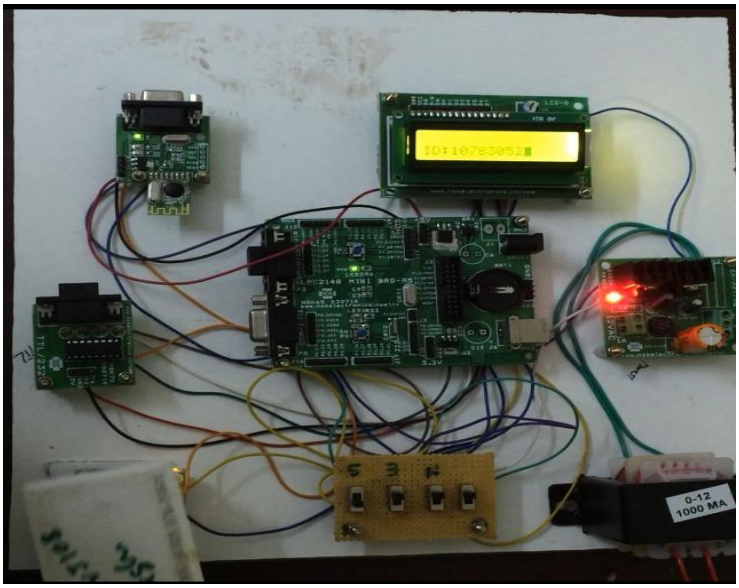

Fig 4 Vehicle section

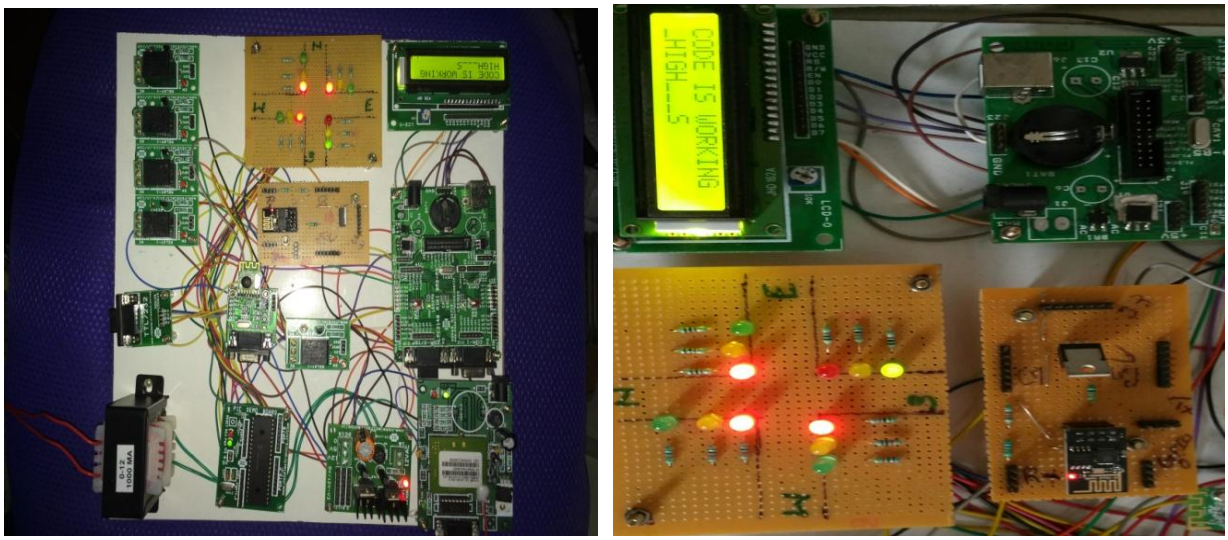

Fig 5 Monitor section

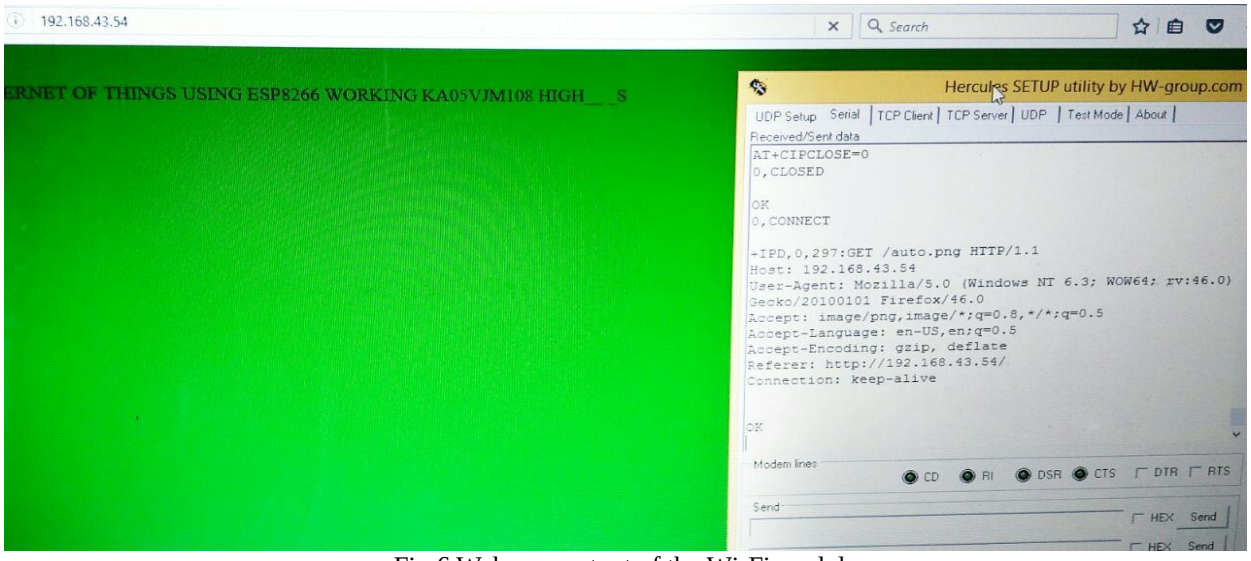

Fig 6 Webpage output of the Wi-Fi module

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V. CONCLUSION AND ENHANCEMENTS

RFID together with Internet and GSM technologies are anticipated to create a revolution in traffic management and control systems. The data base contains online statistical information, which can be used by operators and planners to develop better models in the future. The system saves valuable details in the records of the database, which can provide valuable information to planners and investigators. Further enhancements can be done to the prototype by testing it with GPS, so that the exact location of stolen vehicle is known. It can be improved by extending in a multi-road junction.

REFERENCES

[1] R Hegde, RR Sali, M S Indira, "RFID and GPS based automatic lane clearance system for ambulance", International Journal of Advanced Electrical and Electronics Engineering, Volume 2, 2013.
[2] Suresh Sharma, "Traffic light priority control for emergency vehicle using RFID", International Journals and Innovations in Engineering and Technology, Volume 2, 2013.
[3] Traffic Management Centre. [Online] www.bangaloretrafficpolice.gov.in
[4] Khalid Al-Khateeb, Jaiz A Y Johari, "Intelligent dynamic traffic light sequence using RFID", International Conference on Computer and Communication Engineering, 2008.
[5] P Arunmozhi, P Joseph William, " Automatic ambulance rescue system using shortest path finding algorithm", International Journal of Science and Research, Volume 3, 2014.
[6] P Sreelekha , D Vishnu Vardhan, "Implementation of green wave system for traffic clearance of emergency vehicles and for detection of theft vehicles", International Journal of Science and Research, Volume 4, 2015.
[7] Sreemana Datta, "Real time road traffic light signaling using image processing with emergency vehicle detection and traffic signal violation detection", Scholars Journal of Engineering and Technology, 2013.
[8] Rajeshwari Sundar, Santosh Hebbar, Varaprasad Golla, "Implementing intelligent traffic control system for congestion control, ambulance clearance and stolen vehicle detection", IEEE Sensors Journal, Volume 15, 2015.
[9] B Pavitra , B Santosh Kumar, "An implementation of green wave system for emergency and stolen vehicles", International Journal of Engineering Trends and Technology, Volume 16, 2014.
[10] P Bellavista, G Cardone, A Corradi and Foschini, "Convergence of MANET and WSN in IoT urban scenarios", IEEE Sensors Journal, Volume13, 2013.