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A New Approach to Implement Emergency Vehicles Clearance and Detection of Stolen Vehicles

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***Abstract*— 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. Due to this, these emergency vehicles are not able to reach their destinations in time, resulting into a loss of human lives. We have developed a system which is 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. In addition to the green wave path, the system will track a stolen vehicle when it passes through a traffic light. So, it is an autonomous 2-tier system which will help in the identification of emergency vehicles or any other desired vehicle. It is a novel system which can be used to implement the concept of the emergency vehicle clearance and detection of stolen vehicles.**

***Index Terms*— Green wave, Emergency Vehicle Clearance, tracking, detection of stolen vehicles, ARM.**

I. INTRODUCTION

The Green wave systems are most suitable to provide clearance to emergency vehicles during rush hour. Many systems are used to implement the green wave systems. We have developed a cost effective system using Radio frequency identification (RFID) Technology, Global system for mobile communication (GSM) modules and latest high speed Microcontrollers to achieve the desired results. The primary objective is to identify the emergency vehicle and track its location so that we can provide a green wave to the emergency vehicle. Conventional technologies use image processing systems to identify the emergency vehicle. But these systems have a drawback during bad weather conditions. Due to wind rain, fog, etc., the image received by the camera is distorted by noise and it becomes difficult for the system to identify the desired vehicle. Thus, we have built our system using RFID transponders and readers. The advantage of RFID is that it is a cost effective system which will provide uninterrupted communication in our network even in bad weather conditions.

II. BLOCK DIAGRAM AND OVERVIEW

The basic block diagram of the system is illustrated in Fig.1. The system comprises of a RFID reader and a RFID tag or transponder. We will use a high frequency reader which will provide long range to the system. During the manufacturing of vehicles, passive tag or transponders are embedded inside the dash board of the vehicle such that it is not easily visible to human eyes. During the registration of the vehicle, each vehicle gets a Unique license plate number. In our system a database is maintained, in which table comprises of information like Unique ID of tag against which the vehicle license plate number and its category is stored. We have defined 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. A priority "T" for stolen vehicles. However, as per the demand of the user, more levels and categories can be added easily. Readers are installed on every junction of the city, on top of the roads. The reader reads the unique ID present on the tag or transponder and sends the information to the main system to check its category and priority in the database and take the desired action accordingly. For immediate update of category of vehicle and also its priority level the database is connected to the GSM module. The RTO database is also connected to the main database, so that regular updating of the system database can be done. As soon as the vehicle is registered with Regional Transport office (R.T.O), the vehicle is registered with our system as well. The microcontroller unit is connected to the police control room, to send the alert signals of any stolen vehicle detected.

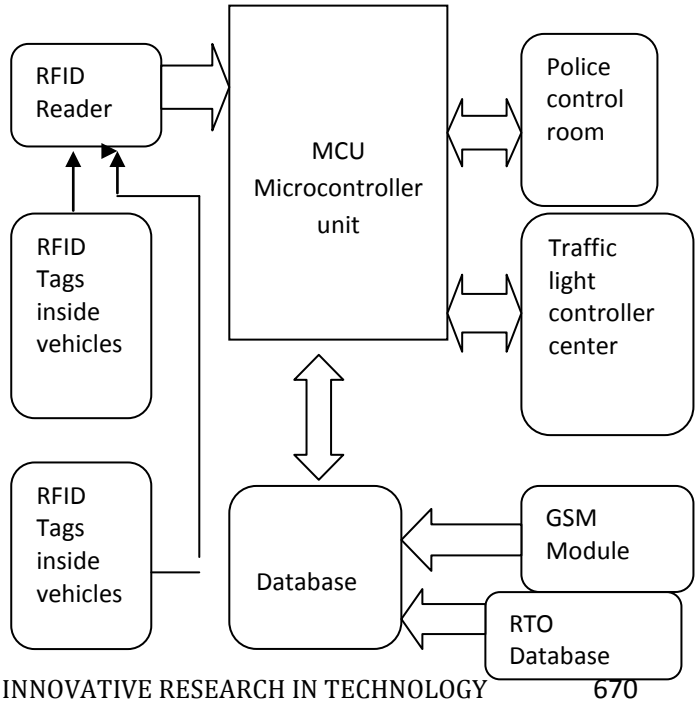

Fig. 1.Block Diagram

Table 1: BLOCK OF DATABASE

Unique ID	Category	Priority	No Of junctions
XX123	Emergency	HT	4
YY456	Stolen	T	----
ZZ789	Normal	L	----

III. HARDWARE DESIGN

A. RFID Readers

High frequency RFID readers are installed above the roads prior to every traffic light system in all directions in such a manner that the entire area comes under the range of RFID reader.

B. RFID Transponders

Passive RFID transponders are installed inside every vehicle at the time of manufacturing. RFID transponders consist of unique ID. Once the vehicle is registered and gets the license plate number, its data is stored in the database along with the category of the vehicle, either 'Normal' or 'Emergency', which could be changed to any other category as per the requirements.

*C. ARM7 HARD*WARE

The ARM7 family includes the ARM7TDMI, ARM7TDMI-S, ARM720T, and ARM7EJ-S processors. The ARM7TDMI core is the industry's most widely used 32-bit embedded RISC microprocessor solution. Optimized for cost and power-sensitive applications, the ARM7TDMI solution provides the low power consumption, small size, and high performance needed in portable, embedded applications. The ARM7TDMI core uses a three-stage pipeline to increase the flow of instructions to the processor. This allows multiple simultaneous operations to take place and continuous operation of the processing and memory systems. The ARM7TDMI core has seven modes of operation.

- User mode is the usual program execution state
- Interrupt (IRQ) mode is used for general purpose interrupt handling
- Supervisor mode is a protected mode for the operating system
- Abort mode is entered after a data or instruction pre fetch abort
- System mode is a privileged user mode for the operating system
- Undefined mode is entered when an undefined instruction is executed.

The interrupt settings of ARM support the DHLS to response to the interrupt coming from the server section.

UART communication

Serial data communication uses two methods, asynchronous and synchronous. The synchronous method transfers a block of data (characters) at a time while the asynchronous transfers a single byte at a time. It is possible to write software to use either of these methods, but the programs can be tedious and long. For this reason, there are special IC chips made by many manufacturers for serial data communications.

Data transfer rate

The rate of data transfer in serial data communication is stated in bps (bits per second). Another widely used terminology for bps is baud rate. The baud rate used in this DHLS for data transmission is 9600.

Max232

MAX232 is compatible with RS-232 standard, have dual transceiver. Each receiver converts TIA/EIA-232-E levels into TTL/CMOS levels. Each driver converts TTL/CMOS levels into TIA/EIA-232-E levels. The MAX3232 is characterized for operation from -40°C to +85°C for all packages.MAX3232 is purposed for application in high-performance information processing systems and control devices of wide application

D.LCD DISPLAY

LCD MODULE (2X16 CHARACTER) Dot matrix LCD modules are used for display the parameters and fault condition.16 characters 2 lines display is used. It has controller which interface data's and LCD panel. Liquid crystal displays (LCD's) have materials, which combine the properties of both liquids and crystals. Rather than having a melting point, they have a temperature range within which the molecules are almost as mobile as they would be in a liquid, but are grouped together in an ordered form similar to a crystal. An LCD consists of two glass panels, with the liquid crystal material sandwiched in between them. The inner surface of the glass plates are coated with transparent electrodes which define the character, symbols or patterns to be displayed polymeric layers are present in between the electrodes and the liquid crystal molecules to maintain a defined orientation angle.

One each polarizer's are pasted outside the two glass panels. These polarizer's would rotate the light rays passing through them to a definite angle, in a particular direction When the LCD is in the off state, light rays are rotated by the two polarizes and the liquid crystal, such that the light rays come out of the LCD without any orientation, and hence the LCD appears transparent. When sufficient voltage is applied to the electrodes, the liquid crystal molecules would be aligned on a specific

direction. The light rays passing through the LCD would be rotated by the polarizes, which would result in activating/highlighting the desired characters.

Figure 2 – LCD Diagram

The LCD's are lightweight with only a few millimeters thickness. since the LCD's consume less power, they are compatible with low power electronic circuits, and can be powered for long durations .The LCD's don't generate light is needed to read the display. By using backlighting, reading is possible in the dark .The LCD's have long life and a wide operating temperature range. One of the most popular output devices for embedded electronics is LCD. The LCD interface has become very simple. This is due to the availability modules for LCDs. The LCD along with necessary controller (LCD Controller) and mounting facility is made available in the module itself. The LCD controller takes care of everything necessary for the LCD. We communicate with the LCD controller with the help of a command set provided by the manufacturer.

E.GSM NETWORK

Global system for mobile communication (GSM) is a globally accepted standard for digital cellular communication. GSM is the name of a standardization group established in 1982 to create a common European mobile telephone standard that would formulate specifications for a pan-European mobile cellular radio system operating at 900 MHz GSM provides recommendations, not requirements. The GSM specifications define the functions and interface requirements in detail but do not address the hardware. A GSM modem can be an external device or a PC Card / PCMCIA Card. Typically, an external GSM modem is connected to a computer through a serial cable or a USB cable. A GSM modem in the form of a PC Card / PCMCIA Card is designed for use with a laptop computer. It should be inserted into one of the PC Card / PCMCIA Card slots of a laptop computer. Like a GSM mobile phone, a GSM modem requires a SIM card from a wireless carrier in order to operate.

As mentioned in earlier sections of this SMS tutorial, computers use AT commands to control modems. Both GSM modems and dial-up modems support a common set of standard AT commands. You can use a GSM modem just like a dial-up modem.

In addition to the standard AT commands, GSM modems support an extended set of AT commands. These extended AT commands are defined in the GSM standards. With the extended AT commands, you can do things like:

- Reading, writing and deleting SMS messages.
- Sending SMS messages.
- Monitoring the signal strength.

IV. HARDWARE IMPLEMENTION

In our prototype implementation we have used ARM7 microcontroller along with low frequency RFID reader (125 kHz) and passive transponders based on EM4102. Three different categories are emergency, stolen and normal. In our coding section, three different UIDs (Unique identification code) of tags are stored in the program. A 16x2 (Liquid crystal display) LCD is interfaced with the microcontroller to display the category of the vehicle with the traffic light model. The traffic light model is shown by red and green (Light emitting diode) LEDs in the model. The code written is compiled in Keil µVision4 and burned on microcontroller using Universal serial bus (USB-ASP) programmer. The prototype structure is same as shown in Fig. 1. The RFID transponders are fitted in four manually driven toy cars. The RFID readers read the information from the tag; this information is fed into the microcontroller unit for the further processing. The information read is unique identification code (UID). Once the vehicle is in the range of the RFID reader, the reader reads the UID on tag and compares it with UIDs stored in the database. If it corresponds to any of the category defined, then the LCD displays the category of the vehicle. If the vehicle category is ‘emergency’, the traffic light module is activated. Assuming the average speed of the emergency vehicle, the red light is turned to green and the process goes on for all the junctions through which the emergency vehicle shall be passing. The timing of the red lights is such that the red light turns to green only when the vehicle is 300m away from the junction, so that a green wave is given to the emergency vehicle only. Now, if a stolen vehicle passes from any of the junctions and its information is already updated on the system, the system will give an alert signal using red LED indicating that a stolen vehicle has passed from the junction. If a normal vehicle is passed, no action is taken by system. In that case, the reader just detects it and that data can be used for data monitoring purposes. The drawback of the prototype is that if one or the other vehicle approaches, the LCD goes blank and it does not detect any of the vehicles hence it does not support anti-collision feature for passive tags. The system uses low frequency tags and readers. Hence, we get a low range of operation that is just 4 to 5 cm.To resolve all these issues which are mentioned above we used readers with anti collision features. To increase the overall range of the system, we used high frequency readers. By using the above mentioned techniques, the major drawback of the prototype was resolved. A highly

efficient prototype is finally developed.

V. RESULT AND CONCLUSION

The program was successfully burned on the micro-controller using USB programmer and when an emergency vehicle approaches this reader, it is successfully detected by the system as an emergency vehicle and traffic light module is activated. On the other hand, if any stolen vehicle is detected, it is displayed on the LCD. The system is efficient. This prototype presents a novel solution to implement the concept of green wave in urban cities. The overall system is quite cost effective and has various advantages over the conventional technologies. In traditional systems, to track the vehicle so as to provide green wave, GPS is used. The cost of a GPS module is very high as compared to a RFID transponder. The transponders are not only very cheap to manufacture but are also very small in size. Small size of transponder gives an advantage over the GPS, GPS can be easily removed by anyone, whereas it is very hard to locate a RFID transponder and remove it. We also have an option of updating the system dynamically with the help of a SMS through the GSM module. In some of the cases, to identify the vehicle, image processing based system is used, which has a major drawback during the bad weather conditions. Bad weather may be due to heavy rain, fog, dust storm. On the other hand, our system is not affected by any of these bad weather conditions. Our system can work in any weather, so it has the capability to provide 24x7x365 surveillance without any disruption. The traditional system can't provide 24x7x365 surveillance. This system is very helpful in building a smart city. The city equipped with the developed system will never have any issues related to traffic management. Moreover it will make the city more secure in context of detection of stolen vehicles. Green wave also helps in saving environment as it will reduce emission of CO, NOx, PM10.It will also reduce the consumption of fuel by the vehicles which are provided with the green wave. More travelling in platoons will get a clear way without any traffic.

REFERENCES

[1] A'GreenWave'Reprieve,BlaiseKellyB.eng*MSc*,Blaise @kello.co.uk Available at http://gse.cat.org.uk/papers?download=6%3Ablaise-kelly-a-green-wave-reprieve.

[2] Karmakar, N, Handbook of Smart Antennas for RFID Systems, Wiley-IEEE Press, Pages: 13 -56.

[3] Want, R. , Intel Res., Santa Clara, CA, USA , Pervasive Computing, IEEE , Jan.-March 2006 **,** Volume**:** 5 ,Issue:1 Page(s): 25 - 33

[4] Introduction to high speed microcontrollers , available at http://www.arm.com/Images/doc2545.pdf

[5] Image Processing: Principles and Applications by Camastra, F.

Neural Networks, IEEE Transactions Volume: 18, Issue: 2 Publication Year: 2007.

[6] Preradovic, S. Electr. & Comput. Syst. Eng., Monash Univ., Clayton, VIC. Karmakar, N. ; Balbin, I. "RFID transponders " Volume**:** 9 ,Issue:5 Microwave magazine, IEEE Page(s): 90 - 103

[7] Digi International Inc, "XBee/XBee-PRO RF Modules", available http://ftp1.digi.com/support/documentation/90000982_B.pdf

[8] Arm7 Corporation, "Arm Datasheet", available http://www.wvshare.com/datasheet_html/LPC2148-PDF.html.

[9] RFID reader manufactured by rhydoz labs, documentation availableat http://www.rhydolabz.com/documents/rfid/RFID_Reader_Serial_TTL.pdf.

[10]Passive transponders

"http://www.rhydolabz.com/documents/rfid/EM4102_DS.pdf ".

[11]Armkeilμvsion4available http://www.keil.com/arm/boards/arm7.asp.

[12]Gouging Shan "Urban Traffic Trunk Two-direction Green Wave Intelligent Control Strategy and Its Application "Intelligent Control and Automation, 2006. WCICA 2006. The Sixth World Congress. Volume: 2 Publication Year: 2006 , Page(s): 8563 – 8567

[13]Wei Cheng; Xuemin Li; Pengcheng Du " Urban arterial road green-wave control based on genetic algorithm Awareness Science and Technology (iCAST), 2011 3rd International Conference" , Publication Year: 2011 , Page(s): 68 – 71.